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TO THE READERS

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PLENARY SESSION

METHODS FOR OPTIMIZATION IN SHAPED CHARGES DESIGN

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ABSTRACT *It is advantageously to invest new ideas in optimization of ammunition in time of building their construction. The effective constructions decrease quantity of munitions for performing battle tasks and bring influence on new capabilities. The methods of applied mathematics for optimization are well-known from ancient time and were used in middle centuries. One interesting way to apply mathematics in optimization shaped charges is variation calculus and Cauchy problems, for example. In first case, the integral characteristic for powerful of the shaped charges is a cumulative jet length. The possibility of using of the variation calculus is proved in optimization of the shaped charges by forming of compact jets with maximal length. In other case, the cumulative jet velocity could be described by equation with an independence time assumption in a term its formation. In this case, the Cauchy problem for the first order differential equation is formulated about unknown function of the shaped charge geometry. The solution allows designing a profile of a cumulative liner or a shell profile. In both this cases, the profiles ensure no-gradient velocity jet forming, which allows decreasing influence from shaped charge focus distance to armour plate.*

KEY WORDS *Shaped Charge, Design, Optimization*

1. Ancient Daidan's Problem in Shaped Charge Optimization

The variation calculus has arisen from problems which are possible to describe in following manner. Some expression is presented; it contains an unknown function and its derivatives. We have to find this function with condition that its expression should receive extreme value. Ones of the most known problems of this kind are the Daidan's (Cartage Dido) is parametrical problem and the Bernoulli's brachistochrone (the faster letting down curve) problem [1, 2].

Dynamics of many mechanical systems, including ammunition are described by differential equations. A formal solution of our problem is an integral [1]:

$$I = \int_{z_1}^{z_2} F[z, y(z), y'(z)] dz$$

where the sub-integral function F depends z , function $y(z)$ and its first derivative $y'(z)$.

The boundaries can be both fixed and no fixed. The problem is in determination of a function $y(z)$, in case the integral have to be extremal. The functional extremum (sometimes conditional) could be reached only on the extremal $y = y(z, C_1, C_2)$ which is a solution of a differential second-order Euler – LaGrange’s equation [2]:

$$F'_y - F''_{zy} - F''_{yy'} y' - F''_{y'y'} y'' = 0$$

by boundary conditions

$$y(z_1) = y_1; y(z_2) = y_2;$$

The boundary value problem has not always had a solution, especially analytical, but sometime the solutions are more than one [1, 2].

The simple example of our problem is an isoperimetric problem for optimization of internal volume of shaped charge with an analytical solution for a vary function of a profile of a cumulative liner.

The axis-symmetrical form of ammunition construction makes the optimization problem a solution in determination of the maximal area space which is described by figure rotation $ABCD$ around Oz -axis – Fig.1. The figure $ABCD$ is bounded by straight lines $x=0$, $x=H$ and flat curves $y = \Phi(x)$ and $y = \varphi(x)$. The function $y = \Phi(x)$ is known and it describes an internal surface of the shell, at rotation (very often this is a straight line of cylindrical shell) and the function $y = \varphi(x)$ describes an exterior surface of a cumulative liner. The rotation of $ABCD$ gives an explosive volume of a charge.

The physics of cumulative jet forming gives following limitations for unknown function $y = \varphi(x)$, this function is continuous and it has a positive first derivative, and

$$\varphi'(0) = \gamma_{AV}; \quad \varphi'(H) = \gamma_{AR}, \quad (1)$$

Where γ_{AV} and γ_{AR} are local static angles of a cumulative liner (which are connected with collapse cumulative liner angles) and they are chosen of ability by conditions of forming cumulative jet: for compact, discrete or dispersal cumulative jet. For example, the critical collapse angles for compact jet are [3]: for steel $20^\circ \leq 2\alpha(\gamma) \leq 140^\circ$; for copper $36^\circ \leq 2\alpha(\gamma) \leq 146^\circ$, for aluminum $30^\circ \leq 2\alpha(\gamma) \leq 150^\circ$,

The boundary conditions are following:

$$y(A) = \varphi_0; \quad y(B) = \varphi_H \quad (2)$$

The length of a cumulative liner profile is unknown in advance. It could be determined as a function of necessary cumulative jet length from armor penetration ability.

Length of a flat curve is:

$$L = \int_0^H \sqrt{1 + \varphi'^2} dz. \quad (3)$$

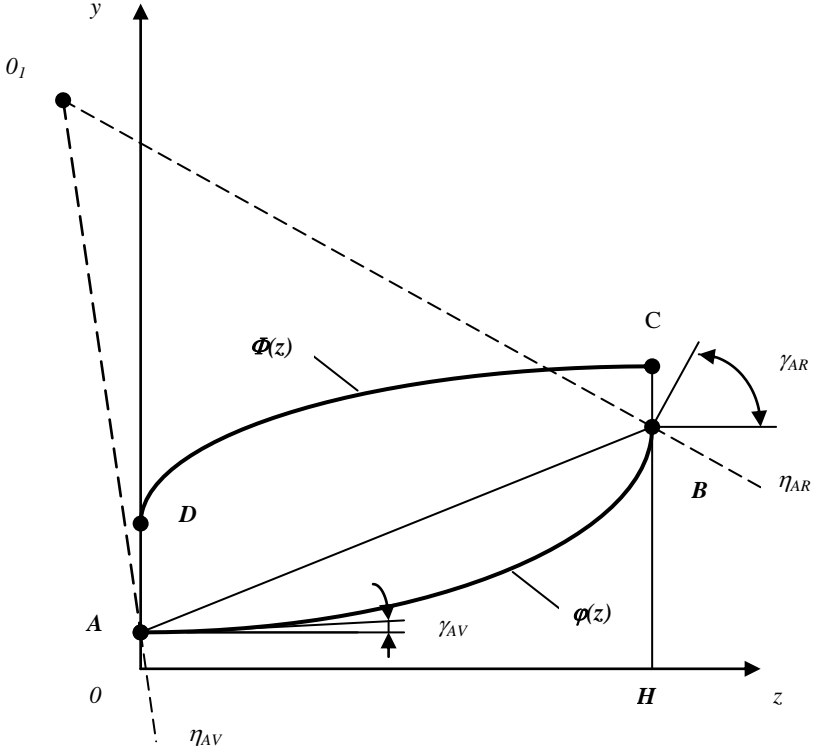


Fig.1. Determination Schema for a Cumulative Liner Profile, $y = \varphi(z)$.

So, the following problem is formulated - among all functions $y = (x)$, which meet requirements (1), (2) and (3), it is necessary to select such, for which-one the area S_D of a figure $ABCD$ will be maximal. Then:

$$S_D = \int_0^H (\Phi - \varphi) dz. \quad (4)$$

It has to decide the Euler's equation for a function:

$$J^* = \varphi + \lambda \sqrt{1 + \varphi'^2},$$

Where λ is the LaGrangian's multiplier.

If we use a technology [1] we are taking a following decision:

$$\varphi'^2 = \frac{\lambda^2}{(C_1 - \varphi)} - 1$$

$$\frac{d\varphi}{dz} = \pm \frac{\sqrt{\lambda^2 - (\varphi - C_1)^2}}{\varphi - C_1}.$$

But there physically requirement is $\varphi' > 0$ and then finally we have [1]:

$$(z + C_2)^2 + (\varphi - C_1)^2 = \lambda^2. \quad (5)$$

The equation (5) is a circle equation and the solution of a problem is a circle arc. The arc length is not determined but it depends of the function $\alpha(\gamma)$ for compact, discrete or disperse jet conditions (1). The crossing of normal straight-lines η_{AV} and η_{AR} in a point O_I to tangents in points A and B gives us a center of the circle with radius λ , which is equal to:

$$\lambda = \frac{\sqrt{H^2 + (\varphi_H - \varphi_0)^2}}{2 \sin(\gamma_{AR} - \gamma_{AV})}. \quad (6)$$

And

$$C_1 = \frac{\cos \gamma_{AV}}{2 \sin(\gamma_{AR} - \gamma_{AV})} \sqrt{H^2 + (\varphi_H - \varphi_0)^2} ; \quad C_2 = tg \gamma_{AV}. \quad (7)$$

So the analytical solution is shown for a liner profile. It gives maximal usage of free area with physics relation for cumulative process and added integral condition (3).

This problem is a simple example of vary calculus possibility in optimization of the cumulative charges. It is necessary to mark that the optimization of cumulative effect on argument of maximal usage of a volume of the charge is partial decision because the liner collapsing process is not static. But the use of kinematics and dynamics make the problem complex and it has to search a solution numerically.

2. An Euler's Equation for a Cumulative Jet Length

The length of a cumulative jet is a main parameter for an estimation of cumulative charge efficiency. The length elongation of a cumulative jet by charge volume limitation is an actual optimization problem.

The problem solution is conducted in framework hypotheses of the Orlenko-Stanukovitz's flat-radial schema - Fig.2.

The following equations for surfaces profiles with height H are given in the Cartesian coordinate system zOy : $y_1=F(z)$, $y_2=\Phi(z)$, $y_3=\varphi(z)$ and $y_4=f(z)$. The first and second equations describe exterior and internal surface profiles of the charge shell and the third and fourth equations describe external and internal surface profiles of the cumulative liner. The second and third equations describe exterior and internal surfaces of the explosive charge. There have limitations. All of functions are continuous also they have continuous first derivative. And, the following conditions are always executed:

$$\xi \geq F(z) \geq \Phi(z) \geq \varphi(z) \geq f(z); \quad H \geq 0; \quad y \geq 0. \quad (8)$$

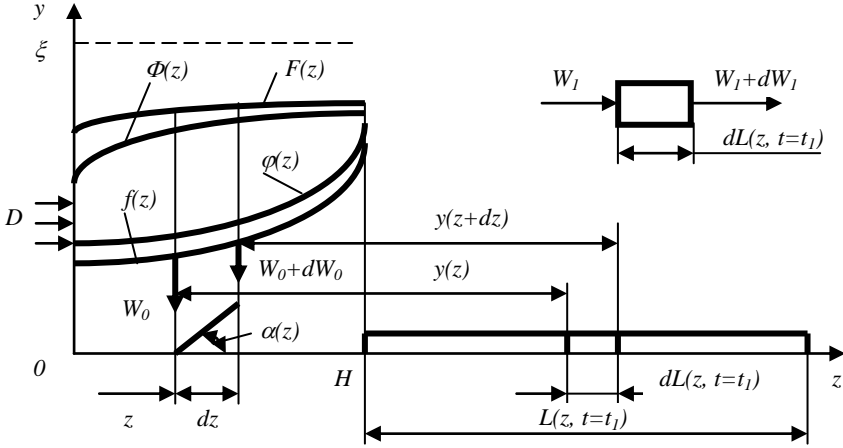


Fig.2. Flat-Radial Schema of Liner Collapsing and Gradient Jet Forming.

The detonation wave front is flat and perpendicular to polar charge axis at move from left to right. The limitations are not present on permissible deformation of a jet material.

We get assumption the collapsing velocity of a charge liner $W_0(z)$ does not depend on time and it is a function only coordinate z [4]. $W_0(z)$ is connected to the jet initial velocity speed $W_1(z)$ in cross-section z by a kinematics proportion:

$$W_0(z) = W_1(z) \operatorname{tg} \frac{\alpha(z)}{2} = \frac{k_i D}{2} \sqrt{\beta(z) [2 + \beta(z)]^{-1}}, \quad (9)$$

Where k_i is a coefficient it is taking into account reallocating of impulse of detonating on different elementary parts of a cumulative liner by detonating products moving along the liner profile;

$\beta(z)$ is a dynamic load coefficient of a cumulative charge cross-section:

$$\beta(z) = \frac{m(z)}{2M(z)} \left[1 + \frac{M_h(z) - M(z)}{M_h(z) + M(z) + m(z)} \right]; \quad (10)$$

$M_n(z)$ is a linear mass of an elementary part of the shell;
 $m(z)$ is a linear mass of an elementary part of a explosive charge;
 $M(z)$ is a linear mass of an elementary part of a cumulative liner.

Full collapsing of a liner will happen during time $t_l = H/D$. The isolated elementary part of a liner with coordinate z and length dz will take up a position between coordinates $y(z)$ and $y(z+dz)$:

$$dL = \left\{ \left(\frac{W_0}{tg \frac{\alpha}{2}} \right)' \left[\frac{H-z}{D} + \frac{f(H)}{W_0(H)} - \frac{f}{W_0} \right] + \frac{W_0}{tg \frac{\alpha}{2}} \left[-\frac{1}{D} - \frac{f'W_0 - fW_0'}{W_0^2} \right] \right\} dz. \quad (11)$$

The following expression for a collapsing angle of a liner is described at gradient moving of a jet [4]:

$$tg \alpha = f' - f \frac{W_0'}{W_0} + \frac{W_0}{D} \quad \text{or} \quad Atg^2 \frac{\alpha}{2} + 2tg \frac{\alpha}{2} - A = 0, \quad (12)$$

$$\text{where } A = f' - \frac{f\beta'}{\beta(2+\beta)} + \frac{1}{2} \sqrt{\frac{\beta}{2+\beta}}.$$

But the collapsing angle is always positive and solution is:

$$tg \frac{\alpha}{2} = \frac{-1 + \sqrt{1 + A^2}}{A}. \quad (13)$$

If we integrate (11) from 0 up to H with account (12) and (13) the full-length expression of a jet at the moment of the end of its forming will be received. This expression is invariant on a ratio of detonation velocity D :

$$L = \int_0^H \left\{ \frac{A}{\sqrt{1+A^2} - 1} \left[\frac{\beta'}{\sqrt{\beta(2+\beta)^3}} \left(B_H - \frac{1}{2}z \right) - f' - \frac{1}{2} \sqrt{\frac{\beta}{2+\beta}} \right] - \frac{A'}{\sqrt{1+A^2} (\sqrt{1+A^2} - 1)} \left[\sqrt{\frac{\beta}{2+\beta}} \left(B_H - \frac{1}{2} \right) - f \right] \right\} dz, \quad (14)$$

Where $A' = f'' - \frac{(f\beta' + f\beta'')(2 + \beta)\beta - 2f\beta'^2(1 + \beta)}{\beta^2(2 + \beta)^2} + \frac{1}{2} \frac{\beta'}{\sqrt{\beta(2 + \beta)^3}}$.

B_H is a known function of a dynamic load coefficient at $z=H$:

$$B_H = \frac{H}{2} + f_H \sqrt{\frac{2 + \beta_H}{\beta_H}}.$$

β', β'' are first and second deliveries of a dynamic load coefficient.

The expression (14) is assumed for searching of a functional extremum:

$$I = \int_0^H \bar{L}[z, \zeta(z), \zeta'(z)] dz, \quad (15)$$

Where \bar{L} is a given function;

0 and H are given integrating boundaries;

$\zeta = \zeta(z)$ is a varied function from charge geometry for example it would be an exterior or an internal surface profile of the shell, the charge or the liner.

The required function $\zeta = \zeta(z)$ is a solution of a boundary value problem with rigid-catching ends for an Euler – LaGrange’s ordinary differential equation:

$$\bar{L}'_{\zeta} - \bar{L}''_{z\zeta} - \bar{L}''_{\zeta\zeta} \frac{d\zeta}{dz} - \bar{L}''_{\zeta'\zeta'} \frac{d^2\zeta}{dz^2} = 0 \quad (16)$$

And given boundary conditions

$$\zeta(0) = \zeta_0; \zeta(H) = \zeta_H. \quad (17)$$

It is possible to formulate two basic vary problems if we change $\zeta = \zeta(z)$ in (16) and (17) into $\Phi = \Phi(z)$ and $f = f(z)$:

1. Problem for a maximal length of a cumulative jet at varied argument for a cumulative shell profile in a case of unconditional extremum.

There are padding limitations for a shell profile:

$$F(z) = \Phi(z) + \Omega; \quad \Omega = const \quad (18)$$

Where Ω is the thickness of the shell of a charge which is a constant value at $z = z(0; H)$ in a perpendicular direction to charge axis.

Then an extremum of a functional is:

$$I_{\Phi} = \int_0^H \bar{L}[z, \Phi(z), \Phi'(z)] dz, \quad (19)$$

Where the varied function $\Phi = \Phi(z)$ is a shell profile of a charge.

The required function $\Phi = \Phi(z)$ is a solution of a boundary value problem with rigid-catching ends for an Euler – LaGrange’s ordinary differential equation:

$$\bar{L}'_{\Phi} - \bar{L}''_{z\Phi'} - \bar{L}''_{\Phi\Phi'} \frac{d\Phi}{dz} - \bar{L}''_{\Phi'\Phi'} \frac{d^2\Phi}{dz^2} = 0 \quad (20)$$

And given boundary conditions

$$\Phi(0) = \Phi_0; \Phi(H) = \Phi_H. \quad (21)$$

2. Problem for maximal length of cumulative jet at varied argument for cumulative liner profile in case of unconditional extremum

There are padding limitations for a liner profile:

$$\varphi(z) = f(z) + \delta; \delta = const. \quad (22)$$

Where f is the thickness of the liner of a charge which is a constant value at $z = z(0; H)$ in a perpendicular direction to charge axis.

Then an extremum of a functional is:

$$I_f = \int_0^H \bar{L}[z, f(z), f'(z)] dz, \quad (23)$$

Where the varied function $f = f(z)$ is a liner profile of a charge.

The required function $f = f(z)$ is a solution of a boundary value problem with rigid-catching ends for an Euler – LaGrange’s ordinary differential equation:

$$\bar{L}'_f - \bar{L}''_{zf'} - \bar{L}''_{ff'} \frac{df}{dz} - \bar{L}''_{f'f'} \frac{d^2f}{dz^2} = 0 \quad (24)$$

And given boundary conditions

$$f(0) = f_0; f(H) = f_H. \quad (25)$$

Both problems don’t have an analytical solution. A full notation of an Euler – La-Grange’s equations are complex expressions which ones are completely uncovered by the Nuton’s binomial formulas of a binomial for the first and the second problem respectively:

$$F^{\mu}(z) = (\Phi(z) + \Omega)^{\mu} = \sum_{v=0}^{\mu} C_{\mu}^v \Phi^{\mu-v} \Omega^v; \mu = \mu(0; 6)$$

$$\varphi^\mu(z) = (f(z) + \delta)^\mu = \sum_{v=0}^{\mu} C_{\mu}^v f^{\mu-v} \delta^v ; \mu = \mu(0; 12)$$

In result, the main optimization problem with a unconditional extremum about maximal length of a cumulative jet is formulated and two Euler – LaGrange’s equations are written for it. The varied arguments are cumulative shell and liner profiles.

The Euler – LaGrange’s equations notation do not allow receiving an analytical solution of a problem they are necessary to decide numerically for example by method of fire.

3. Example. Problem for Maximal Cumulative Jet Length with No-Fixed Right Boundary. Conical Liner is Additional Condition.

The following problem is delivered. What is a local static angles of a liner opening ($tg\alpha = f(z)$) at the moment of the end of jet forming for a maximal jet length. The additional condition is referred to a varied function.

The left boundary condition is set from experimental expertise and does not conflict with the physics of a process approximately $f(0) = f_0 \equiv 0$. The right boundary condition is not known and it is connected to a solution of a problem. It is on straight-line $z = H$ on a cut $H \in [0; \Phi - \delta]$.

The transversally condition would be utilized for its determination:

$$\bar{L}'_{f'} \Big|_{z=H} = 0 , \tag{26}$$

That is also solution of a problem. The opening angle of a liner conical profile to straight-line $z=H$ is determined and in this case this is a problem solution in a unique fashion:

$$\begin{aligned} & - (A')'_{f'} (1 + A^2) \left(\sqrt{1 + A^2} - 1 \right) \left[\left(B_H - \frac{1}{2} z \right) \frac{\beta'}{\sqrt{\beta(2 + \beta)^3}} - f' - \frac{1}{2} \sqrt{\frac{\beta}{2 + \beta}} \right] + \\ & + A \sqrt{(1 + A^2)^3} \left(\sqrt{1 + A^2} - 1 \right) \left[\left(B_H - \frac{1}{2} z \right) \frac{(\beta')'_{f'}}{\sqrt{\beta(2 + \beta)^3}} - 1 \right] - \\ & - \left[(1 + A^2) \left(\sqrt{1 + A^2} - 1 \right) (A')'_{f'} - \right. \end{aligned}$$

$$-AA'A'_j \left(2\sqrt{1+A^2} - 1 \right) \left[\left(B_H - \frac{1}{2}z \right) \sqrt{\frac{\beta}{2+\beta}} - f \right] \Big|_{z=H} = 0. \quad (27)$$

The simplification alternative of a problem is esteemed. For this purpose the additional conditions are entered: the cylindrical shell has constant thickness and the liner has conical constant thickness. It would be utilized following expression for length of a cumulative jet [5].

$$L = H \left[\left(\frac{1}{Dt\alpha} + \frac{1}{W_0(H)} \right) W_0(0) - 1 \right], \quad (28)$$

Where $W_0(H)$ and $W_0(0)$ are collapse velocities of a liner in cross-sections $z=H$ and $z=0$ respectively.

The first derivative is equated to zero:

$$W_0^2(H) + Dt\alpha^2 \alpha(W(H))'_{tg\gamma} = 0,$$

Where $W_0(H) = \frac{D}{2} \sqrt{\frac{\beta_H}{2+\beta_H}}$ and β_H is a dynamic load coefficient at $z = H$.

Then

$$\beta_H^3(2 + \beta_H) + 4tg^4 \gamma \beta'^2_{tg\gamma} = 0. \quad (29)$$

If we shall decide (29) for $tg\gamma$, we take a following equation:

$$\begin{aligned} & q_{8,1}tg^{16}\gamma + q_{8,2}tg^{15}\gamma + q_{8,3}tg^{14}\gamma + q_{8,4}tg^{13}\gamma + q_{8,5}tg^{12}\gamma + q_{8,6}tg^{11}\gamma + \\ & + q_{8,7}tg^{10}\gamma + q_{8,8}tg^9\gamma + q_{8,9}tg^8\gamma + q_{8,10}tg^7\gamma + q_{8,11}tg^6\gamma + q_{8,12}tg^5\gamma + \\ & + q_{8,13}tg^4\gamma + q_{8,14}tg^3\gamma + q_{8,15}tg^2\gamma + q_{8,16}tg\gamma + q_{8,17} = 0, \end{aligned} \quad (30)$$

Where $q_{8,1} \dots q_{8,17}$ are constants and functions of density of main parts of a charge and magnitude H . The equation (30) solutions are obtained by the way 16 radicals. Two are real and others are integral conjugate radicals. We decided that the stable solution of a problem is received in a value interval of a high to caliber proportion

$$\frac{H}{2\Phi} \in [0,8;2,3]. \quad (31)$$

Solutions are unstable at the left and on the right of this interval and they have a form of integral conjugate radicals and negative radicals. The analyze of obtained results in a

interval of stable solutions show the value differences in of two positive radicals decrease with (31) proportion increase and tends to zero point at $H/2\Phi = 2,3$. On the basis of analysis of results it is possible to consider for a solution of a problem following proportion:

$$\operatorname{tg}\gamma = \frac{\Phi}{H}. \quad (32)$$

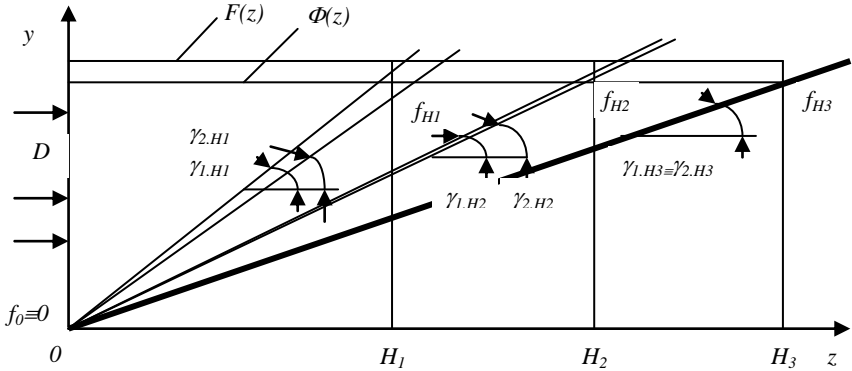


Fig. 3. Schema and Interval of Taking of Pair of Positive Solutions:

$$\frac{H_1}{2\Phi} = 0,8 \quad \dots, \quad \frac{H_3}{2\Phi} = 2,3.$$

Relation (32) determines the opening angle of a cumulative conical liner at which one the cumulative jet has maximal length at the moment of the end jet forming. This solution as well as in the previous problem has physical sense. Always the maximal elongation of a jet is received by maximal value of a dynamic load coefficient at the liner top and by minimal value of coefficient at the liner basis. This is illustrates at the Fig.3:

4. Cauchy Problem in Shaped Charges Optimization

The collapse angle of a cumulative lining part on Fig.2 is determined under the formula from (12) and in accordance with (9) we have

$$\operatorname{tg}\alpha(z) = \frac{df(z)}{dz} - \frac{f(z)}{W_1(z)\operatorname{tg}\frac{\alpha(z)}{2}} \left[\frac{dW_1(z)}{dz} \operatorname{tg}\frac{\alpha(z)}{2} + W_1(z) \frac{d(\operatorname{tg}\frac{\alpha(z)}{2})}{dz} \right] + \frac{W_1(z)\operatorname{tg}\frac{\alpha(z)}{2}}{D}$$

If we demand the condition $W_1(z) = W_1 = \text{const}$, we take following equation:

$$tg\alpha(z) = \frac{df(z)}{dz} - f(z) \frac{1}{\sin \alpha(z)} \frac{d\alpha(z)}{dz} + \frac{W_1}{D} tg \frac{\alpha(z)}{2}. \quad (33)$$

But from (9) about angle $\alpha(z) = 2arctg \frac{D}{2W_1} \sqrt{\beta(z)[2 + \beta(z)]}^{-1}$ and we remake

(33) in following equation:

$$\frac{2 \in(z)}{1 - \in^2(z)} = f'(z) - \frac{f(z)D}{2 \in(z)W_1} \left\{ \sqrt{\beta(z)[2 + \gamma(z)]^3} \right\}^{-1} \beta'(z) + \frac{W_1 \in(z)}{D} \quad (34)$$

$$\text{Where } \in(z) = \frac{D}{2W_1} \sqrt{\beta(z)[2 + \beta(z)]}^{-1}.$$

Materials densities of the shaped charge shell and the explosive charge and the cumulative lining are constant values. Then the elementary masses of the shell, the explosive charge and the lining participate through dynamic load coefficient $\beta(z)$ in (10) for following equation:

$$\begin{aligned} & \frac{df(z)}{dz} - E(z)A(z)a(z) \frac{dF(z)}{dz} - E(z)[A(z)d(z) + C(z)c(z)] \frac{d\Phi(z)}{dz} + \quad (35) \\ & + E(z)[B(z)b(z) + C(z)g(z)] \frac{d\varphi(z)}{dz} + E(z)B(z)e(z) \frac{df(z)}{dz} + \frac{W_1 \in(z)}{D} - \frac{2 \in(z)}{1 - \in^2(z)} = 0, \end{aligned}$$

$$\text{Where } E(z) = \frac{f(z)D}{2 \in(z)W_1} \left\{ \sqrt{\beta(z)[2 + \beta(z)]^3} \right\}^{-1}, \text{ and } A(z), B(z), C(z), a(z),$$

$b(z), c(z), g(z)$ and $e(z)$ are some functions from materials densities of the shell, explosive charge and lining and geometry in this cross section of the shaped charge.

The equation (35) is a first order differential equation for unknown one of the following functions - $F(z)$, $\Phi(z)$, $\varphi(z)$ or $f(z)$, and given other three functions and one initial conditions for solving the problem for one of the unknown functions. This equation is assumed for formulation of a Cauchy problem about determination of the geometrical performance of the elements from shaped charge, which ensures no-gradient forming of a cumulative jet.

There is possible to formulate following basic Cauchy problems:

- 1. Problem for Cumulative Lining Profile Design which ensure No-Gradient Velocity or Given-Gradient Velocity Cumulative Jet;**
- 2. Problem for Shaped Charge Shell Profile Design which Ensure No-Gradient Velocity Cumulative Jet.**

For example for real constructions - a cylindrical shell with constant thickness and conical lining with inconstant lining thickness, we could design from (35) the lining profile with inconstant thickness:

$$\frac{d\delta(z)}{dx} = \left\{ \frac{2 \cdot \varepsilon(z)}{1 - \varepsilon^2(z)} - \frac{W_1(z) \cdot \varepsilon(z)}{D} + \frac{df}{dz} + [B(z)b(z) + C(z)g(z)] \frac{df}{dz} \right\} \cdot Q(z)$$

Where $Q(z) = \{1 - E(z)[B(z)b(z) + C(z)g(z)]\}^{-1}$ and $\delta(z) = \varphi(z) - f(z)$.

The Cauchy problem is formulated for a first order differential equation about unknown shaped charge elements profile function – liner conical profile - $f(z)$.

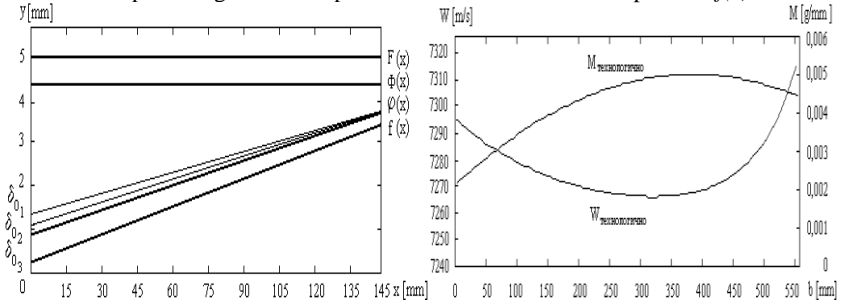


Fig.4: Technological Shape Charge and No-Gradient Velocity Jet Performance.

The numerical solution of a problem allows design a conical profile of a cumulative lining with no-gradient velocity forming of a cumulative jet. The evidence is an approximately equal penetration thickness at short different distances to armor plate - Fig.5.

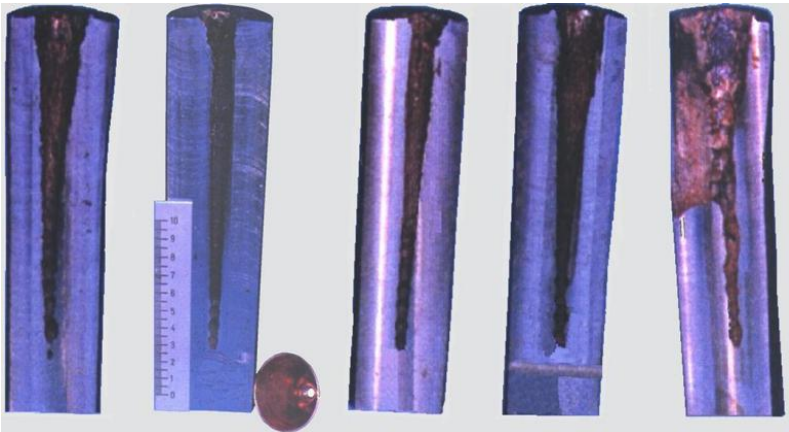


Figure 5: Testing of the No-Gradient Velocity Jet in Short Different Distances to Armor Plate.

In result, the Cauchy problem is formulated for a differential equation of first order about an unknown shaped charge elements profile function $f(z)$. The numerical solution of a problem allows design a profile of a shaped charge element which ensures no-gradient velocity forming of a cumulative jet. The equation (35) is common for elements profiles of the shaped charge – shell, explosive charge and liner and allows optimization task formulation for construction design by two ways - from shell to lining if there have limitations for shell, or from liner to shell if there have limitations for liner.

5. Conclusion

The integral characteristic for powerful of the shaped charges is a cumulative jet length. So, make the cumulative jet length function for required optimization, it is possibility using the variation calculus to design shaped charges which to form compact jets with maximal length. In other case, the Cauchy problem for the first order differential equation is formulated about unknown function of the shaped charge geometry. The solution allows designing a profile of a cumulative liner or a shell profile of the shaped charge. In both this last cases, the profiles ensure no-gradient velocity jet forming, which allows decreasing influence from shaped charge focus distance to armour plate.

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MATHEMATICAL MODEL FOR COMPUTING THE UNGUIDED ROCKET TRAJECTORIES

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Abstract: This paper presents the study of a mathematical model used for computing the unguided rocket trajectory. The aerodynamic forces and moments, the thrust and gravitational forces are taken into consideration regarding this model. A numerical application was designed based on this model in order to compute all the ballistic characteristics of the rocket on the trajectory.

Keywords: Unguided Rocket, Effectiveness, Trajectory, Mathematical Model

1. Introduction

An unguided rocket is a self-propelled weapon system because of the energy provided by the combustion of the fuel contained in the rocket motor [2] (see figure 1). The unguided rocket is constituted of two parts: a warhead section, containing the munitions or sub-munitions and a propulsion section including the rocket motor which contains the propellant. In order to keep an aerodynamic stability during the flight, the unguided rockets are equipped with stabilizer fins [1]. Unguided rockets can be launched from man portable launchers, as anti-tank weapons, from aircrafts or from multiple rocket launchers [3].

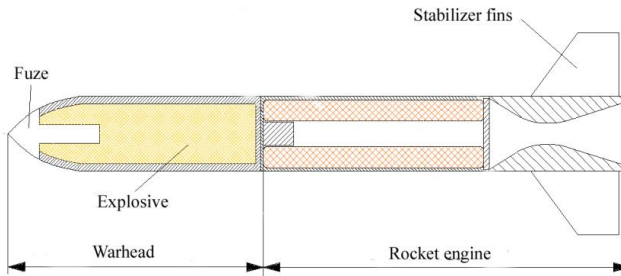


Figure 1. Design of an unguided rocket

The term “accuracy” measures the distance between the effective point of impact and the theoretical point of impact, the aimed point; in other words, it is the measure of the

capacity of the rocket to reach the target at a given point. But there are various error sources which cause the rocket to disperse from the theoretical point of impact [4]. These dispersion errors are calculated by comparing the actual flight trajectory and an idealized trajectory.

2. Error sources

The error sources will affect the trajectory and the accuracy of the point of impact is represented by the errors made during the mechanical design, the manufacture and the assemblage of the rocket. During the launch phase they can modify some forces which act on the rocket [5]. In detail, these errors are:

- a static and dynamic imbalance: the geometric longitudinal axis does not coincide with the principal axis of inertia, the mass centre of the rocket is not located on the longitudinal axis, the mass is not correctly distributed, the inertial spin axis is displaced from the rocket centreline; the rocket is then spinning, which causes unwanted motions of the launcher equivalent to an angular velocity;

- an aerodynamic instability because of wrong calculations of the static margin (the distance between the mass centre and the centre of pressure) and the aerodynamics coefficients; which alter the yaw oscillation distance (after a disturbance during the boost phase, the motion of the rocket generally becomes a sinusoidal oscillation about a lateral axis), which depends on the static margin and the aerodynamics coefficients;

- an incorrect determining of the degree of stability (which determines the angle through which the rocket will turn in response to thrust misalignment or wind) ;

- inaccuracies in the method of determining the drag and the direction of the thrust (instead of being parallel with the rocket longitudinal axis, the thrust is displaced in a radial manner);

- inaccuracies in the warhead detonation device which causes fuzing errors and has an effect on the range;

- fins misaligned or bent which cause additional aerodynamic forces and will result in dispersion and which, in its turn, modifies the static margin;

- the flexibility of rocket which is not a perfectly rigid body and has an angular rate;

- an irrelevant choice of the propellant : the propellant temperature can affect the burning time and the thrust of solid propellant rocket (misalignment) and a variation in a parameter that influences the delivered total impulse (volume, chemical composition, mass) can modify the burnout velocity.

During the launch phase, the launcher cannot compensate all the errors, the muzzle velocity and the initial angular velocity are altered in comparison to the values of the ideal firing [6].

Others error sources are due to inaccuracies during the prelaunch phase:

- an inexact knowledge of location of launcher and target, due to an incorrect map grid;

- an error in positioning launcher: if the inclination of the tube is not correctly and precisely aligned with the desired angle of inclination, then the point of impact will be moved compared to the intended point of impact.

The other main error source is the taking into consideration of the wind. It modifies the direction of the trajectory by perturbing the forces which act on the rocket and it induces a rotational motion of the rocket. Indeed, during the boost phase, a wind normal to the direction of the flight causes the rocket to turn towards the direction from which the wind is blowing; during the ballistic phase, the direction of the lift is altered, as well

as the magnitude and the direction of the drag (the wind produces an axial drag component, normal to the intended trajectory). The rocket then cocks into even drifts with the wind [7].

Moreover, the atmospheric data, which change with the season, the time of day, the temperature, the humidity and the altitude of the flight, amongst others, have an effect on the force magnitudes (since the aerodynamic forces depend on the density, for instance) and then on the trajectory of the rocket and the location of the point of impact.

For our study, we will only consider the initial error sources conditions which are not well enough determined since there may be mismeasurements of these firing conditions. The other error sources are not the object of our study.

3. Mathematical model of the basis trajectory

The mathematical model of the trajectory is obtained taking into consideration all the forces and the moments acting on the unguided rocket, based on the major theorems of the dynamics.

The fundamental principle of dynamics gives us the equation of the centre of mass motion [2]:

$$m \frac{d\vec{V}}{dt} = \vec{R} + \vec{P} + \vec{T} + m\vec{g} \quad (1)$$

where:

- m – mass of the rocket (variable in time);
- \vec{V} – velocity of the rocket centre of mass;
- \vec{R} – drag force;
- \vec{P} – lift force;
- \vec{T} – thrust force generated by the rocket engine;
- \vec{g} – gravitational acceleration.

The dynamic moment theorem for a variable mass gives the equation of the motion around the rocket centre of mass [2]:

$$\frac{dK_O}{dt} = \Sigma \vec{M} + \vec{M}_{\vec{v}_2} + \vec{M}_T \quad (2)$$

where:

- \vec{K}_O – kinetic moment;
- \vec{M} – aerodynamic moment;
- $\vec{M}_{\vec{v}_2}$ – damping moment of the rocket engine flow;
- \vec{M}_T – moment of the rocket engine thrust.

After projection of the equation (1) and (2) on the axes of the reference system (figure 2) we obtain a complete system of differential equations that describes the trajectory of the rocket and the motion around the centre of mass:

$$\frac{dx}{dt} = V \cos(\theta_V) \cos(\theta_H), \quad (3)$$

$$\frac{dy}{dt} = V \cos(\theta_V) \sin(\theta_H), \quad (4)$$

$$\frac{dz}{dt} = V \sin(\theta_V), \quad (5)$$

$$\frac{dV}{dt} = a_R \cos(\alpha_V) - K_x V^2 - g \sin(\theta_V), \quad (6)$$

$$\frac{d\theta_V}{dt} = K_z^\alpha V \alpha_V - K_z^\omega \omega_\eta - \frac{g}{V} \cos(\theta_V), \quad (7)$$

$$\frac{d\theta_H}{dt} = K_z^\alpha V \alpha_H - K_z^\omega \omega_\xi, \quad (8)$$

$$\frac{d\alpha_V}{dt} = -K_z^\alpha V \alpha_V + K_z^\omega \omega_\eta + \omega_\xi + \frac{g}{V} \cos(\theta_V), \quad (9)$$

$$\frac{d\alpha_H}{dt} = -K_z^\alpha V \alpha_H + K_z^\omega \omega_\xi + \omega_\eta, \quad (10)$$

$$\frac{d\omega_\xi}{dt} = -K_m^\alpha V^2 \alpha_H - K_m^\omega V \omega_\xi - K_j \omega_\xi, \quad (11)$$

$$\frac{d\omega_\eta}{dt} = -K_m^\alpha V^2 \alpha_V - K_m^\omega V \omega_\eta - K_j \omega_\eta, \quad (12)$$

where:

- x, y, z - position of the rocket centre of mass on the trajectory ;
- θ_V – the angle of inclination of the trajectory in the vertical plan, that is the angle between the velocity and the horizontal axis;
- θ_H – the angle of inclination of the trajectory in the horizontal plan;
- α_V – the angle of incidence in the vertical plan;
- α_H – the angle of incidence in the horizontal plan;
- ω_ξ, ω_η – the angle velocities;
- $a_R = \frac{T}{m}$ –the reactive acceleration;
- $K_x = \frac{1}{2m} \rho S C_x$ –coefficient based on the drag coefficient;
- $K_z^\alpha = \frac{1}{2m} \rho S C_z^\alpha$ –coefficient based on the lift coefficient;
- $K_z^\omega = \frac{1}{2m} \rho S l C_z^\omega$ –coefficient based on the supplementary lift coefficient;
- $K_m^\alpha = \frac{1}{2j} \rho S l C_m^\alpha$ –coefficient based on the moment coefficient;
- $K_m^\omega = \frac{1}{2j} \rho S l^2 C_m^\omega$ –coefficient based on the supplementary moment coefficient;

- $K_j = \frac{c_j Q_s}{J}$ –coefficient of damping moment.

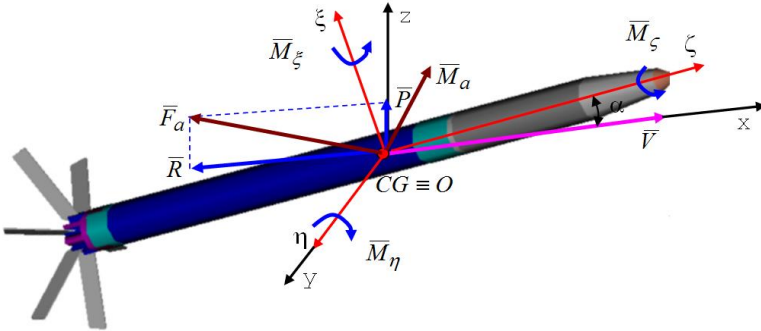


Figure 2. Forces and moments acting on the unguided rocket

The PRND numerical application made by the authors is based on the presented mathematical model (figures 3 and 4). This program is composed of four modules, as the following screen capture shows it:

- the DATA MANAGEMENT module is to save or open all the data relative to our simulation ;
- the PRND PARAMETERS module enables us to set all the characteristics of the unguided rocket given by the manufacturer data, which are constant during our study ; for our simulation we chose the 122mm GRAD-type unguided rocket;
- the FIRING CONDITIONS module enables us to define the parameters concerning the launching of the rocket, that is the initial conditions;
- the TRAJECTORY COMPUTING module calculates the trajectory of the rocket by clicking on the CALCULATE button and by clicking on the VIEW button enables us to select the results we want to visualise and displays them in the form of graphs;

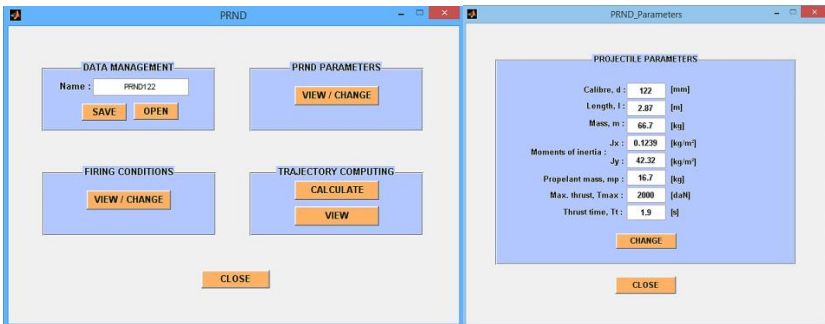


Figure 3. PRND menu and the projectile parameters

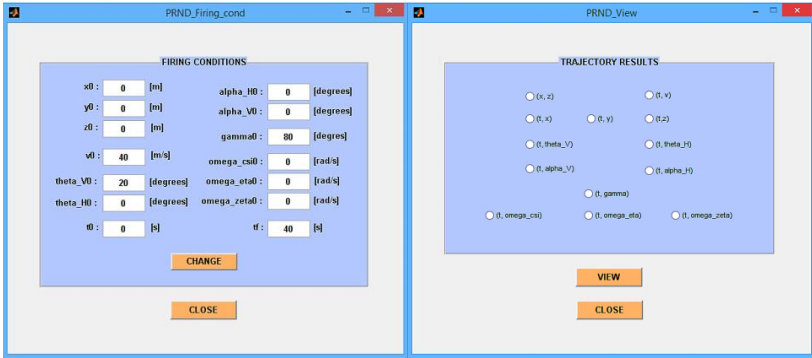


Figure 4. The firing conditions and the trajectory results

4. Numerical results

Next we will apply the mathematical model presented above with the PRND application for some firing conditions fixed (table 1) in order to obtain the elements of the basis trajectory.

Table 1. Initial firing conditions

x_0 [m]	0	v_0 [$\text{m}\cdot\text{s}^{-1}$]	40
y_0 [m]	0	γ_0 [degrees]	80
z_0 [m]	0	ω_{ξ_0} [$\text{rad}\cdot\text{s}^{-1}$]	0
θ_{V0} [degrees]	20	ω_{η_0} [rad/s]	0
θ_{H0} [degrees]	0	ω_{ζ_0} [$\text{rad}\cdot\text{s}^{-1}$]	0
α_{H0} [degrees]	0	t_0 [s]	0
α_{V0} [degrees]	0	t_f [s]	40

First, we focus on the trajectory of the unguided rocket in a vertical plan (figure 5), which has a parabolic form, and on the evolution of its velocity (figure 6).

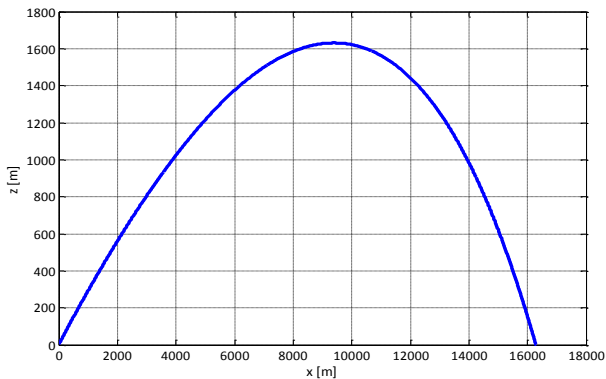


Figure 5. Trajectory of the 122 mm rocket

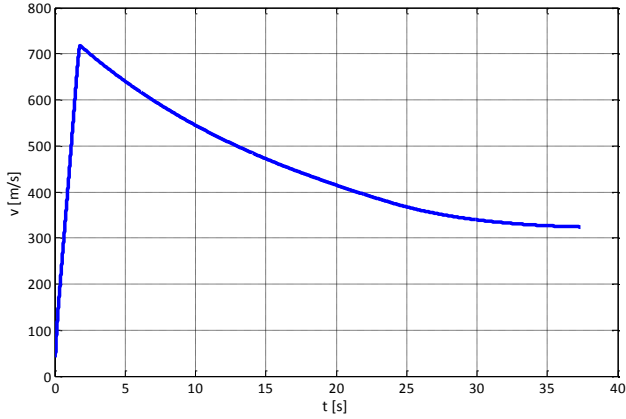


Figure 6. Evolution of the rocket's velocity

After a quick increase, until $V_{max}=718.1$ m/s, reached in 1.82 seconds, the velocity decreases. With these two graphs, we can determine that the point of impact is situated at 16290 m and it is reached after 37.38 seconds with a velocity of 324 m/s.

Then, we focus on the motion of the rocket because of the evolution of two characteristic angles, θ_V and α_V , and on the rotational velocity (figure 7).

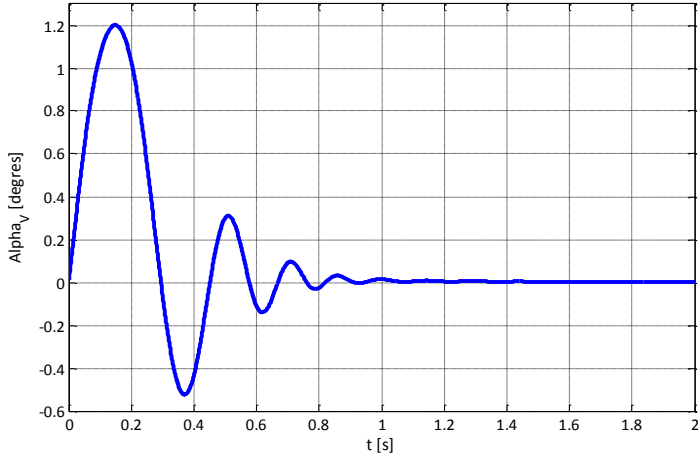


Figure 7. Evolution of the incidence angle

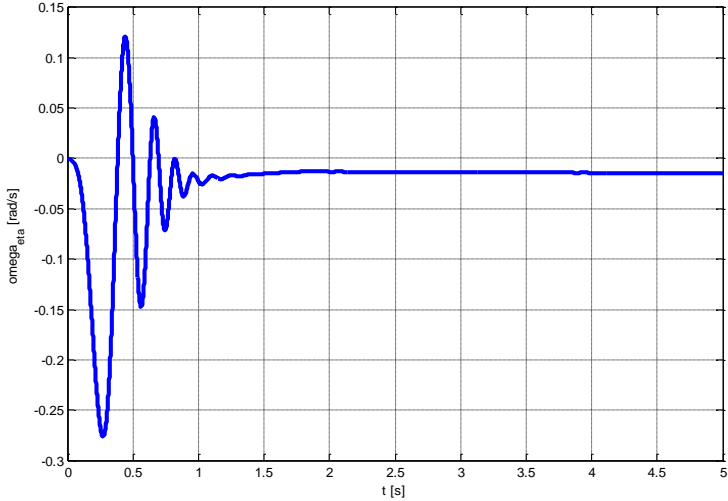


Figure 8. Evolution of the angular velocity

At the very beginning, α_V (the angle between the axis of the rocket and the axis of the velocity) and ω_η (the angular velocity around the axis $\overline{y_p}$) oscillate: the rocket is unstable and describes oscillations around the trajectory (figure 8).

4. Conclusions

In this article we have presented a mathematical model and a numerical application made by the authors that can be used to calculate any trajectory of the unguided rocket. All these trajectories are calculated from a certain initial firing condition. That firing condition can be disturbed by some error sources, also presented in this paper. In order to calculate the effect of the error sources on the trajectory we will modify the equations (3) – (12) by introducing the variations in order to be able to calculate the unguided rocket effectiveness.

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RESEARCH CONCERNING THE UNGUIDED ROCKET EFFECTIVENESS

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Abstract: For the unguided rockets it is essential to obtain the minimum errors possible so that the ammunition can hit the aimed target at the expected point. It is necessary to evaluate how a variation, even negligible, of one of the firing initial conditions could influence the location of the point of impact.

Keywords: Unguided Rocket, Effectiveness, Trajectory, Mathematical Model

1. Introduction

Nowadays, when new types of conflicts exist, more than before the armament system has to be accurate in order not to hit the civil population and civil buildings. That is why in the development of any weapon system, it is necessary to understand as well as possible all mechanical requests interacting in the system [1]. In the case of the unguided rocket, being a long range armament system, the accuracy is more difficult to obtain. We will analyze the effect of the initial firing conditions on the accuracy of unguided rockets.

2. Mathematical model of the unguided rocket effectiveness

In order to analyze the accuracy of the rocket firing it is necessary to study the influence of each initial condition variation on the rocket ballistic characteristics. We will use the mathematical model simplified for the rocket trajectory, having the rotational velocity neglected, [5]:

$$\frac{dx}{dt} = V \cos(\theta_V) \cos(\theta_H), \quad (1)$$

$$\frac{dy}{dt} = V \cos(\theta_V) \sin(\theta_H), \quad (2)$$

$$\frac{dz}{dt} = V \sin(\theta_V), \quad (3)$$

$$\frac{dV}{dt} = a_R \cos(\alpha_V) - K_x V^2 - g \sin(\theta_V), \quad (4)$$

$$\frac{d\theta_V}{dt} = K_z^\alpha V \alpha_V - \frac{g}{V} \cos(\theta_V), \quad (5)$$

$$\frac{d\theta_H}{dt} = K_z^\alpha V \alpha_H, \quad (6)$$

$$\frac{d\alpha_V}{dt} = -K_z^\alpha V \alpha_V + \frac{g}{V} \cos(\theta_V), \quad (7)$$

$$\frac{d\alpha_H}{dt} = -K_z^\alpha V \alpha_H, \quad (8)$$

where:

- x, y, z - position of the rocket centre of mass on the trajectory ;
- θ_V, θ_H – the angle of inclination of the trajectory in the vertical/horizontal plan;
- α_V, α_H – the angle of incidence in the vertical/horizontal plan;
- $a_R = \frac{T}{m}$ –the reactive acceleration;
- $K_x = \frac{1}{2m} \rho S C_x, K_z^\alpha = \frac{1}{2m} \rho S C_z^\alpha, K_m^\alpha = \frac{1}{2J} \rho S l C_m^\alpha$ – coefficients for the drag, lift and aerodynamic moment;
- $K_z^\omega = \frac{1}{2m} \rho l S C_z^\omega, K_m^\omega = \frac{1}{2J} \rho S l^2 C_m^\omega$ –coefficients for supplementary lift and aerodynamic moment;
- $K_j = \frac{C_j Q_0}{J}$ – coefficient of damping moment.

In fact, the hypothesis presented above does not significantly affect the results because the angular velocities are almost zero. In the system of equations (1) – (8), the main variables are: $x, y, z, V, \theta_V, \theta_H, \alpha_V$ and α_H . The initial values of those variables: $x_0, y_0, z_0, V_0, \theta_{V0}, \theta_{H0}, \alpha_{V0}$ and α_{H0} represent the initial firing conditions [3,5]. Firstly, we suppose that all this initial conditions are very well determined, without disturbances. In this condition we obtain an ideal trajectory, named basis trajectory. We consider that the ballistic parameters of the basis trajectory are: $\bar{x}, \bar{y}, \bar{z}, \bar{V}, \bar{\theta}_V, \bar{\theta}_H, \bar{\alpha}_V, \bar{\alpha}_H$.

In reality, the initial firing conditions are not very well determined [2]. In that case, the initial firing conditions have small variations: $\delta x_0, \delta y_0, \delta z_0, \delta V_0, \delta \theta_{V0}, \delta \theta_{H0}, \delta \alpha_{V0}$ and $\delta \alpha_{H0}$. In time, due of this initial small variation [4], the real trajectory will have the following variations:

$$\begin{aligned} x &= \bar{x} + \delta x, y = \bar{y} + \delta y, z = \bar{z} + \delta z, V = \bar{V} + \delta V, \\ \theta_V &= \bar{\theta}_V + \delta \theta_V, \theta_H = \bar{\theta}_H + \delta \theta_H, \alpha_V = \bar{\alpha}_V + \delta \alpha_V, \alpha_H = \bar{\alpha}_H + \delta \alpha_H. \end{aligned} \quad (9)$$

Using the relation (9) in the system of equations (1) – (8) we will obtain a new system of equations for the variations of ballistic characteristics:

$$\frac{d\delta x}{dt} = -\bar{V} \cos(\bar{\theta}_V) \sin(\bar{\theta}_H) \delta \theta_H - \bar{V} \cos(\bar{\theta}_H) \sin(\bar{\theta}_V) \delta \theta_V + \cos(\bar{\theta}_V) \cos(\bar{\theta}_H) \delta V, \quad (10)$$

$$\frac{d\delta y}{dt} = \bar{V} \cos(\bar{\theta}_V) \cos(\bar{\theta}_H) \delta \theta_H - \bar{V} \sin(\bar{\theta}_H) \sin(\bar{\theta}_V) \delta \theta_V + \cos(\bar{\theta}_V) \sin(\bar{\theta}_H) \delta V, \quad (11)$$

$$\frac{d\delta z}{dt} = \bar{V} \cos(\bar{\theta}_V) \delta \theta_V + \sin(\bar{\theta}_V) \delta V, \quad (12)$$

$$\frac{d\delta V}{dt} = -\alpha_{\bar{x}} \sin(\bar{\alpha}_V) \delta \alpha_V - 2K_x \bar{V} \delta V - g \cos(\bar{\theta}_V) \delta \theta_V, \quad (13)$$

$$\frac{d\delta \theta_V}{dt} = K_2^\alpha \bar{V} \delta \alpha_V + K_2^\alpha \bar{\alpha}_V \delta V - \frac{g}{\bar{V}} \sin(\bar{\theta}_V) \delta \theta_V, \quad (14)$$

$$\frac{d\delta \theta_H}{dt} = K_2^\alpha \bar{V} \delta \alpha_H + K_2^\alpha \bar{\alpha}_H \delta V, \quad (15)$$

$$\frac{d\delta \alpha_V}{dt} = -K_2^\alpha \bar{V} \delta \alpha_V - K_2^\alpha \bar{\alpha}_V \delta V - \frac{g}{\bar{V}} \sin(\bar{\theta}_V) \delta \theta_V, \quad (16)$$

$$\frac{d\delta \alpha_H}{dt} = -K_2^\alpha \bar{V} \delta \alpha_H - K_2^\alpha \bar{\alpha}_H \delta V. \quad (17)$$

3. Numerical results

In this paragraph we present some numerical results obtained after having solved the equations (10)-(17). In that case we have considered initial variations of the firing conditions and we want to see the impact of this initial variation on the trajectory elements.

The value of $\delta \mathbf{x}$ is constant and equal to $\delta \mathbf{x}_0$ during the flight. In this case we have obtained a translation of the trajectory in the \mathbf{x} direction with $\delta \mathbf{x}_0$. The same behavior is obtained for $\delta \mathbf{y}$ and $\delta \mathbf{z}$.

A variation of the value V_0 changes the value of V during the flight, but in all the cases, the value of δV at the impact is close to zero, which means the value of V at the point of impact is almost unchanged (figure 1). If the muzzle velocity decreases, the point of impact will be in front of the desired point of impact and if the muzzle velocity increases, the point of impact will be behind of the desired point of impact: for a maximum change of 10 m/s, we obtain a deviation of 146.625 m (figure 2). A change of V_0 has an important influence since the target could be missed up to a hundred of meters.

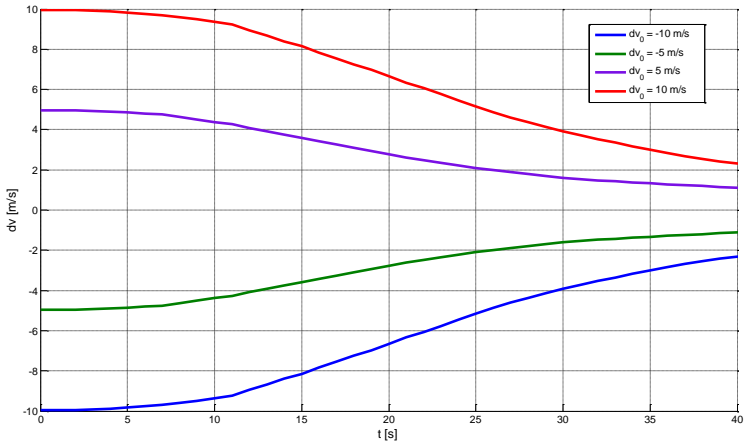


Figure 1. Influence of δV_0 on the δV

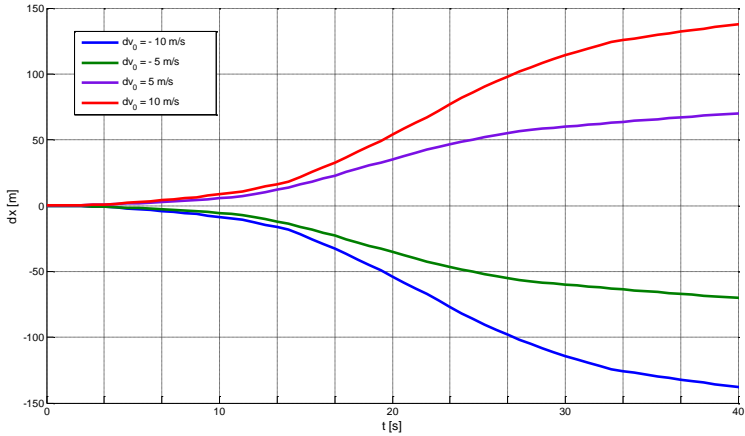


Figure 2. Influence of δV_0 on the δx

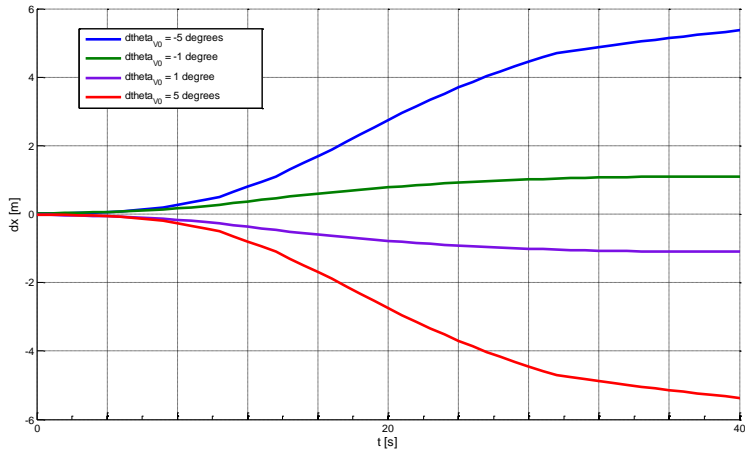


Figure 3. Influence of $\delta \theta_{V0}$ on δx

The initial value of θ_V has a significant influence on the δx (figure 3). If the initial value of θ_V decreases, the range x increases and if the initial value θ_V increases, the range x decreases. For a maximum change of 5 degrees, the point of impact moves around 6 m (0.03% of maximum range 16290 m).

4. Unguided rocket effectiveness simulation

After studying the influence of a single variation of one of the initial conditions in the previous paragraph, we will now make simulations considering overall variations of initial firing conditions.

These simulations, which are a series of points of impact, enable us to determine the mean point of impact (MPI) and the circular error probable (CEP), which will be compared with the size of several specific targets. Then, we are able to determine the rate of damage inflicted.

With the following variations: $\delta x_0 = \delta z_0 = 0.1$ m, $\delta V_0 = 5$ m/s, $\delta \theta_{V0} = \delta \theta_{H0} = 1$ degree we obtain the results presented in figures 4 and 5. The mean point of impact has as coordinates $x_m = 16\ 297$ m and $y_m = 24.78$ m. The CEP is 504.66 meters. In comparison with the basis trajectory, the mean point is deflected on the left of around 20 meters and in front of the desired point of impact with around 80 meters.

In this part, we will compare the size of targets with the CEP in order to determine the probability of impact and damages. To simplify, we consider the target as being circular having the radius r_T . Firstly we consider the target centered on the mean point of impact (16 239; - 13.86) and we will modify the radius in order to determine the probability of damages.

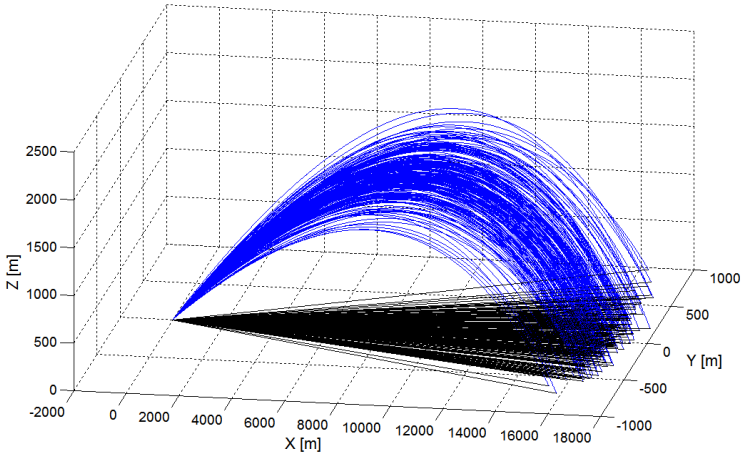


Figure 4. Trajectories

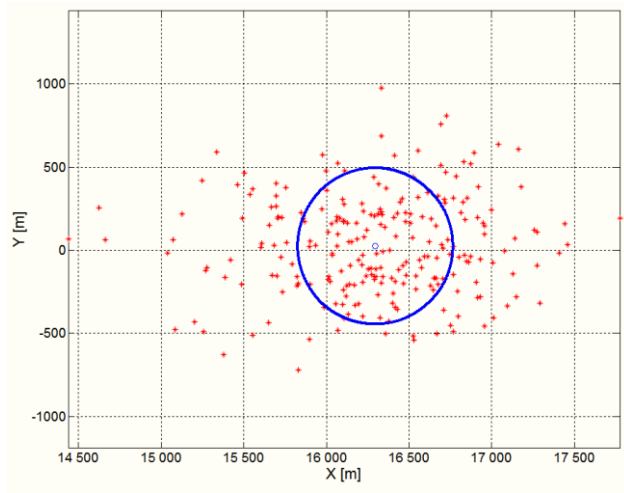


Figure 5. Points of impact and CEP

- **Case: $r_T < CEP$.** We take in consideration a target having the dimension smaller than CEP. In that case the probability to hit the target is 15.63% (figure 6), meaning that we need 7 unguided rockets to have a chance to reach the target.
- **Case: $r_T = CEP$.** For a target having the dimension comparable with CEP, the probability to hit is 50% (figure 7).
- **Case: $r_T > CEP$.** The probability of hitting a target with $r_T = 600$ meters is 62.50% (figure 8).

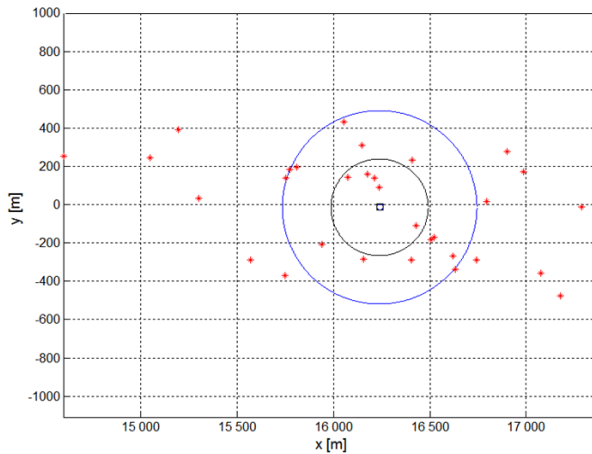


Figure 6. Target vulnerability for $r_T = 252.33$ meters ($CEP/2$)

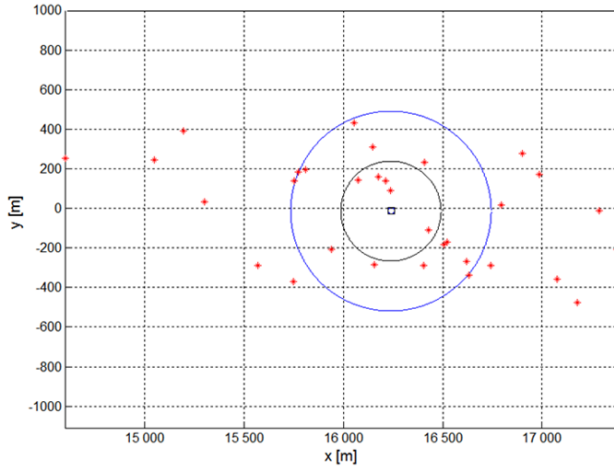


Figure 7. Target vulnerability for $r_T = 504.66$ meters (CEP)

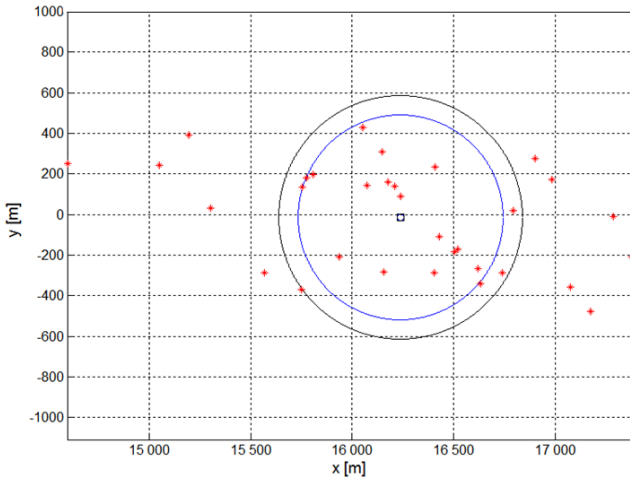


Figure 8. Target vulnerability for $r_T = 600$ meters

In the following table we have presented the probability of impact determined for some dimensions and positions of the targets.

Table 1. Probability of hitting the targets with different dimensions

Parameters	$(x_T, y_T) = (x_m, y_m)$	$(x_T, y_T) \neq (x_m, y_m)$		
		$d < CEP$	$d = CEP$	$d > CEP$
$r_T = 100\text{ m}$	0 % -	0 % -	3.13 % 32 shoots	0 % -
$r_T = 252.33\text{ m}$	15.63 % 7 shoots	15.63 % 7 shoots	3.13 % 32 shoots	0 % -
$r_T = 400\text{ m}$	37.50 % 3 shoots	31.25 % 4 shoots	28.13 % 4 shoots	15.63 % 7 shoots
$r_T = 504.66\text{ m}$	50 % 2 shoot	46.88 % 3 shoots	37.50 % 3 shoots	21.88 % 5 shoots
$r_T = 600\text{ m}$	62.50 % 2 shoot	59.38 % 2 shoot	50 % 2 shoots	31.25 % 4 shoots

4. Conclusions

In this article we have presented a mathematical model for computing the effect of the initial firing conditions on the trajectory accuracy. The obtained results lead us to the following conclusions: if the target is too small in comparison with the CEP the probability of impact is equal to or near zero; if the size of the target increases, the probability of impact increases; the best probabilities of impact are in the case when the centre of the target is inside the circle of CEP. Using the mathematical model presented above it is also possible to determine the minimal number of shoots to reach the target.

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RECRUITMENT AND SELECTION OF PERSONNEL IN THE MODERN HIERARCHICAL ORGANIZATION

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Abstract: *Human resource management is a skillful combination of business affairs and personnel matters. Workforce organization should be treated as an asset of the company and the potential to competitiveness of the company during the operation of the market. The article speaks of particular importance for the organization and employees the need to make rational decisions in the field of human capital management company.*

Keywords: *Human Resource Management, personal policy, HR processes, staff recruitment and selection*

Introduction

Analysis of the literature suggests that the concept of human resource (HR) management appeared in Poland for the first time in the nineties of the twentieth century. Originally this was a translation of the English-language literature (called Human Resources Management), and it has been formally adopted by the authors of Polish publication. Currently, often uses the term - human capital management.

Alexis Poczowski formulated such a definition of HRM: *"Human resource management is defined in the management concept in area of the HR function of companies in which human resources are seen as an asset for the company and a source of competitiveness, calling for the strategic integration of personnel issues and business affairs, an active role in the line management in solving personal issues and points to the need for creating organization culture, integration of HR processes and building employee engagement as a tool for achieving the goals"*.¹

It implies that human resource management is a skillful combination of business affairs and personnel workforce should be treated as an asset for the company and the potential of competitiveness in the company while existing on the market. So the question in the publication is of particular importance of employees for the organization and the necessity to make rational decisions in the field of human capital management. None modern organization can function properly without adequate human resources. The employees' skills should be properly utilized, parallel to the chance of human potential developing.

It is mentioned in another definition, in which HRM is presented as *"a strategic and coherent approach to the management of an organization's most valuable assets – which are the working in people who individually and collectively contribute to achieving or-*

¹ [10] p. 34.

gation's objectives."² This means that human resource management is the management of employment, aiming to gain a competitive advantage over other organizations and, what's more, the correct recruitment and selection process, which allows to employ highly dedicated and qualified staff by using multiple techniques, such as cultural, structural and personnel ones.

Taking issues related to human resources management the authors wanted to point out that the purpose of HRM is not only increasing productivity and organization's profit but also the development of the individuals. HRM concerns training, continuous development of skills acquired at the workplace and ensuring the workers' well-being so that they could feel valued and adequately rewarded for their work.

Caring for people is helpful in shaping and creating a suitable climate and organizational culture. It is nothing more than "personal policy of the organization." This term should be understood as the sphere of management that involve conscious formula making of the social potential in the organization.

Commonly the personnel policy is understood as programs and directions of state management of public affairs, consistent application of the principles and methods by managers in relation to subordinates. With regard to the article topic, however, the most relevant is the understanding of the personnel policy as business managers actions, consisting of making choices in the existing operational areas. Personnel policy exists only when it is possible to make choices. Each decision has its own character and manner. For personnel policy it can be understood as team's objectives, policies and measures arising from the HR strategy, aiming to serve its implementation, through appropriate guidance in relation to the operational management of people in organizations.³

Selected HRM processes in modern organization

The first phase of HR process in an organization is undoubtedly the process of HR planning. It is understood as forecasting HR demand based on detailed description of particular positions and the workers features. It is to maintain still and proper level of meeting the needs of the organization. In planning there are some particular main phases that are presented in Figure 1.⁴

Attracting workers cannot be accidental, because it would expose the organization to malfunction. Forecasting supply and demand when it comes human resources should be understood as the necessary number of employees to meet the needs of the organization. This applies to the competence, as well as qualifications. This is possible only after a thorough observation, assessment and diagnosis of the work done in the organization. Employment Plan, which is the last step in the planning process of human resources is the "demand for labor organizations in the planning period, in terms of qualitative and quantitative (qualifying) and the time-space and ways to remedy the imbalance between employment forecast and desirable"⁵.

An important issue about which the employer should keep in mind is to provide opportunities for promotion and career development and appropriate to inform the employee about existing opportunities for development. The solution can be not only in the

² [1] p. 19.

³ [1] p. 108.

⁴ [12] p. 198.

⁵ [8] p. 51-53.

planning of employment, but also in the selection of training and in the development of methods for assessing work-which translates into determining payment.

When the specific staffing needs, it's time to start the recruitment process. It is "accepting job applicants, conducted by well-known (also to a candidate) mode. It is a process which aims to bring about individual positions to be fulfilled, so that - on the one hand – ensurance and efficiency of the tasks assigned to the work position, and on the other one – that these tasks were adapted to the possibilities, aspirations and expectations of the candidates. It is also the attraction of the organization of relatively large number of candidates to assure their selection"⁶.

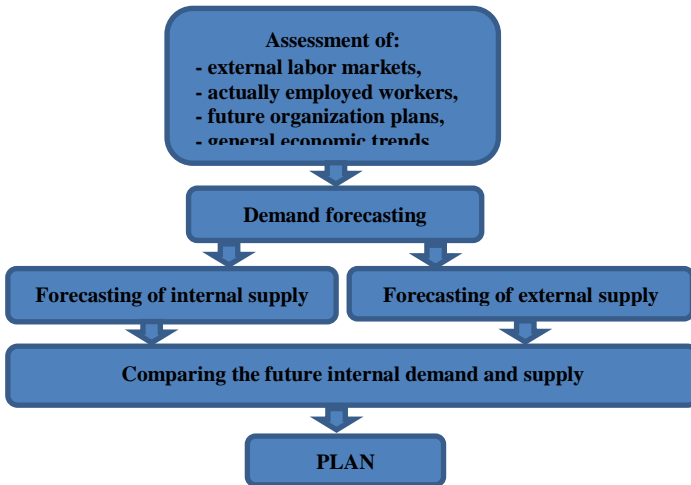


Fig.1. Planning of Human Resource Management process

Source: [7] p. 429

The mentioned before selection is based on "an evaluation obtained during the recruitment of candidates for the job and a candidate for the position that best meets the expectations of the employer as a result of the job description and its profile of the qualifying profile of the employee. While the selection competencies of job candidates in terms of their suitability for the position are examined. Estimated are also personal qualities, qualifications, skills and experience of the candidates"⁷.

After deciding on employment of employee's there is some time for adaptation. This is generally the process of adjusting to a person to conditions available in the new workplace. The employee is introduced to the company and implemented in future tasks. An important aspect in these activities is to ensure that adaptation will proceed peacefully and as soon as possible.

The key to successful adaptation is to create a basis for the task force on the problems and belief in their own ability to cope with stress. It is in the process of adaptation what is important to realize the employee that being calm and assertive form the basis of the output from difficult situation.

⁶ [14] p. 22-23.

⁷ [14] p. 24-25.

A very important process of human resources management, which has a direct impact on the operations and the results of the company, is motivating employees.

Positive motivators encourage certain actions, attitudes and behaviors for the sake of the expected and associated with them satisfaction and gratification. Negative motivators are to discourage the actions, attitudes and behaviors known to be harmful, unwanted or inappropriate - for the sake of possible reprisals⁸ In modern organizations, incentive systems are usually based on both positive and negative motivators. Please note that the performance will be achieved only if an appropriate balance is maintained between rewarding employees and their punishment (using a "stick and carrots").

In order to diagnose the performance and functioning of the organization's staff the process of measuring the human resources staff is used. Staff evaluation is *"the process of comparing their performance, qualifications and personal qualities and attitudes and behaviors manifested by established criteria consistent with those used in the institution standards (benchmarks). The result of the assessment is to determine the "value" of each individual employee (the pros and cons), and an assessment of human potential of particular groups of workers, and finally, the entire staff of the institution"*.⁹ The most common in organizations is to assess the current, as it is constantly made by the employee's superiors. It can be done formally - the action shall be documented or informally - to assess how the tasks represented the attitude and behavior of individual employees are only individual assessment of superior.

The last process that takes place during the operation of the employee in the organization is exempt. This is usually a consequence of changes the organization and its environment. The demand for labor force change that requires some flexibility in the human resources management, so that not to expose the organization to financial losses caused by the maintenance of unnecessary staff. *"Releasing staff is purposeful action leading to termination of employment contracts, the termination of certain grounds for the provision of the employees working for the former employer. Separation of employees of the organization may be due to the initiative of the director representing the interests of the company. If the motive of exemption is excessive employment in the company, it is called the job cuts"*¹⁰. It is also important that the party terminating the employment relationship can also be a worker and in this case refers to the so-called. *"Departure"* or *"released"* from the workplace.

Figure 2 illustrates the HR processes. This is the simplifying HR model made by the authors as the whole process starting from planning the employment to reduce the level of it is more complex and complicated in practice.

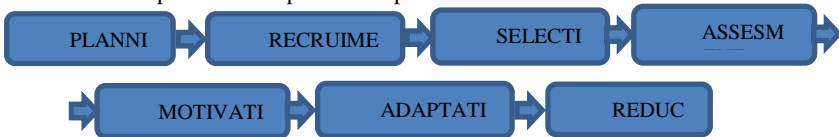


Fig. 2. Selected Human Resource Management processes

Source: its own

⁸ [9] p. 257.

⁹ [11] p. 284.

¹⁰ [6] p. 403-404.

The role and actions of recruitment and selection in human resources management process

Overall, the recruitment process (in the literature also called recruitment) is attracting candidates to the organization's work in such numbers that allows to perform the selection. *"The result of properly conducted recruitment process should be to obtain the most suitable composition of candidates with necessary skills and qualifications"*.¹¹ The activities of recruitment are directed to inform potential candidates about the organization and the ability to work as part of its structure. It is also important to create a positive impression in order to increase the willingness to work.

Due to the criterion which is the source for recruiting candidates, recruitment processes are divided into internal and external. The first one is connected with *"seeking candidates among the staff that is already employed, therefore, it is to attract employees by changing the existing working conditions and wages"*¹². The advantage is certainly clear career paths for employees and usage of their existing skills and knowledge about the company. It also allows to reduce the costs associated with the collection and verifying information about potential candidates. Using internal recruitment raises the level of motivation of employees do a better job by showing them the possibilities and opportunities for advancement, and career development within the company structure. An important benefit is the reduction of time to adapt to the employee to the organization, the prevailing requirements of new tasks due to the fact that he is familiar with the internal procedures and organizational culture of the company. The disadvantage of this method of selection may include calling the conflict among employees applying for promotion to the particular position. Such conflict can paralyze work for long time, so it is recommended to make sure that there were clearly stated reasons for choosing no other person in the new position. Another weakness of internal recruitment is a kind of "state of the place", due to the lack of fresh ideas and inspiration that new employees bring to the organization.

External recruitment is when organization's internal resources are not sufficient, and there is need to fill in the new positions. Employees are drafted from outside the structures of the company. The main advantage is confidence that the company will have a relatively large number of applicants for the position, hence - more possibilities of the right person choice. In addition, employees from outside the company often bring new and exciting ideas that give chance to *"refresh"* existing patterns of functioning. The disadvantages of this method are the high costs of the recruitment process. Typically, external recruitment campaigns are relatively expensive and time consuming. Another weakness is the risk of demotivation for current employees by providing them information that they are not adequately knowledgeable and have no chance of promotion.

After an appropriate employment plans and analysis recruitment process can begin. There are two types distinguished: the broad and the segment one¹³. The main difference between them is distinguishing who they are directed to and what is the nature of making recruitment activities. The first concerns searching candidates for jobs that do not require specialized skills. It is typical about manufacturing jobs, so the wanted candidate is among the wide range of the population, such as in the whole of the district. However, segment recruiting is to attract candidates with specific field of knowledge, skills and

¹¹ [14] p. 61.

¹² [13] p. 25.

¹³ [2] p. 61.

qualifications. In this case, the carrying out of the recruitment takes place in a slightly different way than the above one. Information about searching the employee to the company should be included in media that are of interest for data information by specialists or experts, such as businesspeople or lawyers. The announcement should include details about the nature of work and the description of looked for the candidate.

One of the most common methods are newspaper ads. They are placed in newspapers and journals. Their choice is affected by three factors: cost, readers' profile and publishing level. Table 1 shows the factors to be considered while preparing and designing ads.

Table 1. Features having impact on announcement design

Feature	Comments
Organization image	Advertisements for recruitment shall comply with the public image of the company and improve it. For example, the traditional bureaucratic organization can succeed by using cutting-edge, and full-page color ads, nor employ such employees who with no trouble would adjust to the culture by such actions.
Position type	Notice the position of Director at the highest level requires a different approach than a job ad for a regular collar worker.
Selected media	Each media has its own style, which does not always fit to the data announcement. It is worth viewing a few older numbers of selected newspapers or magazines to find out what works for them and what is not. Notice of frivolous content will not work in a formal magazine but would do much more in suitable place for it.
Target market habits	Notice by which the company is looking for a qualified and experienced accountant, working for a large traditional organization with a long history, is unlikely to attract the right people, if they were to title: "Can you creatively deal with numbers?". While it is sometimes useful to ignore some standards, it should be done with caution.

Source: [5] p. 42

The table shows that the content, form and the location of the ads have a direct impact on the chances of success in the search for suitable candidates for the job. A very simple and common method of recruitment is the use of bulletin boards. They may be placed, for example, in the post office agencies, employment agencies and even the supermarket. It is inexpensive and relatively simple method, so it used mostly by small firms seeking all possible methods to reduce the costs associated with the recruitment process.

Another example of recruitment are work trades. We can divide them into general (they offer a wide range of career choices), local and fair organized by employers who are looking for a large number of new employees for various positions. Another form of job fairs are known as open days. That is the method that higher education students are searched by universities and higher schools when they want to raise their proposed courses of study. Such an event must be carefully planned and prepared so that it was possible to monitor the process and the results were obtained and preserved for later use.

The acquisition of potential candidates for the vacant position is also support of employment agencies. Their function is to collect information about job seekers and companies seeking employees and to make proposals to "fit". The company choosing to get help employment agencies must take into account the cost of hiring the company. It is assessed in different ways, but mainly based on the salary for the position.

A common technique seen in search of employees to the highest position in the organization is to identify a potential candidate by a third party. When a company receives an indication of a potential candidate, contact with him and is trying to gain the information necessary for a realistic assessment of qualifications and competences. This technique provides employment opportunities to people who, because of low self-esteem underestimate their abilities or are not aware of them. Using this method, remember to keep the criteria for work, not for personal reasons and not forcing people to referrals too radical and rapid changes associated with their employment. Reprehensible is also recommending people to come especially if they do not fit the profile of sought worker (which is called nepotism). Often the case in choosing the method of recruitment is conducting meetings in the form of recruitment by Assessment Centre (multifactorial evaluation). It is innovative method used in the recruitment process as a set of tasks with a variety of forms and used to verify the competence relevant to the position for which they are applied for. Assessment Center also has its use in making other personnel for existing employees. It can be also used to determine the strengths of the employees and what areas should be developed, and thus the planning of development activities in the organization, such as training¹⁴.

When the list of candidates for a given position is closed, the selection process begins. Its aim is to reduce the number of candidates and selection of the best ones in terms of qualifications, experience and other required features. It is possible to conduct positive selection (selection of the best) or negative (rejecting the worst). The most commonly used method of selection is to analyze the application documents which is usually CV and the list of application.

During the analysis of the documents the data on education, work experience and declared skills are examined in particular. The task of which is to draw conclusions and to assess the human basis of documents is difficult. To facilitate this, the selectors bring specially prepared forms for CV, which allows the system to standardize the assessment of candidates and their qualifications. Unfortunately, people often guided by the desire to get a job give false information about themselves or conceal certain issues (eg. language proficiency, ability to use computer programs). Verifying the facts is possible only during the work show or during the interview.

Types of interviews with candidates for the study are presented below.

Individual Interview - carried by only one person. Prior to the interview questions must be carefully determined to be asked to the candidates.

Informal Interview - the interview between the candidate and two or more people involved in the selection. The results and findings are often transmitted to other members of the group or appointed committee that makes the final hiring decision.

Panel Interviews - are considered to be the most widely used method of selection. They rely on the confrontation of several candidates for the position of a group of people responsible for the selection.

Structured Interviews - rely on the detailed preparation of each stage and asked for the questions so as to constitute a logical whole. To ensure the highest degree of objectivity questions should be asked to candidates in the same way. The final decision is based on the collected primary materials and notes taken during the interview.

¹⁴[15] p. 68-69.

Interviews based on criteria - tend to focus on certain elements of the personal profile. The aim is to carefully examine the details of a personal profile that will contribute to the future of work and ensure efficiency. Very similar form of the particular interview is focused interview. The difference is stressing the questions related to the position rather than the previously concerned-personal profile.

Episodic Interview - is to examine the suitability of the use of skills possessed by the candidate under certain circumstances. Frequently asked are the questions that are used to assess the motivation of the candidate and his involvement on the job.

Stimulus Interview - questions are used to stimulate the imagination of the candidate. Are asked questions like "what if ...?" which allows to determine whether a person will be able to find themselves in the future workplace.

Final Interview – there were probably some other selection technics used before. The interview is used to verify if all necessary documents are delivered. It is the last chance to fulfill any needed information. During that phase negotiating starts and it is time to make the decision by both sides of the recruitment process¹⁵.

A completely different method of selection is to recommend the preparation of a presentation by the candidate for the post. This allows you to examine communication skills and presentation of certain content in a public forum. Requires the ability to make a presentation to the plain language and good use of time.

Another method of selection may be psychometric tests. They are used because of the accuracy of results and ease of use. Importantly, psychometric tests should be used only with the consent of the candidates¹⁶.

Using that method selection manager is to obtain a sufficient amount of information on the candidates and maximize the opportunity to take an appropriate decision about employment. To do so, keeping the practicality of the method chosen and the meaning in its usage and practicality is crucial. The most commonly used method is still an interview, because it works regardless of position. Interview allows direct confrontation, deeper understanding and simultaneous verification of previously provided biographical data. When selecting a method of recruitment a manager should also be aware that it is desirable not only to the development of the employment of a new employee, but also in the form of personal development managers and other people involved in the selection process.

Choosing the appropriate method should pay attention to factors such as job that will be filled with impact of the chosen method of both the candidate and the organization and the likelihood of achieving the desired results. However, the most important feature that should be characterized by effective selection is primarily accuracy in the selection of a candidate for an employee organization.

Conclusion

Issues related to human potential management in modern organization is concerned as difficult, so it is important to have well prepared workshop of personnel policy. Please note that all administrative action should be carried out diligently and conscientiously. The mutual willingness to cooperate and to create a positive relationship between employee and employer is crucial in the situation. These relations, although it remains at the

¹⁵[3] p. 18-20.

¹⁶ [4] p. 39-43.

business level should be honest and sincere. Knowing the exact specifics of HR processes and adhering to these rules, it is possible to be close to the real implications of the actions and foreseen in the field of human resources management.

Considering the currently used methods commonly used in the recruitment and selection, do not forget the Internet. "The times when the website has served as a bulletin board are gone, the development of e-recruitment has led to the fact that today virtually the entire process of obtaining workers can be administered on-line".¹⁷ The main benefits of using the Internet in recruitment and selection process is reducing costs, saving time and universal access, regardless of the place of the candidate. These features result in continuous growth of interest in gaining employees in the Internet. It is also possible to check employee's skills of using modern information technology and systems.

Based on the collected materials, acquired knowledge and described assumptions it can be concluded that the changes taking place during the implementation of HR processes aim to improve the situation of the organization. Managers have the opportunity to improve their managerial skills by gaining experience and increasing the precision of the decisions taken by professional practice. It is necessary to be aware also of applicants (during the recruitment and selection) and employees. They represent human potential, that is managed by senior management level. This has an impact on their career and further development within the organizational structure of the company.

Quoted by the authors of the article, definitions and expressions are only the theoretical aspect of the personnel process from recruitment through to dismissal. The conclusions that arise when analyzing the content of these relate mainly to the fact that the knowledge of this area can be significant help during the work for those who are involved in human resources management. It is also important area for universities that are trying to find and collect as many students and recruit top faculty who are available at the labor market.

The authors issues may give rise to further, more exhaustive study of the literature relating to the HR processes and the organization from the employment side. It is also possible to perform testing for processes such as human resources and personnel policy in the university as modern organization, where appropriate human resource management has a significant impact on its operations.

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ADVANCES IN THE AREA OF GREENER MUNITIONS

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Abstract: *The paper provides an overview of the lessons learned in Romanian MoD while trying to reduce the environmental impact of the armament systems, in the context of fast changes in legislative, social and technological challenges. Legislative risks and drivers, steps to be followed and relevant aspects regarding available solutions for reducing the environmental impact of munitions are discussed.*

Keywords: *environmental impact; heavy metals; toxicity; energetic materials; munitions*

1 Drivers demanding for Greener Munitions

Firing of conventional munitions has an important effect on the environment, which manifests mostly in the firing position (direct action of gases over the operators and nearby personnel; deposition of incomplete burn products on the soil; atmospheric pollution; direct action of the shock wave against operators, nearby personnel and structures; noise pollution) or in the target position (explosion effect; unexploded ordnance; fragments from projectiles, fuses, etc., resulted from firing; soil, water and air contamination; noise pollution). Other important negative effects are generated during manufacture and disposal of the munitions, but these are easier to control and mitigate.

In the last two decades we assisted to stronger and stronger trends, which are driving increased pressure on users and manufacturers of energetics and munitions to approach the improvement of the environmental impact of their products, starting with compliance with the national and international applicable regulations.

The complexity of environmental legislation regarding manufacture, use and waste treatment is expanding rapidly around the world, but especially in EU and US. REACH, RoHS, and other directives are introducing more and more restrictions and disclosure regulations. In parallel, the enforcement agencies and NGO's are stepping up surveillance as they become more aware on how to enforce regulations so they are active in exposing violations.

Nations are increasingly concerned about environmental, health, and safety aspects incurred by the use and disposal of these materials, and they are willing to support higher acquisition costs for environmentally friendly ordnance that can diminish the costs related to the management of training ranges and disposal actions. In the public sector, we can see increased efforts to update the purchasing policies by taking into account the environmental impact of the products. The best example is the EU Ecolabel scheme aiming at highlighting products that have a reduced environmental impact throughout their entire life cycle, from the raw material to production, use and disposal.

In this context, of fast changes in legislative, social and technological challenges, numerous countries and organizations have acknowledged the environmental impact of military activities and dedicated a lot of effort towards its assessment and mitigation. Munitions were blamed as the main vector for spreading dangerous chemicals in the environment, varying from heavy metals to complex organic molecules, thus the concept of Green Munitions (or Greener Munitions) being introduced and developed in MoDs and industry.

In Romania, the National Defence Strategy adopted in the last years urged the RO MoD and the defence industry to adapt and comply to EU legislation, to prevent pollution and optimize the waste management, to extend their efforts to re-establish and preserve the environment, to encourage and promote less pollutant activities and technologies and to reduce negative impact of military activities on the environment. In this context, the RO MoD has decided to improve its knowledge, procedures and tools for the environmental management in order to diminish the consequent impacts.

The involvement in the excellent collaborative work performed within European Defence Agency - EDA-GEM2 project *Environmentally Responsible Munitions – ERM* (Ad Hoc project led by UK and supported by other six nations: NL, PT, GE, FR, NO and RO) greatly contributed to a better understanding of this area.

2 Impact of legislation on ammunition production, use and disposal

National legislation is usually defined by: Laws, Decrees, Decisions of the Government, Orders of the Ministry/Agency of Environment, Standards or Regulations. A synthesis of the provisions regarding the maximum allowable concentrations for substances of interest should be used for the comparative evaluations after field and laboratory experiments. Regarding the European legislation, the first to be mentioned is the Directive 2000/76, which has direct implications upon incineration installations of ammunitions and EM, requiring the use of a series of filtration and purification systems for gases resulted in the process. The Directive is based on an integrated approach, containing both provisions concerning the maximum permissible air emissions and maximum allowable values for water emissions. The incineration or co-incineration installations have to be approved and operation approval is given by the competent authorities only if it satisfies the 76 Directive requirements. The Directive requires installations equipped with special monitoring system of the plant parameters and emissions values. The fulfillment of 76 Directive provisions makes EM's incineration process very expensive, so many demil agencies are starting to re-evaluate the possibility of recovery and reuse of EM.

The provisions of other EU regulations were analyzed as they may affect the future use of certain chemicals in the manufacturing process of EM and ammunitions.

What we concluded after the EDA-ERM experience was that the most important legislative drivers in EU, in this area, are the REACH for the manufacture, the waste directive and the air quality directive for disposal and the national provisions regarding thresholds concentrations of different contaminants in air, water and soils for the use of munitions. An EDA study on Ammunition non-EU Dependencies [1] revealed that basically for all infantry, tank and artillery ammunitions there are major non-EU dependencies generated by environmental legislation and especially by REACH.

ECHA (European Chemicals Agency - Helsinki, Finland) is the EU agency that administers the registration, evaluation, authorization and restriction of chemicals. SVHC (Substance of Very High Concern) chemicals, which are listed by the agency, have to be authorized by the ECHA before production, import or use inside the EU. Member states, ECHA or the European Commission may propose a substance to be identified as a SVHC. At this point, more than 140 substances are on this list, including some very important chemicals for the ammunition industry, such as 2,4-dinitrotoluene, di-butyl-phthalate, di-isobutyl-phthalate or bis-(2-ethylhexyl)phthalate. The SVHC list is amended continuously and a substance which is once on the list will be always on the list. The substances identified in the SVHC list are eventually included in Annex XIV of the REACH Regulation and once included in that annex, they cannot be placed on the market or used after a date unless the company is granted an authorization. For example, at this point 2,4-dinitrotoluene, di-butyl-phthalate or lead and other 20 compounds used in ammunitions are on this authorization list.

In RO, a review of the ammunitions in use and their components revealed the following substances of concern from the perspective of the EU and national legislation: Pb compounds (picramate, oxides, azide, styphnate); Sb compounds; Ba compounds; Hg compounds; Sr compounds; W; Potassium nitrate; Potassium chlorate; Ammonium perchlorate; Phthalates (dioctyl and dibutyl); Halogen-compounds (carbon tetrachloride, hexachloroethane, hexachlorobenzene); DPA and nitroso/nitro derivatives; Centralites; NC; TNT; DNT; RDX; PETN; EGDN; NG.

3 Ways to make munitions greener

There are numerous ways to reduce the environmental impact of military training, such as the use of greener materials, replacement of toxic compounds from ammo parts, smart range management to control contamination and ease of remediation, extensive use of self-destruction mechanisms, practice with non-pollutant blank ammunition, detection and disposal of unexploded ordnance (UXO), and others.

An important phase of the process should be the acknowledgement of the significant environmental problems raised by the legislative or social drivers and the development of a coherent assessment process for the evaluation of environmental impacts. This could involve for the MoDs to enforce specific environmental policy for the development of new munitions, for the periodic T&E phase, or the procurement phase. There are European countries, such as UK [2], which have successfully developed and applied environmental management systems and assessment methodologies to assist MoDs in the identification, characterization and prioritization of the environmental impacts and risks, related to the manufacture, use and disposal of ammunitions and energetics.

The legislative targets and drivers should be very well defined, which involves a thorough study of the national and international legislation regarding the environmental provisions in manufacture, use and disposal.

Secondly, an inventory of all the munitions in use and their main constituents should be performed, conducting to the selection of “problematic” ingredients that could be the source of pollution/health issues and could make the object of replacement and subsequent redesign of the system.

The third phase, and maybe the most difficult, is the development of the theoretical and experimental tools for the assessment of the environmental impact in very specific

situations. If we are to refer just to the use of the ammunitions, a proper assessment involves the following: calculus and/or measurement of the combustion products and residues released in the environment, measurement of deposition rates, and evaluation of short/long term effects, persistence, transport, eco-toxicity and toxicity.

Once the problems identified, the replacement of hazardous compounds and redesign of the munitions can be taken in account. This issue made the object of many recent scientific publications the synthesis and characterization of new energetic materials (EMs) as replacements in primers, igniters, boosters, main charges or propellants. But not only the explosive substances are to be blamed for the environmental impact. Plasticizers and stabilizers are sometimes far more dangerous if released in larger quantities or under the form of more toxic combustion products. Also, a lot of work was dedicated to replacement of toxic heavy metals in the ammunitions parts that are released in the environment by abrasion, projectiles, combustion/detonation or as UXO. But often the replacement of “dangerous” components in the ammunition does not guarantee a lower environmental impact. It involves redesign of the system and can produce other hidden impacts, such as energy consumption and supplementary emissions of potentially hazardous chemicals.

Alternatives to the replacement of the energetic or metallic components may be the improvement of the fuse systems (to reduce UXOs rate), the design for disposal coupled with recover and reuse techniques, extending the use of training dummies and smart range management.

4 Analysis techniques for environmental impact assessment

One difficult step in the environmental impact assessment related to the use of ammunitions is the measurement of the combustion products and residues released. Usually, gaseous products and solid residues are to be determined. CO, CO₂, NO_x, HCN, NH₃, PHA, dioxins, metals, PM_{2.5} and PM₁₀, unburned EM, are often monitored.

4.1. LIVE MEASUREMENT OF COMBUSTION PRODUCTS AND RESIDUES

Maybe the most challenging task is the live measurement of combustion products and residues. In the case of pyrotechnic items and small arms ammunition, this can be performed in indoor shooting ranges/labs with total containment of the products and residues in closed vessels, usually plastic (PE) containers or bags. The gaseous products can be analyzed using FTIR, chemo-luminescence (for NO_x) or electrochemical sensors mounted directly inside the recipient. The aerosols can be collected using specialized pumps with particle counter systems and porous filters, while the solid residues deposited in the recipients are washed with distilled water and analyzed by AAS or ICPMS. The fumes collected on glass fiber can be analyzed for metal content by the same techniques or by SEM-EDX, when morphological characterization is also performed.

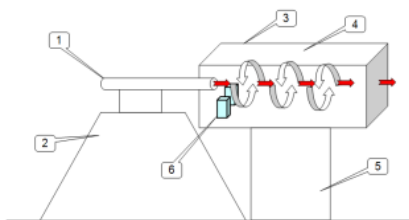


Figure 1: Experimental setup: 1. Lab weapon; 2. Weapon support; 3. Frame; 4. LDPE membrane; 5. Support; 6. Electrochemical detectors

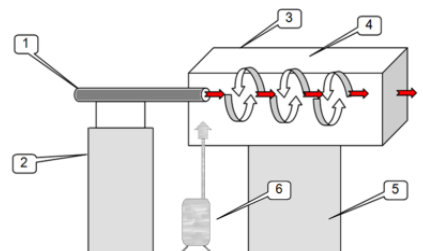


Figure 2: Experimental setup: 1. Lab weapon; 2. Weapon support; 3. Frame; 4. LDPE membrane; 5. Support; 6. Specialized sampling pump with glass-fiber filters

Studies performed at Military Technical Academy (MTA) during the EDA-ERM project on several 9x19 mm ammunitions using experimental setups according to figures 1 and 2 showed that even combustion of simple base propellants is not always ideal and can produce high concentrations of CO, NO_x and unexpected dangerous gaseous products, such as HCN and NH₃, probably due to the DPA stabilizer (table 1).

Regarding the metal residues/fumes, AAS and SEM-EDX measurements performed on four types of ammunitions, including ammunitions with composite Cu bullet and Sinoxid/Sintox primers, revealed high concentrations of Pb and/or Cu in the residues for all types (figures 3 and 4). The metal composition of residue indicates that composite Cu bullets are not entirely greener as they generate high quantities of Cu, which is equally dangerous for the environment (same threshold values with Pb for soils) but much safer for the human health (almost 3 orders of magnitude higher threshold values compared with Pb).

Table 1: Gas concentrations measured for typical 9x19 ammo

Ammo	FMJ-SINOXID Concentration [mg/g propellant]	FMJ-SINTOX Concentration [mg/g propellant]
CO	484.52	450.60
CO ₂	248.27	236.07
NO	9.46	7.86
NO ₂	1.57	1.51
NH ₃	7.56	6.01
HCN	4.32	2.97

It is also noticeable the large concentration of lead residue produced by the ammunitions with lead bullet and lead-free primer, this indicating that a large amount of the lead residue is generated through the erosion of the exposed back of the bullet.

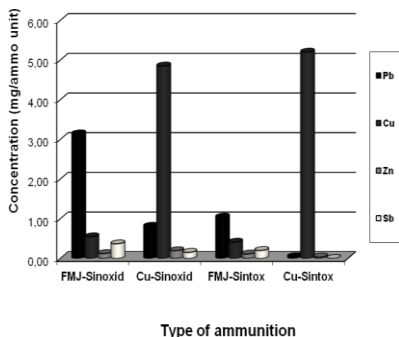


Figure 3: Metallic residues by AAS

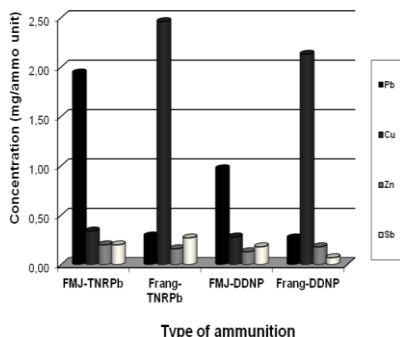


Figure 4: Metallic fumes by SEM-EDX

The morphological analysis of the metallic fumes using SEM showed that the vast majority of the particles have diameters in the range $0.1\div 0.7\ \mu\text{m}$, which are considered very dangerous for the accumulation in the respiratory tract.

The study also revealed that over 90% of the solid residue (50 to 100 mg per ammo unit) is composed by unburned or partially burned propellant and that is a serious source of contamination especially for the outdoor firing ranges where the cleaning up of the deposits is not possible.

Other research teams [3] evidenced that replacing the lead core of the bullets with other harder materials, like tungsten or steel, could produce higher emissions of copper due to the abrasion with the bore.

For large caliber and large pyrotechnic items, live measurement of the combustion products and fumes is almost impossible because measurements have to be performed with real life weapons in open firing ranges and they are too dependent on the weather (temperature, wind speed, wind direction, humidity). On the other hand, the rapid spread of products into the atmosphere gives little sample uptake for any further analysis.

However, it is possible to simulate the real firing conditions through burning large caliber propellants for the obtention of combustion products (solid and gaseous) in special designed ignition chambers in which the pressure can be fitted to match cannons or mortars.

The solid residues spread on the soil can also be collected and analyzed according to the procedures described by Walsh *et al.* [4], preferable after deposition on snow.

MTA performed the analysis of the emissions for the 12 kg HCH type RO smoke candle LF-12 and determined maximum aerosol concentration (photometrical), gaseous emissions (electrochemical sensors) and metal content in the fumes (SEM-EDX). The results are given in tables 2 and 3.

Table 2: Aerosols and gases from LF 12 smoke candle

Atmospheric cond.			LF-12 aerosols	Gas emissions Max. conc. (ppm)				
Wind (m/s)	Temp. (°C)	Humidity (%)	Max. conc. (particles/cm ³)	HCN	NO	NO ₂	CO	Cl ₂
2-4	28.5	61	4.3 x 10 ⁶	4.7	3	0.5	61	0.9

Table 3: Relative concentrations of elements (wt. %) in LF-12 aerosols

Elements	C	Al	Zn	Ba	Pb
Relative conc. (wt. %)	55.24	15.47	23.24	3.80	2.25

The measurements revealed the presence of dangerous gaseous products, such as CO, HCN, NO_x and Cl₂ but also the presence of Pb and Ba compounds in the aerosols, due to the use of Pb₃O₄ and Ba(NO₃)₂ oxidizers in the igniter.

4.2. CHARACTERIZATION OF SOIL CONTAMINATION

During the last decades, numerous countries have performed the characterization of contamination sources from the use of ammunitions in various ranges for live-fire training or testing. By far, the Technical Co-operation Program (TTCP) program [5] run by United States, Canada, UK, Australia and New Zealand, have brought the greatest contribution to the development of protocols for EMs contaminated sites characterization. Their investigations regarding EM residues in soils at training ranges showed that TNT and its degradation products (A-DNT), RDX, HMX and AP are the usual contaminants for the impact areas. They also showed that about 99.997 % of the EM is transformed to non-hazardous compounds if high order detonation occurs, indicating that UXOs and low order detonations are the main cause for the site contamination. Another important contribution of the TTCP work was the development of multi-increment sampling strategy and also the validation of environmental military threshold values for explosives in soils, a valuable instrument in the context of absence of corresponding national legislation.

But while contaminations in the impact areas are dominated by high explosives, and this contamination can be greatly reduced by UXOs collection and disposal, the contamination in the firing area is dominated by unburned propellants (DNT, NC and NG) and heavy metals from primers and abrasion.

A study performed by MTA during the EDA-ERM program in the Artillery Testing Range of the RO Armed Forces, using modern multi-increment sampling and composite sampling techniques, indicated soil and vegetation contamination, especially with Pb and Cu in the firing line areas (table 4). The contamination was limited to the upper layer of the soil (50 cm) as indicated by the depth core samples collected down to 3 m and the aquifer analysis did not evidence any transport of the contaminants.

Related to soil contamination, aside for the degree of contamination, “fate and transport” studies are equally important as they indicate how a contaminant behave in a specific environment as a result of its potential to be transported, or transformed and transported, and finally being accumulated in some media.

Table 4: Soil concentrations at artillery systems firing line

	Hg	Cu	Pb	Zn	Sb	Cd	Cr	Ni
Average on hot spot samples (mg/kg)	0.16	<i>1,482.50</i>	$\frac{356.7}{8}$	164.00	2.33	0.59	43.26	31.31
Average on composite samples (mg/kg)	0.12	<i>331.04</i>	$\frac{127.7}{8}$	102.88	1.74	0.50	39.44	29.21

During the last decade, extensive studies were performed regarding fate and transport of munitions contaminants shifting the general opinion about the “greenness” of consecrated explosives [6-11]. Thus, nowadays TNT and HMX are regarded as greener explosives due to their lower solubility and biodegradability (TNT) compared to RDX.

Performing toxicity and exposure assessment for the potential contaminants is another difficult task as the toxicity data for energetics and munitions components are not easily available.

5 Green options for munitions in design and manufacture

Obviously, the first option in our mind for making munitions greener is the replacement of harmful compounds. EMs and especially nitro-compounds, lead compounds and AP were the first to blame for spreading dangerous chemicals in the environment. Lately, a number of publications were dedicated to the synthesis and characterization of greener alternatives to primary and secondary explosives as well as oxidizers for composite propellants. Those were discussed in detail in reputed publications by Klapoetke [12], Talawar [13] and finally by Brink [14] so these will not make the object of our discussion.

What we concluded from our experience in the EDA-ERM project was that there are very few options for the replacement of the consecrated explosives that are really taken in account by the industry. For example, the lead azide and lead styphnate are still produced and used in detonators and primers because their overall quantity/manufacturer is limited and part of it could be exempted on the basis of defense applications. So, basically the pressure for the replacement of lead compounds is generated mostly by the users and range holders.

One of the main concerns of the industry nowadays is related to the replacement of phthalates and stabilizers, which are requested in large quantities and are no longer available in Europe due to REACH. Sebacates, adipates and terephthalates are investigated as replacements as they are not yet on the SVHC list.

Regarding the replacement of RDX in explosive formulations, in spite of numerous new candidates presented by the academia, the industry prefers to reorient towards HMX, which is regarded now as a greener alternative due to its lower solubility. So the focus is on new binders systems which could diminish HMX sensitivity and could assure convenient and safe recovery of the original crystals. Thermoplastic elastomers could represent a solution but the recovery of the explosive will finally involve the use of solvents and the overall greenness of the process could be compromise.

Starting from the principle of polymers used in pharmaceutical application for controlled drug release, MTA performed preliminary studies regarding the synthesis of “smart copolymers” based on copolymers of acrylic acid and alkyl-acrylates, which are insoluble at neutral or acidic pH, but can dissolve in water at 30-40 °C and basic pH values. The results obtained so far are promising as copolymers soluble at pH greater than 10 and insoluble at lower pH values were obtained. This “on demand” water solubility could be used for the incorporation of explosive crystals as well as for controlled recovery of the explosive while maintaining its original morphology.

Considering that the UXOs are responsible for the majority of the environmental impacts, and the average dud rate is 5%, another serious alternative to the replacement of the harmful EMs is the improvement of the fuse systems and the addition/improvement of self-destruction mechanisms to existing fuses in order to reduce or eliminate the UXOs.

Regarding the reduction of heavy metals contamination, having in mind that sampling and chemical analyses are very expensive, we concluded that we could significantly reduce that cost by knowing what we are looking for and where we have to look. Especially for small arms training ranges, we concluded that the best option available at this time, considering also the shortcomings of the proposed alternatives, is to adopt smart range management systems. Databases containing information about the chemical content of ammunition (warheads, propellants, fuzes) could be linked to a range registration database comprising the reports of the users, with the type/number of ammunition used and the number of lost duds. Thus, an image of the identity and distribution of contaminants from munitions is supplied in order to develop a proper monitoring strategy and remediation measures.

6 Conclusions

The excellent collaborative work performed within the EDA-GEM2 project *Environmentally Responsible Munitions – ERM* greatly contributed to a better understanding of the area of greener energetics and greener munitions in the Romanian MoD. The lessons learned by performing the study on legislative impacts and drivers revealed that the industry and the users are not always looking for the same solutions when looking for greener products. While MoDs are mostly interested by controlling, monitoring and reducing range contamination with explosives and heavy metals, the manufacturers issues are more related to the provisions of the EU regulations regarding the restriction in use of some chemicals listed as substances of very high concern.

Development of analysis procedures and infrastructure for the assessment of environmental impact of munitions is always a difficult task especially when live measurements are to be performed. The main solutions for the live detection of combustion products and residues and typical results were discussed here.

Studies regarding the characterisation of soil contaminations usually target the impact areas for contamination with EMs, while contamination with heavy metals and propellants of the firing line areas is equally important.

Besides the replacement of harmful explosives from the energetic formulations, which is always regarded as the first option, there are also some other options to consider for reducing the environmental burden related to the use and disposal of munitions, which could be faster implemented by the users and manufacturers.

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DEFENSE, SECURITY AND MILITARY TECHNOLOGY

A METHOD OF ADAPTING A NON LETHAL CONFIGURATION TO A HAND FIREARM

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***Abstract:** The paper focuses on a very delicate subject: how to configure a kinetic non lethal firearm by spending less money and how to ascertain its fatal injury probability towards the target. Nowadays, due to the vast tactical improvements and technological advances, the missions for Government personnel may also include temporary incapacitation to the opponent as a maximum accepted trauma. It is, though, proposed a model that easily reconfigures a lethal firearm into a non lethal one and, also, the circumstances of its regulated usage.*

***Keywords:** Non lethal configuration, non lethal kinetic ammunition, firearms, riot control, protester repel*

1. A perspective approach on lethal firearms. Non lethal firearms

History confirms the fact that human nature is defined, besides others, by a conflictual state. This conflictual state is directly influenced by each individual's desire or by each group of individuals' desire, because man is a social being, to satisfy their primary needs: safety, diversity, importance and connexion. One right principle which, in

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a approximate manner, embraces the human behavior is the one that states that “Your right ends where my right commences”. Without being able to express this principle, early people ascertained the effects of not respecting it and, driven especially by the need of safety, they conducted different actions, also comprising the neutralization of the persons considered a threat.

The existing weapons, which were used in order to procure food, gained the auxiliary role of protecting the individual or the group of individuals from the threat of their peers. Regarding Europe, an important evolution considering the fight devices was produced when the black powder was introduced in the continent. The black powder, according to historians [1], [2], was introduced in Europe by the Mongolians, together with the associated weaponry (field cannons), in the Battle of Mohi, close to the actual Romanian borders, in the year of 1241.

A relevant moment throughout history is the appearance of the first hand held personal weapon. It’s functioning was based on the same consequences as nowadays. A ball was propelled by the gases produced from the explosive transformation of the black powder. It is believed that, shortly after the black powder was introduced into Europe, the first hand gun was conceived, on a region which now is comprised by Germany. Its name was “hand gonne” (Figure 1). This weapon could be either fixed on the ground, or fixed on the saddle of a horse, thus increasing its portability.



Figure 1. Saddle mounted „hand gonne” [4]

It appears that the ground fixed hand gonne was first used in 1247-1311s Spain [3], [4]. Instead, the first usage of the cavalry mounted hand gonne was mentioned in the manuscripts of Marianus Jacobus only in 1449 [4]. Nevertheless, there is one certain thing. The “hand gonne” lead the way for developing the small caliber modern weapons and changed the perspectives regarding battle engagement and fighting capacity of an individual or of a small group of individuals.

Hundreds of years passed until modern firearms begin being developed. Systems like Matchlock, Wheellock, Flintlock, Percussion, Pinfire, Rimfire preceded the modern Centerfire [4]. All of these systems had one purpose: improving the quality of the firearms in the aspects of precision, safety, pace and manageability. The concept, though, remained unchanged. Individual firearms satisfy the human needs.

Nowadays, people's reaction to threat is, basically, the same. The way by which it is manifested, though, is different due to technological and behavior advancements of the society. While in the first half of the XX century firearms were intended to possess a higher lethal capacity, the last period of time faced a great diversity of counter manners to threat, especially due to the improvements of the combat body armor and due to the complexity of the international human rights. So, a variety of requirements, like public order reestablishment, riot control, protester repel, evacuation of people in/from outdoor areas/confined areas, with a minimum print over the environment [5] could not be completed by using the classical lethal weapon systems.

The new criteria quested for a new requirement: introducing the non lethal fire weapons. This domain, simple as a concept, still generates nowadays designing issues. This is due to the numerous fatality cases obtained after employing non lethal weapon systems in modern conflicts [5], [6].

In the 1980s, the USA made a first important step towards the development of non lethal systems, by the Group of Politics Assessment for Non Lethal Weapons. The first such systems that equipped the order forces were the pepper spray and the electroshock guns (Figure 2).



Figure 2. Pepperspray (left) and electroshock weapon Taser® X26 (right)

A large variety of non lethal systems with different purposes exist nowadays. Of these, an interest system is the non lethal kinetic system, which propelles a projectile towards an opponent and has the terminal effect in the limits of guaranteeing a non lethal strike. Because the proprieties of the human body are very different depending on the reference area, the major issue with the kinetic non lethal weapons is that they may cause powerful strikes (Figure 3), which, in some situations, may lead to fatality.



Figure 3. Impact of a non lethal kinetic round (www.reddit.com)

Due to the uncertain nature of the terminal effects of kinetic non lethal systems, in 1999, the NATO group defined the non lethal weapons as weapons which are explicitly destined for incapacitating or repeling the opponent, with a low fatality or permanent trauma probability, or for neutralizing equipments, within the requirements of generating a reduced impact over the environment [5].

Even though this definition settles the fact that a non lethal system may cause death, de scientific research domain regarding the impact of the non lethal weapons is oriented for obtaining a lower as possible probability for causing lethal traumas. The main non lethal systems that can produce fatality are the kinetic non lethal weapon systems [6]. By this, numerous criteria were elaborated in order to evaluate their target effect [7, 8], [9].

The variety of the existing non lethal kinetic weapons raises the level of uncertainty for each type of ammunitions' target capabilities. The following part will familiarize the reader with the configurations for some non lethal kinetic systems and, also, with the issues that those have encountered throughout exploitation in various missions.

2. Configurations for the non lethal kinetic weapon systems

There are numerous attempts on creating a non lethal kinetic firearm. Now matter what is the propulsion system (propellant or compressed air), these firearms fire a round that, at a certain distance from the muzzle, possess an energy that should not produce lethality. According to NATO standards, the minimum required energy in order to produce lethality is 79 J [6]. We could also consider a bone fracture limit, which is stated to be 60 J [10]. In order not to provoke death, taken from exterior ballistics calculations, the energy possessed by the ball at the required distance from the muzzle must not exceed 79 J.

This maximum energy limitation implied changes into the design of weapons and ammunitions. Since the expression for the kinetic energy is known, i.e. $KE = \frac{1}{2}mV^2$ where m is the mass and V the velocity, if one consider, for example, the NATO 5.56x45 mm intermediate caliber round, with the SS109 ball which weights 4.02 g, fired from a standard proof barrel, its energy will be around 1800 J at the muzzle and about 400 J at a distance of 300 m (Figure 4). So, in order to reduce this amount of energy, at least four things have to be considered:

- reduce the mass of the projectile;
- diminish the muzzle velocity;
- design a less aerodynamic projectile;
- identify a more elastic material for the projectile.

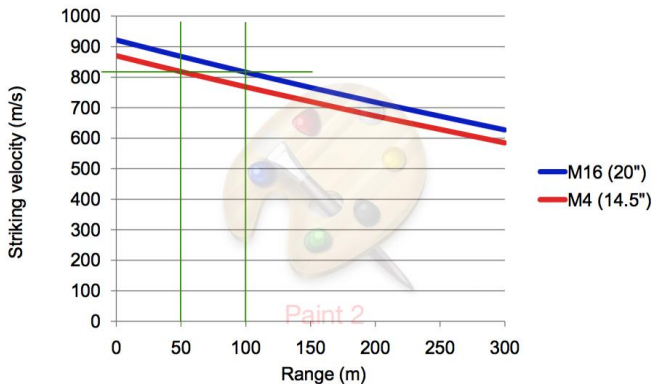


Figure 4. Striking velocity of a 5.56 mm SS109 ball at different distances, fired from different weapons (Colt M16 and Colt M4) [18]

When thinking about reducing the mass, one might say that the mass of the one man portable small caliber arms bullets are already small (up to 11 grams). They gain the energy by being propelled with high velocities (up to 950 m/s). So, instead of reducing the mass, a reduction in the propelling velocity should be considered in this case. A normal trend nowadays is to adapt portable grenade launchers, i.e. 40 mm grenade launchers, to be capable of firing non lethal rounds, with projectiles having such velocity and mass in order not to exceed, on a specified path, the lethal energy limit.

The muzzle velocity of a projectile can be reduced either by changing the propellant, or by changing the propelling system, i.e. compressed air. Together with diminishing the muzzle velocity, one should consider the fact that changes in design of the projectile should be attended. A regular projectile shape, comprised by an ogival part, is able to penetrate the human skin [6]. So, the changes are needed to assure that, during impact with the human target, the projectile transfers its momentum and its energy only to produce a blunt trauma to the body, so that life threatening side effects are partially reduced.

An aerodynamic projectile will not have a great loss of energy on its path towards the target. If the non lethal range of the round is recommended to be at a specified distance in front of the muzzle, one must assure that the energy drop is sufficiently high so that the risk of occurring exceeding energy impacts is low.

The materials composing the projectile define the energy and the momentum transfer between it and the human body. So, the more rigid is the material, the more likely is that the energy transfer mechanism is too slow, so a penetration of the skin may be predictable. If materials composing the projectile have a very high elasticity, than the energy transfer will be performed with a low efficiency and the incapacitation of the target will not be produced.

Besides the lethal energy specified by NATO, there are other concepts that can govern the efficiency of the non lethal kinetic weapons. This is the energy density [10], which is in fact the ratio between the kinetic energy of a round and the maximum formed contact surface between it and the target during impact. It is considered that a threshold of 0.06 J/mm^2 is required for skin perforation [10]. A proposed NATO standard [7] correlates the impact force and the maximum contact surface between the projectile and the target and uses their ratio, which is the normal tension, in order to estimate the system's effect towards the human body; it should not exceed 10 MPa.

Because it is pretty difficult to produce a kinetic non lethal weapon system that can score high for all these considerations, which should be in a pure synergy, many manufacturers have encountered issues with their products, issues related to the terminal effect over the human body.

FN 303

The FN 303 (Figure 5) is produced by FN Herstal (Belgium) and it has been assigned to countries all around the world. It is an semiautomatic, compressed air, kinetic non lethal riot control weapon which fire a 18 mm round, designed to break

upon impact, so that the risk of penetrating the skin is reduced. This weapon was introduced in 1993 and, since then, it had served in plenty of conflagrations: the Afghanistan war, the Iraq war or the Lybian revolution. The producers state that the rifle is very accurate at 25 m, has a very good probability of hitting the torso up to 50 m and can be engaged for targets which are up to 100 m far [11].

Despite of that presentation, in the year of 2004, in Boston, the FN 303 was involved in the killing of one person [12]. A police officer was aiming at a rioter, but the fired round hit another person in the eye, leading to a death by massive blood loss [12]. After trials, the Boston Police concluded that, after 300 rounds fired, the FN 303 loses significantly its accuracy, and may produce trauma towards other sides of the body of the person who is aimed at, or towards other human or material targets. After the killing, the Boston Police and FN Herstal were lawsuited for a 15 million dollars wrongful death damages. In 2007, Boston Police destroyed all the remaining FN 303s, as they were considered more powerful and deadly than thought.



Figure 5. FN 303 non lethal weapon [11]

Alsetex COUGAR non lethal weapon

The French COUGAR 56 mm caliber kinetic non lethal weapon (Figure 6), in comparison to the FN 303, uses a classical pyrotechnical propellant in order to launch the projectile on its path.



Figure 6. COUGAR non lethal weapon [10]

The projectiles fired by this weapon consist in a powder covered in a latex frame (Figure 7), called “bliniz”. It is designed to largely expand upon impact, so that its energy transfer mechanism should be highly efficient.



Figure 7. The “bliniz” 56 mm non lethal round [10]

The projectile produces around 130 J at the muzzle, but due to its high expanding mechanism during impact, its energy density was calculated to be below the skin penetration level at a distance of 10 m.

Walther P99T

The Walther P99T non lethal pistol (Figure 8) is based on the P99 police pistol, developed by German weapon manufacturers Walther in the year 1996. It is redesigned in order to be able to fire rubber ball ammunition, 10x22T caliber (Figure 9), for which the ball is pyrotechnically propelled.



Figure 8. Walther P99T non lethal pistol (forum.guns.ru)

The specified non lethal range starts from about 10 m from the muzzle and the pistol is accurate on engaging targets at a distance up to 50 m. The issue with the ammunition is that the ball consists in rubber. The rubber, even if it possesses good elastic proprieties, loses its mechanical proprieties after approximately one year, due to material aging.



Figure 9. 10x22T non lethal ammunition (forum.guns.ru)

If engaging targets on a distance less than 10 m, the energy of the ball may produce serious trauma to human body. So, this kind of ammunition presents a great drawback in assuring a non lethal effect on its entire trajectory.

The three presented non lethal weapon systems are representative for the kinetic non lethal weapons that are available all over the world. Each system has its drawback, of course, but trials are being made in order to improve the security of that systems during usage. Besides this issue, one should also consider the economical impact that creating a new kind of weapon or buying a new lot of weapons has. The whole process comprises homologation stages, testing stages, producing stages, which might be very costly and time taking.

3. An adaptive over-caliber non lethal configuration for a pistol

In order to simplify the process of adopting a new weapon, this paper bases its research on a patent regarding a magazine-loaded over-caliber non lethal energy projectile initiated by projectile of the live ammunition with pivoting magazine assembly, patent number WO2000014473 A1 dating from 16th of March 2000 [18]. This system, although it looks like a good alternative to stand alone non lethal weapons, does not present a reliable option for design and mounting on a specific platform and does not present terminal ballistic data regarding its measured effect towards the target.

This system was recently reintroduced into debate with the manifestations in Ferguson, USA, when a 18 year old unarmed black person was shot dead by the police [14]. So, in order to overcome the deadly force transported by a lethal pistol, the adaptive over-caliber non lethal system was proposed to the Ferguson Police. It is designed to be mounted on the standard police firearm Glock® 19 (Figure 10).



Figure 10. *The over-caliber non lethal system proposed for Ferguson Police Glock® 19 pistols [15]*

To be able to verify this system's proprieties and performance, the current paper proposes an over-caliber non lethal system adapted for the standard issue Romanian security forces sidearm: the Cugir LP5 pistol, chambered for the 9x19 mm Parabellum ammunition. Figure 11 illustrates the Cugir pistol, together with the mounted over-caliber non lethal system.



Figure 11. *The over-caliber non lethal system adapted and mounted on the Cugir LP5 pistol*

The adapted system consists of two elements: the mount, which is fixed on top of the slide of the pistol and the over-caliber ball (Figure 12), which has a hole drilled on one side that is aligned with the barrel and another 4 holes that allow it to be supported by the 4 arms of the mount.



Figure 12. *The over-caliber non lethal ball*

In order to check if the mount can withstand the weight of the ball, which is around 100 grams, a static finite element analysis simulation was taken using SolidWorks® Simulation software. The results are shown in Figure 13.

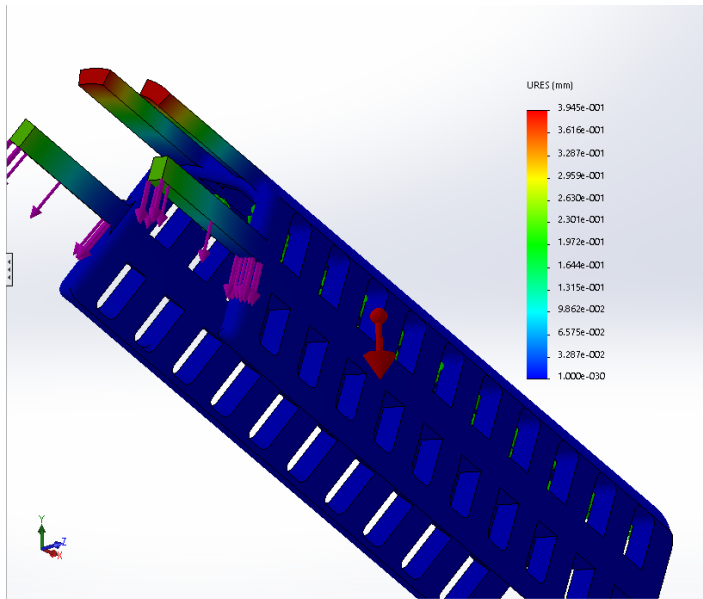


Figure 13. The maximum displacement obtained on the mount by the static weight of the ball

The solver concludes the fact that the maximum displacement of one arm is around 0.4 mm. The material does not exceed its elastic limit. In this configuration, the over-caliber system should not comport deformations that could alter the firing process and the safety of the shooting.

Upon firing, the 9 mm bullet will exit the muzzle and will enter the hole drilled in the ball, which is concentric with the barrel. Due to the impulse transfer, the bullet will travel together with the over-caliber ball towards the target, with a lower velocity and, from a certain point, with a reduced kinetic energy.

Due to the intermediate ballistics, a consideration regarding the place where the ball will be placed must be made. After running an assessment for the interior ballistics of the LP5 pistol firing with Romanian 9x19 mm Sadu ammunition, the plot of the pressure vs. time inside the barrel is illustrated in Figure 14.

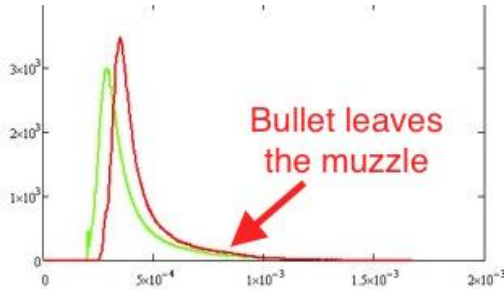


Figure 14. Pressure vs. time variation inside the barrel of the LP5 pistol with two different kinds of ammunition [17]

So, considering the drop of pressure after the bullet leaves the barrel of the pistol, and the recommendation that any muzzle velocity recording device should be placed at a least 4, 5 calibers distance from the muzzle, a distance of 35 mm is suitable for mounting the over-caliber ball.

Up to this point, the non lethal proposed system looks suitable for equipping the LP5 pistol. The testing of the exterior and terminal characteristics are the next steps to be achieved in order to assess the performance of the over-caliber system.

4. Numerical simulation for the behavior of the bullet-ball assembly

Numerical simulations can foresee the behavior of the bullet-ball assembly on the trajectory. In the beginning, there are two important things that have to be assessed. What may be the trajectory, the velocity during the path and what is the kinetic energy that may be transmitted during the path towards target.

The exterior ballistics of the new formed projectile is important in order to verify the distance it can be carried towards target. Having known the mass of the ball, which is 100 grams in this case (Figure 15), the mass of the 9 mm bullet (8 grams) and the initial velocity of the bullet (380 m/s), the initial velocity of their assembly can be calculated by considering the conservation of the momentum for the ideal case of a plastic impact.

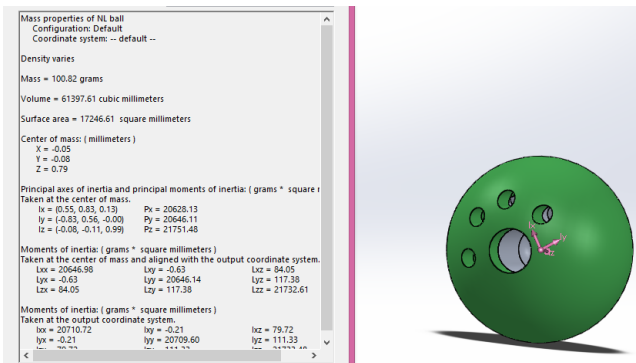


Figure 15. The mass of the over-caliber bullet

$$m_{bullet}V_{0,bullet} = (m_{bullet} + m_{ball})V_{0,ball} \quad (1)$$

where:

m_{bullet} represents the mass of the bullet;

$V_{0,bullet}$ represents the initial velocity of the bullet;

m_{ball} represents the mass of the over-caliber ball;

$V_{0,ball}$ represents the initial velocity after impact of the bullet-ball assembly.

The initial velocity of the bullet-ball assembly is calculated to be 28 m/s. For a ball, using the Siacci method for calculating the trajectory of a projectile [16], the ballistic coefficient will be 1.5. The obtained trajectory for different shooting angles have been plotted with Matlab® and are illustrated in Figures 16, 17 and 18.

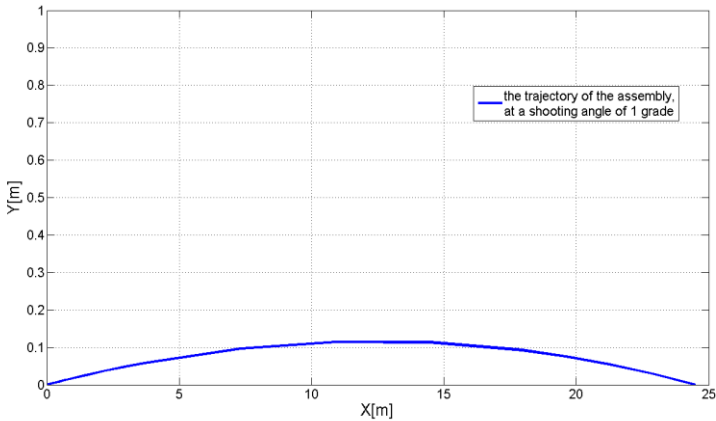


Figure 16. The trajectory for the bullet-ball assembly, shooting angle of 1°

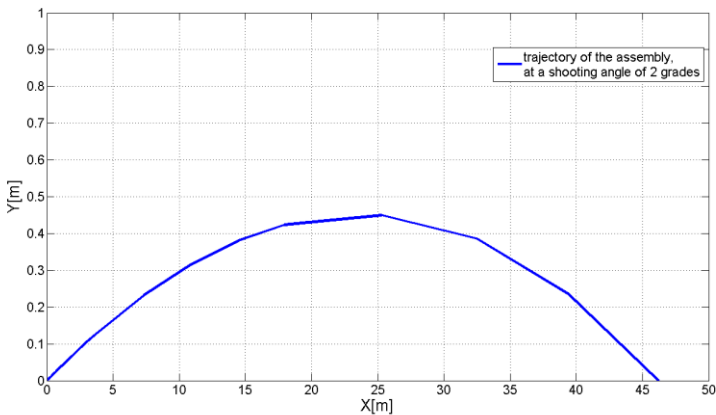


Figure 17. The trajectory for the bullet-ball assembly, shooting angle of 2°

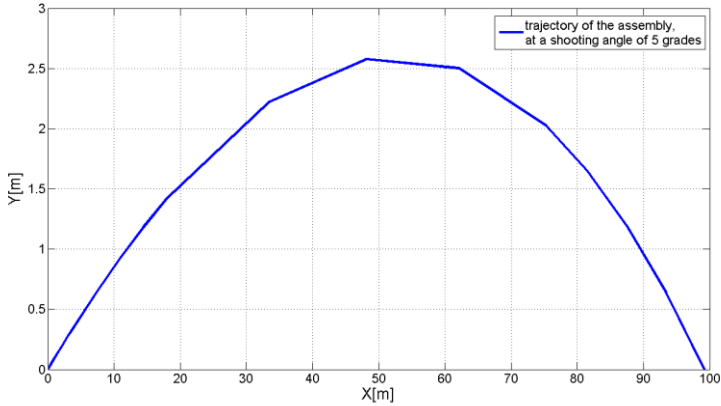


Figure 18. The trajectory for the bullet-ball assembly, shooting angle of 5°

As it was expected, the total length of the trajectory is highly diminished. Numerical simulations calculated that at a shooting angle of 1° , the maximum obtained trajectory is 25 m. At a shooting angle of 2° , the maximum longitudinal distance is around 46 m and at a shooting angle of 5° , which still allows the direct aiming in facile conditions, the maximum trajectory length will be around 100 m. This is due to the fact that the mass of the projectile is larger, the ballistic coefficient is larger and the initial velocity is smaller.

If we consider what would the amount of energy be when the bullet-ball assembly forms, so when its initial velocity will be 28 m/s, then one can calculate the initial kinetic energy to be 42.3 J and the initial energy density will be 0.043 J/mm^2 if we consider the contact surface to be 1/2 of the sphere exterior diameter. In both situations, the data is below the lethality threshold stated by NATO standards [6], [10]. Due to the normal involution of the assembly's velocity, these values will be the highest data that may be obtained on the path throughout the trajectory, so that the non lethal effect will be accomplished on each distance step.

A finite element analysis was performed in order to foresee the behavior of the bullet and the ball during and after the impact. The software used in order to achieve this is LS-Dyna. In order to simplify the simulation, basic materials have been chosen for the bodies involved. The bullet is considered to be consisted only of lead, so its bimetallic jacket is neglected. The ball is consisted of 2024 T351 strengthen aluminum, on the inside, and of Mooney-Rivlin rubber on the outside. These materials have been chosen from the solver's database. Since we are dealing with a axis symmetrical 3D real situation, for the ease of computation the problem is reduced to a axis symmetrical 2D situation (Figure 19). The chosen mesh is fine on the assumed impact area and coarser towards the exterior of the ball. Also, an impact between the over-caliber assembly and a rigid wall is tested.

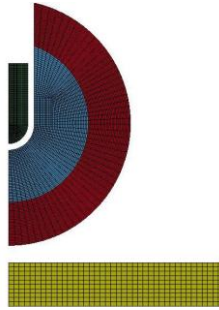


Figure 19. Initial configuration: the bullet (green), the ball (inner part in blue, outer part in red) and the rigid wall (yellow)

The dynamical contact between the bullet and the ball produces a local energy transfer, which causes different particle velocities inside the materials (Figure 21). After a period of time of $5e-7$ seconds, the assembly commences moving as a single body, with an initial velocity of about 30 m/s (Figure 22). After a period of $2e-4$ seconds, the assembly impacts the rigid wall.

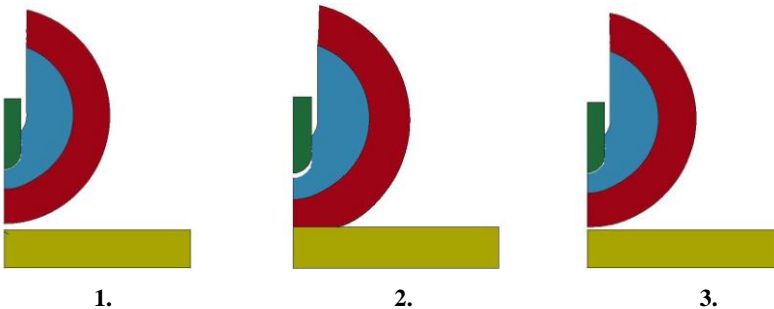


Figure 21. Simulated contact between the bullet and the ball and between the assembly and the rigid target

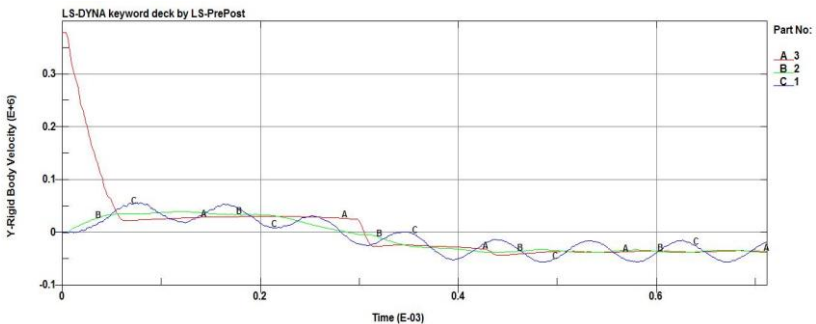


Figure 22. Evolution of velocity after the impact between the bullet and the ball. A – bullet velocity; B – inner ball part velocity; C – outer ball part velocity

Each component velocities are seen in Figure 22. After the impact between the bullet and the aluminum part of the ball, there is an energy transfer and the three components begin marching together, but with different velocities. After the impact with the rigid surface, due to the elasticity of the rubber, the ball bounces back, thing that is reflected in the negative side of the velocity plot.

5. Discussions

The finite element simulation was performed with an initial bullet velocity of 380 m/s. The materials were chosen so that a perforation of the ball is not achieved. Fortunately, the 9 mm bullet is round nosed, so it does not possess material perforation characteristics as good as a rifle bullet, i.e. the SS109 from the 5.56 mm NATO ammunition. The 2024 T351 aluminum offers good mechanical resistance and due to its reduced density, when compared to steel, contributes to a lighter over-caliber ball mass. The Mooney-Rivlin rubber is a hyperelastic material, which performs well during the impact with a rigid body.

The energy transfer mechanism during the impact between the ball assembly and the rigid target is highly dependent on the exterior casing of the ball. If the chosen material is too elastic, the terminal effects can be diminished and if the rubber is too rigid, case that could also be possible from the ageing of the material, the impact mechanism could produce serious injuries to the target.

According to the numerical simulations, the presented configuration may be suitable for the 9 mm Cugir pistol. It performs safely and it manages to transport the ball assembly towards the target on an acceptable trajectory (up to 100 m for direct aiming). What is still to be acknowledged is the precision of this non lethal system, the distance for which the accuracy is satisfying and what are the real effects upon the human target.

5. Final conclusions

The non-lethal over-caliber system for the Cugir pistol may be an option for extending the shooting capabilities of Romania's Army sidearm weapon. Also, this system may be extended to different kinds of weapons, i.e. the 40 mm grenade launcher. Besides the performance and terminal requirements, there are still issues that need to be settled.

The ergonomics of the weapons is one of the issues that need a close assessment. So, the question that arises is: is the non lethal over-caliber system suitable for firing within keeping the ergonomics of the pistol? Economically speaking, there is a major total price difference between a newly designed non lethal weapon and the presented adapted platform. But is this platform going to meet the needs of the shooter, with respect to the speed of response to different threats and to the right response depending on the situation? Is this platform able to assure that accidental lethal rounds will not be engaged towards the target without the express will of the shooter ?

There are, though, enough things to be accounted for in order to proceed with the development of this system. So, the final step will be the shooting range trials, where persons interested in it should make sure that all the important fields regarding the over-caliber system are verified.

Acknowledgement

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SINGLE-STEP APPROACH TO PROPELLANT CHARGE DETERMINATION

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Abstract: The sufficient muzzle velocity of the projectile under the condition of safety pressure is the main task to tackle during the process of small arms propellant charge design. Customary contemporary methods comprises the multiple repetitions of theoretical assessment-experimental shooting-results evaluation cycle. The paper presents another single-step approach to propellant charge determination and illustrates it on the example.

Keywords: Internal ballistics, reloading, propellant charge, small arms

1. Introduction

The design of the propellant charge represents the crucial part of the small arms ammunition production. The choice of the proper type of the propellant and the appropriate propellant mass shall be focused the most, because of the desired power output of the weapon system together with the requirements on safety and reliability of use (see e.g. analysis [1]). The problem has to be solved every time when the cartridge components are changed (the type of the projectile typically) or another lot of propellant powder or primers are introduced. The situation become most frequent during the development of the new type of cartridge when a wide spectrum of criteria should be followed (closely elaborated in e.g. [2]).

Among other requirements the maximum ballistic pressure and initial velocity are emphasized. There are quantified demands on the mean maximum ballistic pressure of the propellant gases prescribed in the regulations as well as limiting value of its extreme. If the three standard deviations rule is applied for the extreme values, demands on maximum ballistic pressure considering 9×19 cartridges could be approximately expressed by numerical data in following Table 1 (piezo-electric transducer method).

Table 1.
Maximum pressure requirements*

Regulation standard	Maximum ballistic pressure (mean ± 1 assumed standard deviation)
C.I.P. tables [3]	(235±11) MPa
NATO standardization agreement [4]	(230±11) MPa
PTI technishe richtlinie [5]	(270±11) MPa
SAAMI datasheets [6]	(241±7) MPa
Czech (national) defence standard [7]	(230±11) MPa
Custom development example	(200±15) MPa

* the methods of measurement differ.

The initial velocity should meet the external - terminal ballistics criteria [8] (the faster the better usually, without any adverse transitional ballistics and dispersion effects).

2. Problem formulation

In order to reach defined requirements, the design of propellant charge has to be determined. In the field of the small arms the problem is generally reduced to the smokeless powder type selection, the mass of the propellant assessment and primer with appropriate flash impulse selection. This process is regularly carried out in cycles of three basic steps:

- theoretical estimation, proposal;
- experimental shooting, measurement;
- results processing and evaluation, conclusion.

These cycles are repeated until the desired congruence with the requirements is achieved (see Fig.1).

The “cycling” appears to be costly and time-consuming, therefore the single-step method of the determination proposal should have been found to enable the objective to be reached within just one undergoing of each step of the process.

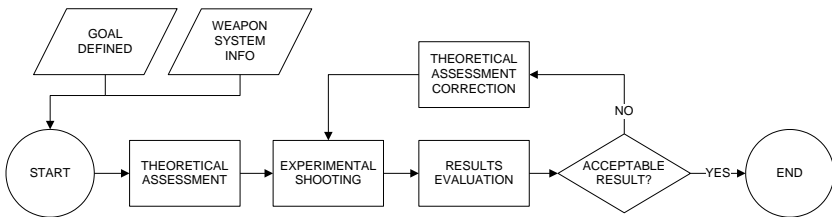


Figure 1. The process of propellant charge determination.

3. Methods

The theoretical assessment of the propellant charge could be done by several ways. As the most effective has to be evaluated one with the balanced ratio between output precision and input demands at the moment.

The simplest one is to stick to the reloading manuals. The advantage of the use of manuals is the promptitude and elementariness of tabled data for the production components, but there are also the strong disadvantages, because the manuals does not contain information about competitor’s products and are compiled with strong focus on safety, therefore not very accurate [9].

The most common and practical technique lies in the thermodynamic modelling of the given weapon system. The interior ballistics action could be successfully described by both the “western” [10, 11] or “eastern” [12, 13] models. The results of thermodynamics modelling are usually reliable enough within the interval of the undiverted conditions and are not able to cope fully with the wider changes of input parameters.

The more “complete” solution could be obtained by the robust hydrodynamic finite-volumes codes [14], but the significant need of the amount of input parameters decreases its applicability.

If there is a case of previous shooting done already, the results should be utilized by the correction theory application with the empirical coefficients [15] or the regression should take place [16].

Table 2.

The comparison of the propellant charge theoretical assessment methods.

Method	Demands		Precision
	Input data	Sources	
Reloading manuals	+	+	–
Thermodynamic models	0	0	+
Hydrodynamic-FEM models	–	–	+
Correction theory	+	–	+

The safety requirement is the cardinal element of the experimental shooting. Therefore the safe (decreased) propellant charge has to be prepared and fired first, regardless the theoretical predictions. The validity of the propellant charge “safe level” is given not only by the absolute value of the maximum pressure achieved, but also by the dispersion of this values. (The shooting risk level cannot be controlled unless the uncertainty of the maximum pressure value is known.)

Thus commonly the group of cartridges containing the same safe charge is fired in first batch, then another batch with increased charged subsequently and further on as illustrated in Fig 1. The expected value of maximum pressures would be represented by sample mean of the batch, according to relation

$$\bar{p} = \frac{1}{n} \sum_{i=1}^n p_i, \quad (1)$$

where p stands for the maximum pressure and n for the number of shots in the batch.

Related maximum pressures variance of the tested charge would be guessed using unbiased sample variance of the maximum pressures within the batch given by

$$s_p^2 = \frac{1}{n-1} \sum_{i=1}^n (p_i - \bar{p})^2 \quad (2)$$

After that the refinement of the charge or the input data should be made and the process would end while the results are acceptable and the resulting mass of the propellant charge ω_R is determined. The accepting condition could be done by statistical hypothesis testing

$$H_0 : \bar{p} = p_D, \quad (3)$$

where p_D represents demanded maximum pressure level, by the means of the Student's test

$$t = \frac{\bar{p} - p_D}{\frac{s}{\sqrt{n}}} \quad (4)$$

The resources could be saved compared to abovementioned when not the batches, but the scale of individual charges are fired. The scale has to start with safe charge and increment steps should be very small to maintain safety; the range of scale should confidently cover the safe charge as well as theoretically assessed charge. Then the maximum pressure values could be guessed by the means of the regression function. When there would be the assumption of the scale range to be broad reasonably, the dependency of maximum pressure p on the powder mass ω could be approximately replaced by the first term of the Taylor series [17]

$$\delta p = p(\omega + \delta\omega) - p(\omega) = \frac{1}{1!} \frac{\partial p(\omega)}{\partial \omega} \delta\omega + \frac{1}{2!} \frac{\partial^2 p(\omega)}{\partial \omega^2} \delta\omega^2 + \dots \quad (5)$$

and then for the regression the simple linear function should be found in the form

$$p = \beta_0 + \beta_1 \omega, \quad (6)$$

where β_0 and β_1 are regression parameters.

With the use of least square method the values of the parameters could be assumed by correspondent statistics b_0 and b_1 :

$$b_0 = \frac{1}{m} \left(\sum_{i=1}^m p_i - b_1 \sum_{i=1}^m \omega_i \right),$$

$$b_1 = \frac{\sum_{i=1}^m (\omega_i - \bar{\omega}) p_i}{\sum_{i=1}^m (\omega_i - \bar{\omega})^2}, \quad (7)$$

the constant m stands for the number of shots fired in the scale.

If the changes in variance of the maximum pressure values would remain negligible inside the scale interval, the variance assumption could be calculated by the means of relation

$$s_p^2 = \frac{1}{m(m-2)} \left\{ m \sum_{i=1}^m p_i^2 - \left(\sum_{i=1}^m p_i \right)^2 - \frac{\left[m \sum_{i=1}^m p_i \omega_i - \left(\sum_{i=1}^m \omega_i \right) \left(\sum_{i=1}^m p_i \right) \right]^2}{m \sum_{i=1}^m \omega_i^2 - \left(\sum_{i=1}^m \omega_i \right)^2} \right\} \quad (8)$$

The resulting mass of the propellant charge ω_R shall be calculated like

$$\omega_R = \frac{p_D - b_0}{b_1} \quad (9)$$

All the statistics calculations could be done by specialized statistical application or with comfort in the environment in some kind of widely spread economical spreadsheet software as well, e.g. in the MS Excel the function AVERAGE is related to (1), STDEV to (2), T.TEST to (4) and LINEST to (7) and (8), if need be the national equivalents should be used [21].

4. Example

Let me consider the illustrative case based on situation during development of 9×19 cartridge: the velocity and in-bore behaviour test with new type of smokeless powder.

The objective is to determine charge to get maximum pressure value approximately equal to

$$p_D \approx 200 \text{MPa} . \quad (10)$$

The theoretical and numerical analysis (based on the solution of assembled models described in [18]) indicates that the mass of the propellant charge should be closed to

$$\omega \approx 0,3 \text{g} . \quad (11)$$

The common method was carried out in four steps. The values of obtained pressures are depicted in the Fig. 2 in a simplified illustrative way and related statistics data are recorded in Table 3.

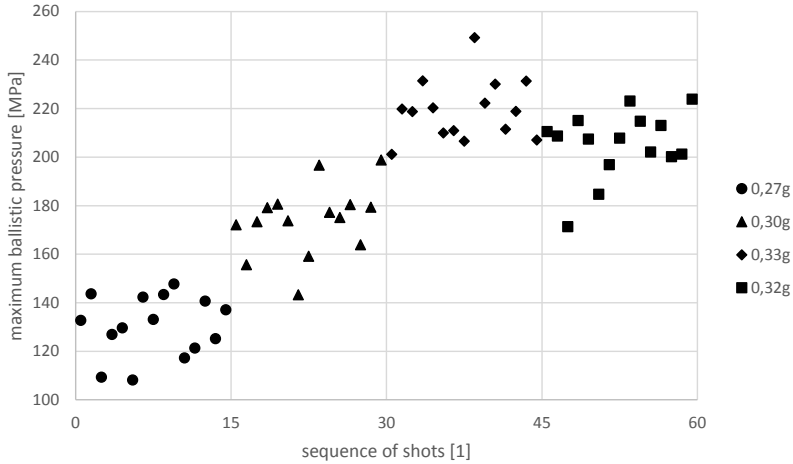


Figure 2. The simplified illustration of obtained maximum pressures in four batches.

Table 3. Propellant charge determination record – common approach.

Batch order number	Number of shots n [1]	Mass of the propellant charge ω [g]	Maximum pressure $\bar{p} \pm s_p$ [MPa]	Note
1	15	0,27	130 ± 13	safety charge
2	15	0,30	176 ± 15	not accepted
3	15	0,33	221 ± 13	not accepted
4	15	0,32	205 ± 14	accepted

The results of the process with single-step approach applied follow illustrated in Fig. 3 and Table 4 in the comparable manner with Fig.2 and Table 3.

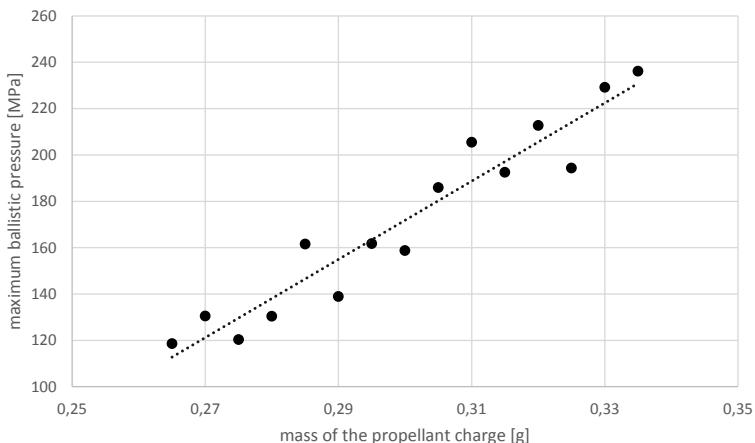


Figure 3. The regression line constructed from scale of maximum pressures.

Table 4.
Propellant charge determination record – single-step approach.

Number of shots m [1]	Regression parameter b_0 [MPa]	Regression parameter b_1 [MPa·g ⁻¹]	Maximum pressure $p_D \pm s_p$ [MPa]	Mass of the propellant charge ω_R [g]
15	- 334,7	1688,5	200 ± 13	0,32

5. Conclusion

The presented single-step approach to propellant charge determination does provide the same results as the commonly used batch “cycling” approach, the values of resulting variables are based on the same numbers of experimental shots and the resources demanded are significantly lower usually.

The process of the evaluation is more advanced, but still could be done easily, without special software or hardware. The suppositions have to be fulfilled, especially requirements on significance of system change and independence of maximum pressure variance, but also sufficient number of shots and increment step size should be maintained. If doubted, further statistical testing might be performed.

However described approach is considerably distant from standardization regulations and therefore the method cannot be used to certification examining, it can be recommended as more effective way of testing during development. When used in the case of charge verification, it could provide the value of ballistic correction coefficient besides the commonly expected results.

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METHODOLOGY FOR DETERMINING THE PARAMETERS OF GAS ENGINE OF AUTOMATIC SMALL WEAPONS

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ABSTRACT: Based on the quasi-thermodynamic method are displayed equations down the pressure and temperature in the accession channel and in the cylinder of the gas engine of automatic small weapons. Presented a methodology for determining the thermodynamic and kinematic parameters of the gas engine. Set the parameters of the gas pulse and frequency of the shooting.

KEY WORDS: automatic small weapons, internal ballistics.

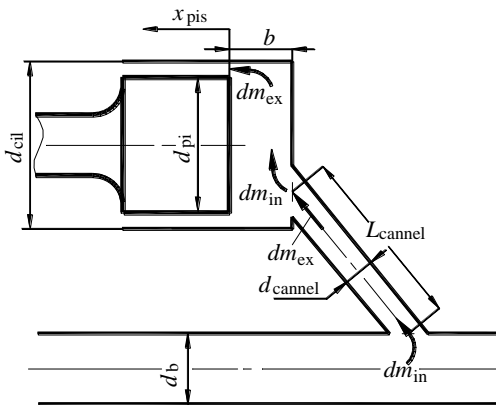


Fig. 1. Shema a gas engine with a short connecting channel

The gas engine which is sketched in Fig. 1 is a typical example of an open thermodynamic system. The connecting channel is an open thermodynamic system with fixed borders, while tsilindrobatalnata part has mobile border, and it is the piston. This fact determines the two different equations.

1. Differential equations for determining the temperature and pressure in the accession channel

It is assumed that the temperature in the binder channel is different from the temperature in the chamber. In this case, the equation

of the first law of thermodynamics conditions of the channel will have the following form:

$$(1) \quad idm_{in} - idm_{ex} = d(Mu) + dQ_w,$$

wherein: $idm_{in} = c_p T_b dm_{in}$ enthalpy is at the mouth of the barrel gases; T_b - the gas temperature in the chamber; $idm_{ex} = c_p T_{ch} dm_{ex}$ - enthalpy of gas leaking from the channel; T_{ch} - temperature of the gases in the channel.

In equation (1) is obtained:

$$c_p T_b dm_{in} - c_p T_{ch} dm_{ex} = Mdu + udM + dQ_w.$$

The above equation is divided into words $M_{ch} c_v T_{ch}$ and redundancies from which follows:

$$(2) \quad k \frac{T_b dm_{in}}{T_{ch} M_{ch}} - k \frac{dm_{ex}}{M_{ch}} = \frac{dT_{ch}}{T_{ch}} + \frac{dM_{ch}}{M_{ch}} + (k-1) \frac{dQ_w}{M_{ch} RT_{ch}}.$$

From the above equation is determined differential temperature

$$(3) \quad dT_{ch} = \frac{T_{ch}}{M_{ch}} \left[\left(k \frac{T_b}{T_{ch}} - 1 \right) dm_{in} - (k-1) dm_{ex} - (k-1) \frac{dQ_w}{RT_{ch}} \right].$$

The current value of the temperature in the chamber is calculated by the expression:

$$T_i = T_{i-1} + (dT)_{i-1}.$$

To obtain the differential equation for determining the pressure it is necessary to use the differential form of the characteristic equation bearing in mind that the volume of the channel is constant. Should,

$$(4) \quad \frac{dV}{V} = 0, \quad \frac{dp}{p} = \frac{dM}{M} + \frac{dT}{T}.$$

By substituting (4) into (2) is obtained,

$$k \frac{T_b dm_{in}}{T_{ch} M_{ch}} - k \frac{dm_{ex}}{M_{ch}} = \frac{dp_{ch}}{p_{ch}} + (k-1) \frac{dQ_w}{M_{ch} RT_{ch}}.$$

For differential pressure finally obtained:

$$(5) \quad dp_{ch} = k \frac{p_{ch}}{M_{ch}} \left[\frac{T_b}{T_{ch}} dm_{in} - dm_{ex} \right] - (k-1) \frac{dQ_w}{M_{ch} RT_{ch}}.$$

The change in pressure in the chamber is calculated by the expression:

$$p_i = p_{i-1} + (dp)_{i-1}.$$

2. The differential equations for determining the temperature and pressure in the cylinder space of the gas engine

It is assumed that the temperature in the cylinder of the gas engine is different from the temperature in the binder channel. In this case, the equation of the first law of thermodynamics conditions of cylinder gas engine will have the following form:

$$(6) \quad idm_{in} - idm_{ex} = d(Mu) + pdV + dQ_w,$$

wherein: $idm_{in} = c_p T_{ch} dm_{in}$ It is the enthalpy of the gas inflow channel; T_{ch} - the gas temperature in the channel; $idm_{ex} = c_p T_{g\ en} dm_{ex}$ - enthalpy of gas leaking from the channel; $T_{g\ en}$ - the gas temperature in the cylinder of the gas engine.

For equation (6) was prepared:

$$c_p T_{ch} dm_{in} - c_p T_{g\ en} dm_{ex} = Mdu + udM + pdV + dQ_w.$$

The above rovenstvo is divided into words $M_{g\ en} c_v T_{g\ en}$ and redundancies from which it follows:

$$(7) \quad k \frac{T_{ch} dm_{in}}{T_{g\ en} M_{g\ en}} - k \frac{dm_{ex}}{M_{g\ en}} = \frac{dT_{g\ en}}{T_{g\ en}} + \frac{dM_{g\ en}}{M_{g\ en}} + (k-1) \frac{dV_{g\ en}}{V_{g\ en}} + (k-1) \frac{dQ_w}{M_{g\ en} RT_{g\ en}}.$$

From the above equation is determined differential temperature.

$$(8) \quad dT_{g\ en} = T_{g\ en} \left[\left(k \frac{T_{ch}}{T_{g\ en}} - 1 \right) \frac{dm_{in}}{M_{g\ en}} - (k-1) \frac{dm_{ex}}{M_{g\ en}} - (k-1) \frac{dV_{g\ en}}{V_{g\ en}} - (k-1) \frac{dQ_w}{M_{g\ en} RT_{g\ en}} \right]$$

The current value of the temperature in the chamber is calculated by the expression:

$$T_i = T_{i-1} + (dT)_{i-1}$$

To obtain the differential equation for determining the pressure is to be used it underlying the differential form of the characteristic equation,

$$k \frac{T_{ch} dm_{in}}{T_{g\ en} M_{g\ en}} - k \frac{dm_{ex}}{M_{g\ en}} = \frac{dp_{g\ en}}{p_{g\ en}} + \frac{dV_{g\ en}}{V_{g\ en}} + (k-1) \frac{dV_{g\ en}}{V_{g\ en}} + (k-1) \frac{dQ_w}{M_{g\ en} RT_{g\ en}}$$

For the differential pressure to give a final:

$$(9) \quad dp_{g\ en} = p_{g\ en} \left[k \frac{T_{ch} dm_{in}}{T_{g\ en} M_{g\ en}} - k \frac{dm_{ex}}{M_{g\ en}} - k \frac{dV_{g\ en}}{V_{g\ en}} - (k-1) \frac{dQ_w}{M_{g\ en} RT_{g\ en}} \right]$$

The change in pressure in the gas engine is calculated by the expression:

$$p_i = p_{i-1} + (dp)_{i-1}$$

Below shows the results of calculated made with displayed equations to determine the pressure and temperature in the accession channel and the cylinder of the gas engine "Kalashnikov" 7.62 in Created opportunity from time to time step, which is calculated intra- ballistic process flowing into the barrel of the gun.

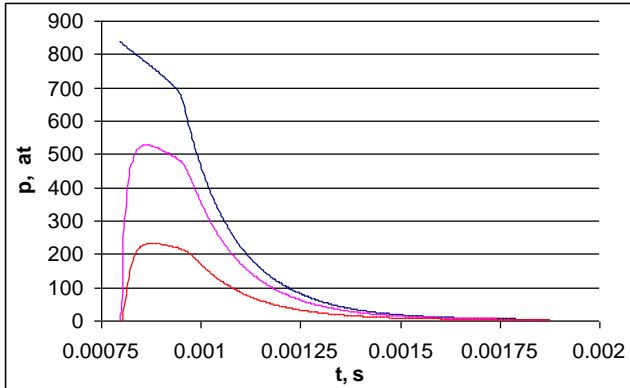


Fig. 2. Amendment of the pressure in the barrel of a "Kalashnikov" 7.62 - above in the accession channel-average curve and cylinder of the gas engine - as a function of time.

Figure 2 shows the change in pressure in the barrel - above defined equation of state and the expression

$$dT = (k-1)T \left(\frac{\bar{Q}_{ch} m_{ch}}{MRT} d\psi - \frac{dm_{ex}}{M} - \frac{dV}{V} - \frac{dQ_w}{MRT} \right),$$

in the accession channel-average curve determined by the equation of state and the expression (3) and the cylinder of the gas engine - as defined by the equation of state and the expression (8).

Determination of other parameters related to gas engine

Ignoring the strength of the return spring as it is much smaller than the gas, the path of the piston of the gas engine during the gas pulse is determined by the expression:

$$(10) \quad x_{pi\ i} = \frac{p_{g\ en} f_{pi}}{2m_{pi}} \Delta t_b^2 + v_{pi\ i-1} \Delta t_b + x_{pi\ i-1},$$

wherein: $p_{g\ en}$ is the gas pressure in the gas engine; f_{pi} - the area of the piston crown; m_{pi} - the mass of the piston and prision; v_{pi} - the speed of the piston; Δt_b - time interval, which is calculated in the process barrel.

Fig.3. It shows the result of calculation of the path of the gas piston engine of a "Kalashnikov" 7.62 as a function of time during the gas impulse.

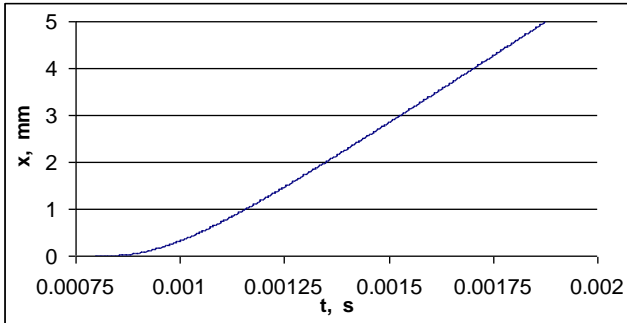


Fig. 3. Path of the gas piston engine of a "Kalashnikov" 7.62 as a function of time.

The speed of the piston is determined respectively by the expression:

$$(11) \quad v_{pi\ i} = \frac{p_{g\ en} f_{pi}}{m_{pi}} \Delta t_b + v_{pi\ i-1}.$$

Figure 4. It shows the result of the calculation speed of the gas piston engine of a "Kalashnikov" 7.62 as a function of time during the gas impulse.

After the expiry of the gases, their impact on the piston is stopped and it continues to move backward momentum, as it is applied on only the power of the recoil spring. During this period the movement of the plunger is described by the following equations:

$$(12) \quad x_{pi\ i} = \frac{F_{sp}}{m_{pi}} \Delta t_{g, en}^2 + v_{pi\ i-1} \Delta t_{g, en} + x_{pi\ i-1},$$

$$(13) \quad v_{pi\ i} = \frac{F_{sp}}{m_{pi}} \Delta t_{g, en} + v_{pi\ i-1},$$

wherein: F_{sp} the force of the recoil spring.

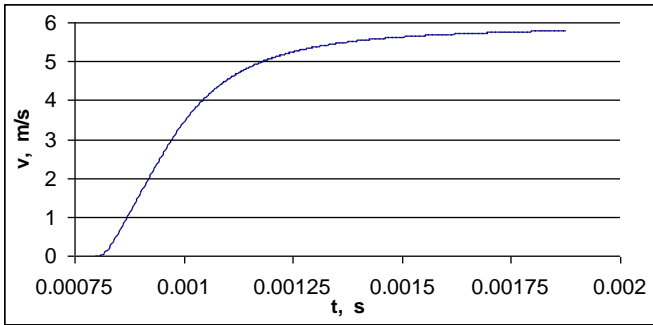


Fig. 4. Amendment of the speed of the gas piston engine of a "Kalashnikov" 7.62 as a function of time during the pulse.

In figure 5. It shows the result of calculations for the road and the speed of the gas piston engine of a "Kalashnikov" 7.62 as a function of time during recharging.

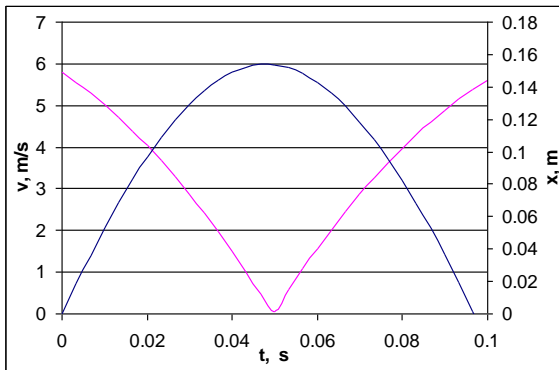


Fig. 5. Amendment of the speed and path of the piston (convex curve) of the gas engine "Kalashnikov" 7.62 as a function of time during the process of refueling.

It should be clarified that the initial speed with which the kinematic parameters are calculated in the process of recharging, is actually the last value of the speed obtained at the end of the pulse. This speed can be reported in Figure 4. and it is 5.75 m / s.

The path which takes the piston during the entire pulse (together with the period of the leakage) is 4.96 mm. The path which takes the piston during the period in which the bullet is moving between the exhaust outlet of the gas engine and the end of the barrel (that is the main part of the pulse) is 0,17 mm. The impulse and the process of recharging in many different time intervals. By ignoring resistances that cause the process of ejection of the cartridge and insertion of a new cartridge in the chamber, the time interval for which the recharging is carried out is about 0,01 s. The period of the entire pulse takes about 0,00108 s., And the period during which the bullet is moving between the

exhaust duct and the end of the barrel takes about 0,00016 s. In other words, the period of the pulse is from 100 to 600 times shorter than the period of recharging. Time interval, which calculated the processes in the barrel and the gas engine is 0,00000236 s, and the time interval, which calculated parameters of overcharging is 0,0033 s. i.e. the difference is 1400 times.

As a criterion for authentication results displayed using skorostrelnosta. From Fig. 5 shows that the time for one cycle (shot and recharging) of a considered example (AK 7,62H39) is about 0,1 s. In this case, for skorostrelnosta was prepared

$$\text{quantities shot for 1 min} = \frac{60}{\text{the time one cycle in seconds}} = \frac{60}{0,1} = 600 .$$

It is clear that the speed of the shooting a composite indicator of automatic weapons.

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EQUATION FOR DETERMINING THE PRESSURE CHAMBER OF ROCKET ENGINES WITH LIQUID FUELS

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ABSTRACT: Based on the quasi-thermodynamic method is displayed equation to determine the pressure in the rocket engine using liquid fuel.

KEY WORDS: rocket engines with liquid fuels.

In the chamber of the rocket engine using liquid fuel - Fig. 1, fuel and oxidant enter the liquid phase it is assumed that there is a surplus of oxidant. With the engine in a closed circuit camera in entering and gas from gazgeneratora. Excess oxidant passes into the gas phase, but not by combustion but by evaporation under which absorbs heat. Absorbed heat by evaporation of the fuel and oxidant involved in burning more account in determining the specific heat of combustion. For example, the specific heat of combustion of kerosene with liquid oxygen is four or five times less than the specific heat of combustion of kerosene by oxygen gas. In this case, having in mind that the volume of the combustion chamber is constant, the equation of the first law of thermodynamics will have the following form:

$$(1) \quad dQ + udm_g + idm_{gg} - idm_{ex} = d(Mu) + dQ_{ox} + dQ_w,$$

where dQ imported heat of combustion; dQ_{ox} - a elementary amount of heat necessary to evaporate the excess oxidant; dQ_w - heat loss; $udm_g = c_p T dm_{fu}$ - internal energy of gases produced by combustion; idm_{gg} -enthalpy of the gases of gasgenerator; $idm_{ex} = c_p T dm_{ex}$ - enthalpy of the gases expiring; T - the gas temperature in the chamber.

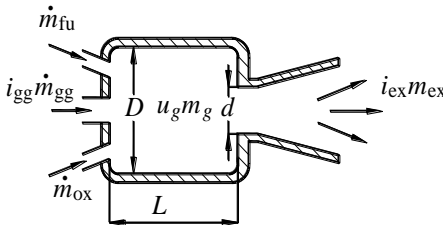


Fig. 1 Scheme of rocket engine with the necessary indications.

Accompanying example was developed with the following data:

$$D_{cha} = 0,2 \text{ m}; L_{cha} = 0,4 \text{ m}; d_{ex} = 0,05 \text{ m};$$

$$V_{cha} \square 0,0125 \text{ m}^3; \dot{m}_{fu} \square 40 \text{ kg/s}; \alpha = 1,5$$

In equation (1) was prepared:

$$H_u dm_{fu} + c_v T dm_{fu} + c_p T dm_{gg} - c_p T dm_{ex} = Mdu + udM + dQ_{ox} + dQ_w.$$

H_u is the specific heat of combustion of fuel and oxidant.

The above equation is divided into words Mc_vT and cuts out what follows:

$$(2) \quad (k-1) \frac{H_u dm_{fu}}{RTM} + \frac{dm_{fu}}{M} + k \frac{dm_{gg}}{M} - k \frac{dm_{ex}}{M} = \frac{dT}{T} + \frac{dM}{M} + (k-1) \frac{dQ_{ox}}{RTM} + (k-1) \frac{dQ_w}{RTM} .$$

Taking into account that $dM = dm_{fu} + dm_{ox} + dm_{gg} - dm_{ex}$ from the above equation is determined differential temperature,

$$\frac{dT}{T} = (k-1) \frac{H_u dm_{fu}}{RTM} + (k-1) \frac{dm_{gg}}{M} - (k-1) \frac{dm_{ex}}{M} - \frac{dm_{ox}}{M} - (k-1) \frac{dQ_{ox}}{RTM} - (k-1) \frac{dQ_w}{RTM} .$$

Finally gets:

$$(3) \quad dT = (k-1) \frac{T}{M} \left(\frac{H_u dm_{fu}}{RT} + dm_{gg} - dm_{ex} - \frac{dQ_{ox}}{RT} - \frac{dQ_w}{RT} \right) - \frac{T dm_{ox}}{M} .$$

Equation (3) represents the differential equation for determining the change in temperature in the chamber of the rocket engine using liquid fuel.

The current value of the temperature in the chamber is calculated by the expression:

$$T_i = T_{i-1} + (dT)_{i-1} .$$

For calculating the current pressure value using the equation in the form status:

$$p = \frac{RMT}{V} .$$

In the figures 2, 3 and 4 show the results of numerical experiments conducted with equation (3). The curves show the change of parameters during the starting process, the regime and spiraea engine. Numerical example is developed with data on fuel kerosene and liquid oxygen oxidizer.

Fig. 2 is a change in the average temperature in the chamber of the rocket engine liquid propellant at different fuel supply as a function of time.

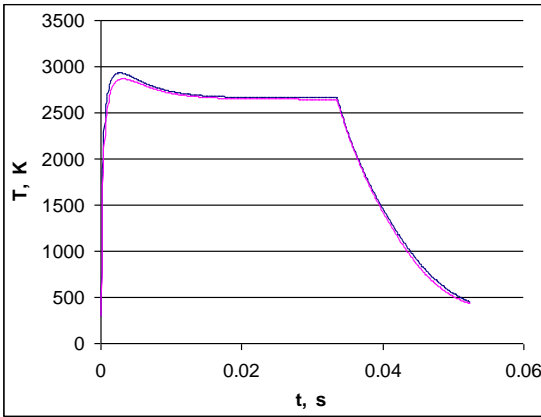


Fig. 2 Amendment to the temperature as a function of time in the combustion chamber of the rocket engine liquid propellant at different fuel supply as a function of time.

Fig. 3 shows the change in pressure in the chamber of the rocket engine liquid propellant at different fuel supply as a function of time.

Fig. 4 shows the change of mass of the working substance in the combustion chamber of a rocket engine with a liquid fuel as a function of time.

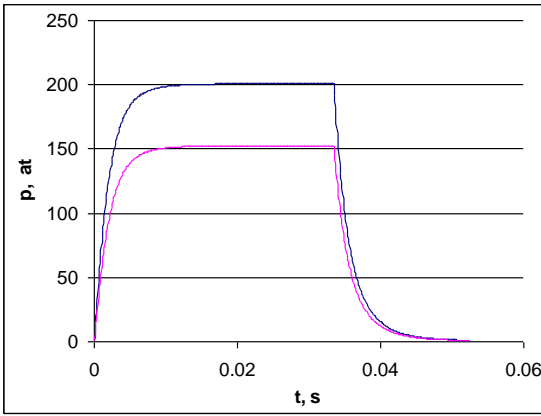


Fig. 3. Change the pressure as a function of time in the combustion chamber of the rocket engine liquid propellant at different fuel supply as a function of time.

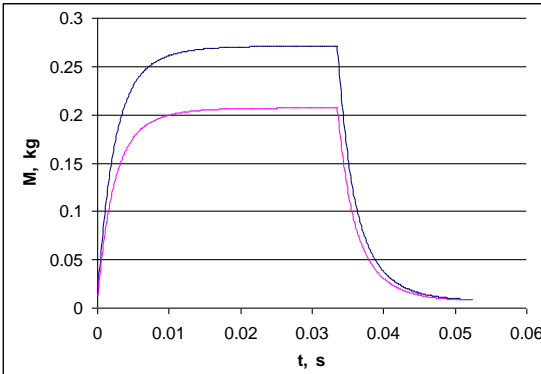


Fig. 4. Amendment of the mass of the working substance as a function of time in the combustion chamber of the rocket engine using liquid fuel.

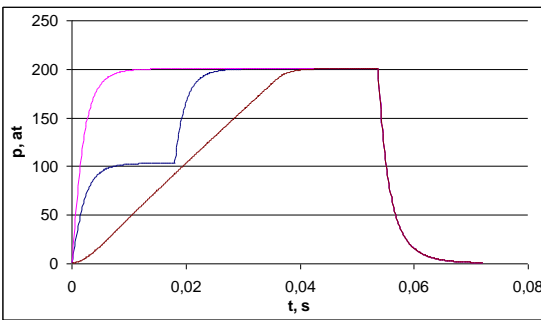


Fig. 5. Amendment of the pressure in the combustion chamber with three different ways of starting - usually a stepped manner and smoothly in a linear law.

Fig. 5 shows the change of the pressure in the chamber in three different ways of putting - typically, a stepped manner and continuously in a linear law. The latter is used linear law amending the submission of fuel and oxidizer.

The displayed figures can trace the logic of the development process and to conclude on the adequacy of the equation (3) and mathematical model as a whole. To check the verification of the equation (3) and computational methods are generally made calculations for engine NK-33 (Nikolai Kuznetsov - 33) who works in a closed circuit. The results obtained are as follows:

- Chamber pressure - calculated value 142,6 at, factory worth 142 at, difference 0.43%;
- Tractive force - calculated value 161,6 t, factory worth 154 t, difference 4.7%;
- Specific impulse - calculated value 298,6 at, factory worth 297 at, difference 0.55%.

The vast difference, for traction due to the fact that they have not reported any losses in the nozzle of the engine.

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OPTIMIZATION OF PROJECTILES MOTION IN A VACUUM ACTIONABLE BY A REACTIVE SYSTEM

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Abstract: *The trend of obtaining a bigger projectile range involving significant weight increase of the gun since they are subjected to stresses its systems (barrel, elastic connection, carriage etc.) increases substantially upon increasing the kinetic energy of the projectile leaving the cannon barrel. A solution to remove these easements, such as increasing the range does not affect the weight of the projectile, lies in equipping projectile with a solid propellant rocket motor, to be put into operation after the projectile leaves the cannon barrel. This provides increased initial impulse of the projectile and therefore it's range, leaving unchanged the cannon and thus energy dimensions and weights of the rolling artillery components. In this paper, we approach the problem of determining the optimal timing of commissioning of the rocket engine acceleration subject to the maximum range for projectile motion in a vacuum.*

Keywords: *reactive system, rocket, ballistics, cannon barrel, optimum momentum.*

1. INTRODUCTION

Resolving the problem in the vacuum movement interests because there are situations in which the solution provides, at least in a first approximation, information on the best time of commissioning of the rocket engine acceleration. Studying the problem in case of air movement is made using assumptions of the fundamental problem of exterior ballistics. In this case the optimal timing of commissioning can cause near-actual conditions using optimization methods. It also can highlight the influence of various parameters on the optimal timing value.

The following are studying the movement of this type of projectile using simplifying assumptions:

a) the motion is in vacuum only under its own weight, considering that the vector \vec{g} is constant;

b) consider the life of the accelerator is very low, in this range the dominant force is traction of the engine; It can be admitted in first approximation so that the fuel is consumed instantaneously and that the direction of speed remains virtually constant during the active period.

Therefore, in a current point P , on the trajectory has an increase continuously of the speed module, from the $V \cdot \vec{\tau}$ at the value $(V + \Delta V) \cdot \vec{\tau}$, in which the path denoted $\vec{\tau}$ by the unit tangent vector at the point P , and

$$\Delta V = V^* \cdot \ln \left(1 + \frac{\Delta m}{m^*} \right) \quad (1)$$

where V^* is the actual speed gas out of the rocket engine nozzle, $\Delta m = \frac{\omega Q}{g}$ is the mass of solid fuel, and $m^* = \frac{q_2}{g}$ is the mass of the projectile after consuming propellant reserve.

2. EXPRESSION OF RANGE FOR THE PROJECTILE EQUIPPED WITH AN ENGINE ROCKET IN A VACUUM MOTION

It is considered that the movement of the projectile is composed of two phases: the first phase is moving of the projectile fire from leaving the cannon barrel to the commissioning of rocket engine; the second phase of the motion starts when the rocket engine operation stop.

Since it has been found that the supply of propellant is consumed instantaneously, it is clear that the position of the projectile and the tangent to the trajectory at the beginning of the second phase coincides with the end of the first phase. To study the movement in the first phase it is contemplated that the projectile is launched from the point O_I with speed \bar{V}_0 (figure 1). The plan of fire is defined system O_Ixy with horizontal O_Ix and the vertical axis O_Iy ; vector \bar{V}_0 axis angle is θ_0 the angle of projection.

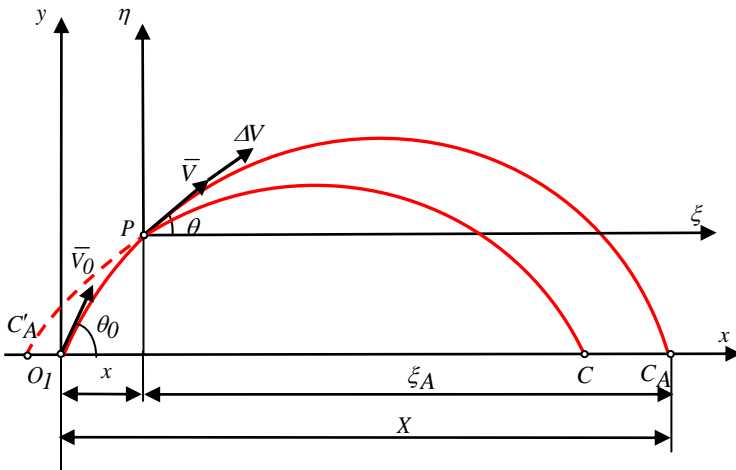


Figure 1. The range of the projectile equipped with an engine rocket

The differential equations of the projectile motion in vacuum

$$\begin{cases} \ddot{x} = 0, \\ \ddot{y} = -g, \end{cases} \quad (2)$$

with initial conditions $t = 0$, $x = y = 0$, $\dot{x} = V_0 \cdot \cos \theta_0$, $\dot{y} = V_0 \cdot \sin \theta_0$ results:

$$\dot{x} \equiv V \cdot \cos \theta = V_0 \cdot \cos \theta_0 \quad (3)$$

$$\dot{y} \equiv V \cdot \sin \theta = V_0 \cdot \sin \theta_0 - g \cdot t \quad (4)$$

and integrating once again:

$$x = V_0 \cdot t \cdot \cos \theta_0 \quad (5)$$

$$y = V_0 \cdot t \cdot \sin \theta_0 - \frac{1}{2} \cdot g \cdot t^2 \quad (6)$$

where to get known trajectory equation:

$$y = x \cdot \operatorname{tg} \theta_0 - \frac{g}{2 \cdot V_0^2 \cdot \cos^2 \theta_0} \cdot x^2 \quad (7)$$

Differentiating equation (7) relative to x give

$$\operatorname{tg} \theta = \operatorname{tg} \theta_0 - \frac{g}{V_0^2 \cdot \cos^2 \theta_0} \cdot x \quad (8)$$

which θ is the angle formed by the tangent to the trajectory at a point with $O_I x$ axis.

It is noted that instead of the independent variable, t , can be selected one of the variables x or θ . The following is taken as an independent variable angle θ . The equations of motion in relation to variable θ obtained from relations (7) and (8):

$$x = \frac{V_0^2 \cdot \cos^2 \theta_0}{g} \cdot (\operatorname{tg} \theta_0 - \operatorname{tg} \theta) \quad (5')$$

$$y = \frac{V_0^2 \cdot \cos^2 \theta_0}{2 \cdot g} \cdot (\operatorname{tg}^2 \theta_0 - \operatorname{tg}^2 \theta) \quad (6')$$

From equation (3) is obtained speed of the projectile at a current point, P , of the trajectory:

$$V = V_0 \cdot \frac{\cos \theta_0}{\cos \theta} \quad (9)$$

and from relations (5) and (5') results dependence of the variables t and the angle θ :

$$t = \frac{V_0}{g} \cdot \sin(\theta_0 - \theta) \cdot \frac{1}{\cos \theta} \quad (10)$$

where $\theta_0 \geq \theta \geq -\theta_0$

In point P , occurs the instant rocket engine operation, so that the speed of the projectile becomes:

$$V_I = V + \Delta V$$

or in view of (9)

$$V_I = V_0 \cdot \frac{\cos \theta_0}{\cos \theta} + \Delta V \quad (11)$$

The movement of the projectile in the second stage is related to the system $P\xi\eta$ (figure 1).

In relation to this system, the second phase trajectory equation of motion is:

$$\eta = \xi \cdot \operatorname{tg} \theta - \frac{g}{2 \cdot V_I^2 \cdot \cos^2 \theta} \cdot \xi^2 \quad (12)$$

Fall coordinates C_A of the system $P\xi\eta$, respectively $\xi = \xi_I$ and $\eta = -y$, must verify equation (12) result

$$\xi_A^2 - \frac{V_I^2 \cdot \sin 2\theta}{g} \cdot \xi_A - \frac{2 \cdot V_I^2 \cdot \cos^2 \theta}{g} \cdot y = 0 \quad (13)$$

Equation (13) is an equation which can determine value of ξ_A . Retaining solution that makes sense physical in problem, obtain:

$$\xi_A = \frac{V_I^2 \cdot \sin 2\theta}{2 \cdot g} \cdot \left(1 + \sqrt{1 + \frac{2 \cdot g \cdot y}{V_I^2 \cdot \sin^2 \theta}} \right) \quad (14)$$

so that the total range of the projectile launched from point O_I is:

$$X = x + \xi_A = x + \frac{V_I^2 \cdot \sin 2\theta}{2 \cdot g} \cdot \left(1 + \sqrt{1 + \frac{2 \cdot g \cdot y}{V_I^2 \cdot \sin^2 \theta}} \right) \quad (15)$$

where, taking into account the relations (5'), (6') and (11), resulting in the end:

$$\begin{aligned} g \cdot X(\theta) &= (V_0 \cdot \sin \theta_0 + \Delta V \cdot \sin \theta) \cdot (V_0 \cdot \cos \theta_0 + \Delta V \cdot \cos \theta) - \\ &- V_0 \cdot \Delta v \cdot \sin(\theta_0 - \theta) + (V_0 \cdot \cos \theta_0 + \Delta V \cos \theta) \times \\ &\times \sqrt{(V_0 \cdot \sin \theta_0 + \Delta V \cdot \sin \theta)^2 - 2 \cdot V_0 \cdot \Delta V \cdot \operatorname{tg} \theta \cdot \sin(\theta_0 - \theta)} \end{aligned} \quad (15')$$

or by dividing both sides by V_0^2

$$\begin{aligned} D(\theta) &= \frac{X(\theta)}{(X_{max})_{V_0}} = \frac{X(\theta)}{\frac{V_0^2}{g}} = \frac{g \cdot X}{V_0^2} = (\sin \theta_0 + v \cdot \sin \theta) \cdot \\ &\cdot (\cos \theta_0 + v \cdot \cos \theta) - v \cdot \sin(\theta_0 - \theta) + (\cos \theta_0 + v \cdot \cos \theta) \cdot \\ &\cdot \sqrt{(\sin \theta_0 + v \cdot \sin \theta)^2 - 2 \cdot v \cdot \operatorname{tg} \theta \cdot \sin(\theta_0 - \theta)} \end{aligned} \quad (15'')$$

which was introduced notation:

$$v = \frac{\Delta V}{V_0} \quad (16)$$

and it was considered that $\frac{V_0^2}{g} = (X_{max})_{V_0}$ is maximum range with V_0 speed of the projectile fired in the absence of the second phase, when the projectile is not equipped with rocket engine.

3. THE OPTIMAL MOMENT OF COMMISSIONING ROCKET ENGINE FOR THE PROJECTILE MOTION IN A VACUUM

3.1 Problem formulation

The resulting expression of the range is a function of the θ angle that defines the projectile position when operating with rocket engine on the trajectory and hence lasting, t of the first phase; other dimensions, for example V_0 , θ_0 , ΔV , in the expression (15'), or v , θ_0 , in the expression (15''), are considered in the following as parameters.

So, if you are given the initial conditions (V_0, θ_0) and the value of extra speed, ΔV to determine the optimal momentum of commissioning of the rocket engine it is necessary to study the extremes of function $D = D(\theta)$ from condition

$$\frac{d}{d\theta} D(\theta) = 0 \quad (17)$$

who can be written

$$f_1(\theta) + \frac{1}{\sqrt{f_3(\theta)}} \cdot f_2(\theta) = 0 \quad (17')$$

where:

$$f_1(\theta) = v^2 \cdot \cos 2\theta + 2 \cdot v \cdot \cos \theta_0 \cdot \cos \theta$$

$$f_2(\theta) = \left[\cos 2\theta_0 + \frac{\cos^2 \theta_0}{\cos^2 \theta} + v \cdot (3 - 4 \cdot \cos \theta_0 \cdot \sin^2 \theta) \cdot \frac{\cos \theta_0}{\cos \theta} + v^2 \cdot \sin 2\theta \right] \cdot v \cdot \sin \theta$$

$$f_3(\theta) = \sin^2 \theta_0 + 2 \cdot v \cdot \cos \theta_0 \cdot \sin \theta \cdot \operatorname{tg} \theta + v^2 \cdot \sin^2 \theta$$

Rationalizing the equation (17'), finally gives:

$$\begin{aligned} & (1 + 2 \cdot v^2) \cdot \cos^6 \theta + 6 \cdot v \cdot \cos \theta_0 \cdot \cos^5 \theta - \left[\sin 2\theta_0 + v^2 \cdot (2 \cdot \cos^2 \theta_0 + 1) \right] \cdot \cos^4 \theta - \\ & - 2 \cdot v \cdot (1 + 3 \cdot \cos^2 \theta_0) \cdot \cos \theta_0 \cdot \cos^3 \theta + (2 - 3 \cdot \cos^2 \theta_0 + v^2) \cdot \cos^2 \theta_0 \cdot \cos^2 \theta + \\ & + 2 \cdot v \cdot \cos^3 \theta_0 \cdot \cos \theta - \cos^4 \theta_0 = 0 \end{aligned}$$

equation admitting roots $\cos \theta = \cos \theta_0$ and $\cos \theta = -\cos \theta_0$ thus in the end equation (17) becomes:

$$\left(z^2 - z_0^2 \right) \cdot \Phi(z) = 0 \quad (18)$$

using the notations:

$$z = \cos \theta, \quad z_0 = \cos \theta_0 \quad (19)$$

and

$$\Phi(z) = (1 + 2 \cdot v^2) \cdot z^4 + 6 \cdot v \cdot z_0 \cdot z^3 - (1 - 3 \cdot z_0^2 + v^2) \cdot z^2 - 2 \cdot v \cdot z_0 \cdot z + z_0^2 \quad (20)$$

Equation (17) admits roots $\theta = \theta_0$, $\theta = \pi - \theta_0$, $\theta = -\theta_0$, $\theta = \pi + \theta_0$. Of these, last three roots are foreign, second and fourth having respect and corresponding distal third of the second point of intersection of parallels to the axis Ox (distance OC_A).

The other roots of the equation (17) are given by equation $\Phi(z)=0$. Based on Descartes's theorem, the analysis variations signs polynomial number $\Phi(z)$, that equation has two positive roots or none. To locate these roots is considered polynomial expression:

$$\Phi_1(z) = \frac{d\Phi(z)}{dz} = 4 \cdot (1 + 2 \cdot v^2) \cdot z^3 + 18 \cdot v \cdot z_0 \cdot z^2 + 2 \cdot (3 \cdot z_0 - 1 - v^2) \cdot z - 2 \cdot v \cdot z_0$$

Since $\Phi(0) > 0$ and $\Phi(1) > 0$, $\Phi_1(0) < 0$ and $\Phi_1(1) > 0$ if there are two positive roots they will be smaller than unit.

We note these two roots z_1 and z_2 ($z_1 < z_2$); if both roots are contained in the range $(z_0, 1)$, then these roots correspond to two points on the trajectory; a corresponding lower root nearest point of origin and root larger, corresponding a point more distant of origin.

To determine whether roots z are located in the variable domain of existence $z_0 \leq z \leq 1$, it is necessary to analyze the sign:

$$\Phi(z_0) = (v + 2) \cdot z_0^2 \cdot \left[2 \cdot z_0^2 \cdot (1 + v) - v \right]$$

knowing that the other end of the range it has $\Phi(1) = (v + 2 \cdot z_0)^2$.

Obtained following cases:

$$\text{A) } z_0 > z_0^*, \quad \Phi(z_0) > 0,$$

$$\text{B) } z_0 < z_0^*, \quad \Phi(z_0) < 0,$$

$$\text{C) } z_0 = z_0^*, \quad \Phi(z_0) = 0,$$

where

$$z_0^* = \sqrt{\frac{v}{2 \cdot (v + 1)}}$$

i.e. the

$$\theta^* = \arccos \sqrt{\frac{v}{2 \cdot (v + 1)}}$$

However, the sign analysis tool for function

$$\Phi_1(z_0^*) = 2 \cdot z_0^* \cdot (v + 2) \cdot \left(v - \frac{1}{2} \right)$$

cases distinguished:

$$\text{a) } v > \frac{1}{2}; \quad \Phi_1(z_0^*) > 0;$$

$$\text{b) } v < \frac{1}{2}; \quad \Phi_1(z_0^*) < 0;$$

$$\text{c) } v = \frac{1}{2}; \quad \Phi_1(z_0^*) = 0.$$

3.2 Solving the problem in different cases

a) Case $v > 0,5$

For $z_0 = z_0^*$ we have $\Phi_1(z_0^*) = 0$ and $\Phi_1'(z_0^*) > 0$ which means that $0 < z_1 < z_0^*$ and

$z_2 = z_0^*$. It is noted that in this case the function (15') has a maximum point $z_2 = z_0^*$; therefore the maximum range is achieved if the rocket engine operates on leaving the cannon barrel.

If $z_0 > z_0^*$ then $z_1 < z_2 < z_0$, so that the function (15') has a maximum point $z = z_0$; therefore maximum range if the rocket engine works, also on leaving the cannon barrel.

If $z_0 < z_0^*$ so $0 < z_1 < z_0 < z_2 < 1$ then the function (15') has a minimum point $z = z_0$ and an absolute maximum point $z = z_2$. To achieve maximum range, it is necessary that the rocket engine is operated at a point of the trajectory whose position is defined by $\theta = \theta_2 = \arccos z_2$ (figure 2).

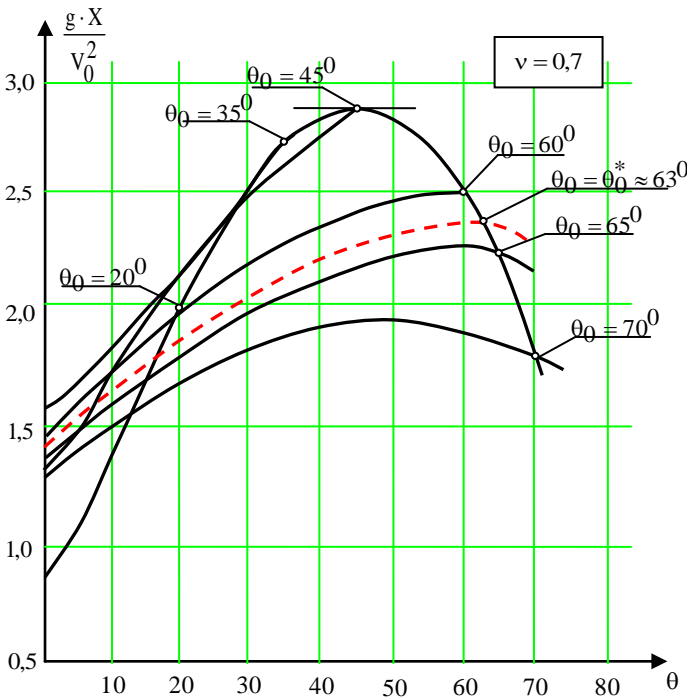


Figure 2. Function $\frac{g \cdot X}{V_0^2}$ for $v = 0,7$

b) Case $v = 0,5$

For $z_0 = z_0^*$, that is $\theta_0^* \cong 65,9^0$, we have $\Phi(z_0^*) = 0$ and $\Phi_1(z_0^*) = 0$. The equation $\Phi(z) = 0$ thus has a double root ($z_1 = z_2 = z_0^*$). The maximum range obtained if the rocket engine is operated on leaving the cannon barrel. The same situation occurs in the case $z_0 > z_0^*$ when the equation $\Phi(z) = 0$ has no root in the area $(z_0, 1)$ figure 3.

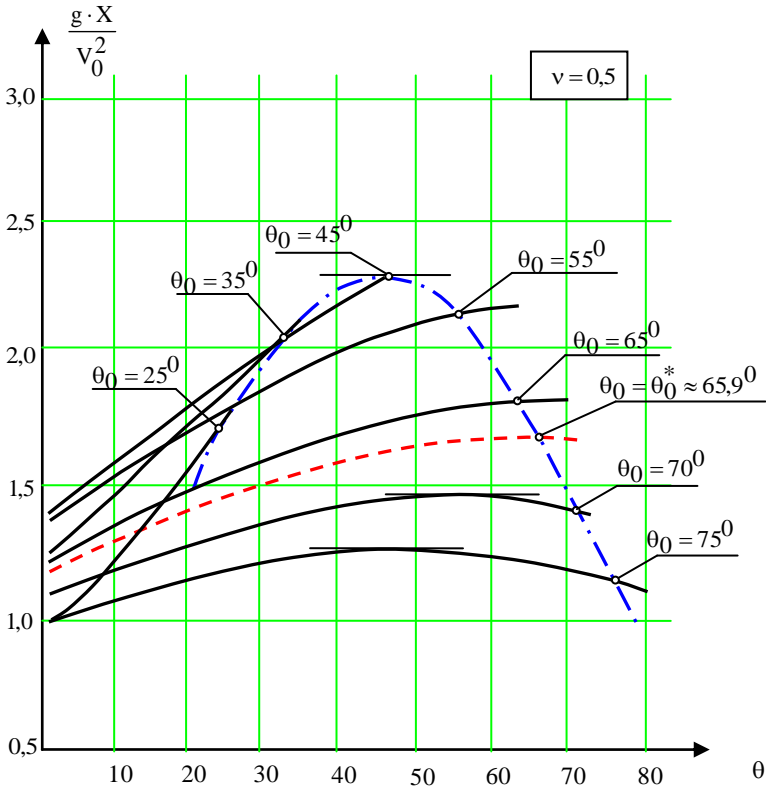


Figure 3. Function $\frac{g \cdot X}{V_0^2}$ for $v = 0,5$

c) Case $v < 0,5$

For $z_0 > z_0^*$ the equation $\Phi(z) = 0$ has two real roots z_1 and z_2 , or either in the domain $(z_0, 1)$. In figure 4 are plotted roots of the equation, $\theta_2 = \arccos z_2$ and

$\theta_1 = \arccos z_1$ for different values of v and θ_0 ; $\theta_2 = -\arccos z_2$ and $\theta_1 = -\arccos z_1$ are foreign roots and corresponding to the maximum distance OC_A .

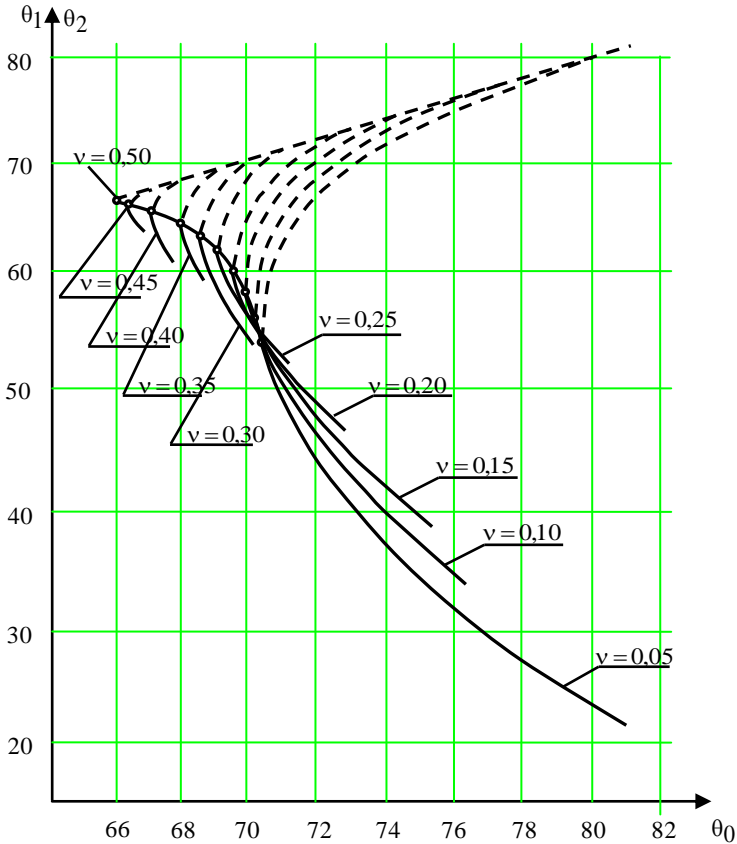


Figure 4. Functions $\theta_1(\theta_0, v)$ and $\theta_2(\theta_0, v)$

From what has been stated that, $v < 0,5$, the inclination of importance demarcating θ_0^{cr} where the maximum range is obtained by operating the rocket engine in a given point on the trajectory or in the moment when leaving the cannon barrel.

4. CONCLUSIONS

The results obtained are qualitative given simplifying assumptions mentioned at the beginning of the paper. Considering the aerodynamic forces and the fact that growth of speed ΔV is not instantaneous, the rocket engine operating at a certain time, lead to correction of these results sometimes in rather small limits.

It is expected that when the real movement of range addiction variable θ for different parameter values θ_0 and V have the same character, modifying obviously limit values, θ_0^* , θ_0^{**} and θ_0^{cr} .

The results of the study of the motion of the projectile in a vacuum are as close to reality as the drag force is less than the weight of the projectile. Such situations are found, for example, when the projectile has a better aerodynamic shape, a weight of $50 \div 100 \text{Kg}$ and a speed of up to $200 \div 250 \frac{\text{m}}{\text{s}}$; also when the heavy weight projectile is fired of initial high speed, over $1200 \div 1500 \frac{\text{m}}{\text{s}}$, when most of the trajectory is great heights, above $8 \div 10 \text{km}$, where the air density is very low.

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AN APPROACH FOR ESTIMATION OF THE GEOMETRICAL PARAMETERS OF THE CANNON BARREL

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Abstract: - In this paper is made an attempt for more detail explanation of the mechanism of the wearing in the cannon barrel bore. The dominant process of wearing in the middle of the cannon barrel is a high-velocity movement friction. An statistical model is worked out for the influence estimation of the geometrical parameters of the cannon barrel bore. The wearing of the bore influences to the ballistic characteristics of the cannon.

Keywords: - wearing out, ballistic

1. Introduction

Ballistic parameters of the artillery systems are constantly changing due to the wearing out of the cannon barrel during the exploitation process. This change can be studied with the help of statistical modeling methods. The aim is to make the link between the number of shots and the wear that can be used to estimate the degree of wear, respectively, to make a quantitative assessment of the technical condition and readiness for combat artillery weapons.

The wearing of the working surface due to friction at high velocity movement occurs in the form of complex and multi-variant in content and parameters physical and chemical processes and defines the exploitation reliability of the technical system.

2. Mechanisms of wearing at high-velocity movement friction

The friction of hard bodies at velocity of sliding of over 100 m/s is a borderline case of external friction [6, 8]. A characteristic feature of this type of friction is the intensive heat exchange at the contact area. In some cases the contact temperature can reach the melting point of one of the materials subjected to the friction. In that case the friction parameters of the participating elements will be defined by the properties of the melted film.

On both surfaces of friction – the barrel bore wall and the projectile guiding elements – a sharp asymmetry of temperature fields is observed. The thickness of the highly heated surface layers of the projectile considerably exceeds the thickness of the analogically heated surface layers of the barrel bore wall. Since the cannon barrel possesses better mechanical properties and melting point of the cannon steel is much higher than that of the copper alloy of which the projectile guiding belt is made, the wearing process occurs by ‘applying’ thin surface layers from the projectile belt onto the barrel bore walls [3, 8].

As a result of the high temperature of the rubbing surfaces, at the borders of contact appears intensive plastic deformation. In some points of the real contact area occur local centers of melting which, with increasing the projectile velocity, grow into bigger melted sections of considerable area at the contact borders. Thus, the friction surfaces wearing at

high velocity friction is the result of worsening the mechanical properties, high adhesion and transferring of highly heated and melted thin surface layers on the barrel bore.

Due to the wearing of the guiding belt, the middle part of the barrel bore (the cannon muzzle half of the barrel bore) is covered with a thin film (adhesion residue). At first sight, at those conditions of friction, there should not be any wearing in the barrel bore. However, the experience and the study of the artillery systems barrel bores show that there is wearing of the bore.

One of the main reasons for the occurring of the cannon barrel bore wearing process is the availability of high thermal tensions in its surface layers, resulting in high temperature gradients. The thermal tensions bring about the cracks formation in the rubbing surfaces of the barrel bore which later grow bigger and cause particles from the bore surface to detach and tear off. At high velocity friction in the bore, with increasing the velocity of sliding, especially with the systems with higher muzzle velocity, the points of the microroughnesses on the barrel inner surface get melted. During the next firings, the barrel unlike the material, transported by the guiding belt, has not been heated yet to the melting point and is covered with a thin film, thus no further melting of its surface layers can occur.

The borders of the friction contact are the guiding belt friction surface and the film surface. The heated section and the melted film on the surface of the barrel bore are oxidized, turn brittle and are easily separated mechanically. The film appears after the high temperature friction process completion. The barrel bore surface wearing in the form of cracks formations happens much more intensively since the temperature gradient is much higher.

3. Statistics modeling of the wearing process at high velocity friction

Having analyzed the mechanisms of wearing in the mid-section of the cannon body, it becomes obvious that in the muzzle (second) half of the barrel bore the adhesion residue from the guiding belt is smaller and more evenly spread over the internal surface. Therefore, when carrying out the passive experiment, the measuring of the degree of wearing is made at six cross-sections, perpendicular to the axis-bore line and located at different distances from the muzzle of the barrel bore .

In order to model statistically the wearing process in the mid section of the cannon barrel bore of 12 artillery systems M-30, six cross-sections, located at 600 to 850mm from the muzzle have been measure diametrically at every 50mm. The measurements have been taken during exploitation at every 1000 shots [4].

Taking into consideration the experience accumulated and the physico-chemical nature of the wearing process of the cannon barrel bore, the graphic interpretation of the correlation 'wearing - number of shots' appears as a parabolic or a step curve with a symmetry axis – the abscissa. The mathematical modeling of wearing, using equations of a higher range functions and particularly one-factor-models of non-linear regression, turns out to be much more adequate compared to the linear approximation of the process [5].

As the variety of non-linear correlations is very big, we have focused on several kinds of polinoms. The assessments of these polynom coefficients are usually defined by the method of the smallest squares (MSS) [2]. With the MSS we get assessments which are adequate, not displaced and effective.

Coefficients of linear regression have geometric interpretation. The proportionality factor is the slope of the rights and free member is the value of the observable magnitude at a zero meaning of the control value.

Functional equation of theory:

$$\hat{y}_{x_n} = a_0 + a_1 x + a_2 x^2 + \dots + a_k x^k = \sum_{k=1}^n a_k x^k \quad (1)$$

To find the coefficients of the regressive equation (1), a system of four normal linear equations is created

$$\left\{ \begin{array}{l} \sum_{i=1}^n y_i x_i = b \sum_{i=1}^n x_i + a \sum_{i=1}^n x_i^2 \\ \sum_{i=1}^n y_i x_i^2 = b \sum_{i=1}^n x_i^2 + a \sum_{i=1}^n x_i^3 \\ \sum_{i=1}^n y_i x_i^3 = c \sum_{i=1}^n x_i^2 + b \sum_{i=1}^n x_i^3 + a \sum_{i=1}^n x_i^4 \end{array} \right. \quad (2)$$

After solving the systems normal equations (2), the following results are obtained for the assessment of the coefficients of the regressive equations (1), which are usually presented in a table.

For each of the coefficients of the regression is calculated significance as actual check null hypothesis that the relevant ratio is zero. The verification statistics has Student's distribution. If any of the coefficients obtained with negligible significance, the corresponding independent variable can be excluded from the analysis without significant loss of information.

The evaluation of the obtained model are based on the following parameters: the sum of the diversion squares of each measuring y_{ij} of the predictive value \hat{y}_x :

$$SSE = \sum_{j=1}^n \left(y_{ij} - \hat{y}_x \right)^2 ; \quad (3)$$

the sum of the diversion squares of average values in groups \bar{y}_i :

$$SSR = \sum_{j=1}^n \left(\hat{y}_x - \bar{y}_i \right)^2 ; \quad (4)$$

the sum of diversion squares of all measuring y_{ij} of their average value \bar{y}_i :

$$SST = \sum_{j=1}^n \left(y_{ij} - \bar{y}_i \right)^2 \quad (5)$$

R-square can be defined as a ration of the sum of diversion squares of each measuring of the predictive values and the total sum of the square of all measuring

$$R_{\text{square}} = R^2 = \frac{\sum_{j=1}^n \left(\hat{y}_x - y_i \right)^2}{\sum_{j=1}^n \left(y_{ij} - \bar{y}_i \right)^2} = 1 - \frac{\sum_{j=1}^n \left(y_{ij} - \hat{y}_x \right)^2}{\sum_{j=1}^n \left(y_{ij} - \bar{y}_i \right)^2} \quad (6)$$

the best indication of the approximation quality after summing of the additional coefficients in model

$$\text{adjusted } R_{\text{square}} = r^2 = \frac{n-1}{k-1} \frac{\sum_{j=1}^n \left(\hat{y}_x - \bar{y}_i \right)^2}{\sum_{j=1}^n \left(y_{ij} - \bar{y}_i \right)^2} = 1 - \frac{n-1}{n-k} \cdot \frac{\sum_{j=1}^n \left(y_{ij} - \hat{y}_x \right)^2}{\sum_{j=1}^n \left(y_{ij} - \bar{y}_i \right)^2} \quad (7)$$

a square root of the average square error or the standard error of the regression

$$RMSE = \sqrt{\frac{1}{n-k} \sum_{j=1}^n \left(y_{ij} - \hat{y}_x \right)^2} \quad (8)$$

Based on the resulting curves from the experiments, a comparative analysis can be made of the selected models and respective residuals of the empiric correlations. The graph of the regressive equation are shown in fig. 1.

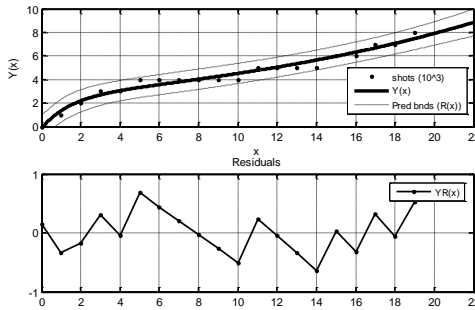


Fig. 1 Graph of the wearing model of a diametrical cross-section, located at 850 mm from the muzzle depending on the number of shots.

The resulting regression equation can be applied to solve the main task of internal ballistics [1]. This will consider the effects of wear on the cannon barrel bore on its ballistic parameters. Using the algorithm [1] it is shown a graph of the change in pressure and muzzle velocity depending on the distance traveled of the projectile, taking into account the wear of the barrel bore in fig. 2.

The muzzle velocity (V_2) reducing under the influence of factors wearing out is presented in fig. 3. Despite the small amount of wear in the middle part of the barrel there are some preconditions for reducing the pressure of powder gases and muzzle velocity.

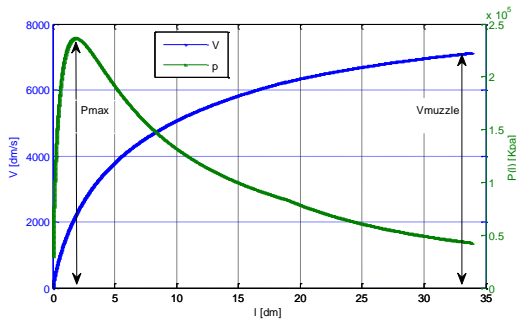


Fig. 2. Graph of the pressure and muzzle velocity depending on the distance traveled of the projectile.

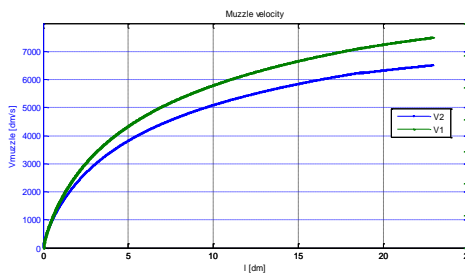


Fig. 3. Graph of the muzzle velocity as a function of projectile motion.

4. Conclusion

With the resulting regression equation it can research the cause - effect relationships between quantitative variables. Pursuant to the methodology of statistics analysis of the regressive equations, we can find the best values of the indices: SSE; R-square; Adj R-sg; RMSE. Then we can choose the adequate model made with the regressive correlation (1). The use of the regression equations allow to investigate the influence of the wearing process at high velocity friction. The graphic interpretations are shown in Fig. 1 and Fig. 3 give to visually assess the impact of wearing on ballistic characteristics of the cannon.

The regression equation can be used to predict the value of wearing out at a certain value of shots. In this way it can improve the system for maintenance of the cannon barrel and control life cycle of products.

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ECONOMIC ASPECTS OF AMMUNITION DEMILITARIZATION

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***Abstract:** The management and maintenance of ammunition stockpiles face many issues mostly related to the aging of the stored units and many other factors, related to the defense reform, include changes in the security environment and reductions in the number of security forces. The complexity of the situation increases because the armed forces also procure ammunition: defense reform implies the destruction of surplus ammunition stockpiles, but standardization or modernization requirements simultaneously call for the procurement of modern ammunitions.*

And the answer that have to answer logistics is to dispose the surplus ammunitions or to retain them in stockpiles? This paper give an answer.

***Keywords:** demilitarization, disposal, obsolete ammunition, surplus ammunition, economic aspects*

1. Introduction

As an expensive commodity the ammunitions generate costs throughout its entire life cycle: from design to purchase, storage, surveillance and proof, handling, and use, and potentially all the way through to the ammunition’s disposal. This implies adopting a ‘whole-life management’ approach to ammunition [1].

Logistics require the armed forces to procure more conventional ammunition than they use and to store until the time they are used or retired.

The management and maintenance of such stockpiles face many issues mostly related to the aging of the stored units and many other factors, related to the defense reform, include changes in the security environment and reductions in the number of security forces [7]. The complexity of the situation increases because the armed forces also procure ammunition: defense reform implies the destruction of surplus ammunition stockpiles, but standardization or modernization requirements simultaneously call for the procurement of modern ammunitions. Also the production technology requires lengthy production runs and it is often procured in large quantities to anticipate the eventual demands of a state’s security apparatus [7].

These factors altogether produce surplus ammunition in many states and Bulgaria is no exception.

These surplus ammunitions require reliable disposal – the end-of-life tasks and actions for residual materials resulting from demilitarization operations, encompassing

the process of redistributing, transferring, donating, selling, abandoning, or destroying military munitions [8].

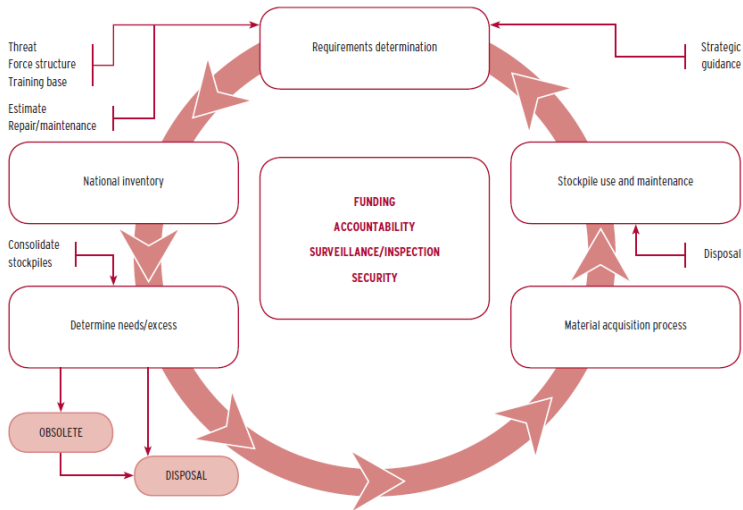


Figure 1 Ammunition life-cycle management

Source [1]

Despite other disposal initiatives, often surplus ammunition stockpile eventually requires demilitarization – the act of removing or otherwise nullifying the military potential of ammunitions [8]. Such action is to be carried out in a safe, cost effective, practicable, and environmentally responsible manner [8].

In this meaning, the demilitarization of ammunition is an example of a process where personal safety, environmental concerns, ethical dimensions all of them relevant at both the policy and function levels, but also economic aspects.

And while safety and environmental issues is well recognized because they are reflected directly into the society, the economic aspects often remain in the sidelines.

2. Economic aspects of ammunition demilitarization

The demilitarization process of obsolete ammunition in Bulgaria is related with many problems. The problems could be consolidated in two main areas connected with each other:

- legislative base;
- technology level of facilities for demilitarization.

The problems with national legislation base are well recognized in. The main problems related to the legislative base are terminology problems – most of the standards [4, 8] in the area of ammunition use the term “demilitarization”, but the Bulgarian legislation introduce the term “utilization”.

The terminology difference per se is not problem, but the problem is that Bulgarian legislative base in these parts, related to the ammunition demilitarization doesn't follow philosophy of STANAG 4518 [8] and as a result we have costs for demilitarization [3, 4] 20÷50% higher than average indicative costs on supposition that technology level in Bulgarian companies is not higher – the Bulgarian companies don't offer technologies with levels higher than level II [5] and the salaries of the workers involved it's not high. The reason for this increment is for one side monopoly of the national companies (according to the national legislation it's impossible to carry ammunition for demilitarization outside), but the main reason is that legislative base limited the companies performing contracts in technology terms. Some times the regulation forces the companies to perform open burning/open detonation rather than other techniques, and sometimes in reverse. And the driving motive is not the economic efficiency, neither safety nor environmental issues, but imperfect rules in legislative base, as "...*propellants are burned out...*". And the company has to burn all the propellants in the lot, instead to produce fertilizers for example.

Table 1.
Indicative demilitarization costs [5]

Ammunition Nature	Indicative Costs, euro/tonne	Remarks
Small arms ammunition	101-529	Less than 20 mm calibre Dependent on technique and economy of scale
Fuzes	237-1039	
Propellant	856	Although conversion to commercial explosives may lead to cost recovery
Warheads (High explosive)	101-529	Costs after removal and destruction of cartridge cases
Cannon and medium calibre	419-757	20 mm ÷105 mm
Pyrotechnics	1654	

The lower technology level of companies involved in demilitarization also affects the price, but this affect mainly to the safety. The unplanned explosions at munitions sites and factories confirm that. Practically, we have unplanned explosions related to the demilitarization every year in last decade [9].

Last years in Bulgaria, excess stockpiles of obsolete or unserviceable munitions have reached a level requiring demilitarization on an industrial scale, often in a race against time, because the ammunition tends to become unsafe with age.

This last trend it's not well recognized in logistics structures in Bulgarian MoD and we don't have differentiation between obsolete munitions – which are unserviceable and which are obsolete due to defense reform in generally meaning. All of them have to be demilitarized (or utilized), including these that repair will cost up to for times lower than demilitarization, and moreover sometimes we demilitarize high valued ammunition items that are not needed at this moment, but would be needed after ten years for

example. Unfortunately, the legislative base doesn't insist for economic analysis before any act and as a consequence the Ministry of Defense suffers financial damages.

The decisions like this should be taken after economic analysis and we propose mathematical model to support.

3. Mathematical model

To provide the support needed mathematical model should:

- encompass all the factors that should be considered;
- generate retention limits for individual items, as well as a group of items;
- develop estimates of costs and other factors.

To do this we developed standard net present value model with modifying the expression for revenues from disposal.

Generally, the model should give the answers of two questions:

- To dispose or to retain?
- How many years to retain?

And the answer of first question seemingly is simple enough – if the net value (disposal savings minus retention savings) is negative – retain, if positive – dispose.

Formulation of this mathematically is:

$$N(n) = DS(n) - RS(n) \quad (1)$$

where:

$N(n)$ – net present value;

n – the year of stock being into consideration for retention;

$DS(n)$ – savings from disposing of stock for future year, n ;

$RS(n)$ – savings from retaining stock for future year, n ;

In turn for $DS(n)$ we have:

$$DS(n) = SS(n) + SR(n) \quad (2)$$

where:

$SR(n)$ – salvage revenues, depending for annual training requirements in future years.

And for $SS(n)$ we have:

$$SS(n) = \sum_{i=1}^{i=n-1} (d)(TR)(AC)(Q)(M) \quad (3)$$

where:

(d) – discount factor;

(TR) – expense for training requirements;

(AC) – expense for storing;

(Q) – expense for qualification (if needed);

(M) – expense for maintenance (if needed);

In turn for $RS(n)$ we have:

$$RS(n) = \sum_{i=1}^{i=n-1} (d) [(TR)(U) + AE] \quad (4)$$

where:

(U) – unit price;

(AE) – administrative expenses for procuring.

4. Conclusion

Using of this model we can trades disposal savings against retention savings and we are able to compute economic retention limit. Nevertheless that many of the addends are not easy to estimate, this model will be an useful tool for decision-makers.

Evaluation of this model will be performed next year.

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ASPECTS OF LOGISTICS IN THE EU OPERATIONS IN THE CONTEXT OF EUROPEAN POLICY ON SECURITY AND DEFENCE

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Abstract: The paper reveals contemporary challenges in front of the European Union in the field of international and regional security aspects. Take a good look at cooperation between EU and other international organizations. Report makes review of battalion battle groups of European Union, main factors affecting logistic support and various ways to multinational integrated logistic support. Take an all – round view of future new logistic strategic capabilities.

Keywords: European policy on security and defence, EU battalion battle groups, multinational integrated logistic support and strategic logistic capabilities.

The European Union (EU), almost a quarter century after ratification of the Maastricht Treaty, slowly and methodically has become a key factor for international security. Successfully interaction between military, political, economic and social instruments in the field of security raised EU in the position of peacekeeper, not only in Europe, but also in Asia and Africa. Taking responsibility for overcome the crisis, post-conflict reconstruction and delivery of humanitarian aid to the destitute populations in different parts of the world, define EU like the organization with the widest influence in the system of international relations.

Lisbon Treaty turned the European Security and Defence Policy (ESDP) into the Common Security and Defence Policy (CSDP). The main innovations of the treaty aimed at the gradual establishment of a common European defense. Current possibilities for conducting missions have been expanded till: Humanitarian and rescue; Conflict prevention and peacekeeping missions; Peacekeeping missions; Crisis management; Disarmament; Advice and assistance in the military field; Stabilization after the end of conflicts.

A mutual defense clause has been introduced for the first time. Two restrictions was accepted:

- Clause does not affect common security policy and defense policy of certain Member States concerned, namely those who traditionally maintain neutrality;
- Mutual defense clause does not affect commitments made in the framework of the North Atlantic Treaty Organisation.

At present, the EU has three options for conducting operations:

- Independent operations without the use of NATO resources - using one of the operational headquarters provided by the Member States;
- Operations using the resources of the common assets and capabilities of NATO - based on the " Berlin Plus" ;
- Operations led by the EU Operations Centre.

The formal elements of the Berlin Plus agreement include:

- A NATO-EU Security Agreement that covers the exchange of classified information under reciprocal security protection rules;
- Access to NATO planning capabilities for EU-led operations;
- Availability of NATO assets and capabilities for EU-led civil-military operations;
- Procedures for release, monitoring, return and recall of NATO assets and capabilities;
- Terms of reference for using NATO's Deputy Supreme Allied Commander Europe (DSACEUR) for commanding EU-led operations;
- EU-NATO consultation arrangements in the context of an EU-led operations making use of NATO assets and capabilities;
- Arrangements for coherent and mutually reinforcing capability requirements, in particular the incorporation within NATO's defence planning of the military needs and capabilities that may be required for EU-led military operations.

Improvement of logistic support for EU operations, activation of the "Berlin Plus" is the ability to exploit the opportunities of the NATO Support and Procurement Agency (NSPA). The Agency is guided by supported by three basic principles: consolidation, centralization and competition. Consolidation is ordering larger quantities in order to save resources for delivery. Centralization – don't need to use multiple suppliers of goods and services. Competition is ensure that our customers get the best quality at the lowest price.

NSPA develops its activities in three major areas:

- Weapons and equipment - provides support for a wide variety of weapon systems and equipment;
- Logistics of material resources - provides the performance of the entire logistics chain - from delivery to recycling (destruction);
- Logistics operations.

NSPA has got business relations with Organisation Conjointe de Coopération en matière d'Armement (OCCAR). The Organization is an international organisation whose core-business is the through life management of cooperative defence equipment programmes and consolidates 6 currently Member States: Belgium, France, Germany, Italy, Spain and the United Kingdom. OCCAR currently manages eleven important armament programmes with a total operational budget in 2015 of about € 3.4 Billion. Programmes with influence over logistic capabilities are:

- A400M – A Tactical and Strategic Airlifter - The programme has been officially launched and integrated into OCCAR in May 2003. The current intention of the Participating States is to procure a total of 170 aircraft made up as follows: Germany 53, France 50, Spain 27, Turkey 10, UK 22, Belgium 7, Luxembourg 1 (Luxembourg is represented by Belgium within the OCCAR A400M Programme). The delivery schedule extends to 2024;

- LSS - Logistic Support Ship - it is a logistic support ship programme for Italy. LSS will offer an extraordinary capacity and a high degree of flexibility at low support cost in various scenarios. It will be conceived since the beginning of the design phase with enhanced "dual use" features, fit for traditional military tasks and able to intervene also during peace time, supporting Humanitarian and Disaster Relief Assistance Operations (i.e. modular hospital, electrical power/drinkable water ashore and containers). The LSS will be capable of supporting a naval Joint Task Force, to support disaster relief operations, to provide medical support (NATO Role 2 LM) and to transport naval and aviation

fuel, fresh water, ammunitions, lubricating oil, food, spare parts and 20 ft ISO containers. The delivery of the LSS is planned for 2019.[15]

The European Union in recent years constantly expands its cooperation with international organizations (UN, NATO, OSCE, African Union and others) and hardly works on the gradual establishment of a common European defense. As expected, the strategic partner of the EU in the field of defense is NATO.

On November 22, 2004 at a conference for application of military capabilities was taken a decision to build the 13 EU battle groups possessing capabilities for two parallel operations.

To determine the possible nature of future operations, the necessary operational capabilities and form of using military forces were developed five scenarios:

- Large-scale operations in the maintenance of peace;
- Humanitarian intervention of high-intensity;
- Regional wars in defense of European security interests;
- Prevention of attacks involving weapons of mass destruction;
- Defense of the EU, which provides protection to the four largest airports, two largest ports, ten at key energy facilities and the entire capital of the member states, including EU headquarters.

The next important step in building of European armed forces is approved the request for the creation of Synchronised Armed Forces in Europe (SAFE) by the European Parliament. They will be built on common standards and interoperability. SAFE is based on voluntary participation and combine civil and military capabilities.

One element of security and defense policy is connected with the creation of a European rapid operational force (EUROFOR). The main intend is to implement the so-called "Petersberg tasks", including humanitarian, peacekeeping and peace-imposing operations. They include units of armed forces of France, Italy, Portugal and Spain. The structure of EUROFOR includes the Headquarters staff battalion, battle group and supporting entities. The core of the battle group is Portuguese infantry battalion. It is equipped with wheel armored vehicle "Pandur II", 84 mm man-portable reusable anti-tank recoilless rifle "Carl Gustav", anti-tank guided missile "Milan", 120 mm. mortars and 160 parts of other trucks.

The combat support include 155 mm. Artillery battery with maximum fire range up to 40 km. (Spain), air defense platoon, armed with missiles "land - air" "Mistral" (France), intelligence units (Spain, France), squad for radio-electronic combat, engineering company and signal platoon (Italy) CBRN platoon, formation of psychological operations, military police and CIMIC (Spain).

Logistic support is carried out by transport and recovery unit, medical unit (role 2). The air medical evacuation and strategic transportation is provided by Portugal Air Force. Strategic transportation by sea is ensured by Spanish Navy.

Eurocorps was created in 1992 as the concrete implementation of a political will that has developed since the 1950's. The Eurocorps comprises military contributions from its five member states: Belgium, France, Germany, Luxembourg and Spain. Additionally, four states are associated: Greece, Italy, Poland, Turkey, and have thus pledged to contribute personnel to the staff. HQ Eurocorps took part in SFOR and KFOR missions in former Yugoslavia. At the beginning of the third millennium it is now available as a Rapid Reaction Corps HQ for both the EU and NATO. The European Corps is not subordinate to any other military organization. It is deployed on the authority of the

Common Committee representing the member nations, the Chief of Defense, and the Political Director of the Ministry of Foreign Affairs. The Corps can also be deployed at the request of the framework nations. Eurocorps is capable to participate in all types of future operations: disaster relief, humanitarian aid, security assistance, low intensity conflicts, peace keeping, medium intensity conflicts, peace restoring and enforcing up to high intensity conflicts. The Eurocorps command posts are capable of commanding multiple battalions, brigades, divisions and army corps level troops.

On 2 October 1995, was finally materialised process about creation of Multinational Maritime Force (MMF). The Commander of EUROMARFOR (CEMF) will be ready to, when activated by High Level Interministerial Committee (CIMIN), conduct a rapid integration of the assigned Force and the subsequent early establishment of a EU maritime capability, with a special focus but not limited to the Mediterranean Theatre and its approaches, in order to support primarily the EU security and defence requirements in the maritime domain by means of:

- Crisis Management. Including conflict prevention, crisis response (e.g. humanitarian and disaster relief and non combatant evacuation), post-conflict stabilization and peace support operations (peace-keeping, peace-making, peace-building and peace-enforcement);

- Cooperative Security. Including all operations to contribute to prevent conflicts and develop regional security and stability through dialogue, confidence-building, and increased transparency;

- Maritime Security. Including all operations to contribute to the maintenance of a secure and safe maritime environment (maritime security operations; maritime situational awareness; maritime interdiction missions; protection of freedom of navigation; protection of critical energy infrastructure and sea lines of communication).[4]

The European Air Group (EAG) is the only independent air-minded organisation in Europe. It comprises the Air Forces of 7 European nations: Belgium, France, Germany, Italy, the Netherlands, Spain and the United Kingdom. The Group has got links with many other organisations and nations. The EAG undertakes projects and studies in order to identify realistic ways to improve the interoperability between member nations.

After a meeting of defense ministers of the countries of the Weimar Triangle (Germany, France and Poland) - Ursula von der Leyen, Jean-Yves Le Drian and Tomas Shemonyak in Schwielowsee, near Potsdam, in a joint statement, they informed that they will support creation of more powerful European policy on security and defence. The ministers agreed to observe the implementation of the decisions of the summit of NATO in Wales last year. Among these solutions is the creation of special vanguard of rapid reaction forces numbering several thousand people who should be able to deploy anywhere in the world for 48 hours.

Based on the current political uncertainty in Europe, ministers of defense of the Visegrad countries - the Czech Republic, Hungary, Poland and Slovakia signed a military pact to coordinate defense planning and creation of a common military unit that operates under the auspices of NATO and the EU. The warhead of Visegrad battle group will be ready by 2016. It will consist of 3,000 troops from four countries. It serves as a milestone for defense cooperation in the area of training, exercises and capability development.

In the context of military policy is created Balkan Battle Group (HELBROC), consisting of military units from Bulgaria, Cyprus, Romania and Greece. Technical agreement on the creation of the group was signed on 13.11.2006 by the defense ministers of

the four countries. Bulgaria participated with infantry company. Bulgarian officers and sergeants are serving at the headquarters of the Balkan battle group. Ukraine joined in HELBROC later.

Without a comprehensive, well-planned and rehearsal logistic system no one operation can succeed. Logistic embraces all aspects of support in the theatre in operation, from the initial deployment of forces to its withdraw, covering the resupply of consumable items (food, water, fuel, ammunitions and etc.), the maintenance and repair, transport and medical care.

The operational environment for EU-led military operations is likely to be characterised by long distances and consequently long Lines of Communications, limited infrastructure, difficult terrain, hostile climate, scarcity of basic facilities and limited or nonexistent host nation support (HNS). More than of one military operation may occur at the same time, anywhere in the world, possibly involving more than one Host Nation and lasting for protracted periods. All these conditions determine challenging scenarios that may have a considerable impact on the size of the logistic effort necessary to sustain the force and to enable it to operate effectively. In this environment it is necessary to assume austere conditions, mainly in the initial phase, especially in Life Support.

The main factors affecting logistic support are: Civil-Military Activities; Availability of Resources; Readiness; Legal Aspects; Human Rights and Gender; Interoperability; Standardisation; Protection of the Logistic Chain and Environmental Protection

There are various ways to implement logistic support from a fully multinational integrated logistic support to purely national support. The chosen mode depends on the type, scale, and size of an operation, and on the characteristics and factors affecting logistic support. Prerequisites are:

- Multinational logistic solutions - to optimise the logistic footprint commensurate with the operational needs;
- Interoperability – is consisted as a broad framework that includes military, civilian and military-civilian aspects;
- Standardization of material, recourses, services and procedures.

Limitations for multinational logistic support usually are: Supply with ammunitions, explosives and chemical weapons; Supply with pharmaceutical and medical materials; Maintenance.

Troop's contribution nations are responsible for ensuring that forces assigned to EU-led military operations are fully supported and fit for task. Usually they deploy national support elements (NSE) that provide logistic support to their national forces deployed in EU-led military operations. NSE is under the command of national authorities.

The basis of the effectiveness of logistics support to those multinational military forces of EU compliance with the uniform principles and standards prior bilateral or multilateral agreements. Contracting is most often used for maintenance of weapons and communication systems, health services, expertise, training of professionals, strategic movement and transportation, air medical evacuation service stations, air or sea landing, maintenance of infrastructure, customs and border control and others. Some logistical activities can be outsourced to non-government organisations (NGOs) and companies. If the area of operation does not exist legitimate government, maintenance is carried by concluding individual agreements with local suppliers. Contracting opportunities depend on the equipment available in the area and the reliability of local trade organizations.

The use of common structures, mechanisms and maintenance agreements allow considerable savings in the provision of national forces and expand the opportunities for improving the quality of logistics support. They generally minimize operational costs and supplies and help reduce national forces and means of logistics in the area of operation. In certain cases, the cooperation of the resources of the countries participating in the European military forces.

Procedures supply markets are very specific due to the following reasons: The demand is based on the mechanisms of public procurement; The limited number of suppliers; Duration of product development; Specific requirements in support; The strategic nature of some technologies.

European Union notes the readiness to establish a European system of security of supply. Consider options, permanent warehouse for the CSDP, which currently serves only new civilian missions to be improved by extending and improving the availability of the stored equipment. For this to achieve better synergy between military and civil activities, where appropriate, while respecting the different chains of command and the different nature of civilian and military missions.

By 2020 EU countries will have a number of new logistic strategic capabilities such as: A400M and C-17 transport planes and A330 air tankers. Today EU countries have only five C-17 transport planes which can carry the heaviest loads – the UK is leasing them from the US (which has over 200 C-17s). Transport planes are crucial for most types of military operations, including humanitarian missions. For example, one of the reasons EU governments could not get aid quickly to South East Asia after the 2004 tsunami was the lack of long-range transport planes. Aircraft are very expensive to maintain. So the EU could set up a shared pool of transport aircraft, starting with the 180 A400M transport aircraft which six different EU countries plan to buy. The fleet would be available to EU members, to the EU collectively or to NATO. To save money, some countries could operate their A400Ms from one main base, using a single planning, servicing and logistics organization to support the force. The European Defence Agency is already drafting proposals for pooling some A400Ms. Meanwhile NATO is planning a similar arrangement for a fleet of C-17s – the alliance would jointly own the planes, and it would operate and maintain them at one central location instead of spreading the aircraft and maintenance centres all over Europe. These planes could be put at the disposal of the EU under pre-agreed rules between the EU and NATO.

Committee on Foreign Affairs to the European Parliament notes the limited progress made in projects of pooling and sharing. Admirers is progress in the field of refueling in the air using Airbus A330 Multi Role Tanker Transport (MRTT). Unfortunately, only a very limited number of countries - have participated so far in this project (France and UK). Under the plan to build armed forces of Belgium, the country will buy three aircraft Airbus A330 Multi Role Tanker Transport (MRTT) this year. It is expected that in 2016 two aircraft Airbus A330 Multi Role Tanker Transport (MRTT) to replace Boeing 707 in the Spanish Air Forces. In December 2014 it was announced that Netherlands Air Force chose Airbus A300 - MRTT to replace KDC - 10 in 2020.

The outsourcing of services such a food, service, health and medical support, supply, maintenance, infrastructure and engineering support is one aspect of streamlining logistics. However, an even more challenging aspect of logistic and the outsourcing to private actors in the provision of services to military units in international operation. Under what condition can private civilian contractors be send abroad? Unfortunately there aren't

“safe” rear areas behind the frontline where civilian can move around in relative safety. In modern hybrid war it is increasingly difficult to distinguish enemies from friends. Private participation within or bordering upon the battle zones also complicates responsibility in relation to the Geneva Convention and other parts of international human law. The main disadvantage of the process is that military contingents become dependent on external actors who follow primarily economic interests. Other important part of process is how fast political and military leaders can activate the contracts they had previously signed with companies. In most cases, private companies do not have enough own capacities but buy them on the other market. In crisis situations and during the preparation phase for operations, the market usually reacts with an increase in price levels and a decrease in offers. The use of contractors to support military operations includes a risk of contract failure to deliver the contracted support. This fact must be considerable planning and co-ordination during all phases of an operation between relevant EU actors, Troop Contribution Nations (TCNs) and the Host Nations (HN). Very important principle in planning process is that the contractor support may mainly, but not exclusively.

It is of key importance that the commanders defines precisely comprehensive operational requirements at an early stage in cooperation with TCN and to agree with the service providers in advance binding legal consequences which result from deficiencies in the performance of service. Inherent possible risk related to the specific nature of the tasks led in EU-led military operations should be considered and it should be examined in each case whether the contract should address specific circumstances (state of war, terrorism, massive public disorder) in order to guarantee its implementation by contractors even in deteriorated security environment. It may also include the right of service providers to outsource work to local sub-contractors, but the Prime Contractor has to guarantee the quality of the service.

Pre-mission support solutions enhance readiness, reduce crisis response time, may provide additional benefits for risk reduction, and limit price escalation. Since, EU-led military operations would likely require rapid deployment, pre-mission support solutions will facilitate planning and deployment, and empower the OpCdr to meet support requirements for rapid deployment of EU military forces. In addition, standardized statements of work should be prepared that can be tailored to the requirements of the particular EU-led military operation to allow swift tendering. Military commanders and planners should be aware of the specific requirements to implement an effective and efficient CSO in the planning and execution of military operations. [4]

“Athena” is a mechanism which handles the financing of common costs relating to EU military operations under the EU's common security and defence policy. It was set up date by the Council of the EU on 1 March 2004. The rules on contributions to “Athena” are set out in article 41.2 of the Treaty on the European Union. Member states contribute an annual share based on their Gross National Income. “Athena” is managed by an administrator and under the authority of a Special Committee made up of representatives from the member states contributing to the financing of each operation. The mechanism can finance the common costs of EU military operations as well as the nation borne costs, which include:

- HQ implementation: travel, administration, locally hired staff, IT systems, public information, Force Headquarters deployment and lodging;
- For forces: infrastructure, medical evacuation and services, identification;
- Reimbursements to/from NATO or/ and other organizations.

“Athena” can also finance costs relating to the transport and lodging of forces, and multinational headquarters below FHQ level, if the Council decides.

“Athena” may also finance the following:

- Barracks and lodging/infrastructure, essential additional equipment, medical services, acquisition of information (theatre level intelligence, reconnaissance and surveillance, including air to ground surveillance & reconnaissance and human intelligence);
- Other critical theatre-level capabilities (demining, chemical, biological, radiological, and nuclear (CBRN) protection, storage and destruction of weapons).

European defense cooperation is an important part of the solution to reduce both national duplication and European capability gaps. There are Pooling & Sharing projects of the European Defense Agency. This projects work on a European level but are focused mostly on one specific capability and one cooperation domain. A second tendency are the regional forms of defence cooperation. The forms of regional defence cooperation are mostly focused on maintaining the existing military capabilities within the cooperating countries. The comprehensive permanent structure makes it possible to have deep but balanced forms of cooperation (and gives a drive to even deeper cooperation possibilities) and as such a better cost-benefit ratio while retaining national autonomy on the operational level. Cooperating at a regional level between a limited number of neighbouring states of equal size and/or with a common vision on defence is also much easier than on a European level. This doesn't mean that regional defence cooperation couldn't be an interesting stepping stone for again more defence cooperation from a European perspective.

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INVESTIGATION OF POSSIBILITY FOR USING THE FINITE ELEMENTS METHOD (FEM) FOR DEFINITE THE FREQUENCY OF CROSS VIBRATIONS TO THE BARREL OF THE SMALL ARM

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Abstract: *There are present a investigation of possibility for using the finite elements method (FEM) for definite the frequency of cross vibrations to the barrel of the small arm in the report.*

Key words: *vibrations; small arms.*

In the last decade other countries have made researches about increasing effectiveness on the battle weapons, they have proved the big effect from the transversal vibrations on the barrel to the group and the accuracy on the target. The transversal vibrations are turned to be one of the main reasons for reducing the accuracy of the shooting, because of sagging the barrel in the horizontal and vertical level, and for reducing the grouping, because the bullets get out of the barrel in a different stage of the movement of the muzzle part.

In Republic of Bulgaria this kind of research haven't been made yet and that why in this document it is investigated the possibility of using the method of ending elements for determination the frequency of self-transversal vibrations on the barrel of the shooting weapons.

For determinating the frequency of self-transversal vibrations, the barrel is accepts for a pole with complex section, stably attached on the one end and free from the other.

The existing similar models for determinating the frequency of self-transversal vibrations on the barrel of the battle weapons have these following disadvantages:

- their formulas are applicable only for cylindrical or tapered barrels and they can't be used for barrels with complex form;
- the models don't offer formulas for determinating the frequency of self-transversal vibrations on the barrel in presence of added mass lying on it;
- the target that is placed on that research is to verify convergence of results from frequency of self-transversal of barrel of small arms, the results from using the method of the final elements and the results from the experimental shootings.

The target of research is:

- creating a model of a real barrel with software product based on the method of the final elements and the frequency of self-transversal vibrations of the barrel;
- conduction of experimental shootings and the frequency of self-transversal vibrations of the barrel;
- processing the results and assess the adequacy of the model.

True the researching is imputed the following restriction: it is explored only the secondary frequency of self-transversal vibrations, influencing the grouping on semi-fire.

The creating of three dimensional model on the barrel is realized with the program SOLD EDGE ST3 , for base is used a real existing ballistic barrel , designed for rounds 7,62x39 model 43 year.

On the program NX 7.5 NASRAN is committed the separation of the three dimensional model of the barrel in elements. For barrel, designed round model 43 year, are used 10 point elements with length cathetus 8 mm. The total number of the elements is 7600, and for the points are 14362. For the add weights are used 10 points elements with length cathetus 2 mm, there for the number of elements and the points are as it follows: for weight with mass 0,027 kg - 3612 elements and 7356 points: for weight with mass 0,054 kg - 6476 elements and 11462 points, for weight with mass 0,081 kg - 9455 elements and 15796 points. For weight with mass 0,105 kg - 11398 elements and 18640 points. For weight with mass 0,204 kg - 20700 elements and 32112 points. For weight with mass 0,303 kg - 29752 elements and 45125 points. For weight with mass 0,406 kg - 44758 elements and 66867 points. For weight with mass 0,506 kg - 51673 elements and 76738 points.

For the analysis of the two barrels is used steel mark 50 Pa with the following characteristics: flexural modulus - 2,16.105 MPa; density of the material - 7840 kg/m³; yield strength - 748 MPa; ultimate tensile strength - 980 MPa.

For the weights used steel 45 with the following characteristics: modulus of elasticity - 2,0694. 10⁵ MPa; density of the material - 7829 kg / m³; yield strength - 129,5 MPa; ultimate tensile strength - 262 MPa. Data on the barrel: weight - 1,123 kg; length to the point of attachment - 0,496 m; outside diameter at the point of attachment - 0,03 m; inner diameter of the channel - 0,00762 m. For maximum pressure in the barrel channel is accepted value Pmax. cp = 2800 kg/cm².

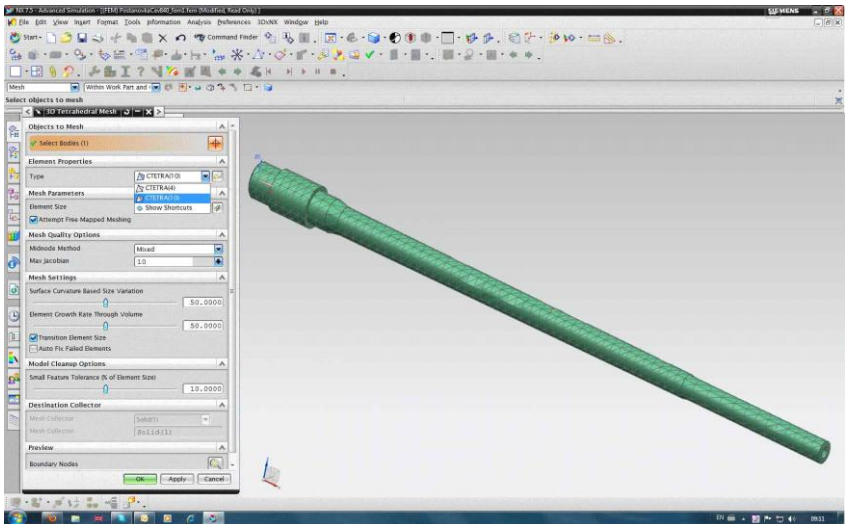


Figure 1: Ballistic barrels three-dimensional model, using cartridges 7,62x39mm.

Place the maximum pressure is 471 mm from muzzle cut. The attachment of weight to barrel is carried out in four points, which corresponds to the actual attachment.

Calculations were performed with real tables with weights placed sensor that: 0,027 kg, 0,054 kg, 0,081 kg, 0,105 kg, 0,204 kg, 0,303 kg, 0,406 kg, 0,506 kg.

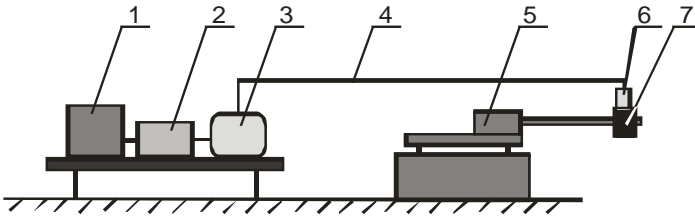


Figure 2: Scheme of experimental investigation devices disposal.

1- computer (program "Lab View 8.5"); 2- DAQ - measurements plate NI USB-6211 – National Instruments; 3- measurements amplifier Type 2635 – Brüel & Kjær; 4- cable; 5- base for ballistic barrel; 6- sensor for vibrations measurement.

The experimental study was performed in an indoor shooting tunnel in the workshop "Small and anti-aircraft weapons" in Central artillery technical testing ground (military unit 26940 - Stara Zagora). FIG. 2 is a schematic of the deployment of the equipment used to conduct the experimental shooting.

Results from a theoretical study, done using a computer model and experimental study are presented in Table 1 and FIG. 3.

Results obtained from the computer model and the experimental study of the second frequency oscillations own cross ballistic barrel, designed for cartridges 7,62x39 mm.

Table 1
Results obtained from the computer model and the experimental study

Distance from end of barrel to the mass [m]	Results of the experiment	Results of the computer model		Results of experiment examination	Results of the computer model	
	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]
Mass of added weight on barrel – 0,00 [kg]						
0	428	449	-4.9065			
Mass of added weight on barrel 0,027 [kg]				Mass of added weight on barrel 0,054 [kg]		
0	408	422	-3.4314	392	404	-3.0612
0,01	414	427	-3.1401	400	412	-3,0
0,02	418	432	-3.3493	408	420	-2.9412
0,03	420	436	-3.8095	410	427	-4.1463
0,04	422	440	-4.2654	418	433	-3.5885
0,05	426	443	-3.9906	422	438	-3.7915
0,06	427	443	-3.7471	426	442	-3.7559
0,07	428	445	-3.972	428	442	-3.271

Distance from end of barrel to the mass [m]	Results of the experiment	Results of the computer model		Results of experiment examination	Results of the computer model	
	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]
0,08	429	448	-4.4289	428	447	-4.4393
0,09	430	448	-4.186	428	448	-4.6729
0,10	430	448	-4.186	430	448	-4.186
0,11	430	454	-5.5814	430	455	-5.814
0,12	429	451	-5.1282	430	455	-5.814
Mass of added weight on barrel 0,081 [kg]				Mass of added weight on barrel 0,105 [kg]		
0	382	392	-2.6178	376	382	-1.5957
0,01	392	402	-2.551	382	393	-2.8796
0,02	398	402	-1.005	394	404	-2.5381
0,03	406	420	-3.4483	402	414	-2.9851
0,04	412	427	-3.6408	408	423	-3.6765
0,05	418	434	-3.8278	414	431	-4.1063
0,06	420	440	-4.7619	422	438	-3.7915
0,07	426	444	-4.2254	424	443	-4.4811
0,08	427	446	-4.4496	426	446	-4.6948
0,09	428	447	-4.4393	428	447	-4.4393
0,10	430	447	-3.9535	428	447	-4.4393
0,11	430	454	-5.5814	429	454	-5.8275
0,12	429	449	-4.662	428	448	-4.6729
Mass of added weight on barrel 0,204 [kg]				Mass of added weight on barrel 0,303 [kg]		
0	358	359	-0.27933	350	347	0.85714
0,01	368	372	-1.087	360	361	-0.27778
0,02	378	386	-2.1164	378	375	0.79365
0,03	390	398	-2.0513	382	388	-1.5707
0,04	398	410	-3.0151	398	401	-0.75377
0,05	408	421	-3.1863	408	413	-1.2255
0,06	414	430	-3.8647	412	424	-2.9126
0,07	420	437	-4.0476	418	433	-3.5885
0,08	424	442	-4.2453	422	438	-3.7915
0,09	425	445	-4.7059	425	441	-3.7647
0,10	426	444	-4.2254	426	440	-3.2864
0,11	426	444	-4.2254	426	447	-4.9296
0,12	425	443	-4.2353	425	438	-3.0588
Mass of added weight on barrel 0,406 [kg]				Mass of added weight on barrel 0,506 [kg]		
0	343	339	1.1662	332	332	0
0,01	352	353	-0.28409	344	346	-0.5814
0,02	364	367	-0.82418	356	360	-1.1236
0,03	376	381	-1.3298	368	374	-1.6304

Distance from end of barrel to the mass [m]	Results of the experiment	Results of the computer model		Results of experiment examination	Results of the computer model	
	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]	Second frequency [Hz]	Second frequency [Hz]	Relatively mistake [%]
0,04	386	394	-2.0725	378	379	-0.26455
0,05	390	407	-4.359	387	400	-3.3592
0,06	404	418	-3.4653	400	412	-3
0,07	410	427	-4.1463	406	421	-3.6946
0,08	416	434	-4.3269	412	428	-3.8835
0,09	420	437	-4.0476	414	432	-4.3478
0,10	420	437	-4.0476	416	432	-3.8462
0,11	420	443	-5.4762	416	438	-5.2885
0,12	418	434	-3.8278	415	429	-3.3735

The results presented in Table 1 and the graphs of FIG. 3 show that the nature of the ongoing processes in the pattern and experimental research is the same. Average relative mistake between experimental data and data generated by the computer model is 3.319%. Statistical hypothesis test may be performed by comparing the variances of the experimental data and the data obtained from the computer model. The null hypothesis is that the dispersion of the data obtained from the computer model is commensurate with the dispersion of the experimental data. To check the hypothesis using the following formula (1.1) [3]:

$$\chi_0^2 = \frac{SS}{\sigma_0^2} \quad (1.1)$$

where:

$$SS = \sum_{i=1}^n \left(y_{Ei} - \bar{y}_E \right)^2 \quad \text{- adjusted amount of the squares of the data of the}$$

experimental firings;

$$\sigma_0^2 = \frac{1}{n-1} \cdot \sum_{i=1}^n \left(y_i - \bar{y} \right)^2 \quad \text{- dispersion of data from the computer model};$$

$$\bar{y} = \frac{1}{n} \sum_{i=1}^n y_i \quad \text{- arithmetic average of the data from the computer model};$$

$$\bar{y}_E = \frac{1}{n} \sum_{i=1}^n y_{Ei} \quad \text{- average of the experimental data};$$

n - number of data;

$n-1$ - number of degrees of freedom.

The null hypothesis is rejected when $\chi_0^2 > \chi_{\alpha/2;n-1}^2$ or $\chi_0^2 < \chi_{1-\alpha/2;n-1}^2$.

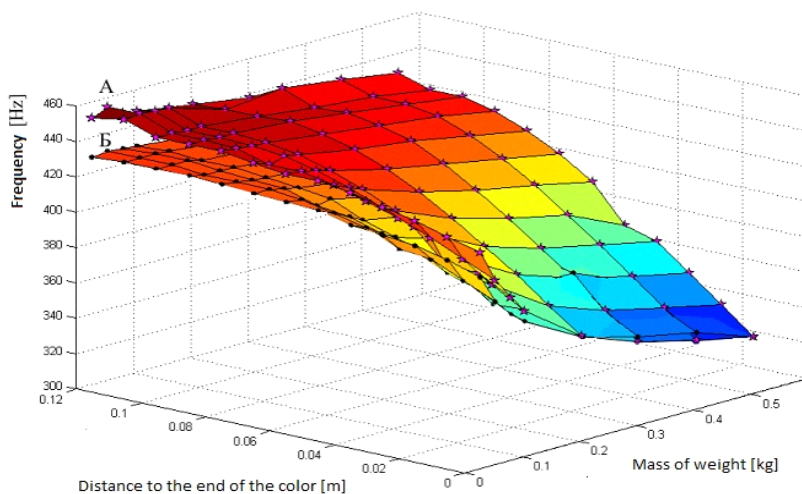


Fig. 3. Graphs of the value of the second frequency transverse vibrations resulting from the experimental shootings and computer models, depending on the distance of the mass to the muzzle cut.

A - schedule change frequency obtained from the computer model;
 B - schedule change frequency derived from experimental firings.

Table 2

Results obtained in checking the null hypothesis of the data generated by the computer model and the experimental study of ballistics barrel, designed for cartridges 7,62x39 mm

N_0	Mass of weight [kg]	α	χ^2	$\chi^2(0,025;12)$	$\chi^2(0,975;12)$
1	0,027	0,05	6,517299	23,3366	4,40778
2	0,057	0,05	7,447145	23,3366	4,40778
3	0,081	0,05	7,192955	23,3366	4,40778
4	0,105	0,05	7,528324	23,3366	4,40778
5	0,204	0,05	7,650971	23,3366	4,40778
6	0,303	0,05	7,425903	23,3366	4,40778
7	0,406	0,05	7,275668	23,3366	4,40778
8	0,506	0,05	7,992084	23,3366	4,40778

The results presented in Table 2 indicate that the null hypothesis can be considered a true computer model, and the same can be used for practical determination of the second frequency of own oscillations of the developed cross tubes for arms.

Conclusions:

1. The study of the possibility of determining their lateral oscillations of the barrel FEM shows the applicability of the method to determine the same, regardless of the complexity of the shape of the barrel and the presence of added mass at various points along its length.

2. The main advantages of creating a model of the barrel using the software are:

- it is possible to create a model that corresponds to the actual shape and dimensions of the barrel, regardless of its complexity;

- it is possible to design a model of the barrel with the added weight, taking into account the actual form and the actual place where the weight is placed;

- it is possible to adjust the accuracy of the resulting solution.

3. The main shortcoming of the computer model of the barrel is the need to purchase and study of relevant software, with which to carry out modeling, leading to a significant appreciation of the study and a large expenditure of time.

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NATO COLLATERAL DAMAGE ESTIMATION METHODOLOGY FOR CONVENTIONAL WEAPONS

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ABSTRACT: *Strategic environment is influenced by unpredictable and dynamic political, social, technological and military processes. Conflicts are complex and difficult to predict and control. This requires flexible policy development, organization, doctrine, operational concepts, and above all the capabilities of future forces and command structure of the Armed Forces.*

KEYWORDS: *Law of Armed Conflict, Collateral Damage Estimate Methodology, Collateral Hazard Area, military operations, collateral objects, methodology for assessment of collateral damage.*

In many Member States of NATO is perceived a certain order to assess the attendant losses, especially when applying firing shots. The problem is not developed in the component commands and tactical formations in which this line does not give a complete answer to the question "What is the relationship between the leverage, the means intelligence assessment of combat losses and to minimize the collateral damage in destruction of different types of objectives operational and tactical units? ".

By 2010, there are several methods for assessment of collateral damage (MOSZ) in producing fire-hit (USA, UK etc.).

In essence the procedure for assessment should include common standards, methods, techniques and processes, and to apply them in the planning of joint fire support to assess and minimize collateral damage.

Procedures for valuation of collateral damage should be used consistently on all levels of command, to maintain common standards and to provide commanders and staffs with common procedure in making decisions.

This line assessment should assist commanders to assess risk against military necessity and proportionality of the use of force in the process of decision making. In the assessment results should become a means of commanding the joint forces (commanders components) for the principles of international law. This evaluation should be a balance between science and art, which shows the best result for the potential losses of associated objects.

To unify the procedure in planning operations today in NATO accepted methodology for assessing the collateral damage of the US. It includes common standards, methods, techniques and processes used in planning the firing strokes to assess the collateral damage, and the use of all means to reduce them. Assist commanders weigh risk against military necessity and the proportionality assessment of the use of force in the process of decision. In short, the methodology is a means of commanding respect for law.

All pre-planned operations must be conducted in accordance with International Law and conventions which includes Law of Armed Conflict (LOAC). Further, the developed procedures (including checks and balances) must ensure compliance with principles of LOAC. In this way, lethal force will be used only when necessary and when the expected collateral damage will not be excessive in relation to the concrete and direct military advantage anticipated from an attack. The Collateral Damage Estimate (CDE) is an integral part of the Targeting process and must be conducted prior to the prosecution of authorised targets with lethal force; it continues throughout the execution process.

The Collateral Damage Estimate Methodology (CDEM) supports employment of conventional munitions¹ for any type of operation where they could be used. It provides commanders with an understanding of weapon effects, incidental consequences, and mitigation techniques, enabling more balanced, comprehensive judgments and decisions.

The methodology, its components and its products are not, nor should they be considered an exact science. The CDE methodology is an estimate of the potential for collateral damage and constitutes one tool to manage and reduce risk of CD during NATO operations. As such, CDE and TEA are inputs to the commander's decision-making process. The initial CDE may differ from the actual result following attack/weapons release due to the fluid/changing nature of the intelligence, operational and targeting environment. All kinetic pre-planned engagements (including prosecution of Time Sensitive Targets) must be subject to the CDE Methodology.

NATO CD risk management is two-fold:

- The methodology is designed to provide a credible estimation to enable the identification of possible courses of action based on the level of risk, thereby allowing NATO commanders to understand, consider and mitigate CDE risks. A determined level of responsibility for approving

- The technical basis for the application of these CDE levels is based upon national munitions effectiveness data for air-, ground- and sea-launched weapons as they are released to NATO by the nations.

The collateral damage thresholds are based on increasing risk levels that will require specific courses of action to engage the target. Figure 1 depicts the interaction between collateral damage and weaponing restrictions for each CDE Level.

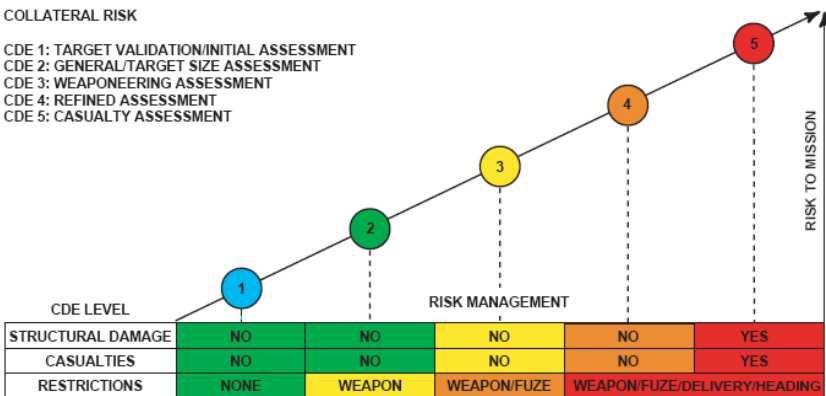


Figure 1. Risk and the Collateral Damage Estimation Methodology

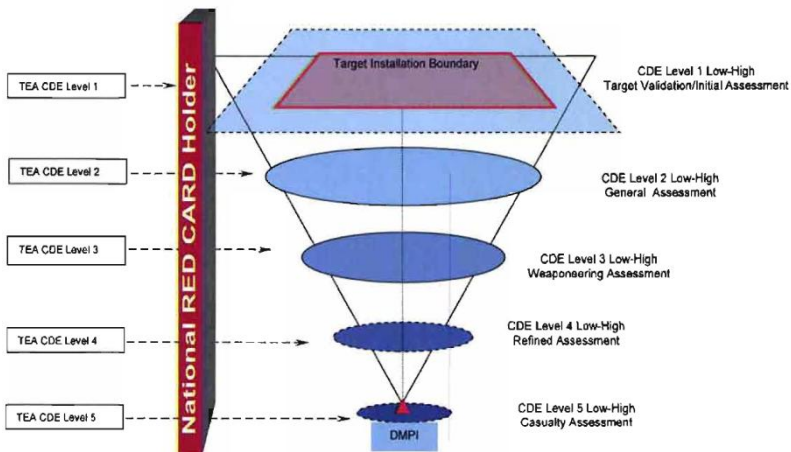


Figure 2: CDE Level Cone

The CDE methodology shown in Figure 2 is based on the US CDEM utilized in ISAF. It is based on 5 progressive and ascending CDE levels. Each level is based on refined analysis of available intelligence, weapon type and effect, the physical environment, target characteristics, and delivery scenarios with specific thresholds established for each of the five CDE levels. These levels express the risk estimation for collateral damage based on the existence of Collateral Risk Objects in the computed Collateral Hazard Area (CHA).

For CDE Levels 1 and 2 the Collateral Effects Radius (CER) that defines the CHA, will be outlined in the respective OPLANS in order to enable the commander to conduct quick collateral damage estimation without the requirement to go through a detailed weaponnering process based on the information provided by the nations on the CER of conventional weapons that will be used in the operation. Levels 3 to 5 consider the weapons options in increasing detail to minimize the CDE risk.

To authorize an engagement (other than level 5 High), the respective COE level criteria must be fulfilled. If any COE level criterion is not fulfilled, either the target is not authorized for engagement or more detailed planning/mitigation must take place at the next higher CDE level before any engagement can be authorized.

Target Engagement Authority. The TEA is the level of command required to authorize an engagement at each CDE level, and is defined in the OPLAN specific to a NATO operation. The appointed TEA is the lowest level of delegated authority. For Time Sensitive targets (TST), the delegation of the TEA and authorized COE level will be part of the TST Decision Matrix.

Target Identification. This COE Methodology requires that the target is a positively identified (PIO), legitimate, pre-planned military target, authorized for prosecution. At least, two different means to PIO the target are deemed necessary'. The generic approach for the methodology presupposes absolute accuracy in the location of the target. If the

target location inaccuracy is known, for COE the target changes from a point to a circle with this inaccuracy as radius.

National Red Card Holder. As compliance with national legal obligations remains a national issue, Nations are critical enablers to the CDE process. A National red card holder will be designated and can prevent the planning or execution of a target by his national assets and authorise or stop the process at any point.

Planning responsibilities. As CDE incidents could have strategic effects on the operation, CDE key elements will be defined in the SHAPE OPLAN. This will be binding for all subordinate commands and will be implemented through guidance and specific instructions on the CDE process in their respective OPLANs and orders. The NAC has to approve the level of casualties.

At each CDE level an assessment is produced. If CD Risk Objects are not within the computed CHA or if the specified level of risk to CD Risk Objects is not exceeded, a higher CDE level is not needed. If a low assessment is rendered, the methodology supports engagement of the desired target based upon the conditions and restrictions specified by the CDE level concurrent with the low assessment estimate. If CD Risk Objects are within the CHA or the specified level of risk to CD Risk Objects is exceeded, the next CDE level processes are required to be performed.

CDE Level 1 Target Validation/Initial Assessment.

For CDE Level 1, the area inside the Target Installation Boundary (TIB) and the defined surrounding Level 1 CHA is clear of CDE Risk Objects. There are not significant environmental or CBRN concerns within the Level 1 CHA. If the target fulfils the above-mentioned criteria, this qualifies the Target as CDE Level 1 LOW. The appointed TEA for CDE Level 1 can then authorize the engagement. If the target fails to meet any of the criteria or CDE Risk Objects are identified within the TIB and CHA) it is qualified as CDE Level 1 HIGH and it must be further examined at CDE Level 2, or at CDE Level 5 if there are significant environmental or CBRN concerns, before any lethal engagement may take place.

CDE Level 2 General Assessment.

CDE Level 2 begins the process of defining weaponeering options that both achieve the desired target effect and mitigate the potential for collateral damage. This level takes a low risk approach to CDE with the least number of weaponeering and tactical employment restrictions an assessment is done based on the target's size compared to the weapon system's or delivery platform's delivery error for unguided or ballistic munitions in order to determine their use. For Precision Guided Munitions (PGMs) an assessment is done to evaluate target engagement on individual aimpoints while minimIZing the weaponeering restrictions.. The area inside the defined Level 2 CHA must be clear of CDE Risk Objects. If the target fulfils the above-mentioned criteria this qualifies the Target as CDE Level 2 LOW. The appointed TEA for CDE Level 2 can then authorize the engagement. If the arget fails to meet either criteria or CDE risk object(s) are identified within the CDE Level 2 CHA), the target is qualified as CDE Level 2 HIGH and must be further examined at CDE Level 3 before any lethal engagement may take place.

CDE Level 3 Weaponeering Assessment

CDE Level 3 begins the process of refining weaponeering options that achieve the desired effect on the target and mitigate collateral damage, by attacking the target with a different weapon or with a different method of engagement. The goal of CDE Level 3 is

to achieve a low CDE assessment while limiting the number of tactical weaponeering restrictions. Considering the weapon class and system, delivery platform, and/or PGM warhead type, CDE Level 3 determines appropriate delivery systems, warhead, and fuse combinations that mitigate the risk of collateral damage while still achieving the desired effect on the target. CDE Level 3 will be supported based on released national products (i.e. CER tables for PGMs. Air to Surface Unguided Munitions (ASUGM) and Surface to Surface Ballistic Munitions (SSBM). If the target fulfils the above-mentioned criteria this qualifies the Target as CDE Level 3 LOW. The appointed TEA for CDE Level 3 can then authorize the engagement. If the target fails to meet either criteria the target is qualified as CDE Level 3 HIGH and must be further examined at higher CDE Level 4 before any lethal engagement may take place. For CDE Level 3 HIGH assessment, serious consideration should be given when engaging the target with PGMs only. However, if PGMs are not available, the target must be examined at CDE Level 4.

CDE Level 4 Refined Assessment

At CDE Level 4, mitigation techniques in addition to delay fusing (bomb burial) are applied. These mitigation techniques include variable time fusing (air burst), shielding, delivery heading and aim point offset. CDE Level 4 takes into consideration characterization of structure hardness. The probability of fractional structural damage from blast is based on the assumption that civilian personnel will be located in collateral structures which afford some measure of protection from fragmentation. The use of unguided or ballistic munitions is highly discouraged at this level and above. If the target fulfils the required criteria this qualifies the Target as CDE Level 4 LOW. The appointed TEA for CDE Level 4 can then authorize the engagement. If the target fails to meet any other criteria the target is qualified as CDE Level 4 HIGH and must be further examined at CDE Level 5 before any kinetic/lethal engagement may take place.

CDE Level 5 Casualty Assessment

CDE Level 5 is used when all reasonable and known mitigation techniques have been exhausted and some level of collateral damage appears unavoidable. CDE Level 5 is also performed when Level 1 assessment determines CBRN and/or environmental concerns. The attack is likely to cause damage to surrounding civilian buildings and may cause civilian casualties. Casualty assessment needs available intelligence (Pattern of Life, Demographic Data) to provide an estimate of population density in a specific collateral concern area. Commanders must be aware that they are assuming significant risk of collateral damage when engaging a target assessed under CDE Level 5. For example:

a. A target qualifies as CDE Level 5 Low if it is estimated that civilian casualties will be under or equal the Non-combatant and Civilian Casualty Cut-off Value (NCV). Civilian property is likely to suffer damage.

b. A target qualifies as CDE Level 5 High when it is assessed that the NCV will be overtaken. The appointed TEA for CDE Level 5 High holds sole target engagement authority.

Limitations and Exclusions

1. The CDEM accounts for all conventional munitions (see Para 3) currently in planned/authorized for use in NATO operations except as noted below and in the respective tables. It is not applicable to nuclear and nonlethal capabilities.

2. CDE as specified in this instruction is not required for surface to surface direct fire weapon systems. The risk of Collateral Damage from these weapon systems is presented

by the distribution of munitions in the target area and not from the explosive effects of the warhead. The LOAC principles of distinction, proportionality, necessity and humanity (Reference A) are considered for employment of direct fire weapon systems.

3. The CDEM does not account for weapon malfunctions, operational delivery errors, or altered delivery tactics based on operator judgment, neither does it account for unknown transient civilian or non-combatant personnel and/or equipment in the vicinity of a target area.

4. The CDEM does not account for individual marking or adjusting rounds when employing surface-to-surface ballistic munitions (SSBM) in the Observer Adjusted (OA) method of engagement.

5. While the CDEM can be applied to any geographic region, weapons effects may vary in different environments.

6. This CDEM does not account for the risk to own/allied forces.

7. This CDEM accounts for primary weapon effects only; secondary effects need to be analyzed during the Target System Analysis (TSA) and the Target Analysis (TA).

8. This CDEM does not supersede national targeting directives. National caveats and national-level rules of engagement.

9. This CDEM takes into account that the use of multiple weapons against a single DMPI will be treated as a single weapon (exemptions are ripple release of weapons and dispenser delivered SUB-munitions (see Para 3).

10. As shown in Figure A1 a ripple release (stick) of weapons against a single DMPI requires the examination of every single weapon, unless the stick-length and associated CER stay within the confines of the area defined for CDE level1.

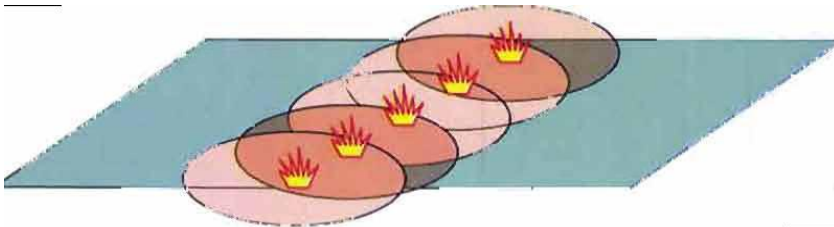


Figure A1: Ripple Release of Weapons

11. For dispenser delivered sub-munitions, the weapon effectiveness depends on the release altitude and dive angle due to adverse effects such as wind conditions and weapon dispersion. The use of these weapons requires the examination of the sum all CER, that defines the Risk Area Perimeter. If this area is clear of CD risk objects, the target is cleared for engagement. If the area is not clear of CD risk objects, the target engagement requires TEA Level 5 Low or Level 5 High approval.

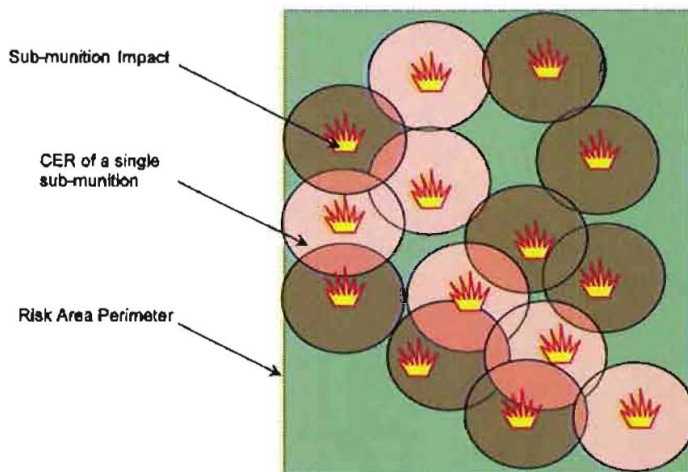


Figure A2: Dispenser delivered sub-munition CD Risk Area

To achieve interoperability of national units in multinational joint task forces are needed uniform standards in the planning of operations, as the Armed Forces of the Republic of Bulgaria as the countries forming these forces.

To a certain consistency in the work of the headquarters of the national joint force component commands and tactical formations in their composition should be adopted certain order to assess the collateral damage that meets the accepted methods of work in other member states of NATO.

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The report does not contain classified information

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NATURE AND CHARACTERISTICS OF THE COLLATERAL DAMAGE

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ABSTRACT: *Leading military states implement fundamental reform (transformation) of the armed forces to adapt to threats, risks and challenges of the new information age. Military construction in these countries are subject to the new military strategy, the essence of which is the purpose of the war (military conflict) to be achieved in the shortest possible time and with minimal losses.*

KEYWORDS: *incidental loss, armed forces, local conflict, military operations, collateral objects, methodology for assessment of collateral damage. collateral objects, dual-use, human shields.*

Military operations in the present moment and those conducted in recent years show that it is necessary to constantly change in goals, objectives, structure and organization of modern armies.

The analysis of such operations shows that the structure of the coalition forces in Iraq, Afghanistan, Kosovo, Bosnia and Herzegovina constantly undergo changes in size, objectives, goals and priorities depending on the specific situation of the operation and defined desired end result.

In today's security environment the majority of the operations are joint in nature. This is because of the nature of modern threats and the need for dealing with them, which cannot be achieved by using the abilities of only one type forces.

This requires both the design and the conduct of operations to apply the joint approach.

In the world there are many organizations, especially NATO and the European Union which maintain, manage and implement policies where possible not to cause shocks or firing to prevent concomitant losses in their application in modern military conflicts around the world. Upon engagement of NATO forces, which we have witnessed in recent operations conducted in Kosovo, Afghanistan, Iraq, Libya, when planned and plotted firing strikes must be reported and the level of collateral damage.

MATTER OF COLLATERAL DAMAGE

To unify the procedure in planning operations today in NATO accepted methodology for assessing the collateral damage of the US. It includes common standards, methods, techniques and processes used in planning the firing strokes to assess the collateral damage, and the use of all means to reduce them. Assist commanders weigh risk against

military necessity and the proportionality assessment of the use of force in the process of decision. In short, the methodology is a means of commanding respect for law.

Accompanying losses are defined as unintentional or accidental injured or affected people and / or objects that are not valid military targets during the application of the firing stroke. These losses will be considered a violation of the law when they are comparable to the expected military advantage of the attack (JP 1-02, JP 3-60).

Planning and management of operations Joint Staff is responsible for policy without hitting, which was not carried out an assessment of the losses. Headquarters performs this function through management structure of military intelligence MTIMS (Military Target Intelligence Management Structure), in cooperation with combat commanders and the intelligence service. The role and the specific characteristics of the policy without hitting, which was not carried out an assessment of the losses are as follows:

- Developing a common policy and guidance for the evaluation of collateral damage.
- Coordination with Combat Command, offices, agencies fighting and united support group for technical coordination effectiveness of ammunition to determine the operational requirements which provide the framework methodology for the evaluation of collateral damage.
- Providing control for the overall training in studying the methodology for assessing the collateral damage.
- Maintain a database of trained and certified analysts (including name, rank, date of training, a result of the trained ... validity of last change) to validate requests for services from Combat Command or organizations wishing to have training course in methodology and to coordinate the accreditation of the course.
- Validation of new information about incidental losses prior to its inclusion in the methodology.
- Provide an overview of the tables for the population density to provide standardized issue to use.
- Reviewing and coordinating the requirements for automation; ensure the review and development of automated programs to ensure policy, training and synchronization programs.
- Notify the structures of the Ministry of Defence when drawing new tables radius of collateral damage to ammunition and techniques of hitting.

In the US and NATO was created technical group United for coordinating early effectiveness of ammunition (OTGKEB). This is a unified organizational-tion operated by logistics center. She leads workshops that focus on specific aspects of the choice of firing means (weaponering), its impact and collateral damage.

This group should be assigned the following responsibilities:

- Develop and publish information on the effectiveness of conventional weapons. The group, in coordination with staff, to develop, maintain and distribute tables relating to the evaluation of collateral damage, which in turn are the basis for an assessment of the losses;
- Development of assessment tables accompanying losses, apart from the adopted legislation, when adopted new samples of armament weapons. The tables should be made not less than twice a year and distributed by the group to the users;
- Contribute to technical supplement the adopted legislation, simultaneously with the development and entry into service of new products and new data on the effects of fire equipment;

- Approval of the funds, sources and methods used to display or calculate the values of the radius of the effect of concomitant loss to the tables relating to the evaluation of collateral damage and performance data on the firing means.

Based on the proposals of the group, Commander of Joint Force may decide to destroy different types of goals that contribute to the objectives of the operation (Figure 1).



Figure 1. Decision to destroy different types of goals

There operational and legal principles in deciding to move to firing at targets hit opponents.

The operating principles are: to achieve the objective of the operation (the mission); protection of their own forces; avoid concomitant losses.

Legal principles: justification; necessary; proportionality.

Having the right to strike only military targets, there must be abstinence from deliberate destruction of civilian population and buildings (homes, hospitals, schools, religious sites and other sites). It also requires underlying assumptions civilian casualties and destruction cannot end with the achievement of certain military success.

Analysis of Figure 1 shows that depending on the mission, which was awarded to the joint forces, the aim of the operation is determined by the highest priority.

One of the biggest challenges facing the commander of joint forces and the commanders of the components it is to protect their own forces and resources in the operation. As the risk for their own forces is higher, and so the challenge Commander (commander) is big and it must take all necessary measures for the protection.

Avoidance of collateral damage or minimize them to an acceptable level creates the conditions to maintain the battle rhythm of the operation. Assuming concomitant losses above a certain level can result rather than the (requested) undesirable effects and they lead to a negative impact on the course of the operation and / or desired end state.

Legal principles in deciding the application of firing hit the goals are threefold:

- First - whether there is a legal justification for an attack on a target;
- Second - is it necessary to inflict a blow to the firing target;
- Third - obligatory use of proportional force for scarfing impact on the target.

Failure to comply with these principles may cause excessive negative effects on civilians and be defined as a violation of international law. Moreover, political leaders and commanders could become the subject of massive criticism to affect heavily on military targets, allies, partners or national targets. Commanders of NATO operations appreciate the preservation of the lives of civilians. Servicemen from all levels (strategic, operational and tactical) must demonstrate these values in the use of force to perform the military tasks and avoid collateral damage.

COLLATERAL OBJECTS, DUAL-USE, AND HUMAN SHIELDS

Accompanying losses are unintentionally or accidentally injured or affected people and / or objects that are not designated as military targets during the application of the firing stroke. These losses will be considered a violation of the law when they are comparable to the expected military advantage to cause operational shocks and fires. When considering the collateral damage is necessary to take into account at all levels, protect vulnerable non-military objects (accompanying objects), aims to double use and living shields.

Objects that are defined by international law as a civilian (non-military) are considered protected. Their knowledge is the basis for development of the process of destruction of the goals and they must be described in the rules for the conduct of any military operation.

The rules for military conduct are issued by the competent military authorities legal situations which outline the circumstances and constraints under which the joint forces will begin and / or continue combat operations Opposed forces.

Protect vulnerable non-military objects can be divided into two categories, as is determining their sensitivity. The codes for each order processed by intelligence with standardized description (Table 1).

778XX	Diplomatic Facilities, Foreign Missions, and Nongovernmental Organizations
776XX	Religious, Cultural, Historical Institutions
434XX	Medical Facilities
721XX	Medical Schools
72300	Medical Interest Site
496XX	Civilian Schools
75300	Civilian Refugee Camps
75900	Prisoner of War Camps
775XX	Government Detention Facilities
43210	Sewage Waste Facilities
439XX	Dams
438XX	Dikes and Other Water Control Features
77700	Libraries

Table 1. Core no-strike list category codes

In the first category are protected vulnerable non-military objects.

As such are defined:

- Diplomatic offices, foreign missions and neutral non-military property
- other nations in the area of operation;
- Religious, cultural, historical institutions;
- International organizations (UN, NATO, EU, OSCE, the African Union and others)

and non-governmental organizations (International Committee of the Red Cross and Red Crescent, "Amnesty International"), property, equipment and personnel;

- Civilian and military medical facilities;
- Public educational structures - civilian schools, colleges, universities and institutes, but those military;

- Refugee camps;
- POW camps and state prisons;
- Facilities that after the destruction will lead to contamination of drinking water sources and rivers;

- Dams and dikes whose destruction can cause flooding to civilian objects.

In the second category includes protected from martial law vulnerable non-military objects.

As such are defined:

- Non-military units;
- Civilians places, such as stadiums, parks, theaters, supermarkets and areas of recovery;

• Public facilities that are used to transfer electricity, oil or water consumption civilians, gas stations, transportation facilities, fire, post offices, police stations and other financial institutions;

- Farm equipment;
- Facilities with an unknown destination;
- Protected vulnerable non-military objects can be changed (for the US President or the Minister of Defence), which is reflected in the rules for military conduct.

If there is an existing joint target list (JTL) and/or RTL, they shall be used to focus the IC and prioritize their MIDB production and review efforts for possible No-Strike entities. If a JTL/RTL does not exist, established special engagement zones, named areas of interest (NAI), or designated search areas may serve the same purpose. If none of these exist, combatant command personnel shall attempt to refine the scope of effort for the IC by geographic/regional priority. For urban areas, the priority is as follows:

Priority	City Size
1	National Capital
2	Regional/State Capital
3	Cities with population over 250,000
4	Cities with population over 100,000
5	Cities with population over 20,000
6	All other

Table 2. Urban Area Priority List

No-Strike entities must be named distinctly with an assigned identification (e.g., basic encyclopedia (BE)) number/O-suffix) and classified by their functionality with an appropriate CATCODE IAW reference c. Facilities must be geospatially defined as discrete entities with a precise GPS quality geographic center and corner point boundaries. They must be entered in MIDB to support validation by the appropriate authority and realistic target deconfliction during the conduct of combat operations. If required, combatant commands may request IC support for No-Strike entity development. Development of new nominations should be requested via the nominationdatabase change request (NOM-DCR) process IAW subparagraph 2.c. below, with amplifying information provided via e-mail to the appropriate RAC. Requirements to support development of existing entities in MIDB should be submitted via Community On-Line Intelligence System for End Users and Managers (COLISEUM).

Coordinates relating to physical No-Strike entities are produced and maintained in MIDB. Accurate positioning of physical No-Strike entities is essential for minimizing collateral damage and critical to the CDE process.¹⁰ Since automated CDE tools depend on accurate plots of the NSL to ensure valid CDE results, care must be exercised in the methods used to derive No-Strike entity locations. Coordinate sources listed below 1 meter controlled image base (CIB) on Table C-A-3 are not accurate enough to provide reliable depictions using automated CDE tools. Properly acquired GPS coordinates should be used to cue and further refine No-Strike locations on imagery (reference k). Orthorectified mono imagery should be used whenever stereo imagery is not available. Sources for deriving positional data are listed below, in order, based on accuracy:

Priority	Coordinate Source
1	Digital Point Positioning Database
2	Precise Orthorectified Image Datasets
3	CIB 1 Meter
4	CIB 5 and 10 Meter
5	Uncontrolled National Technical Means Imagery with Rapid Positioning Capability

Table 3. Sources for Deriving Positional Data

No-Strike entity information is likely to come from a variety of sources (particularly after an operation begins): CSAs, Services, Components, JIACG, Coalition partners, Interagency partners, etc.... Regardless of source, each stakeholder must nominate No-Strike entities for MIDB entry through the GEMINI portal.¹¹ If stakeholders do not or cannot have access to GEMINI then they must pass the required information to the appropriate combatant command No-Strike Coordinator for data entry into GEMINI.

Stakeholders may not regularly communicate with combatant commands and the information they provide may be either incomplete or difficult to validate. To facilitate the positive identification, location, and validation of No-Strike entities, combatant commands may utilize the JIACG, as well as command CSA and coalition partner liaisons. Despite the GEMINI process outlined above, combatant commands can expect to receive information from interested parties by fax, phone, e-mail, or visits from stakeholders. Commands must reach-out to subordinate commands, allies, coalition

partners, host nation, and the JIACG to refine No-Strike entity information and encourage stakeholder participation and feedback.

DIA's GEMINI Web-based portal for production and dissemination of MIDB facility and unit-related intelligence is the approved method for nominating new possible No-Strike entities. When doing so, agencies shall follow the NOM-DCR guidelines and procedures established within GEMINI. As nominations are developed, agencies shall provide as much information as possible. Location and source of information is critical. Identify the entity by CATCODE to ensure it is forwarded to the correct RAC. Agencies should ensure contact information in GEMINI profile is current.

Important attributes in reporting potential new No-Strike entities include, but are not limited to: date of nomination, country, entity name, coordinates (suggested format DD.MM.SS.SSSX/DDD.MM.SS.SSSX) or location with GPS or priority 1, 2, or 3 coordinate sources preferred using World Geodetic System 1984 (WGS-84) Datum (see Table C-A-3), coordinate accuracy, perimeter boundary, number of personnel at the facility and work schedules (if known). Important attributes for reporting and/or nominating virtual No-Strike entities include internet protocol (IP) or uniform resource locator (URL) addresses (or other uniquely identifying features in cyberspace) and the geospatial location of any physical systems or nodes that utilize the virtual network. Requestor provides point of contact, organization, e-mail address, phone, and fax telephone numbers for validation purposes.

Protected or collateral object categories may be modified by the Secretary of Defense (SecDef) or President as the military or political situation dictates. Changes to these categories will be reflected in operation specific ROE.

DUAL-USE TARGETS

Targets characterized as having both a military and civilian purpose/function are characterized as dual-use. In most cases, dual-use targets consist of facilities/structures associated with senior governmental level command and control, national communications infrastructure, media centers, national power and petroleum, oil, and lubricants infrastructure, industrial facilities, and public utilities providing support to the civilian population and the military effort.

There may be objects (targets) with a double use (purpose), which is most commonly used for civil and military purposes.

As such are defined:

- Facilities for command and control of high government level;
- Infrastructure of the national communication system;
- Media centers;
- National Electrical and oil facilities;
- Industrial facilities and public facilities providing support for civilian and military campaign.

Objects (targets) with dual purpose can also be objects protected by law, but occupied by troops, and also by paramilitary fighters. Protected by law structures occupied by soldiers performing military task lose the legal protection and are considered military targets. Based on current intelligence commanders are responsible for defining the predominant function of structures protected by law and whether the purpose is dual-purpose.

The rules for military conduct any operation provide rights and / or bans strikes not targets dual purpose.

Irrespective of the rules for military conduct civilians working within the target dual-use should be considered as collateral damage in their assessment, according to the methodology used by NATO.

HUMAN SHIELDS

As a separate category of objects can be created define human shields. They are civilians or unarmed group of people who are about acting military order to prevent impact on it. There are cases where human shields are voluntary participation and support actions of the opponent. In this case they lose their status as protected and are valid military objectives. In other cases, hostile could force to compel civilians to shield military objectives. These persons are protected and will not be defeated (fired). Only involuntary human shields should be considered for the evaluation of collateral damage. If the status of human shields is not clear, apply the most restrictive rules and they must be protected as vulnerable non-military objects (accompanying objects).

Accompanying facilities are civilian and non-military objects, structures, machines and materials that do not support the activities and / or functions of the opposing military or martial abilities.

The report does not contain classified information

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CULTURAL CHALLENGES AND ADAPTABILITY OF THE BULGARIAN TROOPS IN A MULTINATIONAL ENVIRONMENT

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Abstract: *The report outlines some key challenges when working in a multinational environment and the role of organizational and cultural barriers to adaptability of the military for effective cooperation and interaction on missions in multinational and coalition military operations.*

Keywords: *multinational units, coalition, adaptability, cultural obstacles, missions.*

A progressive increase of multinational forces employed in several missions under the aegis of United Nations (UN), North Atlantic Treaty Organization (NATO) and, recently, European Union (EU) represents one of the significant changes within the armed forces of European countries in the last decades. With the term “military multinationality” we usually mean any kind of cooperation among the military from different nations, but in detail we have to distinguish between horizontal cooperation and vertical integration.

In the last few years, in a trend towards a growing integration, soldiers of different nationalities have more and more interacted and cooperated under an integrated command structure. Particularly, this phenomenon was a matter for Western countries’ soldiers, but not only for them: the “internationalization of military life” is a global phenomenon.

Cooperation and progressive integration represent a major challenge for the military organization, symbol of unity and national sovereignty and traditionally reluctant to change. It would not be rash to uphold that the European armed forces have played an essential role in the development of national identities and in the strengthening, even though wars, of the concept of nation-state. The idea that the armed forces are a symbol of national sovereignty and a “public good” of each country is still strong in the political and military thought of European elites and in public opinion in general.

Military sociologists define this period as postmodernism and outline some common trends in the armed forces, in the first place seems to be a change in the purpose of the armed forces. The traditional purpose of war is gradually shifting from the execution of missions and tasks that until recently seen as typical war - for example, participation in international operations, peacekeeping, humanitarian and rescue operations, restoration of statehood and establishment of civil infrastructure and post-conflict etc. Another aspect of the postmodern forces is increasing convergence between the military and civilian field in ensuring security.

More and more often is necessary soldiers to work in a multinational, mixed gender, multiethnic and multicultural environment. They meet different cultures - their colleagues from other national contingents in the coalition and the local population in the area of operation, the various types of armed forces, etc. In third place seems increasingly greater use of multinational forces authorized by international institutions. A direct result of this trend is the increased communication of the military in a multicultural and multiethnic environment, which requires different competencies than those in the performance of the traditional role of the army. Not least as a general trend seems to be increasing and the full integration of women in the military forces.

In this report special interest are trends related to the growth of ethno-cultural and sexual diversity among the staff of the military organization and the internationalization of the armed forces, which is expressed in ever greater use of multinational forces in coalition operations.

To be an effective military organization, it should encourage and imposes a model of intercultural relations based on the principle of harmonious co-operation of representatives of various cultural communities.

The time of homogeneous forces both nationally and internationally passes. There is a broad consensus among the people who make the decisions in security and defense, and among researchers that political legitimacy and saving resources are among the most important advantages of the multinational coalition operations. Moreover, there are publications, according to which, in racial, ethnic, cultural and gender relation military contingents prove more effective in today's military operations, which require specific skills, often different from the traditional skills of war.

On the other hand, the question of the operational efficiency of the multinational coalition forces remains a serious debate. A number of recent studies indicate the most important barriers to operational efficiency objectives of the different countries participating in the coalition, doctrine, logistics, levels of education and training of military forces, language barriers, leadership styles, restrictions on the exchange of information and more.

Described reasons can be regarded as organizational and cultural barriers to adaptability of soldiers operating in a multinational and multicultural environment and are largely related to the preparation of the military leaders and their teams for effective integration in the coalition forces. In this study, we pay special attention to cultural issues and cultural adaptability of soldiers at work in a multinational environment.

The term cultural adaptability denote a person's ability to understand and realize their own and those around him preconceptions, stereotypes, prejudices based on cultural differences and adapt as needed to ensure maximum effective achievement of tasks team.

Consider cultural adaptability as a critical factor for the effective integration of Bulgarian troops in the multinational and multicultural environment, because cultural differences can not only have a direct effect on successful cooperation, but also to leave a mark and thus indirectly influence on every element of daily operations in coalition.

Multinational coalitions can be described as a group of people - leaders and followers together in teams representing various national cultures, with different levels of training with different organizational structures, doctrines and concepts, various procedures for decision-making and different levels of technological development.

Results of surveys show categorically that in this extremely complex ensemble lack of skills in team work in a multicultural environment is one of the most important barriers to effective implementation of tasks in the multinational coalition.

Therefore we think training leaders and their teams in this respect is one of the critical factors for improving the effectiveness of coalition operations.

To be effective in today's and future multinational military operations, leaders need to be military professionals in the traditional sense, but also be able to interact with many civilians actors in the area of operation and perform tasks that are not traditionally perceived as military. They should be able to perform complex roles - purely military, but also a mediator, a soldier, diplomat, soldier and statesman others.

Moreover, military leaders should develop a strong coalition and joint culture as future military operations will be multinational, joint and with the participation of many civilian structures. At the same time, the mix of roles could lead role to crisis and tensions in the professional military identity, which some authors warn.

Estimates of the experts regarding the factors influencing the efficiency of multinational coalitions can be combined into four groups.

The first group includes factors related to organizational structure, such as connections and hierarchical relationships between the different organizational units.

The second group includes factors associated with the management of processes in the organization, such as the way of decision-making and sharing responsibilities within the organization, creating a clear and consistent understanding of wormwood, tasks and procedures, a common vision and shared responsibility, exchange information between coalition partners and others.

The third group includes factors associated with people in the organization. As examples there may be mentioned recruitment and staff development, cohesion, motivation, training, rotation periods, satisfaction of participating in the mission, leadership skills and more.

The fourth group includes factors associated with organizational culture as norms, values, communication skills in a multicultural environment, trust between the coalition partners and others.

The first two groups of factors can be defined as organizational barriers to effective multinational military operations, while the latter is more associated with cultural adaptability. The third group of factors - people in the organization include organizational and cultural barriers. Of course, this division is conditional because often organizational and cultural barriers between them.

One of the most frequently mentioned by experts organizational factors that adversely affect the effectiveness of multinational operations are different periods of rotation of national contingents and the lack of synchronization in this regard. Which leads to the necessity of adaptation process to be repeated several times and difficult communication between servicemen.

Regarding the duration of the period of rotation of experts did not reach consensus. According to some of them the duration of a mission from 4 to 6 months is not enough to absorb the position and working to build a social network to facilitate the process of exchange of information and decision making. At the same time, some experts warn that a possible increase of the rotation period of 6 months would lead to problems with the mental stability of the military as a result of the large levels of stress when conducting high-intensity operations.

Another important factor that affects the organizational effectiveness of multinational operations is the lack of a system for extracting lessons learned to assist the process of training the next contingents. Experts suggest that rarely anyone interested in the experience of soldiers returning from the NATO operation.

Experts unanimously highlighted as a factor not conducive to the effectiveness of coalition operations, different training systems in Member States and the lack of standardization in this regard. The problem is exacerbated when there is not enough time for immediate preparation for a joint operation, especially if it involves countries from NATO and partner countries.

An important factor that affects the organizational effectiveness of coalition operations are the selection and appointment of suitably qualified people in the right places. There is a feeling that some nations do not employ enough qualified people to positions that are available to them and thus impedes the work.

Experts pay special attention to the lack of good communication of the different organizational levels and a positive attitude among the soldiers themselves to exchange information. This affects the quality of the process of decision making and raises questions about the trust between the coalition partners.

Along with those factors that influence the effectiveness of coalition operations and management-related processes in the organization, experts point to some factors that are already known. Among them are the problems with the technological interoperability and especially different information systems, lack of common doctrines and strategies and differences in the provision of resources for coalition partners.

Not least attention should be paid to factors that may be described as political-military and operate at a strategic level. Here we can mention the different national goals of states participating in the coalition - impose national restrictions on the use of contingents, sometimes experts question the security forces and the effective execution of tasks.

Among the most important cultural barriers continue to be insufficient level of English proficiency of the military, which is not native language. This leads to difficulties in communication with the coalition partners, difficulty in perceiving the nature of the tasks and the self-isolation of those who do not speak the language well enough. A major problem is the special English language and abbreviations, which some experts define as "third language in NATO" The problem has another side - the military, for whom English is the native language begin to perceive the coalition partners who do not speak the language well enough as incompetent appear doubts in terms of cooperation and reliability coalition partners.

This situation requires a change in the style of communication military personnel for whom English is the native language. Experts recommend to avoid the use of dialect words, slower and more clearly to pronounce words, to observe the reactions of the interlocutor and others. These are ways to minimize the effect of insufficient knowledge of English by coalition partners and to improve the overall understanding of the goals and objectives of the operation.

Another important barrier to the effectiveness of multinational operations is associated with the culture of decision making and implementation of process management in the military organization. This is directly related to the different national cultures. For some nations is typical centralized type management process, while others

give priority to decentralized management and provide more power to the leaders of the lower management levels in the military organization.

The second aspect of the management process that experts identified as important, is connected with the culture of avoiding making decisions due to "fear of possibly wrong decision." For some nations is characterized by learning from their mistakes rather than from good practices and even stimulate this process. In this sense, their soldiers do not understand how there can be any fear of making a wrong decision.

The third aspect of the management process that experts say deserves attention is the "orientation to task for spending the time to build and maintain social networks". To a large extent this attitude is associated with different leadership styles of coalition partners, determined by different national culture. In the first case it comes to so-called direct leadership style where the problem sets and seek his resolve as quickly without the need to collect additional information and attract resources. In the second case we witness the so-called indirect style in which leaders sought the maximum possible information to make a decision and tries to mobilize informal networks to accomplish the task.

Of course, these communication styles are typical not only for the leaders but followers in the military organization as carriers of different national culture. The problem is that in their clash sometimes occurs feeling too disrespectful attitude in direct placing of the problem or the desire to avoid it if too many are looking for justifications and explanations.

The next factor that experts identified as a barrier to the effectiveness of multinational operations associated with different military culture of the countries represented in the coalition. In some nations dominate traditional military culture, while others are more highly developed culture of postmodern armed forces. This problem arises especially in a situation when performing a peacekeeping operation, while using heavily armed forces.

Not least the experts suggest that among military personnel from different countries in the coalition often seen different perception of the role of women in the military, their capacity for participation in international operations, the effectiveness of such operations.

Those cultural differences, which do not exhaust the entire range of possible barriers, definitely create misunderstanding between the coalition partners and strains of working in a multinational environment. Therefore, they require careful analysis and targeted training of soldiers for participation in multinational operations. The problem is not the existence of cultural differences - something natural in multinational coalitions, but in the lack of ability of servicemen realize and understand their own and those around him prejudice, stereotypes and prejudices based on cultural differences that above we were defined as cultural adaptability.

In order to improve the effectiveness of multinational operations it is necessary to follow the following considerations.

First is the preliminary preparation for the operation. Experts agree that officers from headquarters should get to know before you go on a mission, to be trained together as a group to have prior experience in joint coalition environment and know well the procedures for decision-making in NATO. According to them they are required common doctrine and standardization of training for participation in multinational coalition operation.

Secondly it is necessary to pay special attention in the rotation of national contingents and staffs positions in order not to lose valuable lessons from the experience of their predecessors, and to be transmitted to the next shift. So military personnel will learn from mistakes and best practices of its predecessors, and headquarters or division will become a learning organization.

Thirdly, experts recommend to prevent dominance of any nation in the operation headquarters, this means giving preference to multinational model, not the model leading nation. Such an approach they believe will give a boost to the construction of identity and the Coalition will contribute to the perception of the operation as NATO operation, not in the interest of a particular nation. Crucial in this respect is to use only the symbols of the Union and national symbolism and demonstration of national identity to remain in the background.

Great attention is paid to the effectiveness of the processes of exchange of information between the coalition partners. The problems here are, on the one hand, reluctant to share information because of national regulatory restrictions, on the other hand, a lack of technical capacity in some nations. In any case, the difficulties in the exchange of information highlighted as a very important issue obstructing the effective management of processes in operation headquarters and the formation of a common understanding of the situation. This is a matter of trust between the coalition partners.

Elimination of all national restrictions on the use of forces is also among the most frequently-mentioned recommendations with military-political nature. Experts agree that if there are national restrictions, it is better not to conduct a multinational operation. All nations in the coalition should have shared responsibilities and be able to rely fully on its coalition partners in any situation. They are of the opinion that the existence of national restrictions called into question the credibility of the partners in the coalition.

The fourth group of recommendations is related to the creation and development of cultural adaptability when working in a multinational environment. These include training for intercultural communication in order to achieve openness and receptiveness of foreign culture - both the local population and colleagues from other nationalities.

Next experts pay special attention to building leadership skills to manage different racial, ethnic and cultural teams. Not least cited as a key factor for the success of the operation building and development of informal social networks and informal communication between military personnel of different nations. According to them, they must use all available opportunities for people to interact with each other informally.

In conclusion we can say that the foregoing literature review suggests consensus on a number of points. When groups possessing diverse cultural and organizational backgrounds must work together, differences among them can become major impediments to mission success. Gaining an awareness of these differences is a necessary first step in developing strategies to overcome these differences and forge effective working alliances. In nearly every coalition operation, personnel from diverse groups are expected to interact effectively in order to achieve mission objectives. Knowledge of inter-group variations in core cultural values and their related behavioral consequences can help to promote positive inter-group relations. Implementation of planning, coordination, communication, and training processes that are designed to meet the needs of diverse groups is required to increase the effectiveness and efficiency of coalition operations.

On the whole, much work remains to be done. There is a need for access to empirical studies that test theories and models in this area in order to develop a knowledge base for informing policy relating to multinational military teams.

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A DISTRIBUTION SYSTEM DESIGN MODEL

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Abstract: Large varieties of mathematical programming models have been developed to provide decision support to the design engineer. The paper deals with some of the problems and offers practical solutions.

Key words: warehouses, Distribution System design.

I. Introduction

Distribution system design is the strategic design of the logistics infrastructure and logistics strategies, which delivers products from one or more sources to the customers. Because of the long-term impact of the distribution system, the interrelated design decisions, and the different objectives of the various stakeholders, designing a distribution system is a highly complex and data intensive engineering design effort [2,8]. The results of the models and tools have to be very carefully validated. The uncertainty of the forecasted data has to be explicitly incorporated through sensitivity and risk analysis. The final configuration is often based on the balance between many different factors and many alternative configurations may exist. However, modeling-based design is the only available method to generate high-quality distribution system configurations with quantifiable performance measures [5].

II. Exposition

In today's rapidly changing world, corporations face the continuing challenge to constantly evaluate and configure their production and distribution systems and strategies to provide the desired customer service at the lowest possible cost. Distribution system design focuses on the strategic design of the logistics infrastructure and logistics strategies to deliver the products from one or more sources to its customers at the required customer service level. Typically, it is assumed that the products, the sources of the products (manufacturing plants, vendors, and import ports), the destinations of the products (customers), and the required service levels are not part of the design decisions but constitute constraints or parameters for the system. Distribution system design focuses on the following interrelated decisions [7]:

1. Determining the appropriate number of distribution centers
2. Determining the location of each distribution center
3. Determine the customer allocation to each distribution center
4. Determine the product allocation to each distribution center
5. Determine the throughput and storage capacity of each distribution center

The data analysis and synthesis phase of the design project will be highly dependent on the individual project. The overall goal of this phase is to create a data set that contains valid and agreed-upon data for all the major components in the design project.

For many objects in the data set, there may be only a single data value, for example, the longitude and latitude coordinates of city. For other objects, the data can only be described by statistical distributions and their characteristics in function of possible scenarios.

For example, the demand of a particular customer area for a particular product may be stored as its statistical distribution type, mean, and standard deviation for the worst-case, best-guess, and best case scenarios.

All the data for a distribution system design project [9] is typically stored in a single database. Using a database allows the use of database validation tools and consistency checks. The data is organized in function of objects and their characteristics. Similar objects are collected in classes. The most important objects in a distribution system design project [4] and some of their characteristics are described in the following.

The Location-Allocation model considers manufacturing facilities (plants), customers, and distribution centers (depots). It determines the location of the distribution centers and the allocation of customers to distribution centers based on transportation costs only. The distribution centers can be capacitated and flows between the distribution centers are allowed.

The algorithm starts with an initial solution in which the initial location of the distribution centers is specified. This initial location can be random, specified by the user, or the result of another algorithm [3].

Based on this initial location, the network flow algorithm computes the transportation distances d and then assigns each customer to a distribution center with sufficient capacity by solving the following network flow:

$$\min \sum_{i=1}^m \sum_{j=1}^n c_{ij} d_{ij} w_{ij} + \sum_{j=1}^n \sum_{k=1}^l c_{jk} d_{jk} v_{jk} \quad (1)$$

$$\sum_{j=1}^n v_{jk} = dem_k, \quad k = 1..l \quad (2)$$

$$\sum_{j=1}^n w_{ij} \leq cap_i, \quad i = 1..m \quad (3)$$

$$\sum_{k=1}^l v_{jk} \leq cap_j, \quad j = 1..n \quad (4)$$

$$\sum_{j=1}^n w_{ij} - \sum_{k=1}^n v_{jk} = 0 \quad j = 1..n \quad (5)$$

Where;

w_{ij}, v_{jk} - the product flows from plant i to distribution center j and from distribution center j to customer k , respectively.

c_{ij}, c_{jk} - the transportation costs per unit flow and per unit distance from plant i to distribution center j and from distribution center j to customer k , respectively.

d_{ij}, d_{jk} - the inter-facility transportation distances from plant i to distribution center j and from distribution center j to customer k , respectively.

cap_i, cap_j - The rough put capacity of plant i and distribution center j , respectively.

dem_u - demand of customer k .

Circumstance (2) ensures that each customer receives its full demand. Circumstance (3) and (4) ensure that the capacity of the plants and distribution centers is observed. Circumstance (5) ensures that the total inflow into a distribution center is equal to the total outflow, that is, that conservation of flow is maintained. This network flow formulation can be very efficiently solved by a linear programming solver for all realistic problem sizes. The result of the allocation phase is the assignment of customers to distribution centers as given by the flow variables.

$$x_j = \frac{\sum_{i=1}^m c_{ij} w_{ij} a_i + \sum_{k=1}^l c_{jk} v_{jk} a_k}{\sum_{i=1}^m c_{ij} w_{ij} + \sum_{k=1}^l c_{jk} v_{jk}} \quad (6)$$

$$y_j = \frac{\sum_{i=1}^m c_{ij} w_{ij} b_i + \sum_{k=1}^l c_{jk} v_{jk} b_k}{\sum_{i=1}^m c_{ij} w_{ij} + \sum_{k=1}^l c_{jk} v_{jk}} \quad (7)$$

Where:

$(a_j, a_k), (b_j, b_k)$ - cartesian location coordinates of customers i and plants k .

x_j, y_j the location coordinate variables of distribution center j .

The solution provided by (6) and (7) is optimal with respect to the squared Euclidean distance norm, and it provides sufficient accuracy at this level of a strategic design project for the Euclidean distance norm. It should be noted that the iterative solution algorithm based on the partial differential equations is usually started with this center of gravity solution as starting point. The location phase provides new locations for the distribution centers. Based on these new locations the distances between the various facilities can be updated.

The models ignore the capacity restrictions of distribution centers. All of the previous models considered only a single product and this ignore the single-sourcing customer service constraints.

Through developing a model that incorporated both capacity and single-sourcing constraints, one of its fundamental characteristics was that the flow was modeled along a complete path from supplier, through the distribution center, and to the customer by a single flow variable. Formulations of that type are called path-based [6]. If a flow variable exists for each transportation move, then the formulations are said to be arc-based [4]. The difference between path-based and arc-based formulations is illustrated in

Figure 1. Path-based formulations have many more variables than arc-based formulation for the equivalent system. On the other hand, arc-based formulations have to include the conservation of flow equations for each commodity and each intermediate node of the logistics network.



Fig.1. Illustration of arc and path-based transportation flows.

Several major factors such as cycle and safety inventory and taxation have not been discussed so far. More comprehensive models that incorporate these factors have been developed, but such models must be used with extreme care and typically have a steep learning curve. Their use can be only recommended if the models will be used repeatedly.

III. Conclusion

This design project illustrated again the following observations about strategic distribution system design. First, without modeling-based decision support, the configuration of a distribution system is essentially reduced to intuition or guesswork. Second through careful modeling-based sensitivity analysis a limited number of high-quality candidate configurations can be identified and submitted for final selection.

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OPTIMISATION OF SUNFLOWER OIL TRANSESTERIFICATION PROCESS USING SEQUENTIALLY GENERATED SYMMETRICAL DESIGN

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Abstract: *The methanolysis process of crude sunflower oil was modelled and optimised using sequentially generated symmetrical design and response surface methodology. The maximum yield of 89.6 wt.% was obtained at NaOH catalyst loading of 0.4 wt.%, temperature of 55 °C, reaction time of 68 min and molar methanol to oil ratio of 8.5:1.*

Keywords: *optimisation, sunflower oil, sequentially generated symmetrical design.*

1. Introduction

The biodiesel is a mixture of fatty acid methyl esters. The most common way to its production is by transesterification of plant oils with methanol in presence of an alkaline catalyst. The research of the modelling and optimisation of methanolysis reaction can be generalized into several directions – single factor experiments, multifactor experimental modeling and optimisation, dynamic and artificial neural network modelling.

Based on [1,2] single factor experiments, the factors for obtaining maximum yield of fatty acid methyl esters (FAME) in the methanolysis of sunflower oil were determined. Such analysis provides invaluable a priori information for ascertaining of the limits of the independent variables in mathematical modelling. Vicente et al. [3,4] have used three factor experiment and central composite design at the modelling and the optimisation of the methanolysis. In addition, they obtained maximum purity of FAME based on a second order polynomial mathematical model. Rajkovic et al. [5] used full four factor experiment, response surface methodology, artificial neuron network and analysis of variances in order to investigate the methanolysis process.

The aim of our research was to solve the optimisation task for obtaining of maximum yield of FAME at the methanolysis of sunflower oil at the following conditions:

- ❖ raw material for methanolysis – intermediate product, which has been obtained by the technology process neutralization;
- ❖ four independent variables – initial concentration of the catalyst sodium hydroxide, reaction temperature, methanol to oil molar ratio and reaction time;
- ❖ the experiments to be carried out based on sequentially generated symmetrical design.

2. Materials and methods

The crude sunflower oil was obtained from the local sunflower oil factory and is an intermediate product after the technology process neutralization. Its fatty acid composition (% by weight) is as follows: 5.4% palmitic acid, 4.6% stearic acid, 24.7% oleic acid, 64.5% linoleic acid and 0.8% other acids. Its mean molar weight is 876.5 g/mol and the acid value is 0.56.

The transesterification reaction was carried out in a 250 cm³ two-necked round-bottomed flask, immersed in a water bath with thermostat control and equipped with a

reflux condenser and a stirrer. The calculated catalyst amount was dissolved in a methanol and added to a reaction vessel. The sunflower oil was thermostated separately and added to a round-bottomed flask too. The temperature was controlled and maintained at the desired level ($\pm 0.1^{\circ}\text{C}$) by water circulating by means a pump. When the methanolysis finished, the mixture was transferred into a separatory funnel and was allowed to settle. The FAME upper layer was then washed for four times using warm 5% citric acid. The yield of methanolysis reaction is determined in volume units (cm^3) and subsequently is recalculated in weight % at FAME density of $0,87 \text{ g/cm}^3$. The density of the product is determined using picnometer, when the dynamic viscosity - using Hoppler viscosity meter.

3. Modelling and optimisation of the sunflower oil transesterification process

Coded and natural values of the independent variables chosen are presented in **Table 1**.

Table 1.
Coded and natural values of the factors

Independent variables	Levels		
	$x_i = -1$	$x_i = 0$	$x_i = 1$
Initial concentration of the NaOH (catalyst) x_1 , %	0,4	0,8	1,2
Reaction temperature x_2 , $^{\circ}\text{C}$	30	45	60
Methanol to oil molar ratio, x_3	5:1	10:1	15:1
Reaction time x_4 , min	40	60	80

The chosen sequentially generated symmetrical design comprises two parts – the first consists of 16 experiments, while the second - 8 experiments respectively [6]. The mathematical model consisting of four factors and 16 experiments has 15 regression coefficients:

$$\hat{y} = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_{12}x_1 \cdot x_2 + b_{13}x_1 \cdot x_3 + b_{23}x_2 \cdot x_3 + b_{14}x_1 \cdot x_4 + b_{11}x_1^2 + b_{22}x_2^2 + b_{33}x_3^2 + b_{44}x_4^2 \quad (1)$$

\hat{y} – predicted FAME yield, wt. %;

b_0 – mean response;

b_1, b_2, b_3, b_4 – the first-order model coefficients;

$b_{12}, b_{13}, b_{14}, b_{23}, b_{24}, b_{34}$ – interaction coefficients;

$b_{11}, b_{22}, b_{33}, b_{44}$ – quadratic coefficients of the independent variables.

The results of the yield of the FAME for the first part of the experiment are presented in **Table 2**.

The values of regression coefficients have been calculated based on the following equations [6]:

$$b_0 = a \sum_{u=1}^{16} y_u + p \sum_{j=1}^4 \sum_{u=1}^{16} x_{ju}^2 y_u \quad (2)$$

$$b_i = e \sum_{u=1}^{16} x_{ju} \cdot y_u \quad (3)$$

$$b_{ij} = g \sum_{u=1}^{16} x_{iu} x_{ju} y_u \quad (4)$$

$$b_{ii} = c \sum_{u=1}^{16} x_{iu}^2 \cdot y_u + d \sum_{j=1, j \neq i}^m \sum_{u=1}^{16} x_{ju}^2 \cdot y_u + p \sum_{u=1}^{16} y_u \quad (5)$$

y_u – experimental yield of FAME, wt. %;

a, p, e, g, c – constants.

Table 2.

Part 1 - matrix of the experiment and yield of fatty acid methyl esters

№	Coded values of the factors				Yield, wt. %		Relative error, %
					Experimental, y	Predicted, \bar{y}	
	x_1	x_2	x_3	x_4			
1.	1	1	1	1	64,1	1,5	97.5
2.	-1	1	-1	1	86,7	123,4	42.4
3.	1	-1	-1	1	80,2	88,2	10.0
4.	-1	-1	1	1	81,5	95,7	17.5
5.	1	1	1	-1	62,8	11,0	82.3
6.	-1	1	-1	-1	82,5	118,4	43.6
7.	1	-1	-1	-1	76,1	83,7	10.1
8.	-1	-1	1	-1	76,8	88,2	14.9
9.	1	0	0	0	82,9	83,0	0.1
10.	-1	0	0	0	88,1	87,9	0.1
11.	0	1	0	0	83,4	84,1	0.9
12.	0	-1	0	0	87,2	86,4	0.9
13.	0	0	1	0	84,7	82,3	2.8
14.	0	0	-1	0	83,9	86,2	2.8
15.	0	0	0	1	87,8	86,5	1.4
16.	0	0	0	-1	83,4	84,6	1.5

The values of the regression coefficients are calculated (**Table 3**) for following values of the constants [6]: $a = 0.236111$, $p = -0.069444$, $e = 0.05$, $g = 0.625$ and $c = 0.402778$.

Table 3.

Values of the regression coefficients for Part 1 of the experiment.

Regression coefficients	Value	Regression coefficients	Value	Regression coefficients	Value
b_0	88.122	b_{12}	-25.188	b_{34}	-1.438
b_1	-2.475	b_{13}	-11.563	b_{11}	-2.619
b_2	-1.115	b_{14}	-2.188	b_{22}	-2.819
b_3	-1.975	b_{23}	-27.688	b_{33}	-3.819
b_4	0.935	b_{24}	-2.063	b_{44}	-2.519

The comparison between the obtained experimentally and the calculated yields of FAME, based on the mathematical model, manifests large relative error of the predicted values (97,5% and 83,3%, **Table 2**). Therefore, in part 2 we conducted eight additional experiments, which results are shown in **Table 4**.

Table 4.

Part 2 - matrix of the experiment and yield of fatty acid methyl esters

№	Coded values of the factors				Experimental yield y , wt. %
	x_1	x_2	x_3	x_4	
17	-1	1	1	1	83,4
18	1	-1	1	1	85,8
19	1	1	-1	1	74,2
20	-1	-1	-1	1	77,8
21	-1	1	1	-1	79,0
22	1	-1	1	-1	81,4
23	1	1	-1	-1	71,3
24	-1	-1	-1	-1	74,1

The values for the regression coefficients are calculated using formulae 2 to 5 for parts 1 and 2 (**Table 5**). These have been calculated based on the experimental data presented in **Tables 2** and **4** and using the following conditions:

- ❖ number of the experiments $N = 24$;
- ❖ values of the constants [6]: $a = 0.229167$, $p = - 0.0625$, $e = 0.055556$, $g = 0.0625$ and $c = 0.39583$.

Table 5.

Part 1 and 2 – values of regression coefficients

Regression coefficients	Value	Regression coefficients	Value	Regression coefficients	Value
b_0	87,78	b_{12}	-4,53	b_{34}	-0,006
b_1	-2,84	b_{13}	-4,46	b_{11}	-2,28
b_2	-1,86	b_{14}	-0,27	b_{22}	-2,48
b_3	-0,41	b_{23}	-2,67	b_{33}	-3,48
b_4	0,935	b_{24}	-0,26	b_{44}	-2,18

The subsequent step was to estimate the statistical significance of the regression coefficients and also to check the adequacy of the model. In order to evaluate the above, we used seven experiments at the centre of the plan at values of the independent factors: $x_1=0$, $x_2=0$, $x_3=0$ and $x_4=0$. The results were the following: $y_1 = 88.5$, $y_2 = 86.5$, $y_3 = 86.9$, $y_4 = 87.7$, $y_5 = 87.5$, $y_6 = 88.4$, $y_7 = 88.1$. Based on the method presented in [6], the calculations showed that the interaction coefficients b_{14} , b_{24} и b_{34} (**Table 5**) have the following values - 0.26875, - 0.25625 and - 0.00625. Their absolute values are less than the $F_{critical} = 0.365$ [6] and therefore were excluded from the mathematical model.

The final equation in terms of coded factors for quadratic polynomial model is presented in the following equation:

$$\hat{y} = 87,7819 - 2.8389x_1 - 1.8611x_2 - 0.4056x_3 + 1.8945x_4 - 4.5312x_1x_2 - 0.4562x_1x_3 - 2.6688x_2x_3 - 2.2831x_1^2 - 2.4831x_2^2 - 3,483x_3^2 - 2.1831x_4^2 \quad (6)$$

The mathematical model performed sufficiently well at significance level of 0.05 because the dispersion ratio $S_{res}^2 / S_{\varepsilon}^2$ was 3.356 and is lower than the value of $F_{critical} = 3,999$ [6].

The graphical display of the mathematical model is a surface (**Fig. 1**), every point of which is the predicted yield of fatty acid methyl esters at specific values of the four complementary variables.

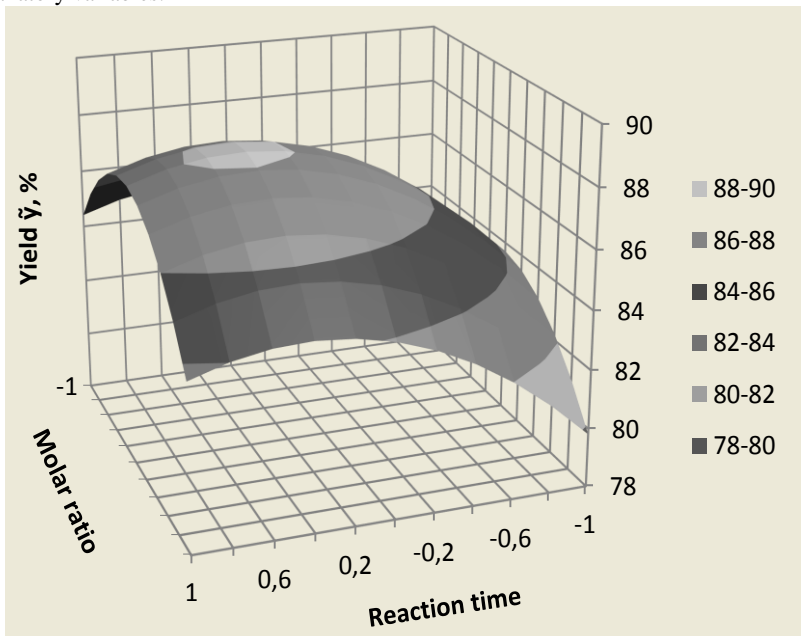


Figure 1. Surface plot of FAME yield as a function of the methanol to oil molar ratio and the reaction time at the catalyst loading 0.8% and reaction temperature 45°C

The aim of the optimisation is to determine the values of the factors at which maximum FAME yield is obtained. In essence, the absolute maximum of the mathematical model has to be calculated. This can be done by step by step investigation of the mathematical model. At step 0,1 of all complementary variables, the program “Project” calculates the FAME yield of all combinations of the factors' values. The outcome is at what values the maximum yield is obtained. The applied program presents the results in the following way:

#####

Maximums:

<i>y</i>	<i>x₁</i>	<i>x₂</i>	<i>x₃</i>	<i>x₄</i>
89,63	-1	0,7	-0,3	0,4

#####

The recalculation of the coded values into natural dimensions indicated (**Table 6**) the following parameters for maximum yield at the methanolysis of sunflower oil:

Table 6.

Conditions for maximum yield of fatty acid methyl esters

Factors	Natural values	Maximum yield, %
Initial concentration of the catalyst NaOH <i>x₁</i> , %	0.4	89.6
Reaction temperature <i>x₂</i> , °C	55.5	
Methanol to oil molar ratio, <i>x₃</i>	8.5	
Reaction time <i>x₄</i> , min	68	

The experiments based on the factor values of the maximum showed FAME yield 87,7% (2,2 wt.% error), density 0,871 g/cm³ and viscosity 4,6 mm²/s.

Conclusion

We created mathematical model of the sunflower methanolysis process based on sequentially generated symmetrical design of four factor experiment and response surface methodology. This model allows the determination of the FAME yield at the whole surface of the factors' dimension, defining the influence of the separate factors and their interaction and in addition - defining the optimal solutions based on in advance established categories.

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МУЛТИМОДАЛНИ ПРЕВОЗИ И НАСОКИ ЗА РАЗВИТИЕТО ИМ В БЪЛГАРИЯ

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Abstract: *In this report the nature of multimodal transport is considered. Attention is drawn to the transport policy that the European Union carried out with respect to this type of transport as well as major problems and ways of development of multimodal transport in our country.*

Key words: *multimodal transport, development, transport, terminal*

Съвременният пазар за транспортни услуги налага на операторите необходимостта от динамично развитие, постоянно внедряване на нови технологии за превоз, съхранение и доставка на товарите. От особено значение за ефективното изпълнение на превозния процес е наличието на развита инфраструктура, осъществяване на пълно транспортно обслужване от страна на един мултимодален транспортен оператор на принципа "от врата до врата", строго придържане към срока на доставка, оптимизация на логистичните схеми и намаляване себестойността на превозите.

Резултат от съвременните тенденции в транспорта е развитието на международните превози наречени *интермодални* или още *мултимодални* превози. Дефиниция на международна транспортна конвенция за мултимодални превози от 1980 год. гласи: "Международен мултимодален транспорт означава превоз на товари чрез най-малко два различни начина на транспорт на основата на мултимодален транспортен договор, от мястото в една държава, от което товарът е взет от мултимодален транспортен оператор, до мястото на доставка в друга държава". Характерното за тях са четири елемента:

- необходимостта от използване на най-малко два вида транспорт;
- наличието само на един договор за превоза;
- наличието само на един изпълнител, оператор на превоза, отговорен за целия маршрут на доставката;
- превозът е между две и повече държави.

Друг основен характерен елемент на интермодалните превози е, че при операциите при преговаряване, товарът се преговаря заедно с транспортната единица – транспортно средство или транспортно устройство.

Мултимодалните превози са тясно свързани с развитието на контейнеризацията, която създава основи за взаимното сближаване на различните видове транспорт и най-вече между морския, железопътния и автомобилния. Установени са еднакви способности и условия за превоз в различните видове транспорт, в резултат на унифицирането на товарните единици и изискванията за правилно и ефективно използване на контейнерите.

Целите на мултимодалната система са:

- оптимизиране на общото транспортно време;

- минимизиране на разходите за транспорт;
- усъвършенстване на товарните превози от производителя до потребителя.

Един от определящите фактори за реализацията на мултиmodalните превози е необходимостта от създаване на стандартни товарни единици. Това означава притежаване на контейнерен парк и контейнерно оборудване с параметри на ISO, които да са унифицирани от гледна точка на габарит, вид и тип, да отговарят на технико-технологичните изисквания за превоз на широка гама от товари с различни характеристики и други. Съществен елемент от мултиmodalната система е наличието на развита техническа инфраструктура: контейнерни депа и контейнерно оборудване, сухоземни контейнерни терминали, морски контейнерни терминали и развита логистична мрежа.

Най-важният елемент на мултиmodalните превози е обособяването на мултиmodalния оператор, чието задължение е да достави товара от началната точка на изпращането му до мястото по предназначение. Мултиmodalният оператор може да бъде морски или сухоземен превозвач, подготвен организационно с необходимия капитал и оборудване за изпълнение на задачите по комплексното обслужване на доставката. Операторът може да бъде също така частичен транспортен изпълнител или пък да е само организатор на комплексното обслужване на доставката на товара (*non-vesel operator, NVO*). Операторът е единственият партньор на клиента - товародател или товарополучател. Като приема поръчката и сключва договора, той поема върху себе си всички задължения за реализирането на мултиmodalния транспорт. Със съставянето на единен документ за мултиmodalния превоз операторът поема също и пълната отговорност за изпълнението му. Тази отговорност обхваща както неговите собствени действия, така и тези на превозвачите по участъците и изпълнителите на различни видове транспортни услуги по линията на превода. Операторът сключва договори с отделните превозвачи и извършители на услуги, които носят отговорност за договорените работи изключително пред него. Той е длъжен да развие необходимата логистична система, чрез която става възможно управлението на цялата мултиmodalна транспортна система. Разходите по доставката в мултиmodalния транспорт се покриват чрез единни фрахтови тарифи включващи и възнаграждението на оператора.

От всички видове мултиmodalен транспорт ЕС отдава най-голямо значение на развитието на сухопътните системи за превоз т.е. на железопътно-автомобилните превози, както в рамките на отделните страни, така и между тях. Те (сухопътните системи) в най-голяма степен съчетават ефективността на железопътния транспорт при превода на масови товари на далечни разстояния с безспорните предимства на автомобилите при превода на близки разстояния и възможността за директно вземане и доставяне на товарите от и до клиента. развитието на комбинирания транспорт се налага приоритетно и от търсенето на нови възможности за успешното решаване на транспортните проблеми, свързани със задръстванията по магистралите и нарастването на пътно-транспортните произшествия, със замърсяването на околната среда, с големите разходи на течни горива и пр.

Във връзка с това ЕС препоръчва въвеждането на пътен данък, който да покрива щетите, предизвикани от автомобилния транспорт и който да съответства на наложената на железопътните превозвачи такса за използване на железопътната

инфраструктура. Едновременно с това се провеждат и конкретни организационни мероприятия за насърчаване на комбинирания транспорт като:

- допускане на движението на автомобили с контейнери с максимално натоварване 44 t, докато нормата обикновено е 40 t. Това се прави поради по-голямата тара при контейнерите, използвани за комбиниран превоз;

- разрешаване на вътрешни превози в дадена страна от превозвачи на други страни;

- създаване на възможности за нарастване на скоростите за движение на товарните влакове за комбиниран транспорт до 100-120 km/h;

- увеличаване на дължината на влаковете до 600-750 m и тегло до 1200-1500 t.

Развитието на комбинирания транспорт в Европа се подкрепя от Конференцията на европейските министри на транспорта. Определените от тях трансевропейски транспортни коридори, част от които пресичат територията на Р България са една от най-важните предпоставки за развитието на комбинираните превози между европейските страни. Те се насърчават и от създадения Международен съюз на фирмите за комбинирани превози, в който членуват голям брой фирми за спедиторски и транспортни услуги.

В страните на ЕС приоритет се дава на развитието на мултиmodalния транспорт с контейнери, ремаркета, полуремаркета, сменяемите каросерии, т.е. на неприсъединяваните пратки. Тези превози заемат понастоящем около 75-80 % от комбинирания транспорт. Бързо развитие получават и превозите по технологията Ро-Ла, - превоз по определени маршрути на голямотонажни автомобили (влекачи с ремаркета и автомобили с ремаркета) върху железопътни платформи. При съпоставянето на варианти за доставка на товари на разстояния по-големи от 250-300 км и прилагане на автомобилен транспорт до 20% от превозното разстояние, най-ефективни от гледна точка на разходите са именно ро-ла превозите по железница.

Транспортната политика на България съответства на очертаните насоки и виждания на Европейския съюз и цели чрез интегриране на транспортния процес да осъществи оптимално използване на инфраструктурата, което заедно с усъвършенстване на услугите, модерен мениджмънт, гъвкав логистичен подход и нови технологии да осигури по-висока конкурентоспособност на транспортната ни мрежа в региона.

Националната нормативна база, в която е въведена директива 92/106 на ЕС регламентираща интерmodalните превози е разработена в съответствие с изискванията му и определя основните изисквания към този вид транспорт. Главна цел на транспортния сектор на България е бъдещето развитие на интерmodalната транспортна система и по-високо качество на товарните транспортни услуги в съответствие с политиката на ЕС за интерmodalна транспортна система, като усилията в този сегмент са съсредоточени към изграждане на мрежа и логистични терминали за комбиниран транспорт, покриващи Общоевропейските транспортни коридори.

Железопътните линии в Р България, включени в Европейското споразумение за международни комбинирани превози и свързаните с тях обекти (AGTC) са:

- Русе – Горна Оряховица – Дъбово – Димитровград (310 km)

- София – Мездра – Горна Оряховица – Каспичан – Варна (543 km)

- Драгоман – София – Пловдив – Димитровград – Свиленград (382 km)

- Пловдив – Зимница – Карнобат – Бургас (294 km)

- Видин – София (279 km)

- София – Кулата (210 km)

Към AGTC са включени и 9 гари за извършване на международни комбинирани превози – София, Филипово, Стара Загора, Русе, Димитровград-север, Варна, Бургас, Каспичан и Горна Оряховица.

За България съществуват потенциални възможности за развитие на мулти-модални превози, които могат да се систематизират на основание на следните изводи:

- основните маршрути за вътрешни и международни контейнерни превози съвпадат с направленията на българските участъци включени в AGTC и Общоевропейските транспортни коридори – IV, VII, VIII, IX и X;

- съществува регулярен и устойчив трафик на ТИР автомобили от и към България и страните от Близкия изток към Европа, който позволява организирането на международни комбинирани превози на унифицирани транспортни единици, при високо качество на услугата, регламентиран срок на доставка, гарантиране потребителската стойност на стоките и стимулиращи цени;

Транспортното министерство разработи Стратегия за развитие на транспортната инфраструктура до 2015 г., като част от общата Стратегия на правителството за интегрирано развитие на инфраструктурата на Република България. Въз основа на предварително определени критерии за оценка са избрани приоритетни проекти с национално значение:

1. Проектът за изграждане на Интермодален терминал в гр.София, в района на гара „Подуяне” - разпределителна. Той е един от малкото инфраструктурни проекти с готово прединвестиционно проучване. Планира се да бъдат усвоени значителни средства от Структурните фондове на ЕС – около 16,5 млн. евро. Изборът първият интермодален терминал да бъде изграден в София е направен, защото той ще бъде връзка с три европейските транспортни коридора и четири пристанища. Чрез терминала се свързват коридори № 4, №8 и № 10. Терминалът ще бъде и връзка с пристанищата в Лом, Варна, Бургас и Солун.

2. Интермодален терминал и логистичен център в района на гр. Пловдив и гр. Димитровград. Договорено бе и стартира изготвянето на проектно проучване за изграждането на интермодален терминал и логистичен център в района на градовете Пловдив и Димитровград.

3. Терминали за обработка на контейнери в пристанищата Бургас и Варна. С изграждането им приключи един важен етап от развитието им. Проектът е основна част от стратегията за развитие на интермодалния транспорт в страната. Без този проект се обезсмисля изграждането на интермодален терминал в София. В предпроектна фаза на проучване е и интермодалният терминал в Русе, който е част от интермодалната връзка с контейнерния и интермодален терминал в пристанище Варна. С тези проекти България изпълнява Европейската директива за екологичен транспорт, прехвърляйки контейнерните товари от автотранспорт на железопътен транспорт и кораб. Проектът ще има положително въздействие и върху железопътния транспорт в страната.

4. В предпроектна фаза на проучване е и интермодалният терминал в Русе, който е част от интермодалната връзка с контейнерния терминал в Пристанище Варна. За развитието на интермодалните превози интерес представлява и изграждането на логистична транспортна връзка р. Дунав (Пристанище Русе) – жп транспорт - Черно море (Пристанище Варна). Основните преимущества на такава транспортна

връзка са съкращаване на времето за транспорт и на разходите за канални и др. такси в долното течение на р. Дунав. Проблем за реализацията обаче е незадоволителното състояние на железопътната линия между Варна и Русе, както и недостатъчния трафик на контейнери в тази част на Европа. С подобряване на навигацията по водната магистрала „Рейн - Майн - Дунав" и другите политически и икономически промени в региона и черноморския басейн се очаква развитие на трафика и интермодалните превози.

ИЗВОДИ:

1. Комбинираните превози осигуряват значително намаляване на стойността на превода поради обединяването на множество дейности в един оператор. Основното им предимство по отношение на клиентите са възможностите за по-добро съхраняване и опазване на стоката по време на превозния процес поради нейната компактност (палет, контейнер, подвижна каросерия и пр.) без необходимост от претоварване и други манипулации. Всичко това води до намаляване на времето за доставка на товарите до получателите и оптимизира процеса като цяло.

2. Отделянето на въглеродни емисии в атмосферата е в пъти по-малко при комбинираните превози. Екологичният ефект за опазване на околната среда е значителен.

CONCLUSIONS

1. The combined transports provide a significant reduction in the cost of transportation due to the integration of multiple activities in one operator. Their fundamental advantage in terms of customers are the opportunities for better preservation and protection of goods during the transport process due to its compactness (pallet, container, mobile bodywork, etc.) without the need for transshipment and other manipulations. All this leads to a decrease in the delivery time of goods to the recipient and optimize the process as a whole.

2. The carbon emissions in the atmosphere is at times less in combined transportation. The ecological effect to protect the the environment is significant.

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РЕГИОНАЛНА ТЪРГОВСКА ИНТЕГРАЦИЯ В КОНТЕКСТА НА ЛОГИСТИКАТА

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Abstract. *With the accession of Bulgaria to the EU Bulgarian producers are protected from competition as much as they are protected and European producers. This greatly expands the possibilities for increased trade in goods and services, both domestically and internationally.*

Key words: *integration, cargo flows, container terminal.*

Основната характеристика на развитието на търговията със стоки и услуги в региона е постоянно нарастване на стойността на общия износ на стоки и услуги и непосредствена взаимозависимост между вноса и износа на БВП. Степента на интегриране на България в глобалната икономика се е увеличила значително през последните 15 години. Тя е висока, както от гледна точка на търговията със стоки и услуги така и поради изразходването на значително повече средства за внос на стоки и услуги в сравнение с получаваните приходи от износ. „Стъпките към изграждането на добро дългосрочно партньорство с конкурентна организация са следните:

- Планиране на общото сътрудничество. Дългосрочното сътрудничество се планира от самото начало. Страните трябва да са наясно с възможния капацитет и ресурсите, които могат да бъдат споделени между страните. Изграждат се общи модели за обслужване на клиентите чрез съвместни решения;
- Информационна интегрираност. При тази стъпка е необходимо да се изградят общи стандарти за обмен на информация и да се внедри специализиран софтуер за трансфер на данните. Интегрираните информационни системи са сред факторите с най-голям приоритет при изграждане на кооперирането;
- Партньорство. При обща информационна среда е необходимо да се регламентира споделянето на кръстосана фирмена информация. Дългосрочното партньорство е невъзможно без изграждането на взаимно доверие;
- *Разходи и качество на обслужването.* Изграждането на взаимоотношения води до намаляване на разходната част. Уточнява се сътрудничеството при извършване на доставките, както и мерките за избягването на провалени курсове;
- *Диференциация.* Идентифициране възможностите на всеки от партньорите да изпълнява специализирани услуги. Ключовата дума тук е „гъвкавост“;
- *Определяне на разходите.* Инвестициите и оперативните разходи следва да бъдат съобразени предварително. Така ще се спести евентуалното финансово напрежение, което да подкопае взаимното доверие.“ [1]

От съществено значение за България е, че Гърция е в структурата на ЕС. Последното се свързва с отпадането на всякакви ограничения за товаропотоците и в двете посоки. Пристанището в Солун засега разполага с най-големия контейнерен терминал на Балканите. „Само за първото тримесечие на 2013 г. са обработени общо 15 213 TEU, което е ръст от 30,8%, сравнено със същия период на 2012 г. Статистиката сочи, че през последните три години обработените товари между България и Гърция са

нараснали 3 пъти. И все пак общата количество не отговаря на потенциалните възможности на търговските взаимоотношения между двете страни. Разполагаме и със специално бюро за обслужване на български фирми. С оглед на строежа на АМ Струма и жп линията към Гърция ще увеличим значително товарите, които към този момент не са на желаното ниво. Налице е устойчиво увеличаване на транспорта от Азия към Европа. При транспорта на контейнери от азиатските пазари би било много по-бързо и лесно той да се трансформира към България през Солун. Това означава по-ниска цена и по-бърза услуга за предприемача.“ [2]

Данните показват, че около 40% от контейнеризираните продукти в районите на София, Пловдив и Благоевград се отправят за експорт към терминала в Солун. 60% от предназначените за Европа контейнери преминават през София. Интензивен е и транспортният трафик през граничния пункт Кулата. Гърците отдават необходимото значение на този трафик и инвестират усилено в сухопътната си транспортна и логистична инфраструктура. Железопътното трасе, свързващо Солун със София е от съществено значение за съкращаване на времето за преодоляване на пространството между двата града и опериращия засега два пъти седмично блоксовалков влак. Контейнерният терминал на пристанището в Солун обработва около 300 000 TEU годишно. Около 30% от тях се оправят към региона на София, откъдето се разпределят за крайните си получатели към Сърбия, Албания, Македония, Румъния и Унгария. За в бъдеще може да се очаква насочване на повече контейнери към нашите черноморски пристанища Варна и Бургас и към пристанището в Лом. Пристанището в Лом с е потенциални възможности за развитие като разпределителен център за контейнери и насипни товари. Новите индустрии нямат друга алтернатива освен да се снабдяват с материали по р. Дунав и да извозват готовата продукция или жп транспорт по Коридор IV. На базата на критериите за избор на приоритетни проекти за развитие на транспортната инфраструктура на ЕС и предложенията получени от страните членки присъединяващите се страни и Европейската комисия, е идентифициран списък от проекти с най-голямо значение за развитието на Трансевропейската транспортна мрежа. През територията на България преминава Югоизточната главна ос свързваща Европейския съюз през Балканите и Турция с Кавказ и Каспийско море, както и с Египет и Червено море. Предвидени са връзки с Албания и Македония, Иран, Ирак и Персийския залив. Основните мултимодални връзки преминаващи през наша територия са:

- Общоевропейски транспортен Коридор X - клон С, свързващ Белград-Ниш-София и от там по трасето на Общоевропейски транспортен Коридор IV-Истанбул-ТРАСЕКА;

- Общоевропейски транспортен Коридор VIII, започващ от италианските пристанища Бари и Бриндизи и преминаващ през Дурес/Влора-Тирана-Сконию-София-Бургас/Варна;

- Река Дунав-река Сава.

Като основни морски магистрали са включени магистралите в Черно море и връзката му със Средиземно море. Те включват връзките на пристанища Варна и Бургас с пристанищата в Украйна, Русия, Грузия и Турция. Приоритетността до 2020 г. на основните оси, коридори и връзки преминаващи през българска територия е следната: [3]

Приоритет 1. Най-важни оси за развитието на Трансевропейската транспортна мрежа:

- Видин-София-Кулата от Общоевропейски транспортен Коридор IV;
- Общоевропейски транспортен Коридор VII - река Дунав.

Приоритет 2. Най-важни оси за свързването на Трансевропейската транспортна мрежа със съседните държави и региони:

- Общоевропейски транспортен Коридор X - клон С, свързващ Белград-Ниш-София и от там по трасето на Общоевропейски транспортен Коридор IV: Пловдив-Свиленград-Истанбул-ТРАСЕКА;

- Общоевропейски транспортен Коридор VIII: Дурес-Тирана-Скопие-София-Пловдив-Бургас/Варна;

- Морски магистрали: връзките на пристанища Варна и Бургас с пристанищата в Украйна, Русия, Грузия и Турция; Връзката Черно море-Средиземно море.

Приоритет 3. Общоевропейски коридори, които не са покрити от главните оси:

- Общоевропейски транспортен Коридор IX: Букурещ-Русе-Димитровград-Александруполис.

Приоритет 4. Допълнителни връзки от ТІNA-мрежата:

- железопътната връзка Мездра-Плевен-Горна Оряховица;
- железопътната връзка Русе-Каспичан-Синдел;
- пътната връзка Ботевград-Плевен-Бяла;
- пътната връзка Свиленград-Бургас.

Заклучение

Изготвянето на задълбочена и подробна прогноза за трафика и търсенето в тази връзка на транспортни и логистични услуги като цяло и по видове транспорт и направления, която да определи количествените измерения на всички външни и вътрешни фактори при различни сценарии е от съществено значение за определянето на необходимостта от развитие на мрежа в страната. Приемането на България в ЕС, последвалото отваряне към европейските пазари и правото на свободно движение на стоки и услуги дава основание да се прогнозира, че както транспортния така и логистичния сектор ще се развиват с нарастващи темпове близки до тези в страните от ЕС.

CONCLUSION

The preparation of thorough and detailed traffic forecast and the demand in this regard of transportation and logistics services in general and types of transport directions to determine the quantitative dimensions of all external and internal factors for different scenarios is essential for determining the need for development network in the country. Bulgaria's accession to the EU, following opening of European markets and the freedom of movement of goods and services gives reason to predict that both the transport and logistics sector will evolve with increasing rates similar to those in the EU.

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КЛАСИФИКАЦИЯ НА АВИАЦИОННОТО ПРИБОРНО ОБОРУДВАНЕ

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Анотация: Авиационните прибори, датчици, индикатори и сигнализатори се явяват важна съставна част от бордното авиационно оборудване, включително и от бордовите устройства за регистрация на полетна информация на въздухоплавателните средства. В материала е направена класификация на авиационното приборно оборудване, датчици, индикатори и сигнализатори, като е изяснена значимостта им за обективния контрол.

Ключови думи: безопасност на полетите, авиационно приборно оборудване, датчици, индикатори, сигнализатори, класификация.

AIRCRAFT INSTRUMENTATION CLASSIFICATION

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Abstract: Aircraft instrumentation, sensors, indicators and display mechanisms are important components of the airborne avionics, including the on-board units for registration of flight data of aircrafts. The article provides classification of the aircraft instruments, sensors, indicators and signaling devices, presenting their significance for the objective control.

Keywords: flight safety, aircraft instrumentation, sensors, indicators, display mechanisms, classification.

ВЪВЕДЕНИЕ

Боеготовността на въздухоплавателните средства (ВС), безопасността на полетите и повишаването на надеждостта на работа на авиационната техника в полет в значителна степен зависят от това, колко широко са внедрени и ефективно се използват в експлоатацията методите и средствата на обективния контрол, методите за техническа диагностика за определяне на режимите на полета, оценка на работоспособността на авиационната техника и следене за спазване на експлоатационните ограничения.

Грамотното използване на информацията от бордовите устройства за регистрация, автоматизираните средства за контрол и наземните средства за обработка на полетна информация и провеждането на всички видове обективен контрол и подготовка за полети позволява:

- Повишаване на безопасността на полетите с цел предотвратяване на излитане на авиационна техника с неизправности, а също така излитането на екипажи, недостатъчно подготвени за полети или допуснали нарушения на условията за безопасност и правилата за експлоатация на авиационната техника в предишни полети;

- Извършване на анализ на работата на авиационната техника с осигуряване на по-задълбочен контрол на нейното техническо състояние в междурегламентния период на експлоатация след изпълнение на регламентни прегледи, а така също оценка на работоспособността на авиационната техника след облитане;

- Получаване на данни, необходими за определяне на степента на усвояване на бойните и маневрените възможности на ВС и нивото на подготовка на летателния състав;

- Повишаване на качеството на подготовка на летателния състав и отговорността за точното изпълнение на зададените условия на полета;

- Установяване на истинската причина за авиационни произшествия.

Непрекъснатият процес за усъвършенстване на авиационното оборудване на ВС, продиктувана от съвременните изисквания за безопасност на полетите, значително усложняват задачата, решавана от съвременните авиационни прибори (АП). Приборното оборудване се явява важна съставна част от бордното авиационно оборудване, включително и от бордовите устройства за регистрация на полетна информация, на ВС, което изпълнява задачата по получаване на информация за параметрите, характеризиращи пространственото положение и движение на ВС в полет, работата на авиационните двигатели, системите за поддържане на живота на екипажа, предупреждение за опасни режими на полета, сигнализация за откази и други системи. Тази информация се използва за ръчно или автоматично управление на полетите, за контрол на режимите на работа на силовите установки, за изпълняване на задачите полета и осигуряване на неговата безопасност.

Целта на изследването е проучване на структурите от данни за обективен контрол и възможността за предаване на полетна информация в реално време по радиоканал.

ПРЕДНАЗНАЧЕНИЕ И КЛАСИФИКАЦИЯ НА АВИАЦИОННИТЕ ПРИБОРИ, ДАТЧИЦИ, ИНДИКАТОРИ И СИГНАЛИЗАТОРИ

Авиационните прибори служат за контрол на параметрите на полета, работата на силовите установки, различни бордни системи и агрегати, а също състоянието на обкръжаващата атмосфера. В съответствие с това предназначение могат да се разграничат следните групи авиационни прибори:

- Пилотажно-навигационни прибори;

- Прибори за контрол работата на силовата установка;

- Прибори за контрол на работата на отделните бордни системи и агрегати;

- Прибори за контрол на параметрите на обкръжаващата атмосфера.

Пилотажно-навигационните прибори измерват параметрите, свързани с движението на центъра на масата на летателния апарат (координати на местоположението, височина, скорост, линейни ускорения), ъглите на пространствената ориентация на летателния апарат относно земята (ъгли на курса, крена и тангажа) и относно насрещния въздушен поток (ъгъл на атака и плъзгане). Към пилотажно-навигационните прибори се отнасят аерометричните прибори (висотомери, указатели на скоростта и числото на Мах (М), вариометри),

измерватели на ъглите атака и плъзгане, пилотажно-жироскопични прибори (авиохоризонти, жировертикали и жирополукомпаси), курсови и различни навигационни прибори.

Приборите за контрол работата на силовата установка измерват честотата на въртене на роторите на авиационните двигатели, температура на газовете и маслата, налягане на горивото, маслото и газовете, запаса и разхода на горивото, вибрациите и други параметри. Към тази група се отнасят тахометрите горивомери, расходомери, измерватели на вибрациите и други прибори.

Параметрите, характеризиращи работата на различни бордни системи и агрегати, се явяват: температура, налягане и разход на течности и газове, положение на различни органи за управление на летателния апарат и др. Тези параметри се измерват с манометри, термометри, указатели на разхода на въздух, височина и спадане на налягане в херметични кабинни, положение на задкрилки, стабилизатори и други прибори.

Към параметрите на обкръжаващата атмосфера се отнасят температурата, налягането, влажността и скоростта на вятъра. Тези параметри се измерват с помощта на барометри, термометри, хигрометри, плътност метри и измерватели на скоростта на вятъра.

1. Според методите за измерване на подлежащите за контрол параметри датчиците се подразделят на:

1.1 Параметрични – при тях се получава изменение на параметрите (съпротивление, индуктивност и капацитет) на електрическата верига под действие на сигнала от измервания обект;

- 1.1.1. Резистивни датчици
- 1.1.2. Капацитивни датчици
- 1.1.3. Индуктивни датчици

1.2. Генераторни – при използване на сигналите от различен вид от измервания обект се преобразуват непосредствено в електрически сигнали.

- 1.2.1. Магнитострикционни датчици
- 1.2.2. Фотоелектрически датчици
- 1.2.3. Йонизационни датчици
- 1.2.4. Електрохимически датчици
- 1.2.5. Електромагнитни датчици
- 1.2.6. Термоелектрически датчици
- 1.2.7. Пиезоелектрически датчици

2. Механически и електромеханически авиационни прибори

2.1. Манометри

2.1.1. По предназначение:

- 2.1.1.1. Манометри, измерващи абсолютно налягане;
- 2.1.1.2. Манометри, измерващи разлика между две налягания (диференциални);
- 2.1.1.3. Манометри, измерващи отношение между две налягания.

2.1.2. По метода на измерване на налягането:

2.1.2.1. Механически

- Течностни;
- Теглови;
- Пржинни.

2.1.2.2. Електромеханически;

- Манометри от тип ЕНМУ – унифициран електромеханичен манометър, предназначен за измерване на налягане на горива и масла;
- Манометър от тип ДИМ диференциално индуктивен манометър – за налягане до 30 МРа;

2.1.2.3. Електрически

- Електронни;
- Газоразрядни;
- Топлинни;
- Пиезорезисторни;
- Манометрични съпротивления;
- Йонизационни манометри;
- Манометри с електрически честотен преобразувател.

2.1.3. Манометри за излишно налягане.

2.1.4. Вакуумери.

2.1.5. Манометри за абсолютно налягане.

2.1.6. Деформационни манометри.

2.1.7. Според способа за компенсация на грешката.

2.1.7.1. Деформационни манометри с биметалически компенсатори от първи род;

2.1.7.2. Деформационни манометри с биметалически компенсатори от втори род.

2.1.8. Честотни преобразуватели на налягане

2.2. Авиационни термометри

2.2.1. Според способите за измерване на температурата:

2.2.1.1. Електрически термометри чрез съпротивления;

2.2.1.2. Термоелектрически термометри;

2.2.1.3. Биметалически термометри;

2.2.2. Според способите за намаляване грешките термоелектрическите термометрите биват:

2.2.2.1. Термоелектрически термометри с биметални коректори;

2.2.2.2. Термоелектрически термометри с електрически компенсатори;

2.2.2.3. Термоелектрически термометри със схеми, включващи термочувствителни резистори.

2.3 Авиационни измерватели на честотата на въртене и вибрациите

2.3.1. Според принципа на действие:

2.3.1.1. Центробежни;

2.3.1.2. Стробоскопически;

2.3.1.2. Резонансни;

2.3.1.3. Магнитоиндукционни;

2.3.1.4. Постояннотокови;

2.3.1.5. Честотно-импулсни;

2.3.1.6. Поплавкови;

2.3.1.7. Фрикционни;

2.3.1.8. Течностни.

2.3.2. Според метода на измерване:

2.3.2.1. Абсолютни;

2.3.2.2. Косвени

2.3.3. Тахогенератори за постоянен ток;

2.3.4. Тахогенератори за променлив ток.

2.4. Авиационни измерватели на вибрациите

2.4.1. Според измервания параметър:

2.4.1.1. За предвижването – вибромер на предвижването;

2.4.1.2. За скоростта – вибромер на скоростта;

2.4.1.2. За ускорението – вибромер на ускорението;

2.5. Измерватели на височинните параметри

2.5.1. Според метода на измерване на височината:

2.5.1.1. Барометрически висотомери;

2.5.1.2. Радиотехнически висотомери;

2.5.1.3. Акустични висотомери;

2.5.1.4. Оптически висотомери;

2.5.1.5. Инерциални висотомери;

2.5.1.6. Йонизационни висотомери.

2.5.2. Приемници на въздушно налягане

2.5.3. Механически барометрични висотомери

2.5.4. Електромеханически висотомери

2.5.4.1. Според преобразувателя на налягането:

- Електромеханически висотомери с преобразувател на налягане от потенциометричен тип;

- Електромеханически висотомери с преобразувател на налягане от индукционен тип;

2.5.5. Електромеханически барометрични датчици на височина;

2.5.6. Радиовисотомер

2.5.6.1. Радиовисотомер с непрекъснато действие;

2.5.6.2. Радиовисотомер с импулсно действие.

2.6. Измерватели на скоростните параметри

2.6.1. Според методите за измерване на скоростта на полета, измервателите са:

2.6.1.1. Аеродинамически измерватели на скоростни параметри;

2.6.1.2. Доплерови измерватели на скоростни параметри;

2.6.1.3. Инерциални измерватели на скоростни параметри.

2.6.2. Според скоростта, която измерват (истинска въздушна скорост, индикаторна (приборна) скорост, вертикална скорост и пътната скорост)

2.6.2.1. Измерватели на индикаторната скорост

2.6.2.2. Измерватели на истинската въздушна скорост и числото на Мах (М)

2.6.2.3. Измерватели на вертикалната скорост

2.6.2.3.1. Според методите за измерване:

- Чрез интегриране на вертикалното ускорение;

- Чрез измерване на вертикалната съставляваща на скоростта;

- Чрез деферинциране на сигнала от датчика на височината;

- Чрез пневмомеханическо диференциране на статическото налягане - вариометри.

2.7. Измерватели на ъглите на атака

2.8. Измерватели на ъглите на плъзгане

2.9. Измерватели на курса

2.9.1. Според метода за измерване на курса:

- 2.9.1.1. Измерватели използващи магнитния метод – магнитни компаси;
- 2.9.1.2. Измерватели, използващи индукционния метод – индукционен датчик;
- 2.9.1.3. Измерватели, използващи жироскопическия метод;
- 2.9.1.4. Измерватели, използващи жиромагнитния метод;
- 2.9.1.5. Измерватели, използващи жиरोиндукционния метод;
- 2.9.1.6. Измерватели, използващи астрономическия метод;
- 2.9.1.7. Измерватели, използващи радиотехническия метод;

2.10. Горивомери

2.10.1. Според принципа на действие:

2.10.1.1. Поплавкови:

- механически;

- електрически.

2.10.1.2. Манометрични;

2.10.1.3. Капацитивни;

2.10.2. Според метода на измерване на количеството гориво:

2.10.2.1. Тегловно-хидростатически – тензодатчици;

2.10.2.2. Поплавкови;

- Поплавкови електромеханически горивомери;

- Поплавкови електромеханически горивомери с тръстика

2.10.2.3. Акустични;

2.10.2.4. Капацитивни - Електрокапацитивни горивомери;

2.10.2.5. Индуктивни;

2.10.2.6. Резисторни;

2.10.2.7. Радиовълнови;

2.10.2.8. Радиоизотопни.

2.11. Датчици за измерване на разхода на гориво

2.11.1. Според методите за измерване на разхода на гориво

2.11.1.1. Обемни;

2.11.1.2. Хидродинамични;

2.11.1.3. Центробежни;

2.11.1.4. Турбинни;

2.11.1.5. Топлинни;

2.11.1.6. Ултразвукови;

2.11.1.7. Електромагнитни (индукционни)

2.11.2. Турбинни преобразуватели на разхода на гориво

2.11.3. Скоростни разходомери за моментния разход

2.12. Жироскопически прибори

2.12.1 Според степените:

2.12.1.1. Двустепенни жироскопи;

2.12.1.2. Тристепенни жироскопи.

2.12.2. Според схемата на корекция:

2.12.2.1. Схема за корекция на тристепенен жироскоп в плоскостта на магнитния меридиан;

2.12.2.2. Кинетична схема за корекция по посока на вертикалата за място

2.12.2.3. Кинетична схема за хоризонтална корекция по главната ос на тристепенен жироскоп

2.12.3. Коригиращи устройства

- 2.12.4. Демфиращи устройства
- 2.12.5. Аретиращи устройства
- 2.12.6. Датчик на ъгловата скорост
- 2.12.7. Лазерни жироскопи

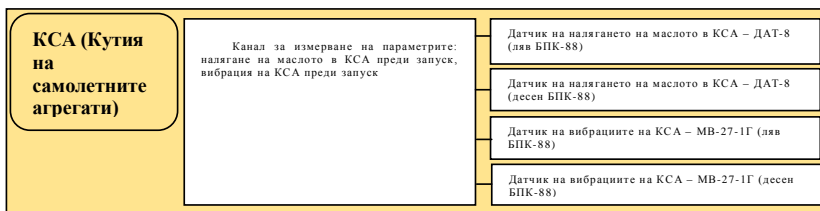
3. Индикатори и сигнализатори

3.1. Пилотажно-навигационни индикатори

3.1.1. Индикатори, показващи информация за положението на ВС в пространството;

3.1.2. Индикатори, показващи информация за направление на полета;

3.1.3. Индикатори, показващи информация за приборната скорост;



Фиг.1 Аналогови параметри на КСА (кутията на самолетните агрегати)

3.1.4. Индикатори, показващи информация за барометрическата височина на полета;

3.1.5. Индикатори, показващи информация за вертикалната скорост.

3.2. Индикатори и сигнализатори за контрол на работата на силовата установка:

3.2.1. Индикатори и сигнализатори, използвани за контрол на извеждането на авиационни двигатели на зададен режим;

3.2.2. Индикатор за запаса от гориво;

3.2.3. Индикатор за запаса от гориво в разходните баки;

3.3. Индикатори и сигнализатори за контрол на положението на елементите от ВС:

3.3.1. Индикатори за положението на устройствата за излитане и кацане, прилежащи към механизацията на крилото;

3.3.2. Индикатори за повърхностите за управление на ВС;

3.3.3. Сигнализатори за положението на колесника.

3.4. Индикатори за контрол работата на системите на ВС.

3.5. Светосигнални устройства

4. Полетна информация, която е най-важна за обективния контрол и безопасността на полета

4.1. Основна (измервателна) информация:

4.1.1. Аналогови параметри (Регистрирани с приборно оборудване, посочено на фиг.1 и фиг.2– за самолет МиГ-29):

4.1.2. Еднократни команди/сигнали (за самолет МиГ-29):

- Отказ на основна/ резервна (бустерна) хидросистема;
- Прегряване на ляв/десен двигател;
- Сброс на обороти на ляв/десен двигател;
- Помпаж на ляв/десен двигател;

- Пожар;
- Въздушни спирачки – спуснати;
- Аварии остътък на гориво;
- Шапи (колесник) – обран;

<p>Планер</p>	<p>Канал за измерване на параметрите: положение на ръчката за управление по тангаж, положение на ръчката за управление по крен, положение на педалите, ъгъл на отклонение на левия стабилизатор, ъгъл на отклонение на десния стабилизатор, ъгъл на отклонение на десния елерон, ъгъл на отклонение на десния вертикален стабилизатор, положение на РУД (ръчки за управление на двигателите) на левия/десния двигател</p>	<p>Датчик на ръчката за управление по тангаж</p>
		<p>Датчик на ръчката за управление по крен</p>
		<p>Датчик на положението на педалите</p>
		<p>Датчици на левия/десния стабилизатор</p>
		<p>Датчик на десния елерон</p>
		<p>Датчик на десния вертикален стабилизатор</p>
		<p>Датчици за положението на РУД на левия/десен двигател</p>
	<p>Канал на измерване на параметъра на приборната скорост</p>	<p>Датчик за налягане – МДД-Те-0-1,5</p>
	<p>Канал на измерване на параметъра на барометричната височина</p>	<p>Датчик за налягане – МДД-Те-0-780</p>
	<p>Канал на измерване на параметъра на относителната височина</p>	<p>Датчик от блока на параметрите БВП-11</p>
	<p>Канал на измерване на параметъра на истинската скорост</p>	<p>Датчик от блока на параметрите БВП-11</p>
	<p>Канал на измерване на параметъра на ъгъла на атака</p>	<p>Датчик за ъгъла на атака – ДАУ-72-1</p>
	<p>Канал на измерване на параметъра на страничното претоварване</p>	<p>Датчик – МП-95-1,5...+1,5</p>
	<p>Канал на измерване на параметъра на надлъжното претоварване</p>	<p>Датчик – МП-95-3,0...+3,0</p>
	<p>Канал на измерване на параметъра на вертикалното претоварване</p>	<p>Датчик – МП-95-3,5...+10,0</p>
	<p>Канал на измерване на следните параметри: приборната скорост, ъгъл на курса, ъгъл на крена и ъгъл на тангажа</p>	<p>Датчици от курсовертикалата Изд. 705-6-1</p>
	<p>Канал за измерване на параметъра „Тример, надлъжния канал“</p>	<p>Датчици на тримера за надлъжния канал</p>
<p>Канал за измерване на параметъра „Тример, напречния канал“</p>	<p>Датчици на тримера за напречния канал</p>	
<p>Канал за измерване на параметъра „Кормилна машина (надлъжен канал)“</p>	<p>Датчици от кормилната машина</p>	
<p>Канал за измерване на параметъра „Кормилна машина (напречен канал)“</p>		
<p>Канал за измерване на параметъра „Кормилна машина (канал АПУС)“</p>		
<p>Модул на постояннотоковите напрежения</p>		
<p>Модул на променливотоковите напрежения</p>		

Фиг.2 Аналогови параметри на планера

- Катапултиране;
- Изхвърляне на фанар;
- Липса на масло в КСА;
- Горен въздушен вход;
- Форсаж на ляв/десен двигател;
- Положение на носките на крилото;
- Сигнал „Рация“ - натискане на бутон за предаване по радиостанция;
- Спуснати задкрилки;
- Натискане на бутон „Бойна кнопка“;

- Наличие на подвески на точките за окачване.

4.2. Служебна информация (за идентификация):

4.2.1. Датата на полета;

4.2.2. Номер на полета.

ЗАКЛЮЧЕНИЕ

Авиационните прибори, датчици, индикатори и сигнализатори се явяват важна съставна част от бордното авиационно оборудване, включително и от бордовите устройства за регистрация на полетна информация на въздухоплавателните средства. Те играят ключова роля за обективния контрол и за осигуряване на боеготовността на въздушните средства, безопасността на полетите и повишаване на надеждността на работа на авиационната техника в полет, като служат за регистрация на основна, служебна полетна информация, както и времето на полета.

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INFORMATION AND COMMUNICATION TECHNOLOGY

AN ALGORITHM FOR ISAR IMAGE OPTIMIZATION PROCEDURE

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***Abstract:** This article offers an original ISAR image optimization procedure based on impulse noise reduction in presence of additive white Gaussian noise. Improved modeling and information analysis of the filtering system are developed by implementation of notch reduction algorithm over the binary image. Simulation experiments are carried out in MATLAB environment.*

***Keywords:** ISAR image, Image filtering procedure, Image pixels restoration*

1. Introduction

For all Inverse Synthetic Aperture Radar (ISAR) systems high performance and better image reconstruction technologies are vital. An opportunity for improved information analysis in that area is suggested to be the development of better algorithms for recognition of the various flying objects. This task can be facilitated if the model of the aircraft is more similar to the real flying object and has a detailed structure [1]. Another approach for better image can be the additive white Gaussian noise reduction closer to zero value.

There are many image denoising methods which are in existence over the last decades, originated from various disciplines such as probability theory, statistics, partial differential equations, linear and nonlinear filtering, spectral and multiresolution analysis due to the robustness of the systems. Recently, image denoising has been attracting much attention using methods which is based on wavelet domain and spatial domain and the wavelet transform based on local contrast and adaptive mean in the wavelet transform domain [2]. A fuzzy approach to performance measurement of grayscale image denoising algorithms can also be implemented [3].

The object recognition analysis approach for some image is focused on the object's contour as best informative. Some algorithms and methods are developed to achieve more distinctive contour of the object shown. An opportunity for image filtration with high grade of object's contour line retain is described in this paper.

The noise filtering procedure is offered by two stages. Adaptive filtration of the background noise is processed for image's general noise level reduction and this is held

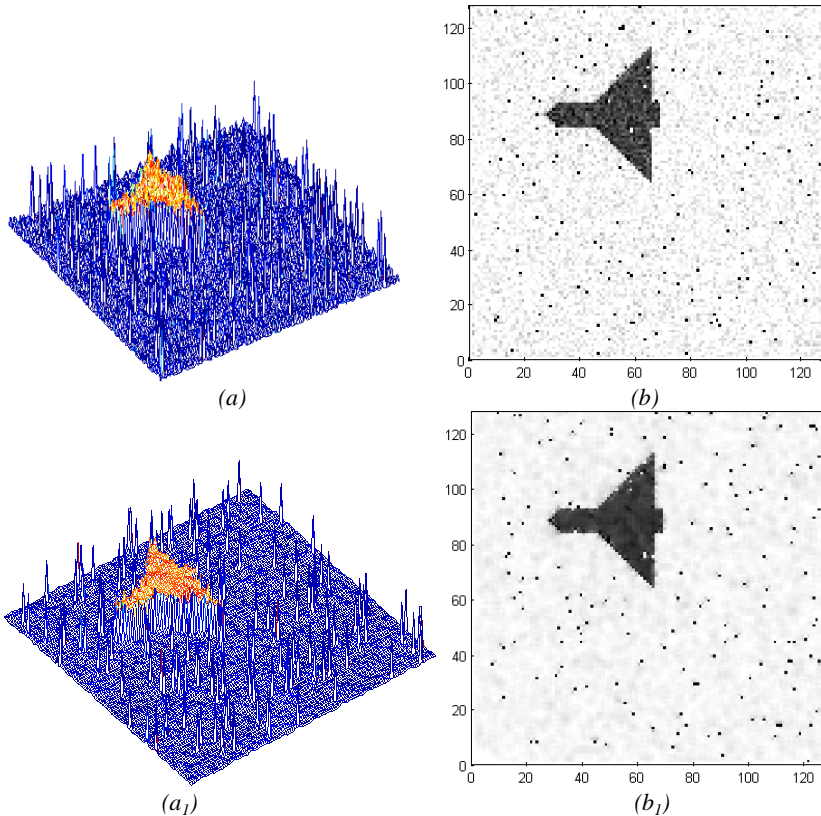
on the first stage. Impulse interferences produced by the peak noise are suppressed with a digital filter offered in this paper.

2. ISAR image processing by adaptive background noise-removal filter.

The ISAR trajectory signal is received from 2D aircraft model. The distance to the object is 50 000 m, its velocity is 600 m/s, altitude is 5000 m. Linear frequency modulation signals are used for image retrieving. The procedure is composed by range compression and azimuth compression using Fast Fourier Transform [1].

A model of reconstructed ISAR image of the flying object in 128x128 pixel grid is used for the experiment in presence of Gaussian white noise with constant zero mean and variance 0.01 and “salt and pepper” noise with density 0.02. The additive “white” noise and impulse interferences produced by the peak noise are presented on figure 1 as isometric projection (a) and pseudo-color map (b) of the 2D flying object. The experiments are developed in MATLAB environment.

The results after the first stage of the filtration process are on figure 1 (a) and (b).



Фиг.1. Reconstructed ISAR image of flying object – before and after adaptive filter processing: isometric projection (a) and (a₁) and pseudo-color map (b) and (b₁).

For the adaptive filtering a filter with linear argument is used to adjust its value according to the local variances of the each pixel's brightness. The adaptive filtering is effective in additive noise smoothing of an observed noisy process, assuming known stationary signal and noise spectra of random noise distribution. The first stage of the filtering is held my means of the Wiener adaptive filter. The local mean and variance around each pixel are estimated in this filtration process:

$$\mu = \frac{1}{NM} \sum_{i,j \in \eta} a(i, j), \quad (1)$$

$$\sigma^2 = \frac{1}{NM} \sum_{i,j \in \eta} a^2(i, j) - \mu^2, \quad (2)$$

where η is the N -by- M local neighborhood of each pixel (i, j) in the image with brightness $a(i, j)$. The new brightness value for each pixel is produced by:

$$A(i, j) = \mu + \frac{\sigma^2 - \nu^2}{\sigma^2} (a(i, j) - \mu), \quad (3)$$

where ν^2 is the noise variance. If the noise variance is not given, all the local estimated variances are used in the procedure.

3. Clustering-based image thresholding for graylevel image reduction to a binary image.

This transformation algorithm is used for the general background noise reduction of the image interferences and object outline preservation. The image is transformed into matrix of binary data.

Otsu's method is used for automatically calculation the optimum threshold separating the classes of pixels following the histogram of the image (foreground pixels and background pixels) [4]. The two dimensional N pixel image with L graylevel values is processed to calculate the probability of the threshold classification for given pixel's graylevel:

$$p_i = \frac{f_i}{N}, \quad (4)$$

where $i = \overline{1, L}$ is the number of threshold; f_i is the number of pixels with values corresponding to threshold i . For one threshold (t) segmentation need the pixels are assorted in two classes.

- C1 with graylevel falling in thresholds numbered $[1, \dots, t]$
- C2 with graylevel falling in thresholds numbered $[t + 1, \dots, L]$.

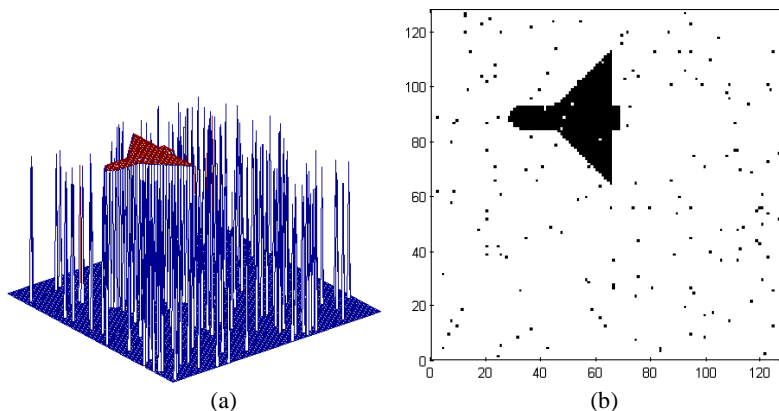
The between-class variance is calculated by:

$$\sigma_B^2 = \omega_1 (\mu_1 - \mu_T)^2 + \omega_2 (\mu_2 - \mu_T)^2. \quad (5)$$

For binary segmentation the optimum threshold t^* is defined by maximizing inter-class variance σ_B^2 :

$$t^* = \text{Arg} \left\{ \text{Max} \left[\sigma_B^2(t) \right] \right\}, \text{ where } t = \overline{1, L}. \quad (6)$$

The results of the receptor field graylevel transformation in binary values are presented in figure 2.



Фиг.2. Isometric projection (a) and pseudo-color map (b) of the image after the clustering-based image thresholding and binary image creation.

4. Rejection filtering procedure for impulse interferences of ISAR image.

Additional filtration procedure is needed in the next stage for removing the residual impulse interferences of the image. The rejection filter offered is designed for binary image processing, monolithic silhouette presence is implied. The processing is held for removing random impulse interferences without silhouette damage but correct some of its malformations. The difference to the known rejection filtration is the changeable aperture.

The filtering procedure experiment is executed in several consecutive cycles. Zero value is used for the border pixels from the first and the last row and column of the matrix of the receptor field. The image is divided to rectangular parts of first order, second order etc. in dependence to the total number of pixels of the aperture that are influenced at once.

The first cycle is processed with parts of first order i.e. 1x1 pixel area of the image is affected; the aperture needed is 3x3 pixels. All pixels of the image are on the beat consecutively but the border ones. The pixels brightness $a_{i,j}$ is recalculated according:

$$A_{i,j} = \text{sign} \left[\text{floor} \left(\frac{W}{7} \right) + a_{i,j} W \right], \quad (7)$$

$$W = \text{sum} \begin{bmatrix} a_{i-1,j-1} & a_{i-1,j} & a_{i-1,j+1} \\ a_{i,j-1} & 0 & a_{i,j+1} \\ a_{i+1,j-1} & a_{i+1,j} & a_{i+1,j+1} \end{bmatrix} \quad (8)$$

Where $i = \overline{2,127}$; $j = \overline{2,127}$; $a_{i,j}$ is the current value of the pixel (i, j) brightness; W is the sum of the brightness values of the neighboring pixels; $A_{i,j}$ is the new, recalculated brightness value of the pixel (i, j) as shown on figure 3. The *floor* function round off the value to the closest integer in direction to zero.

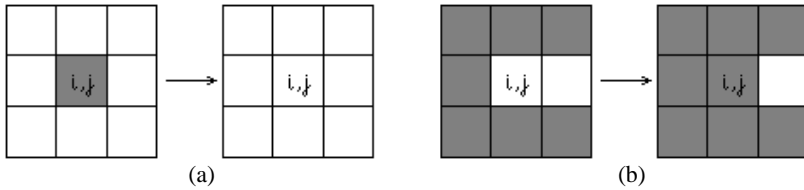


Figure 3. Processing with parts of first order

Having eight neighboring pixels with zero intensity the current pixel (i, j) is also zero filled as shown on figure 3 (a). The same pixel is filled with value of one if more than seven pixels with that value are situated in the surrounding area that time – figure 3 (b).

Procedure with rectangular image parts of second order is processed on the second cycle - every 2×2 pixel area of the image is affected. Each part of that size is represented by five variants shown on figure 4.

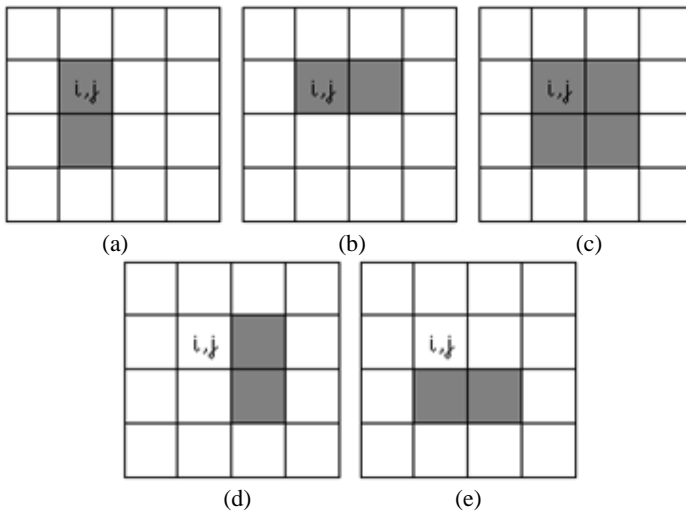


Figure 4. Each part (2×2) of the image is represented by five rectangular shapes - (a), (b), (c), (d), (e).

All the image pixels are on the beat consecutively except the border ones. Image parts of type (a) to (c) are used simultaneously for the surrounding of the pixel (i, j) . Parts of type (d) and (e) are appeared later for the pixels $(i, j+1)$ and $(i+1, j)$. Different aperture is used for each part type with pixel size of 3x4, 4x3 and 4x4 respectively. The pixel brightness in each part type is recalculated in response conditions following.

For part of type (a):

$$\begin{vmatrix} A_{i,j} \\ A_{i+1,j} \end{vmatrix} = \text{sign} \left[\text{floor} \left(\frac{W}{9} \right) + a_{i,j} W \right], \text{ where} \quad (9)$$

$$W = \text{sum} \begin{vmatrix} a_{i-1,j-1} & a_{i-1,j} & a_{i-1,j+1} \\ a_{i,j-1} & 0 & a_{i,j+1} \\ a_{i+1,j-1} & 0 & a_{i+1,j+1} \\ a_{i+2,j-1} & a_{i+2,j} & a_{i+2,j+1} \end{vmatrix} \quad (10)$$

for part of type (b):

$$\begin{vmatrix} A_{i,j} & A_{i,j+1} \end{vmatrix} = \text{sign} \left[\text{floor} \left(\frac{W}{9} \right) + a_{i,j} W \right], \text{ where} \quad (11)$$

$$W = \text{sum} \begin{vmatrix} a_{i-1,j-1} & a_{i-1,j} & a_{i-1,j+1} & a_{i-1,j+2} \\ a_{i,j-1} & 0 & 0 & a_{i,j+2} \\ a_{i+1,j-1} & a_{i+1,j} & a_{i+1,j+1} & a_{i+1,j+2} \end{vmatrix} \quad (12)$$

for part of type (c):

$$\begin{vmatrix} A_{i,j} & A_{i,j+1} \\ A_{i+1,j} & A_{i+1,j+1} \end{vmatrix} = \text{sign} \left[\text{floor} \left(\frac{W}{11} \right) + a_{i,j} W \right], \text{ where} \quad (13)$$

$$W = \text{sum} \begin{vmatrix} a_{i-1,j-1} & a_{i-1,j} & a_{i-1,j+1} & a_{i-1,j+2} \\ a_{i,j-1} & 0 & 0 & a_{i,j+2} \\ a_{i+1,j-1} & 0 & 0 & a_{i+1,j+2} \\ a_{i+2,j-1} & a_{i+2,j} & a_{i+2,j+1} & a_{i+2,j+1} \end{vmatrix} \quad (14)$$

The processes held in the rejection filtering procedure are shown on figure 5 by some typical examples for illustration of the impulse interferences removing as well as missed pixels restoration for the object's silhouette at the same time.

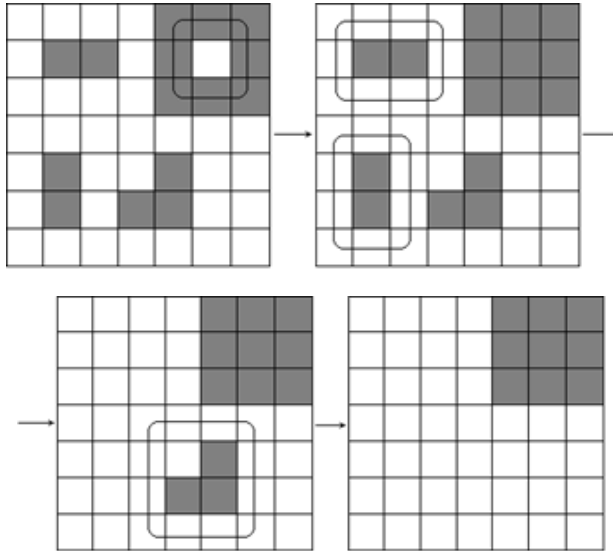
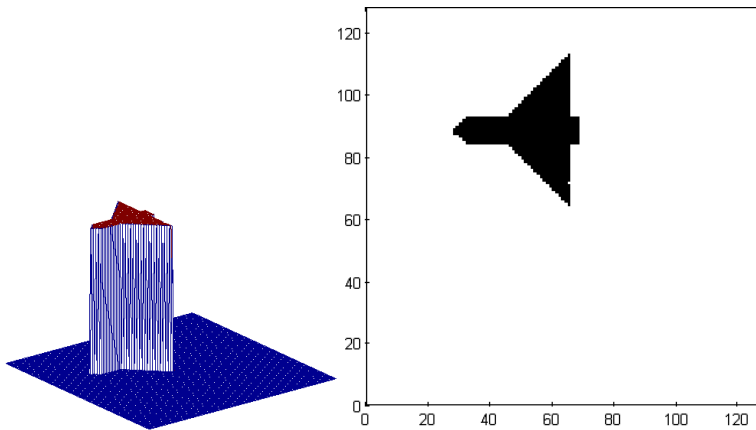


Figure 5. Isolated spots elimination and silhouette's missing pixel recovery. Aperture is changed after the first and the second cycle.

The filtration procedure is carried out for image part of type to fourth order, as the disappearing of object details is most probably if bigger and more detailed aperture usage.

The results of the rejection filtration procedure over the image form figure 2 are shown on figure 6.



Фиг.6 Isometric projection and pseudo-color map of a 2D flying object Binary image after the rejection filtration procedure.

5. Conclusion.

The image after denoising has a better visual effect. The procedure can be used in performance evaluation and comparison of contemporary denoising methods. Self-learning or genetic algorithms as well as fuzzy logic implementations can be used on the next stage if the silhouette of the object is partially damaged or result produced is insufficient for objects classification.

The results of the digital filtration and image optimization algorithm developed can be used for ISAR observation techniques and subsequent image recognition developments.

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A VISION OF THE EVOLUTION OF THE SYSTEM "MAN-COMPUTER"

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Abstract. *This paper explores the technological transformation of the system "man-computer" and its components in the coming decades of the 21st century. Inaugurate the relationship in the development of computer and human, tendencies to personification of computer to artificial intelligent person, human - improved to "post-human" and human-computer interaction to state of regulation between comparable reasonable subjects, communities and civilizations.*

Key Words: *man, computer, artificial intelligence, system, evolution.*

1. Introduction

Nowadays is considered unquestionable essential role of computing in the development of human civilizations. Many concepts characterize ultra-mobile computer present, and future of hyper connection, nanotechnology and artificial intelligence. In this context, the paper investigates some aspects of the development of the "human-computer" for the coming decades as a result of the expected evolution of the mechanical and biological components. The analysis covers three conditional phases - modern (post-PC) [5], advanced (ubiquitous computing [3]) and intermediate. The dynamics of the machine components on study: computer paradigm computing entity role and priority of computing, system connectivity, conceptuality and cognition, interfaces and interaction and personalization. The human component is used indicators: development role, tools, technological dependence.

The aim is to present arguments mutual influence between the system components, accelerating technological evolution, to reveal the nature and direction of their transformation and the conditions for sustainable perspective of human civilization.

2. Technological evolution of the mechanical and biological components

2.1 Post-computer phase

Communication and information technology in the first two decades of the 21st century is defined as "post-computer". Accelerators of this evolution are innovative knowledge and concepts in complex scientific areas, as well as breakthroughs in production technology.

Major computing paradigms are using the computer as a tool for information support, partial replacement of human, global socialization, distribution of computing services and streaming content.

Common computer is mobile and ultra-mobile used with cloud services. The first generations of handheld systems are supporting [2, 5].

Computer as a system is autonomous, with passively-executive role with elements of proactive and significant standby. Computing is the dominant activity, involving considerable mental resources. Systematic interaction is closed type, accomplish if necessary

and sensory connection with reality is minimal. Ultra mobility increases the frequency of the working sessions and minimizes its duration [5].

Implement sensor fusion technology [18] and some context sensitive applications - voice interfaces, location tracking, route, health status and lifestyle.

Cognitive bionic architecture computers and neuromorphic components [7] (SyN-APSE - IBM, Qualcomm, etc.) are developed. According to a Goldman Sachs 2014 report, humanity "is on the verge of a rapid growth in the development and use of artificial intelligence". Numbers of specialized uses of AI (Artificial Narrow Intelligence, ANI) are implemented.

GUI are dominant, but more receptive computers, combining perspective interfaces are developed. Multi modal communication is achieved by speaking 2D-digital images in various incarnations that mimic the movements of the lips and can express emotions (virtual head "Zoe").

Personalized virtual assistant services are offered. Virtual avatars are created by the image, video and answer a dozen questions (Lifenaut). In this way aspects of human appearance and behavior are imitated. Research work on improving 3D- telepresence - voice modules, advice, motivation, appearance and some empathetic reactions (table 1) is doing.

In the post-computer stage biological components of human-computer system is defined as an assisted person. Its role is leading - actively interacting with the real and virtual world, set goals, identify problems, decomposed them of tasks to the computer. Basic tools to support many professional activities are mediated reality (augmented reality/virtuality, mixed reality), biological augmented virtuality, telemedicine, and some virtual simulations of simple systems in the surrounding world.

Informational support systems [4] for cognitive improvement of human potential - in training or in real time are implemented. Aspects of cognitive and physical abilities are intensifying [11].

Technological dependence of man comes in many forms - nomofobiya, addiction, mixing real and virtual personality. Increasing social segregation, time virtual life, detachment of individuals from the established social and cognitive experience. Released pursuit of seclusion and denial of real life (table 2).

2.2 Intermediate phase

In the next evolutionary stage of human-computer system can be described as symbiotic and synergistic (humanistic intelligence HI) [17]. The purpose is the enhancement of human capabilities by mobile computer, interacting with cloud technologies. Digital transformation of the physical world is in progress, M2M-communications are dominated [2,9]. A new type of interaction with "smart" spaces arise. Specialized applications of artificial intelligence (ANI) are wide distributed.

The computer is practically invisible and permanent part of personal space (accessory, smart clothing, implantable module). It functions as a natural extension of the mind and body and can be defined as adapted (prosthetic) computer. Priority of computing and initiative for system interaction is determined flexibly and dynamically by the user - the aim is always ready for cooperation and controllability. His attention is free - can be directed to physical objects [5].

Multimodal computer sensitivity to environment and consumer behavior allows to build a model of the specific environment, profile of human needs and behavior. Susceptibility to current and aggregated context of the physical and social environment is

achieved with hardware and software sensors and contextual machine. Potential partial mediation between man and the real world - adaptation, expansion and filtering of user perceptions of reality arise [2]. The expanded connectivity and receptivity to the real world and man is a prerequisite for advanced cognitive function in several specialized areas.

Symbiotic interaction (SI) is performed seamlessly, on background, context and mobile in real time. The voice interface is dominant. (DARPA - the "Universal translator").

The computer gains more personality by set of modules empathy and programmed conscience. Empathic module contributes to the emotional contact with the computer through empathy placebo (expression and intonation of the voice, the avatar emotional response). The aim is computers become emotionally intelligent and socially qualifying machines, adaptive and adequately responsive to the people. Ethical regulator (R. C. Arkin) observes rules and laws, including the ability to choose between evil and "less evil", acceptable and unacceptable behavior. Ethical adapter minimizes damage from certain actions. It is subject to self-adapting to the user. Violation of technological "morality" causes a change in the "behavior" of the computer (analogue of bad conscience in humans) [1, 6, 10, 20] – table 1.

In the intermediate technological phase biological component is functionally enhanced person, in many cases - a cyborg. For this purpose are used symbiotic computer implants, bio cybernetic technologies for functional prosthetics sectors in the brain (Racine), replacement of organs or tissues, nanorobots. Back in 2009, Stephen Hawking foresees this phase of human development, compensates the biological limits with technological methods with the words: "Humans have entered a new phase of self-designed evolution."

The man owns, operates and constant controls accompanying personalized information space by selectively amplifies/attenuates /edits your situational awareness. An essential tool for this is indirectly by computer perception of the environment. Massively develop thoughtful virtual simulations of the conscious world (second land) for prognostic research in several specialized areas - strategies testing in crises and conflicts.

User's life is functionally intertwined and adapted to the computer at a much higher rate (as used to the shoes and clothes). Separation or absence of portable computer makes psychological discomfort, reduced work capacity, and limited functionality of human (table 2).

Table 1
Computer systems component

Phase	Post-computer	Intermediate	Ubiquitous computing
Paradigm	Post-PC, support and partial replacement of human, artificial narrow intelligence (ANI)	IoT, M2M, symbiotic, synergistic human-computer system intelligence	Ubiquitous computing fabric hyper connectivity, AI, AGI, ASI, smart spaces.
Computing resources	Notebook, ultraportable, handheld accessories, cloud computing, ANI	Adapted (prosthetic) carry computer, cloud computing, ANI	artificial general intelligence AGI, artificial superintelligence - ASI.
Role	Passive-executive role with elements of proactivity	Partial autonomy, controlled by the user.	Equality / cooperation or domination (of superintelligences)
Computing	Dominant activity	Secondary activity.	Autonomy.
System connectivity	Closed type systematic interaction if necessary	Full observability and manageability, interaction as needed	Full potential interaction with bilateral control range
Contextuality	Initial phase of context sensitive applications.	Contextual sensitivity, cognitive functionality in	Equivalent (at AGI) or hyper cognitive skills

Phase	Post-computer	Intermediate	Ubiquitous computing
Cognition		specialized fields.	(superintelligence).
Interfaces and interactions	Dominating GUI. Development interactive computer.	Dominant voice interface, adaptive, multimodal interface.	Analogue of inter-human relations.
Personification	Basic personal completion.	Advanced personal completion.	Artificial intelligent personalities superintelligence.

Table 2
Human systems component

Phase	Post-computer	Междинен	Повсеместен компютинг
Growth	Aided human	Technology strengthened human.	improved human, post human
Role	Leading.	Controls portable personal computing resource.	Cooperation / competition / submission.
Инструменти	Support systems mediated reality, biological OJ, first virtual simulations	Bio-cybernetic technology mediated perception, partial virtual simulations of the conscious world.	Ubiquitous network telepresence, advanced virtual simulations, virtual reality sensory.
Technological dependence	Forms of dependency, addiction, nomophobia, seclusion and denial of real life and others.	Problems of symbiotic commitment	Coexistence of biological and e-civilizations - merger or acquisition

2.3 Ubiquitous computing

Computing paradigm about phase of ubiquitous (pervasive) computing features with scalable smart spaces - computational resource is distributed and invisibly merged into the physical world that is becoming ubiquitous intelligent environment [2, 3]. Cloud solutions are not centralized server farms, and ubiquitous computing fabric.

According to [8, 12, 14, 19], the achievement of adequate computing power and different specific approaches (reverse engineering brain, self-improvement architecture, etc.), thirties of the 21st century is expected a breakthrough in efforts to creating an artificial general intelligence (AGI). It's "a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience." (Linda Gottfredson).

Back in the 90s, Vernor Vinge popularized the term "technological singularity" as pending state when artificial intelligence will evolve to a super-intelligence ISI (Artificial Superintelligence, ASI) [19], exceeding the cognitive potential of the best human brains in practically each area. Singular leap in technological level is characterized by Ray Kurzweil "law of accelerating returns" [14]. Others expect the emergence of AGI and ASI much later [13].

The script for equality and cooperation with people is more likely to AGI as an attribute of artificial (E-) personalities with physical (android/robot) or virtual form (avatar). It may be reproduced or copied biological, psychological and social substructure of personality. Their communication platform is complete - verbal, nonverbal (facial expression, body language, tone of voice) and emotional.

E-personalities emulate human cognitive system. Training them to acquire knowledge and skills almost instantly. Cloned by doubling. They are capable of-body movement by transmitting information for reproduction. Interaction "human-computer" is transformed in an appropriate analogue of inter-human relations. Ethical and legal laws may regulate the relationship of humanity and the emerging e-community as a basis for post-civilization.

The artificial superintelligence accumulate and develop millennial experience and knowledge of humanity [12, 16]. There is the potential for mediation superintelligences between people and the real world such as encapsulation by sensory virtual reality [15].

Along with widely-distributed computing resource superintellect forms ecosystem of cognitive computing - a scalable architecture and algorithms emulate capabilities of the brain uptake of multimodal information, take in mind past experience, acceptance of decision and self-education.

The outcome of the parallel existence of human civilization with that of ASI is undetermined due to uncontrollable such technology. Competition may lead to conflict and domination of superintellect with a final digital transformation of biological civilization (table 1).

After computer-aided and technology strengthened man, in the next phase advanced bio cybernetic and nanotechnology nature of man provides greatly enhanced cognitive abilities, full control over the emotional, psychological and physiological state, extended biological life. It can talk about a new, improved human species – “post human” that better control the physical and living world (Ray Kurzweil, Exponential Finance conference, New York).

It is possible to copy the human mind and character in E- personalities (a project of DARPA "Restoring Active Memory"). The boundary between natural human intelligence and artificial intelligence blurs. It is possible alive virtual copy of a particular person inhabits the cloud and examine real inhospitable worlds - for example by hyper connection with bionic body. Another option is digital immortality after brain death, when the electronic personality (in a physical body or virtual incarnation) continues to function and coexist with its traditional surroundings.

According to the dominance of the competitive advantages coexistence of biological and electronic civilizations is possible or biological society is transformed completely into the electronic and/or virtual (table 2).

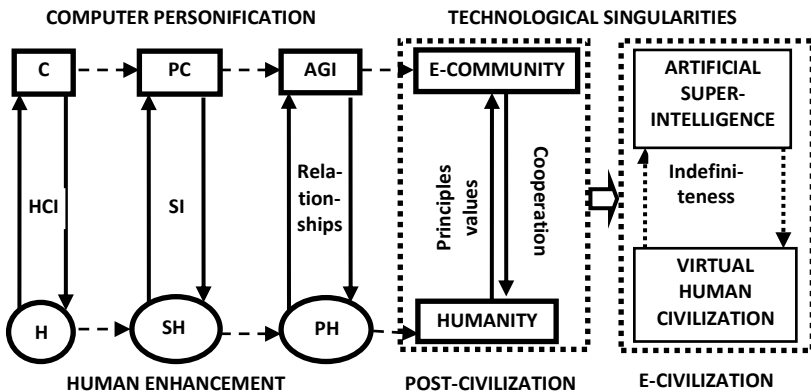


Figure 1. Evolution transformation of the system "human-computer"

In Figure 1 is presented a summary diagram that illustrates the evolution transformation of the system components and their interaction for the three phases. On the one

hand the computer C developed to portable computer PC and artificial general intelligence (AGI), which ended its gradual personification E-personality. Therefore it arises and e-community. Stages of development of biological components are technologically assisted human (H), strengthened human (SH) and improved posthuman (PH). They reflect the relevant technological capabilities to overcome the limitations in the slow biological evolution. Human-computer interaction (HCI), which is characteristic of the stage post-PC, developed in symbiotic interaction (SI) and finally in analog of inter-human relations. There are conditions occur post-civilization, uniting mankind with e-community of smart people (physical or virtual nature) based on appropriate ethical-legal system. It is possible that over time virtual part to dominate against biological humanity in quantitative and/or qualitative terms.

With the advent of artificial superintelligence - a difficult controllable technology - evolution reaches the singularity. The balance in relations with human civilization is undefined, human civilization is transformed to virtual.

3. Conclusion

The dynamics of the system "man-computer" based on the facts in the post-stage computer, as well as technological advances and trends for the intermediate phase. Extrapolation of ubiquitous computing is associated with estimates of analytical agencies, as well as expertise and analytical predictions of scientists with reputation and executives in leading IT-companies. The results are summarized in the conclusions:

1. Human interaction of computer evolution and gradual personification to artificial intelligent person is confirmed: development of neuromorphic architectures, expanding functionality (standby, receptivity autonomy, cognition), more complete communication platform (verbal, nonverbal and emotional), evolution of human-computer interaction through symbiotic interaction in analogue of human relations (cooperation, competition, moral and legal regulation), increasing the potential for imitation/copying all substructures of the human person;

2. Computer dependence of human evolution is revealed: technology requirement, symbiotic link, cyborgization, functional synergy of an individual and human civilization from the development of computer technologies;

3. Personification of the computer is a function of his cognitive potential - the base primitive imitation of personality qualities evolve to artificial intelligent person (physical and/or virtual form);

4. The prospect of physical convergence and fusion of system components (phase ANI - unnoticeable formation, symbiotically and synergistically, related to the human) is changed into comparable people, communities and civilizations (phase AGI and ASI - autonomy, cooperation, competitiveness, domination, ingestion).

5. The relationship in the development of system components is transformed to forms of mutual influence between individuals, communities and parallel civilizations that require legal status and ethical-legal regulation..

The condition for sustainable mutual relations of cooperation is adequacy of human moral and ethical standards and legal system of each evolutionary stage and the extent of their perception in parallel civilizations as a primary regulator.

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ФАКТОРИ НА ОКОЛНАТА СРЕДА ПРИ ФОРМИРАНЕ НА ОТРАЗЕН РАДИО-СИГНАЛ

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THE ENVIRONMENT IN REFLECTED RADIO SIGNALS FORMATION

Alexander A. Kolev¹, Stefan R. Marinov²

Abstract: One of the reasons for the adverse effect of multipath propagation is a reflection of the radio signal. Key factors to evaluate the reflectivity ability of environment is relief and urban built-up areas. In the paper are discussed possible sources of 3D models of urban built-up areas. Analyses have been made of the data structures in architectural 3D modeling.

Keywords: reflection of the radio signal, multipath propagation, 3D models of urban built-up areas.

I. Въведение

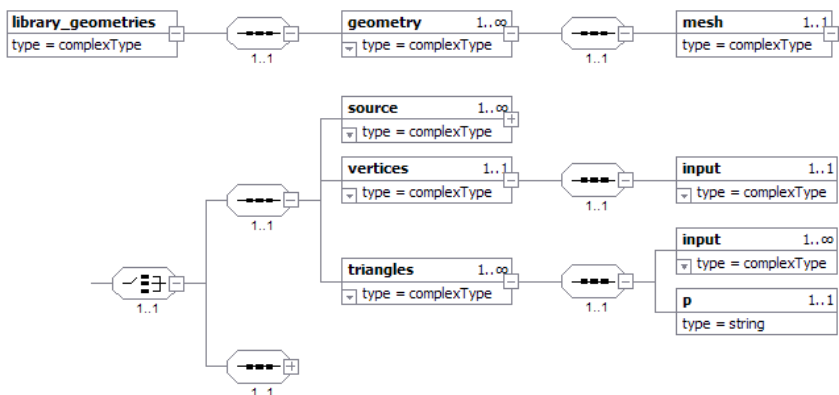
Многолъчевото разпространение на радиосигнал е един нежелан ефект при практическото осъществяване на радиокомуникация. Този физическия ефект се проявява, когато сигналът изминава разстоянието от предавателя до приемника по различни пътища. При разпространение със скоростта на светлината, закъснението на няколко отразени копия на сигнала е малко, но не може да се пренебрегне поради създаването на интерференция, която рязко влошава качеството на приемания сигнал. За да може да се прогнозира качеството на една радиовръзка в реалните условия на дадена местност, желателно е да могат да се отчитат отразяващите способности на околната среда, които основно са релефа и застроените градски площи. Доколкото данните за релефа са сравнително достъпни и се разпространяват в стандартизирани формати, източниците на 3D модели на застроени градски площи все още са малко известни.

В предвид гореизложеното, в материала авторите извършват преглед на източници на 3D модели на застроени градски площи и предлагат сравнителен анализ по показатели: достъпност, детайлност, материал, наличност за населени места на територията на Р. България, тенденции на развитие.

Автоматизираното извличане на данни от файлове във формата CityGML се свежда до прилагане на софтуерен инструмент за анализ на съдържанието на (eXtended Markup Structure) XML структура. Последното е тривиална задача на информатиката и се поддържа от повечето съвременни среди за програмиране.

Друг свободностъпен източник на геометрични данни за застроени градски площи е софтуерното приложение Google Earth. При активиран слой 3D Buildings в основния екран на приложението се визуализират реалистични 3D модели на сгради. Превключва се между два системни варианта на тримерно представяне, а именно *Legacy 3D Buildings* и *3D Imagery*.

Вариантът на тримерно представяне на сгради *Legacy 3D Buildings* първоначално е бил единственият възможен за Google Earth. Позволява даден тримерен модел да бъде селектиран и да бъдат извлечени изграждащите го файлове. За целите на настоящето изследване са значими данните за геореферирани и данните за конструктивната геометрия на тримерният обект. Данните за конструктивната геометрия се съдържат в стандартизирана за 3D графиката структура – COLLADA файлов формат [5]. На фиг. 2 е представена част от информационната структура, имаща отношение към извличане на геометрични характеристики на моделираният тримерен обект.



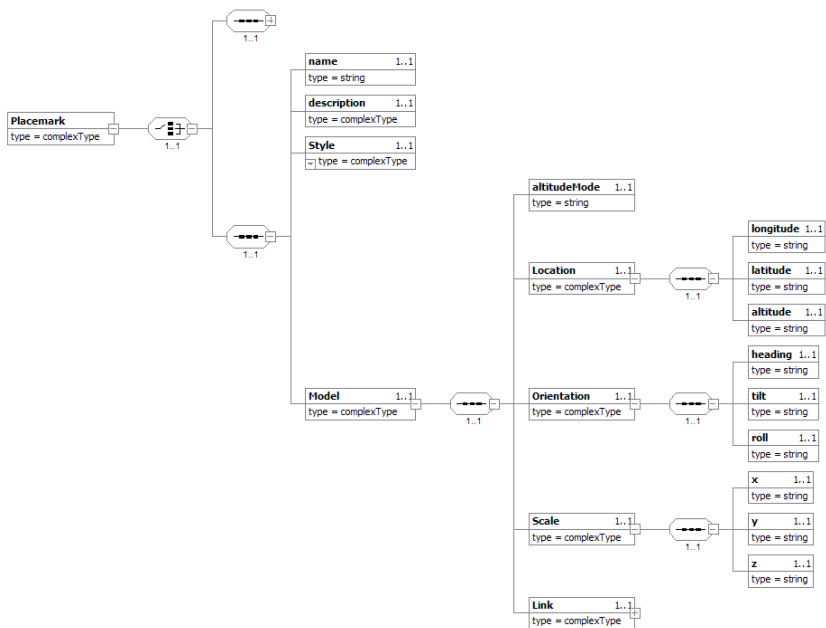
Фиг. 2. Геометрични характеристики с прилагане на файлов формат COLLADA

Друга възможност за придобиване на данни за тримерният обект е файл във формат на програмния продукт SketchUp. Докато COLLADA структурата е от тип XML и програмно извличане на интересуващите ни данни не представлява практическа трудност, то за извличане на данни от SketchUp файлов формат е необходимо да бъде инсталиран въпросният програмен продукт и да бъде реализиран интерфейсен модул с прилагане на програмния език Ruby on Rails.

Не по-малко важни за целите на прогнозиране на условията за многогълчево разпространение са данните за локацията и ориентацията на тримерно моделираната сграда (геореферирани). При използване на *Legacy 3D Buildings* данните за геореферирани на тримерният обект се съдържат в т.н. KML файл. По същество KML файлът също е специализиран XML обект, графично представен на фиг. 3.

Близка до описаната технология на *Legacy 3D Buildings* се поддържа след 2014 г. от Trimble Navigation Limited и е достъпна през on-line портала 3D Warehouse [6].

Другият разглеждан вариант на тримерно представяне на сгради в Google Eart, *3D Imagery*, в основата си използва принципа на стереофотограметрията [7]. Прилагането на този високотехнологичен подход е позволило да бъдат синтезирани и предоставени за визуализация тримерни модели на застроени площи за обширни територии, включително и повечето големи населени места в Република България.



Фиг. 3. Геореферирание с прилагане на модел “legacy 3D Buildings”

Характерна особеност решението в програмното обкръжение на Google Earth е, че тримерните обекти не могат да бъдат селектирани и в следствие на това не е предвиден интерфейс за достъп до данни за конструктивната геометрия на сградите. Частично решение за извличане на 3D модел в стандартизиран файлов формат в този случай е предложено от трети производители на софтуер, и вероятно би работило в противоречие на съществуващите лицензионни споразумения за пролзване на предоставени от Google Incorpration® данни. На фиг. 4 са представени екрани от програмата GoogleEarth, където при фокусиран един и същ градски район, тримерният изглед е показан в различен системен вариант.



Фиг. 4. Тримерен изглед във вариантите *Legacy 3D Buildings* (ляво) и *3D Imagery* (дясно)

Още един разглеждан от автора източник на данни за тримерно представяне на застроени площи е продукт на OpenStreetMap Foundation (OSM) [8]. След 2011 г. работна група 3D Workshop Garching на тази фондация работи по проект *Simple 3D Buildings*. В резултат са съгласувани усилията на софтуерните разработчици на OSM с интереси в тримерното моделиране. Създадена е система за описание на отделна сграда с използване на различни типове полигони за контурите и детайлно описание на различните части като височина, етажност, материал на конструкцията и тип на покрива. Създадени са и са публикувани като свободно достъпни WEB-базираните интерфейси за тримерна визуализация[9], пример е представен на фиг. 5, и за достъп до данните на тримерния модел в структуриран формат XML [10].



Фиг. 5. Изглед във формат на OSM Simple 3D Buildings

За предложеният формат OSM *Simple 3D buildings* са дефинирани две нива на детайлност – Level Of Detail (LOD). Първото от тях, LOD1 е ограничено до призматично представяне на сградата, получено като контурът на основата е екструдирани

на общата височина. Второто, по-детайлно ниво LOD2 повишава представителността на модела като предоставя допълнителни данни за формата и особености на конструкцията на покрива на моделираната сграда.

III. Сравнителен анализ на разглежданите източници на данни за 3D модели на застроени площи

За целите на сравнителния анализ авторът предлага източниците на данни за 3D модели на сгради и застроени площи се изследват по следните показатели: достъпност, детайлност, материал, наличност за населени места на територията на Р. България, тенденции на развитие.

Показателят **достъпност** отразява ефективността на технически, и или административни процедури, които е необходимо да се следват, за да бъдат получени конкретни данни за модела. В случая, когато интересуващите ни данни е възможно да се предоставят след определена заявка към друга административна единица говорим за ниска степен на достъпност. Когато има изградена система за on-line достъп до данни за 3D модели на сгради, но не е наличен удобен човеко-машинен интерфейс за извличане на конкретни данни говорим за средна степен на достъпност. При изграден on-line достъп и предвидена възможност за автоматизирано селектиране, изтегляне и обработка определяме високо ниво на достъп до данните.

Детайлността е показател, който оказва комплексно влияние върху крайния резултат от прилагане на модела. При ниска степен на детайлност съществува вероятност от неправилно оценяване на отразяващата способност. Обратно, при прекалено висока степен на детайлност на 3D моделите в зоната на интерес се повишава интензивността на изчислителните процедури и се удължава времето за решение в неприемлив времеви интервал.

Предоставянето на данни за **материала**, от който са изградени строителните конструкции позволява да се прецизират отразяващите свойства на дадена сграда с отчитане на физическите качества на материала на постройката.

Наличността на изградени 3D модели на застроени площи, особено в национален обхват, е ключова предпоставка за реализиране на бъдеща автоматизирана система за анализ на качеството на радиовръзка. Създаването на моделите е сложна задача, изискваща взаимодействие на различни групи специалисти и специфична организация на работата. Систематичното 3D моделиране трябва да се разглежда не като самоцел, а като комплексно решение, резултатите от което да биват използвани не само във визирания в материала проект, а и в други сфери на науката и практиката.

Тенденциите на **развитие** също са важен показател при оценка на даден източник на данни за 3D модели на застроени площи. Имайки в предвид честата поява на нововъведения в информационната база на тази специфична технология, възможно е да се оцени кои от визирания източници на данни подлежат на развитие в количествен и качествен аспект.

На основа на аргументирания избор на показатели, на табл. 1 са представени оценки на разглежданите източници на 3D модели на застроени площи. Представените оценки по виждане на автора отразяват съвременно състояние на анализирания информационна технология в условията на Р. България.

Таблица 1

№		достъпност	детайлност	материал	наличност	развитие
1.	INSPIRE CityGML	ниска	висока	да	не	да
2.	GoogleEarth Legacy 3D Buildings	средна	средна	не	непълни данни	не
3.	GoogleEarth 3D Imagery	висока	средна	не	да	да
4.	OSM Simple 3D Buildings	висока	ниска	не	да	да

От научно-практическа гледна точка, положителните оценки за наличност и достъпност са решаващи в една бъдеща софтуерна реализация на автоматизирана система за анализ на качеството на радиовръзка. По тези критерии в сферата на интерес попадат *GoogleEarth 3D Imagery* и *OSM Simple 3D Buildings*. По причина, че от Google Incorporation® не предоставят интерфейс за достъп до интересуващите ни данни на 3D модели можем да смятаме, че извличането им с прилагане на други софтуерни методи ще противоречи на известни лицензионни споразумения. Ето защо като най-перспективна система за тримерно представяне с оглед на софтуерна реализация в сегашните условия е *OSM Simple 3D Buildings*.

IV. Заключение

В представения материал авторите изследват предпоставките за създаване на автоматизирана система за анализ на качеството на радиовръзка. Доказана е възможността за ползване на on-line достъпни данни за архитектурни 3D модели на застроени площи и сгради, за населени места от територията на Р. България. Графиките, представени на фигури 2 и 3 са създадени със софтуерни методи за реинженеринг от действителни данни.

При една бъдеща реализация на визираната автоматизирана система могат да се очакват трудности, свързани с високо изчислително натоварване на производствените компютърни системи. Оптимизация може да се търси в насока въвеждане на процедура за препроцесинг в 2D формат, която да редуцира броя изследваните отразяващи повърхнини. Друга възможност за ускоряване решението, за сметка на точността, е разглаждане на гранични случаи, като детайлният 3D модел на сграда се замества с прилагане на съответната описваща рамка (bounding-frame).

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MEASURING THE CHARACTERISTIC OF NON-LINEAR OBJECT

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ABSTRACT: In this paper an experimental model of non-linear radiolocation channel and certain calibration methods are shown. An etalon type non-linear object has been used for the calibration of the experimental model.

KEY WORDS: model of non-linear radiolocation channel, calibration methods, non-linear object.

1. Introduction.

A major problem with non linear radars (NLR) is their short range of operation. To increase the range of detection can be used multi-carrier signals. [1,2] proposes a technical solution with dual-carrier signal.

Method for synthesis of optimal signal is still not developed. Also the advantage of dual-carrier signals compared to single-carrier signals is not applied yet.

2. Synthesis of probe signals for multi-carrier NLR

The main property non linear object is the capability of manipulation of signals with traditional frequency convertor. The only difference is the means of multiplexing of both signals. In the case of NLR the multiplexing is carried out in the electromagnetic waves propagation medium, which allows the multiplexing of multiple signals with various amplitude, frequency and phase. Another important matter is that no working algorithm for frequency conversion of the probing signals has been developed yet. All that makes the multi carrier probing in NLR and the effectiveness analysis remain unresolved.

A system of deterministic signals has been considered. Based on the model of the non-linear radio channel, we can imagine NLR as a set of generators of monochromatic signals. The probing signal is shown below.

$$(1) \quad s_{CC}(t) = \sum_{j=1}^N A_j \cos \omega_j t,$$

where A_j is the amplitude of the signal with frequency ω_j and N is the number of monochromatic signals.

In particular for dual-carrier probing signal with spectral components frequencies ω_1 and ω_2 can be written:

$$(2) \quad S_{CC}(t) = \cos(\omega_1 t) + \cos(\omega_2 t).$$

For weak interaction when nonlinear transformation is determined by quadratic member of the decay of the order of Taylor, the reflected signal can be represented in the following form:

$$(3) \quad S_{OTP}(t) = \beta(1 + \cos(\Omega t))\cos((\omega_1 + \omega_2)t),$$

where β is a constant coefficient, and $\Omega = \omega_1 - \omega_2$.

3. Single-carrier and multi-carrier irradiation of nonlinear objects.

The intensity of the reflected signal $S_{OTP}(t)$ exceeds one and a half times the intensity of the reflected signal in single-carrier irradiation. In [2] has shown that for transformations of second order deviation of the power of the reflected signal from the average value increases proportionally with the increasing number of monochromatic signals N in the probing signal if the following condition:

$$(4) \quad \omega_i - \omega_{i+1} = \omega_{i+1} - \omega_{i+2},$$

I.e. the rate of frequency change of the monochromatic waves is equal. In this case, the elements formation of the spectrum of reflected signal of second order involves more than two spectral components of the probing signal. In particular N -non-linear components with frequencies

$$(5) \quad \omega_H = \omega_1 + \omega_N = \omega_2 + \omega_{N-1} = \omega_3 + \omega_{N-2} = \dots$$

are summed coherently.

The equality of average powers of the probing signals can have different interpretations. In particular, if the dual-carrier signal is formed by using two antennas, to compare the energy of the reflected signals at single-carrier and multi-carrier irradiation it is necessary to modify one frequency in a direction to reach the other ($\omega_1 \rightarrow \omega_2$). In case of equality of the average power of the probing signal flux density in single-carrier irradiation will be greater than the flux density in dual-carrier. This is caused by the increase in the effective area of the antenna twice. For this reason to be correct comparison is important to keep the same area of the antenna system.

In [2] are compared the reflected signals from non-linear objects irradiated with single-carrier and dual-carrier signals using frequency modulated probing signals.

Using directional coupler and power divider one of the signals with average power irradiates through one of the antennas, and the other is delayed and irradiated through the other antenna. In the experiment are compared dual-carrier signal with two antennas and single-carrier signal with one antenna, which proves the significant increase of energy of the reflected signals with multi-carrier irradiation compared to single-carrier.

Multi-carrier irradiation has specific features that should be considered. The first one is the use of ultra wide bandwidth receiver, which in turn leads to reduction of SNR. Another feature is that the necessary linearity of power amplifiers in wide dynamic range of transmitter has to be provided. It also needs to ensure a uniform gain antenna in a sufficiently wide frequency range.

In [1] is developed on the case by the use of different probing signals from N generators with zero phases. Accordingly, the phase characteristics of the emitted probing signals do not affect the frequency response of the reflected signals. Matters of

interest are cases where probing signals are not in phase. From this point of view are considered two four-carrier probing signal shown below

$$(6) \quad S_{1CC}(t) = \cos(\omega t) + \cos((\omega + \Omega)t) + \cos((\omega + 2\Omega)t) + \cos((\omega + 3\Omega)t)$$

$$(7) \quad S_{2CC}(t) = \cos(\omega t) - \cos((\omega + \Omega)t) + \cos((\omega + 2\Omega)t) + \cos((\omega + 3\Omega)t)$$

Both $S_{1CC}(t)$ and $S_{2CC}(t)$ signals have identical frequency response, and the peak-factor (the ratio of the maximum power at any given time - "peak" to the average power) of $S_{1CC}(t)$ is greater than the peak-factor of $S_{2CC}(t)$ a little more than twice. The intensity of the reflected signal (in the band 2ω to $2\omega + 6\Omega$) from probing signal $S_{2CC}(t)$ is two times smaller compared to the intensity of the reflected signal from probing signal $S_{1CC}(t)$. Moreover, in the spectrum of the reflected signal in the case of using $S_{2CC}(t)$ some spectral components vanish.

Increasing the power of the reflected signal N times can be achieved only with maximum possible peak factor, i.e., when all spectral components of the probing signal are in phase.

When a pulse signal with a duty cycle equal to the required peak-factor (N) the power of the reflected signal is N times greater compared to using a continuous signal while maintaining the same average transmission power for both continuous and pulse signals. The same applies to the power of the reflected signal of multi-carrier radiation if all products in nonlinear frequency range from $2\omega_1$ to $2\omega_N$ are taken. It can be concluded that when comparing the performances of different probing signals with the same average power, it is advantageous in terms of power of the reflected signals the one with greater peak-factor. This applies to the comparison of all statements: using multi-carrier and single-carrier probing signals.

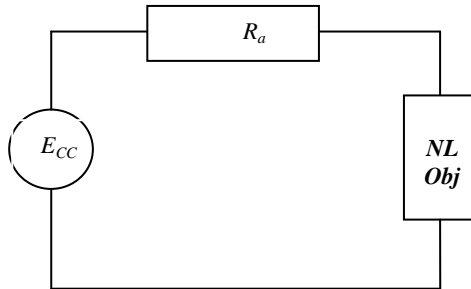


Figure 1

Figure 1 shows an equivalent circuit of an ideal non-linear object (NO), wherein the E_{CC} is the electromotive force caused by the probing signal, R_a is the resistance of the linear portion of the radiation and the U_{NO} is the voltage on the non-linear object. All of these voltages are related with the flowing current I with volt-ampere characteristic $I=f(U_{NO})$.

Transmit power of the ideal nonlinear object is

$$(8) P_{HO} = R_a(I_{HO})^2$$

Of interest is the spectrum of the current flowing through the nonlinear object. Therefore the relationship between the current flowing through the non-linear object and current based on probing signal must be determined

$$(9) I = I(E_{CC})$$

Kirhov equation for perfect non-linear object has the form

$$(10) E_{CC} = IR_a + U_{HO}$$

The function $U_{HO} = f^{-1}(I)$ is determined as the inverse volt-ampere characteristic of the nonlinear object. By substituting it with (10) we get

$$(11) E_{CC} = IR_a + f^{-1}(I) = F(I).$$

Function (11) is the inverse relationship of the requested function (9)

$$(12) I = F^{-1}(E_{CC}).$$

Analytical determination of the magnitude of the current in (12) is difficult. In computing environment that corresponds to a conversion of recorded files and finding their spectrum using a fast Fourier transform.

Calculations show that in linear mode of interaction of probing signal with nonlinear object the combined power of the reflected signal for products of second order (second harmonic for each carrier frequency of the probing signal - $2\omega_1, 2\omega_2, \dots, 2\omega_N$) is always equal to the power of the second harmonic of single-carrier signal if the average powers for single-carrier and multi-carrier probing are equal. Accordingly, the phase differences do not affect the power but influence the shape of the spectrum. Regarding the two signals (6) and (7) the combined power of signals reflected from non-linear object are approximately equal. In modes close to the saturation of the non-linear element the power of the reflected signal increases significantly for probing signals with low peak-factor. This is also valid for single-carrier probing signals with a small peak-factor [3]. Furthermore, the spectrum of the reflected signal is so blurred that impedes optimal reception of the reflected signal.

As a result of the calculations should not expect higher power of the reflected signal with the use of multi-carrier probing signals compared to single-carrier. That is why for real experiments are mostly used single-carrier probing signals.

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SYNTHESIZING AN ADAPTIVE ALGORITHM TO ESTIMATE PARAMETERS OF A MOVING TARGET

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Abstract: This paper presents a synthesis algorithm for adaptive filtering parameters describing the flying path of the target optimal by criterion of the minimum average square error.

Keywords: ISAR, moving target, adaptive algorithm.

1 INTRODUCTION.

Regardless of the approach for the treatment of the radar information in ISAR concludes in realizing the expression (1), which represents a correlation integral of a complex reflected from the target signal and the complex conjugate thereof with a pivot function (2).

$$I(\tau, \beta) = \left| \dot{I}(\tau, \beta) \right| = \left| \int_{-\frac{T_s}{2}}^{+\frac{T_s}{2}} \dot{\zeta}(t) \dot{h}(\tau + t, \beta) dt \right| \quad (1)$$

$$\dot{h}(\tau + t, \beta) = H(t) \exp \left\{ j \frac{4\pi}{\lambda} r(\tau + t, \beta) \right\} \quad (2)$$

ISAR used mode of "super division" in angular coordinates in which a single or group target passes in the class of space-allocation target. These targets are seen as a combination of (N) random statistically independent elementary reflectors, filling a region of space in which is the target. The received signal from the time interval of synthesizing (TIS) T_s described by the expression (3).

$$\dot{S}(t) = \dot{S}(t, \bar{E}, \bar{\varphi}, V_r, a_r, V_T) = \sum_{i=1}^N G(\beta_i) \dot{E}_i(t) \exp \left\{ -j2k \left[R_0 + [V_r(t) - \beta_i V_T(t)]_r + a_r(t) \frac{t^2}{2} \right] + \psi_0 \right\} \quad (3)$$

where: $G(\beta_i)$ - law describing the actual diagram of directional antenna;

$\dot{E}_i(t) = E_i(t) \exp \{ j\varphi_i \}$ - the complex amplitude of the reflected from the i -th elementary reflector signal;

R_0 - slope distance to the target in; $t = \frac{T_s}{2}$

$V_r(t), V_T(t), a_r(t)$ - radial velocity, tangential velocity and radial acceleration of the mass center of the target;

$\beta_i = \Delta\beta \cdot i - \frac{\theta}{2}, i = \overline{1, N}$ - azimuth of the i -th elementary reflector;

θ - width of the diagram of directional antenna;

ψ_0 - initial phase.

In real terms the input processing system in ISAR enters random process $\dot{\xi}(t)$ representing the additive mixture of the useful reflected signal $\dot{S}(t)$ and wide gaussian noise $\dot{n}(t)$.

$$\dot{\xi}(t) = \dot{S}(t, \bar{\lambda}) + \dot{n}(t), \quad -\frac{T_s}{2} \leq t \leq \frac{T_s}{2}. \quad (4)$$

where: $\dot{S}(t, \bar{E}, \bar{\varphi}, V_r, a_r, V_T) = \dot{S}(t, \bar{\lambda})$

Full statistical description of random processes $\dot{\xi}(t)$ is carried out by density functional probability $p[\dot{\xi}(t)]$, that takes into account all the statistical properties of random processes $\dot{\xi}(t)$. To determine this functional use the famous equation for functional white Gaussian noise [1, 2] t.e.

$$p[\dot{n}(t)] = c_0 \exp \left\{ -\frac{1}{N_0} \int_{-\frac{T_s}{2}}^{\frac{T_s}{2}} |\dot{n}(t)|^2 dt \right\}, \quad (5)$$

$$\dot{n}(t) = \dot{\xi}(t) - \dot{S}(t, \bar{E}, \bar{\varphi}, V_r, a_r, V_T). \quad (6)$$

Taking into account the equality

$$|\dot{\xi}(t) - \dot{S}(t, \bar{\lambda})|^2 = [\dot{\xi}(t) - \dot{S}(t, \bar{\lambda})] [\dot{\xi}^*(t) - \dot{S}^*(t, \bar{\lambda})],$$

for functional received signal $\dot{\xi}(t)$ equation is obtained [5]

$$p[\dot{\xi}(t)] = c_0 \exp \left\{ -\frac{1}{2N_0} \int_{-\frac{T_s}{2}}^{\frac{T_s}{2}} |\dot{\xi}(t)|^2 dt - \frac{1}{2N_0} \int_{-\frac{T_s}{2}}^{\frac{T_s}{2}} |\dot{S}(t)|^2 dt + \frac{1}{N_0} \operatorname{Re} \left[\exp(j\psi_0) \int_{-\frac{T_s}{2}}^{\frac{T_s}{2}} \dot{\xi}(t) \dot{S}^*(t) dt \right] \right\}, \quad (7)$$

where: $\dot{S}^*(t)$ - complex conjugate signal $\dot{S}(t)$;

Following [1,7] for the final form of the equation for functional likelihood of random processes $\dot{\xi}(t)$ is obtained

$$F(\bar{\lambda}) = p[\dot{\xi}(t)/t, \bar{\lambda}] = c \exp \left\{ -\frac{T_s}{2N_0} \sum_{i=1}^N G^2(\beta_i) E_i^2 + \frac{1}{N_0} \sum_{i=1}^N \operatorname{Re} \left[G(\beta_i) E_i \exp(j\varphi_i) \int_{-\frac{T_s}{2}}^{\frac{T_s}{2}} \dot{\xi}(t) \dot{S}_{0i}^*(t, \bar{\lambda}) dt \right] \right\} \quad (8)$$

Functional likelihood $F(\bar{\lambda})$ will be used for the synthesis of optimal algorithm and a device for evaluation of the parameters $\bar{\lambda}$.

2 Synthesis of structure an adaptive algorithm to estimate parameters of a moving target.

Much of modern radars operating in pulsed mode, with the consequence that the synthesis of the basic structure of an evaluation unit of the motion parameters of the target turns out to be analog-digital filtering, b.p. It is required to obtain estimates of continuous time parameters (V_r, a_r, V_T) adopted by discrete moments in time reflected

signal from the target $\dot{\xi}(t)$ in conditions of a priori uncertainty centered on the unknown parameter $\bar{\eta} = \|N_{00}\|$. In such a set of random assignment process $\dot{\xi}(t)$, at the input of the system is a sequence of statements signal $\dot{\xi}_\nu$ in discrete moments of time t_ν , $\nu=1,2,3\dots$ has the form

$$\dot{\xi}_\nu = \dot{S}(t_\nu, \bar{\lambda}_\nu) + \dot{n}_\nu, \quad (9)$$

and the equation that describes the useful received signal has the form

$$\dot{S}(t_\nu, \bar{\lambda}_\nu) = S_c(t_\nu, \bar{\lambda}_\nu) + jS_s(t_\nu, \bar{\lambda}_\nu), \quad (10)$$

where:

$$S_c(t_\nu, \bar{\lambda}_\nu) = \sum_{i=1}^N G^2(\beta_i) E_{ci}(t_\nu) \cos \left\{ 2k \left[(V_r - \beta_i V_T) t_\nu + a_r \frac{t_\nu^2}{2} \right] \right\};$$

$$S_s(t_\nu, \bar{\lambda}_\nu) = \sum_{i=1}^N G^2(\beta_i) E_{si}(t_\nu) \sin \left\{ 2k \left[(V_r - \beta_i V_T) t_\nu + a_r \frac{t_\nu^2}{2} \right] \right\};$$

At fixed values of parameters $\bar{\eta} (\bar{\eta} = \bar{\eta}_m)$ priori system equations Communications (parameters $\bar{\lambda}$) has the form [6]

$$\left\{ \begin{array}{l} \frac{dE_{c1}(t)}{dt} = -\alpha E_{c1}(t) + n_{00m} \\ \frac{dE_{s1}(t)}{dt} = -\alpha E_{s1}(t) + n_{00m} \\ \dots\dots\dots \\ \frac{dE_{cN}(t)}{dt} = -\alpha E_{cN}(t) + n_{00m} \\ \frac{dE_{sN}(t)}{dt} = -\alpha E_{sN}(t) + n_{00m} \\ \frac{dV_r}{dt} = 0 \\ \frac{da_r}{dt} = 0 \\ \frac{dV_T}{dt} = 0 \end{array} \right. \quad (11)$$

Or in vector form

$$\frac{d\bar{\lambda}(t)}{dt} = \bar{A} \bar{\lambda}(t) + \bar{B} \bar{n}_{00}(t), \quad (12)$$

where: $\bar{\lambda}^T = \|E_{c1}, E_{c2}, \dots, E_{cN}, E_{s1}, E_{s2}, \dots, E_{sN}, V_r, a_r, V_T\|$ - m -dimensional vector-pillar of the evaluated parameters;

$\bar{n}_{00}^T(t) = \|n_{00}, n_{00}, \dots, n_{00}\|$ - k -dimensional vector-pillar containing the emerging white noise message with zero mathematical expectation and correlation function matrix $M\{n_{00}(t)n_{00}(t+\tau)\} = N_{00}(t, \bar{\lambda})\delta(\tau)$;

\bar{A} - matrix function with size $[m \times m]$ which has the form [5]

$$\bar{A} = \begin{pmatrix} -\alpha & 0 & 0 & \dots & \dots & 0 & 0 & 0 \\ 0 & -\alpha & 0 & \dots & \dots & 0 & 0 & 0 \\ 0 & 0 & -\alpha & \dots & \dots & 0 & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & \dots & \dots & 0 & 0 & 0 \\ 0 & 0 & 0 & \dots & \dots & 0 & 0 & 0 \\ 0 & 0 & 0 & \dots & \dots & 0 & 0 & 0 \end{pmatrix};$$

\bar{B} - correlation matrix with size $[k \times k]$ of the emerging white Gaussian noise with zero mathematical expectation and unknown intensity N_{00} [5]

$$\bar{B} = \begin{pmatrix} \sqrt{\frac{N_{00}}{2}} & 0 & \dots & 0 & 0 \\ 0 & \sqrt{\frac{N_{00}}{2}} & \dots & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & \sqrt{\frac{N_{00}}{2}} & 0 \\ 0 & 0 & \dots & 0 & \sqrt{\frac{N_{00}}{2}} \end{pmatrix}.$$

To solve the problem of discrete filtration is necessary to move from analog type equations (11) и (12) to diff equations of the type [2]

$$\dot{\bar{\lambda}}_v = \bar{\Phi}(t_v, t_{v-1})\hat{\bar{\lambda}}_{v-1} + \bar{n}_{00v}, \quad (13)$$

където: $\bar{\Phi}(t_v, t_{v-1})$ - matrix of fundamental solutions (transition matrix of equation (12)), satisfying the homogeneous differential equation

$$\frac{d\bar{\Phi}(t_v, t_{v-1})}{dt_v} = -\bar{A}\bar{\Phi}(t_v, t_{v-1}), \quad (14)$$

with initial condition $\bar{\Phi}(t_v, t_v) = \bar{I}$; \bar{I} - unit matrix;

$$\bar{n}_{00v} = \int_{t_{v-1}}^{t_v} \bar{\Phi}(t_v, \tau)\bar{n}_{00}(\tau)d\tau, \quad (15)$$

- a sequence of independent Gaussian vector random variables with zero mathematical expectation and correlation matrix [4]

$$\bar{D}_v = M\{\bar{n}_{00v}, \bar{n}_{00v}^T\} = \int_{t_{v-1}}^{t_v} \bar{\Phi}(t_v, \tau)\bar{B}(\tau)\bar{\Phi}^T(t_v, \tau)d\tau. \quad (16)$$

Since messages (estimation parameters $\bar{\lambda}$) are described by linear equations diff (13) and the equation of observation (9) is non-linear on $\bar{\lambda}$, it is the task of obtaining estimates of these parameters in the clock t_v points is non-linear and its solution is necessary to use approximate methods[5]. The class of approximate methods (algorithms) for filtration is obtained by approximation (local) the right solution in a small area of valuation significance $\hat{\lambda}(t)$ of the filtered process. Usually in local approximation is made replacement probability density $p(t, \bar{\lambda})$ with a normal probability density $N[\bar{\lambda}(t), \bar{R}(t)]$. In order to make this exchange is necessary that the following two conditions [3]:

1. The useful signal $\dot{S}(t, \bar{\lambda})$ depends linearly on the message $\bar{\lambda}(t)$ ie.

$$S_i(t, \bar{\lambda}) = S_i(t) + \sum_{j=1}^m h_{ij}(t) \lambda_j(t). \quad (17)$$

2. The filtered message $\bar{\lambda}(t)$ is a Gaussian process.

Known in the literature [2, 3] approximate methods for solving nonlinear tasks relatively simple and highly effective method is "current linearization". The essence of this method consists in the following: suggests that any assessment found the message (parameter) $\bar{\lambda}^*$ moreover it is not necessary that this evaluation is optimal, then nonlinear function $\dot{S}(t_v, \bar{\lambda}_v)$ in observation $\dot{\xi}_v$ (9) decomposes in order of degree of Taylor $(\bar{\lambda}_v - \bar{\lambda}_v^*)$ and limited to linear members decomposition by analogy with the equation (17)

$$\dot{S}(t_v, \bar{\lambda}_v) \approx \dot{S}_0(t_v, \bar{\lambda}_v^*) + \sum_{j=1}^m \frac{\partial \dot{S}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{vj}} (\bar{\lambda}_{vj} - \bar{\lambda}_{vj}^*), \quad (18)$$

where m - the total number of evaluated parameters.

Therefore, the observation equation $\dot{\xi}_v$ (9) was linearized and has the form [2]

$$\dot{\xi}_v(t_v) = \dot{S}_0(t_v, \bar{\lambda}_v) + \bar{H}(t_v) \bar{\lambda}_v + \bar{n}_0(t_v), \quad (19)$$

$$\text{where: } \bar{H}(t_v) = \frac{\partial \dot{S}(t_v, \bar{\lambda}_v^*)}{\partial \bar{\lambda}^T}, \quad \dot{S}_0(t_v, \bar{\lambda}_v) = \dot{S}(t_v, \bar{\lambda}_v^*) - \bar{H}(t_v) \bar{\lambda}_v^*,$$

$\bar{H}(t_v)$ - matrix of the derivatives of dimensionality $[m \times m]$.

The equation (19) of complex shape can be represented by the quadrature component of the observation $\dot{\xi}_v$ and useful signal $\dot{S}(t_v, \bar{\lambda}_v)$

$$\xi_{c\sigma}(t_v) = S_{c\sigma}(t_v, \bar{\lambda}_v^*) + \sum_{j=1}^m \frac{\partial S_{c\sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{vj}} (\lambda_{vj} - \lambda_{vj}^*) + n_0(t_v); \quad (20)$$

$$\xi_s(t_v) = S_{s\Sigma}(t_v, \bar{\lambda}_v^*) + \sum_{j=1}^m \frac{\partial S_{s\Sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{vj}} (\lambda_{vj} - \lambda_{vj}^*) + n_0(t_v), \quad m = (2N+3);$$

$$\text{where: } \dot{\xi}(t_v) = \begin{Bmatrix} \xi_c(t_v) \\ \xi_s(t_v) \end{Bmatrix};$$

$$\bar{H}(t_v) = \begin{Bmatrix} \frac{\partial S_{c\Sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{v1}} \dots \frac{\partial S_{c\Sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{vm}} \\ \frac{\partial S_{s\Sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{v1}} \dots \frac{\partial S_{s\Sigma}(t_v, \bar{\lambda}_v^*)}{\partial \lambda_{vm}} \end{Bmatrix}.$$

Equations (20) and (13) are linear on $\bar{\lambda}$ and vector estimates $\hat{\lambda}_v$ formulated in the task of quasi-linear filtration has the form

$$\hat{\lambda}_v = \bar{\Phi}(t_v, t_{v-1}) \bar{\lambda}_{v-1}^* + \bar{K}_v \left[\dot{\xi}_v - \dot{S}(t_v, \bar{\lambda}_{v-1}^*) \right], \quad (21)$$

where: $\bar{K}_v = \bar{R}_v \bar{H}_v^T \bar{V}_v^{-1}$ - matrix of the optimal gain of the filter, and the equation for the correlation matrix of errors in the filtration has the form

$$\bar{R}_v = \tilde{R}_v - \tilde{R}_v \bar{H}_v^T (\bar{H}_v \tilde{R}_v \bar{H}_v^T + \bar{V}_v)^{-1} \bar{H}_v \tilde{R}_v; \quad (22)$$

where: $\tilde{R}_v = \bar{\Phi}(t_v, t_{v-1}) \bar{R}_{v-1} \bar{\Phi}^T(t_v, t_{v-1}) + \bar{D}_v$ - extrapolated correlation matrix errors of filtration determined by the a priori equation message (13).

The final type of algorithm that describes the extended Kalman filter to assess the information parameters in discrete time is described as

$$\hat{\lambda}_v = \bar{\Phi}(t_v, t_{v-1}) \hat{\lambda}_{v-1} + \bar{R}_v \bar{H}_v^T \bar{V}_v^{-1} \left[\dot{\xi}_v - \dot{S}(t_v, \hat{\lambda}_{v-1}) \right], \quad (23)$$

$$\bar{R}_v = \tilde{R}_v - \tilde{R}_v \bar{H}_v^T (\bar{H}_v \tilde{R}_v \bar{H}_v^T + \bar{V}_v)^{-1} \bar{H}_v \tilde{R}_v, \quad (24)$$

$$\tilde{R}_v = \bar{\Phi}(t_v, t_{v-1}) \bar{R}_{v-1} \bar{\Phi}^T(t_v, t_{v-1}) + \bar{D}_v. \quad (25)$$

The matrix \bar{D}_v is determined by the decision of the differential equation [2]

$$\frac{d\bar{D}(t_v, t_{v-1})}{dt} = -\bar{A}\bar{D}(t_v, t_{v-1}) + \bar{D}(t_v, t_{v-1})\bar{A}^T + \bar{Q}, \quad (26)$$

with initial condition $\bar{D}(t_{v-1}, t_{v-1}) = 0$ where $\bar{Q} = \bar{B}\bar{B}^T$.

The equations (23) and (24) have recurrent form and can be successfully used for the realization of an electronic computing machine.

The structural scheme of the synthesis algorithm for adaptive nonlinear filtering of information parameters described by equations (23)-(25) is shown on fig. 1.

It should be noted that the accuracy of the algorithm for adaptive filtering dependent on the significance of the preliminary assessment $\hat{\lambda}_{v-1}$ on its true value. The importance of the preliminary assessment must be close enough to the true value to be in force approximate equality (18). According to [4] are known several ways of defining the preliminary assessment. The simplest but also the least accurate is the way in which ex

to assessment of the trajectory parameters of spatially-distributed object against the uncorrelated noise.

2. By $T_s \ll 1$ s the trajectory parameters are slowly changing random variables and may be presented as a special case of Markov process with coefficients of displacement and diffusion zero. This greatly simplifies the synthesis of the optimum filter for the assessment of trajectory parameters.

3. The task for the synthesis of an optimal measure of working in conditions of substantial priori uncertainty and non-linearity with respect to the estimated parameters yields inoperable algorithms. The solution of such a task is done using approximate methods, which give quasi-optimal structure of the estimator.

4. Applying the "current linearization" in the algorithm for adaptive filtering linearized dependence of adopted monitoring the trajectory parameters in result of which can be used the standard procedure for Kalman filtering. Linearized multiplier depends on the resulting current assessment, which requires that it be determined for each step of the iteration.

5. Due to the fact that the determination of the correlation matrix of errors involved ongoing evaluation of the information parameters is complicated procedure for filtration. Therefore, the correlation matrix of errors can not be determined in advance (as in the linear Kalman filter), but needs its jointly solve the equation for estimating information parameters. This complication is considerably large in dimension to the vector of filtered parameters.

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A MODIFIED METHOD OF SUBJECTIVE QUALITY OF MULTIMEDIA INFORMATION

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***Abstract:** A method is proposed for subjective quality of multimedia information, consistent with the recommendations on the conditions of observation and selection of subjects. It eliminates some basic drawbacks of traditional approaches and largely unified implementation of subjective evaluation tests of picture quality of video compression algorithms and standards.*

The latest revision of the recommendations of the ITU, describing methodologies for assessing visual quality of digitally encoded video earlier dates back to 2000. Almost all studies they describe fully the opportunities of subjective tests are designed since a basic assessment of television standards. With the expansion of digital formats, processing algorithms and new types of displays, video is everywhere - except on television, also in computers, mobile phones, portable devices. For this reason the International Committee of Telecommunications ITU has initiated the development of a new methodology for visual assessment, which is suitable for application on PC and portable devices. This initiative analyzes, tests and results. So in current work proposes a methodology called SAMVQ, and examined correlation to the objective methods for quality assessment.

Monitoring conditions must be:

- The number of participants is less than 10, they must not experts they must be properly trained in the procedure of monitoring and recording the results:
- Appropriate choice of test footage.
- In determining the length of the sequences take into account two contradictory fact;
 - The first appreciation of the artifacts in digital television, which have a short life and are spatially dispersed, and therefore may not be noticed at least the duration of the test;
 - On the other hand, it is shown that human vision we possess the so-called. "Novelty effect" - gives an average score of all SEQUENCE based on the observed details in recent times.

Due to this the test pictures should not be very long. It is clear that the optimal length of one test video is 15-20 seconds.

There is another feature of human vision, which affects significantly the on conducting the evaluation - the subjective opinion of a sequence is highly dependent on the observed previous one. In the undesirable observer normally seek unlike the front of video, he tends to overestimate the current picture, if it has been defined as poor, or to underestimate, if it has been defined as good. It is therefore appropriate test sessions to be conducted several times under the same conditions, but test video images to be evaluated in a different order. In the worst case can be observed twice - in forward and reverse sequence.

Another important proposal concerns the original sequences. Famous trend is subjective tests, the observers give maximal evaluation of the original sequence when they have prior information that accurately assessed it. However, when such data are

available, subjects rarely tend to indicate the maximum score even though the sequence is of excellent quality. Therefore, in the proposed methodology relies on the inclusion of the original undistorted sequence at least twice somewhere in the series of test distorted videoposledovatelnosti. This allows to obtain a more accurate result for Orientalism Gina and scaling of votes observers.

In most methods of conducting visual tests used a five point scale voting, each level is associated with a particular adjective. These indicators (good, bad, etc.) split physical scale on five equal parts. Their interpretation by observers leads to the division of the scale of psychological irregular intervals. In documentation problem is exacerbated by the complex transfer of these adjective in different languages around the world. It is therefore proposed assessment scale be divided into ten parts, each of which is associated with a particular description either.



Fig.1. Rating scale in SAMVQ

This has some advantages - such as an increased number of voting options and improved distribution of votes. However, the doubling of the zones makes the task more complex and increases the likelihood of confusion in subjects due to the blurring of boundaries between them.

In the process of subjective evaluation of a coding algorithm or different TV system generates a huge amount of data that must be processed and summarized in order to generate a graphical representation or analytical performance of the test system. Depending on the method used for collecting votes outputs are values between 1 and 5, between 1 and 10 or between 0 and 100. In their distribution are available variance due to differences of opinion on various subjects and for the various parameters observed sequences. The first step in the processing of the results is the normalization into the range from 0 to 100. Typically, one test consists of a number of presentations L, each being one of a plurality of test conditions J (image size, compression rate) supplied with a number of reference sequences.

The proposed methodology any combination of test sequence provided k is observed a number of times R. The first step in data analysis is almost always values u_{jkr} determining the average for each of the presentations:

$$\bar{u}_{jk} = \frac{1}{MN} \sum_{r=1}^M \sum_{l=1}^N u_{ijkr}, \quad (1)$$

$-u_{jkr}$ where is the assessment of conditions for observer i j in sequence k , repetition r on observation. It is appropriate that before the processing of results to exclude the highest and lowest score $-u_{jkr}$. Thus protects the result of random errors in the voting process observers.

$-u_{jkr}$ value is assumed to be called and MOS (Mean Opinion Score) - averaged subjective evaluation sequence k in terms of the observation j [1]. It is used as a measure of subjective quality test determined flax videoposledovatelnost.

Representing the results of each average must be accompanied by its confidence interval. The most widely used 95% - was disposed confidence interval is given as follows

This means that with a probability of 95% the absolute value of the difference between the experimental value and the average true average value is smaller than the confidence interval.

Next, it is desirable to be carried out and check the votes of each of the observers for systematic biases by analyzing the results in the following algorithm. First calculate the kurtosis coefficients – tat:(describing the sharpness of the peak of the distribution) for each subject:

$$\beta_{2jkr} = \frac{m_4}{(m_2)^2}, \quad \text{where} \quad m_x = \frac{\sum_{i=1}^N (u_{ijkr} - \bar{u}_{ijkr})^x}{N} \quad (2)$$

Then proceed with the following estimation algorithm: For each observer i and $j, k, r = 1$ to J, K, R :

if $2 \leq \beta_{2jkr} \leq 4$, then

if $u_{ijkr} \geq \downarrow u_{jkr} + 2 \cdot S_{jkr}$, then $P_i = P_i + 1$;

if $u_{ijkr} \leq \downarrow u_{jkr} - 2 \cdot S_{jkr}$, then $Q_i = Q_i + 1$;

otherwise:

if $u_{ijkr} \geq \downarrow u_{jkr} + 20^{0.5} \cdot S_{jkr}$, then $P_i = P_i + 1$;

if $u_{ijkr} \leq \downarrow u_{jkr} - 20^{0.5} \cdot S_{jkr}$, then $Q_i = Q_i + 1$;

if $\frac{P_i + Q_i}{J \cdot K \cdot R} > 0,05$ and $\left| \frac{P_i - Q_i}{P_i + Q_i} \right| < 0,3$,

then they should ignore the results obtained from the subject i .

In order to assess the likelihood that the subjects were actually able to distinguish the two test sequences (after compression and decompression) of each pair is calculated z-test of the obtained objective results. Izpol- mentation following mathematical expression:

$$z = \frac{\bar{u}_{jk}' - \bar{u}_{jk}''}{\sqrt{\frac{S_{jk}'^2 - S_{jk}''^2}{N}}} \quad (3)$$

where: \bar{u}_{jk}' and \bar{u}_{jk}'' are MOS for the two test sequences;

where: S_{jk}' and S_{jk}'' are standard deviations of the two sequences; N -number of experts participating in the tests.

Then sought probability is calculated by the expression:

$$p(z) = \frac{1}{2\pi_{-\infty}} \int e^{-\frac{z^2}{2}} dz \quad (4)$$

Conclusions:

The results of the subjective assessment depend heavily on conditions of production, the selected test material, the method used to conduct the monitoring and collection of results, so it is incorrect to draw conclusions based on them in an absolute sense.

- It is mandatory for presentation of results to be named and the following data:

- Details of the test configuration, if the subjective assessment is conducted on a personal, pocket or any other type of computer;

- Details of selected test video sequences (number, origin, description and characteristics - size, color, motion vector);

- Used software or hardware for compression and decompression of the tested sequences, as well as the settings of its parameters;

- Type of the signal source and the parameters of the monitor (model and date of manufacture, type, display size);

- The settings of the imagers (brightness, contrast, color temperature, distance monitoring);

- Number and type of participating observers (distribution by age, sex, state of vision, level of experience in subjective tests, etc.);

- Used method applied to conduct the test sessions;

- The number of observers whose results were ignored and the reasons for the exclusion;

- Average assessment system - the original and subjective estimates and 95% confidence interval if one's results were eliminated by the described procedure.

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RESEARCHING ON THE INFLUENCE OF THE FRAME RATE, THE SHAPE OF THE BAND IMAGES, THE DEGREE OF COMPRESSION AND THE AMOUNT OF IMAGE QUALITY IN THE H.264 STANDARD

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***Abstract:** There has been a study and analyze the impact of the main parameters of the standard, video compression H.264 on image quality - stability of the algorithm for compression, speed of work, degree of compression, the image size.*

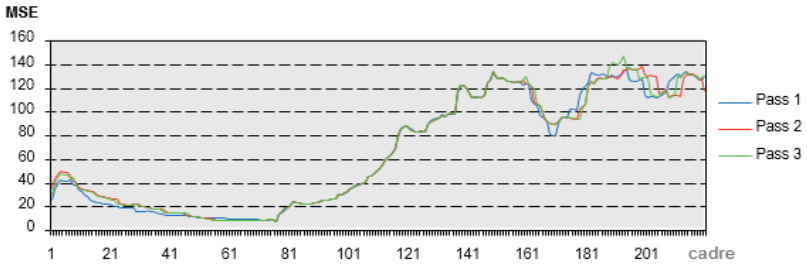
The study is designed to evaluate the task of influence of the main parameters of standard H.264 compression on image quality - the stability of the algorithm for compression speed of his work, the degree of compression, image size, the distance between I-frames - rated by objective and statistical methods. Quality assessment is conducted under two ways - by framing calculate the peak signal / noise and the mean square error using software Annex PSNR_Checker method SSM (Structural Similarity Metric) objective assessment of quality.

First tested the stability of the compression algorithm. For this purpose, two sequences are compressed with the same bit rates successively three times. Estimates of the signal / noise and mean square error of brightness and color are depicted and. From framing comparison shows that H.264 has very little instability in repeated compression of the same video. In the first iteration result is always more optimistic than real: lower MSE, peak signal / noise - a high PSNR, but only after the second repetition coder began can give stable results. The average for the whole duration of the test sequences results are shown in Table 1.

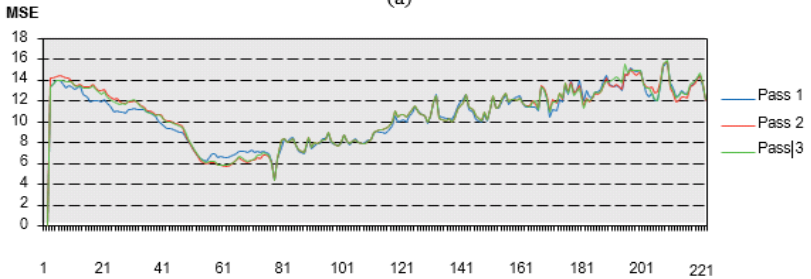
Error values and the signal / noise triple

Table 1. Repetition of the compression process for H.264

Test sequence	Component / bit rate	Number of repetition	MSE	PSNR
„Schumacher“	brightness / 200 kbps	1	69,9	30,9
		2	77,3	30,1
		3	77,4	30,1
	chrominance / 200 kbps	1	13,8	37,2
		2	15,4	36,6
		3	15,5	36,6
„Concert“	brightness / 500 kbps	1	52,9	30,5
		2	47,5	31,4
		3	55,3	30,7
	brightness / 2000 kbps	1	15,8	36,1
		2	13,8	36,8
		3	15,3	36,3

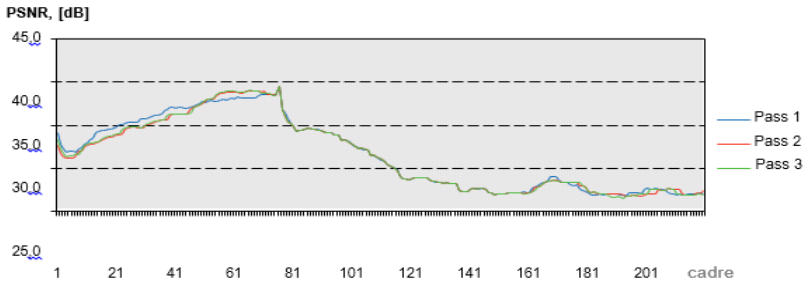


(a)

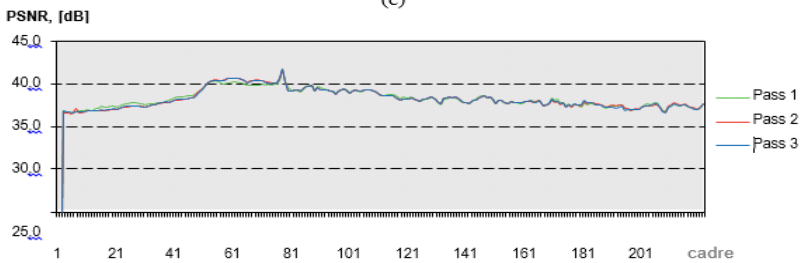


cadre

(b)

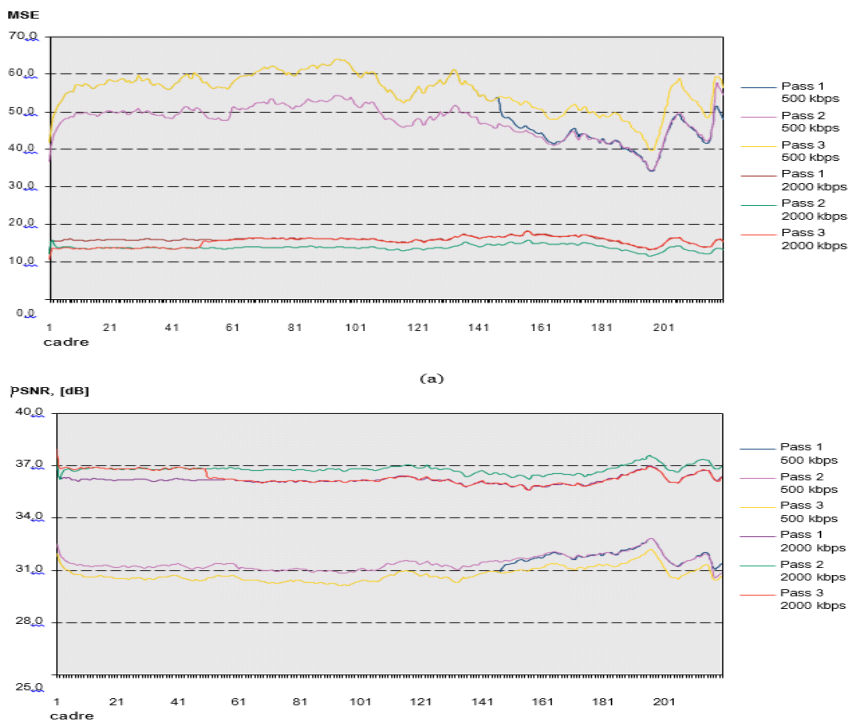


(c)



(d)

Fig.1. Stability of the H.264 codec for test image "Schumacher" and three consecutive passes. Stop motion evaluation at 1000 kbps: (a) MSE brightness; (b) MSE chromaticity; (c) PSNR of the luminance; (d) PSNR chromaticit



(b)
Fig.2. Stability of the H.264 encoder for test image "Concert", three consecutive passes and stop motion assessment of brightness (a) MSE at 500 kbps and 2000 kbps; (b) PSNR at 500 kbps and 2000 kbps

From the results in the table require some peculiarities. First, the differences in quality between different passes are somewhat higher brightness than for color. Second, the magnitude of the differences in quality in different iterations depends on the contextual content of video image, and especially on the degree of movement therein. Third, differences are greater at low bit rate, due to the critical work of the algorithm for compression at this standard. Fourth - H.264 has the slightest instability results of the examination standards.

The following figure 3. shows the experimentally obtained contingent upon time compression test sequence "PCScreen" lasts 8.5 seconds on the image size and set the bit rate compression.

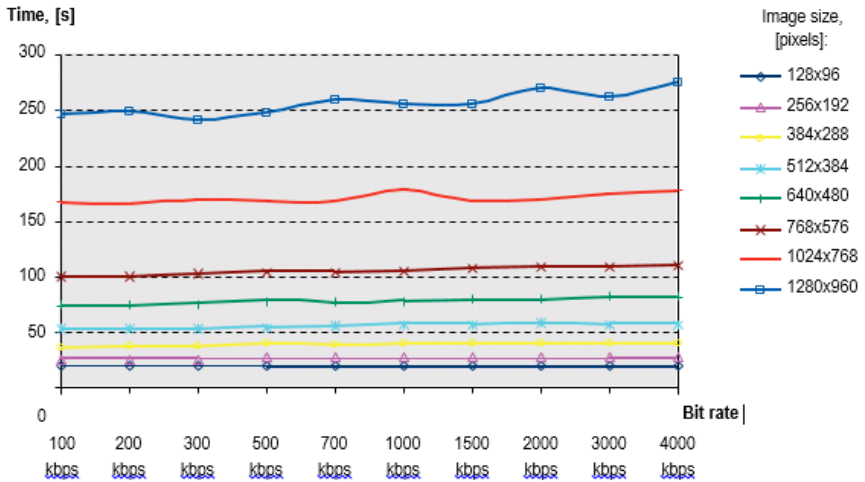


Figure 3. Time compression test video "PC Screen" in H.264 depending on the bit rate at different image sizes.

From the graphs in Figure 3. it is seen that the time compression almost does not depend on the output bit rate. The difference in time with the same image size and different speeds within the errors of reporting or due to other workload on the test system in the present moment, because the experiments were performed on a PC. At the same bit rates are noted down depending on the speed of the picture size and tolerances are smaller interval. As the image is larger, slower is done compress. It is noteworthy extremely slow compression rate which is many times smaller than the actual, especially for large image sizes. This may be due to the very early stage of development, they are located in most applications to compress video in the H.264 standard.

The next stage is tested quality of the compressed image displayed depending on the key indicator of H.264 - the frequency of disposal of the keys in the test sequences. For this purpose the two sequences tested a sequences - "Concert" and "Schumacher", are compressed at two different bit rates - 200 kbps and 1000 kbps. Variable is the distance between I-frames, having asked these values - 6, 12, 25, 50, 100, 200 frames between I-frames. The obtained experimental results are depicted graphically in Figure 4. and Figure 5. The framing comparison between different bit rates and overall results for the entire duration of the test sequence, is shown as measured by PSNR, and by SSM.

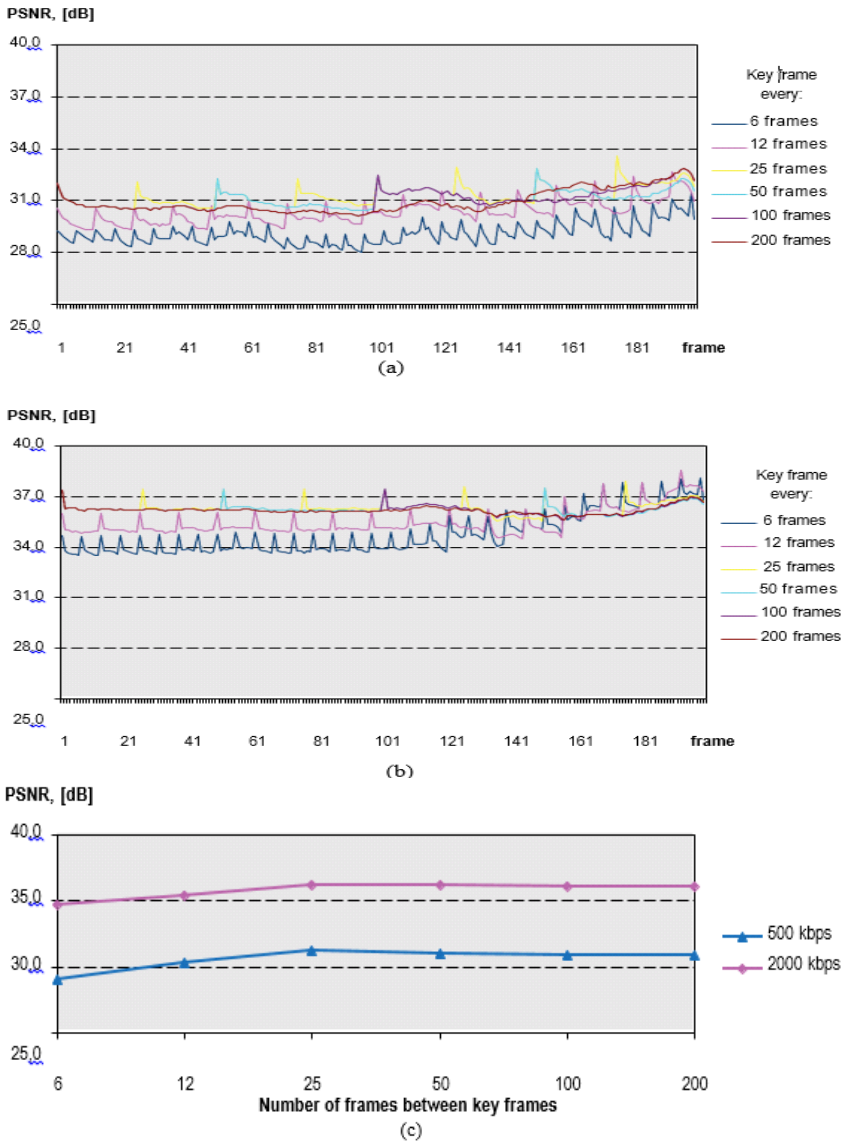


Figure 4. Depending on the image quality on the number key frames a test image "Concert": (a) framing 500 kbps; (b) Frame 2000 kbps; (c) averaged over the whole sequence.

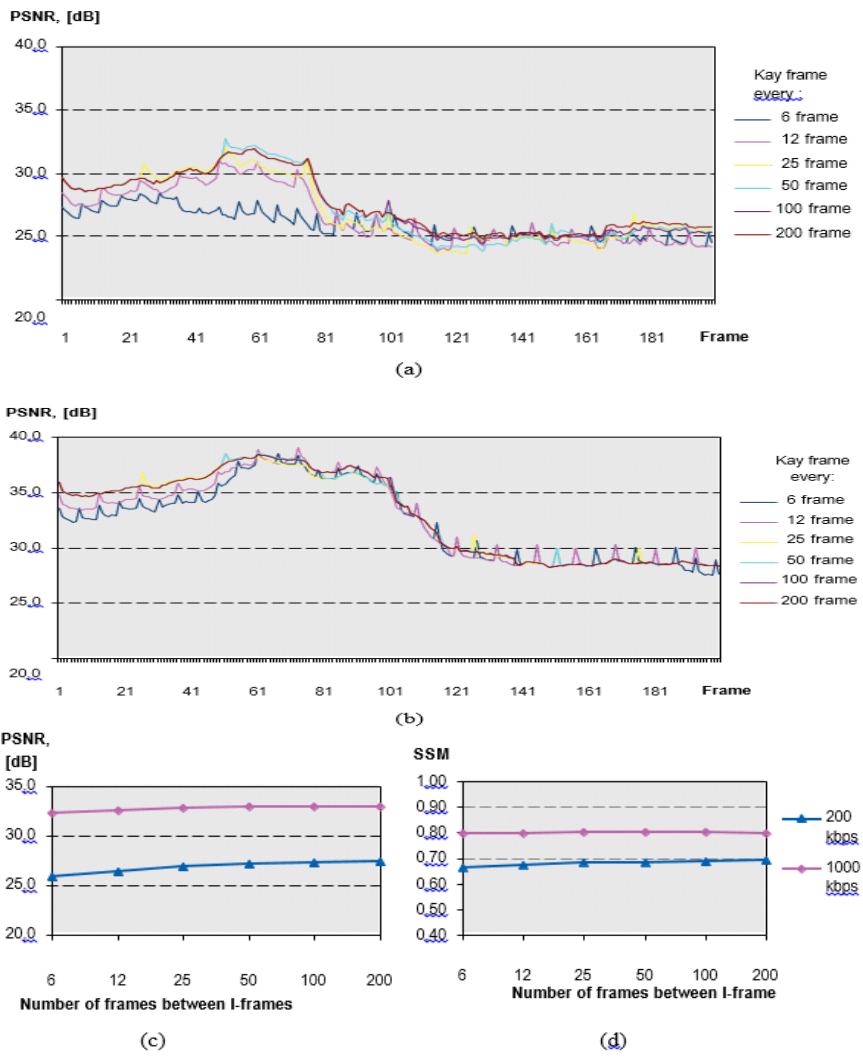


Figure 5. Depending on the image quality, the number of staff for the sequence "Schumacher": (a) framing 200 kbps; (b) Frame 1000 kbps; (c) average SEQUENCE measured by PSNR; (d) medium consistency, measured by SSM

The displayed graphics can draw the following conclusions. First, because the key frames are compressed independently and shall be re-divided the greatest amount of bits in smaller bit rates, with enhances the sense of distance between key frames need to increase information for predicting and staff the motion compensation. Since the output speed is limited, at least on the number of I-frames is provided the above condition and

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the quality is increased. Such is the case co Gatto structure of the group of pictures is retained but reduced output bi- this rate - low quality of personnel located between I-frames.

Second, at higher bit rates will have an increased picture quality by lowering the number of key frames. This is explained by a sufficient amount of information given about the exact predictions of all the images without the key and reducing the number of staff they kay- leads to optimal filling of the output data stream.

Third, because the H.264 format is designed as a multimedia standard for transmitting video of a generic increase of between I-frames can not be done indefinitely. It is known [1] that the younger interval between key frames reduces visibility on the trail of mistakes, which besides everything is highly dependent on the plot of video sequence. Increasing the number of I-frames improves the opportunity for further editing and processing of H.264 compression information. Therefore, when choosing the shape of the group of paintings aid off it is necessary to make certain compromises, depending on all the conflicting requirements.

The last conclusion that can be drawn is that there is a determined Leno distance between keys, which provides maximum quality bar graphs for this particular video sequence. Impressive is the fact that according to both metrics used to evaluate - PSNR and SSM - the difference in the quality between the maximum and the minimum quality for both domestic speeds approximately equal. This shows that the PSNR is doing well with the assessment of this sequence in this standard and that SSM successfully predict the expected subjective image quality after compression mission - all imported from the compression process distortions in the sequence will be seen.

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STEGANOGRAPHY SYSTEM THAT USES THE LSB METHOD OF EMBEDDING INFORMATION IN IMAGES

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Abstract: *Steganography is the method of hiding message in a cover object for cover communication. The article deals with the steganography system which hides text inside images without losing of data (BMP, PNG, TIFF and GIF). The secret message is hidden in the cover image using Last Significant Bit (LSB) method. Described functional of the developing software. Visual and statistical analysis of this algorithm returns satisfactory results.*

Keywords: *steganography, cover image, data hiding, stego image, LSB*

1. INTRODUCTION

In the 21st century, there are a lot of methods of transmitting confidential information, the contemporary computer steganography method becomes more and more popular because of the necessity of new solutions to the problems with the illegal access to sensitive. In modern world, daily, a lot of companies and users communicate and exchange generally accessible and confidential information via the Internet.

There are two main methods for hiding confidential information: cryptography and steganography. The analysis of the methods of the computer steganography is not a single and complete activity because of the dynamic development of this scientific and applicable field and it is enough complex task. [2], [10], [11], [12].

2. MAIN POINTS. METHODS IN THE SPATIAL DOMAIN

The methods in the spatial domain are most often used in the stego programs because of the good hiding of the messages, the big stego capacity and the easy realization.

One of the best literary surveys about these steganographic methods is made in [2], as the methods of replacing the least significant bit LSB (Least Significant Bit) [5], [3], [4], [9] and BPCS (Bit Plane Complexity Segmentation) [8] are added to them. The direct methods embed information directly in the bits of the image carrier.

The method of replacing the least significant bit is the most wide spread method among the methods of spatial domain change. LSB in one image carries in itself least information. It is clear that the human perceptions cannot sense change in this bit.

Actually, the change in LSB is noise which can be used for embedding a hidden message. In images in which every pixel is coded with one byte, the size of the embedded information by this method can reach up to 1/8 of the size of the file carrier.

The nature of the LSB method can be illustrated with the following example.

We have binary sequence with 9 bytes in a still image file with a graphic carrier in BMP format:

```
(11000100 00110001 01000101)
(01010110 10010100 01010101)
(10101101 00100101 11010100)
```

In this sequence every number of pixel of the carrier file is presented with 8 bits as the least byte is the first from the sequence. Because of the imperfection of the human sight the change of the last bit will not be noticed by the person looking at the image [12].

Let us, in the following fragment of digital carrier, hide the number 123 presented with the binary number **01111011**. The modifying of the block of binary numbers is completed by replacing the least significant bits from every byte with binary digit from the presentation of the number 123 (this is the hidden message) starting from the least significant byte.

The result is:

```
(11000100 00110001 01000101)
(01010111 10010101 01010100)
(10101101 00100101 11010100)
```

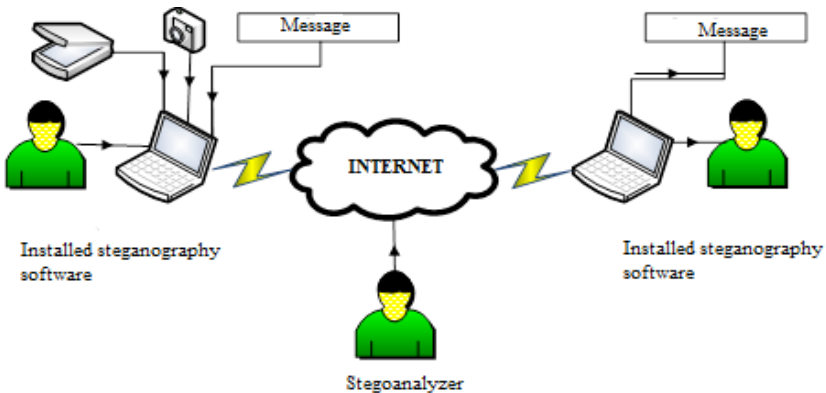


Figure 1. Chart of communication

With the LSB method there are two possible schemes for embedding the hidden messages - linear and shuffled. An example presents the first scheme. The shuffled embedding [7] shuffles the message at random in the bytes of the whole carrier. The methods LSB can be divided in two main types - LSB replacement and LSB matching [5]. In the first type there is a direct replacement of the least significant bytes with those of the message. In the second type we have selected bytes whose least significant bits of the carrier coincide with the bits of the message. As a result the statistical characteristics and the other characteristics do not change significantly in the file carrier[8].

The chart of communication between the sender of the message and the receiver is shown on figure 1. To achieve the goal the message, which has to be hidden, is input in the steganography software, installed on the computer of the sender, who chooses an appropriate image for the container and creates a new stego image. It is sent to the addressee by means of Internet. He in turn reads the confidential message ,using the same steganography software on his computer.

3. EXPERIMENTAL RESULTS

The offered algorithm can work with BMP, PNG, GIFF and TIFF image file formats with no restriction in the size. As it has no block for preliminary compression the maximum size of the information which will be embedded in the image is fixed depending on the size of the carrying file minus the header information. The size of the stego file must be identical to that one of the carrying file. The visual presentation of the program system is shown in figure 2 where in (a) we can see the type of the format and the necessary fields which must be completed in order for the confidential information to be embedded in a chosen image. In (b) we can see the actions and fields which are used for the information to be extracted from the stego image.

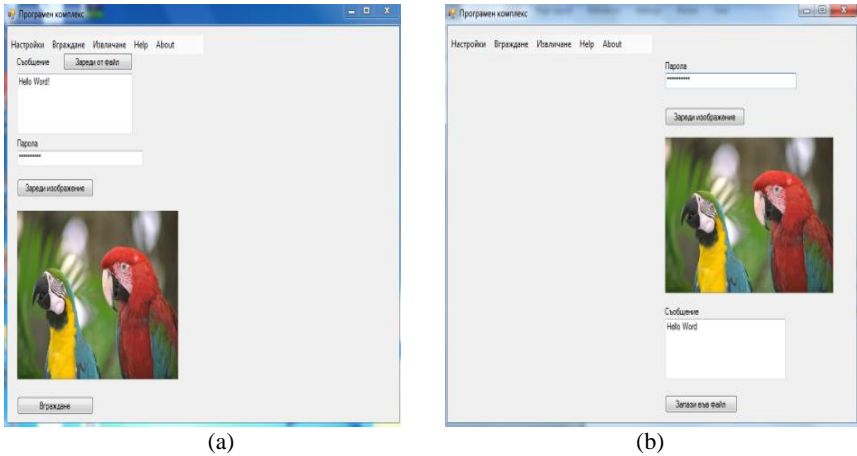


Figure 2. Program system with (a) embedding and coding of the message, (b) extracting and deciphering of the secret message in the image

As a result of the system work we get a stego image containing the confidential information which can be sent to the receiver via non protected channel without arousing any interest in the information in any spying party.

The digital color images are stored in files with 24-bit format and used RGB (Red, Green, Blue) color model [2]. This is precondition for a big informational excess which can be used for the purposes of the steganography.

For realizing of the functions for embedding and extraction of data in the covering image we have chosen the principle of steganography by modification [1] in which the covering images exist preliminary and when embedded they change. We use a method inserting the least significant bit (LSB) which is often used and an easy way for hiding information in an image [1], [13]. We make embedding of the message bits in the least significant bits of the color components of particular pixels from the image. The algorithm is symmetrical, i.e. when embedding and extracting a message identical operations are executed in one and the same order. The essence of the algorithm is based on the fact that the secret information is written in the least significant bits of the pixels of one image with no visible differences in its look.

In figure 3 we have a block scheme of an executed algorithm in which we have a verification if there is data input or no. With the help of a conditional block we check what operation will be executed then we go to embed or extract the confidential information.

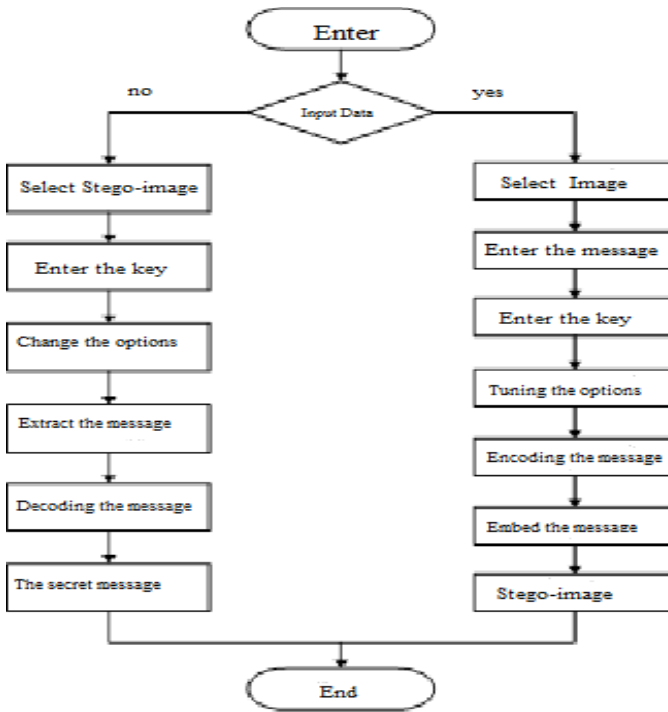


Figure 3. Block scheme of the program system

When entering one and the same key in the party which transfers and the party which receives the message by generating a sequence of random positions of the pixels in the image the sequence is identical in the both images and in this way embedded message can be restored correctly. When entering a wrong password from the recipient we have different sequences and the read bits will not be from the hidden message.

In the concrete realization the method consists of several main steps:

1. Embedding a confidential message:
 - Enter the text which must be hidden;
 - Choose the image which must be hidden;
 - Create a key (password);
 - Choose the settings;
 - Embed the message;
 - Save the stego image.
2. Extracting the confidential message:

- Load the stego file;
- In order to extract information the user must input a key;
- The extraction of information is executed;
- After completing the information the message is stored in a file.

Important characteristics which are defined in the course of the program work are: length of message, the pixels for reading and saving, the reading and saving of the concrete bits.

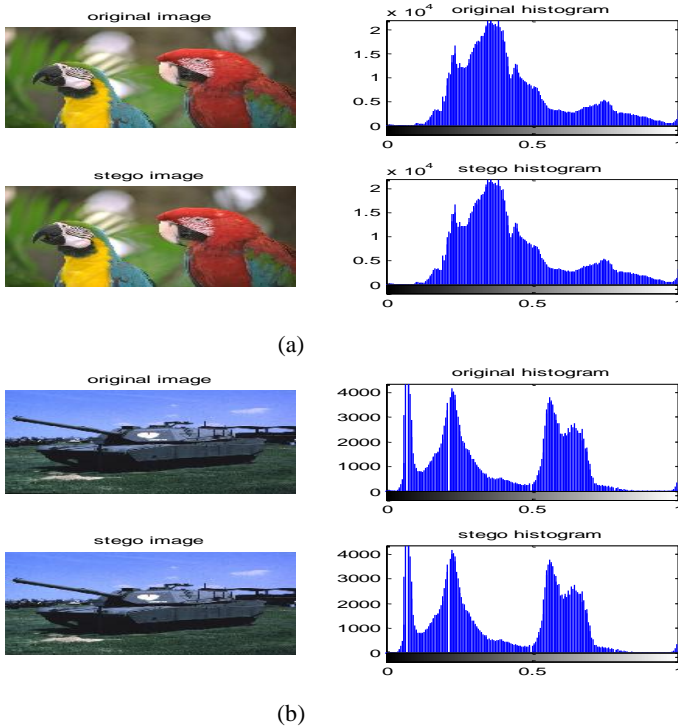


Figure 4. Histogram of original image and stego image: (a) *parrots.bmp*, (b) *amf10.bmp*

The statistical characteristics of the stego image remain the same as those of the original image which can be seen from figure 4 where there are a histogram of the original image and a histogram of the stego image and there is no difference in (a) and (b).

The statistical characteristics with which we check the same in the studied couples images are Signal-to-Noise Ratio (SNR), Peak Signal-to-Noise Ratio (PRSN), Mean Squared Error (MSE) and Structural Similarity Index for measuring (SSIM). They are calculated with the help of integral features of the programming environment Matlab 2014a version. In the same environment are received and histograms of the images. By implementing a program system for embedding/ extracting text messages many tests with different size messages and images have been carried out. The studied algorithm is based

on the LSB method applied and tested on BMP image formats. Test results of the qualitative characteristics MSE, SNR, PSNR, SSIM and E are analyzed.

Table 1 presents the results of the qualitative characteristics of embedded text files in English with a size of 170 to 240 kB and cover digital image parrot.bmp is used.

Table 1. Qualitative characteristics of parrot.bmp image in embedding a different size of the secret message

Size	MSE_{av}	SNR	PSNR	SSIM	E
170B	$2,6809e^{-5}$	79,4718	86,2179	1	7.6200
300B	$4,471e^{-5}$	77,2806	84,0267	1	7.6200
600B	$9,081e^{-5}$	74.2614	81,0075	1	7.6200
10kB	0,0015	61,9987	68,7448	1	7.6202
30kB	0,00455	57,2162	63,9623	1	7,6204
40kB	0,00485	56,0551	62,8012	1	7,6204
50kB	0,0076	55,0116	61,7577	0,998	7,6207
60kB	0,0089	54,2661	61,0122	0,998	7,6208
70kB	0,0125	52,7076	59,7072	0,998	7.6209
80kB	0,0178	51,2512	57,9974	0,998	7.6215
120kB	0,0355	48,2430	54,9891	0,997	7.6224
240kB	0,0355	48,2429	54,9890	0,997	7.6224

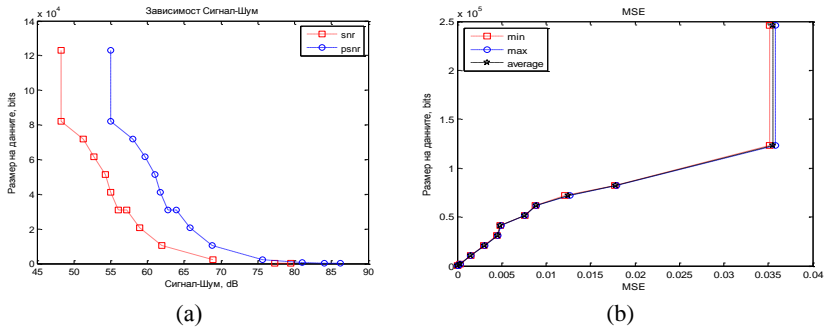


Figure 5. Dependence of (a) SNR and PSNR and (b) MSE_{av} . for parrots.bmp mage for values of 170 to 240 kB

The difference between the minimum and maximum value of MSE is difficult to establish because the change is only in the thousands. The average MSE_{av} was obtained as the average of the minimum and maximum MSE and is visualized in the graph of Figure 5(b).

4. CONCLUSIONS

Steganography use in the spatial domain reaches best results concerning the histograms of the stego images which restricts the possibility for them to yield to the modern stegoanalysis. It is recommended to use scattered embedding because its interception from the stego analyzing programs is harder. By increasing the size of the embedding data

the statistical characteristics of the images deteriorate, although, the visual quality of the images processed with steganography system remains excellent.

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SERVICES PROVIDED BY CERT AND THEIR ROLE IN THE MANAGEMENT OF INCIDENTS

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***Abstract:** In this report are considered the services provided by the CSIRT and their importance for the management of incidents.*

***Key word:** computer security incident response team, services, incident, incident management.*

At the end of the 20th and beginning of the 21st century we have seen the process of globalization, which have new patterns of communication between people and between the institutions in which they found wide application and information technology.

The development of this type of communication provides a number of benefits to the people. At the same time there appeared a multitude of strangers to this point risks and threats posed by the vulnerabilities of information resources used by people and organizations for the implementation of the connection between them. Authority to manage and respond to these vulnerabilities is a CSIRT (incident response team security Computer) the services provided by these teams are the subject of this report.

CSIRT services can be grouped into three categories:

Reactive services. These services are triggered when an event, such as a report for violation, wide distribution of malicious code, vulnerabilities in software, or something that is identified by intrusion-detection system. The Jet facilities are a major component of the CSIRT work.

Proactive services. These services provide assistance and information to help prepare, protect and ensure the constituent systems in anticipation of attacks, issues, or events. Making these services will directly reduce the number of accidents in the future.

Quality management services. These services extend the existing and well established facilities, which are different from the treatment of an accident. This kind of services can give an idea of helping improve the overall security of the Organization and identification of risks, threats and system vulnerabilities. These services are typically proactive, but indirectly contribute to a reduction in the number of accidents.

Some services have both reactive and proactive side. For example, the vulnerability may be carried out in response to the discovery of the vulnerability, which is actively used. But this can also be done proactively by reviewing and testing the software to determine where vulnerabilities exist, so that the problems can be fixed before they are widely known or used.

Descriptions of services are designed to meet the requests for assistance, incidents of a CSIRT, as well as any threats or attacks against the CSIRT. Some services may be initiated by the notification of a third country or by the monitoring systems.

This service alerts and warnings include the dissemination of information that describes an intruder, vulnerability, intrusion alert, computer virus, or a hoax, as well as the provision of short-term recommendations of action for dealing with the problem. Information can be created from the CSIRT or can be reallocated from vendors, other CSIRTs or security experts, or other parts of the constituency.

Manual handling accident incident is related to the receipt, allocation and answering queries and reports, and analysis of incidents and events. Specific activities associated with the reaction may include :

- measures to protect systems and networks, affected or threatened by the offender's activities
- provide solutions and strategies for mitigation of the newsletters or alerts
- search activity of the offender on the other parts of the network
- filtering of network traffic
- repair of systems
- development of other strategies for response.

Since the accident are implemented in different ways by different types of CSIRTs, this service is further categorized depending on the type of activities carried out and the kind of assistance as follows: Accident analysis. There are many levels of accident analysis and very under-services. Essentially, incident analysis is a review of all available information and evidence in its support or artifacts related to the incident or event. The aim of the analysis is to determine the extent of the accident, the extent of the damage caused by the incident, the nature of the incident, as well as the available strategies to respond or bypass. CSIRT may use the results of vulnerability and artifact analysis (described below), to understand and to provide the most complete and up-to-date analysis of what happened on a particular system. The CSIRT correlated activity in incidents to identify all relationships, its trends and patterns. Two under-service, which can be carried out as part of the analysis of the incident, according to the mission, goals and processes of the CSIRT, are:

- Forensic evidence collection: collection, preservation, documentation and analysis of data from a compromised computer system for the determination of changes in the system and to assist in the reconstruction of events leading up to the compromise. This collection of information and evidence should be carried out in a way that documents provable chain of custody that is admissible in a Court of law in accordance with the rules of evidence. Tasks that are involved in the collection of forensic evidence, include (but are not limited to) making a copy on the hard disk of the system; check for changes to the system, such as new programs, files, services, and users; take a look at the running processes and open ports; and check for Trojan horse programs and sets of instruments. CSIRT staff performing this function may also need to be prepared to act as experts in legal proceedings.

- track: tracing the origin of an intruder or the identification of the systems to which the attacker had access. This activity may include tracking the way in which the attacker has entered the affected systems and related networks systems were used.

Response to the incident on site. This service includes all actions taken at the local level, which is necessary if there is suspicion or occurrence of the incident.

Incident response support. Assist the CSIRT and guides of the victim (s) of the attack in the reconstruction of the incident by telephone, email, fax or documentation. This may include technical assistance in the interpretation of the data, providing contact information, or relaying instructions regarding mitigation and recovery strategies.

Coordination of the response to the incident. The CSIRT coordinates response efforts between the parties involved in the accident. This usually involves the victim of the attack, other objects involved in the attack. This may include countries that provide it support to the victim, such as Internet service providers, other CSIRTs and system and network administrators of the site.

Handling of vulnerability: associated with receiving information and reports for hardware and software vulnerabilities; analyzing the effects of vulnerabilities; development of response strategies for the detection and repair of vulnerabilities. Since the processing operations are carried out vulnerability in different ways by different types of CSIRTs, this service is further categorized depending on the type of activities carried out and the type of assistance provided as follows:

Analysis of vulnerability. CSIRT performs technical analysis and research of vulnerabilities in hardware or software. This includes checking suspected vulnerabilities and technical check of the hardware or software vulnerability is defined as where is it and how it can be used. The analysis may include a review of the source code, as used for the correction of errors, to determine where it happens, vulnerability, or trying to replicate the problem on a test system.

Response to the vulnerability. This service includes the establishment of an appropriate response to mitigate or remedy the vulnerability. It also includes notification of others about the strategy to mitigate the effects through the creation and distribution of ballots.

Vulnerability response coordination. This service may include communication with suppliers, other CSIRTs, technical experts, members, and among individuals or groups that initially were discovered or reported the vulnerability. Activities include facilitating the analysis of vulnerability or vulnerability report; coordinating schedules for release of relevant documents, synthesis of technical analysis, carried out by different experts. This service may include the maintenance of a public or private archives of knowledge about information on the vulnerabilities and corresponding strategies for response.

Artifact management Artifact is any file or object found in a system that can participate in the drilling or attacking systems and networks, or that are used to protect from security measures. Artifacts may include, but are not limited to computer viruses, Trojan horses, worms, use scripts, as well as sets of tools.

Artifact handling is related to getting information for copies of artifacts that are used by the offender to carry out the attacks, intelligence and other unauthorised or destructive activities. Because the artifacts are implemented in different ways by different types of CSIRTs, this service is further categorized depending on the type of activities carried out and the type of assistance provided as follows:

Artifact analysis. The CSIRT performs technical testing and analysis of every artifact found in one system. The analysis may include identifying the file type and the structure of the artefact, comparing the new artifact with existing artifacts or other versions of the same artifact to see similarities and differences.

Artifact response. This service includes the determination of the appropriate actions to detect and remove artifacts from the system as well as action to prevent artifacts from the installation. This may include the creation of signatures, which can be added to the antivirus software or IDS.

Coordination of the response of the discovered artefacts. This service includes sharing and aggregation of the results of the analysis and the strategies for response, referring to an artifact with other CSIRTs, vendors, researchers, and other security experts. Activi-

ties include informing the others and synthesizing technical analysis from different sources. Activities may include maintaining a public archive of famous artifacts and their effects and appropriate response strategies.

Proactive Services are designed to improve the processes of the infrastructure and security of voters before any incident or event that occur or are detected. The main objectives are to avoid accidents and to minimize their impact and coverage when they do occur.

Notices That includes, but is not limited to, intrusion alerts, warnings about vulnerabilities, and newsletters. These messages inform the voter for newly discovered vulnerabilities or disruptive tools.

Review of technology this service includes reading mailing lists, Web sites, security for security, as well as current news and magazine articles in the fields of science, technology to extract information related to security of systems and networks. This may include communication with other countries who are authorities in these areas to ensure that you receive the best and most accurate information or interpretation. The result of this service could be some kind of announcement, guidelines, or recommendations, aimed at medium-and long-term security issues.

Security audits or evaluations this service provides a comprehensive review and analysis of the security infrastructure of the Organization, on the basis of the requirements laid down by the organization or by another standard. It may also include a review of the Organization's security practices.

Configuration and maintenance of tools, applications, infrastructure and services this service identifies or provides appropriate guidance on how to configure and maintain tools, applications and common computing infrastructure used by the CSIRT. The CSIRT can also configure and maintain servers, desktops, laptops, personal digital assistants (PDA) and other wireless devices in accordance with the guidelines for security. This service includes escalating to the management of any questions or problems with the configuration or use of tools and applications that the CSIRT believes, can leave the system vulnerable to attack.

Development of security tools this service includes the development of new, specific tools that are needed or desired by the CSIRT. This may include, for example, the creation of security patches for custom software used by constituency or secured software distributions, which can be used to restore damaged resources. This may include the development of tools or scripts that extend the functionality of existing security tools.

Facilities for detecting intrusions CSIRTs that perform this service analyzed and initiate a response for all kinds of events, send any signals, under an agreement for a predetermined level of service. Discovery and analysis can be a daunting task, not only in determining the place of placement of the sensors, but collects and then analyze large volumes of data. In many cases, specialized tools and expertise required to synthesize and interpret information to identify false alarms, attacks, or network events and implement strategies to eliminate or minimize these events. Some organizations choose to outsource this activity to others who have more experience in carrying out these services, such as managed security services.

The dissemination of information related to security, this service provides a comprehensive and useful information that helps improve security. Such information may include :

- guidelines for reporting and contact information for the CSIRT

- archives of alerts, warnings, and other messages
- documentation for best practices
- security guidelines
- policies, procedures and checklists
- development and dissemination of information
- the current statistics and trends in the reporting of accidents
- other information that can improve the general security practices

Quality management services of security services that fall into this category are not unique to CSIRTs. They are well known, established facilities designed to improve the overall security of an organization. These services are designed to incorporate the feedback and lessons learned on the basis of the knowledge gained by means of responding to incidents, vulnerabilities and attacks.

Risk analysis CSIRTs may be able to carry out risk analysis and assessments. This can improve the Organization's ability to assess real threats, to provide realistic qualitative and quantitative assessments of risks to information assets, and to assess the protection and response strategies. CSIRTs, performing this service will assist in risk analysis activities on information security for the new systems and business processes, or evaluation of threats and attacks against assets and systems.

Business Continuity and Disaster Recovery planning based on any events until now, and future forecasts for emerging incidents or security, more and more incidents have the potential to lead to serious deterioration of business operations. Therefore, you need to plan and efforts to choose the best way to respond to such incidents by ensuring continuity of business operations.

Security consulting CSIRTs can be used to provide advice and guidance on best practices for security, to be put into effect. This service includes providing advice and assistance in the development of organizational or electoral security policies. It may also include the giving of testimony or advice on legislative or other governmental authorities.

Awareness raising general awareness about security not only improves the understanding of the security issues, but also helps them to carry out their daily operations in a secure manner. This can reduce the appearance of successful attacks and increase the likelihood of detection and reporting of attacks, thus reducing recovery time and eliminating or reducing losses. CSIRTs, performing this service are looking for opportunities to raise awareness of security through articles, posters, newsletters, websites, or other resources that explain the best practices and provide advice on the precautions taken.

Education/training this service includes the provision of information to constituents about computer security issues, through seminars, workshops, courses and tutorials. These may include guidelines for the reporting of incidents, appropriate methods for respond, tools for responding to incidents, methods for preventing accidents, as well as other information needed to protect, detect, report and respond to computer security incidents.

Evaluation of product Certification or CSIRT may carry out assessments of products associated with resources, applications or other services to ensure the security of the products and their compliance with acceptable CSIRT or organizational security practices. This service can be provided either through the assessment and certification program, depending on the standards to be applied by the organization or by the CSIRT.

Experience has shown that whatever services the CSIRT, the Organization decided to offer the mother or the leadership must ensure that the team has the necessary resources

(people, technical expertise, equipment and infrastructure), in order to provide a valuable service to their constituents. In addition, it may be noted that in the event of changes in technology and the use of the Internet, you may experience other services need to be provided by CSIRTs. Hence this list of services will evolve and change over time.

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ANALYSIS OF THE OBJECTIVITY OF ASSESSMENT IN THE FIELD OF DISTANCE LEARNING

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Abstract: *One of the main problems of distance learning is the choice of instrument for measuring knowledge in the absence of direct contact between the examined and examiner. The paper discusses the question to what extent written papers allow for an objective assessment of students' knowledge. Recommendations on the use of written works for the control of students' knowledge in distance education are provided.*

Key words: *distance learning, review paper, written paper, objectivity of assessment, plagiarism, academic fraud, combat plagiarism*

INTRODUCTION

In recent years, distance learning has become extremely popular due to its flexibility and cost-effectiveness.

It has a significant contribution to improving access to education for audience, heterogeneous in age and social status and successfully fits into the concept of lifelong learning.

For its implementation modern technological tools are inevitably used to represent and transfer information, which usually attract the interest of young people. This educational form is attractive not only for working or family people, but also for the "Generation Z".

The use of e-learning, raises questions about the quality of education gained outside a traditional academic environment and objectivity in the assessment of knowledge, in the absence of direct contact between the student and the examiner.

OBJECTIVES, METHODOLOGY AND RESEARCH DESIGN

In the framework of Item Response Theory (IRT) the students' knowledge is objective and can be measured. For this purpose: oral interview, written exam, tests, essays, coursework, review, thesis projects, etc. are used.

In distance learning at universities of Bulgaria traditionally electronic tests and written papers on the topics of discipline are used.

The paper discusses the question to what extent written papers allow for an objective assessment of students' knowledge.

The aim is to obtain answers to the following questions:

1. Is there plagiarism in the students' written papers?
2. What is the degree of borrowings?
3. Can the written paper be the only element in the assessment?

4. In what cases, the evaluation of the written paper can participate in the formation of the evaluation in the discipline?

Assessment of knowledge in distance education

The written paper presents a means to check the productivity [1] of knowledge. It represents a summarized statement on a given topic as a result of analysis of a large volume of information in the subject area.

It contributes to the deepening and broadening of the preparation, develops the trainees' skills for systematization, structuring and analysis of information from various sources.

The estimation does not require direct contact between the student and the teacher that is why it is widely used in distance learning.

Despite these positive aspects of testing using the written paper, the problem of plagiarism cannot be ignored.

Plagiarism as a problem for the objective assessment

Plagiarism (from lat. plagio - steal) - is copyright infringement by illegal use of someone else's work without indicating the source.

It can exist in various forms [5]

- submitting someone else's text (or part of it) for copyright - verbatim copying;
- paraphrasing someone else's text or part of it and presenting it for copyright;
- plagiarism of patchwork type (from the English patchwork is the art associated with sewing together different pieces of cloth) is a compilation of several texts of other authors (or their parts);
- presentation of one and the same paper of the author under different titles and on different occasions – autoplagiarism.

In students' papers, plagiarism is usually caused by lack of knowledge on the subject, the inability to synthesize the author's text or the lack of motivation to cope with this task. In some cases it is involuntary, and because of incorrect citation of references. Because of incompetence, it is not perceived by students as a serious violation of copyright law.

Plagiarism, stimulated by the accessibility of electronic resources in the global network is becoming a serious and growing problem.

Plagiarism discourages authors of original texts, demotivates good students, makes it difficult for teachers, and compromises the objectivity of the evaluation.

To counteract this phenomenon software known as antiplagiarism system is being developed and offered (free or for a fee) to check the uniqueness of the text.

Software for automated test of uniqueness of texts (antiplagiarism systems)

These systems are software solutions to check the uniqueness of text documents or web sites. As a rule, they are with the intuitive interface, simple and easy to use. For many systems are developed versions that work offline and online. They differ in languages, algorithms used, the quality and speed of checking.

Despite the uniqueness of the algorithms used, the antiplagiarism systems work as follows:

1. Divide a document into phrases with a certain length.
2. Use a few well-known "search engines" at the same time (usually Google, Yahoo! or Yandex, etc.) for searching randomly selected phrases in web sites or documents.

3. Processed and show the results - where the phrases are found, how much was borrowed, i.e. the percentage of plagiarism.

Some of the most commonly used systems are: Copyscape, Antiplagiat, Advego Plagiatus, Text, Turnitin and more.

In many universities, including in Bulgaria, are incorporated automated systems to check the uniqueness of articles, theses and course works, dissertations, etc.

Methodology and research design

To test the thesis that plagiarism is an obstacle for an objective assessment, were analysed the results of the evaluation of the review papers in the discipline E-Commerce Security¹ for the distance learning students.

Students independently prepare a review on a chosen topic in certain subject area. The list of topics is prepared by the lecturer and announced at the beginning of the taught course. The development time is determined by the student and is limited only by the deadline.

The submitted papers participate in the formation of the assessment.

In addition, review papers written by Masters from part-time training courses in Information Technology Management, Software Marketing and Information Systems were also checked.

The scheme of assessment

In assessing the teacher follows linguistic rules, as for example:

1. The General idea of the course subject, if there are significant omissions, unassimilated specific terms, poor language – Fair (3);
2. Understanding of the presented material, the tolerance to inaccuracies in the terms used, relatively good language culture – Good (4);
3. Understanding the presented material and the ability to find the basic ideas, the adequacy of the terms used; good language culture – Very good (5);
4. Understanding and analysis of the material, the ability to go into details, precision of expression – Excellent (6).

The uniqueness of all developed review papers was checked with the systems Advego Plagiatus (<http://advego.ru/plagiatus>) и Text (<http://text.ru/doc-check>) with default settings.

The system Advego Plagiatus shows a degree of uniqueness in the form of two digits (XX%/YY%):

- XX% - the percentage of unique text from the total text (the percentage of verbatim copied text is subtracted);

- YY% - the percentage of the original text of the total text (the amount of rewriting is subtracted).

Copied texts are painted in yellow, the rewritten ones – in blue. If a match is found, the system indicates the address and percentage of the borrowings from this source (Fig. 1).

¹ Project BG051PO001-4.3.04-0016 "New opportunities for lifelong learning by upgrading distance education Centre at the Vasil Levski National Military University according to the scheme of grand BG051PO001-4.3.04 "Development of electronic forms of distance learning in higher education" of the operational program "Human resources development", co-financed by the European social Fund of the European Union.

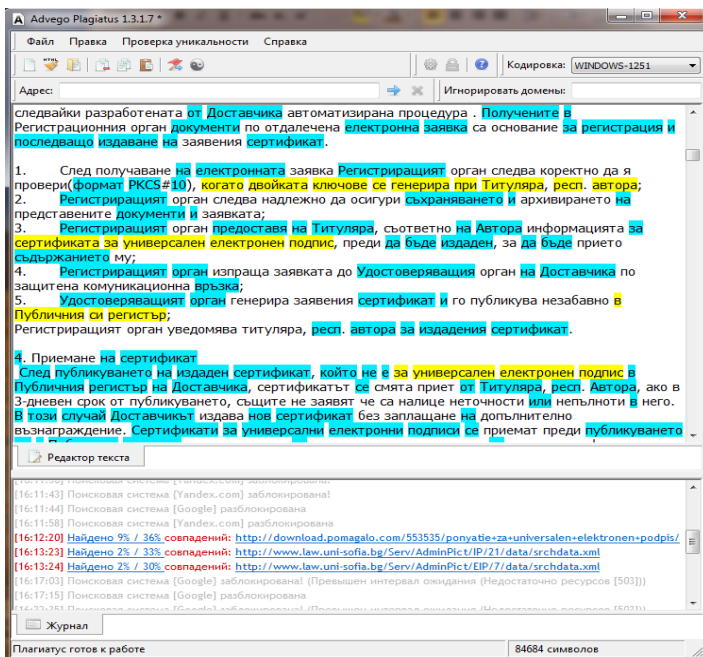


Fig. 1. The result of the work of Advego Plagiatus

RESULTS AND DISCUSSION

Despite the fact that the students were notified about the upcoming test of uniqueness of texts, the system showed a high percentage of borrowings.

28 review papers were checked. Some of the results are shown in table 1.

Table 1. Check results for the uniqueness of the review paper

Review paper Topic	Text uniqueness ADVEGO (Number of checked sources)	Sources address ADVEGO	Text uniqueness TEXT.RU	Sources address TEXT.RU
eMAG.bg e-commerce site analysis	79%/100% (2732)	www.focus_new.net www.mzone.bg www.interactive-share.com	57.05%	www.pefepati.net// - 18% www.download.pomagalo.com/ - 8% www.referati.org/ocenka-na-silnite-i-slabi-strani...goviqta/ - 8% www.znanieto.net/virtuemart/details/7727/53/Икономика/ - 8%
E – Commerce - the essence, advantages and disadvantages	74%/42% (52)	http://znanieto.net http://www-it.fmi.uni-sofia.bg	21.85%	www.download.pomagalo.com/1107324/elektronna_tyrgoviya...mstva_i_nedostatyci/ - 35% www.download.pomagalo.com/433004/ocenka_na_silnite_i_s...ani_na_etyrgoviyata/ - 6% www.znanieto.net/virtuemart/details

				/7727/53/Икономика/ - 30% www-it.fmi.uni-sofia.bg/courses/html - 21%
www.technopolis.bg e-commerce site analysis	100%/100% (1236)	-	88.48%	www-it.fmi.uni-afia.bg/courses/BonI/chapter3.html - 8% advertisingbg.wordpress.com/ - 6% www.helpos.com/ - 5%
Viral Marketing	74%/42% (348)	http://download.pomagalo.com http://internetreclama.com	49.2%	internetreklama.com/75/?-37% www.referati.org/virus-marketing-i-reklama/16642/ref/p25 - 16%
E-commerce as an opportunity to expand market	72%/19% (8207)	www.referati.org www.kaminata.net		
Electronic signature and electronic certificate	65%/35% (2264)	www.referati.org www.tampit.org	52%	www.bcci.bg/bulgarian/ecertification/Q&A.htm - 23% www.referati.org/elektronen-podpis/85853/ref/p7 -22
SILABG.COM e-commerce site analysis	85%/31% (1485)	http://znanieto.net www.referati.org	57.15%	www.znanieto.net/virtuemart/details/7823/53/Икономика/-ТЪРГОВИЯ-В-ИНТЕРНЕТ - 19% www.kaminata.net/elektronna-targoviya-v-internet-t96114.html - 15%
Security of e-commerce	1%/0% (1248)	http://juliannachev.blogspot.com http://www-it.fmi.uni-sofia.bg	0%	www.juliannachev.blogspot.com/ - 100%
Electronic signature and electronic certificate	98%/57% (272)	-	92,26%	www.download.pomagalo.com/553535/ponyatie_za_universal...n_elektronen_podpis/ - 2%

Similar results were obtained in the verification of the uniqueness of thesis and course projects in the disciplines of "Management of Information Technologies", "Software Marketing" and "Information Systems".

Analysis of the results

1. Plagiarism is a mass phenomenon. The results show that about 70% of the students present non-original papers. About 30% of the papers have a high uniqueness.
2. Motivated students are less prone to plagiarism.
3. The difference in results of Antiplagiat Systems is due to the algorithms used, random selection of phrases and sites for inspection.
4. Most of the texts are copied from the websites of the companies that keep text documents databases and distribute them for a fee, or other benefits.
5. The Antiplagiat System cannot establish authorship on the original texts.
6. The establishment of plagiarism in student work through a system of antiplagiat is a personal initiative of the teacher.

Conclusions

1. The students' review papers be used as a measuring tool of knowledge after checking the text for uniqueness. At low uniqueness they cannot participate in the evaluation grade formation.
2. In the case of a high degree of uniqueness, authorship and grade formation in the discipline should be established in the oral interview process.
3. Checking for uniqueness takes a lot of time. With the large academic load of teachers, constant checking is an impossible task.
4. Effective Anti-Plagiarism can be achieved by introducing administrative measures.
5. The administration of universities does not exhibit a sufficient degree of intolerance to students' plagiarism. This is due to the nature of the relationship "seller – buyer“, which is difficult to regulate in the field of education.
6. Many of the students are not interested in gaining knowledge in a particular area. They seek to obtain a diploma with the least possible effort.
7. To assess the knowledge in a discipline, it is advisable to use course projects that are analytical in nature and may include self-study [3]. Topics should be prepared very carefully to limit the possibility of direct plagiarism from the network

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ПЕРСПЕКТИВИ В ИНФОРМАЦИОННИТЕ И КОМУНИКАЦИОННИ ТЕХНОЛОГИИ ЗА ПОВИШАВАНЕ НА СИГУРНОСТТА И ОТБРАНАТА

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PROSPECTS IN INFORMATION AND COMMUNICATION TECHNOLOGIES FOR ENHANCEMENT OF SECURITY AND DEFENCE

Ivan P. Ivanov¹, Rosen S. Iliev²

Abstract: New technologies are an important element for achieving military superiority and to ensure high defense capabilities. Technology trends survey is integral part in Defence Planning Process. The article examined the prospects in information and communication technologies and the possibilities for their application in priority investment projects of the Ministry of Defense and the Bulgarian Army.

Keywords: communication and information systems technologies trends, defence, security, investment projects.

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Анотация: Новите технологии са важен елемент за постигане на военно превъзходство и за осигуряване на високи отбранителни способности. В материала са разгледани перспективите в информационните и комуникационните технологии и възможностите за приложението им в приоритетните инвестиционни проекти на Министерството на отбраната и Българската армия.

Ключови думи: технологични тенденции в комуникационните и информационните системи, отбрана, сигурност, инвестиционни проекти.

УВОД

Новите технологии са важен елемент за постигане на военно превъзходство и за осигуряване на високи отбранителни способности. Както се отбелязва в Стратегическата концепция на НАТО, "Редица значими тенденции, свързани с технологиите ... изглежда ще имат важни глобални последици, които ще се отразят на военното планиране и операциите на НАТО." [4]

Ако се разгледа развитието на войните и конфликтите в миналото се вижда, че стратегията и тактиката на воденето им се променят в резултат от наличието и използването на нови решения и технологии. Като пример може да се посочи първото в света използване на самолета за военни цели от българите при превземането през 1912 г. на смятаната дотогава "непревземаема" Одринска крепост

(Поручиците Радул Милков и Продан Таракчиев в разузнавателен полет извършват бомбардиране от въздуха с две бомби на жп. гара Караагач.).

В едно изследване на НАТО за тенденциите в развитието на технологиите, публикувано в началото на 2015 година [5], особено внимание се отделя на перспективите в биотехнологиите, роботиката, информационните технологии, нанотехнологиите, развитието на енергийните системи и др. Както се отбелязва в него, средата на сигурност продължава да става все по-сложна. Нарастващата достъпност до интернет, интелигентни устройства и мобилни приложения само ще увеличи достъпа до по-широк спектър от технологии. Намаляващите цени на много технологии и бързите промени в производството ще увеличат наличността на сравнително евтини оръжия, които биха могли да компенсират по-сложни и все по-скъпи системи, използвани от НАТО и други военни организации. Бързата промяна в технологиите през следващите десетилетия почти сигурно ще има значително влияние върху характера на воденето на война и на военните операции в бъдеще. В същото изследване се прогнозира, че технологичното превъзходство на НАТО при последните конфликти ще ерозира в бъдеще като възможните противници ще развият иновативни начини да се възползват от евтини и сравнително прости технологии и продукти с възможна двойна употреба, предлагани на пазара. Способността да се развива микро-производство и бързо да се преминава от проектиране до прототип и съответно до завършен продукт ще бъде мощна сила. Затова силите от НАТО трябва да се възползват от възможните асиметрични слабости и да оценяват навреме последствията от нововъзникващите технологии, чието прилагане може да бъде потенциална заплаха за сигурността [5].

РАЗВИТИЕ НА СЪВРЕМЕННИТЕ ИНФОРМАЦИОННИ ТЕХНОЛОГИИ

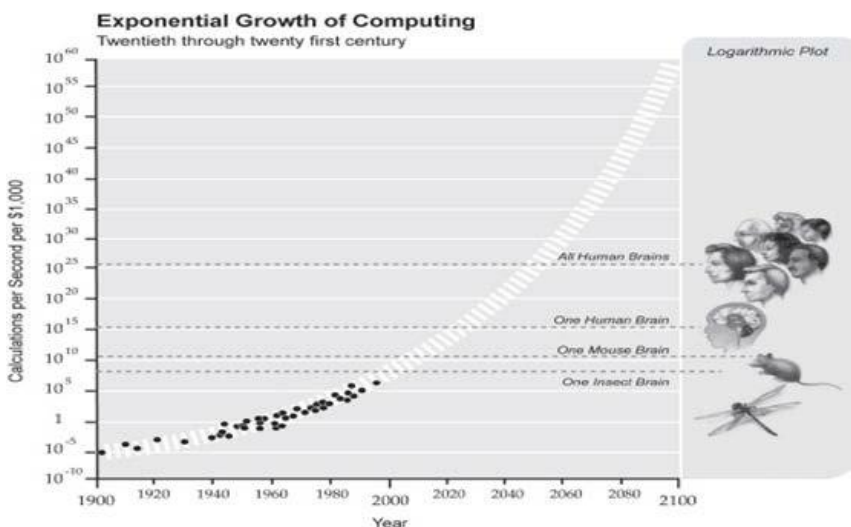
В посоченото по-горе изследване на НАТО се обръща особено внимание на развитието на някои съвременни информационни технологии, които ще бъдат разгледани по-подробно, в съответствие с направения анализ за тях в [5]: Изчислението (Computing); Интернет на нещата (Internet of Things); Изкуствен интелект (Artificial Intelligence); Големи масиви от данни (Big data); Социални мрежи (Social Networks); Комуникации (Communications); Сензори (Sensors); Компютърно моделиране (Computational Modelling); Киберзащита (Cyber Protection) и др.

Изчислителната мощност (Computing) е функция на броя на транзисторите, съдържащи се в чиповете с които работят компютърните системи. Но с нарастването на тяхното количество на единица площ скоро ще се достигне до границите на тяхната материална основа - силиция, т.е. молекулярната структура на силиция на атомно ниво в крайна сметка ще представи ограничение за броя на транзисторите, които могат да бъдат интегрирани върху компютърните чипове. Като резултат, в следващите 10 - 15 години, производителите ще бъдат изправени пред необходимостта да търсят други материали или да използват нови производствени техники.

На фиг. 1 е показана възможността за експоненциално нарастване на изчислителната мощност през близките няколко десетки години.

Нарастващият спад в цената на простите компютърни чипове ще позволи широкото им приложение в много елементи на всекидневния живот (домакински уреди, дрехи, къщи и др.) Тази технология, наречена "*Интернет на нещата*" - (IoT) позволява интеграция на отделните домашни устройства и възможност за

тяхното "общуване" и изпълнение на определени функции в бъдеще, без необходимостта от участие на човека.



Фиг. 1. Експоненциален растеж на изчислителната мощност /Computing/ (от Kurzweil)

Квантовите изчисления (*Quantum computing*) е друга перспективна тенденция в развитието на компютърните технологии. Чрез овладяване на квантовото състояние на електроните, компютрите ще могат да правят едновременно по няколко изчисления, което ще води до значително подобряване на скоростта, с евентуално достигане и надхвърляне на бариерата от 5 exaFLOPS (5×10^{18} Floating-Point Operations Per Second). Тези свойства ще бъдат особено полезни в криптографията, широкомащабното моделиране и работата с големи бази данни.

Огромни количества данни ще продължават да текат през компютърните мрежи и да бъдат обработвани от високопроизводителни сървъри. Използването на интернет, само през последното десетилетие е нараснал повече от 4,4 пъти! Повишената изчислителна производителност в съчетание с подобрения софтуер ще бъдат от ключово значение за развитието и използването на технологиите на бъдещето. Уеб приложенията ще достигнат много по-високи нива на мощност и сложност. Контекстуалното програмиране ще позволи на търсачките да намират информация не само на базата на избрани ключови думи, но също и да разпознават замисъла на търсенето и да предлагат по-пълна и целенасочена информация.

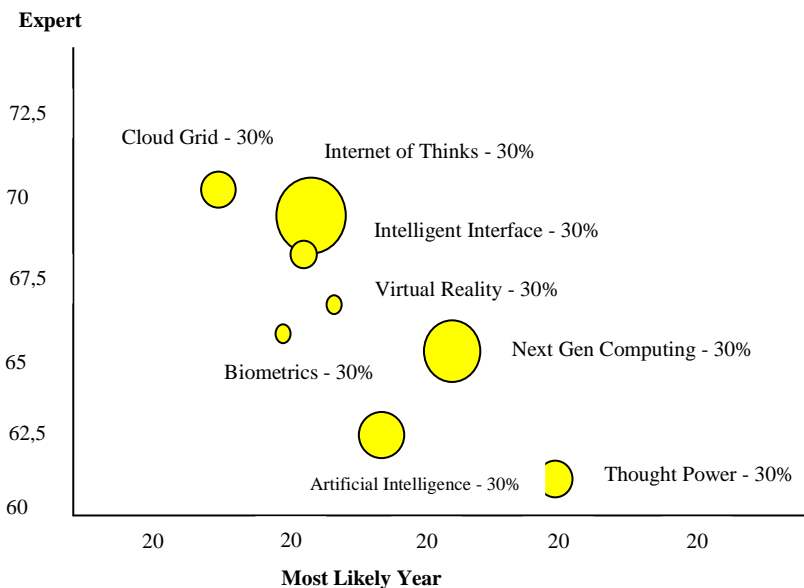
Внедряването на *Изкуствения интелект (Artificial Intelligence)* тепърва започва, като с негова помощ се извършва разпознаване на реч, езиков превод, разработват се системи за подпомагане вземането на решения и др. Пристъпва се към все по-голяма интеграция на човека и машината, използвайки нови интерфейси - чрез говор или жест с интелигентни компютри. Някои от тези възможности вече съществуват в системи като Microsoft Kinect.

Повишаването на изчислителната мощ, съчетано с усъвършенстване на софтуера, е от ключово значение за развитие на ИТ-технологиите в бъдеще. С използване-

то на *облачните технологии*, позволяващи консолидация на хардуерните ресурси и услуги, постепенно ще отпадне нуждата от използване на локални устройства и сървъри за съхранение на информацията, а потребителите ще имат само мрежови устройства за достъп до тези услуги. Всички проблеми, свързани със съхранението, резервирането и донякъде защитата на данните ще бъдат поверени на "информационния провайдер", както е например, при телефонните услуги.

Количеството данни днес нараства с 250 милиарда гигабайта всеки ден, което налага въвеждането на нови техники за анализ на *Големи масиви от данни ("Big Data")*. В момента, добиването на данните е процес от две стъпки: информацията първо се натрупва в базата, а след това, когато е необходимо, се анализира. Новите техники за автоматичен преглед на данните ще позволят анализа да се извършва едновременно с обработката на данните и в базата ще се съхранява само най-важната информация за всеки потребител въз основа на неговите предпочитания или дейности [5]. Това ще позволи данните да бъдат нормализирани и категоризирани за по-късно претърсване и за съчетание с мета-данни, като географски, демографски, езикови и др.

На Фигура 2 е показана прогноза за развитие на технологиите през следващите 15 години.



Фиг. 2. Прогноза за развитие на технологиите до 2030 г. [5]

Социалните мрежи от няколко години набират все по-голяма скорост и вече масово се използват от всички възрастови групи. В момента над 47% от възрастното население на Запада използва приложения на социалните мрежи, като най-бързо растящият пазар на Twitter е в Саудитска Арабия, където 51% от саудитците имат акаунт. Изследванията също така показват, че индивидуалното поведение, настро-

енията и дейности имат измеримо въздействие чрез социалните мрежи върху другите. Диаграма на разпространение на социалната мрежа Facebook е показана на Фигура 3.



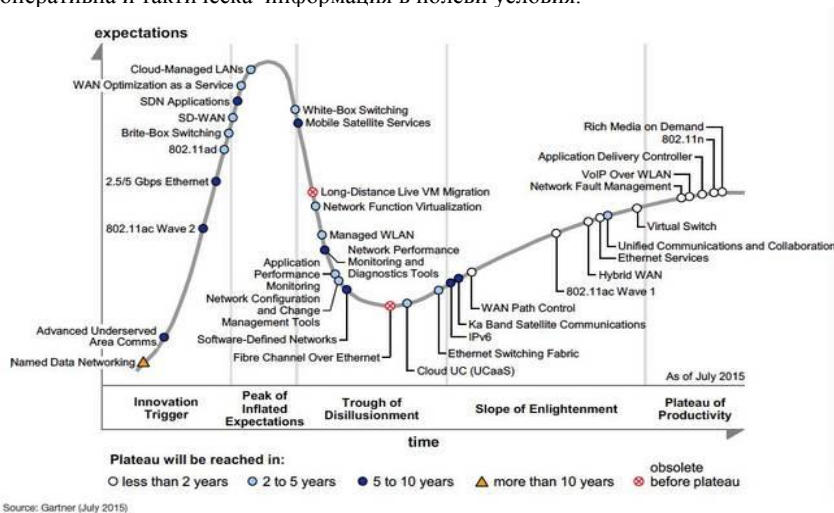
Фиг. 3. Диаграма на разпространението и използването на социалната мрежа Facebook (standingoutinmyfield.wordpress.com/tag/network/)

В световен мащаб, повече от 34% от хората използват интернет за да си взаимодействат едни с други. Този все по-нарастващ информационен обмен изисква и усъвършенстване на *комуникационните технологии*. Според Института за бъдещо развитие (Institute For The Future - IFTF) новите комуникации ще еволюират в три ключови технологии: безжична комуникация, сензори и семантични решения. А според Gartner [3], организациите трябва да трансформират своите мрежи в унисон с развитието на новите технологии с все по-широко използване на виртуализацията, облачната свързаност, мобилността и др. Gartner, през тази година, проследяват и анализират 35 важни технологии за изграждане на мрежи, категории продукти и услуги (вж. фиг. 4). Сред тях са: Brite-Box Switching, 2.5 / 5 Gbps Ethernet, 802.11ac Wave 2, SD-WAN и др.

Начинът, по който хората си взаимодействат чрез новите технологии за комуникация ще продължи да се променя с течение на времето. Утрешните мобилни комуникационни устройства (Mobile Communication Devices - MCD) ще бъдат интегрирани с бордови технологии в състояние на "изкуствено интелигентно поведение" и по-пълно отразяване на нуждите на потребителя и свързането му с други потребители в мрежата. Такова поведение ще бъде подкрепено от повсеместното компютризиране на устройствата от бита и поддържането на интерфейси от типа: машина-към-машина (M2M), които ще следят за околната среда и ще оценяват промените, необходими за поддържане на оптимални условия. M2M конекциите, при които сензори изпращат данни към централен компютър с помощта на безжични мрежи, все повече се развиват и ще имат значителен ръст през следващите десетилетия.

Компютърното моделиране позволява създаването на една смесена виртуална реалност която ще подобри способността на потребителите да асимилират инфор-

мацията от бази от знания и да предприемат съответните действия. По този начин значително ще се подобри вземането на решения, оперативното планиране, воденото на военните действия и др. А с развитието на гъвкавите тънки дисплеи, които могат да се свият, усукат или сгънат ще се подобри начинът за визуализиране на оперативна и тактическа информация в полеви условия.



Фиг. 4. Развитие на мрежовите технологии според Gartner (юли 2015 г.) [3]

Сензорите стават все по-малки и все по-интегрирани едни с други и са мощно средство за добиване на информация от бойното поле. Датчиците все повече ще осигуряват достъп до информация за околната среда и за откриване и следене на промените. Лесното им поставяне и бързо извличане на данните от централизирана информационна система, работеща в реално време, ще спомага много за по-пълна оценка и по-точно вземане на решения.

Петото измерение - *киберзащитата*, става все по-важно във военните конфликти, особено след като НАТО е все по-зависима от компютърните мрежи за обмен на информация при търсенето на информационно превъзходство. Общата сигурност на всяка една мрежа е толкова силна, колкото е най-слабото звено, свързано с нея. Поражението в първата кибер-битка може да създаде определящите условия за цялостното поражение. Затова киберзащитата не трябва да се подценява, а превантивно, постоянно да се подобрява.

ИНФОРМАЦИОННИТЕ ТЕХНОЛОГИИ И РАЗВИТИЕТО НА ВЪОРЪЖЕНИТЕ СИЛИ

Според Националната отбранителна стратегия, приета през 2011 г., информационните ресурси се разглеждат като основен елемент на ресурсите за отбрана. В нея се отбелязва, че „изпълнението на задачите, произтичащи от мисиите на въоръжените сили в голяма степен зависи от постигането на информационно превъзходство и ефективно взаимодействие” [1].

Важен елемент за повишаване на боеспособността и качеството на управление на Българската армия е технологичното развитие на системите за *командване, управление, комуникации, компютризация (обработка на информацията) и разузнаване (откриване, наблюдение и разпознаване) - С4И*. Те се определят като „инструмент за тотално взаимодействие на всички равнища и на всички структури (включително и международни) за постигане на информационно превъзходство на бойното поле” [1].

Във възприетите във Военната доктрина на република България принципни постановки за изграждане на боеспособни и ефективни въоръжени сили, развитието на С4И-системите е залегнало като приоритет и те имат водещо място. Поради важноста на тези системи за осигуряване на информационни способности на въоръжените сили, в Инвестиционният план-програма на Министерството на отбраната до 2020 г. са включени три важни проекта [2]:

✓ Проект 7 „Придобиване на модул за комуникационно-информационна поддръжка на контингент”, с което ще се осигурят в комуникационно и информационно отношение българските военни контингенти при участието им в операции и ще се създадат способности за действие в мрежова среда при осъществяване на националното управление.

✓ Проект 12 “Кибернетична защита”, с който се осигуряват способности за повишаване на кибернетичната сигурност на съществуващи, изградени и предстоящи за изграждане военни системи и мрежи, като се поддържа и развива център за наблюдение и анализ, и център за реагиране и възстановяване.

✓ Проект 13 „Развитие на автоматизирана информационна система на Министерството на отбраната, Българската армия, оперативните и тактически шабове”, като се изгражда единна мрежова информационна среда за функциониране на системата за командване и управление на всички нива – стратегическо, оперативно и тактическо, и подпомагане на дейността на структурите от Министерството на отбраната за успешно изпълнение на мисиите и задачите, чрез непрекъснат, бърз и надежден електронен обмен и достъп до общи информационни масиви.

В проектите за модернизация на С4И-системите в МО и БА се предвижда те да се интегрират в единна информационно-комуникационна среда, която да осигурява високо качество на услугите, оптимизирани финасови разходи за реализация и поддръжка, отвореност за потребителя (“user-friendly”) и др. Това ще се постигне с широко прилагане на съвременни технологии и решения, като WEB, Cloud-computing, виртуализация, с използване на ефективни приложни системи, с реализация на високонадеждни сърверни архитектури и на подходящи средства за комуникация и защита на информацията.

ЗАКЛЮЧЕНИЕ

Технологичното развитие не трябва да се разглежда само като начини за усъвършенстване на класическите оръжия, но и като възможност да се предвидят евентуални бъдещи заплахи и обществени промени, произтичащи от приложението на нови технологични разработки. Развитието и достъпността на нови технологии за обмен и обработка на информация (интернет, социални мрежи и др.), налага военното ръководство много добре да анализира обстановката, за да може да се

възползва от предимството и свързаните с това възможности за предвиждане на технологичните промени и за прогнозиране на тяхното развитие в свой интерес.

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АЛТЕРНАТИВИ ЗА ИЗСЛЕДВАНЕ И ПРОЕКТИРАНЕ НА СОФТУЕРНО ДЕФИНИРАНИ РАДАРИ

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Abstract: *In this work are reviewed opportunities for research and design of software-defined radar based on alternative hardware platforms and software tools. Conclusions are on their effectiveness in different application areas.*

Keywords: *software-defined radar, hardware platform, software tool*

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Съвременните радары са незаменим компонент при извършването на много от военните операции като откриване и разпознаване на цели, въздушно и земно наблюдение, насочване на оръжията, оценка на поражения от ракети и т.н. Това налага развитие и поддържане на разнообразни способности на радарите и рефлектира в създаването на голям брой различни високо специализирани радарни системи. През последните години ефективната работа на радарите изисква все по-голяма скала от допълнителни приложения, като едновременно с това нарастват изискванията за намаляване на цената и нарастване на адаптивността. Много от отговорите на тези предизвикателства могат да бъдат дадени от софтуерно дефинираните радары.

Концепцията за софтуерно дефиниран радар (SDRadar) е реализация на най-новите тенденции в развитието на радарните технологии. Както е известно SDRadar се основава на софтуерната реализация на основните операции (филтриране, смесване, модулация, фазово кодиране, демодулация и др.) с цел да се избегне по-голямата част от специализирания хардуер [1]. Прилагането на концепцията за софтуерно дефинираното радио в радарните системи позволява генерирането на сондиращи сигнали и определянето на параметрите на сигналната обработка да се адаптира в движение в съответствие с решаваните задачи и повишава гъвкавостта на системата, чрез прости софтуерни модули.

Основната цел на софтуерно дефинирания подход е свързана не само с намаляване на разходите, но също и със значително увеличаване на гъвкавостта на системата.

Софтуерно дефинираната радарна платформа може лесно да се препрограмира в различни режими на работа, чрез модифициране на сондиращия и обработката на отразения от целта сигнали в движение тъй като генерирането на сигнали и параметрите за сигнална обработка, могат да се адаптират в процеса на изпълнение на

разглежданата задача. Гъвкавостта на софтуерни системи и тяхната адаптивност ги прави подходящи за много различни радарни приложения.

Едно възможно решение за развитие SDRadar на сравнително ниска цена се базира на използването на разработения от National Instruments (NI) радиочестотния модул Universal Software Radio Peripheral (USRP). Фамилията продукти *USRP осигурява евтина хардуерна платформа за софтуерното радио и е предназначена за използване в лаборатории, университети и др.*[1,2]. Обикновено за създаване на сложни SDR системи модулите *USRP се използват със софтуерния пакет GNU Radio.*

Новоразработените през последните години от National Instruments модули, а именно USRP 2920, 2921, 2922 работят с графичната среда на -LabVIEW. LabVIEW се използва за извличане на данни, управление на инструменти и индустриална автоматизация върху множество платформи, включително Microsoft Windows, GNU/Linux, Solaris иMacOS.

Развитието на тези нови хардуерни и софтуерни технологии с отворен код доведе до разработването на базата на модулите USRP и GNU Radio, на софтуерни радари, радарни приложения и тестови методи с висока сложност и ниска цена.

Разработването на нови генерации предавателни модули е съпроводено с нарастване на възможностите за постигане на високи качествени показатели. В първото поколение USRP сигналът, генериран от компютъра чрез софтуер (GNU Radio или Simulink) се предава до USRP чрез USB буфер. По-новата генерация USRP NI2920 използва графичната платформа LabVIEW и интерфейса Gigabit Ethernet., което води до повишаване на разрешавата способност по разстояние от порядъка 10 пъти.

В литературни източници [1,2,3,4] се съобщава се за специфично приложение на софтуерния пакет LabVIEW, което позволява да се симулира многофункционален радар на базата на хардуерната платформа USRP NI2920, позволяваща превключване между два различни радара - FMCW радар и OFDM радар.

Основното предимство на LabVIEW спрямо другите среди за разработка е богатата поддръжка на инструментална техника. Като основен конкурент за контрол на измервателна техника и инструменти може да се приеме Agilent Technologies.

Компанията Agilent Technologies, предлага решения за проектиране на радари, радарни модули и разработване на тестове [5]. На базата на измервателните устройства на Agilent и системата за автоматизирано проектиране Agilent SystemVue могат да бъдат моделирани реални условия на работа и реализирани тестове на радари и радарни модули.

SystemVue представлява платформа за проектиране на системно ниво и позволява двойно да се съкрати времето за проектиране на физическо ниво на високопроизводителни алгоритми. Платформата предоставя проста за използване среда за разработка с най-напредничавите технологии за моделиране и възможност и за включване към апаратна реализация провеждане на изпитвания.

SystemVue може да се използва за космически и военни приложения, като софтуерно дефинирано радио, софтуерно дефиниран радар и др. Известно е, че тестването на радарни системи може да бъде много трудоемко и скъпо. Радарните системи трябва да бъдат проектирани и тествани в реална среда, което налага да бъдат отчетени и въпросите за шумоустойчивостта, които често са свързани със скъпи

изпитателни постановки за изпитването на прототпа в реално време. Разработени са множество технически приложения за измерване на параметрите и създаване на реалистични сценарии за тестване на радарните системи.

Съчетанието от промишлени, готови за използване програмни средства и измерителни уреди на компанията Agilent подпомага създаването на реалистични сигнални сценарии, имитиращи отразени сигнали от множество цели в сложна електромагнитна обстановка. Към софтуерния пакет SystemVue е разработена библиотека (Radar Model Library W1905), която съдържа повече от 50 параметризирани блока, такива като генератори на сигнали, предаватели, антени, среди за разпространение, цели, приемници, блокве за измерване на основни параметри и др.

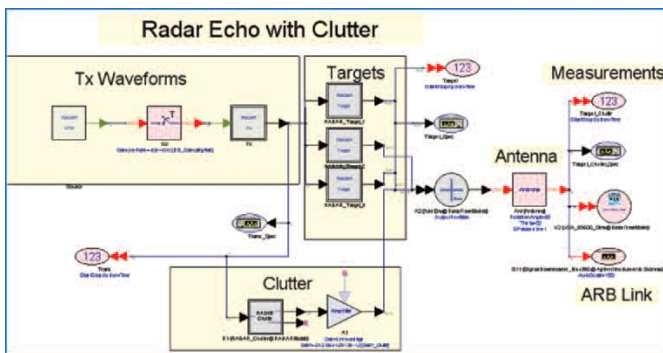
На фигура 1 е показан пример [6] на техническо решение на генератор на радарни цели. Главните атрибути на генератора са параметрите на високочестотния сигнал-носеща честота, лента на модулация, а също и параметрите на сценария: брой и продължителност на отразените сигнали от целта, скорост на целта, азимут, ефективна площ на отражение, тип на пречещите сигнали, активни сигнали за радиоелектроно подавяне, радиосмущения.

Грите първи елемента от ляво са предназначени за генерация на сигналите, необходими за изпитванията на предавателя и приемника.



Фигура 1. Конфигурация на генератора на радарни цели

Отправна точка представлява схемата за моделиране в среда на SystemVue, както е показано на фигура 2. В горната лява част е показан генератора на сигнали на предавателя ("Tx Waveforms"). Създават се още три сигнала от целта, комбинирани един с друг със смущаващите сигнали и се въвеждат в антената. Полученият сигнал може да бъде анализиран вътре в SystemVue и когато сценария бъде окончателно формиран се подава в генератора на сигнали.



Фигура 2. Пример на екрана на SystemVue, изобразяващ схема на генератора на радарни цели

От казаното по-горе се вижда, че системата включваща SystemVue и генератор на сигнали с произволна форма представлява универсално решение за изпитвания на предаватели, приемници, подсистеми и компоненти на радарите. Този подход е подходящ за широка гама радарни системи.

В заключение се налага извода, че съвременните високотехнологични хардуерни платформи и софтуерни реализации предоставят големи възможности за изследване и адаптивно проектиране на радари и радарни модули. Разработването на нови генерации хардуерни модули и развитието на софтуерните инструменти с отворен код ще стимулира разработката на нови радарни приложения и радарни системи.

ЛИТЕРАТУРА

1. Sandra Costanzo, Francesco Spadafora¹, Giuseppe Di Massa¹, Antonio Borgia¹, Antonio Costanzo, Gianluca Aloï, Pasquale Pace, Valeria Loscrù, and Hugo O. Moreno POTENTIALITIES OF USRP-BASED SOFTWARE DEFINED RADAR SYSTEMS Progress In Electromagnetics Research B, Vol. 53, 417{435, 2013
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**INFORMATIONAL SECURITY - LEGAL IMMUNITY FOR COMMERCIAL ACTIVITY
OF MEMBERS OF THE POLISH - BULGARIAN CHAMBER OF COMMERCE
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Abstract: *Information security is a factor of principal importance for the realization of successful trade cooperation between partners from different countries. One of the priorities for every bilateral organization should be the provision of information security to its members. In order to guarantee such a level of security, it is imperative for specialists working at the organization to show a good knowledge of the legal and commercial characteristics of both sides. This, in turn directly depends on the level of qualification of human resources, the type of organizational structure and the goals of the organization. The aim of this work is to clarify the nature of the Polish-Bulgarian Chamber of Commerce as a bilateral organization and to shed light on the way it provides adequate security of its members in their participation in trade turnover between Poland and Bulgaria.*

Keywords: *Polish-Bulgarian chamber of commerce, Bulgarian-Polish law office, Polish-Bulgarian consultancy cluster information security, trade turnover, bilateral relations, cooperation, trade, business, commercial law, employment law, tax law, financial law, Bulgaria, Poland , consultations, cluster.*

In a period of growing globalization, free movement of goods and capitals and increasing need for new markets we observe an intensive growth of the interest of Bulgarian businesses in the Polish market. This market is developed under conditions of long term domestic policy that supports small and medium-sized enterprises, as well as conditions of consistent promotion for foreign investments and intensive utilization of EU funds. According to the elite analysis carried out by "Cushman & Wakefield", Warsaw is first among 34 European cities most attractive to foreign investments. Nevertheless, the direction of investment is not unilateral. A substantial growth in the number of Polish firms that expand their activity in Bulgaria has been observed over the course of the past five years. Statistics illustrate that the amount of trade turnover between the two countries has been rising steadily. Economic analyses and forecasts predict a similar trend for the next five years. There are many factors that determine this good level of bilateral cooperation, with those organizations that support the development of bilateral trade relations playing their pivotal role in this process. One of these organizations is the Polish - Bulgarian Chamber of Commerce. Since its establishment in 2006, for almost ten years, the Chamber has been gaining vital experience primarily in the field of creating of favorable conditions for development of business relations between Bulgaria and Poland. One of the primary aims of this organization is to become a non-governmental regulator of Polish-Bulgarian commercial endeavors, to provide a safe and secure environment on this business route and to build a good reputation among both the Bulgarian and Polish business world. An objective view of key relations, a support for private businesses and open arrangements are at the heart of these objectives. The positive experience and knowledge accumulated in the reality of

one specific country are successfully applied to the other. Each side has its own unique specific features, which leads us to the other important role of the Chamber - to build a unified business foundation that would function well and would add economic value bilaterally. Often Bulgarian optimism and desire for prosperity is combined with Polish pragmatism, confidence and experience. As a result of these efforts a variety of Bulgarian-Polish consortiums have been established. These consortiums have played an integral role in several Public Procurements that are of high priority to our country and include plants for waste treatment, water treatment plants, construction and modernization of railways, road infrastructure etc.

Polish-Bulgarian Chamber of Commerce aims to provide equally high quality of support for both large and small businesses. Several dozen companies with the use of Polish capital have been already registered in Bulgaria and they have been provided with relevant trading partners and markets. In turn, a favorable and secure environment for Bulgarian companies operating in the Polish market has been built that has been assisting their growth in the region. This partnership makes commercial sense and has high potential for future development.

The fields of activity of the Polish-Bulgarian Chamber of Commerce are numerous and diverse. The "Board of Directors" has been established within the organizational structure of the Chamber in order to provide adequate solutions in a variety of areas that include construction, transport, tourism, European funds and programs, real estate, agriculture, engineering, education, pharmacy and healthcare, infrastructure, communications, light industry, etc. It is represented by directors that function in the above mentioned sectors. Each specific request, received by the Chamber, after being processed is sent to the relevant specialized department, where it is analyzed and treated thoroughly. This approach allows for competent service across most economic branches.

The Polish-Bulgarian Chamber of Commerce collaborates with more than 70 businesses and non-profit organizations. According to its statute, it represents a common economic engine for each of its members and partners. On their side, due to their multiplicity and diversity, they develop the power and strategic importance of the bilateral organization. One of the main priorities of the Polish-Bulgarian Chamber of Commerce is building of better quality of relations between the Bulgarian and Polish business world, namely by the means of: setting precise tasks to its structures, improvement of its services, development of a communication policy, creation of conditions for better competitiveness and last but not least, ensuring information security of its members. Entrepreneurs intending to enter a specific market can rely on the complete package of services that includes: legal support as part of the overall provision of information security - company registration, preparation and analysis of contracts, provision of information concerning the legislation of a specific country in a specific field, legal services relating to a particular deal, resolution of conflicts through mediation and arbitration, litigation etc. The Bulgarian-Polish Law Office was created, within the structure of the Bulgarian- Polish Chamber of Commerce, in order to provide professional, timely legal service of the highest level of quality in all of the above mentioned areas.

The Bulgarian-Polish Law Office was founded in order to provide adequate legal solutions in accordance with Polish and Bulgarian legislation. The specific features of this office are determined by its bilateral nature. Extensive analysis of both legal systems and professional qualifications of team members allow for the provision of professional

assistance to its clients in each specific area of both the Polish and Bulgarian legal field. Knowledge of the characteristics of the two nations and the fluent usage of Bulgarian and Polish languages give significant advantages in building an optimal legal strategy, while dealing with each specific case. The office is headquartered in Warsaw, but certain departments are located in Krakow, Sofia and Burgas. Guaranteeing the information security of the Chamber's partners directly relies on professional work conducted by the Chamber in following legal aspects:

Commercial Law – The Bulgarian-Polish Law Office collaborates with a number of institutions and organizations that influence trade turnover between the two countries. Numerous Bulgarian and Polish companies are beneficiaries of different services within the cooperation. These companies represent various industries, such as: transport, logistics, engineering, agriculture, construction, tourism, energy etc. The team will offer you qualified advice in: preparation and realization of investments, preparation of contracts, establishment of commercial associations and branches, transformation of trade associations, changes in company contracts or charters, terms applied by custom of trade, sale of shares, bankruptcies, collection of claims, dispute resolutions outside of the court, litigation etc.

Organizational Law – Over a number of years, Poland has frequently been qualified as an 'economic oasis' in Europe. The interest of Bulgarian entrepreneurs to the vast Polish market has increased exponentially. At the same time, the favorable tax system in Bulgaria attracts Polish investments. As a result, the trade turnover between the two countries is growing progressively. In this aspect, the experts of the Bulgarian-Polish Law Office offer professional services in the following fields:

- Registration of all types of commercial organizations. In this respect we offer: preparation and shaping of the organizational contracts with all their specifications; completion of all necessary legal actions with the notary; preparation and submission of documents for legal registration of the organization; preparation of powers of attorney for filing and obtaining the necessary documents after submitting the documentation for court registration; issue of a registration number of the organization; issue a tax number of the organization; issue of the VAT identification number of the organization; assistance with the process of finding a headquarters; finding a relevant accountancy firm; assistance with the recruitment of personal; assistance with the opening of bank accounts etc.
- Subsequent registration and authorization of the registered organization under the relevant laws as well as the supply of various licenses and permits under applicable Polish or Bulgarian legislation;
- The establishment of legal entities with non-profit purpose;
- Change in the legal status of registered organizations (name, registered office and address, membership, assets, etc.), Liquidation of the organization etc.
- Litigation in disputes between organizations
- Preparation of all types of commercial contracts in two languages

Employment Law - Proper strategy in the field of human resources often has a decisive role in the success of the bilateral business initiatives between the two countries. In this matter, the team offers the following services: advice in recruiting qualified

personnel, drafting employment contracts, representation in labor disputes, representation in the case of employment termination, drafting employment agreements, representation in litigation after termination of employment contracts, representation in front of the labor administration and ministries.

Transport law - Services in transport legislation cover primarily land transportation. We successfully support leading transportation companies, on the route between Poland and Bulgaria, as well as on routes throughout the whole of Europe. In practice, thus far the most disputed decisions have been related to vignettes, tachometers, insurances, permits for transportation.

Tax law – Partners are offered a wide range of services in the field of tax law of Poland and Bulgaria, including: preparation of tax strategies, tax planning and optimization of taxation.

Financial law - Bulgarian-Polish Law Office provides services to individuals, international business investors and various financial institutions. Listed are some examples of financial legislation that we deal with- bank contracts, banking, financing and provision of banking transactions, investments, loans, leases, insurances, foreign exchange transactions, financial instruments, pension transactions, investment funds etc.

Property law - Often Polish-Bulgarian relations are accompanied by disputes relating the different types of property - private, state or municipal. With the acquisition and subsequently the protection of property rights, their carriers face different responsibilities. Experts of the Bulgarian-Polish Law Office provide legal advice and assistance on various studies in the field of property law relating to: analysis of the status of real estate, acquisition of ownership of movable or immovable property, preparation of all types of contracts and documents related to the right to property, assistance in specific notary proceedings, litigation in property cases etc.

Criminal law - Bulgarian-Polish Law Office provides adequate legal assistance at all stages of criminal proceedings - pre-trial, as well as in the court. We provide competent protection with: determining the remand in custody of the police, providing support to persons residing in arrests, providing assistance to victims of crime, protecting suspects and accused individuals, assisting in terminating the criminal proceedings etc.

Besides legal services the Polish-Bulgarian Chamber of Commerce offers trade advice on the following aspects: finding trading partners, making market analyses, recruitment, providing information on upcoming auctions, organizing participation in fairs and etc.

The Polish-Bulgarian Consulting Cluster Center, created in Warsaw under the leadership of the Polish-Bulgarian Chamber of Commerce provides additional security for businesses in both countries. The objectives of the cluster focus on supporting the partnership in the sector of small and medium-sized enterprises of the two countries. The Polish-Bulgarian Consulting Cluster is a business center where each Bulgarian or Polish entrepreneur can receive the necessary support to develop his/her business activities.

A further step aimed at improving quality of services took place on 10/23/2015 at the headquarters of the Bulgarian Industrial Association, where a memorandum of cooperation between the Association of Business Clusters in Bulgaria and the Polish-Bulgarian Consultancy Cluster was signed. The two organizations will cooperate in the areas of entrepreneurship, information security, efficiency of human resources, scientific

and technological development of Bulgarian and Polish business organizations and other areas of mutual interest.

The proposed commercial, legal and administrative services will build a favorable and secure market base for any business bilaterally.

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SOCIAL SCIENCE

ASPECTS OF THE INTERACTION OF STRUCTURES AND AUTHORITIES FOR SOCIAL ADAPTATION OF MILITARIES EXEMPTED FROM MILITARY SERVICE AND THEIR FAMILIES

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Abstract: *The study presents different aspects of the interaction of structures and authorities for social adaptation of militaries exempted of service and their families' members in Bulgaria considering different levels of the process: conceptual and political, normative and legal, every day and practical. The military social work is determined as a very broad term designating the socio-pedagogical complex of different types and areas of activities in the field of satisfaction of social needs of the particular group studied.*

Keywords: *social work, social adaptation, social services, social security, social support*

1. Introduction

Current study accepts social adaptation as a process in which jointly participate state, public and non-governmental organizations and commercial structures, as well as the militaries exempted from military service and members of their families. That definition suggests that in the active cooperation with experts from the relevant departments the individual profiles of former militaries could be determined together with their families in the conditions of the civil socium considering development of economic processes in the regions of their residence and in the activities of modern institutions of civil society.

Social work with militaries exempted from military service and members of their families in the process of social adaptation to conditions of civil socium itself includes a pedagogical component. Its content is based on the direction of socio-pedagogical activity to intensify the potential for adaptation of the personality of the former militaries for maximum possible realization of their knowledge, habits, skills and experience in new social conditions while keeping the previous social status. Socio-pedagogical activities are implemented in the process of social upbringing of the exempted from military service and the inclusion in the new social environment, as well as in the process of restructuring of their micro-socium. That means a comprehensive model of social adaptation to be implemented allowing unity and interconnection of objects, subjects, principles and guidelines of the social adaptation of former militaries and members of their families, its general and specific technologies, the conditions governing the

adaptation potential both of the militaries exempted from military service (along with their family) and of the society in which they are compulsory included.

In order the organization of this process to be effective, a necessary condition is the personal involvement of the militaries at the entrance of their social adaptation. Put another way, the social adaptation of militaries exempted from military service and their families should be seen as a multi-faceted process implemented at various levels (conceptual, political, social, civil, normative and legal, every day and practical). The main activities of this process are related to [1, 4]:

- predicting possible changes in self-esteem and social status of the main social groups, among which an important place is given to former militaries and members of their families;
- setting goals in the development of military social work with them by both the state institutions and public authorities and non-governmental organizations;
- determining the balance between social needs of militaries, and members of their families, and the economic capabilities of state and society in the transitional phase of their development;
- shaping the image of the exempted militaries as a highly professional specialist and the appropriate attitude towards them from society and others.

The implementation of these activities requires implications on the leading indicators of socio-pedagogical characteristics, as follows [3]:

- status of militaries and members of their families as a relatively independent particular social group requiring increased attention from state and society;
- the interlink between the nature of the relationship to this group by state and society;
- the availability of mechanisms of studying social status and work with everyone after the exit from the structures of the Bulgarian army (including members of the families) and others.

Different levels of socio-pedagogical complex of types and areas of activity in social work deserve special attention in the adaptation of military personnel exempted from military service.

2. Levels of social adaptation of militaries exempted of service and their families

2.1. Conceptual and political level of social adaptation of militaries

Conceptual and political level of socio-pedagogical complex of types and areas of activities for solution of social problems of militaries and members of their families assumes the development of social policies regarding this group which when getting on the labor market is turned into a risky one.

In that case, social policy is defined as a specific activity of state bodies in particular, and society as a whole, to meet the vital interests of citizens exempted from military service and members of their families.

The leading indicators for social-pedagogical characteristics of this level are:

- the degree of importance to the state and society of the intellectual and physical potential of persons exempted from military service and members of their families;

- level of preparedness of the state institutions for the realization of the priorities of social policy, purposeful and systematic social work with that category of militaries;
- level of preparedness of state institutions for social work with militaries and members of their families (at all levels of the socio-pedagogical complex), etc.

2.2. Public and civil society level

The level studied suggests participation in the implementation of social policy regarding militaries exempted of service and their families' members of non-governmental organizations and public associations (parties, social movements, foundations, associations, groups, etc.) and commercial entities. In terms of their statutory purposes or commercial interests, these representatives of civil society are able not only to influence the elaboration of social work priorities concerning militaries and their families' members, implemented by representatives of state, but also to put serious efforts in development and functioning of the social infrastructure for the realization of that social policy.

In general terms some of these problems are identified in different kinds of concepts of social protection of militaries, persons discharged from military service and members of their families.

Leading indicators of socio-pedagogical characteristics of this level are:

- the availability and the extent of development of public and non-governmental organizations in the field of social work with former militaries and members of their families;
- the degree of the practically realizable orientation of public and civil organizations to social work with former militaries and their families' members in the structure of other targets of the activity;
- the degree of interoperability of these organizations with state institutions and commercial entities in social work with this group;
- the level of the financial potential and the duration of its operation in one or another public organization or association of citizens with military-social orientation, etc.

2.3. Normative and legal level

The normative and legal level to solve these problems envisages provision of socio-legal protection of exempted militaries and members of their families. Socio-legal protection is defined as a system of social guarantees (as well as activities on their development, validation and implementation) assuring minimum and sufficient life conditions, benefits and privileges of different categories of former militaries and members of their families. These social guarantees form part of the general law of the country in the social sphere which can be related to Social Insurance Code, Social Assistance Act, Employment Promotion Law and others.

Hence leading indicators for socio-pedagogical characteristics of this level are:

- the extent of coverage of the social problems of former militaries and members of their families in their transition from military socium and integration into civilian life with normative and legal documents;
- the quality of developed normative and legal documents in the field of the assurance of social rights and guarantees of former militaries and members of their families;

- the degree of practical implementation of the norms of social law by state institutions at different levels (national, regional level and regional level) applied to exempted from military service persons and to members of their families, etc.

2.4. Everyday and practical level

The everyday and practical level of solving the social problems of militaries and members of their families suggests the formation of a system of social work with former servicemen militaries and members of their families both as a specific activity and as part of the structures for social protection of the population.

In this case, the social work with militaries and members of their families is identified as:

- a mechanism for implementation of social policy of state and society in relation to this certain category of the population;
- directions for the integration of former militaries and members of their families in civil society;
- means for the realization of socio-legal protection of this category of the population;
- conditions for the provision of social partnership and social security in society;
- a tool for solving everyday social problems of exempted militaries and members of their families in the places of their residence, etc.

Without the development of the infrastructure of everyday practical level of socio-pedagogical complex, the types and areas of activity, as well as social priorities, remain only intentions, and laws and regulations are just rules on paper. Therein lies one of the reasons for the low efficiency of the activities of state institutions in the implementation of social legislation in the field of social protection of militaries and members of their families.

In the implementation of programs and projects of similar nature it is necessary:

- availability of corresponding infrastructure and quality of activities of specialized institutions in social work with militaries and members of their families;
- level of professional competence of social workers from state institutions oriented towards families of exempted militaries;
- the coverage level of this category of the population (medical, pension, sanatorium, cultural, educational, sports and other areas), etc.

3. Characteristics and relations in social adaptation of exempted militaries and member of their families

The analysis of scientific and other literature, including a number of studies, monographs and developments of recent years, shows that a significant number of specialists continue to be oriented towards the study of parts of socio-pedagogical complex of types and areas of work with militaries exempted from military service and members of their families [2, 4].

For example, several researchers have noted that the most important factors determining the quality of military social work in general, and the social reintegration of exempted militaries (and their families) as part of the Armed Forces of the Republic of Bulgaria are [1, 2, 4]:

- successes in military reform, leading the army to a new quality of operation, based on the priority of the new legislation and NATO membership;
- significant humanitarian changes in military socium and in the system of military education;
- effective functioning of the system of formation in militaries of values corresponding to the qualities of country's citizens;
- improving their material standard of living;
- ensuring the principle of social justice in addressing issues of work and life character, etc.

A significant part of researchers and social workers state that the basis of social adaptation of militaries exempted from military service and members of their families is the legal provision of the process [3]. The state, according to them, must provide to this category of the population not only an acceptable standard of living, but also to provide a certain compensation for the limited rights of military service. Namely state social policy in the field of law guarantees the right of persons exempt from military service and members of their families the corresponding living conditions in civilian terms.

There is a basic contradiction. Its essence lies in the fact that on the one hand the state provides a legal basis for the removal of the military from civilian to military socium. On the other hand, there are the carried out by state activities in the social protection of this category of violations on the socio-normative field. The practice shows that it is the government institutions at different levels which do not meet the accepted laws and regulations and that way they do not realize the rights of this category of the population. For the prevention of the creating situation mechanisms constituting the processes of social protection are included. Thus underlined conflict is the source of the emergence of the term „*social protection*”, the content of which is limited to establishing a regulatory system for the stabilization of society aimed at minimizing the social contradictions arising in the legal and economic status of the individual groups of the population. The state offers its citizens social protection in the situations of risk in normal life such as illness, unemployment, death of a man who supports the family, age, disability. The social protection is a combination of social and legal guarantees ensuring for every member of the society the realization of the most important socio-economic rights, including the right to a standard of living necessary for normal reproduction. Thus the analysis of the practice of moving the militaries from the military to the civil socium shows that today such guarantees are sufficient, i.e. on regulatory and legal level such a switch will not or should not create social problems for the families of former militaries [4].

The existence of such problems at the everyday and practical level requires social protection. The emphasized contradiction - between the declarative nature of normative and legal provision of social needs of exempted militaries and members of their families and the actual level of implementation of standards and meeting the needs of this group, is in the basis of understanding the problems of social adaptation of persons exempted from military service and members of their families.

Recognizing the insufficient development of mechanisms ensuring the needs of this specific group at the stage of transition to the civilian socium, many researchers focus their efforts in the search of conditions to optimize the process of reintegration of the militaries [4]. The limited opportunities to influence the processes of conceptual-political, socio-civic and normative-legal level of socio-pedagogical complex - types and

areas of activity for social adaptation of exempted militaries, objectively put the attention on the psychological problems of this process. Within this direction there have been a number of studies on issues concerning social and psychological assistance; socio-psychological adaptation of exempted militaries; their socialization as a socio-psychological problem; psychological support to their families; their social and psychological rehabilitation; socio-psychological support to them and their families; psychological and pedagogical provision of social work with them, etc. Along with this, the social work with this category of the population not only implements the system of social guarantees ensuring minimal sufficient and living conditions. Such one-sided understanding deforms its nature, leads to a limitation of its potential and presents exempted militaries and members of their families as consumers in a state of a social crisis.

The socio-pedagogical modeling of the processes of passage of exempted from military service persons and members of their families from the military in civil society allows to specify the contents of the processes in socio-pedagogical complex of different types and areas of activity with this category of persons. The social work is called to satisfy the social needs of the representatives of specific groups of the population, including military personnel exempted from military service and members of their families but their social needs are different. The satisfaction of those needs that provide minimum and sufficient conditions for life refers to *social protection*. The violation of these conditions leads to a threat to people's lives, a threat to the functioning of the human organism in the society. The periodic satisfaction of social needs of persons in a state of social crisis refers to their *social support*. In cases where exempted militaries and their families in the process of transition from the military status to the status of citizens fall within social crisis, they need such support. The realization of the established state guarantees to meet the social needs of a wide range of persons entitled to them relates to their *social security*. This process and activity are inherent in the presence of such guarantees to exempted militaries and for members of their families. The satisfaction of social needs of persons through the provision of certain social services can be characterized as their social "servicing" or *social assistance*.

4. Conclusion

Military social work is a very broad term designating the socio-pedagogical complex of different types and areas of activity of various entities on satisfying the social needs of their customers carried out on conceptual, political, legislative and practical level. At each of these levels it provides:

- theoretical development and scientific substantiation of the problems, i.e. formation of the *theory of military social work*, part of which is the theory of social work with exempted from service militaries and members of their families;
- ensuring the functioning of educational institutions for military social work (training of social workers as specialists in a particular professional activity), i.e. development of military social work as a *scientific and educational complex*;
- realization of goals and tasks of the practical social work with militaries exempted from military service and members of their families, i.e. military social work as *good practices*.

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SOCIAL NEEDS OF MILITARIES EXEMPTED FROM MILITARY SERVICE AND MEMBERS OF THEIR FAMILIES AND THEIR SATISFACTION

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Abstract: *The paper examines the social needs of the militaries exempted from military service and members of their families and their satisfaction considering the main characteristics of the transitional period, stages of transition and tasks of social work with this particular group. The accent is on the need of efficient social work providing timely and adequate answers to the social needs.*

Keywords: *social adaptation, social security, social assistance, social environment*

1. Introduction

Dynamically developing complex, in perspective as a system, of types and areas of activity (professional and non-professional, professional and voluntary), which essence is to meet the diverse social needs of citizens exempted from military service and members of their families arising in the course of their interaction with the social environment with the particular socium of living in the period of transition from military service to civilian life, fills the contents of the so-called *social work* with military personnel exempted from military service and members of their families. In its nature, the military social work is an actively transforming work that objectively determines the needs of this groups during the transitional period, i.e. the period of *social adaptation*. The specifics of this process are determined by the differences of social environment military and military socium on the one hand, and civil and social environment and socium on the other.

Social environment is identified by surrounding new conditions for life in the civil socium for the exempted militaries and members of their families. Social macroenvironment includes all the surrounding social, material and spiritual conditions of existence, formation and activity. Social microenvironment represents the immediate social environment of exempted militaries (family, neighborhood of residence, work team, and reference and other microgroups, etc.) which have a decisive influence on their activities, behavior and communication, on their development as a whole.

Civil socium is the social space of the vital activity of exempted militaries and their families; their sustainable social community, united by place and new conditions of life activity, determined by the specifics of the work and lifestyle of civilian life.

Customers (users) of the military social work are as a rule representatives of three specific groups:

The first group are militaries (officers, sergeants, soldiers and sailors). That part of the military social work which is oriented towards this group of users is called social work with military personnel. Its main features are [4]:

- it is conducted on the place of the military service (and residence of military service), i.e. barracks, headquarters, range, ship, command post, etc.;
- for this social work the specialists are prepared in the field of psychology, sociology, organization of cultural activities, etc.;

- the social work (its separate types and directions) is part of their functional responsibilities;
- facilities for this type of social work is determined by the basis of the military organization within which it is implemented.

The second group of users of military social work is constituted of the families of military personnel exempted from military service. The combination of the types of activities aimed at satisfying their social needs gives an idea of the social work with family members of military personnel exempted from military service.

This part of the users should be a priority for military social work regarding that namely the family, as part of civil society, is what is basically in the reproduction of the nation. It is the family where from the first days of life attitude to the surrounding world, to others are formed. Namely there corresponding cultural environment is created. The priority of this part of the users of military social work is determined by the importance of the family for militaries, including after discharge from military service, from that role that it plays for them in terms of military service and civilian life.

Characteristics of work with family members of military personnel can be defined as follows:

- it is carried out by the residence of the militaries: military garrisons, polygons, bases;
- its organization is not practically determined by regulations and not enters the functional responsibilities of some or other officials (with the exception of specialists working with families of militaries);
- facilities and professional staff providing this part of the work is practically absent;
- the social work with family members of exempted from military service is not developed, though it refers to this part of users.

The third part of the users of military social work are the militaries exempted from military service. The total of types of activities aimed at addressing their social needs are defined as social work with persons exempted from military service. This work is appropriate to be conducted at the place of residence of exempted militaries. It is assigned to the non-governmental civil structures (with significant restrictions) and it does not enter into the circle of duties of military officials (with the exception of the military district). In practice it does not have its own personnel and facilities. Another characteristics is that it completely lacks regulatory provisions. This part of the customers of the military social work may rely primarily on civil social services - directorates „Labour Office” (LOD) and directorates „Social Assistance” (DPS) (which do not consider them as customers). Social needs of former militaries are satisfied partially at the expense of military structures for social recreation and rehabilitation (military hospitals, sanatoria, rest homes, hospitals, etc.) [3].

2. Main characteristics of the transitional period

Different studies on the problems of the transitional period under the terms of the military to civilian life show that the composition of the users of military social work is too different [1, 4]. Besides that a client of military social work is also the civilian personnel of military units, staffs and controls, of polygons and bases (before their dismissal from work). Users can be not only individuals but also different social groups

such as: community of several families; associations; foundations; social movements, etc. The specificities of their collective social needs should be taken into account which undoubtedly significantly determine the specificity of directions, areas of strength and opportunities of military social work.

It is noteworthy that the subject of social work with exempted from military service militaries and members of their families is a specific person who [2, 4]:

- for various reasons ends legal relationship with one or another military structure;
- is in a transition period from the living conditions of the military socium to the conditions of life and work in the civil socium;
- is forced to change type, scope and contents of its activities in a situation of lack of job in the civil socium;
- significantly changes the social status in terms of striving for its preservation;
- is in a deteriorating financial situation of the family, etc.

The transition period of exempted militaries and members of their families from living conditions of military socium to civil socium in each case takes a different period of time. Everyone in a transitional period goes through several stages.

The first - preparatory stage, is characterized by the psychological adjustment of the militaries still flowing through the procedure of compulsory military service and in search of a new place of work and residence. Exempted from military service militaries and members of their families left to live in the place of service in the transitional period easier adapt to the conditions of civil socium in connection with the minor changes to these conditions. However, after completion of the adaptation period to civilian life, conditions of military socium are a factor that further complicates the vital activity for these people. In Bulgaria there is no practice of timely preliminary determination of variants of jobs for potentially exempted militaries and members of their families in the places of their future residence.

The second stage is of entry into the civil socium characterized by the psychological orientation of the exempted from military service to acquaintance with the conditions of vital activity in this socium.

The third step is getting used to the status of full member of the civil socium characterized by psychological adoption and acceptance of new conditions for life activity.

The fourth stage is of development of the exempted from military service in civil socium which is characterized by the psychological activity to change the conditions of life in the civil socium.

Mutual relation and mutual conditionality of these stages represent a transitional period of the militaries to the status of the civilian persons, the contents of which is called “*social adaptation*”.

Therefore, social work with militaries exempted of service and members of their families is a practical activity of relevant institutions and organizations as well as individuals in ensuring their interconnection with civil socium and with the new living environment. In its essence, this work represents the personal assistance for their integration into the civil socium.

In some cases the first and second stage may coincide if serviceman under exemption from military service (before the termination of the legal relationship with the military

organization) already has a certain job in a civic organization, without change of residence of the family.

3. Tasks of social work with militaries exempted of service and their families

A main goal of the social work with the militaries and members of their families is the harmonization of their interaction with the new (civil) social environment, with the particular socium. That way, during the transitional period: the period of social adaptation of exempted from military service persons the priorities of the content of social work are (in degrees): social protection (higher level); social support (second degree); social security (third degree); social services or assistance (fourth degree). After completion of the period of social adaptation of exempted from military service persons and members of their families, the contents of social work with them changes and social services and social security are on the first places. Social protection and social support to this category of the population in these conditions are necessary only in availability of a situation of social risk, abnormal life activities (failure of the period of social adaptation, alcoholics, various addictions, disability, unemployment, etc.).

Social work with military personnel exempted during the period of their social adaptation solves a number of problems. First these are the organization and implementation of targeted effects on humans for the purpose of socialization in civil environment, providing entry into this addiction to the concrete civil socium and its development. This task also determines the need of preparation of social workers of different profiles specializing in the inclusion of a person in the society.

On the second place is the task of improving the social environment (and of course, the specific socium) in the interests of the people. Applied to social adaptation of exempted militaries and to members of their families, this task is realized through the formation of a positive image of exempted from military service as stimulating the interest of employers to employ this category of the population, development their motivation for training or professional retraining, creation of public or non-governmental organizations, etc. This task also determines the need for special training of social workers specializing in restructuring of social relations in the society [2].

On the third place is the task of optimizing the interaction of militaries and members of their families and the new social environment of a civil or other specific socium. It determines the need for training of social workers with particular knowledge and skills specializing in the harmonization of customer interaction and social environment.

Thus the content, purpose and tasks of social work with exempted militaries and members of their families reflect its pedagogical orientation, which is precisely the feature of experience in the development of social work as a whole. The pedagogical component of social work with this group of the population necessitates the formation of two types of specialists: social pedagogues and social workers, among which there are both similarities and significant differences [5].

The content of the process of social adaptation of exempted militaries and members of their families and tasks of social work with them predetermine as an insufficient practice that to receive only social (socio-psychological, socio-legal, socio-economic, etc.) protection and realization various kinds of social assistance (educational, medical, consumer, psychological, etc.). This is the administrative approach leading to waste of manpower and resources to duplicate the efforts of specialists from different profiles and

leading to this an ordinary man found in normal condition to be displayed outside the clients of social work, and its departments begin their work only when he/she goes into the category of risky, „troubled” individuals.

4. Conclusion

The essence of social work with militaries exempted from military service and members of their families during the transition period lies in the social adaptation of this category of the population to the new conditions of life activity in particular socium, which embraces the following stages: preparatory, entry, tolerance and development. The successful outcome of the social adaptation of the individual person lies in the psychological acceptance of the new conditions of vital activity, in preserving and developing the social status and finding a job, which ensures consistent with this status material living conditions of the family.

Such an understanding of social work with militaries exempted of service and their family members determines the logic of further research, the essence of which consists in: analyses of the history of the development of social work with the category of the population; indication of contradictions, shortcomings and difficulties but also on the objective and subjective errors in its development; development of experimental model for social adaptation of exempted of service militaries and members of their families in accordance with the understanding of it as a socio-pedagogical phenomenon on the basis of analyses of the Bulgarian experience of social adaptation of the militaries.

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ILLEGAL MIGRATION IN THE EUROPEAN UNION AND THE FIGHT AGAINST IT

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Abstract: This report aims to give emphasis to the issues concerning illegal immigration flows in the recent years, which is a tremendous challenge for the member states of the European Union. Effective fight against illegal migration requires a comprehensive approach and balanced policy by the EU institutions, ensuring the security of Member States, effective border control at the external borders, and implementation of the national requirements for entry, residence, and employment of foreigners. Subject to the conditions and the procedures for granting special protection to foreigners as well as migrants’ rights protection in the context of current international humanitarian law. To deal effectively with illegal immigration the Member States need to work closely with “Europol”, “Frontex”, EASO” and “Eurojust”. It aims to combat human beings traffickers and criminal networks in order to enhance the cooperation with third countries to be successfully removed these criminal networks; third countries to respect international law in term of saving human lives at sea, ensuring the protection of refugees and respect of the fundamental rights. It is required the EU to prevent and reduce the illegal migration on its own fight against it, especially through an effective return policy, in full respect of fundamental rights.

Keywords: Smuggling of Migrants, combat illegal migration

In the European Union (EU), more and more people live that have come beyond its borders. Some seek a better future while others are forced to leave their homes because of hostilities, political prosecution, or natural disasters.

In 2014, 276 113 migrants entered the member states of the EU illegally, which represents an increase of 138% compared to the same period in 2013. To enter the European Union secretly via land, air, and sea routes, most migrants have recourse to criminal networks of smugglers¹.

People from the Middle East² and North Africa try to reach the shores of the European continent for different reasons and through different channels. Some of them look for legal pathways, while others risk their lives, in order to escape from poverty, wars, political oppressions, as well as to find family reunification, knowledge, and education.

¹ European Commission’s website – http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/irregular-migration-return-policy/index_en.htm

² Middle East – Traditional definition of the countries of the Arabian Peninsula, Iran, Iraq, Turkey, Cyprus, Syria, Lebanon, Israel, Jordan, Egypt and the occupied Palestinian territories - "Gaza, the West Bank of the Jordan River and and Eastern Jerusalem".

Smuggling of migrants is a fast growing global criminal activity. Poverty, social and political instability, as well as unavailability or limited access to legal channels for migrants and protection seekers, push people to look for the services of criminals who facilitate their unauthorized entrance, transit or stay into the countries of the EU.

Smuggling of migrants has for a purpose to transport migrants across the borders illegally in order to obtain, directly or indirectly, a financial or other material benefit, and the purpose of trafficking in human beings is their exploitation. Moreover, trafficking of human beings does not necessarily imply crossing borders; it can be carried out within a country as well. Smuggling of migrants is an extremely profitable business, as criminal networks thrive due to low risk of detection and sanctioning.

For people, who do not meet or no longer meet the requirements for entry and residence in the territory of a EU member state, are being used different expressions as: "unlawful", "illegal", "irregular", "undocumented" migrants and "pending status migrants. The report uses the terms "illegal" and "illegal" migrants.

The term "illegal migration" means the act of entering into a country in violation against the norms of international law, the EU law, and the national law, and it is illegal border crossing or lack of a residence visa after an authorized stay.

Unscrupulous criminal networks organize trips of a large number of migrants, ready to do anything to reach the EU. They do substantial profits while jeopardizing the lives of migrants. To maximize profits, human beings' smugglers often cram in unseaworthy vessels hundreds of people, including small inflatable boats or cargo ships that vessels are at the end of their life cycle, or in trucks. Large numbers of migrants drown in the sea, suffocate in containers, or die in the deserts³.

Migrants are being treated as commodities by smugglers similarly to drugs and firearms and the same smuggling pathways are being used by them. Smugglers are constantly changing their routes in order to meet the security situation into the transit countries and the law enforcement of countermeasures. They abuse with the procedures for legal entry and stay as well.

The irregular migration flows and in particular those by sea, primary along the Central and Eastern Mediterranean routes, has increased exponentially over the past year. Over 220 000 migrants reached the European Union through this route in 2014, representing an increase of 310% compared to 2013 (Frontex, 2015)⁴. This unprecedented influx of illegal migrants and the ruthlessness of the smugglers, who often expose migrants to life-threatening risks and violence, require a strong response. Around

3 000 irregular migrants are estimated to have lost their lives in the Mediterranean Sea in 2014 (UNCHR, 2015)⁵.

There are several reasons for this striking increase in the illegal migration flows: the dramatic situation in Syria, Eritrea, Southern Sudan, the Democratic Republic of Congo, and Iraq. It can be said that Libya is a "failed state" because the law is not being executed there. As a result, ideal conditions were established for human traffickers to act in complete impunity and the country has become one of the main starting points for migrants on their way to the EU.

³ Communication from the Commission to the European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU Action Plan against Migrants Smuggling (2015-2020), Brussels, 27.5.2015, COM (2015) 285 final, page 2.

⁴ Frontex – European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union.

⁵ UNHCR – United Nations High Commissioner for Refugees. The Office of the UNHCR, also known as the UN Refugee Agency.

Over the past years, some of the Member states of the EU took decisions to legalize vast majority of their illegal migrants, which enabled them to acquire legal rights to live and work in the “host” country. This in turn raised concerns about the ability of those Member States to control the migrants’ flows.

Illegal migration in the EU is seen as a form of territorial population movement where the entry and residence of foreigners and stateless persons, in the “host” country, shall be made in violation of international law, the EU law, or the national law of the Member States. Infringement may be illegal entry into the territory of a country, residence, performing employment or business.⁶

Combating illegal migration represents a complex of legal, economic, and social measures. It aimed at preventing irregular entry, irregular residence, and irregular employment on the territory of the EU member states.

The increase in the number of migrants is a challenge for the European Union, which forces governments of member states to look for common solutions. In 1999, the European countries took a decision for creating of the so-called area of "Freedom, security and justice." This decision gives the European Union powers of legislative measures in the new areas in respect to:

- migrants;
- political refugees;
- border control⁷.

In 2002, the EU adopted regulations designed to stop the smuggling of migrants so-called “package support”. It is the current EU legislation to combat smuggling of migrants and consists of:

– Council Directive 2002/90/EC of 28.11.2002, defining the facilitation of unauthorized entry, transit and residence (3) and, on the other hand, minimum rules for penalties, liability of legal persons and jurisdiction, which is the subject of this framework Decision – a common definition of the crime of aiding illegal entry, transit and residence;

– Council Framework Decision 2002/946/JHA of 28 November 2002 on the strengthening of the penal framework to prevent the facilitation of unauthorised entry, transit and residence;

In accordance with Article 68 of the Treaty on the Functioning of the European Union, the European Council identified in its conclusions of 26 and 27 June 2014, "the strategic guidelines for legislative and operational planning within the area of freedom, security and justice" for the period 2014 – 2020. In the guidelines, the focus is on target transposition, implementation, and consolidation of existing legal instruments and measures. It is underlined the need of implementation of the global approach to migration, optimal use of legal migration, offering protection to those in need, combating illegal migration and effectively managing the borders.

In terms of illegal migration, the strategic guidelines invite to actions to eliminate the root causes of this phenomenon and to control migration flows. In each of these two aspects, the cooperation with countries of origin and transit of migrants has an extremely important role.

The main objectives of the European Union in terms of illegal migration are:

⁶ Vanya Stamatova, *The concept „illegal migration” in the European Union law*, Burgas Free University, *Scientific Conference with international participation 2013 z.*, page 176.

⁷ *“Immigration as a problem of the European union in the global world”*, Sofia 2007, Bulgaria, *Public debate “Citizens for Europe” – “Alpha Research”*, page 2.

- strengthening and expansion of regional protection programs;
- decisive efforts against illegal transfer across borders and human beings’ trafficking;
- an effective common return policy establishment;
- implementation of the actions announced by the “working group on the Mediterranean affairs”, which group was created after the tragic incidents in the Mediterranean Sea in the autumn of 2013.

The fight against human beings’ trafficking is part of the EU policy to tackle with the illegal migration by more than a decade. The Convention of the Council of Europe to combat human beings’ trafficking (entered into force on 01.02.2008) aims at: preventing human beings’ trafficking, protecting victims of trafficking, prosecution of traffickers, and promote coordination national action and international cooperation.

The EU adopted two main legislative acts to combat "irregular" migration:

- “Directive 2008/115/EC⁸ of the European parliament and of the Council of 16 December 2008, on common standards and procedures in Member States for returning illegally staying third-country nationals”. The Member States were urged to enforce the Directive by 24 December 2010. The first report, concerning its implementation, was adopted in March 2014 and the report highlighted the positive developments as well as existing challenges. The main areas for further actions include ensuring adequate implementation, promoting consistent practices that are compatible with fundamental rights, improved cooperation between Member States and strengthening the role of Frontex.

- “Directive 2009/52/EC of the European parliament and of the Council of 18 June 2009 providing for minimum standards on sanctions and measures against employers of illegally staying third-country nationals”. The Member States were urged to enforce the Directive by 20 July 2011. The first report on the implementation of the directive was presented on 22 May 2014.

In response to the human tragedy at the Mediterranean Sea, in April 2015, the EU took immediate measures. Based on a proposal submitted by the European Commission (action plan of 10 points), Member States committed, on 23 April 2015, with Declaration of the European Council to take immediate measures for saving lives and strengthening the EU actions in the field of migration.

The following important documents were developed: *Resolution of the European parliament*⁹, *European security program*¹⁰, *European Program on Migration*¹¹ and the *EU Action Plan against the Smuggling of migrants (2015-2020)*¹².

European Parliament Resolution, of 29 April 2015, aims to respond to the recent tragic events at the Mediterranean Sea and offers a package of emergency measures to be taken immediately.

8 “Directive 2008/115/EC⁸ of the European parliament and of the Council of 16 December 2008, on common standards and procedures in Member States for returning illegally staying third-country nationals”.

9 European Parliament resolution, of 29 April 2015, on the latest tragedies in the Mediterranean and EU migration and asylum policies (2015/2660(RSP)).

10 Communication from the Commission to the European parliament, the Council, the European economic and Social Committee and the Committee of the Regions, the European agenda on security, Strasbourg, 28.4.2015, COM (2015) 185 final.

11 Communication from the Commission to the European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A European Agenda on Migration, Brussels, 13.5.2015, COM (2015) 240 final.

12 Communication from the Commission to the European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU Action Plan against Migrants Smuggling (2015 - 2020), Brussels, 27.5.2015, COM (2015) 285 final.

The European Security Program, of 28.04.2015, emphasizes that cooperation within the EU and with third countries in the fight against smuggling of migrants is a priority in the fight against organized crime networks.

European Program for Migration, of 13 May 2015; the fight against smuggling of migrants was identified as a priority in order to avoid the exploitation of migrants by criminal networks and reduce incentives for illegal migration. The program was set the target of transformation the migrant smuggling networks from low risk business with high returns into "high-risk activities with low returns for criminals." Actions to combat criminal networks of human beings trafficking and smuggling are primarily a way of preventing the exploitation of migrants from these criminal networks¹³. These are also a deterrent to illegal migration.

The European Union Action Plan against Migrants Smuggling, of 27 May 2015;

the plan identifies specific actions, required for implementation of the above two programs in this area, and it includes key actions that are identified. The stricter response from Europe to the smuggling of migrants is the following:

1) *Strengthening of police and judicial actions; the more important actions in these directions are:*

- establishing of a register of suspicious vessels and monitoring of their activities;
- supporting the Member States in taking vessels in tow to the shores, intended for using by smugglers or their destruction at sea;
- establishing of a single “point of contact”, concerning the issues of the migrants smuggling, in each Member State;
- establishing of a contact group of the EU agencies, concerning the issues of the smuggling of migrants.

2) *Improving of collecting and sharing information; the more important actions in these directions are:*

- deployment of liaison officers on migration issues in some key delegations of the EU;
- strengthening of the joint operational team “MARE” (Marine Affairs Research and Education)” as an information center on the EU, concerning the smuggling of migrants;
- further development of the intelligence: Africa – Frontex;
- increasing of monitoring the pre-frontier areas; Eurosur 14;
- supporting the Europol investigations for detection of Internet clues, used by smugglers of human beings.

3) *Enhancement of human trafficking prevention and assistance to vulnerable migrants; the more important actions in these directions are:*

- conducting of information and prevention campaigns in non-EU (third) countries, devoted to the risk of trafficking of human beings;

¹³ These efforts are within the European Security Programme and Strategy for Maritime Security. Smuggling of migrants and trafficking of human beings are two different activities but interrelated ones, carried out by criminal networks. The difference in the first case, migrants are voluntarily involved in illegal migration, paying for the services of a smuggler to cross international borders, while in the second case they are victims that undergo a severe coercive exploitation and may be associated with the transition border or not. In fact, the two phenomena are difficult to distinguish, because people voluntarily leave and expose themselves to a risk of labour or sexual exploitation.

¹⁴ Eurosur is the information-exchange framework designed to improve the management of Europe's external borders. It aims to support Member States by increasing their situational awareness and reaction capability in combating cross-border crime, tackling irregular migration and preventing loss of migrant lives at sea.

- development of a guide for preventing the migrants smuggling by 2017;
- development of guidelines for border and consular services;
- initiation of proposals for launching negotiations on readmission agreements with the countries of origin of illegal migrants.

4) *Increased cooperation with non-EU third countries; the more important actions in these directions are:*

- putting into practice and consolidation of the bilateral and regional cooperation framework;

- financing of projects to help non-EU (third) countries for developing strategies for fighting against trafficking of human beings and smuggling of migrants; for improving police capabilities and juridical system and development of integrated border management;

- establishing a platform for European cooperation with non-EU (third) countries and regions in the field of human beings trafficking and migrants smuggling;

- optimization of the use of the EU funds through joint or coordinated planning.

Conclusions:

1) The current social and economic processes in global, regional, and national scale have a significant impact on the development of processes associated with illegal migration.

Effective fight against this phenomenon requires an integrated approach and balanced policy by the EU institutions. It ensures the security of Member States, effective border control at the external borders, implementation of the national requirements for entry, residence, and employment of foreigners, subject to the conditions and the procedures for granting special protection to foreigners as well as migrants' rights protection in the context of the current international humanitarian law.

2) There is no the EU Member State that can cope alone with this tremendous challenge as illegal migration. It is necessary to be improved the existing EU legislation for combating the smuggling of migrants and human beings trafficking to ensure that there are appropriate penalties for smugglers, while they avoid the risks of incurring criminal responsibility from the persons providing humanitarian assistance to migrants in distress.

3) In order to deal effectively with illegal migration the EU Member States need:

- to work in close cooperation with Europol, Frontex, EASO (European Asylum Support Office) in Eurojust; it aims to combat human beings traffickers and criminal networks across the borders, detecting and tracking of their funding and determine their way of action for not enabling them to earn money by putting at risk migrants lives;

- to strengthen the cooperation with non-EU (third) countries, especially with the neighboring countries of Libya; it is essential to be successfully eliminated these criminal networks, both in terms of training in law enforcement and in terms of the provision of information services;

- non-EU (third) countries to respect the international law in terms of saving human lives at sea, ensuring the protection of refugees and respect of the fundamental rights;

4) To prevent illegal migration is necessary to be established a balanced and effective European return policy (sending illegal migrants, who do not need international protection, back to their own countries). All Member States must transpose into national

legislation the “Directive on common standards and procedures for returning illegally staying third-country nationals” and the “Directive providing for minimum standards on sanctions and measures against employers of illegally staying third-country nationals”. It is recognized the usefulness of readmission agreements with third countries, but it must be considered within the overall EU relations with the affected countries. These agreements must be accompanied by incentives to assist their implementation by the third countries.

5) The real danger for the security of the EU comes from people arriving in the EU with criminal intentions, including for carrying out terrorist acts. It is about individual migrants, who are deployed in large refugee flows, arriving on the Continent and subsequently these criminals may resort to illegal networks of smugglers and to participate in the people and drugs trafficking as well.

Such a serious challenge in most significant degree requires consolidation of the European Agency for the Management of Operational Cooperation at the External Borders of the EU (Frontex), the European Police Office (Europol), the European Prosecutor's Office, law enforcement authorities of the EU and the national authorities in each Member State in investigating of criminal events and justice.

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GLOBAL CLIMATE CHANGE - A CHALLENGE FOR EUROPEAN UNION AND THE INTERNATIONAL COMMUNITY

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Abstract:

This report is designed to give an emphasis on problems relating to some of the major challenges for the international community at the present time as global climate change and global warming, rising temperatures have unprecedented effects worldwide and lead to the melting of glaciers, sea level rise, is causing flooding or drought in places where previously not seen such extreme phenomena. Increasingly, these unusual climatic conditions affecting the economy, the environment, health and daily life. This is proof that climate change is a reality and risks for the whole planet are colossal, which requires the taking of urgent action at national, regional and international levels.

Keywords: global climate change, global warming

One of the biggest challenges to the international community at the present time are global climate change and global warming. Rising temperatures have unprecedented effects worldwide and lead to the melting of glaciers, sea level rise, is causing flooding or drought in places where previously not seen such extreme phenomena. Increasingly, these unusual climatic conditions affecting the economy, the environment, health and daily life. This is proof that climate change is a reality and risks for the whole planet are colossal, which requires the taking of urgent action at national, regional and international levels. Some of the effects of climate change are the following:

- rising sea levels threaten low-lying island States and coastal communities;
- extreme weather conditions threaten food production and heat over the past decade have caused the untimely death of thousands of people around the world;
- the shortage of water and food, causes a regional conflicts, famine and occurrence of refugees;
- some plant and animal species are at increasing risk of extinction.

Climate change leads to more severe floods and cyclones, threatening areas considered earlier for safety. Droughts cover larger territories and more people incur losses. More predictions of Oxfam by 2015, an average of 375 million people a year will be affected by climate-related disasters.¹⁴

There are different theories about the amendment of the global contemporary climate, but so far the theory prevails for the greenhouse effect. If emissions are not reduced, the

¹⁴ OXFAM - 54% increase in number of people affected by climate disasters by 2015 could overwhelm emergency responses - <http://www.oxfam.org/pressroom/pressrelease/2009-Q4-21/increase-number-peopleaffected-climate-disasters>

concentration of greenhouse gases in the atmosphere are expected to double compared to the pre-industrial era by 2035, which will cause an increase in global temperature by more than ± 2 °C. In the long term there is a risk of global warming, with more than 5 °C, which is equivalent to the Earth's temperature variations between the last ice age and the present condition. The consequences of such warming will cause significant changes in the global map. Over 200 million people will be forced to migrate owing sea level rise and extreme events such as floods, droughts and hurricanes. Global warming above 2 °C would be irreversible damage to the planet's biodiversity, water resources and the world market for food.

Humanity has always been at risk of unexpected and adverse changes in climate as a result of the action of natural factors (Earth and space). Space is assigned to the factors the parameters of the Earth's orbit and solar activity. To earthly factors include shifting of the Earth's poles, changes in the speed of Earth's rotation, changes in the appearance of the physiographic the Earth. Natural factors have an influence on the distribution of temperature, atmospheric general circulation, ocean currents, the area of the cryosphere, and hence on the climate and its changes.

Anthropogenic (human-caused) factors affect by altering certain properties of the components of the climate system (the surface of the land, vegetation, atmospheric composition). This influence begins to manifest many moons ago, as a result of the processing of land, deforestation, urbanization, etc. On our planet, the climate is constantly changing, but the change in the past has been natural for tens and hundreds of thousands of years, it now change caused by human activity is only possible for a few decades.

Research has shown that by 1750 onwards, global concentrations of carbon dioxide (CO₂) in the atmosphere has risen by 37%. This is mainly due to the burning of fossil fuels (coal, oil, and natural gas) for the production of energy, as well as deforestation. In recent decades, greenhouse gases have the dominant role in terms of global climate change.

Comprehensive overview of climate data over the last decade brings together 303 people scientists from 48 countries behind the view that global warming is undeniable fact, the results of their collaborative work are published in the "Report on the State of climate change 2009", issued by the U.S. National Oceanic and Atmospheric Service¹⁵ in July 2010.

Ten are key indicators¹⁶ that show global warming, climate change, and these are the following: (1) higher ground temperatures; (2) higher temperatures over the oceans; (3) high levels of heat in the oceans; (4) the higher air temperatures near the surface of the Earth; (5) the higher humidity; (6) the higher sea surface temperatures; (7) sea level rise; (8) the reduction of sea ice; (9) the reduction of snow cover; (10) the shrinking of glaciers. The relative movement of each of these performance-enhancing in the first seven and a decline in the last three of them – undoubtedly proves that our planet is undergoing a warming over the last half century, as well as that of the Earth every decade since 1980 is hotter than the previous.

The report confirms the conclusions of the UN intergovernmental panel on climate change (IPCC)¹⁷. The data in the "Fourth assessment report"¹⁸, from 2007, showing that

15 National Oceanic and Atmospheric Administration (NOAA), The report is available at: <http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/climate-assessment-2009-lo-rez.pdf>

16 Third National Action Plan on Climate Change for the period 2013-2020, odobren a decision of the Council of Ministers of the Republic of Bulgaria № 459 of June 1, 2012, C.29.

17 Intergovernmental Panel on Climate Change (IPCC), established in 1988 and comprising 1,500 scientists from around the world with the mandate to assess and analyze existing research and knowledge on climate change and its impacts, draw up a detailed

the world has warmed by an average of 0.76 °C compared to pre-industrial levels and that temperatures are rising with an increasing pace. During the period 1993-2003 sea levels have risen almost two times faster than the previous three decades. The temperature in Europe in the last century, also has risen by almost 1 °C, i.e. more than the global average. Rainfall and snowfall have significantly increased in Northern Europe (10% to 40%), while in southern Europe they were reduced by about 20% and more commonly seen drought. Anthropogenic (human-caused) emissions of greenhouse gases are the cause of these changes. Give strong evidence that the warming is caused by human activity and that natural forces could lead to such a rise in global temperature.

This conclusion, however, is contested by some scientists that in the study of the Intergovernmental Group underestimated the role of natural factors and mostly of solar variability. It has been proven that small changes in solar activity cannot explain the observed climate changes of the last decades.

The foundation of modern climate policy at global and European level are the recommendations of the Intergovernmental Panel and they are geared mainly to measures to reduce greenhouse gas emissions emitted by human activity, as the only parameter on which humanity can actually influence.

According to the predictions of the IPCC, if you do not take measures to reduce emissions of greenhouse gases in this century, the average temperature on Earth is likely to increase further by 1.8 °C to 4 °C. This should not be allowed. The European Union considers that it is vital to prevent global warming by more than 2 °C compared to levels before the industrialization. There is serious scientific evidence that above this limit may be irreversible and potentially catastrophic changes¹⁹.

According to the Intergovernmental Group of experts on climate change high rise in atmospheric concentrations of greenhouse gases (carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O)) is the result of human activity from 1950 to the present day.

If we let climate change spontaneously and in the future, this will have serious local and global security implications. The threats of climate change will be far-reaching. Problems such as water shortages, migration of millions of so-called "refugees because of the environment and increased need for disaster assistance, loss of biodiversity and agricultural areas, as well as financial turmoil from the impacts of these issues on global markets will affect seriously the global community, while able to adapt to these changes.

In October 2006, British Economist Nicholas Stern, has published its analytical report, which is the first attempt at a summary economic evaluation "in numbers" on the threats of climate change and once again confirms the enormous economic cost of inaction. That price, along with the social and environmental costs will affect especially hard the poor populations in both developed and developing countries.

Докладът Стърн прогнозира, че в дългосрочен план климатичната промяна може да доведе до ежегодно намаляване на Брутният вътрешен продукт (БВП) между 5% и цели 20%, ако не бъде поставена под контрол чрез намаляване на парниковите емисии. Предприемането на глобални действия срещу климатичната промяна е

report on these issues. Panel reports represent the most authoritative consensus of the international scientific community on climate change.

¹⁸ The report is available at: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

¹⁹ EU against climate change at the forefront of global action to 2020 and beyond, the European communities, 2008, Printed in Belgium, with 5.

вярната стратегия за растеж в дългосрочен план и колкото по-бързо се вземат мерки, толкова по-малко ще струват те.

The Stern report predicted that in the long term climate change may result in an annual reduction of Gross domestic product (GDP) between 5% and 20%, if it is not placed under control by reducing greenhouse gas emissions. Taking global action against climate change is a correct strategy for growth in the long term and the sooner action is taken, the less it will cost you.

In 1972, the UN (United Nations) held the first International Conference on "the human environment in Stockholm (Sweden). From this Conference originated the principle "Think global, act local". The fight against climate change is a major item on the agenda of the international community and the European Union (EU). Have adopted the following international agreements:

1) United Nations Framework Convention on climate change (UNFCCC), in force from 21.03.1994 and has been ratified by 194 countries. It outlines the general framework of international efforts to tackle the challenges posed by climate change and adopt the principle of "common but differentiated responsibilities". According to its provisions, Governments of Member States:

- collect and share information on greenhouse gas emissions, national policies and best practices – through the so-called. National communications and annual national inventories of greenhouse gases;
- draw up national strategies for mitigating and adapting to the expected impacts of climate change;
- cooperate in preparing for adaptation to the effects of climate change, including through the provision of financial and technological assistance to developing countries.

2) The Kyoto Protocol (KP) to the UNFCCC was adopted in December 1997 but shall enter into force on 16.02.2005. is the first legally binding global instrument, engaging developed countries with specific quantitative reductions in their greenhouse gas emissions. Under the Protocol, industrialized nations as a whole must reduce their emissions of six greenhouse gases by about 5 percent from 1990 levels during the so-called. "First commitment period" from 2008 to 2012 for developing countries are not set emissions targets. The Protocol provides for reductions to be achieved through both the reduction of emissions in the countries themselves, and through investments in clean-up or more environmentally friendly technologies in other countries (the so-called flexible mechanisms under the Kyoto Protocol).

From some shortcomings and gaps in these documents having the need to develop and the conclusion of a new global agreement on climate change for the period after 2012, the conferences of the U N on climate change held in Bali (2007) and in Copenhagen (2009) pursue this aim.

As the next major step forward in the negotiations to reach a new global agreement on climate change has characterized the 16th Conference of the parties to the UNFCCC held in Cancun, Mexico in December 2010 is a package of decisions Adopted, known as a Cancun agreements and represents a key step towards building a comprehensive and legally binding framework for climate-related measures to be taken after 2012.

The meeting of the parties to the Kyoto Protocol, held from 26.11. to 08.12.2012 in Doha, Qatar, Member States undertake to its continuation and furthermore adopted a roadmap for the development of a new agreement on climate change, which would bind all the major economies in the world, including emerging countries like China and India.

The second stage of operation of the Kyoto Protocol starts on 01.01.2013 and cover only about 15% of global greenhouse emissions, after Canada, Japan, New Zealand and Russia. United States again did not join the mechanism for limiting greenhouse gas emissions.

At a meeting in Germany in June 2015, countries discussed opportunities for reducing greenhouse gas emissions by 2020, according to the UN, progress has been made on the drafting of the text of the agreement. The meeting helped pave the way to a global treaty to be signed by the Member States of the United Nations in December in Paris on the 21st Conference of the parties to the UN Framework Convention on climate change. Of the new Treaty, which will succeed the current Kyoto Protocol, it is expected that a more serious commitment from around the world – including the United States, China and others to reduce emissions. It is expected to achieve a new, legally binding international agreement to address climate change for the period after 2020.

The EU and the international community achieved significant progress in the last decade in the fight against climate change. As regards the contribution of the EU, the objective of reducing by 40% the emissions of the Union, which was agreed by the European Council, confirms its leadership role in the fight against climate change on a global scale. This is also an invitation to other major economies to demonstrate responsibility, offer their own purposes well before the meeting in Paris.

Безспорен е факта признат от международната общност, че Европейския съюз предприема адекватни действия в борбата с климатичните промени и отстоява необходимостта от ограничаване на глобалното затопяване до не повече от 2°C в средносрочен период. Приети са следните по-важни нормативни документи в рамките на ЕС:

Undisputed fact is recognized by the international community, that the European Union shall take appropriate action in combating climate change and assert the need to limit global warming to no more than 2 ° C over the medium term. Accepted are the following legal documents within the EU:

1) Regulation 2012/601/EC of 21.06.2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council;

2) Decision 2011/278 / EU of 27.04.2011 laying down EU-wide harmonized rules for transitional free allocation of emission allowances under Article 10th of Directive 2003/87 / EC of the European Parliament and of the Council;

3) Regulation (EC) no 1031/2010 Commission on graphics, management and other aspects of auctioning of allowances for greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for trading greenhouse gas emissions trading within the community;

4) Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the allowance trading scheme for greenhouse gas emissions of the community;

5) Directive 2009/28/EC of the European Parliament and the Council to promote the use of energy from renewable sources and amending and subsequently repealing directives 2001/77/EC and 2003/30/EC;

6) Directive 2009/30/EC of the European Parliament and of the Council amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce the levels of greenhouse gas emissions and

amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC;

7) Directive 2009/31/EC of the European Parliament and of the Council concerning the storage of CO₂ in geological formations and amending Directive 85/337/EEC, Commission directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC and 2008/1/EC, and Regulation (EC) No 1013/2006 of the European Parliament and of the Council;

8) Regulation (EC) No 443/2009 of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the community's integrated approach to reduce CO₂ emissions from light-duty vehicles;

9) Directive 2008/101/EO of the European Parliament and of the Council amending Directive 2003/87/EO so as to include aviation activities in the scheme for trading greenhouse gas emissions trading within the community;

10) Directive 2004/101/EO of the European Parliament and of the Council amending Directive 2003/87/EO establishing a scheme for greenhouse gas emission allowance trading within the greenhouse gases within the community in respect of project mechanisms provided for in the Kyoto Protocol;

11) Directive 2003/87/EO establishing a scheme for greenhouse gas emission allowance trading within the greenhouse gases within the community and amending Council Directive 96/61/EO;

12) Консолидирана версия на Директива 2003/87/EO от 13 октомври 2003 година за установяване на схема за търговия с квоти за емисии на парникови газове в рамките на Общността и за изменение на Директива 96/61/EO на Съвета.

On 16 April 2014 Parliament approved the agreement on the regulation of the European Parliament and of the Council amending Regulation (EC) no 525/13 concerning the technical implementation of the Kyoto Protocol during the second period of commitments to reduce greenhouse gas emissions, approved at the Conference on climate change in Doha in 2012.

In the Republic of Bulgaria adopted the following important legal documents:

1) Law to curb climate change (CCL) Promulgated, SG. 22 of 11.03.2014, in force from 11.03.2014;

2) Environmental Protection Act (EPA), (Gg. 91/2002, AMB. amend. Gg. 42/2011);

3) Energy Law (EL), (Gg. 107/2003, AMB. amend. Gg. 47/2011);

4) Law on Renewable Energies (LRE) (Gg. 35/2011);

5) Energy Efficiency Act (EE), (Gg. 98/2008 AMB. amend. Gg. 35/2011);

6) Financial management of disaster risk and insurance opportunities for adaptation to climate change in Bulgaria, 01.07.2014;

7) Analysis and evaluation of the risks and the vulnerability of sectors in the Bulgarian economy than climate change, 20.06.2014;

8) Third national plan for action on climate change for the period 2013-2020, approved by decision No. 439 of June 1, 2012, of the Council of Ministers;

9) Second national action plan on climate change 2005-2008

Climate change and the need to adapt to them put a number of questions in front of public administration and development, whose solution is becoming more imperative after each consecutive report of the IPCC from 1990 onwards. In this context, the European Commission published in 2007 a green paper "Adapting to climate change in Eu-

rope – options for EU actions", followed in 2008 by the white paper, which sets the framework of the European strategy for adaptation to climate change and is accompanied by an assessment of the impact of proposed policies in this area (Impact of Europea ' s Changing Climate, 2008). In March 2012, enabled European Internet platform for adaptation to Climate change-ADAPT, and in April 2013, was adopted an EU strategy for adaptation to climate change "(EC, 2013)²⁰

Adapting to climate change can be directed either to reduce the potential impacts of the effects of climate change on natural and human systems and the common vulnerability to climate change, or to increase the capacity for adaptation. In respect of policies related to climate change, there are different types of adaptation: an advanced, autonomous and planned adaptation. Proactive adaptation is carried out before the effects of climate change to be noticed, while autonomous adaptation does not constitute a conscious response to climatic stimuli but is triggered by environmental changes in natural systems, as well as changes in the market or in the well-being of human systems. Contrary to these two approaches, planned adaptation is the result of a deliberate political decision based on raising awareness of the fact that conditions have changed or are about to change and that action is needed in order to restore, maintain, or achieve a desired state.

Key factors to support the ability for adaptation are: economic resources, technology, information/awareness, skills/human resources, natural resources, infrastructure and institutional support/management.

They feature the following types of measures and actions: predictable (proactive) adaptation that takes place before the impact of climate change to be noticed, as opposed to Jet adjustment, which is limited to taking action to alleviate impact after it happened. Other types are so-called defensive/mitigation measures that seek to reduce the negative effects, contrary to the opportunistic measures aimed at strengthening the exploitation of beneficial effects.

Conclusion:

1. One of the most important problems facing the international community at present is climate change, because it invariably affects the other global problems such as conservation of biodiversity, the conservation of clean drinking water, protection of the sea and the forests, poverty, the provision of food and good living conditions.

2. Combating climate change is not only a regional but also a global problem whose solution is necessary taking measures of an international character. Member, national planning policies, identify the right as an essential tool to prevent global climate change and as a key instrument to ensure the universal efforts to evade the progression of this rapid process of climate change²¹.

3. Climate change is a global problem, to overcome that global action at all levels (national, regional and local) – on the part of Governments, business and each one of us individually. The choice is ours – the right and obligation to act and to take advantage of the opportunities of a low-carbon development, or to be idle witness to the changing life of the planet, which will leave the legacy of generations after us.²²

20 Anton Popov and authors, analysis and evaluation of the risks and the vulnerability of sectors in the Bulgarian economy of climate change-general part, operational programme environment 2007-2013, 15.

21 Carlson, J. International Environmental Law, Climate Change, and Intergenerational Justice. University of Iowa Legal Studies Research Paper, 2009, c. 76.

22 Third national plan for action on amendments change for the period 2013-2020, odobren by decision of the Council of Ministers of the Republic of Bulgaria no 459 dated 1 June 2012, s. 35.

4. It is envisaged that Member States of the United Nations in December in Paris on the 21st Conference of the parties to the UN Framework Convention on climate change to sign a global climate agreement, binding all countries and entering into force by 2020, as well as to find ways of increasing the proportion of the 2020 targets and actions for reduction of emissions so the world has a chance to remain under the ceiling of 2 °C increase in temperature. Of the new Treaty, which will succeed the current Kyoto Protocol, it is expected that a more serious commitment from around the world – including the United States, China and others to reduce emissions. It is expected to achieve a new, legally binding international agreement to address climate change for the period after 2020.

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THE RELATIONSHIP BETWEEN TARGETING AND MILITARY DECISION MAKING PROCESS

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Abstract: *The report examined the changes occurred with the introduction of doctrines and guidelines for planning of operations at the operational and tactical level, by analysis of the main points of the group planning and management of the joint effects on the process of joint identification and destruction of targets.*

Keywords: *planning process, targeting process, fires planning.*

Planning purposes in operations in past military conflicts has always been an integral part of the planning of fire defeat opponents. This process is occurring in sub planning fire defeat of all levels, the process was mainly directed to the destruction of entire funds with deadly effect, and the use of funds to non-lethal effect has been addition to the results from the deadly effect.

Changes occurred in recent years, especially with the introduction of guidelines for the planning of operations at the operational and tactical levels, require an assessment of the need to carry out certain activities in the process of planning objectives as well as to indicate its connection with process operational planning and identify the main points of the group planning and management of the joint effects on the process of joint identification and destruction of targets in the steps of the process of operational planning.

The co-determination and destruction objectives are closely related to the joint operational planning process. At the operational level information is obtained in the form of notes or operational concept for the operation, which includes the mission, desired end state, objectives and effects tasks for subordinates. For specific areas of planning, fire support and joint identification and destruction of targets provide additional information, including guidance on the planning process of joint identification and destruction of objectives, and common priorities for the process itself. The planning process requires careful coordination and synchronization. In the operations of the joint forces can simultaneously using conventional forces and special operations such the entire width and depth of the joint operation area in linear and nonlinear construction. The direct and indirect attacks against the opposing center of gravity must be aimed at achieving the necessary operational purposes in accordance with the concept of the operation, while limiting potential side effects in the next phases of the operation.

The integration and synchronization of deterrent action and maneuver commanders support the maximum achieving the operational level. Within its zones to conduct operations, land, air and naval components can be specified for supporting or supported commanders to integrate and synchronize maneuver, joint fire support and deterrent action. In addition, they define and plan objectives, priorities, effects and schedule impact. Commander component defined as supported in the joint area of operation impact on targets

throughout the area of operation and has responsibilities to plan and manage the process of planning purposes in accordance with the priorities set by the commander of the joint forces. These activities should be coordinated with the appropriate commanders component commands. In the event that these effects have an adverse impact on other operations authorized by problem Commander of the joint forces. Planning involves analyzing and understanding the interaction and connectivity of multiple systems at the operational level (political, economic, social, informational, etc.) to determine the consequences of the actions of forces. Planning purposes in the operations of the joint forces is carried out in the general process of planning operations and follows its phases. The main processes of planning objectives, determining the order of impact on them and the anticipated effects is done in developing the plan for the operation as the beginning place in phase 1 and the end - with the development of the operational plan and its approval by the strategic commander. Planning of operations of joint forces consists of eight steps.

Step 1 - "Initiating planning" was held with the aim to develop and maintain a certain level of awareness of the operational environment in order to ensure execution of the operational assessments, estimates and opinions of operational performance of the strategic commander. The main responsibility in this step brings the group for operational planning of joint operations to be supported by all departments in the headquarters of the joint forces, representatives of ministries, government, non-government organizations. In this step, depending on the planned operation determines the type, composition and timing of deployment of various groups and centers of the departments of the headquarters of the joint forces and the relations between them. The desired outcomes of this step of planning in response to the crisis are determining the need for deployment of an operational team communication and intelligence accountability in the area of interest and assess the nature of the threats and risks. The bases for work in this step are the documents received from the Strategic Command. Such documents are:

- Initiating an order/directive;
- The strategic planning guidelines-guidance on the joint identification and destruction of targets and joint fire support;
- The concept of the operation or a sample thereof;
- Strategic goals for the impact.

In its activity the Group for Planning and Management of Cooperative Effects does the following (GPMCE):

- Formation of the GPMCE;
- Studying all initiating documents;
- Send a request for additional information to the Group of intelligence planning, if necessary;
- Makes an estimate of the time for the planning of the processes of joint fire support and joint identification and destruction of targets.

As a result of this step in planning is developing guidelines for joint identification and destruction of targets for inclusion in the preliminary combat orders to subordinate units.

Step 2 - "Mission analysis" starts on the basis of receipt of a warning order from the Strategic Commander or his guidance for the initiation of advance planning, a project of the strategic evaluation or project of the options for a military response. In this step, you activate the group for operational planning for the joint operations, will be the warning order to subordinate components. The group operational planning of the joint operations

carried out analysis of the task to be performed, the time available, the political objectives, desired final State, the potential military and non-military factors, the need for external coordination and additional instructions. In this steps the group to deploy for a comprehensive assessment of the operational environment. The results of the analyses and activities in this step can be the following:

- Development and giving the warning order to the components;
- An analysis of the mission, based on the assessment of the Commander of the joint forces;
- Preparation of proposals for military option for a response from the joint forces after receiving suggestions from the commanders of the components and sending them to the Strategic Commander.

Incoming information about the group in this step is:

- Certain critical conditions (points) and operation phases of the operational model;
- Received an integrated database for the purposes of the operation in the area.
- The Group continues its activities as: determines the operational effects and actions;
- Develop criteria for prioritizing the objectives;
- Preparation of information for inclusion in the mission analysis briefing related to the joint determination and destruction of targets;
- Participate in the analysis of critical points and the Centre of gravity by phases and lines of operation;
- Preparation of joint guidelines for the identification and destruction of targets for inclusion in the guidelines of planning Commander;
- Develop a list of prohibited purposes of impact, when entering information in initiating documents.

Step 3 – “Development of options for action”.

This step starts upon receipt of the strategic assessment of the crisis, the military options to reply or instructions on the planning of strategic commander.

The operational planning group of joint operations on the basis of the work of the group for a comprehensive assessment of the operational environment (designated operational objectives, operational centers of gravity (own and the opponent), critical ability, critical requirements and critical points) determines the lines and the phases of the operation and developed an operational model for the planning and management of the operation.

The planning and management of the joint effects-based criteria for success to achieve the operational objectives and the results of the analysis of all the active parties in the theater of operations of the group for the operational planning of joint operations, determines the operational effects to be achieved for the implementation of the designated Commander of operational objectives.

Offers appropriate use of funds for a joint fire support on the conditions laid down in the operational model phases and lines of operation. A key role here holds the joint identification and destruction of targets by liaison officers component commands and those for senior staff. Jointly defining activity and destruction of targets is a summary of the requests from the component commands and distribution objectives integrated in the joint list of the priority objectives of the joint coordination group for the identification and destruction of targets to the beginning, and in the course of the operation in accordance

with the capabilities of crossfire and percussion means of participating in the various phases and lines of operation component commands.

Specific activity of GPMCE is as follows:

- An analysis of additional incoming intelligence to be used in the development of options for action;
- On the basis of the operational model and options for action the opponent discusses possible lists of goals for each option for action, taking into account the critical points and the Centre of gravity;
- Started the development of a matrix for the management of the impact;
- Analysis of forces and means of intelligence and impact for their appropriate use for each option for action;
- Analysis, how to act on the critical points and the Centre of gravity for action for each variant;
- Proposal for the use of non-lethal and lethal forces and means of influence on the discussed options for action;
- Support group for intelligence planning in the development of options for action of opposing forces;
- Assist the joint operational planning group in the development of their options for action;
- Developing a request for airspace management;
- Draw up a proposal for the desired operational effects on phases of the operation;
- Shall draw up a proposal for the priorities of the effects on phases of the operation;
- The objectives allocated between the components.

The end result of this step have developed options for use of forces and means of jointly defining the objectives and destruction in each of the options developed for the action of its own forces and resources.

Step 4 – “Analysis and simulation on the options for action”.

Activity of GPMCE is as follows:

- Updating of all lists of purposes depending on the specific conditions of the operational environment;
- Clarification of the criteria for the nomination and prioritization of the objectives in the area of operation;
- Specify the tasks of the joint fire support;
- Start of the development of the synchronization matrix of objectives;
- Specify the measures for efficiency;
- Assessment of the effects after impact on the objectives of each option for action of opposing forces;
- Assessment of the effects of the main actions of troops for each version of own troops;
- Proposal for the use of non-lethal and lethal forces and means to achieve the required effects on any option for action.
- A proposal by the Commander of the joint forces on how to use the powers and means of intelligence and the impact each option for action;

Step 5 – “Comparison and assessment of the options for action”.

Activity of the GPMCE lies in:

- Participation of experts from the Group during the comparison of each option for action;
- Updating of lists of purposes depending on the new intelligence information;
- Offers options for the use of forces and means of impact on the objectives of each option for action;
- If necessary, report the pros and cons of the use of forces and means of impact on the objectives of each option for action;
- Offers a line of impact on objectives, what forces and means of joint fire support to use, use of lethal and non-lethal forces and means and what effects will occur after the impact on the objectives in the area of operation;

Step 6 – “Approval of option for action”.

The activities of GPMCE lie in:

- With experts involved in approving the option for action;
- Finally being developed all lists with goals, impact matrix in targets and joint synchronization matrix;
- Final tasks are developed and the schedule of the joint fire support;
- Final performance measures are being developed;
- Develop the use of forces and means for the establishment and destruction of the objectives set out in the approved option for action; In applying the method of parallel work to give prior martial orders/orders to subordinate formations;

Step 7 – “Developing the concept for the conduct of the operation” and “Plan of operation”.

Activity of GPMCE:

- Updating lists of objectives and the plates under the new intelligence information;
- After validation of the concept of operation and rules for use of force completes the establishment of lists of objectives;
- Coordinate the sequence of effects in phases, objectives and stages of the operation in accordance with the operational model in order to ensure freedom of action and implementation of operational effects;
- Coordinate operational effects through consistent impact on objectives;
- Prepare Annex and coordinating instructions of the joint fire support as an integral part of the concept of operation of the joint operational forces.

Step 8 – Evaluation and review of the plan for the operation.

Activity of the GPMCE lies in:

- Participates with experts from the group in the evaluation and revision of the plan for the operation, if necessary;
- Constantly analyze and update all lists/plates with goals after receipt of new intelligence information;
- If the operational environment is developing a proposal for the use of forces and means of influence on the targets;
- Through experts provide expertise for planning purposes in the functional groups in the headquarters of the joint task force.

Planning is the main process performed by an expert group for planning and management of the joint effects. This process is a support process in planning the operation.

Planning of targets is a key process performed by the experts in the planning and management of the joint effects. This process is a process planning in support of the operation. The planning process is a fundamental factor for the success of the operation of the joint forces. The realization of the process of planning the goals expressed in the various means of destruction as a priority of the opponent, as well as in the conduct of a complex of measures for the conservation of its resources.

The experience of modern armed conflicts shows that the effective planning of objectives in operations resulting in sharply increasing degrees of destruction of the gangs at the enemy, inflicting certain losses and reduce his potential battle to the level requested, and, in certain cases, through destruction of critical priority objectives and targets of high value are achieved and the objectives of the operation.

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ИНТЕГРАЦИОНЕН МОДЕЛ НА ИНФОРМАЦИОННИТЕ ЛОГИСТИЧНИ СИСТЕМИ

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Abstract: *The integration of information is becoming a major problem worldwide and is essential for dynamic business and public sphere, regardless of whether an organization is small, medium or large. The purpose of this paper is the study of the problems in the application of information systems and offering integration model to improve the parameters of their operation.*

Key words: *logistics, information systems, integration model.*

Увод

Обмяната на данни и информация е основна функция на информационните системи и е с изключително важно значение за логистиката.

Развитието на информационните технологии предлага нови възможности за изграждане на взаимовръзките при осъществяване на логистиката. Всички решения в съвременните организации, обаче се нуждаят от обективна, точна, достоверна, достъпна и навременна информация. Целта на съвременните информационни системи е да осигурява информация с тези качества.

Така основните задачи на логистичните мениджъри са да разберат предизвикателствата на пазара и да осигурят правилното управление на потока от информация.

Философията на логистиката е в наличието на точния продукт, на точното място, в точното количество, точно навреме и с минимален разход. За реализацията на тази философия основно значение има информационното обслужване на логистиката, което се основава на избраната логистична технология и съответните информационни системи.

По наше мнение информационните системи, базирани и обслужващи логистичните технологии се обособяват и функционират като информационни логистични системи.

В последните години, обаче се очертава, че една информационна система не може да обхване всички логистични процеси и като краен резултат - не е достатъчна. В същото време, въпреки наситения пазар от софтуер продукти за обслужване на информационните нужди на организацията, няма система, която да обхваща всички процеси. В тази насока се полагат огромни усилия, но до момента не е постигнат задоволителен резултат. Не се вижда и в близкото (а може би и в по-далечното) бъдеще да бъде реализиран такъв проект. Това, от своя страна налага организациите да внедряват повече от една информационна система, а не рядко и сами да инвестират в разработването на такива.

Отделните информационни системи съхраняват информация за процеси в своя база от данни, без обаче да създават възможност тази информация да бъде споделена. Това води до редица негативни последици и затруднява правилното функциониране на организацията като цяло. В резултат - се налага необходимостта да се

разработи модел, който да синхронизира и интегрира информацията в и извън организацията.

Интеграцията на информацията се превърна в основен проблем от световен мащаб и е от първостепенна важност за динамично развиващия се бизнес и обществена сфера, независимо от това дали дадена организация е малка, средна или голяма. Тенденцията големи международни компании да ползват информационни системи за оптимизация на логистиката с цел намаляване на оперативния разход и повишаване нивото на обслужване с цел увеличаване на конкурентоспособността все по-често се наблюдава и на българския пазар. Осигуряването на конкурентна информационна среда в и извън организацията гарантира нейната конкурентоспособност на всички нива и създава безспорни предимства за развитие и растеж.

Целта на настоящата разработка е изследване на проблемите при приложението на информационните системи и предлагане на интеграционен модел за подобряване на параметрите на тяхното функциониране.

1. Проучване приложението на информационните логистични системи в организациите.

Предлаганите на българския пазар ERP информационни системи са със доказано приложение в логистиката. Ползите са безспорни - оптимизация на разходите, ръст в приходите, приток на свежи парични потоци, генерирани в следствие на минимизираните разходи и увеличените приходи.

За целите на настоящето изследване е проведено проучване, чрез анкета с цел анализ на приложението на информационни логистични системи в организациите (София град и Софийска област). Проучването е проведено в организации в и извън сферата на материалното производство. В проучването участват организации от обществения сектор и малки, средни и големи предприятия от различни бизнес сфери – производство, търговия, услуги.[1]

Целта на анкетата е да се провери степента на развитие и приложение на информационните логистични системи в стопанския живот на страната и значението, което организациите отдават на информационните логистични системи като предпоставка за подобряване на своята дейност.

Анкетата се състои от 15 въпроса. Обект на проучване са 10 организации. Според критерия „брой на персонала”, изследваните организации се разпределят в три основни групи: големи – 2; средни – 5; малки – 3. От тях, в общественя сектор са 2 – голяма и средна организация, в производствената сфера са 2 – 1 голямо и 1 средно предприятие, в търговската сфера са 2 – 1 средно и 1 малко предприятие и в сферата на услугите са 4 – 2 средни и 2 малки предприятия.

От проведената анкета и резултатите от нея могат да се направят следните изводи:[2]

- Независимо от вида и размера на организациите, всички използват софтуер за логистичните процеси, които най-често са свързани със счетоводни, складови, транспортни, управление на човешки ресурси, деловодни и други операции. Повечето организации определят броя на информационните системи, които използват за оптимален на този етап.
- По-голямата част от организациите не правят анализ на информационните системи, респективно информационната среда, което от своя страна налага извода, че те нямат яснота относно ползите в тази посока. Основна причина

е липсата на добра информационна култура, което показва празнина в знанието и ограничаване на възможностите за развитие и повишаване на ефективността.

- Въпреки големия брой фирми, производители на информационни логистични системи и приложения, както и големия брой предлагани софтуер продукти, повечето организации сами полагат усилия и инвестират в собствени проекти, които да покрият нуждите на организацията. Това от своя страна развива информационната структура, но създава и съответните затруднения.
- Всички организации виждат полза от информационните логистичните системи, като повечето от тях са готови да осигурят финансов и човешки ресурс за разработване на нови приложения. Това се дължи на полезността, която намират в системите и приложенията, и непрестанно нарастващите нужди, определени от динамичното развитие на средата.
- Много малка част от организациите използват възможностите, предлагани от информационните технологии за интеграция на информационните ресурси. Те нямат яснота за възможностите, които се предлагат от високите технологии, но въпреки това намират полза в обединяването на системите и приложенията.
- Организациите в по-голямата си част не познават инструментите за интеграция, тоест не знаят как може да интегрират информационните логистични системи и приложения, което не позволява да се развиват в правилната насока. Въпреки това незнание, всички организации биха интегрирали информационните си ресурси при възможност.

2. Интеграционен модел.

Стратегията на дългосрочния успех предполага използване на иновационния потенциал за осигуряване на взаимодействие между различните участници в информационните процеси и концентриране на техните ресурси.

През последните години се обособява пазарна ниша за предлагане на интеграционен софтуер, който да отговори на нарастващите нужди от интегриране на вече внедрени софтуерни приложения в организацията.

Това налага необходимостта от предлагане на интеграционен модел, който да бъде с широко приложение, и да бъде достъпен, както за големите, така и за средните и малките организации.

Разработеният и предлаган **интеграционен модел** (пълното наименование на интеграционния модел е интерфейс за приложно програмиране (Application Programming Interface – API)) представлява интерфейс за разработчици и програмисти, чрез който се създават приложения и софтуер инструменти. Той се изгражда от различни модули за извличане на информация за: обработка (трансформация); съхранение; въвеждане; синхронизация на трансферирането на данни и информация. [3]

Моделът дава възможност за създаване на различни софтуер модели за интеграция на приложения и системи.

Предлаганият продукт има следните **предимства** пред съществуващите досега алтернативи:

- срокът за интеграция ще зависи единствено от нуждите на потребителя;
- стремежът е разходите по проекта да бъдат изключително занижени;
- минимален риск от неуспех на проекта.

Прилагането на интеграционния софтуер не изисква нужда от опит в реализацията на сложни интеграционни проекти. С него могат да се реализират комплексни интеграционни проекти, благодарение на общите точки за достъп. Възможностите за интеграция, чрез предлагания модел са представени на Фигура 1.



Фигура 1. Взаимовръзки, осъществявани от интеграционния модел.

От Фигура 1. е видно, че двупосочната интеграция в реално време е най-сложния и в същото време най-функционалния тип интеграция. Тази интеграция работи на принципа заявка-отговор, като по този начин се решават проблемите с липсата на контрол и обратна информация и не се изисква интервенция или участие от служител, за да функционира нормално.

Принципът на позициониране на модела в информационната система на една организация е показан на Фигура 2.



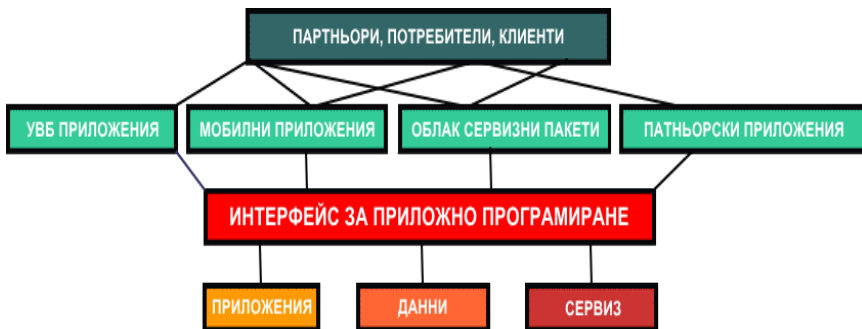
Фигура 2. Позициониране на интеграционния модел в информационната система.

На Фигура 2. са показани възможностите на модела за интеграция с инфраструктурата, сервизите и приложенията. Предложеният модел позволява да се осъществи непрекъснат информационен обмен в реално време, което от своя страна води до по-голяма функционалност по всички нива на организацията и оптимизира бизнес процесите.

Системата може да поддържа няколко формата за обмен на данните в зависимост от нуждите на клиентите. Този модел предлага възможност клиентите да получават и обработват необходимите данни, според своите цели и информацион-

ни нужди. Благодарение на документираните характеристики на входящите данни, информационната система може да извърши конкретна обработка коректно и да извърши правилните действия. Респективно, след тази обработка, данните могат да бъдат пренасочени към други системи и приложения, независимо от позиционирането им в или извън организацията.

Схематично моделът е представен на Фигура 3.



Фигура 3. Интеграционен модел.

Основната функция на предлагания интеграционен модел създава и най-важната му характеристика, а именно - **осигуряване на обща точка за достъп**.

На тази основа моделът предоставя следните **оперативни възможности**:

- ✓ Осигуряване на обща точка за достъп;
- ✓ Теоретично безкраен брой потребители;
- ✓ Гарантиран модел на входящата и изходяща информация;
- ✓ Автономност на точките за достъп (всяка работи независимо от другата);
- ✓ Възможност за семантично разделение на точките за достъп;
- ✓ Възможност за взаимоотношения на точките за достъп;
- ✓ Възможност за осигуряване на различни версии на софтуера, чрез номер на версията като основна точка за достъп;
- ✓ Възможност за включване и изключване на потребители (системи и приложения) по всяко време в зависимост от нуждите, както и създаване на автоматизиран процес за това (абонаментен план);
- ✓ Бързо надграждане, чрез създаване на нови точки за достъп.

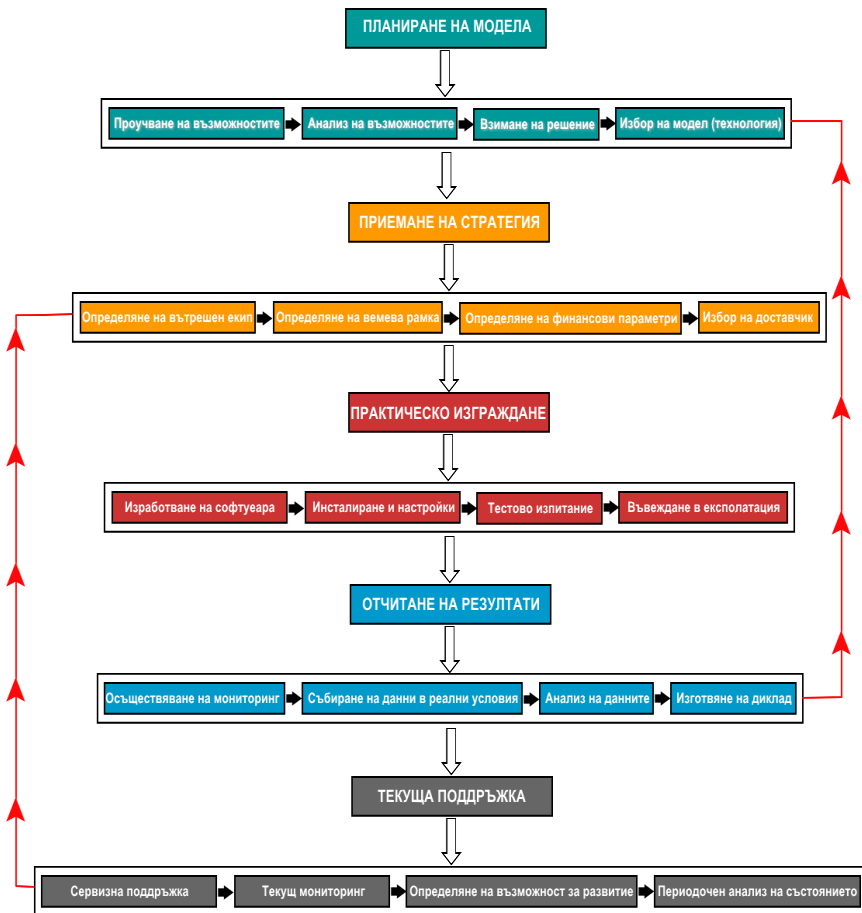
Предложеният модел за интеграция създава възможност за интеграция на предварително внедрени софтуерни продукти, както и включването на нови без риск от загуба на информация, която към момента е събрана, обработена и „складирана“.

Чрез модела се позволява на всички желаещи участници в бизнеса да се интегрират в обща информационна система, изградена на **принципа „всеки към всеки“**, чрез който се създава нова бизнес логика.

При създаване на модела е необходимо да се посочат процедури, по които да бъде създаден и приложен на практика, тоест необходим е алгоритъм, като чрез него се определя последователността на действията. Целта на алгоритъма е да положи основата на общи правила, върху която да се надгражда всеки отделен (частен) случай.

Предлаганият интеграционен модел се стреми да подобри софтуерната архитектура, съвместимостта, функционалността, поддръжката, дизайна и други. Ползата се изразяват в повишаване на ефективността на информационните ресурси, които подпомагат постигането на целите на организацията.

По наше мнение, внедряването на предложения интеграционен модел изисква следването на алгоритъм, който включва последователността и същността на необходимите процедури. – Фигура 4.



Фигура 4. Алгоритъм за внедряване на интеграционния модел

Въпросът със сигурността на информацията винаги стои на преден план, тъй като организациите се стремят максимално да защитят информационните си системи от външни и вътрешни посегателства и злонамерена намеса.

Предлаганият интеграционен модел позволява на организациите да решат проблемите, свързани със сигурността на информацията в три основни **направления**:

➤ **Постоянен обмен:** Залага се в самото начало при проектирането на информационната инфраструктура, като основната цел е минимизиране на периодите на неработоспособност.

➤ **Цялостност и конфиденциалност:** Защитата на данните срещу манипулация или неправомерен достъп е основна задача в единната информационна среда, през която се пренася критична и конфиденциална информация, чрез различни форми на публичен пренос (включително и през Интернет).

➤ **Сигурност:** централизирано управление за достъп на потребителите и оторизация към всички системи и приложения.

Можем да обобщим, че сигурността на информацията е от голямо значение за всяка организация, независимо от сферата в която развива дейността си. Информационните системи са изложени на ежедневни рискове и са обект на постоянни атаки, което води до необходимост от осигуряване на цялостен механизъм за контрол и защита на информацията.

На българския софтуерен пазар в момента предлагането на сходни продукти е ограничено, но то следва макар и бавно световните тенденции. Ползите от такъв вид продукт са безспорни, но предлагането на сходни продукти на пазара тепърва „прохожда“.

По наше мнение, предлаганият в настоящия труд интеграционен модел притежава следните **иновативни елементи**:

- До момента не съществува аналогична българска разработка и настоящия проект може да заеме съществуващата в момента незаета ниша на информационен интегратор между различните информационни системи и друг софтуер;
- Иновативен е подхода на техническа реализация като вид архитектура;
- Функционалността на модела е насочена към всички организации и индивидуални потребители;
- Възможност за оптимизация на информационните канали между клиентските приложения;
- Възможност за използване на различни среди и протоколи за комуникация.

Особено голям потенциал за реализация на предлагания интеграционен модел има най-вече в по-малките предприятия, които използват ограничен брой софтуерни приложения и нисък бюджет за програмно осигуряване, но изпитват нужда от интегрираната им употреба с оглед по-висока ефективност и функционалност на малочисления персонал и достъп до информация "от първа ръка" на управленския състав.

Приложението на предлагания интеграционен модел е свързано с постигане на следните **стратегическите цели, насочени към повишаване на ефективността на информационните логистични системи**:

- Дългосрочна употреба;
- Гъвкавост и автономност;
- Създаване на устойчива интегрирана информационна система.

На българския софтуерен пазар в момента предлагането на сходни продукти е ограничено, но то следва макар и бавно световните тенденции.

Компанията Lambda Labs, базирана в Сан Франциско скоро ще пусне API за разпознаване на лица, който ще може да работи с приложения за Google Glass.

Заявките за приложен интерфейс към компанията растат с 15% месечно и вече са над 5 млн. на месец. Новата технология на Lambda Labs ще позволи в приложенията за Google Glass да се интегрират функции за запомняне на лица, търсене на известно лице в група, интелигентна адресна книга и други. [4]

Друг сходен продукт е Google AdWords API, който е разработен за програмисти, представляващи големи рекламодатели и трети страни с познания в технологиите. Той включва агенции, специалисти по маркетинг, чрез търсещи машини (SEM) и други специалисти по онлайн маркетинг, които управляват няколко клиентски профила или големи кампании. [5]

Програмата Facebook Marketing API позволява на разработчиците да изграждат инструменти и услуги, които програмно създават, купуват и управляват рекламни кампании във Facebook. Приложението се ползва за брандовете, чрез трети страни – доставчици, за да се управляват многомилיוнни рекламни кампании, които са твърде сложни за осъществяване, чрез обичайния инструмент за публикуване на реклама във Facebook. [6]

През последните години и в България се полагат усилия за разработването на API приложения. Такава е платформата за онлайн търговия Deltastock API [7], който е напълно безплатен и е достъпен за всички демо клиенти по подразбиране. При него клиентите с реални сметки трябва да подпишат допълнително споразумение, за да активират API.

По наше мнение, приложението на интеграционния модел води до повишаване на **ефективността** на функционирането на информационните логистични системи в следните направления:

- Моделът може да осигури мобилност, единна информационна среда и централизирано управление, което от своя страна може да намали инвестициите - тоест да доведе до печалба.
- Структурата на модела осигурява пълната му и точна адаптация към изискванията на индивидуалната бизнес ситуация и създава възможност за свободен и неограничен достъп до интегрираната информационна система.
- С предлагания модел може бързо и лесно да се имплементират приложения и модули. Той позволява сравнително лесна поддръжка и не на последно място, но от особена важност - бъдещо адаптиране към промените и развитието на бизнес средата.
- Моделът дават възможност за интегриране, както вътре в организацията, така и извън нея. Така се създава обща информационна среда и се достига необходимата ефективност. Фирмите придобиват информационна гъвкавост, бързина и адаптация за нови разработки.
- Чрез интеграционния модел могат да се управляват важни бизнес транзакции и той често има директно влияние върху взаимодействията с клиентите и възможностите на бизнеса за действие.
- Предложеният модел позволява да се осъществи непрекъснат информационен обмен в реално време, което от своя страна води до по-голяма функционалност по всички нива на организацията и оптимизира бизнес процесите.
- Моделът позволява да се повиши ергономичността, която пряко влияе върху потребителите и тяхната производителност. Така следва да се повиши производителността на отделните служители и работници.

Мениджърите ще получат нови възможности за планиране и мониторинг на бизнес процесите, както и да изградят своите стратегии за бъдещо развитие на нова по-здрава информационна основа, базирана на повече информация от самата фирма и нейните партньори.

- Чрез предлагания интеграционен модел може да се постигне по-голяма сигурност на предаване и обмен на информацията.

За aprobация на предложени интеграционен модел е приложен качествен метод - получаване на експертни оценки с цел проверка на практическата значимост и приложимост на модела в обществения и стопанския живот на страната и значението, което организациите отдават на създаването на нови информационни канали като предпоставка за подобряване на своята дейност. Проучването на експертните мнения е извършено, чрез метода на лично полуструктурирано интервю с експерти от сферата на информационното обслужване на организациите – ръководители и специалисти. Интервюирани са общо 10 експерти като проучването е проведено в организации от и извън сферата на материалното производство. В проучването участват организации от обществения сектор и малки, средни и големи предприятия от различни бизнес сфери – производство, търговия, услуги. Според критерия „брой на персонала”, изследваните организации се разпределят в три основни групи: големи – 2; средни – 5; малки – 3. От тях, в обществения сектор са 2 – голяма и средна организация, в производствената сфера са 2 – 1 голяма и 1 средно предприятие, в търговската сфера са 2 – 1 средно и 1 малко предприятие и в сферата на услугите са 4 – 2 средни и 2 малки предприятия.*

На всеки от поставените въпроси, в зависимост от тяхната значимост, експертите са поставили оценка от 1 до 5.

В Таблица 1. са представени средните стойности на дадените оценки от 1 до 5 за всеки от поставените въпроси.

Таблица 1.

Средна стойност на показателите за практическа приложимост на интеграционния модел

Показатели	Средна стойност на оценка от 1 до 5
Приложимост	4,8
Инвестиционно намерение	4,5
Ползи за организацията	4,9
Ползи за логистиката	5
Финансови ползи	4,4
Улесняване на доставчици	4,9
Улесняване на клиентите	4,9
Качеството на информацията	5
Скорост на информацията	5
Ефективност на информационните логистични системи	4,8
Обща средноаритметична стойност:	4,7

* Проучването на експертните мнения е проведено през 2014 г. в организациите, участвали в анкетата, проведена през 2013 г., резултатите от която са представени в параграф 1. на настоящата разработка.

От представените резултати могат да се направят следните **изводи**:

- Организациите приемат предложения интеграционен модел и го оценяват високо.
- Наблюдава се следната тенденция, очертана от оценките на различните по вид организации - Тези с нестопанска цел, работещи в общественния сектор най-слабо разбират възможностите на модела и затова са го оценили по-ниско. Организациите от голям и среден тип дават висока оценка на модела и са склонни да инвестират в такъв вид интеграция. Малките предприятия са скептични от гледна точка на възвръщаемост на инвестицията въпреки, че и те намират своите ползи.
- Въпреки високия резултат на оценка процеса на вземане на решение за каквато и да е инвестиция в условията на световна икономическа криза е сложен и носи своите рискове.

В заключение повишаването на ефективността на информационните логистични системи може да се постигне, чрез прилагане на интеграционен модел, който има за цел да подобри взаимовръзките между партньори и клиенти като осигури връзка между различните софтуерни продукти и може да извлече информация от даден продукт, да я обработва (ако е необходимо) и да я въвежда в друг софтуерен продукт.

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CADETS AND STUDENTS

СПЕЦИФИКА НА УПРАВЛЕНСКАТА ДЕЙНОСТ В АРМИЯТА

ДИМИТЪР ГЕОРГИЕВ ГЕОРГИЕВ
МИРОСЛАВ ВЕЛКОВ ВЕЛКОВ

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Abstract: *Актуалността на темата се състои в това, че управленската дейност в момента е една от най-изследваните и най-описваните в научната литература. Това е съвсем логично, тъй като тя се смята за най-значима и се приема като определяща за крайния резултат на всички други дейности, които се управляват*

Keywords: *управленската дейност, решение, организаторска дейност, планиране*

1. Introduction

Нарастващата значимост специфика на управленската дейност в Българската армия се определя предимно от следните фактори : извършващата се реформа; големите изменения в ценностната система и стила на живот на младите хора и военнослужещите през последните години; необходимостта да се поддържа боеспособността и боеготовността на българската армия при наличие на материално-техническо и финансово затруднение.

2. Main part

1. ПСИХОЛОГИЧЕСКА СЪЩНОСТ И СТРУКТУРА НА УПРАВЛЕНСКАТА ДЕЙНОСТ.

1. 1. Същност, съдържание и цел на управленската дейност

В научната литература съществуват много определения за управлението. Внимателният им анализ, независимо от аспекта показва, че всички те имат за основа класическото определение на Рос Ъшби. Според него основната и главна цел на управлението е стремежът да се постигне равновесие с изменящата се среда, да се приспособи към изменението на външните условия, като при това запази качествената си определеност.

Въпреки, че много автори подлагат на дискусия универсалността на едно такова определение, в крайна сметка то дава една добра основа за анализ на управленската дейност, най-малко поради следните две основания :

- показва, че усъвършенстването на управлението може да се постигне без промяна на приетата управленска концепция ;
- промяната на управленската концепция /частична или цялостна/, е способ за усъвършенстване на управлението.

И в двата случая целта е адекватност на условията и запазване на качествената определеност.

В психологическата литература управленската дейност най-често се свързва с понятието “въздействие”. Много разпространено и прието като работно от изследователите е определението, че “управлението е целенасочена дейност за въздействие върху съзнанието на хората /най- вече по посока на мотивацията/ с цел повишаване ефективността на тяхната дейност при изпълнение на определени задачи.”

Най-често управленската дейност във всеки социален организъм, включително в армията, се анализира от три страни:

1. От функционална гледна точка – като процес на обединяване на цялото с оглед реализиране на целенасочено поведение спрямо приетата цел;
2. От субстратна гледна точка – като процес на получаване, преработване и предаване на информация с оглед вземане на решение;
3. От структурна гледна точка – като реализация на цел чрез оптимизиране взаимодействието между елементите на управляемата система.

Ако анализираме дадените дотук определения и гледни точки ,можем да кажем, че в най-общ план, ключови понятия спрямо управленската дейност са: въздействие – целенасочено поведение – цел, т.е. въздействие за постигане на целенасочено поведение спрямо обоснована и приета цел.

Основна цел на управленската дейност в армията е поддържането на висока боеспособност и боеспособност. Нейното постигане изисква преди всичко следното:

- познаване на закономерностите и тенденциите в армейската система и насочване на нейното развитие съобразно с тях;
- своевременно откриване и разрешаване на възникващите противоречия, преодоляване на препятствията по пътя към поставените цели;
- запазване и развитие единството на армейската система, способността да преодолява или неутрализира вътрешните и външните отрицателни въздействия;
- провеждане на реалистична управленска политика, основана на строго отчитане на субективните и обективните възможности;
- контрол и правилно използване на наличните ресурси – личен състав, време, финансови и материално-технически средства;
- повишаване управленската култура на подчинените от отделните изпълнителски звена;
- рационално използване на колективния ум;
- развитие на кадрите.

Много често, особено при сегашния преход от едно общество към друго или по време на дълго продължаващи реформи, целта на управленската дейност е свързана с някакви промени. Понятието “промяна” е свързано и с управлението в онези социални организации, които участват в някаква форма на конкуренция /България или Румъния е по-готова за Европейския съюз ?/. Именно затова проблемът “про-

мяна” сега е един от най-изследваните и дискутираните. Повечето от изследователите смятат, че за да бъде ефективно управлението в процеса на промяната, а и след това, първо е необходимо да се анализира и докаже следното:

- необходима ли е промяната;
- има ли възможност за извършване на промяната /финансова, материално-техническа, от гледна точка на човешките ресурси/;
- изисква ли промяната някаква подготовка на изпълнителите;
- какво социално напрежение ще създаде промяната ;
- как да стане промяната, или кой е най-ефективния начин за промяна от всички възможности ;
- каква е цената на промяната /средства, социално напрежение, обществени реакции и др./ ;
- ще доведе ли промяната до значим ефект /струва ли си да се прави тя/.

Тази схема показва, че започването на промяната не може да бъде резултат на нечие хрумване, а е научно обоснован извод на основата на задълбочен анализ и изследвания. Реализираната като “хрумване” промяна най-вероятно ще има отрицателни ефекти.

Освен това, необходимо е да се предвиди, че хората, които засяга промяната, я приемат по различен начин. Едни я приемат бързо, като необходимост, други я отхвърлят, трети се стремят да не се обвързват с нея. Командирът, като военен лидер, трябва да се съобразява с индивидуално-психическите особености на подчинените, които могат да доведат до съпротива спрямо новите идеи. Най-често тази съпротива се поражда от две групи причини:

1. Причини от социално-икономически характер:

- страх от съкращаване или понижаване на длъжността;
- заплахата за социалния статус;
- стремеж да се запазят предишните социални връзки;
- нежелание за приспособяване към промените в колектива;
- заплахата, че новата обстановка ще доведе до намаляване на удовлетвореността от работата;
- недоволство от слабо лично участие и незначителната роля в промяната;
- недоволство от вмешателството на внедряващите нововъведенията в личната работа.

2. Причини от личен характер:

- страх пред неопределеността, предпочитане на стабилността;
- неразбиране на същността и значимостта на промените;
- възприемане на новите методи на работа като лична обидата;
- необходимост от смяна на навиците, засягащи професионалната гордост;
- нежелание да се изразходват сили за преквалификация;
- задълбочаване на специализацията и намаляване чувството на собствена значимост в трудовия процес.

Относно съдържанието и структурата на управленската дейност, в психологическата литература също има различия. Те са в резултат на различните аспекти за анализ.

1.2. Структура на управленската дейност.

Най-ранното схващане /още от 1926 година/ на френския индустриалец Анри Файол е, че структурата на управленската дейност включва следните елементи: планиране, организиране, контрол и регулиране. На тази основа някои автори смятат, че управлението изпълнява планираща, организираща, контролираща и коригираща функция.

От гледна точка на съвременния характер на управленската дейност, този подход може да се приеме при следните условия:

- управленската дейност се разглежда за голям период от време;
- последователността в схемата “планиране – организация – контрол – регулиране” е върна само в най-общ план.

Управленската дейност може да се разглежда като дейност на личността и като съвместна дейност на йерархически взаимосвързани длъжностни лица. Нас ни интересува първия аспект.

Непосредствените наблюдения върху дейността на съвременния ръководител показват, че при нея често липсва горепосочената последователност. Случва се да се вземе решение за нещо, което не е планирано, или да се контролира появата и развитието на нещо, което не е предвидено. Казано с други думи, във всеки момент на ръководителя може да се наложи извършването на някакъв “управленски акт”, който той не е планирал за деня.

По тази причина, в съвременната управленска дейност, в това число и в армията, могат да се наблюдават различни емпирични единици /съвещания, преговори, разговори по телефона, работа с документи и др./. Всяка емпирична единица може да има различно съдържание, например съвещанията много често са различни.

Психологическият анализ на тези емпирични единици показва, че управленската дейност съдържа три компонента, три типа дейност:

1. Диагностична дейност – създава моментния образ на управлявания обект /неговото състояние, в частност – проблемната ситуация/;
2. Творческа дейност – на основата на създадения образ се изработва програма за бъдещата дейност, чрез която обекта на управление може да се приведе в желаното състояние;
3. Организаторска дейност – обезпечават изпълнението на програмата.

Тези компоненти са взаимно свързани и образуват психическата структура на управленската дейност. Те в различна степен присъстват в дадена емпирична единица, в зависимост от нейното съдържание.

Съгласно тази теория, управленската дейност изпълнява две функции :

- производствена – свързана с качествените и количествени измерения на крайния резултат;
- възпитателна – свързана с разглеждането на управленската дейност като средство за обучение и възпитание на личността.

Приложен към дейността на ръководителите, дейностният подход позволява да се диференцират две групи от важни нейни характеристики. Първата група може да бъде дефинирана като индивидуална управленска концепция (ИУК) на личността, а втората – като нейно професионално майсторство.

ИУК представлява личното виждане на ръководителя за системата от изисквания, предявявани към работата му и тази на поверения му колектив, от гледна точка на тяхната постижимост в конкретните условия, с наличните сили и средства, а също така начините за решаване на поставените пред екипа задачи. Изгражда се в процеса на професионалното обучение и се уточнява в хода на придобиването на управленски опит. ИУК изпълнява ред функции:

- ценностна, която определя значимостта на всеки отделен проблем в структурата на дейността;
- структурираща – пренастройва системата от външни изисквания в съответствие с личностната значимост на всеки ръководител;
- мотивационна – определя колко усилия са необходими за изпълнение на задачите;
- селективна, която от множеството проблеми, спонтанно възникващи в процеса на управление, подбира тези, които заслужават вниманието на ръководителя и;
- контролна, с която завършва процесът на въздействие върху процеса на управление.

При анализа на управленската дейност трябва да се изхожда от това, какъв тип е тя:

А/ **властнически**, където ръководителят е началник на подчинени в прекия смисъл – отдава заповеди и изисква изпълнението им, поощрява, наказва и т.н.;

Б/ **лидерски** тип, при който една личност, без да е облечена във формална власт, чрез силата на авторитета си влияе на хората;

В/ **щабен** тип – управленската дейност се осъществява от група длъжностни лица, които не са ръководители на колектива;

Г/ **представителен** тип – означава дейността на представителя на една организация сред служителите на друга организация, която не е подчинена на първата нито пряко, нито косвено. Намира проява в сферата на отношенията между ведомствата и институциите. В армията се наблюдават и четирите типа управление, като всеки от тях си има своя специфика.

2. СПЕЦИФИКА НА УПРАВЛЕНСКАТА ДЕЙНОСТ В АРМИЯТА.

Ако се търси специфика на управленската дейност в армията, то би трябвало да се тръгне от понятието “власт”, т.е. да се видят особеностите на властта, която командирите имат в качеството си на военни лидери.

Най-широкият общоприет смисъл на властта е, че тя е **монополно право** на нейния субект над причините за даден резултат в обекта. Казано с други думи, това е привилегията да причиняваш. Монополът върху причините всъщност е ресурс на властта.

Ако разгледаме властта като компонент на обществените отношения, т.е. в тесен смисъл, то тя може да се дефинира като субективна зависимост от произвола на чужда воля. Именно в този аспект властта е асиметрично отношение – това, което е достъпно на субекта на властта, е отнето на обекта.

Това “асиметрично отношение” в армейските организации, за разлика от други такива, е доста специфично. Първо, то е много устойчиво в някакви регламентирани рамки. Даже за неочаквано възникнали критични ситуации механизмът за

неговото реализиране е описан. Тази особеност не трябва да се разглежда като ограничение на творчеството на военния лидер. В повечето случаи тя подпомага управленската дейност в армията.

Властта на ръководителя зависи и от организацията на управленския социален организъм, в който има изградена мрежа от организационни отношения. Те осигуряват цялостност на системата, поддържайки оптимални взаимоотношения между нейните елементи. По този начин властта на отделните индивиди зависи от създадената организация и от мястото им в нея. Тези разсъждения са верни за т.нар. идеална организация. На практика във всеки социален организъм се наблюдава непрекъсната динамика: движение на индивидите в цялата система, инцидентно протичащи връзки или тяхното преразпределение в системата.

В армейските социални организми тази динамика е съвсем малка.

По тази причина правата и задълженията на индивида не се изменят ситуативно, което би могло да се приеме като позитивна характеристика на управленската дейност в армията. Това всъщност не е така. Задълженията на военните лидери във вид на отговорности са много големи, а тяхната неизменност означава, че те винаги носят голяма тежест. Психолозите смятат, че отговорността на офицера има две измерения : **огромни и постоянни** и затова с право я определят като много голям стресор. Това дава отражение върху управленската му дейност. Всеки негов управленски акт има не само социален и икономически аспект /както е при другите ръководители/, но е свързан и с безопасността на живота на подчинените му.

Във всеки случай, всяко управление предполага въздействие върху процесите в името на някаква цел, т.е. консумиране на властта. В този смисъл, едноличният ръководител, като има най-голяма власт, има и най-голяма възможност за въздействие върху линията, която ще следва целия колектив. Властта, която притежава, му дава възможност да господства и твори битието по свой образ, в зависимост от своите интереси, морал и интелект.

Тези разсъждения, отнесени към командирите от армията, се нуждаят от известна конкретизация, която би очертала някои особености в управленската дейност на офицера.

Първо, офицерът не е в истински смисъл едноличен ръководител. Правата му над другите са предписани, като следствие от функциите на неговия статус. Той не може своеволно да ги променя.

Второ, ако се разшифроват правата му, ще се види, че те са следствие от неговите задължения. Например правото да проверява и взисква от другите за неща, за които той носи отговорността.

Трето, принципът за единоначалие не означава, че военният лидер има безгранична лична власт над другите. Съгласно уставите, този принцип се реализира на демократична основа.

2.1. Деформации при упражняване на властта в армейски условия.

Упражняването на властта поражда и някои рискове. Както в другите социални организми, така и в армията , тя поражда някои деформации. По-характерни от тях са :

1. Пристрастен и тенденциозен подбор. Командирът пренебрегва всяка ин-формация, която не съпада с неговото мнение и избор на решение. Това най-често

става несъзнателно, особено при проблемна ситуация. Може да се получи така, че той инстинктивно да се страхува от алтернативните решения. Поради тази причина би могъл избирателно да пропуска информацията, които са в полза на неговото решение.

Този начин на използване на данни може да бъде и съзнателен. В този случай се говори за негативен елемент в стила на ръководство.

2. Необоснован оптимизъм при вземане на решения. Тази деформация при вземане на рискови решения води до негативни последици, описани във военната история. Военният лидер е необосновано уверен в собственото си становище, смята за най-вероятно това, към което се стреми и което според него е най-ползено. Такова поведение може да следва от някои личностни черти на офицера, но може и да е в резултат на техническото състояние, в което изпадат хората, носещи голяма отговорност за изпълнение на задачите.

3. Ефект на регресивното мислене. Изразява се в това, че минал отрицателен опит при вземане на рискови решения се експлоатира спрямо новата ситуация. Това е много опасно, защото в бойна обстановка страхът от минали несполуки може да отхвърли най-доброто решение в актуалната ситуация. Затова някои военни психолози смятат, че едно от условията за успешна бойна дейност на командира е критичността на неговото мислене.

4. Ефект на забранения плод. Има случаи, когато спуснатите “отгоре” указания за избягване на дадени решения правят тези решения най-примамливи и желани. Отначало се подлагат на обсъждане, за да се види защо трябва да бъдат отхвърлени, след това се включват като алтернативни и накрая се избира някое от тях. В много случаи това се получава в резултат на недобри взаимоотношения между инстанциите по вертикала, или на предварително формирани нагласи за противопоставяне. Пример : главната героиня в ТВ сериала “Никита”.

5. Ефект на ранговото влияние. В групи със строго йерархизирана структура на властта, каквито са воинските, се нарушават информационните процеси и процесът на вземане на решение. В резултат на конкретни изследвания е доказано ,че членовете на групата с най-нисък ранг е най-малко вероятно да влияят на общото решение, дори и когато са с правилно становище. Този ефект обяснява очакването, че членовете с по-голям ранг упражняват голямо влияние и не се нуждаят от голяма поддръжка, за да бъдат приети техните предложения. Нискостоящите могат да се съгласят с носителите на властта, даже когато знаят, че тяхното лично мнение е по-добро.

2.2. Разлики между управлението в армейски условия и управлението в гражданска социална среда.

По принцип, управлението в армията има големи разлики, отличаващи го от всяко друго. Те се обслужват преди всичко от значимостта на целите, характера на воинската дейност и на условията, в които тя протича. В най-общ план могат да бъдат открити следните особености:

- правата и задълженията на военния лидер са регламентирани в по-голяма степен, но това не означава, че той няма възможност за проява на инициативност и творчество;

- подчинените не се избират от командирите, а се назначават от други инстанции. Тяхното участие в подбора на кадри е ограничено само за професионалните военнослужещи и гражданските лица;
- клетвата към Република България обвързва със задължения, които не са договорни, а вечни. Никой не може да се освободи от тях по желание, да стачкува, нито да си подаде оставката;
- командирите от всички нива имат проблеми с честата смяна на личния състав;
- командирите имат повече власт от който и да било цивилен началник и могат да наказват подчинените си за неща, които биха минали незабелязано извън армията;
- най-важната особеност е тази, че военният лидер очаква от подчинените си да приемат евентуално и смъртта на бойното поле, за да бъде изпълнена поставената задача.

3. ВЗЕМАНЕТО НА РЕШЕНИЕ – ЦЕНТЪР НА УПРАВЛЕНСКАТА ДЕЙНОСТ В АРМИЯТА.

3.1. Видове решения, условия и етапи за вземането им.

По своята психологическа същност вземането на решение е основен компонент на всяко волево действие, осъществявано от личността. Управленската дейност е преди всичко волева. Решението е онзи начален момент, без който е невъзможна волева дейност.

Като взема решения, командирът непрекъснато внася изменения в живота на частта, подразделението, щаба, привежда ги от едно състояние в друго или изменя степента на даденото състояние, задължава да се действа за постигане на определената цел. Затова няма ли решение, не може да започне и управленския процес.

В зависимост от условията за вземане на решение, те биват:

- решение при пълна определеност: налице е цялата информация за проблемната ситуация и са известни последиците от всеки възприет вариант за действие;
- решение при неопределеност: командирът разполага с непълна информация за проблемната ситуация и факторите, които и влияят;
- решение при наличие на риск: тук всяка алтернатива за действие се съпровожда от различни изходи и с различна степен на събдяване, свързани с опасност за неговите последици;
- решение при противодействие: командирът действа в конфликтна обстановка и трябва да избере най-удачното си поведение.

За да бъде ефективен процесът на вземане на решение, необходимо е да се спазят няколко условия:

А/ Нужно е военният лидер да изпитва потребност от вземане на решения и да има условия за нейното удовлетворяване;

Б/ Проучване опита на другите, тъй като голяма част от проблемите не са нови или уникални, следователно те вече са имали някога и някъде свое решение;

В/ Командирът да умее да се съветва с подчинените си и особено с офицерите от щаба, защото колкото и висококвалифициран да е, не може да има еднакво висока подготовка за правилното решаване на всички проблеми;

Г/ Уточняване на необходимите средства за изпълнението му;

Д/ Събиране на достатъчно информация за обосноваването му, но без да се отлага за обхващане на всички възможни данни по всички линии;

Е/ Определяне на периода и етапите, в които решението ще бъде изпълнено.

Последното условие заслужава да му бъде обърнато допълнително внимание. Етапността предполага най-напред проблемната ситуация да бъде разпозната и осъзната.

Второ, трябва да бъде събрана необходимата информация, която не само да разкрива състоянието на нещата в момента, но и това, което би могло да се случи и в бъдеще. Тя трябва да е от различни източници, при отчитане на мотивацията на участниците в проблемната ситуация. Тъй като военните лидери може да получат едностранчива, изкривена, а понякога и неадекватна на действителността информация, тя трябва да бъде подлагана на проверка.

Трето, при наличие на вече обработена и качествена информация, би могло да се премине към анализиране на проблемната ситуация. Стремещът трябва да бъде към разграничаване на същественото от несъщественото, задълбаване под повърхността на проблема, оценка на съществуващите тенденции, прогноза за бъдещото развитие на нещата, предпазване от групи екстраполации и разкриване на факторите, които влияят на събитията.

Четвърти етап представлява определянето на алтернативите, които предхожда тяхната оценка и приемането на решение.

Пето, необходимо ще бъде да се създаде организация на изпълнението, включваща формулиране на решението по такъв начин, че да бъде разбрано от подчинените и юридическото му оформяне като заповед, разпореждане и т.н.

Шести и последен е етапът на контрол и оценка на резултатите. На този етап се определя ефектът от взетото решение и се затваря целият цикъл.

Ако решението се е оказало неработоспособно, командирът трябва да го преизгледа и да се обърне към следващата алтернатива при избора.

Във всеки случай, проверката на резултатите е полезна за военния лидер. Ако решението е добро, той ще знае какво да прави при друг подобен случай. Ако пък се окаже лошо, ще знае какво да не прави следващия път.

3.2. Психологически особености на груповото вземане на решение за бой от щаба и възможно поведение на защитно бягство от отговорност.

Потенциалът на групата /щаба/, която взема управленски решения зависи, но не е механичен сбор от потенциалите на включените в нея офицери. Тук задачата е още по-сложна, защото освен от личностнопсихологическите, зависи и от социалнопсихологическите особености, свързани с общуването, колегиалността, психическата съвместимост, поемането или бягството от отговорност и др.

Правилното съотношение между единоначалието и колегиалността при вземане на групово решение зависи от много обстоятелства, като основните от тях са свързани с особеностите на конкретната ситуация и стила на ръководство на командира. Най-подходяща е тази пропорция, която осигурява вземането на най-бързо и най-ефективно решение, особено при бойна ситуация. Оптималността на това съотношение зависи и от психическата съвместимост на членовете на групата. Проблемните ситуации съдържат твърде много възможности за поява на противо-

речия и конфликти, които сред офицерите от един щаб не са обусловени от различия в интересите, а по-скоро в разбиранията, оценките, опита и недостатъчната натренираност за съвместна работа от такова естество.

Важна особеност при много случаи на групово вземане на решение в стресова ситуация е т.нар. бягство от отговорност. Аспекти на този проблем са анализирани от френския изследовател Джанис. Той обобщава осем вида поведение за защитно бягство от отговорност на групови съветници на видни военни и политически ръководители :

Първо. Илюзия за неуязвимост, споделяна от по-голямата част от членовете от групата, в резултат на което се възцарява прекален оптимизъм и се поема извънреден риск.

Второ. Колективни усилия за рационализиране на решението, за да се отстранят предубежденията, които биха накарали членовете на групата да се откажат от предишните си становища, хипотези и решения.

Трето. Безусловна вяра в етичността и високия морал на групата, в резултат на което членовете и въобще не се замислят върху етичните последици от взетото решение.

Четвърто. Противникът се таксува като прекалено порочен, за да се гласува доверие на предприетите от него опити за преговори, или като прекалено слаб и глупав, за да се вземат насериозно преследваните от него цели.

Пето. Върху всеки член от групата, който излиза с аргументи срещу стереотипите, илюзиите и поетите общи ангажменти, се упражнява пряк натиск, за да се покаже, че всяко несъгласие е несъвместимо с изискването за лоялност спрямо самата група.

Шесто. Самоцензуриране на членовете на групата във връзка с несъгласията и различията от привидния консенсус /единодушно мнение и одобрение/, като всеки отделен член омаловажава значимостта на личните си съмнения и противните доводи.

Седмо. Споделена илюзия за единодушие в постъпките и действията, произтичащо отчасти от самоконтрола и от лъжливото предположение, че “всеки, който си мълчи, е съгласен”.

Осмо. Поява на “пазачи”, т.е. обособяващи се членове, които по собствена инициатива предпазват групата от противниковата информация, която евентуално би могла да наруши чувството за самодоволство на групата по отношение на ефективността и моралните аспекти на нейните решения.

Има основания да се смята, че посочените осем вида поведение на защитно бягство от отговорност при групово вземане на решения в стресова ситуация в някои случаи се проявяват и в работата на военните щабове, особено в бойна обстановка.

3. Conclusion

Предизвикателствата, произтичащи от това, че България вече е членка на НАТО, налагат на военните лидери да имат добре оформено разбиране за своите цели, задачи и функции в качеството си на командири и офицери от щабове на различни нива.

В хода на своята управленска дейност ще се налага често да се справят с тежки мисловни казуси при ограничени срокове и дефицит на информация, като внима-

телно се пазят от погрешни решения и действия, които могат да доведат до фатален изход живота на подчинените, особено в бойна обстановка. За да успеят, трябва отлично да познават спецификата на военното лидерство и разликите му от това в другите социални среди, изкушенията на властта и деформациите, до които може да се стигне при прилагането и, както и етапите при вземане на командирско решение. Много важно е да се овладее и изкуството на работа в екип, който принцип е основополагащ в подготовката на офицерите от страните, членки на НАТО.

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ФАКТОРИ, ВЛИЯЕЩИ ВЪРХУ ПОВЕДЕНИЕТО НА ЧОВЕК В КОРАБНИ УСЛОВИЯ ПРИ ЕКСТРЕМАЛНИ СИТУАЦИИ

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Анотация: В моряшката професия съществено влияние върху психиката и поведението на корабните екипажи оказват множество фактори. Докладът разказва за някои от тях и описва тяхното въздействие.

Ключови думи: Море, фактори, поведение, моряк, екстремални ситуации

В моряшката професия съществено влияние върху психиката и поведението на корабните екипажи влияят множество фактори:

Сензорната изолация, психическата депривация и информационния глад.

Психическата депривация и сензорният глад снижават работоспособността на моряците и могат да доведат до влошаване на познавателната дейност на моряците. При по-сложни условия се наблюдават разстройства на ориентацията във времето и пространството, изострена реакция на слаби дразнителни, повишаване на агресивността и конфликтността вследствие спадане на личностния поведенчески толеранс.

По време на плаването у моряците понякога се развива т.н. интерпретационен синдром. Той се появява при недостиг на информация както от брега, така и от страна на корабното ръководство за характера на рейса, съдържанието на и предназначението на превозваните товари и други услуги на море. Когато моряците са лишени от значима за тях информация, те започват индивидуално и групово болезнено да тълкуват всякакви незначителни признаци на произтичащите наоколо събития и явления, мисли които могат да обхванат цялостния живот на моряка – от съмнения и натрапливости спрямо дейността на корабното ръководство или други членове на екипажа, до натрапливости свързани със семейството, заболяване на децата, съпругеска изневяра и пр.

Подобни преживявания изпитва един от моряците на моторен кораб „ЕЛЕНА”, които се засилват по време на плаването без никой да забележи промяната и да предприеме необходимите превантивни действия, което превръща младия и неопитен моряк в убиец на двама души от екипажа.

Животът на моряка се характеризира с постоянно очакване – влизане в пристанището тръгване на плаване, завършване на рейса и пр. В морето минават десетки години от живота на моряците, но те възприемат тези години като очакване на живота на брега. На кораба възникват илюзии за бреговия живот, които като правило не съответстват на реалността. Това обстоятелство често води до възникване на неуредици и конфликти, личностни разстройства .

б) Личностното пресищане в екипажа като затворена социална общност

Продължителното съжителство на хората в затворена социална общност каквато е корабният екипаж води до личностно пресищане. То от своя страна предиз-

вжива повишена агресивност, конфликтност и непоносимост, а всичко това влошава качеството на корабната дейност и е опасно за корабоплаването.

Когнитивният дисонанс в офицерския състав от управленското и оперативното ниво при вземане на отговорни решения .

Когнитивният дисонанс е изследван от американския психолог Леон Фестингър. Капитанът на кораба и останалият офицерски състав от управленското и оперативното ниво ежедневно изпитват когнитивен дисонанс при вземане на управленски решения, особено в екстремални ситуации. Това е свързано с повишено нервно-психическо напрежение, породено не само от високата персонална отговорност, но и от трудността на ситуацията, за която офицерите нямат готови решения нито от практиката, нито от теорията и трябва да се разчита на собствената интуиция и творческите си способности.

Монотонността на корабния живот и еднообразието на трудовите процеси.

Една от особеностите на морската дейност е наличието на монотонни дейности, режими и ситуации. Интензивното работно натоварване предизвиква повишаване на психофизиологическото напрежение и усилва субективната оценка за монотонността . Монотонната дейност въздейства върху психофизиологическото състояние на човека и предизвиква редица нежелателни явления, като:

- превъзбуждане и изтощаване на едни центрове, притъпяване и възникване на задръжки в други центрове;

- умора на функциониращите органи

- понижаване на мотивацията, което се проявява в загуба на интерес към дейността, обкръжаващите хора и околната среда;

- отсъствие на положителни емоционални ефекти;

- стремеж да се прекрати работата;

- Едностраничното натоварване на ограничена група нервни клетки по време на продължителната монотонна дейност на море предизвиква функционално изтощение, развиване на задръжни реакции. Това води до ускорено появяване на умора, сънливост, безразличие, усамотяване, стереотипност в поведението, вялост, снижаване на работоспособността, спадане на интелектуалната продуктивност, намаляване на жизнения телесен тонус, отслабване на волята и вниманието и др.

- Монотонната дейност, съчетана със сензорната изолация и психическата депривация, на фона на дефицита от значима за моряците информация води до нарастване на стреса, тревожните очаквания, влошаване качеството на дейността и увеличаване на грешките, което от своя страна застрашава безопасността на корабоплаването.

Денонощният режим на работа на моряците по време на плаване води до нарушения на „биологичния часовник” и биоритъма на човека, което предизвиква нарушения на съня и други психо-соматични разстройства.

Биоритмите са колебание на смяна и интензивност на процесите и физиологическите реакции в организма, обусловени от влиянието на външни и вътрешни фактори. Най-съществено влияние оказват върху работоспособността и настроението на човека денонощните биоритми, свързани с периодите на географските цикли – смяната на деня и нощта, изменението на осветеността, т.н „бели нощи” или „черни дни” и пр.

Нарушаването на съня както по продължителност, така и по качество, влошава работоспособността и самочувствието, способства за повишаване на нервно психическата възбуда, която влияе отрицателно на носенето на вахтата и изпълнените на непосредствените функционални задължения.

Продължителното безсъние води до влошаване качеството на работата, а хроничното недоспиване се равнява на алкохолно опиянение. Ролята на безсънието в корабоплаването – както в търговското, така и на военните кораби не е добре проучен проблем. Това води до грешки в оценката и анализирани на обстановката, влошава вземането на решение и отдаването за заповеди, затруднява изпълнението на бойните задачи. Счита се, че безсънието е една от причините за т.н. „дружески огън“, които по време на войната придоби застрашителни размери.

Австралийски изследователи са установили, че продуктивността на хората, които не са спали в продължение на 18-24 часа съответства на поведение на хора, които имат в кръвта си 0.05 промила алкохол. Хора, които не са спали в продължение на 25-26 часа имат продуктивност, равностойна на тези, в чиято кръв се съдържа 0.1 промила алкохол. Съгласно конвенция ”STCW’ 95” установява лимит от 0.08 промила алкохол за моряците.

Обездвижването е голям бич за моряците и астронавтите, но докато космическата психология космическата медицина предлага ефективни решения то корабната медицина и морската психология са в дълг на моряците от всички страни по света.

Микроклимата и обитаемостта на корабните помещения, кумулативно въздействие на вибрациите, вълнението на морето, шума, лъченията на кораба;

Изпарението на горива и масла, шумът, вибрациите, постоянното изкуствено осветление, йонизиращите лъчения, електромагнитното излъчване се явяват основни ”замърсители” на корабната среда и оказват съществено негативно влияние върху тяхната работоспособност.

Познаването на факторите влияе изключително много на разбирането на възможните проблеми, които биха били възникнали на море. Познаването на факторите също способства за превенцията на много инциденти произлизащи от психологията на морската професия. Затова организирането и провеждането на специализирани курсове и беседи за факторите влияещи върху психиката на моряка в екстремални ситуации, биха били от изключително голямо значение за психичното здраве и работоспособността на моряците по света.

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ОТРАЖЕНИЕ НА КРИЗАТА ВЪРХУ БЪЛГАРСКАТА ИКОНОМИКА: ПРОБЛЕМИ НА ФИСКАЛНАТА ПОЛИТИКА

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Резюме

След достатъчно дълго време на икономически растеж, през 2009 г. българската икономика навлезе в рецесия. Причини за тази рецесия бяха:

-отвореността на българската икономика;

-наличието на ниско ниво на спестявания в българското социално пространство; при ниските равнища на спестявания, България става още по-зависима от чужди преки инвестиции. Освен темпа на нарастване на БВП, основните показатели, от които чуждите инвеститори се интересуват преди да инвестират, е бюджетният дефицит и резервите в чужда валута. Естествено, потенциалните инвеститори следят и развитието на текущата сметка на платежния баланс, и личното потребление като процент от БВП. И двата показателя представят българската икономика като риск. В страна, в която повече от 20% от работоспособното население се намира в чужбина, като превежда средства за издръжка на близки и роднини (като същевременно инвестираше в имоти по време на бума на този пазар), подобни показатели биха се оценили като по-лоши в сравнение със съответните показатели на една балансирана икономика.

От друга страна, проблеми в кризисни условия за държавния фиск създава и сивата икономика. Нещо повече, наличието на този феномен у нас е сред основните условия - наред, разбира се, със спадналите доходи от данъци в условията на криза – за формиране на дефицит в икономиката.¹

Понякога икономиката се дели не на две, а на три части -легална, сива и черна². Първата включва легално регламентирани фирми, чиято дейност е в пълно съответствие с обществените изисквания. Характеризира се с институционализирана заетост и самонаетост, легални сделки при стриктно изпълнение на задълженията към данъчните власти, общественото осигуряване и наетата работна сила. Втората включва икономически структури, които наред с легалната дейност осъществяват и нелегална, която е в нарушение на обществените изисквания. Тя се нарича "сива икономика", защото не всичко се облага с данъци. В нея съществуват освен легалната заетост и самонаетост и форми на нелегална заетост и самонаетост, осъществяват се полулегални сделки при частично изпълнение на задълженията към държавата, общественото осигуряване и наетата работна сила.

Третата част, черната икономика, включва мафиотските структури, които съществуват нелегално и осъществяват криминална дейност. Налице е нелегална

¹ Политики за противодействие на икономическата криза: динамика на скритата икономика 2009, Policy Brief No. 20 декември 2009

² Пачев, Т., Икономическа социология, Тракия- М., С., 2004

заетост и самонаестост. Сделките, които се осъществяват, също имат нелегален характер. Избягват се всякакви данъчни и други задължения към държавата. Проблемът, който възниква при тройното деление на икономиката, засяга главно "сивата" и "черната" им съставна част. Различията между тях са трудно осъществими и в голяма степен имат условен характер. Общото между тях е, че нямат съответствия с обществените потребности и изисквания. И при двете икономики (макар и частично в сивата) не се плащат данъци, съществува нелегална заетост и самонаестост, не се изпълняват задълженията към общественото осигуряване. Обстоятелството, че в единия случай тези нарушения са драстични, а в другия случай са прикрити чрез легалната икономическа дейност, съществено не променя нещата. И при черната икономика се търсят различни начини на прикритие и формално легализиране на дейността, подобно на сивата икономика. Поради изложените съображения наименованието "сива икономика" губи социално-икономическия си смисъл, защото не дава еднозначна представа за нейната същност.

Представа за размера на незаконната икономика се получава по косвен начин. За целта се използват различни методи. По -важни от тях са:³

а) Изучаване на факторите, които способстват за нейната поява и развитие. Те обикновено биват икономически, социални, законодателни, политически, административно-контролни. В една по-голяма степен на конкретност трябва да се изучава тяхната пропускателна възможност за появата и развитието на такава икономика. Например в каква степен законното производство не е в състояние да задоволи обществените и личните потребности със стоки и услуги. Същото се отнася за отсъствие на нормативна уредба, регламентираща трудовата дейност или неспазването на съществуващата, за политическите, социалните и данъчните решения, касаещи тази дейност.

б) Изучаване на формите, в които се проявява тази икономика. Големото разнообразие от форми, в които се реализира незаконната икономика, силно затруднява тези, които ги изучават. Въпреки това основните форми са незаконното производство и търговия, нерегламентираните битови, комунални, медицински, образователни, консултантски и др. платени услуги, надомна работа, транспортни услуги и т.н. Специфични форми на такава икономика съществуват както в държавните, така и в частните фирми, които трябва да се познават от административно-контролните органи.

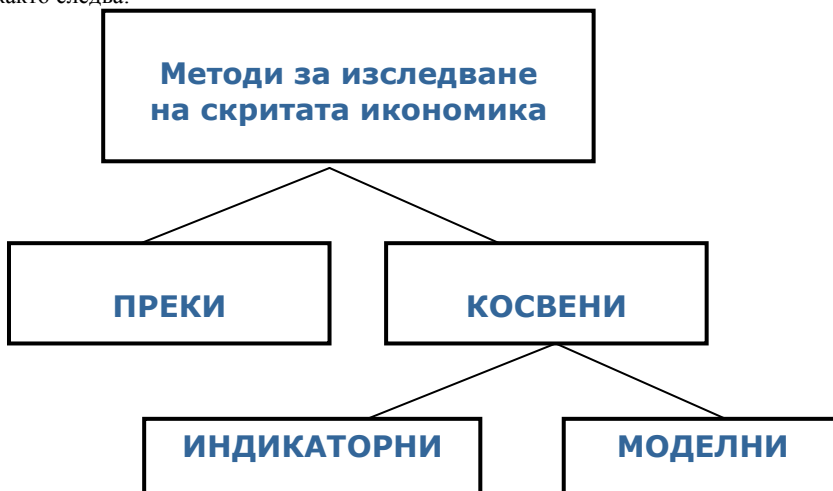
в) Изучаване на движението на парите в обращението или монетарен метод. Известно е, че сделките в незаконната икономика обикновено се правят с помощта на налични пари. Така се преодоляват данъците и банковия контрол. Ако се изучава движението на парите в обращението, ще се установи несъответствието между банковите операции и количеството на парите между последното и това, което е необходимо за обращението на фактическия БВП. Когато несъответствието в пари е голямо, това е индикатор за развита незаконна икономика и обратно. Такива проучвания трябва да се правят периодично и да обхващат по-големи отрязъци от време. Така ще се следи динамиката на нарастване или намаляване на незаконната икономика.

³ Политики за противодействие на икономическата криза: динамика на скритата икономика 2009, Policy Brief No. 20 декември 2009

г) Социологически методи. Както пряката, така и косвената анкета могат да допринесат за набиране на информация за сивата икономика.

В случая по-важно значение има косвената анкета, при която анкетаторът сам провежда разговор с респондентите (изследваните лица). Важно изискване на тази анкета е анкетаторът добре да познава антуража на анкетираният лице и самото лице. Това дава възможност да се набере информация за мястото и режима на работа, за доходите и начините на тяхното получаване, за условията, при които се осъществяват трудовите задължения. Така по косвен път могат да се направят заключения дали икономическата дейност, която изследваните лица осъществяват, е законна или незаконна. Аналогична задача може да изпълни и едно добре организирано и проведено интервю под формата на свободна беседа, наблюдението, груповите дискусии и др.

Съществуват, разбира се, и други методи. Но както споменатите, така и неспоменатите, дават ориентировъчни резултати. Поради тази причина цифрите за относителния дял на незаконната икономика в брутния вътрешен продукт на дадена страна са променливи и непълни. Отделните методи могат да се обобщят както следва:



фигура 1 Методи за измерване на икономиката в сянка

Необходимо е мерките за борба със скритата икономика да бъдат:

- приоритетно насочени към подобряване на правоприлагането и върховенството на закона;
- подкрепени от административни реформи и реформи в контролната система, целящи повишена ефективност;

- оценени по разходи - ползи.⁴

Позиция по темата

В резюмето бе разгледано мнението на автор, свързан с изучаването на сивата икономика – начините на нейното измерване, наличието на проблеми при измерването ѝ и пр. Защо обаче изследванията върху сивата икономика са толкова актуални в момента? Отговорът е поради това, че в бюджета на страната има формиран дефицит, който заплашва корелацията на страната с Еврозоната. Тезата е, че дефицитът до голяма степен се дължи и на фискалната политика. Тогава, въпросът се трансформира във възможностите на държавата и нейния избор – да повиши ли данъчните ставки или да реализира по –висок контрол върху събираемостта им?

Натискът върху приходите на предприятията води до повишаване на стимулите за избягване на данъчни и осигурителни задължения с цел подобряване на икономическата позиция и получаване на допълнителни конкурентни предимства. Нарастването на равнището на безработица през последните месеци показва, че съкращаването на персонал в България става сравнително лесно, което е възпиращ фактор за увеличаване на скритата заетост. България е на второ място, само след Чехия, по свобода на регулациите за наемане на работна ръка. Същевременно тя е една от малкото страни-членки на ЕС, в която разходите за труд продължиха да бележат съществено покачване дори през първата половина на 2009 г. Макар това да е естествено развитие в средносрочна и дългосрочна перспектива, предвид далеч по-ниските равнища на заплащане в страната в сравнение със средните на ЕС, в краткосрочен план - в условията на криза, то може да доведе до увеличаване на безработицата и натиск за укриване на част от възнаграденията с произтичащата от това загуба на социална защита. Към второто тримесечие на 2009 г. индексът на разходите за труд в страната е бил с най-високата стойност в ЕС - 113,5, сравнено със средния за ЕС-27 от 102,57.

Свиването на икономическата активност води до спад в приходите на държавата, което от своя страна може да предизвика ограничаване на качеството на предлаганите обществени услуги, вкл. влошаване на контролната и одитната дейност на администрацията по отношение спазване на законодателството. Балансът по консолидирания бюджет за 2009 г. сериозно се влоши, като има вероятност до края на годината 2010 г. тази тенденция да се задълбочи. Прогнозите са, че неизпълнението на годишните приходни разчети може да достигне 20-22%. Като следствие от рязкото свиване на вноса, износа и вътрешното потребление, косвените данъчни приходи, които традиционно допринасят за над 50% от приходите в бюджета, изостават значително през 2009 г.

От друга страна, съществуват фактори, които работят в обратна посока:

- може да се очаква, че в условията на криза скритата икономическа дейност, свързана с официалната икономика, ще се свива по-бързо в сравнение с общия темп на спад поради по-ниските разходи за ограничаване на тези дейности. Например, много по-лесно е прекратяването на взаимоотношенията с недеклариран

⁴ Политики за противодействие на икономическата криза: динамика на скритата икономика 2009, Policy Brief No. 20 декември 2009

работник или с доставчик и/или клиент, с когото няма подписан договор и оборотите не се отчитат;

- скоростта, с която се търси влизане в скритата икономика в резултат на кризата, вероятно ще бъде по-ниска от скоростта на излизане от пазара или преминаване в други форми на скритата икономика на неформалните субекти. Тези процеси в много голяма степен зависят от качеството на дейността на контролната и правораздавателната система в страната, от продължителността и сериозността на кризата, както и от предприеманите мерки от страна на правителството.

От друга страна, възниква въпросът – как у нас да се регулира данъчната политика – като основен приходоизточник в бюджета през последните години – в условията на криза – чрез увеличение на данъците или спад на тяхната ставка, като се има предвид, че икономиката в сянка допълнително задълбочава този проблем?

Известно е, че много често на държавния бюджет се гледа като на план на приходите и разходите на държавните органи и институции в рамките на една година. Като че ли през последните години това определение добива широка популярност. Това се дължи на две причини:⁵

Първата се свързва с лесното възприемане на определението, а втората с убеждението, че в съвременните пазарни стопанства, тъй като преобладават либерални управленски идеи, участието на държавата в икономиката е умерено и фискалните инструменти на финансовата политика стоят на заден план.

На държавният бюджет обаче не бива да се гледа само като на план, а като на понятие, което изразява определени финансови (преразпределителни) взаимоотношения между държавата и частните лица, от една страна, и между самите държавни органи и институции (в т.ч. и тези на местната власт и самоуправление), от друга. Тези взаимоотношения са свързани с формирането на постъпленията в бюджета и тяхното изразходване за нуждите на обществото, в т.ч. за икономическия му просперитет. Ако приемем тези позиции като изходни в разсъжденията, на бюджета ще трябва да се гледа като на сложен механизъм за упражняване на власт, т.е. на въздействие върху икономическия растеж и развитие.

И в либералното пазарно стопанство бюджетната политика има огромно значение. В същото време бюджетната политика у нас през последните десет години постави доста интересни въпроси.

По-малко държава от финансово-икономическа гледна точка означава нисък дял на преразпределение на създадения доход от частното стопанство чрез инструментите на бюджетната политика - данъците и бюджетните разходи. От друга страна обаче, как се отразява това при недостатъчна събираемост на данъците?

За да се изследва този въпрос, ще се представи накратко данъчната политика и тежест в страната през последните години:

Както е известно, в края на миналия и началото на настоящия век идва въвеждането (от 01.01.2008 г.) на единен пропорционален данък върху всички доходи (т.нар. „плюсък данък"). Този данък е отрицание на прогресиите и на необлагаемия минимум. Интересното при него обаче е, че, макар да е защитаван от учени с либерални възгледи, от страни с традиционни пазарни отношения, той не

⁵ Атанасов, Н., Съвременния бюджет между регулативизъм и неолиберализъм, Годишник на Висше училище, Колеж по икономика и администрация, Пловдив, 2008, с 90-101

намира приложение в тях, а само в някои, които осъществяваха преход. В страните с развито пазарно стопанство този данък не е бил въвеждан. Т.е. там се акцентира върху преразпределителния и социалния ефект на подоходното облагане.

Аналогична тенденция на развитие имаха данъчните размери на корпоративните данъци. До 1997 г. наблюдавахме три размера -36 %, 26 % (за облагаема печалба под 2 млн. лв.), 6,5 % (данък за общините) и 15 % (данък върху дивидентите, ликвидационните дялове и доходите на чуждестранните лица). Една година по-късно основните размери са намалени съответно на 30 % и 20 %. Последователно в първите години на XXI век размерите продължават да намаляват, а данъкът за общините бива отменен. Така на настоящия етап имаме един размер на корпоративния данък (10 %) независимо от големината на облагаемата печалба. Данъците върху дивидентите и ликвидационните дялове са 5 %, а върху доходите на чуждестранните лица и върху някои разходи размерът е 10 %. На тази основа могат да бъдат направени подобни изводи - ориентация и възприемане изцяло на пропорционално облагане с нетрадиционно ниски размери.

Това обаче далеч не е причина за спад в размера на икономиката в сянка.

Другите преки данъци - имуществените, на сегашния етап са пропорционални, с изключение на този върху превозните средства, като за последния са налице различни размери според типа на превозното средство и неговата мощност. Т.е. може да се каже, че данъкът върху превозните средства засега притежава някакъв по-силно изразен преразпределителен ефект дотолкова, доколкото собствениците на по-мощни и по-скъпи превозни средства дължат прогресивно нарастващ данък. В случая можем да говорим по-скоро за изключение от възприетото правило за пропорционално облагане на доходите и имуществата у нас като алтернатива на прогресиите.

Аргументните, че прогресивното облагане на доходите е неефективно, защото влияе негативно върху стимулите за труд и стремежа за реализиране на по-високи доходи, изглеждаха приемливи те добиха популярност у нас в условията на стопанска криза и отразяват стремежа за нейното преодоляване.

Сочените негативи на прогресивното облагане не могат да бъдат приети от нас по принцип и въобще, а само тогава, когато данъчните размери са скокообразни и достигат наистина високи нива.

У нас, през последните години БВП нарастваше със сравнително високи темпове. Оказва се обаче, че небалансираният растеж също създава проблеми - бързо нарастване на кредита, влошаване на saldoto по текущата сметка и висока инфлация. В духа на антицикличната и антиинфлационна политика правителството би трябвало в такива условия да увеличава данъците.

От гледна точка на развитието на бизнес цикъла у нас бихме могли да формулираме следния въпрос: ⁶Възможно ли е бъдещо намаляване на данъците в случай на криза? В условията на рецесия, за да се стимулира деловата активност, се предлага намаляване на данъците. В нашия случай обаче те едва ли ще може още много да бъдат намалявани, тъй като размерите им вече са необичайно ниски. Тогава какви мерки ще бъдат предприемани в условията на евентуален спад на БВП (т.е. на рецесия)? Очевидно е, че, след като данъчните размери са вече доста

⁶ Атанасов, Н., Съвременния бюджет между регулативизъм и неолиберализъм, Годишник на Висше училище, Колеж по икономика и администрация, Пловдив, 2008, с 90-101

ниски, бъдещото им съкращаване в условията на рецесия едва ли би изиграло решаваща роля за преодоляването ѝ.

За същия период наблюдаваме нарастване на постъпленията от подоходни данъци с темпове, доста по-високи от растежа на БВП. Причината за това нарастване според официалното становище се дължи на намалените им размери.

В тази връзка се изтъква, че предприятията, които преди това не са декларирали всичките си доходи, са започнали да го правят, или с други думи е намалял делът на скритата икономика.

От чисто теоретична гледна точка тази теза е лесна за възприемане, но все пак не стана ясно какъв е бил размерът на скритата икономика преди и след намаляването на данъците. Освен това нарастването на БВП в номинално изражение води само по себе си до по-големи номинални постъпления в държавния бюджет. Явно върху постъпленията от подоходни данъци оказват влияние много фактори и е много трудно да се прецени кой от тях има основна роля.

От друга страна, като се има предвид, че много голяма част от данъкоплатците са сключили трудови договори с работодателите си за минимална работна заплата (нейният размер допреди това попадеше под необлагаемия минимум), сега вече стават реални длъжници. Физическите лица с високи доходи вече плащат по-малко данък. Но не стана ясно дали ефектът от облагането на лицата, работещи на минимална заплата, не превिшава „загубата“ на постъпления от тези с високи доходи, като така общият резултат за бюджета да е положителен.

Тук следва да се спомене, че решаваща роля за растежа на БВП играят чуждите инвестиции, които през последните години растяха скокообразно.

Според официалната статистика чуждите фирми са предпочели да инвестират на пазара на недвижими имоти и в сферата на финансовите услуги. Това са сфери на икономически дейности (както се уверяваме напоследък) - твърде рискови, а капиталите, заети в тях, са с висока степента на мобилност. С други думи бързото изтегляне на чуждите капитали може да доведе до голямо забавяне на икономическия растеж. Много важно в случая е да отбележим, че като важен фактор в процеса на привличане на чужди инвестиции бе сочено понижаването на преките данъци. Оставаме с впечатлението, че нашата страна като че ли се намираще през последните години в данъчна конкуренция с останалите източноевропейски страни с цел привличане на повече чужди инвестиции.

Освен че е спомогнал за повишаване на номиналния доход, притокът на чужди инвестиции ежегодно превишаваше изходящите от националното ни стопанство капитали, с което на практика балансираше недостига (отрицателното салдо) по текущата сметка. Традиционно по-големите разходи на българските фирми и домакинства за вносни, отколкото за стоки - национално производство, позволяват на чуждите капиталови потоци да имат ключова роля за финансовата стабилност.

В друга част от бюджетната политика - управлението на държавния дълг, също станахме свидетели на мерки с подчертан либерален характер⁷. Главните аргументи в тази посока са наличието на нетни емисии на пазара на ДЦК и предсрочното изкупуване на брейди облигации. Резултатите от дълговата политика

⁷ Атанасов, Н., Съвременния бюджет между регулативизъм и неолиберализъм, Годишник на Висше училище, Колеж по икономика и администрация, Пловдив, 2008, с 90-101

намериха израз в съкращаване на квотата на държавния дълг спрямо БВП и насочване на средства от бюджетния към частния сектор на икономиката.

В крайна сметка може да формулираме извода, че провежданата бюджетна политика през последните десет години имаше подчертано либерален характер, което обаче не намали дела на сивата икономика.

В обобщение, следва да се каже, че кризата се отразява на българската икономика по безспорно негативен начин, като наличието на висок дял сива икономика и реалния риск от оттегляне на чужди капитали създават опасност от задълбочаване на последствията от кризата. Ето защо, ключовите фактори за реализиране на положителен прираст във фиска са оптимизирани на контрола върху сивата икономика и общо подобряване на инвестиционната среда у нас, особено по отношение на администрацията и обслужването на бизнеса.

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ГЛОБАЛНАТА КРИЗА И НЕЙНОТО ОТРАЖЕНИЕ ВЪРХУ ИКОНОМИКАТА НА Р. БЪЛГАРИЯ

/Трудовия пазар и заетостта в България– проблеми в контекста на Европейската стратегия по заетостта и икономическата криза/

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Въведение

Въпреки усилията, свързани с преодоляване на последиците от кризата, тя обхваща както всички напреднали страни, така и редица сектори. Един от тези сектори е трудовия пазар. Въпросът, свързан с този пазар е актуален, защото разкрива «тесните места» пред политиката по заетостта, като в условията на настоящата криза, тези тесни места се свързват най-вече с невъзможността да бъде постигнат устойчив растеж на заетостта, както постигане на целите на Стратегията от Лисабон. Ето защо, в настоящата разработка, ще се направи анализ на проблемите, които са поставени съобразно Стратегията по заетостта, като се коментира документа Employment in Europe 2008 от гледна точка на заетостта в условията на криза.

1. Коментар /резюме/ на Европейската стратегия за заетостта и проблемите, свързани със заетостта в ЕС

Европейската стратегия за заетост се основава на политиките за ускорени стабилен икономически растеж на страните от общността, на структурни реформи и ускорено въвеждане на новите технологии с цел създаване на повече и по-качествени работни места, повишаване на конкурентоспособността на европейските икономики и по-нататъшно развитие на европейския модел за социална сигурност.

Съгласно нея до 2010 г страните членки на ЕС, следователно и България, следва да достигнат следните конкретни цели, а именно:

- равнище на заетост общо за трудоспособното население от 70 %
- равнище на заетост на жените - 60 %
- равнище на заетост на по-възрастните работници (55-64 г) - 50 %
- предлагане на нов старт на всеки безработен младеж, преди да са минали 6 месеца, откакто е останал без работа, а за възрастните - 12 месеца
- участие на населението във възрастовата група 25-64 г над 10 % в различни форми на учение през целия живот
- намаляване на равнището на отпадане от образователната система до под 10%.

След старта на Европейската стратегия по заетостта през 1997 г. бяха направени две оценки на нейното изпълнение. През 2000 г. бе направена междинна оценка насочена към три основни въпроса:

- ⇒ оценка на степента на релевантност на процеса на ниво ЕС;
- ⇒ оценка на приложението на приетите насоки по заетостта;
- ⇒ оценка на процедурите, чрез които се цели изпълнението на

Люксембургският процес.

Направената оценка разкри някои силни и слаби страни в изпълнението на ЕСЗ. Бяха идентифицирани следните положителни резултати: реализацията на Люксембургският процес допринесе за изграждането на интегрирана рамка подпомагаща провеждането на структурните реформи в страните членки на ЕС. Изпълнението на ЕСЗ доведе до включването на повече участници на европейско и национално ниво в провеждане на политиките по заетостта, а така също и повиши прозрачността на този процес.⁸

През 2002 г. бе направена оценка на влиянието на изпълнението на ЕСЗ. Тя бе извършена съвместно от страните членки и Европейската комисия. Задачата на страните бе да изготвят национални проучвания, на чиято база Комисията да оцени ефекта от изпълнението на Стратегията на ниво Европейски съюз. Освен националните проучвания бяха изготвени оценки на изпълнението по тематични направления: технически анализ, макроикономическа оценка, предприемачество, равни възможности, учене през целия живот, модернизация организацията на работа, превенция и активизиране, данъчна реформа, включващ пазар на труда, взимане на решения при изпълнение на политиката по заетостта.⁹

В обновената през 2003 ЕСЗ са записани по-конкретни цели и сравнителни показатели, като например до 2010 г осигуряване на грижи за деца за най-малко 90% от децата на възраст от 3 години до задължителната възраст за започване на училище и за 33 % от децата под тригодишна възраст".

Перспективата за постигането на пълна заетост се свързва с усилията, които са необходими за улесняване участието на по-голям брой хора на пазара на труда. Това означава да се засили политиката, целяща постигането на професионалното равенство между жените и мъжете, по-добре да се съчетава професионалния и семейния живот, улесняване заетостта на възрастните, борба срещу продължителната безработица, интеграция в обществото на най-уязвимите групи от населението.

Постигането на пълна заетост се свързва с:¹⁰

> Нарастването на участието в труда на основата на по-доброто съвместяване на семейния и професионалния живот както на мъжете, така и на жените, улесняване на достъпа до заетост и оставането в нея на специфични групи от населението като продължително безработни, инвалиди, възрастни, хора от малцинствата.

> Улесняване внедряването на съгласуваните стратегии за заетост и в частност, отчитане по-добре на целите за увеличаване на заетостта с необходимостта от подобряване на нейното качество.

⁸ Employment in Europe 2008 European Commission Directorate-General for Employment, Social Affairs and Equal Opportunities Unit D.1 Manuscript completed in October 2008

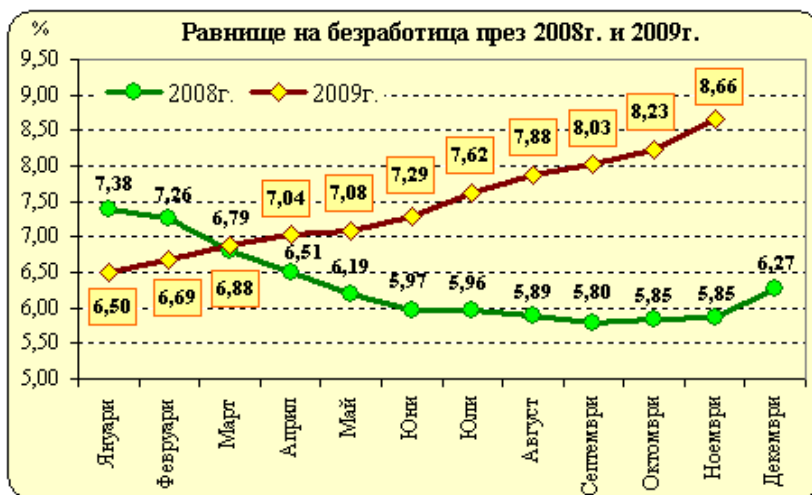
⁹ Десет години Европейска стратегия по заетостта (ЕСЗ), Люксембург: Служба за официални публикации на Европейските общности, 2008

¹⁰ Десет години Европейска стратегия по заетостта (ЕСЗ), Люксембург: Служба за официални публикации на Европейските общности, 2008

- > Борбата с продължителната безработица.
- > Развитието на местните и регионалните стратегии за заетост;
- > Подобряването на достъпа до образование и подготовка през целия живот и в частност в областта на новите технологии, за да се предотврати недостига на квалифицирана работна сила.
- > Насърчаването и разпространението на добрите практики.
- > Улесняване движението на европейските граждани, отчитане на връзките между миграционните потоци и политиките за заетост.
- > Изследването на връзката между социалната политика и политиката на конкуренция.

2. Отражение на кризата върху заетостта в България

Според статистически изследвания, равнището на безработица в страната през ноември 2009 г е 8.66%. В сравнение с октомври 2009 г, то е по-високо с 0.43 процентни пункта, а спрямо ноември 2008 г. - с 2.81 процентни пункта.



фигура 2 Равнище на безработица в страната

Източник: <http://www.bra.bg/>

След единадесет години на растеж, през 2009 г. българската икономика навлезе в рецесия. Очакванията са за икономически спад от 6% през 2009 г. и 1% през 2010 г. се оправдават.

Дори преди кризата съществуваша множество индикации, че наличните трудови и капиталови ресурси се използват непродуктивно - признак за наличието на съществен дял скрита икономика. През 2009 г. броят на икономически неактивните

и обезкуражените българи в трудоспособна възраст е над 1,7 млн. души. Осигуряването на официална заетост за тези лица при преобладаващата средна работна заплата в частния сектор за първите девет месеца на 2009 г. би реализирало допълнителен трудов доход в размер на 11,8 млрд. лв.,3 или 18,6 % от очаквания БВП за 2009 г. Официалната статистика отбелязва наличието на съществена разлика - около 30 % за първите девет месеца на 2009 г. между равнището на заплащане в частния и в обществения сектор.

Равнището на безработица продължава е по-ниско от средното за страната в 7 области: София-град - 2.73%; Бургас - 5.97%; Габрово - 6.42%; Варна - 6.87%; Стара Загора - 7.10%; Пловдив - 7.91%; Перник - 8.23%. В област Русе равнището на безработица съвпада със средната за страната стойност - 8.66%. В останалите 20 области равнището на безработица е над средното за страната и най-високите му стойности продължават да се отчитат в областите: Смолян - 15.69%; Търговище - 14.19%; Монтана - 14.05%; Шумен - 13.35%; Видин - 13.20%.

През декември 2009 г. общият показател на бизнес климата се понижава с 2.3 пункта в сравнение с предходния месец предимно поради влошаване на бизнес климата в промишлеността и услугите. Такава динамика се е наблюдава и през месец декември през миналата година.

През декември съставният показател бизнес климат в промишлеността се понижава с 1.3 пункта в сравнение с предходния месец поради по-песимистичните оценки на мениджърите както за настоящото бизнес състояние на предприятията, така и за бизнес ситуацията през следващите шест месеца. Настоящата производствена активност се оценява като намалена, но има известно подобрене в прогнозите за производството през следващите три месеца. Осигуреността на предприятията с поръчки остава почти на същото ниво в сравнение с предходния месец. Несигурната икономическа среда, посочена от 55.5% от предприятията, и недостатъчното търсене както от страната, така и от чужбина се определят като основните фактори, които затрудняват развитието на бизнеса. През декември по-голямата част от предприемачите очакват запазване на продажните цени в промишлеността през следващите три месеца.

Съставният показател “бизнес климат в строителството” през декември приблизително запазва равнището си от предходния месец. По мнение на строителните предприемачи строителната активност и нивото на поръчките намаляват, като очакванията за следващите три месеца са дейността да продължи да се свива. Очаква се и по-нататъшно намаление на персонала. През декември финансовите проблеми са основният фактор, затрудняващ дейността на предприятията, който за първи път от месец ноември 2008 г. Измества несигурната икономическа среда на второ място. Засилва се и влиянието на недостатъчното търсене. През декември предприятията, които предвиждат намаление на продажните си цени продължават да са повече от тези, които считат, че цените им ще се повишат през следващите месеци, в резултат на което за тринадесети пореден месец балансовият показател е отрицателен (- 13.4%).

През декември съставният показател “бизнес климат в търговията на дребно” се понижава с 3.2 процентни пункта в сравнение с предходния месец. Това се дължи на влошените оценки и очаквания на мениджърите за бизнес състоянието на предприятията. Обемът на продажбите през последните три месеца също намалява, като и прогнозите за продажбите през следващите три месеца не са оптимистични.

Очакванията за поръчките към доставчиците обаче се подобряват - балансовият показател се покачва с 5.1 процентни пункта предимно поради нарастване на поръчки към доставчици в страната. Факторите, които бизнеса определя като затрудняващи дейността им, са несигурната икономическа среда, недостатъчното търсене и конкуренцията в бранша. По отношение на продажните цени в търговията на дребно анкетата не отчита очаквания за увеличаване на цените.

След отчетеното повишение през ноември 2009 г., през декември съставният показател "бизнес климат в сектора на услугите" се понижава с 5.5 пункта в сравнение с предходния месец, което се дължи на по-песимистичните оценки на мениджърите за настоящата бизнес ситуация в предприятията и по-умерените очаквания за следващите шест месеца. През последните три месеца търсенето на услуги, както и персоналът в сектора са намалели, като не се очаква по-нататъшно намаление през следващите три месеца. Основните фактори, които затрудняват дейността на предприятията от сектора на услугите са несигурната икономическа среда и конкуренцията в бранша. По отношение на цените в сектора, преобладаващи са очакванията те да запазят равнището си през следващите три месеца.

Следва да се добави, че кризата допринася и за други проблеми - извън чисто икономическите – основен сред тези проблеми е продължителната немощ на държавните институции да се справят с корупцията и безотговорното поведение по високите етажи на властта. Отчуждаването на политиките от преките поети задължения пред избирателите и бруталното третиране на властта като основен източник на доход е причина за основните негативи в икономически план. Често те добиват израз на икономическа мимикрия. Това е така, защото се изтласква класическият трансмисионен механизъм за прилагане на дори удачна икономическа политика. Сигналите, посланията на тази политика се блокират от създадените корупционни механизми за връзка между икономическите агенти и държавните институции.

Нагледно този проблем се проявява в (не)усвояването на фондовете на ЕС, предназначени за България. След мерките на ЕК за спиране на част от потоците първата реакция на правителството 2004-2009 г. беше да обяви, че държавата разполага с бюджетен излишък, който може да замести спрените парични потоци от ЕС. Опитите за последващи промени останаха по-скоро самостоятелно действие на част (и то незначителна), а не на правителството като цяло. В тези условия, каквато и програма да представяше правителството, тя беше използвана не по предназначение.

Днес България се отнася към групата на проблемните страни, които заемат 5% от общия БВП на развиващите се пазари и 20% от общия брой държави. Благодарение на общо взето добрите макроикономически баланси на развиващите се пазари като цяло, тези пазари (особено Китай) имат по-добри резултати от развитите страни, макар и в тях да се стигна до процеса на откъсване от дъното на кризата (Франция, Германия). Тъй като е отнесена към проблемните страни сред развиващите се пазари, към българската икономика няма такива очаквания.

Заклучение

Анализът на заетостта в Европа отбелязва, че наред с редицата постижения, които са постигнати, съществуват и редица проблемни сфери, които следва да

бъдат в центъра на вниманието на националните политики в областта на труда. Тези проблемни сфери засягат неравномерността в динамиката на заетостта по региони и страни, както и различните темпове, с които се променят структурите на заетостта. Особено внимание се отделя на проблемни сегментни групи като младежи, възрастни хора, групи от малцинствата, професионални структурни дисбаланси и т.н.

Очертани в повече детайли, проблемите при младежите се идентифицират като трудности, които младите хора имат за първоначална заетост след завършване на средно или висше образование; трудности за наемане на стабилна и сигурна работа. Преобладаващите форми на временни работни места, продължителната икономическа неактивност са проблеми, които общността има да решава в среда на застаряващо население и намален естествен приток на трудови ресурси.

Друга група проблемни участници на трудовия пазар са възрастните хора (55-64 г.). Активното стареене заема все повече централно място в дискусиите и политическите действия на страните на ЕС. Проблемът произтича от външна за пазара на труда система, а именно демографската система, която е силно дебалансирана в посока на застаряване на населението на Европа. В рамките на системата на пазара на труда този проблем се интерпретира като необходимост от задържане на работната сила в заетостта и възможно най-пълното интегриране на наличните трудови ресурси. Тук става въпрос за широк кръг от политики и действия, свързани с осигуряването на условия за интегриране или освобождаване на работна сила чрез създаване на по-добра среда за поддържане на добро здравословно състояние на хората над 50 години; установяване на разумно висока граница на пенсионна възраст; нарастване на разходите за активни политики на пазара на труда за обучение през целия трудов живот, за гъвкави форми на почасова заетост и организация на труда; за преосмисляне на финансовите инструменти, с които се въздейства върху работодателите да освобождават възрастните заети и да наемат младежи и за създаване на финансови стимули за предлагане на труд от страна на населението в тази възрастова група.

Съществен проблем е този за балансирането на търсенето и предлагането на работна сила и съчетаването им по професионален признак чрез създаване на по-гъвкава среда за професионално развитие на работната сила. Във връзка с това, развиващата се дискусия за т.нар. гъвкава сигурност на работата се свързва не само с външните условия (условията за освобождаване и наемане на работна сила), но и с редица иновативни практики за вътрешна гъвкавост на вертикалната и хоризонталната организация на труда, създаване на условия за по-висока инициативност при участието на работниците в процеса на вземане на решения и за по-ефективна трудова дейност.

Качеството на заетостта като "условия на труд" в най-широкия смисъл на това понятие (равнище на заплащане на труда, здравословни и безопасни условия на труд, възможности за обучение и професионална квалификация, социална защита на работното място, социална осигуреност и т.н.) са също проблеми от дневния ред на заетостта на европейския трудов пазар.

Проблемите на трудовия пазар са породени и от кризата, обхванала Европа и света. Заетостта на трудовия пазар в Европа ще бъде в зависимост от мерките, които ще предприемат отделните страни и обединението на усилията на икономическите системи на държавите – членки на Общността.

Що се отнася до ситуацията в България, следва да се каже, че тук се наблюдават общите тенденции, свързани със заетостта в ЕС. При това, особеност е и следното:

- ⇒ проблемите, които кризата поражда пред публичния сектор;
- ⇒ наличието на проблеми, свързани с неусвояване на фондовете и последваща липса на финансови средства за инвестиции;
- ⇒ в резултат на всичко това - задълбочаване на проблемите, свързани със заетостта и безработицата в страната.

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ВАЛУТЕН БОРД. ИЗБОРЪТ НА БЪЛГАРИЯ. ПЪТЯТ КЪМ ЕВРОЗОНАТА

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Въведение

През 2009 година, икономическата криза дойде у нас с пълна сила. Макар и дошла със закъснение, тя заплашва да остане по-дълго и да нанесе по-тежки поражения, отколкото в развитите страни. Разбира се дълговото и бюджетно бреме, с което те омекотиха срива на икономиката си, ще има дългосрочен негативен ефект, докато България има шанса да излезе в отлична кондиция от кризата, стига да предприеме необходимите реформи, които да подпомогнат процеса на реструктуриране на икономиката и повишаване на нейната ефективност.

Въпреки всичко българската банкова система като цяло стои доста стабилно - ликвидна, добре капитализирана, печеливша и с диверсифицирана собственост. По своята устойчивост банковият сектор в България превъзхожда немалко от сродните икономики, но не липсват и такива, които имаха по-умерено и балансирано развитие във възходящия етап на икономическия цикъл. Основна причина за това е настоящия валутен борд, който се определя като фактор за стабилност в страната.

Ето защо, възниква въпросът – дали страната следва да запази своята ориентация към валутен борд или да работи по отношение на приемането ѝ в Еврозоната.

Цел на настоящата разработка е да направи обща характеристика на същността и предимствата на системата на валутния борд и еврозоната, както и да очертае евентуалния път на страната към Еврозоната.

Тезата на изследването гласи, че към настоящия момент – предвид кризата-България няма възможност да се присъедини към Еврозоната, което означава, че валутния борд у нас ще бъде запазен.

Обект на изследване в разработката е валутния борд като начин на установяване на ценова стабилност. Предмет на изследване са възможностите –като предимства и недостатъци – на страната да се присъедини към Еврозоната.

Основните предизвикателства, свързани с присъединяването на страната към еврозоната са две: финансови – с оглед на кризата и регулативни -с оглед на необходимостта от цялостно имплементиране на законодателството на еврозоната в българското банково законодателство. Следва да се посочи, че втория проблем е по-лесно определен в сравнение с първия, имайки предвид традициите и стабилитета на българската банкова система.

Параграф първи. Обща характеристика на еврозоната и предимствата и недостатъците от членството в системата

1. Обща характеристика на еврозоната и отражение върху финансовите институции и финансовата система

Еврозоната е институционално обединение, чрез което се цели постигането на конвергенция и улеснение на свободите, регламентирани в договорите за създаване на Европейския съюз. Приемането на страна в рамките на еврозоната представлява

предизвикателство, тъй като не само е свързано с постигането на дадени критерии, но и едновременно с това е насочено към спазването им, към приспособяването към взаимосвързаността и пр

Развитието на Европейската валутна система съпътства интеграционните процеси и подкрепя изграждането на Единния вътрешен пазар. Тя преминава през различни етапи, чрез които постепенно се е доближавала до целта — „един пазар — една валута“. Първоначално се създава европейската разчетна единица (ЕРЕ). Впоследствие беше изградена системата на колективно плаващите валутни курсове и европейската парична единица (ЕКЮ).

Сега функциониращата валутна система в ЕС е създадена на основата на Икономическия и валутен съюз, развитието на процесите на икономическо и социално обличаване и конвергенцията в Европейското икономическо пространство.

Изграждането на ЕСЦБ е свързано с функционирането на ЕВС и прилагането на инструментите на общата парична политика. Съобразно чл. 3 от Статута нейните задачи са:

- да определя и прилага паричната политика на Общността;
- да осъществява операции с чужди валути;
- да поддържа и управлява официалните валутни резерви на участващите страни-членки;
- да съдейства за хармоничното функциониране на системите за плащания;
- да допринася за плавното осъществяване на политиките от компетентните власти, свързани с надеждния надзор от кредитните институции и стабилността на финансовата система.

За осъществяването на тези задачи е разработена операционна рамка от инструменти на паричната политика, които се прилагат от ЕСЦБ, като операции на открития пазар, поддържане на резервни средства и минимални резерви по сметки от кредитни институции заедно с ЕСЦБ.

Създаването на общия пазар в рамките на Европейския съюз (ЕС) заедно с изграждането на икономически и паричен съюз и въвеждането на общи политики в редица ключови области са основните механизми за постигане на целите на Съюза, установени в Договора за създаване на Европейската общност (ДЕО). Сред основните приоритети на Общността е изграждането на вътрешен пазар, премахващ ограниченията за свободно движение на стоки, хора, услуги и капитали. След интензивна законодателна дейност на европейските институции и на страните-членки в периода 1985 - 1992 г. единният пазар става реалност през 1993 г. Единният пазар на услуги, като част от европейския вътрешен пазар, се базира върху свободата за установяване и свободното движение на услуги, установени в ДЕО.

Изграждането на единен и интегриран пазар на финансови услуги не е еднократен акт, а продължителен процес, който страните-членки изминават от 70-те години на миналия век до днес. С приемането на Първата и Втората банков директиви се поставят основите за хармонизиране на банковото законодателство в ЕС и за засилване на сътрудничеството между надзорните агенции. Усилията на Базелския комитет за хармонизиране на банковите регулации и надзорни практики са допълнителен катализатор за адаптиране на европейското банков законодателство към промените и тенденциите на световната банкова сцена. С подписването на Договора за ЕС в Маастрихт през февруари 1992 г. и последвалите изменения в ДЕО се създават институционалните основи на икономическия и паричен съюз.

Ако 90-те години на XX век преминават под прожекторите на засилващата се икономическа конвергенция, довела до успешното въвеждане на единната валута през 1999 г., то единният пазар на финансови услуги бележи изоставане, което и до днес не е напълно преодоляно. Именно въвеждането на еврото се разглежда като уникална възможност за предприемане на редица инициативи, които да позволят на доставчиците и потребителите на финансови услуги да се ползват все по-свободно от възможностите на единния финансов пазар. През 1999 г. Европейската комисия (ЕК) прие Плана за действие в областта на финансовите услуги (Financial Services Action Plan - FSAP), предвиждащ до 2005 г. да се изпълнят конкретни мерки, засягащи функционирането на кредитните институции.

Ето някои от предвидените мерки: актуализиране на директивата за инвестиционните услуги, въвеждане на директива за финалния сетълмент, приемане на директива за трансграничното използване на обезпечения, постигане на съгласие за директива за отдалечената продажба на финансови услуги, препоръки за подобряване на информационното осигуряване при ипотечното кредитиране, изработване на „пътна карта“ за повишаване сигурността и ценовата ефективност на единния пазар на плащания, план за действие за предотвратяване на измамите и фалшификациите в платежните системи, изработване на политика за електронната търговия с финансови услуги, приемане на директива за оздравяването и ликвидацията на банките, приемане на директива за електронните пари, изменение на директивата за прането на пари, препоръки за разкриване на информация от банките и други финансови институции и заздравяване на пазарната дисциплина, промяна на капиталовите директиви за банките и инвестиционните посредници и адаптиране към Базел II, развиване на правила за разумен надзор на финансовите конгломерати и др.

Констатираният успех на тази „напрегната“ във времето програма се дължи в немалка степен на политическия натиск за изпълнение на FSAP и на новия подход за подготовка на законодателството (Lamfalussy process), допринесъл за подобряване процесите на консултации и сътрудничество между институциите и не в малка степен за по-гъвкавата реакция на изпълнените мерки към протичащите промени на финансовата сцена. Нещо повече. Атестат за качеството на въведените мерки е обстоятелството, че в много отношения тяхното съдържание е доста по-обхватно от първоначално предвиденото.

Към настоящия момент, основните насоки на действие, които стоят пред регулацията на банковия сектор в рамките на еврозоната са:

- ◆ динамично консолидиране на вече постигнатия напредък и гарантиране на стабилното прилагане и действие на вече съществуващите правила;
- ◆ въвеждане на по-добри регулативни принципи във всички области на политиката за финансови услуги;
- ◆ подобряване конвергенцията в областта на надзора;
- ◆ засилване на конкуренцията между доставчиците на финансови услуги, особено на пазарите на дребно;
- ◆ разширяване външното влияние на ЕС на глобализиращите се капиталови пазари.

2. Основни предимства от членството в еврозоната

Основните предимства от въвеждането на еврото и присъединяване към еврозоната са следните:

По-ниски цени за транзакциите: като се премахне цената за обмен на валута, фирмите, участващи в търговия между държавите, не трябва да плащат комисиона за обмен на валута или да се застраховат против колебания на валутните курсове.

По-ефективен пазар: общата валута намалява възможността за ценова дискриминация, елиминира разходите за информация при потребление на стоки и трансгранично разполагане на бизнеси и оттам стимулира интегрирането на пазара и пазарната ефективност.

По-голяма икономическа сигурност: стабилността на разменния валутен курс увеличава устойчивостта на цените и приходите, което усъвършенства качеството на производствените, инвестиционните и потребителските решения - а това на свой ред увеличава общото благосъстояние.

По-ниски лихвени проценти: по-голямата икономическа сигурност намалява също и рисковата премия по лихвените проценти, затова те обикновено са по-ниски при по-едри икономики и при такива, които са по-малко зависими от търговия с чужда валута.

По-висок икономически растеж: според теориите за „новия растеж“ мощните и по-интегрираните икономики с по-висока производителност, повече натрупване на капитал, по-добра информираност, повече икономии от мащаба и по-ниски лихвени проценти могат да постигнат постоянни високи равнища на икономически растеж.

3. Основни предизвикателства при членството в еврозоната

Паричният пазар в еврозоната е пазар за междубанков краткосрочен дълг или пазар на депозити. Според ЕЦБ, той се характеризира с висока степен на интеграция от 1999 г. насам.

От своя страна, това –особено в условията на финансова криза - поражда риск пред инвестиционната дейност на финансовите компании, тъй като има опасност от т нар. ефект на доминото.

Типичен пример за това е факта, че след старта на третия етап на Европейския икономически и паричен съюз (ЕПС) колебанията по отделни държави на лихвените проценти по кредитите за действително осъществените транзакции или лихвените проценти по необезпечените кредитни транзакции в евро с овърнайт срок, по предлаганите междубанкови ресурси в евро и по репооперациите в евро силно намаляват в еврозоната. На практика те се доближават до нула сред отделните страни членки.

През 2007-2008 г. обаче се отчитат съществени изменения на краткосрочните парични пазари, свързани с появата на ликвидни проблеми в контекста на наблюдаваната глобална несигурност на финансовите пазари. От август 2007 г. колебливостта на лихвените проценти на краткосрочния паричен пазар, особено на овърнайт лихвените проценти, силно нараства вследствие на засилващата се световна финансова несигурност. За да гарантира нормалното функциониране на паричния пазар, ЕЦБ осигурява ликвидност чрез серия от рефинансиращи операции - ключов инструмент на паричната и политика

Лихвените проценти по обезпечените краткосрочни финансови инструменти също се характеризират с висока степен на интеграция. Въпреки това делът на краткосрочните дългови ценни книжа, емитирани от резиденти в еврозоната и притежавани от резиденти на други страни - членки на еврозоната, е все още твър-

де нисък в сравнение с този за акциите и облигациите, макар да се отчита, че този дял бележи увеличение с течение на времето. Пазарът за краткосрочни дългови ценни книжа става все по-интегриран, но все още съществуват различия в стандартите и практиките на отделните пазари по отношение на краткосрочните дългови инструменти.

Обобщение

По същество, валутния борд представлява фиксиран валутен курс. От теоретична гледна точка, при фиксирания валутен курс има пълна и сигурна конвертируемост на две валути по предварително дефиниран курс и във всеки момент. Валутният курс не се определя на пазара, а дискреционно от централната банка. Има два типа фиксиран курс:

- фиксиран курс, който не е закрепен със закон – т.е. централната банка обещава конвертируемост, но не е фиксирано със закон;
- фиксиран курс със закон – както е в България. Курсът не може да се промени, ако не се промени законът.

Валутният борд бе въведен у нас след доста тежка криза, като основното предимство е, че възстанови и запази ценовата стабилност в страната. Следва обаче да се посочи, че се водят доста дебати по отношение на неговото запазване или присъединяването на страната към еврозоната.

Функционирането на Европейската валутна система е елемент на Икономическия и валутен съюз в ЕС и допринася за задълбочаването на интеграционните процеси. Държавите, които не се присъединиха към ЕВС, отговарят на конвергентните критерии и участват в осъществяването на политиката за икономическо и социално сближаване.

Основните предизвикателства, свързани с присъединяването на страната към еврозоната обаче се състоят не толкова в критериите и изискванията, които се поставят от институциите, управляващи еврозоната, колкото от самата криза и нейното отражение върху ликвидността на пазарите и свободните финансови средства.

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БЕЗОПАСНОСТТА НА КОРАБОПЛАВАНЕТО ПРЕЗ XXI ВЕК

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***Анотация:** В края на XX в. и в началото на XXI в. Между народната морска организация (ИМО) утвърждава като главна идея в мореплаването издигането, чрез поддържане на високи професионални стандарти, на ролята на човека и корабния екипаж, без които не могат да се решат генерално проблемите на корабоплаването, независимо от усъвършенстваните технологии.*

***Ключови думи:** безопасност, корабоплаване, корабен екипаж, стандарти, проблеми*

1. Въведение

Приетите нови стандарти от Конференцията на ИМО обхващат изключително високи изисквания към качеството на превозваните товари и извършваните услуги по море. Корабоплаването трябва да бъде безопасно с гарантирана степен на сигурност, поради което нарастват техническите изисквания към корабите и системите за управление.

Най-важният елемент от тези изисквания са хората с техните професионални, етични, физически и психически качества, висока отговорност, работоспособност и дисциплинираност. Новите изисквания на ИМО утвърждават като най-важен елемент сред ценностите хората на борда на кораба, тъй като от тях в най-голяма степен зависи качеството на останалите два елемента.

2. Изложение

Грижите за опазване на човешкия живот и оцеляването на море са изведени като първостепенно задължение на компаниите и екипажите в редица ръководни документи на ИМО. Сред тях са Международна конвенция за безопасност на човешкия живот на море (SOLAS 1974) и Протоколът към нея, Моделен курс Personal Survival, издаден в Лондон през 1988г. и др.

Новите изисквания на ИМО към човешкия фактор са систематизирани в Конвенцията STCW '95 по няколко основни направления:

- Образование и квалификация;
- Физическо и психическо здраве;
- Социално-психически климат в корабните екипажи и високо качество на човешките отношения на борда на кораба и в компаниите на брега.

Поради изключителната важност на проблема за безопасността на човешкия живот на море ИМО въвежда като задължително изискване подготовката на моряците чрез специализиран курс и издаване на съответен сертификат.

Новите елементи относно носенето на корабната вахта са свързани с отчитането на факторите **умора и безопасност**, като главна предпоставка за безопасното

корабоплаване. Администрациите се задължават да фиксират задължителен период за почивки на вахтените и да препоръчат такива системи на вахти и дежурства, че постъпващите на вахта, и особено тези от първата вахта, след престой в пристанище да бъдат достатъчно отпочинали.

Всички вахтени (офицери и редови) трябва да имат почивка не по-малко от 10 часа на 24 часа. Почивката може да се състои от две части, но едната винаги трябва да не е по-малка от шест часа. Това условие може да се нарушава само при аварийни ситуации и аварийни учения.

Установяването на минимум 10 часа почивка не означава, че останалото време задължително трябва да бъде заето с вахта или с друга дейност. На администрациите се препоръчва да изискват воденето на записи за работното и почивното време, за да контролират спазването на изискването за почивки. За близко плаване и къси рейсове администрациите могат да установяват и други условия за почивки.

В интерес на работата, времето за почивка от 10 часа може да бъде намалено на 6 часа, но за повече от два последователни дни и при условие, че седмичното време за почивки е не по-малко от 70 часа.

Администрациите трябва да изискват схемите и разписанията за вахтените да бъдат окачвани на подходящи места. Капитаните и главните механици се задължават да подписват разписания за вахтите с имената на длъжностните лица, които ги носят. Разписанията трябва да бъдат окачвани на входовете – съответно на мостика и на машинното отделение, а при стоянка – и до трапа. Това задължение се отнася с особена сила за многонационалните екипажи, където хората не се познават много добре.

Трудът и животът на моряците се определят от многообразни условия, които могат да се систематизират в три основни групи.

Природната среда, включваща хидро-метеорологичните условия на плаването, влияе съществено върху работоспособността на моряците по време на вахта и върху възможността за възстановяване на изразходваните физически и психически сили.

Обитаемостта на кораба, включваща множество фактори като температура, работна среда, чистота и влажност на въздуха, електромагнитно поле, статично електричество на кораба, качество на корабните системи за вентилация и кондициониране е също важен психологически фактор. От нея в голяма степен зависи работоспособността на екипажа и отдиha след вахта.

Социалната среда е най-важното социално-психическо условие на борда на кораба по време на плаването и престоя в пристанищата. Към нея се отнасят режимът на плаване, интензивността, националния състав на моряците и техните културни особености, социално-психическият климат в екипажа, ограничения приток на информация, обездвижването, смяната на часовите зони и други.

Офицерите от управленско и оперативно ниво имат комплекс от задължения, свързани със създаване на благоприятен социално-психологически климат в корабния екипаж и хармонизиране на човешките взаимоотношения като важен фактор за безопасността на корабоплаването.

Междоличностното общуване в корабните екипажи може да бъде квалифицирано по критерии, като цели, ситуация, брой на хората, културно-етнически особености и степен на социализация на участниците, средствата и др.

Целите на поддържането на междоличностни отношения между членовете на корабния екипаж следват логиката на мотивите за неговото сформирание и органи-

зиране като професионална стопанска и социална структура. Взаимоотношенията между хората тук следва да не поставят под съмнение поддържането на нормалните условия за работа и мотивация за труд, съхраняването на психическото здраве и благополучие на моряците.

Някои фактори от социално-психическо същество могат да предизвикат сериозни отклонения в здравето на моряците и да застрашат общата безопасност на работа на кораба.

Неефективната и несистемна **комуникация** между трите структурни нива на корабния екипаж (управленско, оперативно и изпълнително) може да доведе до цял комплекс от негативни социално-психически явления в корабния екипаж. Сред тях са пасивност и апатия у част от членовете на екипажа; тревожност и безпокойство; разпространяване на слухове, клюки, недоверие; затруднена групова интеграция и корпоративен дух; откъснатост между трите нива на екипажа.

Индивидуалните особености на личността на моряка, неправилният стил на корабното ръководство и организация, липсата на социална подкрепа в екипажа могат да доведат до неблагоприятно протичане на **адаптацията** на кораба.

Неправилният стил на работа на лицата от управленско и оперативно ниво снижава активността, нарушава мотивацията и нагласите на екипажа, влошава отношенията на борда на кораба и създава условия за повишен риск при корабоплаването.

Тези явления се предшестват и съпровождат с комплекс от симптоми, които ръководният състав на кораба трябва да познава и за чиято профилактика и терапия трябва да предприема необходимите мерки.

Вследствие на **информационния дефицит**, сензорната депривация и личностното пресищане в екипажа възникват неблагоприятни социално-психически явления: психическа умора, повишена раздразнителност, психическа несъвместимост и непоносимост, грубост в отношенията, усамотяване, затрудняване на комуникационните процеси.

Моряци с голям жизнен опит твърде точно долавят характерологичните и поведенчески промени при продължителни плавания, които формулират с образния жаргон “хвана го желязото”. Този популярен моряшки израз отразява конкретни социално-психически промени у личността и екипажа по време на продължително плаване, свързани с феномените личностно пресищане и психическа депривация.

Личностното пресищане и психическата депривация оказват твърде съществено влияние върху междуличностните отношения в корабния екипаж и социално-психическия климат, поради което заслужават специално внимание.

Личностно пресищане възниква в процеса на груповото общуване в корабния екипаж. Хората, живеещи в затворени социални общности, често изпадат в особени психични състояния. Тези състояния се характеризират с лесна възбудимост и раздразнителност, взаимно омръзване и непоносимост, засилена потребност от усамотяване, потискаща и задушаваша социално-психическа атмосфера в корабните помещения. Психичното пресищане на личността е вътрешно състояние, конкретна форма на отрицателни последици от натоварване в трудовата дейност.

В корабни условия личностното пресищане се проявява по-силно и неговите въздействия върху личността са по-негативни, отколкото във всяка друга професионална среда.

За профилактика на негативните последствия, офицерският състав на кораба трябва добре да познава симптомите на личностното пресищане:

- Понижаване на жизнения тонус, трудовата активност и инициативата на личността;
- Наличие на апатия, чувство на умора, отпадналост, тревожност;
- Стесняване на интересите на личността и ограничаване на мотивацията;
- Болезнено отношение към приятелски реплики, които в други условия са обичайни и появата на студена маска върху лицето;
- Спадане на интереса към музиката, книгите, филмите и другите корабни развлечения;
- Възникване на конфликти по най-незначителни поводи, дори такива каквито в миналото са отминавани с шега.

Психическата депривация е състояние на лишение от нещо. Това състояние може да е свързано с липса на сън, храна, секс, липса на обичайната за човека среда. Психическата депривация води до съществени отклонения и разстройства. В корабни условия ограниченията на човека са много по-продължителни, поради което познаването на необходимите мерки за превенция е много важно за командния състав.

Формите на депривация на кораба са многообразни:

Сензорна депривация – възниква поради лишаване или ограничаване на необходимата информация вследствие на изолацията на кораба.

Полова депривация – възниква поради полово въздържане и снижаване на половата активност.

Социална депривация – възниква под влияние на обкръжаващата социална среда на кораба и прекъсване на връзките с близките на брега.

Признаци на психическата депривация на море са снижаване на емоционалния тонус и работоспособността, апатия и песимизъм, намаляване скоростта на реакциите, загуба на чувството за реалност, двигателно безпокойство и др. Всички тези симптоми се пораждат от липсата на нормалните дразнителни, с които човек е свикнал да живее на брега.

Препоръчителни са следните дейности за профилактика и терапия на личностното пресищане и психическата депривация:

- Своевременно установяване и вярна оценка на ранните симптоми на личностното пресищане;
- Промяна в ритъма и последователността на трудовата дейност – този подход се използва успешно при организиране труда на космонавтите. Целесъобразно е и периодично прекъсване на някои от дейностите, за които това е възможно и включване на пауза;
- Разширяване сферата на социални контакти, подобряване съдържанието и качеството на общуването между членовете на корабния екипаж.

Към социално-психологичните фактори застрашаващи живота на кораба могат да се отнесат и употребата на алкохол и наркотици. Това е толкова често срещано явление в моряшкото ежедневие, че нерядко убягва от общественото внимание. Съществува известна склонност, такава зависимост да се възприема за напълно нормално.

3D ТЕЛЕВИЗОРИ

ДОБРОМИР ЖИВКОВ ДОЙЧЕВ
ЗЛАТОМИРА МИЛЕНОВА СТОЙЧЕВА

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Abstract: *3D развлеченията въвеждат емоцията на 3D кино изживяването в дома ви. 3D ефектите придават на изображенията повече дълбочина и реализъм, което означава, че ще бъдете погълнати от спорта, филмите и игрите както никога преди.*

Keywords: *3D телевизор, технология, стереопсис*

1. Въведение

3D телевизията е технологична иновация, която дава на телевизионното изображение дълбочина на образа. 3D ефектът се постига чрез прожектирането на два аналогични образа, единия предначанен за лявото, а другия за дясното око. С помощта на специални 3D очила, двата образа се обединяват в резултат на което се вижда обемно. За гледане на 3D телевизия ни трябва 3D телевизор, на който също така могат да се гледат безпроблемно и стандартни двуизмерни програми с отлично качество.

Всички ли 3D технологии са еднакви? Не. Различните производители използват различни технологии в своите 3D телевизори. В тях могат да се залагат различни настройки, например без 3D очила, и предлагат разнообразни варианти по отношение на качеството на картината. Заслужава си да отделите време в проучване на предимствата на всяка технология.

1. Възприятие на 3D

Като хора, нашето усещане се контролира от визуалното впечатление и в продължение на векове ние се опитваме да уловим и репродуцираме триизмерния свят на нашата реалност. Пещерните хора са го правели чрез добавяне на отсенки към техните пещерни рисунки. Изкуството в средните векове е било коренно променено чрез нарастващото разбиране на перспективата на художниците. Триизмерното изобразяване датира от средата на 19-ти век, от зората на фотографията, но едва сега, смесено със звук и движение и прожектирано на телевизионни екрани с висока разделителна способност, 3D е в състояние напълно да ни завлечи и то директно в нашите домове. Но как точно работи възприемането на 3D? За щастие, ние сме родени с „3D готовност“. Нашето триизмерно зрение е базирано на ефекта стереопсис, който се смята, че се е развил при хищниците, за да могат да разпознават неуловимата маскировка на своята плячка.

2. Какво е стереопсис?

Ефектът стереопсис Ви дава стереоскопично зрение – възможността да виждате в дълбочина. Като цяло, всяко едно от очите Ви вижда леко различен образ на една и съща сцена. Вашият мозък анализира и обработва различията между двата образа, за да реконструира пространствените условия, позволявайки Ви да виждате нещата в триизмерна дълбочина.

3.1. Триизмерно записване

За запис в 3D, така че възпроизвеждането да се доближава до нашето естествено възприятие, лещите на камерата трябва да имитират окулярното разстояние между човешките очи. При европейците това разстояние е средно 6,35 см, което се използва като стандарт при кинодейците. Филмите се снимат с 3D камера. Камерата снима отделни кадри през левият и десният обектив-предназначени съответно за лявото и дясното око. Снима със 100кадъра в секунда /50L /50R/.

3.2 Какво виждаме в реалност на 3D телевизора ?

Отделете време и се разходете до близкият ви магазин за телевизори. Включете очилата, поставете ги и погледайте...Разни статични обекти изглеждат плоски в дълбочина. Самата картина изглежда ,като декор от куклен театър - образите са като изрязани от картонени плоскости разположени един зад друг - това производителите наричат 3D ефект....Тоест имаме двуизмерни картини ,които се движат една пред друга. Липсва обема и дълбочината, каквито има в действителността..

4. Какво е 3D телевизор?

Разбира се, в най-основния смисъл 3D телевизор е всеки телевизор, който е способен да изобрази видео в три измерения. Тези дисплеи постигат това с помощта на нови технологии, с цел за да се доставят различни изображения към всяко око на зрителя. Така всяко око вижда една и съща сцена, но в малко по-различен ъгъл (както е в реалния живот), тогава мозъкът ни поставя тези изображения заедно и е в състояние да интерпретира получената информацията в трето измерение.

Докато термини като LCD и плазмен телевизор се отнасят до много специфични технологии, то терминът 3D телевизия не се отнася за която и да е специфична технология за дисплей. Това може да доведе до объркване. Различните производители залагат на различни технологии за 3D с цел постигане на възможно най-доброто 3D изживяване.

5. Може ли всеки да гледа 3D?

Не! Между 5% и 10% от хората страдат от стерео слепота, според College of Optometrists in Vision Development. Те често имат добро възприятие за дълбочина - което разчита на нещо повече от stereopsis, но не могат да възприемат дълбочинното измерение на 3D видео презентациите. Някои стерео-слепи зрители могат да гледат 3D материал, няма проблем, стига да носят очила, но той просто ще изглежда като 2D за тях. Други могат да получат главоболие, умора на очите или други проблеми.

6. 3D TV качество на картината

Качеството на триизмерната картина зависи от качеството на отделния телевизор и се определя от фактори, които добавят или намаляват дълбочината на триизмерните изображения. Факторите за качеството на 3D картината са:

- * Добра еднородност на екрана
- * Висока резолюция на картината
- * Естествени цветове
- * Висок контраст

III. ЗАКЛЮЧЕНИЕ

В редки случаи, индивидуално може да усетите лек дискомфорт, като визуална дезориентация или леко главоболие.

Препоръчвам на родителите да контролират децата, които гледат 3D телевизия, за да се избегне дискомфорт. Не препоръчвам 3D телевизия за деца на възраст под шест, тъй като техните визуални усещания все още не са напълно развити.

Макар че 3D-технологията е сравнително нова, тя вече предизвиква някои сериозни опасения за здравето сред част от специалистите. Има хора, за които тази система на видеоизображения е причина за сериозни оплаквания – главоболие, сърцебиене, виене на свят. Лекарите вече дори са измислили име за това състояние – киберболест. Причината за нея те виждат в несъответствието между движението на очите и лещите на очилата, които се използват пред 3D-екрана. Когато обектът на екрана се приближава очната ябълка реагира на това и се променя, докато очилата – не.

Колкото по-близо е човек до екрана, толкова се увеличава риска той да се почувства зле или състоянието му да се задълбочи, показва изследване, проведено по поръчка на най-голямата японска телевизионна компания NHK.

Въпреки че някои производители на 3D-телевизори ги продават със стикер на панела, предупреждаващ да не се гледа след употреба на алкохол, по време на бременност, в напреднала възраст или при недоспиване, малка част от потребителите обръщат внимание.

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ПОВЕДЕНЧЕСКИ СТРАТЕГИИ И ПСИХОЛОГИЧЕСКА ПОМОЩ В БОЙНИ УСЛОВИЯ

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МИРОСЛАВ ВЕЛКОВ ВЕЛКОВ

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Abstract: *Актуалността на темата се състои в това, че поведенческите стратегии и психологическата помощ в бойни условия в момента е една от най-изследваните и най-описваните в психологичната литература. Това е съвсем логично, тъй като тя се смята за най-значима и се приема като определяща за крайния резултат на всички други дейности*

Keywords: *поведенчески стратегии, психологично осигуряване, психологична помощ*

1. Introduction

Нарастващата значимост специфика на управленската дейност в Българската армия се определя предимно от следните фактори : извършващата се реформа; големите изменения в ценностната система и стила на живот на младите хора и военнорслужещите през последните години; необходимостта да се поддържа боеспособността и боеготовността на българската армия при наличие на материално-техническо и финансово затруднение.

2. Main part

Поведенчески стратегии в бойни условия.

1. Същност, съдържание и цел на управленската дейност

Стратегиите на поведението биват изграждани още в процеса на обучение на военнорслужещите чрез, използване на основните функции методите за възпитание могат да бъдат следните:

- формираща- осигурява формирането на съзнанието и поведението на възпитаника;
- управленческа- управлява развитието на личността;
- коригиращо регулираща- осигурява възможност да се коригират отделни страни във формирането на съзнанието и поведението на личността;
- стимулираща- стимулира се положителното в проявлението на съзнанието и поведението на личността;
- потискаща- осигурява потискане на отрицателните за обществото прояви на личността;
- организираща- осигурява организацията на възпитателният процес;

-познавателна- осигурява се получаването на познанието за състоянието на личността в даден момент.

Армейската обществена среда, така както и в обществото, изисква спазването на определени норми на поведение характерни за нея. Това естествено налага формирането на определени привички у войните, които да ги характеризират като войни и да се оценяват положително в армейската среда. Твърде често, когато се говори за възпитание се набляга на идеализираната страна и съвсем малко се говори за материалните стимули, потребностите на военните. Счита се за достатъчно да се споменат думи като войнски дълг, патриотизъм, смелост и т.н. и с това въпросът да се приключи. Войнът е приобщен към висшите нравствени добродетели и ще се проявява като дисциплиниран, уставен, със съзнание за дълг и чест. Практиката обаче не потвърждава изцяло това схващане и за проявяване на определено поведение и формиране на определени морално-бойни качества се налага прилагането на определени материални и нематериални стимули най-вече под формата на отпуски за военните.

Възпитание на военните в процеса на военната дейност

Трудът винаги е бил основа на обществения прогрес, решаващ фактор и материална база за формирането и развитието на човека. По силата на своето въздействие върху човешката личност той притежава огромни педагогически възможности.

В този смисъл трудът справедливо се сравнява с талантлив педагог, способен да направи това, което е невъзможно да бъде постигнато и с най-тънките методи за възпитание.

Войнската дейност по своите педагогически възможности има много преимущества. Изисквайки от отделните войни и войнските колективи големи и разнообразни натоварвания, тя развива умствените им способности, възпитава такива качества като изпълнителност, колективизъм, закалява волята и издръжливостта им.

Анализът на елементите на войнския труд показва, че учебния процес заема централно място и фокусира в себе си всички останали съставки. В него и чрез него войните изучават военното дело, като усвояват необходимите знания, умения и навици. В учебно- възпитателният процес дълбоко е залегнала идеята за органическо съчетаване на теоретичната и практическата подготовка, за постигане на по висока полева натренираност на войските, представляваща основата на тяхната бойна готовност и боеспособност. Управленческата стратегия се базира и на видове комуникация която осъществяват командирите.

Формални комуникации – те следват организационно-управленската структура, т.е. те са стъпаловидно ориентирани. Формалните комуникации в частта се движат в три посоки –

- *Отгоре-надолу* – командирът може да бъде и субект, и обект на тази комуникация. Обект, когато приема информация от по-горния щаб и субект, когато предава информации на подчинените си. Взаимоотношенията в този вид комуникация са кодирани в уставите.

- *Отдолу-нагоре* – тук командирът също е субект и обект, само че предава информация на своите началници, а получава такава от подчинените си.

- *Хоризонтална* – осъществява се с равните по длъжност командири. В нея военният лидер също е субект и обект и общува по законите на военната етика.

Неформални комуникации – независимо от строгата йерархия в армията, малките звена и щабовете, където служат десетина колеги със сходна възраст и стаж, много от формите на комуникация се извършват като неформални разговори. В действителност, независимо от съществуващите ограничения, хората в щаба не могат да бъдат спрени да говорят и обсъждат неща дори извън чисто служебните, дори и в хода на учение.

Независимо от негативното мнение, което командирите имат по принцип за неформалната комуникация между подчинените си, тя трябва да се приеме като факт, че неформалната мрежа може да работи и за тях, стига умело да я използват.

Има някои правила които военният лидер трябва да следва за воденето на ефективна комуникация с подчинените си.

Когато общува с подчинените, командирът преди всичко и винаги си поставя за цел да предаде или получи необходимата делова информация. За тази цел, поне с шабните офицери, той го прави чрез речеви контакт – директно или по телефона. Това позволява да се поставят основни или уточняващи въпроси, да се дават указания и отговори, да се проверява правилно ли е разбрано казаното. Като предава на подчинения някаква информация лично, командирът така или иначе го оценява като личност, чувства емоционалното му състояние, опитва се да разбере как е възприета заповедта, разпореждането, указанието и т.н. и в зависимост от това може нещо да добави, да коригира.

Общуването лице в лице е особено важно и ценно в случай, че е необходимо да се измени гледната точка на подчинения или да се коригира неправилно разбраната информация.

3.2. Психологично осигуряване на военослужещите.

С Наредба № Н-12 от 18 май 2011 г. за психологичното осигуряване на военнослужещите от Министерството на отбраната, Българската армия и структурите на пряко подчинение на министъра на отбраната се уреждат задачите и дейностите на специализираните звена и органи за психологичното осигуряване.

Психологичното осигуряване представлява системен процес по определяне на психологичната пригодност, психичните ресурси и потенциал, поддържане и укрепване на психичното здраве, повишаване психическата устойчивост на военнослужещите и сплотеността на военните формирования/структури за справяне със специфични задачи и изисквания чрез система от професионални и организационно-административни дейности, стандарти и ресурси. Психологичното осигуряване се реализира от специализирани звена и органи с цел подпомагане на командири-те/началниците и ръководителите по изграждане и поддържане на оптимален психологически климат във военните формирования/структури, прилагане на гъвкави командно-лидерски практики, укрепване на бойния дух, войнския морал и повишаване психичната устойчивост на военнослужещите.

Основни направления на дейността на специализираните звена и органи за психологично осигуряване са:

1. определяне на психологична пригодност, психични ресурси и потенциал;
2. психологични интервенции;
3. обучение в психологични умения;
4. разработване и прилагане на превантивни програми;
5. психосоциални анализи, прогнози и стратегии;

6. приложно-изследователска и научна дейност.

Принципите на психологичното осигуряване са:

1. екипност и мултидисциплинарност;
2. системност;
3. спазване на професионални стандарти;
4. целесъобразност, приложност и адекватност;
5. способност за непрекъснато адаптиране (гъвкавост).

Специализирани органи за психологично осигуряване са:

1. психолози в щабовете на видовете въоръжени сили;
2. психолози във военните формирования от БА;
3. психолози в НВУ „Васил Левски“ и ВВМУ „Н. Й. Вапцаров“;
4. психолози в служба „Военна информация“ и служба „Военна полиция“;
5. психолог в Националната гвардейска част (НГЧ).

Центърът по психично здраве и превенция (ЦПЗП):

1. провежда обучение в психологични умения за практическа работа на различни категории командири/началници/ръководители на структури;

2. подпомага разработването на специализирани приложни програми за обучение на курсантския и сержантския състав във висшите военни училища, професионалния сержантски и професионалния старшински колеж;

3. разработва съгласувано с видовете въоръжени сили програми за повишаване психичната устойчивост на военнослужещите от военните формирования/структури;

4. разработва и прилага превантивни програми;

5. осъществява методическа помощ и координация на специализираните органи за психологично осигуряване по чл. 6, ал. 2, т. 1, 2, 3 и 5;

6. изготвя теоретични и научно-приложни разработки по психосоциални проблеми в Министерството на отбраната, Българската армия и структурите на пряко подчинение на министъра на отбраната и предлага практически подходи за тяхното решаване;

7. изследва рисковите фактори в армейската среда, които влияят върху организационната ефективност, личностното функциониране и психичната готовност на военнослужещите, и предлага на командирите/началниците подходи за тяхното ограничаване;

8. изготвя периодични анализи по текущата дейност в областта на психологичното осигуряване;

9. провежда психологично консултиране, психотерапия и кризисни интервенции;

10. провежда консултиране на организационно ниво по водене на преговори, вземане на решения, работа в екип, разрешаване на проблеми;

11. участва в психологичното осигуряване на контингентите за операции/мисии извън територията на страната;

12. извършва оценка на психологичната пригодност на кандидати за приемане на военна служба;

13. извършва оценка за психологична пригодност на военнослужещите от военните формирования/структури по чл. 162, т. 3 от Закона за отбраната и въоръжените сили на Република България (ЗОВСРБ);

14. извършва специализирани психологични изследвания на военнослужещи и цивилни служители по Закона за защита на класифицираната информация;

15. участва в изготвянето на оценка на степента на риска при участие в операции/мисии извън територията на страната;

16. участва в разработването, адаптирането и провеждането на дейности в Министерството на отбраната, свързани с изпълнение на национални промотивни и превантивни програми;

17. провежда изследване за определяне на психичните ресурси и психологичния потенциал на кандидати за заемане на национални или международни длъжности в щабове и/или органи на международни организации или на други международни инициативи и за обучение в чужбина;

18. осъществява контакти и взаимодействие със сходни структури в страната и в чужбина.

Психолозите в щабове и в.ф. на видовете въоръжени сили:

1. планират, разработват и организират дейностите по психологичното осигуряване в съответния щаб на вида въоръжени сили;

2. координират дейностите по психологичното осигуряване в подчинените военни формирования на съответния вид въоръжени сили;

3. изготвят и представят по команден ред периодични анализи по текущата дейност в областта на психологичното осигуряване;

4. участват в планирането на психологичното осигуряване на контингентите за участие в операции/мисии извън територията на страната;

5. организират и координират дейностите по психологично осигуряване на военнослужещите от военните формирования, определени за участие в операции/мисии извън територията на страната (преди, по време и след завръщане);

6. провеждат кризисно консултиране по заявка на семействата на военнослужещите, участващи в операции/мисии извън територията на страната;

7. организират и контролират провеждането на социално-психологически изследвания по актуални проблеми, свързани с психичната готовност на военнослужещите;

8. ръководят дейността по проследяване реадaptацията на военнослужещите, завърнали се от операции/мисии извън територията на страната, и координират изпълнението на превантивни програми;

9. участват в сертифицирането на военни формирования, подготвящи се за участие в операции/мисии извън територията на страната;

10. разработват и контролират прилагането на приложни програми за психологично обучение на различни категории военнослужещи.

2 Ред за провеждане на дейностите по психологично осигуряване на военнослужещите и контингентите, участващи в операции/мисии извън територията на страната

1. Разработване на план за психологично осигуряване на контингентите и военнослужещите, подготвящи се за участие в операции/мисии извън територията на страната, за всеки контингент.

Планът се разработва от щаба на вида въоръжени сили, подготвящ контингента.

2. Провеждане на психологичен скрининг на определените за участие военнос-лужещи.

Целта на психологичния скрининг е да подпомогне командния състав при идентифициране на военнослужещи, склонни към прояви на дезадаптация и/или на рисково (нежелано) поведение. Психологичният скрининг се провежда от психолозите на военните формирования по методика, разработена от ЦПЗП. Идентифицираните скрининг положителни военнослужещи се насочват към ЦПЗП за допълнително специализирано изследване.

3. Обучение в психологични умения преди заминаване

Обучението в психологични умения се осъществява от ЦПЗП и специализираните органи за психологично осигуряване като част от цялостната програма за обучение на участниците в операции/мисии извън територията на страната.

Психологичното обучение на контингентите преди заминаване включва:

а) предварителна подготовка, която се провежда съгласно годишния план на военното формирование/структура и се извършва от психолозите на военното формирование;

б) непосредствена специализирана подготовка за конкретната операция/мисия, която се планира с продължителност 12 – 18 учебни часа и се извършва от екип на ЦПЗП и психолози от вида въоръжени сили.

4. Оценка на психологичния климат

Целта на оценката на психологичния климат е да проследи динамиката на неговите параметри по време на подготовката на контингента за участие в мисията, както и да подпомогне командния състав за оптимизирането им.

Оценката на психологичния климат се провежда от психолозите на военните формирования.

5. Сертифициране на формированията

Сертифицирането на формированията включва като елемент и оценката и мониторинга на психосоциалния климат, взаимоотношенията между различните категории военнослужещи и равнището на групов сплотеност.

Целта на сертифицирането е да се изследва и прогнозира ефективността на военнослужещите за изпълнение на задачите по време на операции/мисии извън територията на страната, дори и при неблагоприятни за личния състав условия и събития. В състава на комисията по сертифициране се включва и психолог.

6. Работа със семействата на участници в операции и мисии извън територията на страната

Целта е да се даде възможност на семейните партньори на участниците да се запознаят помежду си, да си уговорят система за контакт и обмен на информация по време на отсъствието на техните съпрузи/съпруги, да очертаят типичните трудности, които са срещали или очакват да срещнат, и собствените си ресурси за справяне и подпомагане, т. е. да бъдат окуражени да изградят „група за самопомощ“. В рамките на това събиране участниците получават информация от психолозите за най-често срещаните реакции при раздяла.

7. Дейностите по психологично осигуряване по време на операции/мисии извън територията на страната включват:

7.1. Подпомагане процеса на вземане на решение от Щаба на отбраната и СОК при заявка.

7.2. Специализирани дейности от психолога в състава на контингента.

7.3. Провеждане на антикризисни интервенции и психологически дебрифинг (дифузия, демобилизация) след критичен инцидент.

7.4. Доклади с оценка и анализ на психологичния климат и психологичното осигуряване по време на изпълнение на задачите на операциите/мисиите извън територията на страната.

7.5. Групова работа на прекия команден състав след изпълнение на бойна задача, която има следните цели:

установяване фактологията на дадено събитие, разискване на различните гледни точки на участниците, подробно разглеждане на всички аспекти от изпълнението на задачата с акцент върху детайлите с цел анализ и извличане на полезни изводи/поуки от практиката;

емоционална вентилация на участниците, снижаване на психичното напрежение, превенция на боен и кумулативен стрес; свързан е със стремежа за по-успешно справяне със спецификата на поставените им задачи, за редуциране на напрежението, на проявите на стрес и кризи, за превенция и понижаване броя на неприятните и нежелани инциденти.

Време за провеждане на груповата работа:

Груповата работа започва непосредствено след приключване на бойната задача.

Груповата работа се извършва при спазване на следните правила:

правило за доверителност („тук и сега е мястото да се говори за възникналите трудности“);

правило „в дискусиата всички са равни“;

правило за реда на изказване (например: по или срещу часовниковата стрелка...).

8. Психологично консултиране на семейства:

Начин на провеждане:

8.1. Организиране работата на приемни – за семействата, роднините и близките на участниците в операции и мисии извън територията на страната, към които да се адресират заявки и запитвания от тяхна страна.

8.2. Провеждане на информационни сбирки от командването на военните формирования/структури за семейните партньори на участниците в операции/мисии извън територията на страната с участието и на психолозите по места.

8.3. Изготвяне на специализирани информационни материали за семействата на военнослужещите в операции/мисии извън територията на страната.

8.4. Осигуряване на възможност за индивидуални, семейни и детски психологични и социални консултации (включително по телефон) при наличие на заявка.

9. Психологично осигуряване при завръщане на контингентите (военнослужещите) от операции/мисии извън територията на страната:

9.1. Психологични изследвания за прояви на професионален и боен стрес и за посттравматични стресови разстройства сред завърналите се.

Целта на изследванията е ранното и навременно диагностициране на проявите на остър и подостър стрес и планиране на профилактични дейности за превенция развитието на инвалидизиращи посттравматични стресови разстройства.

Непосредствено след завръщането на контингента в рамките на един календарен ден се провеждат:

а) изследвания за диагностициране на вероятни прояви на остър стрес и планиране на профилактични дейности за превенция на развитието на посттравматични стресови разстройства;

б) групова психологична работа за подпомагане процесите на емоционално стабилизиране и реадaptация;

в) провеждане на антикризисни интервенции при наличието на кризисни събития и/или инциденти по време на операцията/мисията;

г) индивидуално психологично консултиране за подпомагане на реадaptацията при индикации и/или заявка от страна на участниците.

Специалистите от ЦПЗП изготвят заключения със съответни указания и препоръки за по-нататъшна психологична работа с военнослужещите, показали прояви на посттравматичен стрес. Изготвените заключения се изпращат до щаба на вида въоръжени сили.

9.2. Групова психологична работа за подпомагане процесите на емоционално стабилизиране и реадaptация.

Целта на психологичната работа в този период е да се подпомогне процесът на реинтеграция на военнослужещите към ежедневните дейности в семейството, професията, приятелския кръг и по-широкия социален контекст.

Основните задачи са:

а) подпомагане процеса на емоционално отреагиране, преработване, осмисляне и интегриране на преживелищния опит от участие в операции и мисии извън територията на страната;

б) подкрепяне на реалистичните очаквания и нагласи при срещата с промените, произтичащи от отсъствието и завръщането на военнослужещите в различните системи на функциониране, в които са включени;

в) формиране на нагласи и умения за управление и контрол на стреса.

9.3. Провеждане на антикризисни интервенции при наличието на индикации.

9.4. Индивидуално психологично консултиране (при индикации и/или заявка) за реадaptация при завръщане.

Целта е осигуряване на достъпно и конфиденциално психологично пространство за онези участници в операции/мисии извън територията на страната, които показват ясни белези на дистрес и/или търсят психологична помощ в процеса на реадaptация към условията на живот и работа след завръщане.

9.5. Психолозите във военните формирования провеждат следните дейности по психологичното осигуряване на военнослужещите, участвали в операции/мисии извън територията на страната:

а) на третия месец след завръщането – психологично изследване с тестови методики на всички участници и психологично интервю с показалите неблагоприятни резултати; особен акцент да се постави върху участниците, преживели критични инциденти и/или с различни прояви на стрес по време на операцията/мисията, както и военнослужещите, определени в Центъра по психично здраве и превенция след завръщане като рискови по отношение на развитието на посттравматично стресово разстройство;

б) на дванадесетия месец след завръщането – само с военнослужещи с обективни данни за нарушено психологично функциониране.

По заявка в посочените изследвания се включват специалисти от ЦПЗП.

За посочените дейности психолозите от военните формирования изготвят писмен анализ и в двуседмичен срок го изпращат по команден ред.

Психолозите във военните формирования планират групова работа с участници в операции/мисии извън територията на страната с продължителност 2 учебни часа месечно в рамките на програмата по психологично обучение.

След приключване на операцията/мисията командирите следят за прояви на рисково поведение на участниците по посока на дезадаптивно и агресивно поведение, рисково шофиране и ПТП, употреба на алкохол и психоактивни вещества, дисциплинарни нарушения, семейни проблеми. При констатирани промени в поведението и прояви на рисково поведение военнослужещите да бъдат насочвани към съответните психолози, а при констатирана необходимост – към ЦПЗП.

ЦПЗП и специализираните органи за психологично осигуряване съгласувано с командирите/началниците извършват психологично консултиране на семействата на участниците, както и на военнослужещи, участвали в операции/мисии извън територията на страната, освободени от военна служба.

9.6. Възстановителни програми за подпомагане процесите на реадaptация.

Правила за практическа психологична работа на преките командири.

I. Работа по отношение на отделния военнослужещ

1. Да се приема военнослужещият като личност, като се зачитат, уважават и удовлетворяват, в рамките на уставните изисквания, неговите потребности.

Да се обръща особено внимание за:

- финансови, семейни и/или лични проблеми;
- употреба или злоупотреба с алкохол и/или лекарствени препарати;
- протичане на адаптацията на новоприети военнослужещи;
- проблеми в комуникацията;
- безпокойство, тревожност и песимизъм;
- несправяне с възложените задачи.

2. Да се поставят ясни цели, които да са конкретни, измерими и изпълними:

2.1. Да се определя конкретната роля на всеки военнослужещ при изпълнение на задачите, като се поставя ударението върху:

• взаимната ангажираност и включеност на военнослужещите от военното формирование в изпълнението на поставените задачи и значимостта на индивидуалните постижения;

• приемане на целите и ценностите на военната система;

• създаване атмосфера на внимание и загриженост за здравето и безопасността на военнослужещия при изпълнението на поставените задачи;

• доверие към подчинените.

2.2. Да се осигуряват необходимите ресурси за изпълнението на задачата.

2.3. Да се използват единни критерии за оценка на резултатите.

2.4. Да се признават вложените усилия и проявената компетентност чрез формиране на:

• чувство за ясна, навременна и еднозначна връзка между реално показаните резултати и получената от военнослужещите оценка за изпълнението на задачата;

- усещане за приемане и зачитане на знанията, уменията и компетентността на военнослужещия при поставяне на задачи и отдаване на заповеди от страна на командирите;

- възможност военнослужещият да получава признание за положените усилия.

II. Работа по отношение на военното формиране като цяло

1. Да се поставят ясни и значими цели и задачи, които дават смисъл на усилията и трудностите, с които се сблъскват и преодоляват военнослужещите. Да се осигури:

- съвместно участие и взаимозависимост между военнослужещите в хода на изпълнението на поставените задачи;

- еднакво отношение и условия към всеки военнослужещ, чувство за справедливост и доверие;

- спазване на дисциплината като необходимо условие за отговорно и съпричастно изпълнение на поставените задачи;

- възможност за общо прекарване на свободното време и за общи положителни преживявания.

2. Да се постигне доверие и съпричастност към взетите от командира решения чрез:

- показване на компетентност и професионални умения при организиране на войсковия живот, водене на занятия и вземане на решения;

- проява на загриженост както за благополучието на военното формиране, така и към отделния военнослужещ;

- достоверност и изчерпателност на информацията;

- проява на грижа и внимание към подчинените военнослужещи;

- признаване на вложените усилия от всеки военнослужещ;

- проява на доверие във възможностите на военното формиране;

- подчертаване на значимостта и ролята на военното формиране.

3. Да се следи за следните признаци:

- слаба вътрешна сплотеност на военното формиране;

- ниска ефективност на военното формиране при изпълнение на поставените задачи;

- чести конфликти между военнослужещите;

- неудовлетвореност на военнослужещите;

- чести отсъствия по здравословни причини;

- свръхчувствителност към критика;

- пренебрегване на заповеди;

- безмълвно или открито противопоставяне и агресивно отреагиране.

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CONTEMPORARY MARITIME SECURITY CHALLENGES IN THE BLACK SEA REGION

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Abstract: The analysis of the security factors is of great matter for the ability to fortell the potential threats from different size

Keywords: security, region

1. Introduction

Черноморският регион се намира на кръстопът между Европа и Азия, Русия и Близкия изток, свързан е със Централна Европа посредством река Дунав и Средиземно море и е на ос от нарастваща геополитическа важност като външна граница на Европейския съюз и източна граница между Евроатлантическата общност и Близкия изток. До началото на ХХ в. регионът беше зона на множество конфликти между Великите сили; по време на Студената война беше граница между двата блока и след края на двуполосния модел, Черноморският регион се превърна в зона на стратегическа връзка, транспортен и енергиен коридор с нарастваща важност в Европа. След атентатите от 11.09.2001 г., регионът се превърна в „основен център” на борбата с тероризма. С оглед на това, че е на границата с нови заплахи и наличието на смятани за „замразени” конфликти, регионът се оказва източник на предизвикателства за сигурността.

2. Main part

Съвременни предизвикателства за морската сигурност

Използването на въоръжени сили срещу територията на дадена държава традиционно е най-сериозният начин за негативно повлияване на сигурността. След приемането на нашата страна в НАТО и ЕС, има минимален шанс за появата на подобна заплаха, идваща от друга черноморска или средиземноморска страна. Несъмнено, това е поради установяването на климат на кооперация в региона и най-вече поради членството на страната ни в единствения функциониращ военно-политически блок. Въпреки това, от друга страна, именно този факт може да предизвика опити за различни видове въоръжени нападения или терористични атаки над части от територията ни и в нашето морско пространство. С оглед на това ние можем да приемем съществуването на възможности за атаки (индивидуални удари) с балистични ракети, включително и оръжия за масово унищожение (ОМУ) на националната територия или на чужди военни бази у нас, свързани с военни действия в държави като Иран, Ирак, Сирия и т.н.

Други потенциални източници на въоръжен конфликт в Черноморския регион са свързани с най-изостреният проблем на територията му, а именно конфликтът между Русия и Украйна. Други проблеми се прибавят от наразбирателствата между бившите Съветско-кавказки републики, проблемите с кюрдите в Турция, пробле-

мът в Кипър, териториалните конфликти в Приднестровието и др. Възможността за каквото и да е включване на Република България в тези конфликти се смята за минимална, като се вземе в предвид балансираната външна политика, ненамесата ни в двустранни конфликти и в конфликти, които не засягат директно националната сигурност.

Контекстът включва една от най-големите заплахи за сигурността в световен мащаб – **тероризмът**. Разглеждайки проблемите на морската сигурност, терористичните атаки на морски обекти могат да са: атаки с конвенционално оръжие или ОМУ; използване на цивилни кораби като „кораби-бомби“ за разрушаване на обекти от голямо разстояние; използване на цивилни кораби за транспорт на членове на терористични организации, целящи да предизвикат инцидент, засягащ сигурността, а също така и опасни стоки – оръжие или опасни товари, устройства или части за устройства за предизвикване на инциденти; корабите могат да се използват и за пренасянена хора или нелегална търговия, с цел придобиване на средства подпомагащи терористични операции¹¹. Факторите, които привличат международния тероризъм към Черно море са:

- възможността за кооперация със структури на организираната престъпност, имащи значително влияние в черноморските страни;
- фактът, че регионът се намира на важен кръстопът в трафика на наркотици – един от важните отрасли, поддържащи терористичните организации;
- възможността за установяване на терористични клетки на базата на вече съществуващите структури на екстремистките ислямски организации и Ислямските полувоенни групи, действащи в източната част на региона;
- подходящите условия за проникване на представители на терористични структури, установяване на техни бази и използването им за нахлуване в европейските страни и САЩ, създадени като резултат от голямото количество нелегален трафик на хора, особено от по-нестабилните региони (Кавказ, Близкия изток, Средна Азия) през Балканския полуостров към други части на света.

Според настоящите източници, най-голям риск и въпрос за решаване с най-голяма тежест от терористичните заплахи, произхожда от възможния трансфер на поддръжници на Ислямска държава от Европа към Сирия и Ирак през Турция и възможността за обратното проникване.¹²

Всяка негативна промяна на регионалната среда за сигурност, произлизаща от етнически или религиозни различия на Балканския полуостров или произтичащи от въоръжени местни конфликти в съседни региони на Балканите (войната в Ирак, обстановката в Чечня) рязко увеличават възможността от реализация на терористични атаки над обекти на територията на държавите от черноморския регион, включително и срещу техните пристанища и цивилни кораби.

Заплахата от тероризъм в черноморския регион може да има негативни икономически последици като подкопава надеждността на много междуконтинентални проекти, свързани с транспорт, комуникации и преноса на енергоносители. Някои

¹¹ Боян Медникаров, Морският тероризъм и пиратство като негативни фактори на морската сигурност, в Сигурност на морската транспорта система, Варна 2008, стр. 168-169.

¹² Вижте информацията от доклада на Турското разузнаване, <http://www.dnevnik.bg/sviat/2015/02/19/2476117..>

от тези проекти пресичат (или е предвидено да пресичат) нестабилни райони и възможността те да станат жертва на терористична дейност не е изключена, което би довело не само до икономически и финансови загуби, но също така и до екологични катастрофи.

В горния контекст можем да включим също и кибер заплахите (заплахите за информационната сигурност) срещу системи за навигация и доставяне на стоки. Достъпът до тях би позволил на терористични или криминални организации и групи да получат информация за преноса на атрактивни за тях товари, пътници кораби; те биха могли при нужда дори да променят курса на навигация на корабите и да извършат по-лесно своята нелегална дейност. Преднамерено нарушаване на нормалната работа на електронните системи и средства за позициониране, контрол и навигация на корабите при навлизането им в теснини и канали към пристанищата, създава условия за проблеми с управлението на корабите и екологични катастрофи. В глобален мащаб регионите с по-голяма терористична активност съвпадат с регионите имащи по-голяма концентрация на пиратство. За територията на Черно море през последните десетилетия няма установени случаи на класическо пиратство или въоръжени грабежи на кораби на море.

Повечето съвременни рискове и заплахи имат междуграничен характер и в морето те не могат да утежнят междудържащите различия на национално-етническа и религиозна база, но те могат да създадат условия за влошаване на желанията за контрол над важни морски региони за изследване на ресурси, което води до проблема с определянето на морските граници. Това се отнася за 17 км зона в Черно море, която може да стане обект на спор между България и Румъния, поради откриването и бъдещото добиване на полета природен газ. Например румънския блок „Нептун“ съдържа около 100 милиарда m^3 газ, заобиколен вероятно от други атрактивни зони, както и българския блок „Хан Аспарух“. Други предизвикателства, свързани с определянето на морските граници, включват извършването на много нелегални дейности като трафика на стоки и дрога, хора и незаконно оръжие, нелегален риболов и др., както и свързаните с тях национални и международни отговорности за противодействие и защита срещу подобни действия¹³.

Нелегалната търговия с оръжия, технологии с двойно използване и компоненти за ОМУ е значителен проблем за сигурността. Тази криминална дейност се възползва от натрупаните огромни арсенали оръжие от времето на Студената война, от многото построени заводи за оръжие, упадъка на управната системата в държавите от бившия Съветски съюз и липсата на ефикасен контрол над оръжието в някой от държавите в източната част на региона.

Широкото разпространението на технологии с двойно използване и най-вече компоненти за ОМУ го прави по-достъпно за държави, терористични и престъпни организации.

Трафикът на конвенционално оръжие също предизвиква проблеми от подобен мащаб. Нелегалната търговия с тях е основен източник на въоръжение на сепаратистки движения, псевдвоенни групировки и терористични организации. Списъкът с разпространено оръжие включва от леко стрелково оръжие и противопехотни мини до противотанкови гранатомети и преносими противовъздушни ракетни комплекси. Трудно е да се разграничат легалната и нелегалната търговия на

¹³ Кирил Колев, Сияна Люзканова, Кризисен мениджмънт в българските териториални води.

конвенционално оръжие в региона. Индикация за това е фактът, че нелегалната търговия се извършва по три основни начина: „официален” метод, при който нелегалната придобивка се извършва чрез легална институция; чрез неправителствена търговия, когато оръжието е произведено от „непозната страна”; чрез класическата търговия на черния пазар. След установяването на надежден контрол над търговията с оръжие в Република България и Република Румъния в края на 90те години на миналия век, днес Русия, Украйна, Молдова и Кавказките републики могат да бъдат посочени като потенциален източник на нелегално оръжие. Най-сериозни обвинения в това отношение се хвърлят на Армения и сепаратистките режими в Приднестровието и Абхазия.

Важно е да се акцентира върху негативното влияние върху сигурността на Евро-Атлантическия регион от търговията с нелегално оръжие със Сирия, Иран, Либия и някои неправителствени групировки като ХАМАС и Хизбула. Въпреки това те са успели да направят големи трансфери с конвенционално оръжие и има почва да се смята, че се опитват да придобият и ОМУ. Така се създават сериозни рискове, произтичащи от формирането на значителни асиметрични потенциални заплахи за южния фланг на НАТО и източната и южната граница на ЕС.

Трафикът на различни видове **дрога и контрабандата с акцизни стоки** също имат сериозен негативен ефект върху сигурността. Нелегалната търговия с наркотици в Средиземно и Черно море претърпя динамични промени, характеризирани с увеличено потребление, промяна на коридорите за доставка, увеличение на производството на синтетични наркотици и постоянно увеличение на престъпните мрежи.

Специфичното географско разположение превръща региона в кръстопът на многопосочни канали за дрога и нелегална контрабанда на стоки. Морските канали за пренос на наркотици в Черно море представляват сериозен интерес. В голяма част те започват от руското или грузинското крайбрежие и достигат пристанища в Румъния, България и Украйна (предимно Одеса). Част от трафика преминава през Босфора и достига южните пристанища на Европа.

Нелегалната миграция и трафикът на хора също е сериозно предизвикателство за сигурността. Потоците от бежанци по море се формират поради социалноикономически и военно-политически причини. Един от най-големите потоци на бежанци е на базата на социално-икономическия фактор и е Азия-Средиземно море-Западна Европа.

Замърсяването на морската околна среда и екологичните катастрофи на море са много сериозно предизвикателство пред нас и може да има дълготрайни последици на икономическо и социално ниво. Най-сериозни екологични катастрофи се случват при разливи на големи количества нефт, проблеми с навигацията на корабите или терористични актове. Досега е имало само няколко случая на значителни екологични катастрофи в Черно море, свързани със замърсяване на морето⁴ и за в бъдеще предизвикателство е поставено пред екологичната сигурност на предприятията от енергийната индустрия.

3. Conclusion

Повечето от новите рискове и заплахи за сигурността имат междудържавен характер и силно влияят едновременно на националната и международната сигурност. Могат да завършат с влошаване на контрола над важни морски региони или с

недобрият контрол на ресурсите вътре в тези региони. Анализът на представените предизвикателства, заплахи и рискове показва видимо динамичната среда за сигурност в Черноморския регион. От друга страна това е регион, предлагащ много нови икономически перспективи, които по-нататък ще допринесат за по-голяма независимост на енергийните потоци и социално-икономически напредък.

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UNMANNED MINE COUNTERMEASURES UPDATE

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Abstract: *This paper represents the unmanned mine countermeasures updates until April 2014. We recognize the background and challenges, the programs for MCM development and the newly invented equipment and also the possible path of further development.*

Keywords: *mines, MCM capabilities, underwater defence, unmanned devices.*

1. Introduction

Mines can be incredibly effective weapons, not only can they destroy shipping they can deny large areas of sea to all traffic, choke off ports, restrict the flow of traded goods and generally have impacts wholly disproportionate to their cost.

2. Main part

Minesweepers are an enduring image of the battle against mines but the last combined influence sweep system deployment was in 2005.

The rise of unmanned systems to counter mines has come about for a number of reasons, primarily the desire to remove sailors and divers from the mined environment as much as practicably possible.

When looking at the mine countermeasures capability it is important to start with mission requirements and threats.

Expeditionary Missions, mines are a basic sea denial weapon, their objective is not necessarily to sink ships but deny movement. Clearing Sea Lines of Communication (SLOC) and supporting amphibious operations are the most common expeditionary MCM requirement. The objective may not always be the complete neutralisation or disposal of all mines but to provide assured access to an acceptable level of risk.

National Missions, when looking at this subject we should not forget the legacy of old sea mines and other unexploded ordnance. Any new capability must still be able to counter these old fashioned but no less deadly threats. In addition, harbour and port clearance are national missions. Accurate 'charting' is essential to safe navigation and operations for both surface and sub surface equipment. This mission is carried out on a routine (the sea bed is constantly changing) and reactive basis.

Threats, the diversity of mine threats creates a significant challenge and so does the environment into which they are placed.

These environments can include the surf zone, very shallow water, shallow water and deep water.

Expanding these broad classifications based on water depth we might also include ports, offshore infrastructure and other man made environments.

Types of device include surface, anti invasion, buried, partially buried, moored contact, bottom influence, moored influence, floating contact and rising influence.

The increasing demand for petrochemicals has driven the industry to exploit reserves in inhospitable environments and it is this that has created a sophisticated industrial and scientific community where one of the outcomes has been underwater robotics and survey technologies.

The mine countermeasures field both contributed to this and exploited it.

One of the most significant issues is classification of mines, once detected, and can be a time consuming process.

A significant problem is that of false target detection.

The sea bed environment of any large port or well trafficked channel is likely to be cluttered with all manner of debris and this dramatically increases the false target rate.

Research on the automated classification of threats continues to improve false target discrimination rates and speed the process up significantly. Target recognition and being able to discriminate a discarded grain sack or can of Coke from a mine might be relatively simple for the human eye/brain but for an autonomous system, it is very far from simple.

The increase in throughput by virtue of using multiple autonomous systems combined with intelligent target recognition software is one counter to this tactic, meeting brawn with brains.

Once detected and classified the device has to be destroyed or disposed of and this was generally carried out by clearance divers.

Programmes

The Future Mine Countermeasures Capability (FMCMC)

After the UOR (Urgent Operation Requirements) infused MCM operations in Iraq had concluded a programme to look at the next stages of MCM was launched.

The Future Mine Countermeasures Capability (FMCMC) accurately predicted that the future of MCM was portable, offboard and dedicated systems, POD for short, able to carry out recce, hunting, sweeping and disposal tasks.

It was intended that FMCMC would be demonstrated using existing MCM vessels and matured, before transitioning to the C3.

Mine Countermeasures, Hydrographic and Patrol Capability (MHPC)

In 2009 The Future Mine Countermeasures Capability (FMCMC) was absorbed into another programme, Mine Countermeasures, Hydrographic, and Patrol Capability (MHPC)

Offboard and unmanned systems would be developed, proven and deployed from existing specialised MCM vessels whilst still retaining the capabilities of those specialist vessels, hull mounted sonars for example.

If offboard systems could be proven as effective from any vessel then the platform from which they were operated from could be considered separately.

It also recognised that now matter how unmanned and autonomous systems developed the skills of the clearance diver would still be needed in some circumstances and the tremendous advantages of the human eye/brain would take some time for a machine to best.

Finally, MHPC recognised the convergence of MCM and Survey, much of the equipment used in MCM operations had been developed for offshore survey and engineering, the REMUS 100 being a very good example.

Equipment

Shallow Water Influence Minesweeping System (SWIMS)

The Shallow Water Influence Minesweeping System (SWIMS) was designed to operate in the shallow waters in the south of Iraq and was obtained as an Urgent Operational Requirement (UOR)

SWIMS consists of a towed magnetic and acoustic source, a tow/power delivery cable, a power conditioning and control subsystem, and an external or palletised power supply. Its small size and reduced weight require minimum handling equipment, and it is deployable from a helicopter or surface craft by two personnel. 12 QinetiQ modified remote controlled Combat Support Boats (CSB) were also used to tow Australian Defence Industries (ADI) Mini Dyad System (MDS) and Pipe Noise Makers (PNMs) ahead of the RN minehunters as part of the SWIMS payload. It is worth noting that the system demonstrator was available within 3 weeks of order placement, a truly remarkable feat.

Australian Defence Industries are now Thales Australia and this system have evolved into a comprehensive package called the Australian Minesweeping System (AMS)

SWIMS comprised two main components, the towing boat and payload.

The towing boat was a rapidly modified Combat Support Boat, in service with the Royal Engineers. Modifications included the telemetry and remote control equipment, additional power generation and power distribution equipment.

The SWIMS payload consisted of multiple towed bodies in an array that was designed to simulate the acoustic and magnetic signature of a ship, and would thus, fool the mine into detonating, possibly destroying the unmanned system rather than a real ship.

In addition to floats and connecting equipment, the payload array consisted of two towed bodies, a Pipe Noise Maker and Mini Dyad.

Pipe Noise Makers are simple and robust systems that do pretty much as the name suggests, make noise.

Mini Dyads sound small, at 7.7m long and weighing in at 1.6 tonnes, they are not.

They are simply a steel tube containing multiple steel and ferrite disc magnets with multiple Mini Dyads arranged to simulate different magnetic signatures

The MoD selected the ADI system because it was the only one available that did not need additional power and could operate in shallow waters. The system was ordered in late December 2002 and delivered in late January, they were hired for 12 months and the acoustic generators purchased outright.

One complete array comprised 2 Mini Dyads and 2 Pipe Noise Makers.

Telic SWIMS

REMUS 100

The Remus 100 is very low cost, less than a quarter of a million pounds each, and was seen as a cheap de-risking stepping stone towards the future capability.

Hydroid are now owned by Kongsberg.

The Royal Navy contracted with Kongsberg to upgrade the 12 in service REMUS100 systems to include a BlueView Technologies 3D MicroBathymetry system, Kongsberg

Geoacoustics GeoSwath interferometric sonar , modular endcaps and digital ultra short baseline (USBL) acoustic positioning systems.

Some were also fitted with an Inertial Navigation System.

Seafox

The Seafox is a one shot mine neutralisation system, simply put, it swims to the mine and blow itself and the mine up.

Seafox has been continually developed by Atlas and now comes in two variants (plus a training version), Combat and Inspection. The Combat variant is armed with a 1.4kg shaped charge, the Inspection variant isn't. They can be distinguished by colour, black = combat and orange = inspection.

Launching is carried out using a crane attached cradle and recovery uses a basket, again attached to a crane.

It is a very simple, robust and effective system.

The Mk II variant introduced a capability to destroy floating mines and the latest version has a safer fuse system if it needs to be recovered without being fired.

The inspection variant has a 360 degree sonar and internal navigation system for autonomous operations

REMUS 600

The REMUS units will greatly enhance mine countermeasures capability within the littoral area, providing a detailed maritime survey, mine detection and classification capability in the 30m to 200m depth range.

the REMUS 600 AUVs will add new capabilities and act as a force-multiplier, allowing existing assets to conduct operations independently.

COBRA

In 2012, the COBRA neutralisation charge was introduced to service.

COBRA is a demountable EOD disruption device designed to be placed in close proximity to a mine or unexploded munition and the launch vehicle withdrawn to a safe distance.

A buoy is released with an RF receiver that receives the firing signal from an operator, up to 22km away.

The charge is initiated by a number of other methods including shocktube and acoustic.

The COBRA makes a lot of sense given the cost of the Seafox, instead of being a disposable one shot system, Seafox is now capable of being reused, much cheaper to blow up a COBRA than a Seafox.

Fast Agile Sweeping Technology (FAST)

A mine counter measures (MCM) flexible agile sweeping technology (FAST) technology readiness demonstrator (TRD) that will ultimately enable MOD to put a combined influence sweep (CIS) replacement into service using FAST Technology. Key objectives for this programme include de-risking the key technologies for a unmanned surface vessel based MCM influence capability and the development of technology and system integration maturity, using a design and build TRD programme. Quantified mine sweeping performance and effectiveness against mine threats in a realistic scenario will be demonstrated along with deployment, recovery and capture of a FAST unmanned surface vessel from an MCM. The development of an open architecture approach to the FAST components and the transfer of MOD mine sweeping research knowledge to the UK industry supplier base are also important.

Flexible Agile Sweep Technology (FAST)

By 2011 Atlas had evolved the system into something called the Containerised Integrated Mine Countermeasures System (C-IMCMS)

The C-IMCMS (Containerised Integrated Mine Countermeasures System) consists of a port-able combat management system as well as the analysis software CLASSIPHI for post mis-sion analysis of side-scan sonar data, the unmanned surface vessel (USV) FAST, the autonomous underwater vehicle (AUV) SeaOtter Mk II and the mine disposal system (ROV) SeaFox. The system was deployed from the shore; operations on board various ship types are also possible.

Another sweep system was also considered, the Kockums Self Propelled Acoustic Magnetic Sweep system or SAMS

This is an impressive system and when deployed in multiples can rapidly clear large areas. It can also be used to reduce the number of devices so that the more sophisticated detection and disposal activities can proceed at a quicker pace.

It is not clear what sweep technology FAST used, the Excelis Modular Advanced Remote-controlled Surface Sweep System or those from Thales Australia.

The ADI (now Thales Australia) Advanced Minsweeping System combines acoustic, magnetic and Electric Potential (UEP) / Extremely Low Frequency Electric (ELFE) sources that produce ship like signatures.

The towed bodies generates power for the acoustic and electrical sources so no additional power generation is required.

Modern mines have the ability to distinguish older non combined sweep signatures, an acoustic signal with no accompanying magnetic signature is immediately detected as a sweep system and given a good stiff ignoring. Combined influence systems solve this by carefully tuning all sources into a single signature, very cunning.

Recent Developments

DSEi 2013

In September 2013 at the DSEi exhibition in London two of the short listed companies showed off their offerings, Atlas Elektronik and Thales.

Both manufacturers seemed to have similar approaches, small craft that could be operated in either manned or unmanned modes and both able to launch and recover a range of unmanned underwater systems for sweep, recce and disposal of underwater explosives and mines.

Thales showed the HALYCON system and Atlas Elektronik, ARCIMS.

It must be said that these system did not suddenly appear and have been the product of many years evolution.

Atlas Elektronik

Atlas Elektronik showed ARCIMS. ARCIMS has been developed over quite a long period from the various systems such as FAST and SeaFox. Atlas teamed up with the makers of the Bladerunner speedboat, ICE Marine.

Platform Characteristics

- LOA – 11 m
- Beam – 3.2 m
- Draft – 0.5 m
- Weight – 6000 kg
- Payload Capacity – 3000 kg
- Propulsion – Twin engine with water jet or propeller

- Speed - > 40 knots
- Towing speed – 8 knots (typical)
- Certified for manned operations

ATLAS Minesweeping Payloads

- [1] Power Generation Module (PGM)
- [2] Towed Magnetic Sweep
- [3] Towed Acoustic Sweep
- [4] Towed Electric Sweep

Operational benefits

Performance

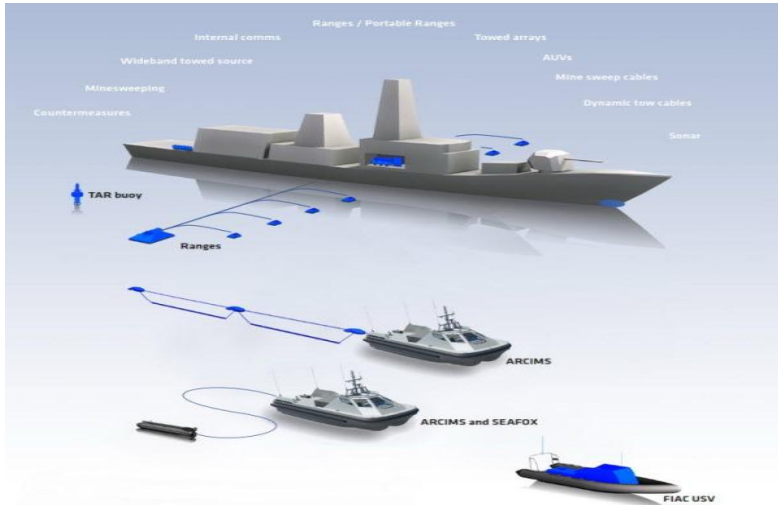
- World leading remote MCM capability
- High levels of automation
- Advanced mission planning and analysis tools
- Reliable command and control
- Proven safety features
- High towing capability
- High manoeuvrability
- Shock resistant
- Stand alone or integrated operation

Physical characteristics

- Compact and scalable USV
- Light weight
- Road, sea and air transportable
- Military specification

Supportability

- Reliable
- Minimal maintenance
- Minimal training requirement
- Full ILS support



ATLAS Elektronik Offboard Systems showing ARCIMS

As can be seen from the graphic, Atlas envisaged ARCIMS having the ability to tow sweep equipment and deploy its own unmanned systems

An autonomous means of launch and recovery of small unmanned underwater systems or ROV's was absent.

Thales had partnered with Autonomous Surface Vehicles in 2012, a UK company specialising in unmanned surface craft.

Latest News

The motorboat Hazard – currently being put through its paces by a specialist team of sailors in Portsmouth Naval Base – can act as the ‘mother ship’ to an assortment of hi-tech remote-controlled and robot submersibles.

The article had two important things to note.

First, the craft is obviously the Atlas Elektronik ARCMIS, the one built by ICE Marine, that undisclosed customer really was the Royal Navy.

Second is the small ROV, although there is no autonomous launch and recovery system like the Thales Halcyon with its Saab Seaeye Falcon, the ROV shown is the Ocean Modules V8 M500 Intervention.

The V8 M500 is a new design (2013) from Ocean Modules, a Swedish company that sell their products in the UK through Atlantis Marine in Somerset.

What is also interesting is that both the Atlas and Thales concepts use civilian ROV's modified to carry disposal devices.

3. Conclusion

Unmanned systems are unlikely to completely remove humans from the mine countermeasures mission but the last decade has seen the technology advance to a level where we are now on the cusp of a genuine step change in the ability of naval forces to counter them.

After a decade of development, multiple research projects and demonstrators, man kind is making solid progress towards an integrated mine countermeasures capability that can be rapidly transported to operational areas, deployed from non specialised vessels or the shore and operated at a stand off distance, thus, largely removing personnel from the danger zone.

Whatever technology emerges, the real challenges will be with bandwidth, latency, mission planning, false alarm rejection, energy density for the platforms and getting all the systems to talk to each other, basic systems integration.

It must be remembered that the mine is not really the issue, it is the minefield. Defeating a minefield not only needs the technical ability to do so but to do so with enough confidence to reduce risk to acceptable levels. The definition of 'acceptable' is likely to change depending on mission, the risk appetite when dealing with a requirement to escort a civilian very large crude carrier might be completely different to that of conducting a small scale amphibious raid.

One significant challenge that is likely to emerge is the underwater IED, no longer do mines need to be made in sophisticated factories and one underwater IED in amongst a hundred oil drums/fridges/sacks poses a throughput issue only likely to be solved with multiple parallel detection devices, high power data processing and intelligent software that mimics the human eye/brain recognition capabilities.

It should also be noted that in all of these programmes, visions and technology fests, there is nothing apart from clearance divers for the surf zone, which means that Amphibious Operations could be hugely curtailed by a handful of surf zone mines or IED's. There are two other future trends to note, first, the convergence of MCM and Survey and second, containerisation of systems.

The reduction in manpower as described will no doubt be noted by many.

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ВИДОВЕ 3D ТЕХНОЛОГИИ

ЗЛАТОМИРА МИЛЕНОВА СТОЙЧЕВА ДОБРОМИР ЖИВКОВ ДОЙЧЕВ

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Резюме: 3D телевизори могат да използват много различни технологии на дисплея, за да постигнат 3D ефект. В крайна сметка, всички тези техники доставят 3D графика с помощта на някои технологични иновации, за да предоставят различни изображения за всяко око на зрителя. Ако се интересувате от технологията зад 3D дисплеите тогава бих препоръчал прочетете задълбоченото ръководство за това как 3D телевизора работи, както и сравнението на активната и пасивната 3D технология.

Ключови думи: 3D телевизор, технология, 3D очила

1. Въведение

Тези технологии, а също и списък на техните плюсове и минуси, с цел по-добро разбиране на това какво да търсите и от какво да се притеснявате когато купувате нов 3D телевизор. Трябва да се спомене, че в момента всички 3D технологии, които се предлагат се нуждаят от някаква форма на очила за постигането на тази 3D ефект. Въпреки това, технологиите не са много натрапчиви и по-голямата част от хората бързо забравят, че носят 3D очила, когато се потапят в 3D средата.

1. Анаглифна технология

Това е най-старата 3D технология, с която сме запознати. Тя разчита на използването на очила с различни нюанси на цвета за всяко отделно око. Изображението за лявото и дясното око, се показват едновременно на екрана и са изкривени едно спрямо друго. Освен това, изображението за всяко око се показва в различен цвят, който не може да премине през цветното стъкло за другото око. В резултат всяко око, получава уникален образ и ние сме в състояние да възприемаме в 3D. Въпреки това, тази технология е изпълнена с много проблеми, като ужасното цвето-усещане (благодарение на цветните филтри), и много слабото 3D изживяване като цяло. За щастие нито един от големите производители не се опитва да продава тази стара и остаряла технология, но ако възнамерявате да гледате 3D телевизия с анаглифна технология, не забравяйте да поддържате безопасна дистанция. Анаглифните очила предоставят изключително ниско качество на 3D, причинявайки главоболие и преумора на очите, дори и при кратко гледане.

Основен недостатък на анаглифните изображения е неправилното цветопродаване. Благодарение на ефекта на бинокулярното зрение комбинираното обемно изображение се възприема като еднотонно или ахроматично. Адаптацията към специфичните условия на възприемане става сравнително бързо, но след 15 до 30

минути цветовата чувствителност у наблюдателя намалява и възниква чувство на дискомфорт от възприемането на нормалния (не червено-син) свят.

2. 3D телевизори базирани на очила с активен затвор

/компресия - Side by Side или Top and Bottom/ Очилата с активен затвор /Active Shutter подкрепени от Panasonic, Samsung и Sony/ - съдържат течни кристали и поляризационни филтри, които помагат да се затъмни стъклото, когато се прилага слабо напрежение . Това напрежение се включва и изключва с много бързи темпове (100 пъти в секунда - 100 Hz), така че стъклото пред всяко око да бъде тъмно или прозрачно - позволявайки на правилното изображение от телевизора да стигне правилното око на зрителя. Стъклата са синхронизирани с 3D телевизора чрез трансмитер и ли по Блутут.

При очилата с активен затвор, левите и десните изображения се редуват бързо на дисплея. Когато зрителя гледа екрана през такива очила, всеки затвор е синхронизиран да блокира нежеланото и да пропуска само желаното изображение. Така, всяко око вижда само подходящата гледка в перспектива. Лявото око вижда само лявото зрително поле, а дясното око - дясното зрително поле. Едно основно предимство е, че тези очила елиминират ефекта на сянка, който се получава при другите технологии за 3D дисплей. И тъй като този метод е много щадящ очите, е идеален избор за домашно гледане. Докато някои телевизори идват в пакет с тези активни 3D очила, много съвместими комплекти изискват от вас да си ги закупите отделно, като допълнителен аксесоар - а те не са евтини. Те са чувливи и това се усложнява допълнително от факта, че очилата от една марка няма да работят с друг телевизор.

-Предимства

Основните предимства на телевизорите базирани на очила с активен затвор е, че ще държат цените на дисплеите сравнително ниски, тъй като не изисква значително изменения, необходими за текущите LCD и плазмени 3D телевизори. Единствената необходима промяна е по-високата честота на опресняване, което е необходимо за осигуряване на разделни изображения към всяко око, без да бъде пожертвано общото усещане при гледане и по-добрата синхронизация на 3D изображенията от телевизора с очилата. Също така, тази технология се базира на доказали се технологии за дисплеи като LCD, плазмени и DLP ,което означава, че ще има по-малко промени.

-Недостатъци

Хората, които са много чувствителни към честотата на обновяване могат да възприемат леко трептене при гледане с активни очила на 100Hz 3D дисплей (тъй като всяко око вижда само 50 Hz). Това обаче може да бъде облекчено ,чрез покупка на по-висок клас 3D телевизор, който включва над 200 Hz честота на обновяване. Освен това, очилата с активен затвор изискват батерии/някои се зареждат/, а също така и са по-скъпи от пасивните поляризационни очила. Това ще бъде проблем за тези, които обичат дълго да седят пред телевизора. Също така теглото е два пъти по-голямо ,от това на поляризираните очила ,плюс по-високата им в пъти

цена. Въпреки това, има голяма вероятност, цените да бъдат свалени с цел насърчаване поупката на 3D телевизори.

- обемисти очила с батерии
- електромагнитни вълни
- по-тъмни триизмерни образи
- ограничен ъгъл на виждане

3. 3D телевизори с пасивна поляризация

На киноманите, които наскоро са гледали 3D филми, като „Аватар” например, в кината със сигурност са им раздавани поляризирани очила за гледане на филма. В киното, два прожектора поляризират светлината под различен ъгъл за всяко око, която очилата съответно декриптират, за да осигурят Full HD качество. При домашна употреба обаче, филтърът, фиксиран отпред на телевизионния панел позволява само половината резолюция и половината яркост. Това е така, защото взема отделни редове за изображенията за лявото око (напр. 1, 3, 5) и за дясното око (напр. 2, 4, 6). Един дисплей поляризира светлината с половината от нейната резолюция 45 градуса наляво, а с другата половина от резолюцията – 45 градуса надясно. Друго неудобство е ограниченият зрителен ъгъл. Зрителите през цялото време трябва да гледат само направо, иначе може да се получи преумора на окото, заради двойното оконтуриране.

От голямо значение е, че пасивните 3D очила не са скъпи. Можете дори да гледате пасивни 3D телевизори у дома със същите 3D очила, които се използват в повечето кина (оттук и брандинга на LG Cinema 3D "). Пасивни очила на една марка ще работи с телевизор от друга марка, те са взаимозаменяеми. Пасивните 3D очила също са сравнително леки и удобни. Някои производители предлагат дизайнерски 3D очила, които се явяват неразличими от редовни слънчеви очила. Могат дори да се носят навън, тъй като предлагат UV защита..

-Предимства

Пасивно поляризираните дисплеи предоставят отлично предаване на цветовете и са добри при премахване на ghosting, което се дължи на отличното отхвърляне между лявото и дясното око. Освен това, тъй като не разчита на техниката на активен затвор, гарантира свободно от трептене 3D изживяване. Очилата са много леки и не се нуждаят от презареждане или подмяна на батерия - така може да гледате колкото дълго поискате. Понеже в очилата няма електронни компоненти ,няма да се притеснявате от електромагнитно излъчване. И накрая, тъй като очилата са пасивни по природа, те са много евтини, което е значително предимство пред очилата с активен затвор.

- + няма замъгляване на образа
- + леки евтини очила без батерии
- + няма вредни вълни
- + Качество на картината - Смущения 1%
- + Ъгъл на виждане - Вертикално 26
- + Ъгъл на виждане - Хоризонтално free

-НЕДОСТАТЪЦИ

Не изобразява Full HD 1920 x 1080, а на половината (1920 x 540). Работата е в това, че поляризацията е презредова по хоризонтала, затова и резолюцията пада 2 пъти когато гледате през очилата има много ясно видими малки черни междуредови полоси.

В момента тази технология я прилагат само LG и Toshiba в телевизорите си и е по-евтина в сравнение с базираните на очила с активен затвор дисплеи. Въпреки, че все още има работа по създаването на масови 3D телевизори, включващи техниката на пасивна поляризация, тя се нуждае от някои основни промени в начина, по който изображението се показва на екрана на телевизора. Това означава, че технологията все още е необходимо известно време за да се развие напълно, преди да е готова да се конкурира с базираните на активен затвора LCD и плазмени дисплеи. В същото време тя вероятно ще бъде ограничена до твърдите 3D фенове, които могат да похарчат един куп пари за скъпи 3D прожектори/дисплеи за своите системи за домашно кино.

4. Автостереоскопични телевизори - 3D без очила

Автостереоскопични дисплеи, понякога наричани в търговията Auto 3D.

Автостереоскопичният формат на гледане не изисква очила. В този случай, пред дисплея е поставен слой с лещовидни филтри. Всяка от лещите прекрива няколко пиксела. Поради тази причина производители като Тошиба поставят в този тип телевизори дисплей с двойно по-голяма резолюция - за да компенсират. Тези дисплеи не са много практични, защото изискват създаване на специализирано съдържание, което се основава на проследяването на окото. Значителна замаяност и главоболие са общо срещаните странични ефекти от автостереоскопичните дисплеи, които използват лещовидни филтри или паралакс бариери.

Въпреки, че всеки би се радвал да има 3D телевизор без очила, истината е, че все още сме доста далеч от разполагането на технология за създаване на високо качествена 3D телевизия без очила. В много от прототипите има сериозни недостатъци, като например по-ниската разделителна способност на екрана, отколкото обикновените LCD и плазмени 3D телевизори, както и много ограниченият зрителен ъгъл и разстояние за гледане. Освен това в момента не са подходящи за няколко зрители. Тяхното подобрение ще отнеме още няколко години, преди да има някакъв шанс за масовата поява на високо качествена 3D автостереоскопичен дисплей.

5. Размер на екрана и зрителна дистанция

Оптималният размер на екрана, резолюцията на екрана и дистанцията на гледане са "Светата Троица", когато става дума за успешно създаване на вашия 3D Home Theater. Това е важно да се разбере от самото начало, за близко взаимодействие между трите фактора и че трябва да се предприеме цялостен подход за определяне на оптимална настройка за 3D Ready системата ви за домашно кино. Производителите ще ви кажат, че по-големият екран винаги е по-добре ... че 1080p е по-добре от 720p и закупуването на 70 инчов TV винаги е по-добре от покупката на "хилав" 42-инчов телевизор. За съжаление, това е далеч от истината и може да ви спести много пари, като мъдро изберете оптималният за вас 3D телевизор, и при отчитане на

ограниченията, наложени от бюджета ви. Преди да се потопите в насоките за избор на оптимален размер на екрана и разстоянието на гледане за следващият ви 3D телевизор, нека се спрем върху основните фактори, които влияят върху вашето 3D изживяване. Както сте разбрали тези, ще се наложи да извървите дълъг път да ви помогна да вземете правилно решение относно най-добрия размер за 3D телевизор - според вашите изисквания.

III. ЗАКЛЮЧЕНИЕ

1. Принцип на работа при активната 3D технология

Системата на активните 3D HD телевизори е последователна система, при която се използват очила с активни затвори. Всички 1080 линии от предлаганата резолюция се излъчват от телевизионния дисплей директно в очите на зрителя, а инфрачервен сигнал от двете страни на очилата отваря и затваря лявата и дясната леща на очилата при изключително бърза скорост. В резултат на това, мозъкът възприема тези бързо движещи се 'кадри' като 3D. Тук е важно да отбележим, че всички модели очила с активни затвори са с етикет Full HD 3D, тъй като е важна големината на резолюцията – линиите, които се излъчват от телевизори, трябва да са 1080 на брой, за да използвате този тип очила

2. Принцип на работа при пасивната 3D технология

Голяма част от пасивните 3D HD телевизори използват дисплейни панели на LG, които работят с технологията Film Patterned Retarder (FPR). При нея, 3D ефектът се създава когато образите показвани отляво и отдясно на приемника се гледат с поляризирани очила. В този случай, вместо гледането на бърза последователност от 'активни' кадри, системата използва резолюция от 540 линии за всяко едно от очите, а мозъкът възприема 3D образи с висока резолюция. Това прави очилата, които се използват по-евтини, по-леки, и по-удобни.

Съветите на специалистите при избор на подходящата за вашето добро настроение технология, е да сравните усещането при гледане с различните модели очила, а след това да направите своя избор на базата на по-добрата за вашите финансови възможности цена. Изборът може да варира от 'пасивните' модели Vizio Theater 3D и LG Cinema 3D до 'активните' модели Sharp Quattron LCD или Panasonic Viera Plasma.

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SPECIFICS OF CONTEMPORARY ARMED CONFLICTS

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Abstract: *This report addressing future military operations, which are expected to be based exclusively on new technologies, information, accuracy, speed, skills and preparation for taking informed decisions and establishment of arrangements for their implementation*

Keywords: *armed conflicts, new wars.*

The fact is that in the last twenty years objectively reduces the number of military and armed conflicts in the world, the number of victims in these conflicts, the number of military coups and cases of genocide. Projections show undeniable, however, that future wars will be for energy resources / oil and gas, but especially for water / for winning economic superiority to achieve strategic advantages. Projections show undeniable, however, that future wars will be for energy resources /oil and gas, but especially for water/ for winning economic superiority to achieve strategic advantages. Meanwhile, in medium and long term is expected to remain likelihood of traditional forms of war and armed conflicts in the modification of the objectives and content to hold short operations to achieve limited political objectives by operating a small, but high combat capabilities contingents. They are not excluded cases of return of rivalry for regional supremacy, use of armed actions in “unfreezing” of the “frozen” conflicts and emergence of new forms of traditional military conflicts.

In the next ten years, non-traditional forms of conflict will become traditional at the dominance of low-scale conflict, led to brutal and violent methods, particularly with regard to the civilian population.

New wars have a logic that is different from the logic of what I call ‘old wars’ – the idea of war that predominated in the nineteenth and twentieth centuries. In the original version of the argument, I derived this logic from the differences between old and new wars in actors, goals, methods and forms of finance. These are:

- actors: Old wars were fought by the regular armed forces of states. New wars are fought by varying combinations of networks of state and non-state actors – regular armed forces, private security contractors, mercenaries, jihadists, warlords, paramilitaries, etc.

- goals: Old wars were fought for geo-political interests or for ideology (democracy or socialism). New wars are fought in the name of identity (ethnic, religious or tribal). Identity politics has a different logic from geo-politics or ideology. The aim is to gain access to the state for particular groups (that may be both local and transnational) rather than to carry out particular policies or programmes in the broader public interest. The rise of identity politics is associated with new communications technologies, with migration

both from country to town and across the world, and the erosion of more inclusive (often state-based) political ideologies like socialism or post-colonial nationalism. Perhaps most importantly, identity politics is constructed through war. Thus political mobilisation around identity is the aim of war rather than an instrument of war, as was the case in ‘old wars’.

- methods: In old wars, battle was the decisive encounter. The method of waging war consisted of capturing territory through military means. In new wars, battles are rare and territory is captured through political means, through control of the population. A typical technique is population displacement – the forcible removal of those with a different identity or different opinions. Violence is largely directed against civilians as a way of controlling territory rather than against enemy forces.

- forms of finance: Old wars were largely financed by states (taxation or by outside patrons). In weak states, tax revenue is falling and new forms of predatory private finance include loot and pillage, ‘taxation’ of humanitarian aid, Diaspora support, kidnapping, or smuggling in oil, diamonds, drugs, people, etc. It is sometimes argued that new wars are motivated by economic gain, but it is difficult to distinguish between those who use the cover of political violence for economic reasons and those who engage in predatory economic activities to finance their political cause. Whereas old war economies were typically centralising, autarchic and mobilised the population, new wars are part of an open globalised decentralised economy in which participation is low and revenue depends on continued violence.

The implication of these differences is that, whereas old wars tended to extremes as each side tried to win, new wars tend to spread and to persist or recur as each side gains in political or economic ways from violence itself rather than ‘winning’.

The most common criticism of the ‘new wars’ argument is that new wars are not new. It is argued that the Cold War clouded our ability to analyse ‘small wars’ or ‘low-intensity wars’, that many of the characteristics of new wars associated with weak states can be found in the early modern period and that phenomena like banditry, mass rape, forced population displacement, or atrocities against civilians all have a long history.

Of course this is true. Many of the features of new wars can be found in earlier wars. Of course the dominance of the East-West conflict obscured other types of conflict. But there is an important reason, which is neglected by the preoccupation with empirical claims, for insisting on the adjective ‘new’.

Critics of the ‘new wars’ thesis often concede that what is useful about the analysis of ‘new wars’ is the policy implication of the argument. But this is precisely the point. The term ‘new’ is a way to exclude ‘old’ assumptions about the nature of war and to provide the basis for a novel research methodology. The aim of describing the conflicts of the 1990s as ‘new’ is to change the way scholars investigate these conflicts and thus to change the way policy-makers and policy-shapers perceive these conflicts. Dominant understandings of these conflicts that underpin policy are of two kinds.

On the one hand, there is a tendency to impose a stereotyped version of war, drawn from the experience of the last two centuries in Europe, in which war consists of a conflict between two warring parties, generally states or proto-states with legitimate interests, what I call ‘Old Wars’. This term refers to a stylised form of war rather than to all earlier wars. In such wars, the solution is either negotiation or victory by one side and outside intervention takes the form of either traditional peace-keeping – in which the peace-keepers are supposed to guarantee a negotiated agreement and the ruling principles

are consent, neutrality and impartiality – or traditional war-fighting on one side or the other, as in Korea or the Gulf War.

On the other hand, where policy-makers recognise the shortcomings of the stereotypical understanding, there is a tendency to treat these wars as anarchy, barbarism, ancient rivalries, where the best policy response is containment, i.e. protecting the borders of the West from this malady. The use of the term ‘new’ is a way of demonstrating that neither of these approaches are appropriate, that these are wars with their own logic but a logic that is different from ‘old wars’ and which therefore dictates a very different research strategy and a different policy response.

In other words, the ‘new wars’ thesis is both about the changing character of organised violence and about developing a way of understanding, interpreting and explaining the interrelated characteristics of such violence.

Evolution in the global environment inevitably resulting in a change in the strategic security concepts. In terms of participants conflicts continue to be classified into three broad groups:

- Interstate;
- Internal state;
- Conflicts with non-state actors.

At first sight nothing new, but in fact there are serious changes in the probability of occurrence of different categories of conflict, geo-spatial parameters of these conflicts, especially in the forms and how to use armed force to resolve them.

The likelihood of inter-state conflicts as a whole decreases as the main reasons for this trend is of a different nature. On the one hand influenced by the inability of recurrence of acute bipolar confrontation and achieved military superiority of NATO, discouraging any conventional strategic threats. On the other hand the risk of unpredictable consequences for regional and global stability, and criminal actions against those who would provoke interstate conflicts also reduce the likelihood of their occurrence. The probability of causing internal state conflict increases because of increasing globalization associated with cultural conflicts, irrational and inefficient management, as well as the expansion of the environment in which destabilizing groups can operate.

Conflicts between state security structures, on the one hand, and non-state actors, mainly in the face of terrorist organizations and groups are expected to increase in quantity and to sharpen as opposition. In this sense, connected result is expected to increase the importance of the role of armed forces in the fight against terrorism - domestic and foreign, especially when he is pursuing strategic impact of their actions.

Regardless of the outlook, unfortunately do not change the fundamental causes of the war. Famous are the 9 reasons cited by General James Dubik, not war disappear in the foreseeable future:

The reasons for the war are stored in the human heart. Always and everywhere hatred, envy, power, greed, and other qualities of human nature led to wars.

The war - is the realm of emotions. The success of the war depends on emotions, as only emotional charge causes people to attack each other.

War - it is a conflict of desires of various people, nations, states, etc.

War has always been ambiguous. The real reasons for the war are often false. Everyone sees only an enemy that wants to see. War - it is not only the use of force, but the threat of force.

War perfected the art of killing. Any military conflict led to the development of sometimes incredibly fast, military equipment and military art.

War - is a continuation of politics by other means (here Dubik quotes the author of this aphorism - Carl von Clausewitz).

In the war - has its own logic. Having begun the war acts according to its laws and forms new laws. It radically changes the lives of the affected countries, nations and people.

War lives in the collective memory. People unconsciously assess the world based on the experience of previous wars.

The war can only end in two ways: its decision to terminate or complete exhaustion of the warring parties.

However, understanding changes to win. Today is not enough to break the army of the enemy or occupied territory. If the first military phase is short and firm in your results, the next phases of recovery and development may continue for decades. All this puts the other requirements and conditions the international community.

The philosophy of keeping future war is based on general and preventive approach to the whole range of potential missions focusing on impact will be placed more on general and causes than on private and symptoms of threats. These changes entail the need for related radical changes in military concepts and doctrines of preparation and conduct of the war, and from there to the development and operational use of military forces.

Military power in these conditions is determined by access, speed and information sharing. Modern warfare becomes network-centric military operation in conceptual reflection of the information age. In practice, this means the application of emerging tactics, procedures, techniques and technologies in a network operated forces to create an undeniable military superiority.

The nature of future war will undoubtedly be directly affected by the development of modern technology. In technical and technological spectrum that war can be distinguished three levels. In the upper level of the spectrum fall rocket-cosmic forces that are high-tech and super expensive. Construction and maintenance of this type of forces is within only countries recognized as major players in the global geopolitical space. The average level of technical spectrum includes conventional armies that recently strengthened its versatility, while becoming more and more expensive. In the lower level of the spectrum covered terrorist groups armed with automatic weapons, difficult to predict as goals and objectives, building actions on the principle of "minimum resources for maximum damage to the enemy." From a technical and technological point of view an essential feature is the fact that the fight against modern terrorism is complicated due to the increased probability of getting access by terrorists to specialized technology and weapons.

In the future war is expected to lead dynamic, high pace and intensity operations covering large spatial, geographic and climatic areas and expanding into outer space. Precision weapons resembling a destructive force to tactical nuclear weapons will be used from the start of the war to destroy similar weapons systems for command and control of objects of air defense and operational-tactical groupings opponents. Expectations are that the tactical battle will be short and explosive increasing intensity. Typical operations in the conduct of future war are also the absence of front-line

command and management difficulties, sudden and quick maneuvers, complex structured defense, strong information integration.

Existing basic principles of warfare as determining the geographic areas of responsibility, the overwhelming use of conventional ammunition, melee, physical protection, huge stocks, vertical links of control in the future likely will be replaced by functional areas of responsibility, precision munitions strikes in depth information protection, flexible and focused logistics, network management environment.

In future war acquire essential information and psychological operations. They are expected to be held during the preparatory period and during the exchange of firing strokes in order to achieve information and psychological superiority over the enemy of the theater of operations to weaken his resistance and will to win and ensure effective command and control in the common system of fighting. The success of ongoing operations will increasingly depend on the established conditions for efficient operation in saturated information environment, allowing commanders to analyze the battle space in real time, to communicate, share design information and knowledge with its allies and partners to take appropriate solutions in the shortest possible time.

The manifestation of a new organization of armed struggle is bound to create a unique approach to conducting operations with united forces. This type of operations are designed around the basic principles of network-centric operation, resulting increasing the quantity and quality of shared information between operating in a flexible network forces; sharing situational awareness to generate a unified operational picture of the situation and the implementation of a new type of cooperation and auto-synchronization; increasing the speed of command and sustainability of systems for command, control and as a result increase efficiency.

Network-centric organization, understanding and behavior become guiding principles for the forces and necessary for the successful conduct of operations, based on the effect. These principles include:

- Struggle for information superiority through initial timeliness, accuracy and consistency of information;
- Shared understanding of unified operational picture of the battle space and build a network system;
- Increase the level of initiative of subordinates to increase responsiveness and pace of operations;
- An increasing convergence of intelligence, operations and logistics to achieve precise effects;
- Exchange of information with the forces and effects, reducing the need for concentration of powers in certain geographical areas;
- Increase the pace and speed of movement in the battle area of improving protection and zhivuchestva forces; access sensors in depth by expanding the use of remote sensors in a network deployment; constant intelligence, surveillance and use of sensors as part of a maneuver to gain information superiority;
- Elimination of procedural boundaries of the Armed Forces to conduct combined operations at lower levels and achieve the desired effects;
- Speed of command by processes and procedures, creating informational advantages and superiority in decision-making.

Summarizing the main features of future war can say that it will be a machine, not man-oriented, in shapes resulting from technology but not from organizations with an

emphasis on deterrence warfare instead of engaging in destructive battles set of industry-technological, rather than the command-administrative basis.

In conclusion it can be said that future military operations is expected to be based exclusively on new technologies, information accuracy, speed, skills and preparation for making informed decisions and establishment of arrangements for their implementation. Implemented swiftly in the planning of their own forces, these features will bring the expected benefits in the battle area, and new technologies will be fundamental and decisive weapon with the help of which will win wars and to defend peace. The realization of all this, however, brings its predizvikatelstva- political, as confidence between the allies, or constraints on the spectrum kontseptsionni example of the need for a comprehensive review of existing military doctrines and philosophies of warfare, command, such as the inevitable fundamentally change the traditional hierarchical model of decision-making and more.

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METHODOLOGY TO REDUCE COLLATERAL DAMAGE

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ABSTRACT: *A methodology was developed to assess lethality and collateral damage for the Focused Lethality Munition (FLM) program. FLM is a new nonfragmenting, precision-guided weapon with damage effects mechanisms that differ from the principal fragmentation damage effects for traditional weapons. To date, guidelines to determine lethality, based on mannequin test data, have not been articulated for nonfragmenting warheads such as FLM. Medical and military documentation was surveyed to derive lethality criteria for four FLM damage effects mechanisms and establish guidelines to address combination effects. The criteria were successfully applied to assess FLM military utility and preliminary validation of the procedures was conducted. Future plans include further augmentation of the model as additional data from program office continuation testing and operational weapon use become available.*

KEYWORDS: *Lethality; collateral damage; mannequin test data; focused lethality weapon; wound severity assessment.*

The Focused Lethality Munition (FLM) program was conducted to assess the military utility of a focused-lethality precision-guided weapon. In the modern urban battle space, adversaries routinely place legitimate military targets near civilians or objects such as hospitals and churches protected under the Law of Armed Conflict. The ability to use air power for targets requiring minimal collateral damage is currently limited by the weapon fragmentation effects of available air-to-ground weapons, which can cause significant collateral damage. The FLM weapon was designed specifically to address high-value target prosecution, while minimizing collateral damage outside the focus area.

The FLM weapon combines two technologies to offer a more localized kill mechanism compared with the current steel case warhead, which has a fragmentation effect of 2,000 feet or more.¹ First, the multiphase blast explosive technology uses tungsten fill to increase the explosive weight and enhance nearfield blast, as compared with conventional highexplosive fills. Second, the case surrounding the tungsten fill is composed of carbon fiber, which requires less energy to rupture than a comparable steel case. Upon detonation, the composite breaks into small, nonmetal fibers, thereby minimizing warhead fragmentation effects. The FLM warhead is integrated into the Small Diameter Bomb I in place of the current warhead.

The FLM warhead has the same weight, center-of-gravity tolerances, and outer mold line as the Small Diameter Bomb I, and operators use the same mission planning tools. The only modifications include incorporation of FLM weaponeering characteristics and collateral damage estimation calculations.

Science Applications International Corporation (SAIC) provided FLM assessment support to the United States (U.S.) Central Command from February 2007 through May 2008 under the Trusted Agent contract, with weaponeering expertise from the Decisive Management Professionals International (DMPI) subcontractor. The assessment team collected FLM lethality, collateral damage, and accuracy data during five static detonation events at Eglin Air Force Base, Florida, and 11 F-15E live-fly events at White Sands Missile Range, New Mexico. Primary data sources included human surrogates (i.e., full-weight mannequins, gel men, wooden dummies, and blast test devices) arranged in operationally realistic scenarios (Figure 1).



Figure 1. FLM test setup

PROBLEM DESCRIPTION

Mannequins and blast test devices provide a readily available and cost-effective mechanism to address damage incurred during weapons tests. However, they do not provide a definitive means to determine lethality because mannequins are not living. Some damage can be observed (e.g., severed limbs). Many other types of injuries are not directly visible (e.g., internal injuries) and must be inferred to estimate the impact on lethality. To date, guidelines to determine lethality, based on mannequin data have not been articulated for nonfragmenting warheads such as FLM. Whereas the principal damage effects mechanism for traditional weapons is fragmentation, FLM damage results from a combination of other factors:

- Blast pressure impulse exerts G-forces on the body that can damage the spine, neck, and appendages.
- Blast overpressure can compress and damage airfilled structures, such as the lungs, ears, and gastrointestinal tract.
- Thermal effects can burn the skin and respiratory structures.
- Secondary weapon component debris, though minimal for FLM, can penetrate the organs and soft tissues.

To assess FLM military utility, a set of lethality guidelines was developed and applied for nonfragmenting warheads, based on research of medical and military literature.

DEVELOPMENT OF THE SOLUTION

To develop a methodology to determine lethality for nonfragmenting weapons, the definition of a “serious/ lethal” wound was first tackled. The Joint Munitions Effectiveness Manual (JMEM) Weaponering System, the standard U.S. Armed Forces weaponering tool, does not directly define a serious/lethal wound (JTCG-ME 2006; DIA 2003). However, it is widely accepted throughout the targeting and assessment community that serious/lethal is a wound category between the JMEM serious (i.e., one that requires hospitalization) and lethal (i.e., one that causes immediate death) categories. Thus, a serious/lethal wound is characterized by sufficient injury to cause death within 4 hours of the kinetic event when competent medical attention is unattainable.

Second, attention turned to the Department of Defense (DoD) severity scale to identify the numbers and types of severity categories needed (Chairman of the Joint Chiefs of Staff 2006). The DoD severity scale is used to describe personnel injury during battle damage assessments by the DoD. The DoD scale classifies the severity of human wounds into one of five categories:

- deceased (lethal)
- very serious (life is imminently endangered)
- serious (immediate concern, but no imminent danger to life)
- incapacitated (hospitalization required)
- not seriously injured (no wounds or minor injuries that do not require hospitalization)

A similar five-category scale was developed for FLM purposes: lethal, severe, moderate, light, and no injury (Rows A and B in Figure 2). For FLM assessment purposes, the DoD category for not seriously injured was subdivided into light and no injury to facilitate calculation of the collateral effects radius (distance associated with P # .10 of serious/lethal wound to a standing human) and the risk estimation distance (distance associated with P # .001 of human injury, considering posture, warning level, and terminal ballistic condition of warhead). Further, the DoD categories for deceased and very serious were combined into a single category representing lethal, on the basis of the JMEM description of serious/lethal wounds. All of the categories were color coded, with red for lethal and blue for no injury, for ease of interpretation.

Third, the medical and military literature was researched to clarify the individual damage effects mechanisms for FLM and to establish criteria for each of the five categories in the FLM wound severity scale.

Blast pressure impulse effects. Blast pressure impulse is the primary damage effect mechanism for FLM. Observations of full body translation caused by the pressure impulse of kinetic events in recent combat operations indicate a relationship between the distance the human body is propelled and the severity of the injury incurred (JTCCG-ME, 2006).² Thus, the FLM wound severity ratings were linked to distance propelled to provide criteria for assessing impacts of blast pressure impulse (Row C in Figure 2)

A	FLM Scale	Lethal		Severe	Moderate	Light	No Injury
B	DoD Scale	Decreased	Very Serious	Serious	Incapacitated	Not Seriously Injured	
C	Distance Propelled	≥ 10 feet		> 5 feet but < 10 feet	1 to 5 feet (depending on impact geometry)		
D	Blast Overpressure Percent Lung Contusion	Severe Area > 50%			Moderate Area > 10% but < 50%	Slight and Trace Area > 0% but < 10%	No Injury Area = 0%
	Blast Overpressure Qualitative Severity Level	Very serious injury/lethality predominant		Some severe injury	Some moderate injury	Injuries greater than trace unlikely	Injury unlikely
E	Thermal Injury Severity	Major 1 st / 2 nd degree > 25% 3 rd degree, > 10%		Moderate 1 st / 2 nd degree 15 to 25% 3 rd degree, 2 to 10%	Minor 1 st / 2 nd degree < 15% 3 rd degree, < 2%		No thermal injury
F	Required Secondary Debris Wound Treatment	Immediate medical care for survival or penetrates skull		Less urgent surgery for survival	Simple medical care in treatment facility	Self-help treatment	

Figure 2. FLM severity scale components

- Humans propelled a distance of 10 or more feet suffer sufficient G-forces to produce very serious or lethal injury, corresponding to the FLM lethal category. The cause of death in these instances is cardiac arrest, severe neck or spinal injury, severe brain trauma, or traumatic amputation of a major limb (arm or leg).

- Humans propelled more than 5 but less than 10 feet suffer serious injury, corresponding to the FLM severe category. Injuries may include brain concussion, hemorrhaging of the brain and vital organs, severe ligament damage, and bone fractures.

- Humans propelled between 1 and 5 feet either suffer no injuries or are incapacitated for a short period, depending on the geometry of the impact. The injuries sustained correspond to the FLM moderate, light, or no injury categories.

The primary factor differentiating among these three categories is the portion of the body taking the brunt of the impact. A higher severity rating of moderate is assigned if the body falls head or face first or impacts another stationary object such as a wall or vehicle. In some rare cases, humans propelled less than 5 feet receive serious injury requiring extended medical attention (often associated with blunt trauma from impacting a hard surface or object).

Blast overpressure effects. Blast overpressure is a secondary human lethality mechanism for FLM. Blast overpressure produces a crushing effect on the human body, potentially causing severe injury to the lungs, ears, other organs, and soft tissue (Pennard 2007). Blast overpressure lung injury creates contusions that cause hemorrhaging, swelling, and fluid accumulation, leading to labored and progressively less efficient breathing (De Lorenzo and Porter 1991). Additional symptoms include disturbances in consciousness, small strokelike symptoms, and bloody sputum. Use of cardiopulmonary resuscitation or mechanical respirators on individuals with blast overpressure lung

injuries may release air bubbles into the bloodstream, which can cause severe injury or death if they reach the heart or brain.



Figure 3. Blast test device

Blast test devices are frequently used to gather blast overpressure data during weapons effects tests. A blast test device is a rigid cylindrical device about the size of a human torso that measures external pressure loading due to blast overpressure (Figure 3). Measurements obtained from four pressure transducers evenly spaced around the circumference of the cylinder at midheight represent the pressure felt on the chest, right side, left side, and back of a human thorax. Each measurement is saved as a separate data file constituting a pressure-versus-time trace for a given location on the blast test device. Data are then entered into the INJURY 8.2 software program to predict lung injury from blast overpressure.³

The FLM wound severity ratings were correlated to two different types of blast overpressure estimates provided by INJURY 8.2 (Row D in Figure 2). Qualitative estimates provide labels for an easy-to-read designation of the severity of injury expected.

Quantitative estimates provide probabilities associated with the degree of lung contusion expected, as characterized by the percentage of total lung surface area contused (directly related to lung hemorrhage).

INJURY 8.2 output (probability)

Example	Severe	Moderate	Slight/trace	No injury
Case 1	0.00	0.01	0.16	0.84
Case 2	0.05	0.42	0.23	0.30
Case 3	0.40	0.40	0.15	0.05

Table 1. INJURY 8.2 output for blast overpressure damage

In general, the FLM severity category associated with the highest INJURY 8.2 probability indicates the most likely severity of injury, following the JMEM 50-percent lethality criterion rule:

- Any category associated with an INJURY 8.2 probability greater than .50 was always selected as the final severity category (e.g., no injury for Case 1 in Table 1).

- In cases where none of the probabilities exceeded .50, the team located the largest probability and inspected the probability in the next most severe category. If the combined values produced a probability greater than .50, then the more severe category was selected. If the combined values failed to produce a probability greater than .50, then the category with the largest value was selected for the final rating (e.g., moderate for Case 2 in Table 1).

- In the case of a tie, the more severe category (e.g., severe for Case 3 in Table 1) was always selected.

- If the INJURY 8.2 severe category met the criteria described in the preceding paragraph, an FLM rating of lethal was always assigned if the probability was .50 or greater; otherwise, the FLM rating remained at severe.

Thermal effects. Thermal is a secondary human lethality mechanism for FLM. The severity of thermal injury or burns is characterized by (a) degree, based on the severity of the tissue damage that may extend to the underlying fat, muscle, or bone; and (b) amount of body surface area involved. Burn degree is designated as either first-degree (redness and swelling in the outermost layers of skin), second-degree (redness, swelling, and blistering, with damage extending beneath epidermis to deeper layers of skin), or thirddegree (full-thickness burn that destroys the entire depth of skin, causing significant scarring).

Amount of body surface area involved is expressed in terms of the “rule of nines” used by health-care professionals for adult burn patients (Arizona Burn Center 2008). For the rule of nines, each arm with its hand included constitutes 9 percent of the body surface area; the front of each individual leg with its foot is 9 percent; the back of each individual leg with its foot is 9 percent; the chest is 9 percent; the abdomen is 9 percent; the back is 9 percent; the buttocks are 9 percent; the face, back of the head, and neck are 9 percent; and the genital area (perineum) is 1 percent.

Burns involving the hands, feet, face, eyes, ears, or genitals are considered especially critical because the skin is thinner. To account for this fact, a weighting scheme was applied to the traditional rule of nines (Figure 4).

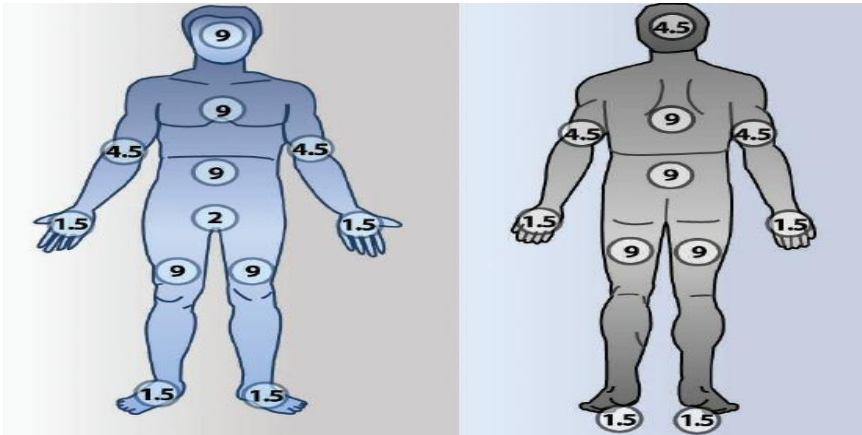


Figure 4. Weighted rule of nines

Whereas hands and feet are normally lumped in with their limbs, ratings were assigned for each limb and additional values for each hand or foot. Thus, maximum values of 9 percent were applied to each arm (4.5 percent for the front and 4.5 percent for the back), 3 percent to each hand (1.5 percent for the front and 1.5 percent for the back), 18 percent to each leg (9 percent for the front and 9 percent for the back), and 3 percent to each foot (1.5 percent for the top and 1.5 percent for the bottom). The genitals and the face were assigned double values—9 percent for the face alone and 2 percent for the genitals. Altogether, the weighting permitted an increase of up to 17.5 percent of the total body surface area burned if critical body parts were affected.

Taken together, the burn degree and percentage of body surface area affected are used to identify burn severity:

- Minor burns are (a) first- or second-degree burns covering less than 15 percent of an adult's body or (b) third-degree burns covering less than 2 percent body surface area. Minor burns, which may be treated at home or in a doctor's office, are linked to an FLM severity rating of light (Row E in Figure 2).

- Moderate burns are (a) first- or second-degree burns covering 15 to 25 percent of an adult's body or (b) third-degree burns covering 2 to 10 percent body surface area. Moderate burns, which should generally be treated at a hospital, are linked to FLM severity ratings of severe or moderate.

- Major burns are (a) first- or second-degree burns covering more than 25 percent of an adult's body or (b) third-degree burns covering more than 10 percent body surface area. These burns are the most serious and should be treated in the specialized burn unit of a hospital, correlating to an FLM severity rating of lethal (Thivierge 2008).

Secondary debris penetration. A tertiary human lethality mechanism for FLM is secondary debris, either from weapon components or objects in the area (e.g., vehicles, buildings, and other objects). Secondary debris may contribute to lethality within the target area; however, there are no reliable methods or models to predict the effects of secondary debris for all target environments. The criteria in Row F of Figure 2 were developed for FLM severity ratings of secondary debris penetration.

Criteria for the lethal category were based on the following considerations. Wounds that penetrate the skull are usually immediately lethal. Very serious wounds that require immediate treatment include injuries that disturb consciousness, breathing, the airway, or circulation; major injuries to the head or torso; or major hemorrhaging. For example, major hemorrhaging is generally the imminent threat for most wounds involving the abdomen and chest because they house the vital organs (Owen-Smith 1981). Shock, which is considered very serious and requires immediate treatment, can arise from major muscle damage, especially when associated with a major fracture, severe burns, major hemorrhaging, multiple wounds, and pericardial injuries.

The remaining FLM severity categories represent less serious injuries. Injuries that require surgery or intensive medical care, but will not cause death if delayed, received FLM ratings of severe (e.g., weapon component debris penetrates the abdomen but does not affect any internal organs). Injuries that require medical care, but can be managed by simple treatment and dressing provided in a medical care facility, are categorized as moderate (e.g., abdominal debris that causes moderate bleeding). Injuries that can be treated by self-help are categorized as light (e.g., small surface wounds) (Owen-Smith 1981).

Finally, after researching the individual damage effects mechanisms for blast pressure impulse, blast overpressure, thermal, and secondary debris penetration, guidelines were established for estimating combined effects. The postdetonation condition of an individual is not always caused by only a single mechanism. Combinations of effects may cause multiple injuries that can lead to a higher severity rating than would be associated with any one injury by itself. The following factors were considered when addressing combined effects for mannequins with multiple injuries:

- amount of potential blood loss
- location of injuries, with the head, chest, abdomen, and genitals being the most vulnerable in the case of blunt trauma and penetration injuries
- head injuries combined with other injuries
- injuries affecting the airway or respiratory system
- injuries combined with major burns

For the FLM program, the overall severity level was assigned on the basis of the highest severity level of the individual sustained injuries. For example, if blast pressure impulse was moderate and thermal injury was severe, the overall severity rating was severe. If there were multiple injuries at the same severity level, that severity level was assigned. The question of whether multiple injuries at the same severity level translate into a higher overall severity level has not been adequately resolved.

CRITERIA APPLICATION

After each FLM test event, photographs of the test site were taken for comparison to pretest setup, displacement of the mannequins from their original positions measured, and extent of any damage (e.g., burns, punctures, missing limbs) thoroughly documented

to enable application of the preceding criteria. The criteria for blast pressure impulse, thermal damage, and combination effects resulting from these two damage effects mechanisms were successfully applied. Data for blast overpressure were collected but not used because of data corruption. The collected data did not meet the quality parameters for input into INJURY 8.2. Secondary debris effects were documented for completeness but not included in the scoring because of the unpredictable and unrepeatable nature of secondary debris.

Of the two damage effects mechanisms assessed, thermal presented the most challenges. Application of the criteria for blast pressure impulse was relatively straightforward because it primarily involved simple measurement of the distance each mannequin was propelled. Assessing thermal damage to the skin on mannequins entailed determining the degree of the burn, the percentage of body surface area affected, and the specific body parts burned. FLM thermal injuries may result from fire associated with the explosion or from the tungsten fill of the warhead. Tungsten can potentially cause significant thermal injury when it impacts the skin because of the high temperature and velocity of the tungsten at the time of impact. The chief difficulty was translating guidelines developed for human burns to evidence obtained from mannequins, which cannot exhibit the same thermal effects as humans because they do not have skin.

During the initial static tests, primary reliance was on observations of thermal effects in commercially butchered pigs to identify applicable thermal guidelines for mannequins. These guidelines were based on the professional expertise of Reddoch Williams, M.D. By his estimations, if the skin was covered with a significant layer of tungsten (i.e., no skin visible underneath), the burn was classified as third degree. A moderate layer of tungsten (i.e., skin barely visible underneath) led to a classification of second-degree burns. A light dusting of tungsten (i.e., skin clearly visible underneath) was classified as first-degree burns.

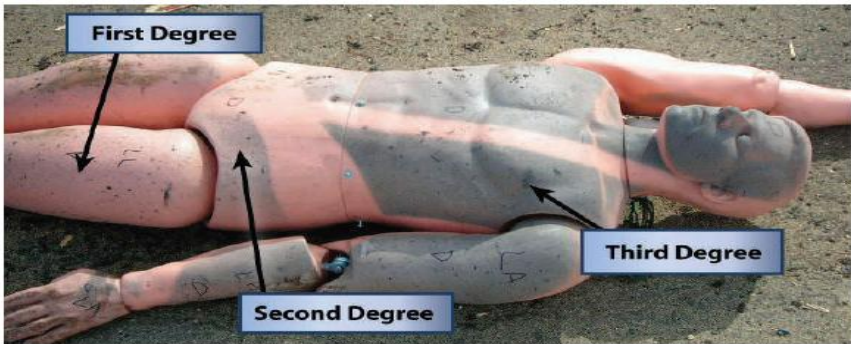


Figure 5. Burns in mannequins

When applied to mannequins, these guidelines translated into third-degree burns if the surface of a mannequin was charred with the outer layer of rubber cracking. When the surface of the mannequin presented a gritty gray-to-black appearance to the point where the discoloration and grit could not be removed by wiping, the mannequin was characterized as having second-degree burns. When the surface of the mannequin presented a gritty gray-to-black appearance, but the discoloration and grit could be

removed by wiping, the mannequin was characterized as having first-degree burns. Figure 5 provides examples for each degree of burn.

When assigning thermal severity ratings, the severity level was increased if the injuries were associated with the respiratory system or eyes. Burns to the faces of mannequins were recorded and assessed for airway burns by degree of charring to the mouth and nose and for burns to the eyes by degree of charring or tungsten on the eye area. There was no method to directly determine thermal inhalation and vascular injuries to mannequins.

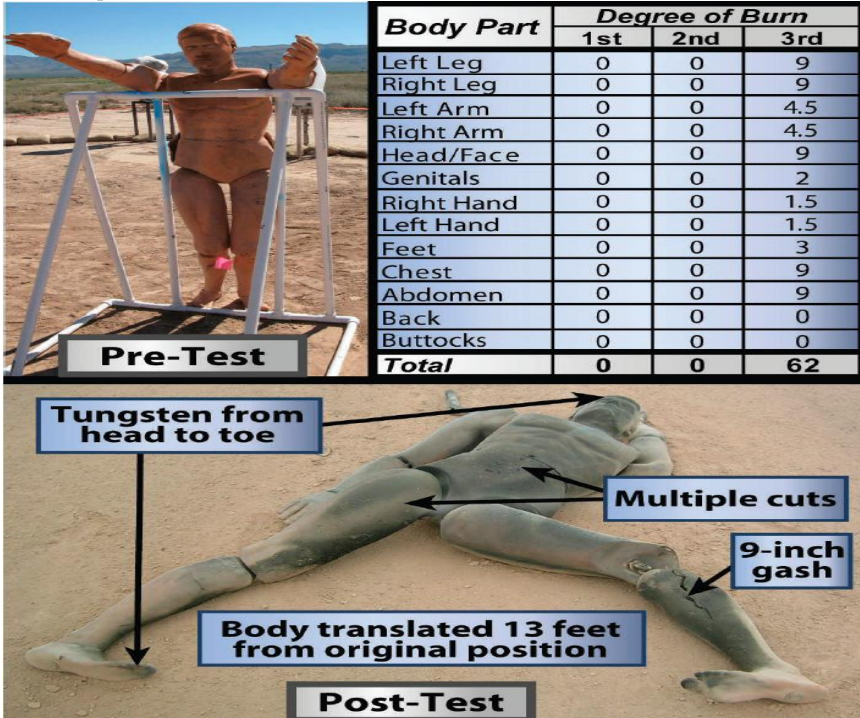


Figure 6. Sample validation slide

CRITERIA VALIDATION

Two methods were used for preliminary validation of the criteria and assessment procedures. Both techniques provided considerable support for the validity of the FLM severity criteria.

Logistic regression analysis. First, the results of a logistic regression model provided initial confirmation for the legitimacy of the lethality evaluation criteria. The logistic regression analysis was conducted to provide supporting evidence for the lethality/nonlethality cutoff distance the team estimated based on visual observation of the outcome for each mannequin (i.e., criteria were applied to derive a lethality rating for each mannequin and then the results were visually inspected to determine the distance

representing the cutoff between lethal and nonlethal). For a more objective, mathematical approach, a logistic regression analysis was completed—a statistical technique was used to predict lethality, based on distance from the impact. The analysis included 64 FLM test articles (32 designated as lethal and 32 designated as nonlethal). The mathematical model obtained from the logistic regression correctly categorized 59 of 64 cases (92 percent). Further, the predicted cutoff distance between lethality and nonlethality exactly matched the distance determined on the basis of visual inspection alone. The orderliness of this outcome lends credence to the validity of the underlying procedures used to determine lethality.

Independent application of criteria. Second, an independent verification of criteria application was conducted to address validity. Two people with no previous connection to the FLM program were asked to provide independent lethality ratings for a sample of 20 mannequins (12 lethal, 1 severe, 2 moderate, 2 light, and 3 no injury). The independent assessors had several days to review the FLM severity criteria and descriptions before individually completing the validation task. A briefing provided background information on the test setup, the targets, and the collateral concerns; depictions of the pre- and post-test layouts; and a separate slide for each mannequin with pre- and posttest photographs, descriptions of injuries, distance the mannequin was propelled, and thermal injury data (degree of burn, percentage of body surface area affected, and body parts burned) (Figure 6). The independent assessors provided ratings for blast pressure impulse, thermal effects, and overall lethality as well as descriptions of their rationale for each rating.

The kappa statistic for inter-rater agreement was .76, a value that indicates “excellent” agreement among the three sets of ratings for the sample of 20 mannequins (Fliess 1981). When disagreements occurred, the independent assessors tended to assign more severe ratings. In particular, the independent assessors experienced difficulty deciding whether to assign moderate, light, or no injury ratings when the body was propelled 1 to 5 feet. They had trouble evaluating the critical deciding factor of impact geometry for these cases, in part because it was difficult to discern from photos alone whether the body had been thrown face first or simply fell forward after the blast.

FUTURE PLANS

The criteria provided a defensible and repeatable approach to determine lethality for nonfragmenting, precision-guided weapons such as FLM. The FLM operational manager at the U.S. Central Command was able to use the final report, delivered in May 2008, to provide a military utility recommendation for the FLM weapon and develop future plans. As additional data from program office continuation testing and operational weapon use become available, it is expected that the methodology will be augmented. The methodology presented in this article represents the preliminary development, application, and validation of procedures and guidelines. With additional research and data, the methodology can easily be expanded to provide robust and repeatable procedures. Several focus areas for the future include:

- development and verification of more concrete guidelines for thermal effects
- instrumentation with blast test devices that meet specifications for use with INJURY 8.2, with attention to proper setup (e.g., anchoring to prevent tip over during blast; coating of pressure sensors and wires for sufficient protection against flames, heat, tungsten, particles, and light)

- use of autopsy reports for definitive determination of lethality
- more robust validation of lethality determinations (including initial decisions regarding damage effects and criteria application).
- overall enhancement of criteria to boost specificity and eliminate as much subjectivity as possible
- verification of the full model with all four damage effects mechanisms and combination effects.

The report does not contain classified information

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