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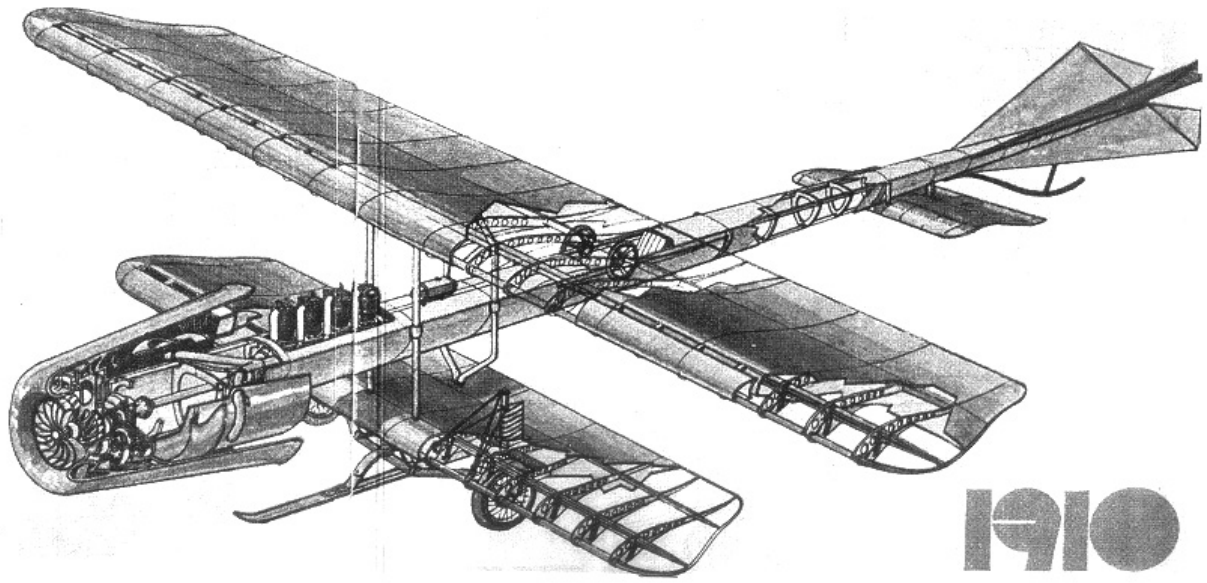

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C O N T E N T S

NEWEST PROVISIONS IN REGULATIONS APPLIED FOR SMALL UNMANNED AIRCRAFT SYSTEMS

Róbert SZABOLCSI

Óbuda University, Budapest, Hungary

Abstract: *26 January 2015 at 3 a.m. a quadrotor was landed on the White House lawn. This event showed that the UAV-technology is readily available at many hobby shops, and the access to these robot systems is still open for everyone. The fly into White House garden raised many security issues whether Secret Service is able to keep White House clear from such intruders infiltrating into sensitive zones of the White House. This controlled flight into White House grounds accelerated regulatory and rulemaking works and activity carried out in many countries by many organizations authorized to make rules and regulation in this special field of the aviation. The purpose of the author is to give on overview about new norms and rules planned to be activated in regulations of the Federal Aviation Authority, United States, as an example, and, where it is invited, to make comments and proposals on the given issues open for discussions.*

Keywords: *UAV, UAS, small UAS, regulations of the UAS, integrating UAS into airspace, segregated airspace, non-segregated airspace, human factors.*

1. INTRODUCTION

Unmanned Aerial Vehicles (UAV) and Unmanned Aerial Systems (UAS) are useful tools in many governmental (public), and in many non-governmental (civil) applications. There are many different types of UAVs with large variety of possible sensors applied for solution of the given flight mission.

The emerging problem of these UAV flights is the use of airspace, and ensuring flight safety at the level of the manned aircraft, as the minimum.

The UAV flights in civil applications are organized by their operators responsible for keeping regulations, and behavior in general. The unfortunate event emerging on US White House lawn showed that airspace management is still based on thin legs [1].

Due to the potential beneficial applications of small UAS, the FAA has been seeking to incorporate the operation of UAS into the national airspace system (NAS) of the USA since 2008. April 2008, the FAA chartered the small UAS Aviation Rulemaking Committee (ARC).

In April 2009 the ARC provided the FAA with recommendations on how small UAS could be safely integrated into the NAS.

Since that time, the FAA has been working on a rulemaking to incorporate small UAS operations into the NAS.

2. RELATED WORKS, PRELIMINARIES

The Federal Aviation Authority had released news about rulemaking activity on the issues of the integration of the UAS flights into common airspace [2].

The summary of the newly proposed initiatives can be found at [3], whilst the complex legal study can be found at [4].

The 14CFR Part 107 FAA Federal Aviation Regulations (FARs) will be supplemented with new chapters dealing with UAV regulations [5].

In UAV airworthiness compliance evaluation Szabolcsi had published a series of papers. In scientific article [6] Szabolcsi gave new definitions, which can be applied in UAV certification procedures including both type- and airworthiness.

Due to lack of regulations in the field of UAV airworthiness certification Szabolcsi derived a new concept of the flying and handling qualities of the UAVs applied in measure of compliance procedure [7].

In article [8] Szabolcsi had laid down basic principles applied in airworthiness certification of the automatic flight control systems of the UAVs.

In scientific paper [9] Szabolcsi derived flying qualities proposed for measure of the compliance of the type- and airworthiness of the lateral/directional automatic flight control of the UAVs.

In paper [10] Szabolcsi defined flying qualities available for measure of the compliance of the type- and airworthiness of the longitudinal short period motion of the automatic flight control of the UAVs.

3. PROVISIONS AND PROPOSALS FOR UAS REGULATIONS

In references [3,4] a new set of proposed definitions, rules and norms are published and in many cases expert are invited to make comments on these items and issues.

The references of [3,4] cited here are dividing the new proposals of the following four chapters:

1. operational limitations of the UAS;
2. operator certification and responsibilities;
3. aircraft requirements;
4. model aircraft.

The following chapters are deriving the new proposals and provisions to regulate those areas not covered yet with norms and rules. The author will make his comments to fill gaps, or, to show bottlenecks in the norms proposed by rule makers.

4. OPERATIONAL LIMITATIONS OF THE UAS

This set of new norms very important ensuring flight safety of the UAS integrated into any airspace.

The newly proposed regulations are strictly follows [3,4] and supplemented with comments and proposals of the author to be as defined below:

1. Unmanned aircraft must weigh less than 55 lbs (cca 25 kg). The ‘weight’ used here is the total gross weight of the UAV including all devices and gauges applied on-board. The trend of the UAV development shows that weights are decreasing with simultaneous increase of technical capabilities.
2. Visual line-of-sight (VLOS) only; the unmanned aircraft must remain within VLOS of the operator or visual observer.
3. At all times the small unmanned aircraft must remain close enough to the operator for the operator to be capable of seeing the aircraft with vision unaided by any device other than corrective lenses. The requirement defined here is no devices with exemption of contact lenses can be used to enlarge flight envelop in VLOS.
4. Small unmanned aircraft may not operate over any persons not directly involved in the operation. It means that urban flights aloft human are forbidden.
5. Daylight-only operations (official sunrise to official sunset, derived by the local time).
6. Must yield right-of-way to other aircraft, manned or unmanned. There is still a missing rule and norm how to yield right-of-way to other UAV, and how to decide who is first.
7. May use visual observer (VO) but not required. There is a possibility to assign observes supporting activity of the operator.
8. First-person view camera cannot satisfy “see-and-avoid” requirement but can be used as long as requirement is satisfied in other ways.
9. Maximum airspeed of 100 mph (87 knots).
10. Maximum altitude of 500 feet above ground level. This altitude limit is lower than Class G airspace provides.
11. Minimum weather visibility of 3 miles from control station.
12. No operations are allowed in Class A (18,000 feet & above) airspace.

13. Operations in Class B (upper limit is 10,000 feet), C (upper limit is 4,000 feet), D (upper limit is 2,500 feet) and E airspace are allowed with the required ATC permission.
14. Operations in Class G airspace (FL600) are allowed without ATC permission.
15. No person may act as an operator or VO for more than one unmanned aircraft operation at one time. There are some solutions providing simultaneous control of more than one UAV. The ground stations designed with that capability must be changed to that of capable of control a single UAV.
16. No careless or reckless operations. It is responsibility of the operator to behave keeping all written or unwritten rules of UAV flights and ground maintenance.
17. Requires preflight inspection by the operator. The operator must be able to maintenance the UAV, to carry out inspections defined in regulations following special check-lists prepared for given type of the UAV.
18. A person may not operate a small unmanned aircraft if he or she knows or has reason to know of any physical or mental condition that would interfere with the safe operation of a small UAS. The personal responsibility of the UAV operator for this condition is undoubtedly.
19. Proposes a microUAS (μUAS) option that would allow operations in Class G airspace, over people not involved in the operation, provided the operator certifies he or she has the requisite aeronautical knowledge to perform the operation. The total mass of the μUAS is defined to be less than 4,4 lbs (cca 2 kg) [4].

5. OPERATOR CERTIFICATION AND RESPONSIBILITIES

The long-lasting argues finally came to the end: a question about piloting of the UAV is answered, and, requirements for operators are proposed to be as follows [3,4]:

1. pilot of a small UAS would be considered for "operator". A classical terminology of the 'pilot', and his or her rights and responsibilities are no longer used. There were many argues made on this item. Some of experts stated that operator is a pilot with those rights and responsibilities provided for pilots of manned aircraft. The opposing opinion was that UAV operator is the person trained well-enough to steer the UAV, and he/she must not be considered for pilot, due to his absence aboard. After a long-time discussion a proposal is made by FAA to make difference between UAV operator, and pilots of manned aircraft.
2. operators would be required to
   - pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center. Still there is no decision about any training courses and its syllabuses available for UAV operator applicants. The basic principle of the testing procedure will be outlined later.
   - be vetted by the Transportation Security Administration;
   - obtain an unmanned aircraft operator certificate with a small UAS rating (like existing pilot airman certificates, never expires). The UAV pilot will be designated among those of operating air vehicle aloft.
   - pass a recurrent aeronautical knowledge test every 24 months. The basic idea is very close to certification of the maintenance staff as it is regarded in EASA Part-66 Regulation. The certificate expires after a given endurance, and, it must be prolonged after given period of time.
   - Be at least 17 years old. It is matter of decision whether the national UAV regulations can be different from that of the FAA proposals, or it can compile rules and procedures from regulations mentioned above.
   - Make available to the FAA, upon request, the small UAS for inspection or testing,

and any associated documents/records required to be kept under the proposed rule. This rule is strictly follows those regulations are in force for any types of the manned aircraft.

– Report an accident to the FAA within 10 days of any operation that results in injury or property damage. The injury can be caused for human or non-human beings. There is still no norm upon that cases which differ from each other significantly. The volume of the damage caused in properties also not defined yet. If to follow that rule any damage must be reported independently of its volume, i.e. it can put large overload on aviation authorities responsible for archiving incidents and accidents.
– Conduct a preflight inspection, to include specific aircraft and control station systems checks, to ensure the small UAS is safe for operation.

If there is no technical support the operator must execute any activity necessary to have safe UAV.

6. AIRCRAFT REQUIREMENTS

The aircraft requirements are very important ensuring that level of the flight safety defined for manned aircraft. The newly proposed rules are followings:

1. FAA airworthiness certification not required. However, operator must maintain a small UAS in condition for safe operation and prior to flight must inspect the UAS to ensure that it is in a condition for safe operation. Due to lack of procedure defined for the inspection it is proposed to prepare it for the given UAS type and train, drill operator to execute it carefully.
2. Aircraft Registration required (same requirements that apply to all other aircraft). The type certification of the UAS is required, and provides safe UAVs applied for given flight missions. This procedure ensures that only high quality UAV and UAS will be available on the free market.
3. Aircraft markings required (same requirements that apply to all other aircraft). If aircraft is too small to display markings in standard size, then the aircraft simply needs to display markings in the largest practicable manner.

7. THE MODEL AIRCRAFT

The FAA has issued an Advisory Circular AC91-57 on model aircraft in 1981 deriving operating standards for the operators [11].

The Public Law 112-95 of the USA defines a model aircraft as an "*unmanned aircraft that is (1) capable of sustained flight in the atmosphere; (2) flown within visual line of sight of the person operating the aircraft; and (3) flown for hobby or recreational purposes*."

The Section 336 of Public Law 112-95 defines a model aircraft as an "unmanned aircraft". A model aircraft that weighs less than 55 pounds would fall into the definition of small UAS.

Public Law 112-95 specifically prohibits the FAA from promulgating rules regarding model aircraft that meet all of the following statutory criteria:

– the model aircraft is flown strictly for hobby or recreational use;
– the model aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization;
– the model aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization;
– the model aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft;
– when model aircraft is flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport

air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation.

The references [3,4,11] give deep details of model aircraft design and certification, and defines strong rules for the maintenance of the UAV on-ground, and aloft. The past decades were famous for continuous rulemaking following changes in the technology and in aviation, in general.

Final findings of [3,4] about model aircraft are as follows below:

1. proposed rule would not apply to model aircraft that satisfy all of the criteria specified in Section 336 of Public Law 112-95 (listed above);
2. the proposed rule would codify the FAA's enforcement authority in part 101 by prohibiting model aircraft operators from endangering the safety of the NAS.

CONCLUSIONS

The FAA of DoT U.S. has long-lasting experiences in UAV and UAS regulations.

Starting with early 80's many knowledge and experiences had been compiled in regulations starting with simple-paged advisory circulars, and finishing with highest, common, public law.

Although proposed regulations try to cover as much as fields of aviation, there are many issues still open for discussion and comments awaited by regulatory experts.

The most important items not regulated yet are as follows:

- –UAV aircraft worthiness evaluation;
- –procedures applied for evaluation of the UAV worthiness;
- –UAV operator selection;
- –UAV operator certification;
- –UAV operator registration;
- –rights and responsibilities of the UAV pilot;
- –procedures of the preflight inspections made by UAV operators;
- –establishment of the approved knowledge testing centers;
- –establishment of the syllabus of the operator training;
- –involving certified trainers into drill of the UAV operators.

The open issues in the field of UAV regulations open very intensive period of time, and busy with challenges to be solved by aviators. The economically-driven initiatives forecast that solution to all problems threatening development of UAV technologies will be found in very short time.

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EURO-ATLANTIC COLLABORATIVE PLATFORM OF INFORMATIVE COOPERATION DESIGNED TO COMBAT UNCONVENTIONAL THREATS

Ioan BĂLĂCEANU*, Ion BĂLĂCEANU**

*The General Inspectorate of Border Police, **Hyperion University, Bucharest

Abstract: *Globalization, seen both as an significant element in human development and also as a disturbing factor for the society, continues to characterize the evolution of the contemporary world, especially of those leading state or non-state actors. The phenomenon, acting in key business areas on the basis of well-defined system of regulations also generally accepted, has different manifestations that may cause, in the system of international relations, interactions and challenges among participants and non-conventional threats hard to be controlled and to quantified, especially in border areas affected by illicit trafficking. Those aspects motivate our attempt to investigate the possibilities to improve the cooperative activity of international intelligence for efficient operations to combat unconventional threats specific to border areas.*

Keywords: *international stage, globalization, asymmetric non-conventional threats, security umbrella, international intelligence cooperation.*

1. INTRODUCTION

After the dissolution of the Soviet communist threat, the dynamic of contemporary international relations is marked by an irreversible transition from one bivalent era to one multivalent ,, network era,, open for informational cooperation required to facilitate planning of the operations designed to combat contemporary unconventional asymmetric threats.

The interdependence between the components of international system of democratic values imposed the implementation and enforcement of new governance rules based on *the collaborative platform* which enabled the consensus and coordination of international democratic systems activity efforts with attributions in adjusting the dynamic of noxious elements, occurring in the contemporary security.

Some rules, of international concern, must be respected as a priori because they can solve coherently current security problems related to control, security and border permeability, areas of major importance in the context of the rising of the globalization process.

The unconventional threat fits perfectly in the pattern of globalization consequences, whether it is about organized crime or terrorism.

Moreover, it may be noted that, along with the evolution of international relations, it has grown a system of unconventional threats with resources, actors, strategies, objectives and their own means of action.

This system has developed meticulously, building the three pillars of support (internal corruption, transnational organized crime and international terrorism), complementary in their activity to threat and destroy freedom, safety and security of democratic states.

The activity of effectively fight against the flow of unconventional threats is possible only through a joint effort of cooperation, managed by international collaborative structures which can work effectively on the basis of strategies, techniques, tactics and procedures designed to identify and combat unconventional asymmetric threats and the causes of their evolution (we consider in particular the activities developed by: Istanbul Cooperation Initiative, Barcelona process, the Greater Middle East, Russia sanctions generated by the aggression Ukraine etc.).

Such cooperation initiatives should lead to political and economical stabilization, to reconstruction and respect of the values, culture and tradition of social entities from affected areas.

The identification of right answers to the types of unconventional threats must involve a framework of regional and international informational cooperation, which may attract both the specialized structures of civil and academics society, along with international bodies.

This collaborative platform thus achieved may be able to lead participants to a better understanding of the factors generating asymmetric threats and adverse effects induced in the states security.

The approach of multinational cooperation system is necessary due to the fight against asymmetric threats, requires consistency in security forces structure and in strategies formulation.

Depending on the experience and skills of the actors involved in the phenomena of social insecurity overall management, international cooperation should establish a set of priorities and concrete ways to limit and stop these phenomena, anticipating tendencies that may occur later and techniques, combat tactics and concrete procedures, with efficiency and minimum consumption of resources.

Cooperation can be a viable solution only as far as can overcome the theory stage, the transition to concrete measures that can optimize informational management system of international cooperation, based on realistic strategies and clear enough for the participants.

In essence, they should investigate ways and concrete directions of cooperation taking into account the specific appearance of the domino effect, specific to globalization of international relations (negative implications of unconventional threats in some areas with a relative immunity, generated and amplified new types of unconventional threats).

International intelligence cooperation should be done both at conceptually and acting levels.

The purpose of this approach must be done to design architecture of a new security system, connected to the realities and specificity of this beginning of millennium, able to take into account permanently the diffuse character, adaptable and flexible new risks and threats to national, regional and international security.

The United Nations Organization, as an international democratic structure, is the only authority that can achieve a consensus on the perception of unconventional threats legitimizing riposte actions and response arrangements (preemptive or preventive) against them.

So from this perspective, effective cooperative internationally work should consider an efficient management of the world organization characterized by the use of a legal framework, eliminating dissent, flexibility and adjustment to new parameters forces of climate and strengthening security universal vocation of the United Nations

2. THE NATO COLLABORATIVE FRAMEWORK IN INFORMATIONAL COOPERATION TO COUNTERACT UNCONVENTIONAL THREATS

Regarding the timing of changing the global security environment characteristics, among military theorists there had been no clear consensus.

There were several considerations regarding the placement of this moment, as follows: the dissolution of Soviet bloc in the early 90s (marking the new world order); 1991 (NATO Strategic Concept Release year); the events of September 11, 2001 (the kamikaze attack upon civilian and military targets with civilian airplane); Prague time (major moment with significant changes in strategic perception of institutions involved) etc.

Regardless of these opinions NATO, as the prime provider of security in the Euro-Atlantic area, has demonstrated that it has the necessary resources and sufficient knowledge to identify and harmonize optimal response solutions, giving the Alliance's the status of collective defense alliance and basic actor of international dynamics.

In support of these claims we can mention the events of the late twentieth century from Europe (Serbia, 1999), the events f in Middle East from the beginning of XXI century (Iraq 2001 and 2003), the events from Afghanistan (ongoing), relevant coordinates supporting the role and vocation as a security umbrella of NATO for Euro-Atlantic community.

Moreover, through the measures taken in countries near the arch of Eastern European insecurity to deploy missile shield, can be argued NATO system reliability, flexible framework that can adjust and refocus to identify and implement viable solutions. The existing structures in the field of cooperation with responsibilities at NATO and EU level, involved important state actors (USA, Germany, France, Russia, Ukraine etc.) in solving both the European oldest crisis, but also the current crisis from East European area.

At the same time was maintained a Mediterranean dialogue and effective measures have been taken to achieve an optimal level of control and security in the Black Sea tensioned area. These efforts were concentrated both to boost cooperation in areas of interest, and for shaping a new security architecture which can define better the dynamics of contemporary international environment. Informative cooperation between NATO states is based on national informative contributions in accordance with extremely complex procedures. This type of international cooperation mechanisms presents also perfectible features, as some important confidential information are too sensitive and cannot be shared with all members of the Alliance. As a consequence, there are required training activities of national informational support, so that each Member State to become a crucial element in the struggle carried by Alliance in combating unconventional threats to global and continental security.

It is regrettable that we had to face the tragic events (September 11, 2001 terrorist attacks on US targets, terrorist attacks in Spain, UK, Turkey, Russian Federation, France etc), to take important measures to secure the informative system in order to eliminate the possibility of information leakage to the areas of responsibility of the cross-border organized crime structures and international terrorism.

Such examples justify the need to intensify Member States efforts to optimize cooperation in identifying viable ways to organize the whole NATO architecture of informational system.

We insist on the fact that the whole point of the Alliance is to streamline the system of collective defense of Member States, this mission being the main factor which will enhance mutual trust between the intelligence services and to increase the exchange of useful information, timely documentation purposes also countering global threats, thereby linking the appropriate anticipatory response. Cooperation of Alliance structures in the informational field will require a new stage in the collaborative work of specialized services, characterized by moving the center of gravity from the area of information exchange (information of a general activity) in the cooperation actions and specific cases area(recovery activity of the potential partners involved). Such logic should avoid unwanted informational accidents, the effort focusing on the need to identify effective ways of targeting and use of logistical, financial and human resources that are at the disposal of informative community.

The Alliance's vision on cooperation in intelligence activities may have certain limitations imposed both by objective reasons given by partitions and secrecy of special services activity and also by the fact that, the unpredictable world of intelligence is a world of competition rather than cohesion. The major players dominate permanent informational network, and the actors with modest informational possibilities are always pushed towards the periphery. This explains the fact that the exchange of data and information between intelligence services may fall within the term,, state within a state', is characterized by its own diplomacy, is based on specific agreements and treaties and their codes cannot be decrypt by the unadvised.

The partition of informational activity field is necessary for the following reasons: some deductions to intense exchange of data and information that may affect the safety of sources; different understanding of limits on the individual's right to information (privacy) and the necessity of informational system security.

The analysis of those two reasons, which justify limited access to information with specific nature, can conclude that the enhancing of cooperation in intelligence field depends heavily on the development of an information system set on special regime of information sources and also adjusted on specific approaches (private - security).

In the same context, we support the logic approach in the field of intelligence cooperation relations based on mechanism simple - complex, which requires the coordination of all activities of special services (domestic, regional and international) by NATO decision-making structures.

However, in order to avoid gaps in carrying informational activity, it requires increasing the coherence between the services of the same State, by avoiding overlapping areas of responsibility.

Analysis of the regional security environment highlights a set of common threats with specific features and forms, familiar only to countries from particular areas. For this reason there were European initiatives such as seminars and conferences which created premises for the assertion of a common language study of asymmetrical threats.

This is the first stage of real communication, community specific informational that ensures the coherence of activity of formulating and implementing appropriate response measures and actions. The second stage concerns the setting of common terminology that can ensure the compatibility of informational national structures with other regional or allied structures.

The development of a security culture that facilitates the communication at the level of states security and between these and other public authorities and institutions (civil society) is the third stage of real communication specific to intelligence community.

At this stage are set the bases of informational structures reconfiguration, element contributing to the structural and operational compatibility requirements.

3. THE EUROPEAN UNION COLLABORATIVE FRAMEWORK IN INFORMATIONAL COOPERATION TO COUNTERACT UNCONVENTIONAL THREATS

The new challenges and threats at the safety of democratic states guided the European institutions efforts towards strengthening cooperation between states of the European Union in the fight against unconventional threats.

At the present time the EU institutions and organizations coordinate a wide range of specific instruments of European security policy.

Their use is made on the basis of security structures contributions, participating effectively in multilateral informational trade.

European Union, at executive level, has limited opportunities (reduced operational capabilities) to combat unconventional threats from the community area or beyond.

This issue has been analyzed more seriously at the beginning of this century (after the conflict in Serbia), when, as a result of decisions taken by the European Union, began to appear own structure able to stop unconventional threats it its area of responsibility.

In the first stage were implemented forces designed to organize intelligence cooperation, represented by four structures of the European Union, which, together, form a information community structure (an intelligence agency) as follows: Joint Assessment Centre (SITCEN), Europol, Military Intelligence Division of the European Management (INTD) and the European Union Satellite Centre (EUSC).

Most European states, in relation with the four structures, plead for the development of these mechanisms and their transformation into effective tools supporting informative strategies and policies.

Moreover, at present, EUSC and INTD meet the standards structures while EUROPOL and SITCEN should be reformed on the following issues: extending Europol responsibilities;

consolidation and development of SITCEN in comparison with the current monitoring and evaluation of risks and asymmetric threats (is envisaged increasing terror attacks on European democratic states); increasing cooperation with Central European intelligence structures specialized Community bodies (Court of First Instance, Eurojust, etc.) and national intelligence structures.

The activity to streamline the management system of cooperation between EU intelligence structures is imposed by the increasing contribution of information, efficiency, timeliness and safety in their submission to the operational structures. This effort will focus on at least four major areas where the needs of information contribution, priority as follow:

- *collection capacity* - some member states show a weak technical capacity to collect information, greatly restricting their opportunities to provide timely and effective information support for operational structures;
- *external information support* - due to lack of experience SITCEN structures fails to respond effectively to the needs of European Union in the field of external information support necessary in decision-making process;
- *humanitarian action and civil protection* - national security agencies must provide real information support to those humanitarian actions and civil protection, thereby increasing the capacity of the European structures involved in managing this problem;
- *compatibility and interoperability in action* - some informative structures of the European Union cannot operate effectively together in operations to combat unconventional threats because not all countries rise up to current requirements on consistency of informative activities.

The tendencies to strengthen computerized cooperation are best represented by multilateral component of the European informative system, SITCEN, which, employed with military and civilian personnel, provide early warning and current information for specialized bodies in crisis management, regarding situations and events unconventional with important repercussions on the security of community member.

Meanwhile, the SITCEN is an operational point of contact between it and the staff deployed in national assessment centers (crisis units) located within or outside the European Union. In addition, staff SITCEN will be strengthened with experts from some Member States to cover the mission of developing informative analysis approaching EU policies.

Some Member States of the European Union expressed doubts on their employment in a dynamic and multilateral information exchange at European level, considering SITCEN a common mechanism for the management of European information system. However, as a whole, we can appreciate the existence of a constant concern of European leaders to achieve a collaborative platform designed to optimize the management of cooperation system between EU states, especially during planning operations to combat unconventional threats. Also, those leaders have admitted some difficulties that have restricted bilateral information exchange, situation that affected the climate of trust and extension of cooperation at community informative level. Moreover, at the request of states heads were submitted concrete proposals on information integration unit to manage all aspects of contemporary international terrorism phenomenon.

In the area of informative exchanges, since the beginning of this century (2003), Romania has concluded agreements with the intelligence services of the member states to increase cooperation at EU level, especially for dissemination of terrorist information. In order to obtain a more dynamic cooperation activity with EU countries, operational and institutional capacity of the Romanian Police were aligned with EU standards, implementing best practices of police cooperation in the fight against organized crime.

Romanian police cooperates with the European Police Office in unconventional threats targeting in particular the following informative activities: establishing channels of information and ways of providing information to Romanian state; the supply with personal data by the structures of the European partners; evaluation of information and sources of origin; procedures regarding confidentiality of information;

representation problem of liaison officers; responsibilities of the parties on the settlement of disputes.

The Contracting Parties are required to take all measures so that exchanges of data and information to be carried at all times. National contact point between the European Police Office and Romania is the National Focal Point, a specialized unit of Ministry of Internal Affairs in informational cooperation issues at national and international level. In National Focal Point structure was organized SIRENE office, which deals with solving national connections between Schengen countries.

CONCLUSIONS

The survey of the area of improving international informative cooperation in combating unconventional threats reveals at least the following conclusions:

- international informative cooperation, conceptual and acting, should support the design of a new world security system, adaptable and flexible to new and unconventional threats and risks connected to the realities and specificity of this beginning of the millennium;
- the activity of effectively fighting against the flow of unconventional threats is achieved through the joint efforts of international structures based on strategies, techniques, tactics and procedures for planning operations to combat unconventional asymmetric threats
- the phenomenon terrorism cannot be dissociated from specific forms of financing provided by the phenomenon of cross-border organized crime and corruption, in this scenario, continues its role of guaranteeing the general framework of expression the irregularities both in the internal space, as in the border area;
- NATO and the EU member states should be set up in a collaborative system able to develop strategies against unconventional threats, primarily directed towards reducing, controlling and combating the scourge of terrorism, cross-border organized crime and other threats that endanger international stability;
- specialized structures of the Ministry of Internal Affairs, especially those of Romanian Police, increased their cooperation with the structures of the European Union states to align operational and institutional capacities to EU standards and implementing best practices of police cooperation in the fight against organized crime and terrorist scourge.

Acknowledgement:

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SECURITY POLICY AND ECONOMIC PRIORITY OF THE SLOVAK REPUBLIC

Milan SOPÓCI*, Katarzyna SZCZEPAŇSKA-WOSZCZYNA**

*Armed Forces Academy of GeneralM.R.Štefánik, LiptovskýMikuláš,
**Academy of Business in Dabrowa Górnicza

Abstract: *The article deals with some aspects of the SlovakRepublic security policy and its trends in the year 2015. It compares theory and reality of recent days after terrorist attacks in France. The article is also concerned with economic objectives of the Slovak Republic in compliance with security policy. Energy security is of particular interest. The role of Ministry of Foreign Affairs and European matters are being discussed in the conclusion of the article.*

Key words: *policy, security, strategy, economic, energy, development, diplomacy, territory, cooperation.*

INTRODUCTION

At the end of 2014 the Slovak Government adopted an important document ”Slovak Foreign and European Policy Agenda in 2015".

The contents of this document deviates significantly from similar documents of recent years. As already indicated in the introduction, there are important changes and changed attitudes toward current situation in different parts of the world.

Unlike those of the past twenty years, the changes in the security environment brought about by the crisis in Crimea and in south-eastern Ukraine, as well as by developments in the Middle East, require that the Slovak Republic’s foreign policy face new challenges.

There have been violations, of the sovereignty and territorial integrity of our neighbouring country, of the overall geopolitical balance of the European continent as well as of the principles of international law. Looking ahead, Slovakia must be ready to react to developments that may be described as a shift from relatively stable conditions to a period of low predictability, especially in countries east of our border and in the Middle East.

It is possible that the dramatic changes that have occurred in Europe in the context of the crisis in Ukraine, and in the Middle East due to the activities of extremists from the so-called Islamic State of Iraq and the Levant (ISIL), will result in a prolonged period of instability (1).

The Ukrainian crisis has also had an adverse impact on the broad, long-existing domestic political consensus as to Slovak foreign policy.

Despite different opinions among some political actors, Slovakia’s foreign policy will continue to call for a respect for the fundamental principles of international law, and to promote a peaceful resolution of the crisis and at the same time maintain Ukraine’s sovereignty and territorial integrity.

It will primarily assist in the implementation of democratisation and reform processes in the country, which may provide the basis for long-term stabilisation and prosperity. In this respect, the SlovakRepublic will seek within the EU to prepare a long-term strategy with concrete steps for implementing the Association Agreement with Ukraine.

On the other hand, we need to recognize, that resolvingthe Ukrainian crisis will not be possible without Russia, or by taking action against Russia. The work of the new European Commission (EC) and the European Parliament (EP) is being set in motion this year.

We have high expectations mainly of the European Commission because energy policy will be coordinated by Slovak Commissioner as a Vice President. Slovakia’s efforts to create a stable, secure and favourable international environment must result in favourable economic development, with a positive impact on the quality of life of its citizens.

The activities related to Slovak foreign policy in 2015 will focus on five main priorities:

1. Strengthening the security of the Slovak Republic and the wider Euro-Atlantic area
2. European policy
3. Strong voice in spreading stability and prosperity in the world
4. Promoting Slovak economic interests

5. Ensuring services to citizens via consular assistance and tools for cultural and public diplomacy

We can argue about the above stated intentions especially in the area of security policy and promoting Slovak economic interests.

1. Strengthening the security of the Slovak Republic and the wider Euro-Atlantic area

Membership in the North Atlantic Treaty Organization (NATO) will remain of paramount importance for the security of Slovakia. The Slovak Republic will fully support the implementation of the decisions taken at the Wales Summit. Particular attention will be paid to strengthening the Allies' security in the Alliance's eastern flank.

We can definitely agree with this measure. But how should we understand the effort of Slovakia to contribute to the strengthening of defence capacity of Ukraine? The involvement of Slovakiain the conflict may give rise to problems in relations with Russia, which is currently deciding on the strategic gas and petroleum supplies to the Member States of European Union. Furthermore, both Donetsk and Lugansk areas are part of Ukraine.

In addition to the security situation in Ukraine, Slovakia will pay particular attention to supporting the fight against terrorism as well as extremist and militant groups in the Middle East and North Africa.

These have become security and humanitarian threats, not only in that region but also in the broader context, including posing risks to the internal security of European Union Member States. Recent Islamists terror attacks in France are a good example.

Slovakia is ready to contribute to the efforts of the international coalition in the fight against the so-called Islamic State of Iraq and the Levant (ISIL), and to assume its share of responsibilities (2). In terms of solution for global crises, challenges and threats the year 2015 will be critical.

Certainly, one may agree with this statement due to the fact that Slovakia has appeared on the blacklist of Islamic terrorist organisations for the first time. Furthermore, based on evaluation that Slovakia has not been threatened by any terrorist attack we belong to the countries with a low probability of such attacks. However, it cannot be excluded. If it really is the case, some concrete steps to strengthen national security shall be specified in the measures, but they are absent.

All Member States take appropriate measures according to the level of threat – Germany promotes peaceful activities and cooperation with Islam and officially tries to combat nationalistic tendencies particularly in the eastern part of the country.

The proposal of France is surprising – one of its measures is the establishment of compulsory six-month military service as a tool for strengthening the defence against terrorism and criminality and for promotion traditional values of France among youngsters – democracy, freedom of expression, love, and national pride. Similar proposal will be needed in Slovakia as well. The growing interest of the USA and Canada in Central and Eastern European regions due to the situation in Ukraine is a strong signal for more active security policy in Slovakia. We would like to maintain an active political dialogue and cooperation - at bilateral level within the Visegrad Group (V4) countries, European Union and as a NATO Member. Cooperation with the association of national economies BRICS (Brazil, Russia, India, China and South Africa) brings very promising prospects. In this area it is required to mobilise our contacts as soon as possible not only from security aspects but also from economic ones.

Another very interesting area is a relation of Slovakia to the countries of sub-Saharan Africa. Slovakia will continue its bilateral activities and economic cooperation, particularly with the Republic of South Africa, Ethiopia, Kenya and Nigeria and will participate in proposing and implementing EU Common Foreign and Security Policy (CFSP).

While it is easy to understand in relation to first two countries, the development of other two countries is unpredictable. Kenya has no longer been a stable and democratic state. In relation to Kenya it has been said that the country faces economic collapse, corruption and conflicts.

The situation in Nigeria is even worse – Islamic Terrorist Movement Boko Haram, which is even worse as ISIL due to its brutality and aggressiveness, governs almost half of the country and systematically destroys Christian community. These two areas certainly need to be revisited. Particular attention will also be paid to the dynamically developing area of cyberspace and its security. In compliance with the strategic documents of the EU and NATO, Slovakia will strengthen the security of its critical infrastructure, including that of its national information and communication systems.This area might be considered to be the most important and most difficult in the near future.

Recent attacks on various state institutions and organisations in the USA, the country with the highest level of information technologies development in the world, prove that each country is vulnerable in the case of a targeted attack including the world´s powerful countries.

2. Slovak economic interests

Development of the Slovak economy is connected with foreign policy and our participation in the global market. Economic diplomacy actively promotes the economic interests of the state abroad. Its main instrument is support for the trade and investment activities of enterprises in their entry into foreign markets, and promotion of their interests in given territories, as well as strengthening the interest of foreign investors in doing business in Slovakia.

Trade and investment relations mainly within the European Union and with the countries in its neighbourhood will always be at the forefront of the Slovak Republic concerns. Slovakia will also strengthen cooperation with traditional markets such as Japan, South Korea, India and China.

Furthermore, Slovakia will strengthen the territorial diversification of exports via greater involvement in the areas of the Arabian Peninsula, Latin America and Africa (3).All three areas were important markets for Slovakia in the past (in distant history for Czechoslovakia as well). The Latin America countries such as Argentina, Chile, Brazil have been our important trading partners. Similarly, Arab countries in Africa (Egypt, Libya, Tunisia), or countries in Arabian Peninsula (Saudi Arabia, Yemen, UAE) can be added.

In the past, traditional trading partners of the Slovak Republic were Angola, Ethiopia and the Republic of South Africa. It is true that our traditional trading commodities were mostly weapons, weapon systems and ammunition. However, due to the recession in arms manufacturing and the current security situation in the world, the above mentioned is no longer relevant.

Within international economic organizations, and multilateral economic and financial groupings Slovakia permanently focuses on overcoming the impacts of the current global Slovakia supports creating preferential conditions for Slovak industries and sectors of the national economy, as well as using the infrastructure and outcomes of such organisations and groups in favour of Slovak economic interests, including the interests of businesses.

Within the Organisation for Economic Cooperation and Development (OECD) the priority of the Slovak Republic is seeking effective solutions to overcome the impact of the crisis, particularly in the areas of unemployment (long-term and young people), education, and public administration reform. A short-term internship for government experts at the OECD, based on the Memorandum of Understanding between the Slovak Republic and the OECD will be a new tool. 70,000 € will be allocated for the implementation of joint Slovak-OECD projects in 2015.

Within the World Trade Organisation (WTO), Slovakia would like to continue to support the continuation of multilateral negotiations. The basis for further work will be the outcomes of the 9th WTO Ministerial Conference in Bali. Based on these outcomes, Slovakia will continue to prepare multilateral trade agreements in cooperation with other EU Member States. A key outcome of the 9th WTO conference has been the adoption of the Trade Facilitation Agreement, which will contribute to a significant reduction in the administrative burden on domestic producers. Within the EU common trade policy, Slovakia mainly promotes gaining better access to the largest and fastest growing world economies via ambitious free trade agreements with the EU's strategic partners – the United States and Canada.

Slovakia will pay close attention to the course and outcome of negotiations on free trade agreements with India, Japan, and the ASEAN countries as well as to the application of a special trade regime with Ukraine.

Slovakia supports cooperation with the World Bank Group (WBG) in the area of using paid professional technical assistance and counselling in selected areas of Slovak interest (e.g. in the area of climate changes and transition to a low carbon economy, efficiency of public spending or innovation agenda). Slovakia is prepared to coordinate its positions with the other EU Member States during the implementation of the reform of the International Monetary Fund (IMF).

3. Energy security

Energy security seems to be the fundamental issue of economic security in the forthcoming period.

On the one hand, Slovakia has every interest in strengthening stabilisation and development in this area because EU energy policy is coordinated by Maroš Šefčovič, the Vice-President of the European Commission.

On the other hand, the main goal in this area will be to ensure the stability and security of energy supplies for Slovakia and their economic sustainability.

This must be based on the strategic platform that is represented in Slovakia by the Druzba Pipeline and the Brotherhood gas transit pipeline, such transit comprising a considerable source of income for the state budget.

It should also be borne in mind that there is not currently a great demand for gas in Europe, so some of the alternative projects being considered do not appear to be sustainable from an economic point of view. At the same time, we should think about both alternative routes and alternative resources.

Therefore, Slovakia will support the Southern Corridor to ensure alternative energy sources, not South Stream project in its present form. This effort has been significantly influenced by the Vladimír Putin statement who announced Russia´s withdrawal from the South Stream project.

He announced that Russia would seek new transit lines for secure and stable gas supplies to Central and Western Europe. Russia is currently intensively negotiating with Turkey and other potential transit partners.

The company Eurstream, which may be considered as being Slovak and Czech company, sees its chance to succeed in this competition. The proposed route passes through Bulgaria, Romania, Hungary, Slovakia and further west.

One of the advantages of this proposal is the use of the routes that have already been built which would substantially decrease the costs for the construction of the gas transit pipeline.

The proposed project also complies with the European Union legislation. Another advantage is a real diversification of resources.

From the economic perspective the proposed project should contribute to the reduction in gas prices (the estimate of Eustream based on current prices in world markets is 325 USD/tis m^3). It should also create a possibility of gas reverse flow. The project should be implemented by the consortium or a joint venture – by Slovakia, Romania, Bulgaria and perhaps also by Turkey.

The consortium of companies from these countries has a great chance to obtain European funding - (EK, EIB – European Investment Bank) for implementation of the project up to 70%. Estimated total costs of the project are between 750 million and 1 billion EUR.

The partners shall assess commercial as well as technical part of the project and the rest will be resolved by political decisions. Technical matters are the least difficult in this case(4).

The Ministry of Foreign and European Affairs (MFEA) actively pursues the foreign policy and economic interests of the Slovak Republic in the changing international environment of energy security.

In bilateral and multilateral contexts it promotes the diversification of transit lines and resources, and the building of a cross-border energy infrastructure. It will also promote informed discussion on nuclear energy and contribute to the formulation of the EU common energy policy.

CONCLUSION

In 2015 the diplomatic sector will continue its partnership with the non-governmental sector, which in modern diplomacy participates in formulating and implementing foreign policy. The MFEA will use the platform of the 10th GLOBSEC annual international conference, in which preparation it is involved, in order to enhance political dialogue at the highest levels, and to spread awareness of the issue of regional and wider European security. The MFEA will also use the annual Tatra Summit forum in relation to the European and economic agenda in a similar manner (1).

During 2015 it will assess the level of achievement of the objectives included in the Medium Term Strategy of Foreign Policy by 2015 and will prepare the ground for the adoption of the new strategy by 2025, with a forecast by 2030.

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ELECTROMAGNETIC SPECTRUM DOMINATION

Laurian GHERMAN

"Henri Coandă" Air Force Academy, Brasov, Romania

Abstract: *In this paper the importance of electronic warfare is presented taking into consideration the information age environment. In order to understand the electronic warfare in the information age, first we should understand how the electromagnetic spectrum is used today. Electronic warfare actions aim at the employment of electromagnetic spectrum for its own use while limiting its use by the enemy. In this context, any device involving the use of electromagnetic energy is important in terms of electronic warfare. In the information era, military relies heavily on the use of the electromagnetic spectrum for communications, electronics, surveillance, research, navigation, weapons systems, own protection, etc. After the land, sea and air battlefield we should add the electromagnetic spectrum and cyberspace battlefield. And to control in an efficient way these new battlefields we should have a special structure with a specific mission. This structure is vital also because a lot of operations are conducted during the peace times as electronic support operations.*

Key words: *Electronic warfare, Electromagnetic spectrum, Electronic attack, Electronic support, Electronic defense*

I. INTRODUCTION

Today the electromagnetic spectrum is used in an increased number of military systems.

Without electromagnetic spectrum we cannot imagine network centric warfare in information age. We use a lot of sensors based on electromagnetic spectrum in order to obtain a live image of the modern battlefield.

In the same time we use electromagnetic spectrum to transmit information between our military systems in a flexible way. For this reason the access to electromagnetic spectrum is vital for modern military operations.

The electromagnetic spectrum is the new battlefield of our age. Electronic Warfare (EW) – is defined as the operating military action involving the exploitation of the electromagnetic spectrum which presupposes the emission interception and identification, electromagnetic energy engagement, including the directed energy, while reducing or preventing hostile actions within the electromagnetic spectrum.

In order to understand the electronic warfare in the information age, first we should understand how the electromagnetic spectrum is used today.

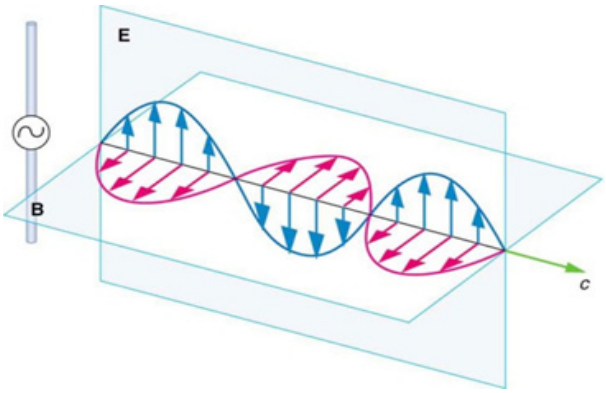

Fig. 1 Electromagnetic waves

First let us go back in history when all these things started.

The information age is deeply rooted in the industrial age, when James Clerk Maxwell (1831-1879) proved theoretically the existence of the electromagnetic field. In 1865, he published his work "*A dynamical theory of the electromagnetic field*" where he demonstrated that the electric field creates magnetic field and the magnetic field creates electric field and both travel in space in form of waves, at the speed of light.

He told us that we are surrounded by an electromagnetic spectrum.

The next big step was taken by Heinrich Rudolf Hertz (1857-1894) who practically demonstrated the existence of the electromagnetic waves. This research gave us the possibility to communicate over very long distances. For the very first time in history, we were able to communicate over long distances at the speed of light.

Electronic warfare actions aim at the employment of electromagnetic spectrum for its own use while limiting its use by the enemy.

In this context, any device involving the use of electromagnetic energy is important in terms of electronic warfare.In the information era, military relies heavily on the use of the electromagnetic spectrum for communications, electronics, surveillance, research, navigation, weapons systems, own protection, etc.

It becomes obvious that the dominance of the electromagnetic spectrum is a crucial component of military operations in the information age, based on intensive use of information systems and electronic communication in general.

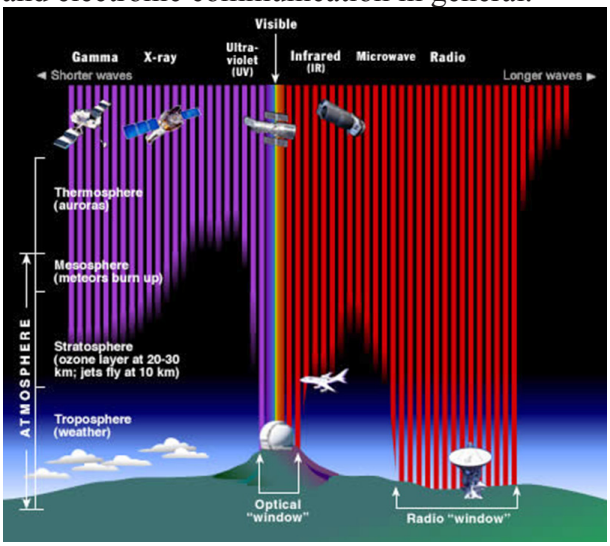

Fig. 2 Attenuation of electromagnetic waves in atmosphere

In order to dominate the electromagnetic spectrum both offensive action (electronic attack EA) and defensive actions (electronic defense ED) are needed.

These two actions always require informational support provided by electronic surveillance actions (ES).

Electronic warfare is an important form of strategic, operational and tactical insurance which is organized and implemented in all forms of combat actions in all types of armed forces.

Considering this, it is necessary that electronic warfare actions to be synchronized in all types of armed forces to the efficient exploitation of the electromagnetic spectrum itself. To get a clear-cut picture of how the earth's atmosphere attenuates the electromagnetic waves, according to their frequency, it is necessary to analyze Fig. 2. It is noted that most of electromagnetic waves from outer space, do not reach the earth because they are attenuated by the earth's atmosphere. However, there are two "windows" which provide the minimum attenuation of electromagnetic waves, for radio waves, and a part of the visible and ultraviolet spectrum.

According to the standards, the radio and microwave spectrum is divided into several frequency bands according to Fig. 3.

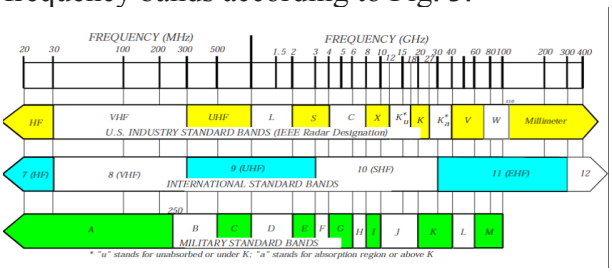

Fig. 3 Frequency bands according to standards

II. SPECIFIC ACTIONS OF ELECTRONIC WARFARE

Electronic warfare actions are electromagnetic operations specific to electronic warfare that produce effects in the electromagnetic environment and provide operational support.

These actions are:

- Electronic Surveillance – ES
- Electronic Attack - EA
- Electronic Defense - ED

Electronic warfare is that military action based on exploiting electromagnetic energy to obtain situational awareness and offensive and defensive effects.

Together with the conduct of electromagnetic operations, it represents warfare in the electromagnetic environment.

Electronic surveillance – ES – represents the activity of exploiting the electromagnetic energy for situational awareness and for information gathering.

Electronic surveillance is focused on providing knowledge of the electronic situation at any time and of cues and warnings on the activities of the electromagnetic environment.

Electronic surveillance includes monitoring of electromagnetic environment with the purpose of immediate threat recognition in support of electronic warfare operations and other tactical actions such as avoiding threats, directing their weapons to combat and target selection.

Electronic surveillance actions include configuration and allocation of resources for electronic surveillance missions, the modality of sending the operational commander of data gathered from the electromagnetic environment and using them for tactical decision making.

Electronic defense – ED – represents the action of using the electromagnetic energy to protect own and allied forces and the effective use of the electromagnetic spectrum by them.

Electronic Defense – ED represents the actions taken to ensure effective capacity utilization, for self-interest of the electromagnetic spectrum when EW specific means are used by the enemy.

ED consists in those passive or active measures taken to protect personnel, facilities or equipment from the effects of enemy electronic warfare actions or friends that reduce, cancel or destroy their combat capabilities.

Directed energy weapons DEW are weapons of defense-electronics, when used for defensive purposes.

Most modern combat systems using electromagnetic energy from own forces or NATO endowment, have working modes designed to resist the effects of enemy electronic attack.

As with ES and EA components of EW, ED use is a way to obtain a military advantage in a given conflict situation.

The essential difference between these components is that, while ED is an integral part of the design or operating methods and means of electronic systems, the ES and EA implementing requires special equipment, operation governed by a number of specific rules.

Naturally, from the definitions accepted for EW components, it results that ED virtually opposes the other two, with different purposes. Therefore, any development or modification of ES and EA technologies involves an immediate reaction from ED technologies and vice versa.

Electronic attack – EA – represents the action of using electromagnetic energy, in offensive purposes.

Electronic attack involves the use of electromagnetic energy, of directed energy or anti-radiation weapons to attack personnel, facilities and equipment intended to degrade, neutralize or destroy the enemy's fighting ability, being considered a form of "fire". Electronic attack is used to hinder, interrupt, misinform, or prohibit the destruction of command and control capabilities and of the enemy's fight and to reduce its ability to model and exploit the electromagnetic environment. Electronic attack / EA includes directed energy weapons / DEWs, high power microwaves / HPM, electromagnetic pulse / EMP and radiofrequency devices / RF, having an important role in destroying the opponent through joint operations and combined kinetic and electromagnetic attacks. To ensure maximum efficiency, the performance of an efficient electronic attack is performed only after understanding how to use electromagnetic environment by the adversary.

CONCLUSIONS

Taking into consideration all this elements it is obvious we need a single structure to control the access to electromagnetic spectrum.

After the land, sea and air battlefield we should add the electromagnetic spectrum and cyberspace battlefield.

And to control in an efficient way these new battlefields we should have a special structure with a specific mission.

This structure is vital also because a lot of operations are conducted during the peace times as electronic support operations.

For this structure the mission cannot be splinted in peace, crises and conflict mission. This structure must be operational 24/7/365.

Otherwise without this structure when the conflict occurs we will lose the fight because during the peace time our systems were compromised.

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ESTABLISHMENT OF THE UNMANNED AERIAL VEHICLE SYSTEM CLUSTER: MISSION, MOTIVATION, VISION, GOALS

Róbert SZABOLCSI

Óbuda University, Budapest, Hungary

Abstract: *The Unmanned Aerial Vehicles (UAV), or Unmanned Aerial Systems (UAS) are promising tools in solution of many tasks of the public or civil applications. Understanding importance of the UAV applications last year many scientific events were organized devoted to this topic. The scientific conference held by Department of Control for Transportation and Vehicle Systems at Budapest University of Technology and Economics in 2013 took decision about establishment of the cluster involving segments of the Hungarian UAV industry and research groups working separately to have privileges from the cluster. The UAS cluster was found last year and enlarged this year to improve cluster skills and power to reach main goals defined before by cluster founder-members. The purpose of the author is to give a sketch about the cluster so as to bring it closer both to the academic, higher educational, industrial partners, and to the individual experts interested in UAV and UAS technologies.*

Key words: *UAV, UAS, UAS governmental (public) applications, UAS non-governmental (civil) applications, clustering, UAS cluster.*

1. INTRODUCTION

The UAV and UAS technologies applied in both public and civil purposes show strong trend in evolution.

Many applications and tasks covered by UAV flights.

Although many questions in the field of UAV applications are open and still not answered, the future users require new answers for challenges arising both in ground maintenance and in-flight situations.

Most of developed manufacturers provide full-scale maintenance system, and, there is strong guarantee on many items of the unmanned aerial systems.

Understanding importance of UAV applications itself, the European Committee had decided brake the walls in bottlenecks of the applications. First problem to be solved is the airspace management problem.

The present situation is that UAVs mostly fly in segregated airspace clear from any kind and any type of other aircraft. The problem is how to integrate the UAV flights into the airspace, and how to eliminate the need to segregate it.

The European Commission (EC) COM(2014)207 is about to solve the integration problem with that or higher level as conventional aircraft and aviation does.

Starting with the year of 2016 the integration must start for new UAVs and new model aircraft [3].

The second basic document focusing at UAV applications, and focusing on aviation, in general, is the EC's document called Flightpath 2050 – Europe's Vision for Aviation [4].

Chapter 'Prioritising research, testing capabilities & education' in its main goals for 2050 emerges establishment of a network of multi-disciplinary technology clusters created on the basis of collaboration between industry, universities and research institutes [4].

This strategic vision motivated the author to start to organize establishment of the first Hungarian UAV-cluster.

The purpose of the author is to brief the scientific society about this new initiative leading to establishment of the cluster working as virtual lab, and open for all those individuals and legal entities agreeing with the Charta of the cluster.

2. PRELIMINARIES AND RELATED WORKS

A long-lasting preparation of the cluster establishment has been started December 2013. January 2014 is famous for a kick-off meeting organized at Óbuda University.

Parties expressing wish to take part in historical event of establishment of the cluster evaluated the Charta of the cluster inspired and prepared by the cluster founder Prof. Dr. Szabolcsi.

After many readings the final version of the Charta was accepted by participating parties spring 2014. After calling to take part in cluster establishment eight legal entities had agreed to enforce the establishment process.

In UAV airworthiness compliance evaluation Szabolcsi had published a series of papers.

In scientific article [5] Szabolcsi gave new definitions, which can be applied in UAV certification procedures. Due to lack of regulations in the field of UAV airworthiness certification Szabolcsi derived a new concept of the flying and handling qualities of the UAVs applied in measure of compliance procedure [6]. In article [7] Szabolcsi had laid down basic principles applied in airworthiness certification of the automatic flight control systems of the UAVs. In scientific paper [8] Szabolcsi derived flying qualities available for measure of the compliance of the airworthiness of the lateral/directional automatic flight control of the UAVs.

In paper [9] Szabolcsi defined flying qualities available for measure of the compliance of the airworthiness of the longitudinal short period motion of the automatic flight control of the UAVs.

3. SITUATION ANALYSIS LEAD TO CLUSTER ESTABLISHMENT

The strategic document of EC Flightpath 2050 calls participants involved into UAV design and production to unify resources to accelerate penetration of the newest technologies in everyday life. The fundamental challenge appearing is to ensure that level of flight safety of the UAVs as it established for manned aircraft aviation since many decades ago.

The common aviation is famous for staffs keeping norms and regulations very strict. The question is how to make the participants of the UAV-aviation to keep and to follow the written, and many times, the unwritten norms, rules, regulations, and, pattern of behaviour.

These days represent the beginning of the new era famous for historical events in development of the UAV-aviation. Last year in October EASA interviewed all those experts ready to answer the complex set of questions starting with main principles and finishing with deep, sophisticated questions of airspace management, type- and airworthiness certification of the UAVs, flying and handling qualities of the UAVs, and, also many items of the education and training were evaluated.

The Federal Aviation Authority (FAA), U.S. had published first set of new regulations related to UAS 15 February 2015.

The basic regulatory document now is open for discussion. Being highly motivated FAA started to regulate following segments: operational limitations of the UAV, operator certification and responsibilities, aircraft requirements, and, finally, the model aircraft. However, there are many open items waiting for discussions, and decisions. Due to complexity of the problems and tasks to be solved, a single organization or a single company rarely can solve them in short time with limited resources, successfully. It is better to start to think in clusters, or in virtual labs to maximize effectiveness of the activity in UAV design and development. Hungary has long-lasting experiences in UAV design and development. The early 90's was the era of the development of the 'Bat' UAV. At the end of 90's the joint Czech-Hungarian UAV development program had been started and run to design new 'Soyka' reconnaissance UAV.

The Czech party had run his own project till 2010. The 2008 year is famous for starting development of the new UAV at Bonn Hungary Electronics Ltd., with participation of Technical University of Budapest, Óbuda University, and Institute for Computer Science and Control at Hungarian Academy of Sciences, as well.

The same year the Military started to use METEOR UAV for training of GBAD units in Poland. Gaining experiences from those years, 2013 is famous for using first time UAV coded METEOR 3MA for aerial targets during shooting drill in Ustka, Poland. After calling to take part in cluster establishment, following four founder-organizations triggered the new initiative and 26 June 2014 signed the Charta of the Unmanned Aerial Vehicle System Cluster (UAS_C) [1]:

- Institute of Mechatronics and Vehicle Engineering at Óbuda University;
- Electronics, Logistics and Property Management Co. at Ministry of Defense;
- BHE Bonn Hungary Electronics Ltd.;
- Hungarian Aviation Industry Foundation.

22 January 2015 the cluster had been enlarged with following four founder-member organizations [2]:

- Institute for Computer Science and Control at Hungarian Academy of Sciences;
- John von Neumann Faculty of Informatics at Óbuda University;
- Department of Control for Transportation and Vehicle Systems at Budapest University of Technology and Economics;
- Department of Aeronautics, Naval Architecture and Railway Vehicles at Budapest University of Technology and Economics.

All founder-members have large-scale experiences in UAV design, production, development, innovation, research and education promising effective achievement of the main goals outlined in the Charta of the cluster. The Board of the Cluster (BoC) made following statements in Charta of the cluster:

- the UAV and UAS systems are used worldwide in large-scale applications including both public and civil applications;
- the increasing need from the users of so high-technology products and other joint services is the motive of establishment of the UAS_C focusing on unmanned aerial vehicle systems with a broad spectrum of joint robotic initiatives;
- the existing economic demand on the accessible UAS services motivated founders to unify human resources, research and development infrastructure, teaching and training activities to develop products that are identified, designed, prototyped, engineered, produced, marketed, and sold by cluster members;
- there is the indisputable trend when UAV and UAS research and development go ahead to the regulations;
- ensuring high level of the flight safety of the UAV and UAS systems must be the key point of the research, development and production of the unmanned aerial vehicle systems.

4. FUNDAMENTAL PRINCIPLES OF THE UNMANNED AERIAL VEHICLE SYSTEM CLUSTER

The cluster-founders had agreed on establishment of the Board of the Cluster (BoC) leading the cluster members to achieve its goal.

The BoC credo is in following principal pillars of the cluster:

- the UAC_C is a non-governmental organization working as a virtual lab;
- the UAS_C is an autonomous organization;
- the UAS_C activity is morally and intellectually independent of all political authority;
- the UAS_C rejects intolerance in all mean of it, and always open to dialogue;
- the UAS_C emphasises personal and corporate social responsibility of the members in promotion of the development of the UAV and UAS technologies;
- the UAS_C underlines freedom in research, development, teaching and training activities;
- the UAS_C is an organization of those legal entities and individual persons able and ready to work together to reach synergies to maximize effectiveness of theirs activities;
- the UAS_C will
    - integrate partners working in the research and development areas of the main scope of the cluster;
    - unify resources;
    - systematize and share knowledge;
    - share experiences and best practices;
    - propagate results in the field of UAV and UAS research and development, production, and maintenance;
    - establish synergies between cluster members;
    - trigger new initiatives in the field of UAV and UAS research and development;
    - establish, enlarge and widen international co-operations in the knowledge-triangle;
    - provide presentation of the cluster members both domestically and internationally;
    - cooperate with governmental organizations in legislation, certification and other areas in order to speed up the development of the Hungarian UAS industry;
- the UAS_C believes that this form of co-operation equipped well-enough so as to develop it by research and innovation;
- the participating students are entitled, able and willing to enrich their minds with that knowledge provided by the cluster members and co-operating corporates and other partners.

The cluster is open for all individuals and legal entities agreeing with those principles and goals outlined in the Charta of the cluster.

The first indisputable result of the cluster establishment is the conversation between cluster-members sharing information, knowledge, end experiences gained in the past years.

5. THE MEANS ENSURING ACHIEVEMENT OF THE MAIN GOALS OF THE CLUSTER

To attain main goals of the UAS_C by following such principles defined above the cluster calls for effective means, suitable to present conditions:

- the membership in UAS_C is the volunteer one;
- the wish for UAS_C membership can be signified by agreeing with goals and norms of this Charta via signing it;
- recruitment of new members to join the UAS_C to present resources for reaching its main goals is the mission of the cluster;

- the BoC:
  - consists of representatives of the eight founder-member organizations and the Cluster Founder;
  - sessions two times per a year to establish annual working plans, to evaluate results, to get lessons learned from activities carried out by cluster members;
  - decides about membership in UAS_C;
  - establishes centres to reach goals of the cluster;
- the UAS_C creates and runs a website to reach maximum of publicity;
- the UAS_ C establishes a new series of scientific conferences organized 2-yearly;
- the UAS_C establishes and starts an international peer-reviewed scientific journal with two volumes per a year.

6. CONCLUSIONS AND FUTURE WORK

The cluster now is established and started to work out basic regulations needed for carry out mains tasks of the cluster. 22 January 2015 the BoC agreed on plan of activity for the first half year of 2015. A proposal by the cluster founder was made on establishment of the following centers but not limited to:

- Research, Development, and Innovation Center;
- Education & Training Center;
- Production & Repair Center;
- Service & Maintenance Center;
- Regulatory Center;
- Customer & Marketing Center.

The cluster establishment serves as a unique opportunity for cluster members, and non-members but interested in, individuals and legal entities in the fields of UAV design and application to create value useful for society.

The new era of the wide-range UAV applications is knocking on the door. The global trends in UAV and UAS design and production requires new methods to be a partner in the joint development programs.

The UAV-aviation future in military missions is undisputable. The single UAV sent to war theatre minimizes the threat of loss of the pilot, or any crew of the conventional aviation.

However, there might be arise new challenges when UAV pilot staff member is leaving the Military after his contract is inactive: to recruit pilots for the next, new rotation so as not to lose skills and administrative certification is very challenging today. Physical and mental overload of the UAV-pilots is threatening the success of the selection process.

The public UAV-aviation can appear although in disaster relief missions, or in firefighting missions. The information provided by UAVs can affect very much effectiveness of the execution of the given task put for disaster relief teams.

The UAV-aviation in civil applications will be extended for segments unbelievable before. Delivering small weights, goods, products under 0,5 kgs (i.e. pizza, chocolate, jewelry, gifts, perfumery etc.) can be the typical field of the new UAV-applications.

Many new possible applications are shown in agriculture, movie shooting industry, building industry, public and private transport, entertainment, food industry.

The question today how international (ICAO, EASA, DoT FAA, NATO etc.) and domestic regulations support these new UAV-applications, or, if the regulations conflict, how to understand regulating rules and norms, how to prioritize regulating norms.

The lead-nations and countries go ahead in regulating activities well, so those countries, legal entities following the main stream have basics and preliminaries in the establishment of the domestic regulations.

The years we face are promising if to take part actively in rule-making process, in establishment of the new sub-systems needed for safe UAV-aviation.

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THE UNITED NATIONS' PERSPECTIVE ON THE INTERNATIONAL SECURITY SYSTEM AND THE GLOBAL WORLD'S ASYMMETRIES

Oana-Andreea PÎRNUȚĂ

Transilvania University of Braşov, Romania

Abstract: *The present study analyzes the geopolitical and geostrategic background of the international security environment as the world has registered a very important shift from bipolarity to a fragmented universe where all sorts of antagonisms come into being. The present-day international security context requires a unitary action initiated by the international society against the new asymmetric security threats. Today globalization plays an important part being perceived as the process through which the global connections are expanded and life is organized at a global scale. Thus, the global conscience is generated. It aims at creating and strengthening a global society. The security systems have reconfigured their dynamics due to the relations between the member states, organizations and international organisms. The United Nations' reform should be based upon a political system of liberal globalization. The United Nations' perspective stipulates that the essential features regarding the strengthening of security promote the human rights as well as the social and economic development. The impact of globalization on the states' security can be understood only if the actors' perspective on the international relations is repatterned and the political integration instruments of the present and future relations are redimensioned.*

Key words: *globalization, international security, global system, United Nations, asymmetries.*

1. INTRODUCTION

The geopolitical and geostrategic features have changed in the recent years.

Regarding the global geopolitical and geostrategic framework, it can be said that there is a great range of political actors, involved in the international geopolitical pattern. They are responsible for the peace or the insecurity of the entire world.

It is very important for the strong and powerful to know how to interweave the security interests of each state with those of the whole world in order to prevent the situation in which one of the actors, irrespective of the power possessed, could be affected when it comes to the issue of interests.

2. THE INTERNATIONAL SECURITY FRAMEWORK

The international system needs an institutional architecture able to control the rhythm of global instability through efficient strategies.

When the communist regimes collapsed, the European security environment has been influenced by powerful seisms.

The political and administrative European map has suffered changes in certain regions.

This particular European remapping had major implications in the past and it also has at present.

When referring to security, wealth and political traditions, we can consider Europe as a continent divided into three distinct areas:

Western Europe standing for a stable political region, consisting of countries with old political traditions and representing economic and cultural powers;

Central Europe where the countries have more easily overcome the transition period, being economically assisted by the Western countries;

Eastern Europe, considered to be one of the most dynamic security environments.

NATO and the EU require several strategic objectives, which are to be implemented in order to assure the regional and areal security.

In this context, the main goal of Romania's and Bulgaria's integration in NATO (2004) and the European Union (2007) was the strengthening of both NATO and the European Union's south-eastern flank together with the inclusion of these two countries in the American anti-missile defense system as Octavian Manea considers in his article on the constitutionalization of the international political system published in the Romanian revue *Sfera politicii* (Sphere of Politics), no. 116-117 (2005). Under such circumstances, the United States of America and a strong Europe should combine their resources in order to handle the new global, continental and regional challenges. A common security design is highly recommended. This common pattern is the only one being able to incorporate NATO and the EU in order to create a global management of the post 9/11 security environment. In other words, we deal with a rethinking of co-operation according to common interests: international terrorism, weapons of mass destruction, failed states etc. Concerning the present-day security environment, it is worth to mention several specific features, such as: the dissolution of bipolarity, the emergence of a new era within the framework of which the United States of America is considered to be the only credible and viable political, economic, military and financial superpower (Petrescu, 2005:45-48), the European Union as a generator of stability and progress, the powerful economic and military development of China as well as the diplomatic offensive of Russia. All the previously mentioned major features prove that the future international security environment will be based on a multipolar structure. Among the main features of the security environment, we can also mention the emergence of several new tendencies regarding the functioning of institutions as well as political, economic and security organizations, which aim at repatterning and redimensioning the operative structures and strategies.

3. THE GEOPOLITICAL DIMENSIONS OF THE EUROPEAN SECURITY ENVIRONMENT

Several dramatic changes have occurred in the security environment once the bipolarity period was over. It is important to mention some of these changes: the conflicts emerged within and between the states located near the border of the European Union, international terrorism, the proliferation of weapons of mass destruction, organized crime, illegal immigration, failed states, economic and social underdevelopment, human rights violations, inefficient multilateral institutions, ecological problems.

Nowadays, it is more difficult to identify these factors than it was to identify the political and military threats, which existed throughout the Cold War. That is why, the states and the international security organizations have repatterned their security strategies in order to fight against the new types of risks and threats to security (Sarcinschi, 2007:63).

In the early 21st century, the main objective of the European security environment is the reduction of the conventional risks and the elimination of the situations in which a continental or regional armed conflict could emerge.

The amplification of the asymmetric risks and threats has caused the dramatic revival of ethnic and religious nationalism as well as the widening of the economic and social gaps with negative effects on security (Petrescu, 2008:29).

The present-day risks and threats have acquired an international status, without taking into consideration the countries' borders. Therefore, there are not anymore major gaps between the internal security and the external one. This has led, in the field of defense and security, to the tendency, shared by the majority of actors, to act within the framework of regional or global organizations.

The main objective is to develop a common security and common defense strategies, which can be implemented in a regional or/and global context.

The enlargement of NATO and EU eastwards had a strategic impact on the international relations system, with a major influence on the international security environment.

Regarding the geopolitical context, in the present-day Europe, there are two major dimensions.

The two dimensions are the Euro-Atlantic dimension and the Euro-Asian dimension. The Euro-Atlantic dimension has been strengthened by the enlargement of NATO eastwards. This enlargement has also generated several difficulties regarding the management of the other dimensions.

On the one hand, there are no weaknesses in the geostrategic field and on the other hand, there are several disagreements within the Euro-Atlantic dimension.

Therefore, the so-called "New Europe" emerged.

This New Europe incorporates states, such as: Romania, Bulgaria, the Czech Republic or Poland. All these countries have been recently integrated into the North-Atlantic Alliance.

All these facts could lead to a repatterning of the Euro-Atlantic relations, but not necessarily to a strengthening of these relations. According to certain specialists, these previously-mentioned states, through the process of integration, have turned into supporters of the American unilateral strategy. This could be underlined by the fact that these states can have the role of a gateway towards the former-Soviet space, especially through Poland and the Baltic countries, but also towards the Caspian space and the Middle East, through the Black Sea, with the support of Romania and Bulgaria. In this context, the security and stability of Europe are endangered by risks known as "residual risks", which are mentioned in the European security strategy that was adopted by the Brussels European Council on the 12th of December 2003.

The so-called residual risks represent a heritage of the end of the Cold War and were generated by former Soviet states, or countries which were under the USSR's influence. *A Secure Europe in a Better World*, the European security strategy, identifies the global challenges as major threats to the stability and security of the European Union.

Among the European strategic objectives, it is worth to mention the following ones: building security in the European Union's neighbourhood and promoting an international order based on effective multilateralism. The *EU Security Strategy* mentions the major risks and threats to the European region: terrorism, the proliferation of mass destruction weapons and, of course, organized crime, which recently has turned into a global threat as well. These kinds of residual risks can generate the appearance of transnational risks and threats, which could affect the stability and security of some regions located at the edge of the European continent.

4. GLOBALIZATION AND THE INTERNATIONAL SECURITY ENVIRONMENT

The major changes, which occurred in the international security environment, have affected the early 21st century. Globalization becomes more and more a necessary and irreversible process, with both positive and negative effects within the framework of society. Teodor Frunzeti and Alexandra Sarcinschi, the authors of an article, on international security highlighting its dimensions and strategies, published in the volume entitled *Lumea 2009* standing for the 2009 World, consider that throughout the Cold War, the major threat to security was considered to be a large, extensive and expansive nuclear conflict that could have been a total military and human disaster.

Subsequently, it was thought that the issues on security lost in their intensity. Nowadays, analysts focus their attention, again, on the military dimension of security, through the initiation and intensification of the *war on terror* and the multidimensional character of risks and threats has acquired recognition (Frunzeti & Zodian, 2009:33).

Recently, security, at a global level, has experienced a dramatic change. The former risks and threats have been replaced by new ones, modern ones, which are more terrifying, being generated by international terrorism and the proliferation of the weapons of mass destruction.

Therefore, the world has witnessed the development of international crime organizations, illegal drug and human trafficking as well as the policies implemented by the failed states.

The new risks and threats to international security have been generated against the background of the phenomenon of globalization and the process of fragmentation, but also in the context of traditional conflicts, religious tensions and ethnic disputes taking place in certain regions all over the world.

5. GLOBAL SECURITY SYSTEMS

In the early 21st century, the concept of security plays a central role. Therefore, it is necessary to repattern the world order. The beginning of the millennium has highlighted a wide range of risks and threats associated with the phenomenon of globalization. Among the most dangerous risks, it is worth to mention terrorism, international organized crime and religious extremism.

The states have to focus their attention and efforts on the prevention and control of these asymmetric threats in order to assure stability within the framework of the global security system.

5.1. DYNAMICS OF THE RELATIONS BETWEEN STATES AND INTERNATIONAL ORGANISMS

Each global security system is founded on the principles of democracy, efficient governing and compliance with laws.

The states have to co-operate at an international level in order to avoid major conflicts. In the case in which such conflicts have already started, states have to manage such crises and conflicts strengthening the framework of stability, security and peaceful coexistence.

According to the *European Security Strategy*, in a world in which threats, markets and means of communication have a global dimension, the people's security and prosperity depend more and more on the existence of an efficient multilateral system as Traian Liteanu mentions in his course on security theories and doctrines. We have to build a stronger global society by a good functioning of the international institutions and a world order based on a set of norms established by the international law.

The international relations are founded on the framework constituted by the United Nations Charter. Also, the main objectives of the United Nations Security Council are the protection of peace and the strengthening of security. Therefore, states and international organizations are preoccupied with the consolidation of the United Nations so that the UN should provide the necessary means to implement efficient actions. The relations between states and the European Union or NATO have been improved by the processes of European and Euro-Atlantic integration, actively influencing the international security environment and therefore strengthening the community, which represents the states that share principles, such as: democracy and market economy. Therefore, the global security and stability have been strengthened.

Thus, the united Europe turns into a global actor and a pole of power and stability. The European Union and NATO are the organizations that promote and strengthen the states' security relations as well as the Euro-Atlantic relations.

The security systems have the role of raising the awareness, among the member states, regarding the interdependence of their vital interests in a world, threatened by major risks and dangers, in which the international co-operation and a new solidarity process is required in all fields of activity as Mureşan, Pop & Bonciu consider (European Institute of Romania. Study nr. 4: 11), by repatterning the joint operative methods initiated by the states having similar interests.

5.2. THE INVOLVEMENT OF THE UNITED NATIONS IN THE PROCESS OF GLOBALIZATION

Nowadays, it could be noticed that the United Nations face a turning point. The activity of this organization is perceived as being not a very convincing one, being assessed by the weak as having the role of a recording device (Bădescu & Dungaciu,1995:216), being coordinated by the Western powers.

In the contemporary society, a major necessity is represented by the development of an international system and political institutions, which aim at finding efficient solutions to the process of globalized economic transitions, to the consolidation of stability, the promotion of peace, the conflict management, geopolitical inequalities as well as to the entire world which relies, more than never, on the international co-operation.

A repatterning and reform of the United Nations is highly required today.

On the one hand, there is a group of institutions, such as: the World Bank, the International Monetary Fund and the World Trade Organization, and, on the other hand, there is a military alliance similar to NATO.

According to Gustave Massiah, it is highly required to implement a strategy, which should take into consideration the challenges faced by the international institutions, globalization, wars, international law, the guiding lines of global democracy and the international social contract, the strategic role of the international law, the emergence of a strategic axis aiming at the democratization of the international system.

Peace represents the basic objective of the United Nations. During the Cold War, the United Nations played an important part: namely, decolonization and nuclear disarmament treaties.

There are cases in which the United Nations Organization lacks the necessary rights to impose the respect of the peoples' rights or it is viewed as being not strong enough to manage and stop certain conflicts.

It can be said that the United Nations Organization faces a crisis, felt against the background of unilateralism and crisis multiplication. Therefore, the perspective used for the enforcement of peace should be repatterned. According to the same Gustave Massiah, the world trade and money, the peoples' right to choose their form of development and the correlation of the levels of economic management are three major aspects regarding the development of an international system in accordance with the requirements of modern society.

It is worth to mention the fact that the world trade does not have the capacity to reduce poverty.

This problem can be solved in the case in which the process of national development is prior to global integration. It is also known that trade liberalization increased the structural problems of poor countries. But, every people has the right to choose its own development model.

There are two very important dimensions: the process of peacebuilding and the process of conflict regulation.

The United Nations has to take into consideration these dimensions.

The contemporary society should be repatterned in accordance with the conditions imposed by freedom and equality.

Michael Shooyans in *L'ONU et la globalisation* highlights the way in which the United Nations deals with globalization.

He criticized the United Nations' active contribution to the promotion of globalization: globalization means that the economic changes have multiplied at a global level; globalization promotes the interdependency of human societies; globalization affects the sovereignty of the states because their power is reduced and subjected to the control of a worldwide political power; the process of globalization has its foundation on the international labor division; globalization helps the wealthy countries; the UN is actively involved in the promotion of globalization as a rescuing solution for humanity, which otherwise is doomed to not have a future anymore.

The United Nations approaches globalization not only from an economic, political or legal point of view, but it also highlights the global soul.

The basic instruments used by the United Nations Organization for the promotion of globalization are the following ones: the world pact, which aims at joining the fundamental values concerning the human rights, the environment and the labor norms, the positive international law system.

The United Nations Organization uses the positive international law as an instrument for the development of a superstate, an international criminal court.

Overall, the tendency is to create a new political and legal world order.

The 1994 United Nations Development Program Report specified for the first time the need for a world government as the national governments could not find anymore viable solutions to the mankind's problems.

So far the UN agencies have had only a consulting role, but it is very important for these institutions to become executive agencies.

Thus, the United Nations Industrial Development Organization would become the World Ministery of Industry, the Food and Agriculture Organization would become the World Ministery of Agriculture and the International Labor Organization would become the World Ministery of Social Affairs.

There are fields of activity, which require new institutions of the type of the permanent International Police, which would summon the states that violated the norms, in front of the International Court of Justice or in front of other Special Courts. If the decisions implemented by the Courts are not complied with, either military or non-military penalties are applied according to the situations.

5.3. THE UNITED NATIONS' PERSPECTIVE ON THE INTERNATIONAL SECURITY SYSTEM AND THE GLOBAL WORLD'S ASYMMETRIES

It is worth to mention that globalization has not only specialized the organized crime groups, but it has also led to the increase of the illegal activities carried out by these groups, through violence, threats or blackmail, in order to gain huge profits.

The process of globalization helped these groups to spread at an international level because it made possible the consolidation of the relations between the criminal groups able to create more complex strategies.

Thus, the organized crime has got a global character. And this process has affected the activity of the political, economic and social state institutions, but also the states' stability and national security.

The phenomenon of organized crime has acquired a special status, being determined by its transnational features and its capacity of corrupting important components of the decisional structures.

The crimes made by the members of such groups had devastating effects, which differed from state to state, depending on the source and the dimensions of the consequences.

At an international level, the role of the state, regarding the implementation of norms, will become very important. Once the international economy expanded, the social governing will gain a global status, the international laws will automatically have a greater importance when dealing with preventing the organized crime.

At an international level, the global institutions and organizations are based on interstate agreements and treaties and the international civil associations will exert public functions in fields, such as: the human rights, environmental preservation, the implementation of international laws and the struggle against the global organized crime.

It is well known that the security environment is influenced by information, being exposed to multiple threats.

In this context, the informational aggression is the kind of danger which uses information as a weapon against the entities that process the information. Thus, the victims become dependent on their aggressors.

The fact that it became easier to have access to the modern communication and transportation means led to co-operation forms among several states, regions and civilizations from all around the world. But, it is important to mention that these forms and means could initiate dangers, risks and asymmetric threats to the citizens' stability and security.

Therefore, the state has to find, through its institutions, the most efficient solutions used to strengthen the citizen's safety and stability. Also, these strategies have to be adapted and correlated to the ones found at international level. The approach is very important as it should integrate both the national environment and the international one in the context of global co-operation.

The debates regarding the development center around two schools of thought. One school considers that the development or lack of development is a consequence of the actions initiated by national forces. The other school considers that the international factors are important when it comes to development, the inequalities being highlighted.

In this context, there have been identified three main asymmetries of the global world, playing an important role in the international security system. All these asymmetries are perceived according to the UN specialists' perspective.

The first asymmetry focuses on the technological developments concentrated in the developed states. The technological progress represents the main source of economic growth in these states being distributed from the center towards the periphery. But this transfer is not very efficient and its advantages are distributed unequally in the developing countries.

The second asymmetry focuses on the macro-economic vulnerability, which is specific to the developing countries. This internal vulnerability appears when the external shocks occur due to the currencies of the developed countries and the nature denoting rules that apply only in favor of the transformations of a whole cycle specific to the money flows from the developed states towards the developing countries.

The third asymmetry is based on the contrast between the high degree of capital mobility and the international labor mobility, especially the unskilled labor. This feature is specific to the third wave of globalization.

This asymmetry was specific neither to the first wave of globalization within the framework of which the production factor was very mobile, nor to the second one characterized by a reduced mobility.

Globalization has registered important advantages in the developed countries because this process led to an important increase in income due to a better usage of the resources. But, globalization has also registered negative effects, especially in the poor regions where the spread of epidemics occurs as fast as the population grows.

Globalization is the phenomenon which has contributed, on the one hand, to prosperity and the consolidation of stability and on the other hand, to the security problems, leading to the emergence of insecurity.

6. THREATS, RISKS AND VULNERABILITIES IN THE GLOBAL SECURITY SYSTEM

Security represents a state in which the dangers that can cause physical, mental or material damages are controlled in order to protect the health and wealth of both the individual and the community. Therefore, security is a fundamental right of the human being.

Nowadays, the state of security is interpreted according to several non-military indicators, such as: economic security, political security, personal security, educational security, health security, community security, environmental security.

The idea of security is based on two main tendencies.

Every state tries to reduce its insecurity either by diminishing its internal vulnerabilities or by preventing and counterattacking the external threats, which are hard to manage, irrespective of the situation.

In the contemporary society, we are often confronted with the concept of risk and that of security.

The human activity is influenced by every economic, political, social and military decision.

Therefore, the decisions that have been taken have a greater or a smaller impact not only on the individual's security, but also on the national and global security.

Every decision has a certain degree of risk. When we assume a risk, we also assume, more or less consciously, the consequences of the choice we made, irrespective of the field of activity, and especially in that of homeland security.

Globalization and the liberalization of commercial or informational exchanges do not allow the separation of the evolutions registered at the internal and international levels within the framework of a globalized world. In this context, the internal and external risks can fuel each other.

But, it is important to mention that the background, against which the dynamics of the multiple interdependencies among states are built, is a positive one. This is possible through the generalization, at a European level, of the co-operation regarding the strengthening of stability and security.

Furthermore, this fact is possible through the active involvement of the United Nations, NATO, the European Union or the Organization for Security and Co-operation in Europe in the management of the global security problems.

7. CONCLUSIONS

In the contemporary society, the international relations coexist with the global ones. The international relations are defined in terms of sovereignty, and the global ones have passed beyond the state borders in the economic, social, political and cultural fields of activity.

Thus, globalization can be seen as a progress of the international organization, having new paradigms.

Globalization brings not only new opportunities, but also new risks and threats. This phenomenon highlights the interdependence between states, being a process guided by economic, political and technological forces.

Recently, the promotion of anti-globalization has taken an extremist emphasis. The specific means have imprinted a terrorist character to these actions. But, generally speaking, the aspects of globalization are controversial and favorable if we refer to development, integration and security.

There should also be mentioned the beneficial effects of globalization on the population, in the sense that this process can improve the standard of living and can bring stability.

Some social and state elements could be affected by globalization and this fact could lead further on to the strengthening of superstate and transnational factors.

Those who believe in globalization perceive it as having a beneficial impact on the security of states.

Those who view it with mistrust are those who see in it a global act, which is not able to assure a global security and this could lead to an uncontrollable situation, a global chaos.

The impact of globalization on the states' security can be understood only if the actors' perspective on the international relations is repatterned and the political integration instruments of the present and future relations are redimensioned.

A security strategy in globalization is highly required being based on the one hand, on a holistic thinking of the global players and on the other hand, on an interdisciplinary understanding of the phenomenon and processes animated by the other local, regional and transnational players. Thus, the common aspects of globalization and security can be easily harmonized and merged together in a single mechanism. These aspects have a historical, educational, psychological, religious and environmental nature.

Such a security strategy in globalization has as a main objective the mutual shaping and adjustment of globalization and international security. This type of shaping can be achieved being based on similar values and through a harmonization of the differences between globalization and security.

Thus, the phenomenon of globalization should help people reach a peaceful state and strengthen stability by means of its main instruments identified with integration, development and security.

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STUDY ON PERFORMANCE-BASED TRANSFORMATION IN THE CASE OF AVIATION TECHNOLOGY INSERTION

Cătălin CIOACĂ*, **Mircea BOŞCOIANU***, **Sebastian POP****

*"Henri Coandă" Air Force Academy, Braşov, Romania
**Transilvania University from Brasov, Romania

Abstract: *The architecture of military aviation organizations is complex and interactive. In this respect, the initiated scientific approach shows combative capacity improvement opportunities by identifying and implementing coherent and effective best practices in major projects and procurement of military weapons systems. The objective of this paper is to draw guidelines in terms of performance, processes and technologies, enabling the planning, implementation and monitoring of successful transformations generated by insertion of new technologies. For the integration of organizational excellence in military aviation architectures the binomial Benchmarking - Lean Enterprise Architecture is used. Finally, the model is implemented in the current Romanian Air Force's case.*

Keywords: *Aviation Technology Insertion, performance based transformation, Benchmarking, Lean Enterprise Architecture, Romanian Air Forces*

1. INTRODUCTION

The term "technology insertion" is used to describe: minor improvements, a new version, major modernization or replacement of the system.

IT projects have a high rate of failure (partial or total), with reference to the operational objectives, especially regarding new technology insertion [1,2,3] or in the case of neglecting organizational aspects [4].

For projects procurement of military and weapons associated systems risks can be grouped into the following categories: technical (e.g. Inconsistencies with initial technical requirements) [5]; costs (e.g. overrun the budget planned) [6]; time (e.g. non-calendar of activities); bureaucracy (e.g. lack of flexibility) [7].

According to technological determinism, the most important factor in achieving success for an organization is the technology [8].

Investment programs such as "technology push" in the military remove the fear of being "left behind" (low confidence in the existing technique).

Complex socio-technical systems theory highlights the limits of predicting organizational behavior, but argues success through the high capacity to adapt to the environment [9].

Other theories claim that technology is a dependent variable in the organization of other factors, such as human (as a decision-maker and user) [10]. Policy makers need to efficiently manage the lifecycles of combat systems without compromising the performance objectives [5].

Repeatedly extending lifetime or reducing procurement of new systems projects are temporary solutions in terms of budget constraints.

The main arguments for the introduction of new military technologies are [11]: cost reduction, the need to develop new capabilities, maintaining knowledge base defense, legislative requirements and industrial capacity.

To minimize costs and maximize value throughout the investment cycle, there are two possible directions to be followed by makers of defense [12]:

- technology insertion (new or upgrading aging systems for increased performance and/or reduce operating costs and maintenance);

- the opportunities offered by civil technology.

Change management in military organization has acquired new meanings amid increasing complexity accelerated technique/weapon systems and reducing their development cycle. Through transformation the military organization develops proactively combat capabilities in order to achieve and maintain competitive advantage, the main change courses being: people, organization, processes and technology [13].

2. STRATEGIES FOR PERFORMANCE-BASED TRANSFORMATION

2.1. Benchmarking best practices

The benchmarking method was originally used for measuring and comparing business processes in an organization in order to improve performance [14].

Developed as a form of competitive analysis, benchmarking can be applied to any type of organization, and strategic investment projects in order to identify the most effective practices.

The need to monitor process efficiency is the main reason for applying this technique [15].

In military aviation organizations, the need for studies of performance was felt along with the strategic decisions acquisition of modern weapons systems (e.g. Change the fleet of fighter jets). Given the environmental peculiarities defense industry benchmarking procedure is the most appropriate method of identifying potential opportunities to improve performance of certain components.

Benchmarking is a cyclical process whose ultimate objective is to determine the best practices that lead to superior performance when implemented in your own organization. Selection of evaluation partner/partners is based on the criterion of possibility to transfer the results of this / these.

Data analysis should provide answers to the following questions: What are the conditions generating performance? There are similar conditions in the transforming organization?

If not, what are the changes necessary to the successful implementation of best practices?

Action Plan Performance resolves the issue of closing the gap by identifying and implementing best practices / equipment in order to enhance the performance level.

Benchmarking best practices for the identified problem (aviation technology insertion) includes specific elements of the benchmarking process (oriented to identify the most effective practices), benchmarking performance (focused on quality analysis equipment) and strategic benchmarking (examination assessment strategies followed by the partners).

In the literature there are several models of implementation of benchmarking, and the great challenge is effective planning and implementation of a strategy. Application cycle P.D.C.A. (Plan-Do-Check-Act) can be successful in terms of total involvement of the management organization that will be responsible for implementing changes [16]. For the integration of organizational excellence in architecture are proposed the following steps: determining the strategic objective knowledge of their organization, identifying areas where there is some malfunction, selecting partner / partners of comparison, the development and implementation of the results of benchmarking to improve performance [17].

2.2. Lean Organization Arhitecture

Designing an organizational architecture is performed in accordance with the strategic objective to be met: the transition to multi-role combat aircraft operations F-16.

The concept of architecture description refers to the specific patterns of organization engineering (instruments and methods of conception, design, implementation and maintenance). Lean Enterprise Architecture (LEA) is an architectural framework for reengineering the organization, design, construction, integration and implementation of Lean organization, using methods from systems engineering.

In the context of the need of reconstruction of a complex system transformation architecture is required and the key factor is the accelerated nature of the transformation that involves quick decisions.

LEA design includes lean type attributes and recreational requirements of the organization, being complementary to continuous improvement processes (e.g. total productive maintenance). Within the total productive maintenance (TPM) optimization refers to minimizing losses (labor, time, materials), in a context based on the principle *just in time.*

LEA architecture uses a multiphase approach, focused on transforming phases in the life cycle, being developed in an integrative perspective that takes into account the strategic elements.

There are five basic elements arranged sequentially according to the principles of engineering and life-cycle of the organization.

The specifications of each block are tools that lead to improved processes for designing and maintaining lean principles functionality.

The interaction of the lean architecture and the concept of transformation in the context of life cycle take place at several stages.

Each phase creates the necessary conditions for transformation.

The combination of specific methodologies of lean organization with benchmarking process steps for the provision of an image processing actions, and support continuous improvement process (Figure 1).

The implementation of such a process to the organizational structure of the Air Force is a challenge.

At the level of functional cells, in addition to deficiencies related to the lack of trained personnel, access to data needed to implement such a process are limited.

For example, in the management of the supply chain, aviation cell function is more concerned with the existence of a contract and / or the quality and timeliness of services, provided that all maintenance at this level are not sufficient to influence suppliers supply and most decisions are made in the acquisition phase, which makes it impossible to change the phase of support [18].

3. A CASE STUDY IN IMPLEMENTING BENCHMARKING-LEA IN ROMANIAN AIR FORCES

Changes looming in Romanian Air Force, amid the transition to multi-role combat aircraft F-16, generate a complex range of challenges for policy makers resizing infrastructure, security and safety redesign, changing operating and maintenance procedures, new requirements for education and training, budget restrictions etc.

All these pressures lead to the use of benchmarking techniques integrated into the strategic planning process.

Romania completed the purchase of 12 Lockheed Martin F-16AM/BM Fighting Falcons from Portugal, the first aircraft is scheduled to be delivered in 2016 and initial operational capability achieved in 2017. The aircraft entered the Portuguese Air Force equipment in 2002, and the contract includes the cost of upgrading (e.g. avionics, engines), modernization and staff training tracks [19].

Benchmarking aims at implementing the aims of the organization's strategic planning, the performance evaluation of different processes and the identification of best practices for integration into operating procedures in order to improve quality [20].

To establish performance indicators and measurable parameters are grouped according to industry: operational culture (skills, English aviation terminology, Flight Operations features, from collectivistic to individualistic approach, frequent operation and the regular scheduled maintenance), pilot training (need for modern training aircraft and operational regardless of the weather, launch preparation of Bologna stage I, outsourcing service, use of foreign instructors), maintenance (staff training), infrastructure and organizational architecture.

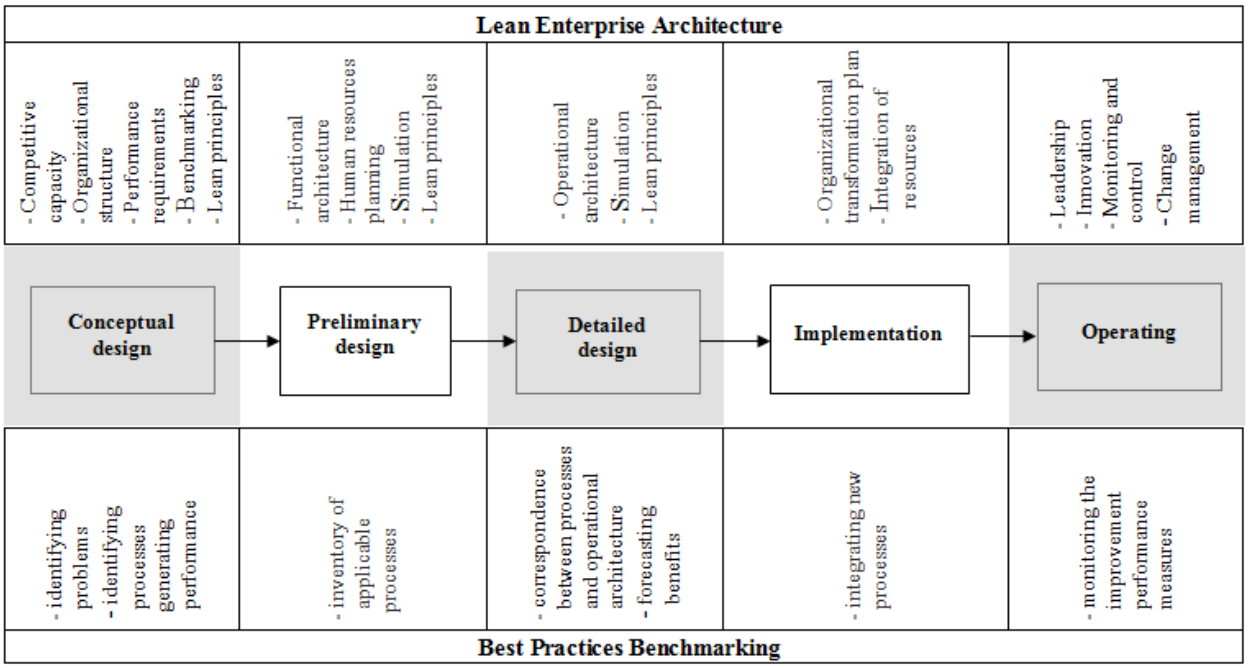

Fig. 1 A framework of implementing Benchmarking-LEA in Air Force

In order to achieve the desired performance characteristics on organizational lean architecture the best practices associated with benchmarking functions and processes are identified and described (Tab. 1).

Aviation technology insertion (ATI) creates a number of difficulties both organizational (technological training, compatibility, operational planning, safety) and local / national (technology transfer). ATI process management provides a flexible, quick and effective response to the demands of modern operational environment. The possible Best-in-ATI Organizations' could be Egyptian Air Force and Polish Air Force (both changed fleet of MiG-21 with multi-role F-16 aircrafts in order to upgrade their military capabilities). Throughout the process of benchmarking, an integrated project team (IPT) in collaboration with decision makers (strategic and operational level) manages the implementation and transformation. Informational resources needed to implement Benchmarking LEA model are diverse: survey (administered by appropriately by questionnaire); web-search (Research Institutions, Institutions benchmarking); reports (from military briefings or news media); scientific research (conferences and workshops papers, PhD Thesis, books).

Tab. 1 Benchmarking Functions, Processes and Best Practices Atributes

Functions	Processes	Best Practices Atributes
Management and Administration	Decision-making powers	- Full integration of all functional areas into an iterative and closed-loop process, with the embedded ability to monitor success and to identify improvement opportunities - Performance management team
	Administrative structure	
	Lean enterprise strategy	
	Redundancy	
	Bureaucracy	
	Audit systems	
Human Resources	HR planning	- Implementation of an accredited quality HR management process throughout the organisation - Adequate training
	Organization structure	
	Education	
	Training	
	Operational culture	
Facilities and Technology	Infrastructure assets	- Asset condition assessment - Process capability analysis - Integrated IT products
	Information Technology	
	Prediction, monitoring and intervention systems	
Logistics Support	Costs of logistics	- Performance-based logistics - Risk management - Implementing resource planning systems
	Transportation	
	Contracting	
	Supply Chain	
	Warranty	
Maintenance, Repair and Overhaul	Budgeting and cost accounting	- Agile MRO facilities using performance-based requirements - Adopt "Just in time" inventory program - Empowered multifunctional work teams - Sustaining manufacturing capability
	MRO planning	
	MRO-decision support tool	
	Location of maintenance checks	
	Availability of supplier resources	
Environmental Performance	Noise impacts	- Formulate a regulatory framework - Monitor air quality and noise - Implement new energy-efficient technologies - Develope fuel efficiency improvement programs
	Emission impacts	
	Power consumption	
	Fuel consumption	

4. CONCLUSIONS

Achieving Romania's assumed objective as a security provider in this sensitive region of Europe is possible in the context of the strategic decision to change the fleet of combat aircraft.

Integration of new aviation systems is not an easy task. Its success is conditioned by the result of the interaction between several factors (training, equipment, personnel, infrastructure, doctrine, organization, information, logistic - TEPIDOIL). The result of such a project is difficult to predict.

The military organization is subject to significant elements of uncertainty in the strategic connections between units and functional cells in the context of ATI. On the one hand there is the influence of the external environment (dynamic security context, technological, budgetary constraints, operational capability requirements) and secondly the impact on strategic units and cells (TEPIDOIL domains). Thus, this Benchmarking LEA approach in Romanian Air Forces may be supplemented to take into account both internal dynamics and the external presented.

Defining performance process – strategic-indicators and identifying best practices do not fully solve this complex problem, a number of challenges resulting from the analysis of possible partners for evaluation:

- increased costs (operational - amid requirements and system reliability "rating standards pilot"; training - providing the necessary flow of training of seafarers to avoid the rise of inactivity problems; the expansion and modernization of operational capabilities - infrastructure, simulation centers);
- limited capacity to absorb investment funds in national defense industry;
- overcoming institutional resistance to change (technical, operational or cultural).

The project must not remain a unique exercise. Future research is directed toward developing Benchmark Performance Metrics based on information provided by the best practice case studies and questionnaires in order to significantly improve the success rate of such an investment project.

Developing a model that incorporates institutional benchmarking process becomes extremely useful in decision making in the context of continuing the trend of acquisition of new military systems.

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CIRCUMTERRESTRIAL COSMOS, THE NEW "BATTLEFIELD"

Bogdan-Cezar CHIOSEAUA, Marian NICORICI

„Carol I" National Defense University

Abstract: *History and previous military conflicts have shown that the main objective of every military power involved in an armed conflict is to win the war. But when several forces are involved and the achievement of this objective is dependent on various factors, it is mandatory to analyse, think of and take a decision regarding the course of action. This is the moment when the paradigms of swiftly adjusting to the situation in the field and to any potential changes, of decreasing the level of uncertainty and of estimating as accurately as possible the enemy's course of action, take shape. All these approaches, given a space dimension and applied to the aerospace military actions, represent real challenges for military strategists and tacticians. The new structure and the highly dynamic and unpredictable operating mode of the military space technologies, coupled with the factors and characteristics of the space environment, require some special procedures and operational components adaptable to the constant evolution of the aerospace forces. The present paper underscores the need for the space dimension to be included as a new zone for conducting military operations, this dimension being defined as a new „battlefield" which requires strategies according to which space power is an indispensable and an extremely important component of the future armed conflicts allowing for endless possibilities and courses of action specific to a wide range of conflicts.*

Keywords: *space, satellite, power, rockets, security, orbits, space programs, missions, crew*

1. INTRODUCTION

The military aerospace actions are the prerogative of the space power, and the space power is the branch which either uses military systems with specific functions in exploring, controling and monitoring the space and which can use its military component in producing a certain effect on the enemy, or, in case of an armed conflict, which can provide support and information to other armed forces branches in order to achieve supremacy on the battlefield.

Using as a reference point the examples and patterns suggested by history, the evolution of the space power can be anticipated.

In a similar manner to the air, navy and ground forces, space power may apply some of the common procedures, and may adapt some strategies and doctrines.

However, the action-related techniques and most of the combat methods are applicable only to space and only to the space power elements that act in this environment.

Thus, the circumterrestrial cosmos becomes a territory for military actions, a possible conflict zone, a new battlefield for the military powers that are endowed with space techniques and forces.

The modern techniques and technologies used and the terrestrial and space systems that are being used in military space actions grant this power a superior operational value, extremely complex and effective, including in the context of non-conventional or asimetric war-like confrontations.

By thoroughly analyzing the possibilities of action of space power and the way in which this power interracts with other armed forces branches, it becomes obvious that space power is directly related to the technical capabilities and technological innovations, to the economic power and people's intelligence, all of them building an invincible military power with highly accurate and efficient reconnaissance, monitoring, communications, guidance, navigation and combat capabilities.

2. AEROSPACE FORCE AND MILITARY ACTIONS IN CIRCUMTERRESTRIAL COSMOS

A basic strategy rule, empirically drawn based on the evidence of two and a half millennia of armed confrontations, is the one that highlights a strategically important objective for one of the parties involved in a conflict, if only because it is important to that party, is worth being attacked by the party involved in conflict and annihilated as soon as possible.

Defending and protecting that particular objective and identifying the threats/attacks which may be innitiated against it, are a priority for the force involved in the conflict, the 'defender', and the achievement of these defensive requirements can easily be realised from space, with the help of the surveillance means, technicians and space technologies.

So, geopolitically speaking, space acquires the status of a very important zone, a true battlefield, a vital area not only for undertaking military actions, but also for carrying out daily activities.

The control the area above the Earth's atmosphere, ranging from 100 kilometers above the sea level, in all directions, to the infinite of the Universe, attaches a highly strategically importance to a state, entity or alliance, in achieving their own interests and purposes. In fact, the decisive nature of confrontations, the syncronising and integrating of combat actions, the accurate and decisive strike of the enemy's vital points are becoming more and more dependent not only on the cosmic means and components, but also on the space techniques and technologies which are increasingly being used in conducting and controlling the military actions.

The sum of the space means, components, systems, techniques and technologies and the way they interact from a military standpoint are specific to m.o. of an armed forces branch, for which reason the terms *aerospace force* and *space power* must be created and used. These new concepts, aerospace force and space power, result in extending the military actions on a vertical axis, fact which allows the military elements and systems to act when and where it is necesary, without geographical and physical limitations, as in the case of the other armed forces. Moreover, the armies that are not equipped with such a technology and do not own any space means, cannot speak about a real space power in the context of an armed conflict, even if during peace time, the space power *'manifests itself in a concrete manner if only to discourage a potential aggresor'*[1]. To illustrate this, we could analyze by means of the space observation-exploration actions, an extremely important indispensable military action of a power which, although it does not represent a threath to those affected by such actions, is still a discouraging or dishearteaning factor for the potential opponent, who finds himself in a position in which most of his actions, and troops maneuvers are known, thus revealing his intentions, and he cannot take action or come up with solutions to counter these actions.

The term of *space power* is used for the first time in 1964, when strategists and theorists analyzing air power, and facing an increasing rate of missions and flights into the outer space, tackle this issue, but they do not define it as an armed forces branch.

Later, in 1968, lt.col. David Lupton, an officer in the United States Air Force, publishes the paper *'On Space Warfare, a Space Power Doctrine*"[2], a paper in which he exposes a first version of the space power definition, based on the similarities with the definitions for ground, navy, and air power offered by Mahan, Billy Mitchell, Hap Arnold and other authors. Thus, they believe that for an accurate definition of space power, three characteristics must be taken into account:

-it must be an element of national power;

-its purposes must be military and non-military;

-the space systems it uses may be military and/ or civil.

In conclusion, Lupton states that space power represents '*a nation's abillity to exploit extraterrestrial space for acomplishing national purposes and it includes the sum of a nation's astronautical capabilities. Only a nation that owns such capabilities and it is able to exploit them can be called a space power.*'[3]

In 1994, after analyzing the space systems, colonel Robert Larned, an officer member of the command team within the department of operations of the Air Force Space Command (ASFC) of U.S.A., expands Lupton's definition, stating that space power represents '*the ability to exploit the national, civil and military, security space systems and the strategic infrastructure of national security.*[4]

His argument draws upon the division of space techniques, technologies and actions into least three systems of distinctive properties, such as:

- a system deployed in space (like those placed on the terrestrial or geostationary orbits);
- a single or multiple terrestrial or offshore system (such as detection radars, command and control centers, missiles and launching pads, infrastructures of firing ranges and training centers, weapons and ammunition factories, research and test centers etc.)
- a system designed to establish communications links.

Given these elements, as well as the importance and the need to develop these new branches, in the 90's American military analysts attempt to define space power by separately analyzing the two terms (power and space), and later on, they combine the defintions obtained in order to create the commonly used concept of *space power.*

Consequently, they defined space as being „*the area above Earth's atmosphere, infinitely spread and in all directions, starting from approximately 62 miles (100 Km) from the Earth's surface*"[5], and power „*the ability of a state or of a non-statal actor to fulfill its purposes in the near presence of other actors situated on the planet.''*[6].

The final result is the definition of space power, the accepted and most commonly used version, the one that states that „***space power*** *represents the ability of a state or of an non-statal actor to fulfill its purposes and objectives in the near presence of other actors situated on the planet, through the control and exploiting cosmic space"*[7]. The growing importance attached to the use of space power, and the capabilities involved, considerably improve the security assurance levels, a fact also shown by the authors of United States Space Operations Doctrine, who in the document 'AFDD 2-2, Space Operations', attribute „*the capability of using the aerospace force for the support of the national security strategy and for the acomplishment of national security objectives*" to space power [8]. The dimension and the facilities avaible in the circumterrestrial space have transformed this area into one in which a lot of of civil, guvernamental and military users perform their daily activities, users who are reliant on satellite communication services, the Global Positioning System (GPS), TV or radio transmisions or information about clime changes and weather conditions that might affect certain areas. For both these users and the space power, the constituents the elements comprising the infrastructure necesary to produce, use and exploit this area are defining, these elements relying on the modernisation and adaptation of the domains and branches to which they belong and which might be grouped into the next categories:

- hardware elements or facilities and equipment used for manufacturing and launching multiple space means of command and control;
- technology-related elements: laboratories, institutes, medical and technological research centers, special means of transportation, energy sources;
-industry-related elements: especially private industry because of the high costs and inovation needs in many branches;
-education-related elements, in order to allow for, among others, the access of a high number of universities, in order to educate engineers and specialists able to develop advanced space research programs;
-specific geographical elements, requiring a vast teritory propitious for executing launches and other experimental activities;
- elements related to intellectual climate, traditions, and activities fostering public awareness, moral and intellectual support for space activities in order to promote confidence in space bodies and organisations.

Following analysis of the space power concept, including the levels onto which it is structured, it became necessary to include in the analysis other elements as well, some of them intrinsic to this power.

So, the elements that belong to the space systems used only for military purposes, along with those of the comercial ones, that belong to the civilian systems and with those the belong to the infrastructure and to the scientific and research field delineate the space activities.

By analyzing space activity from a military point of view and by using as a reference point the laws and principles that affect the organisation, planning and performing of military actions, it can be concluded that space power has a defining role in undertaking modern military actions, and the way in which it is used depends on the strategy, on the commanders' abilities to act at a tactical level, on the intelligence and data made avaible by the space systems. Consequently, we could state that the use of space power relies on military art, the one which „*just like any other arts has its own theory and principles, otherwise it would not be an art"*[9] .

The action-related elements of space power include both offensive and defensive components. Therefore, satellite and anti-satellite weapons (ASATs) are operated both as intercontinental balistic missiles (ICBMs) and anti-balistic missiles (ABM), with launching rockets (boosters) and intercepting missiles, with both manned and unmanned space ships, as well as with an infrastructure developed on the ground, composed of radars and space surveillance sensors, command and control centers, communication networks and facilities destined to launch military operations in or through space.

All these rely on technologies and infrastructures which have required substantial investments on the part of the great powers and states with a vested interest in the air space, investments whose beneficiaries are agencies and departments that manage space activity.

The importance that the great powers attribute to space power has become even more evident in the last period, when U.S. and former- U.S.S.R. investments made between 1980-1990 have reached almost 80 billion dollars on each side, with the purpose of building military space means[10], and facilities for launching, conducting and coordinating these from the ground. Moreover, between 2013-2014, other important investments have been made, such as those made by the European Space Agency whose budget has reached 4.1 billion euros (Germany 22.9%, France 22.6%, Italy 10.5% and Great Britain with 8.1%) [11] or of the U.S.A., who is planning to invest 17.6 billion dollars in NASA .

Struggling to maintain Russia as an elite space power, in September 2014 the Russian president Vladimir Putin declares that 'Russia will become a space superpower" [12] and, to be more convincing, he reveals the sums alloted to the construction of the new Vostochny space cosmodrome, near the Chinesse border.

Thus, Russia has planned to spend approximately 100 billion rubles (almost 17 billion dollars) for the cosmodrome that will replace the one at Baikonur, in use since the U.S.S.R fell apart. By the end of 2015, this figure will be supplemented with another 50 billion rubles (8.5 billion dollars) [13].

The main reasons that justify these huge investments are:

-fame, pride and prestige, in connection with the race to conquer the space, arguments that highlight a nation's high level of development;

-the contribution to the development of technologies in the field of communications, and of the means of surveillance of ground targets and strategic points;

-the development of the space scientific and technological research;

-the designing and building of a military force in the field of security and defense;

-the overcoming of boundaries and finding of a solution to colonise other celestial bodies.

It can, therefore, be said that considerabile efforts are being made in order to obtain and maintain the status of space power, a power compelled to protect its investments, a power that is incresingly plausible, discouraging and highly effective in new armed confrontations.

3. CONCLUSIONS

Nowadays space power is becoming the component that assures space supremacy, the kind of force that fully controls the circumterrestrial space and imposes domination on the new battlefield so that it prevents the enemy from undertaking action in this area, from placing on the orbits any system or device, so that the freedom of action belongs to the one who has space supremacy.

In conclusion, the space dimension of the military confrontations is similar to those on the ground, in the air or at sea. It defines the ability of the parties involved in a conflict to impose their will in the circumterrestrial space in the form of airspace operations and combat actions on all levels: strategic, operative and tactical. The growing importance, size and dynamics of the military actions in this field highlight the role and the position of the aerospace force in modern warfare.

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HYBRID WARS IN THE AGE OF ASYMMETRIC CONFLICTS

Andrei JOSAN, Cristina (COVACI) VOICU

Bucharest University of Economic Studies, Romania

***Abstract**: The beginning of the twenty-first century was marked by proliferation of hybrid wars, held between flexible and sophisticated adversaries engaged in asymmetric conflicts using various forms of warfare according to the purpose and timing. The emergence of this new kind of war specifically for the new globalized economy, increasingly integrated and polarized, has questioned the traditional and conventional military thinking, generated a debate on the definition of the new concept of hybrid war and appropriate measures to take in order to adapt to the new reality imposed by it.*

***Keywords:** asymmetric warfare, conflict, hybrid wars, hybrid threats, security, warfare*

1. INTRODUCTION

Throughout history, especially after long periods of peace, has always been difficult for contemporaries to identify changes in the nature, type and character of the war.

In the same time you may see that after periods of economic growth we'll face decline and recession. Are those two connected? Today we assist to a very difficult period for economic environment. Humanity or specialist has no answer for the needs of society itself.

Is that because we traverse a distinct period that we never have faced with or is that because we didn't adapt to society evolution and we didn't learn previous lessons about economy and how these interacts with conflicts, security and societies responses to these events.

Being difficult to make economic predictions changes in economic and political life were determined by circumstances, changes or adjustments in the use of technology and the dynamics of conflict.

Although, there have always been well-established principles and strategies of international relations. Modern prophets of the apocalypse, including Robert Kaplan (1994), Francis Fukuyama (1992), Samuel Huntington (1996) and, to a lesser extent, David Kilcullen (2013) offered a vision of a future world dystopian, characterized by anarchy Thomas Hobbes, while others, such as Martin van Creveld (1996, 1999) and Phillip Bobbitt (2003) found that the state is in terminal decline as an actor in international relations, which pave the way for the establishment of chaos and war (Johnson, 2014: 1).

Others think that future war will bear "amongst the people", "in the presence of civilians", "against civilians" or "civil defense" (Smith, 2006: 5), leading to massive loss of life among them. Britain's official military doctrine from 2009, refers to the character of the war in negative terms and defines future hybrid battlefield of the future as inevitable one "*contested, congested, cluttered, connected and constrained*" (MOD, 2010).

Also, most work on global strategic trends provide a violent future marked by conflicts over diminishing natural resources, climate change and population growth.

On the other hand, in contrast, lies a series of projections of future supporting, based on statistics that the number of wars both major and minor, tend to diminish (Pinker, 2011).

But the best clues about the type of war near future are provided by the current asymmetric conflicts, conflicts that take the form of widespread insurgent movements involving operations in rural and urban areas with the support and sympathy of the local population against coalition interventions West led by the United States (in the Middle East, Africa, Afghanistan, Iraq, etc.) or insurgency backed by a foreign power against their own governments (hybrid warfare waged by Russia in Ukraine).

Conflicts of today's world shows us clearly that we live in a world of conflict unconventional hybrid, becoming more numerous, that they will probably coexist in the future, with classic conventional wars, held directly or through intermediaries. (Johnson: 2014: 71).

2. HYBRID WAR: A DIFFERENT TYPE OF UNCONVENTIONAL WARFARE

During the Cold War, all conflicts were analyzed and interpreted in the context of ideological and strategic confrontation between alliances grouped around the two superpowers, the United States and the Soviet Union. Cold War led to a strict division of spheres of influence that made potential threats to be much more predictable and resolved. After 1991, the end of the bipolar world stable opened a new era marked by bloody conflict in the Balkans and the former Soviet Union in the 1990's and the collapse of the Soviet Union and the Warsaw Pact has triggered a moment of unification in international relations in conditions under which the United States became the sole global power. Numerous conflicts erupted in the aftermath of the Cold War marked a new phase in international relations, the use of force in interstate conflicts has become acceptable again, a situation illustrated by the two Wars against terror, Iraq and Afghanistan initiated by the US after the attacks of September 2001 conflict between Russia and Georgia in the summer of 2008, the NATO-led intervention in Libya in 2011 and Russia's recent military operations in Crimea and Ukraine (Bachmann & Gunneriusson, 2014: 11). It is obvious that strategic stability that has prevented any direct military confrontation between NATO and the Warsaw Pact no longer exists in the twenty-first century.

Military analysts and international relations theorists have noticed that the beginning of the twenty-first century was marked by proliferation of *hybrid wars*, held between flexible and sophisticated adversaries engaged in asymmetric conflicts and using various forms of warfare according to the purpose and time chosen. The emergence of this new kind of war specifically for the new globalized economy, increasingly integrated and polarized, has questioned the traditional and conventional military thinking, generated a debate on the definition of the new concept of *hybrid war* and appropriate measures to take in order to adapt to the new reality imposed by it. (Glenn, 2008: 73).

Currently, the traditional classification of conflicts between *Big and Small* versus *Conventional and Irregular* is too simplistic and does not reflect the realities of the contemporary world, a world in which both non-state actors and state using increasingly more unconventional forms of warfare and simultaneously support, encourage and participate in conventional armed conflicts (Hoffman, 2007: 5).

Conflicts are becoming more characterized by a hybrid combination of traditional and unconventional tactics planning and execution of decentralized and involve state actors and non-state technology that uses both simple and sophisticated in innovative ways (Conway, Roughead Allen, 2007). An important feature of contemporary art of war is how to wear war convergence in the sense that we are witnessing a *convergence* of factors both physical and psychological, of the kinetic and non-kinetic, combatants and non-combatants, of state and non-state actors. This convergence has made irrelevant classical distinction between types of warfare - conventional warfare, unconventional, terrorism or criminal activity - given that we are witnessing a proliferation of a diffuse type of war, worn in different ways having many variants (Gray, 2006). In the view of many military analysts, the *hybrid war* will be the new type of war that will characterize the twenty-first century, a war in which opponents will use unique combinations and hybrid threats to attack enemy targets by speculating vulnerabilities. Distinct challenges caused by opponents that use fundamentally different approaches, conventional or unconventional terrorist will be replaced by some from the opponents *simultaneously* using all forms and all conventional and unconventional warfare tactics, including criminal activities (smuggling, narco-terrorism, illegal trade with last generation gangs, exploiting urban criminal networks, etc.) that destabilize governments and provide resources insurgents. Security challenges currently not come only from a State which selects one of the forms of waging war, but increasingly more from the states and/or groups of non-state actors that selects the whole arsenal strategies, tactics and technologies best suited to achieve the goal and combine them in unique and innovative ways according to their own strategic culture, geography and purposes. In the contemporary world, globalized and technologically prepared, asymmetric conflicts fought between opponents in diffuse conflicts, the line between insurgency, terror and conventional warfare are increasingly irrelevant, have shown that organized groups in the networks have a capacity of warfare similar to that of nation-states, managing a series of victories against them (Arquilla, 2007: 369).

Hybrid war that can be worn as well by nation-states, and by non-state actors, incorporating the entire spectrum modes of warfare, including all conventional military capabilities, tactics and combat units unconventional terrorist acts challenge chaos, violence discriminatory, cyber-war, financial, media, etc.

These multi-modal operations can be performed by separate units or even the same unit but generally are conducted and coordinated tactical operations in the same battlefield in order to achieve *synergies* both in terms of physical size and psychological conflict.

Results can be obtained at all levels of war and, therefore, there is a *compression* levels at which wage war situation is complicated by the simultaneous *convergence* of modes of warfare.

The novelty of this combination of types of war used and innovative adaptations of existing weapons systems and hybrid threats is the *complexity* of increasingly large.

The hybrid forces and weapons systems can effectively incorporate advanced technology in their structure and strength of their strategy that you can use in innovative ways, different and sometimes more effective compared to standard parameters and ways in which they are usually operated. Therefore, from an operational perspective, the spectrum of limited operational capabilities, hybrids are *superior* military forces available to Western countries (Nemeth, 2002).

Hybrid wars are nothing new, but they turn to have different approach.

The history of military conflicts revealed that in most wars were no military operations both conventional and unconventional.

In cases where there was a significant degree of strategic coordination between conventional and unconventional forces that operate separately these wars were described as *compound wars*.

The combination of conventional and non-conventional military capabilities, whether tactical or operational have been integrated, not an entirely new historical phenomenon, as evidenced by the military history of the American Revolution, the Napoleonic invasion of Spain, the American Civil War, the Boer wars, Arab revolt against the Ottoman Empire during the reign of T.E. Lawrence, the war in Vietnam when the unconventional tactics of the Viet Cong's were combined with the conventional North Vietnamese Army, the Russian-Chechen war, etc.

The major difference between the wars and the hybrid combination is given by the extreme complexity of how merging conventional and unconventional military capabilities. Compound wars provides synergy and a high degree of combining conventional and unconventional capabilities at the *strategic* level, but do not reach the complexity, the simultaneous fusion and *operational* tactical battlefield of hybrid wars. If compound wars unconventional capabilities were more distractions role opponent, harassing thereof in a theater of war separately or in adjacent rear and due to the fact that it is based on a separation of forces operating concept compound war does not cover the full spectrum of war diffuse mode hybrid conceptualized war.

The most important change, distinctive character in terms of modern warfare is the *blurring* and *blending* modes and types of war. Hybrid war combines lethality of conventional armed conflict between states with fervor and fanaticism unconventional war. For such hybrid wars, opponents (states, groups sponsored by states, non-state actors that are self-financing) will try to gain access to modern military capabilities, advanced weapons systems technologically, to create and support large-scale insurgency whose tactics will involve the creation of ambushes, the use of improvised explosive devices and assassinations that they will combine with high-tech capabilities such anti-satellite weapons, terrorism and cyber war directed against financial targets. For example, if it was between Israel and Hezbollah in 2006, during which it was clearly demonstrated that non-state actors have the ability to study and exploit vulnerabilities to deconstruct Western style of warfare by highly efficient countermeasures (Johnson, 2010). State actors, in turn, to turn their conventional armed forces units that adopt new tactics of unconventional warfare adapted hybrid (as was the case of the Fedayeen in Iraq in 2003) or opt for a merger between conventional forces with some unconventional, such militias highly trained fighters, equipped with sophisticated weapons. A good example of a *hybrid war* is ongoing conflict between Russia and Ukraine. The Russian offensive policy was manifested by territorial annexation of Crimea in April 2014 by threatening the use of military force by separatist groups operating support provided in Ukraine through initiation of covert operations of Russian Special Forces. That happened by hiring mercenaries by cyber-war, economic and media, against Ukraine. Russian operations shows that hybrid warfare can be adopted with very great success by state actors in asymmetric conflicts and highlights some defining characteristics of the new type of war: the non-declaration of the state of war; the use of armed civilians in military operations along the lines of asymmetric conflict; collisions without direct contact by blocking military installations by the so-called protesters; using asymmetric and indirect methods; simultaneous battles on land, air, sea and cyberspace; advantage using media in a manner that demonstrates that, far from being a peripheral component, it is the backbone of the new type of war in the post-industrial; troops management in a unified informational sphere (Berzins, 2014: 4). Russia does not recognize the existence of a state of war in Ukraine and simultaneously organizing complex military operations planned in a holistic manner, involving regular armed forces, special forces, armed and unarmed civilians, paramilitary forces, all in a hybrid war, whose nature remains largely undefined (conventional war or civil war? aggression interstate or intra-state conflict?) (Bachmann & Gunneriusson, 2014: 15).

The conflict in Ukraine may lead to a new balance of power in the region, given that NATO and the Western world in general were unable to respond quickly, coherent and concerted Russian aggression. The fact is that the *hybrid war* in Ukraine has brought Russia into leading player position in the region and exposed, on the one hand, vulnerabilities EU states dependent on Russian gas and, on the other, NATO, whose hesitant reactions were determined so the limitations imposed by Article 5 of the Treaty authorizing the use of force only for collective defense against an attack of the Member States and the frictions between the Member States were unable to reach an agreement regarding actions against Russia. Also, at least so far, the failure to adopt effective economic sanctions against Russia revealed the weaknesses of contemporary globalized economic system.

4. CONCLUSIONS

Hybrid wars require redefining rules requiring international order, as to date, the international community and the law of war were directed by limiting the opportunities for action in conventional conflicts like those in the twentieth century. The new type of hybrid war will cause a paradigm shift in the military doctrines, extremely complicated endeavor, as shown if NATO abandoned in 2012 the so-called Comprehensive Approach doctrine based on recognition of the existence of *hybrid threats* in *NATO's Bi-Strategic Command Capstone Concept* of 2010, while the National Security Strategy of the United States in 2002, reconfirmed in 2012, is clear on certain *hybrid threats* (NSSUSA, 2002, 2012). Also, to make hybrid threats to international security is necessary to rethink the role of states, non-state actors such as transnational corporations and NGO's in a globalized, interconnected and interdependent, increasingly more conflicts, military, economic, cyber, information and media takes place in a battlefield universal and abstract.

Lethal capacity and capabilities of organized groups whether or not sponsored by state actors are increasing and state actors are increasingly inclined to adopt unconventional ways of warfare. These trends require a review of the way tactics are viewed and unconventional means that until now they were considered to be the only weapons they could use in asymmetric conflicts non-state opponents weaker in confrontations with state actors that had the overwhelming superiority. In the future, it is likely to assist in the adoption and use of specific capabilities of hybrid war by more and more state actors. Instead of weakness, future opponents may exploit such means because of their effectiveness, and they may, as Frank G. Hoffman stated, come to be seen as *tactics of the smart and nimble*. (Hoffman, 2009: 37-38).

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ASPECTS ON THE OPERATIONALIZATION AND THE USE OF MILITARY POWER IN MULTINATIONAL OPERATIONS

Dorel MIRON

Land Forces Headquarters, Bucharest, Romania

Abstract: *The need for regional and international stability, which is politico-military in its whole, led to the merger of efforts to maintain a balance of power of the main strongly military industrialized countries. The criteria of accomplishing the alliances went beyond the technological development and have a strong expansion on the "strategic" partners with an economic and military potential which is heavily undersized compared to a widely accepted standard within the alliance. In this context, it is particularly important to review the factors bearing a direct and indirect influence on the operationalization and the use of the military power in multinational operations. It is vital to identify the most optimal solutions and to implement new, innovative concepts that will be able to integrate the spectrum of risk and information uncertainty situations based on a dynamic management of the defense resources. In our research of the manifestation of economic influence on the defense resources, we have identified new lines of approaching the military potential within the land forces participating in the multinational operations in the latest theaters of operations where the Romanian military forces were present. In this sense, we make known our concern for defining an integrator operational environment for expressing the solutions of collaborative workflow within the alliance and beyond.*

Keywords: *security, operational environment, multinational military action, appropriate resources, resource supply flow.*

1. INTRODUCTION

The transformation of the contemporary society as a whole, the inventions and the technological innovations in all fields have led the developed states towards new and new directions in order to meet their own economic and not only economic interests, in the wide range of expression of power.

The needs for representation and affirmation of state or alliance identity have increased considerably and the issue of safety and security of the contemporary socio-economic level has become one of the major issues of the regional and international stability.

The hot spots of political and military instability can be anticipatory identified and isolated in order to prevent and end conflicts, to limit the extension of disastrous effects that could be generated in case they got out of control.

2. ASPECTS ON THE OPERATIONALIZATION AND THE USE OF MILITARY POWER IN MULTINATIONAL OPERATIONS

2.1 Aspects on the operationalization.

The terrorist actions associated with the outbreak of regional conflicts on a smaller or larger scale, challenge the reaction capability of the military and non-military stability forces, at multinational joint working level. For example, there are well known the efforts to maintain a climate of normality in the air traffic affected by the events of September 11, 2001 or the incident in the Ukrainian airspace with the Malaysia Airlines company on July 17, 2014 and other such events. All these negative circumstances out of control may seriously affect the stability of a branch of the economy, such as air transport. The nature of the means of action and the change of attitude about the multinational joint work have generated new directions on the concept of providing and allocating resources, irrespective of their nature: human, technologic, organization forms, strategies or doctrines.

Therefore, new critical structures are identified which, by their damage, may irreversibly affect areas of economic stability, either socio-political or military, not long ago known as safe areas or fields.

Our research was focused on understanding the mechanisms, the modes of action of the destabilizing factors, especially on the multinational elements, on critical areas and on identifying the similarities at the level of expressing the abnormalities, and on formulating solutions in a personal manner.

The process of planning military action refers directly to a particular way of defining the area of military confrontation, of identifying and appointing the operational environment, which following personal observations is perceived differently at the level of the military structures participating in multinational operations. This different "perception" of the conflict implicitly reflects on defining the framework of the military action that is generated by the so-called "background" of each category of forces and its state affiliation.

The means of approaching a target, of expressing missions, of allocating human, material and time resources are, and are displayed differently depending on the event to be managed from a multinational perspective. The multinational military action requires by its very nature efforts to balance all the elements of the early planning stage until the end of the conflict, meaning the achievement of the desired end state. It is very important to understand the issues related to the joint work at the level of the force, to timely identify the differences at the conceptual level regarding the means of using and logistically supporting the force, of replacing the damaged parts and of regenerating the important elements of the military operation on the whole.

Our observation is the need for understanding and defining the behavior in an operation (combat) of each participant in multinational activities, for defining priorities on specific issues not expressed in general, due to the different way to react to the same category of stimuli specific to the theater of operations. After identifying the particular means of approach of different categories of forces under the same operating conditions, we can proceed to the next step, namely the balancing of the complementarities between the concerned parties analyzed in the matter. In a different context, General Patton expressed the plan of operations as an information plan, in the sense of the plan you build upon as much as you are required and as far as the opportunity allows it.

Therefore, we consider the innovative sequential approach to be appropriate in the multinational operational environment, in the sense of "dosing" the joint effort on the peculiarities identified on the behavior of each component in the first stage: "the identification and the definition of the predictable behavior of the forces participating in multinational operations."

Another guideline that we have identified consists of the means of assigning special resources, not only depending on the specificity of the forces involved but especially on the event that can occur at some time after the confrontation or the interaction with the enemy forces. The anticipation of certain events is not sufficient unless it can be supported by the adequate resources, designed for a specific sequence of the operation.

This approach requires the identification of several response options, taking into account the risks that may appear and the opportunities that may take place at a certain time. Setting the courses of action and conducting the war game seem to be sufficient for the identification of risks and opportunities. The situation is somewhat different in a multinational context because of the danger of fratricide and especially of the inappropriate sizing of resources per unit of event. The approach of the course of operations in a multinational context, from our point of view, requires the development of an algorithm to cover the functional aspects per event. Such an algorithm involves the understanding of the drawbacks, of the differences generated by some peculiarities of the force, by its mode of action in the multinational context overlapped with the interaction with the opponent and implicitly with the effects of the extended battlefield.

2.2 The use of military power in multinational operations. The personnel involved in the process of planning a multinational operation can easily understand the implications of the internal, but also external, determinations of the dynamics of the armed forces. We acknowledge the importance of addressing both types of determinations due to the specific influences that they may generate corresponding to each factor separately, but with a cumulative expression potential due to their interconnection and interaction. In this regard, the external determinations are: the actual process of globalization, the revolution in the field of military affairs and weapons systems, the new features of the contemporary security environment, the changes occurring in most modern states' armies or the reliance on the affiliation to a particular alliance or politico-military "agreement".

In retrospect, the Romanian Army militaries' participation in multinational missions of suppressing terrorism, peace support or humanitarian operations is proof of the professionalism and value shown in all the missions where they participated. These coalition type missions were conducted under NATO, EU and UN and they are expressions of fulfilling the commitments that Romania has assumed as a member of the international community. In the same context, we identified and expressed principles specific to the multinational actions in terms of achieving force training and readiness. Training is designed to take place according to the main principles: compliance with the national and NATO doctrine; achieving all goals of preparation for carrying out the tasks undertaken for collective defense and for specific action outside the national territory; the headquarters' (commanders) assuming responsibility for training the structures under their control; maintaining combat cohesion and high morale of the troops as priority objectives of the training. All forms, procedures, methods and stages of training have a common overall objective, namely to build the capabilities necessary for conducting operations in the multinational environment. Thus, the objectives and the content of training, for all echelons, are developed mainly according to the METT-T list of essential requirements of missions and the level of training of each structure. Training the headquarters mainly comprises a set of activities conducted in a unified design through which the unity of thought and action of the personnel is achieved, the act of leading the forces and training are made efficient in order to solve situations that may arise during some real actions. Under the auspices of the effectiveness of the leadership and the balanced use of force, we assert the need for applying and implementing the best lessons learned and identifying new innovative ways based on understanding the "mechanisms" of generating, distributing and redistributing the defense resources in the national and international context. The technological gap clearly observed between different forces participating in multinational operations, must be crossed in the early planning stage in order to avoid transforming it in lessons learned. In other words, if a certain issue is known from the planning stage, we think it is not necessary to assume the potential risk of encountering a disadvantageous event related to the matter, which would be later transformed into "a lesson learned".We support the idea of planning the resources of the force in the so-called context of interaction.

The identification and formulation of the context is the duty of the military planners and not the special obligation of the performers to formulate lessons learned after taking some identified or not risks during the action (by exploiting the opportunity). Most of the times the efficiency of actions in multinational operations was observed only if behind them there was a thorough planning and if the forces were accommodated within a joint action framework and if the acting routine specific to each participating force was eliminated.

In the variant of algorithm regarding the development of capabilities at the level of the European Union shown in figure 1, we can observe that the central position is occupied by the catalog of requirements for fulfilling a mission, as a result of the detailed dissemination of the necessary capabilities identified on a single planning framework.

The expression of the planning hypotheses summed up in illustrative scenarios can be realistic starting points that contribute to the development of a relevant vision of the size of the resources which need to be assigned on a wide range of requirements in carrying out certain missions. The personal contribution to the interpretation of such an algorithm is to identify the sequence of events associated with the important moment of the military action, starting from the planning stage. The expression of the risks associated with each stage may correspond to the "war game" method, only after more possible courses of action have been developed: "the most likely", "the most dangerous" and "the least likely" and "the least dangerous".

The dimensioning of the multinational force can be established not on the basis of the size of the structure but rather based on the criteria of the cumulative summing up the capabilities of the forces which are planned to be employed.

Another principle suggested to be implemented in terms of planning and use of resources is modularization.

This feature of the modular design of the defense resources' command and control system provides more flexibility in its development and use, in the sense that the force commander activates only those items he needs at some point, according to development of the situation, mentioning the possibility of adding other items that were not initially planned. Another advantage of the modularization is the possibility to deploy in the field and thus achieve greater protection by getting cover from the enemy action on a particular area of interest.

We consider important that the valuing of the principles expressed above should be applied sequentially on areas of interest within planning and more than that, we recommend considering the identification of other methods, principles and innovative conceptual models to promote efficiency and the correct sizing of forces in the multinational context. In this regards, we believe that the forms of training having an important impact on the profile of commanders and headquarters are the training courses conducted in the country and abroad, the participation in the planning and conduct of multinational exercises, staff training and the simulation training exercises (SIMEX) in the centers of training by simulation. "The Advanced Distributive Training" was implemented in the Land Forces by developing operational capabilities by extending the forms and methods of conducting the web-based courses, by distributing the constructive simulations in the network (distributed interactive simulation), currently characteristic to the military educational institutions where the commanders and their staffs are trained and specialized.

2.3 Diagrams and charts.

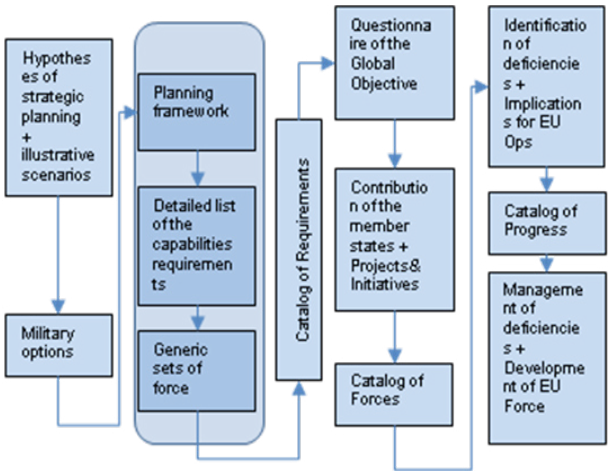

Fig. 1. Variant of algorithm regarding the development of capabilities at EU level

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3. CONCLUSIONS

As following my thoroughgoing study related to the aspects of operationalization planning military multinational operations it has been drawn a series of conclusions and I had formulated suggestions for planning process improvement, respectively for shaping the behavior mechanism for multinational expectation.

The first aspect is linked to comprehension of the interaction amongst generator of power factors, and certain consequences which may emerge thereafter some failures with major impact. In these direction, I had illustrated the airborne events that have been had an effect on air traffic system, and all restrictive measures as of air and air defense military operations sphere of influence.

Subsequent to multinational operations analysis, it has been confirmed malfunctions for the reason of disparate attitude of actors to the action of the same external stimulation group, manner which has concluded in wastefulness during the cure sequences of disadvantage/ crisis situation.

Since different background (technological and approach) of the joint multinational military actors, it can be observed conceptual discrepancies in perceiving the reality of the theater of operations, and the assumptions horizon in planning military operations, especially in stability and support operations.

In this framework, behind conclusions there are realistic suggestions addressed to leaders and planners of joint multinational operations. One of these suggestions is referring to the critical strategic actors' point of view synchronization.

In order to produce realistic scenarios, linked to contemporary technological reality, and placing on the list of priorities the external stimuli group, as socio-economic terrorism – non-military and military, it has to take into consideration rehearsal training for military planners of joint operations, in a crisis situation context.

In the future, for effectiveness, I would recommend a sequential approach of the military operations planning phases for multinational environment, regardless the character, divided by events that could happen or not (likelihood) – due to the dynamic character of influence factors, preemptive to risks assuming, but pursue the favorable situations, and opportunities design for solving problems with different certainty level.

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CURRENT ISSUES CONCERNING THE WORKFLOW IN THE MILITARY ENVIRONMENT

Daniel ROMAN

National Defence University „Carol I" Bucharest

Abstract: *The radical transformation of the human society under the impact of the unprecedented evolution of the technological informational environment has profoundly influenced the military action, in a broad spectrum. The military specialists identified certain solutions to the problems generated by the complexity of the battlefield which were mainly focused on importing technologized models from other related domains such as economy, engineering and social sciences, mainly from the competitive environments. Currently the workflow is perhaps one of the best solutions that can support the management of complex structures, functions, tasks, alerts, reports, notifications, tasks lists, etc. continuously changing under the permanent influence of external and internal factors, based on predetermined and self-improvable algorithms and processes.*

Key words: *operational environment, land forces, workflow, operative air defense monopost.*

1. INTRODUCTION

The economic field, from a historical and conceptual perspective, can be characterized by excellence as one of the oldest and realistic spaces of confrontation.

Contextually, the deep changes in such a competitive environment may interact directly or indirectly with other different or similar systems, such as the socio-economic, the security, and so on.

Not a few times has the inspiration of the economic models transformed the look and the behavior of military structures by differentiated approach and new attitudes, as products specific to the conflict space, namely the theaters of operations.

The efficient use of the resources and the maximization of the profit transformed the economic organizations into agents specialized to adopt the most appropriate models supported by innovative cybernetic information systems.

The partial understanding of "the mechanism" and the principles underlying the economic interactions between the established structures, resulted in a conceptual approach and in the merge of concepts of descriptive potential of facts specific to a certain military conflict.

The increase of the complexity of the military operational environment determined natural reactions for identifying and implementing certain force management methods and efficiently applying the fighting potential at one point in the armed confrontation space.

Land forces, through their specific tasks, can be characterized by spatial, temporal and operational elements, which require increased and effective multidimensional protection. In this sense, for an integrated formulation of the response options, we highlight the systemic approach to planning military action with the organization, coordination and control of the activities in space and time.

Command and control of the military actions specific to the environment of operation in depth, at contact and in the back, and also the selection of forces on the main direction of effort, on the other direction, in direct support to the main effort and the reserve can be integrated to the concept of systemic approach in order to achieve efficiency.

Relevant to the assertion we made is that the distribution of the fighting power and emphasizing the interaction with the combat environment, especially with the particularities of the enemy's actions. The dual nature of the land forces operations in the physical space on land and in the air, makes us formulate different assumptions on researching the behavior of the specialized structures on confrontation environments.

Thus, we selected as representative behavioral study subject of the land forces the air defence missiles and artillery structures. Rephrased, the mission of every air defence fire system is fighting the air enemy for defending and ensuring the freedom of movement of the troops and assets of combined tactical task forces, where they are deployed / operate; uninterrupted for the entire duration of their mission, both day and night, in all weather conditions.

The research of the rephrased mission of the air defence missiles and artillery structures shows the multiple character of the air defence actions in at least three respects: the air enemy, the objective which has to be air defended and the confrontation environment. If it is relatively simple to interpret the factor of the air defence actions resulted in the air defendable objective by layout, directions and nature of its defensive or offensive operations, the temporality of its actions, not as easy is approaching the air enemy and of course applying the specific environmental conditions. The character of the air enemy's actions in relation to the combat possibilities of the air defence missiles and artillery structures sizes the dimension of the air space of responsibility depending on the tactical and technical characteristics of the air defence systems as shown in fig.01 below.

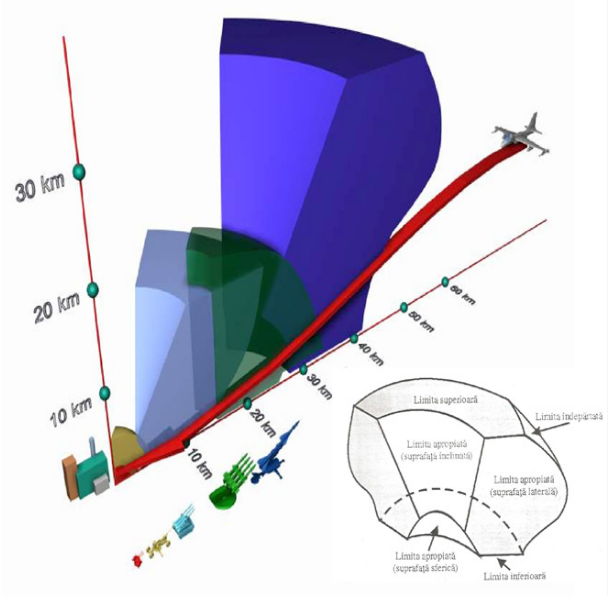

Fig. 01 Tabular representation of the airspace of responsibility according to the specifications of the supplied air defence missile or artillery systems.

The capability of the air defence actions specific to the land forces is given by the implications of the relief, namely the coverage angles which lead to a physical reduction of the airspace of responsibility. We show that this reduction affected by the terrain is not specific to the actions of the air enemy or not to the same extent. In order to identify, at least from this point of view, solutions to mitigate the influence of the terrain, we resorted to the implementation of the six rules of deploying the air defence missiles and artillery troops and assets, as follows: mutual support, balanced air defence fires on directions and in depth, overlapping fires, weighted coverage, early engagement, defense in depth.

Fulfilling the conditions for reaching the aspirations generated by the landforms specific to the deployment area, are limiting and with no prospects of strengthening the fight with the air enemy, from our point of view. Therefore, we turned our attention to understanding the air defence phenomenon and identifying the relationships that can be established between two or more air defence systems.

We observed the sequential nature of fighting the air enemy on distinct phases: reconnaissance of the airspace (to the maximum limit of radar, optical, etc tracking, associated with the terrain possibilities), discovery and identification of the aircraft's affiliation, aircraft classification, continuous tracking of the air target, combat and destruction of the target (conducting the actual air defence firing), ratification of the effect on target and resumption of the action, if required. A second observation is that regarding the original way of achieving combat sequences with the air enemy of different air defence systems. Whatever air defence system we would discuss, it performs the same typology of target engagement and thus operates with the same basics: the direct distance to the target, the size of the elevation and azimuth angles (angular velocities), the target velocity and its flight height, they are all measurements relative to a single reference system: the axle of the fighting machine, the middle of the battery firing position, the command post (the radiolocation station) of the battalion, namely of the air defence missile and artillery regiment. Whichever analyzed structure we take into consideration, they are all characterized by an individual unique system of reference which describes the interaction with the aerial target. To facilitate our approach, we defined the notion of *operative air defence monopost,* namely that air defence reaction system capable of fulfilling autonomously all the phases and sub-phases of the *air defence workflow* from that of reconnaissance of the airspace to that of destruction of the aerial target.

Involving the limitative nature of the air defence workflow from the tabulated values due to the terrain features, the angles of coverage generated by the dynamics of the actions of the land forces (the objective which needs to be air defended) raised the question whether it is possible to adopt the principle of *single frame of reference* (forward edge of the battle area, center of the firing position, etc.) and „bringing" the air defence systems from the state „of fighting in collaboration with..." to the state of „performing the air defence collaborative workflow together with...".

Basically, the innovative idea is to deliberately or conditionally engage the air defence monoposts on each phase and sub-phase of the air defence collaborative workflow (certain constraints regarding the electromagnetic emissions and so on) when they have maximum efficiency, fire power and protection. We emphasize the sequential character of each operational air defence monopost, in other words it can take part only in certain sequences which can be coherent or alternating, which is possible due to a *air defence collaborative platform*.

We justify the reasoning of the air defence collaborative platform by the fact that for establishing the air defence workflow, the radar stations transmit the actual coordinates of the target to the firing channels. The data transmission time, related to the speed of the target creates difficulties for the air defence firing in terms of decreasing the firing areas or the forward edges of the battle areas (fig.01) and approaching the aerial target to the parameter of the critical path of the weapon system. Calculating the time elapsed since the acquisition of the aerial target by the radar station is different for a different radar station or firing channel if we work in cooperation and it can be the same efficient time if we work in collaboration. Basically, by extrapolating the position data (deployment in the terrain) of the components of the air defence system in the two variants, we observe a significant time gain in terms of tens of seconds or even full minutes, which means an effective increase of the fire zone / launch area.

The above statements are supported by applying the following formula.

$$d_{desc} = d_{î} + V_{ŢA} * (t_{zî} + t_{p}) \qquad (1)$$

and

$$D^2_{desc} = H^2_{ŢA} + (d_{î} + V_{ŢA} * (t_{zî} + t_{p}))^2 , \qquad (2)$$

where:

- d_{desc} – the necessary horizontal acquisition distance;
- $d_{î}$ – the horizontal distance to the forward edge of the battle area;
- $V_{ŢA}$ – the aerial target's speed of operation;
- $t_{zî}$ – the flight time to the meeting point of the projectile/ missile and the target;
- t_{p} – the necessary time to prepare for firing;
- D_{desc} – required inclined tracking distance;
- $H_{ŢA}$ – flying height of the air target.

Most often, military planners of air defence operations work with tabular data specific to the air defence missile or artillery systems and omit the essential meanings of the cooperative working relationships or collaborative workflow.

Another aspect is the precision and accuracy of the data, of the informational collaborative workflow (fig.02) regarding the situation of the aerial area of responsibility of the land forces and covering a wider range of heights where the aerial targets can operate.

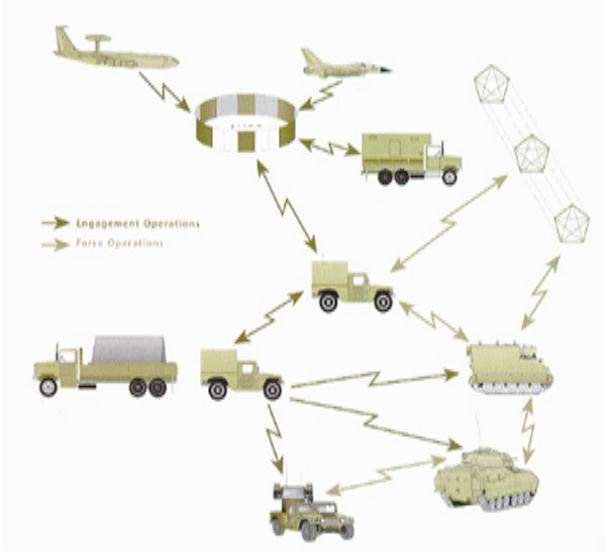

Fig. 02 A functional variant in the "intelligence" section, of the air defence collaborative workflow.

The variant we suggest for the collaborative workflow of the air defence systems of the land forces may be one of the best and necessary responses in terms of effectiveness of the air defense artillery systems in the army is currently equipped with.

Only the development of a collaborative platform for managing the airspace would be the most appropriate means of achieving a viable security of the area of responsibility, linked with technical and tactical capabilities of those connected to such a platform.

This suggested variant takes into account the capabilities of all elements acting on the airspace, from all categories of forces (air, land and naval), they are basically all the beneficiaries of the sum of actions and security efforts in the air.

By comparison, we could compare the air defence collaborative workflow with network warfare, but it goes beyond it exactly by the distribution of the power of decision and control to all the elements integrated into the network.

The advantages of this practical air defence collaborative work method are the following: the reconnaissance, acquisition and tracking of the passive target is performed in secret without the target's discovery of the air defence engagement, thus achieving the element of surprise, firing from concealed positions or

even while on the move; the very short reaction time from the moment of acquiring the target; achieving an economic and efficient volume of air defence fire; achieving greater freedom of movement in the tactical field by undertaking the optical tracking by other air defence collaborative workflow users; the accuracy and the speed in determining the firing elements, etc.

Concerning the disadvantages of this method, we could mention there practically are none, as long as at least two entities in the air defence collaborative workflow network simultaneously track the target, any user logged on to the functional platform (reliable radio connections, GPS) can fire on that target under maximum protection and safety conditions. By extrapolation, we can extend the method of air defence collaborative workflow method to a number of N targets which form a real ”on-line” air image recognized by any user logged on to the platform.

In the future, we intend in our approach to theorize the air defence collaborative models to come up with argumentative mathematical justifications and to fulfill one of the wishes of the national air defence system from the land forces, namely the interoperability of the air defence missile and artillery systems of the current endowment in a practical manner.

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METHODOLOGY OF TARGET ANALYSIS FOR THE ACTIONS SPECIFIC TO THE VERTICAL COMPONENT OF THE BATTLE SPACE

Lucian MOLDOVAN

"POTAISSA" 3rd Anti-aircraft Defense Battalion, Turda, Romania

Abstract: *Ensuring an efficient and flexible use of the air space by all the categories of the armed forces, at the same time respecting the rules and measures for maintaining order in the air space, triggers a reconsideration of the vertical dimension of the tridimensional battle space, in the sense of obtaining a certain degree of control over it allowing reaching the objectives set while land and naval operations are conducted. In this context, there is a fully understandable tendency manifested by NATO states' armed forces to integrate the air force and anti-aircraft forces in NATINADS air defense system and to create and use structures capable of engaging the air enemy, rapidly deployable, and which might comprise command-control subsystems and weapons subsystems, interoperable from the point of view of procedures, reaction speed and mobility, at the level of all categories of forces. The approach used in the present paper is centered on a clearly delimited segment of the air threat, to be more precise, on the analysis and planning of the action of air and anti-aircraft means in order to timely and efficiently engage the air enemy. Also, the article includes an analysis of the target setting process within the process of military operations' planning which facilitates the commander's selection of air targets and allocation of the combat means appropriate for engaging them, at exactly the right time during the military operation. Thus, without being complicated, the process of setting targets integrates in a constructive manner the activity of air and anti-aircraft structures and of fire support structures with the system of military intelligence, by exploiting the capacities of analysis, prediction, and intelligence gathering, allowing the engagement of targets in a unitary manner, established during wargames, in a way that has proven to be fully efficient both in conventional military operations and in the stability and support operations.*

Keywords: *battle space, air space, air operation, target, targeting process.*

1. INTRODUCTON

The modernizing and operationalizing process of the new structures acting within the vertical component of the battle space, having profound implications in the domains of military theory and military practice, has led to the necessity of elaborating a new theory to support their training, leading, endowing and manner of acting. Due to the reorganization and modernization of military structures, there is a need to adapt, organize, plan, carry out and control air and anti-aircraft operations, according to regulations in NATO forces, thus, ensuring the flexibility and rapid and efficient reaction capacity for accomplishing the missions. Thus, taking into account the circumstances of the modern battlefield and the density of users of the vertical component of the battle space, the success of operations conducted in the air space depends a lot on the coordination and synchronization of action of all the forces engaging the air enemy.

As the air and anti-aircraft systems constitute the center of gravity of the fight with the air enemy, their evolution includes increasing the reaction speed, the maneuver capacity and precision, as well as increasing the action range, while developing the organization and possibilities of air space surveillance.

The article presents the methodology of analyzing and establishing air targets, defining for the structures involved in the combat against an air enemy, stressing out the massive use of information technology in command and control structures, moreover in ensuring the interoperability of vertical component structures within the targeting process. Also, the article includes tactics, techniques, and procedures for integrating, synchronizing and accomplishing the missions specific to air and anti-aircraft structures, electronic warfare and fire support, as operating systems in the operations conducted in the air space, according to the air operation conception, applicable both in joint and combined operations.

Thus, the article synthesizes a few directions characterizing the passing to a new methodology of analyzing and setting air targets and to a new manner of working, on the basis of mainly large scale processes such as: getting rid of routine activities, massive use of information technology in command and control structures and, most importantly, ensuring the interoperability of the structures engaging the air enemy in the targeting process.

2. TYPOLOGY OF THE SPECIFIC ACTIONS PERFORMED BY THE STRUCTURES OF THE VERTICAL COMPONENT OF THE BATTLE SPACE

The joint defense of air space includes all the measures and means of air and anti-aircraft defense used for annihilating or neutralizing the efficiency of enemy reconnaissance or air attacks against own forces. The purpose of joint defense of the air space is obtaining and maintaining a certain degree of air superiority, by destroying or neutralizing the enemy air force and missiles.

According to the textbook of air defense „defending the air space represents the measures and actions conducted in order to prevent enemy air attacks or reduce their efficiency and diminish loses of own forces, equipment, and means". The mission of forces and means within the vertical component is to ensure air defense, respectively to fight the air enemy to support own forces' operations through the detection, identification, and engagement of air targets in the air space corresponding to the area established through the operation order.

Active air and anti-aircraft defense enclose all the direct defensive actions, carried out in order to annihilate the enemy offensive air actions or to reduce their efficiency. As resources, active air defense uses air and anti-air means, radiolocation sensors, information and electronic warfare systems, as well as command and control systems and weapon systems that do not have air defense as basic mission.

The specific targets for active air and anti-aircraft defense are the following: planes, unmanned aerial vehicles, helicopters and air-launched missiles.

Taking into consideration that no system of air and anti-aircraft defense can completely annihilate hostile air actions, the active air defense actions are completed with passive air defense measures.

Thus, passive air defense includes measures, other than those of active air defense, taken in order to minimize the efficiency of the enemy air attack means and the effects of enemy offensive air actions.

The passive measures include avoiding the enemy attack through engineering and deceit actions, as well as through limiting loses caused by actions of dispersion, engineering protection and recovery after the attack.

In order to defend the air space, the structures within the vertical component conduct joint actions of engaging the air enemy which are complementary, inseparable, and mutually supportive, so as to obtain a certain degree of air superiority and ensure the freedom of maneuver for the land forces.

Anti-aircraft defense includes all the actions prepared and conducted through close and direct access routes of the air enemy and is part of, together with the air structures, in ensuring the combined defense of the air space.

„The anti-aircraft defense structures can be used within offensive operations, defensive operations, stability and support operations, as well as during intermediary operations".

In turn, „the operations conducted by air structures may be divided into four categories: operations of air retaliation, strategic air operations, air operations against ground forces, air support operations, close air support operations", according to the control procedures of the air space.

The air retaliation operations are all the offensive and defensive operations conducted by all the components of joint task forces for countering the enemy air threats in order to obtain and maintain the desired degree of control over the air space.

These operations are joint and are aimed especially at neutralizing the enemy air power and gaining a superior level of control over the air space.

The levels of air space control are the following: the favorable air situation – the level of air space control in which the enemy air effort is insufficient for influencing the success of own military operations; air superiority – that degree of dominating the combat in the air space that allows conducting all types of military operations in a certain place and at a certain time without limitations caused by the interference with enemy forces; and air supremacy – that level of air superiority at which enemy air forces are unable to perform efficient interferences.

The role of air retaliation operations is to protect own forces against enemy air attacks and preserve the desired degree of freedom for accomplishing missions by limiting or forbidding the enemy use of the air space.

In order to gain control over the air space, the efforts of offensive and defensive air retaliation operations must be integrated and synchronized.

The air retaliation operations are considered „offensive“ when performed in order to annihilate or engage the enemy in the place and at the moment chosen by own forces and „defensive“ when performed as a reaction to the enemy initiative.

Strategic air operations are conducted in order to obtain the strategic effects desired, according to the political goals and constraints.

Strategic attacks are carried out against enemy centers of gravity or against other significant targets, including elements of command and basic support infrastructure, having as a purpose reaching a level of annihilation and dispersion of the enemy capabilities up to the point where they are rendered unable of carrying out combat operations or ofensive actions.

Air operations against ground forces are conducted in order to deprive the enemy of the military power necessary to seize a territory or to make use of the maritime space by neutralizing, delaying, or annihilating the ground forces or naval forces.

According to the control procedures of the air space, air operations against ground forces include air interdiction, close air support and the fight against surface naval forces.

Air interdiction is an air operation conducted in order to annihilate, neutralize or delay the enemy military potential before it might be used efficiently against own forces, at such a distance from these that it might not influence the detailed integration of each air mission with the missions of fire support forces and the necessary force maneuver.

Close air support is an air operation conducted by planes and helicopters agains enemy targets found in the proximity of own forces, which necessitates detailed integration of each air mission with those of fire support forces and force maneuver.

Air support operations cover the whole range of missions that may be performed by the air force to its own benefit or to the benefit of the other categories of armed forces, underlining the usefulness of these operations during a crisis situation or a conflict. „Air support operations include the following air support operations: air surveillance and reconnaissance operations, air transportation operations, air electronic warfare operations, air special operations, search and rescue combat operations, search and rescue operations, air replenishment operations and airborne command and control operations”.

Air surveillance and reconnaissance operations are meant to provide early warnings regarding the enemy activities and threats and to detect any changes in enemy capabilities.

The resources used by combined forces may comprise: aircraft equipped for photographic or electronic reconnaissance, TV, early warning airborne sensors, maritime patrol aircraft and airplanes within the combined system of target reconnaisance, surveillance and management, including the unmanned aerial vehicles.

Air transport operations, on the startegic as well as on the operational and tactical levels, provide the speed, flexibility and mobility that allo the components of the joint forces to be deployed, re-deployed, supported, or rapidly evacuated, and are performed both with airplanes and helicopters.

Air electronic warfare, both active and passive, has to be coordinated in order to allow the efficient use of electromagnetic space by the combined forces, at the same time taking electronic measures with the purpose of determining, exploting, reducing, or preventing it from being used by the enemy.

Air special operations are undertaken by

the forces organized, trained, and equipped especially for accomplishing military, political, economic, or psychological objectives by unconventional military means.

Command and control of airborne operations are undertaken with aerial platforms of warning, command and control, airplanes or helicopters ready for use by a commander of command forces and include airborne warning and control systems and airborne command and control centers.

3. CONCLUSIONS THE TARGET SETTING PROCESS FOR AIR AND ANTI-AIRCRAFT DEFENSE STRUCTURES

In accordance with the operation doctrine of the air force, „the target setting process is a process of selecting the objetives to be hit and of identifying the appropriate solutions for launching air and anti-aircraft attacks, taking into consideration the demands and possibilities existing at the operational level".

The process is determined by the trend set by the commander of the joint force, the possibilities of the own forces and the enemy threats and is performed at all the levels of command so as the structures specialized in fighting the air platforms both with lethal and non-lethal means.

The range and flexibility of means allow the air force and anti-arcraft forces to engage the targets at any of the three levels: strategic, operational, and tactical. Thus, the commander of the joint force establishes the objectives that have to be fulfilled and, at the same time, decides upon the targets to be hit, the apportionment of air resources and the anti-aircraft defense forces available, as well as the order of striking targets.

Establishing strategic targets is specific to the air component, in strategic level operations, and has as main objective striking the enemy through direct or indirect attacks against its centers of gravity. These operations may include hitting both military targets and targets other than the military ones, such as: communication knots, energy sources, production facilities and infrastructure.

Establishing the operational targets is meant to set those targets which, when hit, will affect first and foremost the military capabilities of the enemy and include both mobile and fixed targets. Against these, the commander of the combined force may use air and anti-aircraft means, together with the intelligence and electronic warfare structures and the special forces, within concerted actions.

Establishing the tactical targets has the purpose of setting those targets that comprise the enemy forces, means, and facilities placed in the contact zone with own forces, where both the air and the land component could act. That is why it is essential to integrate air operations in the operation plans, maneuver schemes, and firing plans of the land component, and at each echelon, the commander has to identify the high-value targets and the targets allowing a maximal efficiency of own air operations.

The methodology of target analysis, specific to the vertical component structures is a flexible process, which may adapt to any type of military operation and which allows the commander to use efficiently the available resources in order to fulfill the goals set, it is not limited in time and its stages may overlap. The deliberate and dynamic character of the methodology of target analysis supports all the short-term, medium-term, and long-term planning, creating the conditions in which the adaptability of the target-combating process allows fulfilling the commander's objectives. The commanders of the structures fighting the air enemy identify the own objectives, tasks and lists of targets leading to the accomplishment of the combined force commander and the air defense commander implements a unitary selection process of targets in order to minimize the probability of emergence of conflicting situations or the unwanted overlapping of efforts in undertaking military actions.

The actions directed at combating the known targets in a combat zone are planned actions that are performed within the targeting process. According to the doctrine for joint target management "the targeting process is a particular element of the military decision-making process and consists of six stages as follows: intention, orientation and objectives of the commander, setting the targets, validating, designating and prioritizing them, an analysis of capabilities, including establishing weapons, force planning, and mission allotment and, last but not least, evaluating the actions". Commanders use their own cycles of combating targets according to the specific needs and missions, having as common goal fulfilling the objectives of the task group commander, through the systematic selection of targets and the use of appropriate means for obtaining the desired effects. All these activities are the starting point within the decision-making process against the targets emerged in the dynamics of actions, whether anticipated or unanticipated.

Setting, validating, designating and prioritizing targets constitute the second stage of the target-setting process and includes a series of stages that contribute together to accomplishing the commander's goals.

Within this stage, in the first phase, the list of targets is elaborated, by analyzing the data base with targets for the respective operation which, in turn, is analyzed and adapted function of the strategic commander's directives and the constraints imposed by the provisions of national law. The contents of the target list is permanently updated, on the basis of the information obtained during the operation and by analyzing and integrating the list with the designated targets and the list with restricted targets in the context offered by the target list, the lists with prioritized targets will be elaborated, which are in fact the targets allotted to each structure. Depending on the level of the operation, different target lists are made in the following manner: at operational level, the list with the prioritized targets and the list with the targets that must not be engaged, and at tactical level the list with the designated targets, the list with the prioritized targets and the list with restricted targets.

Target setting is the process in which an analysis of the air enemy is carried out, in order to determine the importance and the prioritization of the targets to be engaged, in order to accomplish the commander's goals. The commander's directives, the distribution, the allotment of engagement means and demands from the structures are elements that influence the target setting process.

The final outcome of this process is the combined list with the targets selected and ranked according to priorities, list which contributes to the accomplishment of the goals of the combined operation and is part of the commander's directive. Thus, according to the commander's goals and the structures' requirements, the order of air space control is elaborated, simultaneously setting the manner of using most efficiently the air and anti-aircraft means of engagement.

The target setting cycle is complementary to the process of planning, preparing and conducting operations. This process starts with the commander's directives and priorities and continues with identifying the demands of the subordinate structures' commanders regarding the targets which are about to be hit, the ranking of these demands function of priorities, establishing and alloting the targets or groups of targets on structures, hitting the targets, evaluating the hits by the commanders and restating their directives for the future actions. Structures state their demands and designate both the targets they are able to hit and those which influence their actions and which are outside the technical-tactical means available.

After the commander sets and ranks the targets and decides upon the distribution of air resource and the allotment of the anti-aircraft defense systems, the structures plan and perform the missions given. During the operations, the air component commander leads the process of planning, coordinating, and avoiding conflicting situations connected to setting the targets that are to be hit by the vertical component structures, making sure that this process is undertaken within a single conception. Also, the air component commander makes sure that the other components' commanders of hitting certain targets are solved through the master air attack plan (MAP).

The stages of air target setting are the following:

- *The joint intelligence preparation of the battle-space* is the analytical process used by intelligence structures in order to elaborate assessments, estimates, and other intelligence products within the decision-making process of the commander. This is a continuous process involving four important phases: defining the operational environment, defining the operational environment's influence upon the own and the enemy military capabilities, assessing the air enemy, as well as determining and describing the enemy's potential courses of action.
- *Analyzing the target system* is a systematic approach meant to determine the air enemy's vulnerabilities and weaknesses, elements which may be exploited to the advantage of the own forces.
- *Identifying the components of the target system* signifies identifying the activities and functions of each component of the target system, which ensures the identification of the critical and vulnerable points.
- *Developing the model of the system* is used in order to analyze the relations among the target system components and the relations with other target systems, afterwards being used for estimating the outcomes of different scenarios resulting from the courses of action of own forces.
- *Establishing the intelligence needs* allows the permanent update with intelligence products about the air target and ensures, in case of a lethal attack, minimal risks for own forces or avoiding collateral damages with implications upon the environment.
- *Identifying the component elements of air targets* consists of establishing the most important elements of the target: position, itineraries of movement, and possibilities of repelling the attack.

Air target validation is performed according to the commander's objectives, directives and intentions, with the legal principles specific to target combating, as well as with the rules of engagement implemented. Validating the targets means checking the correctness and credibility of the sources used in the process of updating targets and is performed in order to guarantee coordination upon engaging the target in the area of operations. Targets are validated by evaluation and approves as designated targets, before planning the respective mission.

Air target designation ensures better visualizing of all the targets identified at different command levels. The list with designated targets comprises the targets proposed and ranked in order of priority, according to the commander's order, and includes two types of targets: completely new targets, not included previously in the target list, that are submitted in order to be included, and targets which are already on the list of targets selected to be included in the target prioritizing list in order to be engaged. Designated targets are centralized in a single list with designated targets which is correlated with the objectives of structure commanders and the force commander's objectives.

Air target prioritization is done starting from the objectives and guidelines given by the air defense commander in order to allow using the capabilities of force structure at maximal potential, so as to reflect the successful engagement of targets. Each target has to receive a code made of two figures in the following manner: the first one will characterize the importance of the target for the commander's objectives, that is, the level of priority, and the second one, in case two or more targets have the same level of importance, to show the level of urgency established on the time scale, that is, the level of urgency. The *priority* of a target shows its importance in reaching the commander's goals and corresponds to the degree of difficulty and the effort needed in order to obtain the desired effect upon it. The following system is used to show priority: 1-*critical*, 2-*important*, and 3-*accepted* and 4-*potential*. The *urgency* establishes the time of engagement of the targets by using the following letters thus: *A-immediately, B-urgently* and *C-normally*.

All things considered, we may say that the air target setting process contributes to fulfilling the main objective of air and anti-aircraft operations, that is, the annihilation, dispersion or neutralization of air means, missiles, enemy launching platforms, as well as the support systems and structures, as closely as possible to their base, before they initiate mission execution.

Also, it is very important that within the target-setting process, during operations, all the potential enemy targets be taken into consideration and analyzed: air means, manned and unmanned, airfields and operation bases, electronic warfare systems, C3 installations and facilities, surveillance and control systems, logistics and infrastructure, as they all have their well-defined role in supporting the air operations of the enemy.

4. CONCLUSIONS

In conclusion, in order to perform an efficient process of analyzing, setting and engaging the enemy air targets, it is vital to integrate and synchronize the actions of preparing, planning, executing, and evaluating the operations undertaken by the forces and means of air and anti-aircraft defense, intelligence and electronic warfare structures and fire support structures available, through the direct cooperation of targeting structures from the air force with those from the land forces and from the navy, with special operation forces and other specialized elements within a single conception that might allow accomplishing the mission.

Thus, training the structures fighting the air enemy with respect to the manner of selecting and engaging air targets during the operation planning and execution processes represents an imperative prerequisite of the successful participation of the forces in military operations within multinational or joint structures of forces.

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CONCEPTUAL PROJECTIONS ON NATO MEMBER STATES' AIR FORCES TRANSFORMATION

Cosmin-Liviu COSMA

"Carol I" National Defense University, Bucharest

Abstract: *Since the end of the Cold War to the present, NATO has been involved in a significant number of military operations, which have shown the appetite of the decision-makers and Western military leaders regarding the use of air power as a weapon of choice. However, as demonstrated by some recent counterinsurgency operations, the air instrument is not always effective (or effective), being very situational, regarding the circumstances.*

This reality is the starting point in examining options, limitations and shortcomings in order to develop the concepts that provide the intelectual framework for establishing new transformational capabilities, that once implemented on the force structure, will allow the management of the challenges of an unpredictable, uncertain and in a constant metamorphosis security environment.

Keywords: *military transformation, air force, NATO*

1. THEORIES ON NATO'S MILITARY TRANSFORMATION

The processes in the Euro-Atlantic military structures were involved are known as **transformation**, its character **being one evolutionary rather than revolutionary**.

Its associating has been made with the appearance of the **Military Technological Revolution** (**MTR**), developed by Russian Marshal Nikolai Ogarkov, which was then transformed into **Revolution in Military Affairs** (**RMA**).

Regarding transformation process, there are two schools of thought, the first identifying with the Revolution in Military Affairs, and the second one being a process able to provide solutions to the unpredictable security environment of the 21st century.

In other somewhat similar interpretations, as is the on by the U.S. Department of Defense, the transformation occurs in two separate directions, but interconnected.

The first is represented by **the transformation of forces from the industrial age to the informational age**.

Its main characteristics are the technological advances in information area, collection and information assessment, command and control, but also the very high degree of kinetic precision and non-kinetic weapons that have dramatically reshaped the nature of war. Acquisition, sorting and allocation processes of targets to be hit will take place instantly, the effects being tracked in a qualitative and not quantitative way. New operational reality is different, the execution of leading surgical strikes will take the opponent out of battle rather than physically destructing him.

The forces involved are small, destruction and collateral damage being minimal. The forces involved are small, collateral damage and losses will be minimal. *"In the context of air operations, power application at the right place and time is a concept associated with effects-based operations. This first transformation form of expression is identified by some scholars with the Revolution in Military Affairs"*.

The second form is represented by **transformation of the Cold War specific forces into forces adjusted in accordance to respond the current security environment**.

The objective of this transformation process is to create forces able to address current and future security environment threats (terrorism, air and space attack on the air and space platforms, cyber attacks, the use of cruise and ballistic missiles and chemical, biological, radiological, nuclear attacks etc.). Also, these new forces should be able *"to conduct peace support operations, defend national territory, and conduct stability and low intensity conflict areas operations"*.

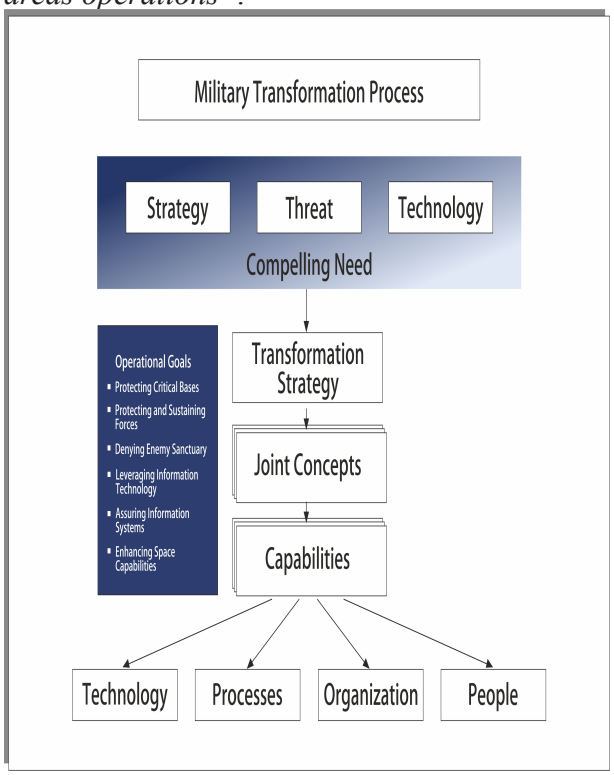

Fig. 1 – Military Transformation Process (source: U.S.DoD, *"Military Transformation – A Strategic Approach"*, Washington, 2003, p.13)

Due to various circumstances, the term **transformation** has different connotations, depending on the individual, organization, category of forces, or the country where the service is subject to debate. In essence, according to some theories of organizational transformation process, there are three different meanings of the term **transfor-mation**: *"(1) The change of external appearance; (2) The change (more subtle and complex) of the condition or function – a conversion into something else; and (3) The change in personality or character entities."*

From the US perspective, the process of military transformation (Fig. 1) begins with strategy, threats and technology analysis, as determinant factors in transforming the force, and the six operational objectives identified in the report QDR 2001. Transformational capabilities *"will be achieved once the development and experimentation results are implemented on the established military forces elements"*.

Depending on the particular context (and the level of ambition), most of the processes that were committed in various air force, were limited to the first sense of the concept. Thus, these forces were upgraded, renewed or reformed, focusing on the technological aspect, the transformation occurring in the structures of command and control, communications, respectively in the acquisi-tion and equipping with new equipment to create new actionable capabilities, or expand their existing ones. Despite this, efforts have been made towards the implementation of changes at the organizational doctrine to force transformation.

If for the U.S. Air Force, the **transfor-mation** is *"a process through which the military gains and maintains an advantage through changes in operational, organiza-tional and/or technology concepts, which significantly improves combat capability or the ability to respond to a constantly changing security environment"*, for NATO this expressed by the statutory mission *Allied Command Transformation (ACT)*: *"ACT will be the driving factor of change; it will allow, facilitate and advocate for continuous improvement of military capabilities to enhance the interoperability of military importance and effectiveness of the Alliance."*

The reference document of the U.S. Secretary of Defense – **Transformation Planning Guidance (TPG)** – considers **transformation** to be *"a process that shapes the changing nature of both the military competition and cooperation through new combinations of concepts, operational skills, human factor and organizations that exploit the advantages of the nation and provides protection against asymmetric vulnerabilities to preserve the current strategic position."*

Even though the two theories are not mutually exclusive, and identifying areas of congruence, however these approaches are natural reflection of domestic factors pertaining to specific organizations, regarding the concepts or objectives that aim to be achieved through this process of transformation.

While the US Department of Defense vision on transformation is seen from a procedural perspective, integrative, redefining the standards to achieve military success to their specific operational environments involving large innovative processes in the NATO sense, valences are rather Holistic highlighted the need to fulfill certain performance criteria, measurable result by satisfying critical conditions, the existence and operation of transatlantic organization as a whole. Thus interoperability or superior military capabilities are key factors in achieving military objectives as part of the functionality Alliance. One of the areas of congruence derives precisely from the relation of subordination / conditioning of operational capability and interoperability, the reference being to reduce the gap between US and European partners, considered still an open question.

2. CONCEPTUAL PROJECTIONS OF AIR FORCE TRANSFORMATION

2.1 New threats, new concepts, new roles of the Air Force. While current security environment features – fragmentation, non-linearity, unpredictability, multiple asymmetries, terrorism, crime and extreme violence – are the image of a new kind of war, **globalized and interconnected**, the ones associated to future threats are the stochastic coordinates (random, probabilistically and statistically modeled) of complex visionary constructions based on "*estimates of events' evolutions"*, hard to manage due to the *"huge volume of data and the high degree of uncertainty."*.

Briefly stated, these are characteristics of the current and forecasted confrontation environment in which the Air Force – through its undeniable attributes – is forced to act, by being

"the tool of choice in the contemporary era, when Western politicians and military commanders need to collect information and wish to react, to project power and to win wars. From another perspective of the spectrum of conflict, airpower can put pressure on the diplomatic approach, as they may act to punish countries that support terrorism."

If in the Riga Summit in 2006, the North Atlantic Council (NAC) has emphasized the coordinates of the new context created by the multiple threats to the security of allies, highlighting the global influence of these opponents unpredictable actions: *"NATO members are faced with complex threats, sometimes under direct relationship, such as terrorism, manifested on a global scale, with fatal results, the proliferation of weapons of mass destruction, respectively the instability generated by failed states"*, in Bucharest in 2008, NAC advanced the idea that alliance members must ensure those *"appropriate capabilities necessary to meet the new challenges of the XXI century and to succeed in this endeavor, being necessary transforma-tions, adaptations or recast as necessary. Transformation is a continuous process and requires constant and active attention"*. The urgent need to develop new military capabilities adjusted to the new security context has been discussed in the NATO Summit in 2002, when, by signing the **Prague Capabilities Commitment**, Alliance members expressed their consent on further action to transform national defense systems in order to obtain greatly improved defense capabilities. Addressing the generation of forces is based on specific capabilities, both the US and NATO, thus designed to provide the necessary means for transformational concepts and operational requirements metamorphosis in skills, capacity to generate effects in theater, in order to address current and future threats. From this new perspective, through joint, combined and multi-agency action, as the norm of contemporary military operations of NATO, the air forces are involved in missions whose main objectives are: (1) **Ensuring the territorial integrity, sovereignty and political independence**; (2) **Ensuring the capability to respond to crises throughout the full spectrum of operations**; (3) **Protecting strategic access and freedom of movement globally**

(space, international waters, air and cyberspace environment); and (4) **Promote order, peace, stability and security**.The establishment of an Air Force, shaped in terms of effects generation on adversaries capabilities, should meet requirements regarding the optimal size and shape, positioning within the defense system during operations etc. It also requires future concepts development and a shift in emphasis: (1) From single-focused threats – to multiple, complex challenges; (2) From nation-state threats – to descentralized network threats from non-state enemies; (3) From conducting war against nations – to conducting war in countries we are not at war (safe havens); (4) From major conventional combat operations – to multiple irregular, asymmetric operations; (5) From predetermined force packages – to tailored, flexible forces; (6) From massing forces – to massing effects; (7) From an emphasis on ships, guns, tanks and planes – to focus on information, knowledge and timely, actionable intelligence; (8) From static alliances – to dynamic partnership; (9) From focus on kinetics – to a focus on effects; and (10) From static defense, garrison forces – to mobile, expeditionary operations.

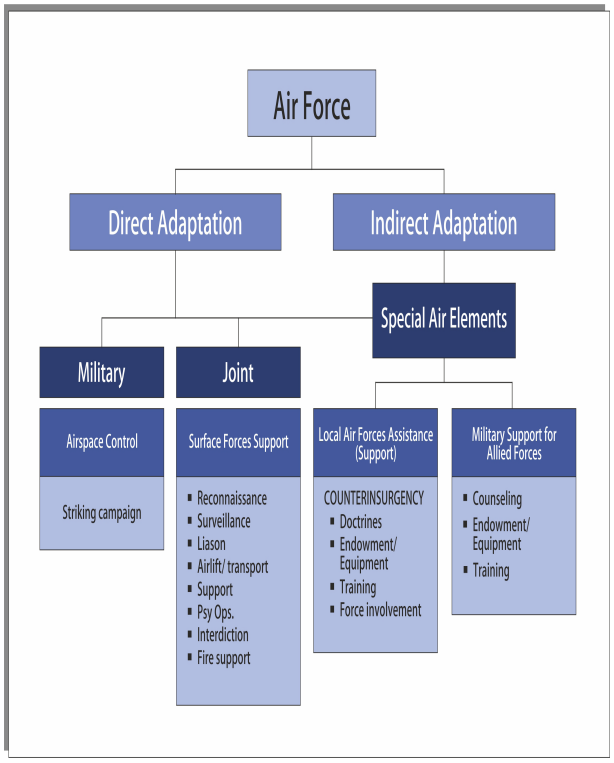

Fig. 2 – Air Force adaptation (sursa: Jean-Jacques Patry, *"L'ombre déchirée, la puissance aérienne contre la terreur"*, L'Harmattan, 2007, Paris)

Along with operations conducted under NATO operational framework, integrated into Combined Joint Task Force (CJTF) or in NATO Response Force (NRF), conducted in the NATO Area of Responsibility (NATO AOR) or outside the AOR, the air force must be able to neutralize any adversary and control any situation across the full spectrum of operations, from collective defense to counter-terrorism, from countering aggression and peace enforcement to humanitarian and military support operations.

Future air forces should be able to perform various operations regardless of location and time of deployment, whether it is an urban environment, obstructed coastal areas, austere or remote locations.

2.2 Forms of adaptation of the Air Force. The entire evolution of air power was the result of a long process of transformation, both institutional and at the endowment level, due to technological progress and infusion of new concepts. There remains pertinent the debate created around the validity of institutional adaptation options, around ways of expression and how they can change the conduct of the fight against threats of 21st century.

In its study on the use of air power against new threats, as asymmetries, terrorism etc, the French author Jean-Jacques Patry emphasizes the existance of two forms of adaptation. The first one, known as **direct form**, involves converting air power in aerospace power, and the second one, as **indirect form of adaptation** referring to the development of special air forces (elements) (Fig.2).

Direct Adaptation. Classic air campaign, as those performed in Iraq and the former Yugoslavia, they were determined – at least for the United States – a fundamental change in the application of air power.

The United States define this aggregate as an aerospace power, representing *"the ability to use platforms operating in the aerospace, or the ability to permeate it for military pur-poses"*. This attribute is not the exclusive preserve of a single weapon, but of a whole ensemble increasingly integrated, whose effectiveness depends on the overall performance of weapons systems and the use of command and control architecture designed on network data management basis, aiming to provide an enhanced surveillance capabilities.

This development is not the result of the fight against asymmetric systems, but rather that of some actions of industrialized nations, thought to neutralize an enemy rapidly, with accep-table human and material losses. In this case the debate is on the opportunity to address asymmetric threats, in the context of air power evolution to aerospace one.

A quick review of the main features of this development, for air operations justifies its role in the fight against collective unconventional armed violence, asymmetric, hybrid type, etc.

The core of this evolution lies in the maximum (and optimum) use of the third dimension, to monitor, analyze and generate effects on the adversary gravity centers (state institutions, economic production systems, armed forces units or operational facilities) as a strategic indirect approach, aimed at the destruction or paralysis of the opponents military power or political sources, so causing them to give up withotut armed resistance.

Indirect Adapting. One aspect of novelty of the last two decades in conventional campaigns is the development of special forces, their beginnings being found in the Cold War years in countries like the United States, the Soviet Union and Britain.

After the Gulf War, this type of force units was adopted by other countries like France and Germany, adapting it to other unconventional conflicts: Israel, South Africa, Colombia.

The best example of an indirect adaptation is provided by **Air Force Operations Command** (**AFSOC**) and its units through the wide range of features and missions they perform. AFSOC regroup at the end of 2000 around 13,000 combatants (and in 2010 around 15,000), 102 airplanes and 58 helicopters, being integrated for operations the **US Special Operations Command** (**USSOCOM**), with responsibilities on planning, command and control, equipment and training for this type of operation.

Special Air Forces areas of expertise are numerous, they being able to ensure the implementation of all generic tasks set by US Special Forces USSOCOM.

A brief analysis allows the execution almost of all these missions in unconventional conflict spectrum, and while some of them - **Peace Operations, Humanitarian Demining, Humanitarian Operations, Civil Affairs, PSYOPS, Information Ops, Combat Search and Rescu (CSAR), Search and Rescue (SR)** etc.

Thus, AFSOC has gradually formed a set of force intrusion in hostile territories capabilities, link/ liason capacity, refueling and support in all weather conditions, regardless of the external environment, and able to provide adequate responses to extreme combat situations, throughout the full spec-trum of operations, classic and unconventional.

These Special Forces capabilities, synergistically integrated wih the effects provided by the air forces, confers increased tempo of operations, flexibility in use of forces and assets, as well as increased flexibility, acting against opponents significantly different in expression, if we consider the classic way of warfare.

Operational limitations of contemporary forms of adaptation. In the previous forms of adaptation presentation, the premises of the analysis were features and capabilities held almost singularly by American forces alone. For the other NATO countries' air forces, the problem can not be discussed as trenchant, no European state possessing such significant air and space power capabilities, similar to those previously described, and having no special forces strong enough to provide a consistent response to asymmetric threats at the operational level.

2.3 Air Force conceptual transformation. The purpose of defense transformation aims to ensure those skills (in the form of military capabilities), that will allow the military organization to maintain the ongoing initiative across the entire spectrum of conflict.

To satisfy the conditions favorable to this end, the developing of transformational concepts is one of major importance.

In this direction, the **Allied Command Transformation (ACT)**, as a enabler force for change, developed a methodology to generate the NATO necessary military capabilities, configured in a manner to address new security context, known as **Capability Development Process**.

In order to achieve operational air forces operationally adjusted, suitably equipped, with a high degree of combat readiness, able to evolve in a complex environment, different in expression – at NATO planning and decision levels – the approaches are focused on determining the requirements imposed by development of operating concepts and Joint fulfillment of the roles built around various scenarios and missions. The **Future Concepts and Transfor-mation Division** (US) through the reference document on the Air Force transformation – **The US Air Force Transformation Flight Plan** – drew a direction to follow, consisting of a set of clearly defined objectives: (1) cooperation with other services, defense departments in order to enhance the interoperability of the operations carried out within the joint and coalition framework; (2) continuing resolute implementation of innovations processes; (3) creating a flexible and agile organizations that facilitate transformation and culture change institutiona-lization; (4) the transition from planning threat-based and platfotm-based to effects-based, respectively to adaptive capabilities, through new concepts of the air force operations (CONOPS); and (5) developing operational capabilities to enable transfor-mation objectives. Mostly, these objectives are part of organizational processes, which gives necessary dynamism to defense strategy, so being capable to address varied and ever-changing threats. Relationship between technological, organizational and doctrinal concepts is one of interdependence. Transformation is not just new equipment purchased, but has more complex implications, enabling at organizational the capitalization of technological advances. Mutual dependence is also supported by the statement that *"there is neither revolution in military affairs nor transformation, if new technologies are not incorporated into the processes of change in organization, doctrine, which, however, requires time"*.

For ensure the transformation conditions, there should be satisfied changes in both organizational culture and staff development models, to foster the Air Force transformation.

The next step is to adapt the organization with the aim to institutionalize this new culture.

A special importance is the development of concepts to enable the transformation of an Air Force organizational culture belonging to the Cold War into a new type of culture, specific of sufficiently flexible forces that can carry a wide range of operations, globally, in accordance with the current security environment operational tempo.

The organiza-tion, instruction/ training or endowment/ equipping are other issues linked with the conduct of operations outside the own air bases perimeters.

To maximize success in operations conduc-ted outside the area of responsibility is required to set up structures to assist and support the allies to develop their own strong air forces, respectively: *"(1) the creation of new structures, which by its own control elements to plan and execute missions in expeditionary units framework; (2) the integration of the other categories of the air forces to achieve increased operational capacity in an efficient manner."*

Another important aspect of transformation aims to develop management programs to put the right man in the right place at the right time, and programs that prepare tomorrow's modern leaders by providing education, training and necessary experience for understanding the dynamic security environment.

The **transformation** is supported by the institutionalized involvement of research centers and laboratories, the result sought being to implement innovative processes (**Air Force Research Laboratory** and **Product Centre, Air Force Battlelabs, Advanced Technology Demonstration** etc.) and emerging technologies. Thus, the research products are integrated into the operators' and strategic planners' products, aiming at achieving distinctive capabilities of future **operational concepts** (**CONOPS**).

Innovative ideas are then tested in simulation laboratories of the mission (**Battlelabs**), in order to test their applicability to the final integration. The aim of these tests and simulations is to generate operational and logistical capabilities that impact across the organization, doctrine, training mode, acquisition and equipping requirements.

Associated to transformation, the allocation of necessary resources for procurement becomes of strategic importance for defense under increasingly limited budgets. In both current conditions and those of future conflicts, quality parameters on development and equipping combat forces will remain the military effectiveness, defined as *"a process by which armed forces transform resources in combat capabilities. Those resources are: "human and natural resources, financial resources, technical potential, industrial base, government structure, social characteristics, political capital, intelligence of military leaders, namely the existence of moral."* While a deeper analysis of military effective-ness involves assessing different factors such organizational attitudes, behaviors and relationship, it also implies the notion of **efficiency**.

Resource efficiency is one aspect that contributes to the successful completion of a set of military activities (process defining victory).

The weapons system the Air Force is supplied with – in order to progress in a security environment where technology is evolving at a dizzying pace – requires changing the purchasing and procurement processes conducted. It is necessary *"to decrease acquisition cycle time and increase credibility in executing programs"*. Complete review of guidelines governing the purchases must be supported by the application of principles based on innovative concepts, providing the necessary flexibility for rapid integration of emerging technologies into the system. An approach of this type, with an evolutionary character, meets the ultimate goal of creating desired effects in theater *"with today's technology today rather than with yesterday's technology tomorrow"*.

Other recent transformational concepts offset the enormous gap existing between the U.S. and its European allies, when it comes to participation (with material, human and financial resources) to missions where NATO is involved, by offering solutions. Thus **Smart Defense** released in 2010, is based on **cooperation**, **prioritizing** and **specialization**.

Acting smart to achieve these objectives, members of the alliance would be, amid the current economic situation, namely the reduction of defense budgets, to be able to "produce" security with limited resources.

Operationally, the transformation is designed to maximize the Air Force capabilities across the entire spectrum of current and future conflicts.

It is essential to maintain the superiority achieved, but it also requires the development of additional capabilities to meet future threats that are particularly complex: *"(1) the expansion of action possibilities in worldwide operations; (2) The integration of airborne, space and information components in a synergistic manner to achieve operational advantage; (3) rapid projection of forces globally and in the airspace; (4) establishment of effects on demand anywhere, anytime; and (5) creation of simulators that can quickly and accurately replicate any theater of combat actions in the world by using specific tools to generate scenarios"*.

Also, it is loomed that in the future the Air Forces will be able to integrate data sensors in real-time detection; exploit sensor networks to create sources of invulnerable information; use bio processing, nano information or develop the technology that enables synthesizing fuels, water etc.

In a new type of conflict, battlefield where armies are no identifiable physical footprint, "marked by nonlinearity and indeterminacy, chaos strategy, aerospace component becomes primordial role" aerospace power involvement may take the form of "missions external defense missions counterterrorism, counterinsurgency operations or the type of stabilization and reconstruction ".

Identifying, tracking and neutralizing these opponents become a priority task of the Air Force, by using the entire technological arsenal that it owns, together with the work of government intelligence and security agencies.

The result of joint efforts allows the execution of precise strikes on the center of gravity of these structures, whether state or non-state actor.

The recognized capability of the Air Force to execute surgical strikes is an invaluable asset in counterinsurgency operations, other advantages consisting in the execution of information operations, cyber intelligence, surveillance and reconnaissance and global mobility.

3. CONCLUSIONS

Transforming the Air Force requires a relevant reassessment of both the experience resulted from their involvement in recent conflicts, as well as theories developed in fields of theory and airspace strategy, resulting in integrated solutions in the development of operational capabilities necessary to combat future threats.

Distinctions between war and peace, nation and society, politics and economics, national, transnational and international, force and violence are blurred in this type of confrontation, resulting in mixed, hybrid forms, hard to identify and define.

In the process of transformation, **Revolution in Military Affairs (RMA)** provides *"a consensus on what a modern army is: small and highly trained units, rapidly deployed and using information technologies, which are more flexible and more lethal"*. RMA, as the last stage of military transformation is defined by five distinct characteristics: (1) doctrinal flexibility; (2) strategic mobility; (3) configurability and modularity; (4) the ability to act together and connectivity in an international environment; and (5) the versatility to operate in conflict and Operations Other than War - OOTW.

In other words, modern military forces of the 21st century must be a **versatile mix of adjustable organizations** structured *"in a rotational cycle, which provides ready to act in the full spectrum of conflict forces"*,

being able to provide effects in various unpredicted contingencies.

It is therefore vital that the changes they undergo structures coalition forces and means to be significant, causing air forces to obtain flexible, proactive, larger capacity than the projection in the theater, regardless of where such actions required for defense or attack.

It has ensured total domination of space combat, accurate and high intensity projection of air power, the development of fully integrated or independent action.

New theories and advanced models, both by the Allied Command Transformation and other structures engaged in the undertaking of transforming the military organization (Future Concepts and Transformation Division etc.) are designed to provide the necessary tools for the metamorphosis of the concepts and operational requirements in military capabilities which, once integrated to the force level, to determine the management of threats posed by opponents who rely on surprise, deception and asymmetric and unpredictable expression.

In the future threats context, an optimal balance should be determined in terms of impact, from traditional missions (surveillance and reconnaissance, air interdiction and close satellites and space-based radars, executing missions by air platforms possessing stealth technology or unmanned air vehicles, using smart munitions or actions of electronic air support, etc.) and the new kind favored by technological progress and application of new technologies (surveillance of air space through warfare, psychological, informational, deterrence, coercion and so on).

Considering population-centric operations, the Air Force will conduct a variety of missions, from the surveillance, prevention and interdiction, and continuing with the stability, protection, or post-conflict (protection of the civilian population segments, support for democratic and legitimate governments etc.).

The implications are many, and if *"we start from the principle that the transformation is thought to be continuous, both concepts and operational design must be reevaluated together with the way of transposing them into practice."*

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MILITARY OPERATIONS IN AND FROM OUTER SPACE, A THREAT TO WORLD SECURITY AND STABILITY

Bogdan-Cezar CHIOSEAUA

„Carol I" National Defense University

Abstract: *People evolve, mankind is growing more complex, and once Cosmos misteries revealed, the distance between the individual and the system, on the one hand, decreases due to networks and access to databases via high-tech communications satellites and, on the other hand, increases as a result of strong pressures on the individual generated by the information and media war, the fight for resources, or the evolution of civilizations from the oil-based one to the atomic era that has just begun.*

Today's challenges, dangers and threats have raised some issues in studying, addressing and countering them because of the difficulty in identifying, defining and establishing the objectives that they pursue. These threats to global security and stability appear and manifest in areas with radical changes and transformations, in areas with political and ideological, social-economic, informational, military or other types of cleavages. Thus, we cannot say that challenges, dangers and threats mostly appear at times of radical changes or major ruptures. They exist throughout our existence as humanity, they occur in times of stability also, are dynamic and complex and they also different and unpredictable forms of expression and represent real threats to global security and stability.

This paper highlights the potential threats that may arise from the spatial dimension, the use of power and space technologies operating in this area, as well as the programs and projects through which they are controlled.

Keywords: *threats, dangers, space, satellites, missiles, security, technology, programs, sockets.*

INTRODUCTION

All security structures, no matter their nature is, are targeted by many challenges, dangers and threats. Vulnerabilities of these structures face to the 3rd millenium challenges, dangers and threats are minimal, however their security and securing issue is quite delicate.

Space challenges, dangers and threats occur most often together or as a cumul, as they are specific to this region and they operate their functions and pressures not only at a certain moment in time and place, but also permanent and everywhere. In present and near future, mankind is not able to react to such events, our capabilities being limited to observation and actions to reduce victims and damages.

Thus we can not control meteorites that can approach Earth, the solar and cosmic radiation, or of possibile actions in space generated by extraterrestrial beings and technologies, but we can oversee Earth around space, we can study and monitor phenomena in this area and can accommodate spatial platforms to achieve first contact with extraterrestrial entities.

Race to win supremacy in this new field of military actions pushed economic and military powers of the world to allocate huge amounts for investment in equipment and technologies needed to dominate space.

The interest for this area outlines two directions, namely:

- first direction: the research and study of Earth around space, atmospheric and cosmic phenomena occurring in this area and execution of experiments to control factors that may influence the conduct of actions in and from cosmos;
- second direction: it is developing in parallel with the first and concerns the deployment of military satellites with spying, communications, terrestrial research functions, while developing space vehicles transporting these techniques and technologies necessary to possible military action.

It should be noted that orbit transport vehicles are almost identical to the composition of ballistic missiles that can carry nuclear warheads.

Human presence in space is becoming more and more active, and this is not confined only to knowledge and exploitation of cosmic area, but is also takes into consideration expanding the security zone, Earth protection and defence, together with identification of courses of action to mitigate global challenges, dangers and threats of cosmic nature.

Directly relatied to the intensity of Erah around space actions are operations on the ground, coming as a result of possible challenges and threats from cosmos and being intended to provide support and to ensure necessary protection and defense measures.

Regardless of the coverage and content, challenges, dangers and threats have three different but complementary sources, three specific categories:

- cosmic nature
- geophysical and geoclimatic
- human nature.

The challenges, dangers, threats and vulnerabilities of cosmic nature are based on a variety of factors and actions that can activate them, as follows:

- Changes, transformations, metamorphoses into planetary cosmophysics;
- Changes, metamorphosis in cosmic magnetism;
- Increasing or decreasing the cosmic and solar radiation;
- Objects or cosmic bodies dangerously approaching the Earth.

Regardless of the factors that activate them, all these challenges, dangers, threats and vulnerabilities affect structures at economic, social, military levels, and take shape of a war of survival in a hostile environment, a war of people againstof an environment with limits, no rules, still in exploration, an environment that must be known in order to be understood and controlled.

Space war, the war of cosmos against humanity does already excist in forms affecting the entire planet in its structure, at a shells and ecosystems level, and can get dimension of a total disaster.

1. SPACE POWER – VECTOR OF SECURITY

The term security raised and continues to raise some questions in terms of its defining for each area in which it is used.

Analyzed by philosophers and linguists that term can express serenity, confidence, or can be characterized by the presence of a sense of safety in the absence of danger.

However analyzed on segments of society or at a world level, it can be said that, for example, for the political class, the term security can have several meanings.

For politicians who hold the power, security can be a state that is wanted to be imposed or preserved, while at the same time, for opposition politicians, the same state can be regarded as an unstable situation in terms of security, generating conflicts and tensions.

In some countries due to political governing regims, these goals of power and opposition are present, but conversely, power seeking to create instability and conflicts, while opposition struggle for safety and security.

For the army and the military actions, the term security is particularly important. It represents the core mission of the armed forces and also each soldier's mission, on the battlefield when executing specific military operations in order to eliminate all hazards, to ensure his own protection and his comrades and/or to defend the entrusted for safety and security objective.

On the macro scale and analyzed in terms of nature, geographic location, resources, size and importance of the objective to be insured and directly related to the type and size of the forces involved and the threats and vulnerabilities that confronts the area, the security level can have national, international, transnational valences as well as regional or global ones.

New threats and vulnerabilities involve for Romania the development of strategic objectives, the establishment of national systems for preventing and fighting, strategically coordinated by the CSAT and technically / operationally coordinated by the structures of the Ministry of National Defense, Ministry of Interior, Ministry of Justice or other state structures.

The emergence of these services and organizations and especially its activities must be within legal norms of operation, thus giving birth to the security system legislation which is based on the national security strategy, the main document governing the national security system.

International cooperation between institutions responsible for the regional security is developing a new principle, the principle of collective security that underlies Security Strategy of Romania and attaches importance to the role of the Romanian state in all international institutions.

The current security strategy widens the risk and unconventional threats spectrum and diversifies the typology of crises and conflicts that are manifested internally or internationally.

This new context leads to a multiplicity of the national safety and security state dimensions,

including political, economic, financial, military, civic, social and environmental terms that request identifying new international and international resources that can be mobilized to defend the fundamental interests of Romania.

The document underpinning national defense planning is the National Security Strategy of Romania. This provides a larger approach to security issues and takes into account all the dimensions of the security state. The strategy presents vulnerabilities, challenges and risk factors with their solutions and dimensions, with the following implications:

- Politico-administrative;
- Economic;
- Social;
- Education, research and culture;
- National security and public order;
- National defense;
- Foreign policy.

So there can be identified two main areas of action for the security policy of Romania, internal policies, where it is dealed with political, military, economic, social and environmental dimension and external policies.

Option dilemmas of the foreign policy of Romania involving security paradigm continue to be manifested, at least in the short term. As there is not a personal, clear, vision on national security yet and guiding ourselves after the two elements of stability, the EU and NATO, it is quite difficult to adapt and it will become even more difficult if the visions of the two organizations will become competing or contradictory.

In the military plan, Romania will benefit from the advantages of locating missle shield components on its territory in the future. This partnership with the US leads to security guarantees obtaining and to relations consolidation with the most powerful ally within NATO, even if some disadvantages in relation with Russia should be taken.

The installation of the missile shield is part of a US security strategy in the eastern European Union, the implementation of this control system showing the level of involvement of the US in imposing circumterrestrial space supremacy.

It is known that, over time, countries have always fought for dominance and control, and most representative examples are the two great superpowers, USA and Russia.

They have developed strategies and techniques, they have invented technologies that have produced information and information is power. Therefore it is demonstrated once again that who owns the information owns the power, has total control.

At their turn, weapons and weapons systems means power. Being an indicator of the strength, their use intimidates, subdues, hurts and the development of weapons technology and weapons systems means power amplification.

One of the latest nowadays confrontations is taking place outside the Earth's surface, into space, where the "last battle for power" has begun.

Circumterrestrial space control is military owned by the US by having a well defined space doctrine.

American Space Doctrine, adopted in 2010, reflects principles that are inclined to dialogue and international cooperation and provide additional information related to the use of space for US national security, calling on world countries to act responsibly in space in order to prevent negative incidents.

The first time that the possibility of using outer space for strategic defense of US territory was defined, it was during the administration of US President Ronald Reagan, but the idea of effective control of outer space in case of conflict dates back to 1963, an idea promoted by the Air Force in 1983 and that causes the emergence of the doctrine, "Strategic Defense Initiative" [1], doctrine that clearly defines the manner and means by which the US wants to achieve military control of space.

At the core of the American Space Doctrine are seated four pillars:

- Deterring opponent or defense against any enemy attack;
- Unhindered access by the US in space;
- Disrupting any hostile cosmic systems;
- Improving the military operations of the US and its allies by space systems.

Thus, it is acted on several levels, both for the ensurance of the control of outer space by the United States and for protection against possible ballistic missile attacks, using terrestrial, naval, air and cosmic systems.

In 1996, the administration of President Clinton issues a document regarding the US space policy, saying that "free access to space is a vital national interest" [2], thus recognizing the importance of outer space.

After the events of September 11 the trend of reviewing American Space Doctrine is continued and in the 2006 version it is reaffirmed that the US critically depend on cosmic capacities, and they are vital to national interests.

The next step was the location and use of missile defense systems to protect against possible ballistic missile attacks.

2. PROGRAMS, PROJECTS AND PROCCUPATIONS CONCENRING EARTH AROUND SPACE

Nowadays, on an international plan, in terms of programs, preoccupations and projects regarding circumterrestrial space, the most developed segment is missle defense.

Missle defense is a system, a technology for detecting, tracking, intercepting and destroying offensive enemy missles.

Initially this system was designed to protect against intercontinental ballistic missiles with nuclear combat cargo, and recently, it developed new defense capabilities including protection against short-range and medium-range missless armed with warheads or conventional fighting charges.

Missile interception technology has varied over time, in the 60s, ballistic missile defense system using nuclear warheads, after that warheads that use kinetic energy and then the laser.

Alongside the already established and active countries in space (United States, Russia, China), there are other actors on "spatial stage" (UK, France, India and Israel), with the same intentions of capacity, air defense systems and missile defense development.

Missile defense systems can divide into several categories, depending on the range of missiles that can be intercepted, the phase of thr trajectory in which the intercept is made and depending on the area in which the interception is made (inside or outside the Earth's atmosphere) as follows:

- Depending on the range of interceptor missiles:

- Strategic missile defense systems - with long-range (7km / s) - A-135 system owned by Russia and designed for Moscow defense and te US "Ground-Based Midcourse Defense" system for missile that could come from Asia;

- "Theater defense" type defense systems that can act with speed of 3 km / s. The term "theater" in this context includes military the entire region located for military operations, region which usually extends in a radius of several hundred kilometers;

- Tactic type missile defense systems - against tactical ballistic missiles with short range that may have a speed of up to 1.5km / s.

- Depending on the trajectory of intercepted ballistic missiles:

- Boost phase (launch phase) missile defense systems allowing the missiles interception while the engines are switched on, usually after their launch the aimed territory. The disadvantage is the very short missles interception time, about 180 seconds;

- Intermediate phase missle defense systems which allow the missles interception after the engines were ignited. The advantages are huge geographical coverage, even mainland and disadvantages, the need for more space for installation and the existence of powerful radars with special properties;

- Terminal phase missile defense systems - allows missiles interception after they have reentered the Earth's atmosphere. They are advantaged by requiring less sophisticated radars but disadvantaged by very short reaction time, sometimes less than 30 seconds and by the covering of a smaller geographical area.

- Depending on the location of the missile related to the atmosphere:

- Endoatmospheric missile defense systems (inside Earth's atmosphere)

- Exoatmospheric missile defense systems (outside the earth's atmosphere)

All these systems have been developed and implemented in programs and projects designed for the anti-aircraft defense and later for the missile defense.

For example, the US has developed a national missile defense military program called "Strategic Defense Initiative", which was providing the creation of a North American missile defense shield against possible intercontinental ballistic missile attacks by a state enemy, especially by the USSR, program that costed more than 100 billion dollars, and which was abandoned in 1991 after the collapse of the Soviet Union.

However, undertaken research under this program have been valued in other projects like the one in 1992 when Gokona military base in Alaska, debuted the "High-Frequency Active Auroral Research Program" (HAARP) project, the most important US military project for climate distortion and manipulation, particularly for military purposes.

Other future projects aim combating enemy missile by curtains made of laser beams emitted from ground or submarines launched missiles, neutron bombardment with particle accelerator produced neutrons, establishing a network of mirrors for directing the laser waves to missles or bombarding them with "projectiles rain" from launching installations that are stored on satellites. At the European level a controversial initiative is being born, the one to place Ground - Based Midcourse (GDM) antimissile system installations in Eastern Europe, but as a result of not so friendly reactions from Russia, the plan was abandoned in favor of the Aegis missile defense system, from the Black Sea area, with the possibility of expansion in Romania.

In February 2007, the US has officially started negotiations with Poland and Czech state regarding the location of a Ground - Based Midcourse missile defense system. Announced objective was to protect most of Europe from long-range missiles that might come from Iran.

The basis Ustka - Wicko, which belongs to the Polish army was chosen as a possible place to locate 10 US interceptor missiles. Russia has objected again and was suspended from the Treaty on Conventional Armed Forces in Europe (Treaty signed on 19 November 1990 in Paris by the Warsaw Pact countries - Albania, Bulgaria, Germany (GDR), Czechoslovakia, Poland, Romania, Hungary and the USSR on the one hand and NATO on the other hand, which was providing the significant reduction of armed forces and armament for both signatory parties and the respecting of a balance between East and West), and President Putin has threatened of a possible new Cold War.

Russia has threatened deployment of short-range nuclear missiles on its border with NATO action, unless the US abandons plans. However, in order to locate a high-power radar, Russia stood at the negotiating table with the Czech state.

On August 20, 2008, after lengthy negotiations, US Secretary of State Condoleezza Rice and polish Foreign Minister Radoslaw Sikorski signed at Warsaw the "Agreement between the United States and the Government of the Republic of Poland on the deployment of ballistic missile defense interceptors in Polish Republic ".

Again Russia warned Poland that is exposed to an attack, even nuclear, by approving the United States to deploy interceptors on its territory, Russian General Anatoly Nogovitsyn saying that "Poland - through the implementation of the system is exposed to a target - 100% ".

In May 2008, according to some information that emerged, Russian President Dmitri A. Medvedev and Chinese President Hu Jintao met "... to conclude a nuclear cooperation agreement and together condemn American proposals for a missile shield in Europe. Both countries called the plan as a blow to international confidence that will disturb the balance of power "[3].

Romania is also part of the countries that need protection against nuclear and ballistic threats thus on 4 February 2010, agreed that since 2015, to host elements of the missile defense system on its territory.

In recent years, due to strained relations between the US and Iran, Iran did not hesitate to declare that in the case of an armed conflict, countries hosting US troops would become a "target" for their missiles.

Romania hosting US military bases on its territory has asked since the NATO Summit in Bucharest (2-4 April 2008) the extension of the missile defense system in Europe and in vulnerable areas.

Thereby a four steps strategy was designed for placing missile shields in both southern and northern Europe, in order to protect both allied states and military and civilian personnel deployed in those countries against potential Iranian attacks. Romania, Bulgaria and Turkey are considered the "vulnerable" wing of NATO concerning the missiles possibilities that might come from the Middle East.

According to Robert Gates, US Defence Secretary, Iran's ballistic missiles would not be a problem but short- and medium-range missles would. The fact that NATO will expand its project on the missile defense system in Romania has generated reactions from Russia, but not as strong and aggressive as for Czech Republic and Poland.

In November 2010, following the NATO Summit in Lisbon, NATO and Russia agreed on the European missile defense system, Oleg Ostapenko, Russian Ballistic Forces commander, saying "we are willing to work with NATO experts in the field of antiballistic for developing a missile defense architecture, from conception to radars and missle interceptors location variations and to the common exploitation of the control and data collection centers" because a European missile defense system is better designed after the territorial principle (sectorial) of the division of responsibilities for individual states or groups of states for detecting and destroying missiles in a particular sector of defense. The current strategic challenges posed by the US missile shield deployment in Europe, cause a new reorganization of the aerospace defense of Russia. This starts the procedures for the establishment of a new category of forces, Forces for the Aerospace Defense (FAD), a new structure that, since 1 December 2011, is acting on the first line of strategic defense in order to ensure the air defense (missile defense) and is served by defense systems that use missles, early warning radars and space control systems.

New category of forces copies European missile defense structure model, but is more complex, including Russian Space Forces missions that are responsible for launching satellites and space shuttles.

The new structure includes over 3,000 people, military and civilian personnel specialized and trained, organized as a military structure, with command and control center in Krasnoznamensk, near Moscow and under military command.

Russia continues to believe that placing missile radars in Europe and deployment of interceptor missiles from the missle shield composition is a potential threat to Russian nuclear arsenal, even if Washington tries to convince them that its mission is to protect Europe and NATO allies against attacks of unpredictable states like Iran.

CONCLUSIONS

Faced with the threats that could come from space, programs, projects and preoccupations concerning the circumterrestrial space security as well as great powers' reactions confirm again that in the future, Space Forces will be a part of the world countries' National Security Systems, and at a space level we will have to deal with space politics, space strategies, laws that will regulate the space activity and, why not, space justice and space police.

The approach of the challenges and the economics, political and especially military structures receptivity to the future technologies that, if ignored, would harm generally the art of war and implicitly the art of approaching the space conflicts, are outlined by the need to permanently relate to history lessons, to the lessons of the past.

The features of the circumterrestrial space, of this new battlefield, the new military structures configuration and the soldiers way of training determine a new approach of the war preparation, especially for missions execution. Their issues regarding the possible circumterrestrial space conflicts and they impose to be studied and analized during the different exercices training program.

Human resource serving this area is need to be highly trained and specialized in the following domains: conceptual domain, military leadership, technical and technological creation and in the action one. It must be capable of continuous investment in intellectual effort, to show intelligence, acting mainly creative and innovative.

Contemporary military art and modern history present many uncertainties regarding the concept and execution of future military operations, despite numerous hypotheses and theories issued years ago.

It is very likely for us to witness a militarization of the cosmos soon, with all the consequences thereof. We must be constantly prepared to respond to the space threats and must continually analyze the international geo-political situation that aims the circumterrestrial space, being able to value the knowledge gained by the military approach of security and stability.

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QKD PROTOCOLS – SOFTWARE IMPLEMENTATION BENNET-BRASSARD vs. BRUSS

Gabriela MOGOS*, **Gheorghe RADU****

*Escuela Superior Politecnica de Chimborazo, Riobamba, Ecuador,
**"Henri Coandă" Air Force Academy, Braşov, Romania

Abstract: *Quantum cryptography, and especially quantum key distribution systems – Quantum Key Distribution, realizes a quantum key exchange between the sender and the receiver. The quantum key exchange is made in two steps, by a quantum channel and a public channel. The most important characteristic of a quantum key distribution system, and especially of quantum cryptography, is that no attempt to intercept the communication can be performed, and that it also alerts the legitimate parties who communicate.*

The purpose of this paper is to present comparative studies regarding the percentage of errors from the key for two Quantum Key Distribution protocols: Bennett-Brassard and Bruss. The studies were done for two situations: the absence and the presence of cyber-attacks, and they analyze the degree of security of the protocols.

Keywords: *security, quantum cryptography, qubits.*
MSC2010**:** 81P45, 94A15.

1. INTRODUCTION

The security of conventional encryption depends on two main aspects: the encryption algorithm, and the encryption key.

The encryption algorithm, which should be powerful enough in order to make impossible the decryption based only on the encrypted text.

The encryption key should be big enough to assure a powerful encryption, and most of all, it should be secret.

Quantum cryptography offers new methods to secure the communications.

As compared to classical cryptography, which involves different mathematical algorithms to secure the information, quantum cryptography is focused on the physical support of the information.

Using the principles of quantum physics, we can create and implement a communication system with the purpose to always detect any attempt of attack, due to the fact that any attempt to "measure" a quantum carrier of information will modify the carrier particle, and will leave "traces".

The search for good security criteria under stringent conditions led to early studies of quantum eavesdropping, and finally to the first proof of the security of key distribution.

There are several methods of detection of attacks on quantum key distribution systems.
(1)The classical method – the identification of qubits altered by the enemy;
(2) QBER – the estimation of the error rate from the primary key;
(3) Bell's inequality.

Quantum Bit Error Rate (QBER) consists in the calculation of the percentage of errors from the key, obtained at the end of the quantum transmission, after the step of communication of the polarization bases from the public channel.

Quantum Bit Error Rate method for detection of the enemy may be applied to most of the key distribution systems. Each system has its own accepted error rate, and exceeding it means the intervention of an enemy. Using QBER method for determining the percentage of errors from the key, this paper presents a comparative study between two protocols: Bennett-Brassard and Bruss, in the absence of intruders, and in their presence, by an Intercept-Resend cyber-attack.

2. BENNETT-BRASSARD and BRUSS PROTOCOLS – SHORT OVERVIEW

2.1 Bennett-Brassard protocol. Charles Bennett from IBM, together with Gilles Brassard from the University of Montreal (1984; 1985), starting from Stephen Wiesner's study "Conjugate Coding" [3], developed a key distribution protocol using polarized photons.

The polarization states form two orthonormal bases as follows: a linear basis for linear polarization, and a diagonal basis for circular polarization. The states of the diagonal basis are polarization states at $\pm 45^0$ of the states of the rectilinear basis. The Bennett-Brassard protocol (BB84) [1] [2] is as follows:

The Sender sends to *the Receiver* a row of polarized photons.

The Receiver, using randomly one of the two bases, will measure each photon. In the absence of the noise, or of an intruder, *the Sender* and *the Receiver* will obtain the same measurement result if they choose the same basis. Using a public channel, *the Receiver* communicates to *the Sender* the measurement basis he had used, without revealing the result obtained. When the measurement bases are not well chosen, the results will be erased. The sequence of bits thus obtained is called *raw key*. The encryption key obtained with the help of Bennett-Brassard protocol (BB84) is the "one time pad" type, and cannot assure a "perfect security", because there are situations of "denial" of the message ownership (the sender encrypts the message with the key obtained, and after sending it, he pretends that the message was encrypted with another key).

2.2 Bruss protocol. In 1998, Bruss [4] proposes an extension to the Bennett-Brassard protocol into a six-state, with three complementary bases protocol. The six-state protocol is quite similar with BB84, but *the Sender* sends one of six states instead of one of four.

The Receiver chooses to measure randomly in one of the three bases, and again, *the Sender* and *the Receiver* discard any bits for which they used different bases.

The security analysis of the six-state protocol shows that *the Eavesdropper*'s information gain for a given impaired error rate is lower than in the BB84 protocol.

3. BB84 vs. BRUSS

The purpose of this paper is to present a comparative study regarding the percentage of errors from the key obtained by the two protocols.

Consequently, we made a software application for each protocol: Bennett-Brassard and Bruss, and we measured the percentage of errors from the key in two cases: in the absence, and in the presence of a cyber-attack.

We studied the most common cyber-attack on quantum protocols, which is Intercept-Resend attack.

Each simulation was realized with the help of a circuit containing 3 computers o which a module of the application was running, each of them communicating by a switch.

The connection between the computers was made by a UTP cable, simulating the quantum channel, as well as the classical channel.

The modules of each application will run on each of the 3 computers: *the Sender*, *the Receiver*, and in the case of *Intercept-Resend* cyber-attack – *the Eavesdropper*.

The modules are written in C++ language.

In this research, we did not take into consideration the errors appeared due to the equipment.

We tested the application on a variable number of input data (qubits), and we studied how the errors varied.

3.1. The ideal case. After running 10 times of each application, for the ideal case, we obtained the following results for an initial key with sizes ranging from 160 to 2560 qubits.

***Bennett-Brassard protocol* – results**

nr crt	Initial qubits = 160		Initial qubits = 320		Initial qubits = 640		Initial qubits = 1280		Initial qubits = 2560	
	Final bits	QBER (%)	Final bits	Eroare (%)	Final bits	Eroare (%)	Final bits	Eroare (%)	Final bits	Eroare (%)
1	81	50	166	49	298	54	669	48	1312	49
2	86	47	160	50	327	49	664	49	1338	48
3	91	44	157	51	319	51	617	52	1267	51
4	70	57	181	44	309	52	652	50	1331	49
5	78	52	169	48	317	51	640	50	1344	48
6	75	54	149	54	314	51	645	50	1234	52
7	82	49	158	51	316	51	644	50	1300	50
8	84	48	176	45	329	49	626	52	1254	52
9	91	44	159	51	317	51	633	51	1288	50
10	81	50	162	50	313	52	641	50	1337	48

Fig.1. Values of QBER depending on Initial number of qubits.

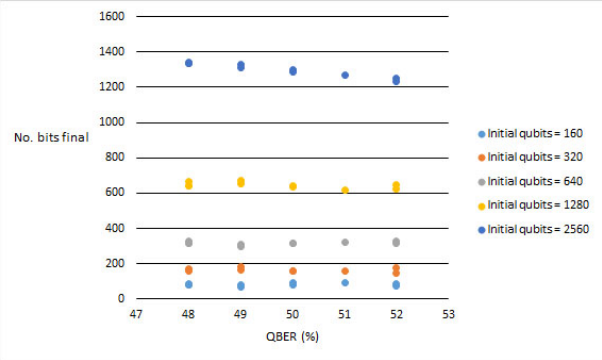

Fig.2. Variation of the error according to the dimension of the input data.

***Bruss protocol* – results**

nr crt	Initial qubits = 160		Initial qubits = 320		Initial qubits = 640		Initial qubits = 1280		Initial qubits = 2560	
	Final bits	QBER (%)	Final bits	Eroare (%)	Final bits	Eroare (%)	Final bits	Eroare (%)	Final bits	Eroare (%)
1	81	50	166	49	298	54	669	48	1312	49
2	86	47	160	50	327	49	664	49	1338	48
3	91	44	157	51	319	51	617	52	1267	51
4	70	57	181	44	309	52	652	50	1331	49
5	78	52	169	48	317	51	640	50	1344	48
6	75	54	149	54	314	51	645	50	1234	52
7	82	49	158	51	316	51	644	50	1300	50
8	84	48	176	45	329	49	626	52	1254	52
9	91	44	159	51	317	51	633	51	1288	50
10	81	50	162	50	313	52	641	50	1337	48

Fig.3. Values of QBER depending on Initial number of qubits.

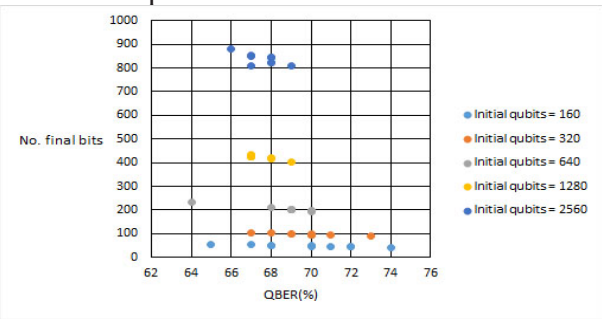

Fig.4. Variation of the error according to the dimension of the input data.

We can see that in the case of Bruss protocol, QBER is bigger than in the case of BB84.

Although the communication is realized in secure conditions, it is important to know that in the case of Bruss protocol, the receiver had to choose a single measurement basis of 3 for reading the qubit, while in the case of BB84 protocol, the receiver needs to decide over one of the two measurement bases.

For the ideal case, we conclude that in Bennett-Brassard protocol, the probability to measure a qubit correctly is 1/4, while in Bruss protocol the probability is 1/6.

3.2. The cybernetic attack – case. The theoretical and practical vulnerabilities of quantum key distribution systems have always constituted the main starting point of the methods of attack on these systems.

In this part of the paper, we propose the implementation of the applications of BB84 and Bruss protocols – with eavesdropper, together with the data sets obtained from running the applications.

The *Intercept-Resend* attack [6] is the most common type of attack used on quantum key distribution systems.

The Eavesdropper interrupts the quantum channel, measures each qubit received from the *sender* in one of the measurement bases (according to the protocol), which he had chosen randomly. Then he sends the qubits read to *the Receiver*, and he will replace the compromised qubits with others, without leaving traces of the attack [5].

After running each application for 10 times, we obtained the following results for an initial key with sizes ranging from 160 to 2560 qubits.

***Bennett-Brassard protocol* - results**

Initial - 160				Initial qubits - 320				Initial qubits - 640				Initial qubits - 1280				Initial qubits - 2560			
No final bits Receiver - Inamic	No final bits Emittor - Inamic - Receiver	QBER Emittor-Inamic (%)	QBER Emittor - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Emittor - Inamic - Receiver	QBER Emittor-Inamic (%)	QBER Emittor - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Emittor - Inamic - Receiver	QBER Emittor-Inamic (%)	QBER Emittor - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Emittor - Inamic - Receiver	QBER Emittor-Inamic (%)	QBER Emittor - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Emittor - Inamic - Receiver	QBER Emittor-Inamic (%)	QBER Emittor - Inamic - Receiver (%)
81	39	50	24	166	80	49	25	298	152	54	24	669	269	48	21	1312	614	49	24
86	41	47	26	160	77	50	24	327	149	49	23	664	307	49	24	1338	666	48	26
91	42	44	26	157	82	51	26	319	155	51	24	617	333	52	26	1267	589	51	23
70	36	57	23	181	79	44	25	309	159	52	25	652	307	50	24	1331	640	49	25
78	43	52	27	169	81	48	25	317	162	51	25	640	294	50	23	1344	640	48	25
75	40	54	25	149	74	54	23	314	160	51	25	645	320	50	25	1234	691	52	27
82	44	49	28	158	76	51	24	316	148	51	23	644	333	50	26	1300	614	50	24
84	41	48	26	176	80	45	25	329	166	49	26	626	346	52	27	1254	666	52	26
91	37	44	23	159	78	51	24	317	168	51	26	633	307	51	24	1288	640	50	25
81	42	50	26	162	83	50	26	313	149	52	23	641	320	50	25	1337	666	48	26

Fig.5. Values of QBER depending on Initial number of qubits.

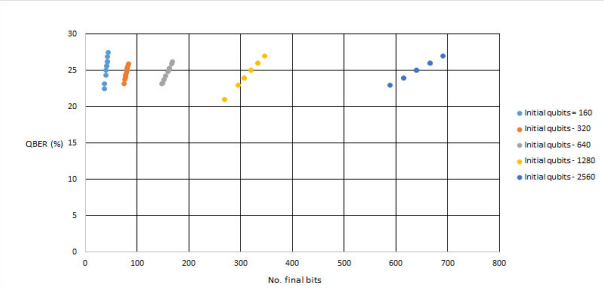

Fig.6. Variation of the error according to the dimension of the input data

***Bruss protocol* - results**

No final bits Receiver - Inamic	No final bits Sender - Inamic - Receiver	QBER Sender-Inamic (%)	QBER Sender - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Sender - Inamic - Receiver	QBER Sender-Inamic (%)	QBER Sender - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Sender - Inamic - Receiver	QBER Sender-Inamic (%)	QBER Sender - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Sender - Inamic - Receiver	QBER Sender-Inamic (%)	QBER Sender - Inamic - Receiver (%)	No final bits Receiver-Inamic	No final bits Sender - Inamic - Receiver	QBER Sender-Inamic (%)	QBER Sender - Inamic - Receiver (%)
48	17	70	11	166	59	49	19	298	110	54	17	669	239	48	19	1312	614	49	24
52	19	68	12	160	57	50	18	327	121	49	19	664	237	49	19	1338	666	48	26
49	18	70	11	157	56	51	18	319	118	51	18	617	220	52	17	1267	589	51	23
47	17	71	10	181	65	44	20	309	114	52	18	652	233	50	18	1331	640	49	25
54	19	67	12	169	60	48	19	317	117	51	18	640	229	50	18	1344	640	48	25
43	15	74	10	149	53	54	17	314	116	51	18	645	230	50	18	1234	691	52	27
46	16	72	10	158	56	51	18	316	117	51	18	644	230	50	18	1300	614	50	24
52	19	68	12	176	63	45	20	329	122	49	19	626	224	52	17	1254	666	52	26
57	20	65	13	159	57	51	18	317	117	51	18	633	226	51	18	1288	640	50	25
45	16	72	10	162	58	50	18	313	116	52	18	641	229	50	18	1337	666	48	26

Fig.7. Values of QBER depending on Initial number of qubits.

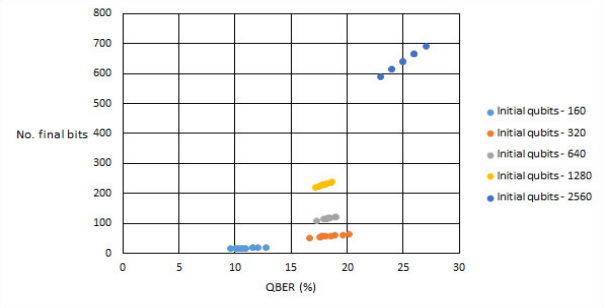

Fig.8. Variation of the error according to the dimension of the input data.

In the case of a cyber-attack, *the Eavesdropper* will send to *the Receiver* a part of the qubits, only the ones which he managed to measure, the rest of the qubits being false.

On his turn, during the process of reconciliation Sender-Receiver, *the Receiver* will introduce his own error when reading the qubits, by randomly choosing the qubits received from the Intruder from the measurement bases.

At the end of the process, both *the Sender* and *the Receiver* will see that the percentage of errors from the key is very big, which proves the existence of an intruder, and they will give up the protocol.

CONCLUSIONS

As a result of the data previously presented, we may conclude that the simplest method to detect the *Intercept-Resend* attacks on Quantum Key Distribution protocols is to measure the percentage of errors from the key.

Consequently, for a simpler detection of the intruders acting by Intercept-Resend attacks, the parties need to run the Quantum Key Distribution protocol for the ideal case (secure communication environment), where the possible errors could be only due to the equipment.

At the end, the parties may establish a maximum admitted upper limit of these errors.

If after running a Quantum Key Distribution protocol in an unsecure environment the value of the errors is higher than the maximum admitted limit, it means that the whole process was compromised by the presence of an intruder.

Thus, for Bruss scheme, the raw key consists of one-third of the qubits received on average, as opposed to one-half for BB84, and we can see, the Bruss protocol remains secure under an eavesdropper attack.

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ANALYSIS OF THE FUNDAMENTAL LIMIT PROBLEMS IN PROBABILITY THEORY

Ana-Maria RÎTEA, Sorina Mihaela STOIAN

Transilvania University of Braşov, Romania

Abstract: *This paper is aimed to emphasize that the DeMoivre-Laplace integral theorem, the Lindeberg-Feller theorem, the Lyapunov's theorem and some others are a good basis for a large variety of problems of fundamental importance to the theory of probability itself and to its multiplicity of applications in the economic sciences, technology, natural sciences, even in the process of transmission of information or in computer science and of course in many others. With the multicriterial analysis method we want to establish which one has the sustainability more efficient.*

Keywords: *approximation, limit theorems, multicriterial analysis , precision, probability*

1. INTRODUCTION

Let v_n be number of successes in n Bernoulli samples. It is assumed that each success has probability p. Then $b(k; n. p)$ is the probability of event $v_n = k$.

Usually we are interested in the probability of the next event: *the number of all the successes that lie between two limits initial data, α and β* . For α and β integers, with $\alpha < \beta$, then this event is defined by the relationship $\alpha \leq v_n \leq \beta$. Its corresponding probability is given by

$$P[\alpha \leq v_n \leq \beta] == b(\alpha; n, p) + b(\alpha + 1; n, p) + \cdots + b(\beta; n, p). \quad (1)$$

Since the above sum can have many terms, a direct evaluation is impossible.

First DeMoivre and then Laplace realized that whenever n is larger, it can successfully used the normal distribution function, in order to obtain simple approximation of the probability (1).

This is very important as we will see below, not only for numerical computation.

A basic problem is to determine a scheme of independent trials which consist in determining the probability $b(k; n, p)$ that in n trials an event A will occur k times, and that in the rest $n - k$ samples the complementary event $\bar{A}$ will occur.

First we want to find the probability that event $A^{(r)}$ will occur in k specific samples (for example in trials with the numbers $r_1, r_2, \ldots, r_k$) and do not occur in the rest $n - k$ samples. But this probability is $p^k q^{n-k}$ (according to the multiplication theorem of independent events). Now, according to the additivity theorem of probability $b(k; n, p)$ is equal to the sum of the probabilities above calculated for all different modes k of occurrences of the event and $n - k$ nonoccurences from among n samples. From combinatorial theory we know that the number of such ways is

$$C_n^k = \binom{n}{k} = \frac{n!}{k!\,(n-k)!}, 0 \leq k \leq n.$$

Therefore, we obtain for the probability $b(k; n, p)$ the following estimation

$$b(k; n, p) = \binom{n}{k} p^k q^{n-k} = \frac{n!}{k!\,(n-k)!} p^k q^{n-k}. \quad (2)$$

It is noted that for large values of n and k, the computation of probability $b\ (k;\ n, p)$ using the formula (2), involves great difficulties. Thus there is a need to obtain asymptotic formula that allows the calculation of these probabilities with a sufficient degree of accuracy.

Thus, the main step is to obtain an asymptotic formula for (2).

DeMoivre is the first which determined in 1730, such a formula for asymptotic Bernoulli's scheme when $p = q = \frac{1}{2}$. Later this result was generalized by Laplace in arbitrary case $0 < p < 1$.

2. LIMIT THEOREMS

In this way, we have the following limit theorem:

Theorem [(1)] (the DeMoivre-Laplace local limit theorem) *If the probability of occurrence of some event A in n independent trials is constant and is equal to $p, (0 < p < 1)$, and $q = 1 - p$, then, the probability $b(k; n, p)$ that in each of the trials event A will occur exactly k times satisfies the relation*

$$b(k;n,p):\frac{1}{\sqrt{2\pi npq}}e^{-\frac{x^2}{2}} \to 1 \qquad (3)$$

as $n \to \infty$, uniformly in all k, for which $x_{n,k}$ lies in some finite interval, and verifies the equality

$$x_{n,k} = \frac{k - np}{\sqrt{npq}}, \quad 0 \le k \le n \qquad (4)$$

If M is an arbitrary positive constant set, then for those k for which

$$|x_{n,k}| \le M$$

we have

$$C_n^k p^k q^{n-k} \sim \frac{1}{\sqrt{2\pi npq}} e^{-\frac{x_{n,k}^2}{2}} \qquad (5)$$

(The convergence is relative to n and is uniformly relative to k)

Demonstration

From

$$x_{n,k} = \frac{k - np}{\sqrt{npq}}$$

it results that

$k = np + \sqrt{npq}x_{n,k}$

$n - k = nq - \sqrt{npq}x_{n,k}$.

Because $|x_{n,k}| \le M$ we have

$$\begin{cases} \frac{k}{np} = 1 + \frac{\sqrt{npq}}{np} \cdot x_{n,k} \to 1 \text{ şi deci } k \sim np \\ \frac{n-k}{nq} = 1 - \frac{\sqrt{npq}}{nq} x_{n,k} \to 1 \text{ şi deci } n - k \sim nq \end{cases}$$

(6)

Using the Stirling formula we can writte

$$C_n^k p^k q^{n-k} \sim \sim \frac{\left(\frac{n}{e}\right)^n \sqrt{n}\sqrt{2\pi}}{\left(\frac{k}{e}\right)^k \sqrt{k}\sqrt{2\pi}\left(\frac{n-k}{e}\right)^{n-k}\sqrt{n-k}\sqrt{2\pi}} \cdot p^k q^{n-k} \sim \sqrt{\frac{n}{k(n-k)}}\frac{1}{\sqrt{2\pi}}\varphi(n,k)$$

where

$$\varphi(n,k) = \frac{n^n}{k^n(n-k)^{n-k}}p^k q^{n-k} = \left(\frac{np}{k}\right)^k \left(\frac{nq}{n-k}\right)^{n-k}.$$

Because $k \sim np$ and $n - k \sim nq$ it results that

$$C_n^k p^k q^{n-k} \sim \frac{1}{\sqrt{2\pi npq}} \varphi(n,k).$$

Further we demonstrate that

$$\varphi(n,k) \sim e^{-\frac{x_{n,k}^2}{2}}$$

We use Taylor's expansion of $ln(1+x)$

$$ln(1+x) = x - \frac{x^2}{2} + \cdots + (-1)^{n-1}\frac{x^n}{n} + \cdots for\ |x| < 1$$

and we get

$$\ln\left(\frac{np}{k}\right)^k = k\ln\left(\frac{np}{k}\right) \sim k\ln\left(\frac{k - \sqrt{npq}x_{n,k}}{k}\right) = k\ln\left(1 - \frac{\sqrt{npq}x_{n,k}}{k}\right) =$$

$$= k\left(-\frac{\sqrt{npq}}{k}x_{n,k} - \frac{npq}{2k^2}x_{n,k}^2 - \cdots\right)$$

$$\ln\left(\frac{nq}{n-k}\right)^{n-k} = (n-k)\ln\left(\frac{nq}{n-k}\right) \sim (n-k)\ln\left(\frac{n-k+\sqrt{npq}x_{n,k}}{n-k}\right) =$$

$$= (n-k)\ln\left(1 + \frac{\sqrt{npq}x_{n,k}}{n-k}\right) == (n-k)\left(\frac{\sqrt{npq}}{n-k}x_{n,k} - \frac{npq}{2(n-k)^2}x_{n,k}^2 + \cdots\right)$$

because $\left|\frac{\sqrt{npq}}{k}x_{n,k}\right| < 1$ and

$\left|\frac{\sqrt{npq}}{n-k}x_{n,k}\right| < 1$ (*)

are satisfied for n sufficient large for

$|x_{n,k}| < M$. So

$$ln\varphi(n,k) == \ln\left(\frac{np}{k}\right)^k + \ln\left(\frac{nq}{n-q}\right)^{n-k} \sim k\left(-\frac{\sqrt{npq}}{k}x_{n,k} - \frac{npq}{2k^2}x_{n,k}^2 - \cdots\right) +$$

$$+(n-k)\left(\frac{\sqrt{npq}}{n-k}x_{n,k}-\frac{npq}{2(n-k)^2}x_{n,k}^2+\cdots\right)=$$

$$=\left(-\sqrt{npq}x_{n,k}-\frac{npq}{2k}x_{n,k}^2-\cdots\right)+\left(\sqrt{npq}x_{n,k}-\frac{npq}{2(n-k)}x_{n,k}^2+\cdots\right)=$$

$$=\frac{npq}{2}x_{n,k}^2\left(-\frac{1}{k}-\frac{1}{n-k}\right)+\cdots=-\frac{n^2pq}{2k(n-k)}x_{n,k}^2+\cdots.$$

We justify why we neglegt the terms of developing the terms with higher level that two for $n\to\infty$. When n is sufficient large, the two quantities from (4) are smaller than $\frac{2}{3}$ and

$$k\left|\frac{\sqrt{npq}}{k}x_{n,k}\right|^3=(n-k)\left|\frac{\sqrt{npq}}{(n-k)}x_{n,k}\right|^3$$

Because $pq<1$ and $|x_k|\le M$it does not exceed

$$\frac{n^{\frac{2}{3}}}{k^2}M^3+\frac{n^{\frac{3}{2}}}{(n-k)^2}M^3$$

which evidently tends to 0 when $n\to\infty$ due to relations (6). Thus, using these relationes, it results that

$$\ln\varphi(n,k)\sim\frac{n^2pq}{2npnq}x_{n,k}=-\frac{x_{n,k}^2}{2}$$

This is equivalent with

$$\varphi(n,k)\sim e^{-\frac{x_{n,k}^2}{2}}$$

And it follows (5).

Remark. The approximation is used if n is sufficient large such that $np\geq 5$ and $n(1-p)\geq 5$.

Some problems require the study of probability theory amounts to a large number of random variables. Central limit theorem establishes the conditions under which the limit distribution of the considered sums is normal.

Theorem [(2)] (DeMoivre-Laplace) *Let A be an eventwhich has the probability of realisations $p=P(A)$ in to an independent trials array. If S_n is the number of realisations of a in n trials, then for any a and b, $a<b$,*

$$\lim_{n\to\infty}P\left(\left\{a\le\frac{S_n-np}{\sqrt{npq}}\le b\right\}\right)==\frac{1}{\sqrt{2\pi}}\int_a^b e^{-\frac{x^2}{2}}dx\,.$$

(7)

Demonstration

Let k be a possible value of S_n such that $S_n=k$ it means

$$\frac{S_n-np}{\sqrt{npq}}=x_{n,k}$$

according to the relation (1). Then the probability of the event from the right of the formula (7) is

$$\sum_{a<x_{n,k}<b}P(\{S_n=k\})=\sum_{a<x_{n,k}<b}C_n^kp^kq^{n-k}$$

Given the fact that

$$x_{n,k+1}-x_{n,k}=\frac{k+1-np}{\sqrt{npq}}-\frac{k-np}{\sqrt{npq}}==\frac{1}{\sqrt{npq}}$$

we obtain

$$\sum_{a<x_{n,k}<b}P(\{S_n=k\})\sim$$

$$\sim\frac{1}{\mathcal{K}}\sum_{a<x_{n,k}<b}e^{-\frac{x^2}{2}}\left(x_{n,k+1}-x_{n,k}\right)\qquad(8)$$

The correspondence between k and $x_{n,k}$ is bijective and when k varies from 0 to n

, $x_{n,k}$ varies in interval $\left[-\sqrt{\frac{np}{q}},\sqrt{\frac{np}{q}}\right]$

, not continuous, with step

$$x_{n,k+1}-x_{n,k}=\frac{1}{\sqrt{npq}}.$$

For n sufficient large, the interval will contain $[a,b)$, and the points $x_{n,k}$ will be in entire of $[a,b)$, dividing it into equidistant intervals of length $\frac{1}{\sqrt{npq}}$.

We assume that the lowest and highest value of k that satisfy the conditions $a\le x_{n,k}<b$ are, respectively, j and l and we will have

$x_{j-1} < a < x_j < x_{j+1} < \cdots < x_{l-1} < x_l < b < x_{l+1}$,

and the sum from (2) can be written

$$\sum_{k=j}^{l} \varphi(x_{n,k})(x_{n,k+1} - x_{n,k})$$

where

$$\varphi(x) = \frac{1}{\mathcal{K}} e^{-\frac{x^2}{2}}.$$

This is the Riemann's sum for definited integral

$$\int_a^b \varphi(x)dx.$$

Making $n \to \infty$, the division becomes more and more fine and the sum converges to the given integral. It remains to determine the constant $\mathcal{K}$ In the formula

$$\lim_{n\to\infty} P\left(\left\{a \le \frac{S_n - np}{\sqrt{npq}} \le b\right\}\right) == \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{x^2}{2}} dx$$

(9)

$$\lim_{n\to\infty} P\left(\left\{-b \le \frac{S_n - np}{\sqrt{npq}} \le b\right\}\right) == \frac{1}{\mathcal{K}} \int_{-b}^{b} e^{-\frac{x^2}{2}} dx$$

(10)

If we note

$$X = \frac{S_n - np}{\sqrt{npq}},$$

then

$$M[X] = 0,$$

$$D^2(X) = 1$$

and we obtain

$$P\left(\left|\frac{S_n - np}{\sqrt{npq}} \le b\right|\right) \ge 1 - \frac{1}{b^2}. \qquad (11)$$

Combining the relations (9) and (10) we will obtain the relation

$$1 - \frac{1}{b^2} \le \frac{1}{\mathcal{K}} \int_{-b}^{b} e^{-\frac{x^2}{2}} \le 1$$

and making $b \to \infty$ we get

$$\mathcal{K} = \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}} dx = \sqrt{2\pi},$$

so the constant $\mathcal{K}$ from the Stirling's formula is $\sqrt{2\pi}$.

Before giving a new wording to DeMoivre-Laplace theorem, we will introduce the notion of *convergence in distribution*.

Definition 1. *Let $\{X_n\}_{n\in\mathbb{N}}$ be a random variables string and $\{F_n\}_{n\in\mathbb{N}}$ be the string corresponding distribution functions. If the string distribution functions $\{F_n\}_{n\in\mathbb{N}}$ converges to a distribution function F in all the continuity point x_0 of the distribution function F corresponding to the random variable X, ie if*

$$\lim_{n\to\infty} F_n(x_0) = F(x_0)$$

then we will say that the string $\{X_n\}_{n\in\mathbb{N}}$ ***converges in distribution*** *to X and it is noted*

$$X_n \xrightarrow{rep} X.$$

Remark. Because there may be more random variables with the same distribution function, it results from definition that the limit of a range of random variables converges in distribution is not unique.

Remark. An example of such convergence is the following: if $\{X_n\}_{n\in\mathbb{N}}$ is a string of random variables distributed

$Bi\left(n, \frac{\lambda}{n}\right)$ then $\{X_n\}_{n\in\mathbb{N}}$ converges in distribution to the random variable X distributed Poisson with parameter λ. (Relation between binomial distribution and Poisson distribution).

We now give a more general DeMoivre-Laplace theorem. We note with

$$S_n = X_1 + X_2 + \cdots + X_n, n \ge 1$$

where $X_j, j = \overline{1,n}$ are independent Bernoulli random variables. We know that

$$M[X_j] = p,$$
$$D^2[S_n] = npq, \quad j = \overline{1,n},$$

and for every n,

$$M[S_n] = np, \quad D^2[S_n] = npq.$$

Note

$$X_j^* = \frac{X_j - M[X_j]}{D[X_j]},$$

$$S_n^* = \frac{S_n - M[S_n]}{D[S_n]} = \frac{1}{\sqrt{n}} \sum_{j=1}^{n} X_j^* \qquad (11)$$

S_n^* is a random variable and is called a normalized random variable. We have for every j and n

$$M[X_j^*] = 0\ , D^2[X_j^*] = 1$$

The liniar transformation that leads X_j in X_j^* or S_n in S_n^* aims to bring them to a random variable with mean 0 and variance 1. Every S_n^* is a random variable which takes as values

$$x_{n,k} = \frac{k - np}{\sqrt{npq}}$$

This is just $x_{n,k}$ from DeMoivre-Laplace theorem and

$$P(\{S_n^* = x_{n,k}\}) = C_n^k p^k q^{n-k}, 0 \le k \le n$$

If we use the corresponding distribution function

$$P(\{S_n^* < x\}) = F_n(x)$$

and if F is the standard normal distribution function, then DeMoivre–Laplace theorem can be written in a form that is more elegant

$$\lim_{n\to\infty} F_n(x) = F(x)$$

Remark. The theorem can be extended in the following sense: let $\{X_n\}_{n\in\mathbb{N}}$ a string of independent random variables with the same distribution that does not need to be specified. It should, instead that $M[X_j] = m < \infty$ and $D^2[X_j] = \sigma^2 < \infty$. The Laplace theorem occurs also in these conditions.

Application. We will now determine how likely wrong betting options, 4 players of 15, each playing independently during a game, where the probability that a player has bet wrong is $p = 0{,}3$.

The bett is a random variable with binomial distribution:

$$X: \begin{pmatrix} k \\ C_n^k (0{,}3)^k (0{,}7)^{15-k} \end{pmatrix}, k = \overline{0,15}$$

$$P_{15,4} = C_{15}^4 (0{,}3)^4 (0{,}7)^{11} = \frac{15!}{4!11!} \cdot 0{,}0081 \cdot$$

$$0{,}05764801 = 0{,}2186$$

With the help of DeMoivre-Laplace theorem we can approximate

$$x_{15,4} = \frac{4 - \frac{15}{4}}{\sqrt{15 \cdot 0{,}3 \cdot 0{,}7}} = 0{,}1408$$

$$C_{15}^4 (0{,}3)^4 (0{,}7)^{11} \sim \frac{1}{\sqrt{2\pi \cdot 0{,}3 \cdot 0{,}7 \cdot 15}} e^{-\frac{(0{,}1408)^2}{2}} \approx 0{,}2225$$

Theorem [(3)] For the sums S_n in generalized conditions above and $a < b$ there we have

$$\lim_{n\to\infty} P\left(\left\{a < \frac{S_n - nm}{\sigma\sqrt{n}} \le b\right\}\right) == \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{x^2}{2}} dx\ .$$

(12)

The general formulation of laws limit arises in the following way:

Let $(X_n)_{n\in\mathbb{N}^*}$ a string of random variables. If there exists two strings of real number $(a_n)_{n\in\mathbb{N}^*}$ and $(b_n)_{n\in\mathbb{N}^*}$ such that

$\frac{X_n - a_n}{b_n} \xrightarrow{B} X$, where X has a determined distribution law, then distributions thus obtained constitutes a family that we call family of type L distributions, in which the normal law occupies a very important place.

Theorem [(4)]. Central limit theorem (Lindeberg-Levy)

Let $(X_n)_{n\in\mathbb{N}^*}$ be a string of independent random variables, identically distributed, admitting moments of order one and two. If we consider the string of random variables $(Y_n)_{n\in\mathbb{N}^*}$

$$Y_n = \frac{\sum_{k=1}^n X_k - M(\sum_{k=1}^n X_k)}{D(\sum_{k=1}^n X_k)}$$

then

$$Y_n \xrightarrow{B} X \in N(0;1),$$

$$\lim_{n\to\infty} F_n(x) = \lim_{n\to\infty} P(\omega: Y_n(\omega) < x) = \frac{1}{2\pi} \int_{-\infty}^{x} e^{-\frac{y^2}{2}} dy.$$

Demonstration

It is noted immediately that

$$M\left(\sum_{k=1}^n X_k\right) = \sum_{k=1}^n M(X_k) = nm\ ;$$

$m = M(X_k), k = 1,2, \ldots$

$$D^2\left(\sum_{k=1}^{n} X_k\right) = \sum_{k=1}^{n} D^2(X_k) = n\sigma^2;$$

$\sigma^2 = D^2(X_k), k = 1,2, \ldots$

and, so,

$$Y_n = \frac{\sum_{k=1}^{n}(X_k - m)}{\sqrt{n}\sigma}$$

Then.

$$\varphi_{Y_n}(t) = M\left(e^{it^{Y_n}}\right) = M\left(e^{it\frac{\sum_{k=1}^{n}(X_k-m)}{\sqrt{n}\sigma}}\right) =$$

$$= M\left(\prod_{k=1}^{n} e^{i\frac{t}{\sqrt{n}\sigma}(X_k-m)}\right) =$$

$$= \prod_{k=1}^{n} M\left(e^{i\frac{t}{\sqrt{n}\sigma}(X_k-m)}\right) =$$

$$= \prod_{k=1}^{n} \varphi_{(X_k-m)}\left(\frac{t}{\sqrt{n}\sigma}\right) = \left(\varphi\left(\frac{t}{\sqrt{n}\sigma}\right)\right)^n$$

Because for every $t \in \mathbb{R}$, if n is sufficient large, $\left|\frac{t}{\sqrt{n}\sigma}\right| < 1$, then we can extend in series around the origin, the function φ and we will obtain

$$\varphi\left(\frac{t}{\sqrt{n}\sigma}\right) = 1 - \frac{\sigma^2}{2!}\frac{t^2}{\sigma^2 n} + \theta\left(\frac{1}{n^{\frac{3}{2}}}\right) =$$

$$= 1 - \frac{t^2}{2n} + \theta\left(\frac{1}{n^{3/2}}\right)$$

It follows that

$$\varphi_{Y_n}(t) = \left(1 - \frac{t^2}{2n}(1 + \varepsilon_n)\right)^n,$$

$$\lim_{n\to\infty} \varepsilon_n = 0$$

and

$$\lim_{n\to\infty} \varphi_{Y_n}(t) = e^{-\frac{t^2}{2}}$$

From the uniqueness and inversion theorem it results that

$$\lim_{n\to\infty} F_{Y_n}(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{y^2}{2}} dy.$$

Theorem [(5)] (Lyapunov) *Let $(X_n)_{n\in\mathbb{N}^*}$ be a string of independent random variables for which there exist*

$M(X_k) = m_k, D^2(X_k) = D_k^2, M(|X_k - m_k|^3) = H_k^3, k \in \mathbb{N}^*.$

We note

$$S_n = \left(\sum_{k=1}^{n} D_k^2\right) \qquad H_n = \left(\sum_{k=1}^{n} H_k^3\right)^{1/3}$$

If

$$\lim_{n\to\infty} \frac{K_n}{S_n} = 0$$

then

$$Y_n = \frac{\sum_{k=1}^{n} X_k - M(\sum_{k=1}^{n} X_k)}{D(\sum_{k=1}^{n} X_k)} \xrightarrow{B} X \in N(0,1)$$

ie

$$\lim_{n\to\infty} F_{Y_n}(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{y^2}{2}} dy.$$

Demonstration

We will use also the characteristic function method; as

$$D^2\left(\sum_{k=1}^{n} X_k\right) = \sum_{k=1}^{n} D^2(X_k) = S_n^2$$

The random variable Y_n can be also written in the following form

$$Y_n = \frac{\sum_{k=1}^{n}(X_k - m_k)}{S_n}$$

and, with this,

$$\varphi_{Y_n}(t) = M\left(e^{it^{Y_n}}\right) = M\left(e^{i\frac{t}{S_n}\sum_{k=1}^{n}(X_k-m_k)}\right) =$$

$$= M\left(\prod_{k=1}^{n} e^{i\frac{t}{S_n}\sum_{k=1}^{n}(X_k-m_k)}\right) =$$

$$= \prod_{k=1}^{n} M\left(e^{i\frac{t}{S_n}\sum_{k=1}^{n}(X_k-m_k)}\right)$$

So,

$$\varphi_{Y_n}(t) = \prod_{k=1}^{n} \varphi_{X_k - m_k}\left(\frac{t}{S_n}\right)$$

But,

$$\varphi_{X_k - m_k}(t) = e^{-itm_k}\varphi_{X_k}(t) = a_k(t) + ib_k(t)$$

If we note with $G_k(x)$ the distribution function of the random variable $X_k = m_k$, it results that:

$$a_k(t) = \int_{-\infty}^{\infty} \cos txdG_k(x) =$$

$$= 1 - \frac{D_k^2 t^2}{2} + \frac{t^3}{6}\int_{-\infty}^{\infty} \theta_1 x^3\, dG_k(x)$$

$$b_k(t) = \int_{-\infty}^{\infty} \sin txdG_k(x) =$$

$$= 1 - \frac{D_k^2 t^2}{2} + \frac{t^3}{6}\int_{-\infty}^{\infty} \theta_2 x^3\, dG_k(x)$$

with $|\theta_j| < 1, j = 1,2.$
Then,

$\varphi_{X_k - m_k}(t) = 1 - \frac{D_k^2 t^2}{2} + t^3 R_k$, where

$$|R_k| = \frac{1}{6}\left|\int_{-\infty}^{\infty} (\theta_1 x^3 - \theta_2 x^3) dG_k(x)\right| \leq$$

$$\leq \frac{1}{6}\int_{-\infty}^{\infty} |x^3||\theta_1 - \theta_2| dG_k(x) \leq \frac{H_k^3}{3}$$

and, from here,

$$\varphi_{X_k - m_k}\left(\frac{t}{S_n}\right) = 1 - \frac{D_k^2 t^2}{2S_n^2} + \frac{t^3}{3S_n^3}$$

and

$$\ln \varphi_{Y_n}(t) = \sum_{k=1}^{n} \ln \varphi_{X_k - m_k}\left(\frac{t}{S_n}\right) =$$

$$= \sum_{k=1}^{n} ln\left(1 - \frac{D_k^2 t^2}{2S_n^2} + \frac{t^3}{3S_n^3}\right).$$

Because $\frac{K_n}{S_n} \to 0$ when $n \to \infty$, it results that for every

$\varepsilon > 0$, there exist a rank $N(\varepsilon)$ such that for every

$n > N(\varepsilon)$ we will have $\frac{K_n}{S_n} < \frac{\varepsilon}{|t|}$, $t \neq 0$.
From here it results that

$$\frac{H_k^3}{S_n^3} < \frac{\varepsilon^3}{|t|^3}$$

if $n > N(\varepsilon)$.

From the Lyapunov's inequality (the monotony of absolute moments) we have $D_k \leq H_k, k \in \mathbb{N}^*$ and, so,

$$\frac{D_k^2}{S_n^2} \leq \frac{H_k^2}{S_n^2} = \left(\frac{H_k^3}{S_n^3}\right)^{2/3} \leq \frac{H_k^2}{S_n^2} \leq \frac{\varepsilon^2}{t^2}, k = 1,2,\ldots,n$$

Then, for every $\varepsilon > 0$,

$$\left|-\frac{D_k^2 t^2}{2S_n^2} + \frac{t^3 R_k}{3S_n^3}\right| < \frac{\varepsilon^2}{2} + \frac{\varepsilon^3}{3} < \varepsilon^2$$

We put

$$\ln \varphi_{Y_n}(t) = \sum_{k=1}^{n} ln\left(1 - \frac{D_k^2 t^2}{2S_n^2} + \frac{t^3 R_k}{3S_n^3}\right)$$

In the form

$$\ln \varphi_{Y_n}(t) + \frac{t^2}{2} =$$

$$= \sum_{k=1}^{n}\left[\ln\left(1 - \frac{D_k^2 t^2}{2S_k^2} + \frac{t^3 R_k}{3S_n^3}\right) + \frac{D_k^2 t^2}{2S_n^2}\right].$$

Such that $|\ln(1+x) - x| \leq |x^2|$ if $|x| \leq \frac{1}{2}$, with notation

$A_k = -\frac{D_k^2 t^2}{2S_n^2}$, $B_k = \frac{t^3 R_k}{3S_n^3}$, we can write

$$\left|\ln \varphi_{Y_n}(t) + \frac{t^2}{2}\right| =$$

$$= \left|\sum_{k=1}^{n} \ln(1 + A_k + B_k) - (A_k + B_k) + B_k\right| \leq$$

$$\leq \sum_{k=1}^{n} |A_k + B_k|^2 + \sum_{k=1}^{n} |B_k|.$$

But

$$\sum_{k=1}^{n}|B_k| \le \frac{|t|^3 K_n^3}{3S_n^3} \le \frac{\varepsilon^3}{3}$$

also

$$\sum_{k=1}^{n}|A_k + B_k|^2 \le \varepsilon^2 \sum_{k=1}^{n}(|A_k| + |B_k|) \le$$

$$\le \varepsilon^2 \frac{|t|^2}{2} + \frac{\varepsilon^5}{3}$$

From here, it follows that

$$\left|\ln \varphi_{Y_n}(t) + \frac{t^2}{2}\right| \le \varepsilon^2 \frac{|t|^2}{2} + \frac{\varepsilon^5}{3} + \frac{\varepsilon^3}{3} < \varepsilon$$

if $\varepsilon < \frac{1}{3|t|^2}$

So,

$$\lim_{n\to\infty} \varphi_{Y_n}(t) = e^{-\frac{t^2}{2}}$$

and from theorem of convergence of characteristic functions, it follows that

$$\lim_{n\to\infty} F_{Y_n}(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{y^2}{2}} dy.$$

Remark. If the variables of the string $(X_n)_{n\in\mathbb{N}^*}$ are identically distributed, then

$$D_k^2 = \sigma^2;\ H_k^3 = H^3, k \in \mathbb{N}^*$$

and

$$S_n = \left(\sum_{k=1}^{n} D_k^2\right)^{1/2} = \sigma\sqrt{n}$$

$$K_n = \left(\sum_{k=1}^{n} H_k^3\right)^{1/3} = H\sqrt[3]{n}$$

It follows that

$$\frac{K_n}{S_n} = \frac{H}{\sigma} n^{-1/6} \xrightarrow[n\to\infty]{} 0$$

ie it satisfies the requirement of Lyapunov.

Definition. *We say that the string of independent random variables $(X_n)_{n\in\mathbb{N}^*}$ verify the* ***„L" condition (Lindeberg condition)*** *if, for every $\varepsilon > 0$, it follows the relation*

$$(L) \quad \lim_{n\to\infty} \alpha_n(\varepsilon) =$$

$$= \lim_{n\to\infty} \frac{1}{S_n^2} \sum_{k=1}^{n} \int_{\{x;|x-m_k|>\varepsilon S_n\}} (x-m_k)^2 dF_k(x) = 0$$

where

$$F_k(x) = P(\{\omega; X_k(\omega) < x\}).$$

Theorem [(7)] (Lindeberg-Feller) *Let $(X_n)_{n\in\mathbb{N}^*}$ a string of independent random*

$$\lim_{n\to\infty} F_{Y_n}(x) = \Phi(x), x \in \mathbb{R}$$

and

$$\lim_{n\to\infty} \max_{1\le k\le n} \frac{\sigma_k^2}{S_n^2} = 0$$

if and only if

$$\lim_{n\to\infty} \frac{1}{S_n^2} \sum_{k=1}^{n} \int_{\{x;|x-m_k|>\varepsilon S_n\}} (x-m_k)^2 dF_k(x) = 0$$

(is satisfied the „L" condition).

We highlight some direct consequences of Lindeberg Feller theorem.

Consequence [(7)] *If the random variables that compose the string of independent variables $(X_n)_{n\in\mathbb{N}^*}$ are identically distributed, then*

$$\lim_{n\to\infty} F_{Y_n}(x) = \Phi(x), \forall x \in \mathbb{R}$$

Demonstration

In this case,

$M(X_k) = m$, $D^2(X_k) = \sigma^2, k \in \mathbb{N}^*$ and, so,

$$S_n = \sigma\sqrt{n}.$$

With these, the Lindeberg's condition become

$$\alpha_n(\varepsilon) = \sum_{k=1}^{n} \frac{1}{n\sigma^2} \int_{\{x;|x-m|>\varepsilon\sigma\sqrt{n}\}} (x-m)^2 dF(x) =$$

$$= \frac{1}{n\sigma^2} n \int_{\{x;|x-m|>\varepsilon\sigma\sqrt{n}\}} (x-m)^2 dF(x)$$

and, so, $\lim_{n\to\infty} \alpha_n(\varepsilon) = 0$

ie Lindeberg's condition is accomplished.

Consequence [(8)] *If the string of the independent random variables $(X_n)_{n\in\mathbb{N}^*}$ has the property that the random variables X_n are uniformly bounded, and admits finite dispersions*

$$\lim_{n\to\infty} S_n = +\infty,$$

then

$$\lim_{n\to\infty} F_{Y_n}(x) = \Phi(x)$$

Demonstration

Given that the random variables $X_k, k \in \mathbb{N}^*$ are uniformly bounded, it results that $(\exists)A > 0$ such that$X_k - m_k \leq A, k \in \mathbb{N}^*$. From that, it follows that:

$$\int_{\{x;|x-m_k|>\varepsilon S_n\}} (x-m_k)^2 dF(x) =$$

$$= \int_{\{x;|x_k(\omega)-m_k|>\varepsilon S_n\}} (X_k(\omega)-m_k)^2 dP(\omega) \leq$$

$$\leq A^2 P(\{\omega; |X_k(\omega)-m_k| \geq \varepsilon S_n\})$$

Since

$$\lim_{n\to\infty} S_n = +\infty,$$

we can take n sufficient large such that $\varepsilon S_n > A$, and in this case,

$$P(\{\omega; |X_k(\omega)-m_k| \geq \varepsilon S_n\}) = 0$$

and

$$\int_{\{|x-m_k|>\varepsilon S_n\}} (x-m_k)^2 dF(x) = 0, \quad k \in \mathbb{N}^*$$

which implies checking the condition „L".

Given the Lindeberg-Feller central limit theorem, we can easily prove the theorem of Lyapunov.

Theorem [(9)] (Lyapunov) *Let the string of the independent random variables* $(X_n)_{n\in\mathbb{N}^*}$. *If there exists* $\eta > 0$ *such that:*

$$\lim_{n\to\infty} \beta_n(\eta) = \lim_{n\to\infty} \frac{1}{S_n^{2+\eta}} \sum_{k=1}^{n} M(|x_k - m_k|^{2+\eta}) = 0$$

then

$$\lim_{n\to\infty} F_{Y_n}(x) = \Phi(x), \forall x \in \mathbb{R}$$

Demonstration

We verify if the „L" condition can be checked:

$$\alpha_n(\varepsilon) =$$

$$= \frac{1}{S_n^2} \sum_{k=1}^{n} \int_{\{|x-m_k|>\varepsilon S_n\}} (x-m_k)^2 \frac{\varepsilon^\eta s_n^\eta}{\varepsilon^\eta s_n^\eta} dF_k(x)$$

$$= \frac{1}{\varepsilon^\eta S_n^{2+\eta}} \sum_{k=1}^{n} \int_{\{|x-m_k|>\varepsilon S_n\}} (x-m_k)^{2+\eta} dF_k(x) \leq \frac{1}{\varepsilon^\eta} \beta_n(\eta)$$

Passing to the limit,

$$0 \leq \lim_{n\to\infty} \alpha_{n(\varepsilon)} \leq \frac{1}{\varepsilon^\eta} \lim_{n\to\infty} \beta_n(\eta) = 0$$

ie the condition „L"is satisfied.

For $\eta = 1$ is obtained exactly the formulation of Lyapunov's theorem directly demonstrated previously.

If the the string of independent random variables $(X_n)_{n\in\mathbb{N}^*}$ are

$$H_k^3 = M(|x_k - m_k|^3), k \in \mathbb{N}^*$$

and if

$$\lim_{n\to\infty} \frac{K_n}{S_n} = 0$$

where

$$K_n = \left(\sum_{k=1}^{n} H_k^3\right)^{1/3}$$

then

$$\lim_{n\to\infty} F_{Y_n}(x) = \Phi(x), \forall x \in \mathbb{R}.$$

3. THE MULTICRITERIAL ANALYSIS

In this part of the present article, the authors have proposed to analyze the 9 theorems presented in previous side from the point of three ways.

We have the following variants:

- variant (a): the extent of which one applies more frequently theorems
- variant (b): the difficulty to apply the 9th theorems
- variant (c): the reliable of application of the 9th theorems

9 criteria have been chosen:

1.	**Local theorem Moivre-Laplace [(1)]**
2.	**Moivre-Laplace theorem [(2)]**
3.	**Theorem [(3)]**
4.	**Central limit theorem Lindeberg-Levy [(4)]**
5.	**Lyapunov theorem [(5)]**
6.	**Lindeberg-Feller theorem [(6)]**
7.	**Consequence [(7)]**
8.	**Consequence [(8)]**
9.	**Lyapunov theorem [(9)]**

Fig. 1

Based bet on score, weighting of the criteria resulted as follows:

	[(1)]	[(2)]	[(3)]	[(4)]	[(5)]	[(6)]	[(7)]	[(8)]	[(9)]	Points	Level	γ_i
[(1)]	**1/2**	1	0	1/2	0	0	0	0	0	2	8	0,2
[(2)]	1	**1/2**	0	1/2	1/2	1/2	0	1/2	0	3,5	7,5	0,7
[(3)]	1	1	**1/2**	1/2	0	1/2	0	0	0	3,5	7,5	0,7
[(4)]	1	1	1/2	**1/2**	1/2	1	1/2	0	0	5	5	1,7
[(5)]	1/2	0	1/2	1	**1/2**	1/2	1/2	1/2	1/2	4,5	6	1,4
[(6)]	1/2	1/2	0	1	1	**1/2**	1/2	1/2	1	5,5	4	2,2
[(7)]	1	1	1/2	1/2	1/2	1	**1/2**	1	1/2	6,5	3	3,1
[(8)]	1	1	1/2	1/2	1	1	1/2	**1/2**	1	7	2	3,9
[(9)]	1	1/2	1/2	1	1	1	1	1	**1/2**	7,5	1	4,7

Fig. 2

It is noted that the main diagonal of the array contains only quadratic criteria for scoring 1/2 values because no criteria may be more important or less important than the criteria itself.

The γ_i weighting coefficients can be calculated with different formulas. We chose to use FRISCO practice formula (empirical formula given by a renowned creative group from San Francisco – US) that has been recognized worldwide as being the most performance and is long used.

Therefore, with,

$$\gamma_i = \frac{p + \Delta p + m + 0,5}{-\Delta p' + \frac{N_{crt}}{2}}$$

where

- p is the sum of points obtained (on line) of the considered element
- Δp the difference between the score of the considered element and the score at the top level element; if the element taken into account is the one located on the top floor, results Δp with the value 0
- m the number of outclassed criteria (exceeded from terms of score) the by the criteria taken into account
- N_{crt} the number of considered criterion
- $\Delta p'$ the difference between the score of the considered element and the score of the first element (resulting with a negative value); taken into account if the item is located on the first level, $\Delta p'$ results with the value 0

We obtain

$$\gamma_{(1)} = \frac{2 + (2-2) + 0 + 0,5}{-(2-7,5) + \frac{9}{2}} = \frac{2,5}{10} = 0,2$$

$$\gamma_{(2)} = \frac{3,5 + (3,5-2) + 1 + 0,5}{-(3,5-7,5) + \frac{9}{2}} = \frac{6,5}{8,5} = 0,7 = \gamma_{(3)}$$

$$\gamma_{(4)} = \frac{5 + (5-2) + 4 + 0,5}{-(5-7,5) + \frac{9}{2}} = \frac{12,5}{7} = 1,7$$

$$\gamma_{(5)} = \frac{4,5 + (4,5-2) + 3 + 0,5}{-(4,5-7,5) + \frac{9}{2}} = \frac{10,5}{7,5} = 1,4$$

$$\gamma_{(6)} = \frac{5,5 + (5,5-2) + 5 + 0,5}{-(5,5-7,5) + \frac{9}{2}} = \frac{14,5}{6,5} = 2,2$$

$$\gamma_{(7)} = \frac{6,5 + (6,5-2) + 6 + 0,5}{-(6,5-7,5) + \frac{9}{2}} = \frac{17,5}{5,5} = 3,1$$

$$\gamma_{(8)} = \frac{7 + (7-2) + 7 + 0{,}5}{-(7-7{,}5) + \frac{9}{2}} = \frac{19{,}5}{5} = 3{,}9$$

$$\gamma_{(9)} = \frac{7{,}5 + (7{,}5-2) + 8 + 0{,}5}{-(7{,}5-7{,}5) + \frac{9}{2}} = \frac{21{,}5}{4{,}5} = 4{,}7$$

According to the criteria were the following notes for each variant N_i.

	Variant (a)	Variant (b)	Variant (c)
Criteria	N_i	N_i	N_i
(1)	10	3	9
(2)	5	2	6
(3)	2	9	4
(4)	9	6	5
(5)	7	4	8
(6)	6	10	7
(7)	4	7	3
(8)	3	8	2
(9)	8	5	10

Fig. 3

It may take into account different weight now and consequence of each criterion, complementing and enhancing the table above notes (lines) with the coefficient of importance:

4. CONCLUSIONS

Multicriterial analysis technique is useful in the composition of an ranking, while qualitatively and quantitatively, of product variants, objects, methods, models, equipment, structures, creations, etc. A first valence would be that the result of such analysis in order not only put options, but it quantifies in value terms.

Rankings, to a large extent, have a high degree of subjectivity and aims the most of the time only the qualitative aspect. Multicriterial analysis technique gives, from the viewpoint of its user, results found to a great extent objectives (ie, this technique objectifies in an important measure the results).

It is noted that after the ranking did, the approximation theorems studied in this paper are preferred to be taken in the variant (b).

We want to emphasize that point III is our own creation. Efforts have been made to develop this multicriterial analysis applied to approximation theorems studied in this paper, hoping that we will develop it in the future.

		Variant (a)		Variant (b)		Variant (c)	
Criteria	γ_i	N_i	$N_i \times \gamma_i$	N_i	$N_i \times \gamma_i$	N_i	$N_i \times \gamma_i$
(1)	0,2	10	2	3	0,6	9	1,8
(2)	0,7	5	3,5	2	1,4	6	4,2
(3)	0,7	2	1,4	9	6,3	4	2,8
(4)	1,7	9	15,3	6	10,2	5	8,5
(5)	1,4	7	9,8	4	5,5	8	11,2
(6)	2,2	6	13,2	10	22	7	15,4
(7)	3,1	4	12,4	7	21,7	3	9,3
(8)	3,9	3	11,7	8	31,2	2	7,8
(9)	4,7	8	37,6	5	23,5	10	47
Final ranking			106,9		122,5		108

Fig. 4

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NEW CLASSES OF R -COMPLEX HERMITIAN FINSLER SPACES WITH *(α,β)*-METRICS

Monica A.P. PURCARU, Gabriela CÂMPEAN

Transilvania University, Braşov, Romania

Abstract:*The aim of this paper is to investigate three special* R *-complex Finsler spaces with (α,β)-metrics.We characterize Weyl metric,quadratic metric and another special (α,β)-metric in* R *-complex Finsler spaces conditions.Some properties of these metrics are demonstrated.Finally we came with some explicit examples.*

Keywords: R *-complex Finsler space,(α,β)-metrics*

1. PRELIMINARIES

The study of R -complex Finsler spaces is quite new.It has been initiated in[10] and it have been recently developed in[3],[4].[7].

In the paper [10], it was extended the well-known defnition of a complex Finsler space [1], reducing the scalars to $\lambda \in R$. The outcome was a new class of Finsler space called the R -complex Finsler spaces [10].

In this section we keep the general setting from [3,10] and subsequently we recall only some needed notions.

An R- complex Finsler space is a pair *(M,F)*. where F is a continuous function $F : T'M \to R_+$ satisfying the conditions:

i) $L = F^2$ is smooth on $\widetilde{T'M} = T'M\backslash\{0\}$;

ii) $F(z,\eta) \geq 0$ the equality holds if and only if $\eta = 0$;

iii) $F(z,\lambda\eta,\bar{z},\overline{\lambda\eta}) = |\lambda| F(z,\eta,\bar{z},\bar{\eta})$; $\forall \lambda \in R$,

The fundamental function L of a R -complex Finsler space, induces the following tensors:

$$g_{ij} = \frac{\partial^2 L}{\partial \eta^i \partial \eta^j}; g_{i\bar{j}} = \frac{\partial^2 L}{\partial \eta^i \partial \bar{\eta}^j}; g_{ij} = \frac{\partial^2 L}{\partial \bar{\eta}^i \partial \bar{\eta}^j}$$

which satisfy interesting properties, obtained as consequences of the homogeneity condition iii)

$$\frac{\partial L}{\partial \eta^i}\eta^i + \frac{\partial L}{\partial \bar{\eta}^i}\bar{\eta}^i = 2L;\ g_{ij}\eta^i + g_{j\bar{i}}\bar{\eta}^i = \frac{\partial L}{\partial \eta^j}$$

$$2L = g_{ij}\eta^i\eta^j + 2g_{i\bar{j}}\eta^i\bar{\eta}^j + g_{\bar{i}\bar{j}}\bar{\eta}^i\bar{\eta}^j$$

$$\frac{\partial g_{ik}}{\partial \eta^j}\eta^j + \frac{\partial g_{ik}}{\partial \bar{\eta}^j}\bar{\eta}^j = 0; \frac{\partial g_{i\bar{k}}}{\partial \eta^j}\eta^j + \frac{\partial g_{i\bar{k}}}{\partial \bar{\eta}^j}\bar{\eta}^j = 0$$

Having an R - complex Finsler space, if we suppose that F satisfies the regularity conditions: $g_{i\bar{j}}$ is nondegenerated, (i.e., $\det(g_{i\bar{j}}) \neq 0$, in any $u \in T'M$), and it defines a positive definite Levi-form for all $z \in M$, then such a class of spaces is called R - complex Hermitian Finsler space.

Consider the sections of the complexified tangent bundle of T′M. Let $VT'M \subset T'(T'M)$ be the vertical bundle, locally spanned by $\{\frac{\partial}{\partial \eta^k}\}$, and VT′′M its conjugate.

The idea of complex nonlinear connection, briefly (c.n.c.), is an instrument in 'linearization' of the geometry of the manifold T′M. A (c.n.c.) is a supplementary complex subbundle to VT′M in T′(T′M), i.e. $T'(T'M) = HT'M \oplus VT'M$. The horizontal distribution $H_uT'M$ is locally spanned by $\left\{\frac{\delta}{\delta z^k} = \frac{\partial}{\partial z^k} - N_k^i\frac{\partial}{\partial \eta^j}\right\}$, where $N_k^i(z,\eta)$ are the coefficients of the (c.n.c.). The pair $\{\delta_k = \frac{\delta}{\delta z^k}, \partial_k = \frac{\partial}{\partial \eta^k}\}$ will be called the adapted frame of the (c.n.c.).

A (c.n.c.) related only to the fundamental function of the R - complex Hermitian Finsler space (M,F), (called Chern-Finsler (c.n.c.)), has the following local coefficients:

$$N_k^i = g^{\bar{m}i}\frac{\partial^2 L}{\partial z^k \partial \bar{\eta}^m} = g^{\bar{m}i}\left(\frac{\partial g_{r\bar{m}}}{\partial z^k}\bar{\eta}^r + \frac{\partial g_{s\bar{m}}}{\partial z^k}\eta^s\right)$$

Also, in a R - complex Hermitian Finsler space, we have recovered the Chern-Finsler connection, which is metrical, of (1,0)- type, and it is given by

$$L^i_{jk} = g^{\bar{m}i}\left(\delta_j g_{k\bar{m}}\right); C^i_{jk} = g^{\bar{m}i}\left(\dot{\partial}_j g_{k\bar{m}}\right);$$

$$L^i_{j\bar{k}} = C^i_{j\bar{k}} = 0$$

where δ_j is the frame corresponding to the Chern-Finsler (c.n.c.).

2. R -COMPLEX FINSLER SPACE WITH WEYL METRIC

We consider $z \in M$, $\eta \in T'_z M$, $\eta = \eta^i \frac{\partial}{\partial z_i}$. An R - complex Finsler space (M,F),with Weyl metric is a space where:

$$L = F^2 = 2\alpha\beta$$

$$\alpha^2(z,\eta,\bar{z},\bar{\eta}) = Re\{a_{ij}\eta^i\eta^j\} + a_{i\bar{j}}\eta^i\bar{\eta}^j$$

$$\beta(z,\eta,\bar{z},\bar{\eta}) = Re\{b_i\eta^i\}$$

Proposition 2.1: *The invariants of this class of* R *-complex Finsler spaces are:*

$$\rho_0 = \frac{\beta}{\alpha}; \rho_1 = \alpha; \rho_{-2} = \frac{-\beta}{2\alpha^3}; \rho_{-1} = \frac{1}{2\alpha}; \mu_0 = 0$$

Proposition 2.2:*The metric tensor field of a* R *-complex Finsler spaces with (α,β)-metric: L(α,β)= 2αβ is given by:*

$$g_{i\bar{j}} = \frac{\beta}{\alpha}a_{i\bar{j}} - \frac{\beta}{2\alpha^3}l_i l_{\bar{j}} + \frac{1}{2\alpha}\left(b_{\bar{j}}l_i + l_{\bar{j}}b_i\right)$$

Or in the equivalent form:

$$g_{i\bar{j}} = \frac{\beta}{\alpha}a_{i\bar{j}} - \frac{\beta}{\alpha^3}l_i l_{\bar{j}} - \frac{\alpha}{2\beta}b_{\bar{j}}b_i + \frac{1}{2\alpha\beta}\eta_i\eta_j$$

The next aim is to find the formulas for the determinant and the inverse of the tensor field $g_{i\bar{j}}$. The solution is obtained by the following Lemma like in [7], for an arbitrary non-singular Hermitian matrix $Q_{i\bar{j}}$.

Lemma: *Suppose:*

- *$(Q_{i\bar{j}})$is a non-singular $n\times n$ complex matrix with inverse $(Q^{i\bar{j}})$*
- *C_i and $C_{\bar{i}} = \bar{C}_i$, i=1,..,n, are complex numbers;*
- *$C^i = Q^{i\bar{j}}C_{\bar{j}}$ and its conjugates;*
- *$C^2 = C^i C_i = C^{\bar{i}}C_{\bar{i}}$;*

$H_{i\bar{j}} = Q_{i\bar{j}} \pm C_i C_{\bar{j}}$

Then

$Det(H_{i\bar{j}}) = (1 \pm C^2)det(Q_{i\bar{j}})$

Whenever $(1\pm C^2)\neq 0$ the matrix $(H_{i\bar{j}})$ is invertible and in this case its inverse is

$$H^{\bar{j}i} = Q^{\bar{j}i} \mp \frac{1}{1 \pm C^2}C^i C^{\bar{j}}$$

Proposition 2.3: *For the* R *- complex Hermitian Finsler space with the metric F= $\sqrt{2\alpha\beta}$ the determinant and the inverse of the fundamental metric tensor $g_{i\bar{j}}$ are given by*

$$i)\ g^{i\bar{j}} = \frac{\alpha}{\beta}H^{\bar{j}i}$$

$$ii)\ det(H_{i\bar{j}}) = \frac{(2\beta^2 + \alpha^2 A)(\alpha^2 - \gamma)}{\alpha^2(2\beta^2 + B)}det(a_{i\bar{j}})$$

Where

$$H^{\bar{j}i} = a^{\bar{j}i} + Q\eta^i\bar{\eta}^j + \left(T + \frac{\alpha^2 P}{\sqrt{2}BN} + 2\alpha P\right)b^i b^{\bar{j}}$$

$$\eta^i\bar{\eta}^j + \left(T + \frac{\alpha^2 P}{\sqrt{2}BN} + 2\alpha P\right)b^i b^{\bar{j}} +$$

$$\left(R + \frac{\alpha PM}{N}\right)b^i\bar{\eta}^j + \left(Sb^{\bar{j}} + \frac{\alpha PM}{N}\right)b^{\bar{j}}\eta^i +$$

$$\frac{\beta P}{\sqrt{2}\alpha^2 N}l^i l^{\bar{j}}$$

$$+ \left(\frac{P}{\sqrt{2}N} + \frac{\beta P}{\alpha}\right)l^i b^{\bar{j}} + \left(\frac{P}{\sqrt{2}N} + \frac{\beta P}{\alpha}\right)b^i l^{\bar{j}} + \frac{PMB}{\alpha N}l^i\bar{\eta}^j +$$

$$\frac{PMB}{\alpha N}\eta^i l^{\bar{j}}$$

Example 1:

We consider α as in [4], given by

$$\alpha^2(z,\eta) = \frac{|\eta|^2 + \varepsilon(|z|^2|\eta|^2 - |<z,\eta>|^2)}{(1+\varepsilon|z|^2)^2}$$

defined over the disk $\Delta^n_r = \left\{z \in C^n \,||z| < r, r = \sqrt{\frac{1}{|\varepsilon|}}\right\}, \varepsilon < 0$.We set $\beta(z,\eta) = Re\frac{<z,\eta>}{(1+\varepsilon|z|^2)}$,where $b_i = \frac{\bar{z}^i}{(1+\varepsilon|z|^2)}$ and we obtain

$$F_\varepsilon = \frac{|\eta|^2 + \varepsilon\left(|z|^2|\eta|^2 - |<z,\eta>|^2\right)}{(1+\varepsilon|z|^2)^2} \pm \left(Re\frac{<z,\eta>}{(1+\varepsilon|z|^2)}\right)^2$$

3. A SPECIAL CLASS OF R -COMPLEX FINSLER SPACE WITH *(α,β)*-METRIC

Following the ideas from real case we shall introduce a new class of R - complex

Finsler metrics.We take

$$L(\alpha,\beta) = F^2 = \frac{(\alpha+\beta)^4}{8}$$

In order to study the R - complex Hermitian Finsler space with this metric, we suppose

that $a_{ij} = 0$. Thus, only the tensor field $g_{i\bar{j}}$ is invertible.

Proposition 3.1:*The invariants of this class of* R - *complex Hermitian Finsler space are:*

$$\rho_0 = \frac{(\alpha+\beta)^3}{4\alpha}, \rho_1 = \frac{(\alpha+\beta)^3}{4}$$

$$\rho_{-2} = \frac{(\alpha+\beta)^2(4\alpha+\beta)}{8\alpha^3}, \rho_{-1} = \frac{3(\alpha+\beta)^2}{8\alpha}$$

$$\mu_0 = \frac{3(\alpha+\beta)^2}{8}$$

Next step is to go forward and we demonstrate :

Theorem 3.1:*The metric tensor field of an* R *-complex Hermittian Finsler space a with (α,β)-metric* $L(\alpha,\beta)=\frac{(\alpha+\beta)^4}{8}$ *is given by:*

$$g_{ij} = \frac{(\alpha+\beta)^3}{4\alpha}a_{ij} + \frac{(\alpha+\beta)^2(4\alpha+\beta)}{8\alpha^3}l_i l_j + \frac{3(\alpha+\beta)^2}{8}b_i b_j + \frac{3(\alpha+\beta)^2}{8\alpha}(b_j l_i + l_j b_i)$$

Or in the equivalent form:

$$g_{i\bar{j}} = \frac{(\alpha+\beta)^3}{4\alpha}a_{i\bar{j}} + \frac{(\alpha+\beta)^3}{8\alpha^3}l_i l_{\bar{j}} + \frac{6}{(\alpha+\beta)^4}\eta_i\eta_{\bar{j}}$$

After some preparations we compute the inverse of the fundamental metric tensor:

Proposition 3.2: *For the* R - *complex Hermitian Finsler space with the metric* $L = F^2 = \frac{(\alpha+\beta)^4}{8}$ *the determinant and the inverse of the fundamental metric tensor* $g_{i\bar{j}}$ *are given by:*

$$i)\ H^{i\bar{j}} = a^{i\bar{j}} - \left(\frac{1}{2\alpha^2+\gamma} + P|M|^2\right)\eta^i\bar{\eta}^j - N^2Pb^ib^j - MNPb^j\eta^i - \bar{M}NPb^i\bar{\eta}^j$$

$$ii)\ det(H_{i\bar{j}}) = \left[\frac{(2\alpha^2+\gamma)}{2\alpha^2} - \frac{12|\mu|^2}{\alpha(\alpha+\beta)^7} + \frac{3(2\alpha^2+\gamma)(1+\alpha\nu)}{\alpha^2(\alpha+\beta)^4}\right]det(a_{i\bar{j}})$$

Where:

$$N = \frac{(\alpha+\beta)^3}{4},\ M = \frac{N}{\alpha} - \frac{1}{2\alpha^2+\gamma},$$

$$P = \frac{24\alpha(2\alpha^2+\gamma)}{(\alpha+\beta)^7(2\alpha^2+\gamma)+6(\alpha+\beta)^3(2\alpha^2+\gamma)(1+\alpha\nu)-24\alpha|\mu|^2}$$

Once obtained the metric tensor we must give the expressions of Chern-Finsler(c.n.c.).After some trivial calculus we have:

Proposition 3.3: Let (M,F) be a R-complex Hermitian space with *with (α,β)-metric* $L(\alpha,\beta)=\frac{(\alpha+\beta)^4}{8}$. Then we have the following expressions of Chern-Finsler(c.n.c.):

$$N_j^i = N^{\alpha}{}_j^i - \frac{3}{2(\alpha+\beta)}\left[\frac{(2\alpha-\beta)(S-1)}{\alpha^2} + 3(\bar{\varepsilon} + +MNP\omega)\right]\frac{\partial a_{l\bar{m}}}{\partial z^j}\eta^l\bar{\eta}^m\eta^i - (A\eta^i + Tb^i)\eta^l - -[(S+A)\eta^i + (T+\bar{M}NP)b^i]\bar{\eta}^m - \frac{1}{\alpha}\left(T - \frac{\bar{M}NP\bar{\gamma}}{2\alpha^2}\right)\frac{\partial a_{l\bar{m}}}{\partial z^j}\eta^l\bar{\eta}^m b^i + PN\left(\frac{1}{\alpha}\frac{\partial l_{\bar{m}}}{\partial z^j} + \frac{\partial b_{\bar{m}}}{\partial z^j}\right)\cdot(Nb^i + M\eta^i)b^{\bar{m}}$$

Where:

$$S = \frac{1}{2\alpha^2+\gamma} + P|M|^2 S = \frac{1}{2\alpha^2+\gamma} + P|M|^2,$$

$$A = \frac{3}{2(\alpha+\beta)}\left(\frac{\overline{\gamma S}}{\alpha} + \varepsilon S - 1 + MNP\omega\right)$$

$$T = \frac{3}{2(\alpha+\beta)}\left(N^2P\omega + \frac{\bar{M}NP\bar{\gamma}}{\alpha} + \bar{M}NP\bar{\varepsilon} - 1\right)$$

As in [3] we have an example:

Example 2:

We construct this example like in [3] on $M = C^3$ where we set the metric

$$\alpha^2 = e^{z^1+\bar{z}^1}|\eta^1|^2 + e^{z^2+\bar{z}^2}|\eta^2|^2 + e^{z^1+\bar{z}^1z+^2+\bar{z}^2}|\eta^3|^2$$

,the (1,0)-differential form $\varepsilon = e^{z^2}\eta^2$ and we have :

$$F = \frac{e^{z^1+\bar{z}^1}|\eta^1|^2 + e^{z^2+\bar{z}^2}|\eta^2|^2 + e^{z^1+\bar{z}^1z+^2+\bar{z}^2}|\eta^3|^2}{\frac{i}{2}\left(e^{z^2}\eta^2 + e^{\bar{z}^2}\bar{\eta}^2\right)}$$

4. R -COMPLEX FINSLER SPACE WITH QUADRATIC METRIC

In this case we consider $L(\alpha,\beta) = F^2 = \frac{(\alpha+\beta)^4}{\alpha^2}$

We compute the invariants and we have:

Proposition 4.1:*The invariants of this class of* R *-complex Finsler spaces with quadratic metric are:*

$$\rho_0 = 1 - \frac{\beta^4}{\alpha^4} + \frac{2\beta}{\alpha} - \frac{2\beta^3}{\alpha^3}, \rho_{-1} = -\frac{2\beta^3}{\alpha^5} - \frac{3\beta^2}{\alpha^3}$$

$$\rho_1 = 6\beta + \frac{2\beta^3}{\alpha^2} + 2\alpha + \frac{6\beta^2}{\alpha}, \mu_0 = 3 + \frac{3\beta^2}{\alpha^2} + \frac{6\beta}{\alpha}$$

$$\rho_{-2} = \frac{2\beta^4}{\alpha^6} + \frac{3\beta^3}{\alpha^5} - \frac{\beta}{\alpha^3}$$

Following the same steps like before we can compute:

Proposition 4.2:*The metric tensor field of an* R *-complex Hermitian Finsler space with* (α, β)*-metric* $L(\alpha, \beta)=\frac{(\alpha+\beta)^4}{\alpha^2}$ *is given by:*

$$g_{i\bar{j}} = \left(1 - \frac{\beta^4}{\alpha^4} + \frac{2\beta}{\alpha} - \frac{2\beta^3}{\alpha^3}\right) a_{i\bar{j}} + \left(\frac{2\beta^4}{\alpha^6} + \frac{3\beta^3}{\alpha^5} - \frac{\beta}{\alpha^3}\right) l_i l_{\bar{j}} + \left(3 + \frac{3\beta^2}{\alpha^2} + \frac{6\beta}{\alpha}\right) b_i b_{\bar{j}} + \left(-\frac{2\beta^3}{\alpha^5} + \frac{1}{\alpha} - \frac{3\beta^2}{\alpha^3}\right)\left(l_i b_{\bar{j}} + b_i l_{\bar{j}}\right)$$

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COMPARATIVE EVALUATION OF PROJECTILE'S DRAG COEFFICIENT USING ANALYTICAL AND NUMERICAL METHODS

George SURDU*, **Georgică SLĂMNOIU***, **Alin – Constantin SAVA****, **Ioan VEDINAŞ****

*Research Center for Navy, Constanța, Romania, **Military Technical Academy, Romania

Abstract: *In this paper is presented an algorithm for projectile's drag coefficient evaluation using empirical and semi empirical relations. The algorithm can be useful for engineers who work in design, maintenance or experimental testing of ammunitions, when drag coefficient for a projectile is necessary. The paper offer an evaluation of drag coefficient using the algorithm and the numerical determination using a numerical application for the flow around the projectile configuration. This validated algorithm for drag coefficient evaluation can be implemented in a standalone application.*

Keywords: *drag coefficient, ammunition, aerodynamics, projectile, aerodynamic configuration, finites volumes method*

1. INTRODUCTION

The application of an analytical method for drag coefficient calculation gives us the possibility to anticipate in a scientific manner the results for design, maintenance or testing with low resources consumption.

In fact this kind of studies offers to engineers a powerful instrument in evaluate the influence of their choices in: products design, experimental data interpreting or products evaluation in different stages of their lifetime cycle.

Some of these studies are to evaluate the projectile's point-mass motion in air and evaluate the influence of changes in projectile structure on projectile's point – mass trajectory.

This study is based on the evaluation of drag coefficient for an aerodynamic configuration of 30 mm caliber projectile. using an analytical algorithm and a numerical method. The drag coefficient is evaluated using its geometrical dimensions, Mach number, Reynolds number and initial conditions for the numerical simulation. The study from this paper has two main objectives as follows: drag coefficient evaluation using the proposed analytical algorithm and drag coefficient using simulation CFD software.

The evaluated drag coefficient is for Mach values between 0.8 and 3.0.

The projectile aerodynamic configuration is a 30 mm projectile and presented in Fig.1.

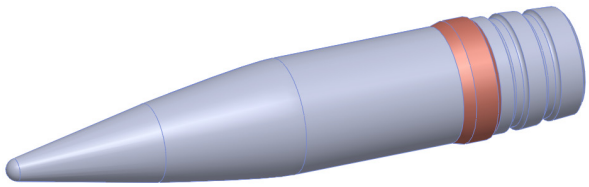

Fig. 1 Aerodynamic configuration of 30 mm caliber projectile used

The study is based on projectiles geometrical dimensions and his flight conditions.

The purpose of the study is to evaluate drag coefficient comparing the results for it obtained by the two methods the validated one which is numerical and the analytical one.

The numerical method is time and resources high consummator and is not proper for our goals so we want to evaluate the analytical method for further use.

2. MATHEMATICAL MODELS USED

The study has two main objectives as we mentioned before and for these objectives are two different mathematical models: drag coefficient evaluation through simulation uses a VOF (finites volumes method) to solve the pressure and velocity filed around projectile configuration and the analytical algorithm that use simple empirical relations to evaluate the drag coefficient. In this case, the mathematical model for the analytical evaluation for drag coefficient is the main subject of the study, so in the following we will present the mathematical model for it.

The mathematical model [1, 2, 3] for drag coefficient estimation uses projectile's geometrical dimensions (Fig. 2).

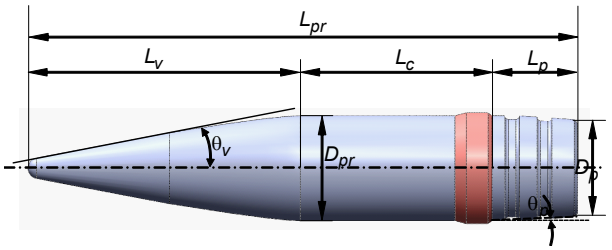

Fig. 2 Projectile's dimensions used

These dimensions are: L_{pr} – projectile's total length, L_v - ogive length, L_c – cylindrical length, L_p - tronconical length, D_{pr} - transversal section diameter, D_p projectile back – side diameter, θ_v – ogive half angle, θ_p –half angle for projectile's tronconical part.

For the algorithm of drag coefficient estimation, we use the following relations [1,2]:

$$\lambda_{pr} = \frac{L_{pr}}{D_{pr}} \quad (1)$$

$$\lambda_v = \frac{L_v}{D_{pr}} \quad (2)$$

$$\lambda_c = \frac{L_c}{D_{pr}} \quad (3)$$

$$\lambda_p = \frac{L_p}{D_{pr}} \quad (4)$$

$$S_f = \frac{\pi \cdot D_{pr}^2}{4} \quad (5)$$

$$S_{lat} = K \cdot \pi \cdot D_{pr} \cdot L_{pr} \quad (6)$$

$$K = 0,688 + 14,5 \cdot 10^{-3} \cdot \lambda_{pr} \quad (7)$$

Where λ_{pr} is projectile's relative length, λ_v is ogive relative length, λ_c is cylindrical part relative length, λ_p is relative length of tronconical part. S_f is transversal projectile's area. S_{lat} is projectile's lateral area [1,2].

$$C_x = C_{x0} + C_{xi} \quad (8)$$

Where C_x is the drag coefficient [1,2] as sum from C_{x0} - the drag coefficient at zero incidence angle and C_{xi} induced drag coefficient [1,2].

$$C_{x0} = C_{x0}^f + C_{x0}^u + C_{x0}^{post} \quad (9)$$

Where C_{x0}^f is the friction drag coefficient, C_{x0}^u is the pressure drag coefficient, C_{x0}^{post} is zero pressure from projectile's bottom drag coefficient [1,2].

$$C_{x0}^f = C_f \cdot \eta_\lambda^* \cdot \eta_M \cdot \frac{S_{lat}}{S_f} \quad (10)$$

This coefficient for supersonic flows is very small and can be zero value [1,2].

$$C_{x0}^{post} = k_c \cdot \frac{0,0155}{\sqrt{\lambda_f \cdot C_f}} \cdot \left(\frac{S_{pf}}{S_f}\right)^{3/2} \quad (11)$$

Where k_c=0.5.

$$C_{x0}^u = C_{xu}^v + C_{xu}^p \quad (12)$$

Where ogive's drag coefficient is C_{xu}^v and backside of the projectile's drag coefficient is C_{xu}^p [1,2].

$$C_{xu}^v = \frac{0,6825}{\lambda_v} + \frac{0,1186}{0,21 \cdot \lambda_v^2 + M^2 - 1} \quad (13)$$

$$C_{xu}^p = \left(0,0016 + \frac{0,002}{M^2}\right) \cdot \theta_p^{1,7} \cdot \alpha \quad (14)$$

$$\alpha = \sqrt{1 - \frac{S_{pf}}{S_f}} \quad (15)$$

$$C_{xi} = K_x^* \cdot C_z^{\alpha} \cdot \alpha^2 \quad (16)$$

with $K_x^* = \frac{2,5 + \lambda_v}{1 + \lambda_v}$.

3. NUMERICAL RESULTS

Initial data used to make the simulation and calculate the drag coefficient are in Table 1.

Table 1. Initial data for numerical model

Parameter	Value
Caliber [mm]	30
L_{pr} [mm]	150.28
L_v [mm]	69
L_c [mm]	70.8
L_p [mm]	5.2
D_p [mm]	26.8
Mach number [-]	0.8 to 3.0
θ_v [deg]	11
θ_p [deg]	4

Drag coefficient values for obtained by numerical simulation and analytical calculation are exposed in Table 2.

Table 2. Numerical results

Crt. No.	Mach number value	Simulation Drag coefficient value	Analytical method drag coefficient value
1	1.2	0.211866705	0.213342729
2	1.3	0.229140652	0.237542381
7	1.4	0.242002676	0.247089692
8	1.5	0.23395962	0.237404203
9	1.6	0.209559464	0.213008992
10	1.7	0.191938139	0.199917306
11	1.8	0.180461835	0.184917575
12	1.9	0.173554289	0.182381161
13	2	0.166293308	0.169964721
14	2.1	0.16142056	0.16571252
15	2.2	0.15577706	0.16394538
16	2.3	0.151776531	0.151947723
17	2.4	0.147041135	0.156343951
18	2.5	0.143698138	0.152558084
19	2.6	0.140540984	0.141941886
20	2.7	0.140657387	0.142356453
21	2.8	0.134699216	0.138538851

Mach number contours are presented in Figure 4. Contours are results from simulation method.

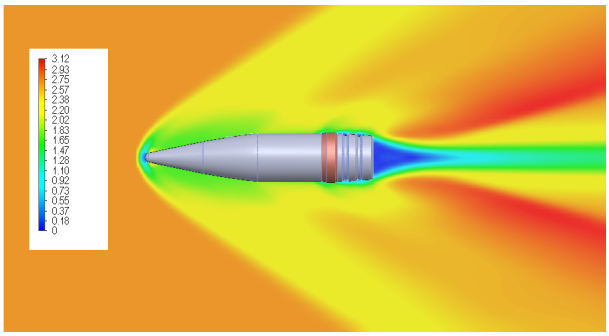

Fig. 4 Mach number contours

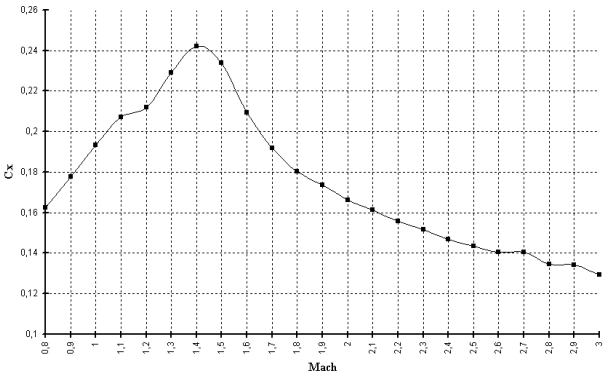

Fig. 5 Drag coefficient evolution with Mach number – simulation –

From simulation drag coefficient is calculated and its values are represented in Table 2. Drag coefficient evolution with Mach number is presented in Fig. 5.

Drag coefficient evolution with Mach number resulted from analytical calculation is represented in Fig. 6.

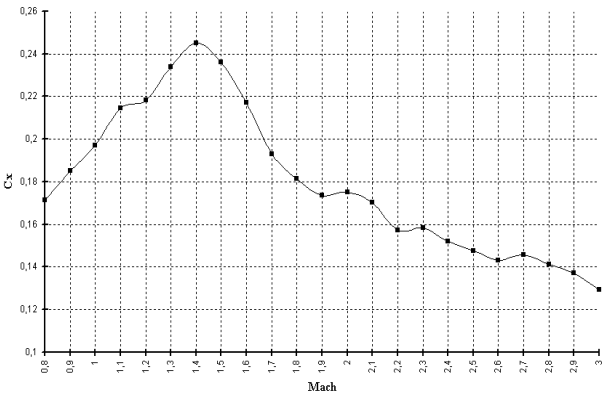

Fig. 6 Drag coefficient evolution with Mach number – analytical determination

In Fig. 7 are exposed the drag coefficient evolutions with Mach number together. As we can see from this graph are not big differences.

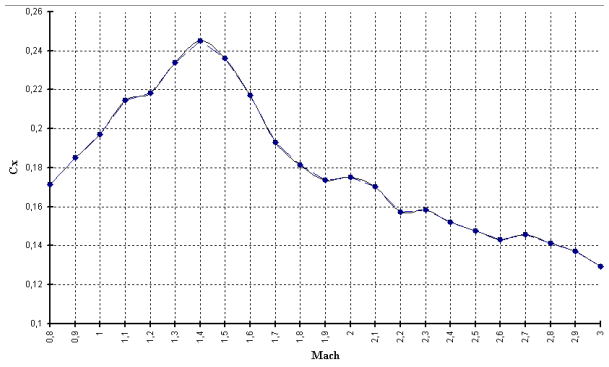

Fig. 7 Drag coefficient evolution with Mach number simulation vs. algorithm

The differences between the two set of data are presented in Fig. 8.

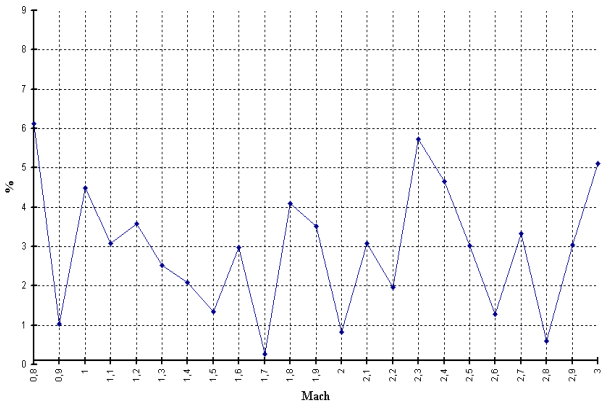

Fig. 8 Drag coefficient evolution with Mach number

As we can see, we have an absolute difference between 0 to 6 % for the presented methods. In the same time we have can approximate a 3% mean value for error.

In this situation, we can consider for preliminary calculations the simplified method by the presented algorithm to calculate the drag coefficient for aerodynamic configuration of projectiles.

4. CONCLUSIONS

The Mach contours are calculated using a VOF simulation software, see Fig. 4 and drag coefficient was calculated using this method.

On the other hand, the drag coefficient was calculated using the algorithm presented in chapter 2, and the results obtained for it were pretty good compared with the simulation ones.

The errors between the presented methods were small and this gives us assurances that we can use for a preliminary drag evaluation the analytical method. This kind of study can be used to implement the presented analytical method in a software module for projectiles drag coefficient evaluation. The usefulness of this type of study can be seen in experimental testing, design of different type of products.

Acknowledgment:

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COMPARATIVE METHOD FOR DETERMINING THE MECHANICAL STRESSES

Ioan GHIMBASEANU

Transilvania University of Brasov, Romania

Abstract: *The electric tensometry is a method for measuring the deformations by using some transducers. These transducers turn the variation of a mechanical size into variations of an electric size.Compared with this method the aim of the paper is to develop interactive software for simulation the mechanical testing. The purpose of this paper is to compare the results of the two methods. The method can also be applied to measure the tension of aircrafts, rockets, ballistic missiles and gun barrels.*

Keywords: *sensor, transducer, sensitive element, software simulation, mechanical testing*

1. INTRODUCTION

The tensometric resistive sensors are those resistive sensors where the electrical resistance variation is produced caused by the variation of the conductor's length, as an effect of the elongation or of the contraction. Whether the tensometric sensor is mounted on a certain part of the piece subjected to deformation caused by a stress, then, it will suffer deformations in the same time with the piece supporting it.

Measuring the variation of the sensor's resistance through electrical methods, being proportionally with its elongation, the deformation of the part of the piece subjected to study can be determined on the basis of a previous measurement standard, establishing in the end the non-electric size inducing this deformation.

Tensometric transducers with paper support – In order to avoid the difficulties caused by the direct mounting of the resistive sensor on a piece, the transducer is previously stuck, by using a glue, on a paper support. As the electric resistance of the sensor must be higher enough as the transducer should have a corresponding sensitivity, the total length of the resistive wire is of about 10^2 mm. To reduce the surface on which the sensor is laid, the wire should be grid-shaped (fig. 1). [4]

Grid 1 is mounted on the paper support 2, at both ends two copper conducters 3 are glued to the larger surface, by means of which the transducer is connected in the circuit of measurement. The resistive sensor of the transducer is protected by a thin foil of paper 4 wich is glued above. This type of transducer, well-known, has a series of advantages, among which a relative easy mounting, a possibility of manufacturing transducers of various shapes and configurations, a uniformity of transducers produced simultanously and keeping the quality standard.

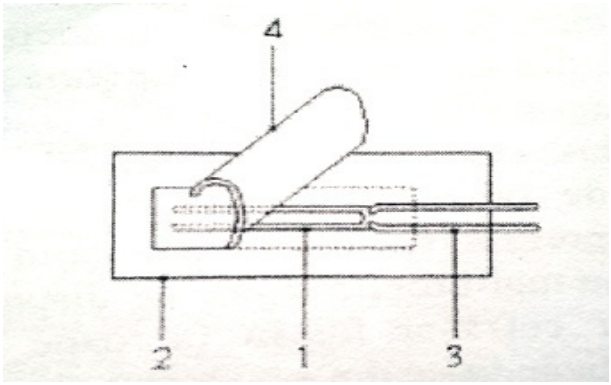

Fig. 1 Transducer with paper support

2. EXPERIMENTAL RESEARCH STUDY ON USING A TENSOMETRIC SENSOR ON PAPER SUPPORT

2.1.Description of the probe endowed with tensometric marks subjected to mechanical traction

The sketch of the probe is shown in figure 2. The material used is steel OLC45.

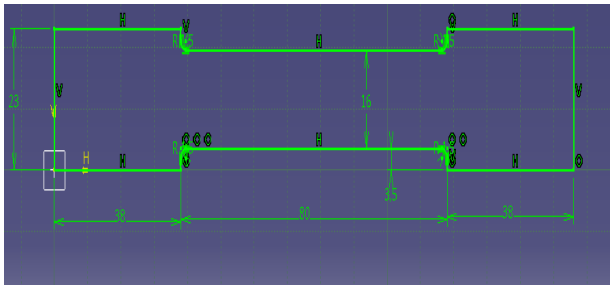

Fig.2 The sketch of the probe

2.2 The equipment used for the experimental research study

Tensometric marks is shown in figure 3. For testing the traction and determining the relative elongation, a traction device and a Wheanstone bridge are used and are shown in figure 4.[1,6]

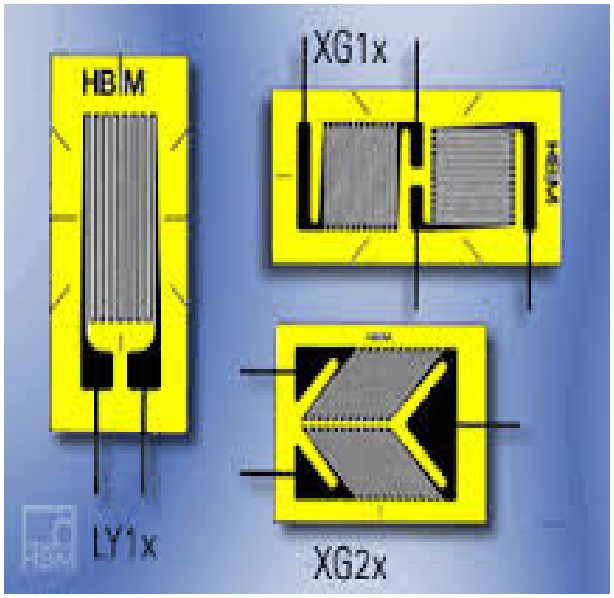

Fig.3 Tensometric marks

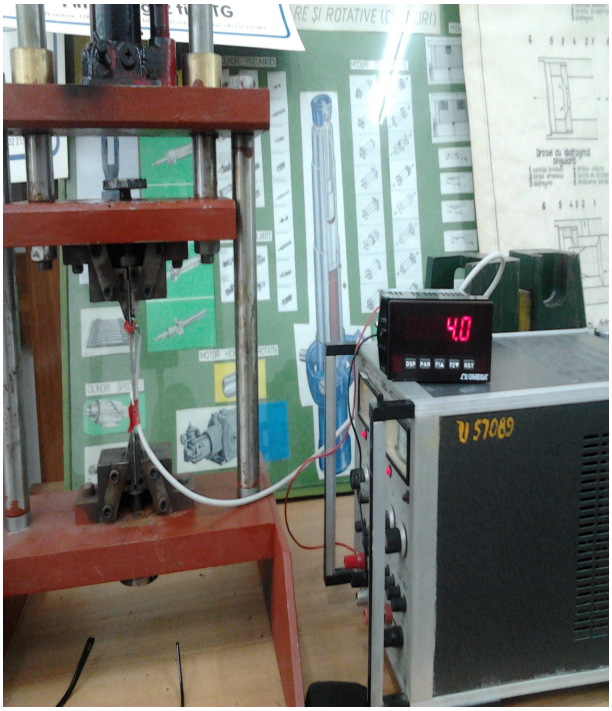

Fig. 4 Device for the traction test

2.3 Experimental test

On the basis of the calculation of the unbalanced tension of the bridge, the following equation results, as it can be shown below:

$$\varepsilon^2(k^2\Delta u + k^2y^2\Delta u + 2k^2\gamma\cdot\Delta u - k^2u + k^2\gamma^2u) + \varepsilon(4k\Delta u - 4k\gamma\Delta u - 2k\ u - 2k\gamma u) + 4\Delta u = 0 \quad (1)$$

The data for the tests one can obtain are recorded in table 1.

3. STATICAL ANALYSIS WITH FINITE ELEMENTS AT TRACTION TEST

The Generative Structural analysis programming module of CATIA environment allows the simulation of the test pieces mechanical behavior. [2, 3, 5]
The sketch of the probe is shown in figure 2.
The drawing of the test pieces model is shown in figure 5.

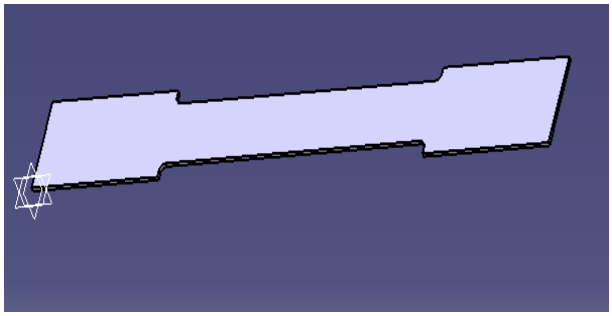

Fig. 5 Test pieces model

The displacement constraint and the distribuited force of 7000 N is shown in figure 6 and 7.

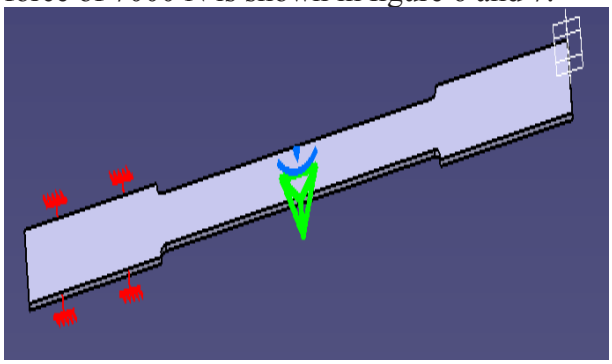

Fig.6 The displacement constraint

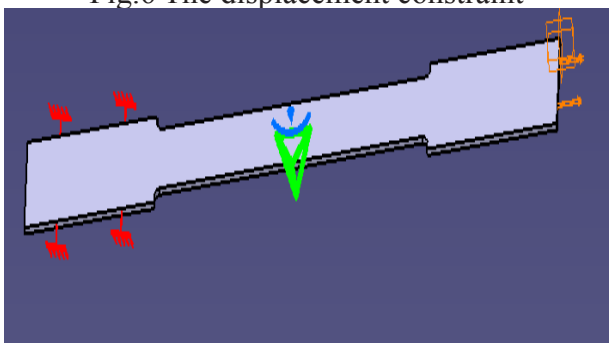

Fig.7 The distribuited force

Solving the model and processing the results

The calculation model is launched. Figure 8 shows the deformation of piece.The stress von misses is shown in figure 9.The stress principal tensor is shown in figure 10.

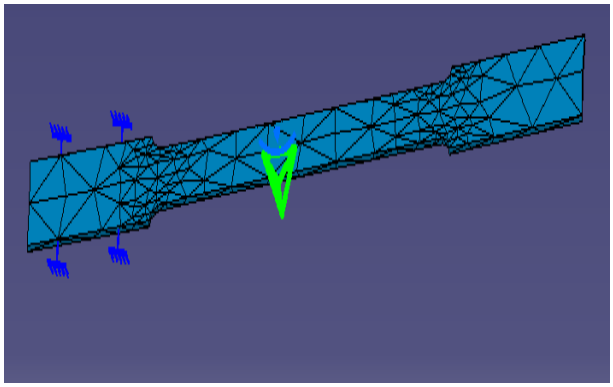

Fig. 8 The deformation of piece

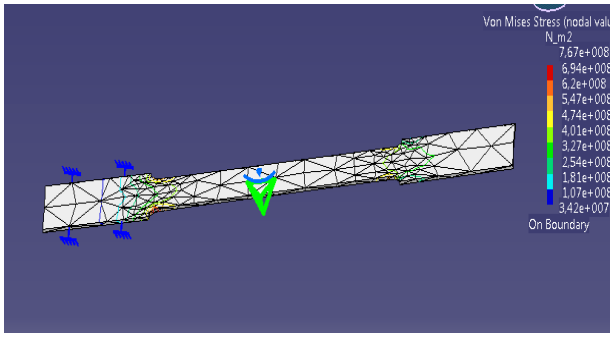

Fig. 9 Von Misses Stress

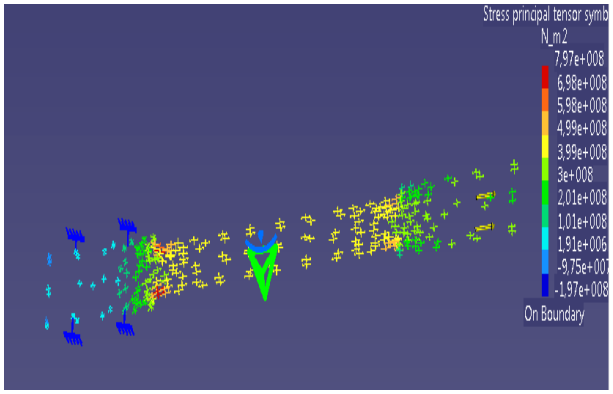

Fig. 10 The stress principal tensor

Table 1.Experimental data

Δu	b_0	h_0	R_0	K	γ	E	L	$[10^{-5}]$	Δl	σx10^6	F
mv	mm	mm	Ω			N/ mm^2	mm		mm	$[N/m^2]$	N
1								1,4	0,002	2.94	47,04
4								2,2	0,00314	4,62	73,92
5								25,3	0,036	53.15	850,4
6								36,5	0,0522	76.65	1226,4
7								45,8	0,065	96,18	1538,8
8								54,9	0,078	115,29	1844,6
9								64,2	0,091	134,82	2157,2
10								121	0,173	254,1	4065,6
11						2,1		132	0,188	277,2	4435
12	16	1	121,1		0,3	$\cdot 10^5$	143	146	0,20	306,6	4905
13								162	0,23	340,2	5443,2
14								188	0,26	394,8	6316,8
15								208	0,29	436,8	6988,2

Several values of mechanical stresses is shows in table 2.

For the node x=78 y=11.5 z= 1 and F=7000 N the resulting calculated stress by the experimental method is σ=4.368e+008 N/m^2 and simulate value is for the node x=78 y=11.5 z=1 σ=4,36895e+008 N/m^2 .

4. CONCLUSION

The method described previously allows the determination and the calculation von misses stress of material subjected to tensile stress. The measurement device of a high precision is used for determining the tension of unbalance occurring in the test piece following the tensile test. Then, the specific deformation of the test piece is calculated, the pulling force and the corresponding unitary stress.

Compared with this method the aim of the paper is to develop interactive software for simulation the mechanical testing.

The purpose of this paper is to compare the results of the two methods. For the node x=78 y=11.5 z=1 and F=7000 N the resulting calculated stress by the experimental method is σ=4.368e+008 N/m^2 and simulate value is for the node x=78 y=11.5 z=1 σ=4,36895e+008 N/m^2 . This shows that the static simulation of traction stresses by using Catia program is very good.

This shows that the static simulation traction stresses by using Catia program is of very good. The simulation by using Catia software can be used to determine the tensions inside the structure of helicopters (blades), of aircraft's (fuselage, wings), radar antennas and guns.

Table 2 Mechanical stress value

X[mm]	Y[mm]	Z[mm]	Von mises stress[N/m^2]
43,1937	8.267	1	4.094e+008
52.87	6.71	1	4.34 e+008
58.98	11.59	1	4.36 e+008
52.52	11.44	1	4.33 e+008
68.88	10.94	1	4.37 e+008
78	11.5	1	4.36 e+008
87.29	11.48	1	4.37 e+008
95.78	11.54	1	4.35 e+008
108.51	11.32	1	4.14 e+008
111.96	11.48	1	3.80 e+008

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THE EFFECT OF ELECTROMAGNETIC RADIATION EMITTED BY CELL PHONES ON POPULATION - A CURRENT ISSUE

Jeler Grigore Eduard

Military Technical Academy, Bucharest, Romania

Abstract: *The last time there was an explosive development of mobile communications, radar equipment used in aviation, medical devices using MRI and CT, using microwaves in the food or household purposes, various electronic devices used in industry, scientific research aimed at providing speed, security and convenience. But these technologies have triggered a series of questions on the health effects associated with their use body health: assessing the risk associated with using mobile portable, a long time living near power lines and use portable radar installations used by the police. This article aims to treat medical problems associated with the use of cell phones by population.*

Keywords: *mobile phones, electromagnetic radiations, SAR,*

1. INTRODUCTION

Today, mobile phones are sources of electromagnetic field most commonly encountered in everyday life and a significant part of global telecommunications.

Currently in Romania there are no comprehensive studies on population irradiation with electromagnetic waves, and the hazard of using mobile phones can make it difficult to research.

In late 2009, according to figures published by the International Telecommunication Union, it was estimated that there were 4.5 billion mobile users worldwide.

In Europe there are a number of telephones greater than the number of inhabitants of 100% lead and detached from the rest of the world according to figure 1, 2 [2].

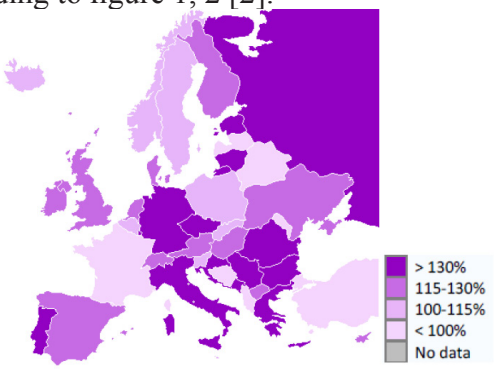

Fig. 1 Distribution of mobile users in Europe [according to data published by the International Telecommunication Union in 2009] [2]

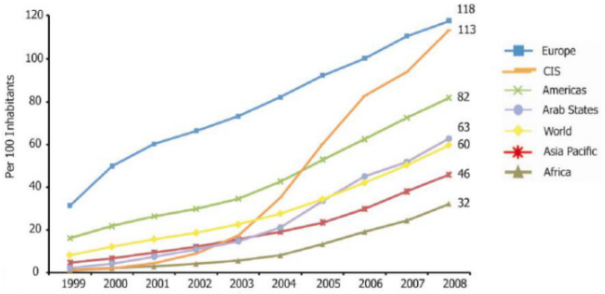

Fig. 2 Development of mobile telephony in the world per 100 inhabitants [according to data released by the International Telecommunication Union in 2009] [2]

According to figures presented previously observed intense use of cellular phones by population, with the possibility of adverse health effects, and according to the International Agency for Research on Cancer electromagnetic fields produced by mobile phones are classified as possibly carcinogenic to humans.

In Romania, according to figures released by the three major mobile phone companies, cellular phone users situation is shown in Fig. 3.

The situation presents both the number of subscribers and prepaid users.In recent years a number of studies have been conducted or are underway to better assess the long-term effects of electromagnetic fields produced by cell phones on the human body. WHO (World Health Organization) will conduct a formal risk assessment of all studied health outcomes for exposure to radio frequency fields by 2012.

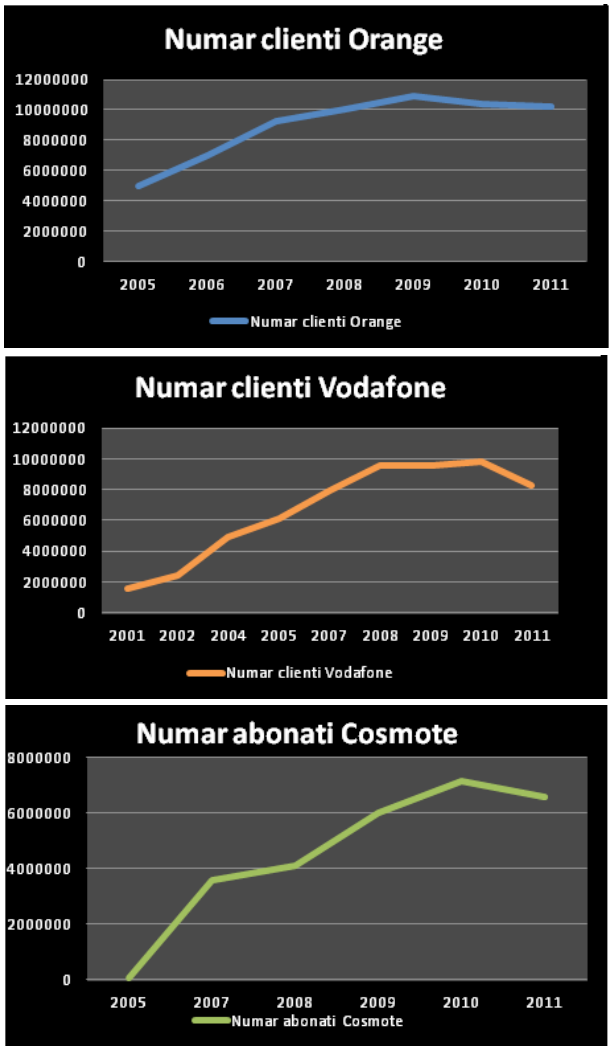

Fig. 3 The customer number of the three major cellular telephone companies in Romania

In this context steadily increasing number of users, the more long exposure time, the mobile phone becomes a "toy" increasingly used since childhood and new information on the effects of electromagnetic fields, investigate the characteristics of exposure levels, SAR, becomes an issue for public health research [10, 11].

2. STUDIES ON THE HEALTH EFFECTS OF MOBILE TELEPHONY

Due to the frequent use of cellphones by population in the last 10 years have been introduced radiation monitoring systems electromagnetic field emitted by cellular phones. On this line the European countries and some Scandinavian countries have participated in a number of epidemiological studies and clinical and experimental in order to determine the possible adverse effects of mobile phone use on the human body.

Between the years 2009-2010 were continued studies on the harmful effects of mobile phones on the human body. These studies were carried out by the SCENIHR (Scientific Committee on Emerging European and Newly Identified Health Risck), ICNIRP (International Commission for Non-Ionizing Radiation Protection), WHO (Word Health Organisation), CCARS (Scientific Advisory Committee on Radio Frequencies and Health).

The Eubarometer study showed that Spanish population is one of the populations concerned the effects of mobile phone radiation emitted by the human body, although it is one of the populations less informed.

The Interphone study has been realized in 2010 attended by 13 countries. It was applied to a population aged 30-59 years who used a cell phone for 5-10 years.

The study started from the premise that there is a relationship between mobile phone use and the occurrence of brain tumors (gliomas and meningiomas) and salivary gland tumors.

The result was that there is a direct relationship between the cell phone and the occurrence of brain tumors [8, 9].

Studies have shown that the SAR distribution in the head depends on the type of phone and characteristics of communication systems; the more distance from the head and phone is higher with both decreases the amount of energy [9].

The other studies has been realized in four Nordic countries on the incidence of gliomas, meningiomas on a group of 60.000 patients with brain tumors diagnosed during 1994-2003.

The conclusions were that there were no significant changes in the incidence of these tumors in that period; information was obtained from the cancer registries of the four Scandinavian countries; also, the conclusion was the need for more advanced methods of study [8].

A study in 2009, funded by the European Commission for exposure to electromagnetic fields was studied the possible effects on the hearing aid by exposure of 73 volunteers in an electromagnetic field with a frequency of 1947 MHz for 20 minutes.

The result was that there was no immediate effect on hearing aid. (EMFN-EAR-Exposure at electromagnetic fields).

In May 2011 WHO in collaboration with the IARC (Agency for Research on Cancer) was classified use cell phone as possibly carcinogenic (could be at risk, therefore need attention on cell phone-cancer link) [6].

In 2009 SCENIHR conducted a study on the opinion in March 2007.

When it was concluded, using three epidemiological methods, in vitro and animal studies, that there is not relationship between mobile phone use and brain cancer incidence increased. The results were the same [4].

Studies in vivo and in vitro studies showed no genotoxic or mutagenic effects from use the mobile phone [8].

Have been published some register which showed evidence of cell phone effects on sleep and on the EEG (electroencephalogram), the mechanism is not known. Have been not reported effects on memory, cognitive disorders [8]. Studies on mice exposed to a frequency of $900\ MHz$, for 5 days, at a SAR value between $0.3 - 3\ W/kg$, showed an improvement of memory.

The two studies were performed on neuronal cultures using a frequency of 900 MHz at a SAR value of 1 W / kg: in the first study there were no reported changes (Vecchio, 2009); in the second study has been a slightly higher level of neurons; noted that in the second study authors indicate an increase in temperature to 37-39 degrees. In 2002 were described a series of symptoms such as skin redness, burning as well as some general symptoms: difficulty concentrating, cough, palpitations, events that have been suggested as the possible effects of exposure to cell phone. But studies which were made in 2007, was show that these events are not fully determine to exposure to cell phone [4]. Recommendations of the European Council of 12 July 1999/519 on the general population exposure to sources of electromagnetic fields at frequencies between 0-300 GHZ, fixed basic restrictions related to human exposure and references to sources of electromagnetic field. These restrictions are based on guidelines published by ICNIRP [4].

3. WHO (WORLD HEALT ORGANIZATION) RESPONSE

In response to these problems, WHO established international program on Radio Frequency Electromagnetic Fields in 1996, aimed at assessing the scientific evidence of possible adverse health effects and by 2012, WHO will present these results.

In May 2011, a specialized agency from WHO, International Agency for Research on Cancer (IARC), was analyze the potential risk of cancer from exposure to radiofrequency fields for mobile users. WHO also aims to identify and promote research priorities in this direction.

To this purpose, WHO develops public information materials and promotes dialogue between companies producing cell phones, researchers, industries and people to improve their understanding of the possible health effects [5].

4. LEGISLATION

EU legislation on electromagnetic field is based on the recommendations of 12 July 1999 (1999/519 / EC) on the limitation of exposure of the general public to electromagnetic field "Council Recommendation (1999/519 / EC) of 12 July 1999 on the limitation of the exposure of the general public to electromagnetic fields $(0 - 300GHz)$ " [1].

The main components of this recommendation are summarized briefly below: the current exposure limits are based on thermal effects of electromagnetic radiation and the frequencies of the radio frequency, microwave and millimeter wave they are specified in terms of specific absorption rate (SAR expressed in $\frac{W}{kg}$). This parameter is the energy dissipated per unit time per unit mass of the body irradiated and consider the type of radiant source, operating frequency and duration of exposure. SAR limits may relate either to the average energy absorbed in the whole body or locally (legs, hand, head). Current internationally accepted limit for averaged SAR for whole body for occupational exposure is $0.4\frac{W}{kg}$. This value is based on the finding that the absorption of a power level by $4\frac{W}{kg}$ produces a temperature rise of $1°C$ in a biological environment. So with a safety factor of 10 was adopted by the SAR limit by $0.4\frac{W}{kg}$.

Population exposure has been limited to the level of $0.08\frac{W}{kg}$ by the introduction of a safety factor of 50 compared to the value of $0.4\frac{W}{kg}$. [1].

In Romania the exposure to electromagnetic radiation is regulated by the "Order no. 1193 of 29 September 2006 approving the Regulation on the limitation of exposure of the general public to electromagnetic fields from 0 Hz to 300 GHz Issuer: Ministry of Public Health, published in the Official Gazette no. 895 of 3 November 2006, in line with European legislation [7].

The main components of this order are briefly summarized below: Upon exposure according to frequency electromagnetic field is used commonly used eight quantities:

1. Contact current (Ic)
2. The current density (J)
3. The electric field strength (E)
4. The intensity of the magnetic field (H)
5. Magnetic induction (B)
6. The power density (S)
7. The Specific Absorption (SA)
8. Specific Absorption Rate (SAR) - is a measure of the rate at which energy is absorbed by the human body when exposed to a radio frequency (RF) electromagnetic field;

It is defined as the power absorbed per mass of tissue and has units of (W/kg). SAR is usually averaged either over the whole body, or over a small sample volume (typically 1 g or 10 g of tissue). The value cited is then the maximum level measured in the body part studied over the stated volume or mass [7, 3] Basic restrictions, given in Table 1, are set so as to take into account the uncertainties related to individual susceptibility, environmental conditions, the age and health of the population, according to European legislation above [7].

Table 1. Basic restrictions on exposure the electromagnetic field under European law [7]

Frequency range	The magnetic flux density (mT)	Current density $(\frac{mA}{m^2})$ (rms)	Full-body SAR Environment $(\frac{W}{kg})$	Located SAR (head and body) $(\frac{W}{kg})$	Located SAR (hands and legs) $(\frac{W}{kg})$	Power density, S $(\frac{W}{m^2})$
0 Hz	40	–	–	–	–	–
>0 – 1 Hz	–	8	–	–	–	–
1 – 4 Hz	–	$\frac{8}{f}$	–	–	–	–
4 – 1000 Hz	–	2	–	–	–	–
1000 Hz – 100 kHz	–	$\frac{f}{500}$	–	–	–	–
100 kHz – 10 MHz	–	$\frac{f}{500}$	0,08	2	4	–
10 MHz – 10 GHz	–	–	0,08	2	4	–
10 – 300 GHz	–	–	–	–	–	10

4. CONCLUSIONS

From this study the following conclusions are deduced:

- the studies have not shown a direct relationship between mobile phone use and the occurrence of brain tumors or salivary gland.
- it is need for more than 10 years of study because some tumors have slower development time.
- it is necessary that the epidemiological studies are overlapping numerical methods for the determination of SAR values for different cell phone models and their validation with laboratory experiments

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PCA VERSUS LDA IN IMPLEMENTING OF NEURAL CLASSIFIERS FOR FACE RECOGNITION

Marian Dorin PÎRLOAGĂ*, Ciprian RĂCUCIU, Emil CRETU**, Marius ROGOBETE***

**Military Technical Academy, Bucharest, Romania,* ***University Titu Maiorescu, Bucharest, Romania,*

Abstract: *This paper propose to better determine people's face recognition methods using images. Using the selection of features principal component analysis and linear discriminant analysis I conducted experiments by implementing two methods called Self Organizing Map classification (SOM and CSOM 1). I tried to get the best recognition rates for different color components, followed by selection of features concatenation. Applications training consisted of images from a database of its own. Analysis was performed by changing a number of 80 to 360 neurons trained with a pitch of 40 to obtain a recognition rate of 100%. Finally I concluded for the best versions of selections for features that the two methods give proposing future research.*

Keywords*: principal component analysis, linear discriminant analysis, Self Organizing Map, number of neurons, the recognition rate.*

1. METHODS OF EXTRACTION AND SELECTION OF FEATURES FROM IMAGES

Extraction and selection characteristics for faces of people in an image are two important stages on the success and performance of the recognition and face detection (fig. 1).

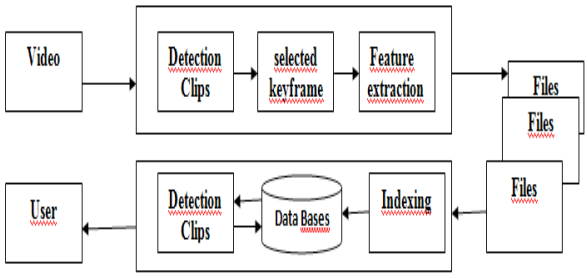

Fig. 1. Extraction and selection of features in an image

A correct implementation of the recognition regions obtained from image segmentation process requires input video representation in a stable form of data analyzed by eliminating redundant information and retaining information for face recognition.

The process of obtaining such a representation of the region of interest is known as the step of description / retrieval features.

Description is directly related to the chosen data structure for representation, against which there is a strong dependence on the developed application.

The possibilities for description of a region is diversified depending on the methods implemented for selection of features:

- characterization of the region contour shape (contour descriptors);
- characterize the region based on its interior (descriptors regional or time);
- topological description of the region of interest (textures);
- morphological description of the region of interest (morphological descriptors).

Choosing a proper description is essential for the success of the shape recognition process. Also, a fundamental principle which oversees construction shape descriptors is their invariance principle to various types of linear or nonlinear transformations applied form of interest. The desired invariance of the set of descriptors used at the starting point, scaling, translation, rotation and reflection.

Practical experience shows that the most important aspect for the recognition of forms is the selection characteristics / properties or descriptors used.

Selection is a process characteristic features data compression and can be equated with a linear or nonlinear transformation of the initial space of n-dimensional observations assumed in a space with fewer dimensions.

The transformation performed conservation information and enables the development of algorithms in real time with efficient algorithms in terms of computation time and memory resources required only small spaces.

If a single class of forms, selection of characteristics is considered optimal if the dimensionality reduction achieved with the original information preservation majority.

If there are several classes of shapes, selection efficiency characteristics is given in particular the possibility of separability of classes, which depends mostly on the distribution of classes and selected classifier.

As a reference in this work we have demonstrated in various [1-7], the performance of classifiers, and as a measure of the effectiveness of selected features can be considered the possibility of their error.

Note that most transformations used to select characteristics are linear but non-linear transformations can be used even if they are difficult to implement

They can provide a higher efficiency expressing the dependence of the real forms observed raw data extracted and selected characteristics of those forms.

2. METHODS FOR THE SELECTION OF CHARACTERISTICS

Size space features large extent influence the efficiency and performance of classification algorithms. Thus, a number of classification algorithms effective in small spaces become impractical in larger spaces.

Therefore we sought to implement changes to prioritize the importance of characteristics and allow transformed space thus reducing its size by removing the least significant data, while retaining the essential information for classification.

In this paper we experienced select those features that contain the greatest amount of information on that form.

We presented the results of selection methods that provide an application characteristics in the area of military interest through proven performance on recognition rate.

2.1. Principal components analysis (PCA). Principal components analysis (PCA Principal Component Analysis) is a standard method of data analysis that enables the detection of the most prominent trends in a set of data.

PCA reduces the number of variables that the size of a data set.

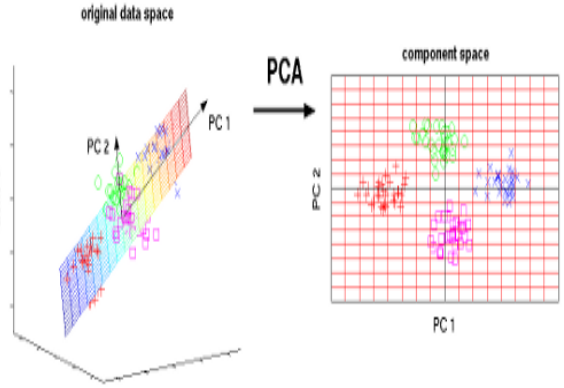

Fig. 2. Version for representation using PCA projection

The picture shows a network in a two-dimensional subspace. PCA is used to view the data by reducing the dimensionality of the data.

The three variables are reduced to a smaller number, two new variables called principal components (PC). Using PCA, we can identify two-dimensional plane which best describes the varied data.

Space using PCA rotating selection of original data that the axes of the new terms have the largest variation of data in a certain direction. Axes and new variables are called principal components are ordered and variation.

The first component, PC 1 is the direction with the largest variance of the data. PC Division 2 is the largest variance that remained after the first orthogonal component. The representation allows to obtain the required number of components that covers a space and the desired amount of variance.

Let X be a space ^{n} cloud data. The main components of this set are the directions along which ^{n} elongation is the most significant cloud. Knowing these directions can serve both purposes of classification and to determine the most important characteristics of point cloud analysis.

Most transformations used to select characteristics are linear, nonlinear transformations while having a higher complexity, are more difficult to implement, but may have a higher efficiency, better expressing the dependence of the forms observed raw data observed characteristics selected these forms [11].

Karhunen-Loeve transform is a linear method for selecting features. Let X be an n-dimensional random vector. Looking for an orthogonal transformation enabling optimal representation of the vector X with respect to the minimum mean square error criterion. Projecting cloud directions given by its main components, the immediate effect is a compression of the information contained in that crowd.

According to reference [8], identifying the main components of cloud data analysis reduces to determining the values of vectors and eigenvalues of the matrix analyzed crowd dispersal.

Linear nature of the standard PCA method, performed by linear projection data analyzed components or main directions suppose but a number of major shortcomings in the processing of input data. Thus, they developed a series of nonlinear generalizations of the classical variant, an example being Kernel PCA algorithm presented in reference [9].

2.2. Linear discriminant analysis (LDA). Linear discriminant analysis (Linear Discriminant Analysis, LDA), as the main component analysis is a statistical method for selecting the characteristics.

Unlike PCA, in which case projection for the purposes of seeking to maximize total covariance matrix, here is seeking a projection in terms of maximizing the covariance matrix of the covariance matrix interclase and minimizing the accumulated inside other classes.

LDA tries to find the best projection direction vectors belonging to different classes drive are best separated.

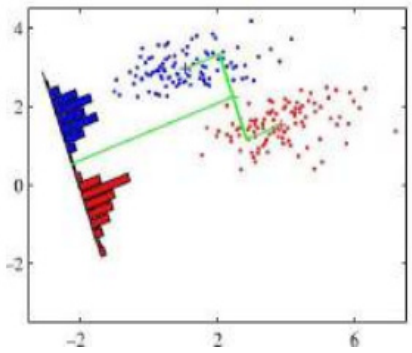

Fig. 3. Variant of projection for representation using LDA

Presentation of the algorithm and the applications that have been described in [10]. There were also tested for applications of LDA transform two-dimensional vector and pixel classification of soil and vegetation images using LDA transformed.

3. EXPERIMENTAL RESULTS

Through various experiments we tried validating theoretical interest arising from the comparative study of methods for selecting features using PCA and LDA methods for classification as SOM and CSOM1 80-400 neurons in neural networks trained with a step 40.

The database contains 556 personal photos of 46 subjects who were asked to stimulate different physiognomic states, against a pale and normal lighting. It was shown in [6].

The main criterion for validating the importance of selection methods analyzed is the performances in the subsequent classification / recognition and entry forms as classifier we used a trained neural network.

Experiments to determine the most effective method of selection.

The experiment consisted in selecting 4 of the 46 subjects of the database in 7 test images / 7 training images.

The 7 images drive and 7 test images were chosen at random, and are analyzed in terms of the form RGB color spaces, C1, C1C2 and C1C2C3.

The original images were reduced in size by using the Paint for 90/120 pixels.

Fig. 4. Images of individual photographing subjects in the database used for testing / training

Considering the fact that a large percentage of an image in the database is the background, I applied a face detection algorithm discovered by prof. Neagoe presented in reference [9], implemented in Matlab.

Methods for selecting features that we used PCA and LDA are and classifiers that I used CSOM and SOM. They are presented in the paper [9,11,13,14].

Concurrent Self Organizing Maps CSOM method was discovered by Neagoe and Ropot and presented in [13].

For the selection of features with PCA we retained 100 features for each color, and then the resulting concatenated vectors of the three colors 100 features 3x = 300 features being used in classification.

LDA for the selection of characteristics we used the same conditions as in [9].

We imposed the following parameters CSOM networks and SOM: stop condition after 400 epochs of training; neighborhood radius decreases by 1 at every age; for the first 200 periods, and for the next 200 era.

The results obtained using images resulting from the scan, which have been reduced in size 90/120 interpolated pixels.

Table 1. Results using the database 7i / 7t, the recognition rate for PCA method C1C2C3 components [%] feature selection process followed by concatenation

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
SOM	PCA	23.55	37.42	43.22	55.16	58.19	64.70	**67.99**	63.90	**67.99**	62.22
	LDA	78.34	93.56	89.14	88.25	91.37	98.23	**100**	**100**	**100**	**100**
CSOM 1	PCA	46.22	29.32	47.16	46.12	6302	61.38	72.88	71.15	72.99	**74.93**
	LDA	**100**	67.52	69.91	75.23	87.38	89.29	96.62	97.44	99.34	97.39

Table 2. Results using the database 7i / 7t, the recognition rate for PCA method C1C2 components [%] feature selection process followed by concatenation

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
SOM	PCA	26.06	36.58	43.35	51.62	61.40	61.02	**67.7**	62.90	61.02	62.15
	LDA	79.44	98.24	94.85	96.36	96.36	98.61	**100**	**98.61**	**100**	**100**
CSOM 1	PCA	45.23	33.58	45.98	46.36	57.64	60.64	64.40	66.66	70.79	**71.55**
	LDA	**100**	91.10	92.22	89.05	95.23	94.10	97.86	97.4	98.24	98.24

Table 3. Results using the database 7i / 7 t, the recognition rate for PCA method for component C1 [%] feature selection process followed by concatenation

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
SOM	PCA	27.33	37.43	46.68	49.51	58.76	63.72	64.16	**69.70**	60.44	59.98
	LDA	65.48	95.22	99.01	**100**	99.61	100	**100**	**100**	**100**	**100**
CSOM 1	PCA	3947	33.73	43.12	46.99	57.58	59.66	66.42	67.45	**70.13**	69.15
	LDA	**100**	97.66	97.32	97.99	**98.40**	99.26	**100**	**100**	**100**	**100**

Table 4. Results using the database 7i / 7 t, the recognition rate for RGB component PCA method [%], using the classifier CSOM

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
CSOM 1	PCA	46.73	35.86	48.32	48.19	60.33	63.36	64.95	67.45	**71.54**	**71.54**
	LDA	78.53	70.23	57.58	67.95	75.19	75.50	78.40	79.37	80.56	**82.86**

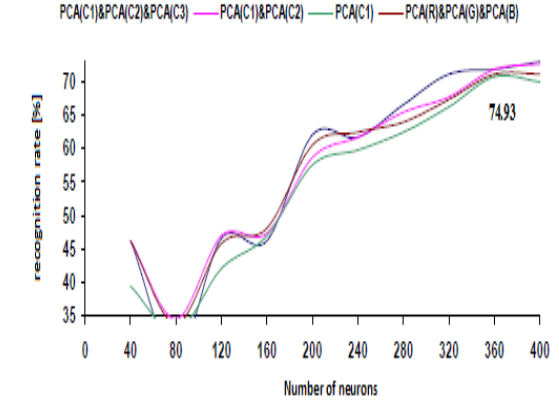

Fig. 5. Graphical representation database 7i / 7t, the recognition rate using PCA, CSOM 1 and fusion of features

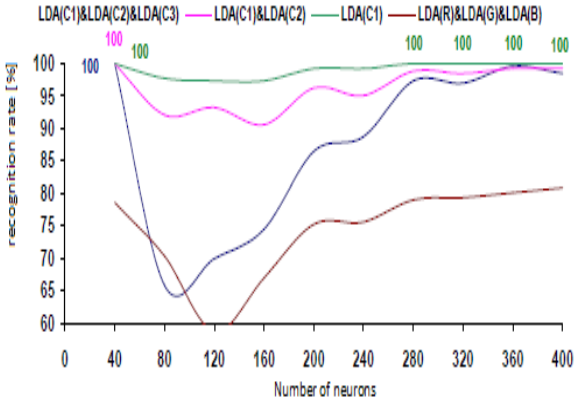

Fig. 6. Graphical representation database 7i / 7t, the recognition rate using LDA, CSOM1 1 and fusion of features

The final experiment conducted training entire database with 46 individual photos surprised in normal subjects and testing their recognition in one of the screen shoot made of crowds Agomer sites and contains 3 subjects in the first database.

The same conditions were used as in the previous experiment to give the following results:

Table 6. Results using the database 46i / 1t, the recognition rate for RGB component PCA method [%], using the classifier CSOM 1

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
CSOM 1	PCA	48.43	37.36	50.22	50.23	62.45	65.34	66.56	69.43	**73.14**	**73.14**
	LDA	80.52	72.21	59.60	69.80	77.10	77.52	80.43	81.40	82.59	**84.88**

Table 7. Results from the database 46 and / 1t, the recognition rate for PCA method C1C2C3 components [%] feature selection process followed by concatenation

Method	Features selection	Number of neurons									
		40	80	120	160	200	240	280	320	360	400
SOM	PCA	25.43	39.44	45.45	57.56	60.75	66.71	**69.90**	65.32	**69.90**	64.12
	LDA	80.30	95.50	91.16	90.67	93.98	99.09	**100**	**100**	**100**	**100**
CSOM 1	PCA	48.54	31.85	49.16	48.87	65.00	63.48	74.56	73.54	74.99	**76.93**
	LDA	**100**	69.85	71.90	77.32	89.87	91.09	98.54	99.45	**100**	**100**

4. CONCLUSIONS

The final results, involving the entire database showed that the best solution is to implement color components C1C2C3 [%] selection process followed by concatenation of features offered by the SOM method of classification and feature selection using LDA.

If CSOM1 using the same selection method features a 100% recognition rate results from the training of 360 neurons. Regarding the recognition rate for RGB component PCA method [%], using classifier Csömöri 1 all features using LDA selection proved with the best rate of 84.88% recognition for 400 neurons involved. In this case the selection of features using PCA smaller achieve results that a recognition rate of only 73.14% from 360 neurons involved. Looking processing time this is tens of minutes in both cases.

Future opportunities for the development of research is emerging in the real-time image processing. Therefore I will follow different implementations other than Matlab, which carries a large number of computing that require processing time and high computing power.

We will continue to implement the application using Python modules offered by Accord.Net The framework provided by OpenCV. Experiments show actual processing time of about 400 ms. using this method, compared to tens of minutes offered by The experimental using Matlab.

Relevant is that the military applications of detection and / or individuals face recognition that local Trackbacks detection, suspicious persons or prohibited in various sports events, the data recorded at the border of the fugitives, etc., are needed both to obtain a 100% recognition rate and the processing of a real-time / signaling themselves- all in order not to lose the operating time.

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MOBILE INDOOR POSITIONING USING WI-FI LOCALIZATION

Bianca BOBESCU, Marian ALEXANDRU

Transilvania University, Brasov, Romania

Abstract: *The goal of this paper is to build an application that describes the Wi-Fi trilateration method for indoor positioning using Android-based mobile devices. Objectives, scopes, limitations and the significance of this research are also topics covered in this article. The indoor signal propagation problem is resolved by receiving a collection of signal strength measurements that improves localization accuracy. The accuracy subject involves the well-known problem of indoor signal propagation which is resolved by collecting received signal strength measurements and using them in the trilateration algorithm. Indoor positioning technique opens possibilities for development of various intelligent systems that provide the user with location-based information inside buildings.*

Keywords: *Wi-Fi, indoor positioning, trilateration, Android*

1. INTRODUCTION

In the past few years, localization of mobile phones has become a true necessity for which a variety of technologies have been used in order to obtain it with a good accuracy. The problem requires creating map based floor plans of interiors, choosing the effective positioning technology and algorithms and deploying the appropriate positioning devices inside buildings [1].

Most of the existing systems that offer indoor localization services use different wireless technologies like Bluetooth, Wi-Fi, signals of cellular towers and ZigBee. The methods using Wi-Fi are of more preferable because Wi-Fi networks are prevalent in most public buildings and its use doesn't require additional infrastructure and it allows determination of the location of each mobile device.

The Wi-Fi Localization technique that was considered was Wi-Fi Trilateration which will be illustrated in the current paper.

This technology uses Wi-Fi signals to estimate the distance between the user and the transmitter. The distance was used to generate a circle around each transmitter. Then, by getting the intersection of the three circles, the location of the user was pinpointed. If given the correct information, it will produce a unique answer.

On the other hand, the circles generated will not intersect at a single point or will not intersect at all when the information given is imperfect. Another problem is that Wi-Fi signals are variable.

Blocks, such as walls and equipment found inside a building, and other factors like the number of people around may affect the signal strengths [2,3].

In this paper the indoor localization method based on Wi-Fi signal strength trilateration technique is considered. It is simple in realization and estimation and can localize position of a mobile device within one room.

2. THE INDOOR LOCALIZATION

2.1 Wi-Fi trilateration approach. Wi-Fi Trilateration uses the strength of signals to estimate the distance of the user from each of the three transmitters. The method that has been implemented is the Spherical Trilateration Algorithm which uses parameters of known Wi-Fi networks like frequency of Wi-Fi signal, its signal strength, the network MAC - address and real coordinates of Wi-Fi access points in the location.

The received signal strength by the mobile device can be used for distance estimation between access point and mobile device. This method involves three or more access points disposed in the building. The signal strengths of these points are decreasing exponentially and depend on the distance between transmitter, receiver and the random noise factor.

Therefore, this dependency can be considered as a function of distance. The distance estimated by the signal strength is presented as a circle with a radius around the access point.

The intersection of three access point radiuses provides a point or an area of receiver. This model can be shown as such equation system [4]:

$$d1^2 = (x - x1)^2 + (y - y1)^2$$

$$d2^2 = (x - x2)^2 + (y - y2)^2$$

$$d3^2 = (x - x3)^2 + (y - y3)^2$$

where $x1$, $x2$, $x3$, $y1$, $y2$, $y3$ are the coordinates of access points, d1, d2, d3 is the estimated distances. The solution of these equations gives points of circles intersection providing an area of indoor localization (Fig. 1).

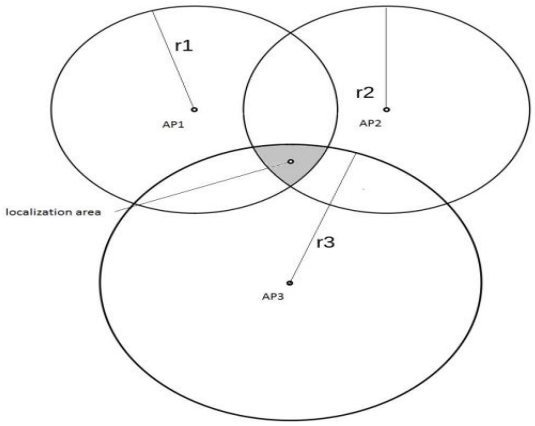

Fig. 1. Indoor localization area provided by trilateration approach

2.2 Wi-Fi trilateration based on RSS measurement collection. In the present paper, signal strength levels of three access points allocated in the three rooms within the floor were measured with the application implemented in the Android smartphone, using the WifiManager API with the function calculateSignalLevel.

This data is collected to estimate distance for the trilateration method described above. These measurements are made in 15 points at the 1 meter interval for each access point using developed Android application.

This application found three different access points by MAC addresses and measured the RSS levels 10 times for each of 15 distances for every access point.

The RSS level changes at time therefore it is necessary to use its average value.

The AP RSS levels are displayed in the Table I and the AP's signal strength depend of distance is shown in the figure bellow (Fig. 2).

The RSS – distance dependency of each AP was measured taking as reference point the 0 m distance from each AP.

Table 1. RSS levels

Distance (m)	AP1 RSS (dBm)	AP2 RSS (dBm)	AP3 RSS (dBm)
1	-33.3	-38.8	-43
2	-45.7	-43.1	-50.3
3	-50.9	-48.9	-65.7
4	-51.7	-55.2	-61.2
5	-51.8	-75.1	-62.5
6	-53.4	-75.5	-66.4
7	-57.8	-76.4	-70.5
8	-62.4	-80.4	-72.3
9	-65.7	-80.8	-74.7
10	-62.9	-76	-78
11	-72.9	-88.6	-76.07
12	-72.7	-88.2	-86.02
13	-63.9	-91	-79.03
14	-74	-91.9	-85.08
15	-76.7	-92.1	-82.05

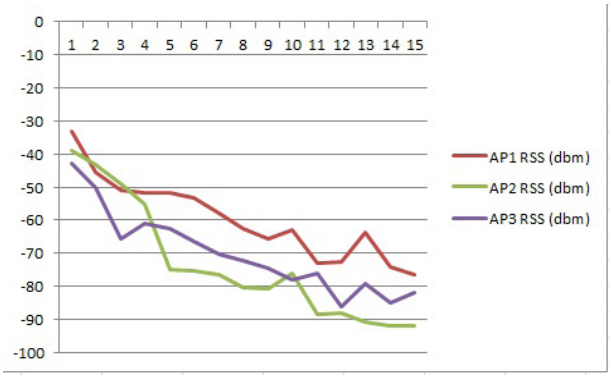

Fig. 2. APs RSS levels

Proceeded measurement points may be selected for distance estimation as reference points. The reference points are the points with RSS level difference more than observational error calculated for each of 15 measurement points. Thus it is possible to determine the distance by the RSS as a segment between two values. The observational error is calculated with formula:

$$\Delta = \sqrt{(\sigma \cdot t) + A^2}$$

where Δ is the observational error in dBm, σ is the standard deviation divided by square root of number of measurements and A is the observational error of the mobile device.

3. SYSTEM DESIGN

3.1 Description of the system architecture. The system is designed by following a client-server architecture which consists of three main modules, the network which contains at least three Wi-fi Access Points, the client device (which can be also be a Wi-Fi enabled device like mobile, smartphone, PDA, etc.) which is an Android operating system smartphone and the server (Fig. 3.).

3.2 The client. The mobile device is presumed to have Wi-Fi connection capabilities, which are automatically turned on as the application starts. Using Android's WifiManager API, the device will scan all available connections it can detect. This information will contain the Service Set Identifier (SSID), the Received Signal Strength Indicator (RSSI) and MAC Address of each router. This module will select only the pre-defined SSIDs and plug their RSSIs into the Wi-Fi Localization algorithm as mentioned in the theoretical framework. The resulting coordinate values (x,y) would be used on the server side. Figure 4 shows the application running on the client side.

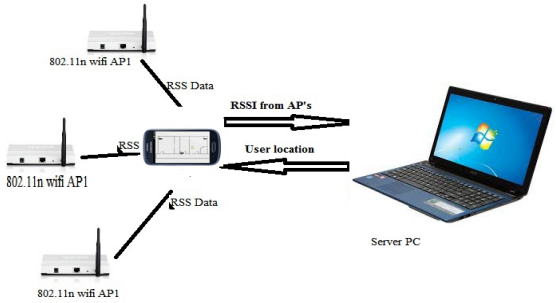

Fig. 3. Framework of indoor positioning system

Fig. 4. Application running on Samsung mini

3.2 The server. The server runs the positioning algorithms which calculate the location co-ordinates of the user. The server runs two types of algorithms a) To calculate distance of user from respective AP and b) Trilateration algorithm to find exact location of user from distance. The server then sends these location co-ordinates back to the client device. The Android device has the front end application showing the indoor map of the system. The indoor map in this system is developed using HTML5 Canvas element and invoked in an android application. The location co-ordinates calculated by server are shown in the indoor map as the user position.

This is a part of user positioning in indoor environment. Navigation involves the choice of destination in the system. The co-ordinates of destination are known and programmed in the indoor map itself. Using the user co-ordinates and destination co-ordinates the application helps you to navigate in the system.

3.3 The Routers. The routers installed in the network are TP-LINK TL-WR841N. In compliance with the IEEE 802.11n standard, TL-WR841N can easily establish a wireless network and may reach a transmission speed and 15x coverage, 5x higher than that of conventional 11g products. With a transmission speed of up to 300 Mbps, it provides excellent capabilities to mitigate data loss over long distances and crossing of obstacles in small offices or apartments, even in buildings with reinforced concrete structure. Moreover, the wireless signal can be detected easily over extended distances where conventional 11g products do not allow this. The router provides bandwidth-intensive applications.

4. RESULTS

The test environment is as shown in the picture below:

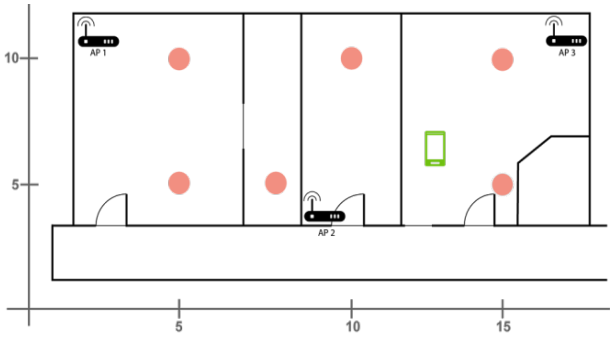

Fig. 5. Partial map of the building

The results were taken in the K Building, Transilvania University of Brasov, Electronics and Computers Department. The map only illustrates three of the rooms which each have an AP installed in. The red dot in the figure shows the test locations where results were taken. RSS data samples were taken over a period of time and used for positioning. Table 2 shows the actual distance (m), system calculated distance (m), positions and accuracy. The accuracy in calculating the distance and exact location is as follows:

Results show that the positioning accuracy of Wi-Fi indoor positioning using tri-lateration method is around 2-2.5 m (Fig 6) The Accuracy of the system can be further improved if more number of similar access points is deployed in the system. Complex nature of indoor environment is the big hurdle for doing positioning in indoor system. Obstacles like walls, glass, metal objects, and moving objects need to be handled very carefully while positioning.

Table 2: Actual distance, system calculated distance, positions and accuracy. It can be observed that the RSS values go higher once the client gets further from an AP.

No. test dot	Location	RSS Values (dBm)	Exact Location (x,y) (m)	Observed values (x,y) (m)
1	Room AP3	(-90,-71,-68)	(15;5)	(15;8.8)
2	Room AP3	(-89,-73,-70)	(15;10)	(13.02;10.72)
3	Room AP2	(-78,-65,-80)	(10;10)	(9.02;8.25)
4	Room AP2	(-79,-55,-82)	(8;5)	(8.89;6.23)
5	Room AP1	(-55,-76,-81)	(5;6)	(7.96;7.25)
6	Room AP1	(-65,-84,-90)	(5;10)	(6.04;10.25)

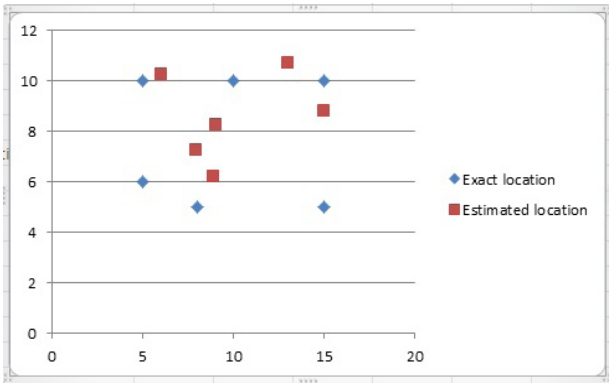

Fig. 6. Positioning accuracy around 2- 2.5 m

CONCLUSIONS AND FUTURE WORK

The Wi-Fi trilateration method is using for indoor positioning and provides low accurate localization.

For its improving more accurate signal propagation models can be used or expanded measures of signal strength including most number of reference point. Moreover, the further work can be continued on the Wi- Fi fingerprinting approach because the indoor localization algorithm described above may be considered as a special case of fingerprinting.

The realization of fingerprinting approach requires also advanced measurement of RSS and building the radio map and can provide high accurate indoor localization.

Future scope of the system lies there in the efficient indoor navigation system which can be useful in many places. Accuracy in positioning can be improved a lot with the combination various technologies like Bluetooth, GSM and RFID's. Indoor system for user and device tracking for security reasons can also be the future scope of the system.

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OPTIMIZING FACE RECOGNITION IN IMAGES

Marian Dorin PÎRLOAGĂ*, Ciprian RĂCUCIU, Emil CRETU** , Marius ROGOBETE***

**Military Technical Academy, Bucharest, Romania, **University Titu Maiorescu, Bucharest, Romania*

Abstract: *The paper aims to optimize practical applications for detection and face recognition using Haar-Like classifiers in conjunction with a centroid algorithm to detect the gaze direction. For selecting method we have implemented principal components analysis (PCA), and for image resizing after detected we used the interpolation method. The proposed algorithm is tested by a database of its own and by training aiming at detecting and recognizing faces in crowds crowded. Practical application in Microsoft Visual Studio was held in CSharp using predefined elements in Open Cv. Finally we present comparative results with other three systems that implement biometric technologies, about false acceptance rate, false rejection rate, and processing time.*

Keydords: *recognition, image, technologies, processing, detection*

1. EXTRACTION AND SELECTION OF FEATURES THE CHOICE OF METHOD SELECTION. PCA VS. LDA

A performance analysis methods using PCA and LDA selection deploying two classification methods using SOM and Csoma was presented in [1].

We demonstrated by fusion of features on networks trained containing a number of 80-360 neurons with a step of 40 neurons that there is a great recognition for a single color component C1, over 95% using LDA and 74, 95% using PCA for involvement of more than 360 neurons.

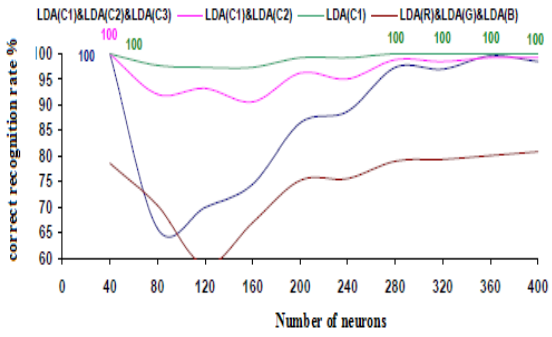


Fig. 1. Representation of performance results for LDA

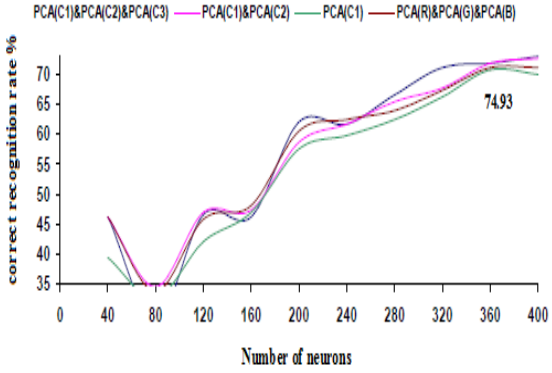


Fig. 2. Representation of performance results for PCA

The object of the military real-time recognition, we turned to recent studies have shown that training time approx. 40 ms can be achieved only by using PCA. LDA allows drives to dozens of minutes.

PCA also allows good image compression, Karhunen-Loeve transform for each 20 allowing every pixel images that we represent vectors each with 20 dimensions. Each vector can represent all of the same pixel intensity values of the photo-image analysis.

It should be mentioned results Turk and Alex Pentland Matthew who showed Laboratory Massachusetts Institute of Technology that is reasonable recognition using PCA by changing the image acquisition conditions with an angle of up to 45 degrees to the other schemes recognition using vector of the common face.

In reference [2] is demonstrated that PCA allows to describe variations between images of models with significant differences in features.

In reference [3] it was shown that using 16 subjects the three types of image formats by changing lighting conditions that the 6 types of resolution (512 x 16 x 16 ... 512), for a total of 2592 images entrained can get a correct recognition rate of 96%, above the normal lighting of the light 85% below to 64% above the size of the image. The results showed that the maximum 19% can be obtained by changing the lighting rejections, 39% and 60% by changing the orientation by changing the size of the acquired images.

All these considerations led us to the decision to use the selection method using PCA in practical applications performed in this paper.

2. THE CLASSIFICATION ITSELF

Implementation of neural structures as forms of visual classifiers is one of the most common applications of neural networks. The training of a neural network for visual pattern recognition (2D or 3D) requires, in principle, the approach has three distinct directions, generic schematic below:

(1) {visual forms (2D or 3D)} entry extraction / selection shape descriptors (1D) {lot of training (1D)} standard neural network;

(2) {visual forms (2D)} input {lot of training (2D)} specialized 2D neural networks;

{Visual forms (3D)} entry extraction / selection projections (2D) {lot of training (2D) 2D specialized neural networks;

(3) {visual forms (3D)} entry extraction / selection shape descriptors (3D) {lot of training (3D)} 3D specialized neural networks.

Neural networks listed in the previous paragraph (2) are specialized structures involvement with 2D input forms, the flexibility organization of neurons in the input layer in the form of two-dimensional arrays of different shapes (circular, hexagonal, etc.).

An efficient method which eliminates the step neural classification of feature extraction is disclosed in reference [4].

Essentially, the method consists in transforming space training vectors into a new space whose dimension is equal to the number of classes.

Such vectors are transformed pseudo-features are subsequently presented a classical multilayer networks.

Finally, it must be made and natural observation that because of fast development and implementation of new structures of neural networks, neural computation range theory applied in pattern recognition (visual) is much larger, far exceeding the possibilities of coverage and presentation in an article.

3. CUBIC INTERPOLATION

Resizizing and image detection for forced comparing the same size as the test image was performed using cubic interpolation methodology.

This approach assumed predefined approximation techniques based on Spline function.

It was proposed that computer application, after applying interpolation to achieve:

-Display the added image to a grayscale

- Save a text file of faces involved

- writing the labels of involved faces in a text file for loading and subsequent detection

Interpolation is a method of estimating the values applied in a location without measurements, based on measured values in neighboring points.

The process consists in finding a function f (x, y) to represent the entire surface z values associated with points (x, y) arranged regularly performing a prediction function z values for other positions arranged regularly.

The considerations that led to the choice of interpolation were offering a large space for data input processing, a very short time and the possibility of implementing applications using open source.

Implementation method of spline functions in the process of cubic interpolation.

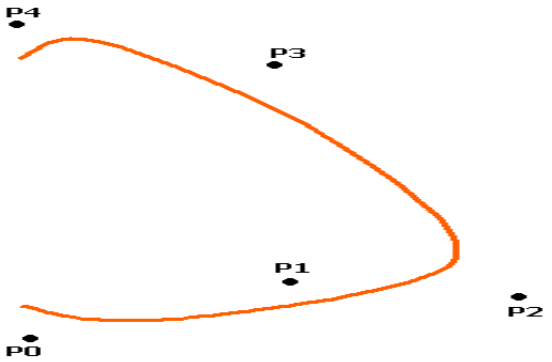
For the development of facial recognition applications to people insisted that uses triangulation method.

It is developed by Peuker, Delaunay triangulation and use. The result is a network of triangles (TIN type structure) perfectly circumscribed circles, which makes the distance between points forming the triangle tops always be minimal. For each triangle is stored coordinates and attributes of the three peaks, topology and slope inclination and direction of the triangle surface [5]. Triangulation works best when data is distributed evenly on the surface to be interpolated. The method is accurate and uses linear interpolation or cubic polynomial. Suitable for large data sets, being fast enough. Allows applications with open source: QGIS (Quantum GIS) with a processing time and SAGA (System for Automated Geoscientific Analyses).

A comparison of the main methods for implementing cubic interpolation was represented by www.geo-spatial.org studies using 101,987 points and 8-core 2.8GHz PC. Thus TIN interpolation using existing QGIS software can process data in a time of 12 seconds and SAGA applications in about 4 seconds.

Experimental methods for the construction of a cubic spline interpolation curve using a basic set of splines. Interpolation curve is obtained as a linear combination (weighted sum) of them. In this case we obtain an interpolation curve on which each checkpoint exerts global influence.

Providing local control on cubic spline interpolation can not be obtained except by renouncing some conditions on the curve. Dropping the requirement that curve to pass through checkpoints, leading to the approximation curves B-spline curves called (Fig. 3).



$$C_i(t)=\frac{1}{6}\begin{bmatrix}t^3 & t^2 & t & 1\end{bmatrix}*\begin{bmatrix}-1 & 3 & -3 & 1\\ 3 & -6 & 3 & 0\\ -3 & 3 & 0 & 0\\ 1 & 0 & 0 & 0\end{bmatrix}*\begin{bmatrix}P_{i-1}\\ P_i\\ P_{i+1}\\ P_{i+2}\end{bmatrix} \qquad t\in[0,1]$$

Fig. 3. Graphical representation and mathematical spline function

Detection and recognition of people

Their detection and recognition is mainly aimed at identifying their human and their location in the image, regardless of the parameters: position, scale, rotation (in the image plane), orientation (rotation out of the plane of the picture), light [11].

The detection is the first step in automatic face recognition systems, the first step in systems "surveillance".

This is an important step in the initialization for tracking (tracking site) face or body in image sequences [26].

Difficulties

We identified these difficulties:

- high dimensionality space features: A grayscale image (8 bits / pixel) size 19 × 19 on a drive to 256,361 possible combinations of intensities;
- orientation face confusing rotate out of plane image. This should be clearly defined vertical axis of the head directions: front, profile, half profile and non-vertical head axis and rotation in the image plane / optical axis of the camera;
- conditions image acquisition variables: lighting, camera parameters (sensor gain, image resolution, objective);
- occlusions;
- facial expression of the face is confused with a non-rigid object variable appearance;
- presence / absence of structural elements: glasses, beard, mustache etc.

4. EVALUATION DETECTION ALGORITHMS - PARAMETERS

Evaluation of algorithms for detection is achieved by determining the best detection rate (TPR) and false detection rate (FPR).

The rate indicates the percentage of good pixel detection and detected by the algorithm, and the false detection rate indicates the percentage of pixels that do not belong to the detected as being of image.

TPR = NTP / NTP + NFN , (1)
FPR = NFP / NFP + NTN, (2)
where:
NTP is the number of pixels of the face detected correctly (true positives)
NFN is the number of pixels of the face undetected (false negatives)
NFP is the number of pixels of the non - face detected as type face (false positives)
NTN is the number of pixels to the right of the non undetected (true negatives).

When detection algorithm depends on a parameter, it will influence the values of variable detection rates [15].

Algorithm characterization can be performed using the ROC curve (Relative Operating Characteristics), which is in the following figure dependence between FPR TPR AND variation in the parameter algorithm [6,7,19]

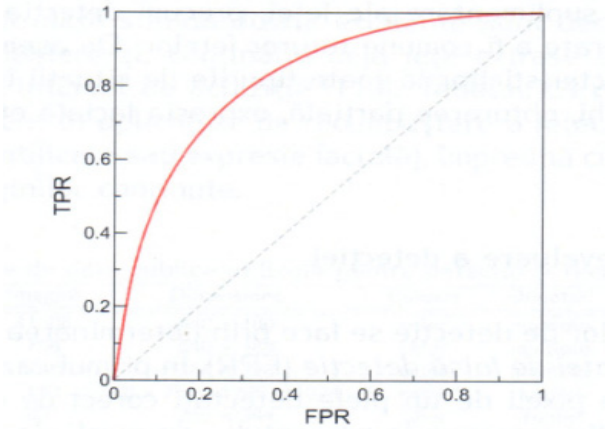


Fig. 4. ROC curve (Relative Operating Characteristics)

Another parameter evaluated is the percentage of the pixel detection of facial skin (SDR) is the number of pixels reaportul skin of the face detected NTP and the total number of pixels in the image N skin skin [20, 21, 22].

SDR = NTP / N skins

The objectives of the work were:
Identification of problems related to their detection
• Locating and - determining the position of a single face in an image
• Detection of facial component elements - the presence and location: eyes, eyebrows, nose / nostrils, mouth, lips, ears etc.
• Recognition / their identification
• Recognition of facial expression
Another concern may be human posture estimation and tracking its

And detection based on color and matching templates in conjunction with the method of detection and tracking eye gaze direction.

Detection and tracking eye gaze direction has been described in reference [8], [9]

5. ANALYSIS OF GAZE DIRECTION

Obtaining the 2 eyes images based on region features antopomorfice supposed eyes must have 1/8 of the total height height and width of the face 1/5 of the total width of the face, and the existence of two sub-images containing the eyes of image with the highest resolution (level 0).

The imagery size depends on the scale at which found scaling fixed size (60x80), the pixels by interpolation resulting a bi-linear front [23,24].

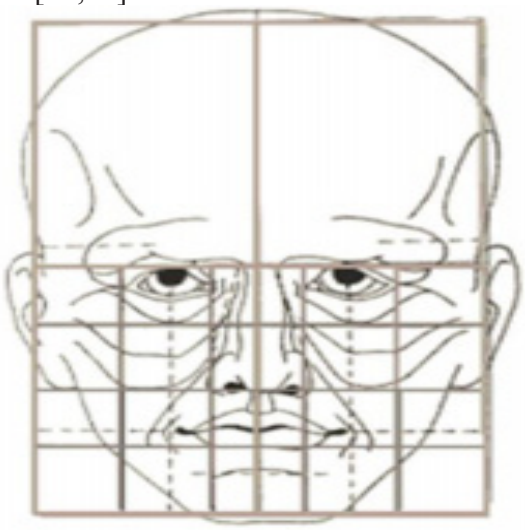


Fig. 5. Detection of the centroid of the analyzed elements located on map

Eye image stabilization stage is performed for detection and tracking is not sufficiently precise for movements of the head of a few pixels. This means the difference between successive frames to create binary image motion and the calculation of moments of order 1 (center of mass).Centroid points results are used to estimate the location of the eyes in the face image or a good accuracy for low-resolution images) [25].

5.1. Comparison between left and right eye

The left eye and right eye are compared to determine where the user looks:

They are analyzed: the left eye image is made] and lower the mirror image of the right eye.

Thus, if the user directly to the camera will look the difference is small.

If the user is looking to the left, then put the eye in the mirror will seem like the right look and the difference is obvious.

Further analyzes of intensity differences between right and left eye image reflected and design (summation) to measure their vertical line of vision [25].

5.2. Measuring the line of vision. Gaze detection step involves right eye left eye, determining if any of eye movement and direction of movement.

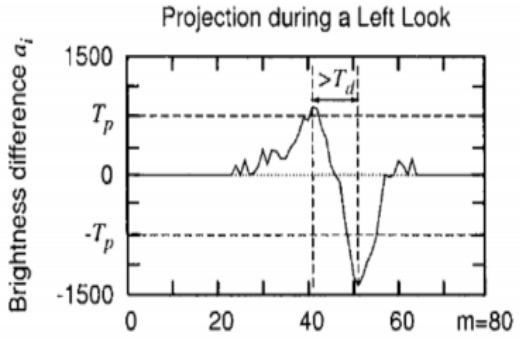


Fig. 6. left eye gaze detection

$$a_i = \sum_{j=1}^{n} (I_r(i,j) - I_\ell(m-i,j)) \quad , \quad (3)$$

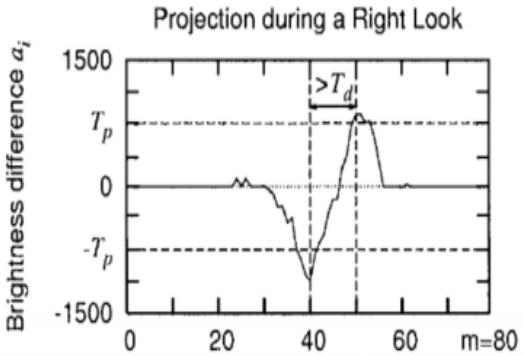


Fig. 7. right eye gaze detection

$$a_{\min} = \min_{i=\{1,\ldots,m\}} (a_i) \qquad a_{\max} = \max_{i=\{1,\ldots,m\}} (a_i)$$
$$i_{\min} = \arg\min_{i=\{1,\ldots,m\}} (a_i) \qquad i_{\max} = \arg\max_{i=\{1,\ldots,m\}} (a_i) \quad , \quad (4)$$

There are eye movement:

$$a_{\max} > T_p \qquad a_{\min} < -T_p \quad , \quad (5)$$

5.3. Examples of location analysis and line of vision. Analysis of gaze direction is a modern method described in [25,18]] and is based on the comparative study of eye movements result to certain directions.

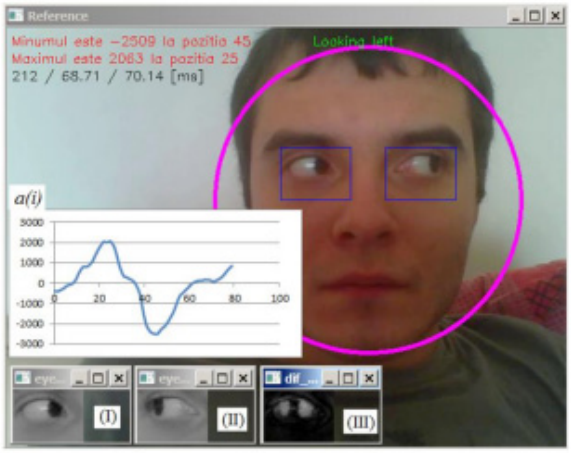


Fig. 8. Illustration left gaze detection results [25]

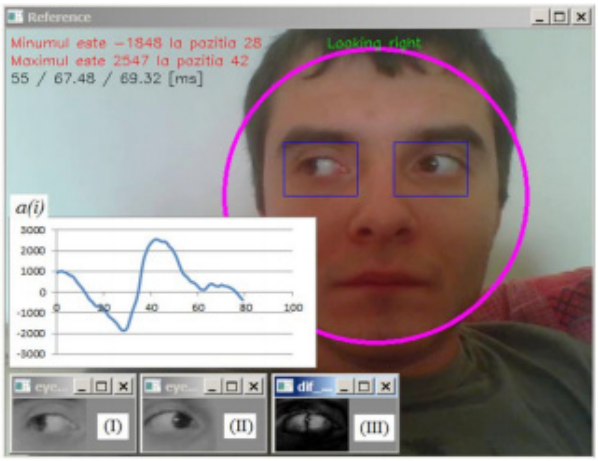


Fig. 9. Illustration of gaze detection results right [25]

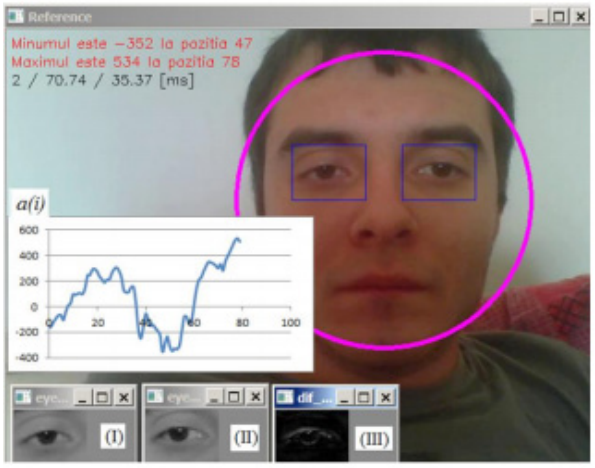


Fig. 10. Illustration of the eye detection results by the center [25]

The algorithm of the location of the pupil

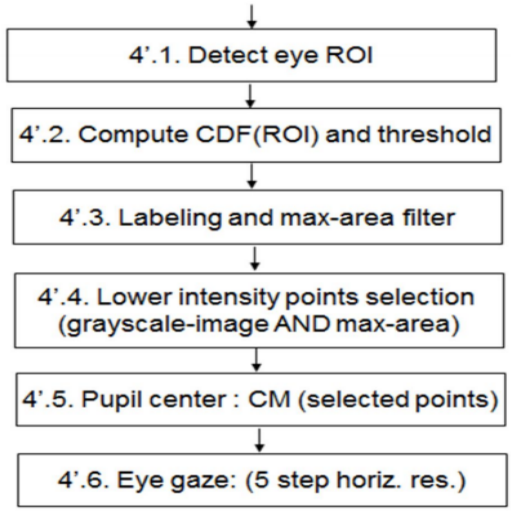


Fig. 11. Block diagram of the pupil localization algorithm

5.4. Estimating line of vision. Estimation of the application made personal line of vision involves two main steps:

detection and face tracking and eye direction detection [16,17].

1. Face Detection was performed by the method Viola Jones and OpenCV
2. Detection eye position (Viola Jones) required validation features antropomorfice.şi initialization sablonlui eye.
3. Face tracking was done by tracking the template matching (MatchTemplate / OpenCV)
4. Detection and tracking pupil

Alternative Step 3: CAMSHIFT / OpenCV

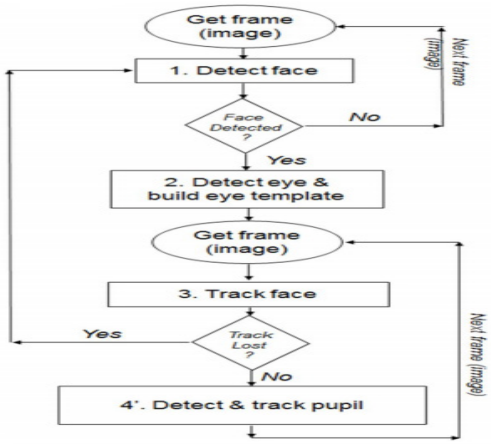


Fig. 12. Scheme drive centroid algorithm for detecting gaze

The algorithm itself. Specific algorithm used in the application is using centroid gaze detection and is described by the following equations, where S is the threshold used to discriminate pupil.

$$X = \sum_{j=1}^{m}\sum_{i=1}^{n}\mu_{ij}x_i \Big/ \sum_{j=1}^{m}\sum_{i=1}^{n}\mu_{ij}, \quad Y = \sum_{j=1}^{m}\sum_{i=1}^{n}\mu_{ij}y_i \Big/ \sum_{j=1}^{m}\sum_{i=1}^{n}\mu_{ij}$$

$$\mu_{ij} = -\mu_{ji} = \begin{cases} 0, & pentru \quad 0 \le \mu < S \\ 1, & pentru \quad S \le \mu < 255 \end{cases}, \quad (6)$$

5.5. Description of the experiment.

The application was made from library HAAR classifiers implemented using cubic interpolation technology through predefined functions dumps.

The program runs independently and requires the installation of Microsoft Visual Studio 2013 programming language being developed in C Sharp.

Main considerations underlying its choice was very fast processing speed, the real-time and accessible menu operation / programming [12,13,14]

Programming steps:

1. Declare all variables, objects and image vectors

-definition type font

-definition images after detection results and therefore to be registered in the database

-generating one vector with all images added

-generating one vector with labeling subjects

2. Charging classifier for face detection and eye front type Haar Cascade
-loadind existing faces and labeling each of them
- Capture initialization room (open room)
- Initialization counter drive girls
- Getting a gray frame capture device (camera)
- Initialization detector Emgu facial image processing
3. Define the action for each element detected
4. Redimensiunea detected face image as a comparison to the same scale forced test image using cubic interpolation.
5.Obtain the current capture device
6. Displaying the faces, processed and recognized

6. DATABASE

The database is personal created and is described in reference [10].

Fig. 13. Selection of photos from the database used

Most public databases seek recognition as a database containing personal realized that the background image is recognizable and uniform. The images have dimensions of 90x120 pixels.

Field's face rotation angle to the direction of sight is ± 90 degrees and the upper part of the face is partially obstructed by a percentage of up 40% while maintaining axial symmetry elements of the image. Base color images containing personal data people of different races, genders, ages, lighting conditions, background and context percent body skin visible, capturing more emotional and rotation / head covering. The context in which images can be found is varied, before being bounded by the body clothing, glasses, etc.

In this situation recognition resumed to detect skin regions. Thus, it is necessary to use a skin detection algorithm in addition to color information to use additional features such as face detection eyes, mouth or other common elements.

Matters and invariance characteristics in all kinds of situations in which can be found before (its rotation at an angle, facial expression, filling)

7. THE RESULTS OF THE EXPERIMENT

Training database containing 12 images of 46 subjects selected by the method of PCA and cubic interpolation used pupil centroid classifier for detection / recognition of gaze direction in conjunction with HAAR-LIKE classifiers.

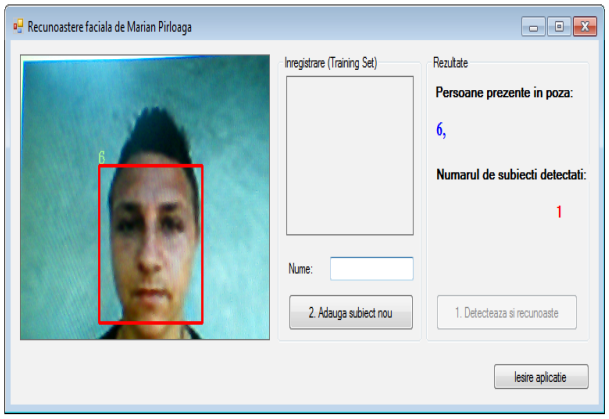


Fig. 14. Screen capture of a person recognized label database

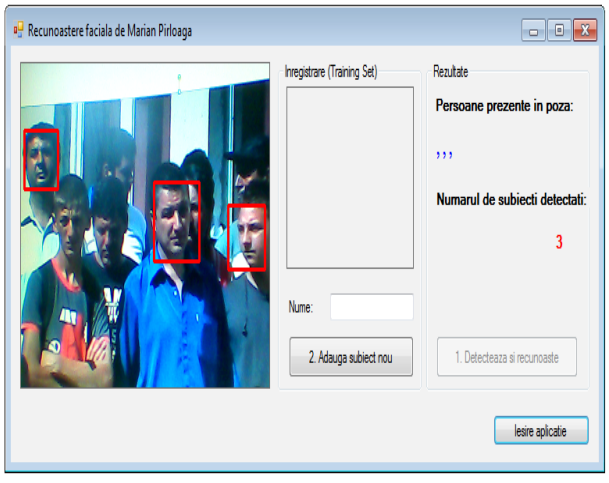


Fig. 15.Captura screen on the recognition of three subjects from the database

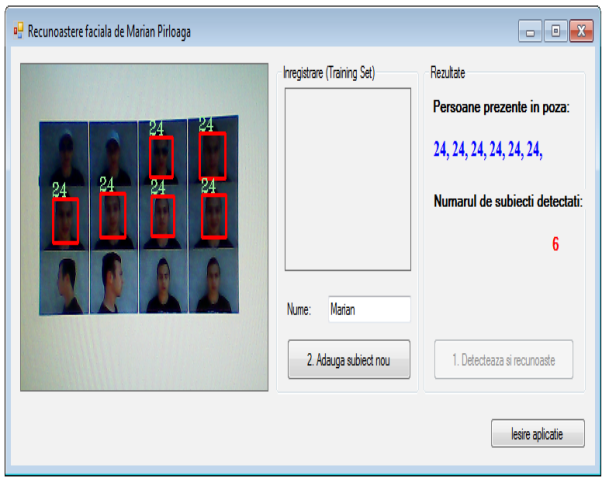


Fig. 16. Screenshot of subject No. 24 database facial recognized in 6 states: glasses, frowning / angry, sad, surprised, joyful. Light: semi-darkness

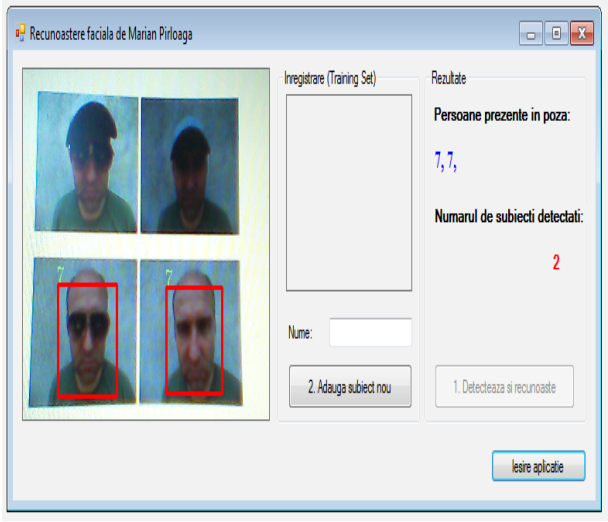


Fig. 17. Screenshot 7 of subject database facial recognized in 6 states: glasses, frowning

8. CONCLUSIONS ON IMAGE PROCESSING FOR FACE RECOGNITION

Applied research aimed at obtaining software for real-time recognition of individuals or crowds busy implementing an algorithm together with the most advanced method recognized by Viola Jones.

We experienced AdaBoost algorithm implementing methods, HAAR-LIKE, and HAAR-LIKE staff in conjunction with an algorithm for recognizing pupil and line of vision, proposed in several applications such as distributed systems [13] opposite the traditional methods and a method The proposed staff.

Table 1. Results summary of performances for each experiment

Indicatory	Distributed Information Systems	AdaBoost Classifier	Classifiers HAAR-LIKE	HAAR-LIKE + classifier classifiers for recognizing pupil
False acceptance rate(%)	45.16	49.05	56.75	over 95.42
False rejection rate(%)	33.80	28.50	24.98	maximum 15.08
Processing Time (sec.)	130	real time	real time	real time
Face recognition for rotation (degrees)	without	60	45	45
Face recognition and emotional states covered above	no	no	yes	yes

1.Method HAAR-LIKE implementing classifiers and a classifier for recognizing the pupil respective line of vision is most applicable for military applications.

This allows a rate of more than 15% false recognition, a recognition rate over 95%, in real time, to a rotation of the subject's face up to 45 degrees, and the recognition of the upper face cover or of the emotional state.

2.Using classifiers HAAR-LIKE processing time remains the same, but the recognition rate is decreased to 56.75%, and the false recognition ncreases to 24.98%. The method allows face recognition when the top is closed, emotional states, but does not allow facial recognition rotated more than 45 degrees.

3.The application allows detection using AdaBoost their higher ungiuri oriented to 60 degrees from the normal position, image acquisition front. Instead false recognition rate of 28.50% high and the recognition is only 49.05%.

The application does not allow the recognition of the upper face covered or emotional states.

4.The results of adopting the method of distributed systems shows that there is great confusion recognition between classes of people, and not make a very good separation between data acquisition and processing in humans, animals or objects in the background.

Best processing time is 130 seconds.
The application does not allow the implementation of the portable computer terminals and interconnected systems assume that in military terms is difficult.
False recognition rate of 33.80% is very high.
5.Using implementation in Microsoft Visual Studio, detection and recognition is performed in real time, there are no delays due eg mathematical processing. in Matlab.
6.The method performed by the conjunction of two classifiers allows recognizing the faces of people in crowds crowded so backlit normal, uniform and on a rough background, surrounded by objects in different lighting.
It allows the recognition of six emotional states associated with the subject, including its recognition wearing glasses, without making confusion with other classes of subjects.
7.All computer applications allow processing of images stored as .jpg, .png or .bmp and fixed video images in real time provided by a video camera.
8.Comparison and practical results lead to software recommendation implies classifiers HAAR-LIKE conjunction with a classifier for recognizing pupil and line of vision, surveillance for military applications involving the detection and recognition of people in crowds or crowded, sporting events, cultural religious, detection of persons under confinement at the border, and pursued the suspects subject to military or police action.
9.Image processing is a complex and very dynamic, with numerous applications in various military.
Further optimization of the application may allow the extraction of useful information from the image and improve the extraction and analysis.
10.The application was tested in applications optimized operative to detect and recognize persons who are the subject for gendarmerie and police missions in crowded crowds - giving good results in terms of operational.

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OVERHEATING ANALYSIS OF THE SPECIAL VEHICLES BRAKING SYSTEMS

Alin-Marian PUNCIOIU, Ioan VEDINAŞ, Marian TRUȚĂ

Military Technical Academy, Bucharest, Romania

Abstract: *This paper shows the basis of thermal calculation of the special vehicle brake. During the braking the vehicle's kinetic energy is converted to heat. Calculation of a special vehicle brake heat can be based on experimental data on actual conditions in the cooling of the brakes braking or can be simulated using finite element method. The thermal regime has a great importance for the smooth operation of the brakes.*

Keywords: *braking system, heat transfer, brake temperature analysis, thermal stress.*

1. INTRODUCTION

Braking is the process to reduce all or part of a vehicle velocity. The braking system of a vehicle is one of the most important structural components thereof, representing the main element in ensuring traffic safety, given the continued growth of the dynamic qualities of the car and traffic intensification.

Depending on the destination of the vehicle and the level of technological development there are met different braking systems solutions. From their analysis one can see that there is a tendency of using complex braking systems for special vehicles.

As is known, during the braking the vehicle's kinetic energy is converted to heat, mainly taken up by the friction elements of the brake mechanisms of the wheels. Usually this heat is released to the environment, the heat transfer can be accelerated by a suitable configuration of the various components of the wheel brake mechanism, leading to the design of brakes ventilated. But if the service brake is applied extensively, heat removal capability to environment is limited, and thus brake components will overheat and this will conduct to some undesirable phenomena.

First, braking mechanisms being in the vicinity of wheel bearings will rise its temperature, and the lubricant will lose its qualities and can determine their seizure.

Second, by increasing the temperature of the wheel brake mechanism components can lead to loss of its physico-mechanical properties. Finally, thirdly and most importantly undesirable phenomenon by increasing temperature conjugate material (steel or cast iron / lining friction) friction coefficient decreases and hence braking effect is reduced dangerously with serious implications for traffic safety.

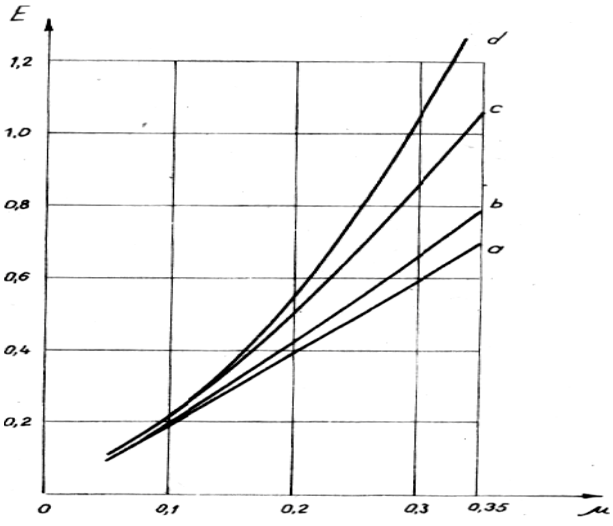

Fig. 1 The efficiency characteristic of drum brake mechanisms
a - simplex, with equal displacement of shoes; b - simplex, with independent displacement of shoes; c - duplex; d – servo
after Marinescu M, (2006)

2. THERMAL CALCULATION

2.1 Considerations on thermal stresses of the brakes. Calculation of a vehicle brake heat can only be based on experimental data on actual conditions in the cooling of the brakes braking [1]. The amount of heat released in a second is determined by the relation:

$$Q = \frac{F_{ft} v_a}{427} = \frac{\mu p_0 \Sigma A v_a}{427} [kcal/s] \quad (1)$$

where: v_a is the slip speed between the drum and the friction lining *(v_a = (V/3,6)·(r_t / r_r); F_{ft}* — the braking force acting on the drum (F_{ft} = $\mu p_0 \Sigma A$*)*; ΣA – lining friction area; p_0— average pressure.

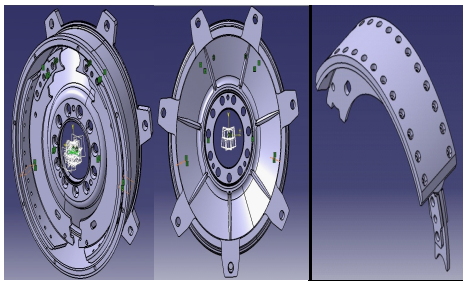

Fig. 2 Braking system with shoe and drum

2.2 Thermal calculation on intensive brakes. In case of short isolate intensive braking, heat exchange with the outside can be neglected, considering that the entire amount of heat that is released contribute to raising the temperature of the brake itself. Due to the very low thermal conductivity of friction, almost all of the heat is taken from drum or disc.

Thermal balance in case of intensive braking from a velocity V to a stop is given by:

$$\frac{1}{2} \cdot \frac{G_a}{g} \cdot \frac{V^2}{3{,}6^2} \cdot \frac{1}{427} = \xi \cdot G_t \cdot c \cdot n_f \cdot \Delta\tau \quad (2)$$

where: ξ is a coefficient representing the fraction of the heat produced and taken to the drum or disc (in the case of drum brakes ξ = 90 ...95% and for disc brakes ξ = 99%); G_t - weight drum (disc); c - heat mass; G_a - vehicle weight; n_f – number of braked wheels; Δτ - the increasing temperature of the drum (disc).

From equation (2) results temperature rise Δτ of drum (disc) in case of an isolated intensive braking from velocity *V* to a stop:

$$\Delta\tau = \frac{G_a V^2}{108500 \xi c n_f G_t} [^o C] \quad (3)$$

If the difference in thermal regime between front and rear brakes of wheels is large temperature increase Δτ determination must be made separately for front and rear brakes, the total energy has to be distributed in the same ratio as brake force distribution on axle.

It is recommended that intensive braking from 30 km/h until the vehicle stops, temperature rise Δτ does not exceed *15*°C.

2.3 Thermal calculation brakes in case of long braking. On long braking it takes account of heat exchange with the environment.

Thermal balance corresponding to a time interval *dt* is given by

$$dQ = dQ_1 + dQ_2 \quad (4)$$

where: dQ is the amount of elementary heat resulting from brake; dQ_1 - the amount of elementary heat transferred to external environment; dQ_2 - the amount of elementary heat consumed in heating the drum (disc).

If elementary heat quantities are replaced dQ, dQ_1 and dQ_2 heat balance becomes

$$q_d A dt = \alpha A_r \tau dt + c G_t d\tau \quad (5)$$

where: q_d is the density of heat flow at the beginning of prolonged braking; A — lining friction surface; α — heat exchange coefficient between the drum and the air; A_r — cooling surface of the drum; τ — relative temperature of the drum in relation to the environment; *c* — the heat mass of the material the drum (disc) is made from; G_t — drum weight; dτ — temperature increase.

By integrating relation (5) and setting the initial condition that at *t* = 0 and τ = 0 it results time required for the drum temperature to reach a predetermined value:

$$t = \frac{c G_t}{\alpha A_r} \ln \frac{q_d A}{q_d A - \alpha A_r \tau} [s] \quad (6)$$

The heat flux density q_d is given by

$$q_d = \frac{G_a}{g\sum A} \cdot \frac{V}{3,6} \cdot \frac{a_f}{427} \left[\frac{kcal}{cm^2 \cdot s} \right] \quad (7)$$

where a_f is braking deceleration.

Heat exchange coefficient α varies with the relative speed of the drum (disc) and ambient air and can be calculated with the relation:

$$\alpha = 1,25 \cdot 10^{-7} + 1,6 \cdot 10^{-10} nr - 3,237 \cdot 10^{-12} (nr)^{1,32} [kcal/cm^2 \cdot s \cdot °C] \quad (8)$$

The cooling surface of the drum A_r consists of the front surface A_f and the surface of the crown A_c. In the calculations front surface have to be equated with the surface of the crown (because both temperature, and α varies with the radius *r),* to give

$$A_r = A_c + \frac{2\pi}{\alpha_g \tau_g} \cdot \int_{r_i}^{r_g} \alpha_{(r)} \tau_{ri} \, r \, dr \quad (9)$$

where $\tau_{max} = \frac{\tau_e}{r_e} \cdot r$

if prolonged braking, maximum temperature of the drum - (disc) can be calculated with approximate relation

$$\tau_{max} \approx 56,5 \frac{\chi q_d}{\rho c} \sqrt{\frac{V}{3,6} \cdot \frac{1}{\pi a_f \alpha_i}} \quad (10)$$

where: ϰ is a coefficient of heat distribution between the friction linings and drum or disc (ϰ = 1 if it is considered that the insulating seals, ϰ = 0,5 if it is considered that the insulating seals); q_d — heat flux density, in kW/cm² and is determined by the relation (7) ; ρ — drum or disc material density in kg/m³; c — heat the drum or disc mass in kJ/kg°C; a_f — vehicle braking deceleration in m/s²; V — the speed of the vehicle, in km/h; $\alpha_t = \lambda/(c\rho)$ — thermal diffusivity m²/s (λ thermal conductivity W/m °C. It must, under the test conditions prescribed by Regulation no. 13 C.E.E. UN brake temperatures not exceeding 300°C.

2.4 Thermal calculation brakes for repeated braking. Repeated braking, when the number is high, it strikes a balance between the heat and the heat discharged, leading to the saturation temperature of the drum (disc) given by

$$\tau_s = \tau_0 + \frac{\Delta\tau}{1 - e^{-b_0}} \approx \tau_0 + \frac{\tau}{b_0} \quad (11)$$

where: τ_0 is the ambient temperature; Δτ— temperature rise due to brake; b — coefficient characterizing the brake cooling conditions; t_0 - range of braking.

Increased temperature Δτ is calculated with

$$\Delta\tau = \frac{\Delta E}{c m_t} \quad (12)$$

where ΔE is the energy absorbed from a single braking (during which the vehicle velocity decreases from V_1 to V_2) and m_t is the mass of the drum (disc).

If the brakes are to stopping the vehicle, the temperature increase Δτ is determined by equation (3).

The coefficient b depends on the size of the friction surfaces, installation conditions of the drum (disc) on the block, vehicle velocity, and so on. For V = 30 km/h the coefficient b = 0,001 ... 0,004 [s^{-1}], higher values correspond to better ventilation brakes (open disc brake).

At heat checking, the saturation temperature does not exceed values that can modify the properties of the friction linings and the drum (disc).

The functioning properly of brake depends on the use of appropriate materials for construction.

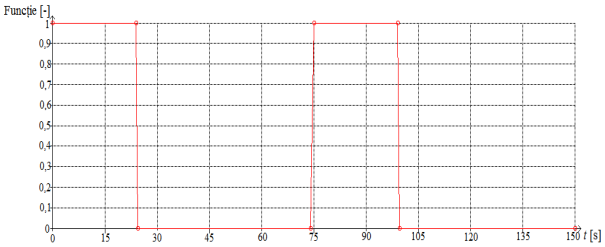

Fig. 3 The law of variation of the heat flow required for a period of 25 seconds brake

As a result of thermal expansion, tensile stresses occur in the drum is determined by the relationship

$$\sigma^{-} = \frac{E\alpha_l \tau}{1 - \delta_p} \quad (13)$$

where: E is Young module, in daN/cm^2; α_l— the coefficient of linear expansion, the m/m • °C; τ - drum temperature in °C; δ_p— Poisson's constant (δ_p = 0,26).

3. COMPUTER-BASED BRAKE TEMPERATURE ANALYSIS

The system (the drum or disc thickness) is divided into a number of discrete nodal points, as illustrated in fig. 4, for a one-dimensional temperature analysis [2]. In fig. 4 the temperature is analyzed only as a function of distance x and time t. Application of the first law of thermo dynamics, or energy balance, to each individual node results in a set of algebra equations whose solution will yield individual nodal temperatures for each finite time interval.

It is therefore necessary to calculate the temperature distribution at some future time from a given distribution at an earlier time, the earliest time being associated with the known initial temperature distribution existing at the onset of braking. The relationship expressing heat conduction between two nodes is known as Fourier's Conduction Law and may be expressed in the form of an exact integral:

$$q_{ij} = \int_{\Delta y} -k\left(\frac{\partial T}{\partial x}\right) b dy \approx -k\left(\frac{dT}{Dv}\right)_{average} b\Delta y \tag{14}$$

where b = width of plate, m;

q_{ij} heat flow between nodal points i and j, Nm/ h

x = horizontal distance between two adjacent nodal points, m;

y = vertical distance between two adjacent nodal points, m;

$\frac{\partial T}{\partial x}$ = temperature gradient, K/m;

The distances Ax, Ay, and b designate control volume size, and k the thermal conductivity of the material. Eq. (14) may be rewritten in the form of the temperature of the two nodal points

$$q_{ij} = -\frac{k\left(T_j - T_i\right) b\Delta y}{\Delta x}, Nm/h \tag{15}$$

where T_i = temperature of node i, K; T_j = temperature of node j, K;

For two-dimensional temperature problems, where T = f(x, y, t), for example, and a square grid size with Ax = Ay, the basic heat conduction between two nodal points becomes

$$q_{ij} = k\left(T_j - T_i\right) b, Nm/h \tag{16}$$

For one-dimensional systems such as a solid disc brake, the basic heat conduction equation with Ay equal to unity becomes:

$$q_{ij} = \frac{k_R\left(T_i - T_j\right) b}{Ax}, Nm/h \tag{17}$$

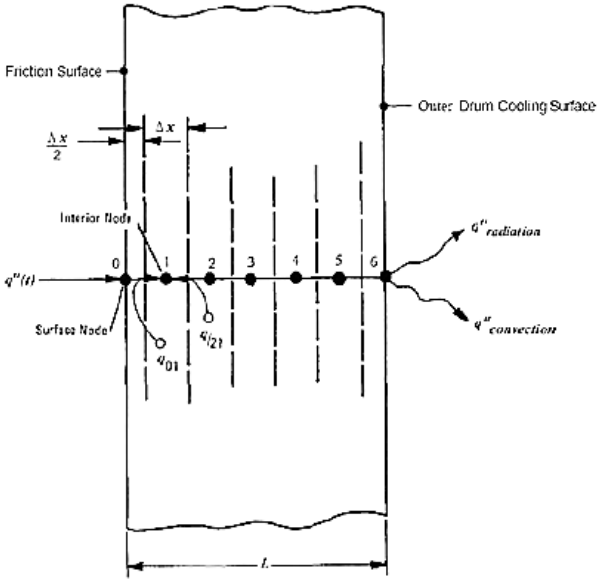

Fig. 4 - Thermal model for finite difference computation (drum brake shown)
after Limpert R, (2011)

CONCLUSIONS

Because of the significant role that the braking installation has to ensure the safety of movement, it is essential that it has a close to 100% reliability.

To meet this requirement a series of constructive measures were taken, in order to permit vehicle braking effectiveness sufficient in the event of the appearance of damage in a section of the braking device or warn in time the driver about an eminent reduction in efficacy.

Brakes are checked on the mechanical and thermal loads. These tests aim to establish their sustainability in terms of wear and the variation coefficient of friction between the friction surfaces along with increasing temperature.

Analytical calculation verification of thermal stresses in the design phase cannot be calculated precisely because it does not meet all the necessary data. It is therefore recommended to be made on the basis of existing data from similar products for predimensioning. Modeling using simulation programs will lead eventually to the establishment of the actual thermal load brake mechanism components.

The thermal regime has a great importance for the smooth operation of the brakes. Reduce heat brake system, in addition to the measures listed, it is also obtained by:

- Correlation between the outer diameter of the drum (the disk) and the diameter of the crown of the wheel;
- Increasing the cooling surface by using drums with circumferential outer ribs (tests indicate a reduction in temperature with 45-65% ribbed drum to drum simple);
- Creation of radial channels in highly loaded disc brake thermal (at rotating disc it creates its interior ventilation, helping to clear heat in the environment);
- By forced cooling of the brakes.

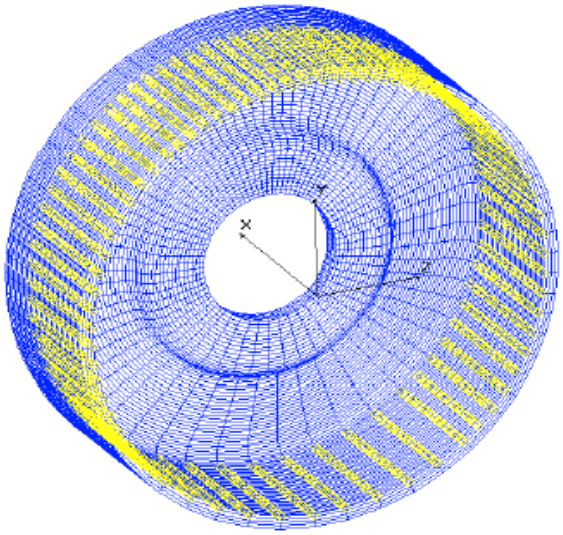

Fig. 5 Scheme of thermal field distribution (internal temperature of 150^0 C) due to intense friction between the shoes and brake drums for armored personnel carrier

after Marinescu M, (2006)

Modeling using simulation programs will lead eventually to the establishment of the actual thermal load brake mechanism components.

For example, in fig. 5, is shown thermal field distribution scheme (for indoor temperature by the heat generated on intense braking 150^o C) for brake drum of armored personnel carrier [4].

Acknowledgment:

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THE INFLUENCE OF THE ROAD SURFACE FOR THE WHEEL CAR

Cristian MINCA

Timisoara, Romania

Abstract: *In temperate climatic conditions the water depths on wet roads are generally low, typically less than 1 mm. In this paper I examine the various types of road surface and the manner in which they can be classified in terms of macro and micro texture. I propose a simplified representation of the tire road interface in which the tire footprint is divided into 2 zones, a dry zone in which dry road friction levels are obtained and an initial wet zone in which there is a water layer between the tire and road and which gives no retardation.*

Keywords: *road surface, macro and micro texture, footprint, dry zone, wet zone, layer*

INTRODUCTION

In temperate climates roads are wet for considerable periods of time after rainfall due to poor drying conditions. This paper examines the influence of road surface type and tire tread on locked wheel retardation for such conditions, firstly examining the mechanics of the tire-road interaction under wet conditions and proposing a general model for the effective dry tire to road footprint under wet conditions and its variation with speed after examination of the experimental data a simple physical model for tire to road contact is proposed.

1. RAINFALL AND WATER DEPTHS ON ROADS

The water depth on a road surface is defined as the height of water above the level of the top of the large scale roughness. This large scale roughness is defined as the macro-texture. In temperate climates and with the typical range of cross-section of modern roads it has been shown (1) that the water depth for rainfall intensities normally encountered rarely exceeds 2 mm and is more typically 1 mm or less. When the rain stops a significant time can elapse before the road surface becomes fully dry. In this paper the data for water depths from the just wet condition to less than 2 mm has been analyzed.

ROAD SURFACE CLASSIFICATION

The skidding resistance of a road surface is influenced by two characteristics of the surface itself.

These are what have become commonly referred to as the macro-texture and the micro-texture of the road surface.

Figure 1 illustrates the nature of the different road surface.

The macro-structure is the large scale roughness of the surface and in bituminous road surfacing it is formed by the aggregate.

Similarly concrete surface is provided with macro-texture by transverse brushing or grooving while the material is still plastic or by sawing grooves into the hardened surface.

Therefore the macro-texture of the road surface can be readily identified.

The major influences of macro-texture on skidding resistance are that it provides drainage paths to allow water to be removed rapidly from the tire to road interface and gives asperities of suitable magnitude to cause hysteresis losses in the tire material as it deforms around the asperities.

The term Rough is used to denote a surface which has good macro-texture.

The term smooth is used to denote a surface which has no macro-texture.

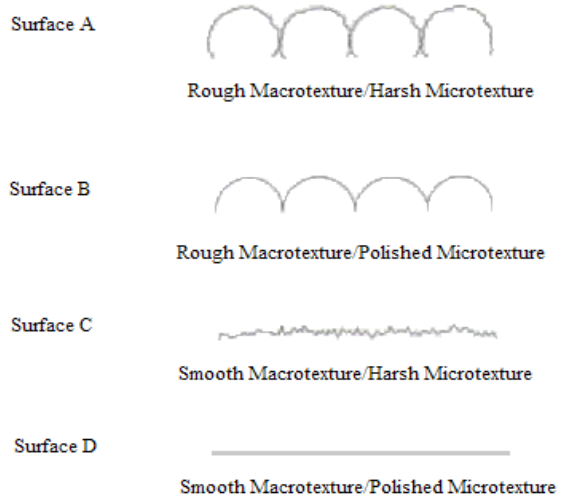

Fig. 1:Terms used to describe road surface texture

The micro-structure is the finer element of the road surface and constitutes the tiny asperities in the surface. For a bituminous surface the micro-texture is found on the aggregate particles with a secondary contribution from the sand sized particles in the exposed bitumen binder or asphalt mortar. In a concrete surfacing the micro-texture derives almost totally from the sand in the mortar. It has been shown that the micro-texture can be assessed by drawing a finger nail across the macro-texture or the exposed bitumen binder. The term Harsh refers to a surface with good micro-texture. The term Polished refers to a surface with no micro-texture.

As there are two states for macro-texture i.e. Rough and Smooth and micro-texture i.e. Harsh and Polished we can combine these to give four distinct types of road surface. These are given in table 1.

Table 1

Type	Macro	Micro
A	Rough	Harsh
B	Rough	Polished
C	Smooth	Harsh
D	Smooth	Polished

CAR BRAKING UNDER WET CONDITIONS

When emergency braking is applied under wet road conditions the frictional force at the tires increases rapidly to a peak value.

At this stage the wheels are still rotating and therefore directional control of the vehicle is in the hands of the driver. ABS braking system essentially operate to maintain the braking force at the peak level so that locking of the wheels does not occur during emergency brake applications. ABS does this by rapid on/off cycling of the braking system to prevent locking of the wheels thus leaving it possible for the driver to use a steering input as an avoidance measure as well as emergency braking. However where ABS is not fitted, it is virtually impossible for the normal average driver to maintain this peak value and there is a rapid and significant drop in the friction force level available. The wheels are now sliding along the road surface i.e. locked wheel braking conditions exist, and the driver cannot steer the vehicle. This paper deals specifically with the locked wheel braking condition. However the theoretical models can also be applied to rotating tires.

It is the lubricating action of the water on the road surface which reduces the skidding resistance on wet road surfaces. Two requirements must be met for effective braking force coefficients to remain available under emergency braking conditions:

1. The water film on the surface must be broken through to provide dry contact between the tire and the road surface.
2. The surface with which the tire comes into contact should not be polished.

In relation to Condition 1 the rupture of the water film is achieved by providing adequate drainage to permit the water to be expelled from between the tire and road surface. This can be provided for by having good tread depth on the tire or by having suitable road surface macro-texture or indeed a combination of both.

In relation to condition 2 the grip at the tire/road contact will depend on the state of non polish i.e. the micro-structure of the surface with which the tire footprint comes into contact. Ideally the surface at the points of contact should have very fine scale sharp edges which will enable the remaining water film to be penetrated.

TIRE-ROAD CONTACT

Moore (2) proposed the existence of three characteristic zones of contact under a rolling or sliding tire in wet road condition, fig. 2

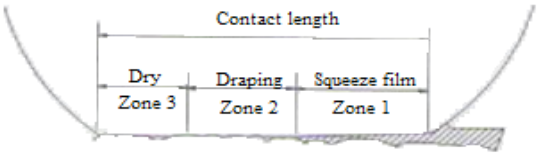

Fig 2: Characteristic zones of contact under a rolling or sliding tire in wet road conditions

The three zones which comprise the tire contact area are as follows:

(1)A squeeze film zone which is at the forward part of tire contact area in the direction of motion. This zone is where the individual tread elements of the tire tread squeeze out the water film under the action of inflation pressure.

(2)A transition zone which is where partial breakdown of the water film is occurring. This zone is where the tire elements having penetrated the squeeze film commence to drape or conform to about the macro-texture of the road surface and to make contact with the macro-texture of the road surface.

(3)A traction or braking zone where the water film has been completely displaced or removed and there is dry contact between the tire and the road surface i.e. almost all wet road skid resistance or tractive capability is developed in this region of contact.

Purushothaman (3) has demonstrated that high value of braking force coefficient, in the same order as those achieved on dry surfaces, occur at very low speeds i.e. when close to to being stopped. This occurs because at this low speed there is extensive breakthrough of the water film between the tire and road surface i.e. zone (3) above is close to maximum. At soon as the speed increases the lubricating action of the water begins to determine the level of the braking force coefficient. The effect of an increase in the speed of rolling or sliding can be explained in terms of the resultant increase in the proportion of contact occupied by the water supported zone in relation to the total contact area. The contact duration time, even at low speed, between the tire and the road is only of the order of a few milliseconds.

In the case of sliding tire this is the time for which any point of the ground is within the tire to ground contact region. Therefore as the speed of the vehicle increases the total contact duration reduces and there is insufficient time for the tire the maximum contact area that is possible in zone (3) thus reducing the braking force coefficient below what would be expected at lower speed. Of course the rate of reduction in braking force coefficient with increasing speed will primarily depend on the macro-texture and micro-texture of the road surface in conjuction with the tire tread pattern.

HYDRODYNAMIC MODEL

It has been shown that the braking force coefficient reduces in value as the speed of the vehicle increases. This decrease is due to the hydrodynamic pressure which builds up in the contact area between the tire and the road. Consider a plane rectangular hard body which slides at some speed over a stationary plane hard surface and allow the body to have the freedom to rotate around horizontal axis, the body pivots and a wedge shaped of liquid builds up between the plane surfaces. This effect is the basis of sliding bearing lubrication. It has been shown that the minimum film thickness i.e. the minimum clearance between the two surfaces is proportional to the square root of the relative sliding speed. It has also been shown that this proportionality holds for a soft elastomer sliding over a hard surface.

Shallamach&Grosch (4) made use of the hydrodynamic theory of lubrication and they assumed that the frictional force, F, is proportional to the effective dry contact area, A_d, so that and that the roughness, micro or otherwise, could be represented as spheres of equal radius r.

$$F=\text{const}.A_d \quad (1)$$

If the lubricating film thickness is h at the sliding velocity v, and h is smaller than r, then the dry area protruding through the film i.e. the dry contact area, A_d is:

$$A_d=2\pi Nr^2(1-h/x) \quad (2)$$

where

N is the number of spheres in the contact area. As hydrodynamic research has shown that film height, h, is proportional to the square root of V substitution into equation (3) can be expressed as follows:

$$\mu = \mu_0(1-bV^{0.5}) \quad (3)$$

where

μ_0 is the dry friction coefficient.

The Shallamach and Grosch model is based on the concept that the upper portion of the spheres protrude through the water film over the entire tire to road footprint area. This model does not accord with the experimental evidence of an initial wet contact area followed by mixed and dry contact areas.

PROPOSED GENERALISED MODEL

In this paper a simpler model is proposed to represent the tire contact area and only two zones of contact are considered, wet and dry. In the wet zone there is not retardation forces available and it is only in the dry zone of the tire footprint that retardation forces are developed. The relationship between the effective retardation forces and the ratio of the wet contact zone and the total tire foot print is derived below:

$$F_v = P.A_c \quad (4)$$

where F_v=the total vertical force at the tire road interface; P=tire pressure;

A_c=the total area of nominal tire foot print

However A_c can be also written as

$$A_c = A_{wet} + A_{dry} \quad (5)$$

As it is the area of dry contact within the total tire/road contact area which gives rise to the frictional forces at the tire/road interface then

$$F_H = \mu_0 F_{v(dry)} \quad (6)$$

where F_H=friction force at tire/road interface

$F_{v(dry)}$=effective vertical force in the dry zone of contact area; μ_0=braking force coefficient between tire and road in dry contact conditions

However $F_{v(dry)} = P.A_{dry}$ (7)

Therefore $F_H = \mu_0 P.A_{dry}$ (8)

and re-arranging equation 5 gives

$$A_{dry} = A_c(1-A_{wet}/A_c) \quad (9)$$

Therefore substituting equation 9 and 4 into equation 8 gives

$$F_H = \mu_0 F_v(1-A_{wet}/A_c) \quad (10)$$

Dividing across by F_v gives the retardation coefficient i.e.

$$\mu = F_H/F_v \quad (11)$$

finally after substitution and re-arranging the final equation which represents the proposed model is obtained

$$\mu = \mu_0(1-A_{wet}/A_c) \quad (12)$$

The time of contact t_c is equal to the length of the contact patch divided by the speed V. This means that when the tire is stationary the contact time is infinite. Consequently the ratio of the wet zone of the contact area, A_{wet}, to the total contact area, A_c, is equal to zero. Therefore the full dry value of friction is available when the tire is stationary.

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IMPROVING INDUSTRIAL SYSTEMS PERFORMANCE BY MONITORING QUALITY COSTS

Flavia FECHETE, Anisor NEDELCU

Transylvania University of Brasov, Romania.

Abstract: *In industrial systems, raw material consumption has a major share in total expenditure. Also the quality of raw materials is essential to obtain a final product that meets the demanding requirements of customers. In this regard, analysis, evaluation and monitoring of consumption of raw materials is a vital condition for the existence of society. This paper aims to present a model for monitoring the consumption of raw materials in the industrial system that produces and sells milk products. The model developed allows highlighting of raw material consumption and the existing losses through every technological stages, helping to improve enforcement measures.*

Keywords: *cost, raw materials, monitoring, specific consumption, losses.*

INTRODUCTION

The correct determination of the performance of an industry is needed to decipher the relationship between industry structure and efficiency of its specific activities and the determinants of the growth or of the shrinkage of them [1]. The cost and earnings are primary performances of businesses and industries from which derive other indicators able to reflect the ability of firms to ensure benefits and high quality products for customers [2]. In this situation a major role is owed by quality costs through whose strict monitoring, organizations can increase profits and also can adjust their costs.

Quality costs expresses all costs incurred in the design, development, production, delivery and after delivery, to prevent, assess and maintain the quality, as well as expenses due to non-quality [3]. Quality costs are the costs involved in ensuring adequate quality and needed to give confidence, as well as losses due to failure of adequate quality [4].

Quality cost approach involves systematic actions [5]:

• Measurement / evaluation of quality costs (collection, processing and registration)

• Analysis of quality costs

• Establish lines of business improvement

Costs related to quality is an important tool for process optimization and quality of relevant activities. Through these costs the company is able to identify inefficient activities, critical points in the development process. Thus the corrective actions or improvements necessary in a particular sector of the company, can be more robust, ensuring the assessment and tracking the effectiveness of measures taken. On the other hand, knowing the financial impact of failures found in different sectors, they can be more easily analyzed, correlated with the leaders, setting the priority measures to be applied.

An effective quality management based on cost of quality includes:

- Establishing a system for measuring the quality costs;
- Developing long-term trend analysis ;
- Establishing annual targets for improving total cost of quality ;
- Monitoring the progress of each goal and initiate corrective action when goals are not achieved.

The most common classification of costs related to quality distinguishes the following four categories:

- ***Prevention costs*** are costs incurred in order to keep costs and assessment failures to a minimum. They are generated by activities taken to prevent or reduce defects.
- **Assessment costs** are costs involved

in determining compliance with quality requirements. These are generated by activities for assessing product conformity to the requirements established by identifying defects.

- **Internal defects** costs are costs incurred by the organization as a result of defects identified before delivery to the customer. They are costs that disappear if there is any defect in the goods before delivery.
- **External costs** are costs incurred defect in the organization as a result of defects found after product delivery to the customer. They are costs that would disappear if there was no defect.

2. MONITORING RAW MATERIAL COSTS

The costs of quality can occur in all phases of the product life cycle, and in all operational levels of the organization. Any organization take measures to avoid failures that can occur in products; These measures can be pre-or post-factum.

Ante-factum approaches involve the adoption of measures to prevent the occurrence of defects and their detection in a time efficient manner. The loss decreases for all products and operational phases of the organization. Evidence of the quality and cost analysis involves the use of indicators, tools and specific documents. For example, the balance cost with quality, which presents the summary of these costs by category (cost of prevention, evaluation, these costs of internal and external failures) in absolute terms and as a share of production value.

The presentation below is intended to illustrate some aspects of quality management effects on raw material costs.

Orientation towards these costs are justified given the large share of raw materials in product costs. The case study is conducted on a company that produces and sells milk products in order to apply a model to monitor the consumption of raw materials on technological phases.

Table 1 shows the calculation of cost for the product "Yogurt" in the amount of 375 g, during the year, which shows that the largest share in the costs have costs of raw materials and materials, that is over 60%.

Table 1. Cost calculation for product "Yogurt"

	Items of expenditure	Unit cost (Lei)	Share of cost (%)
1.	Raw materials	12 328	60,5
2.	Cost of goods sold	1 223	6
3.	Salaries	1 817	8,9
4.	Taxes	142	0,7
5.	Amortization	896	4,4
6.	Energy and water consumption	810	3,9
7.	Supplies (packing aids)	2 354	11,6
8.	Interest	529	2,6
9.	Other expenses	280	1,4
	TOTAL UNIT COST	20 379	100

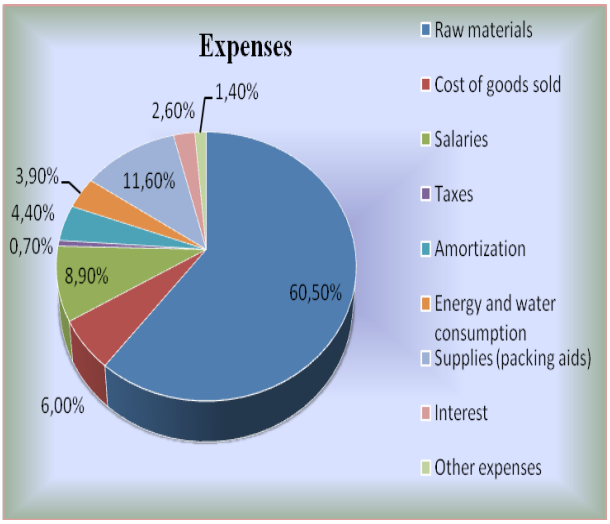


Fig.1 The cost structure for the product "Yogurt"

Changing raw materials with other materials, cheaper, it is a solution to reduce costs, but it could have serious consequences for the quality of the finished product. Most appropriate would be to find ways to reduce these costs by a greater concern for minimizing losses on the entire flow, from receipt of raw materials to product completion.

The main aspects of monitoring the effects on costs of raw material and materials are:

- Monitoring of the procurement process;
- Inventory control of materials;
- Determination of costs and deviations from norms.

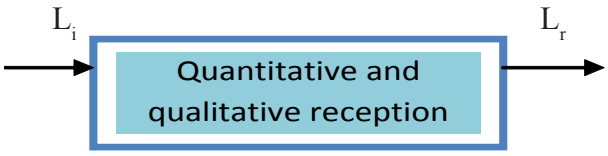
The last aspect will be further developed on an example of loss of material appearing on processing flow.

2.1. Determination of raw materials consumption To determine the consumption of raw materials and losses, we will use each technology stage of processing the product yogurt with a fat content of 2.8%, highlighting some of the management costs of the company.

Thus, before normalization, calculating the amount of milk for manufacturing stages, knowing the amount of whole milk as 4500 kg (corresponding production of a day) and losses in these steps:

- Reception, filtering, cooling, storage: p = 0.05%;
- Normalization: p = 0.20%;
- Pasteurisation: p = 1%;
- Sowing, thermostating: p = 0.1%;
- Mixing: p = 0.5%;
- Packing: p = 0.3%

a.



where: L_i = amount of milk before reception;
L_r = amount of milk after reception;
P_r = losses at reception;

$$L_r = L_i - Pr = 4\,500 - 2{,}25 = 4497{,}75 \text{ kg} \quad (1)$$

$$P_r = 0{,}05\ \% \times L_i = 0{,}05\ \% \times 4\,500 = 2{,}25 \text{kg} \quad (2)$$

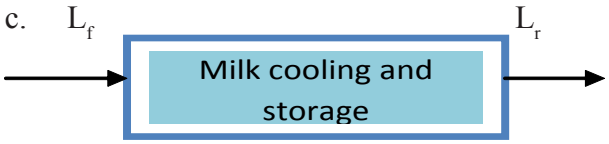
b

where : L_f = amount of filtered milg
L_r = the amount of milk received
P_f = losses at filtering process

$$L_f = L_r - P_f \quad (3)$$

$$L_f = L_r \times \left(1 - \frac{P_f}{100}\right) = 4497,\ 75 \times \left(1 - \frac{0{,}05}{100}\right) = 40495{,}5 \text{kg/day} \quad (4)$$

c.



where: L_f = the quantity of filtered milk;
L_r = the amount of cold milk;
P_r = losses found in milk cooling

$$L_r = L_f - P_r \quad (5)$$

$$L_r = L_f \times \left(1 - \frac{P_r}{100}\right) = 4495{,}5 \times \left(1 - \frac{0{,}05}{100}\right) = 4493{,}25 \text{ kg/day} \quad (6)$$

d.

The fat content of whole milk received is 3.5% and the yogurt will have a fat content of 2.8%, being a fat yogurt category. In order to reduce the amount of fat it would be added skimmed milk.

where : L_n = quantity of milk normalized;
L_f = the quantity of filtered milk;
L_s = the amount of skimmed milk;
P_n = losses of normalization step;

$$L_n = L_f + L_s - P_n \quad (7)$$

C_n = quantity of milk normalized;
G_l = fat content of the normalized milk;
G_{ln} = the fat content of the standardized milk;

$$L_s = \frac{C_n \times (G_l - G_{ln})}{G_{ln}} = \frac{4493{,}25 \times (3{,}5 - 2{,}8)}{2{,}8} = 1123{,}3 \text{ kg/day} \quad (8)$$

$$L_n = 4493{,}25 + 1123{,}3 - P_n \quad (9)$$

$$P_n = 0{,}20\ \% \times (Lf + Ls) = 0{,}20\ \% \times (4493{,}25 + 1123{,}3) = 11{,}23 \text{kg/day} \quad (10)$$

$$L_n = 4493{,}25 + 1123{,}3 - 11{,}23 = 5605{,}32 \text{ kg/day} \quad (11)$$

e. L_n → Homogenization → L_o

where : L_n = quantity of milk normalized
L_o = the amount of homogenized milk
P_o = loss of homogenization step;

$L_o = L_n - P_o$ (12)
$P_o = 0{,}05\,\% \times L_n = 0{,}05\,\% \times 5605{,}32 = = 2{,}8$ kg/day (13)
$L_o = 5605{,}32 - 2{,}8 = 5602{,}5$ kg/day (14)

f. L_o → Pasteurization → L_p

where : L_o = the amount of homogenized milk;
L_p = quantity of pasteurized milk;
P_p = loss of pasteurization step;

$L_p = L_o - P_p$ (15)
$P_p = 1\,\% \times L_o = 1\,\% \times 5602{,}52 = 56{,}02$ kg/day (16)
$L_p = 5602{,}52 - 56{,}02 = 5546{,}5$ kg/day (17)

g. L_p → Cooling → L_r

where : L_p = quantity of pasteurized milk;
L_r = the quantity of cooled milk;
Pr = loss at cooling stage;

$L_r = L_p - P_r$ (18)
$P_r = 0{,}05\,\% \times L_p = 0.05\,\% \times 5546{,}5 = 2{,}77$ kg/day (19)
$L_r = 5546{,}5 - 2{,}77 = 5543{,}7$ kg/day (20)

h. L_r, CB → Sowing → $L_î$

where : L_r = quantity of cooled milk;
CB = the quantity of cultures that is added to milk to obtain yogurt;
$L_î$ = the amount of milk sown;

$L_î = L_r + CB - P_î$ (21)
$CB = 1{,}5\,\% \times L_r = 1{,}5\,\% \times 5543{,}73 = = 83{,}15$ kg/day (22)
$P_î = 0{,}1\,\% \times (L_r + CB) = 0{,}1\,\% \times (5543{,}73 + 83{,}15) = 5{,}62$ kg/day (23)
$L_î = 5543{,}73 + 83{,}15 - 5{,}62 = 5620{,}5$ kg/day (24)

i. $L_î$ → Packing → L_a

where : $L_î$ = the amount of milk sown;
I_a = quantity of yogurt packed;
P_a = losses identified on packaging;

$I_a = L_î - P_a$ (25)
$P_a = 0{,}3\,\% \times 5620{,}5 = 16{,}9$ kg/day (26)
$L_a = 5621{,}3 - 16{,}9 = 5604{,}4$kg/day (27)

j. I_a → Thermostating → I

where: I_a = quantity of yogurt packed;
I = yogurt;
P_t = losses at thermostating;

$I = I_a - P_t$ (28)
$P_t = 0{,}1\,\% \times 5604{,}4 = 5{,}6$ kg/day (29)
$I = 5604{,}4 - 5{,}6 = 5598{,}8$ kg/day (30)

k. I → Cooling of yogurt → I_r

unde : I = yogurt;
I_r = cooled yogurt;
P_r = loss identified on cooling stage;

$I_r = I - P_r$ (31)
$P_r = 0{,}05\,\% \times 5598{,}8 = 2{,}8$ kg/day (32)
$I_r = 5598{,}8 - 2{,}8 = 5596$ kg/day (33)

l. I_r I_d

unde : I_r = cooled yogurt;
I_d = stored yogurt;

$$I_d = I_r - P_d \quad (34)$$
$$P_d = 0{,}05\ \% \times 5596 = 2{,}8\ \text{kg/day} \quad (35)$$
$$I_d = 5596 - 2{,}8 = 5593\ \text{kg/day} \quad (36)$$

The quantity of yogurt produced annually is:

5593 kg/day x 255 days/year = 1 426 215 kg yogurt/year (37)

Specific consumption [6], liter of milk normalized to 2.8 of fat for 1 kg yogurt is:

$$C_s = \frac{L_n}{d \times I_d} = \frac{5605{,}3}{1{,}029 \times 5593} = 0{,}97\ \text{l/kg milk} \quad (38)$$

where : d = normalized milk density;
L_n = normalized milk;
I_d = stored yogurt;

Loss balance is shown in Table 2 and Figure 2.

Table 2. Material balance

Operation	Entries (kg / day)	Losses (%)	Output (kg / day)
Reception	4 500	0,05	4497,7
Filterng	4497,8	0,05	4495,5
Cooling and storage	4495,5	0,05	4493,2
Normalization	4493,2 1123,3	0,20	5605,3
Homogenization	5605,3	0,05	5602,5
Pasteurization	5602,5	1	5546,5
Cooling	5546,5	0,05	5543,7
Sowing	5543,7 83,1	0,1	5620,5
Automatic Packaging	5620,5	0,3	5604,4
Thermostating	5604,4	0,1	5598,8
Cooling	5598,8	0,05	5596
Storage	5596	0,05	5593

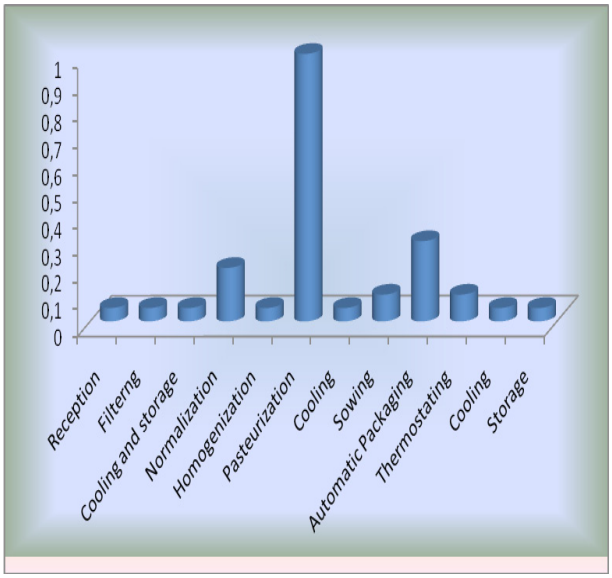


Fig.2 The record of losses in each of the phases of the manufacturing process

The overall losses rises to 113 kg per day, which is about 1,98% of the input. Valuable daily losses are about 244 lei, and the annual output is over 70 000 lei.

Thus, before the start of the manufacturing process shall establish rules on the types of expenses, such as time consumption of materials for the product to be manufactured. Actual cost is determined by adding the losses during the manufacturing process and to modify the rules.

To reduce waste and in the same time the quality costs, investments must be made in the modernization of techniques and technologies that will lead to the reduction of nonconformities, respectively a rigorous control during the manufacturing process. There will be create new categories of costs, depending on the effort that the firm makes investment and add existing ones.

Regarding the cost of raw materials it is necessary to follow all the movements of consumption and quantity of materials involved in the production.

By comparing the data taken from the deposit materials, that can be entered in a form of consumption, with the situation of production achieved, it aims to frame the material consumption within the limits of the standardized consumption, in order to identify the loss or non-conformities, while being able to take the best decisions in this regard.

To watch these losses is necessary to improve the system by drafting documents tracking situations such losses by developing lists to standardize the use of materials and other expenses.

CONCLUSION

Industrial systems performance is focused on the performance of technological processes and also through the quality of raw materials and of the obtained products. Quality of raw materials is critical in any manufacturing activity. Also, due to extremely high share of costs of raw materials in each production activity, it is imperative to implement a system by which to monitor and analyze constantly the consumption of raw materials for production [7].

Thus, this paper has aimed to highlight the importance of creating and implementing a monitoring system for the raw materials consumption. In this sense, in the first part of the work we performed a theoretical exposure in terms of definition and classification of quality costs, as in the second part of the work to achieve an applicative exposure, a study case concerning the determination of the consumption of raw materials and losses related to each stage of the technological process of manufacturing of yogurt.

Because there are no records in the company on the cost of quality, we presented some aspects about the costs of raw materials, revealing the methodology of calculation of raw materials consumption and technological losses coefficients.

Using the mass balance we determined the consumption of raw materials and the losses that were recorded in every stage of the manufacturing process, their reduction can be achieved through a stricter control, as the improvement of the manufacturing technology. It was found that most of the losses occurred during pasteurization stage. In the end of the paper we also presented some improvements measures that may be applied in order to improve industrial system performance.

Acknowledgment:

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THE DETERMINATION AND ANALYSIS OF TIRE CONTACT SURFACE GEOMETRIC PARAMETERS

Cristian MINCA

Timisoara, Romania

Abstract: *In the paper are presented the comparison between theoretical and practical research under different conditions regarding to contact patch between tire and undistortable road in static conditions without applying transversal forces. It is determined and analyzed the variation of geometric parameters of the contact patch (the shape, the dimensions, and the surface of contact patch) depending on the load applied over the tire and the air pressure into the tire. Also, it was determined and analyzed the influence of radial load and the air pressure against the surface of the contact patch. Starting from the probable theory, it was initiated an experimental demonstration with the help of a special stand built in the university's laboratory.*

Keywords: *contact patch, deformation, vertical load, tire air pressure, geometric parameters.*

INTRODUCTION

The contact patch is formed due to interaction between tire and road where inside it normal stresses and longitudinal and lateral tangential stresses are developed. The functional, constructive and dimensional parameters of the tire as well as the nature and the type of the surface of the road or the level of damage of the above mentioned parameters it influences the forces that are transmitted through the contact patch.

The shape and the size of the contact surface between tire and road depend on many factors, among them are tire's characteristics, road's type and the forces applied to the tire. *The influences of different factors against the contact surface are the following:*

-Tire's vertical deformation changes approximately linearly the gross area of the contact surface;

-The running speed changes the shape of the contact patch making the gross area bigger;

-The tread design produces a decrease in the effective surface of the contact area between tire and road.

An increase of the static load of the tire leads to a growth of pressures in the contact patch as well as it increase the surface of the contact patch.

An increase of tire's air pressure leads to a raising of stresses in the contact patch, combined with increasing vertical load.

1. METHODS

The methodology to experimental determine geometric parameters of contact surface.

The stand presented below consist of a frame (5) on which is gantry, in position 4, a bar (2) and on which is fixed the wheel 165 R 13 (1) through the axle (3).

By shifting the weight (G_s) on the bar (2) the wheel is radial loaded with different weights. The support surface of the tire is the platform (6) rigid fixed on the frame (5). The indicator (7) rigid fixed on the axle (3) indicate on the ruler (8) static radius value, corresponding to the applied load.

To determine the tire air pressure it is necessary to utilize a manometer.

The tire is radial loaded by placing the weight G_s on the bar (2) at a certain distance (l_s [m]) to the axes (4) afterwards it has to read the static radius value on the ruler (5).

The normal load of the tire is given of the stand characteristic equation:

$$G_R = G_S \cdot \frac{l_S}{0.315} + 490{,}223 \quad [\text{N}] \qquad (1)$$

Where: G_S- calibrated mass weight of 50 kg

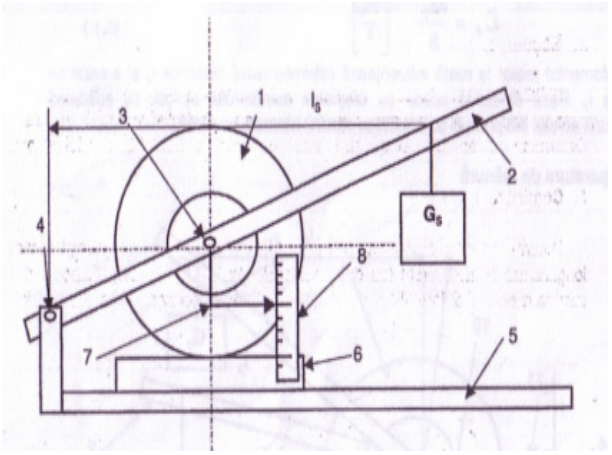

Fig. 1: Functional scheme of the static test stand

For analyzing the contact surface it has to upload the tire with a weight , to establish a tire air pressure, to moisten with ink approximate footprint outline of the contact patch on the tire.

By imprinting on a graph paper (A4 format) it is obtained the geometric shape of the contact patch.

The total area of the contact patch is given by the contour area footprint on the graph paper.

The effective area is determined by counting the stains from the graph print.

The experimental determination of geometric parameters of the contact surface.

For this analyze were established beforehand seven values for the tire air pressure (1,2; 1,4; 1,7; 2; 2,2; 2,6 and 2,9 bar) and also, seven shifts on the bar load with radial weight (1; 1,25; 1,5; 1,75; 2; 2,25; 2,5 m) which offer us seven different load in the limit of 2000-4400 N.

It obtained, totally, 49 contact patches.

The aim of the experiment is to establish the dependence between geometric parameters of the contact patch and the absolute radial deformations of the tire with the vertical load and tire air pressure.

The final results afford us to test certain empiric equations regarding to the shape of the stain which are found in the specific literature. In the pictures 2-5 it is found the evolution of the contact patch's shape and size with the vertical load and tire air pressure.

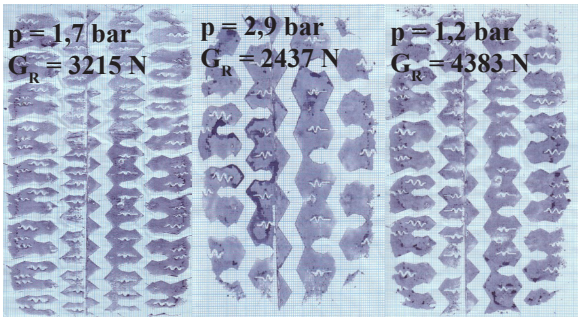

Fig. 2: Tire footprint

The analysis assumed to establish the limit's coordinates of the contact patch with the ink for the patch regarding to Cartesian coordinate system spot at the center of the x-axis along its length and the width of the y-axis.

Analyzing the result of measurements it shows that the footprint is rectangular with rounded corners except the corresponding stains for the vertical light weight and higher air pressure in the tire, these footprints have an elliptic form and that the transition from an elliptical to one rectangular with rounded corners.

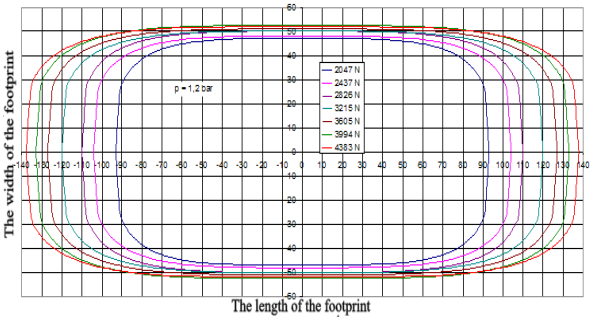

Fig. 3. Variation of the shape and the size of the footprint according to the vertical load and the air pressure p= 1,2 bar

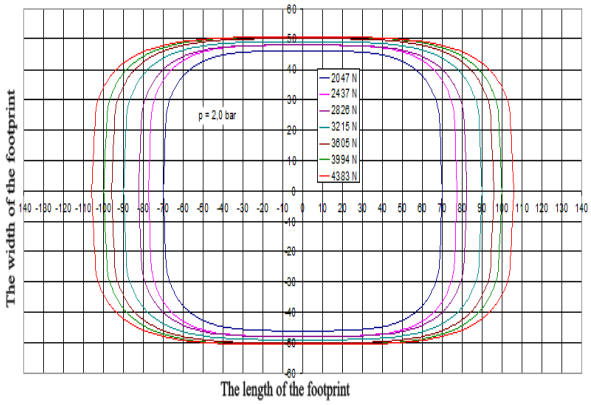

Fig. 4. Variation of the shape and the size of the footprint according to the vertical load and the air pressure p= 2,0 bar

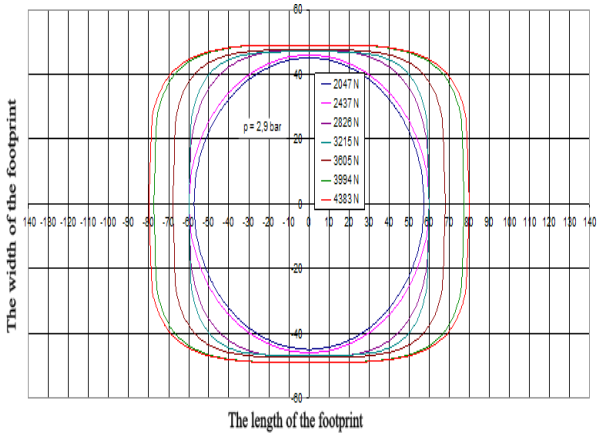

Fig. 5. Variation of the shape and the size of the footprint according to the vertical load and the air pressure p= 2,9 bar

Also, there is little variation of the semi-width of the contact patch with the vertical load and the air pressure of the tire. The extreme limits measured have ranged between 45 and 52 mm at a width of the tread of 100 mm, it results a deviation of –10 % ...+4%, but the extreme measures are outside of the tire features so, in this case it can be accepted that the width of the tire-road contact patch is the same with the tire tread.

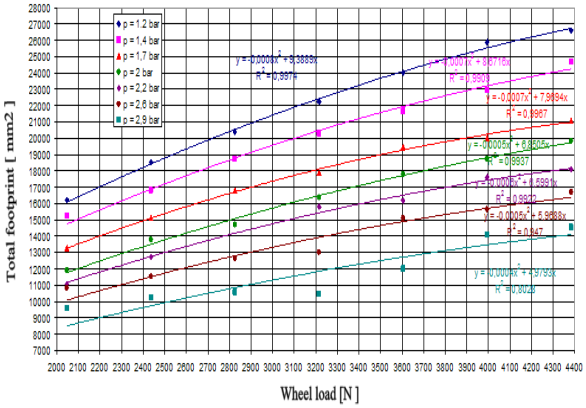

Fig. *6.* The influence of the vertical load and of air pressure from the tire against contact patch area

In the figure 6 is the variation of the total contact patch area, according to vertical load and air pressure from the tire.

It can be seen a parabolic dependence between total contact area and vertical load for all tire air pressures utilized for all rehearsals, the value of the linear correlation coefficient (R2) ranging between 0,803 and 0,997.

Because of afore mentioned accuracy it can be accepted, even generalize, regression function of the parameters involved.

An important result is the equation of effective area and total area: $A_{effective} / A_{total} = 0{,}687...0{,}718$,

with an average of 0,7 which is characteristic for new summer tire.

Regarding to influence of the pressure against contact patch area, picture 6, it observes that there is a parabolic dependence similar for all attempts with vertical load.

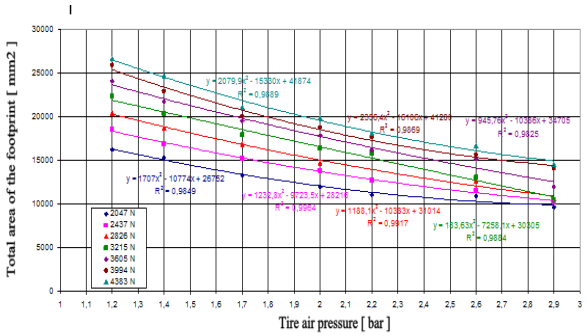

Fig. 7: The variation of the contact patch according with tire air pressure

Knowing the total and effective area of the contact patch it can be determined the influence of the vertical load and tire air pressure against two synthetic parameters, picture 8, utilized in reality, such as:

-apparent average pressure in the stain:

$$p_{ma} = \frac{G_R}{A_{totalã}} \quad (2)$$

-effective average pressure in the stain:

$$p_{me} = \frac{G_R}{A_{efectivã}} \quad (3)$$

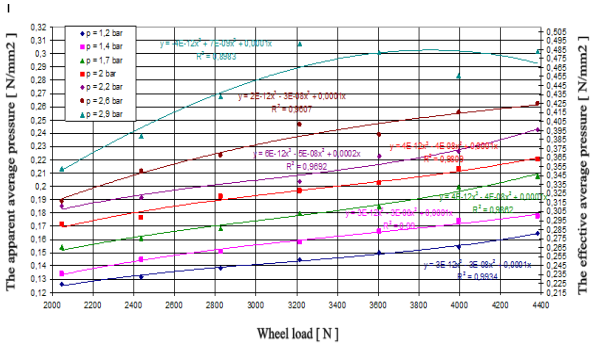

Fig. 8. The variation of apparent and effective average pressure in the stain with vertical load

This analysis is important due to the connection between static radius, vertical load and contact patch length in professional literature [2] under analytical form and equivalent mechanic model Elastic Foundation Approach (EFA) which suggests dependence on below expression (cylindrical sector's cord of tire in contact with the path is equal to the length of the contact patch)

$$\delta_x = \sqrt{r^2 - x^2} - r_s = \sqrt{r^2 - x^2} - \sqrt{r^2 - b^2} \Rightarrow$$
$$p_z(x) = k \cdot \left(\sqrt{r^2 - x^2} - \sqrt{r^2 - b^2}\right)$$
$$p_0 = k \cdot \delta_0 = k \cdot \left(r - \sqrt{r^2 - b^2}\right) \Rightarrow$$
$$p_z(x) = p_0 \cdot \frac{\sqrt{r^2 - x^2} - \sqrt{r^2 - b^2}}{r - \sqrt{r^2 - b^2}} \quad (4)$$

The Elastic Tire Approach (ETA) model suggests the dependency between static radius and vertical load for all tire air pressures:

$$r_s = r_j \cdot \cos\left(\frac{b}{r}\right) + \sqrt{\left(r - r_j\right)^2 - \left(b - r_j \cdot \sin\left(\frac{b}{r}\right)\right)^2} \quad (5)$$

It was observed that for all pressures the correlation coefficients of theoretical radius EFA and ETA overcome 0,9653 even 0,999.

However, concurrently with the increasing vertical load the deviation of theoretical radius is more significant as providing a smaller radius than real radius observation applies to all the pressures and both theoretical models.

If we take into consideration that the theoretical calculation of static radius entering experimental parameters – length of the contact patch- and taking into account that the deviation of the radius is very small compared to the experimental beam is unidirectional, it can be concluded as follows, namely: the tire footprint experimentally obtained on the graph paper is slightly smaller than the real mark, the explanation is the fact that at the extremes of the contact patch the pressure is very low, insufficient to transfer the ink from the tread of the wheel on the paper.

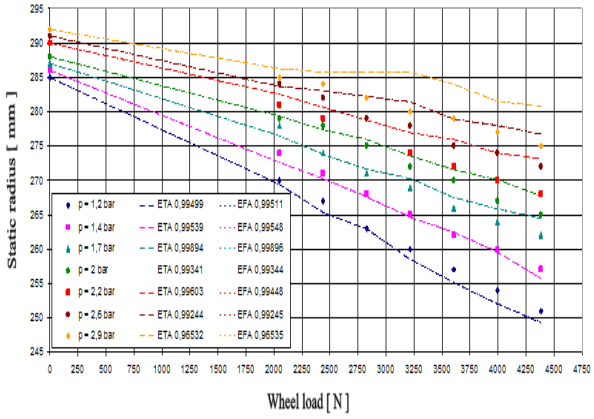

Fig. 9. The dependence of static radius and vertical load

Accepting above mentioned hypothesis and applying a correction to the length of contact patch it was noticed a significant increase in the correlation coefficient it reaching 0,999.

The analysis was numerically carried out and the correction was decreasing with the increase of pressure starting from 10 mm to 5 mm.

However, this observation does not change considerably the analyze mode of interaction tire-road due to normal stresses acting on the extension of the spot are practically zero.

From the analysis of experimental data it can be extracted the influence of vertical load and the tire air pressure on a global radial tire stiffness of the tested tire, the stiffness given by the expression:

$$k_r = \frac{G_R}{\Delta z_{\max}} \quad (6)$$

It is noteworthy that the stiffness coefficient thus calculated can induce significant errors because it envisages only extreme values of the vertical load and the deformation.

The figure 9 presents the influence of vertical load and the tire air pressure an radial stiffness, it is observed that for the same air pressure of the tire, the stiffness coefficient changes a little (slightly decrease with the vertical load), the deviation from an average value is not more than 7% in this context one can neglect the influence on the vertical load on radial elasticity.

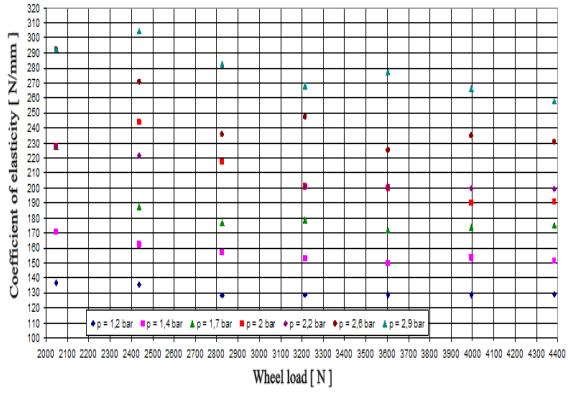

Fig. 10: The dependence of radial stiffness coefficient of vertical load and the air pressure of the tire

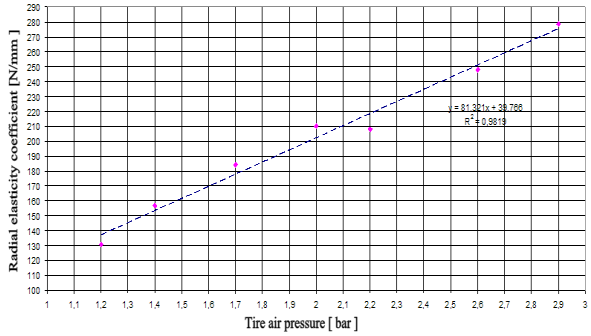

Fig. 11: The variation of elasticity coefficient with air pressure of the tire

The figure 11 presents the variation of the average values obtained for the radial elasticity coefficient with tire air pressure, there is a linear dependence with the tire air pressure given by the expression:

$$K_r = 81{,}32 \cdot p_{aer} + 39{,}76 \qquad R^2 = 0{,}98 \tag{7}$$

Afore mentioned expression of correlation offers us the elasticity share due to tire air pressure from total share, thus for a tire air pressure of 2…..2,2 bar the share of air elasticity ranges from 80-81% of the total.

The values obtained from the analyzed tire correspond to accepted average from professional literature which is 80-85% from the total stiffness expression.

CONCLUSIONS

From the test made to determine the footprint's geometrical parameters it was found that the tire footprint is rectangular with rounded corners without taking into consideration the tire footprints which correspond to small vertical load on the tire and high tire air pressure, the latter presents an elliptic shape and respectively an elliptic shape toward a rectangular shape with rounded corners.

Also, it can be observed a small variation of semi-width of the contact patch with the vertical load respectively tire air pressure, so the extreme limits measured have ranged between 45 and 52 mm at the actual tread width of 100 mm, it results a deviation of -10%.....+4% if we consider that the extreme values were obtained for loads beyond the prescribed limits for such a tire when the significance level is acceptable that the width of the contact patch between tire and road is the same with the tire tread.

The vertical load and tire air pressure influence the contact patch surface noting parabolic dependence of the total area of contact and vertical load for all utilized pressures in the test, the value of the correlation coefficient (R2) ranging between 0,803 and 0,997.

Such a confidence level is acceptable, even generalize the regression function of the parameters involved.

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FLEXIBILITY AND EFFICIENCY ANALYSIS OF A FLEXIBLE MANUFACTURING SYSTEM

Raluca NICOLAE(MANESCU), Anisor NEDELCU

Transilvania University of Brasov, Romania

Abstract: *Flexibility increases the ability of a flexible manufacturing system to auto-organize, coordinate their production activities, all of them leading to its efficiency. In the present paper all of factors analysis will be quantitative but also qualitative type, raporting to flexibility and efficiency. In this sense, the analysis of the efficiency and the flexibility to an flexible manufacturing system will be able to respond quickly with a wide range of external stimulus. Flexibility aimed itself refers to the degree of satisfaction of customers demand.*

Keywords: *flexible manufacturing system, flexibility, efficiency, optimization.*

INTRODUCTION

Current interpretations of the notion of flexible system are: [3]

- system able to perform various tasks with little expense of upgrading-flexibility of use;
- system with the ability to adapt to the demands of the various tasks without specialized adaption elements manufacturing-flexibility;
- system with the possibility of enlargement regarding to the qualitative and quantitative ability;
- system with the ability to be programmed for automatic operation in terms of variation of production load;
- system with the possibility of egalization rhythms of different workstations (system storage capacity).

Flexibility is a new quality of manufacture, which involved radical changes, both in the field of technology of manufacture, as well as in the field of management, leadership and organization of production. [1].

The primary role of flexibility consists in maintaining his success within the organizations and a default flexible fabrication, in an environment where the demands are increasingly larger, feature image belongs to new trends on national and international levels.

In the industrial production system, "flexibility is the ability of the system to bring it into line with the minimum expenses of production variables, so that a longer period of economic system to function with minimal changes in its structure". [4]

The flexibility of the system is determined by the flexibility of each subsystem within the production system, and how to integrate all the subsystems within the system, the relationship between these. [1]

Flexible manufacturing system structure has quality of integrability, possesses the adaptability to a range of tasks, it is technically and economically properly each task separately and is built based on a dynamic concept, all of them leading to efficiency. [1] Regarding [2], tell about a production system that is flexible, if it corresponds to the characteristics described in Fig. 1, below:

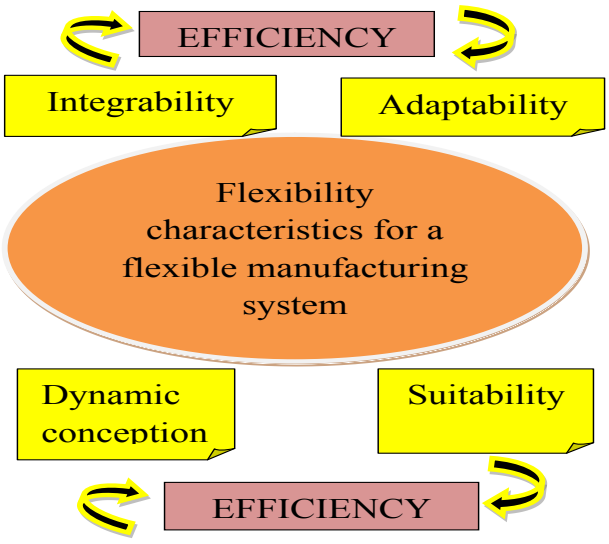

Fig. 1 The report between the features of the flexible manufacturing system and efficiency.

2. METHOD

In the industrial production system," flexibility is the ability of the system to bring it into line with the minimum expenses of production variables, so that a longer period of economic system to function with minimal changes in its structure". [1]

The flexibility of the system is determined by the flexibility of each subsystem within the production system, and how to integrate all the subsystems within the system and the relationship between these. [1]

The relationship between flexibility and efficiency is closely related to depending on several factors: price, quality, professionalism, security, commercial, technical, programming and control cooperation.

Optimum flexibility of a flexible manufacturing system, which could lead to system efficiency, consists in optimizing the number of modules that forms the system.

Acording to [1], the process consists in identifying the number "n", as the number of cases of the use of a module, optimally use cases of a mode that reduces the amount of costs arising from diversity, on the one hand and overcapacities with costs which have to be fitted to reduce product diversity, on the other hand.

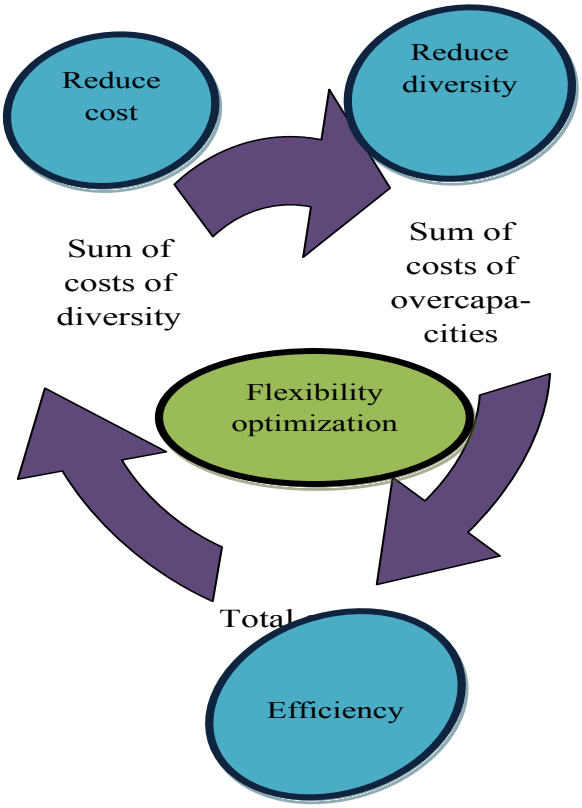

Fig. 2 Graph optimization for a flexible manufacturing system.

Flexibility has to be gained in terms of acceptable economic. [1]

A product is flexible if you meet many needs through a unique product. [1]

A flexible manufacturing system produces some finished products with multiple uses.

In the case of the finished product, flexibility is even greater as it can satisfy many needs. [1]

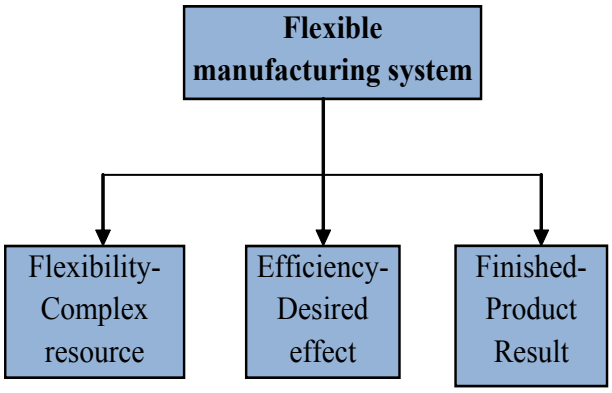

Fig. 3 Comparative analysis

According to [1], determining the best pair medium-technology is the problem of planning flexibility. At the same time they conceive the ideea that manufacturing system should be flexible so as to fit the environment, and technology should be the environment that provides a competitive advantage to the organization.

It is imperative to find a balance between flexibility and efiecienta, a balance in succession, at a higher level.

Sometimes the absence of flexibility is due to big time to adjust the flexible manufacturing system or demand the customer wants delivery periods increasingly shorter.

3. STUDY CASE

Flexibility is in close touch with other concepts such as

- innovation;
- risk;
- strategy;
- change;
- organizational conditions;
- profit;
- adaptation;
- integrability.

The methodology for evaluating the flexibility and for the efficiency for an flexible manufacturing system, it can be described as follows:

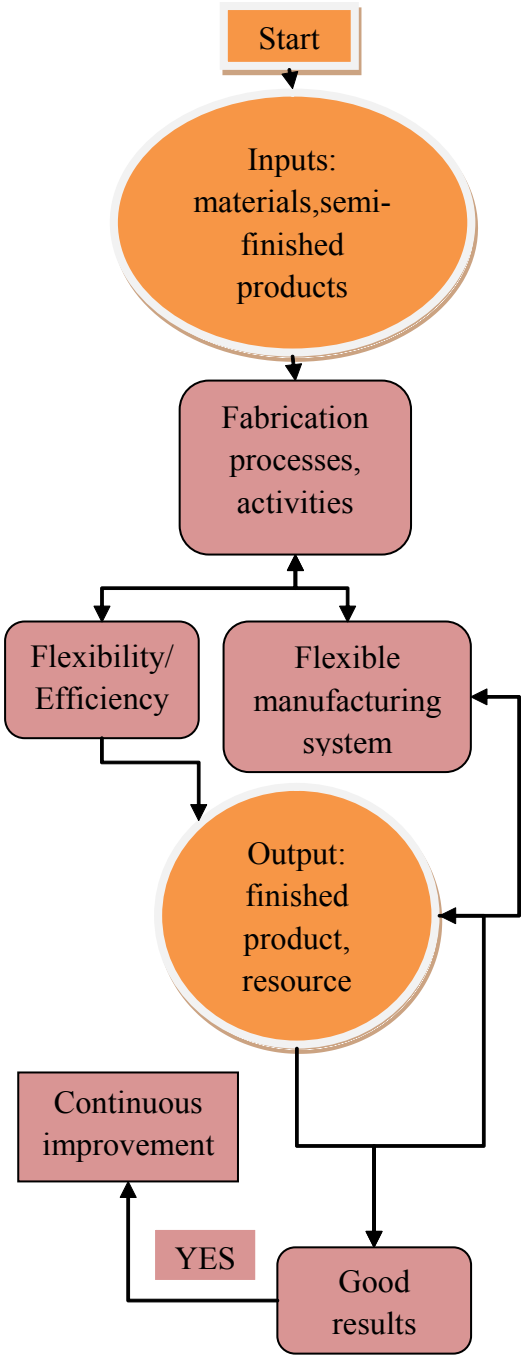

Fig.4 Schema of flexibility/efficiency methodology

Essential in the calculation of the total optimization enter the flexibility as a hierarchical concept plus efficiency resulted:

$$O = F + E \quad (1)$$

Where:
O= optimization;
F= flexibility;
E= effiency.

When the flexibility and efficiency is higher optimization grows.

If you want to measure the flexibility of a product belonging to a flexible manufacturing system, you will need to show you first of all, the possibility of flexible manufacturing system, making a variety of products with the same equipment. This shows the flexibility and efficiency of the product.

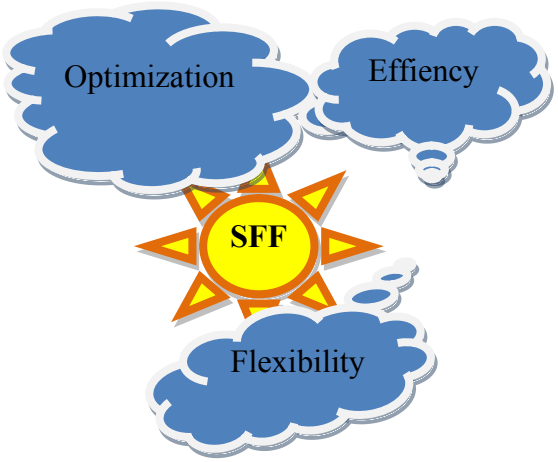

Fig. 5 Flexible manufacturing system resources.

CONCLUSIONS

Flexibility and efficiency analysis of the flexible manufacturing system is designed to ensure the proper functioning of it in optimal conditions during a manufacturing process, is also able to respond to changes in demand.

The current socio-political context and economic multilateral approach has led to the concept of flexibility, which has resulted in efficient products.

Training of personnel and the establishment is a condition indispensable for the optimization of the entire process.

This fact raises a concern for the increase in present paper, the efficiency of flexible manufacturing systems. Thus for flexibility on the system performance analysis, it has been shown that it is necessary for the whole process to be flexible.

It can be assumed that the flexible manufacturing system, will be equipped with a last generation method by which it assesses the flexible fabrication system analytic from a system of measurement.

Evaluation system of flexibility and efficiency of flexible manufacturing system will be based on the management of all the activities.

Now requests and needs are becoming greater. Surviving enterprises must have: a response time shorter and at all levels of activity (design, purchasing, manufacturing, distribution, product, process, etc.), products with increasingly shorter, very good quality, which will become the main condition of maintenance of the products on the market, a "service" for the increasingly personalized customer. [1]

Acknowledgment:

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CASE STUDY: EMPIRIC MANAGEMENT DISREGARDED INDIVIDUALITY IN MATTERS THE WORK/LIFE

Daniela BELU

"Henri Coanda" Air Force Academy, Brasov, Romania

Abstract: : *Our serenity ought to grow from the comprehension of the concept of democracy, by respecting the two fundamental human rights: the right to a favourable environment and the right to assert one's limits. The empiric management is the violation of the privacy of a subordinate individual's life, (by cancelling their spirit, their personality), in instances where their individuality is ignored, when they're defined in improper terms, when their autonomy as a responsible human being that should be consulted/inquired in matters regarding their work/life is disregarded, when they are denied life experiences.*

Keywords: *Empiric management/ Right to enjoy a favourable environment/ Right to assert one's limits/ Competitive attitude towards the subordinates/Contemporary rights of every employee in a corporation*

INTRODOUCE

The victim of the verbal abuse in the military management of the corporation is the competent employee, subordinate/superior/ colleague, whose rights/expectations were violated/ignored in its psychological/legal contract with the institution, whereas he/she had done nothing wrong towards the employer but rather:

- Exercised discipline at the work place and respected the contractual obligations towards the employer/ company internal regulations/state laws or individual morality;
- Contributed to the improvement of the company image towards customers / providers by the professional competence he/ she displayed and the fairness he/she applied in said affairs;
- Achieved professional performance compliant with the assessment criteria for measuring performance that were taken into account in the job specification;
- Displayed a devotion towards the cultures of the military corporation, enforcing them by his/her actions at the work place rather than simply reciting them.

In any given institution, every employee has the following rights:

- the right to benevolence from other employees, leaders/colleagues or subordinates;
- the right to emotional support provided by all the other fellow workers, leaders/ colleagues/subordinates;
- the right to be heard and kindly answered to by interlocutors, leaders/ colleagues/ subordinates;
- the right to have a personal view of the values/priorities in life and at work, different from those around him/her, whether leaders/ colleagues/subordinates;
- the right to have personal emotions/ feelings and personal work/life experience and the right to having them respected / acknowledged as real by the fellow workers, leaders/colleagues/ subordinates;
- the right to receive apologies from the other employees, leaders/colleagues/ subordinates for any jokes he/she might find offensive;
- the right to receive clarifications/ informative answers from the direct superior to the questions that legitimately concern him/her;
- the right to live without unfounded accusation/reproaches;
- the right to not be the victim of personal attacks and professional lynching by fellow workers, be they leaders, colleagues or subordinates;

- the right to have his/her work and personal interests respected in the company by all employees, leaders/ colleagues/subordinates;
- the right to receive encouragement from fellow workers, leaders/colleagues or subordinates;
- the right to not be threatened /intimidated at work by leaders/ colleagues/subordinates;
- the right to not have to be exposed to the rage of leaders/colleagues/subordinates;
- the right to not be privately or publicly offended/humiliated by leaders/ colleagues/ subordinates;
- the right to perform only legal tasks, laid out in a civilized manner by the direct superior, (specified in the job specification, complying with the work regulations, consumption regulations, hierarchic subordinations legalized by the Internal Regulation Policy/ employer's flowchart and the state laws in force).

1. GENERAL TOXICITY OF EMPIRIC MANAGEMENT

What would construe the toxicity generated by empiric management? The refusal to open up to subordinates as human beings with law-given rights and the application of Machiavellian management techniques by the leaders of the corporation, according to the dominating power model; the denial of personal power and performance by excessive control, all with the sole purpose of avoiding the sense of impotence among the members of an incompetent management team. Such leaders are highly determined to control everything, except their own negative feelings, confronting their subordinates with the sole purpose of dominating them, hence feeding their own ego, disguising their true purposes behind the mask of brazen demagogy.

By contrast, a physical aggressor baffles his victim by admitting his own violence, excusing himself and hoping it will never occur again, only to end up doing the same thing all over again. The victim of physical abuse must understand that what happened is as real as it gets and to achieve this, all he/she has to do is look down on his/her wounds.

Much less obvious and much harder to comprehend, yet ever more traumatizing is the abuse practiced by empiric management in corporations. The Machiavellian managers disaffirm their verbal abuses, flawlessly minimizing the physical harm done to the employees by ambiguity and by the conflicts created by the decisions they make and that lead to stress at the work place. The abuse performed by the practitioners of empiric management is always very convincingly occulted by the discourse of such incompetent leaders by minimizing the harm done to the employees and to the entire corporation, aiming to mislead the employees and alter their perceptions. For example, one may often encounter situations where the incompetent leader denies his own words so very convincingly and minimizes the harm done and baffles the victim by placing himself/herself against the offences brought to the employee not long ago, pretending to care about his/her faith, to never abandon him/her in hard times, to not harm his/her interests under any circumstances and to continuously fight for the happiness of his/her subordinates. Machiavellian managers are mere power seekers disguised as charismatic leaders.

Some may be extremely dominating and difficult, while others may, on the contrary, be calm, lonely, quiet, but extremely aggressive, which in fact explains their favourite hobby - hunting. The Machiavellian manager will always describe himself to be the opposite of whatever he expects to be perceived by his subordinate victim, but is characterized by at least one of the following traits:

- petulant;
- projective pathological communication;
- manic-depressive disorder;
- anger outbursts;
- lack of empathy towards the victim;
- excessive control over the subordinates;
- lack of transparency;
- competitive attitude towards the subordinates;
- uncontrolled display of negative emotions – jealousy, envy, hatred, hostility, fear;
- inability to admit/discuss his/her own emotions.

The toxic work environment is wherever practitioners of empiric management exist. This toxicity inflicts effects such as:

- inequality of professional rights / obligations between the professionals employed on similar positions, (equality is dangerous because it may threaten the power seeker's privileges);
- suppression of partnership within the team by exclusive encouragement of competition for access to resources, control with the sole purpose of dominating, in pursuit of the sense of power/security either as a self-standing purpose of the power seeker or as a display of rage;
- the manipulation techniques applied with the purpose of compromising human reciprocity, consensus and "power of the tribe";
- practicing excessive control as a means to display anxiety in face of the unknown in the professional life;
- denying the value of others.

The toxic climate, as an effect of empiric management, leads to the loss of self-confidence among subordinates who, regardless of whether or not they become aware and perceive the changes in their self-image, will rarely comprehend what generated such prejudice.

2. CONCLUSION ABOUT THE CORRECT WAY OF HANDLING VERBAL ABUSE

Let us not fool ourselves thinking that we should remain serene when witnessing empiric management. Serenity is justified only in case of a genuine application of the concept of democracy while respecting the two fundamental human rights:

- the right to enjoy a favourable environment,
- the right to assert one's limits.

The consequences of abuse derived from the empiric management practices applied by the incompetent leaders to the employees are related with the following damages/ prejudices caused to the victims by deformation of their self-perception and spiritual vitality, materialized in:

- deep doubt in one's own spontaneity;
- loss of appetite for work/life;
- powerful feelings of tension/alertness, (tendency to always be "en garde";
- insecurity experienced by the victims related to the impression they make on those around them;
- great sense of worry generated by the belief that there is something wrong with themselves;
- sick tendency to self-analyze and revise the reproaches made by the abuser, hoping to detect what went wrong;
- loss of self-confidence;
- emphasis of a strong sense of self-doubt;
- appearance of a powerful and critical "inner" voice;
- the victims' preoccupation that he/she is not happy although he/she is supposed to;
- sharp sense of wasting time/chances;
- the desire to stop being so "impressionable";
- hesitation in accepting their own perceptions;
- hesitation in drawing their own conclusions;
- imperious desire to escape/run;
- the impression that what they do best may in fact be what they do worst;
- the tendency to live in the future "as soon as…/after…";
- distrust in future relationships.

In the empiric management, abuse affects the spirit and robs the vitality by altering reality. The cause of that is the reaction of the Machiavellian manager that is absolutely uncorrelated with the communication with the victim, who usually ends up thinking that his/her aggressor is honest, direct and very motivated in his/her discourse and that he/she, the victim, is unable to realize where he/she is wrong. Disheartening the victim consists of confusing the victim and has such results as:

- stomach sickness;
- sensing a wall (barrier) rising in the communication with the superior;
- a powerful sense of shame.

The cause of the painful confusion experienced by the victim is the abuse by the one manipulating him/her through:

- refusal to communicate ;

- denial of an upsetting event ever having taken place;
- insinuating that the subordinate victim said something wrong that actually caused the superior's anger/rage.

The subordinate who is ignorant of the Machiavellian leader's hostility may simply assume that he/she just sees things very differently.

The subordinate victim will think:

- that he/she should have expressed himself/herself clearer and then the leader would not be upset with his/her way of thinking;
- that he/she did not grasp reality correctly;
- that he/she has an improper attitude, reason for which he/she is belittled and is hurting;
- that the leader is much like himself/herself and is interested in his/her person;
- that there is something wrong with him/her, experiencing a deep sense of guilt;
- that he/she is inadequate and deserves all charges brought by the aggressor.

What we all want, what we all need, what we take over, what we are afraid of, what we lose or what we give up is CONTROL.

When we cannot take any further step, yet continue to go ahead, when we learn something new by practicing every day, when we give ourselves in to a fit of anger or passion, when we give up diet for chocolate, when we claim that we cannot keep ourselves from doing what we are doing or that we do not enjoy what we are doing and do it anyway, when we force our loved ones to do what we want, we are in fact either taking CONTROL, or giving it up or abusing it, though perhaps unknowingly or under some other name.

Our reaction to CONTROL may be expressed through competence or impotence, materializing into some unfinished business from our past at the moment we leave this world.

We all have control at times and it may include: intimidation, incrimination, negotiation, reprehension, persuasion, flattering and insistence, sometimes known as nagging.

We are all bound to give control over and this is an important lesson in life that may constitute a bitter failure, a proof that we have accepted the cruel reality or a reservation-free acceptance.

The meaning of life, as I look at it, is the confrontation of the fear of a predestined life, the awareness of the power of our own will in the act of loving ourselves and others.

The CONTROL we exercise upon ourselves, upon others and on upon what happens to us is almost always imperfect.

What we must all want is: *to comprehend in a correct and timely manner when there is too much or too little CONTROL, and to choose wisely, in accordance with our free will, the bitter-sweet balance between power and subordination, while enjoying the miracle of life*.

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STRESS IN THE WORKPLACE – SOURCES, EFFECTS AND COPING STRATEGIES

Jaroslav NEKORANEC, Miroslav KMOŠENA

Armed Forces Academy of General M. R. Štefánik Liptovský Mikuláš, Slovakia

Abstract: *The article content is focused on the problems of stress in the workplace. The authors will define the most common sources of work-related stress, their effects on employees' performance, physical and mental health. The authors emphasize the stress factors emerging from the work environment, relationships in the workplace, culture within the organization and work atmosphere, role conflict, career advancement, and balancing work and personal life. In the second part of the article some stress coping strategies, such as gaining social support, taking advantage of the programs targeting on stress coping, reduction of stress in the workplace by improving work environment and work organization, are explained.*

Keywords: *stress, work-related stress, stressors, coping*

INTRODUCTION

Experts in various fields have written and introduced many scientific and professional publications about stress in the workplace and its effects on employees within organizations.

It is therefore appropriate to ask: "Why should we return to this issue?" There are several reasons.

On the one hand, the realization of harmful effects of stress on employees in the workplace has been proclaimed, but on the other hand, the effects and consequences of stress on employees have not been respected.

The current nature of work requires faster work, more work and high-quality work.

This is a simple summary of the present reality in Slovakia. Employers generally require a high performance as to the quality and quantity of work. The employees from the rest of the European Union countries experience the similar problems.

According to the study of the European Fund for the Improvement of Life and Work, over 20% of employees in EU complain about the fact that they are not able to meet a deadline.

The legislation increases a number of hours spent at work. On the contrary, the employers tighten the pace of work.

Employees are consequently caught between a rock and a hard place. On the one hand, they need to leave work in due time; on the other hand, they must meet their employer's requirements. And besides incomplete tasks, the result is *stress*.

23% of employees in EU complain about anxiety states and fatigue.

This number has significantly increased in the last decade. The work schedule shows that, for example, 47% of employees in EU work on Saturday, 24% work on Sunday and 18% at night. To be more specific, 28% of employees complain about stress and 23% about fatigue. [5]

According to European-wide opinion poll 72% of employees believe the most common reason of work-related stress is reorganization of the positions and job insecurity.

66% think that stress is caused by the number of working hours or to the workload. 59% think that stress arises from the exposure to unacceptable behaviour like bullying and harassment. 51% of all employees have stated that work-related stress is a common problem in their workplace.

4 out of 10 employees think that the problem of stress in the workplace has not been solved properly. [10]

The influence of long-term mental load during the work process deteriorates the work performance, mainly perception disorder and attention-deficit disorder occur. Furthermore, motor activity, cognitive and decision-making processes slow down and memory is weakened.

As a result, occupational accidents and wrong decision-making occur. The interpersonal relationships are disrupted by conflicts in the workplace, employee turnover and pathological disruption of relationships in the form of mobbing, the psychological terror in the workplace.

1. SOURCES OF WORK-RELATED STRESS

Theoretical bases of definition of the term stress are perceived differently by several authors. The famous doctor and scientist *Hans Selye* was the first who used the term stress to describe a biological response to physical mechanisms. Selye understood stress as "*the nonspecific response of the body to any demand on it. However, the body has only a limited capacity to respond to stressors. The workplace makes a variety of demands on people, and too much stress over too long a period of time will exhaust their ability to cope with those stressors*."[9]

The effects of the work-related stress are evident in the following areas:

- *physiological disorders* – including blood pressure changes, breathing problems, gastrointestinal disorders, etc.
- *emotional disorders* – such as depressions, anxiety, aggression, low self-esteem, bad intellectual functions, inability to concentrate, etc.
- *behavioral disorders* – including lower performance, injuries, higher fluctuation, the use of addictive substances, communication problems, etc.

An individual experience with the workload or with other stressful situations is determined by variety of factors that influence how the employees experience stress. These factors are:

- *employee's perception of the situation*
- *employee's past experience*
- *presence and absence of social support*
- *individual differences in ways of reacting to stress.*

The stressors which most often occur in the *work environment* are *work overload, special responsibility, conflicts and insecurity, professional career, organizational changes, role conflict* and *interpersonal changes within the organization.*

The work overload appears when demands of organization exceed the capacity of an individual.

A lot of stressful professions can be described as the activities causing overload. Many overloaded people, with lack of relaxation, may find their work activities stressful.

At the same time, less motivation and fewer tasks during the work process can create stress.

If an employer requires the presence of an employee at work without giving him any tasks, the employee can feel bored or under pressure.

We can say that both heavy or weak workload allow each individual to experience stress.

1.1 Working conditions

A lot of research studies have proved that the *work performance decreases*, if the appropriate *working conditions* are not created.

Bad lighting, noise, wrong temperature, lack of oxygen and *insufficient or no air-conditioning* create *negative environmental stressors*.

The effects of these stressors can be cumulated over time and subsequently increase stress and thus decrease performance.

Shortened working hours and *better organized shifts*, allowing relaxation for employees after work, may significantly increase the performance and quality of the work.

However, the requirements for better work environment are rarely accepted by an employer and are evaluated as second-class requirements.

The next effects causing stress are *time pressure* and *tasks with deadline*.

In comparison with the previous generations speeding up changes and development of civilization lead to the different way of life.

Thanks to modern technologies it is possible to process more information, but, at the same time, we have to receive more information and hand it over after its processing.

The tasks with deadline, which are part of well-functioning organization, cause negative pressure and tension. The awareness of extreme urgency can influence our performance in a negative way. A fast pace of work can become a stressing factor if it has a nature of escape from danger, i.e. if it were forcibly imposed. The time rush is accepted unwillingly, because it does not match with the optimal work rhythm of employees.

Especially *responsible and dutiful employees who consider essential to perform at their best*, may experience it unpleasantly. Particularly careful and consistent workers do not allow that their work was of worse quality due to the time pressure.

The time-related stress has a negative impact especially on *demanding mental work*, *particularly during creative activity*. *The time-related stress worsens our perception and concentration and thus the performance decreases, because we are not able to finish our work in time and without stress*.

The time-related stress influences also our *emotions, causes restlessness, tension and conflicts, and creates unpleasant environment, which hinders problems solving, induces chaos and disorganizes our work*. Inappropriately timed work disrupts working stereotypes and causes anxiety and insecurity, and makes impossible to finish of the tasks according to the employee's plan. It also makes impossible to carry out a continuous control.

The amount of work for an employee and its difficulties may also be stressful. In this context the work psychology defines the terms of heavy workload and weak workload which have their quantitative and qualitative characteristics.

The quantitative heavy workload means to have a lot of work while quantitative weak workload means to have too little work to do. The qualitative heavy workload appears if the work is extremely difficult, and, on the other hand, the qualitative weak workload occurs if the work is too simple. [9]

Last but not least, *a special responsibility* is the next stress-causing factor. It occurs especially in the high-risk professions, such as all types of transportation, health care, top management positions, etc. A high responsibility is one of the criteria requiring reliability of various systems in such professions in which the accidents, injuries, hazards for individuals or for large groups of people may occur. Therefore, the most responsible and high-risk professions are those of policemen, rescuers, firemen, etc. Certain professions require the applicants to take psychological tests before they start their job in order to eliminate the individuals who are not appropriate for the profession in terms of psychology (e.g. pilots, flying dispatchers, engine-drivers, train dispatchers, police workers, professional drivers, etc.).

1.2 The other most common sources of stress in the workplace

Each type of work has its own potential stress factors. According to experts dealing with the stress problems, seven categories of sources of stress generally valid for all professions have been identified. These seven categories are:

1. Inner factors connected with profession.
2. Role within the organization.
3. Personality and stress coping.
4. Work relationships.
5. Career development.
6. Culture and atmosphere within the organization.
7. Connection between home and work. [1]

In the previous passage we have been dealing with the category of stressors that affect *working conditions*, i.e. internal factors connected with profession. Let us look at some other above-mentioned factors now.

The next one is the *role within the organization*. If an employee is given different and contradictory tasks and orders, he gets into a *role conflict*.

An uncertain role represents the situation in which indefinite and unclear responsibilities occur. Uncertainty influences also *changes* that are expected or being prepared.

Role conflict arises from the mutual incompatibility between work demands and other aspects of work.

The employee responsible for the behaviour and performance of others but without an opportunity to participate in important decision-making processes, can feel uncertainty and have a conflict within himself, which may cause an intense stress, especially if we talk about responsible employee. For example, employees who are expected to perform careful and creative work, and who, at the same time, are confronted with the strict deadlines, often experience the role conflict. It can also occur in the case of contradiction between work demands and personal rules. If an employee considers a company product inferior but he has to sell it, he can experience the role conflict. [4]

In this connection the third category of stressors, which is related to the *employee personality*, plays a significant role. For example, dutiful employees may succumb to the stressful situations, and extroverts may find isolated work more stressful than introverts. Environmental stressors probably influence some people more easily than others. This is caused by the stress perception. Some people perceive work-related stressors very sensitively, interpret them and react to their presence. In scientific literature, the classification of people into three groups according to perception and reactions to work-related stress, relatively often occurs. The first type of the employee personality is the type A with the following characteristic features: increased competitiveness, aggression, hostility, restlessness and chronic urge to do something. This kind of people suppresses fatigue to achieve or maintain a high level of their job performance. The personality of the type B is also characterized by a high-performance, but for this type, the professional success is not the highest life aim. Typical behavioral traits of this type of personality are cooperation, broad range of interests and ability to relax. In contrast with the previous type of employee personality, employees of this type suffer from cardiovascular diseases and burnout syndrome less than the previous type. A lot of research confirm these facts - M. Friedman and B. H. Rosenman in 1974, Lyness, S., A. in 1993, Ganster, D. C. in 1986, Křivohlavý, J. in 1998 and others. [2]

The *professional career development* is considered to be *one of the most serious stressors* relating to planning and career advancement. This includes *job insecurity* or *job security, desire for promotion, getting higher position in organization, moving to less attractive position* and *loss or lack of opportunities for professional career development*. The feeling of job insecurity highly depends on previous experience and personal characteristics of employees. Furthermore, *changes in the organization* have effect on the development of professional career. They affect, for instance, *the content of work activity and the changes in the structure of departments, work teams or whole organization. The employees may acquire new professional links, such as new working environment, relationships, different social environment, new type of work* and *new work tasks*. These problems are often very stressful, especially when changes within the organization happen too fast, in a short period of time, and people have to deal with insecurity for a long time. *Job loss* as a result of reorganization is very stressful and influences particularly employees of a higher working age, who are not able to find a new job easily.

The current unfavourable circumstances on labour market in the Slovak Republic, besides other factors, affect the *interpersonal relationships* in the organizations in a negative way. Fear of dismissal from work often creates a *negative working atmosphere*. Each employee has certain professional relationships with his co-workers and subordinates. The *relationships and interactions* with others sometimes create a *critical organizational environment*, and therefore they are very often potential sources of stress.

Good interpersonal relationships help to achieve personal goals of the individuals and organizational goals of the whole team, while bad interpersonal relationships are the cause of stress in the organization and affect results of work of the individuals, groups, departments, work teams and sometimes the whole organization. Relationships with the co-workers can influence the *reactions of employees* to the rest of problems within the organization.

The interpersonal relationships can become a source of stress and, at the same time, can act like the protection and social support that influence the way employees respond to the other stressors.

The significant category, which largely influences the behaviour of people in organization, is the *atmosphere in the organization arising from its culture*. Both aspects can become a potential source of stress.

Generally speaking, the organizational culture is related to the *values and standards* shared by the management and employees within the organization which influence behaviour of individuals and the whole group.

The atmosphere in the organization refers to the way of perception of the organization functioning by its employees.

The employees may experience stress, if they *do not share the values* that create a nature of the organization they work in. Disagreement of an employee with the organizational culture can lead to the fact that he will start to feel *isolated and unable to communicate* with other employees.

It also probably means that the role of the employee includes activities he finds disgusting, and which are in conflict with his motives, standards and values.

The atmosphere in the organization can be a source of stress, if the employee believes that way the organization works is *dishonest, unclear and unpredictable*.

In these hurried times the *conflict between work and other roles* is another stress factor. Every adult has, besides his work-role, several roles in life. These roles may require conflicting demands from individual, and consequently they are becoming a source of stress.

Furthermore, employees are expected to fulfil some aims and tasks at work, and their needs are satisfied only partially, but not completely.

The remaining goals and needs may be in conflict with the career goals. This problem is characteristic for *relationship of work and family*. In the circumstances of the Slovak Republic this type of problem occurs especially among *women*.

The conflict between *work role and family care* (especially about children) makes it impossible to fulfil their job responsibilities, but, at the same time, they have a sense of guilt that they do not devote themselves to family in the way they have desired. Nowadays, the managers and entrepreneurs working overtime are in the similar situation.

2. COPING WITH STRESS IN THE WORKPLACE

The psychological risks of the work-related stress lead to the significant costs for organizations as well as for the national economy. When employees suffer from the work-related stress and other psychological problems, they generally tend to miss *a lot of working time*. It is common for employees to come to work; even though they are not capable of working wholeheartedly (we call it an unwished presence).

Overall costs arising from the mental health disorders (related or unrelated to work) are estimated to be *240 billion Euros* per year. Direct costs of the direct treatment represent less than a half of this amount; *the loss of productivity, including inability to work due to illness, represent 136 billion Euros*. Due to the high rate of work inability as well as the significant *employee turnover rate* and the inability to cope with the stressful situations in organizations the employers and companies have to pay considerable financial amounts. The costs arising from the employee selection process and training of new people are increasing due to employees leaving from the organization.

The problems of coping with stress in the workplace are actual from the human as well as the economic point of view. Generally speaking, *coping with stress* is defined as ”a *complex of cognitive and behavioral efforts to manage, reduce or tolerate specific external and internal demands that threaten or exceed the resources of the individual*.” [8]

The structure of coping includes *coping processes, coping skills, coping patterns – strategies and styles,* and *coping resources*.

The *coping processes* are person-environment transactions in stressful situations with different time duration, which emerge from perception of danger, proceed at one or more reaction levels at once or one by one, and result in elimination or adaptation to the stressors.

The *coping skills* represent all personal prerequisites in terms of dispositions and traits that influence coping with external and internal stressors at the behavioral, cognitive and experience level. The coping patterns are addictive, trans-situational, relatively consistent patterns of coping at behavioral, cognitive and experience level that person uses when dealing with the internal or external stressors.

The coping resources need to be distinguished from the coping skills. They work like preconditions for efficient coping processes, in a sense of stressors elimination or adaptation to these stressors in the workplace. They are divided into *internal coping resources* and *external coping resources.*

The *internal coping resources* are related to the individual. They include biological variables (e.g. genetic makeup, age, gender, overcome diseases) and personality traits (psychological resistance, stress tolerance, qualification for certain job, healthy lifestyle, etc.). In professional literature the *external coping resources* are those that represent an *external help* in coping with the load situations. They do not remove stress, neither its consequences, but they do reduce their impact on human being. They are also called the *palliative* – supporting coping resources, moderators of stress coping and mediators of stress coping. [2]

How should we then cope with the work-related stress? There are several options. We can summarize them into three spheres: *reduction of the work-related stress, gaining social support* and *programs for coping with stress in the workplace*.

2.1 Reduction of work-related stress

The most direct way to cope with stress in the workplace is to *change a source of problems*, i.e. elimination of the stressor. It is possible to alter the *physical stressors* in the way they will not be harmful or their effect on performance and health will be of less intensity.

This includes the reduction of noise and dust, setting a proper temperature in the workplace, usage of personal protective equipment, etc. Workplace organization contributes, in a significant way, to the elimination of stress.

Application of knowledge of the *engineering psychology* and *ergonomics* leads to those changes of machines' and devices' construction and operation that optimize job performance and decrease fatigue of the employees.

In the process of the work integration it is also important to pay attention to the elimination of "*overcrowding*", when the workplace is overcrowded and violation of the personal freedom and discomfort occur.

The amount of stressors emerging from the *content of the work* can be reduced by redistribution of work or by giving employees their functions back. Periodic analyses of the employment relationships within the work team can show how to redistribute tasks and adjust the content of the job. Work responsibility should be clearly stated and those whose responsibility changes need the proper training. In the interest of the prevention and elimination of stress, it is necessary to announce the redistribution of work and other changes within the organization and explain to employees how these changes will affect their future.

2.2 Gaining social support

Several authors dealing with the stress problems perceive *social support* as a factor that makes negative effects of stress less intense, reduces our helplessness and increases our trust in ability to deal with the work-load situations – it is so-called *stress buffer model*. [11] This narrower conception connects seeking, providing and receiving social support with techniques that help employee or the work team to cope with stress.

A broader conception of the *social support* is associated with the phenomenon of *relationship support in the environment a human being lives in*. [6]

The content of this term is described as theoretical construct that includes psychosocial resources, or possibly some activity that facilitates to overcome certain crisis, or support provided by other people.

E. Koubeková defines social support as a "*set of relations that individual perceives in communication network as subjectively relevant to maintain his own identity and mental balance*". [7]

By means of the social support, stressed employees can acquire the information and advice on how to cope with stress in the workplace or how to prevent it. They may also gain emotional support and encouragement.

The co-workers are often useful in solving objective work problems and in the questions of career building. Providing the social support by the superiors leads to the satisfaction of the employees with the job and a greater loyalty to their employer.

2.3 Stress coping programs

The most of the stress coping programs do not focus on the implementation of changes in the certain work situations. They are rather individual-oriented and learn employees how they should help themselves while doing their work. The companies do prefer them, because they are not expensive and they can be simply included into other support programs for the employees. Often, they are part of the general health programs of the organizations. Most of them include relaxation techniques, increasing self-esteem, meditation and biofeedback.

Physical fitness programs enable to decrease a physiological reaction to the work-related stress, induce the state of relaxation and get rid of the energy created by stressful situation.

Moreover, the methods and techniques of socio-psychological training and consultations in the field of work and organizational psychology are used for the realization of these programs.

CONCLUSIONS

The long-lasting stress causes a chronic mental fatigue. It is an actual problem especially among young people who do not have time to relax. It is typical for the managers who work more than 12 hours a day and often become workaholics (i.e. people absolutely devoted to their work), and whose work rhythm is completely disrupted, without any rest.

Then people, with mentally demanding job, who are not able to draw their attention away from unsolved tasks, lead a similar life. Mental fatigue gradually decreases the number of opportunities to accomplish any mental activities. It also has an effect of emotionally negative tension that decreases work ability, worsens thinking and disrupts the coordination of mental and physical performances. Besides that, chronic fatigue is related to the health condition; it weakens immune system of the body, causes lack of vitamins and worsens mental and physical condition of employees. Fatigue is a general response to stressful situations. It is possible to reduce chronic fatigue by the *improvement of work environment, elimination of the stressors, improvement of work organization and particularly by removing the time-related stress*.

Improvement of the mental and physical condition and reduction of fatigue can be attained by creating *positive relationships in the workplace, motivation of employees to perform in appropriate working conditions, by positive motivation* and *objective appraisal of the work performance.*

By means of the *preventive anti-stress programs* in the organizations the working conditions are improved and work performance and quality of the work increased without deterioration of mental and physical health of the employees.

Psychosocial risks may occur in every workplace whose quality is closely linked with the stress level that employees are experiencing. Solving the problems of work-related stress is demanding, however, it has to be handled logically and systematically like any other problem of the occupational safety and health. Therefore, the managers of organizations should pay attention to awareness of increasing problem of the work-related stress and support using of simple and practical tools for stress management in the workplace. They should realize that the positive influence on managing the psychosocial risks and stress has an impact on the life quality of employees in the organizations, including the economic point of view.

To conclude, let's have a look at the importance of employees' participation. Although employers have the legal responsibility to ensure a proper evaluation and risk management in the workplace, it is important to involve employees into this activity, because the employees and their representatives are those who know workplace-related problems the best. If they provide the managers and employers with their knowledge, they can assist in planning and implementing the solutions.

However, the employees' participation requires more than a feedback from the bottom to the top; the reciprocal dialogue between employers and employees is needed.

This means that both sides:
- communicate together
- listen to each other's worries
- share opinions and information, and
- make decisions together.

Employees' participation is particularly important for successful managing of stress and psychosocial risks in the workplace, because managers, via consultations with the employees, help to create a trustful atmosphere, in which employees do not fear to express their worries. By employees' participation in the preventive precautions the overall morale will be raised and adequacy and efficiency of the taken precautions will be ensured.

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INSTITUTIONAL GOVERNANCE FROM THE PERSPECTIVE OF SUPERIOR EDUCATION IN THE REPUBLIC OF ECUADOR

Elena POPOVICI

Escuela Superior Politecnica de Chimborazo, Riobamba, Ecuador

***Abstract**: Institutional governance proposes a change in the balance between state and civil society, transferring the responsibility of the government, as main investor, to the public institution. In universities, the introduction of Institutional Governance principles should be considered as a partnership between all implied parties:management, academic body, employees, external environment.*
The purpose of the current research is to analyze, from the perspective of institutional governance principles applied by the universities from developed countries, the possibility of efficiently adapting them in public institutions of higher education from the Republic of Ecuador.

***Keywords**: code, higher education, indicators, institutional governance, principles.*

INTRODUCTION

From the perspective of public entities, institutional governance represents the system for managing and leading a public institution, characterized by the dissemination of responsibility for achieving the institution objectives between all its members. The function of institutional governance is to reduce the role of the state, as owner, in the actual management of public institutions. The interference of politics in higher education has to be gradually diminished, the later having the role of organizing and leading transparently, profitably and with integrity the social interests of citizens. At the same time, this will lead to the creation of an appropriate competition environment between public entities and the private sector. The distribution of responsibilities has into consideration the degree to which each member of the public institution is involved in achieving the set objectives.

1. CONTENTS

The OECD Principles of Corporate Governance were originally developed in response to a call by the OECD Council Meeting at Ministerial level on 27-28 April 1998, to develop, in conjunction with national governments, other relevant international organisations and the private sector, a set of corporate governance standards and guidelines[12].

These principles constitute a useful guide for elaborating and implementing a corporate governance Code, for each country, having as aim the improvement of legal and institutional framework for financial markets, guiding investors, companies and other interested parties.

The process of adapting these principles to the actual conditions of the higher education institutions from the Republic of Ecuador has to take into consideration the fact that the success of this process is directly linked to the traditions and culture of each country. [5]

2. METHODS

The study is based on the analysis of institutional governance principles, applied by the universities in developed countries, which consider "the Code as a vital defender of autonomy and a bulwark against external interference and over regulation"[8].

The role of governance is not limited only to the management, but governance [14] should be approached as a complex process of establishing long-term objectives of the higher education institutions (preparing for the competitive labour market, increasing the education level and the quality of work, research development and contributing to the increase of the standard of living by implementing a high level of knowledge) as well as implementing strategies for reaching those objectives.

The convergence between governance principles in use in Europe and the USA can constitute a good model for developing countries, without taking into consideration the necessity of adapting these to the conditions specific to each country. The strategies and policies built within the institution, implemented responsibly by the management, can have a positive effect over the economic performance of the entity and over the efficient use of public resources[15]. The general and specific objectives will be accomplished with reduced costs when responsibility is shared between all participants. The attention will be mainly directed toward coordination (ex-ante) and only secondarily toward control (ex-post).

The principles of European institutional governance: openness, participation, accountability, efficiency and coherence, are applied differently in European Union countries, in accordance to the legal, economic and social factors that influence the activity of the governance structures in each of them. The necessity for revising the governance structures in Europe [10] was generated by the requirements for increasing the quality of higher education. Although public authorities maintain a central role in regulating and controlling higher education, for the past years there has been a gradual change, meaning the fact that universities have developed their own self-governing methods, based on institutional independence. Thus, the French researcher Guillaume Biot-Paquerot proposes a stricter discipline within the decision factors of French universities, by transposing into practice the governance principles of the private sector[3], though, without introducing a specific code or model of institutional governance.

The Australian institutional governance policy underlines the fact that, for obtaining optimal results in policy development, program management and service providing, it is necessary to establish a policy for collaboration between government, non-governmental actors and universities [6]. The Australian institutional governance code, based on the strategic direction of the institution, builds a set of responsibilities and practices, policies and procedures through which its objectives can be attained[7], by the efficient use of resources.

At the same time, it emphasizes on the role of management in reinforcing the idea that institutional governance practices and procedures are very important for the entire institution, increasing thus the responsibility awareness of all parties involved in applying and using it in current activities.

USA Universities practice a governance and administration policy within which, generally speaking, they establish functioning and control rules for the following domains: the mission of the institution, fiscal stability and institutional policy [13].

It promotes meaningful faculty participation in institutional governance through the development of policy statements and reports related to shared governance and application of those principles to particular situations that are brought to its attention.

The staff is authorized to receive, on behalf of the committee, complaints of deviations from these standards and, where appropriate, to undertake formal investigations [2].

In the Japanese governance code, corporate governance does not refer only to the way in which an entity is lead and controlled, but also to a structure for transparent, fair, timely and decisive decision-making by companies, with due attention to the needs and perspectives of shareholders and also customers, employees and local communities [11].

This Code also has another provision which differentiates it from other codes, namely that, from a juridical point of view it is not being legally binding, thus the management has the choice of not complying to one of the governance principles, on the condition that it can provide a truthful explanation to the participants.

In addition, the Japanese governance code underlines the fact that its principles are only a model which has to be adapted by the entities, according to the specific state to which they belong.

The conclusion is, in fact, that the principles, policies and the basic framework of the institutional governance model which can be implemented in higher education institutions of a certain country have to be built in accordance with the traditions and culture of that particular country [12].

3. RESULTS

The principles of institutional governance, proposed by this study, are focused on the efficiency of funds usage in higher education institutions, following the trends of other world universities[1].

The eight principles, presented below, are based on the analysis of the degree of institutional autonomy and on the connection between financial market build in the relationships between government, non-governmental actors and public institutions of higher education of the Republic of Ecuador.

3.1 Legal framework. Ensuring an appropriate legal framework will allow the application of an efficient corporate governance system that will lead to the possibility of elaborating an Institutional Governance Code and disseminating it both in the public institution and in the external environment.

Within this Code the responsibilities of all implied parties will be established: academic body (polytechnic council), management, employees, shareholders, clients, creditor, providers, regulating authorities, mass-media, community and environment. In the same context, there is the possibility of introducing a model-framework for personalizing the politics and procedures, adapted to each institution.

3.2 Transparency of information. Clear politics and procedures will be established, which will have into consideration transparency of information, both within university and for the external environment, regarding: the entity objectives, short, medium and long-term, as well as the degree of achievement, at relevant terms (annually); the structure of the Polytechnic Council/ the functional organic structure; financial annual results, major planned investments and the state of execution of those in process, both physically and financially; the salary system in action and the possible compensation politics of activities with major impact on the university promoting in the external environment; the legal framework for functioning.

The degree of information transparency will consider the degree to which the awareness of this could affect the security of entity date.

For promoting an open policy toward the external environment, it will be made public the fact that there is classified information and that the internal decisions could suffer influences that cannot be entirely shared.

3.3 Responsibility of Administrative Council. Delimitation of rights and obligations of the Polytechnic Council regarding the coordination of the university mission and strategy, regarding the achievement of intended objectives, the mean for achieving those, establishing the level of risk for non-executing these, permanent monitoring and evaluation; naming / dismissing members of executive management, establishing their responsibilities, as well as the degree in which, the decisions taken, though well-thought of, had as an effect the partial, or even total, unfulfilment of objectives; the follow-through of institutional governance of policies and procedures; handling conflicts at management level. An Internal Regulation will be elaboration, which will contain the action plan necessary to the fulfilment of general and specific objective, in which office, department, compartment, etc. of the university. For each objective there will be specific indicators, based on which a scale of specific, measurable, accessible, realistic and time-efficient objectives will be built.

3.4 Ethics. The university implication in accomplishing the set objectives through: implementation of an Ethics Code, with the purpose of protecting its reputation; formulating clear and flexible procedures, for each position, action, employee, avoiding limitative, bureaucratic activities, as well as academic communication, difficult to understand for the common medium; monitoring the entity activity by following the Ethics Code and mentioning in the working contract of all employees the compulsory compliance to it.

3.5 Independence. Respecting employee rights, by introducing some procedures regarding: work discipline (rights and obligations deriving from legal prescriptions, collective and individual working contracts and internal regulations) and personnel integrity; freedom of opinion, especially for those who work in internal control and auditing departments; protection of the employees that signal deviances from legislation, internal regulations or financial frauds.

This context raises the issue of changing the Internal Regulations of universities, in order to harmonize their provisions with those existing in the Labour Code [4].

3.6 Professionalism. Reaching the set objectives will be accomplished with the help of qualified personnel and personnel employment will take into consideration compliance to the study criteria requested by the specific position.

The standard format of Curriculum Vitae will not include information that affects intimacy (age, gender, residence, sexual or religious affiliation, photos of the candidate).

Continuous training will be inscribed as an obligation of the Polytechnic Council toward its own personnel and will be implemented by inviting the employees to participate, at pre-established time intervals mentioned in internal Regulations, to free informing and training sessions, according to the specificity of their work.

This activity can take place within the university, with internal trainers, experts in their fields of activity, with guest professors from other university, specialists from authorized consultancy offices or others.

3.7 Efficiency and efficacy. Economic efficiency will be evaluated through the lens of the ratio between the expenditure for achieving the set objectives and the degree of achievement.

Economic efficiency will be realized by implementing an internal control system for the management, defined by building a working framework, ensuring that this is implemented within the entity and functions effectively.

Social efficiency will be established by analyzing the way in which the entity objectives will lead to the increase of social responsibility of the entity towards the environment in which it functions, with positive results over social life.

Efficacy will be analyzed according to the degree in which the internal control system of the management will be elaborated and permanently monitored, evaluated, adapted and updated by a Committee, named by the Polytechnic Council, with precise activity rules.

All universities must organizes the internal and managerial control, to obtain reasonable assurance that the entity objectives will be achieved by: effectiveness and efficiency of operations; compliance with laws and regulations; safety and optimization of assets and liabilities; safety and integrity of information.

The first category refers to the basic objectives of the entity, including performance targets. The second category relates to compliance with laws and regulations that regulate the activity of the public entity.

The third category relates to the protection of resources against loss, misuse and damage due to wastage, abuse, improper administration, errors, frauds and irregularities.

The fourth category refers to the preparation of reliable financial and operational information.

3.8 Internal auditing and control. Internal control, which comprises internal auditing, will benefit from adequate procedures which would allow the auditors' freedom of opinion over the discovered results, inscribed in the control and auditing reports.

There will be procedures to limit potential abusive decisions, meaning that all reports will contain proof of noncompliance or infringement of the legislation signalled by auditors.

Financial and administrative activity will be inscribe in procedure manuals which will mainly follow, compliance with the legislation, internal regulations and the Institutional Governance Code approved by the university.

The focus will be mainly on ex-ante control, for correcting financial operations before their execution, in order to avoid waste, abuse and fraud.

In this respect, the institution will establish measures for separating the execution tasks from the control ones and for the rotation of employees with sensible tasks at a certain period of time (4-5 years).

4. FUTURE WORK

In the future, the analysis of the implementation of institutional governance principles can be extended in the Republic of Ecuador, by elaborating some evaluation and monitoring indicators for the efficiency degree of these principles.

Within this context, the result of undertaking the established principles can be analysed, having as a purpose institutional autonomy and the engagement of the Academic Council regarding the quality of the public services offered.

Another indicator can track, through the lens of institutional governance indicators, the results of managerial competence and its direct impact over the public budget, the degree in which the investment resources are used.

The result of implementing the ethics code in the university can be also considered an indicator relevant for the implementation of institutional governance, by controlling corruption and fraud involving public resources.

CONCLUSIONS

The elaboration of an Institutional Governance Code, following these specific principles, will lead to an increase in the responsibility degree of the factors participating within Ecuador university; it will greatly ease the communication between all agents and their engagement in achieving the common objectives will lead to the consolidation of a partnership dedicated to students and useful for society.

The Institutional Governance Code, as a public document, will be communicated to all participants.

The manner in which good governance is applied and functions, in universities, can be assessed according to the result it had on reaching the general and specific objectives of a particular institution, on following the public sector legislation and complying with general principles of governance.

A good compliance program includes[9]: promoting an ethical culture, in the spirit of the law; establishing responsibilities through written documents; setting reference time lines regarding the achievement of objectives; written regulations on good governance policies within the institution; aligning governance policies with the general and specific objectives of the institution; reporting, at fixed dates, of the institution results.

The coherence and consistency in applying good governance principles adopted by universities will lead to improving the results intended and to adapting the objectives in conformity to the current changes that take place in developing countries.

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SURGICAL STRATEGY IN THE TRANSCERVICAL APPROACH OF THE PARAPHARYNGEAL TUMORS IN AERONAUTICAL MILITARY PERSONNEL

Cristian Dragos STEFANESCU*, Viorel ZAINEA, Mura HAINAROSIE**, Razvan HAINAROSIE****

*"Gen. Dr. Aviator Victor Anastasiu" National Institute of Aeronautical and Space Medicine,
**„Carol Davila" University of Medicine and Pharmacy, Bucharest

Abstract: *The parapharyngeal space is an anatomic region that may present various forms of tumoral masses, different by histology, extension and location. For ENT aeromedical examinator, deciding the most proper surgical approach in this treatment may be difficult. The authors analyze diagnostic and treatment criteria used for parapharyngeal space tumors and review the surgical techniques used. Transcervical approach is evaluated.*

Keywords: *trancervical, mandibulotomy ,parapharyngealspace, surgical approach.*

INTRODUCTION

The anatomy of the parapharyngeal space is well known. It has the shape of a pyramid, based upward to the base of the skull, with the top oriented to the hyoid bone's great horn. The pyramid is divided into two separate regions. Anteriorly, the *presyloid* region consists of the deeplobeof theparotid gland, internalmaxillaryartery, inferioralveolarnerve, lingual,auriculo-temporal and fat. Posteriorly, the *retrostyloid* region includes the neuro-vascular package of the neck with the internal carotid artery, internal jugular vein, cranial nervesglossopharyngeal, vagus, accessory, hypoglossalandcervicalsympatheticchain. These two regions are separated by the styloid bouquet of Riolan. [1] Parapharyngeal space tumors are masses located near the pharynx, that do not originate in the pharyngeal wall. These tumoral masses are rare, representingless than 1% of all head and neckmalignancies. More than 80% of the parapharyngeal space tumors are benign, 20% are malign.

The origin of tumors is variable and may arise from any element content at this level either glandular, mesenchyme or nerve tissue, vascular or lymphatic tissue.[2]

Usualy, considering the anatomic component of the two regions of the parapharyngeal space, tumoral differential diagnostic may be suggested my tumor location.

The most usual tumors found in the prestylod region are pleomorphic adenoma of the parotid, imflamatory lymphatic nodes, methastatic lymph nodes, lymphoma, ectopic thyroid. In the retrostyloid region we usualy expect to find paragangliomas, schwannomas, solitary fibrous tumors.

MATERIAL AND METHODS

The authors review the most usual techniques used for parapharyngeal space approach, considering tumoral histology, location, dimensions.

Preoperatory imagistic evaluation including CTwith orwithout contrast, MRI, angiographywith contrast and histopathology, corroborated with clinical and functional aspects are decisional factors in choosing the most suitable surgical approach of parapharyngeal space tumors.

Patient follow-up after a month after surgery is conducted.

CLINICAL DIAGNOSIS

Small size parapharyngeal space tumors may not be symptomatic, or can cause headache, paralysis of the cranial nerves. Large tumoral masses in this region can cause head and neck deformity and asymmetry, dysphagia, difficulty breathing, voice alteration, altered aspect of the oropharynx, with pharyngeal wall bulging medially and pushing medially and anteriorly the tonsillar lodge.

INVESTIGATIONS

Endoscopy To evaluate the deformation occured due to a parapharyngeal mass, endoscopic examination is performed by first intention.

Thus, by direct visualization using 0, 30 and 70 degrees rods, transnasally and transorally, or a flexible fiberscope, tumor extension in the nasopharynx is assessed and also the effect on naso- and oropharyngeal respiratory passage, oropharyngeal region deformation and extension in hypopharyngeal region are investigated.

Imaging examination Routine imaging examination include cervical CT and MRI, which obtain complementary data.

These can be completed by angiography. These methods of investigation evaluates tumor size, location accurate, relations with local anatomical elements, the appearance of the tumor tissue, vasculature, benign or malignant elements, local invasion and extension.

Prior to biopsy, these investigations contribute to the differential diagnosis. Imaging data obtained have important role in risk assessment and in determining surgical therapeutic management.

CT scanning determines the location of the tumoral mass, relation with bony anatomic elements and the parotid gland.

When contrast enhanced, computed tomography scanning evaluates the relation with blood vessels.

In some cases, CT scanning offers sufficient information to suggest an accurate diagnosis.

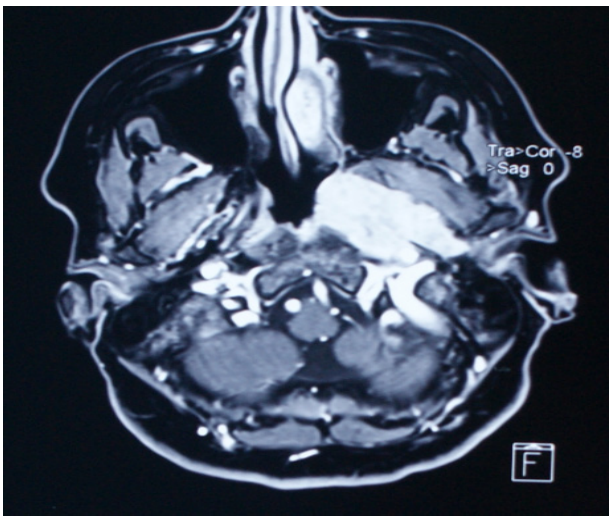

Fig. 1. CT coronal view of a large posterior parapharyngeal mass

Magnetic resonance imaging is useful for evaluating soft tissue and differentiate between tumor tissue and healthy tissue. Relationship to blood vessels is better assessed by this method. Also parapharyngeal extension intracranial tumor can be assessed by MRI.[3]

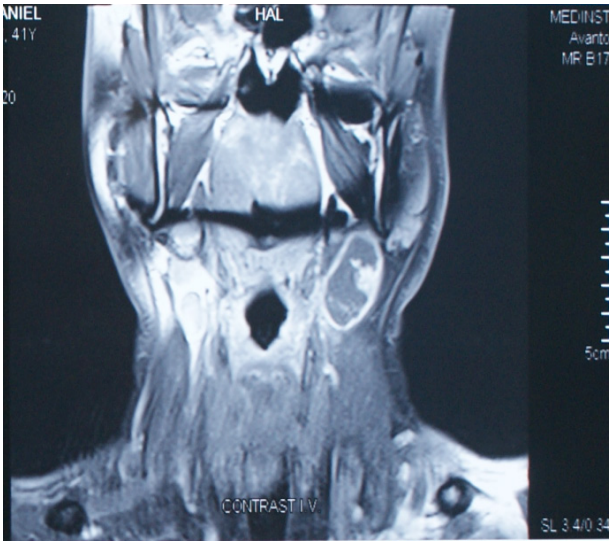

Fig. 2. Contrast enhanced IRM view

Carotid angiography analyzes vascular lesion and tumoral vasculature, determines whether the carotid artery is involved with tumor and evaluates the risc of carotid artery ligation during surgery. Also, angiography is useful in differential diagnosis of neurogenic tumors. [4,5]

Fig. 3. Angiographic evaluation of head and neck vascularity on a parapharyngeal tumor case

Biopsy Biopsy should be performed before surgery in cases when imagistic examination is not suggestive of benign or malign nature of the tumoral mass.

The methods of obtaining tissue samples for histopathological examination include: fine needle aspiration citology (FNAC) blind or radiologically guided, incisional biosy used in non-operative cases and complete surgical excision, having diagnostic and therapeutic purposes [6].

Discussions Surgical management of parapharyhgeal space tumoral masses raises difficulty due to the large variety of vital elements found in this region.

After careful evaluation of tumor characteristics on imagistic exams, biopsy results and evaluation of possible risks, the most suited approach is proposed.

Transoral approach The transoral approach has been described for the removal of small, benign tumors that originate in the prestyloidparapharyngealspace and manifest oropharyngealy. The technique is associated with limited exposure, inability to visualize the great vessels, and an increased risk of facial nerve injury and tumor ruptureEndoscopic transnasal and transoral intraoperatory control widens surgical indication of this approach to larger tumors [7, 8].

The advantages of transoral approach include the absence of cervical scar, of mandibular osteotomies, avoiding facial nerve lesion, the diminished risk of fistulas and wound infection.

This technique is more easily accepted by the patient, offers a wide enough operatory field for the safe and complete excision of a large benign tumor mass.

The transoral approach may be combined with an external approach in order to access lesions with significant involvement of the orophanrynx.

External surgical approach of parapharyngeal space tumors Classically, parapharyngeal space tumors are addressed externally.

Variants include surgical transcervical approach, transparotid approach and mixed transcervical-transparotid approach.

These procedures may be associated with: mandibulotomy, submandibular gland excision and digastric muscle section for optimal enlargement surgical field.

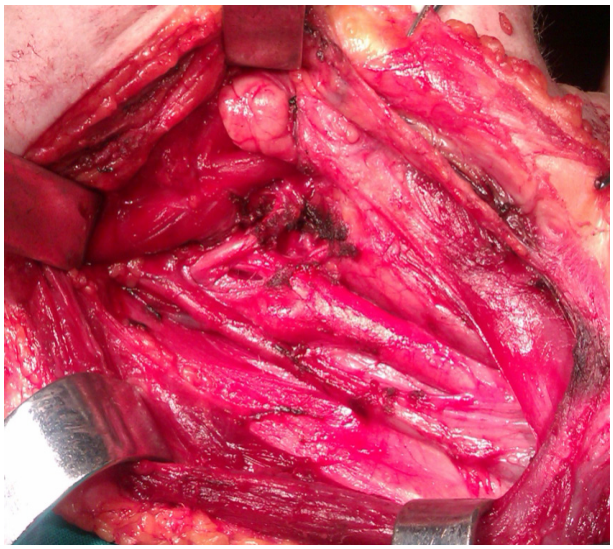

Fig. 4. Cervical lodge dissection to approach the parapharyngeal space. Submandibular glandand digastric muscle are in place.

Transcervical submandibular approach The patient is placed in lateral hyperextension.

The first step of the sungical intervention is to identify and then mobilize or completely remove of the submandibular gland.

In transcervical approach submandibular incision is curved, of about 4-5 cm, about 2 cm below the mandible [9],

extending from the mastoid tip to the greater cornu of the hyoid bone [10],near the anterior border of the sternocleidomastoid muscle [9].

Careful dissection of anatomic superficial plans is performed, with identification and preservation of the mandibular branch of the facial nerve. A facial nerve monitor for safe dissection is recommended. Facial artery and vein are identified, can be retracted laterally or ligated and sectioned. Submandibular gland is discovered, dissected and mobilized anteriorly.

Depending on the need to enlarge the surgical field, in the case of a parapharyngeal space tumor located profound, submandibular gland excision may be necessary [11,12]. Also, mandible is retracted posteriorly [10]. At this point, a large parapharyngeal space tumor becomes easily visible in the operative field, covered by digastric muscle and hypoglossal nerve , and in close proximity to the lingual nerve and the submandibular duct [2].

During dissection, the surgeon palpates and delineates the tumoral mass. Transcervical blunt dissection is performed digitally.

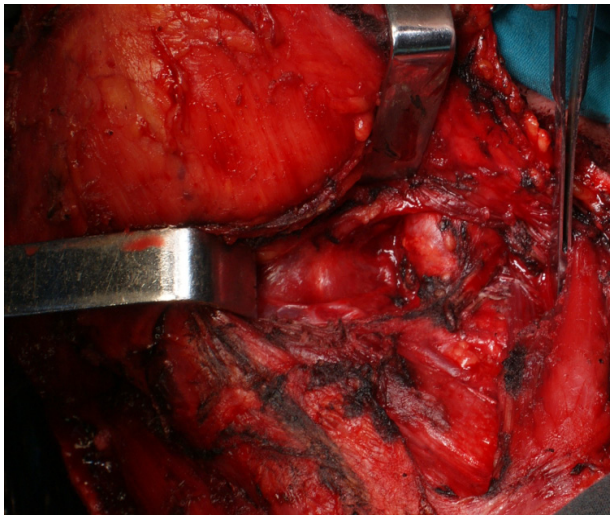

Fig. 5. Tumoral mass discovered under digastric muscle.

The section is not necessary When a wider surgical field is necessary and when tumor resection can not be performed completely, the digastric muscle section is required. The two sectioned ends of the muscle are preserved. Unless a case of a malignant tumor that infiltrates the muscle, at the end of the intervention, after complete ablation of the tumor, the digastric muscle is sutured back.

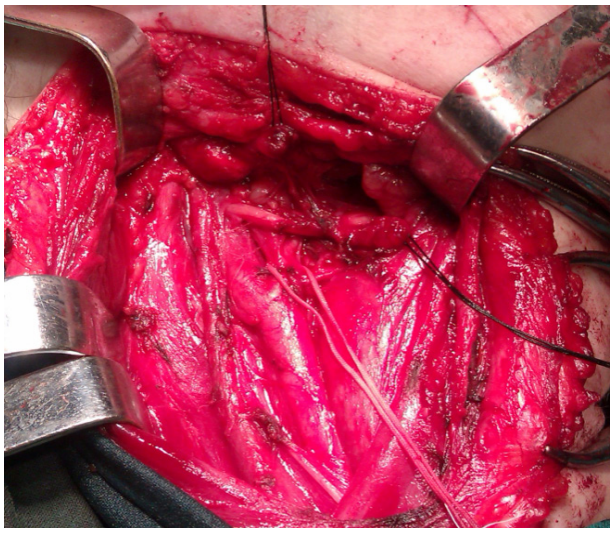

Fig. 5. Digastric muscle section enhances the surgical view

Transcervical transparotid approach Most deep lobe parotid tumors are removed by transparotid approach [13,14]. In this situation, incision is S-shaped or Y-shaped, anterior to the tragus, extended around the earlobe and inferiorly parallel with the mandibular vertical branch.

The edges of the incision are split using small retractors. The superficial lobe of the parotid gland is separated from the sternocleidomastoid muscle insertion and gentle pulled anteriorly and above, while tragus cartilage is pulled back.

At this level the posterior belly of the digastric muscle posterior is discovered. Parotid duct is ligated. Dissection is performed with great care not to damage the facial nerve trunk and branches.

Using dissection microscope and facial nerve monitor is recommended. At this point, parapharyngeal space tumor can be surgically addressed. In cases in which pathological examination reveals a benign tumor the usual surgical technique is superficial parotidectomy with facial nerve preservation.

When a large parapharyngeal tumor is involved, transparotid approach is not sufficient to ensure a good view of all vital elements located in the surgical field and in tumor close proximity.

In these situations , the combined transcervical-transparotid technique is used for gaining optimal access and for minimizing the risk of intraoperative nerve or vascular injury.

Mandibulotomy Especially in cases of malignant invasive tumors or extensive, but also in large benign tumors , for better access [15,16] different techniques of mandibulotomy may be necessary.

Midline mandibulotomy, anterior to the mental nerve,associated with labiotomy and intraoral incision, combined with a transcervical or transcervical-transparotid approach enlarges the exposure. [17, 18,19].

However, subdislocation of the temporal-mandibular articulation, the need of thacheotomy and nasogastric feeding tube, along with cosmetic inconvenient of labiotomy makes this technique is not widely used. The transcervical-transmandibular approach with double osteotomy(midline and the condyle of the mandible [20], associated with application of a rigid mini-plate fixation, for osteosynthesis, provides good control of tumour extension towards the skull base [17].

CONCLUSIONS

There are a wide variety of surgical techniques that can be discussed for optimal management of parapharyngeal space tumors in aeronautical military personnel.

A patient tailored diagnosis and treatment protocol is the best way to preserve the flying aptitude.

Transcervical approach associated with submandibular gland resection may be adequate for complete removal of such tumors, with minimal damage to the anatomic region.

In particular cases the transcervical technique may be modified and extended in various ways, adapted to the needs of complete resection and intraoperative safety.

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THE CONTRIBUTION OF INTERNATIONAL AUDITING STANDARS AND ARRANGEMENTS FOR IMPLEMENTING NATIONAL

Doru TELEMBECI

Abstract: *The objective is to create a model standards managerial control, uniformly and consistently applied in all fields. These standards serve as a reference system for the management of public institutions must implement internal control systems and specialized structures that evaluate these systems. Seen in the light of general principles of good practice internationally accepted and EU internal control policies and procedures are all designed and implemented by management and staff authority to provide reasonable assurance for: objectives of the public entity in an economic, efficient and effective; external compliance, policies and management rules; protect assets and information; prevention and detection of fraud and errors; quality accounting documents and timely production of reliable information on financial and management segment.*

Keywords: internal audit, public entity, internal/managerial control, auditing standards, consulting, risk management.

JEL classification: M42- Audit

INTRODUCTION

Internal audit is an activity that is carried out based on standards. Indifferent of the particular conditions in which the activities of audit, it is necessary to follow certain basic principles contained in the standards for fulfilling the responsibilities of internal auditors.

Standardization body for the internal audit profession globally is Global Institute of Internal Auditors (IIA).Considering these aspects, international standards have been developed for the Professional Practice of Internal Auditing Internal auditors are recommended regardless of the environment in which they operate and on which they need to achieve their standards for conducting internal audit view particularities entities they audit. In this regard, developed IIA General Professional Practices Framework (IPPF). [Adapted from www.theiia.org].

It includes rules authorized IIA, which are organized to facilitate the development, interpretation and application consistency of concepts, methodologies and techniques in the field of internal audit. IIA approved rules include two categories:

- necessary which should ensure compliance with the principles set out therein.

Mandatory rules include: definition of internal audit, Code of Ethics and International Standards for the Professional Practice of Internal Auditing (IIA Standards);

- recommended with confidence, it is recommended to ensure compliance.

These rules describe best practices for the implementation of the definition of internal audit, Code of Ethics and International Standards for the Professional Practice of Internal Auditing. Purpose for which they were designed standards is to contribute to: compliance with the basic principles on which internal audit practice to be followed; establish the benchmark for development and promotion of internal audit activities designed to bring added value to the audited institution; establishment of criteria for assessing the functioning of internal audit and its performance; determining performance improvement activities they carry audited institution.

Professional standards of internal audit include several components connected in a logical whole, which defines auditors imposed on all specialists in the field, as follows: attribute standards - 1000 series - called qualification standards; Standards of achievement - 2000 series - called operating standards;

Standards of practical application - Series AP 1000 and AP 2000 series standards are implemented in specific missions. In actual work, Internal Audit Standards are constantly adapted to improve practice in this area and minimize potential conflicts of interest given that the internal auditor „ *professional competences produce real benefits to the entity, through a systematic evaluation based on auditing standards and best practices, policies, procedures and operations carried out by the entity* "[1, p.17].

The third element is the mandatory IIA Standards, also known as the "Red Book / Red Book". According to the Institute of Internal Auditors, Standards aims are:

- „outlining the basic principles that represent the practice of internal auditing;
- provide a general framework for developing and supporting a wide range of internal audits that generate added value;
- to operate as a benchmark against which to assess the results of internal audit;.
- stimulate improved processes and operations of the organization".

IIA Standards in the preamble states that they are mandatory requirements based on principles, including:

- „statements about the basic requirements for professional practice of internal auditing and for evaluating the effectiveness of implementation of tasks, applying international organizational and individual level;
- interpretations that clarify terms or concepts from statements".

Qualification standards set by the characteristics of the individuals involved in performing audit and internal audit activities and shall consist of four main categories of standards (1000, 1100, 1200, 1300) with several standards subsidiary called practical implementation standards.

Performance standards or achievement defines internal audit activities, define quality criteria to measure them and shall consist of seven main standards (2000, 2100, 2200, 2300, 2400, 2500, 2600) and several subsidiaries standards, known as practical implementation standards.

Standards implementation or subsidiary, practical application is the implementation of the standards of qualification and standards of achievement for specific tasks, such as: creating a system audit, conducting a mission to provide advice etc.

Association Board of Internal Auditors of Romania - AAIR is concerned about how the adoption of Internal Audit Standards. There are ways by which it is estimated that should be adopted internal audit standards as national standards of the US or perform a translation approved by the IIA public institutions based on this „Frame of reference of professional practices" have begun to perform its regulatory framework consists of: code of ethics, professional standards specific manuals etc., to be taken in the internal audit charter of the institution. Standards must be implemented and enforced as they were set to achieve the expected results.

In Romania Romania -AAIR Association of Internal Auditors, which is seeking to join the International Institute of Internal Auditors - IIA US. AAIR

AAIR Committee founding members have established several objectives that were analyzed at the first general meeting, including the adoption of international standards for internal audit and those of good practice in this area recognized as national standards.

Thus, our country according to Law no. 672/2002 amended and republished on public internal audit, general rules were developed for the exercise of public internal audit, approved by Government Decision 1086/2013, which is the legal basis of internal audit, and after their public institutions have developed rules own specific internal audit exercise.

On these rules, we can see that the IIA Qualification Standards are similar in HG. no. 1086/2013 as qualification rules, and Performance Standards are treated as operating rules of internal audit. In Table 1.2 are presented comparatively names IIA Standards and Norms in HG. no. 1086/2013.

From the comparison made clear similarity between the rules applicable to public sector internal auditors and IIA Standards, last serving as a prerequisite for developing these rules.

Table 1 - Comparison of rules applicable to internal auditors in HG. no. 1086/2013 and IIA Standards.

The rules applicable to internal auditors in HG. no. 1086/2013	IIA standards
• Rules Qualifying - Internal Audit Charter and Code of Ethics of Internal Auditor; - Independence and objectivity; - Competence and professional awareness; - The quality assurance and improvement. **Rules of the internal audit function:** - Requirements for the functioning of the internal audit department; - Objectives related to internal audit activities. **Preparing internal audit mission** **Intervention on site** **Internal Audit Report** **Follow recommendations** **Supervise internal audit mission.**	**• Qualification Standards:** - Purpose, authority and responsibilities; - Independence and objectivity; - Competence and professional care; - The quality assurance and improvement. **• Performance Standards** - Management of internal audit; - Type of business; - Planning missions; - Making Mission; - Communication of results; - Monitoring its progress; - Resolution on risk acceptance by senior management.

She shall be treated to special chartered accountant, the independent external auditor or the auditor, which disciplinary, material and even criminal activity. Implementation responsibility standards in practice can be seen to be appreciated when Auditing compliance and hence the quality of audits performed because *,,If in 1974, when the first international standard risk that the internal auditor to conduct an assessment wrong, today the risk is that the internal auditor to conclude that the organization's objectives were achieved, and they really should not be achieved"[*1, p.113]

The internal auditor may be punished in two ways because failed to comply with professional standards: be disciplined professional institution to which it belongs (IIA) may be prohibited or professional practice; be administratively sanctioned by senior management echelon that is for his actions found during the verification of its work through wage penalties, enforcement career on the line, and even termination.

These situations will be analyzed according to the gravity of the failings that you committed the internal auditor.

When the auditor is guilty of breach of professional standards such as violating the principle of confidentiality of information held which is considered a serious mistake, the penalty may even be criminal depending on the damage or the damage to the institution's own interests audited.

Internal auditors and the heads of internal audit structures are not protected against such situations.

If at the first international standards, there is a risk that the internal auditor to make a wrong assessment, risk today is that the internal auditor to provide assurance that the institution's objectives were achieved, when in reality they are facing serious irregularities.

Internal audit standards developed in 2002 recorded a change to be extended only than, that under the main concern of internal auditors not to make mistakes, meaning to properly assess an activity, a program, an institution when there situation has not correctly assessed the seriousness of the facts and objective reasons in reality there are no problems unnoticed liability actually lie with the manager, who was required risk management and internal control objectives.

In Romania, in the AAIR (Association of Internal Auditors of Romania) there are concerns and conflicting views regarding the manner of adoption of Internal Audit Standards, some opinions and declaring the adoption of the US Internal auditing standards as national standards, as others to achieve a translation approved by the IIA US.

CONCLUSION

Standards exist for the delimitation of internal auditor's work, specialization continues its work of analysis and risk assessment, targeting value-added activities and performance evaluation of internal audit.

The above objectives can be met if, in practice internal audit will be implemented international standards and its own standards if we tackle recognized good practice in the field, if we have concerns for continuous improvement of the approach to audit and will be objective and critical of our achievements on line audit.

Exercise of the powers of the internal auditor with impeccable professionalism, professional standards, the application of recognized good practice in the field and IIA are joining a guarantee that the internal auditor should take advantage whenever possible.

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4 www.theiia.org

ENTREPRENEURIAL SKILLS, SWOT ANALYSIS AND DIAGNOSIS IN BUSINESS ACTIVITIES

Luciana Cristiana STAN, **Anisor NEDELCU**

Transylvania University of Brasov, Romania

Abstract: *Examining the factors that determines success or failure of a business, facilitated the creation of specific methodologies for analysis and diagnosis of business activity by determining the role of entrepreneurial skills. Environmental analysis method, competitiveness and the company is the SWOT analysis. SWOT analysis is considered a complex research of economic, technical, sociological, legal and managerial activities that characterize a company that identifies the strengths, weaknesses, opportunities, threats and causes it generates, it makes recommendations to eliminate or minimize negative aspects and/ or recovery of the positive*

Keywords: *SWOT analysis, entrepreneurial skills, business, success*

1. INTRODUCTION

SWOT analysis is a tool by which the necessary information can be analyzed to develop competitive analysis.

SWOT analysis is determined by the role of entrepreneurial skills in business success.

Competitive analysis in small and medium enterprises may consider, for example:

Strengths = local assets, such as university, competitive wages, skilled labor, a strong transportation network, increased social security

Weaknesses = obstacles to growth (problems), for example, poverty, complex regulatory procedures, inadequate infrastructure, limited access to credit [90]

Opportunities = Conditions exogenous (external) favorable, for example, technological changes create new competitive advantages, new Convention international trade, expanding markets

Threats = Conditions exogenous (external) unfavorable (possible problems), for example, closing factories, demographic changes [2], [3]

2. SWOT ANALYSIS FEATURES

Assessment should identify public resources, private and non-governmental organizations, should collect and analyze qualitative and quantitative information and to establish management systems for future use in monitoring and evaluation, to consider economic development opportunities in all important sectors. [2]

SWOT analysis involves a challenge very ambiguous, often strategic, requiring a structure in detail. [1]

2.1 Strengths.

- Basic entrepreneurial resources with exceptional value for entrepreneurship; sites recognized professional studying entrepreneurial elements and transverse degrees higher in world culture
- Establishment of a number of entrepreneurial phenomena that can be authentic examples for university graduates and young businessmen
- Increase in entrepreneurial studies programs complementary studied in universities and other similar institutions

2.2 Weaknesses.

- Poor access to knowledge and application of entrepreneurial skills in general
- Instability entrepreneurial culture public, social and private
- Innovative environmental uncertainty
- Lack of coherent strategies, messaging, communication and entrepreneurship policies in Romania
- Entrepreneurial local market situation, underdeveloped conceptual, unbalanced and immature
- Lack of entrepreneurial success cases

2.3 What allows it to be valued?

- Entrepreneurial skills can be used as a model for the definition of entrepreneurship and building strategies as a basis for the creation of national and international brands
- Supporting entrepreneurial traditions maintain cost effectiveness due to economic

- Development of national values based on sustainability that can be created between entrepreneurial environment-biodiversity-Health- spirituality and performance

- Promoting entrepreneurial skills in the management of companies and businessmen capturing attention through various entrepreneurial strategies

- Coordination results from development of different forms of entrepreneurship

2.4 Concepts derived from the analysis of strengths and weaknesses:

- The performing company can be created to increase the impact and reduce the impact strengths weaknesses?

- The achievement of a database relating to attracting and implementing entrepreneurial skills in the management of companies, can be harnessed for national and international promotion directly from the use of information strategies

- The existence of a weak national capital used that allows the operation of an awareness of the skills and experience of entrepreneurial culture and innovation

- Research on regional innovation, networking and introducing intensive services based on knowledge innovation orientation [4]

2.5 What negative impact has the handicap?

- Entrepreneurial diversity can not be known as a resource to exploit economic value

- Lack of entrepreneurs with vision and openness to innovation and creativity

- Retention of venture capital involvement in projects

- Lack of standards for assessing the impact on entrepreneurial projects in developing entrepreneurial skills

- Inability to design strategies and business plans synergistic performance

- Poor picture of the business environment and investor reluctance

- Danger of resistance to change

3. OPPORTUNITIES, DANGERS IN SWOT ANALYSIS

3.1 Occasions, prospects, opportunities.

- Romanian entrepreneurship success derives from previous entrepreneurial culture

- Campaigns carried out in support of maintaining and preserving the character of entrepreneurship in the European

- Accessibility to financial resources created by the launch and implementation of EU funding

- The existence and involvement of business people with entrepreneurial opening

3.2 Obstacles / Threats / Threats

- Lack of initiative in terms of competence

- Legislative deficiencies related to entrepreneurial development in the territory

- Materialization of entrepreneurial space

- Lack of strategic vision and developing the private sector in public-private partnerships

- Uncertainties related to the development of new entrepreneurs

- Immediate and psychological effects of the crisis [5]

3.3. What opportunities are open?

- The possibility of vision, testing and launching entrepreneurial type strategic objectives

- European support to promote the region and reduce costs in innovative businesses

- The possibility of a positive effect of investment flow to reduce costs capture attention in marketing

3.4 Concepts derived from the analysis of strengths and weaknesses:

- The enterprise interesting can imagine to reduce the impact of handicaps?

- The need for civic campaigns in support of legislation to protect the recovery potential entrepreneurial

- The need to involve civil society negotiate with authorities

- Criticizing the entrepreneurial spirit of improvisation strategies

3.5 What is the risk taken?

- Decrease entrepreneurial potential can lead to the destruction of valuable sites

- Substantiation of business plans

- Perfect timing in an effort to promote investment and entrepreneurship

4. CONTENT ANALYSIS METHODOLOGY AND DIAGNOSTICS BUSINESS ACTIVITY

Career development has a positive significance on issues highlighting a specific dynamic society in various plans by:

- Self-knowledge and interpersonal skills training
- Aces education training profession
- Assuming different roles in life and career
- Integration and planning of various events;

because the goal of achieving a successful career, entrepreneur manages to gain the trust of others and to acquire a set of values thoroughly confirming that a well chosen profession provides trusted, moral satisfaction, social status and self-esteem. [6]

The literature describes numerous theories and concepts on choosing the profession. Most authors seek to explain how individuals choose their studies and professions, why they choose and practice them later.

Although the SME sector in Romania is one of the most affected by the financial crisis, due to lack of liquidity and declining demand, the current period can be seen as an opportunity for small and medium enterprises in identifying and prompt reaction to market changes, finding new ways and flexible in their work.

The following conceptual representation is indicative of the example above:

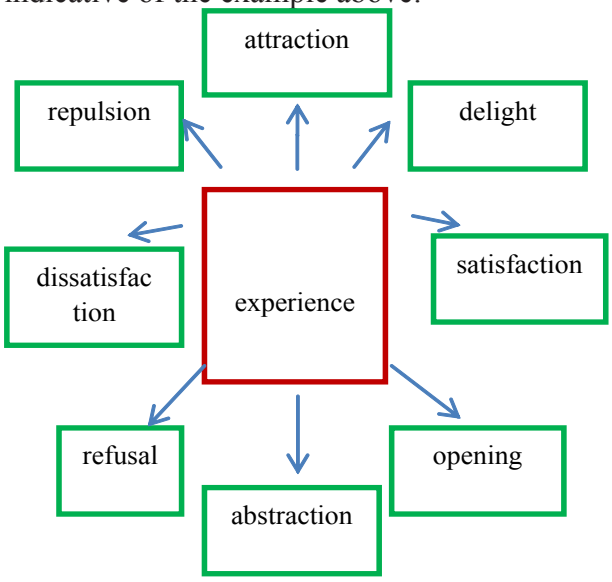

Fig. 1 Conceptual representation of business

Examination of the factors determining the success or failure of a company (business), led to the creation of specific methodologies for analyzing and diagnosing business activity (business)." [7]

Satisfaction Manager should hold based on a more objective evaluation based on measurable indicators of how it performs on the position they occupy within the company.

"Successful managers must understand that their work involves similar income of responsibility." According to [84].

"Distribution subordinates in positions best suited to each of them should be one of the top priorities of managers." [84]

CONCLUSIONS

From the data, we extracted three results that we believe are particularly relevant to the way in which small and medium enterprises in Romania, should organize and develop their business in terms of human resources:

1. The involvement and commitment of employees in the companies they work for have a fairly low level, given that the two main reasons why employees continue to work for the existing firms are no other job offers and money

2. More than half of employees are not evaluated in terms of their performance at work, or are not aware that there is such a system for evaluating employees

3. Only about one-third of employees benefiting from training opportunities and training while the poor results of some of their colleagues are released by most precisely on the lack of necessary skills and abilities.

4. There is a widespread problem in the companies in Romania related to employee motivation and especially their emotional involvement in companies.

More than 1 in 3 employees in the firm defines its role as one of support executing or, lacking such motivation offered by the importance of their work, and on the other hand the percentage of mentioning colleagues or direct the chief qualities as reasons for continue working in the same establishment is very low.

The staff is the labor involved in business development.

5. Lack of motivation and emotional involvement leads to poor performance employees and causes them to leave work if there is a better salary offer.

6. Lack of objective and transparent performance evaluation in companies also affects employee motivation and productivity.

Every employee should be aware that is not rewarded position they occupy in the company, but for how performs in that position, rewarding employees being required to be in correlation with the results.

Acknowledgment:

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THE USE OF COBLATION IN VOLUMETRIC TUMOR REDUCTION OF THE RHINOPHARYNGEAL NEOPLASM FOR AVIATORS

Cristian Dragos STEFANESCU*, Viorel ZAINEA, Mura Hainarosie**, Razvan HAINAROSIE****

*"Gen. Dr. Aviator Victor Anastasiu" National Institute of Aeronautical and Space Medicine,
**„Carol Davila" University of Medicine and Pharmacy, Bucharest

Abstract: *The aim of this paper is to present technic and technological aspects related to coblation surgery on the malignant tumors of the nasopharynx. The methodology of this paper is to investigate pre- and post-operative aspects of the neoplasms of the nasopharynx which underwent volumetric reduction using coblation surgery. The conclusions emphasize the utility of coblation technology associated with endoscopy and Narrow Band Imaging for the surgical approach of malignant tumors of the nasopharynx in aviators. The efficient screening, diagnosis and treatment of nasopharynxneoplasms in the case of aviators will lead also to a reduction of the costs associated with the aggravation of disorders.*

Key words: *nasopharynx , coblation, neoplasm*

INTRODUCTION

The treatment for nasopharyngeal malignant tumors is multimodal: radiotherapy, chemotherapy and surgery. The last one plays an important role in the diagnostic stage allowing the surgeon to approach the tumor, to harvest a biopsy and in the therapeutic stage contributing to improvement of symptoms such as nasal obstruction, otitis media with effusion. The endoscopic approach of the nasopharynx can be done in two ways: trans-nasal with 0° telescopes and tras-oral with angled telescopes (30°, 45°, 70°). In some cases we use combined endoscopic approach, both trans-nasal and trans-oral, for a better evaluation of the whole nasopharynx (especially the key zones like Rosenmuller fossa, torus tubaris).

MATERIAL AND METHODS

The paper presents practical aspects of using coblation surgery on rhinopharyngeal neoplasms and discusses the exposure of the nasopharyngeal tumors through endoscopic approach of the nasopharynx and the use of coblation surgery in the management of rhinopharyngeal neoplasm.

When alarge tumor is approached it is not enough to take a small biopsy, it is important to reduce the volume of the tumor for a better response to radiotherapy and chemotherapy and for easing the obstruction symptoms of the patient[1].

The reduction of the tumor can be realized with coblation. This technique is using plasma based radiofrequency instruments that are able to remove the tissue [2]. The coblation technique works in three different manner: ablation of the tissue (removing an entire volume of tissue/ tumor during surgery), volume reduction of the tissue (decreasing the volume of the tissue/ tumor using thermal energy during surgery) and hemostasis (coagulation of the vessels or cauterizing the tissue in order to stop the bleeding).

The coblation device uses frequencies between 100 and 500 KHz to cut the tissue with minimal necrosis of the surrounding anatomic structures.

The device works in saline environment with (high tension electrical excitation with cutting of the tissue) or without (low tension electrical excitation with heating of the tissue) plasma production.

The saline solution is conducting the electrical power generated between the active electrodes of thecoblation probe and the neutral electrode and the chemical corrosion of plasma produced in the saline environment is cutting the tissue at low temperature with minimal effects on the surrounding structures.

Hemostasis is obtained without plasma production and the coagulation takes place at lower temperatures compared with conventional electrocautery.

The coagulation is achieved through contraction of the elastin fibers of the vessel and reduction of the vessel's diameter and through protein coagulation in the plasma.

Nasopharyngeal coblation surgical approach was made taking into account the surgical risk factors of the anatomic region and the advantages of this technology that is based on a low thermal effect, but strongly melting power. These properties of coblation decrease the surgical risk of vulnerable anatomical structures encountered in the nasopharynx [3].

On the nasopharyngeal upper side wall are high surgical risk landmarks of endoscopic anatomy, such as the internal carotid artery (that corresponds to Rossenmuller fossa), torus tubarisand the pharyngeal orifice of the Eustachian tube.

Coblation and endoscopic techniques allow a good approach of the nasopharyngeal tumor with lower injury risks for the key areas of the nasopharynx.

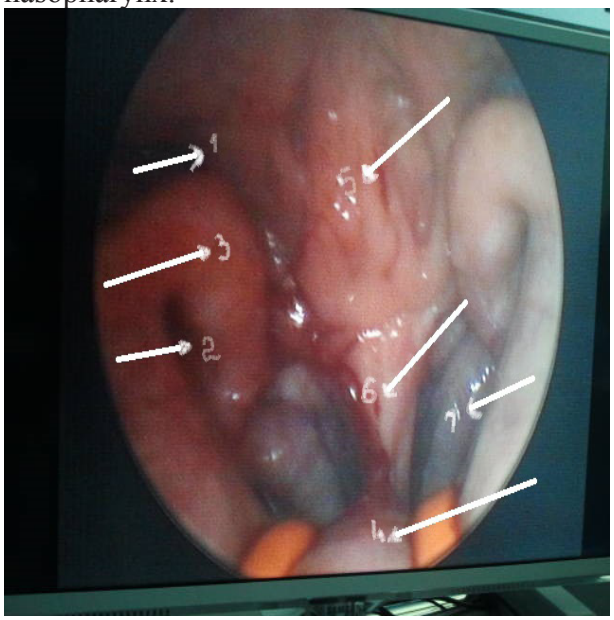


Fig. 1 - Endoscopic transoral nasopharyngeal view with 70° endoscope - 1. Rossenmuller fossa; 2 - pharyngeal orifice of the Eustachian tube; 3 - torus tubaris; 4 – soft palate; 5- Posterior wall of the rhino pharynx; 6 - nasal septum (vomer); 7 - inferior turbinate.

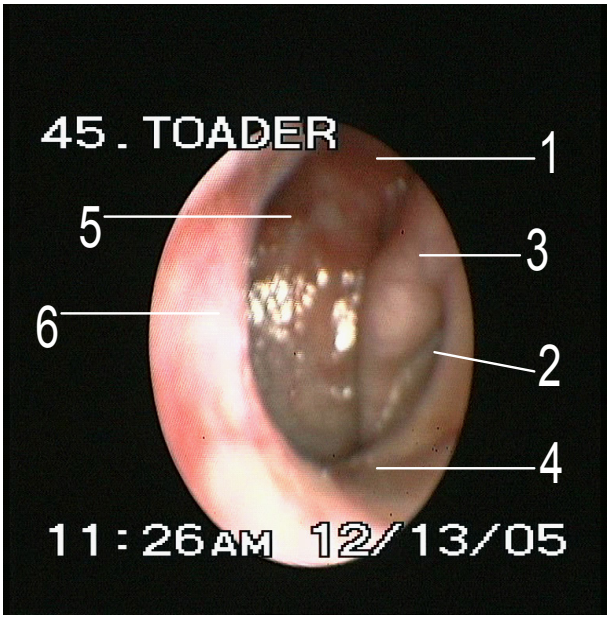
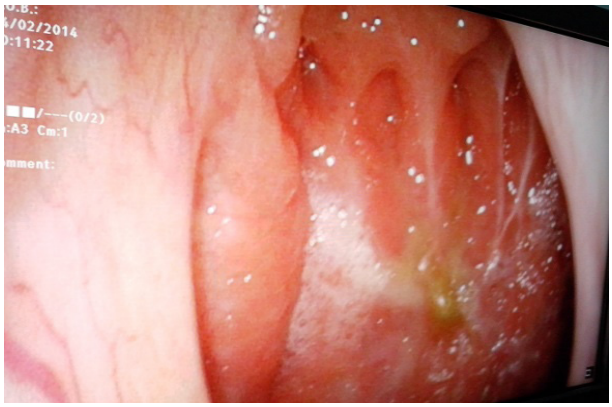


Fig. 2- Endoscopic trans nasal rhino pharyngeal image 0° endoscope: 1. Rossenmuller fossa; 2 - pharyngeal orifice of the Eustachian tube; 3 - torus tubaris; 4 - soft palate; 5- Posterior wall of the rhino pharynx; 6 - nasal septum

The mechanical ensemble used consists of: special retractor with support for the cheeks and tongue; 0°, 30°, 45° and 70° rigid endoscope; special forceps for the trans nasal and trans oral approach [2]. For the transoral approach of the nasopharynx, the soft palate is risen with two Nelaton probes offering a better view of the anatomic and endoscopic landmarks.

Fiberscope with NBI (Narrow Band Imaging) can be usedfor a better assessment of the vascularization of the tumor (tumoral neo-vessels)[4].This is a new endoscopic technique that may improve the accuracy of diagnostic for the premalignant and malignant tumors of the nasopharynx using narrow-bandwidth filters in red-green-blue illumination. NBI allows the analysis of two aspects of the tissue examined: the vascular network and the architecture of the epithelium. In nasopharyngeal carcinoma the vascular network presents vascular proliferation (neo-vessels) and turgid blood vessels [5]. The evaluation of these two patterns offers data for the premalignant or malignant status of the tumor. Using this investigation during surgery, better assessment of the margins of resection can be made.

Obtaining tumor free resection borders is essential for a better outcome of the patient after radiotherapy and/or chemotherapy. There are new radiotherapy protocols, like IMRT (intensity modulated radiation therapy) that were proven to be more effective in treating the tumor and less harmful for the vicinity tissues [6].



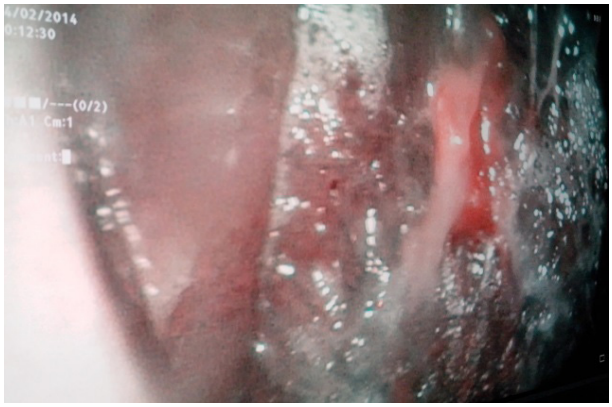


Fig. 3 – Fiberscope view of the nasopharynx
Fig. 4 – NBI view of the nasopharynx

The imagistic investigation is mandatory for surgery. Craniofacial CT or MRI with gadolinium provides the adequate information in terms of tumor localization and dimension, neighbor tissue invasion.The histopathological and/or immunohistochemistry examination of bioptic samples establish the definitive diagnosis and based on these results the patient continues with radiotherapy and chemotherapy as recommended by the oncologist.

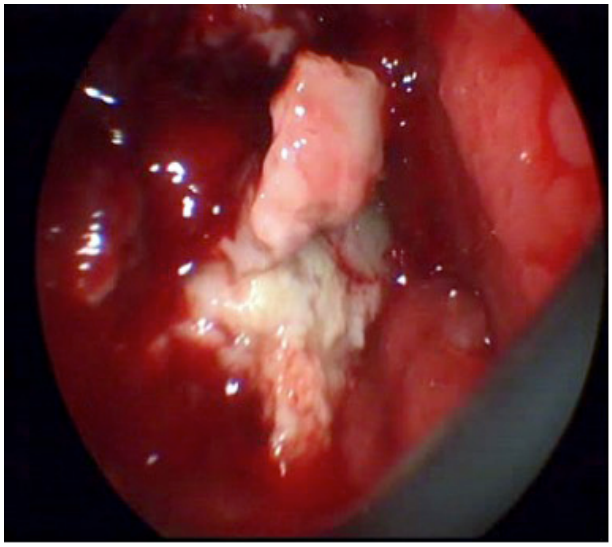


Fig. 5 – Nasopharyngeal tumor – intraoperative aspect

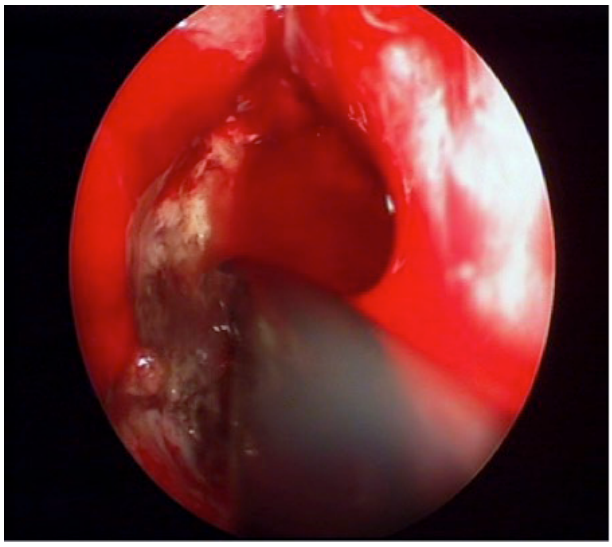


Fig. 6 – The use of coblation for nasopharyngeal tumors

Devices, surgical techniques and technologies used:

We used the specific device driver for nasopharyngeal endoscopic approach, the trans-oral and trans-nasal endoscopic techniques and PROcise®mAx Plasma Wand coblation probe. We also used several accessories and classic and endoscopic instruments.

CONCLUSIONS

The pathology of the nasopharynx became more and more accessible after the development of endoscopic techniques. Once the rhinopharynx became approachable a number of specific tools for proper access to this area were designed. Remarkable progress was made in the surgical technologies that can be used in the nasopharyngeal area. Coblation surgery is a safe and precise method and it can be used in the vicinity of considerably high risk surgical regions because of its decreased thermal effect to the surrounding tissues [3]. The association between coblation, endoscopy and NBI [4] is effective in obtaining tumor free resection borders and improving the response of the patient to radiotherapy and chemotherapy.

Coblation surgery have proved its' efficacy in volumetric tumor reduction of nasopharyngeal neoplasm and it improves the quality life for the patients due to delay of the complications and malfunction in the nasopharyngeal perimeter (impaired nasal breathing, altered permeability of the pharyngeal orifice of Eustachian tube, presence of descendent nasopharyngo-traheal supurrative complications).For the ENT aviationmedical expert, coblation surgery is an excellent method in the approach and management of intricate borderline cases.The efficient screening, diagnosis and treatment of nasopharynx neoplasms in the case of aviators will lead also to a reduction of the costs associated with the aggravation of disorders.

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CHRONOBIOLOGY IN THE LIFE OF MILITARY STUDENTS

Maria- Dorina PAŞCA, Maria-Victorita TĂNĂSELEA, Elena VITELARU

University of Medicine and Pharmacy, Targu Mures, Romania

Abstract: ***Purpose****: In the present workwe aim to expose notions regarding biorhythm and to evaluate certain implications of it in the life of military students that belong to different types of military forces.* ***Introduction****: Based on the idea that biorhythm is the subject of study for chronobiology, a field of biology that has been recently studied, hereof one of the patriarchs of the said field, Prof. Alain Reinberg, from the Chronobiology Unit of the A. Rockefeller Foundation in Paris, states that it represents "the study of temporal organization of living beings and its alterations." **Method****: Thus, the method chosen by us is the statistical study based on applying the questionnaire on a representative control group (250 persons).* ***Results****: It will reflect the influence of intrinsic and extrinsic factors on the daily activities of the body. In conclusion, chronobiology influences the schedule, and the latter, in return, influences collective and individual activities.* ***Conclusions****: Therefore, the importance given to chronobiology grows by the day and can be materialized by setting up schedules, but, unfortunately, it is insufficiently exploited in areas of activity in which it is required.*

Key words: *military students*, *chronobiology, temporal organization*

INTRODUCTION

The ancient Chinese scholars knew schedule bodies, which was the foundation of what we now call chronobiology. We can say, therefore, that the body sends you all the energy in its various forms, to parts of it at a time nictemeral cycle. [1] The existence of living organisms to a genetic biological clock has resulted in the awarding of the Nobel Prize for Medicine ago Erich Wischaus only 19 researchers, Edward Lewis and Christiane Nüsslein - Volhard, the latter being one of the 12 women who won the grand prize . In the present study we aimed to demonstrate the importance of knowing and also in the life of every student applicability cronobiologiei military because it is scientifically proven that those who do not comply and repeatedly disturb inner rhythm gets sick more often and with greater ease, and sometimes very serious disease that can not be cured, due to wear organs.

-tabulation and interpretation of data obtained from the questionnaire to students belonging to 5 units higher military education

-support the existence of a multitude of phenomena taking place in the body permanently succession day - night (nictemeral cycle)

-argument interrelation biorhythm - body

- given that following the success of military trials require extra strength, versatility and performance.

RESULTS

After analyzing the data obtained by the questionnaire containing 10 items, clear differences emerged on the slots and actions under them so proving permanent body conditioning by processes taking place both in the home and in the external. The questionnaire was sent sample of 250 people.

QUESTIONNAIRE

Hi There! I ask you to answer the following questions by writing an "X" in the appropriate box selected response and we would like to identify added:

Age:
Sex:
Year of study:
Specialization / Branch:
University / Academy:

1. Have you ever given your daily biorhythm importance?
   - Yes □
   - No □
   - I do not know □
   - Not interested □

2. How would you describe your general wellbeing at an interval of 30 minutes after awakening?
   - Very tired □
   - tired □
   - rested □
   - energetic □

3. In what time frame you consider that you have the maximum capacity of concentration?
- 08^{00}-10^{00} □
- 10^{00}-12^{00} □
- 12^{00}-14^{00} □
- 14^{00}-16^{00} □

4. Which of the followings we consider to be optimal for performing military firing?
- 13^{00}-14^{00} □
- 14^{00}-15^{00} □
- 15^{00}-16^{00} □
- 16^{00}-17^{00} □

5. Sporting activities you prefer 16^{00}-18^{00} range? (desired response independent of the schedule)
- Yes □
- No □
- I do not know □
- Not interested □

If "Yes", why?
If "No", why?

6. In which of the following intervals during sleep the night you fall on?
- Less than 7 hours□
- 7-8 hours □
- 9:00 □
- More than 9:00 □

7. Are you satisfied with how biological rhythms are observed in arranging daily program schedule?
- Yes □
- No □
- I do not know □
- Not interested □

8. You think the ambient temperature influence your psychomotor ability?
- I see no influence □
- They are more active (a) at low temperatures □
- Are less active (a) at low temperatures □
- The same capacity □
- They are more active (a) at high temperatures □
- Are less active (a) at high temperatures □

9. Within one month you felt (more than 5 days) states of irritability, nervousness / calm optimism?
- Yes □
- No □
- I do not know □
- Not interested □

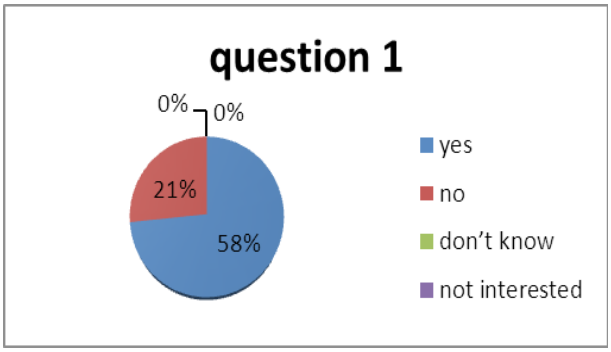
If "Yes", what occasion?

10. Considers that biorhythm had any importance in choosing your future military career?
- Yes □
- No □
- I do not know □
- Not interested □

If "Yes", why and when?
If "No", why?

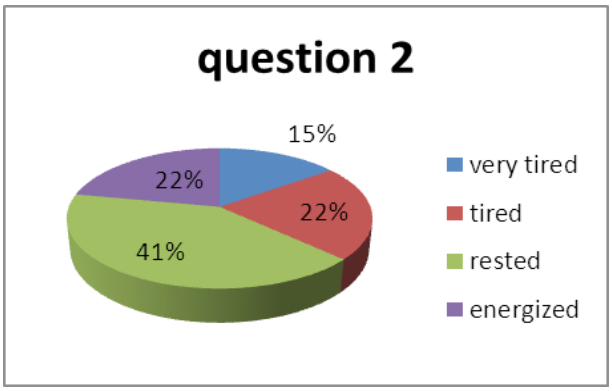
Thanks for your time and we are committed to you communicate study results which have contributed to the achievement of expressing personal opinion!

1. Have you ever given your daily biorhythm importance?



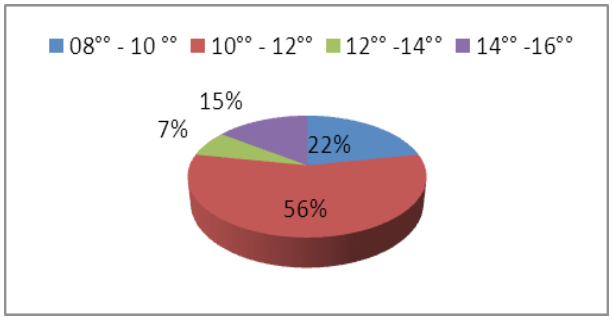
Given the fact that over half of the respondents answered "Yes" to this question, we can say that the concept of biorhythm is becoming increasingly aware, notably the percentage achieving variant 0% answered "I do not care "which shows concern for the wellbeing of the body. However, an equal number of people opting for alternatives "No" or "Not interested", which certifies the relatively recent emergence cronobiologiei science biorhythms. [4]

2. How would you describe your general wellbeing at an interval of 30 minutes after awakening?



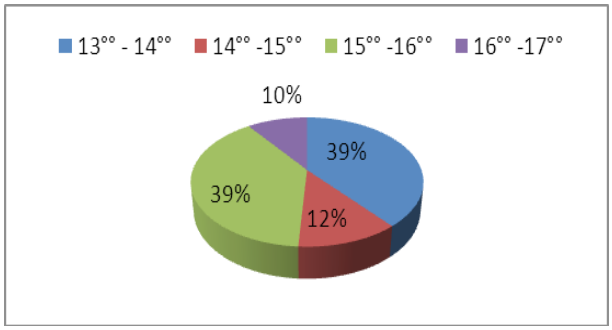
Most of their general condition characterized military students at an interval of 30 minutes after awakening as an ideal, choosing the answer "rest" but there is also negligible percentage on options "energy" and "tired". Only 15% felt tired during this time. Scientific , in the morning appears the stress hormone, cortisol, which causes various organs tone recovery and return to normal circulation, its secretion is diminished around "Lx 23". [2]

3. In what time frame you consider that you have the maximum capacity of concentration?



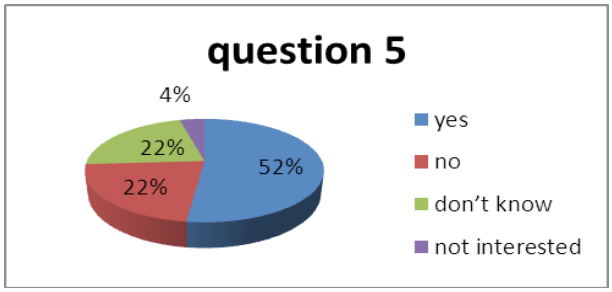
It justified the choice in 56% of the schedule "10 °° - 12 °°" as is "time scholar", the brain is most receptive and ability to make decisions and solve problems as maximum. Now is the ideal time you travel by car, attention and reflexes are much greater. [2]

4. Which of the followings we consider to be optimal for performing military firing?



To perform military firing in the questionnaire, students opting for slots "13 °° - 14 °°" and "15 °° - 16 °°", but for intervals less than "14 °° - 15 ° ° "(12%) and" 16 °° - 17 °° "(10%). The best skill was recorded by researchers between the hours "15 °° - 16 °°" time "Lx 15" showing also the lowest threshold of pain sensitivity. "[4] Moreover, within the same range brains again put in motion, and we can continue the work force as attention and concentration are again in top form. [3]

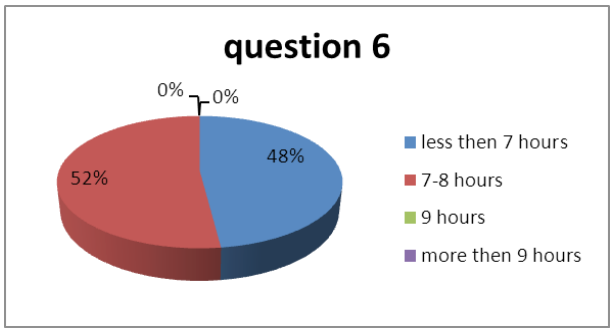
5. Sporting activities you prefer 16^{00}-18^{00} range? (desired response independent of the schedule)



Obviously, most military students (52%) believe the time we suggested as suitable for sport activities. This is supported by the physiology of the human body which is now revived, being willing to come into operation due to the large opening of the lungs and airways.

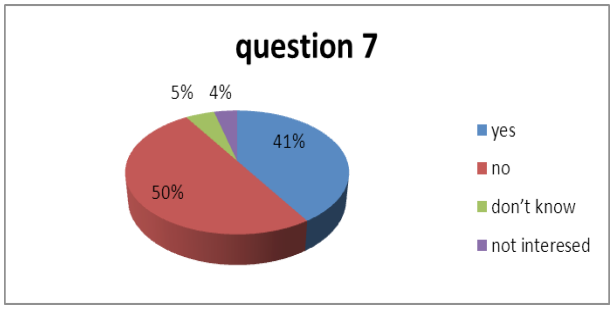
At "17 °°" hands feel the need to move at the same time recorded most sports records. [1]

6. In which of the following intervals during sleep the night you fall on?

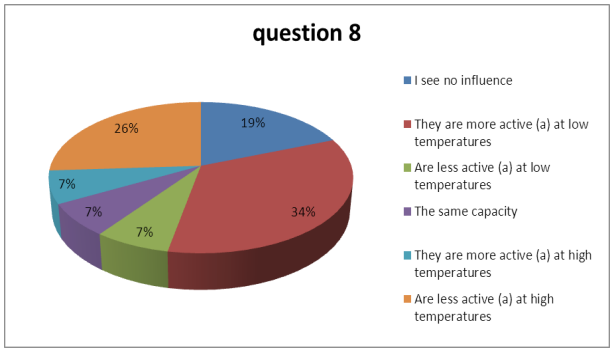


Statistically, sleep duration is associated with 7- 8:00 greatest longevity and very little sleep duration leads to malfunctions such as angina and heart pain. Myocardial infarctions and strokes correspond to a very long sleep durations. Therefore, we consider the responses of students surveyed (52% - "7- 8:00") conducive to maintaining a state of equilibrium of body integrity. [3]

7. Are you satisfied with how biological rhythms are observed in arranging daily program schedule?



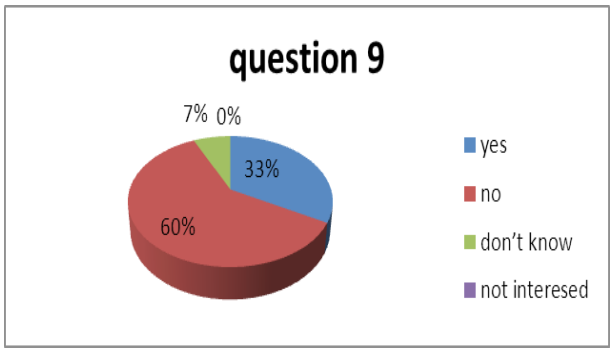
Students military in 50% are dissatisfied with regard to compliance with the biological rhythm in arranging daily program schedule is understandable because military status requires at the outset a more intense training both physical and mental. However, 41% of them show good adaptability and therefore chose the answer "Yes". Because there are answers "do not know" (5%) and "Not interested" (4%), denotes the idea that the military did not address arranging daily program schedule from this point of view. [3].



8. You think the ambient temperature influence your psychomotor ability?

From scientifically proved that alternation body temperature affects psychomotor ability, in the sense that, as the temperature is high, the body is more active. However, in our study, as applied questionnaire, most of the military students (34%) say they are more active at low temperatures, and 26% say they are less active at high temperatures. In descending order, 19% are not aware influences, and the fewest in equal proportions (7%) are less active at low temperatures or high temperatures are more active or deemed to have the same ability to work, both physically, and mentally. [2]

9. Within one month you felt (more than 5 days) states of irritability, nervousness / calm optimism?



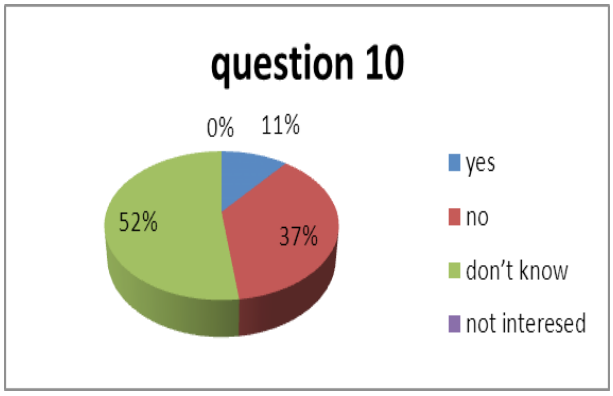
We chose to introduce this question in our questionnaire to highlight the existence of psychophysical cycles. In its detriment, we note the presence of 4 cycles: the physical cycle, the cycle of emotional and intellectual cycles and Intuition.

Physical cycle lasts only 23 days: 11, 5 days of intense work force and capacity, followed by 11, 5 days of fatigue and weakness. Emotional cycle includes 14 days of calm and optimism and nervousness and irritability dominated 14 days.

Intellectual cycle consists of 16, 5 days increased capacity creation, spontaneity and 16, 5-day low yield of intellectual activity. The most recently discovered is intuitional cycle, called "sixth sense" for a period of 38 days. In a psycho-physical cycle, the most sensitive is the transition from one stage to another, when the body shows a maximum degree of instability. It was found statistically as in people over 70 years, most deaths occurring during that period or immediately thereafter.

In this study, 60% of students surveyed answered "No" and 33% "yes" and 7% with "do not know". It follows that, for the most part, we are unaware of the passage from one stage to the next cycle. [3]

10. Considers that biorhythm had any importance in choosing your future military career?



The fact that we have a percentage of 52% of variant answered "do not know" denotes that the concept of biorhythm is circulated recently, but not enough depth in all categories of education and in all age groups. Thus, this response is justified because of uncertainty about the science and its implications. However, we obtained and answers "yes" (11%) and "No" (37%), with the result that a certain part of the population surveyed meet this deadline, but were not influenced by the biorhythm or when choosing future military career.

CONCLUSIONS

This study achieved its objectives and thus can conclude the following:

- In student life there are minimum and maximum military activities undertaken by them in relation to certain times of day or month
- There was tested also exogenous origin of biorhythms assumption that they are subject to environmental factors
- Regardless of the higher military educational institution, every student of this is influenced by the "biological clock", variations in yield from one period to another

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BEEING A LEADER. PERSONAL CHALLANGE OR MANDATORY REQUEST?

Cristian –Marian PANAIT

„Carol I" National Defence University, Bucharest

Abstract: *From the practice point of view, leadership is a phenomenon that resides in human interaction and becomes available to everyone. The two common forms of leadership, assigned and emergent, as a process, can be learned. However, someone in the assigned leadership position does not always become a leader. In the military this is a well known and vastly discussed subject, yet finishing the sentence"A leader is…" will find as many definitions as many people will be asked. This has led to the dramatic increase of many "leadership experts", an entire market of selling what leaders should do. Although this subject was thoroughly researched the presented methods in the paper are as direct observation, counseling, mentoring, building team skills and processes, developing others on daily basics from the assigned leadership position of commanding the first year students within Air Force Academy. Leaders development requires assignment of personnel that will understand it as a mandatory request, a personal challenge to have leader skills.*

Keywords: *leader, leadership, manager, teamwork, military education,*

1. INTRODUCTION

Most military activities are grounded in teamwork. The military student becomes a member of a squad, platoon, company, battalion from the very first day of his training as a future officer.

Air Force is a team of teams. His feeling about the membership importance is decreasing in numbers, one of seven squad members vs. one of the hundreds battalion members.

The assigned leader is the first person who give him importance and a sense of purpose.

As he graduates he will become one of those commanders.

WHEN he will become more aware of that, he will understand the responsibility for being an active, important member is on his own shoulders.

The leader should give his team the higher purpose by making every member feel important.

In a long term, having a mindset focused on the team goals, the future commander will identify his purposes with his unit, instead of his own.

There are, two ways of being a part of a team:

- the individualist, following the rules as much as he understands to, doing the *things right*;
- active member, taking the personal challenge of gaining the skills of a leader by doing the *right thing*.

When in the position of commanding a team, it's maybe a little too late to acquire all those skills needed to perform a "management of meaning: leadership"[1]. in order to have high performance When put in a leadership position, the potential leader will define his style based on the skills he already gain or he will try to take a personal challenge out of his position and shape into what he desire or is requested.

Teamwork is based on six interrelated elements: communication, cooperation, coordination, leadership, assertiveness and planning. The efficiency of one directly influence the efficiency of another (e.g. communication-cooperation). To obtain the skills in maximum possible number of these elements it is definitely a challenge . Teams that practice the six elements of teamwork efficiently will be able to reach their goal with less difficulty.

2. A PERSONAL CHALLANGE WE NEED TO VIEW AS A MANDATORY REQUEST

The reason I started this article with some basic description of an effective teamwork is a common misconception some officers and NCOs fall into while holding the formal authority: There aren't two separate entities: the commander and the team!

While stepping out of the team circle, there will be place for another "entity" which under pressure may hold more authority than the formal one and from the lack of information he possess, that might become a dangerous situation. It is desirable to have a good relationship with the active members of the team especially becausethey put up a great deal of teams morale and level of efficiency. In this case, under pressure situations, members that the assigned leader wouldn't maybe thought of, might emerge. In my opinion, this type of leadership, commanding, while outside of the circle does not suit the military situations in general, it's like God, unseen but felt through the words of religious leaders and books.

A job description is mandatory. However there are levels of performance, from unsatisfactory to exceptional. When developing leaders, starting with basic level to professional, a big par tof responsibility reaches a personal level This brings us to the question of a personal challenge. How will others appreciate the results of the challenge a potential leader took? There are many surveys made but I would like to quote the results that came from a worldwide respected research company, Opinion Research Corporation, on the most valuable trait of a leader [2]:

Table 1. Most valuable traits of a leader, according to research by Opinion Research Corporation for Ajilon Finance.

Rank	Trait	Percentage
1.	Leading by example	26%
2.	Strong ethics or morals	19%
3.	Knowledge of the business	17%
4.	Fairness	14%
5.	Intelligence and competence	13%
6.	Recognition of employees	10%

These results are based upon telephone interviews with a representative sample of 600 adults, 18 years of age or older, who are employed either full- or part-time. Participants included 267 women and 333 men. Interviews were conducted between September 18 and September 21, 2003. The margin of error is approximately plus or minus four percent.

This is no surprise for us military as setting the example is a demand even found in the fundamental general regulations. The discipline by example is found long back in history. We can often see officers and NCOs taking a sideline, watching the work being done with the idea in mind "that is not my job, I have other responsibilities". Remember Plutarh says on Caius Marius who gained his soldiers respect by "matching in labor and abstemiousness... as indeed any voluntary partaking with people in their labor is felt as an easing of that labor, as it seems to take away the constraint and necessity of it....For they (the soldiers) do not so much admire those that confer honors and riches upon them, as those that partake of the same labor and danger with themselves; but love them better that will vouchsafe to join in their work than those that encourage their idleness." [3] The question here is for the students, from whom is expected to practice a form of leadership and set an example as soon as they will graduate. What example will you give? What does it mean to "set an example", for sure not the narrowed idea of how much you can get away with!

3. LEADERSHIP DILEMMAS

Dilemmas may occur while one is trying to figure it out what can be done to become a good leader. Human nature, as we all know is hard to quantify as we are in so many ways very different, therefore this personal challenge needs to have its grounds on better personal understanding.

Studies made on leadership and behavioral psychology gives us good tools to start this quest. One of the tools we have is questioning ourselves on this matter, debate and better understand. Leaders are born, not made. This thought can place us on an idle position.

Many times I heard "I'm not made for this!" BEFORE even trying. It's a great thing to better understand ourselves and come to the conclusion what is the line of duty with the best performance we can give and yes, we cannot do everything on a high level performance. Being in a leadership position, leading men might not be for you but never accept that without trying. What stands in your way to achieve that goal? Circumstances and persistence are some of the major elements in the development process of any leader. Do you consider yourself not very much of a "people" person: reading proper literature, taking classes on empathy, developing a critical thinking, learning about tough-mindedness and how to develop more psychological resistance might improve that feeling. Personal traits will determine who will and who will not be comfortable leading others, we are always learning and changing.

If someone thinks that there isn't much to learn while assigned on a leadership position and with much experience then maybe it's a good thing to question his leadership: "How many followers will I have without my title?". Take in account that a true leader won't go in a popularity quest, a true leader will create more leaders not followers on a basic understanding.

Developing a leaders traits is a process that has roots long ago in history. Just think of the inherited role as a ruler present even nowadays in monarchies and the education received. Great names of leaders will never be forgotten, natural leaders are indeed rarely born, it's a invitation to greatness, an opportunity, but you do not need a title to become one and for sure there aren't any leader developed in a axiological vacuum. It is important to stress as well how the genetics influence ones development as a leader!

Manager - leader. That is another dilemma and often misconception. Many First lieutenants graduate with a diploma of organizational management thus…managers.

As I stated at the very beginning of this paper there are many definitions of what leadership, a leader is. I found so many definitions that my conclusion was only to acknowledge the complexity of this field, however there is one that resonates the most with myself: "Leadership: management of meaning", after Linda Smircich and Gareth Morgan[1].

Leadership is just a different kind of management which starts with self-management and to a certain extent a way of living. "Can we change the world? Probably no, can we change our day? Yes. We have to admit we are never at our full potential"[4].

There are many charts that put a leader in front of whatever a manager means to who made the study, it's very much like a leader is someone that a manger will never be. In my opinion, there isn't one that achieved greatness over the other one. A leader compared to a manager, has something more to offer to his working with people job, than his time, his soul. By soul I mean passion, feelings towards subordinates. That is a two-way road.

Side by side charts are good to observe the general understanding of these two concept and some of them are actually good (Google has plenty from funny to more serious ones) to understand the long road a leader has to walk. Here is an example from Mark Sanborn book, "You don't need a title to be a leader"[5] where the differences are more orientated on the teamwork aspect "leadership is power *with* people, not power *over* people":

Table 2 Leaders vs. Managers

Managers	Leaders
-have employees (subalterns)	- win followers
-react to change	- create change
-have good ideas	- implement them
-communicate	- persuade
-direct groups	- create teams
-try to be heroes	- make heroes out of everyone around them
-take credit	- take responsibility
-exercise power *over* people	- exercise power *with* people

Gender and diversity dilemma. This issue is the subject to some bias, prejudice, personal opinion. It's featuring a combination attributes as gender, ethnicity and nepotism (family member or friend). I will focus on the gender one as it is the most common within military schools.

I would like to tell you some facts that influenced my perspective on military females on leadership positions.

Female students were allowed to participate at military academies admission in 2002. I was a military student also back then.

On one of the scientific communication sessions I participated as a military student, one of the students from a different academy came with a subject on military females status within academies.

The issue was that military females were not assigned on leadership positions, platoon commander deputy.

The debate was closed quite suddenly after one of his platoon colleagues asked why they are not bothered also for not being assigned with the position of the machine gun carrier.

Yes, we are equals in rights and obligations. After I graduated and was assigned at a mechanized infantry battalion I did witness another situation linked in my mind with the one at the scientific communication session.

While during a long march one of the military females that was with us, seemed at her limits with keeping the pace with others so one of her colleagues offered himself to help her with her bagpack. Her reaction? "Why? Do you think I cannot do this? I'm fine!". She was a leader.

She had taken a personal challenge to gain all those traits that leads to respect. More than ten years have passed and I find myself back in the academy seeing military females in leadership positions with very good performance.

What has changed? They proved their qualities. Some took the active membership position within their teams and gained respect.

So if you are a military female and you think you can't be a leader within your team because of gender, maybe you're just finding an excuse for not taking the hard but rewarding path of becoming one.

CONCLUSIONS

I will start the conclusions with what is not this paper. It didn't scientifically breakthrough the field of leadership, it isn't (even though I would like to) about the responsible genome that makes it easier for natural leaders and it isn't about that "magic" something that makes a military stand up when he is down and go on fighting just by hearing his commander yell "Stand up! You're better than that!".

My intention was to raise some questions among the future leaders with the hope that some will actually challenge themselves to become the leader that would make his soldiers stand up fighting. It can be done.

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When editing the articles which are to be published in the review some rules will be respected as follows:

The whole paper must be written with no free space between lines using the Times New Roman CE; the margins of the text: Top – 28 mm, Bottom – 20 mm, Inside – 25 mm, Outside – 20 mm, Header – 18 mm, Footer – 15 mm, Mirror margins activated, Paper format A4 210x297).

It is recommended that the paper should have an even number of pages (maximum 6). The title will be printed in Upper cases 14 pt, bold, centered. The name of the author will be written two free spaces below the title of the paper: First name, surname, font 12 pt, bold, centered. A free space (12 pt) below the name will be left before writing the name of the institution, font 12 pt, centered.

Papers must be prefaced by a brief abstract in English up to 250 words. The text will be written in 11 pt high, Italic, justified, left-right alignment. A number of maximum 8 keywords will be written 11 pt below the abstract. The words will be 11 pt high, Italic, left alignment, separated by a comma.

The text of the paper will be written in English two free spaces below the keywords divided into two columns separated by a 5 mm free space. The characters will be 12 pt high, justify (left-right alignment). The main parts of the paper will be introduced by numbered titles with Arabic figures and printed in capitals, font 12 pt, bold, centered. A free space will be left above the text and another one below it. Paragraphs will be 6 mm indented.

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