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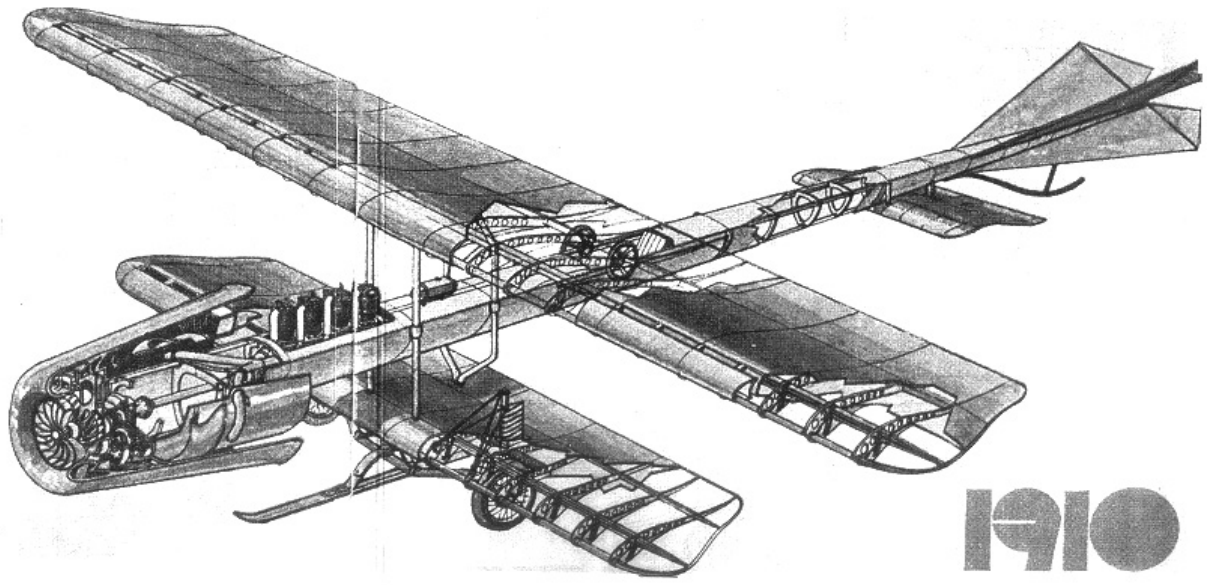

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C O N T E N T S

ORGANISATIONAL CULTURE AS PART OF MANAGEMENT WORK OF THE MILITARY ORGANIZATION

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Abstract: *In organisational theory, the concept of organisational culture is seen as one of the views of the organization, enabling to understand its operation. Organisational culture is often attributed responsibility for a variety of organisational ills and occasionally attributes to create positive qualities. It is necessary that the armed forces managers - leaders thoroughly researched and know the organisational culture of the military organization, as a phenomenon, which allows them to understand the behaviour of organizations and people who work there. They can then easily and better define and explain organisational problems and actions to the military units and facilities, which are happen in their organization. Detailed knowledge and awareness of organisational culture should improve the ability of commanders to analyse organisational behaviour in order to manage and lead a military team.*

Keywords: *organisational culture, the culture of the military organization, management of human resources.*

1. INTRODUCTION

Organizational culture presents the widest scope and specific background of the activities of people in the organization.

The concept of organizational culture is ´ubiquitous extensively operating complex of various and multi- faceted inter organizational factors and conditions that substantially influence the efficiency of operation and development of the organization as well. [1]

The culture of organization coordinates all the processes that are going on.

Virtually everything what is happening in the organization and, everything what produces and serves society, acts on its surroundings and the general public is primarily work of people.

First of all, the success of organization in achieving the objectives in the current challenging, economic and social environment depends on people in the organization who know working methods and procedures and often advanced, difficult and expensive technology; on their involvement, the quality of their work and responsibilities, on coordination of groups and teams and team management too.

These aspects are fully valid in terms of the Armed Forces of the Slovak Republic (SAF).

Organizational culture in SAF is reflected in its entire organizational structure which comprises mainly military units and facilities of individual types of forces- it is the *land forces*, *air forces* and *training and support forces*.

Long-term experience suggests that even in SAF, a purposeful shaping of organizational culture is an essential mean of improving relations in the organization in its own internal environment and also relations to the external environment. It significantly contributes to the formation of a positive image and reputation of SAF.

2. ORGANIZATIONAL CULTURE AND CULTURE OF THE MILITARY ORGANIZATION

The issue of organizational culture has its theoretical solutions. It should be noted that ´organizational culture is a phenomenon that is very complex, difficult to define and punishable, but which significantly affects long- term success of the organization.

On one hand, it can be a source of strength of the organization and carries a competitive advantage; on the other hand, it may be holding back the development of the organization or even be the source of its destruction. [2]

Defining organizational culture by various authors helps to understand its nature and content although the interpretation is varied. Of many definitions of organizational culture, we chose the following: ´it is a system of shared values and beliefs of the members of the organization which largely determines how they behave´. [4]

If we were to generalize the definition of the

organizational structure, we can conclude that organizational culture can be understood as the sum of the *elements* including:

- *a set of basic assumptions, values, attitudes and norms of behavior,*
- *which are shared within the organization,*
- *which are reflected in thinking, feeling and behavior of the members of the organization and in artifacts (creations) of material (building architecture, material facilities of the organization) and immaterial character (language, stories and myths, heroes, habits, rituals and ceremonies).*

All the elements of organisational culture are part of a strictly centralized organization such as SAF. On its basis, SAF organisational culture is formed and the culture of a military organization arising from it.

Within the precise operationalisation of organisational culture concept of the armed forces (culture of the military organization) it is necessary to define the term *military organization*.

F. Škvrnda perceives military organization ´as a specific way of association of armed people meeting, in their business, the policy objectives of society- wide character and social relations and activities subject to the use of weapons and military equipment and the implementation of armed violence´. [5]

The specifics of the military organization as a social organization must meet a number of conditions such as:

- *target and functions* which are institutionally given by the mission of SAF, its social position and a social role in society,
- *requirements* for the control and use of weapons and military equipment, the mass execution of armed violence, and the actions and behaviour of people in these conditions,
- *manner of construction and armed forces replenishment*, individuals and groups, particularly their educational level, professional preparedness, cultural maturity, character of education and training of soldiers, preparation of command corps, etc. All this stands for a personal aspect of the military organization.

There are two planes of the sources of SAF organisational culture- *formal and informal*.

The formal plane is the frame of organisational culture.

These planes are generally complementary but can also be in conflict with each other.

In the military organization, it is embedded in the system of various *legal documents from constitution, laws, rules and regulations to the direct orders* issued by commanders.

It has a unifying character. The informal plane is essentially more variable and more varied. At its creation, more resources are involved.

In addition to the official documents, it is the original environment of participants, their specific social experience which in conjunction with other factors such as the type of *weapon, used technology, history and traditions of the unit itself* create a unique and specific organisational culture of armed forces on the threshold of the second tens of 21st century.

The specific sources of organisational culture in SAF include: *the influence of transnational organizations (NATO) the impact of international joint operations, the impact of economic and market environment (labour market, the impact of the original environment of the members of armed forces, the impact of the profession and related activities, the impact of military and nonmilitary threats, the impact of the current development of military art, the impact of the leader/ commander, the impact of size and duration of existence of the organization, the impact of technology, etc.* [6]

3. THE IMPLEMENTATION OF THE CULTURE OF THE MILITARY ORGANIZATION

Organizational culture in terms of SAF is part of managerial work of *commanders* within *personnel management*. It is an integral part of it. The commanders assume more and more tasks at different levels of governance. It is therefore important to understand the meaning and status of organizational culture in the management and organization, in this case a military formation or an individual military unit.

As indicated, organizational culture is composed of various elements that are needed to be at least briefly defined and identified in application form with real conditions in SAF.

Basic assumptions (potential conviction) are fixed ideas about the functioning of reality that people consider fairly self- evident, true and unquestionable.

They operate completely automatically and unconsciously in humans so it is difficult to identify them. Nevertheless, in terms of SAF this belief stems from the very nature of being a professional soldier who *in case of threat of integrity and sovereignty defends the homeland and in case of non- military threats helps people*.

Values that reflect what is considered important, what individual or group attaches importance, are part of basic assumptions.

While the individual value system of a person determines what is important to him, organizational values are an expression of what is significant to the organization as a whole.

According to professional soldiers, in particular:
- *pride in being a professional soldier,*
- *responsibility,*
- *discipline,*
- *personal growth- possibility of education,*
- *team work,*
- *care for people,*
- *opportunity to get a lifelong job*
- *high level of education of SAF staff* etc.

Values represent the *core* of organizational culture and are considered to be an important indicator of cultural content and means of creating organizational culture. The key organizational values are usually expressed in *mission* or *ethics code* of the organization and are communicated to the employees of the organization. There is not any different in SAF with the *Ethics Code of SAF Professional Soldier*.

The problem, which we encounter with the experience, is that there is a discrepancy between the declared values and those that are actually shared.

The cause of discrepancy may be not only the fact that people do not identify with the official values of the organization, declared management, but also that the values that people declare are the result of their rationalization or just an aspiration.

Value conviction, in this case the military organization, inevitably creates in people a certain *attitude*. The term attitude is customary in relation to *positive* or *negative feelings* regarding certain person, thing, event or problem.

They are a product of evaluation in which the things are integrated by *cognitive*, *emotional* and *conative* component of psyche.

Cognitive processes bring human knowledge, the importance of experiencing emotions and attitudes are interested in evaluating the relationship to the objects- the object seems to be desirable or undesirable, good or bad. At this relationship, some conative (action) emergency is then established and the use of which in the relevant negotiations depends on situational conditions. [3]

SAF are in terms of their focus and activities highly centralized and formalized.

Nevertheless, as it is in other organizations, *group norms* are applied; it means *norms of behavior* adopted in a group, they are *unwritten rules, standards of behavior in certain situations that the group as a whole accepts*.

They encompass the business activities, communication in a group, etc. Group norms are essential for the organization. They define behavior which is in the organization and it is not acceptable and thereby they regulate everyday behavior of people and provide stability and predictable environment. They never occur in written form- if they were, then they would be principles or procedures.

Language, stories and myths are significant elements of SAF organizational culture as well. The language used in SAF reflects assumptions and values shared in them. It stresses the level of *formality* or *informality* of relationships, etc. and it is an important determinant of mutual understanding, coordination and integration within the organization. People in the organization may give equal importance to the terms, allowing them to increase their understanding and emotional well- being, or may not share the meanings which can be a source of misunderstanding and conflicts.

Stories, presented in SAF, especially of the various units and facilities are ´embellished´ stories that occurred in the past. Because of the fact that the members of the organization can easily remember the stories and the stories are emotionally appealing, it is not only an indicator of culture but also an important instrument of their tradition. Similarly, the *myths* are sort of thinking and interpretation clarifying desirable or undesirable behavior in the organization. They have no rational basis but they rather arise because people need something to believe in.

The difference between the stories and myths is that their content is fictional.

Customs, rituals and ceremonies are a daily occurrence in the life of the military organization. They present settled patterns of behaviour that are maintained and transmitted in SAF. As part of organizational culture, they contribute to the functioning of the organization, create stable and predictable environment and allow people to create their own identity. To general public, military *ceremonies* are mainly known.

They are carefully prepared special events held on special occasions (military oath, disposal of graduates of military academies, military parades, etc).

Their importance lie in the fact that they remind and reinforce the organizational values, appreciate achievements and celebrate the heroes of the organization.

They are basically celebrations of culture of the organization including emotional impressive speeches and activities. They often convey experiences to people and enhance their motivation and identification with the organization.

Architecture and organization equipment is another essential element of organizational culture. This aspect is important not only outwardly but also inwardly for the *identity* of the organization. It should be noted that architecture in terms of SAF is very austere and the equipment of the organization and technologies used are implemented mainly by specialization as well as economic potential of the sector.

3.1 Possibility of the commander to influence the culture of the military organization (unit). The commanders of the formations and facilities, as well as lower levels of command, have a considerable opportunity to influence the culture of the military organization. Life of the military unit is prescriptive in the military laws, rules, regulations, instructions, commands of superiors. In spite of this, in the activity of the commander, there is a quite ample scope to influence organizational culture in them.

Based on the experience, the commander may affect the culture of his unit mainly by his *own positive example*. As a positive example, the subordinates can see him in several areas, such as:

- the area of military behavior meeting preparation, his behavior when dealing with the superiors,
- the area of military skills: knowledge applicable within the basic combat skills, in military tactics, military exercises,
- the area of physical fitness- annual testing of physical performance, morning physical exercises,
- the area of interpersonal relationships- creating a positive working atmosphere where mutual trust, respect and support is applied.

The commander, during his tenure in the military formation, brings his own vision of its functioning, his way of communicating with subordinates and superiors, the way of creating professional and interpersonal relationships.

His subordinates formally respect these values as in the military environment respect for the commander is paramount. If the subordinates adopt the commander's vision, it means the operation of the unit; his aims and values, then we can say that they respect him and share the culture of the military organization formed by him.

The commander, who in this way creates organizational culture of the military unit, also becomes a *symbol, bearer of the image, hence its external image for the subordinates*. For the commander, influencing the culture of the military organization is also important in adapting new professional soldiers. The position of the commander is crucial here. If the commander is respected as a leader, he may help the new members to integrate into the unit.

The new members are taught the values of the unit, familiarized with the individual members of the unit and presented the objectives of the unit. In practice, it can be seen that if a new member of the unit is accepted and adopted by the commander, also the other members accept him better. Conversely, if a new member has a problem with the commander, he gets on worse with the other members of the unit too.

When creating the culture of the unit, the way of communication between the commander and members is important as well.

3.2 Possibility of the commander to influence the culture of the military organization through the elements of organizational culture. The elements of organizational culture were defined in a theoretical introduction. The elements of organizational culture, through which the commander influences the culture of his unit, can include: values, attitude, material and immaterial artifacts. The commander, on the basis of values, creates his system of values in the unit.

The values that are carried by the commander and that influence organizational culture of the military unit contain:

- *quality and flexibility in carrying out the tasks*- for successful existence of the military unit, it is important value influencing the unit name at superiors,
- communication in the unit- which should be open, direct and within the good manners,
- team work support and development- it makes work during carrying out the tasks easier and improves the process of adaptation of new members of the unit, teams,

- care of the subordinates- the value that is much appreciated, according to the experience of practice, by the subordinates,
- delegation of powers to the subordinates by keeping the military regulations and descriptions of functional content of the unit members,
- a certain level of independence and freedom to perform tasks- if possible, considering the type of a task and skills of the subordinates, support of self- confidence and self- esteem may occur and support of trust towards their commander as well,
- education of the members of the unit by attending professional courses- it increases flexibility and autonomy of the military unit during the process of carrying out the tasks,
- conflict resolution by consensus, if possible in accordance with the military working conditions,
- responsibility and addressed fulfilling of the tasks, very important value for the success of a military manager in practice, that simplifies the work of the commander who keeps track of carrying out the individual tasks and time scales for their implementation; the subordinates know what to do and how long,
- control system of the subordinates- formal control is focused on performing the tasks, keeping the orders, directives of commands; informal control of the commander is focused on e.g. control of interpersonal relationships of the members of the unit. [7]

The commander influences the culture of his unit also through the attitude and opinion of the organization in which he works. In practice, there are the cases that in SAF conditions, not the impact of the commander's attitude and opinion is so significant but the impact of the manager on the culture of the organization working in the civilian sector.

Professional soldiers of SAF have formed opinion of SAF which the unit commander will affect only minimally. Attitude and opinion of a military professional to SAF is the result of the evaluation towards the organization. It is the result of his experience, repeated experiences which are becoming the rule.

The *artifacts of a material nature* in military environment include: *a building in which the unit works, vehicles at its disposal, weapons, equipment e.g. workshops, car pool, message boards, photos of the members, decorations*….

The experience from practice: the commander of the military unit can e.g. arrange the car pool expansion, request a vehicle and extend the workshop equipment or car pools- through order forms respectively reports to the commander of the formation.

This method of material- technical support expansion of the unit tends to increase work output of the unit members, more flexible task solving and makes unit to be more independent. The values of the unit are strengthened and belong to the elements of organizational culture.

Professional soldiers respond well to so called information boards of the unit, where basic information on important tasks are available. They keep an eye on them and in spite of the numerous tasks and responsibilities, the tasks are not forgotten. It also simplifies communication between the commander and the subordinates.

The notice board with their photos and organizational structure of a platoon is a very good example of creating solidarity and belonging to the unit.

The artifacts of immaterial nature in the military environment include not only customs, ceremonies and symbols of the military formation but according to the experience, among the customs kept by the units belong: *collective meetings after carrying out a difficult task, joint planning of services, help to the individual members of the unit also out of service hours, fulfilling the tasks beyond their duties* etc.

3.3 Organizational subculture in the military unit. In the military environment, there are the specific units in which the *organizational subcultures* occur.

In this environment, the source of the organizational subculture within the formation can be:

- the age of the members of the unit- younger members form their own organizational subculture that differs on e.g. language or interests of the members….
- education of the members of the unit- university education, secondary education…..
- the rank of the members of the unit- officers have their own language, differences in communication, different ways of tasks solving, noncommissioned officers (NCO), warrant officers and crew,
- different functional duties of the members of the unit- e.g. drivers, gunners, operators….

- spatial distance of the individual parts of the unit- e.g. in terms of training battalion, the existence of separated workplaces-workshops, training grounds…..
- the military unit consists of civilian employees as well who have different wok content, work fund, disciplinary power of the commander to them.

3.4 Possibility of the commander to influence subculture of the military unit. According to the experience, for the commander, it is very difficult to form united organizational culture in case of the existence of separated workplaces. The reasons of difficulty of the whole process can include:

- the lack of time for interaction with the members of the unit working at separated workplaces; mostly after arriving to work, they go to a separated workplace where they work till the end of working time,
- different task content,
- opinions of some civilian employees of the military unit of professional soldiers (mainly in the field of financial evaluation of professional soldier and civilian employee, and also ensuring of military equipment of professional soldier),
- working ethic of the former professional soldiers currently serving as civilian employees.

Despite these obstacles in forming organizational culture, the commander of the military unit may affect the cultural integrity of the unit through the following possible ways:

- setting the time for communication with the members of the unit working at separated workplaces,
- informing the members of separated workplaces about the life of the unit, the events that affect its activity,
- if needed, organizing joint briefing with all the members of the unit, e.g. to solve important tasks respectively problems, conflicts of the unit,
- organizing the meetings out of working hours because of e.g. jubilee celebrations or completing difficult tasks,
- engagement of the commander in the care of the subordinates working at separated workplaces.

4. CONCLUSION

The importance of organizational culture for the effective functioning of the organization continues to grow. As well as the interest of the managers in learning more about the field of managerial work.

Knowledge of organizational culture of the organization, in which the manager works, should be a fundamental assumption of his successful operating. Just understanding and developing of organizational culture is a prerequisite for successful operating of the organization as a whole. Therefore, it is necessary to pay attention to this issue. Organizational culture has the same meaning for the practice of a manager working in a civilian sector and also for a military manager, who with respect to the particular operating of the military units, has partially limited initiative of his influence over the unit. Despite of this, it is possible to identify the possibilities of his influence which were outlined in this work as motivation for subsequent study of the given issue and defining the other opportunities of the commander to influence the culture of the unit.

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THE ROLE OF TACTICAL AND ORGANIZATIONAL SOLUTIONS IN CHOOSING TERRORIST TARGETS

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Abstract: *After the terrorist attacks on 11 September 2001 the U.S. Department of Justice started to publish extracts from the „Terrorist Training Manual" on 7 December 2001. Afterwards miscellaneous independent sources and government agencies published the whole manual. The aim of the Author is to demonstrate how terrorist attacks were committed, and how the terrorist forces choose of those targets and arranged timing and how they used open-source intelligence for these purposes.*

Keywords: *terrorism, open source intelligence, terrorist training manual, planning*

1. THE ROLE OF RECONNAISSANCE AND INTELLIGENCE[1]

When planning their actions, terrorist groups consider the characteristics of the goal, the location, the time, the timing, the chosen device and the method. Intelligence is a decisive factor as early as in the first phase of planning a terrorist attack. For example, when planning an attack against a traffic network, it seems to be relatively easy to gather basic information on the targeted network, terminal or vehicle. Nowadays one of the most common forms of intelligence processes is the gathering of so-called Open Source Intelligence.[2]

In the era of the ICT revolution one might believe that the first step of planning consists of nothing else but taking advantage of the opportunities provided by the world wide web.

The next step is filling out the gaps in the information retrieved from the Internet using information sources that prove to be useful even in our time, such as public libraries, maps, passenger information devices, timetables, notices, advertisements etc.

Very few sectors remain on which the basic information required for the planning of a terrorist attack cannot be retrieved by anyone.

Although most countries can be explored in 360 degrees and in high-resolution 3D pictures using applications such as Google Street View, it remains very important to visit the chosen location and to thoroughly inspect the access roads and escape routes, even several times.

The series of terrorist attacks on 11 September 2001 could not have been executed without inspecting the targets several times.

Subsequent investigations have revealed that most of the perpetrators have had previously taken reconnaissance flights to the relevant destinations. (Chailand, Arnaud, eds 2007. 329.) CCTV camera records prove that the suicide bombers committed the attack against the London public transport network on 5 July 2005 have previously visited all of their chosen targets. (Horváth 2010. 59-69.) For the planning and execution purposes of a terrorist attack, the leaders and perpetrators need sufficient knowledge from the security system.

1 This article was elaborated with the support of the Critical Infrastructure Research Project TÁMOP-4.2.1.B-11/2/KMR/001

2 The highest advantage of the open source intelligence may be considered, in the same time, as a disadvantage. The enormous amount of accessible open source data makes difficult to select the relevant information from the "noise". It is even more difficult to filter out those information that is created and disseminated for misinformation purposes.

It looks like an easy task to find web sites providing such information for terrorist groups, however it is far more complicated to find reliable and current sources even for security specialists and secret services. (Horváth 2010. 59-69.)

I have conducted an instinctive empirical study on retrievable information from the Internet. On the 7 July 2005, right after the news appeared on the terrorist attacks against the London public transport network, I asked four of my university students to help me in compiling a quick survey from the information available in the Internet.

I asked them to collect information on the public transport networks of London, Paris, Moscow and New York. The results were shocking.

The gathered data were charts, maps and photos from the subway systems of all four metropolises. We are sure that such information in wrong hands would facilitate planning of terrorist attacks. We obtained traffic pattern information of certain lines, location and accessibility to the stations, the distance between the stations etc.

The world wide web contains several publicly available descriptions on traffic systems might also prove useful for the attackers.

It is an interesting question whether it is possible to define precisely what kind of information is required for terrorist groups for attack planning?

What planning methodology do they use for instance, to elaborate their plans, to select the perpetrators, to decide in the methods, the location, timing, etc?

However, primary information or studies summing up this topic are not available for the public. There are just very few exceptions.

The assumed existence of the training manual of Al-Qaeda became proven. After the terrorist attacks on 11 September 2001 the U.S. Department of Justice published extracts from the „Terrorist Training Manual" on 7 December 2001.

Soon after miscellaneous independent sources and government agencies published the whole manual.

The manual divides terrorist attacks into the following three phases:

- research & reconnaissance;
- planning and
- execution. (Terrorist Training Manual, 2000. 87.)

Preparations obviously start with the designation of the target group of persons, the targets and the specific or expected goals of the terrorist attack.

After that the intelligence gathering phase is started. The manual demands such an inspection when the target is an object. In such cases, an on-scene assessment (field study) is needed from the surrounding area and the interiors of the building (object, base), illustrated by several photos taken where possible.

Substantive aspects of the inspection of the surrounding area could be:

- How wide the surrounding streets are and where do they lead to?
- How can the location be accessed by pedestrians and/or by vehicles?
- Physical characteristics of the given area.
- Traffic lights and pavements.
- Is there a law enforcement organization or a government agency located nearby?
- Is there an embassy or a consulate nearby?
- Economic characteristics of the area.
- Expected time frame of possible traffic congestion.
- Functional characteristics of the area e.g. Industrial, residential or rural area, trees and bushes etc. (Terrorist Training Manual, 2000. 87.)
- Substantive aspects of the inspection of the interior of the buildings (objects, bases) are:
- Expected number of people inside.
- Number of sentinel posts and guards.
- Number and name of the managers of the given organization.
- Location of the phone switchboard.
- When do people arrive at and leave the object? (their routine)

- Location of internal parking spaces.
- Electric supply network and switches.
- Number of buildings, floors and rooms. (Terrorist Training Manual, 2000. 86-87.)

The background information is vital for the success of terrorist attacks.

Terrorist groups may apply multiple methods in order to obtain these data.

Even the leaders of a research focusing on the terror threat posed to the traffic networks of the United States that highlighted several potential vulnerable points, were shocked when they realized how easy it was to get key information from the employees of airports, transport companies or public authorities. (Landree, Paul etc. 2007. 27–31.)

However, insider information is usually more valuable than the irresponsible information leakage of the employees. There are several ways to obtain it. Active members of the terrorist groups or even individuals from their sleeper agent networks can infiltrate into the target organization.

Information may be obtained from employees by different means such as scam, extortion or even by cyber attack. Information gathered from human resources may help to fill in information gaps remained after the analysis of open source information and field studies.

Turning back to al-Qaeda' training manual and the common aspects of decision-making process mentioned there[3] the group leaders (or planners) have to draw up the operation plan based on the results of reconnaissance, considering the following aspects:

- Types of required weapons.
- Number of people required for the execution of the plan and their training.
- An alternative of the original plan.
- Tactical classification of the operation. (silent or loud elimination operation)
- Specificity of the timing of the attack.
- The target of the operation. Is it one individual or many?
- Meeting point for the attackers before execution.
- Meeting point of the attackers after execution.
- Safe withdrawal, escape routes after execution.
- Foreseen difficulties with the execution that the team may encounter. (Terrorist Training Manual, 2000. 87-88.)

2. PLANNING AND TIMING OF TERRORIST ATTACKS

After processing and detailed evaluation of the reconnaissance information the planning and organization phases of terrorist attacks is started, where the above mentioned aspects have to be considered. The preparation phase of the series of terrorist attacks of 9/11 took at least 2 years and al-Qaeda paid attention to every single minor detail. (Rabasa, Chalk et al. 2006/a 37.) We are certain that the preparation, organization and execution phases were not rigidly separated from each other, but rather were conducted concurrently in accordance with the agreed objective and the information available at their disposal.

A detailed description of target selection criteria may be found in the chapter on the characteristics of terror threat of the RAND Corporation's monograph titled Exploring Terrorist Targeting Preferences. It is clear that unavoidable issues regarding goals and circumstances must be answered in the first phase of planning terrorist attacks. Decisions should be made on what kind of damage to be caused, on the estimated number of casualties that attack will probably result, and this should be aligned with the logistic possibilities, the efficiency of the chosen perpetrators as well as the security and other aspects of the selected target. (Libicki, Chalk, etc. 2007. 20-51.) Significant differences may be pointed out in the decision-making scheme of the various terrorist groups.

3 This does not mean that terrorist groups use the same methodology for attack planning purposes. Significant differences may be found between groups, for example in the decision-making competencies or the execution of reconnaissance tasks. The term "common" simply reflects here to unavoidable aspects.

The al-Qaeda terrorist network pays attention to, and accepts the leadership model of its allies.

The central leadership, called "the core" accepts the proposals of its member organizations (operating on a franchise basis) with regard to the goal and the location and is not further involved in the elaboration of certain details of the attack.

It means that the allied organization enjoys a high degree of autonomy. (Rabasa, Chalk etc. 2006/a 63-68.)

The decision-making process is also affected by the internal organizational attributes of the group and the psychological characteristics of its members.

These are probably even harder to define than the psychological and sociological characteristics of terrorism.

Nevertheless, we cannot neglect the evaluation of the psychological background of the decision-making scheme of terrorist attacks since it helps us to understand the attitude of the leaders towards the risks pertaining to their decisions. (McCormick, 2003. 473–507)

Regarding the decision-making process from this point of view the priority is not the safety of the members of the terrorist group, but rather the successful execution of the attack.

According to Bruce Hoffman, the key to the success of the attacks and the survivability of the organization lies not only on the qualifications and technical competencies, but also depends on the intelligence of the leaders.

To support his theory, he mentions how accurately had Osama bin Laden planned the suicide attacks against the U.S. Embassy in Kenya and Tanzania in 1998. (Hoffman, 2006)

The term intelligence in this sense refers mostly to the organizational and systematic skills of the leaders and the planners.

It means they should be able to identify the vulnerability of the selected target, to find the risks and to harmonize the projected goal with the location of the attack, the security environment and other circumstances.

Timing is also a key issue concerning the planning and organization of terrorist attacks.

Having appropriate timing, the political, social and economic effects of a terrorist attack may be multiplied.

There are two major attributes of timing: choosing the time of the day for the attack, and choosing the exact time of execution.

The time of the day for the attack has a symbolic meaning as well.

Timing has additional meaning, because it reflects on other events that a terrorist group might took as a reference, whether they want to react on events supporting their ideology or affecting their operation.

In this regard terrorist groups may consider the following aspects by timing:

- public, religious or community holidays and celebrations;
- election campaigns;
- community, political, cultural and sports events;
- anniversaries;
- reaction to measures taken against the terrorist group, such as the death or arrest of its leaders and members;
- diplomatic events, summits, visits of heads of state or government leaders.

From the above list I would like to elaborate details from the effects of terrorist attacks during election campaigns.

Two relevant examples have to be mentioned here: the series of terrorist attacks committed by PIRA in London in 1992 and the suicide bombings in Madrid on 11 March 2004.

The period of election campaigns have high sensitivity in the democratic countries from a political point of view.

There are several examples of terrorist groups intensifying their activities before the elections.

During the general election campaign period in the beginning of 1992, more than 15 bombings were committed by PIRA in the City, the financial central of London.

The aim of these terrorist attacks was to make political discourse revolve around the Northern Irish question. (Coaffee, 2009. 100)

There is certainly no coincidence either that the series of terrorist attacks in Madrid on 11 March 2004 were committed during the last phase of the parliamentary election campaign.

The repercussions of this one were far more serious than the several-month-long series of PIRA bombings.

Rather than focusing on the anniversary, the timing reflected the importance of the aforementioned parliamentary election campaign.

The attacks were executed on a Thursday, only a few days before the parliamentary elections scheduled for Sunday 14 March. José María Aznar, prime minister since 1996 was aiming to win the elections and to form a government for the third time.

Political analysts said he had high chance to succeed his aim and this was also supported by the poll results.

Yet the election was won by the Spanish Socialist Workers Party led by José Luis Rodríguez Zapatero.

The fact that after the terrorist attack the socialist prime minister candidate promised to withdraw the Spanish soldiers stationing in Iraq with immediate effect played an evident role in his victory.

The promise of the socialist politician also indicated that he did not wish to follow the most important political direction of Aznar, i.e. supporting the anti-terrorism war of the United States unconditionally. (Moreno, 2004. 10.)

There is no empirical evidence or conclusion drawn from other surveys supporting the theory that the series of terrorist attacks had a decisive influence on the outcome.

It is not possible to repeat a parliamentary election under different circumstances.

It is also a fact that if the internal affairs of a country are defined by the competition between the two main political sides, a terrorist attack during the last phase of the election campaign may have a strong influence on the outcome. (Moreno, 2004. 100.)

The exact time of the attack within the chosen period may depend on several factors.

If the main target is a person, the wisest course of action is to attack where security is the weakest, such as on the way from home to work or at a public event etc.

If the target is an institution, a community or an infrastructure system, the timing depends on the type of the target, the opening hours and other business and service aspects.

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MASTER – EXTREME RISK MANAGEMENT TOOL IN AVIATION SECURITY SYSTEMS

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Abstract: *The research is focused on the conception, design and test of a decision-making tool necessary for going through the whole decision process which is specific for aviation security systems, integrating the results of risk assessments and providing the main action course through a graphical user interface. MASTER enables the collection, analysis and display of the level of risk and vulnerable areas based on a created mechanism linking Excel and Matlab components, both in the preventive phase (simulated scenarios decision) and in the response phase (which provides efficient investment solutions).*

Keywords: *risk index, aviation security, graphical user interface*

1. INTRODUCTION

The aviation industry is at the center of national and international transport system, with a significant role in the economic development globally. Aviation security has thus become a priority at the local - national and regional – global level.

Reducing the vulnerability of critical infrastructure of the aviation regarding security risks materializes through significant spending from the authorities. The last two decades have witnessed an increasing trend in the number of passengers and freight volumes. Security requirements have also increased, especially after the attacks of 9/11, and also the security costs (between 1.5 and 2.5 billion for aviation security community sector) (CSES, 2011).

The events of 11 September 2001 led to the identification of serious security problems in the critical infrastructure: limited capacity to discover the sources of risk, the existence of outdated and incomplete database, limited skills of security personnel, limited and inadequate action procedures, response coordination and control in situations of extreme events.

Existing blockages in current research in security risk management of extreme events area caused by extreme events refers to: the crisis approximation knowledge in organizations with different profiles, improving real-time access to information and knowledge in order to save lives, the lack of systems decision support at the strategic, tactical and operational level, the lack of consistent databases which can provide a comparison (generally held by the central authorities and the private and public beneficiaries, very difficult to transmit, not enough correlation between information and risk reduction measures); there are no dynamic set of relevant indicators (eg. risk maps that highlight the dynamic probability of extreme events) there are no security investment strategies based on cost-benefit, cost-risk or real options analysis.

Due to the analysis of the current state of knowledge in the field and the existing blockages, the need for a decision-making tool for the substantiation of extreme risk events in aviation security systems highlighted (SSA), an adaptable, flexible, modular, scalable decision tool, which can be applied both in the preventive phase (by simulated decision scenarios) and in the response (by improving security investments).

The complexity and dynamics of the problem requires urgent involvement of government and policy makers in order to find effective solutions to minimize the potential impact of extreme events on infrastructure associated aircraft systems. Proactive approach to understanding the threats, vulnerabilities and mitigating the consequences provides both prerequisites for effective decision making and direction for future standardization of extreme event risk analysis in both public and private critical infrastructure.

Treatment models of complex socio-technical systems such as aviation ones must take into account the following aspects: quick response by integrating all subsystems of intelligent network management, distributed knowledge organization in order to optimize resources, operation capacity in heterogeneous environments (specific systems knowledge management) interoperability (effective synergistic operation, translation or other communication solutions) open and dynamic structure, effective and rapid cooperation, human-machine integration, agility (adaptability to rapid and unexpected changes in the environment), the ability to quickly reconfigure and to interact with heterogeneous partners (the ability to use additional resources without disturbing the organizational interdependencies and established operating rules) acceptable error tolerance.

2. COMPOSITE INDEX OF SECURITY RISK

The risk of extreme events is regarded as an asymmetric function by the nature of the threat (A), vulnerabilities (V) of an attack and the consequences (C) associated to a possible attack scenario (Willis et al., 2005).

The threat can be defined as the intention to produce a negative change (loss, damage, failure) on the state of a system (Haimes and Horowitz, 2004). The study of the purpose of the threat must be done in specific terms (objectives, types of attack time), the probability can be used as a measure of the risk of an attack.

This threat could be measured as the probability of an attack on a particular target in a particular manner and in a fixed period of time. This probability refers only to the terrorist threat to one type of attack on a specific target, leading to the need for a full description of the typology of attacks combination (hijacking, bomb, cyber) with a limited number of possible targets in a geographic area. The threat is not an accidental or unpredictable phenomenon, however this manifestation is unpredictable and difficult to control. Threat assessment output is input for vulnerability assessment.

Vulnerability defines the degree of (in) capacity of the system to respond at some point to a manifested threat (Smith et al, 2009). In risk analysis, vulnerability is assessed using known or perceived probability of the existence of a breach in the security or malfunctions which may occur in the analyzed target for a certain period of time, under an attack scenario. At some point of time, a system can present a high level of vulnerability to a specific threat, but also some potential for adaptation caused by dynamic ability to respond to new types of threats (Brooks, 2003).

Although belonging to different media organization (the threat - the external environment, the vulnerability - internal environment), there is a link between the two parameters of risk: vulnerability is highlighted against the background of the threat (initiating a successful attack).

The result is a variable defined in terms of severity of the potential impact. In the risk analysis, the result is represented on a scale of severity associated with an event or scenario. To measure the consequence of a successful terrorist attack it is necessary to quantify the expected damage (fatalities/injuries, property damage), without claiming to develop a comprehensive list.

The risk of terrorism can be considered as the expected result for an existing threat on a target based on the method of attack and the type of damage. Asymmetry complicates the understanding of the mechanisms and processes, especially in the context of "technological convergence" described above.

Risk score, expressed in terms of threat - vulnerability - consequences, becomes important for the evaluated organization/ aviation system in relation to the conditions of the level of risk tolerance. This level is then calculated to ensure a balance between costs and benefits.

Each cell of the risk matrix is a combination of the probability of the threat scores (p_a), the probability of vulnerability (p_v) and therefore (a_c), reflected by a single risk score determined as the weighted product of three factors Composite Indicator of Security Risk (ICRS):

$$ICRS = p_a \times p_v \times a_c \quad (1)$$

Risk assessment involves comparing estimated risk levels with defined risk criteria in order to determine the significance of the risks and decide on future actions.

Extreme risk assessment methodology (ERAM) aims primarily to support the decision making, including at a political and economic level, to continuously improve the safety of the air transport system, under the accelerated development in recent decades and its backdrop of increased terrorist events of extreme nature (Cioacă and Boscoianu, 2013).

Consultation of human experts is essential in the study of the problems based on measurable data associated with complex socio-technical systems (eg. model selection analysis, interpretation of results). Quantification represents by no means certainty, but the adequate capture of the dynamics of processes that allows understanding of the highly asymmetric risk assessment in aviation.

Qualitative approach has the advantage of determining risks prioritization without requiring quantitative determination of the frequency and impact of threats to the organization.

If in utility theory, decision weights and the probabilities are the same, in the case of chances estimation theory, probability changes have less effect on decision weights. The similarity is that the weights depend only on the probability decision-making in both theories (Kahneman, 2012).

Because events with low probability of occurrence are overweight when they are described in terms of relative frequency than when formulated in terms of probability (Kahneman, 2012), threat assessment process should take into account this trend. In order to rank the consequences of risk and the association quantitative assessment of risk the following parameters are considered: the degree of destruction of infrastructure and the number of casualties (Dillon et al., 2009).

3. DESIGNING MASTER

MASTER application is a tool developed based on extreme risk assessment methodology, that can be successfully used in the foundation of decision making process by providing results in order to prevent the risks associated with extreme events. Any analysis of threats, vulnerabilities and consequences, with available resources, anticipation serves to anticipate extreme risk situations that may be faced at some point by an organization and to increase the resilience by identifying vulnerabilities and providing investment solutions to reduce thereof.

The main results that can be obtained with MASTER application are: the possibility of design risk scenarios, risk profiling, representation and update the risk map (Figure 1). The application is implemented in a graphical user interface (GUI) using Matlab (R2008b) and carried out on the basis of the methodology described in the risk assessment very (Cioacă and Boşcoianu, 2013).

The GUI design took into account the fact that in most cases the beneficiaries (decision makers) do not have advanced knowledge of computer use. Thus, to solve problems related to communication between the user and the system, but also for improving users ability to use and benefit from the support (Druzdel and Flynn, 2002), resulted in a intuitive and easy to use interface, with personalization and improvement possibilities.

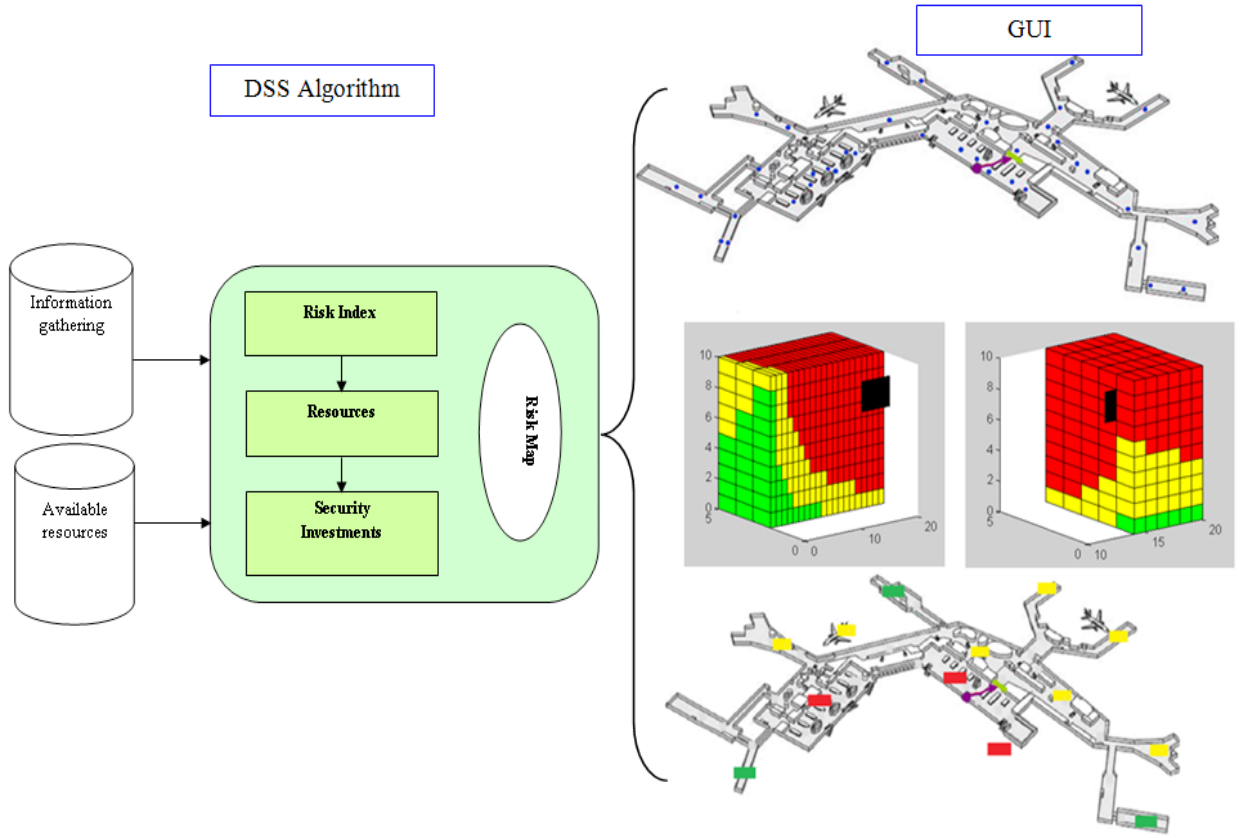

Fig. 1 The architecture of decision support system

The main menu is divided into two parts: the configuration section of the input data (1) and the results section (2) (Figure 2).

The application contains a number of four steps, as follows:

selecting infrastructure element under evaluation, selection risk scenario, assessing risk parameters, displaying the results.

In order to cover the first two stages is required that the user selects from a list of predefined evaluated elements (3).

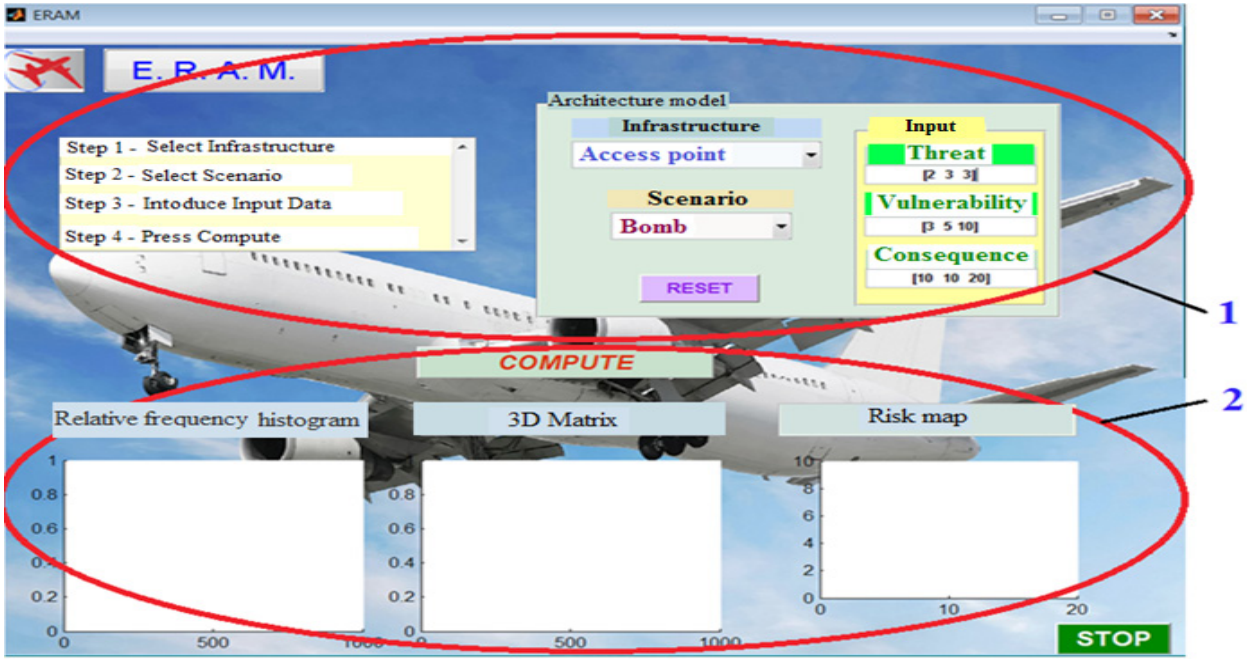

Fig. 2 The main menu of users interface

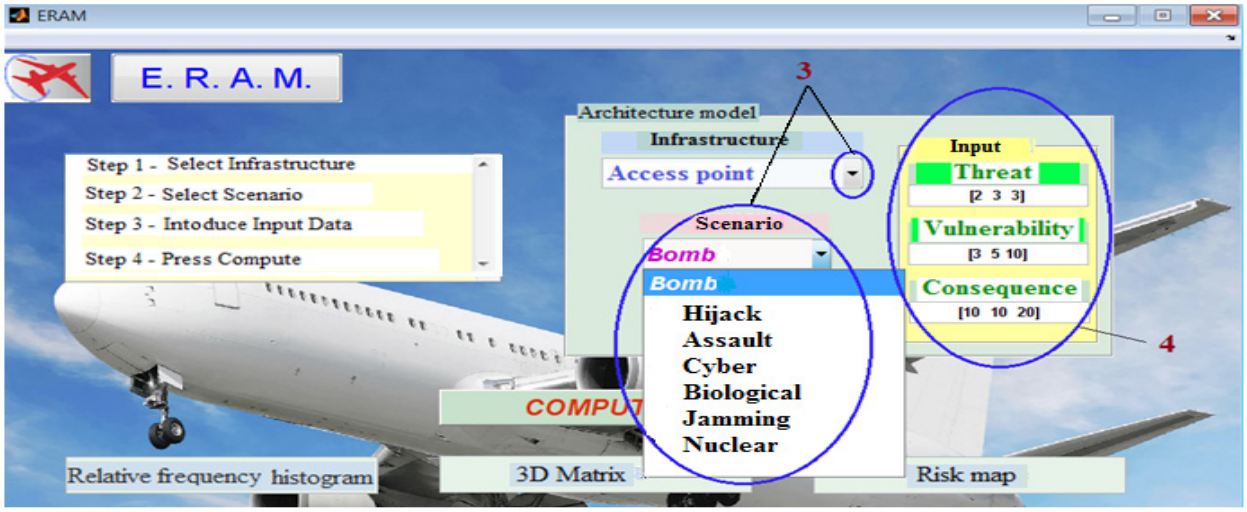

Fig. 3 Stages 2 and 3 of application

The necessary data for step 3 are obtained in real time from the members of the evaluation team, according to the algorithm described in section 4.3 (4) (Figure 3).

Once the input data is entered by pressing the Compile button, the application generates results in three graphs: relative frequency histogram (5) 3D matrix of risk (6) and updated risk map (7) (Figure 4).

Cumulative relative frequency distribution (5) provides decision makers the opportunity to read in terms of probability the risk level composite index.

Positioning the index associated with a scenario and risk facilities on three-dimensional matrix (6) in the red zone because of the potential consequences and vulnerability, it must be interpreted as adopting those measures that allow the option of moving this scenario out of the red zone.

Being an unacceptable risk, the risk map associated scenario (eg. bomb attack on the gateway) is updated (Figure 5).

MASTER application of extreme risk management is installed on a desktop computer at the organization, entering the responsibility of a system administrator, who is part of the security department.

The station becomes the main avenue of the application, while the data storage is the base of future evaluation.

At the request of policy makers (members of the committee cell crisis) risk analysis of terrorism or the emergence of new information about the threat (provided by specialized structure information), the system administrator uses the application to produce a temporary database that together with other data (eg. plan airport security procedures, positioning systems security) developed during the pre-assessment, are sent via intranet to the evaluation team members.

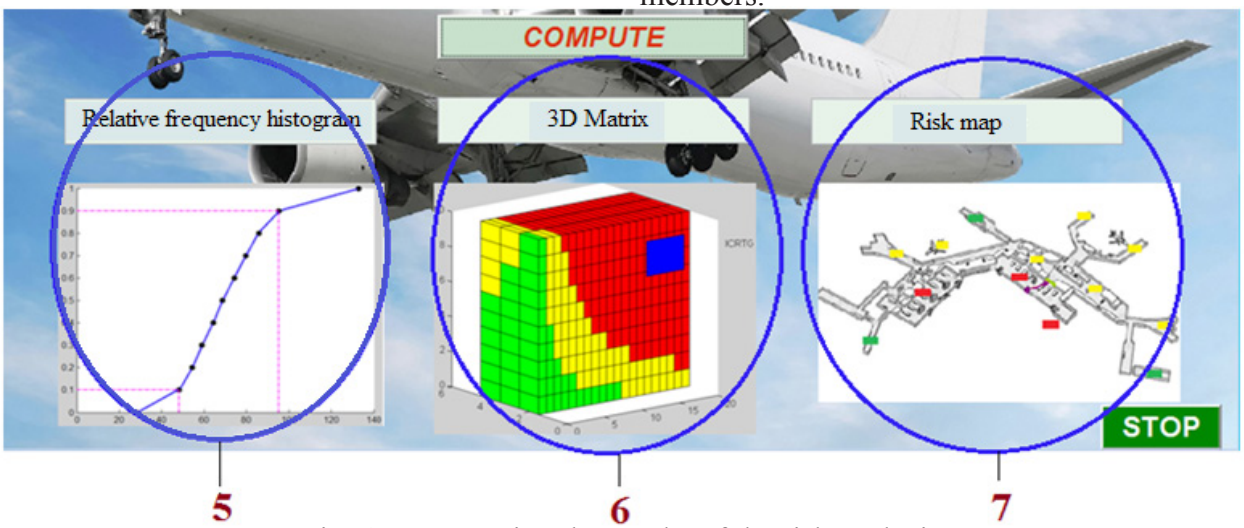

Fig. 4 Representing the results of the risk analysis

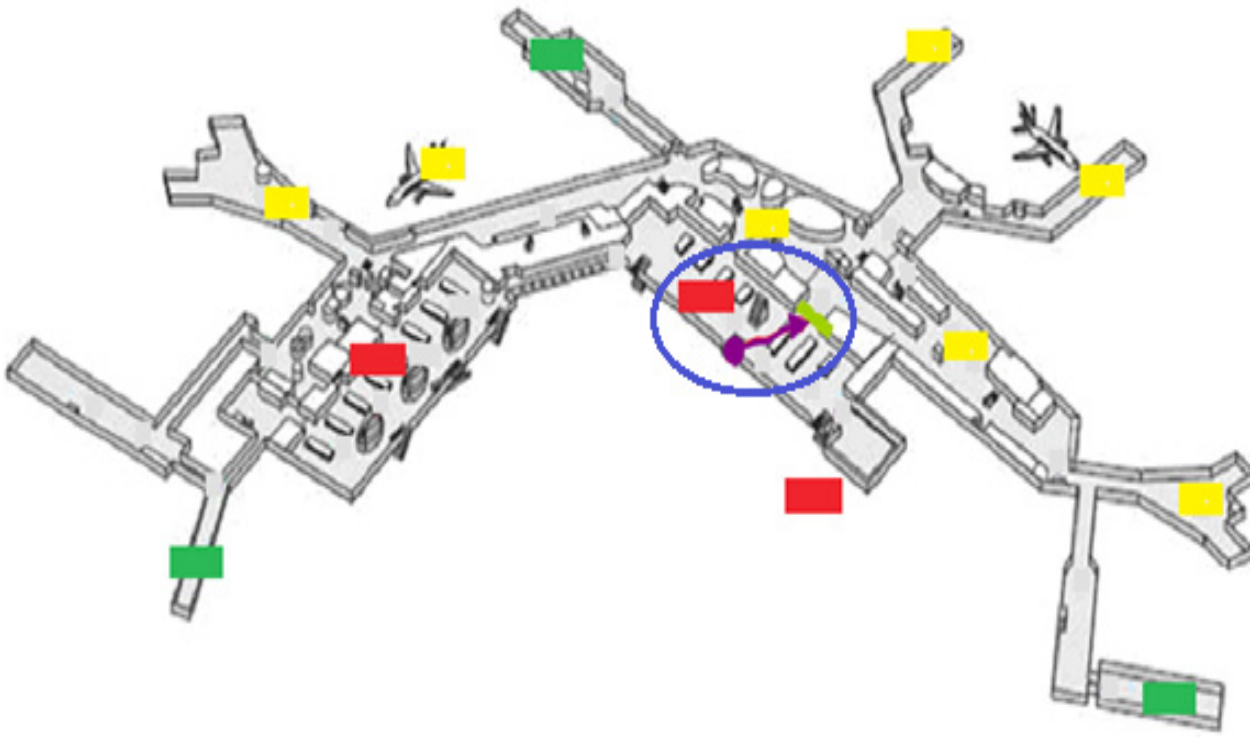

Fig. 5 Updating the risk map for the bomb attack at the gateway scenario

Evaluators who are equipped with tablets or laptop, perform the analysis of the new information and record the results in one database, which is transmitted to the system administrator.

The administrator then loads it into the program and transmits the data to the security manager for print and analysis.

After initiating the request for data, access to database risk assessment becomes limited only to those users who have permission to access the database granted by the system administrator.

Also, data can be viewed by all authorized users and data changes can be made only by those who have been granted permission.

All information flow takes place through a secure intranet.

Security risk analysis in aircraft systems by applying the MASTER instrument provides the following benefits: identifying and assessing security risks extreme risk prioritization based on the composite index of terrorist risk, risk map building based on hierarchical levels, the possibility of evaluating multiple attack scenarios,

achieving a database of quantitative and qualitative risk assessments required for further statistical data, uniform treatment of terrorism risk in the critical infrastructure of Romania, integrating information collected from multiple sources into a coherent, efficient connection (information packages restricted network secure intranet) with other information systems.

4. CONCLUSIONS

Assessing the risk level is a key issue of assessment methods. Risk levels classification is the first step in establishing security objectives and security measures that an organization decides to adopt.

These measures are complemented by implementing measures such as technical improvements, implement new features, adapting work procedures and establish staff training programs, all aimed at reducing the level of risk to an acceptable level.

Contributions to tackling decisions under uncertainty for managing extreme risk events are essential in practice because, in the context of technological progress (especially in the field of Communications and Information), the management of these events remains quite inefficient.

In addition, it still lacks a systematic problem-solving of the decisional support at a strategic, tactical or operational level.

MASTER application complements the proposed risk assessment methodology, providing a particularly useful tool for policy makers, efficient and easy to use, with personalization and improvement.

This is the answer to the current requirement of end users to effectively exploit a modular platform, flexible, adaptable and scalable by security managers situated on different levels, including policy makers, central and local authorities in the field.

Through the design and architecture of the instrument's structure an effective technology transfer and a significantly impact on users can be obtained.

The proposed solution enables the rapid improvement of databases in order to reduce the search area track parameters for achieving security.

Inter-connection of input data transfer and exchange of data and displaying the results are controlled by a special sub-operating system (acting as data management, exchange of information between modules and interaction between users).

Flexibility of the system is independent from the further development of subsystems/ security procedures. Dialogue with the user can be done automatically (slideshow maker relevant information in relation to the original data) and interactive (change data and parameters).

The main result is the conception, design and realization of a decision-making tool used to manage extreme risk events.

Decision support is offered at different levels for: data acquisition and processing; analysis and prediction of the risk situation (spatial and temporal distribution) based on modeling and simulation; ranking sets of counter-measures, determining the feasibility and quantify the advantages/ disadvantages; assessing and prioritizing security investment strategies.

MASTER can be used as a decision tool by the national airspace security authorities (Air Force Staff, Ministry of Transport, Ministry of Interior, the Romanian Intelligence Service) aviation security (Aviation Security and Facilities Directorate, ROMATSA administrators airports, airline operators) and air traffic management (Autonomous Civil Aviation Authority, Air Force Staff) in the process of asymmetric extreme crisis management. The application also can be used for educational purposes, proving good information support for research on security and safety in aviation.

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CASE STUDY: MILITARY ASPECTS OF MANAGEMENT

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Abstract: : *The comprehension of the concept of democracy consists of being generally able to give a correct answer to the following questions:"- What construes manipulation?","- What construes power?", "- What construes an abuse, be it only verbal?", "- What is a victim?". In this paper I tried to unfold the specifics of military management, starting from all that it should not turn into: manipulation, power, abuse and victim.*

Keywords: *management, leadership, charisma, leader, authenticity*

Depending on its relation to the free will of the fellow beings, there are two types of man-specific power:

1. Dominating power,
2. Personal power.

1. PERSONAL POWER VERSUS DOMINATING POWER

The personal power creates healthy inter human relationships of mutuality and cooperation. This type of power is bestowed upon charismatic, confident, highly motivated individuals, (who are adaptable, ambitious, full of initiative and optimistic).

Scientific management may only be applied by persons who hold real personal power as the only way of transforming the science of management into the art of leading the activity of any corporation to excellence, a fact demonstrated by the reality of our days.

The dominating power creates empirical management by applying manipulation techniques in abusive relationships where the verbal aggressor and its victim appear to live in different worlds, both incapable of accepting the other's world. The dominating power generates confusion and lies beneath all cultural limitations and the empirical management through actions such as:

- The aggressor, (as leader practicing the empirical management), denies the abuse he perpetrates over his subordinates;
- Verbal abuse, (consisting in pathological projective, defensive or paradoxical communication), is often perpetrated behind closed doors;
- The stake of the corporate communication is the abuse itself by bringing the subordinates into submission, using the control over them as a purpose in itself, aiming at the abolition of the man/professional's free will by the very hand of the authority figures.

How can we identify and diagnose, without being mistaken, the management abuse in a contemporary corporation?

When, in the life of a corporation we are confronted with the practice of empirical management, we are affected at least by one of the following situations:

1. The authority figures (managers) are irritated/agitated most of the time, even when their subordinates have done nothing to upset them or to provoke their rage. The subordinate victims are always taken by surprise by the inexplicable rage of the superiors and if they had the courage to ask them what causes such treatment, the manipulative managers would either not admit their own attitude or claim to behave that way because of the person asking the question.
2. Machiavellian managers refuse dialogues on matters that frustrate/ dissatisfy their subordinates.

3. The employees in subordination of the practitioners of empirical management often become insecure in their relationship with the authority figures due to the fact that the intentions of their manipulative superiors are systematically veiled by Machiavellian techniques.
4. Employees become inactive and cease to have personal opinions and much less work initiatives because they fear what the Machiavellian superior might think and of what they would have to hear from their aggressor, (the inappropriate authority figure, and practitioner of the empirical management).
5. Employees become vaguely aware of the deadlock their facing as they ask themselves what the matter is with them. "I should not be feeling this bad", they would tell themselves in a haze.
6. Practitioners of the empirical management create a work climate that completely lacks transparency and continuously misinforms by omission, the only goal of the Machiavellian superiors being to bring their employees into submission by withholding information on strategic/ tactical/ operational plans of the corporation, even if it means to block the corporation's activity, believing that "knowledge is power" and they ought to keep it to themselves.
7. The manipulative superiors will apply contradiction to any of their subordinates, automatically supporting the opposite of whatever the interlocutor's view is, without any connection with the reasoning behind the scientific truth; they communicate defensively, abruptly, artificially, ostentatiously, lacking any concern towards the subordinate in question; they claim the subordinate has a wrong way of thinking and contest any professional experience and any scientifically proven truth, thus confiscating the right to accurate thought process and claiming it as their own because they are the "boss", even more so if the subordinate happens to be the real professional.
8. The employees of the corporation start to wonder whether their Machiavellian superiors still see them as people with individual personalities.
9. The manipulative superiors practice pathological defensive/projective/ paradoxical communication, either by denying the existence of problems at the work place or by a momentary display of rage, to serve as a diversion and to avoid the dialogue with the subordinates, colleagues and even their superiors at all costs, and to pursue the domination and apprehend the formal authority within the corporation.

All 9 situations are forms of manifestation, sadly possible to encounter in corporations where empirical management is practiced, with severe consequences on the chances of survival of any form of institution in a competitive international environment of our days. We find that verbal abuse practiced in the empirical management may be:

- outright, (open),
- dissimulated (veiled).

When the verbal abuse is outright, it may take the form of a rage outbreak towards the victim, or the form of an attack, accusing the victim of "being too sensitive".

The dissimulated verbal abuse is much more destructive for the victim because of its indirect nature, as it operates as a veiled attack in the form of a constraint, a form of interpersonal interaction, as a result of refraining from a more intense form of aggression, using Machiavellian techniques to severely reduce the attacked/ abused person's ability to identify and cope with the interpersonal reality.

The employee in subordination of the Machiavellian superior will receive illegitimate orders, without confronting anything concrete, yet having to trust himself and his life experience and no matter how painful it may be, he must admit/acknowledge that the man who represents the authority in the corporation, his own superior, acts like an aggressor and deceives, uses, disrespects and undervalues him.

2. WHAT IS TO BE DONE?

Identifying verbal abuse, (materialized in empirism / Machiavellianism /manipulation in the management of a corporation) falls under the victim's attributions because the manipulative aggressor is not motivated to change.

The employee may find it difficult to identify the abuse itself because he is affected by the manipulator's techniques that make him doubt his judgment. If a subordinate were to feel offended and voice his feelings and say to the Machiavellian superior who verbally aggressed him something like: "- I felt bad when you said that.", his aggressor would not give him a proper answer or show any understanding, but would rather dismiss his victim's feelings, labeling them as unjustified, replying something like: "- I don't know what you're talking about. You're too impressionable." The victim will then doubt his own perception and the reason for that is that, since birth, we have all been taught to ignore our feelings, something that is deeply wrong towards ourselves.

The criteria for determining whether something is bad/uncertain are our very emotions/feelings, (detected through senses – sight, hearing, smell, touch, taste and instinct).

Only after having identified/validated one's own emotions, will one be able to stop any abuse by answering something like:

- "I feel offended."
- "I feel minimized."
- "I feel unappreciated."
- "I feel ignored."
- "I feel disregarded."

Verbal abuse is eradicated when the victim realizes that sharing his emotions/feelings with the aggressor is most certain to result in their denial by the latter.

That is when the victim of the manipulation will free himself and come to understand that "the impression of the truth is possible to be perceived not through someone else's eyes but through his own", (Bach and Dentsch, 1980).

3. CONCLUSIONS: WHAT CONSTRUED MANIPULATION/POWER/ VERBAL ABUSE/VICTIM IN THE MILITARY MANAGEMENT OF THE CORPORATION?

The manipulation in the military management of the corporation consisted in using another person, subordinate /superior/ colleague, to humiliate, offend, lie to/ misinform (even by omission), to block and determine to fail, to constrain into performing illegitimate tasks.

Power in the military management of the corporation is the skill/talent of the employee/ manager/colleague, used depending on their personal conscience/ethics in ways that are constructive/destructive for the fellow workers, or for the corporation/society.

Abuse in the military management of the corporation is the use of one's own freedom (responsibility), to the detriment of the freedom of other individuals, violating/forfeiting the following rights that ought to be acknowledged as rightful for every human being:

1. The right to information, "every person must know exactly what is expected of them and what their obligations within the company are" ;
2. The right to a fair and impartial treatment, "every person must know their own professional standards and must be correctly assessed, compliant with the criteria that measure the professional performance at the work place, equally applied to all employees of the same occupation" ;
3. The right to work according to one's own ability, "every person must perform the job that best represents the specific abilities and skills assimilated based on a real talent in their field of work" ;
4. The right to a fair reward for their work, "every person must be paid according to their contribution to the work place, to society" ;
5. The right to display one's competence and skills, "every person has the right to not be obstructed in the performance of their professional activities and to benefit from equal opportunities at work, or in their profession/corporation/life" ;
6. The right to professional opportunities, "every person has equal opportunities for professional development and career advancement" ;
7. The right to appreciative feedback, every person has the right to be appreciated when achieving performance at work".

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:

- 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;
- 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.

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ANALYSIS OF THE ROMANIAN AIR FORCE SQUADRON ORGANIZATIONAL CULTURE

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***Abstract**: The current article aims at analyzing some of the methods by which the organizational culture of the aviation squadron manages to focus mainly on people and relationships they establish, which builds a particular universe, surrounded by magnetism and sustained by the feeling of belonging to a special group, of collaboration and open communication. The main features of the squadron culture constitute the foundation of this universe, whereas the standard specifications, rules, beliefs and strategies utilized for achieving goals are followed willingly, with responsibility, and not imposed compulsorily.*

***Keywords**: squadron, symbol, patch, behavior*

1. KNOW-HOW. ACQUISITION. CONFIDENCE

Know-how represents the whole body of information and skills that a person uses in solving problems. It is based on facts and data, but, unlike such issues, know-how involves people and it has two dimensions: individual and collective.

The individual dimension consists of the personal memory, experience, talent and abilities that each of the pilots of the squadron acquires during his instruction, training and progress.

This dimension materializes by professional meetings, mandatory controls in flight and annual exams (for maintaining/obtaining the flight license, physical).

The collective dimension is related to the integration of individual knowledge and the creation of relationship networks between members; the rules, standards and values shared by these members are more important in terms of organizational culture.

The squadron facilitates a knowledge-based environment, in which the item of information needed for the on-going activity can be accessed by every member without restriction.

Pilots share their every day work experience during the debrief meetings as well as throughout the spare time they spend together.

The modern techniques of spreading information (computer, storage and recording media, internet) constitute the foundation for the personnel's training; nevertheless, stories, informal gatherings, or even the visual observation of others' work (ground observation of the aircraft evolution until it gets on final) have a considerable share for the progress in flight technique.

The human factor cannot be excluded either, since it holds great importance; the more experienced pilots have the moral obligation to assist the less experienced ones with using the modern technology.

The squadron's youngest members, despite their detaining fresh theoretical knowledge upon graduation, are helped with the aircraft operation by the ones with experience and so, they can easily overcome possible troublesome situations.

Informing and direct communication are important and the most important parts of the entire activity within the squadron. Throughout debriefing, following the flight mission, malfunctions are identified, both success and failures are being shared among the members of the squadron, and optimal solutions for the accomplishment of future missions are being looked for. Any emergency situation that occurs in flight is immediately communicated, even if it didn't affect the mission to a great extent.

Further checks will attempt to identify the insecurity-generating factors that might impact upon the flight performance.

Accordingly, most of the flight shortcomings have turned into lessons learned for every pilot and such events have been analyzed and debated on, in order to avoid air catastrophes:

- during a flight aboard an *IAK-52,* the pilot experienced the obstruction of an one-way clack valve, malfunction which did not appear in the exploitation standards, therefore the squadron personnel identified, evaluated and solved the problem, which afterwards became specific situation mentioned in the Flight Manual;

- during a certain flight period aboard an *IAR-99 Hawk*, there were recordings related to certain "GPS blanks" and to a lack of signal on the board avionics. While executing the missions, the pilots paid attention to the variation of signals, observed them and reported them, so that further flight activity was planned in such a way that it did not overlap with the mentioned "blanks".

The squadron commander manifests his faith in the other pilots by planning their solo flights or double-command flights against complex scenarios.

At the same time, his delegation of authority and responsibilities is a proof of trust offered to the followers: the drawing of the flight plan is the job of the second in command, the flight instructors are responsible with the theoretical learning of new flight exercises, the flight leaders check the training of the pilots etc.

By the fact that no one questions the commander's decisions, but obey them, because "he knows what he is doing", and by everyone's inquiries related to the correctness of the accomplished work, one can notice the faith shown by pilots in their squadron leader.

2. COMPONENTS SPECIFIC TO THE SQUADRON ORGANIZATIONAL CULTURE

My personal experience gained throughout the activities performed within a squadron and my collaboration with members of other similar organizations helped me to identify the essential elements of the organizational culture, which can be divided into intrinsic components, psychological (virtues, beliefs, assumptions – "who and what we are"; "what we consider to be important") and extrinsic components, attitudes (standards, rituals, symbols "how we interact with the things around us").

Myths and symbols are "the facts" which help the newly employed pilots to get an idea about the values, standards and behavior of the other members of the organization, in order for them to adjust to this organization's demands. "Stories" tell about facts which led to certain behaviors, they tell about important people or visionary who offered a new perspective to the organization, or past achievements.

People's desire to fly, to conquer the unknown, has existed since immemorial times, and it made room for myths and legends: Pegasus, the feathered horse, Daedalus and Icarus, the first human beings who built wing of wax to evade from King Minos' maze, and even Alexander the Great, who tied four mythical birds to a basket so he could fly around his kingdom, all these attempts revealed the human being's call of the boundless and eternal sky.

Leonardo da Vinci, forefather of aviation, acknowledged: "Once one has attempted to fly, one will always walk on earth keeping one's eyes towards the sky, the place one has conquered and where one desires to return".

Living in the spirit of this profound feeling, pilots experience the witness status in front of a miracle; they could reach the space where, long ago, Romanian aviation pioneers, such as Aurel Vlaicu, Traian Vuia, Henri Coanda dared to get, through a lot of sacrifices.

Within every squadron, there are names that sound clearly in the mind of its members and which the newly come respect even if they did not meet any of them: Victor Huci, Mircea Toader, Doru Davidovici, Dorel Luca, Valer Muresan being but a few examples out of many other possibilities.

The squadron language has become its own professional jargon, characterized by slogans and mottos which hold a stimulating role in the minds of its members and which are meant to transmit the organization's philosophy, while having a deep emotional impact rather a rational one. Some sayings are generally known by all members of the Romanian air force:

- "Every pilot shows up for his first flight carrying two bags: a full one, on which LUCK is imprinted, and an empty one, named EXPERIENCE. The challenge consists of filling out the EXPERIENCE bag, as much as possible, right before the LUCK bag dries out".

- "The plane doesn't care about the chain of command/ military ranks"

Other sayings display a coded language, more laconically formulated and synthesized, which bear meaning only for the members of a certain squadron.

- "I'd rather fly one solo than ten doubles" – the solo flight being much more important than the one with double command.

- "Aviation is like loving a lion" - it is hard work and involves training with short but intense satisfaction.

- "If your flight resulted in a good debrief, you'd better stop flying or you'll spoil the briefing".

Nicknames, representative for every pilot, are part of the informal register used in direct communication. They are known and used by the squadron members, thus contributing to building a stronger bound among them: Soacra, Neica, Chioru (QXU), Ciff, Tatoo, Talpa, Kapra, Papadie, Cap Mare, etc.

Traditions, rites and customs highlight the important ideas and events of the squadron life.

The events carrying a deep emotional load are celebrated through air shows, each year: The Aviation Day (20th of July), the Romanian aviation pioneer, Aurel Vlaicu's day (13th of September), "n" years since the first jet flight in Romania etc.

The most wanted moment, charged with strong positive emotion, in the evolution of a young pilot is his or her first solo flight, when he or she has the chance to prove that he/she can and is worthy joining the cast.

Connected to this moment is the "baptism" ritual where the pilot is downed and covered with thorns, symbol of the work and sacrifice the aviation asks for.

A special ritual, specific to a certain air combat squadron, occurs every full moon night, when the pilots meet at the Roman Castrum, Potaissa.

One long tolling officially opens the meeting and from that moment all the members obey the rules of the Chronicle, in whose pages a sort of minute of the meeting is recorded, together with lessons learned, personal experiences and sayings.

During this ritual the "Numbskull of the month" is distinguished (the one who had made the most flight mistakes throughout that month), there are stories told, experience shared, so that any barriers between members are destroyed within this informal gathering which comes to strengthen the relationships among crew members. The Chronicle reminded earlier creates a bound between the squadron pilots, it being the fundamental element of an initiation ritual.

Each new member is granted a page in the Chronicle, which he will later on personalize with his own thoughts, verses, sketches, the only condition being that the page should not be removed from the Chronicle.

With the passage of time, other events became traditions, among which we could remind of the annual reunion of the members who left the organization, the instructors' celebration of their first student-pilot who executed a solo flight, or the parties at the end of the flight period where new connections are being established, memories are shared and everyone "talks aviation".

The favorable atmosphere for flight and work is influenced by the architecture of the surroundings, the comfort of the rooms where the pilots are trained, the places where they recover or rest.

The rooms' decoration offers the sentiment of affiliation with all the diplomas, plates, scenes and patches displayed on walls, which brings back memories of the important moments that happened, of the people who are no longer members of the squadron.

All these elements confer a psychological comfort, the sentiment of security and brotherhood.

The social-moral climate is built on collaboration, direct communication, trust and friendship. Personal development is metaphorically compared with an "acorn" which grows due to the fluids extracted from the "soil" of the structure: "be there and do not deny what the structure teaches you", because "even if we are distinct individuals, a great part of our experience is molded by the others" (a reflection written in the pages of the Chronicle).

The logo, the flag, the patch and different emblems epitomize for the squadron, enrich its cultural heritage, render the symbols which need to be respected and transmit in a secret way, the essence of the organization's existence, synthesized in distinctive logos.

The emblem of the IAK-52 Training School Squadron symbolizes the hard work involved in the instruction of the student pilots. The foundation of the emblem is the phrase "Pull-Push" because every student, in his initiation phase, is working against the instructor with abrupt and bullied movements.

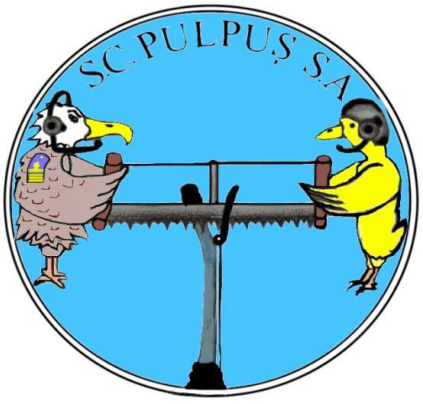

Fig. 1 IAK-52 Training School Squadron's emblem

The 71st Air Base's logo, represented by seven towers on blue background – Transilvania stronghold, suggests the protection of the air space which the flotilla provides for the entire region, their activity being carried under the protection of God Himself - "Nothing without God".

Fig. 2 The 71st Air Base's logo

A patch, suggestive for the idea of membership and for what the group with its own values and beliefs means, is illustrated in picture 3, emblem of the 712th Air Fighter Squadron.

Inspired by the Dacian wolf, symbol of power, strength, confidence, vigilance and affection, the logo stands for the bridge between work and collaboration.

The idea of success obtained as a result of teamwork is found in the motto "Vis Lupi Est Grex"- "The strength of the wolf lies with the pack".

Fig. 3 712th Air Fighter Squadron's emblem

The system of values and code of conduct are reflected by the organization structure, the strategies need to be followed, the rules and the procedures showing what is allowed and what is forbidden must be obeyed.

Many of these rules are known by the squadron members as unwritten laws: in case of the students performing their practical training, it is expected that they stay at the airfield until the end of the flight, even if their activity is over for that day, because an accurate landing should be learned and observed next to others; in a squadron, its representative patch can be worn with "full rights", only after a first solo flight in the current squadron is achieved etc.

Knowledge of the organizational culture is imperative and useful because, on the long term, it is the most effective anticipatory element of an organization and, at the same time, the understanding of collective behavior is essential under the permanent adjustment to changes, given the aspirations of the organization members.

The knowledge of the organizational culture can be difficult for a person due to the concept that the organizational culture stands for an universe of convictions, virtues and beliefs which are offered once and for good, and which are hardly declared or questioned.

3. CONCLUSIONS

In conclusion, we can highlight some defining features of the organizational culture of the squadron:

- philosophy, ideology, virtues, beliefs, responsibilities, hopes, feelings and the mainstreams shared by the members of the organization, amplify their initiative, motivation, competitive behavior and idea of team-work, things necessary for achieving success;
- the squadron sustains communication, information, and trust so that any shared error becomes a learned lesson for all the members of the squadron and they may realize that even the most experienced pilots or technicians can make mistakes;
- the conditions of the workplace are way above the comfort condition imputed in the past and ensure the physical and psychic well being of the personnel;
- the informal connection between the members is strengthening the collaboration and team-work, which leads to better results of accomplished missions.

The organizational culture leads to work performance and optimal achievement of tasks by strengthening the relation between members of the squadron, sharing the knowledge and experience of the individual and the crew, direct information and communication, obeying written and unwritten specifications, and the values and beliefs which nurture the inner motivation for work in every pilot.

The organizational culture needs to be known both at the mythical level, through stories, slogans, heroes and ceremonies, and as reality, conditioned by strategies, structures, systems, leading rules, standards and activities.

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AEROMEDICAL EVACUATION IN NATO LED MILITARY OPERATIONS

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Abstract: *The paper deals with issues connected with system of medical evacuation in NATO led military operations with stress on aeromedical evacuation. Firstly historical development of medical evacuation is outlined. Authors stress the fact that medical evacuation is dynamic system and every part of evacuation chain should be aware of it and adjust their decisions based on changes in operational situation. Later article deals with different aspects of medical evacuation as principles, types and priorities of medical evacuation are. At the end of article are presented the possibilities of usage unmanned aerial vehicles as an aeromedical evacuation and casualty evacuation means.*

Keywords: *medical evacuation, aeromedical evacuation, casualty evacuation, principles of medical evacuation, unmanned aerial vehicle*

1. INTRODUCTION

One of factors that significantly determine military operations is logistic support. High complexity of logistic systems and growing costs on logistic outputs increase necessity to introduce new target planning, management, control and coordination of partial components of logistics. (Šteuček, 2012:58)

One of the most important components of logistics is medical support. Effectiveness of military operation in the joint operational area is strongly influenced by medical support.

Key to success is evenly built medical support with strong, balanced system of medical evacuation. The evacuation of sick and wounded during military operations is influenced by many factors as are operational environment, weather, length and quality of medical evacuation routes and number and type of suitable medical evacuation means in time of need.

Majority of NATO member states is able to ensure robust ground medical evacuation but it is necessary to have enough aeromedevac capacities to meet timelines of medical evacuation practically in every military operation.

Aeromedical evacuation means are more and more key element to ensure medical evacuation is done in time.

Centrally coordinated multinational system of aeromedical evacuation is one of possibilities how to increase effectiveness of medical support.

Contemporary trends reveal the fact, that casualty evacuation in difficult operational environment can be realized through unmanned aerial vehicles (UAVs).

2. HISTORICAL DEVELOPMENT OF MEDICAL EVACUATION

In the history of armed conflicts were in the beginning for the movement of patients used improvised means as were branches, animal skins, some types of sledges and other different wains.

During great conflicts were gradually improved medical evacuation means. Prominent development of ground medical evacuation was done during Napoleon wars beginning by year 1795 by French surgeons Peter Frank Percy a Dominique Jean Larrey.

Napoleon based on their suggestion decided that each division will have unit for medical evacuation of 170 men, physicians and expediently created, horses pulled wains for immediate care for wounded and their transport to rear areas to quick surgical treatment. During subsequent centuries medical evacuation means became integral part of military medical system.

During Krym war and siege of Seavastopol England used evacuation with trains for the fist time. Wounded were loaded on train trucks covered with straw. Czech and Slovak army had train medical evacuation means and in the 1938 mobile units consisted of 20 permanent medical trains, 6 ambulatory medical trains and 6 improvised medical trains.

Even much sooner was medical evacuation realised by water. In the ancient war flotillas probably existed extraordinary boats for evacuation of sick and wounded.

First news about use of aeromedical evacuation emerged in the context Paris' siege in the 1970 during Franco-Prussian war. In that time were 160 casualties evacuated by balloon. French were first to use aircrafts as medical evacuation means. During military manoeuvres v 1912 aircraft equipped with carrier parts executed first flight with patient model. Later Frenchmen arranged aircraft in a way, that the case for casualties was placed under fuselage and in 1913 declared preparedness for evacuation by air.

Aeromedical evacuation was noticeably influenced by invention of helicopters and by their development. In 1928 were USA given first sample of helicopter from French and in 1933 made helicopter able to carry pilot with two patients. Helicopter construction enabled evacuation of two lying patients and one sitting patient. Great boom of this type of medical evacuation was made during wars in Korea (1950-1953) and Vietnam (1964-1975). (Humlíček, Psutka, Witt, 2006:5-6)

3. ANALYSIS OF CHOSEN ASPECTS OF MEDICAL EVACUATION

Medial evacuation is movement of sick or wounded patients under medical supervision to medical treatment facility or between medical treatment facilities as integral part of medical treatment.

System of medial evacuation must always, when it is possible ensure that patient is evacuated to medical treatment facility that is able to provide medical treatment of patients' sickness or injury.

NATO recognizes three categories of medical evacuation related to ground, sea and air operations.

Firstly it's forward medical evacuation, secondly tactical medical evacuation and finally strategic medical evacuation.

Concept of medical evacuation is closely connected with medical service activity, number of sick and wounded and with strategy of keeping combat operation area.

Strength and reliability of medical evacuation system is connected and dependent upon amount of treatment means capabilities which will be needed in the area of combat operation.

This basic principle is main reason for establishment of strong and reliable system of medical evacuation.

It's extremely important to realize that medical evacuation is dynamic process.

Medical status of patient can change and this can require subsequent change of method or priority of medical evacuation.

Forward medial evacuation can be carried out through means of medical evacuation of relevant military unit with medical unit support or medical evacuation means of medical treatment facilities of different level.

Basic principles of medical evacuation is constant ability to evacuate sick and wounded into medical treatment facility or between medical treatment facilities in whatever weather, through whatever terrain and in whatever operation environment; furthermore it is sustainable provision of medical care by well-trained medical personnel and adequate medical equipment according clinical state of patient during whole evacuation; and last but not least ability to regulate flow of patients with different injuries to the most suitable medical treatment facility and track movement of patient through evacuation chain.

To fulfil requirements for medical evacuation are required evacuation means present in the battlefield suitable for accomplishment of mission and constructed on the same technological level as unit that are supported. They can comprise ground evacuation assets (armoured or non-armoured, wheeled or tracked depending on unit they are assigned), air assets (airplanes and helicopters), sea and river assets (depending on geographical limitation of operation). Evacuation means for tactical medical evacuation are as well dependent on a mission. The most probable choice will be use of airplanes, but helicopters and ships can be at disposal depending on character of operational area and evacuation distances.

Casualty evacuation is not sort of medical evacuation because it is unplanned movement of wounded without assigned medical support, or only opportunistic movement with free medical personnel. This type of evacuation will necessarily occur but it is not decisive factor during planning of medical support of military operations a therefore have no influence on process of medical estimation.

Forward medical evacuation is movement of patient from point of injury to the first medical treatment facility and during this type of medical evacuation is necessary to meet clinical timelines in any operational circumstances.

Forward medical evacuation can be to a medical treatment facility of any Role and should be, where possible, to the most appropriate level of care within the timelines and not necessarily to the nearest medical treatment facility.

Forward medical evacuation needs to be configured to meet similar force protection levels as the forces in the area they are required to enter.

Forward medical evacuation teams should be equipped and trained to carry out appropriate pre-hospital care.

Tactical medical evacuation is evacuation of casualties within Joint Operational Area transporting patients between different medical treatment facilities with various level of care (ROLE 1, ROLE 2, ROLE 2 light manoeuvre, ROLE 2 enhanced, ROLE 3). This type of evacuation is realised after patients have been stabilized and can be conducted with ground or air assets.

Strategic medical evacuation is evacuation of patient from Joint Operational Area to the home nation or other NATO country or to a temporary out of theatre safe area. Strategic medical evacuation is national responsibility and in case of non-availability of military means, consideration should be made for the use of civilian charter airplane with adequate medical equipment.

Medical evacuation comes under certain principles, between which belongs principle, that all wounded (especially seriously wounded) must be transported to medical treatment facility of various levels of care as soon as possible; and principle that it is essential to move wounded quickly, but sparingly so that transport would cause as little health damages as possible. (Humlíček, Psutka, Witt, 2006:8)

Sick and wounded, who need evacuation must be sorted into categories based on their medical status. Great number of factors must be balanced to achieve successful evacuation of sick and wounded.

To reach optimal results, decision about evacuation of casualties should be primarily based on clinical decision.

Patients that are designated for aero medical evacuation are sorted into priorities, so urgent patients are evacuated sooner than less urgent cases. Categorization of patients according priorities is done into three groups. (Stanag 2087, 2008:5) Patients are evacuated in succession urgent (P1), priority (P2) and routine (P3).

Priority 1 is labelled urgent and consists of casualties to whom quick evacuation (to 2 hours) is essential for life, limb or function saving treatment or to prevent complication of serious illness or to avoid serious permanent disability. Priority 2 labelled priority comprise casualties, who require specialized treatment, which is not locally accessible and patients have tendency for worsening of their clinical status, if they would not be evacuated with the least possible delay (to 4 hours). Priority 3 labelled routine consist of patients, to whom treatment is locally accessible, but their prognosis would definitely benefit by aeromedical evacuation. (see table 1).

Table 1 – Timeline of medical evacuation

Category	P1	P2	P3
Forward medical evacuation	90 minutes	4 hours	24 hours
Tactical medical evacuation	12 hours	24 hours	72 hours
Strategic medical evacuation	24 hours	36 hours	7 days

3. DISCUSSION ABOUT NEW TRENDS IN MEDICAL EVACUATION

From the times of first usage of aeromedical evacuation, almost every newly developed type of airplane was tested as mean of aeromedical evacuation. Medical evacuation through helicopters is important factor of survival of wounded in contemporary military operations and the level of survival is on the highest level in military history.

This fact has contributed to bringing survival rates of U. S. Forces in Afghanistan and Iraq up to 89.9% compared to 69.7% in World War II. It appears that the next aircraft type to be used in this role may well be the UAV.

The use of Unmanned Aerial Vehicles (UAVs) in many roles is one of the fastest growing of all fields in military aviation.

Through the use of several varieties of UAVs for operational military purposes has most recently been brought to public attention as the result of their use in Afghanistan and Pakistan, there is much more development going on than most people realize.

UAVs have in recent years become even more versatile and essential assets on battlefield.

Current rapid development and fielding of UAVs provide opportunity to evaluate potential of this new type of aircraft for the transportation of casualties. (NATO STO, 2012:19)

Range of requirements for medical evacuation system is determined by defining basic rules and timelines for providing of well-balanced medical care.

The first 60 minutes after traumatic injury has been referred to in the past as the “golden hour”.

Delivering an injured casualty to an appropriate level of care within the prescribed time constraints is the goal of medical evacuation or casualty evacuation.

Current NATO medical doctrine (AJP-4.10(A), 2011:15) has modified this requirement somewhat, with so-called 10-1-2 concept, which mandates that bleeding and airway control for the most severely injured casualties must be achieved within 10 minutes of wounding; medical evacuation assets (either ground or air) should reach the seriously injured casualty with advanced skilled medical aid within 1 hour of wounding at the latest; and casualties requiring surgery must be within a facility equipped to provide this within 2 hours of wounding at the latest.

Current operations by the International Security Assistance Force in Afghanistan have demonstrated that this goal cannot always be met, often due to operational requirements or simple unavailability of dedicated medical evacuation means.

Present evacuation trends indicate that both air and air ambulances will continue to serve in the battle areas of the future, but the increased depth, width, and complexity of the operational areas indicates a recurring need for both lateral and rearward movement.

In this context, smaller and quieter aircraft, whether manned or unmanned, may prove safer and capable of responding in timely manner.

Therefore it appears evident that all potential means for achieving these goals must be considered, including possible use of UAVs.

It has been recommended by many authors that the use of UAVs for casualty evacuation may offer a viable alternative method for casualty extraction and evacuation.

If UAVs are present on the battlefield for logistic support, they may provide a capability for casualty evacuation which could serve in specific instances as a supplement to dedicated medical evacuation means.

It is understandable that the use of UAVs for casualty evacuation under certain circumstances might effectively reduce the exposure of aircrew from enemy fire, while carrying out a casualty extraction to a safer location where a casualty can be transferred to better equipped medical evacuation asset.

Although a UAV might not be equipped to provide medical care en route, time would not be lost in either configuring the aircraft for medical personnel and supplies or in arranging escort gun ships, and thus the time lost before casualty can reach advanced medical care, could be reduced. (NATO STO, 2012:22-23)

Fig. 1. Boeing Unmanned Little Bird (ULB)

The U. S. Marine Corps used ULB in their Limited Objective Experiment, June 2009 to explore the concept of unmanned casualty evacuation.

The current ULB retains the manned version's cockpit/co-pilot seats which could be use to hold casualties. Additionally, the cockpit could be modified to accommodate one or more medical litters.

In the conclusion can be stated that potential use of UAVs for casualty evacuation is ethically, legally, clinically and operationally permissible, so long as the relative risk for the casualty is not increased through the use of the UAV.

The use of this type of aircraft for medical evacuation is neither technologically possible nor acceptable at this time primarily due to the lack of capability of in-flight medical equipment, but we can predict their use in medium-term and long term.

3. CONCLUSIONS & ACKNOWLEDGMENT

The quality of medical evacuation system directly determines effectiveness of medical support in military operations. Sufficient number of adequate ground but particularly air medical evacuation assets ensures guaranteeing the medical timelines for every single type of injuries and this significantly increase prognosis for treatment of casualties. Possible solution for patient evacuation from point of injury is use of UAVs.

Contemporary legislative environment and present development of UAV technology however allow us to use UAVs only for casualty evacuation and thus can be used only for transportation of patient without presence of medical support. This can under certain conditions save life of casualty in case of his acute state in difficult operational conditions. These facts could be inspiring and thought-provoking to further discussion about these issues.

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METHOD FOR DETERMINING THE FAILURE OF FLAPS MECHANISM

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Abstract: *Starting from design stage cinematic scheme of any mechanism, at this stage we must consider possible construction errors, errors due to the technology adopted and errors that may occur during the operation of the mechanism. On the basis of the representative kinematics scheme of a flap actuator we can establish the constructive element errors and kinematics couplings components.*

Keywords: *constructive and technological errors, flaps, kinematics scheme*

1. INTRODUCTION

High lift flap is a device usually placed at the trailing edge of the wing (aerodynamic surface) that operates on the voucher. The role of the flap is to increase the lift coefficient by changing the local geometry. Flap actuation leads to a change in curvature of the wing that will produce an increase in lift at the same speed or a reduction in the incidence rate, see Fig. 1.

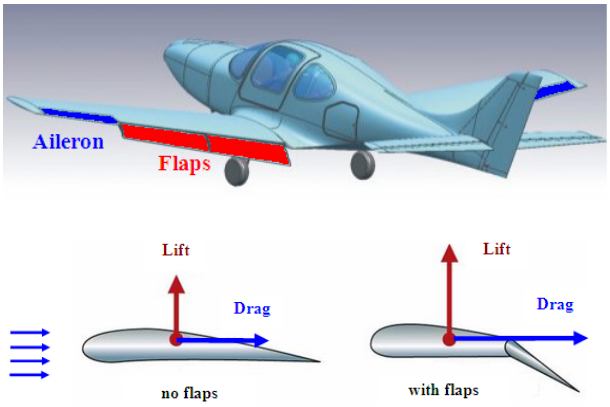

Fig. 1 Landing configuration

The kinematics of the control mechanisms in the structure of the transmission flap, may be considered complex and requires a dimensionally study in order to avoid the occurrence of the phenomenon of buckling of the articulated rod, to minimize friction and the phenomenon of reduction of construction and assembling of game kinematics parameterization rods, and bearings used in rods (Luculescu, 2013).

The most common embodiment of the flaps are shown in Fig. 2.

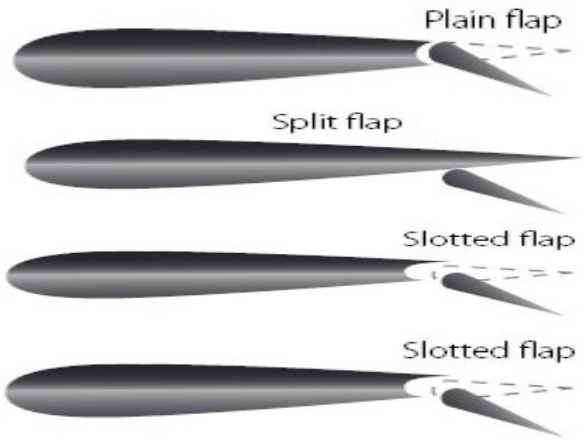

Fig. 2 Usual constructive two flaps (***, 2013)

Flap command is shown in Fig. 3.

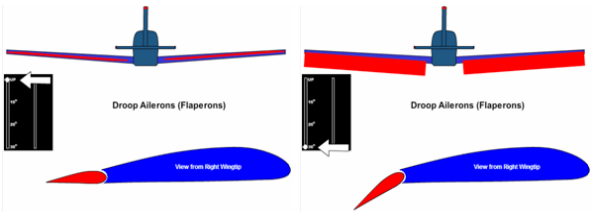

Fig. 3 Flap command (Preston, 2013)

Flap actuator transmits force and motion in the driveline, it includes scenes, sticks and kinematics coupling elements and with varying degrees of freedom. Actuator flaps must fulfill the conditions relating to the accuracy of transmission and reception of kinematics parameters.

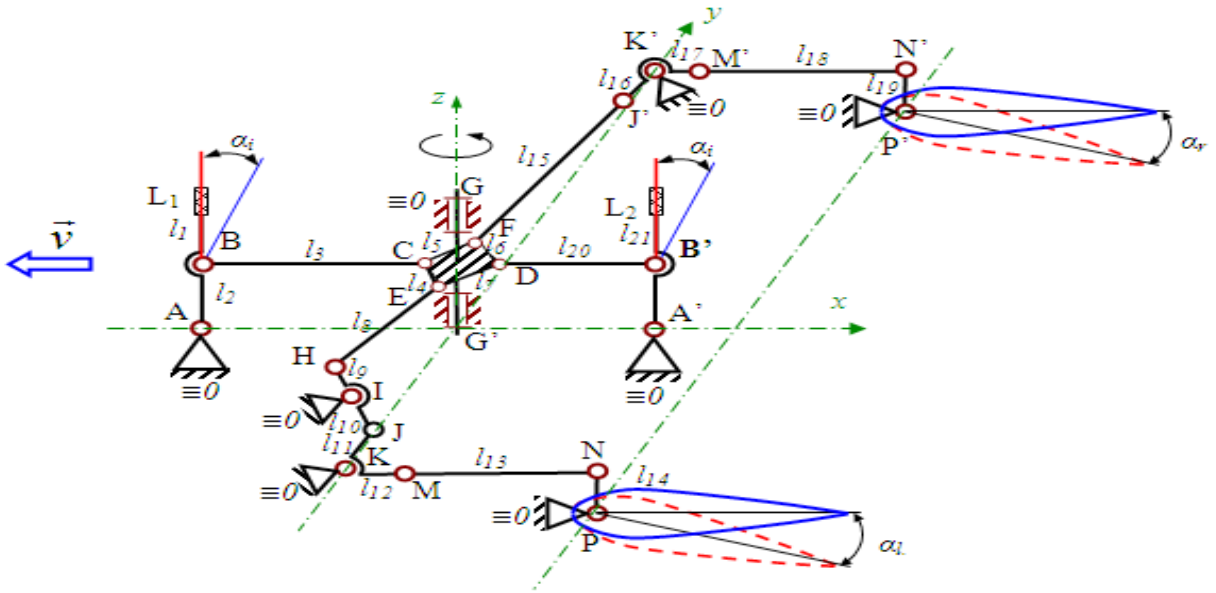

Fig. 3 The control of the aircraft with dual flaps

So it is important to identify and calculate error propagation which exists in the flow signals arranged function and their influence on the position of the mechanism.

Aircraft movements around the center of gravity are possible by steering control surfaces and the curvature drive voucher (flaps).

Roller drive levers work simultaneously being placed two pilot position, and act directly by its driveline on voucher curvature turn at different angles depending on the evolution of the aircraft (ex. 45^0/landing, take-off/25^0). Shutters of curvature (flaps) have coated metal structure and fabric impregnated and has at least two joints flat mounting of the wing trailing edge.

2. DETERMINING THE DESIGN ERROR MECHANISM

For the control mechanism of the flaps articulated bars , see Fig. 3 , (Crețu, 2010; Luculescu, Lazar , 2008) equations of the two flaps position according to the angle of rotation of the two levers are :

for first seat L_1:

$$\alpha_{f\,left} = \alpha_{l\,left}(\alpha_i, l_1, l_2, l_3, l_4, l_8, l_9, l_{11}, l_{12}, l_{13}, l_{14}) \quad (1)$$

for second seat L_2:

$$\alpha_{f\,left} = \alpha_{l\,left}(\alpha_i, l_{21}, l_{20}, l_7, l_8, l_9, l_{10}, l_{11}, l_{12}, l_{13}, l_{14})$$

for first seat L_1:

$$\alpha_{f\,right} = \alpha_{l\,right}(\alpha_i, l_1, l_2, l_3, l_5, l_{15}, l_{16}, l_{17}, l_{18}, l_{19}) \quad (1')$$

for second seat L_2:

$$\alpha_{f\,right} = \alpha_{l\,right}(\alpha_i, l_{21}, l_{20}, l_6, l_{15}, l_{16}, l_{17}, l_{18}, l_{19})$$

Admitting that there are theoretical and formal errors , angular displacement of the lever α_f is influenced by manufacturing tolerances Δl_1, Δl_2, Δl_3, ..., Δl_{19}, the nominal dimensions of cinematic elements of the composition mechanism $l_{1.0}$, $l_{2.0}$, $l_{3.0}$, ..., $l_{19.0}$. It follows that the flap control mechanism can reproduce the functions of position (1), (1 ') only roughly for each value of the angle α_f driving element . These errors appear called constructive errors are random it can be determined in the manner as follows. The functions performed by the actual position of the mechanism kinematics elements analyzed is determined by the equations :

$$\alpha_{f\,right.} = \alpha_{e\,d\,r.}(\alpha_1, l_{1.0} + \Delta l_1, l_{2.0} + \Delta l_1, l_{3.0} + \Delta l_3, \ldots, l_{19.0} + \Delta l_{18}) \quad (2)$$

$$\alpha_{f\,left.} = \alpha_{e\,d\,r.}(\alpha_1, l_{1.0} + \Delta l_1, l_{2.0} + \Delta l_1, l_{3.0} + \Delta l_3, \ldots, l_{14\,0} + \Delta l_{13}) \quad (2')$$

The error introduced into the control mechanism of the flaps is determined by the equations:

- For right flap: (3)

$$\Delta\alpha_{f\,dr.} = \alpha_{f\,dr.} - \alpha_{f\,dr.0}$$

- For left flap: (3')

$$\Delta\alpha_{f\,stg.} = \alpha_{f\,stg.} - \alpha_{f\,stg.0}$$

In calculating these errors constructive develops, functions given by equations (2) and (2 ') , Taylor series , considered turn the actual dimensions of the cinematic elements of the mechanism components l_1 , l_2 , l_3 , ..., l_{19} , the size variables:

$$\alpha_{e_{right}} = \alpha_{e_{right-0}} + \left(\frac{\partial f}{\partial l_1}\right)\cdot\Delta l_1 + \left(\frac{\partial f}{\partial l_2}\right)\cdot\Delta l_2 + \ldots + \left(\frac{\partial f}{\partial l_{19}}\right)\cdot\Delta l_9 + \left(\frac{\partial^2 f}{\partial l_1^2}\right)\cdot\Delta l_1^2 + \ldots + \left(\frac{\partial^2 f}{\partial l_{19}^2}\right)\cdot\Delta l_{19}^2 + \ldots \quad (4)$$

$$\alpha_{e_{left}} = \varphi_{e_{left-0}} + \left(\frac{\partial f}{\partial l_1}\right)\cdot\Delta l_1 + \left(\frac{\partial f}{\partial l_2}\right)\cdot\Delta l_2 + \ldots + \left(\frac{\partial f}{\partial l_{14}}\right)\cdot\Delta l_{14} + \left(\frac{\partial^2 f}{\partial l_1^2}\right)\cdot\Delta l_1^2 + \ldots + \left(\frac{\partial^2 f}{\partial l_{14}^2}\right)\cdot\Delta l_{14}^2 + \ldots \quad (4')$$

Assuming that the manufacturing tolerances is infinite Δ is small compared to the nominal dimensions of cinematic elements , the terms of second order and their superiors in the Taylor series expansion can be neglected. Errors constructive global movement kinematics chains of the two flaps can be calculated with the following relations:

$$\Delta\alpha_{f\,right} = \left(\frac{\partial f}{\partial l_1}\right)\cdot\Delta l_1 + \left(\frac{\partial f}{\partial l_2}\right)\cdot\Delta l_2 + \left(\frac{\partial f}{\partial l_3}\right)\cdot\Delta l_3 \ldots + \left(\frac{\partial f}{\partial l_{19}}\right)\cdot\Delta l_{19} \quad (5)$$

$$\Delta\alpha_{f\,left} = \left(\frac{\partial f}{\partial l_1^{'}}\right)\cdot\Delta l_1 + \left(\frac{\partial f}{\partial l_2}\right)\cdot\Delta l_2 + \left(\frac{\partial f}{\partial l_3}\right)\cdot\Delta l_3 \ldots + \left(\frac{\partial f}{\partial l_{14}}\right)\cdot\Delta l_{14}^{'} \quad (5')$$

The relations (5) , (5 ') parameters Δl_1, Δl_2 , Δl_3, ..., Δl_{19} are random sizes that vary between two sizes but known limits upper and lower deviation tolerances fields.

Constructive errors are determined considering that the dimensions of all cinematic elements are affected only limit errors . The probability of error in practical limit , however, is relatively small. The kinematics analysis of the mechanism studied the flow of signals from element to element leader - led leg flaps can have constant sensitivity S = ct. , Namely: $s_{e_0} = S \cdot s_i$

Considering that the sensitivity of the flow signal is

for right flap:

$$S_{right} = \frac{l_2}{l_1}\cdot\frac{l_5}{l_3}\cdot\frac{l_{16}}{l_{15}}\cdot\frac{l_{18}}{l_{17}} \quad (6)$$

for left flap:

$$S_{left} = \frac{l_2}{l_1}\cdot\frac{l_4}{l_3}\cdot\frac{l_9}{l_8}\cdot\frac{l_{12}}{l_{11}}\cdot\frac{l_{14}}{l_{13}} \quad (6')$$

CONCLUSIONS

The method presented in this paper enables the identification and calculation errors that occur in the construction constructive linkages of the mechanisms used in aviation technology.

Depending on the size of these errors can take a number of variants and technology from design stage to compensate for their size and that they are affected by random errors Δ are errors introduced in the mechanism studied are:

for right flap

$$\Delta s_{right} = s_f^r - s_{f_0}^r = \sum_{i=1}^{10}\left(\frac{\partial s_f^r}{\partial l_i^r}\right)_0 \cdot \Delta l_{i_{right}} \quad (7)$$

for left flap:

$$\Delta s_{left} = s_f^l - s_{f_0}^l = \sum_{i=1}^{10}\left(\frac{\partial s_f^l}{\partial l_i^l}\right)_0 \cdot \Delta l_{i_{left}} \quad (7')$$

or expressed as:

$$\Delta s_{right} = \frac{l_2}{l_1}\cdot\frac{l_5}{l_3}\cdot\frac{l_{16}}{l_{15}}\cdot\frac{l_{18}}{l_{17}} s_i^r \sum_{i=1}^{9}\frac{\Delta l_i^r}{l_i} \quad (8)$$

$$\Delta s_{left} = \frac{l_2}{l_1}\cdot\frac{l_4}{l_3}\cdot\frac{l_9}{l_8}\cdot\frac{l_{12}}{l_{11}}\cdot\frac{l_{14}}{l_{13}} s_i^l \sum_{i=1}^{10}\frac{\Delta l_i^l}{l_i^{'}} \quad (8')$$

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APPLICATIONS OF MULTIVARIABLE CONTROL TECHNIQUES TO AIRCRAFT GAS TURBINE ENGINES

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Abstract: *In this paper are presented two simplified dynamic engine models, based on the general theory of the state variables for linear and nonlinear systems. The constrained optimization problem was formulated using the compact matrix formulas, suitable for the incorporation in MAPLE program solver. The linearized equations were expressed in a matrix form and the engine dynamics was included in terms of variations of the rotational speed following a deflection of the throttle. The linear model of the shaft dynamics for a two-spool jet engine was derived by extending the one-spool model. These models can be used to the entire engine operating envelope, covering a wide range of altitude and Mach number.*

Keywords: *aircraft engine, dynamic model, Laplace transform, control system*

1. INTRODUCTION

The gas turbine engine and its related technologies represent one of the most efficient forms of propulsion and power generation, with applications ranging from land-based power generation, ground-based vehicle propulsion, on-board power and propulsion sources for marine ships, to aircraft propulsion systems.

Design of a gas turbine engine requires the knowledge of multiple academic disciplines including aerodynamics, fluid mechanics, solid mechanics, thermodynamics, chemistry and material sciences (Jaw, 2009).

Controlling such complex machinery requires a thorough understanding of the performance of the engine "system" as a whole.

For some aviation applications, a gas turbine engine must provide a wide range of predictable and repeatable thrust performance over the entire operating envelope of the engine, which can cover the altitude from sea level to tens of thousands meters.

These altitude changes along with variations in flight speed from takeoff to supersonic velocities result in large, simultaneous variations in engine inlet temperature, inlet pressure and exhaust pressure.

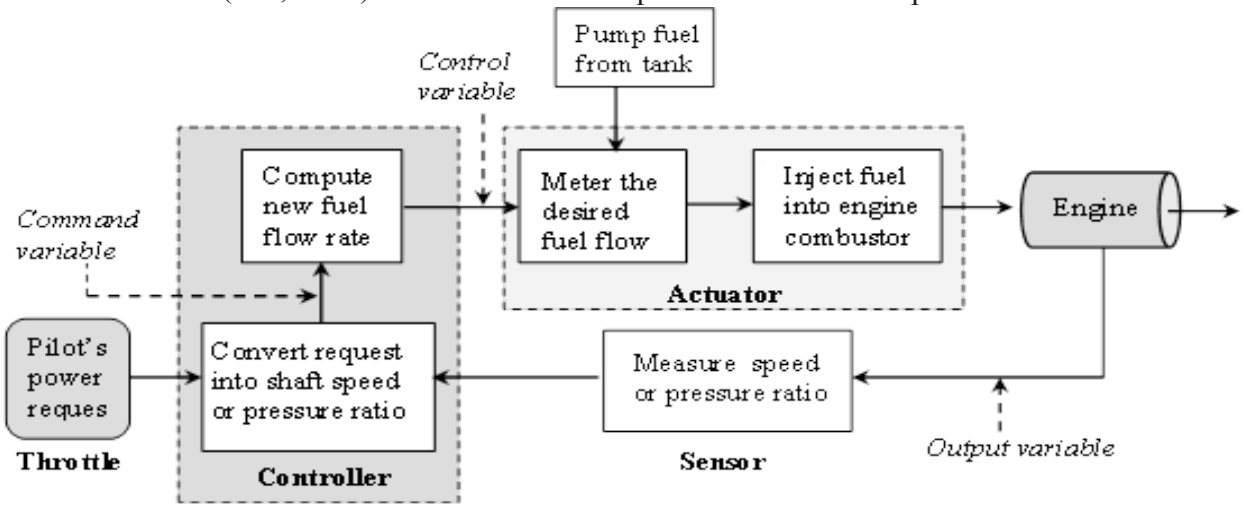

Fig. 1. Functional diagram of a simplified engine control system

These large variations in engine operating conditions and the demand for precise thrust control, coupled with the demand for highly reliable operations, create a significant challenge for the design of the engine control systems (Mattingly, 2006).

Modern gas turbine engine control systems are closed-loop control systems that consist of all four types of control components: controller, sensor, actuator and accessory (Farokhi, 2009).

The simplest engine control system is one that produces desired engine thrust or shaft power by changing the fuel flow (Fig.1).

Because reliable, in-flight engine thrust measurement is not currently practical, the engine shaft rotational speed N or engine pressure ratio (EPR) has been used effectively as an indicator of engine thrust (or power).

Hence, for this simplified control system, the command variable (or the desired output variable) is shaft speed (or engine pressure ratio), the control variable is actuator position, the actuator is fuel metering valve, the output of the metering valve is the fuel flow that is injected in the combustor, the output of the engine is engine power setting variable (shaft speed or engine pressure ratio); furthermore, fuel control accessory components are the fuel tank and the fuel pump and the sensors (Rotaru, 2007).

The resulting compressor pressure ratio and air mass flow rate are plotted on the compressor map once a steady-state has been reached (Fig. 2).

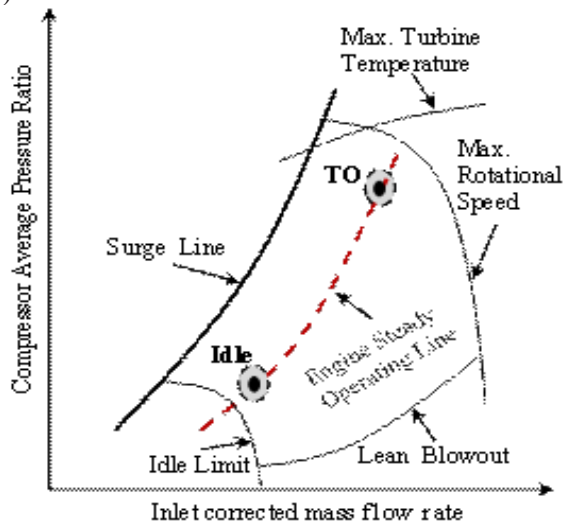

Fig. 2. Engine operating limits on compressor map

Control system complexity can be measured by the number of control variables or by the number of measured variables in the system.

Typically, the number of control variables corresponds directly to the number of actuators and the number of measured variables to the number of sensors.

2. DYNAMIC ENGINE MODELS

Mechanical systems dynamics due to the rotating inertias constitute the most important contribution to the engine transient behavior.

The acceleration of the rotor (consisting of the compressor, turbine and the shaft) based on the principle of Newtonian mechanics is

$$\dot{\omega} = \frac{\Delta Q}{J} \tag{1}$$

where $\dot{\omega}$ is the angular acceleration of the rotor, $\Delta Q = Q_T - Q_C$ represents the difference between the torque produced by the turbine, Q_T, and the torque required by the compressor, Q_C, and J is the mass moment of inertia of the compressor-shaft-turbine body (Fig. 3).

The angular velocity ω is usually substituted by the shaft rotational speed N and the differential torque ΔQ is represented by a function of shaft speed and fuel flow rate W_f.

Substituting these in the torque function, the equation for the shaft rotational speed is expressed as

$$\dot{N} = \frac{f(N, W_f)}{J} \tag{2}$$

Engine dynamics arise from complex, interacting phenomena: gas-flow behavior in the compressor and turbine, shaft inertias and losses, fuel flow transport delay, combustion and the thermal behavior of the engine and its surroundings (Rotaru, 2008).

The linear model of shaft dynamics for one-spool engine, based on the Taylor's series expansion of the function f at a (steady-state) nominal operating point is (Ronald, 2005)

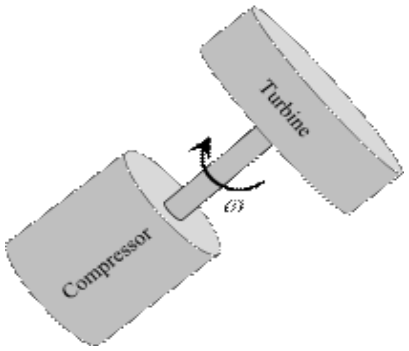

Fig. 3. Engine shaft dynamics

$$\dot{N} = \frac{1}{J}\frac{\partial f}{\partial N}\cdot\Delta N + \frac{1}{J}\frac{\partial f}{\partial W_f}\cdot\Delta W_f \tag{3}$$

The output equation for any engine variable *y* can be expressed as a function of speed and fuel flow as well, so that a small variation of the output variable from its nominal value is expressed as

$$y = \frac{\partial y}{\partial N}\cdot\Delta N + \frac{\partial y}{\partial W_f}\cdot\Delta W_f \tag{4}$$

The transfer function from the input variable fuel flow to the output variable y is expressed as

$$\frac{Y(s)}{W_f(s)} = \frac{b}{s-a} + d \tag{5}$$

where

$$a = \frac{1}{J}\frac{\partial Q}{\partial N};\ b = \frac{1}{J}\frac{\partial Q}{\partial W_f};\ c = \frac{\partial y}{\partial N};\ d = \frac{\partial y}{\partial W_f}$$

For a gas turbine engine, the coefficient a is always less than zero in the control envelope.

Equation (5) represents a first-order lag, which means that the speed response behaves like a lag function after the fuel flow is changed. The linear model of shaft dynamics for a two-spool jet engine can be derived by extending the one-spool model of eq. (3) and eq. (4) with the dynamics of the second shaft.

For a two-spool engine we have

$$\begin{cases} \dot{N}_1 = \dfrac{1}{J_1}\left(\dfrac{\partial Q_1}{\partial N_1}\cdot\Delta N_1 + \dfrac{\partial Q_1}{\partial N_2}\cdot\Delta N_2 + \dfrac{\partial Q_1}{\partial W_f}\cdot\Delta W_f\right) \\ \dot{N}_2 = \dfrac{1}{J_2}\left(\dfrac{\partial Q_2}{\partial N_1}\cdot\Delta N_1 + \dfrac{\partial Q_2}{\partial N_2}\cdot\Delta N_2 + \dfrac{\partial Q_2}{\partial W_f}\cdot\Delta W_f\right) \end{cases}$$

where

$$\begin{cases} \Delta Q_1 = \dot{m}_{t1}c_{p_{t1}}\left(T^*_{4.1} - T^*_4\right) - \dot{m}_{c1}c_{p_{c1}}\left(T^*_{2.1} - T^*_1\right) \\ \Delta Q_2 = \dot{m}_{t1}c_{p_{t2}}\left(T^*_3 - T^*_{4.1}\right) - \dot{m}_{c2}c_{p_{c2}}\left(T^*_2 - T^*_{2.1}\right) \end{cases}$$

The station numbering and the nomenclature used in the above equations are presented at the end of the article.

Similarly, the output equation is given by

$$y = \frac{\partial y}{\partial N_1}\cdot\Delta N_1 + \frac{\partial y}{\partial N_2}\cdot\Delta N_2 + \frac{\partial y}{\partial W_f}\cdot\Delta W_f \tag{6}$$

In the matrix notation, the shaft dynamics for a tow-spool engine are expressed as

$$\begin{bmatrix}\dot{N}_1\\ \dot{N}_2\end{bmatrix} = \begin{bmatrix}a_1 & a_2\\ a_2 & a_2\end{bmatrix}\begin{bmatrix}N_1\\ N_2\end{bmatrix} + \begin{bmatrix}b_1\\ b_2\end{bmatrix}W_f \tag{7}$$

$$y = \begin{bmatrix}c_1 & c_2\end{bmatrix}\begin{bmatrix}N_1\\ N_2\end{bmatrix} + [d]W_f \tag{8}$$

The frequency-domain representation of two-spool engine dynamics expressed in transfer function form for the output variable y is

$$\frac{Y(s)}{W_f(s)} = C(sI - A)^{-1}B + D = \frac{k(s+z_1)}{(s+r_1)(s+r_2)} \tag{9}$$

where I is the identify matrix. This transfer function represents a second-order dynamic system (Richter, 2012).

The general nonlinear form of the state and the output equations of an engine can de expressed by the following equations

$$\begin{cases} \dot{x}(t) = f[x(t), u(t), t] \\ y(t) = g[x(t), u(t), t] \end{cases} \tag{10}$$

where f and g are nonlinear functions of the state variable, the input variable and time. For gas turbine engine, f and g are smooth enough, within the engine's operating envelope, to have a Taylor-series approximation around the nominal operating condition x_0 and u_0.

3. NUMERICAL RESULTS

Starting from hypothesis that compressor air flow rate, G_a, is equal to the turbine gas flow rate, G_{gT}, applying the energy and mass conservation theorems, one can get

$$\begin{cases} \dfrac{\pi J}{30}\dfrac{dN}{dt} = M_T - M_C \\ \dfrac{T_2^*}{T_1^*} = 1 + \left(\pi_C^{*\frac{\gamma-1}{\gamma}} - 1\right)\dfrac{1}{\eta_C^*} \\ G_a = G_{gT} \\ \dfrac{T_4^*}{T_3^*} = 1 - \left(1 - \dfrac{1}{\pi_C^{*\frac{\gamma'-1}{\gamma'}}}\right)\eta_T^* \\ G_{gT} = G_{noz} \\ W_f H_u \eta_a = c_p G_a \left(T_3^* - T_2^*\right) \end{cases} \quad (11)$$

where N is the rotational speed, J- inertia momentum, G-flow rate for air and gases, W_f -fuel flow rate, H_u - low heating value of fuel. For a tow-spool engine the above equations become:

$$\begin{cases} \left(T_1 \cdot s + \rho_1\right)\overline{n}_1 - k_{T_4^*}^{(1)}\overline{T}_4^* + k_{p_4^*}^{(1)}\overline{p}_4^* - k_{p_4^*}^{(1)}\overline{p}_4^* + k_{p_2^*}^{(1)}\overline{p}_2^* = 0 \\ \left(T_2 \cdot s + \rho_2\right)\overline{n}_2 - k_{T_3^*}^{(2)}\overline{T}_3^* - k_{p_2^*}^{(2)}\overline{p}_2^* + k_{p_2^*}^{(2)}\overline{p}_2^* + k_{p_4^*}^{(2)}\overline{p}_4^* = 0 \\ \overline{T}_2^* - k_{p_2^*}^{(3)}\overline{p}_2^* + k_{p_2^*}^{(3)}\overline{p}_2^* = 0 \\ k_{n_1}^{(4)}\overline{n}_1 - k_{n2}^{(4)}\overline{n}_2 + k_{p_2^*}^{(4)}\overline{p}_2^* - k_{p_2^*}^{(4)}\overline{p}_2^* = 0 \\ k_{p_2^*}^{(5)}\overline{p}_2^* + k_{n2}^{(5)}\overline{n}_2 - k_{p_2^*}^{(5)}\overline{p}_2^* - k_{T_3^*}^{(5)}\overline{T}_3^* = 0 \\ \overline{T}_4^* - \overline{T}_3^* - k_{p_2^*}^{(6)}\overline{p}_2^* - k_{p_4^*}^{(6)}\overline{p}_4^* = 0 \\ \overline{T}_4^* - \overline{T}_4^* - k_{p_4^*}^{(7)}\overline{p}_4^* - k_{p_4^*}^{(7)}\overline{p}_4^* = 0 \\ k_{p_2^*}^{8}\overline{p}_2^* + k_{T_3^*}^{(8)}\overline{T}_3^* - k_{p_4^*}^{(8)}\overline{p}_4^* - k_{T_4^*}^{(8)}\overline{T}_4^* = 0 \\ k_{p_4^*}^{(9)}\overline{p}_4^* + k_{T_4^*}^{(9)}\overline{T}_4^* - k_{p_4^*}^{(9)}\overline{p}_4^* - k_{T_4^*}^{(9)}\overline{T}_4^* = k_{S_a}^{(9)}\overline{S}_a \\ k_{p_2^*}^{(10)}\overline{p}_2^* + k_{n2}^{(10)}\overline{n}_2 + k_{p_2^*}^{(10)}\overline{p}_2^* + k_{T_3^*}^{(10)}\overline{T}_3^* - k_{T_2^*}^{(10)}\overline{T}_2^* = k_{W_f}^{(10)}\overline{W}_f \end{cases}$$

The transfer function from the input variables fuel flow, $\overline{W}_f(s)$, and the exit nozzle area $\overline{S}_a$, to the output variable, LPC rotational speed $\overline{N}_1(s)$ and HPC rotational speed $\overline{N}_2(s)$, for a two-spool engine with

$G_a = 90\,kg/s;\ T_3^* = 1500\,K;\ \pi_{C1} = 4;\ \pi_{C2} = 7;$
$I_1 = 9.9\,kg\cdot m^2;\ I_2 = 11.43\,kg\cdot m^2;$
$n_1 = 9000\,rot/\min;\ n_2 = 11000\,rot/\min;$

are

$$\overline{N}_1(s) = \frac{(1.3s + 2.95)\overline{W}_f + (3.65s + 6.27)\overline{S}_a}{1.10s^2 + 4.9\ \ s + 5.60}$$

$$\overline{N}_2(s) = \frac{(2.51s + 5.87)\overline{W}_f - 3.32\overline{S}_a}{1.10s^2 + 4.9\ \ s + 5.60}$$

The responses of the rotational speeds $\overline{N}_1(t) = \Delta N_1 / N_1$ and $\overline{N}_2(t) = \Delta N_2 / N_2$ to an impulse input (Dirac function), to a unit step input (Heaviside function) and to a sinusoidal input ($s = i\omega$) for $\overline{W}_f$ and $\overline{F}_a$ are presented in Figures 4-12.

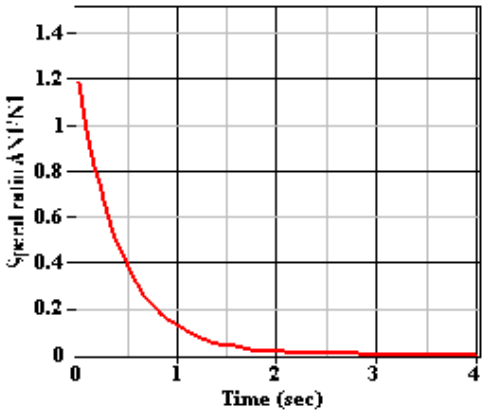

Fig. 4. Impulse response of the LPC rotational speed to the fuel flow rate input

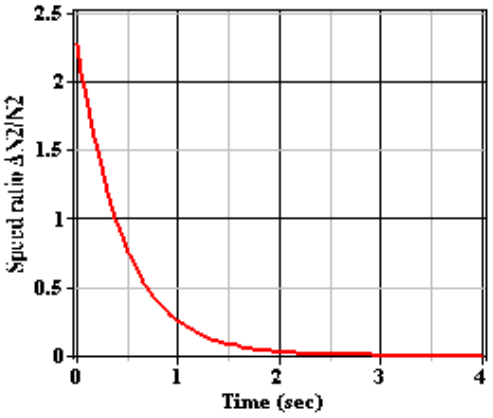

Fig. 5. Impulse response of the HPC rotational speed to the fuel flow rate input

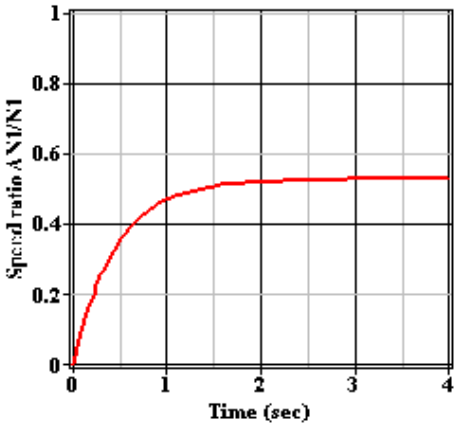

Fig. 6. Step response of the LPC rotational speed to the fuel flow rate input

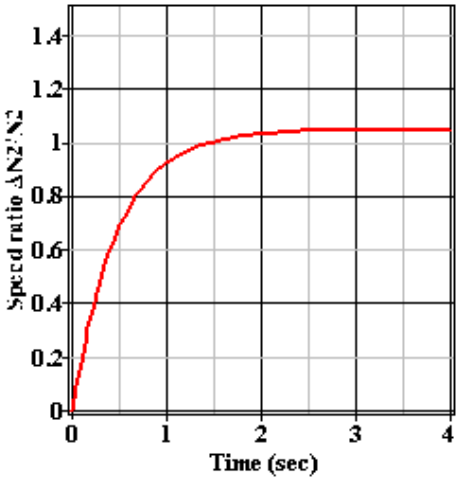

Fig. 7. Step response of the HPC rotational speed to the fuel flow rate input

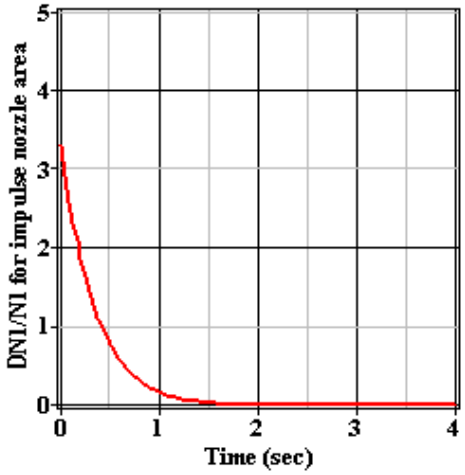

Fig. 8. Impulse response of the LPC rotational speed to the nozzle area input

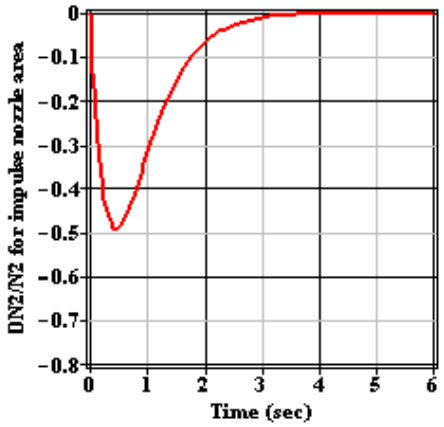

Fig. 9. Impulse response of the HPC rotational speed to the nozzle area input

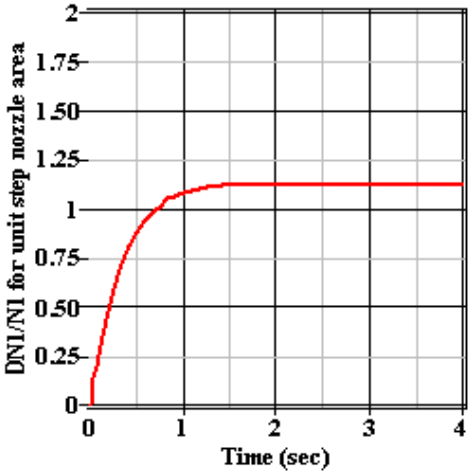

Fig. 10. Step response of the LPC rotational speed to the nozzle area input

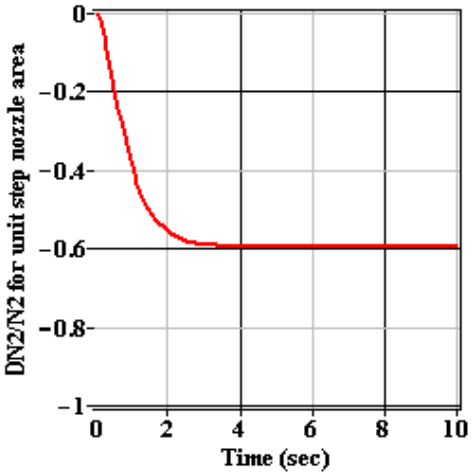

Fig. 11. Step response of the HPC rotational speed to the nozzle area input

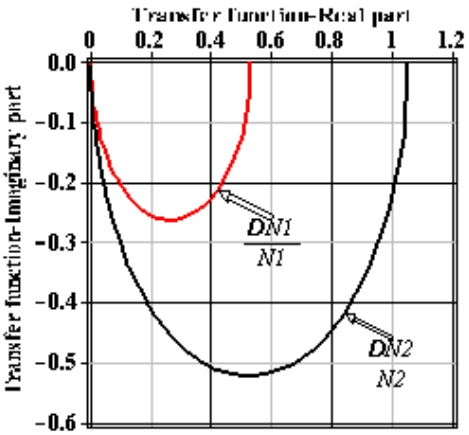

Fig. 12. Frequency response of the LPC and HPC rotational speed

4. CONCLUSIONS

The classical linear compensation is adequate only to govern the engine close to a fixed operating point, as defined by the current inlet conditions and desired thrust set point.

Aside from nonlinearity and parametric changes in the engine, critical variables must be maintained within safety ranges.

Linear compensation is the basic building block of standard aircraft engine control system.

Parametric changes and nonlinearity are addressed with gain-scheduled linear compensators while limit protection logic schemes are used to override the active linear regulator when a critical variable approaches its safety limit.

Even with constant control gains, limit relaxation is reflected in faster responses, and conversely, the main output response will become slower if limits are made more restrictive.

There are two ways of obtaining faster thrust response: redesigning the regulators for larger closed-loop bandwidths and relaxing the protective limits on variables which tend to peak as thrust response is made faster.

Among the variables displaying such peaking are turbine outlet temperature, which peaks during acceleration, stall margin, which tends to undershoot during acceleration and combustor pressure, which tends to undershoot during deceleration.

NOMENCLATURE

The naming convention for the symbols representing engine models and control laws follows the convention defined as: T^* - total temperature $[K]$; p^* - total pressure $\left[N/m^2\right]$; π - pressure ratio; G and W_f - mass flow rate $\left[kg/s\right]$; σ_a - combustion chamber total pressure loss coefficient; γ - ratio of specific heat; $\gamma = 1.4$; $\gamma' = 1.3$; c_p - specific heat at constant pressure $\left[J/(kg \cdot K)\right]$; HPC – high pressure compressor; LPC – low pressure compressor; $x_i = (x_i)_0 + \Delta x_i$.

Subscripts: c – compressor; t – turbine; 1-5 engine cross section number; 2.1 – HPC inlet section; 4.1 – LP inlet turbine.

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INNOVATIVE SOLUTIONS AND UAS LIMITS

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Abstract: *The Unmanned Air Systems technology is matured and is evidenced by the utility and adaptability of vectors used in drones for the last decade. Designing and building aeromechanical drone system focuses on concepts that lead to lower energy consumption during the execution of the mission and a high speed of response. Aerodynamic limits depend directly on the technical characteristics of the flight qualities and properties of materials used in the manufacture of unmanned aerial systems. The article presents an overview of the limits and requirements in the design, production and operation of unmanned systems human on board. This article wishes to point out the main elements of the systems through the drones requirements in the field/domain.*

Keywords: *innovative solutions, UAS, rotary wing, fixed wing*

1. INTRODUCTION

Human unmanned systems onboard as aerial machines are subject to a series of limitations that ultimately may affect the flight characteristics and performances.

All stages of the final product are pegged requirements arising from the limits and conditions of that stage; they are pre-defined and / or modified with the design and product realization.

Based on the requirements imposed on aircraft (Preotu, 2001) we can develop a diagram in figure 1 were we can observe the interdependence domain-limits.

The Unmanned Air Systems technology is matured and is evidenced by the utility and adaptability of vectors used in drones for the last decade in various assignments: both military and civilian.

However the limits that arise in any field often lead to compromises.

The most challenging limits are: mass, handling, vulnerability to weather conditions, threats of kinetic and non-kinetic weapons, technological limits (standards of reliability), legislative limits, airspace management limits.

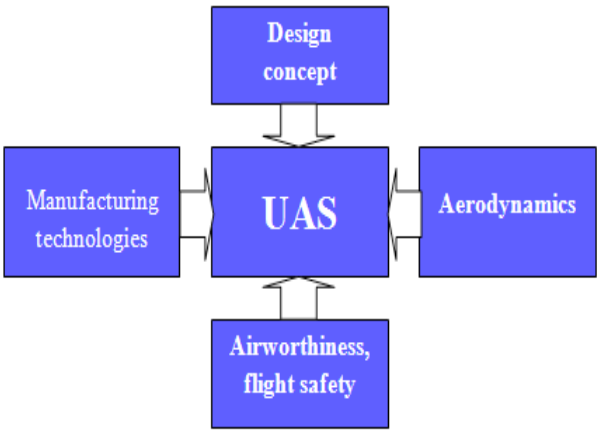

Fig.1. UAS areas

The design and construction of any UAV must follow a series of elements: aerodynamic concept, speed and autonomy, energy, craft sensors, data integration, thermal management and signature acoustic / radar.

Innovative solutions can mark all the stages of making a unmanned air product: conceptual and design, prototyping and manufacturing resources (smart materials, non-conventional energy, propulsion), exploiting (vectors: swarm, autonomy).

2. DEMANDS IMPOSED IN REALIZING OF UAV

2.1. Requirements imposed in designing and manufacturing the aircraft. The design and construction of robotic aerial systems is focuses on innovative aeromechanical concepts which leads to a lower power consumption in missions and a high speed of reaction, see figures 2 and 3, (***2014a, ***2014b). The aerodynamic requirements depend directly on technical characteristics, flight qualities (stability and maneuverability), operating conditions and the effects that occur in the aero-elastic phenomena during the missions, (Cîrciu, Prisacariu, 2013)

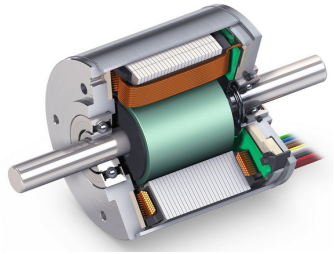

Fig.2. Brushless motor

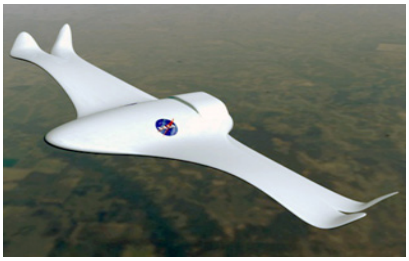

Fig.3. NASA morphing concept

Aircrafts are designed, manufactured and tested in accordance with specific conditions and are used in areas of interests with a permissible operating load factor (us) without any permanent deformation that may occur or may break if the specified factor breaking load is exceeds, (Costăchescu, 1993).

Aerodynamically speaking, the chosen geometry should provide maximum performance with minimum installed capacity and in terms of maniabillity aircrafts must perform movements around the gravity center with minimal effort (minimal) on the flight controls.

Technologies for robotic air system (serial) must ensure technological fractionation schemes, modular shortening manufacturing cycle with extensive use of materials and parts at minimum cost at global level (Preotu, 2001; Reicheneder, 2011) by using CNC manufacturing lines (fig. 4 and 5).

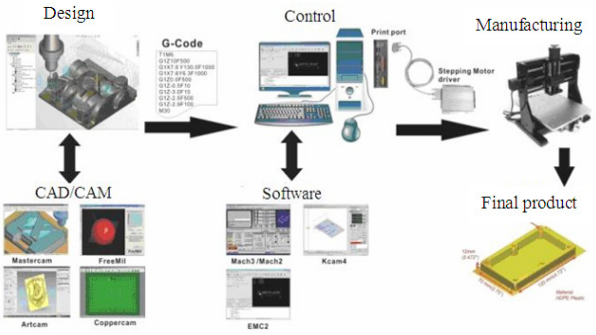

Fig.4. The design and manufacturing diagram

As specific requirements imposed on manufacturing we can mention: the use of standardized parts, minimal use of materials, use of low cost materials and alternative technologies.

2.2. Requirements for flight safety. The safety of operation can be improved either by increasing the reliability of the components of the UAS or to build redundant.

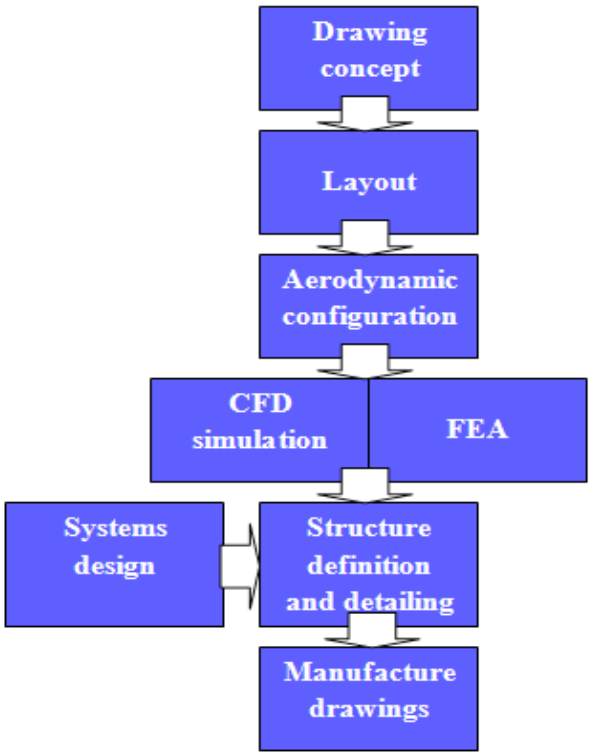

Fig. 5 Design Methodology (Reicheneder, 2011)

To improve safety and to keep costs down we can trace several goals: the use of standardized systems and practices, simplicity in design, redundant design, use of materials certified in aviation, maintain quality control of materials and subsystems which are used, (Seletron, 2007)

The safety issue of an aircraft is directly related to the proper functioning of the components, subsystems and the systems components. Theoretically flight safety is the probability that failure-free operation time exceeds the prescribed time, meaning:

$$S(t) = \frac{N}{N_0} = \exp\left(-\int_0^t \lambda(t)dt\right) \quad (1)$$

Where:

N - number of elements in operation at time t

N0, the number of elements in running at the time t0

λ - Proportionality factor that depends on the time t or the likelihood of a correct execution of a task in a given period is defined as the average time reliability better functioning - ATRBF:

$ATRBF = \frac{1}{\lambda}$, reliability is:

$$S(t) = e^{-\lambda t} \cong 1 - \lambda \cdot t \quad (2)$$

we can point out on the chart (figure 5) the probability of good operation during a mission.

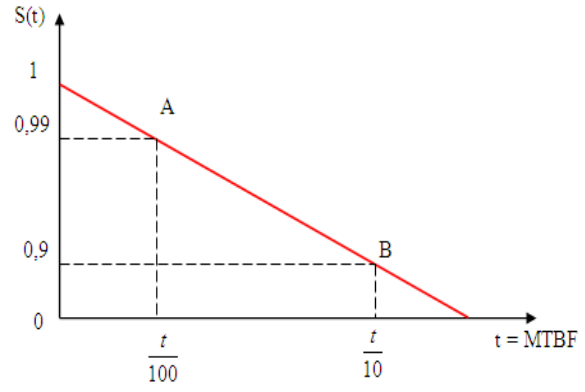

Fig. 5 ATRBF dependence during a mission

Flight safety depends directly on the strength / stiffness vector trim level with air and its redundancy level (duplication flight control, vital equipment).

2.3. Requirements for the use and operation of UAV. Operation of the aircraft in ground and flight involves both a series of maintenance operations and ground control and activities during the missions. For operation and maintenance activities, the aircraft must meet a number of conditions: (figure 10) to allow a simple maintenance operation during a short flight, to allow quick preparation, easy to maneuver in flight be designed, to ensure the safety of maintenance personnel.

Unmanned airborne system requirements for operation airspace needs to posses a modern equipment embarked with functions to assure safety and flight trajectory control (cruise control, Sense and Avoid) depending on the type of missions. Control architectures and control board must fulfil at least the first two functions of the three: Stability and Control (3D stabilizer), navigation (autopilot), autonomy (autonomous system integrated).

2.4. Economic requirements. Unmanned Air Systems are used in various domains and mission due to the reduced resource consumption (operating costs) compared to the piloted aircrafts. For instance the demand for UAV in the U.S. air force is growing (six times since 2004) not only as a replacement for manned aircraft but mostly because of their versatility, and in 2010 more than one third of the planes that were purchases are UAV, comparative data is presented in table 1.

Table 1. Comparative dat

Features	UAV	Manned MH-53
Autonomy	24	2,5
Personnel (24 h)	3	25
Acquisition cost	$ 1 mil.	$ 175 mil.
Per hour cost	$ 336	$ 15.800
Risk (lives)	0	1

2.5. Requirements imposed by the acceptance flight. Although they are trying to harmonize human legislation for on board unmanned aircraft (EASA, ICAO), (Seletron, 2007; ***2014d), accepting unmanned aircraft flights are different in every country, depending on the category of the aircraft and the operating conditions.

European aviation regulations of EASA are developed, (***2014)c, and in effect there are a series of documents on the operating conditions of the UAV over 150 kg in the European Union, which have a mass less than 150 kg, subject to aviation regulations of each state EU membership.

Current national aviation regulations define UAV in RCAR-AZAC, (***2007), and in two other recent national rules which refers to the use of national airspace by civil aircraft which are powered by unmanned systems, (***2014) e, (***2014)f.

3. INNOVATIVE SOLUTIONS

Current status on growth performance focused on two main areas of research: air vector rotary wing and fixed wing. Research on UAS reveals a series of research on innovative solutions (aeromechanical equipment), solutions at various stages of research (concept / design, manufacturing, experimental models), some examples are briefly described in the following lines.

3.1. UAS with rotating and hybrid wings.

a Boeing X-50 Dragonfly. In the 1990s, McDonnell Douglas studied a VTOL aircraft design concept called CRW (Canard Rotor / Wing). CRW is a hybrid vector air mobile canard empennage configuration of a vertical double-free anti-torque propeller and a turbofan powered by a nozzle equipped with a mobile, see figure 6 and table 2, (Simonsen, 2002; Parsch, 2006). Aero revolutionary concept combines the capabilities of a helicopter with those of a fixed-wing jet.

Table 2. X-50 Dragonfly characteristics

Span (wings/rotor)	2,71 / 3,66 m
Length / High	5,39 / 1,98 m
Payload /empty/total	91/ 574 / 645 kg
Speed crz./max.	278/700 km/h
Propulsion	Turbofan Williams F112

Fig. 6 Dragonfly, ***(2014)g

Fig. 7 Eagle Eye, ***(2014)h

b. Bell Eagle Eye. Eagle Eye Program (tilt rotor) began in 1993 with the prototype TR911X powered by gas turbine Allison 250-C20, with the debut flight in 2006, currently marketed in Europe in partnership with Sagem and Rheinmetall, see figure 7 and table 3.

Table 3. Eagle Eye characteristics, ***(2014)h

Span / Length	7,37 / 5,57 m
Pazload / total mass	90 / 1000 kg
Max speed	360 km/h
Autonomy / ceiling	6 h / 6000 m
Propulsion	PW207D Canada

3.2. Fixed wing UAS. Aurora Flight Sciences - SunLight Eagle. The demonstrator flew in tests on May 12, 2009 in Las Cruces, New Mexico airport, been powered by an electric motor and solar cells mounted on the bearing surface, see figure 8 and table 4, (Coppinger, 2009).

Fig. 8 SunLight Eagle, [16]

Fig. 9 MicroFalcon I

Tabel 4. SunLight Eagle characteristics

Span	34,7 m
Mass	75 kg
Speed max.	360 km/h
Autonomy / Ceiling	6 h / 6000 m

b Innocon - Micro Micro Falcon Falcon I. I is a mini-UAV missions ISAR for a single operator. Designed joint wing configuration, the vector is powered by an electric motor-driven traction acquisition sensor mounted on the ventral side, see figure 9 and table 5, ***(2009).

Table 5. Micro Falcon I Characteristics

Span	1,6 - 2 m
Speed crz.	65 km/h
Mass	6 -10 kg
Autonomy/ ceiling	2 h / 3000 m

3.3. Research prototypes. a. Fixed / rotary wing. The key to this innovative design is the ability to switch modes rotary-wing flying fixed wing (rotor 1800), a transformation that takes only 1-2 seconds, see figure 10, ***(2014) h. Battery-powered prototype has limited autonomy to 30 min for a cruising speed of 185 km / h.

Fig. 10 Stop rotary wing

b Airship Endurance UAV VTOL Transformer. Endurance is an airship with two turbines developing to operate completely autonomously, which can provide superior aerodynamic qualities necessary data acquisition missions (ISR), see figure 11, ***(2014)i.

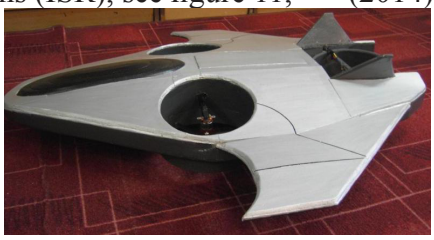

Fig. 11 Transformer V2

Fig. 12 AD-150

c AD 150. Manufactured by American Dynamics, the tilt duct VTOL concept has been developed for future requirements of the U.S. Marine Corps for a high-speed VTOL UAV capable evolve maritime environment on board, figure 12, ***(2011).

d Vortex. Chinese designers market profile presents innovative concepts for VTOL unmanned aircraft configuration in Zhuhai Air Show 2012, see figure 13, ***(2012).

Fig. 13 Vortex UAV

e. Aesir's UAV. A UK company has developed a VTOL UAV that has no external rotating parts, instead relying on a phenomenon known as the Coanda effect to generate lift, mobile surfaces arranged circular allow air flow control device and control the trajectory, see figure 14, (Quick, 2009; Cîrciu, Dinea, 2010)

Fig. 14 AESIR UAV

Fig.15 Cyberquad

f. Cyberquad. It is a recognition platform for use in urban environments and indoors. Can carry high-resolution video camera and biometric sensors (gas, chemical), see figure 15, (Brandon, 2009).

4. CONCLUSIONS AND FUTURE DEVELOPMENTS.

The presence of UAV systems, under modern airspace in the coming years is supported on all levels (research, manufacturing, usage), specialized comparative data on HALE UAV market and forecasts for global investment, presented in figures 16 and 17, (Lucintel, 2011).

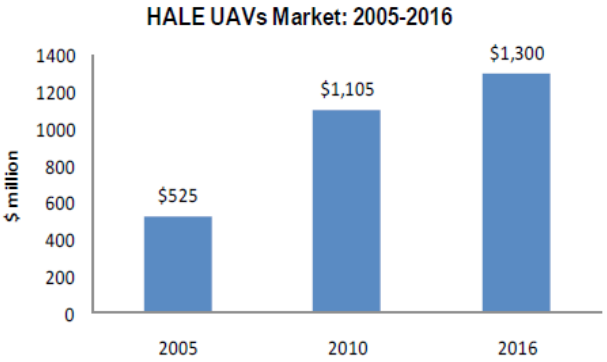

Fig. 16 UAV-HALE evolution in mondial market

Implementation, development and differences in equipment implicitly lead to a difference in costs and capabilities of these aircraft which already have a history and their own evolution with other categories of aircraft known. Research studies state that surveillance missions, reconnaissance and electronic warfare, manned performed onboard will be taken completely by UAS.

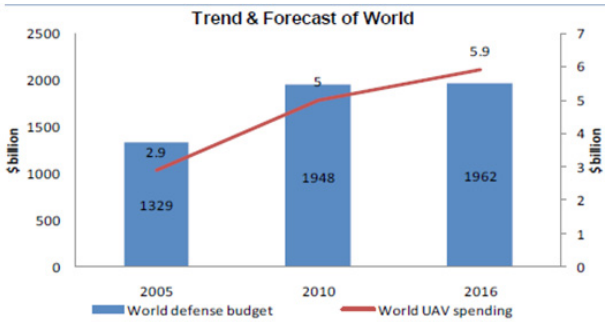

Fig. 17 Forecast invest in UAV market

Three distinct ways of integrating executable tasks are analyzed UAV systems now, (Agafiței, 2007), together with combat systems belonging to other categories of aircraft: combat systems associating a, b through dedication / operational resource allocation specialized c by mixing weapon systems.

Currently three defining factors are combined to motivate the use of UAV: technological advances that provide a significant operating level, the evolving state of the world which is changing and the UAV attributes systems which enable the new benefits and operational capabilities.

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PARTICULARITIES OF POWER LASER ELECTRICAL ENERGY SUPPLY

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Abstract: *Main electromagnetic pollution sources are the PWM controlled power converters, owing the strong non-linear characteristics of the devices from their structure. Power converters presence inevitable means harmonics in power supply current and consecutively, distortion factor weak. Power processing at a poor power factor may distortion the power supply voltages waveforms, disturbing in this way the operation of other equipment are powered in parallel by the same mains. This paper present some aspects resulted after analyses of harmonics in power supply current for voltage converters used to supply power lasers.*

Keywords: *LASER, harmonic pollution, distortion factor, "full bridge" converter*

1. INTRODUCTION

Power converters PWM (Pulse Width Modulation) controlled are often used by power supply of CO2 and YG:Nd pulse and continuous power laser's used in laser processing installation.

The PWM power converters are the main harmonics pollution sources because of strong non-linear characteristics of the devices from their structure.

Switching power converters are placed between main power line and installation, acting like a load for power line and like a source for installation.

Because of this is necessary put in accord performances and parameters of these electronic systems with parameters of electrical power delivered and maximum disturbances allowed by main power supply.

In spite of the PWM convertors are well known, for each particular case it is necessary to took into consideration the condition of functioning, load cycle, electromagnetic compatibility conditions and technical parameters of design when we calculate and create such systems.

2. ANALYSIS OF QUALITY OF ELECTRICAL ENERGY USED TO SUPPLY LASER INSTALLATIONS

Laser processing installations are non-linear consumers which create important electromagnetic disturbances inside electrical distribution network.

Asymmetric current supply creates additional losses of energy with negative effect on energy transfer efficiency.

According with harmonics amplitude the total harmonic distortion (THD) is [6]:

$$THD = \frac{Y_d}{\sqrt{Y^2 - Y_0^2}} \quad (1)$$

where:

$$Y_d = \sqrt{\sum_{k=2}^{n} Y_k^2} \quad (2)$$

where:

Yd – distortion residue;
Y – effective value of periodic distortion wave;
Y0 – continuous component;
Y1 – effective value fundamental component;
Yk - effective value of k harmonic component.

A numerical method computing the currents and voltages RMS values and consecutively the power consumption and power factor is further presented (Fig. 1) [1].

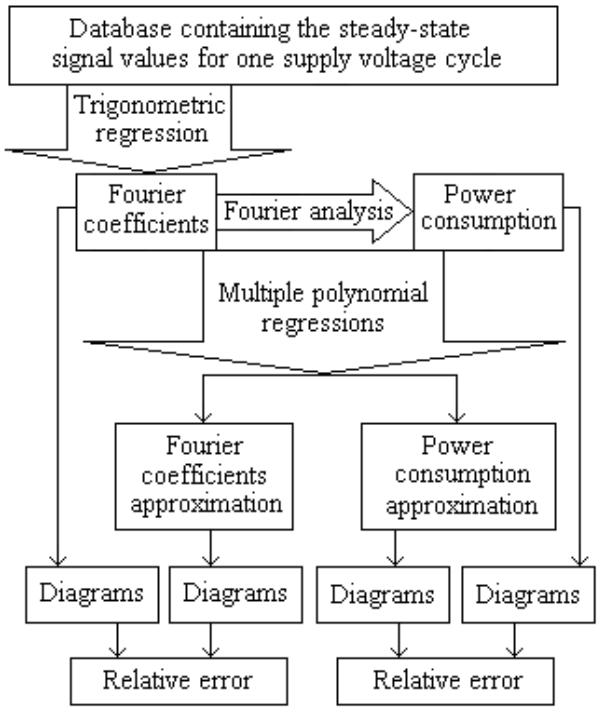


Fig. 1 Block scheme of the algorithm computing volt-amps

The proposed method is the following [4]:

- Approximating the analyzed quantities waveforms by using a trigonometric type regression function, containing n harmonics and based on the least squares method;
- Computing harmonic (sine) Fourier series coefficients;
- Computing volt-amps;
- Computing polynomial type approximating functions (polynomial regression) for volt-amps and harmonic Fourier series parameters (amplitudes, phase-shifts).

The waveforms (voltages and currents) in discussion being no sinusoidal, their harmonic Fourier series are required for power consumption computing. The case involving a voltage and a current as analyzed quantities will be exemplified further:

$$u(t)=C_{u0}+\sum_{k=1}^{m}\left[C_{uk}\cos(k\omega t)+S_{uk}\sin(k\omega t)\right]$$

$$=C_{u0}+\sqrt{2}\sum_{k=1}^{m}\left[A_{uk}\sin(k\omega t+\varphi_{uk})\right] \quad (3)$$

$$i(t)=C_{i0}+\sum_{k=1}^{m}\left[C_{ik}\cos(k\omega t)+S_{ik}\sin(k\omega t)\right]$$

$$=C_{i0}+\sqrt{2}\sum_{k=1}^{m}\left[A_{ik}\sin(k\omega t+\varphi_{ik})\right] \quad (4)$$

By using a simple trigonometric transformation, the trigonometric series becomes a harmonic series, in sine or cosine [1,4]. The voltage and current RMS values are given by the relations:

$$U=\sqrt{C_{u0}^2+\sum_{k=1}^{m}A_{uk}^2} \quad (5)$$

$$I=\sqrt{C_{i0}^2+\sum_{k=1}^{m}A_{ik}^2} \quad (6)$$

Finally, the power consumption relationship comes out, introducing by that: the instantaneous power (p), volt-amps (S), the active power (P), the reactive power (Q), the deforming power (D) and the power factor (K):

$$p(t)=\left\{C_{u0}+\sqrt{2}\sum_{k=1}^{m}\left[A_{uk}\sin(k\omega t+\varphi_{uk})\right]\right\}\cdot$$

$$\cdot\left\{C_{i0}+\sqrt{2}\sum_{k=1}^{m}\left[A_{ik}\sin(k\omega t+\varphi_{ik})\right]\right\} \quad (7)$$

$$S=\sqrt{C_{u0}^2+\sum_{k=1}^{m}A_{uk}^2}\cdot\sqrt{C_{i0}^2+\sum_{k=1}^{m}A_{ik}^2} \quad (8)$$

$$P=C_{u0}C_{i0}+\sum_{k=1}^{\infty}A_{uk}A_{ik}\cos(\varphi_{uk}-\varphi_{ik}) \quad (9)$$

$$Q=\sum_{k=1}^{\infty}A_{uk}A_{ik}\sin(\varphi_{uk}-\varphi_{ik}) \quad (10)$$

$$D=\sqrt{S^2-P^2-Q^2} \quad (11)$$

$$K=\frac{P}{S} \quad (12)$$

Power converters create current distortions which increase harmonic distortion coefficient. Each power convertor creates a unique harmonic spectrum.

The harmonic distortion coefficient is dependent by electric supply network topology. Based on harmonic distortion coefficient it is calculating the total harmonic distortion.

Usually the THD coefficient is below 5%, at this value are not necessary harmonic filters.

Based on static parameters of voltage supply the quality of voltage source is determinate and the installations for voltage adjustment can be chose accordingly.

To measure the parameters of electrical network it used „CA 8335 Qualistar Plus" analyzer and the DataWiever® Software.

It was measured the parameters of current, voltages, apparent power and current and voltage imbalance [2,6].

After analyses of recorded data the following parameters was calculated: the load factor, voltage fluctuation and flicker, current unbalance factor, voltage unbalance factor, current and voltage THD.

Rapid variation of parameters values according with this configuration create voltage fluctuation and flicker.

The values of current and voltage THD based on the load factor of transformer are displayed in fig. 1 and 2 [6].

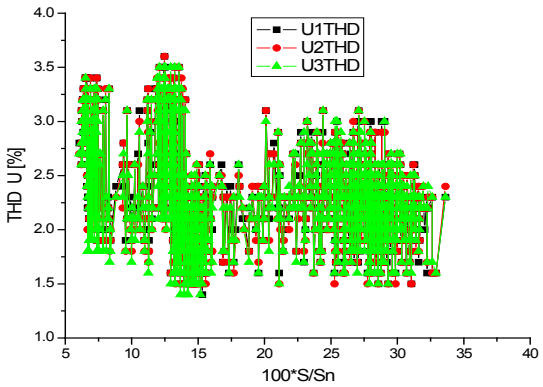


Fig. 1 Voltage THD for laser processing installations

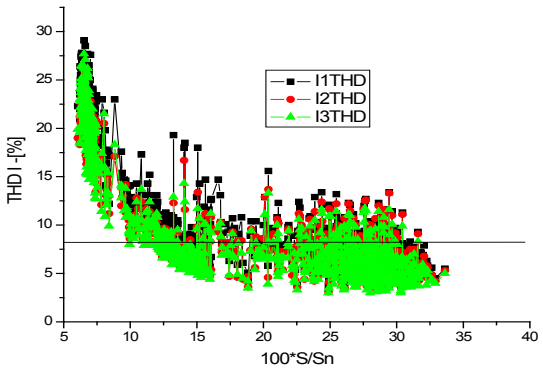


Fig. 2 Current THD for laser processing installations

The high values of current THD create additional loses inside the electric power network and linear loads.

In table 1 and 2 are displayed the first 20 values of voltage and current unbalance factor [6].

Table 1 Value of current unbalance factor

Ora	IR [A]	IS [A]	IT [A]	K2I [%]
7:10:00.000 PM	2,64	3,08	2,688	9,895
7:00:00.000 PM	2,664	3,096	2,696	9,839
7:10:00.000 AM	2,856	3,272	2,824	9,651
2:50:00.000 AM	2,792	3,224	2,808	9,610
12:30:00.000 PM	2,808	3,232	2,816	9,485
7:20:00.000 PM	2,632	3,048	2,672	9,483
12:40:00.000 PM	2,912	3,392	3	9,372
2:20:00.000 PM	2,744	3,136	2,728	9,294
7:30:00.000 PM	2,632	3,024	2,656	9,143
7:00:00.000 AM	2,864	3,256	2,832	9,115
10:30:00.000 AM	2,752	3,2	2,848	9,091
10:40:00.000 AM	2,856	3,344	3	9,043
12:20:00.000 PM	2,784	3,184	2,8	8,942
3:00:00.000 AM	2,824	3,224	2,832	8,919
6:50:00.000 AM	2,88	3,264	2,848	8,897
2:40:00.000 AM	2,824	3,232	2,848	8,895
6:40:00.000 AM	2,888	3,28	2,872	8,850
7:40:00.000 PM	2,632	3,024	2,68	8,829
8:00:00.000 PM	2,584	3,04	2,76	8,779
2:40:00.000 PM	2,744	3,128	2,76	8,712

Table 2 Value of voltage unbalance factor

Ora	UR [kV]	US [kV]	UT [kV]	K2U [%]
6:10:00.000 PM	21,2	21,48	21,3	0,719
6:50:00.000 PM	21,24	21,58	21,38	0,841
7:10:00.000 AM	20,64	20,9	20,78	0,610
5:40:00.000 PM	20,88	21,14	21,02	0,603
11:20:00.000 PM	20,82	21,12	21,02	0,635
1:20:00.000 PM	21,02	21,32	21,16	0,724
1:30:00.000 PM	21,06	21,36	21,2	0,723
5:10:00.000 AM	20,76	21,02	20,9	0,606
6:30:00.000 AM	20,86	21,16	21,06	0,634
10:40:00.000 AM	21,06	21,36	21,2	0,723
10:50:00.000 AM	21	21,3	21,18	0,662
12:30:00.000 PM	20,86	21,16	21,06	0,634
12:40:00.000 PM	20,86	21,14	21,02	0,635
1:10:00.000 PM	20,84	21,14	21,02	0,667
4:40:00.000 PM	21,14	21,42	21,3	0,626
4:50:00.000 PM	21,12	21,4	21,28	0,627
7:30:00.000 PM	21,14	21,44	21,32	0,657
2:30:00.000 AM	20,92	21,2	21,1	0,601
2:40:00.000 AM	20,88	21,2	21,1	0,665
2:50:00.000 AM	20,9	21,22	21,14	0,632

Based on this analysis the following results are obtained:

The value of voltage unbalance factor is according with standards;

The value of current unbalance factor is above standards for a load below 30%;

The value of voltage THD is according with standards;

The value of current THD is raising when the load factor of transformer decrease;

The value of current THD is over limit in 400 cases from 1000 measurements.

3. THE ANALYSIS OF HARMONICS OF CURRENT FROM POWER GRID

The main modules for CO2 laser power supply (high voltage starting pulse 20kV, voltage 8…10kV) are (fig. 3) [3,5]:filter to reduce harmonics from/to power grid; voltage rectifier and filter module; auxiliary power supply; trigger circuit for achieving discharge starting voltage; power modules; the command circuit and operation mode achievement.

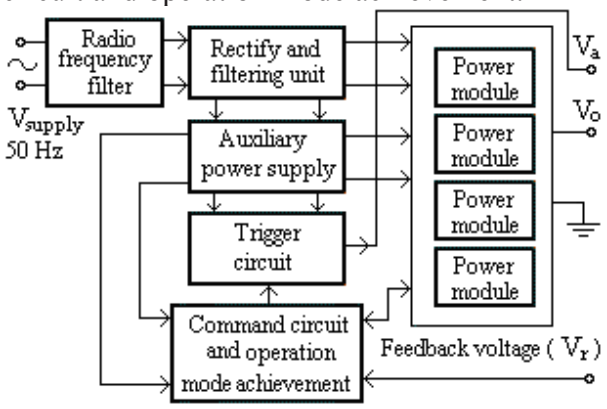


Fig. 3 The main modules for CO2 laser power supply

In order to power a CO2 laser with 1 kW the pulse power supply should have 4 parallel power modules with following parameters (for a minimum efficiency of conversion of electric energy into laser energy of 12,5%):

Power grid with 50Hz, 380V, 3 phase;

Rated output voltage $V_o = 8...10kV$;

Rated load current $I_o = 200mA$;

Voltage adjustment for current $V_r = 0...10Vdc$;

Rated output $P_o = 2kW$;

Pulse repetition frequency $f_r = 0...1kHz$;

Pulse width $t_i = 0,2ms$;

Maximum current pulse $I_{oi\max} = 0,8A$;

Minimum efficiency $\eta = 0,75\%$;

Discharge starting voltage $V_a = 20kV$;

Pulse shape: Train half circle redressed without any special waveform to the converter.

The circuit of Full Bridge voltage converter, for the presented parameters is displayed in Fig.4.

The waveform of the output voltage are shown in Fig. 5 and the waveform of the output current in the primary winding of high voltage transformer and primary winding voltage are shown in Fig. 6 and 7.

The Fourier analysis for the current drawn from the power supply is shown in Fig. 8.

The analysis was performed for several values of load converter (10kΩ; 20kΩ and 50kΩ), the required output voltage is 9kV.

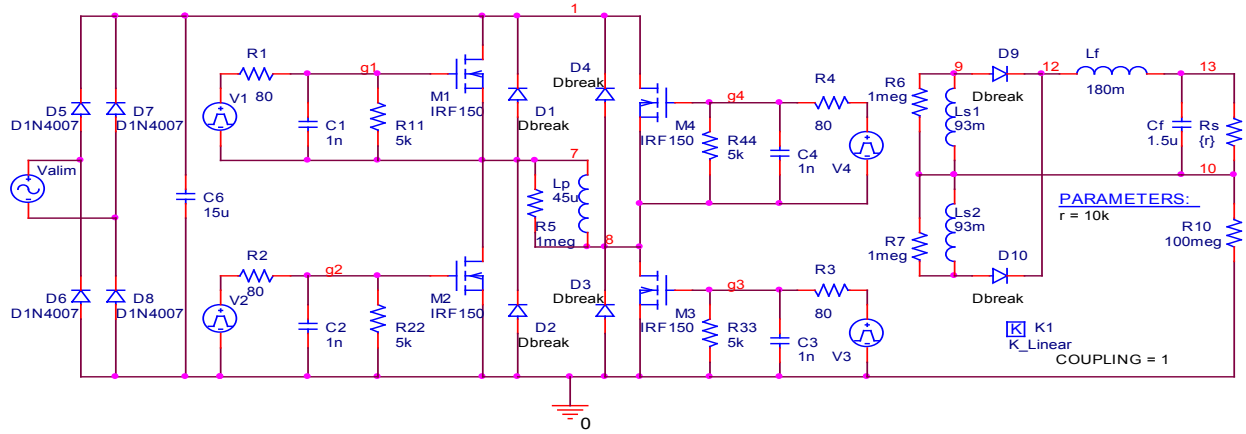
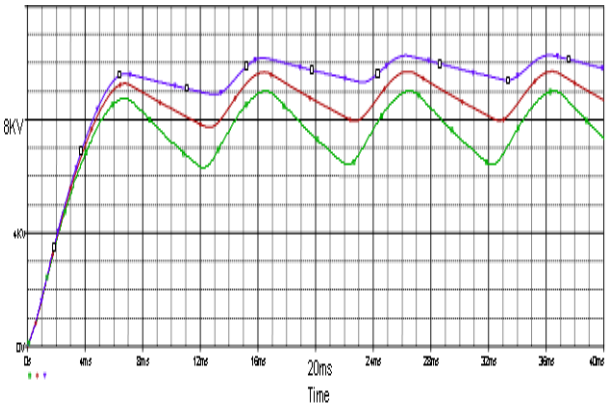


Fig. 4 Full Bridge voltage converter



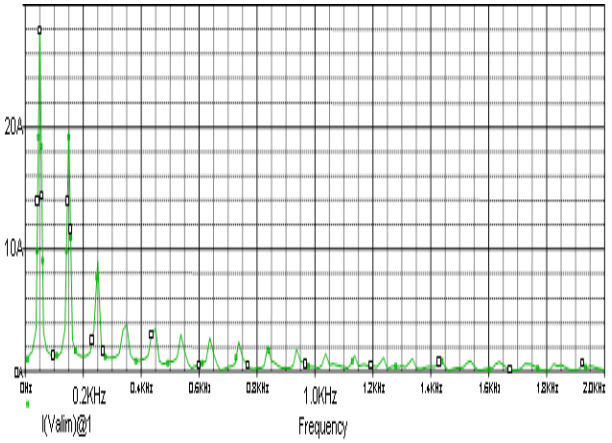
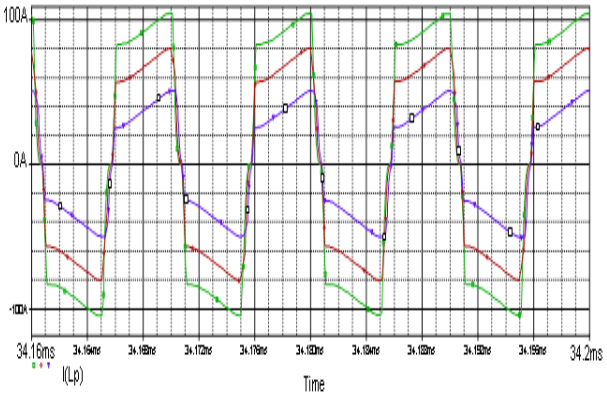


Fig. 5 The waveform of the output voltage (RS = 10k; RS = 20k; RS = 50k)

$R_S = 10k\Omega$



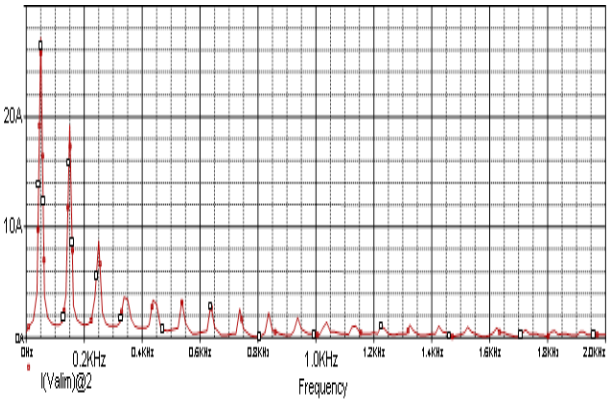
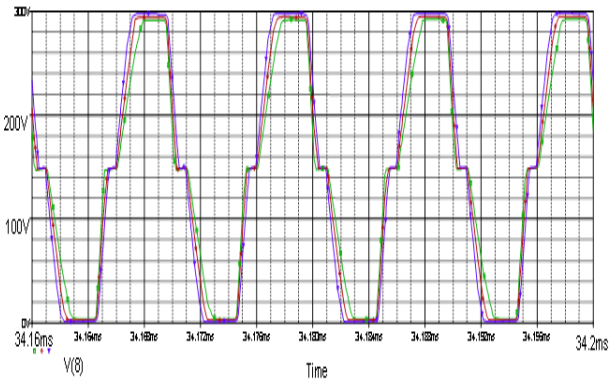


Fig. 6 The waveform of the output current in the primary winding of high voltage transformer I(Lp) (RS = 10k; RS = 20k; RS = 50k)

$R_S = 20k\Omega$



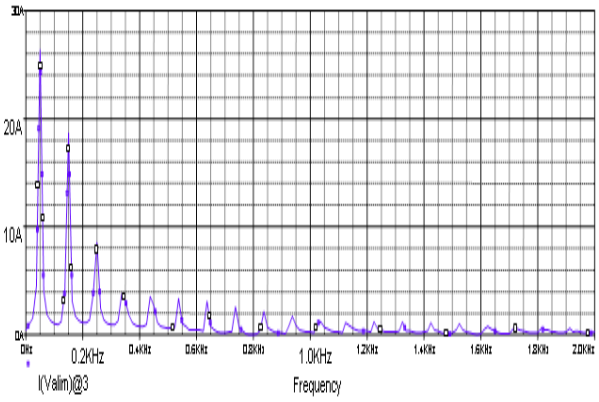


Fig. 7 The waveform of the primary winding voltage of high voltage transformer

$R_S = 50k\Omega$

Fig. 8 The Fourier analysis for the current drawn from the power supply

In Fig. 5 shows both a strong dependence of the output voltage maximum value and the value of its ripple's load module.

For Full Bridge converter the transient regime is lower in comparison with Half Bridge [5], and is approximately 10ms.

From Fig. 8 it is seen that it is generated both even and odd harmonics, the most significant being the fundamental frequency harmonic.

CONCLUSIONS

Equipment supply power lasers are composed of switching power converters, leading to the presence of harmonics in the current drawn from the mains.

Total harmonic distortion factor is calculated based on the harmonic factor that depends on the type of mains and consumer characteristics.

The introduction of harmonic currents in the supply network has the effect of waveform distortion of the system voltage phase electric supply.

From the analysis showed result that the voltage THD value remains at admissible parameters, but current THD value increases with decreasing load factor of the transformer, this imposing and analysis of electromagnetic pollution phenomena for laser processing plants and in particular of PWM power converters in the composition of power sources analyzed.

Following the results obtained by Fourier analysis of voltage Full Bridge converter resulted existence of both even and odd harmonics of the current drawn from the mains, but the amplitudes of harmonics are reduced and do not depend on the converter load and varies quite slightly depending on the type of the converter.

The amplitudes of the odd harmonics strongly depend both on the load and the type of converter.

It follows that the presence of power converters inevitably lead to the presence of harmonics in the current drawn from the mains and therefore distortion of degradation factor, and each type of power converter have its distinct harmonic spectrum.

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ADVERTISEMENT USING BLUETOOTH LOW ENERGY

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Abstract: *The goal of this paper is to build an application that receives commercials depending on a user's location in stores. This can be made using client-server architecture. The server consists of an Arduino and a BLE (Bluetooth Low Energy) device. For the client, a smartphone has been used for which an application has been developed. This application is suitable for its operating system (Android 4.3) so that it can communicate with the server (the BLE device) placed in the store. After connecting to the server, the client waits for data from the BLE module attached to Arduino and displays the corresponding advertisement on the phone screen. A questionnaire has been added in order to receive the user's feedback, so that the advertisement's impact can be monitored. All data is stored in a MySQL database.*

INTRODUCTION

Originally a Nokia research project, BLE (Bluetooth Low Energy), was first introduced by the Finnish firm in 2007 as Wibree.

BLE was released as part of Bluetooth 4.0 under the brand name of Bluetooth Smart. BLE is designed to be an ultra-low power network that can operate on a coin cell battery for up to three years.

Therefore, BLE is very efficient in terms of power consumption, it is reliable and cheap to implement because of its range.

The iPhone 4S was the first commercial product that included Bluetooth 4.0.

At the time, the technology got some attention from industry observers who speculated about its potential - especially regarding a new technology called BLE. With iOS 7, Apple has extended the possibilities of BLE with iBeacons.

Bluetooth 4.0 comes on all Apple devices released since 4S, including Mac devices and increasingly in Android phones such as the HTC One, the Samsung Galaxy SIII and upward. Since Android Jelly Bean (4.3), Google began offering support to BLE signals for the development of technology.

Starting from the iBeacons idea that iOS 7 is elaborating at the moment, something similar was implemented here, but for Android.

Because BLE can transmit within a radius of 50 meters, the developers can create new experiments with city tours, sales, games that can test the ability of finding hidden gems, etc. IBeacons work without Wifi or internet connection, establishing the location is much more accurate and works from the inside.

When the users are getting closer, their devices can receive messages or information about certain interests. In this aspect lies the idea that was used and which is being further developed. When a client is in the iBeacons range and has the Android application activated, s/he will receive commercials on his phone which contain the best current offers of various shops. Hence, the concept has been used to improve shopping experience. Women will definitely love the idea.

Of course, this technology can fulfill numerous tasks ranging from a pay system, health, sports, and especially can have a huge influence in marketing and advertising.

Therefore, the developers have shown particular interest in BLE due to its micro-capabilities to localize.

As Michael E. Cohen from TidBITS states, "The applications which are using iBeacon can provide an answer to the question: "Where am I?" and not in terms of a map as the GPS, but in terms of where the device is located in a relative position to another device.

This means that the initial location can be determined by different sensors up to a micro level, due to the iBeacons that receive the signal from where other devices cannot obtain it.

The aim of this study is to innovate how advertising works in a time when society is constantly evolving and in the same time, new technologies replace old ones.

2. IMPLEMENTATION OF THE SYSTEM

2.1 Description of the system architecture. The main key words relied on when designing this system are 'mobility' and 'flexibility'.

To do this, the system was designed from the start to operate in the most commonly used medium today: the internet.

But how to get on the Internet an advertisement from the stores we walk past every day?

In order to achieve this, a system based on client-server architecture has been designed (Fig. 1).

2.2 The server consists of an Arduino and a device mode BLE (Bluetooth Low Energy).

This has the purpose of transmitting signal in a certain range and when the client passes by, he can detect it and connect to the server if he takes into consideration some signal requirements.

Once the client-server connection is initiated, the server sends the data corresponding to the advertisements through BLE to the client and then it will disconnect

To display the status of the client-server connection, a witness has been chosen, namely a LED. When the LED is on, it means a client is connected and when not, it is available and waiting for a connection.

For creating the server, the Arduino Uno module has been chosen (Fig. 2) because of the information available on the internet, various open source libraries and its flexibility (each module can be adapted to a user friendly mode, requiring less time for debugging and more time to put into practice the programmer's ideas).

This model has been equipped with a ATmega328 microcontroller.

The Arduino module from Fig. 2 consists of:

- ATmega328 microcontroller with Optiboot (UNO) Bootloader
- USB Programming Facilitated by the Ubiquitous FTDI FT232RL
- Input voltage - 7-15V
- 0-5V outputs with 3.3V compatible inputs
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16MHz Clock Speed
- All SMD Construction

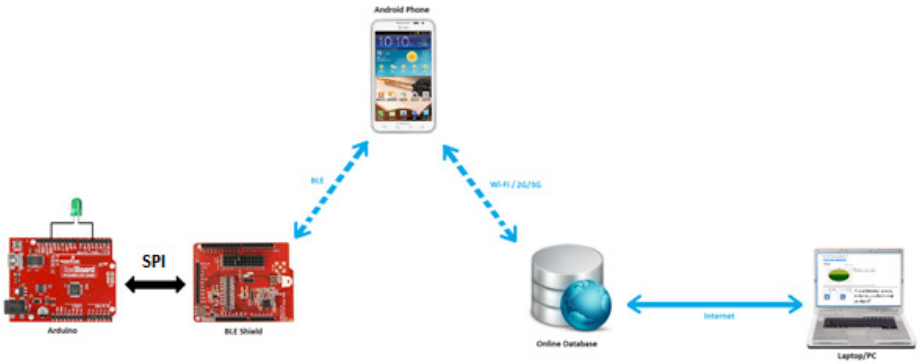

Fig. 1. The architecture of the system

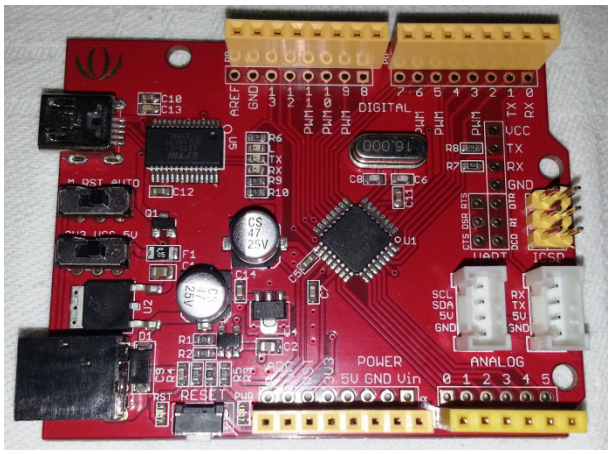

Fig. 2. Arduino module

To the Arduino board, a Bluetooth LE (Low Energy) shield - produced by RedBearLab Company - has been added (Fig 3), which helps the server communication via Bluetooth with the client (the application on the phone).

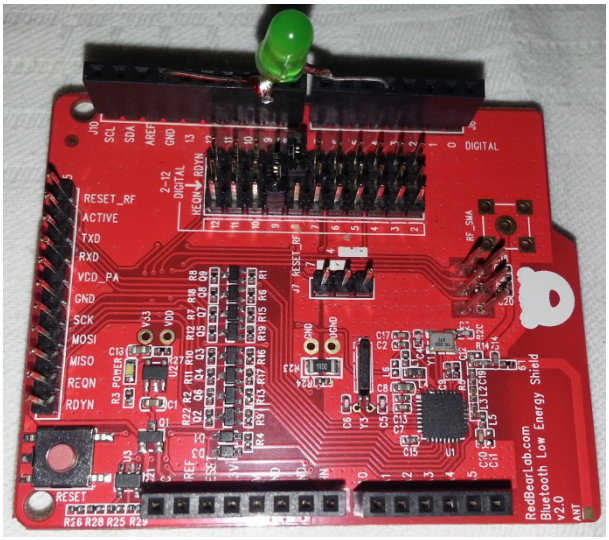

Fig. 3. BLE Shield

The BLE board consists of:

- Besides the on-board PCB antenna, option to use SMA connector for external antenna (soldering is required)
- Flexible REQN and RDYN pins selectable from pin 2 to 12, these pins are fixed at 8 & 9 for BLE Shield v1
- Reset button also resets the Arduino board, and vice versa
- ICSP header provides Vcc (for other shields to get power source)
- ICSP header now passes through (for other shields to connect to the SPI)
- Shield's reset is controllable by Arduino pin 4 or 7.

This shield has the microcontroller Nordic nRF8001 Bluetooth Low Energy IC at its core.

As a way to communicate with Arduino, the SPI protocol is used: protocol which is handled by SPI library from the Arduino development environment (SPI library) using serial communication.

For debugging and connection status, adding a LED witness to the Arduino board has been considered useful in order to notify the seller if the module or server works properly: it will light up when the connection with a client is established and will turn off if the connection is available or not busy with maintaining a connection.

Last but not least, the concept of this system is to be portable. A standard 9V battery has been used to supply the Arduino device.

After creating the server part of the system, Arduino had to be programmed from its own Arduino IDE environment in order to be able to communicate with the BLE module and manage the client connection.

Firstly, the necessary open source libraries have been included. Afterwards the used pins have been defined. Lastly, the on/off switching LED witness has been configured.

2.3 The client – For the client, a smartphone has been used for which an application has been developed. This application is suitable for its operating system (Android 4.3) so that it can communicate with the server (the BLE device) placed in the store.

Samsung Galaxy Note2 was the testing device (Fig. 4).

Fig. 4Samsung Galaxy Note2

For this, an application for Android has been developed, with help from the AndroidDeveloper dedicated software Tools based on Eclipse IDE.The first screen that appears is:

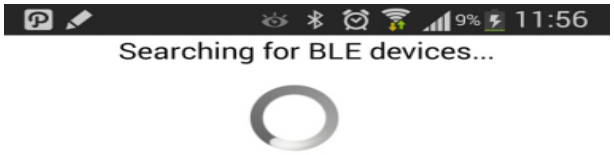

Fig. 5

..and the device with the strongest signal from the list (the closest to the user) is chosen

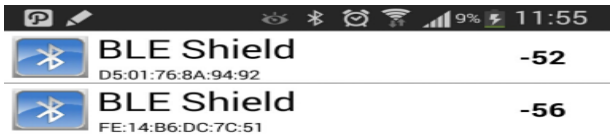

Fig. 6. Received signal strengths

…and displays the corresponding data on a screen

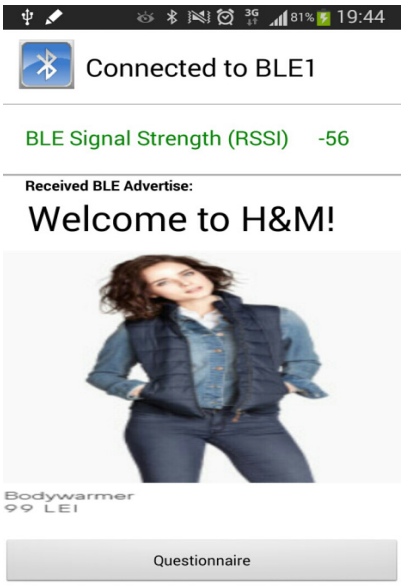

Fig. 7. Advertisement on the smartphone screen

Finally, the user's feedback is requested (Fig. 8).

The application has been created so that it always scans the BLE devices in the area; it displays them in a list and then chooses the device with the strongest signal from the list (the closest to the user).

After connecting to the server, it expects data from the server (BLE module attached to Arduino) and displays the corresponding data on a screen. A button has been added to the questionnaire in order to receive the user's feedback, so that the advertisement's impact can be monitored.

Fig 8. Feedback from the client

After the user completes the survey, the data is sent through the Internet to a certain location and recorded with a php script in an SQL database and then the whole process is restarted on the mobile application.

The utilized libraries specific to BLE Android have been available only since version 4.3.

To connect to the device with the strongest signal from the list the values of the signals were compared and they are stored in the RSSI variable.

Fig. 9. The webpage where the feedback is collected

2.4 The main database online. After sending the response of the questionnaire for the Android application, managing the customer's feedback would be of help and for this a MySql database has been chosen. Therefore, a free domain has been found and a database with a table containing the fields below has been created in MySQL:

- *registrationId*- unique ID for registrations
- *btname*- the name of the BT device from the client's phone
- *answer*- the client's answer
- *shopname*- the name of the shop related to the questionnaire

In order to add/ remove elements from the database some php scripts have been used and for the interface CSS has been used for arranging the page's layout.

The source code of the entire application is not the subject of this paper; it can be obtained only upon request.

3. CONCLUSIONS & FUTURE WORK

There are numerous ways of using BLE in developing applications in almost all areas: from micro-localization of payments, marketing, health, security, traffic performance, product information, advertising, location services and more than that.

To conclude, the work presented in this paper includes an application developed on an Android device for the marketing area. Its purpose is to innovate how advertising works in a time when society is constantly evolving and in the same time, new technologies replace old ones. The internet offers so many opportunities and this is the most important tool used for this application.

In the future this work will be tested in real life at a Shopping Center mall. After the experiment, the data collected and stored in the database will be used for creating new products based on people's wishes/requests.

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FRACTAL ELLIPTICAL SEGMENT ANTENNA. COMPLETE MATHEMATICAL MODEL AND EXPERIMENTAL APPLICATION

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Abstract: *This paper presents a model for fractal segment antennas with elliptical resonators and resonant slots. Bessel polynomials-based calculation methods were used in order to determine the resonance frequencies. Elliptical contour integration was used for emphasizing the validity of the E-H field transformation phenomenon, according to the Maxwell field dynamics equations. These theoretical fundamental ideas are verified through a series of experiments, rendering charts that are specific to the radiating field intensity, field distribution and the main operational frequency domains. The antenna design was obtained through fractal division based on an isosceles triangle element.*

Keywords: *fractal, antenna, directivity, field intensity, impedance, Bessel functions*

1. INTRODUCTION

Fractal antennas are part of the wideband antenna group, having the widest directivity charts.

This type of antenna has been highly used in mobile communication designs, especially since the beginning of 3G, mainly in stripline models and with median gains over 5dB.

The optimal gain is determined by the reference fractal resonator shape and the number of fractal iterations.

This paper presents a fractal segment antenna model with an elliptical stripline three-level slotted reference resonator.

The resonant frequencies were calculated using the Bessel functions, for the elliptical resonator, and the calculation of frequencies for the slot in a waveguide.

This analytical and practical model yielded positive results in all aspects: frequency domain, directivity chart and emission-reception power, for a median gain of 6 dB.

The analytical considerations for the calculations are the synthesis of papers previously published by our research group, which have resulted in designing and producing the prototype for this antenna.

2. DESIGN PRINCIPLES

The reference stripline resonator has an elliptical shape and is slotted along the major ellipse axis (Morariu, 2013). The resonant frequency calculus is presented (according to (Morariu, 2009) and (Machedon, 2012) as follows:

"*The method consists in the equivalence of common radiating surfaces to those two stripline dipoles superi mposed and separated by the dielectric layer as in Figure 1 neglecting the transfer radiation on the elliptical boundary and dipole plane behind the dielectric (their influence is minimal)*."

This procedure results in a stripline cylindrical resonant cavity, "*whose resonance frequency is derived using the calculation for the variation of high frequency electromagnetic field between plates of the parallel elliptical plane capacitor with dielectric* ε_r" (Machedon, 2012).

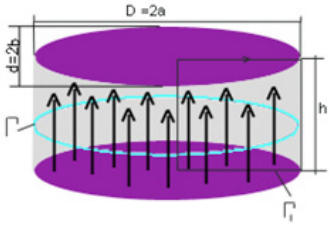

Fig. 1. Stripline equivalent resonator

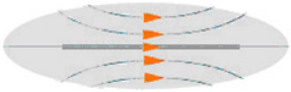

Fig. 2. H_{01} mode

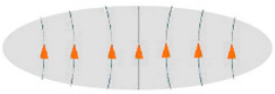

Fig. 3. H_{10} mode

Obtaining the B and E components of the radiating electromagnetic field implies applying the integral form of Maxwell equations iteratively as follows (Machedon, 2012).
The first iteration:

$$S = \pi\, a\, b \tag{1}$$

$$\hat{\imath} = \frac{\sqrt{a^2 b^2}}{a} \tag{2}$$

where ξ is the eccentricity coefficient.

$$L = 2\pi a P(\xi) \tag{3}$$

$$E\left(\xi, \frac{\pi}{2}\right) = \frac{\pi}{2}\left[1 - \left(\frac{1}{2}\right)^2 \xi^2 + \left(\frac{13}{24}\right)^2 \frac{\xi^4}{3} - \right.$$
$$\left. - \left(\frac{135}{246}\right)^2 \frac{\xi^6}{5} \ldots\right] = \frac{\pi}{2} P(\xi) \tag{4}$$

$$b = a\sqrt{1 - \xi^2} \tag{5}$$

$$S = \pi a^2 \sqrt{1 - \xi^2} \tag{6}$$

$$\nabla \times E = \frac{\partial}{\partial t} B \tag{7}$$

$$c^2\, \nabla \times B = \frac{\partial}{\partial t} E \tag{8}$$

$$\oint_{\Gamma_2} E\, dl = -\frac{\partial}{\partial t} \int_{\Sigma_{\Gamma_2}} B\, dS \tag{9}$$

$$c^2 \oint_{\Gamma_1} B\, dl = \frac{\partial}{\partial t} \int_{\Sigma_{\Gamma_1}} E\, dS \tag{10}$$

$$E = E_0\, e^{j\omega t} \tag{11}$$

By deriving (10):

$$c^2\, B_1\, L = \frac{\partial}{\partial t}\left(E_0\, e^{j\omega t}\, S\right) \tag{12}$$

$$c^2 B_1 2\pi a P(\xi) = j\omega E_0 e^{j\omega t} \pi a^2 \sqrt{1 - \xi^2}$$

$$c^2 B_1 2\pi a P(\xi) = j\omega E_0 e^{j\omega t} \pi a^2 \sqrt{1 - \xi^2} \tag{13}$$

$$B_1 = \frac{\sqrt{1 - \xi^2}}{P(\xi) 2c^2}\, a E_0 e^{j\omega t} j\omega \tag{14}$$

By deriving (9):

$$\oint_{\Gamma_2} E\, dl_2 = -E_1\, h = -\frac{\partial}{\partial t} \int_{\Sigma_{\Gamma_2}} B_1\, dS_2 \tag{15}$$

For $dS_2 = h\, da$:

$$E_1 h = \frac{\partial}{\partial t}\left(j\omega \int_0^a \frac{\sqrt{1 - \xi^2}}{P(\xi) 2c^2} E_0 e^{j\omega t} a h da \right)$$

$$E_1 h = \frac{\partial}{\partial t}\left(j\omega \int_0^a \frac{\sqrt{1 - \xi^2}}{P(\xi) 2c^2} E_0 e^{j\omega t} a h da \right) \tag{16}$$

$$E_1 == -\frac{\sqrt{1 - \xi^2}}{P(\xi)} E_0 e^{j\omega t} \frac{\omega^2 a^2}{4c^2} \tag{17}$$

After three iterations of derivation (minimum) and taking into consideration that

$$\overline{E} = \overline{E}_0 + \overline{E}_1 + \overline{E}_2 + \overline{E}_3 + \ldots \tag{18}$$

$$\frac{\omega b}{2c} = \frac{x}{2}\,, \tag{19}$$

the final relation is:

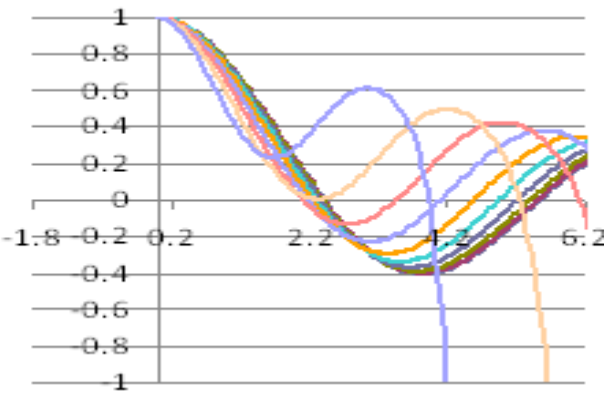

Fig. 4. H(x,ξ) chart as for the major ellipse axis

$$\bar{E} = E_0 e^{j\omega t}\left(1 - \frac{1}{P(\xi)} + \frac{1}{P(\xi)}\left(1 - \frac{1}{(1!)^2}\left(\frac{x}{2}\right)^2 \frac{1}{\sqrt{1-\xi^2}} + \frac{1}{(2!)^2}\left(\frac{x}{2}\right)^4 \frac{1}{\left(\sqrt{1-\xi^2}\right)^3} - \cdots\right)\right) \quad (20)$$

$$\bar{E} = E_0 e^{j\omega t} \cdot H(x,\ \xi)\bar{E} = E_0 e^{j\omega t} \cdot H(x,\ \xi)$$

(21)

$H(x,0) = J_{01}(x)H(x,0) = J_{01}(x)$ it is a Bessel function which can be applied for elliptical resonant surfaces (Morariu, 2009).

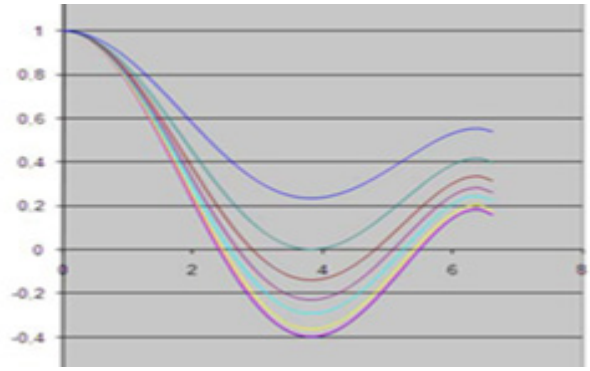

Fig. 5. H(x,ξ) chart for the minor axis of the ellipse

A planar resonant cavity is positioned symmetrically on every major axis of the ellipses, with the following parameters.

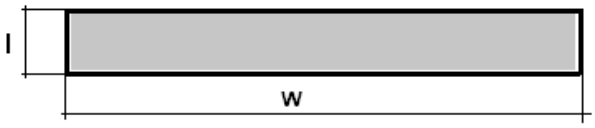

Fig. 6. Stripline resonant cavity [11]

The dynamics of the electric field derives from the electromagnetic wave equation of the plane resonant cavity.

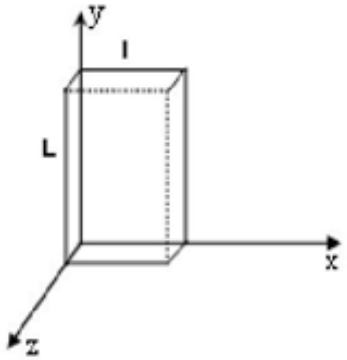

Fig. 7. Model of the plane resonant cavity

The electromagnetic wave equation of the plane resonant cavity is:

$$\frac{\partial^2 H_z}{\partial x^2} + \frac{\partial^2 H_z}{\partial y^2} + \mu\varepsilon\omega^2 H_z = 0 \quad (22)$$

Considering the following conditions:
$E_z = 0$, x = 0 and x = l;
$E_z = 0$, y = 0 and y = L,
the value for H_z can be calculated:

$$H_z = H_0 \cos\left(n\pi\frac{x}{l}\right)\cos\left(m\pi\frac{y}{L}\right)$$

$$H_z = H_0 \cos\left(n\pi\frac{x}{l}\right)\cos\left(m\pi\frac{y}{L}\right) \quad (23)$$

for $0 \le x \le l$ and $0 \le y \le L$.

Specific resonance pulsation for the propagation mode:

$$\omega = \frac{\pi}{\sqrt{\varepsilon\mu}}\sqrt{\frac{n^2}{l^2} + \frac{m^2}{L^2}} \quad (24)$$

$$\lambda_{rez} = \frac{2\sqrt{\varepsilon_r}}{\sqrt{\frac{n^2}{l^2} + \frac{m^2}{L^2}}} \quad (25), \quad L = \frac{\lambda_r}{2} \quad (26)$$

The H_{01} propagation mode is dominant, rendering n=0 and m=1.

$$\omega_r = \frac{4\pi \cdot c}{\lambda_r \sqrt{\varepsilon_r}} \pi r^2 \,,\; f_r = \frac{2c}{\lambda_r \sqrt{\varepsilon_r}} \qquad (27)$$

where $\varepsilon_r \cong 2{,}25$.

Table 1. Slot resonator frequencies for the three fractal iterations, Propagation mode H_{01}

Slot length [m]	Frequency [GHz]
0.032	4.1667
0.048	2.778
0.059	2.259

Considering x = ωb/c and y = ωa/c, the resonant frequencies and corresponding harmonics can be identified.

Table 2. Elliptical resonator frequencies for the minor axis of the ellipse [GHz]

	b1	b2	b3
Length[m]	0.035	0.025	0.017
2.1	2.87	4.01	5.90
2.1 x2	5.73	8.03	11.80
2.3	3.14	4.39	6.46
2.3 x2	6.28	8.79	12.93
3.45	4.71	6.59	9.69
3.45 x2	9.42	13.18	19.39
3.95	5.39	7.55	11.10
3.95 x2	10.78	15.10	22.20
5.25	7.17	10.03	14.75
5.25 x2	17.33	20.06	29.51

Table 3. Elliptical resonator frequencies for the major axis of the ellipse [GHz]

	a1	a2	a3
Length [m]	0.087	0.066	0.05
2.1	1.15	1.52	2.01
2.1x2	2.31	3.04	4.01
2.3	1.26	1.66	2.20
2.3x2	2.53	3.33	4.39
3.45	1.89	2.50	3.30
3.45x2	3.79	4.99	6.59
3.95	2.17	2.86	3.77
3.95x2	4.34	5.72	7.55
5.25	2.88	3.80	5.02
5.25x2	5.77	7.60	10.03

Table 4. Variable elliptical waveguide behavior

a [m]	Dipole frequency [GHz]
0.051	0.980
0.069	0.724
0.091	0.549
0.1255	0.398
0.1765	0.283
0.1	0.5

Table 5. Linear equivalent dipole behavior

λ/4 [m]	Frequency [GHz]
0.09	0.857
0.105	0.480
0.155	0.375

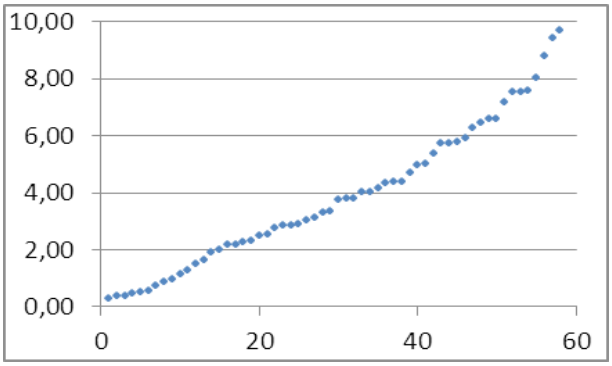

Fig. 8. Experimental frequency spectrum distribution

3. EXPERIMENTAL APPLICATION

According to the previous mathematical description, an experimental model of an antenna with fractal elliptical segments was designed (Morariu, 2013). The antenna has the following parameters.

A. Antenna Architecture

Fig. 9. The main resonator shape (Machedon, 2012)

The fractal generation was based on the isosceles triangle division, with a triangle side ratio equal with the axis ratio of the ellipse:

$$\frac{D_n}{d_n} = \frac{k \cdot L_n}{\frac{B_n}{2}}$$

where k is the surface constant.
The ratio $base_{n+1} = l_n/2$, is maintained.

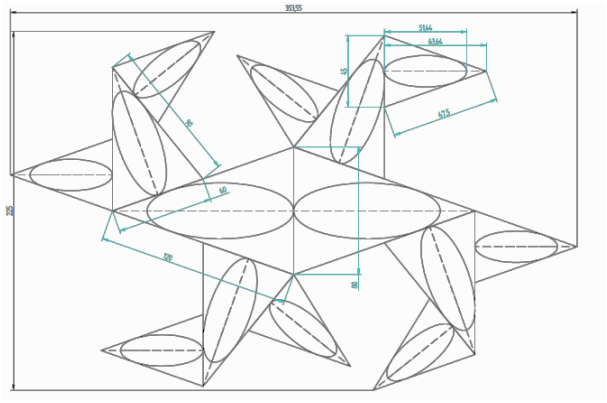

Fig. 10. Antenna design – triangle fractal division

Initial dimensions: k = 0.9; d_0 = 3.8cm; D_0 = 9.14cm; L_0 = 12cm.

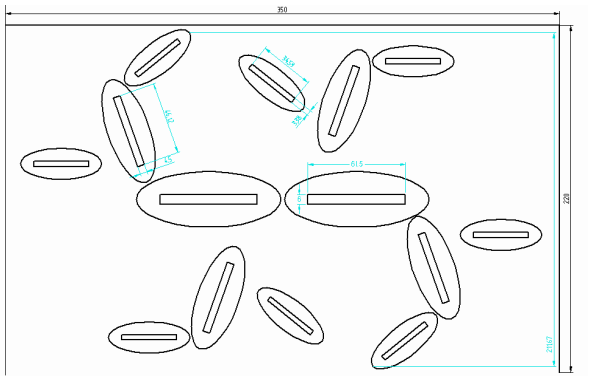

Fig. 11. Fractal antenna with elliptical dipoles – front side

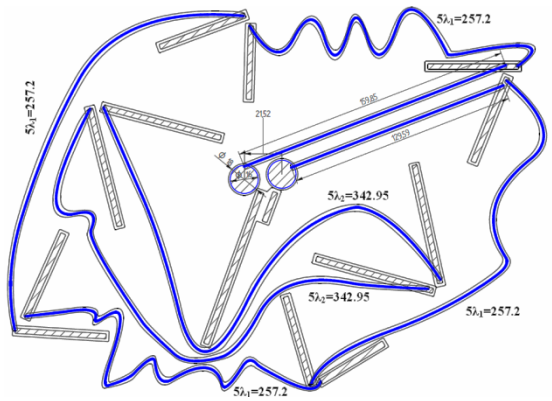

Fig. 12. Fractal antenna with elliptical dipoles back view (full line–phase connection; hatched line–feeder matching segments)

B. Experimental Results

The experimental analysis for the antenna was conducted for two frequency domains: below 1GHz (using scalar spectrum analyzer) and from 1GHz to 18GHz using a VNA (vector network analyzer). The main results are presented in the following section (Morariu, 2013).

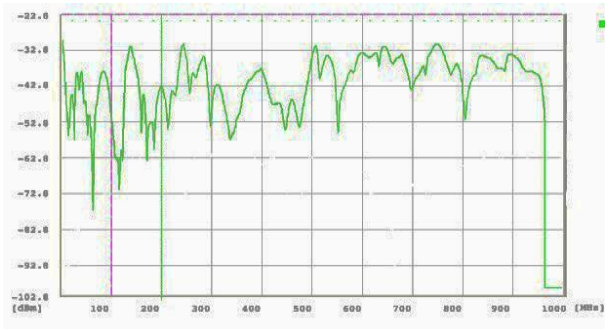

Fig. 13. Frequency spectral diagram – reception

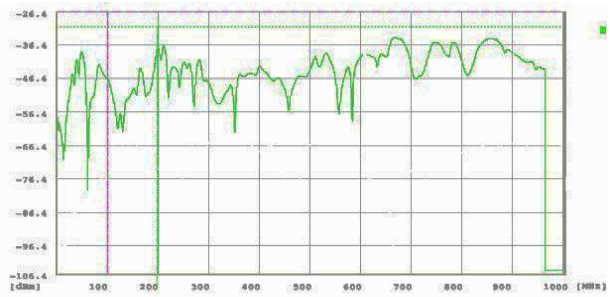

Fig. 14. Frequency spectral diagram - emission

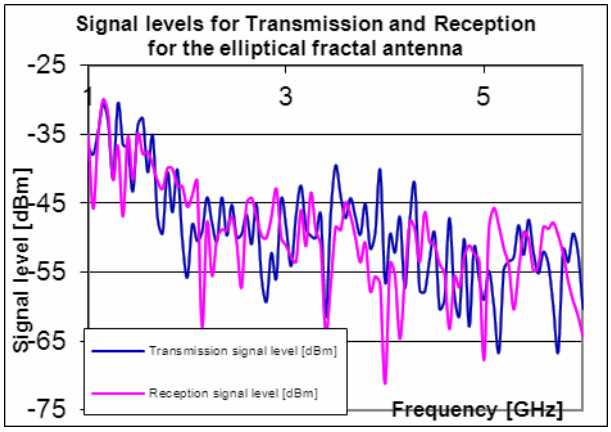

Fig. 15. Signal levels E/R for 1-6GHz

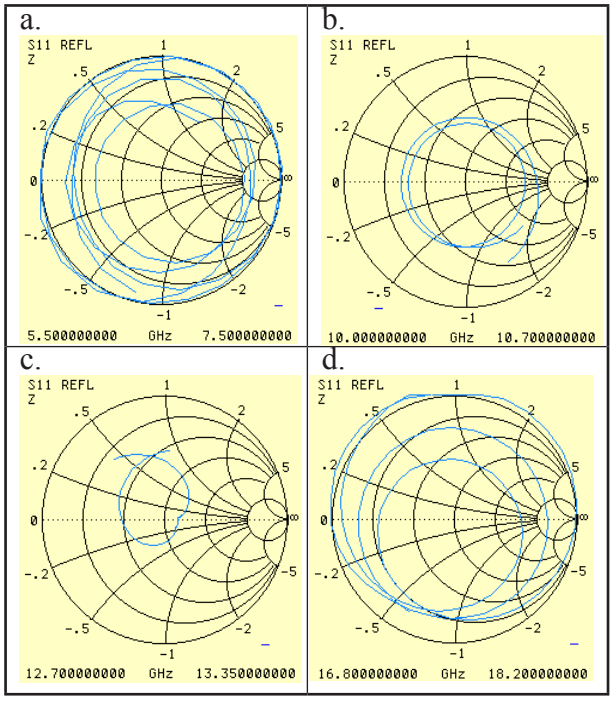

Fig. 16. Smith charts obtained for the frequency domains:
a. 5.5-7.5GHz; b. 10-10.7GHz;
c. 12.7-13.35GHz; d. 16.8-18.2GHz

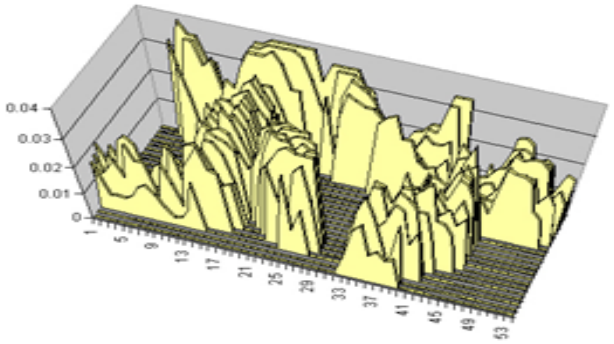

Fig. 17. E field distribution for the radiant elements

The fractal antenna with elliptical segments has a wide directivity chart (fig. 18)

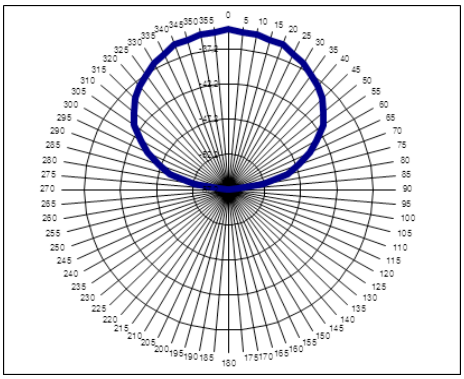

Fig. 18. Directivity chart for the E parameters

CONCLUSIONS

The following aspects can be noted regarding the design and prototyping of the fractal segment antenna with elliptical dipoles:

The analytical calculations and the experimental results yield the same conclusions for 98 percent of the considered aspects, which confirms the theoretical hypothesis.

The frequency domains that were obtained through experiments are even larger than the theoretical estimations, this being a result of the interference between the fractal elements.

The minimum gain for marginal frequencies is larger than 5 dB.

The directivity diagram is wide (approx. 160°) and makes the antenna suitable for mobile communication handheld devices (for small dimensions) as well as base stations, for larger dimensions, given that the emission-reception power is sufficient for an optimal coverage.

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LTE INDOOR RADIO COVERAGE OPTIMIZATION STUDY IN MODERN CITY ENVIRONMENTS

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Abstract: *The goal of this paper is to illustrate an optimization study based on real cellular networks in modern city environments, where many types of obstacles for the radio waves can be found. The studied network is LTE 800 and the overall aim is to identify LTE optimization opportunities, to reduce cell overlapping and to evaluate effectiveness of design changes. It is shown the improvement of the indoor radio coverage after antenna tilt changing or height modification. Also, it is highlighted that the cell throughput depends on how many neighbors has the site that is analyzed, this one being a key factor in LTE cell planning. For these purposes tools like Atoll, ACP (Automatic Cell Planning) and Pace4G SRV were used to check the quality of the transmitter data.*

Keywords: *LTE, antenna tilt, antenna heights, overlapping, cell throughput*

1. INTRODUCTION

LTE (Long Term Evolution) is the fourth generation cellular technology that has the potential to offer significantly faster mobile broadband services and it is described in a set of open specifications published by 3GPP (The 3rd Generation Partnership Project).

The main objectives include significantly improved spectrum efficiency, a significant reduced latency for control-plane and user-plane and support for interworking with existing 3G systems.

As air interfaces technologies for LTE OFDMA (Orthogonal Frequency Division Multiple Access) and SC-FDMA (Single Carrier FDMA) have been chosen.

OFDMA is used on the LTE downlink and it is providing data rates approaching 360 Mbit/s in a 20 MHz channel.

SC-FDMA is used on the LTE uplink and it provides rates up to 86 Mbit/s.

LTE is an all-IP environment, meaning that all interfaces will carry only IP - based traffic. The evolution of this network is known as LTE Advanced, which provides data rates of 1 GBit/s or more (fig. 1).

The main purpose of the tools that were used in this study is to monitor the performance of the LTE network and to identify the possibilities to optimize it.

ACP (Automatic cell planning) software is strongly recommended to generate the traffic map and by read into this map it is ensured best customer experience.

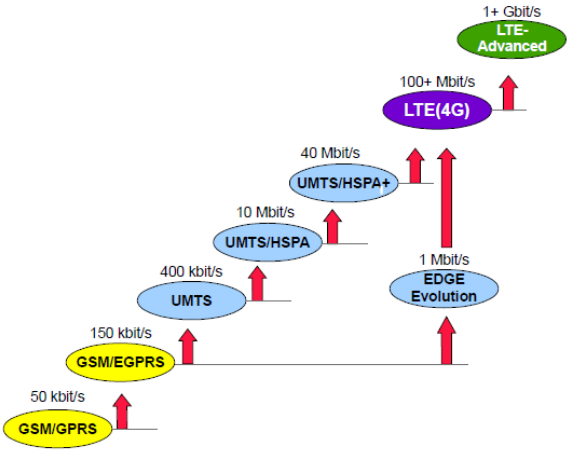

Fig. 1. Evolution of the GSM network [1]

Pace4G SRV software is used for checking the quality of site and transmitter data (there are situations when the antennas are not correctly aligned).

Atoll is a tool that allows network planning and analyzing. It is used by the largest operators for optimization of the network by traffic modelling, simulation, neighbor planning and other available options.

2. THE OPTIMIZATION PROCESS

2.1 Antenna tilts. Optimization was focused on looking for performance improvement through the application of electrical tilt or a combination of electrical and mechanical tilt.

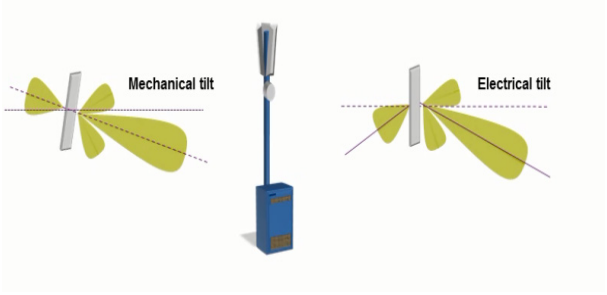

Fig. 2. Mechanical and electrical tilt

The tilt represents the inclination of the antenna; using it the antenna radiation direction can be changed [5].

The mechanical tilt doesn't change the phase of the input signal. The eletrical tilt changes the characteristics of signal phase and it is a built-in function.

2.2 The impact of 'boomer' sites. A key LTE planning guideline is that LTE sites should have relatively low antenna heights (below 30m). A boomer site is a site with antennas that are higher than 30m.

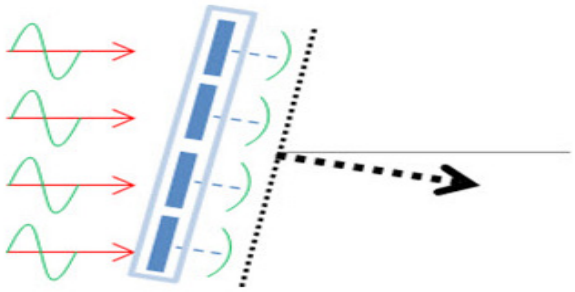

Fig. 3. Mechanical tilt

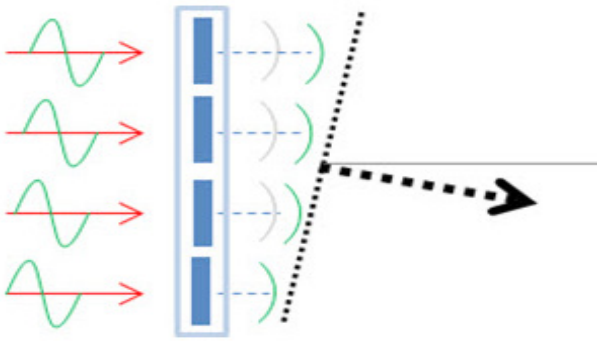

Fig. 4. Electrical tilt

One of the issues that will be faced in many operating markets is that the significant proportions of the available 2G and 3G site locations are very high. This high boomer sites should be avoided.

This view of drive test data (Fig. 5) shows the potential impact of using a high site location of this type. The drive test was performed monitoring an LTE 800 site having antennas of 51m.

The effect of the 'boomer' site is pointed out in the figure below; it can be seen that the site is measured as 'best server' at a distance of about 4.5 km (marked area) from the main station. This is about 2 km outside the nominal coverage area for the site. Long range overshooting is typical for a boomer site and will cause interference in LTE.

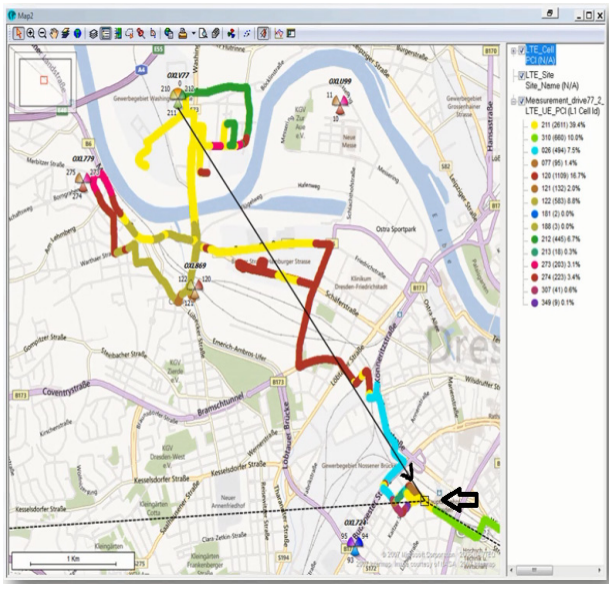

Fig. 5. The effect of the boomer site

2.3 Height optimization. In addition to notice the effectiveness of antenna tilt optimization the study has been extended to test the benefits of antenna height optimization.

The study was based on the same geographical region as used for the antenna tilt study and the frequency band considered was LTE 800. The aim was to identify neighbor relationship with height differentials and tries to improve overlapping by reducing heights to maximum 40 m and then applying antenna tilt optimization.

The screenshot (Fig. 6) shows all the sites from the study. The sites have been colored to indicate the heights. The majority of sites are in the range of 25 to 40 m. In the second screenshot (Fig.7) the result of the height adjustment are shown. These are real sites, but the changes are simulated.

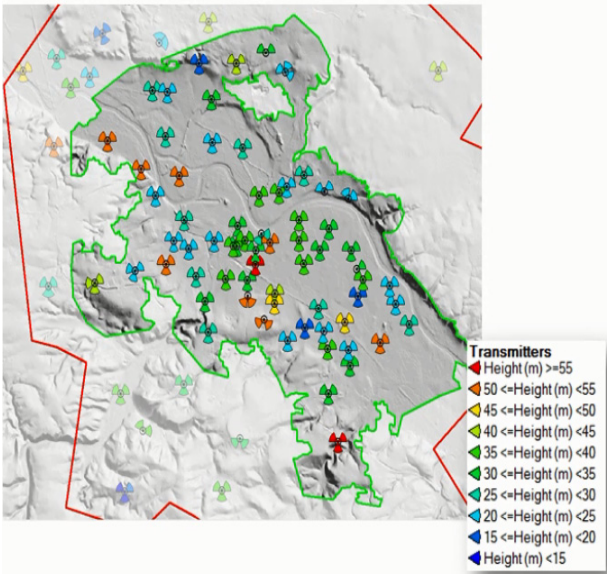

Fig. 6. Antenna heights before optimization

Following the antenna height adjustments, antenna tilt optimization based on a combination of mechanical and electrical tilt has been performed.

The indoor coverage signal level before and after the changes have been made is shown in the Fig. 8. The graph has been obtained by generating a coverage map and representing the area (%) in relationship with RSRP.

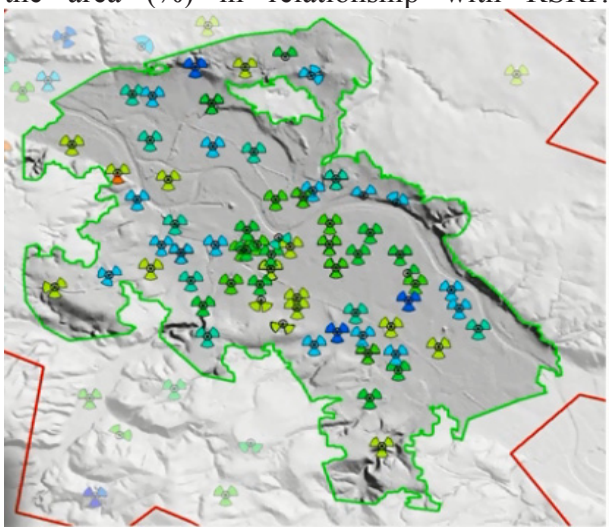

Fig. 7. Antenna heights after optimization

RSRP (Reference Signal Received Power) (dBm) is a parameter used to measure signal strength/quality of cells when cell selection takes place. RSRP threshold is -108 dBm.

The overall coverage is not degraded and there is a small improvement at the edge-cell.

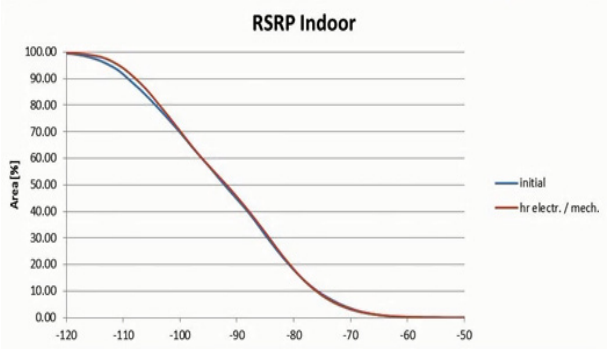

Fig. 8. Indoor coverage area related to RSRP [dBm]

This second graph (Fig. 9) is a histogram showing the distribution by area of the number of cells.

The results are shown before (in red) and after the adjustments have been made (green) and it can be seen that is a very significant shift toward fewer neighbors.

The difference is especially noticeable in the regions with 10 cells. This is certainly because the height reduction significantly reduced the instances of overshooting from the boomer sites.

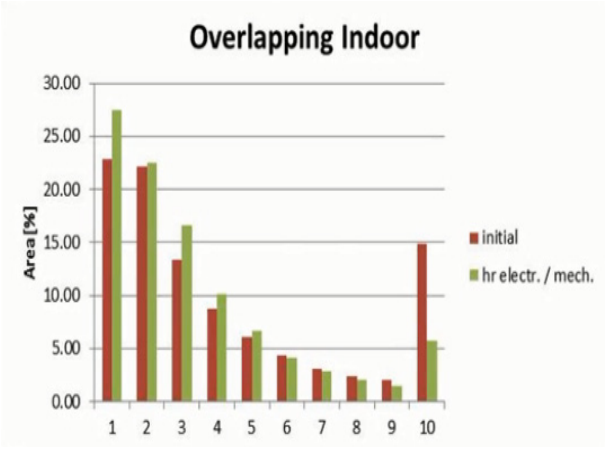

Fig. 9. Overlapping indoor results, area[%] in relationship with number of neighbors

1.4

1.4 Cell throughput. A key factor that will impact the cell throughput is the number of sites that are neighbors with the one that is analyzed, having closed signal levels.

This is an issue in urban areas because the inter site distance is smaller. This effect of too many neighbors is illustrated in Fig. 12.

The graph represents the PDSCH (Physical Downlink Shared Channel) throughput in relationship with SINR (Signal to Interference plus Noise Radio) and it was performed using Atoll software.

It is plotted for several scenarios with different numbers of neighbors. It can be seen that for the curves representing 3, 4 and 5 neighbors, throughput is limited to about 15 Mbit/s.

The red curve shows better performance with 2 neighbors.

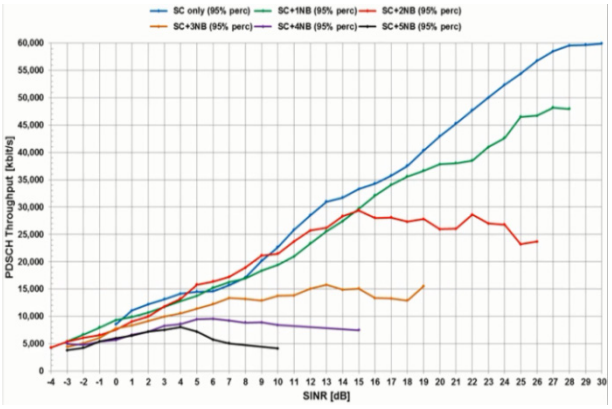

Fig. 12. PDSCH throughput related to SINR and the number of neighbors

The best performance is achieved only when there are just one or no neighbors (represented by the blue and green curves).

Overall it is recommended that the design of the network should be targeted in the maximum of 2 neighbors [1].

CONCLUSIONS & FUTURE WORK

The existing LTE sites have a large variation in height and the site distance differs very much from recommended distances. Overlapping can be further reduced by electrical tilt changing without loss in coverage.

For the overall LTE 800 indoor radio coverage optimization, several conditions should be met:

- Focus in more homogeneous network grid regarding site to site distance and antenna heights (avoid overshooting sites);
- Avoid overlapping areas close to the site;
- Sites with huge tilt close to upper electrical tilt limit should be avoided due to almost no further optimization potential;
- Check for dominant server to avoid overlapping;
- Use the full electrical tilt range especially for sectors pointing to rising terrain to ensure proper SINR conditions.

As future work, we'll focus our efforts to build outdoor radio coverage maps and to apply the same procedures for optimization, using also the software tools mentioned at the beginning.

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EFFICIENCY OF SPREADING SPECTRUM IN DSSS SYSTEMS WITH GOLD SEQUENCES

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Abstract: *Using spread spectrum technique provides, in addition to efficient use of frequency bands, protection against eavesdropping, interferences and high noise immunity, remarkable qualities for military applications. The purpose of this paper is to present experimental results for the study of spectral spreading efficiency when using Gold sequences as pseudo-noise generators. Experiments are intended to highlight the spread spectrum and noise immunity (minimum SNR for extracting data correctly) for three code lenghts.*

Keywords: *communications, spread spectrum, Gold sequences.*

1. INTRODUCTION

The **spread spectrum** (SS) communication is a transmission technique in which a **pseudo-noise** (PN) code (independently from the data) is used as a waveform to spread the signal energy over a bandwidth much wider than the initial bandwidth occupied by data. In receiver, the signal is **despread** using a local replica synchronized PN code used in transmitter.

There are several methods for spreading the spectrum, which are distinguished by the place where, in transmission chain, the PN code is inserted. The basics are:

- Direct Sequence Spread Spectrum **DSSS**: PN code is inserted at the level of input data;
- Frequency Hopping Spred Spectrum FHSS: PN code acts on the carrier frequency.

Especially for military applications, the advantages of using the SS communications are particularly attractive:

- Protection against eavesdropping
- High immunity to fading appeared on communication channel;
- Protection against interference with other communications;
- Anti-jamming.

Order to ensure efficient SS communications, PN code has a few rules on length, autocorrelation, crosscorrelation, orthogonality and bits balance. Commonly used PN codes are: Barker, Gold, Walsh-Hadamard. Note that a complex code sequence provides a more robust link, but the price paid is in complex electronics, especially in receiver blocks, to synchronize the local PN code with the received signal, for despread the spectrum.

Gold sequences are a class of codes which provide larger sets of sequences with good crosscorelation properties.

The purpose of this paper is to present experimental results for the study of spectral spreading efficiency when using Gold sequences as PN generators.

2. COMMUNICATION SYSTEM STRUCTURE PROPOSED

2.1 The work environment. To meet the requirements imposed by the complexity of spread spectrum communication system, was used, as a working environment for experiments, Matlab & Simulink software package.

2.2 System description. The structure of the proposed system is shown in Fig. 1 and consists of:

- The transmitter with: Data Generator, PN Generator and QPSK modulator;
- Communication channel with AWGN;
- The receiver with: QPSK Demodulator, Local PN code generator and Autocorrelator block.

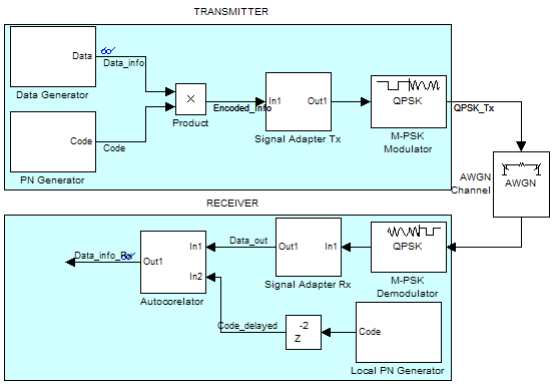

Fig. 1 Block diagram for communication system structure proposed.

Data Generator has been set to generate a random binary number with bit witdh $\mathbf{T_b = 1}$ **ms**, using a Bernoulli Binary Generator from Simulink Library.

Acording [4], a set of Gold sequences with period $N = 2^n - 1$ consisting of $N + 2$ sequences for which, the peak crosscorrelation magnitude q_c and the peak out-of-phase autocorrelation magnitude q_a meet the condition

$q_c = q_a = t(n)$, unde $t(n) = 1+2^{(n+2)/2}$

PN Generator was achieved with a Gold Sequence Generator for which has been selected three settings of **n**, the degree for generators polynomials. In all three cases, was chosen as **N**, the generated code length, be equal to $\mathbf{T_b}$, duration of a data bit. That means Tc, the width of a code bit will be:

$$T_c = T_b / N$$

According to [1,2], that is the use of a short code, with spreading factor N.

Sience the process of synchronizing the local code PN with the received signal is not the subject of this paper, synchronisation was achieved by introducing a fixed delay covering delay due to signal processing.

2.3 Experimental studies. For bit data witdh $\mathbf{T_b = 1}$ **ms**, spectral components occupies a bandwidth shown in Fig. 2.

Experiments are intended to compare the spread spectrum (generated by multiplying data signal with PN code sequence) for three settings of **n**, respectively for three values of bit code witdh:

a. n = 6 => N = 63 and T_c = 1/63000. Bandwidth will be $B_w = \pm$ 63 kHz.
b. n = 7 => N = 127 and T_c = 1/127000. $B_w = \pm$ 127 kHz.
c. n = 9 => N = 511 and T_c = 1/511000. $B_w = \pm$ 511 kHz.

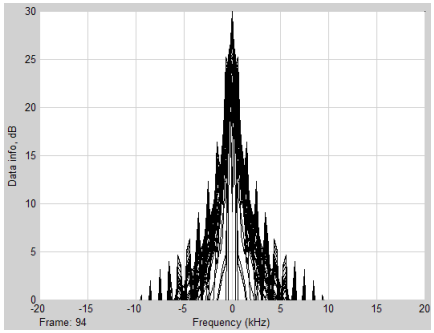

Fig. 2 Spectrum occupied by data signal with T_b = 1 ms and $B_w = \pm$ 1 kHz.

In each of these cases, the aim is highlighting the spread spectrum and noise immunity (minimum SNR for extracting data correctly).

3. EXPERIMENTAL RESULTS

In order to study spreading spectrum, experimental measurements were made on the signal *Encoded_info*. As shown in Fig.1, this signal is obtained by the product between digital signal information, named *Data_info*, and the PN code from Gold Sequence Generator, signal named *PN Code*. Waveforms for this three signals are shown in Fig. 3.

To analyze the noise immunity, measurements aim to determine the minimum signal-to-noise ratio (SNR) until which the receiver extracts correctly the transmited data.

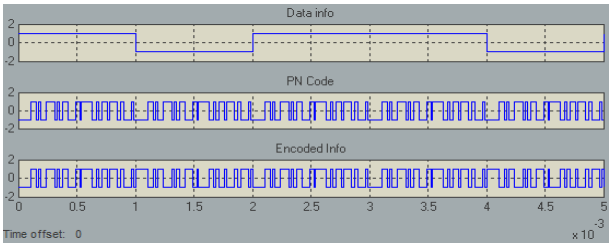

Fig. 3 Waveforms for data, Gold code with N = 63 and their product.

3.1 Spreading spectrum efficiency. In order to compare the three cases, all experiments are made under the same conditions, viewing the spectral components of the signal *Encoded_info* in baseband, between $-1/T_c \ldots 1/T_c$ kHz.

a. For a code length N = 63 and T_c = 1/63000 s = 15.8 us, the initial baseband, shown in Fig. 2, is extended between – 63 … 63 kHz, as shown in Fig. 4.

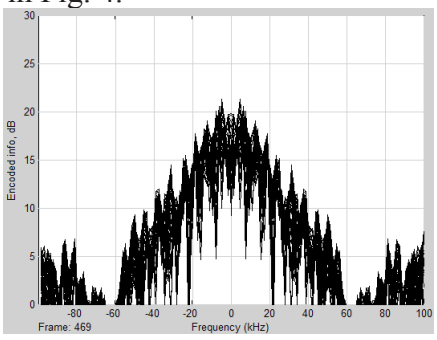

Fig. 4 Spectrum occupied by *Encoded_info* with T_c = 15.8 us

b. For a code length N = 127 and T_c = 1/127000 s = 7.9 us, the initial baseband is extended between – 127 kHz … 127 kHz, as shown in Fig. 5.

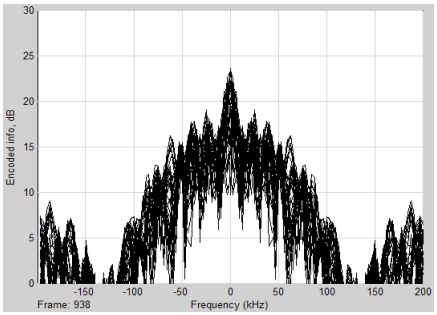

Fig. 5 Spectrum occupied by *Encoded_info* with T_c = 7.9 us

c. For a code length N = 511 and T_c = 1/511000 s = 2 us, initial baseband is extended between – 511 … 511 kHz, as shown in Fig. 6, wider range than in previous cases.

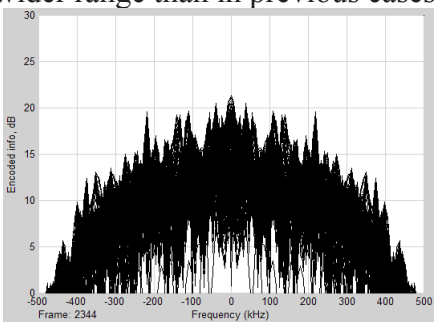

Fig. 6 Spectrum occupied by Encoded_info with T_c = 2 us

3.2 Noise immunity. The modulated signal, at transmitter output, have the spectrum shown in Fig. 7. For a good signal-to-noise ratio, SNR = 10 dB, constellation diagram and signal spectrum at receiver input are shown in Fig. 8 and Fig. 9.

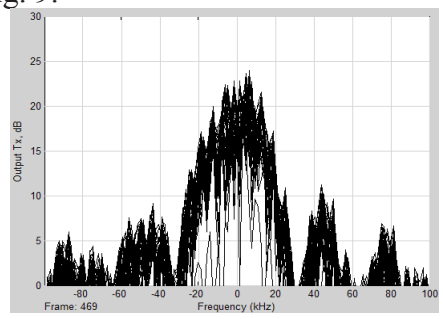

Fig. 7 Signal spectrum at transmitter output (QPSK modulated signal).

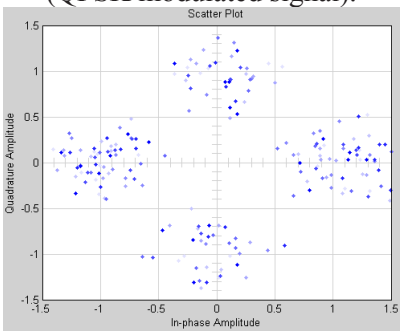

Fig. 8 Constellation diagram at receiver input, for N = 63 and SNR = 10 dB

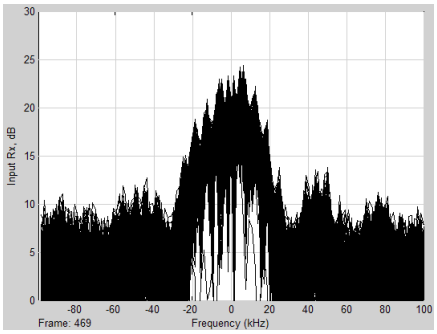

Fig. 9 Signal spectrum at receiver input, for N = 63 and SNR = 10 dB

a. For a code length N = 63 and T_c = 1/63000 s = 15.8 us, the receiver extract correctly the *Data* signal, until **SNR = - 6 dB**. Constellation diagram and signal spectrum at receiver input in this case are shown in Fig. 10 and Fig. 11. From Fig. 11 it can be seen that, for the range – 20 … 20 kHz, certain spectral components exceed the noise level.

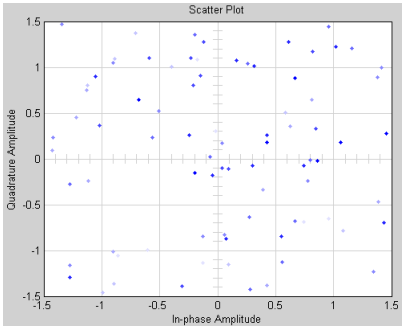

Fig. 10 Constellation diagram at receiver input, for N = 63 and SNR = - 6 dB

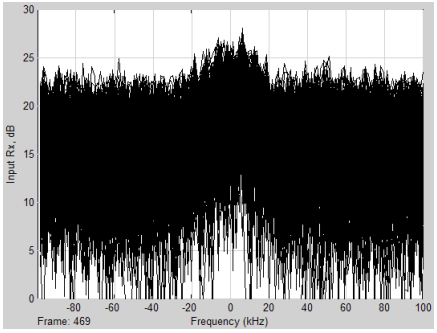

Fig. 11 Signal spectrum at receiver input, for N = 63 and SNR = - 6 dB

b. For a code length N = 127 and T_c = 7.9 us, the receiver extract correctly the *Data* signal, until **SNR = - 11 dB**. Constellation diagram and signal spectrum at receiver input in this case are shown in Fig. 12 and Fig. 13. Now, in Fig. 13 it can be seen that the signal at receiver input is completely covered by noise.

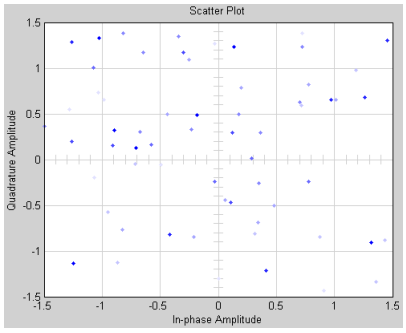

Fig. 12 Constellation diagram at receiver input, for N = 127 and SNR = - 11 dB.

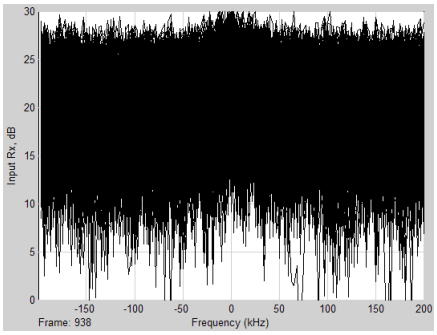

Fig. 13 Signal spectrum at receiver input, for N = 127 and SNR = - 11 dB

c. For a code length N = 511 and T_c = 1/511000 s = 2 us, the receiver extract correctly the *Data* signal, until **SNR = - 16 dB**, what is really remarkable. Signal spectrum at receiver input in this case is shown in Fig. 14. As in previous case, the received signal is completely covered by noise.

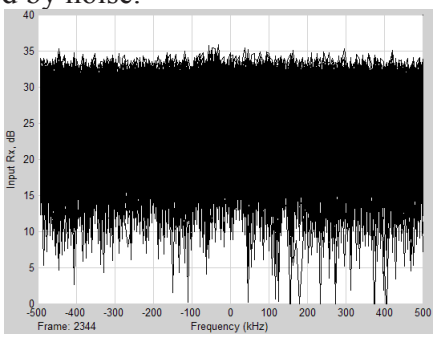

Fig. 14 Signal spectrum at receiver input, for N = 511 and SNR = - 16 dB

This results on noise immunity are summarized in Table 1.

Table 1 Minimul SNR [dB] for different code lengths and bit code widths

Code length, N	Tc [us]	Minimum SNR [dB]
63	15.8	-6
127	7.9	-11
511	2	-16

3. CONCLUSIONS

If the initial spectral components of the signal *Data* reaches a maximum of 30 dB and were concentrated in a narrow band, in all three cases examined, by multiplying the signal with the PN sequence, are obtained spectral components whose maximum is less than 25 dB, on average, being around 20 dB.

Much more obvious is the difference between the three cases analyzed in terms of noise immunity. It is outstanding the resistance to noise of signal spreaders with Gold sequence having length N = 511. As the code length is larger and code bit narrower, the more is better noise immunity.

All this results related to noise immunity can be improved through the use of error-correcting codes. Even without forward error correction techniques (FEC), the use of spread spectrum communications provides protection from noise (random or not) appeared on the communication channel, more than traditional methods.

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DEEP PACKET INSPECTION FOR M2M FLOW DISCRIMINATION – INTEGRATION ON AN ATCA PLATFORM

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Abstract: *In the context of decreased revenues, the mobile operators and technology producers are interested in monetizing the transmission channel used by over the top players. The proposed industrial ATCA integration is suitable for Machine to Machine traffic study, for infotainment or legal survey.*

Keywords: *ATCA, DPI, Data Analytics, Monetization, OTT, Streaming, M2M, PCRF*

1. INTRODUCTION

Deep Packet Inspection (DPI) applications are expected to hit $1.5 B in 2014 (Radisys, 2014). DPI becomes critical for telecom operators in order to add value to the transmission medium used by over the top players (OTT) via services and applications from new mobile hand-held devices. In addition, the traffic is expected to grow even more due to Machine to Machine communication (M2M) in the new Internet of Things, using Quality of Service (QoS), Data Analytics and monetization.

The ATCA platform (Advanced Telecommu & Computing Architecture) is natively suited for high traffic networks due to PIGMG backplane (PCI Industrial Computers Manufactures Group) with a common 40 Gbps "InfiniBand" Switching Fabric behind, useful for very large bandwidth (Bergstrom, 2003; Mellanox, 2009).

For this purpose, we also created a test-simulation environment, useful for development and quick testing before delivering the application to the live platform. By doing this we are following a real-life industrial process for design, testing and service delivery.

2. MEANS AND PURPOSE

2.1 M2M DPI CAPABILITIES. Our purpose is to identify a M2M stream (e.g. DSTP – Data Socket Transfer Protocol) inside a general data capture, alongside HTTP or TCP protocols.

We capture the stream in a file and analyse it or feed the stream directly to the DPI application. For these purposes, we have devised a test environment for debugging and customization.

As test system we are using the ATCA platform from Radisys/Continuous Computing model SH61 40G (fig. 1).

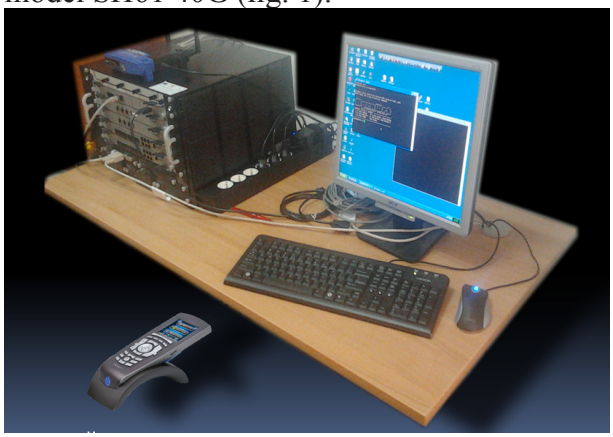

Fig. 1. General view of the ATCA Workbench

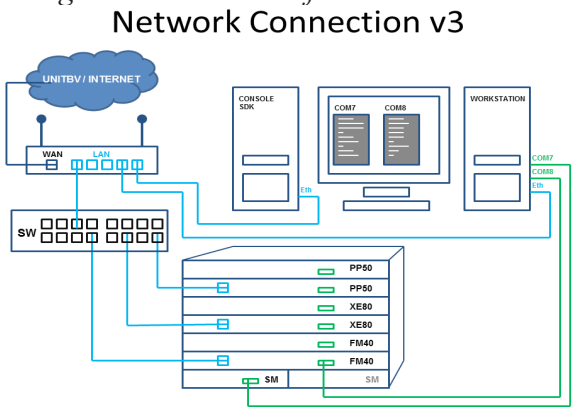

Fig. 2. ATCA Platform Integration – using a router and a multi-port switch for internal (local) and external (remote) access

In the workbench of fig.2, in the platform integrated for our DPI of M2M communications, the 6 available slots are populated as follows: two PP50 boards dedicated to packet processing, two FM40 boards providing advanced switching and two XE-80 computing boards.

2.2 AVAILABLE ATCA INTEGRATION. The physical integration of the ATCA platform is done so that the platform can be remotely accessed for configuration development and testing. The access was devised in order to be able to start the platform only when needed and to eliminate the idle time (Sandu, 2012).

The integration allows remote access for *systolic* process deployment and operation making it also an ideal remote e-Learning tool – with independent sessions possible from different locations, (Machidon et al, 2013).

2.3 CREATING THE TESTING ENVIRONMENT. The simulation environment contains the following components:

- SDK RMI software version – needed for cross-compilation on the RMI / Netlogic / Broadcom XLR 732 MIPS processors used by PP50.
- XLR Simulator for PP50 – used in order to be able to load, run and test the applications.
- *Pretender* – software that provides PP50 external interfaces *gmac* with packets
- Eclipse (C programming IDE – Integrated Development Environment) – used to develop the applications

All the above components are placed together on top Linux Ubuntu OS (Operating System), inside a VMWare image. The Linux OS, the bootloader RMIOS, and Linux loader application being run on a PP50 must all come from the same version of the SDK.

3. SIMULATED ENVIRONMENT

3.1 EXPECTED WORKFLOW ON ATCA PP50. The traffic flow inside PP50 (Continuous Computing, 2011) is simulated on the above-mentioned environment.

The Shared Memory Interface is responsible with the storage of packets. After the Linux Load of applications, `userapp` commands their execution via RMIOS.

Our purpose, in order to be able to parse and inspect packets (DPI), is to identify the masks inside the IP headers as they are stored in the memory.

3.2 APPLICATION LOGIC. Our application, called "PacketClassifier", has two main functions

1. *config_parser* –used to configure the parser engine on the XLR cores, in order to extract packet information (like source and destination IP and port)
2. *process_pkts* – reads each IP header as it arrives and, in case of matching, it proceeds to the classification.

3.3 COLLECTING AND PROVIDING REAL DATA FOR PROCESSING. DSTP on port 3015 represents Nationa Instruments special protocol for the transmissions of measured data is among the most suitable for M2M implementations.

Option 1. Generating a dump *pcap* file using Wireshark that contains a DSTP stream.

For this purpose we have used LabWindows CVI (C for Virtual Instrumentation) built-in Read/Write procedures and we have identified two ways in providing data streams that can be later used by the applications.

The solution is to use a DSTP stream generator and dump the information into a file (for example, we have used already available patterns delivered in from LabWindows CVI – as shown in the following).

Option 2. Using the above-mentioned tool *Pretender* that is provided with the SDK for traffic supply to the *gmac* interfaces:

```
Usage: ./pretender [-p port] -f <tcpdump-
style filter string>

atca@ubuntu $ cd /opt/rmi/fsim_2.0.0/
install/

atca@ubuntu $ sudo ./pretender -p 6001 -i
eth0 -d -f "ether dst 00:1c:25:a2:03:5f"
```

The above command will redirect all packets to gmac0, port 6001, from eth0, if they are addressed (destination) the specified MAC address.

Using this command we can supply real time traffic to the application.

4. APPLICATION DEVELOPMENT IN SIMULATED ENVIRONMENT

4.1 DEVELOPING AND TESTING REAL APPLICATIONS SUITABLE FOR M2M OVER PP50.

Using Eclipse IDE for the initial C programming of services, we benefit from various DPI templates and examples. These examples are then upgraded for practical use in packet filtering according to our needs.

4.2 DATA STREAM INPUT. To validate the applications, they were tested using stream inputs. The data stream is redirected by *Pretender* from the eth0 traffic based on destination MAC (i.e. remote workstation). After that, we launched the application on this streaming input from the local interface eth0. As *Pretender* is already running, the application connects to the stream as soon as it is started, and the `Accepted Connection` is announced.

```
atca@ubuntu $ ./fsim -f boot1
-F0x10000000=/home/atca/workspace-rmi/
PacketClassifier2/PacketClassifier2 -C
gmac0.serverip=192.168.81.128 -C gmac0.
serverPort=6001 -C gmac0.mode=0
```

To test this, we can launch the `ping` command from the local station to various valid destinations and the ICMP (Internet Control Message Protocol) messages associated are visible on the *Pretender* and on the application that is decoded.

4.3 DATA FILE INPUT. By providing the application with a *dumpfile* for analysis we are also validating the off-line functioning mode of the integration.

For monitoring reasons, we had to launching the application first. It would halt until the input connection with *Pretender* is established, but in this way we ensure that the application would process when we want:

```
atca@ubuntu $ ./fsim -f boot1
-F0x10000000=/home/atca/workspace-rmi/
PacketClassifier2/PacketClassifier2
atca@ubuntu $ elfload -a 0x10000000
atca@ubuntu $ userapp
```

From this moment on, there are several ways to feed off-line information to the application. As *Pretender* is using a default file `rxPktFilegmac0` for provisioning the gmac0 interface to the application our efforts consist in populating this data file.

A. We can test the transmission from file using the test tools provided with *Pretender*. The tool *gen_pktfile* will place test traffic into `rxPktFilegmac0` that is being read by the *Pretender*, like in the following:

```
atca@ubuntu $ ./gen_pktfile -o
rxPktFilegmac0 -s 100 -n 10
```

Since *Pretender* is launched and the application is loaded we will see the processed messages in the application's output:

```
[process_pkts]:    cpu_id=0,    Processing
Packets...
[process_pkts]: received message <size=1,
code=0, stid=96 msg0=80006a0001000800
[process_pkts]: received message <size=1,
code=0,   stid=96   msg0=80006a0001000800,
msg1=0
              00: 00 01 02 03 04 05 06 07
              08: 08 09 0a 0b 08 00 45 46
              16: 00 54 00 40 1b e8 40 06
              24: 83 6d c0 a8 01 01 cb 1f
              32: 4e 00 0d b7 31 58 a3 5a
              40: 25 5d 05 17 58 e9 5e d4
              48: ab b2 cd c6 9b b4 54 11
              56: 0e 82 74 41 21 3d dc 87
[process_pkts]: received message <size=1,
code=0,   stid=96   msg0=80006a0001000e60,
msg1=0
              00: 00 01 02 03 04 05 06 07
              08: 08 09 0a 0b 08 00 45 f5
              16: 00 54 00 40 17 fc 40 06
              24: cf 8a c0 a8 01 01 40 3f
              32: 90 00 f3 c4 c3 77 9a 64
              40: b2 be b5 d1 db 20 c6 35
              48: 9d d6 0e b4 d3 b3 f2 5f
              56: d7 e1 5b b1 b0 a9 5d 63
[process_pkts]: received message <size=1,
code=0,   stid=96   msg0=80006a00010014c0,
msg1=0
```

B. Real life scenario involves using a *dumpfile*. We collected a `pcap` trace `dumpfile.pcap` that contains DSTP traffic as shown in paragraph 3.2. This *dumpfile* must be used as input for *Pretender* that will re-format it over gmac0 into a *fsim* compatible format. In order for *Pretender* to use this *dumpfile*, it must be presented as default `rxPktFilegmac0` file so we had to rename the `dumpfile.pcap` to `rxPktFileGmac0`.

A valid way to send the stream from the *dumpfile* towards the application is to use the *Pretender* as interceptor for data but generate the stream using an utility like `dumpcap`, `tcprreplay or bittwist` (some of them might require installation e.g. `sudo apt-get install tcpreplay`).

We have successfully used `bittwist` to send the `pcap` file to *Pretender*. The only constraint we have met is that we need to re-format the `pcap` file before, using `tcprewrite` like below:

```
atca@ubuntu $ tcprewrite -i dumpfile.
pcap -o test1.pcap --dlt=enet --enet-
smac=00:0C:29:42:F8:2A --enet-
dmac=00:0C:29:42:F8:2B
```

With this command we are adding test MAC addresses through conversion. After this step we obtained the `pcap` file `(test1.pcap)` to be transmitted. The full execution cycle in the development simulated integration, see Fig. 3, becomes:

1. *Pretender* start on eth0 with MAC address filtering on the values added in `test1.pcap`.

```
tca@ubuntu $ sudo ./pretender -p 6001 -i
eth0 -d  "ether dst 00:0C:29:42:F8:2B"
```

2. *fsim* application load with connection with *Pretender* over port 6001

```
atca@ubuntu $ ./fsim -f boot1
-F0x10000000=/home/atca/workspace-rmi/
PacketClassifier2/PacketClassifier2 -C
gmac0.serverip=192.168.81.128 -C gmac0.
serverPort=6001 -C gmac0.mode=0
```

3. Send packets to eth0 using `bittwist`:

```
atca@ubuntu $ sudo bittwist -i eth0 test1.
pcap
[sudo] password for atca:
sending packets through eth0
trace file: test1.pcap

4061 packets (726524 bytes) sent
Elapsed time = 11.861160 seconds
```

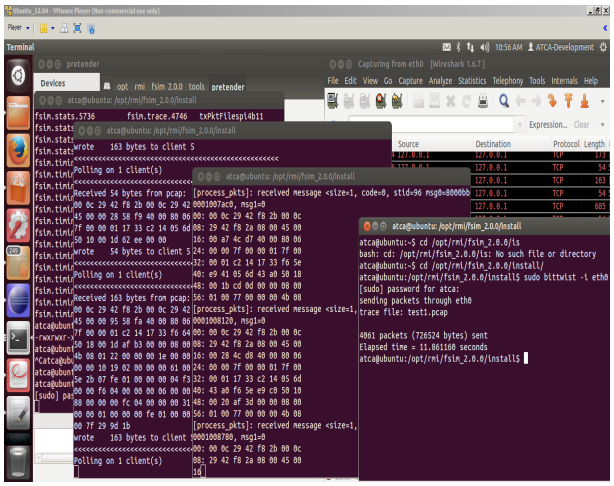

Fig. 3. Application execution on simulated environment (Pretender, fsim userapp, bittwist and Wireshark monitoring)

4. Wireshark monitoring on eth0 will provide visual confirmation.

5. PACKET PROCESSING ON THE ATCA 40G PLATFORM

5.1 EXPECTED WORKFLOW AND EXAMPLES. After development, testing and validation in the simulated environment, we took the following steps in order to execute the application on the real equipment.

Due to the remote connection, the application must be copied from the simulated environment (e.g. development can be done on any PC) to the workbench computer (the "console" connected to the ATCA platform of fig. 2). Only after that, the application can be copied via tftps to the PP50 blade and be executed. The workbench "console" is remotely controlled via TeamViewer.

1. Building the Eclipse project (Build option in Eclipse) in the VMWare image (in our case, it results the *PacketClassifier* file)

2. Local Copy of the software file (*PacketClassifier*) on the computer (e.g. a PC) hosting the simulated environment. The local copy is done via VMWare Option for Shared Folder, via `wmare-config-tools.pl`.

3. Remote Copy to the ATCA workbench computer via TeamViewer File Transfer.

4. Local Copy on ATCA Platform via tftpc – Tftpd32 (Sandu, 2013).

5. Load and execute application on ATCA PP50 in the XLR actual environment.

5.2 INTERFACES CONFIGURATION. Configuring the interface for remote copy means assigning on gmac0 (eth0 under Linux) an IP valid for communication: 192.168.1.147.

As we followed the industry standard, we assigned IPs in sub-domains, separating traffic from management.

Our IP definitions presented below represent administration IPs, so they are going to use default assignments under 192.168.1.X:

```
PP50-0 $ ifconfig -i gmac0
PP50-0 $ Starting Network interface
"gmac0"
Can not get kv entry sysid.
Can not get kv entry shelfid.
Value of key hwaddr = 0x45
Starting dhcp...
Got DHCP response,waiting for IP
assigned...
```

```
IP          : 192.168.1.147
Tftpserver  : 192.168.1.1
Bootfile    : []
netmask     : 255.255.255.0
Default GW  : 192.168.1.1
DNS         : 192.168.1.1
```

To test the validity of gmac0 we could also verify the connection from gmac0 after loading a (default) Linux image:

```
PP50-0 $ dload pcmcia_1 1 /pp50-linux-rmi16-v2.6.3r00
PP50-0 $ userapp -f
```

PP-50 has following IP on eth0 under Linux (i.e. this means the physical gmac0 of the PP-50): 192.168.1.148 and the MAC address is: 00:02:bb:52:9c:80 (00-02-bb-52-9c-80).

We have let Linux DHCP obtain the IP on this interface (i.e. eth0) and tested successfully the connection to the Workstation (192.168.1.179):

```
[root@localhost ~]$ dhcpcd eth0

[root@localhost ~]$ ping 192.168.1.179
PING 192.168.1.179 (192.168.1.179): 56 data bytes
64 bytes from 192.168.1.179: icmp_seq=0 ttl=128 time=0.870 ms
64 bytes from 192.168.1.179: icmp_seq=1 ttl=128 time=0.219 ms
```

Our goal was to check that gmac0 set-up was correct and outside access (in this case to the Workstation) is possible.

We will expect the same behaviour after loading the application, with the gmac0 being correctly configured: eth0 (gmac0) will receive traffic that is sent to it from the Workstation.

5.3 PROGRAM COPY AND EXECUTION. Copying the build (PacketClassifier) command tftpc:

```
tftpc -s 192.168.1.179 -b 1024 -f PacketClassifier
```

We are using Tftpd32 freeware in order to set up a tftp server. The source IP is the IP in the local network (switch-router) of the Workstation (172.168.1.179)

From the PP50 we are initiating a tftpc (copy) in memory of the build.

```
PP50-0 $ tftpc -s 192.168.1.179 -b 1024 -f PacketClassifier
Downloading [PacketClassifier].
Server IP : 192.168.1.179
PP50-0 $ tftpc stall; Check network setup.
Bytes downloaded: 1493018
tftpc: download done. Size [1493018] @ Addr [0x120000000]
PP50-0 $ elfload -a 0x120000000
PP50-0 $ userapp
```

For any subsequent load, it was actually used directly the `userapp` command:

```
dload pcmcia_1 1 /pp50-linux-rmi16-v2.6.3r00
userapp -f
```

5.3 APPLICATIONS OUTCOME. Based on the criteria selected in the masks, TCP and UDP traffic can be separated – with all the relevance that comes from the upper OSI layers. HTTP or, in our case, DSTP for M2M services can be further analysed.
Below is an example for simple IP filtering:

```
// extract the destination IP
dest_ip = (recv_pkt->data[30]<<24)|(recv_pkt->data[31]<<16)|(recv_pkt->data[32]<<8)|(recv_pkt->data[33]);

printk("Destination IP: %d.%d.%d.%d \n",
 (int) ((dest_ip >> 24) & 0xff), (int) ((dest_ip >> 16) & 0xff),
 (int) ((dest_ip >> 8) & 0xff), (int) ((dest_ip >> 0) & 0xff));
// extract the source IP
src_ip = (recv_pkt->data[26]<<24)|(recv_pkt->data[27]<<16)|(recv_pkt->data[28]<<8)|(recv_pkt->data[29]);
printk("Source IP: %d.%d.%d.%d \n",
 (int) ((src_ip >> 24) & 0xff), (int) ((src_ip >> 16) & 0xff),
 (int) ((src_ip >> 8) & 0xff), (int) ((src_ip >> 0) & 0xff));
```

CONCLUSIONS

As DPI is becoming a "must have" capability for the Telecom operator, dedicated ATCA platform integrations are to become more common. The flexibility of the platform is somehow restricted by the complexity of configuration and its industrial cantered applicability.

The ATCA integration we proposed can be used to simplify operational work on this type of platform and meet the demand for specialization by using it in a systolic mode of operation, both for development and for didactical purpose.

The new PCRF (Policy and Charging Rules Function) component available in LTE networks is available exactly because of powerful data processing that comes with ATCA implementations.

Our study, practical integration and development show the relative simplicity of programming traffic discrimination as long extremely powerful packet processors are available.

Statistics, control, filtering, resource allocation or legal survey can be done using this technique, empowering the operators and providing a much needed leverage in front of OTT.

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HYBRID SECURE SOCKET LAYER PROTOCOL

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Abstract: *Randomness is a crucial resource for cryptography, and random number generators are therefore critical building blocks of almost all cryptographic systems. Weak random values may result in an adversary ability to break the system, as was demonstrated by breaking the Netscape implementation of Secure Socket Layer. This paper explores alternatives to traditional ciphers and involves a theoretical study with available implementations described by the quantum literature as well as classical algorithms. This paper provides an original implementation of Secure Socket Layer that includes together Quantum Random Number Generator (QRNG) and Elliptical Curve Cryptography (ECC) in a hybrid cryptographic protocol.*

Keywords: *asymmetric cryptosystems, quantum random numbers, Secure Socket Layer (SSL).*
***MSC2010*:** 81P45, 94A15.

1. INTRODUCTION

In the last ten years, the Internet has enjoyed tremendous success connecting a large number of households and businesses with each other. This has created enormous economic possibilities. However, this economic potential can only be fully realized if the need for secure transmission of information over the inherently insecure and open Internet can be satisfied. Cryptography addresses this need.

One of the fundamentally important research areas involved in quantum information science is quantum communications, which deals with the exchange of information encoded in quantum states of matter or quantum bits (known as qubits) between both nearby and distant quantum systems.

Our paper is related to quantum communication and performs core research on the use of optical qubits – the quantum states of photons, with particular attention to application to future information technologies.

Our paper presents a theoretical demonstration of how to improve the security of Secure Socket Layer protocol by replacing Random Number Generator with Quantum Random Number Generator and the RSA cryptographic algorithm, currently used, with ECC algorithm.

For the beginning, the paper will present *Random Number Generator* (RNG) and *Quantum Random Number Generator* (QRNG), and, advantages of using QRNG in generating a sequence of random bits that are impossible to "guess" by the attackers.

Seeing that, the Quantum Random Number Generator (QRNG) is ideal for applications requiring very high rates of true random numbers, our paper present the importance of replacing the classic Random Number Generator (RNG) used by Secure Socket Layer (SSL) protocols, with quantum one (QRNG).

The reason for replacing the *RSA cryptosystem* (existing in SSL 3.0) with *ECC cryptosystem* will be presented in the second part of the paper through a comparative analysis of those cryptosystems. The comparative analysis is to demonstrate that we can improve the security using less resources, and a short time encryption / decryption.

2. HYBRID SECURE SOCKET LAYER PROTOCOL

2.1 Random Number Generators vs. Quantum Random Number Generators.

Any security application must employ both hardware and software and not rely solely upon software.

Software is just an application, and therefore it can be broken.

The specialists in the computer security field have been migrating to hardware solutions in order to supply the secure systems that protect their information and reduce risks due to loss, theft, or hacking. These solutions introduce a variety of approaches that implement the advantages offered by hardware-based security.

Random Numbers are a cryptographic primitive and cornerstone to nearly all cryptographic systems. They are used in almost all areas of cryptography, from key agreement and transport to session keys for encryption.

Imperfections in Random Number Generators (RNG) [4, 6, 2, 7] can introduce patterns undetected by statistical tests but known to an adversary.

Random number generators based on classical physics are fundamentally deterministic – as is classical physics – even if the complexity of the system can hide the determinism.

A powerful alternative to the Random Number Generator is a hardware-based random-number generator. This is a device residing on a local machine or a stand-alone unit that includes electronics that produce random numbers.

Random number generators based on quantum physics are true random number generators as quantum physical phenomena are intrinsically random.

With this last type of generators, called *Quantum Random Number Generators* (QRNGs), it provides a source of random numbers suitable for applications with the most stringent security standard.

A team of experimentalists from the Joint Quantum Institute (JQI), in partnership with European quantum information scientists, has demonstrated a method of producing a certifiably random string of numbers based on fundamental principles of quantum mechanics.

They report their results in the 15 April 2010 issue of *Nature* [12].

"Classical physics [11] simply does not permit genuine randomness in the strict sense," says JQI Fellow Chris Monroe, who led the experimental team. "That is, the outcome of any classical physical process can ultimately be determined with enough information about initial conditions. Only quantum processes can be truly random - and even then, we must trust that the device is indeed quantum and has no remnant of classical physics in it."

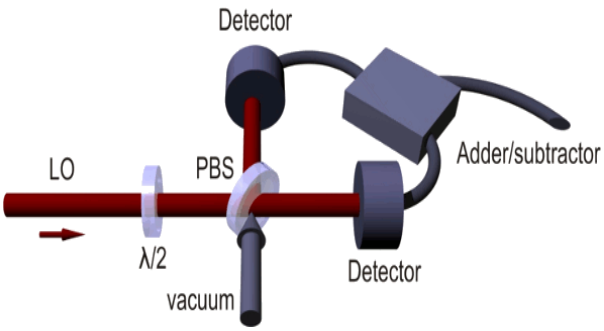
Quantum cryptography, presents a recent addition to the family of device-based random-number generators.

Some U.S. and European companies offer second or third generation quantum cryptography products, and many of the top academic, government, and commercial research institutions have development efforts underway.

In the opinion of top researchers at the National Security Agency [16], quantum cryptography appears to be unbreakable. The use of techniques such as polarized or entangled photons provides assurance against eavesdropping that is unmatched by other technologies.

Due to the apparent fundamental strength of quantum communication and cryptography, future attacks on the technology will likely be limited to brute force attacks by powerful computers (such as quantum computers) or perhaps physical threats to authorized parties.

Based on these considerations, a simple design for a Quantum Random Number Generator is based on a construction with a photon source, a 50/50 beam-splitter and two identical single photon detectors.



This construction ensures a random and balanced probability of detection of the photon at each detector. However, a drawback is that it can only produce one raw bit at a time. In order to increase the bit rate of the Quantum Random Number Generator, a new design has been considered. Although random numbers are required in many applications, their generation is often overlooked. Being deterministic, computers are not capable of producing random numbers. A physical source of randomness is necessary. Quantum physics being intrinsically random, it is natural to exploit a quantum process for such a source.

Quantum random number generators (QRNG) have the advantage over conventional randomness sources of being invulnerable to environmental perturbations and of allowing live status verification.

Quantum random number generators (QRNG) can generate truly random numbers from the fundamentally probabilistic nature of quantum processes.

Quantum Random Number Generator is

a fast, nondeterministic and novel random number generator whose randomness relies on intrinsic randomness of the quantum physical process of photonic emission in semiconductors and subsequent detection by the photo-electric effect.

The statistical tests [15] applied to random numbers sequences longer than 1 Gb produced with this quantum random number generator presents results which demonstrate the high quality of randomness resulting in bias less than 10^{-4}, autocorrelation consistent with zero, near maximal binary entropy and measured min-entropy near theoretical maximum.

2.2 Elliptical Curve Cryptography (ECC) vs. Rivest, Shamir, Adleman (RSA) cryptosystem. Every Secure Socket Layer connection begins with a handshake, during which the two parties communicate their capabilities to the other side, perform authentication, and agree on their session keys. The session keys are then used to encrypt the rest of the conversation, possibly spanning multiple connections. They are deleted afterwards. The goal of the key exchange phase is to enable the two parties to negotiate the keys securely, to prevent anyone else from learning these keys.

Several key exchange mechanisms exist, but, at the moment, by far the most commonly used one is based on RSA, where the server's private key is used to protect the session keys.

Building on the Diffie and Hellman "Public-key Cryptosystem," Ron Rivest, Adi Shamir, and Leonard Adleman created the *RSA* cipher in 1978 [9]. Today, the RSA cipher is the most common form of public-key cryptology in use.

Elliptic Curve Cryptography relies on the difficulty of solving the discrete logarithm problem as the basis of its security [5].

Elliptic Curve Cryptography is a quite newer version of Public-Key Cryptology and can provide the same level of security as RSA, but with smaller key sizes. With all variables being equal, Elliptic Curve Cryptography can run more transactions per second than RSA.

We used in our study these results [1] from the tables below:

Table1. Comparison of RSA (512 bits) and ECC(106 bits)

	Key Generation Time	Memory Requirement	Encrypt/ Decrypt Time
ECC (106 bits)	**57 ms**	108 bytes	**11 ms**
RSA (512 bits)	**383 ms**	157bytes	**77 ms**

Key Generation Time (RSA/ECC) = 6,72
Encrypt/Decrypt Time (RSA/ ECC) = 7
ECC (106 bits)/RSA (512 bits) = 4,83

Table 2. Comparison of RSA(768 bits) and ECC(132 bits)

	Key Generation Time	Memory Requirement	Encrypt/ Decrypt Time
ECC (132 bits)	**98 ms**	117 bytes	**17 ms**
RSA (768 bits)	**889 ms**	236 bytes	**160 ms**

Key Generation Time (RSA/ECC) = 9,07
Encrypt/Decrypt Time (RSA/ ECC) = 9,41
ECC (132 bits)/RSA (768 bits) = 5,82

Table 3. Comparison of RSA (1024 bits) and ECC(160 bits)

	Key Generation Time	Memory Requirement	Encrypt/ Decrypt Time
ECC (160	**108 ms**	125 bytes	**16 ms**
RSA (1024bits)	**2609 ms**	313 bytes	**388 ms**

Key Generation Time (RSA/ECC) = 24,16
Encrypt/Decrypt Time (RSA/ ECC) = 24,25
ECC (160 bits)/RSA (1024 bits) = 6,4

Table 4. Comparison of RSA(2048 bits) and ECC(210 bits)

	Key Generation Time	Memory Requirement	Encrypt/ Decrypt Time
ECC (210bits)	**121 ms**	140 bytes	**15 ms**
RSA (2048bits)	**18399 ms**	621 bytes	**1867 ms**

Key Generation Time (RSA/ECC) = 152,06
Encrypt/Decrypt Time (RSA/ ECC) = 124,46
ECC (210 bits)/RSA (2048 bits) = 9,75

Making a comparative analysis of the two cryptographic algorithms, are three different characteristics [1] namely performance, security and space requirements.

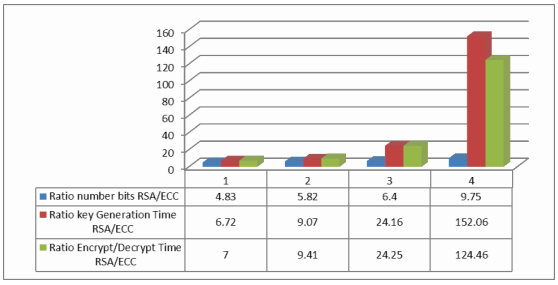


Figure 2. Comparative analysis RSA/ECC

Analysis conclusions:

- *In RSA case*, a doubling of the number of bits causes an increase of six times of *Key generation time*.
- *In RSA case*, a doubling of the number of bits causes an increase of 24 times of *Encrypt/ Decrypt time*.
- *In ECC case*, the *Encryption/Decryption time* remains relatively constant even if the key size increases.
- *In ECC case*, a doubling of the *Number of bits* of the key causes a doubling of Key generation time.

2.3 Secure Socket Layer a hybrid protocol. The Secure Sockets Layer [13] is a standard protocol for encrypting Internet traffic. It is very mature and has been widely implemented and tested for vulnerabilities. As long as no one figures out how to factor large prime numbers in a hurry, the Secure Sockets Layer appears to be in good shape to provide security.

The Secure Sockets Layer protocol defines two different roles for the communicating parties. One system is always a client, while the other is a server.

The most basic function that a Secure Sockets Layer client and server can perform is establishing a channel for encrypted communications.

The cryptographic parameters of the session state are produced by the *Secure Socket Layer Handshake Protocol*. When a Secure Sockets Layer client and server first start communicating, they agree on a protocol version, select cryptographic algorithms, optionally authenticate each other, and use public-key encryption techniques to generate shared secrets.

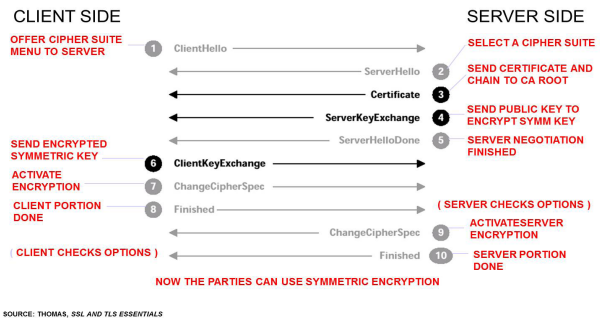


Figure 3. SSL Messages

Two random values are generated and exchanged: *ClientHello.random* and *ServerHello.random*.

These *random numbers* will have a very important role in the Secure Socket Layer protocol. They will be used to obtain:

- Master secret -generated by both parties from premaster secret and random values generated by both client and server.

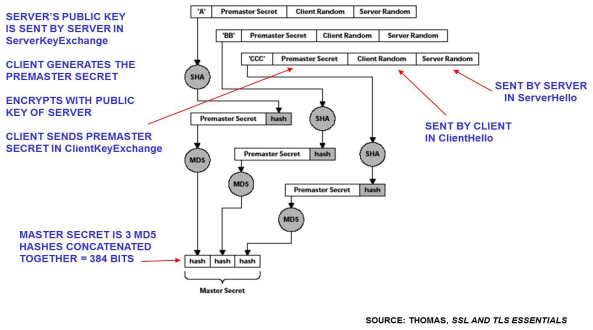


Figure 4. Generating the Master Secret

- Key material - generated from the master secret and shared random values, and, finally, the encryption keys.

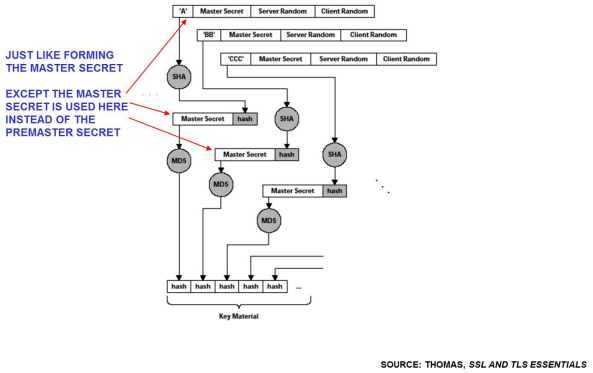


Figure 5. Generation of Key Material

Random numbers are critical to the operation of the Secure Sockets Layer protocol. The random numbers exchanged in *ClientHello* and *ServerHello* messages ultimately determine the encryption key for the session. Random numbers, however, present an interesting challenge to computer systems; software cannot do anything truly randomly.

Instead, software implementations typically rely on algorithms known as *pseudorandom number generators*. These algorithms simulate true randomness with complex mathematical calculations.

Press, Teukolsky, Vetterling, and Flannery [8] report on one widely used pseudorandom number generator that, in an extreme case, effectively generated only 11 distinct random values.

If you know the parameters of the algorithm and one specific value, it is easy to predict all future values that the algorithm will generate.

Predictable random numbers are a serious problem for any security protocol, as they allow attackers to plan and prepare well into the future, waiting, perhaps, for a single, compromised value to appear.

Starting from the above findings (theoretical and practical), the proposed hybrid Secure Socket Layer protocol hybrid will use a Quantum Random Generator and an ECC algorithm.

Why to replace Random Number Generator with Quantum Random Number Generator?

Replacing the Random Number Generator (RNG) with quantum one (QRNG), we can get an increase of the number of bits that should be a "cryptographically secure" random number. Therefore, increasing the number of bits used in the encryption determines a high security of Secure Sockets Layer protocol. In the following, we will show how to connect Quantum Random Number Generator to a computer.

Figure 7. Connect a Quantum Random Number Generator to a computer

The Quantum Random Number Generator device connects to a computer via PCI or USB interface. This enables connecting several Quantum Random Number Generator devices and achieving random numbers acquisition speeds much higher than those of a single device. Quantum Random Number Generator hardware access is implemented as a dynamic link library that communicates directly with the Quantum Random Number Generator device driver.

Thereby, replacing the classic method with quantum one, the obtained key is very safe and we can choose as its dimension to be much higher than that obtained by the classical method.

Since the data will be encrypted using asymmetric cryptographic algorithms, key size is essential in ensuring the security and integrity of encrypted information.

Security is not something we ordinarily associate with randomness, but it is important in this case.

Most computer programs use a technique known as pseudorandom number generation to create random numbers. When used correctly, this approach does yield numbers that have the appearance of randomness.

Generating large numbers using Quantum Random Number Generator, lead to a "*chain reaction*" of improving the security protocol Secure Socket Layer.

We conclude these:

The requirement that a Quantum Random Number Generator be physically manufactured offers a variety of opportunities for the designers to design security features and self-consistency checks directly into the device.

The use of these techniques can virtually eliminate any security concerns regarding theft, spoofing, or even counterfeiting.

The initial condition issues that dominate the software-based Random Number Generator number generators are more manageable for hardware-based Quantum Random Number Generators, since such number generators cannot be forced into a compromising state. Quantum Random Number Generators eliminate most of the security concerns relating to improper handling of the device after receipt, since, unlike Random Number Generators, the hardware generators are not susceptible to software and operating-system attacks.

Why to use Elliptic Curve Cryptography (ECC) on Secure Socket Layer?

- System *Secure Socket Layer* has been updated to support 20 new ECC cipher suites.

- ECC is an emerging public-key crypto-system that *offers equivalent security with smaller keys sizes*.

- Augments end to end encryption for data in flight by helping to maintain data privacy and prevent data leakage of sensitive information particularly when providing the next generation of security level requirements.

- We can *reduce the transmission cost during handshake*.

Replacing RSA cryptographic algorithm with ECC algorithm, we can get the same time for encryption/decryption regardless of cryptographic key size, and, the number of bits of the encryption/decryption key determining a directly proportional increase of the key generation time.

CONCLUSIONS & ACKNOWLEDGMENT

Hardware solutions offer advantages that are unavailable to software-only implementations of security. Software based number generation suffers from the predictability inherent in algorithmically based Random Number Generators. The Quantum Random Number Generator offers the best option for strong security in the long term, especially if the technologies are based on the use of algorithms.

Photons and entangled photons of the sort used in quantum cryptography and communication have a form of tamper evidence and protection built into the technology at the level of quantum-mechanical processes. At the moment, it is widely believed that this technology cannot be defeated.

This theoretical study is part of a larger project that we be will developed by *Facultad de Informatica y Electronica, Riobamba, Ecuador.* The entire theoretical study will be sustained with an experimental hybrid protocol.

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INTERPRETATION OF THE EXPERIMENTAL RESULTS ON THE MECHANICAL PROPERTIES OF THE ALUMINUM ALLOY $ATSi_6Cu_4Mn$

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Abstract: *A highly and actual matter in aircraft construction is the use of lightweight materials so that the obtained aircraft to provide a high degree of maneuverability. The use of aluminum alloys follows this path so that the experimental researches carried out to improve the properties of these materials are a requirement of the Aerotechnic Industry, the validation of experimental results being an extremely important factor.*

Keywords: *aluminum alloy, heat treatment, precision indicators, statistical tests*

1. INTRODUCTION

Aerospace industry requires that the materials used and the manufacturing technologies to be constantly improved as the aircraft functionality to be realized in safe and high efficiency conditions. Studies and researches in this domain are focused on finding new materials or technologies to better respond to the requirements of this industry without neglecting the economic factor [4].

Safety on aircraft flight is closely related to the safe operation of all systems and subsystems components which led to the diversification of equipment and installations on the aircraft. On the other hand, the resistance of the aircraft is continuously re-evaluated so that the carriage of passengers and goods by air is now more secure than transport by land or water.

According to I.C.A.O. statistics, the ratio between the number of transported passengers and number of passengers injured or dead in air disasters, over a year, shows the aircraft as the safest mean of transport [3, 4].

Because the light materials have lower mechanical strength than the heavy metals, special alloys (light) based on aluminum are used [3, 4] (with alloying elements Cu, Mg, Zn, Mn, Ni, Cr, Li, Cd, Ti, V, Zr, Si), based on magnesium (with alloying elements Zn, Zr, Rh, Th, Mn, Al, Li), based on titanium (with alloying elements Mn, Fe, Cr, Mo, Al, Cu, Zr) and based on beryllium (with alloying elements Al, C, Fe, Si) [3, 4].

Aluminum is a light metal with high plasticity, low mechanical strength, high electrical and thermal conductivity and resistance to corrosion in air, water and organic acids. The main disadvantage of aluminum is connected to the very low tensile strength, so that its alloys have a wider use. Properties of aluminum alloys can be improved by heat treatment, which includes hardening, recovery and annealing, known as recovery hardening or aging. Natural aging lasts a long time and the mechanical characteristics are not changing very much, so it is replaced by artificial aging. Through artificial aging is reduced the total aging time at few hours, and the mechanical characteristics are significantly improved [3,4].

2. INTERPRETATION OF EXPERIMENTAL RESULTS

During the experimental researches we have used standard aluminum alloy test tubes $ATSi_6Cu_4Mn$, whose chemical composition is shown in Table 1.1. The heat treatments applied have been carried out according to the following steps: the samples were heated in an oven at 520 ° C for 40 minutes, quenched and then naturally and artificially aged at a constant temperature of 170 ° C over various time intervals (two and four hours) [2, 4, 5, 6].

Table 1.1. The chemical composition of the test tubes used, [%],[4]

Alloy $ATSi_6Cu_4Mn$ (Test tube number)	Si	Cu	Mn	Al	Others
[1; 60]	5,439	3,944	0,417	88,626	1,574

Measuring of the prints and then determining Brinell hardness using table's values are subject to errors of measurement and observation, errors which are inevitable, so we have considered necessarily the results to be processed and interpreted using mathematical statistics. Measurement errors appear both because of the precision class of instruments and also because of unintended errors of reading and matching the instrument, and errors of observing are related both to an observer as to a series of random influences [1, 2, 4].

Precision indicators calculated are[1;2;4]:

- standard deviation of a measurement $s_{D_{ij}}$,
- standard error (standard deviation of the average values obtained), E_i,
- the variation coefficient $CV\%$,
- tolerance, T,
- Maximum spread Δ_{max}

The variation coefficient may take the following values: a) between 1…10%;
b) between 10…30%;
c) >30% .

When the variation coefficient takes values in the first range, the measurement results fall within a small scatter around the mean value; values that are included in the second range are defining the medium dispersion, and if the variation coefficient takes values greater than 30%, the obtained results are indicating a high dispersion.

Classifying the variation coefficient in one of the first two categories expresses the existence of acceptable measurements from statistically point of view, measurements that are certifying that the experimental data are correct, the registered deviations being extremely small.

For values exceeding 30% is considered that the measurements are affected by errors too large, so the experimental data are not taken into account [1, 2, 4], and the set of measurements is resumed.

For calculated precision indicators, indexes have the following meaning:

- first index is the temperature of test tubes when are measured; in the situation 1, is the temperature of the environment;
- second index represents the state in which the test tube are (a number of samples were left as initially, others were heat treated): 1, non heat-treated test tubes, 2 test tubes naturally aged, 3 test tubes artificially aged by heat treatment applied for two hours, 4 test tubes artificially aged by heat treatment applied for four hours [2, 4, 5, 6].

Precision indicator values calculated for prints measured on studied aluminum alloy samples at ambient temperature are:

- for test tubes non heat treated:

$$\overline{D_{11}} = 1{,}763mm; s_{D1} = 0{,}04mm; E_1 = 0{,}10mm$$

$$CV = 2{,}27\%; T = 3s_{D11} = 0{,}12mm$$

$$\Delta_{max} = 0{,}12mm; \quad \Delta_{max} = T$$

- for test tubes naturally aged:

$$\overline{D}_{12} = 1{,}724mm; s_{D12} = 0{,}031mm; E_2 = 0{,}01mm$$

$$CV = 1{,}79\%; T = 3s_{D12} = 0{,}09mm$$

$$\Delta_{max} = 0{,}08mm; \quad \Delta_{max} \le T$$

- for test tubes artificially aged for two hours:

$$\overline{D}_{13} = 1{,}698mm; s_{D13} = 0{,}037mm; E_3 = 0{,}01$$

$$CV = 2{,}18\%; T = 3s_{D13} = 0{,}11mm$$

$$\Delta_{max} = 0{,}09mm; \quad \Delta_{max} \le T$$

- for test tubes artificially aged for four hours:

$\overline{D}_{14} = 1{,}681mm; s_{D14} = 0{,}031mm; E_4 = 0{,}01mm$

$CV = 1{,}84\%; T = 3s_{D14} = 0{,}09mm$

$\Delta_{max} = 0{,}09mm; \quad \Delta_{max} \le T$

The low values of variation coefficient calculated for all the studied samples indicate that the measurements are correct, measurement errors being very small (CV between 1…10%).

Condition $\Delta_{max} \le T$ performed for all studied samples allows a statistical study to be applied in order to verify the normal distribution of the experimental data obtained.

For a relatively small volume of measurements ($3 < n < 50$) we have used the *Shapiro-Wilk test* [1, 2, 4] or *W test* for the verification of normal distribution. Stages to be completed in this regard are:

- standardization or normalization of corrections on sizes $\overline{D}_{ij}$ (medium value of print)
- normal distribution testing of standardized sizes $\overline{D}^*_{ij}$;
- choosing critical values W(n, α) from table 1.2. [1];
- verifying the normal distribution of considered selection;
- for $W > W(n;\alpha)$ is accepted the hypothesis of normal distribution of random variables considered (average values of measured prints on studied aluminum alloy samples) [1;4].

Table 1.2. Critical values of W test[1]

	3	4	5
0,01	0,653	0,687	0,686
0,05	0,767	0,748	0,762

Using statistical tables of W test is chosen the critical value W (n, α) value that compares with the one calculated. [1,4].

Value considered critical, for measurements in technical domain, if we choose four random variables and an error of 0.05%, is $W(4;0{,}05) = 0{,}748$.

If $W > W(n;\alpha)$, is accepted the normal distribution hypothesis of considered random variables (print) [1].

Normality test calculations for precision indicators determines parameter values (average values, standard deviations, standardized diameters) as those listed in Table 1.3 where the values x_i represents in ascending order the placement of standardized values ($\overline{D}^*_{1j}$) corresponding to average values of the print.

Shapiro-Wilk test applied to the average values of measured prints on all samples at ambient temperature leads to the value of $W = 0{,}9579$.

Table 1.3. Average values of precision indicators

i	1	2	3	4
$\overline{D}_{1j}$	1,763	1,724	1,698	1,681
$s_{D_{1j}}$	0,039	0,033	0,041	0,033
$\overline{D}^*_{1j}$	45,21	30,30	41,42	50,93
x_i	30,30	41,42	45,21	50,93

The obtained result, $W = 0{,}9579$, indicates the fact that the calculated value meets the required condition $W > W(n;\alpha)$ [$W(4;0{,}05) = 0{,}748$] (as for the tables 1.2. and 1.3), so that it can be said with 95% statistical certainty that the measured prints are fitting into a normal distribution.

CONCLUSIONS

After processing the experimental results the following conclusions can be set:

- factors that positively influence Brinell hardness (mechanical properties) are the time required during the application of heat treatment and the temperature at which the samples are maintained;
- precision indicators calculations demonstrates that from statistically point of view the measurements are well designed, the collected data is entered in the margin of admitted error, measurement errors being very small;
- measurement errors (calculated with precision indicators) of the prints, highlights the fitting of experimental data into a normal distribution.

The experimental researches carried out on the aluminum alloy *$ATSi_6Cu_4Mn$* subject to heat treatments, correlated with the statistical study, represents is in this way a very useful database on aluminum alloys and their behavior from the point of view of mechanical properties.

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SOCIAL ROBOTIC IN THERAPIES TO IMPROVE CHILDREN'S ATTENTIONAL CAPACITIES

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Abstract: *This paper describes how social robotics can help to improve children's attentional capacities in order to help them in the educational processes. This research is focus in use a robot as a tool in the psychological therapies. There are some projects that have been made to improve the children social capabilities. This article describes some of these projects in order to explain how the social robotic has been used as a therapeutic tool. The final goal of this research is found a methodological way to use a robot not only as a tool but as an agent in the child therapy and also measure the improve of child attention. This research is focus in children between 7 and 11 years old that are attended a regular primary education.*

Keywords: *assisting robot, attention deficit, behavioral interventions, social interface, social robot, therapeutic.*
MSC2010**:** *97C20, 97C30, 97C40, 97C60.*

1. INTRODUCTION

Use robots in common task in these days are very popular. There are robots for almost every area of human development, such as industry, space, medicine, and education.

Social robots are able to establish different kinds of interactions with humans.

Use a social robot as a tool to help people to increase their social abilities or help to fix cognitive deficit is the goal for many researchers.

In this respect there are several social and assistive robots that have been development. Then some of them are mentioned.

Robots Kasper was created with social abilities to help children with autism, is a child size robot and has imitation abilities using physical bodily expressions, facial gestures, it functions as a platform for human – robot – interactions studies [1].

Robot Keepon is a minimalist social robot created to express emotions to interact with it, this robot is also used to help children with autism [2].

Leonardo robot is a MIT robot, it encourage people to interact playfully with it as if a child, this robot has organic appearance which means that it has its own creature appearance [3,4,5].

Papero is a personal robot development by NEC, it goal is interact with children; ti has functions as take care of children, dialogues and games [6]. Like these examples is possible to found more prototypes as robotics faces, or humanoids. The examples that were mentioned are shown in Fig.1.

Fig.1. Social robots

This article intends to demonstrate the hypothesis that using a social robot and particularly social interface is possible to stimulate children attentions in school years.

It is possible to use a social robot as part of psychological therapies as a complementary tool. In order to reach the goal of this research is necessary define Attention Deficit and Hyperactivity Disorder (ADHD). ADHD consist in persistent patterns of inattention and/or hyperactivity and impulsivity, which are severe and common in children in school years in it age and level of development [7].

To measure the attentional capacities of children a difference perceptions test will be used. With this test is possible to know the actual state of child attention, so it is possible to establish the necessary parameters to develop the social abilities of the social robot.

2. SOCIAL ROBOT

Robots become common in our society, is easy to see robots in almost every daily activities.

Robots in their beginning were developed to help humans to do hard and danger works. In these days is possible to talk about robots interacting, collaborating and assistive people.

Talk about social robot is talk about a physical entity embodied in a complex, dynamic, and social environment sufficiently empowered to behave in a manner conducive to its own goals and those of its community [8].

There are several ways for a robot to be social, and they are it social behavior and its physical aspect.

To reach the interaction is not enough to use robot with body, but is necessary the robot actively use their body and develop a kind of body conception; also is important consider that robot need to have a social intelligent [9].

Robots that interact with people used to have an anthropomorphic body and various sensors to interact with people in a natural way, they intend to be a partner to the human and interact with people in their daily life [10].

Cynthia Breazeal from MIT has classified social robot based on its applications but in all cases the robots has been anthropomorphized to reach the interaction and to do any action with humans, and also the robot design will change depending on the environment in which the robot will work and the complexity of the task [11].

The classification establishes 4 kinds of social robots that are: socially evocative, social interface, socially receptive and sociable.

A social robot also can help people to do some specific task, so is possible to talk about Socially Interactive Robot and Socially Assistive Robots [12].

2.1 Social Interface. Considering these parameters of Breazeal classification, to reach the goal of this research is necessary to use a Social Interface which use social signals and similar communication as humans to facilitate the interaction with people in a natural way. The robot need to have enough social intelligent to transmit the message correctly, and this should be complemented with body gestures, gaze and facial expressions [11].

2.2 Socially Assistive Robot. This is the intersection of assistive robot and social interactive robot, they share the goal to provide assistance to human and use social interactions to give this assistance [12]. Assistive robot can help humans to do hard task or to assist them in specific task, but if it is combine with interactions skills, is possible to have a better tool to help humans in a natural way and also interact with them.

Have a tool able to participate as an active part of psychological therapies with children is the goal of this research.

2.3 Anthropomorphize. In all cases, if a social robot is involved, is necessary to talk about physical embodiment [13]. Give a body to the robot implies anthropomorphize it.

The role of anthropomorphizes is not built a synthetic human, but design a system that has to function in our physical world and social space [14].

To reach the interaction goal is necessary to give human attributes to robot. Is important reach the confidence between the child and robot, and never fall in Uncanny Valley witch Mori define as level of apathy that robot wich is very similar to human like can cause [15]. To gain the child attention and confidence is necessary develop a robot that looks like a robot or toy, not like an animal or human been.

Epley define factors that need to be consider in order to anthropomorphize and they are [16]:

- Elicited agent Knowledge, is used as source of induction, and allows establishing similarities between non-human agents using appearance and movement.
- Effectance Motivation, this is given to the non-human agent to reach the ability to give sense to it actions

- Social Motivation, establish social relations with human beings and let it motivations be satisfied.

2.4 Characterization. A Social Robot need to be characterized depends on who will be it users and also depend on what kind of labor and social activity will do. The physical aspect will change drastically focus on the social goal, for example a guide robot never will looks the same as a therapeutic robot, and both of them will not looks the same than a robot to take care of healthy children. Choose the right characterization and embodiment will increase or decrease the social interaction and will determine the success or failure of the task.

In Fig.2 is possible to see all the necessaries characters to have a social robot that will be useful in psychological therapies with children.

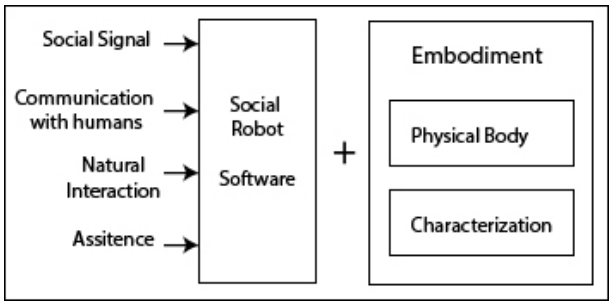

Fig.2. Characteristic for a social robot

3. ATTENTIONAL CAPACITIES

Attention is a basic psychological process. It is essential for the information processing and is related to other cognitive functioning, such as thinking and memory processes.

Luria define attention as an active process, not static [17], and is determined by a number of variables based on experience, interests, motives, and context.

This is a vital process for the optimal functioning of individuals in everyday life. The cognitive process that allows us to focus the organs on relevant stimuli to execute the activity; to focus attention on a stimulus voluntarily, others lose relevance.

For children at school age, attention is an important process. School age is a period ranging from 7 to 12 years old.

It is characterized by a set of changes in the psychological development of the child such as personality development; school becomes the context of socialization and acquisition of essential knowledge. At his phase conceptual thinking, conscious and voluntary nature of the cognitive processes, and greater stability in effective control, are development, this allows the child to adapt in the new social situation of development, characterized by the activity of study.

3.1 Attention Deficit and Hyperactivity Disorder (ADHD). The Attention Deficit and Hyperactivity Disorder (ADHD) consist on persistent pattern of inattention and/or hyperactivity and impulsivity, which are more severe than expected in children in school years [7].

The etiology of this disorder identifies several factors such as genetic, psychosocial, neurochemical developmental and neurophysiological. Although the causes are unknown, "many children with ADHD show no evidence of structural damage to the central nervous system. Contrastingly, children with known neurological disorders caused by brain injury do not have attention deficit disorder and hyperactivity "[7].

Among the psychosocial factors that influence the attention deficit in children are stressful events, dysfunctional families, and generators stressors.

American Psychiatric Association DSM IV has established some criteria for diagnosis of this disorder. These criteria involve inattention, hyperactivity and impulsivity [18] as shows in Fig.3.

Fig.3. Criteria for ADHD diagnosis.

3.2 How measure Attentional capacities?

To measure attentional capacities in children is necessary to use a special test. There are test like Toulouse - Piéron test, it consist in let the child watch 3 figures of the top and mark all figures that are the same, this should be doing from top to bottom and from left to right as fast as possible. Fig. 4 shows part of this test.

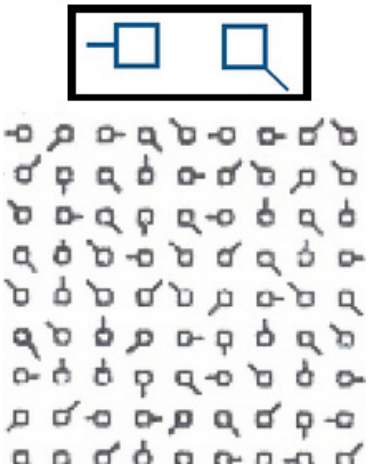

Fig.4. Toulouse - Piéron Test

Other test is Differences Perception test also called Face Test, this test assesses sustained attention and selective attention; it consist in determine which of the 3 faces is different and cross it off. Faces test has integrated 60 graphic elements that are schematic drawings of faces. This test will be used in this research because children will be tested, and because it has faces that can attract the child's interest in do the test. Fig.5. shows an example of part this test.

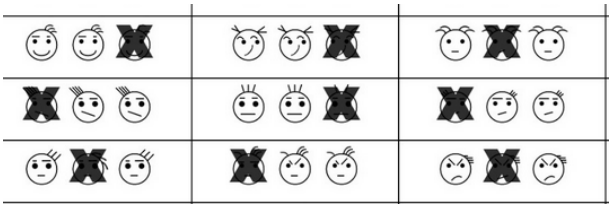

Fig.5. Differences Perception test - Face Tes0.t

With the result of the test, the specific population for this research will be identified and will be possible classified levels of attentions in the population.

4. ROBOTS IN ATTENTIONAL THERAPIES FOR CHILDREN

In school age increase the volume of care and attention span of the child, and this process, like the other cognitive processes becomes voluntary [19].

One of the problems that affect school children is attention deficit. "Attentional problems are persistent and occur frequently associated with other early problems" [20]. It is report that attention deficit / hyperactivity disorder increases the likelihood of developing aggressive and shy behavior, psychiatric disorders with disabilities, cognitive deficits and need for special education [20]. Help the child to overcome these disorders reducing the time of the therapy is the goal, and to reach this goal robotics offer a unique tool to developmental phycology and related disciplines in evaluating complex interaction models [21].

A social robot can be used as part of child therapy. The goal to use a social robot is accelerate the therapy proceed but never replace it or replace the psychology place.

The social robot that will be require is a Social Interface but at the same time a Social Assistive Robot, so combine both characteristic will be the key of the success.

4.1 Robot features. The robot must exhibit peer-to-peer interaction skills because it primary function will be socially interact with children. A robot able to do peer-to-peer interactions will have the following characteristics [22]:

- Express and/or perceive emotions.
- Communicate with high level dialogue.
- Learn/recognize models of the agents.
- Establish / maintain social relationships.
- Use natural cues (gaze, gestures).
- Exhibit distinctive personality and character.
- May learn / develop social competencies.

To create a robot with an intelligent and interactive behavior is important give to it verbal and nonverbal behaviors of humans, such as facial expressions and body language that accompany speech [23].

4.2 Joint Attention. Robot need to have the ability to do attention detection that is to track the attentional behavior and may imply follow the gaze; attention manipulation that allow it to manipulate the attentional behavior of agents, using pointing gestures or words; social coordination that let the agent be able to engage in coordinated interaction with other agents, this implies mastering social techniques such as turn-taking, role-switching and ritualized games [24].

In social psychology Joint Attention is a mutual manifestation and is the same as focus attention [25].

4.3 Computational model. To be able of construct a computational model of possible behavior of the robot is necessary define that the robot will answer to different kind of stimuli.

Balkenius and Björne describes if the stimuli S_i occurs, a response R_i will be generated.

The activation of the response is giving by equation (1) [18]:

$$\Delta R_i(t) = \alpha(1- R_i(t))S_i(t) - \beta R_i(t), \quad (1)$$

where

$S_i(t)$ is the input signal shunted by the current activity of the node and α describes the activation of α trace and
β describes the passive decay of the memory trace.

The context system inhibits associating from stimulus to response through a matrix M, which is described in the equation (2) [18]:

$$\Delta R_i(t)=\alpha(1-R_i(t))S_i(t)-\beta R_i(t)-R_i(t)c_iM_{ji}, \quad (2)$$

where

M can be interpreted as the cognitive set of corresponding to certain contextual representation.

Olsen and Goodrich describes that are metrics that are possible to measure. This metrics are task effectiveness (TE) that measure how a human-robot team accomplish some task; Neglect tolerance (NT), measure haw the robot's current task effectiveness declines over time when the robot is neglected by the user; robot attention demand (RAD) measure how much attention a robot is demanding, this is a measure of the fraction of total task time that a user must attend to a given robot, see equation (3); free time (FT) is a metric related to RAD is the user's free time, is a fraction of the task time that the user does not need to pay attention to the robot, see equation (4); fan out (FO) is used to measure the effectiveness of a human-robots team, see equation (5); finally interaction effort (IE) is related to the time necessary to interact with a given robot, see equation (6) [26]:

$$RAD = IE / (IE + NT), \quad (3)$$

$$FT = 1.0 - RAD, \quad (4)$$

$$FO = 1.0 / RAD, \quad (5)$$

$$IE = NT/(FO-1). \quad (6)$$

Considering all this parameter to measure and the relationship between stimuli and response, it is possible to develop a successfully computational model of the robot behavior.

4.1 Intervention plan. The psychological and social intervention is essential to ensure good prognosis. The psychological intervention consists mainly in the formation of therapeutic groups where children are trained in social skills, assertiveness, where self-esteem, parent training is reinforced and behavioral interventions in the school and family context [7]. The therapeutic group will be conforming not only with children but with the robot also as part of the social group. In Fig.6. shows how would be the group therapy. In the group therapy the robot will interact with each child (with words, facial gestures and body movements) and will receive the answer of the children. In all process the psychologist will be present and will guide the different tasks.

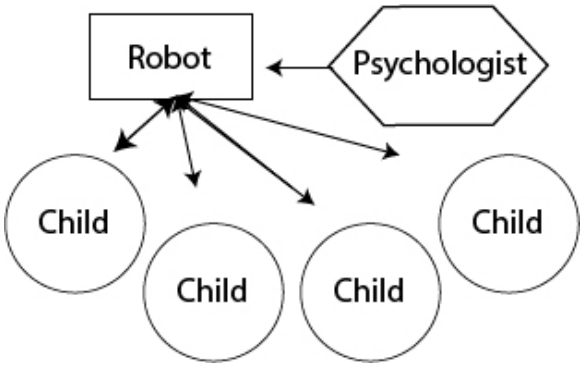

Fig.6. Diagram for group therapy

These interventions are characterized by strategies to improve symptoms of maladjustment through training in problem solving techniques and emotional self.

In his aspect the social robot can help to increase child esteem using dialogues and games oriented to reinforce the child attitude by congratulating all the good deeds.

Other strategies are aimed at targeting sports and leisure activities, orientation of associative simple to complex tasks related to school, such as the geometric representation of the school environment (classroom, pencil, notebook and tables). This activity will guide by the robot using it artificial vision to do object recognition and participating in a collaborative way with the children. In Fig.7 shows how will work the communication in a individual therapy, the psychologist will give the instruction of the task to the child and the robot.

To the child to explain the task that will be doing with the robot, and to the robot to make the example of the collaborative task that will be executed.

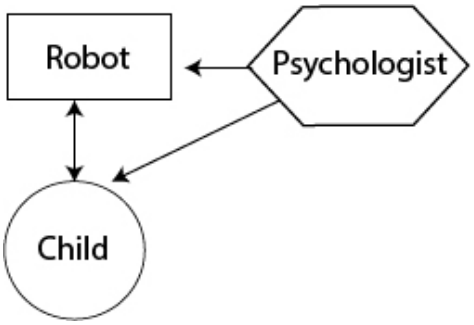

Fig.7. Diagram for individual therapy

Furthermore, in the carrying out of a special and unique activity (work with the robot) effectively, self-esteem and interest is reinforced by strengthening attention.

CONCLUSIONS

A social robot can be a powerful tool in physiological therapies with children. Because the child consider the robot as a toy or a friend and establish a close relationship with it, and therapy can progress quickly.

The robot can guide tasks, and their can gradually increase it level of complexity.

An example of this kind of task can be recognizing geometric figures and they add the task to recognize the figure color. Other task can introduce phrases, songs or games with phrases. Different kinds of therapeutic procedures can be made it using the body movements and facial expression that the robot has, such as imitations games that will work child coordination and imagination with associate elements such as coordination exercises.

This research is the beginning of the project in a primary school, and pretends to improve attentional capacity of children using a social robot in group and individual therapies.

As a futures works, we pretend to use the social robot with autistic children to help them to develop their social and attentional abilities.

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PSYCHOSOCIAL INVOLVEMENT IN EDUCATION PROGRAMS ON PRISONERS

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Abstract: ***Goal, objective, hypothesis:*** *: finding and implementing new educational programs, regarding different categories of prisoners, having in mind their reintegration in community ,becoming aware of the necessity of implying prisoners in therapeutic and educational actions which have as a goal their preparation for reintegration in society, implying him in developing his own personality, reducing at maximum the risk of relapse, social maladaptation and psychic trauma.*

Method: *the way how prisoners develop a positive attitude behavior, applying occupational therapies, in programs developed during 3 months in classes of 60 minutes, having a structure of 12 themes for minors, young people, adults, men and women, 12 in a group.*

Results: *a new conception and vision from the prisoners on the importance of educational programs regarding the development of his personality, taking in consideration that such an attitudinal demarche represents an alternative to his complex metamorphosis during the imprisonment and not only.*

Keywords: *impact – implication – educational program – community – prisoner – reintegration – socialization.*

INTRODUCTION

Promoting an intervention program involves the detainees to consider change of behavior and attitude by applying those methods focusing on positive reinforcement and a technique for increasing the repertoire.

From this point of view, the programs implemented in Romanian prisons, starting in their construction value from:

1) increasing humanity by promoting moral values in relationships bringing hope and peace in a turbulent world and depressing;

2) continuing to cultivate relations with the family and all outside factors causing joy a human relations approach and reconciliation;

3) providing direct programs to develop cultural level, educators and psychologists is true knowledge modelers;

4) providing juveniles detained and not only of the second chance on reducing social and psychological vulnerability;

5) The understanding of the world and place in the world with a permanent call to meditation, the struggle between good and evil, the meaning of life and happiness without you indulge cynicism and resignation, eventually to reach your goal, that of spiritual maturity and the construction of morality function prisoners after release.

To these may be added as recovery experiences specialized custom built with those programs as starting points: community reintegration needs of prisoners from their psycho-social impact on attitudes and behavior beyond.

Thus, this conceptual approach, we developed and implemented in 2002-2007, three therapeutic educational programs and currently applicable to their specific form and addressing:

1) minors

Together - pedagogical intervention program

2) youth, adults, men, women:

With you - the program sent detainees unsought by anyone;

3) young adults, men, women:

Moral health of the family - a crime prevention program; already implemented in the prisons interested in these topics and existing custom system.

As specific features three programs are identified by:

1) Together:

Psycho-pedagogical intervention program addressed to young offenders (14-16 years old) is a new way to find sources and educational resources to implement a new approach to code and later prepare for the social reintegration of the preadolescent years counting and adolescence.

Adolescence, considered by most age which

raises, in particular, can mitigate weaknesses in a program that is intended primarily for those deprived of liberty, and can manifest at some point conduct behavioral risk.

However, psycho-pedagogical intervention program, is part of the action of the socio-educational departments (in rehabilitation centers and prisons) to identify viable solutions with a good community reintegration of young offenders (14-16 years old).

The program also psycho-pedagogical intervention, highlights the quality and gives confidence, using with good results psychotherapy programs coming in prevention, particularly affective and behavioral weaknesses of preteen and adolescent.

Completion of this psycho-pedagogical intervention program developed and specifically targeted young offenders (14-16 years old) will be validated when the person concerned, but especially that it is understood and accepted, and that the chosen path at a time given (voluntary or involuntary) is no longer alone.

We, meant you were close, give it a chance and we're basically together.

Specific compartments psycho-pedagogical intervention program can be found, defined and documented substantial educational value priority, the following goals and objectives that complement each other, forming a whole:

- Education through school education;
- Training and development of skills and work habits;
- Facilitating the educational sequence specific behavioral behaviors to reduce or eliminate the risk;
- Realization of educational and psychological counseling to improve the state of preadolescent and adolescent personality destructiveness;
- Preparation for reintegration into the community, focusing primarily moral and civic education parameters and legal;
- Maintaining and nurturing relationship with the family in a state of deprivation of liberty for the reintegration and re-socialization of the person subject to the law, the best, favorable and stable conditions

2) With you:

The program addresses inmates, inmates who are not looking for anyone (no family or other people). We chose this segment of the incarcerated persons as may be in a time sequence taken behavioral attitude compared to other categories of prisoners who arouses interest and report on social change. "Abandonment" both from their family and other "sources affective" networking and communication lead to situations that may arise deviant behavior "daily" these prisoners, especially affective-emotional and volitional behavior.

Lower self-esteem, self-knowledge and self-confidence and persistence to permanent psychosomatic discomfort arising from these offenders can trigger mutations on destructiveness personality, implementing behavioral-attitudinal swings.

The program also aims to highlight the human quality, reducing the elements: acceptance, understanding, respect and fairness, so the conflicts that may arise at some point and trigger stop "making virus' isolation and loneliness, not accepting and intolerance.

Through its particular structure, the program is intended as a way both the original design and realization (excluding psychotherapy) a strategy in which the prisoner unsought to feel less alone, to accept the help that is offered, and to overcome the front by increasing self-esteem and confidence, and these "cover" the facts, attitudes and behavioral approaches.

Understanding himself will understand others and accepting yourself together, then surely you understand that the chance and hope that is given, it determines not to be alone in fact he is no longer alone.

As intended , the program aims to achieve gradual awareness prisoners unsought , thinking that they are absolutely alone, finally accepting aid offered to them to preserve their moral-psychological integrity . What is the specificity of this program is how to achieve the idea to be decoded identity elements of regression self esteem and self confidence , with no moral and social support from family or others endorsed the prisoner unsought .

In this situation , the application of the

exclusive group psychotherapy mainly based on occupational therapy creates availability pedagogical approach to the subject in the context of the group , reporting to him and finding himself . This approach purely psychotherapeutic starts from the assumption that keeping paramount in such situations is always well-being of the prisoner unsought , given by WHO (World Health Organization) the following components:

1) Acceptance of self = positive attitude towards oneself , accepting personal strengths and weaknesses , positive perceptions of past experiences and future .

2) positive relations with others = trust people , sociable , intimate , need to receive and give affection, empathic attitude , open and warm .

3) Control = feeling of competence and personal control on tasks creates opportunities for exploitation of personal needs, make choices according to their needs ;

4) The meaning and purpose in life = directed the medium and long -term purposes , the positive experience of the past and the future relevance of the belief that they deserve to get involved, curiosity.

5) Personal Development = openness to new experiences , a sense of valuing their potential , capacity for self -reflection , self- perception changes , positive , efficient , flexibility , creativity , the need to challenge the rejection routine

Also, by designing the program, it tries an alternative to relations with outsiders (the idea of finding someone to come to visit - actually know that it is not always a viable and balanced, and simply visit not solve the problem as such, but on the contrary to be the prisoner only around for a limited time and not only his family (the one that they report being incarcerated at the time)

3) the moral health of the family - a crime prevention program, present and developed in prison, aims primarily belonging to the family rediscover and redefine elements of morality that lead ultimately to maintain the health of the institution, certifying that the implementation of new educational strategies specific to given target group - people incarcerated (owned).

However, increased self esteem and confidence of inmates certify the need for methods aimed to neutralize those elements related to: not belonging, irresponsibility, emotional weakness and alienation, the human condition, all of which can trigger at a time, conduct / risky behavior as a first step towards the end, appearance and installation delinquency.

In essence, the program aims to restore and upgrade the quality of the human family seen through the inmate will have to return, to restore or to rely on, first, the love of others, at that and report fully engaging. Particular structure of this program lies in the fact that the family can be represented as an identity of seven keywords: concept - couple - child - account - communication - cooperation - compromise, designed to empower those directly involved in maintaining moral health.

The purpose of the program lies in how to achieve gradual awareness of the importance of the family in these situations and others, with perspective, education in the spirit of being a family and taking into account the psychosocial implications of this goal.

The "scan" above is actually successful implementation of psycho-therapeutic elements (occupational therapy) as ways that personalizing a concept and a construction value, aiming at the maintenance of mental health and reintegration into the community, with the "previous" schedule "With you ".

Matrix shown in three therapeutic educational programs described above, the need for the author to customize the intervention taking into account:

- Age of prisoners;
- Age, sex;
- Social situation (social status, social role, social position);
- The offense;
- State criminal;
- Sentence (months, years);

giving endorsement success, the realization of the desired in good condition. It's actually an identification of the elements that characterize, at one time, cause and effect, psychological intervention and / or psycho-pedagogical proving in time efficient.

In this contextually, psychosocial impact

of these programs determine a new attitudinal behavior, with the ways of alternatives that bring to the fore the involvement detainee himself existential revealing their flaws.

Importantly, from those who develop educational and therapeutic programs focused on a specific issue, to integrate, socialize and recover the person deprived of liberty, eliminating the home: isolation, marginalization of non-involvement, thus making the object man being man

And all this, while therapeutic based educational action will be team: psychologist - teacher - social worker - the priest, then you will notice the behavioral attitude of the prisoner, desired change, reducing the counterparty risk of relapse, social maladjustment and psychological trauma

The big winner in the application in such a therapeutic educational program identity designed, I thought to be co-participation, involvement and constructive approach to change the prisoner passing phase "out the program to check a business "to" get involved, I do, I feel differently, I do well, "the facts that really toiling of this area, it is the feedback in simple yet so emotionally charged statements like" only so "," over so soon? "," different number now days because Wednesdays counts, thank you. "Comments should be extra important will be the success.

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REPATTERNING THE INTERNATIONAL SECURITY ENVIRONMENT: THE IMPACT OF GLOBALIZATION ON SECURITY IN THE CULTURAL FIELD

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Abstract: *The present paper aims at presenting the relationship between globalization and security in the context of repatterning the present-day international security environment. The phenomenon of globalization produces multiple and longlasting effects of social, economic, political, military and cultural nature. The present study shows that the positive effects of globalization lead to the so-called globalization of security whereas the negative effects lead to the globalization of insecurity. National security is a component part of the international security. Any important problem occurring at the international level has a great impact on the national security affecting any state. Of course, the national security has a clear influence on the international security, too. A new approach is required all over the world, a new perspective on global security, that is, the human security centered on the individual who turns into the subject of security. One of the present-day requirements is a strategy of security in globalization, which should be based on the interdisciplinary understanding of the phenomenon of globalization embodied by the regional actors as well as a holistic thinking of the actors playing their parts at the level of the whole world. Their main aims are those referring to the mutual adjustment of globalization and security, unifying the issues which differentiate security from globalization and consolidate the peace, stability and security of the citizen. The present study also presents the opinions on the present-day international security environment and the concept of international security, this part being based on a questionnaire applied to a number of 33 subjects. Thus, this work is based on both quantitative and qualitative research methods.*

Keywords: *globalization, effects, culture, repatterning, international security.*

1. INTRODUCTION

The early 21st century is marked by major political changes with great impact upon the Euro-Atlantic security systems.

Globalization influences the relationship between the national security and international security by the mutations produced in the content of the sovereignty of the states and by shifting to the competence of regional and international organizations with certain responsibilities at the level of human security.

2. REDIMENSIONING THE PRESENT-DAY INTERNATIONAL SECURITY ENVIRONMENT

In the present-day international security environment, the states cooperate in order to promote their own security as well as the national interests and universal values based on the principles of democracy and market economy.

Concerning the centers of power, their hierarchy has been significantly transformed both by changing the way in which the protagonists play their roles and by highlighting the tendencies of strategic redimensioning of partnerships imposed by the interests and objectives of security of the main actors.

The dynamics of the present-day international security environment is characterized by the profound changes that took place in the early 21st century ending with the outbreak of the *War on Terror* and the historical extension of the North Atlantic Treaty Organization and the European Union.

Both the repatterning of the present-day international security environment by the reorganization of the international security organizations and the redefinition of the concepts concerning the collective fight against international terrorism have imposed new aspects to the security environment.

The world is in a continuous transformation, it gets globalized. Thus, new challenges and threats come into being, all of them being generated by new forms of violence based on ethnic disagreements and religious disputes and as a consequence, the present-day international security system is redimensioned (Neag, 2008:90-95).

The new risks and threats turned into asymmetric ones increasing their intensity and enlarging their area of manifestation. The absolute priority consists in preventing and counteracting these new asymmetric forms both within the framework of the democratic states and international security organizations. Thus, a new age is repatterned and within its framework Europe is unified in order to strengthen its stability and prosperity.

The unified Europe becomes a main actor on the international stage turning into a pillar of international security.

The unified Europe plays this main part in the situation in which it seems that the world is still dominated by the United States of America as many political analysts consider that we live in a unipolar age in which the Unites States succeeded in relating as efficiently as possible all the component parts of the political power to the military capacities and the economic as well as cultural ones.

We must admit that the United States of America remains the main economic power of the world benefitting mostly from the process of globalization, of the new digital economy and technological revolution.

Washington owns the most important military arsenal and the American armed forces are deployed on all the continents. Together with its allies, the United States fight against international terrorism. Since 1990 new centers of power have taken shape being confronted with economic or/and political problems, thus a repatterning being required.

The European Union became the second actor of world economy constituted as a civilian power and being confronted with a wide range of problems, such as: the integration issues, a very slow economic growth and structural unemployment and that is why it could not become a powerful military actor.

The Russian Federation represents the second military world power and an energetic superpower.

China and India face an increasing economic development having a huge human potential. Japan still suffers from the slow rhythm of economic rebirth after the recession of the 1990s.

The United States of America has the power which gives access to all the most important problems of the contemporary world.

Thus, the United States involves in all the previously mentioned issues bringing its contribution either directly or by means of the international organizations of security and the economic or financial ones.

The power of the United States of America is still perceived as a condition for stability and security in today's world.

It has the ability to dynamize the processes of globalization, liberalization and democratization of the world. However, the crisis of the Iranian and North Korean nuclear program stands as a proof for the fact that today the United States cannot solve anymore unilaterally a potential threat to the international security.

The most appropriate solution seems to be that of the international co-operation of the most important powers within the framework of the United Nations.

In this context, the effort of the international relations to strengthen the stability at the regional level can be perceived as a stage of the process of consolidating stability at the global level.

There have been used numberless economic, political, diplomatic as well as military instruments to strengthen the stability in the Balkans, Middle East or even in Africa.

The emphasis has also been laid upon developing the relations among states and taking common decisions.

It is worth to mention the basic tendencies in approaching the phenomenon of the organized crime in the early 21st century: the growth of transnational crime, the speculation of laws, the relation between money producing crimes with violent crimes.

In this context, international security is more and more affected by the control exerted by the organized crime on the different territories as well as on both internal and external markets.

Thus, a preventive and systematic approach to global security is required laying emphasis upon prevention and counterattack when dealing with the threat of organized crime to security.

3. THE EFFECTS OF GLOBALIZATION

At present, the world is changing and this happens mainly due to the interaction of the economy with the political system, the social and cultural institutions (Chirot, 1996:54).

Today we are affected by the effects of globalization. These effects are either positive or negative, either white or black, although in the contemporary society the white and the black are relative.

Today the economic standards turn into common standards being easily accepted by the international community. Different standards are here worth to be mentioned just like certain traditions and customs belonging to different cultures. They cannot determine changes at the global level.

Various cultures act differently, sometimes even surprisingly. Thus, the economic factor is not the key issue of the whole process.

There are many diachronic approaches and transnational processes with great impact on security as a consequence of globalization.

On the one hand, globalization has advantages. A great example might be the stimulation of the economic growth or the opening of different types of societies.

On the other hand, the phenomenon of globalization has disadvantages, such as: the destabilization of certain states, the vulnerabilization of entire regions.

Thus, this double-faced process of globalization can be explained by: on the one hand, its positive influence on the democratic community strengthening prosperity and liberty, stability and security and on the other hand, by its negative impact, the instability spreading out from the Middle East to the Asian seacoast.

Instability is generated by a series of factors, such as: poverty, power disequilibrium, government inefficiency, extremist Islamic fundamentalism. The most serious aspect is the lack of security.

It is worth to mention here the major dangers of the contemporary world - terrorism, the proliferation of mass destruction weapons, the organized crime, ethnic tensions, religious disputes, geopolitical rivalries – as they all have a great negative impact on democracy, stability and security.

Governments must respond appropriately by taking harsh measures to protect the territory against the asymmetric risks and threats.

The international antiterrorist coalition aims at managing the international conflicts, stimulating the economic growth, repatterning the security institutions in order to respond to the 21st century requirements.

Today an essential factor is represented by political instability. This issue is one of the most important items in elaborating the security policies highlighting the pressure exerted when expressing certain democratic rights specific to the western civilization.

The international system is defined by a relative distribution of power among the main component states. The main feature of the international system is considered to be unipolarity in the late 20th century and early 21st century.

The United States of America represents the only state entity able to promote its military and non-military interests anywhere irrespective of the region. The United States of America has a superior status in international relations by stimulating co-operation in all the fields of social life.

The security culture consists of the dialogue concerning the international security institutions as well as the economic, political or military alliances. The main problems concern the influences of the changes occurred in the security environment on the alliances, the development scenarios of the alliances and the creation of new forms of co-operation at global level.

Some consider that there is a transatlantic split according to numberless debates on the military operations of Afghanistan or the second Gulf war. Thus, it seems, according to many specialists in the field, that the Americans and a part of the Europeans do not share the same view on using force.

The world in which we live is not anymore a world of classical alliances. It is important for us all, as Europeans, to understand the European policy of defense and security and the reasons for creating certain coalitions.

It is considered that the North Atlantic Treaty Organization will represent a pillar of the Euro-Atlantic security and the European Union will develop as an important economic entity representing an important form of community and security.

All these tendencies develop under the conditions of globalization, a dynamic process of enlarging the interdependences among national states as a consequence of the extension of transnational links in various spheres of economic, political, social and cultural life having a great impact the fact that the problems get more global than national requiring a more global solution than a national one (Bari: 2003).

When defining the concept of globalization, the military dimension has to be emphasized as it is of paramount importance by its fight against terrorism.

Thus, the security of a certain zone, be it South-Eastern Europe or the Middle East, is part of global security. The traditional forms of fight against threats to international security are viewed as being far-fetched

Today we need modern alternatives, new forms of co-operation within the framework of the security community, various strategies and new security policies corresponding to the globalization of insecurity.

We, as citizens, are conditioned to function within the framework of a strategic global environment. Money operates in a global world just like media do in a borderless world. Likewise, security and insecurity got globalized. They cannot be anymore defined in the context of specific regions.

The essence of globalization cannot be reduced anymore to peace and progress. A global world is a world full of risks and threats, an unstable and dangerous world.

Today the essence of this global world can be reduced to a unique parameter: that is, the globalization of insecurity.

4. NATIONAL SECURITY – A COMPONENT PART OF INTERNATIONAL SECURITY IN THE CONTEXT OF GLOBAL SECURITY

The relation between national security and international security, perceived as social realities, is a reciprocal one. National security is a component part of international security. Any problems occurring at the international level have also impact on the national security of any state. Homeland security can influence international security as well.

Within the framework of human security, the individual becomes the subject of security without considering the national, religious or ethnic characteristics. In the international context, human security imposes itself more and more as a vision on global security. In this respect, there are taken into consideration factors, such as: health, longevity, access to education.

In the areas marked by instability, the interventions of the United Nations are associated with a clear vision on these preoccupations.

Romania, as an EU and NATO member state, takes an active part in the prevention and management of crises and conflicts which endanger human security.

According to Zygmunt Bauman, the deepest meaning conveyed by the idea of globalization consists of the undefined, unorganized and self-propelled character of the world's problems; the lack of the center, of a decision taking board (2000:59).

The state is a hierarchical organization having full sovereignty: legislative, executive, economic, military as well as a cultural one.

Two great powers overwhelmed a world made up of sovereign states throughout 50 years. Each power promoted a certain world order based on the military, economic and cultural insufficiency of each state.

Thus, there is registered the tendency of grouping around certain political and military alliances perceived as a measure to defend independence, sovereignty, territorial integrity and to promote the national interests.

Globalization manifested itself due to the disappearance of bipolarity. The states started to replace certain aspects of their sovereignty by some advantages offered by political, military and economic organizations. According to Zygmunt Bauman, globalization and territorialization are facets of the same process, the redistribution of sovereignty and power all over the world being caused by the revolutionary progress of the speed technology (Bauman, 2000: 70).

The connection between globalization and nation is debated by Ilie Bădescu and Dan Dungaciu (1995:136-213) who present the multifarious opinions of some Romanian and foreign sociologists on the phenomenon of globalization, approached in relation to the national state, as a symbol of national identity and space where the national security manifests itself.

Globalization can be approached according to two different theoretical models. The first one aims at unity in diversity and the second aims at unity by ignoring one's own identity.

The first model agrees with the constitution of human groups. The communist experiment is replaced by the political project of globalization. According to this political project, reality is adjusted to nonspecific grids implying a huge risk; thus, anytime the retort to this reality might be launched (Bădescu & Dungaciu, 1995:216).

Hence, it might result the aggression against some states, which can take the violent form of an aggression against humankind. The state-nation will continue to be beneficial for the development of mankind although some consider it to be historically far-fetched.

One of the priorities of the regional community is maintaining the stability at global level, offering the assistance necessary for the creation of international mechanisms of strengthening the sustainable development.

But all the time new risks, threats, vulnerabilities and challenges arise. International terrorism and transnational organized crime have a regional or global character.

It is worth to mention the impact exerted by globalization on the relation between national and international security in the cultural field.

Globalization influences the relation between national and international security by means of the mutations produced in the content of the states' sovereignty. Thus, a series of features specific to the traditional concept of state sovereignty is modified in the sense that these characteristics pass to some regional and international organizations with responsibilities at the level of human security.

It is well known that certain threats aim at both weak and strong states. First of all, we can refer to the negative effects of the globalization of economy, which can be felt by any citizen due to the poverty of people. Secondly, we can mention the international terrorism, which exploits the advantages of globalization in the sense that the weak states turn into its victims. Thirdly, we can refer to the proliferation of the weapons of mass destruction followed by the organized crime networks, the interethnic conflicts as well as the interreligious disputes. All these asymmetric threats must be prevented.

No state has the capacity to fight alone against such new threats irrespective of its power. Thus, the most indicated solution is given by international co-operation.

5. OPINIONS ON THE PRESENT-DAY INTERNATIONAL SECURITY ENVIRONMENT AND THE CONCEPT OF INTERNATIONAL SECURITY

5.1 The Questionnaire. In order to find out the opinions of the young people living in the present-day Romania on the international security environment and the phenomenon of globalization, I suggest the following questionnaire, consisting of a set of 10 questions.

Q1. What is, in your opinion, the most important feature of the present-day international security environment?

a. highlighting a new age marked by the United States of America considered to be the only credible and viable political, economic, military and financial superpower;

b. clearly distinguishing the European Union as a factor of stability and progress;

c. recognizing China's unprecedented economic and military development;

d. revealing Russia's diplomatic offensive.

Q2. For you, what is the most important challenge associated with the present-day global economic crisis?

a. the growth and spread of poverty;

b. the increase registered in the field of internal crime: tax avoidance, embezzlement, blackmail, forgery, abduction etc.

c. political fragmentation within the framework of certain states;

d. violent social movements.

Q3. What are the severest threats, in your opinion, aiming at both the weak and powerful states?

a. the negative effects of the economic globalization felt at the citizen's level by the impoverishment of millions of people;

b. the widespread occurrence of diseases;

c. international terrorism which exploits the advantages of globalization so that the weak states turn easily into its victims;

d. the organized crime networks which threaten the international stability and security.

Q4. In your opinion, what is the most important objective of the international anti-terrorist coalition?

a. international crisis management by putting an end to the proliferation of the mass destruction weapons;

b. the stimulation of the economic growth under the conditions of the free markets development by co-operating with international centers of power;

c. repatterning and redimensioning the security institutions according to the 21st century requirements;

d. I do not know.

Q5. What do you think is the most destructive factor for the stability of the international system?

a. poverty;

b. epidemics;

c. environmental pollution;

d. ethnic tensions.

Q6. What is, in your opinion, the basic principle of global security?

a. the principle of democracy;

b. the principle of efficient governing;

c. the principle of the compliance with laws;

d. I do not know.

Q7. In your opinion, what is the main asymmetry of the global world having the strongest impact upon the world's security sta te?

a. the concentration of the technological progress in the developed states;

b. the macro-economic vulnerability within the framework of the developing countries;

c. the contrast between the high level of money flow and the international mobility of work, especially the unskilled labor;

d. I do not know.

Q8. What is, from a geopolitical point of view, in your opinion, the major dimension in today's Europe?

a. the Euro-Asian dimension;

b. the Euro-Atlantic dimension;

c. the Euro-African dimension;

d. I do not know.

Q9. What do you think is the main risk to the security of the European space?

a. terrorism;

b. the proliferation of the weapons of mass destruction;

c. organized crime;

d. illicit trafficking of drugs and people.

Q10. How do you view the phenomenon of regionalization?

a. as a means of protection against globalization;

b. as an instrument used in order to overcome the difficulties caused by the reduced dimension of the national states;

c. as a form of *hard* essence used to transform the micro-regions into spaces of national states which should co-operate among them;

d. as a *soft* form open to the modernization of the world based on *soft power*.

5.2 The Subjects of the Questionnaire. The previously presented questionnaire has been distributed to a number of 33 subjects aged in between 19 and 23.

It is worth to mention the sex of the subjects: out of the 33 subjects, 12 are male subjects representing 36.36% and 21 are female subjects standing for 63.63%.

Regarding the subjects' nationality, we confront ourselves with unity in diversity.

Out of the 33 students, one student has Venezuelan nationality – 3.03%, another subject has German nationality (Hungarian and Czech) according to that particular subject's statement – 3.03%, 2 subjects have Hungarian nationality – 6.06% and 29 are of Romanian nationality – 87.87%.

All in all, except for the fact that all the subjects are students within the framework of the Cultural Studies program and all of them live in an urban area, we can say that we deal with the phenomenon of *diversity in unity* due to the various religious backgrounds and nationalities registered in this study based on 33 subjects or *unity in diversity* as although they belong to different categories, they are united within the framework of an academic environment, which offers them the same chances irrespective of sex, nationality or religion.

5.3 The Interpretation of the Data on the Present-Day International Security Environment and the Concept of International Security. The first question is about the most important feature of the present-day international security environment and it has registered very interesting results.

Out of the 33 respondents, 11 subjects (33.33%) consider that the main feature is that of highlighting a new age marked by the United States of America considered to be the only credible and viable political, economic, military and financial superpower represented by variant a),

10 subjects (30.30%) think that the most important feature is that presented in variant b), namely clearly distinguishing the European Union as a factor of stability and progress, according to other 7 subjects (21.21%) the main feature of the present-day international security environment is represented by China's unprecedented economic and military development, that is variant c),

and 5 subjects (15.15%) identified variant d) with the most important feature standing for Russia's diplomatic offensive.

All these possible answers demonstrate that the future international security system will be based on a multipolar structure.

The second question refers to the most important challenge associated with the present-day global economic crisis.

Out of the 33 subjects, 15 respondents (45.45%) consider that variant a) is the most appropriate answer to the question, that is, the growth and spread of poverty, which according to them might be the main challenge associated with the crisis.

Other 13 subjects (39.39%) have chosen variant b) represented by the increase registered in the field of internal crime - tax avoidance, embezzlement, blackmail, forgery, abduction – standing for the main challenge associated with the crisis.

Other 2 subjects (6.06%) have chosen variant c) – the political fragmentation within the framework of certain states

and other 3 subjects (9.09%) have selected variant d), identified with the violent social movements.

The third question lays emphasis upon the most severe threats aiming at both the weak and powerful states.

Variant a) has been chosen by 15 subjects (45.45%) who have associated the severest threats with the negative effects of the economic globalization felt at the citizen's level by the impoverishment of millions of people,

variant b) has been selected by a single subject (3.03%) in whose opinion the most severe threats are identified with the epidemics, the widespread occurrence of diseases.

Variant c) has been preferred by 11 subjects (33.33%) who have associated the most severe threat with international terrorism, which exploits the advantages of globalization so that the weak states turn easily into its victims,

and variant d) has been chosen by 6 subjects (18.18%) considering that the organized crime networks could be perceived as the main threat to the international stability and security.

The fourth question centered on the most important objective of the international anti-terrorist coalition has led to interesting results.

Out of the 33 respondents, 17 subjects (51.51%) have chosen answer a) considering that the international crisis management by putting an end to the proliferation of the mass destruction weapons might represent the main objective,

8 subjects (24.24%) associate answer b) with the major objective of the coalition, namely, the stimulation of the economic growth under the conditions of the free markets development by co-operating with the international centers of power.

Other 8 subjects (24.24%) associate this main goal with answer c), that is, repatterning and redimensioning the security institutions according to the 21st century requirements

and answer d) of the type "I do not know" has been chosen by nobody (0%), which is a positive thing.

The fifth question presents the most destructive factor for the stability of the international system and in this case, there have been registered interesting data.

This particular factor is associated by 12 subjects (36.36%) with variant a),

that is, poverty, by no subject (0%) with variant b) represented by the epidemics,

by 4 subjects (12.12%) with the environmental pollution represented by variant c)

and by 17 subjects (51.51%) with variant d) associated with the ethnic tensions.

The sixth question refers to the basic principle of global security.

This is identified by 9 subjects (27.27%) with the principle of democracy standing for variant a),

by 14 subjects (42.42%) with variant b), that is, the principle of efficient governing,

by 9 subjects (27.27%) with the principle of the compliance with the laws represented by variant c)

and only by one subject (3.03%) with variant d) according to which he/ she does not know with what kind of principle to associate global security.

The main asymmetry of the global world with the greatest impact upon the world security state represents the topic of the seventh question.

This most important asymmetry of the global world is associated by 4 subjects (12.12%) out of the 33 respondents with variant a), that is, the concentration of the technological progress in the developed states,

by 8 subjects (24.24%) with answer b), namely, the macro-economic vulnerability within the framework of the developing countries,

by 16 subjects (48.48%) with answer c), that is, the contrast between the high level of money flow and the international mobility of work, especially the unskilled labor

and by 5 subjects (15.15%) with variant d) "I do not know".

The next question, the eighth one, is based on the major dimension of today's Europe from a geopolitical point of view.

This particular dimension has been associated with the Euro-Asian one by 16 subjects (48.48%) who have chosen variant a)

and with the Euro-Atlantic one by 15 subjects (45.45%) who have selected answer b).

No subject (0%) has identified the main dimension in today's Europe with variant c), that is,

the Euro-African dimension and 2 subjects 6.06%) did not know how to answer choosing the last variant d).

The ninth question deals with the main risk to the security of the European space.

In the opinion of 5 subjects (15.15%), this major risk to the European security is terrorism represented by answer a),

9 subjects (27.27%) consider it to be the proliferation of the weapons of mass destruction identified with answer b),

10 subjects (30.30%) associate this main risk with variant c), that is,

the organized crime and 9 subjects (27.27%) have chosen variant d),

namely, the illicit trafficking of drugs and people.

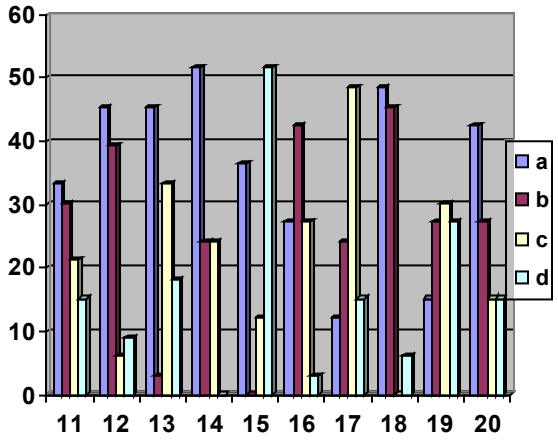
The tenth question is centered on the way in which the phenomenon of regionalization can be perceived by different people.

Regionalization is viewed by 14 subjects (42.42%) as a means of protection against globalization identified with variant a)

and by 9 subjects (27.27%) as an instrument used in order to overcome the difficulties caused by the reduced dimension of the national states represented by variant b).

The phenomenon of regionalization is perceived by 5 subjects (15.15%) as a form of *hard* essence used to transform the micro-regions into spaces of national states which should co-operate among them, perception identified with answer c),

and by other 5 subjects (15.15%) as variant d), that is, a *soft* form open to the modernization of the world based on *soft power*.



Interpretation of Data on the Present-Day International Security Environment and the Concept of International Security: Q1-10

As it can be seen in the Figure presented above, there have been only three cases representing three answers, which have not been chosen by the respondents.

The first case refers to the fourth question. In this particular case, nobody has chosen variant d), "I do not know". Hence, the international anti-terrorist coalition is of great importance for everybody and the major objective of this particular coalition is generally known by people.

The second case refers to the fifth question. In this situation, no one has selected as a possible answer variant b), which means that the epidemics are not perceived by people as being the most destructive factor, not having a great impact on the stability of the international system.

The third case refers to the eighth question. Nobody has chosen answer c). Thus, it results that the major dimension of today's Europe, from a geopolitical point of view, is generally known.

CONCLUSIONS

The phenomenon of globalization does not have the same social effects for all the citizens all over the world. The rich will continue to prosper in the future, too. The poor will live in the same way having the same problems in the future.

Even if the effects of globalization are both positive and negative, this process has to be accepted as an omnipresent reality. Each and every actor must benefit from all the advantages offered by this phenomenon of globalization.

As we have previously mentioned, globalization, as a complex and multidimensional phenomenon, has a strong impact upon the relation between national security and international security. This influence is felt by the impact exerted separately on each component of the relation and on the entire international community.

Globalization influences national security by its multiple effects on the economic, social and political activities of the states all over the world.

Today the states cannot act alone as they are more and more interdependent. The influence exerted by the international security on national security will be greater and greater as a consequence of the growth in importance of the role played by the international community in the crisis management.

It is very difficult to predict what sort of threats will affect us tomorrow and it is even more difficult for us to know how to protect ourselves in the near future.

Our possible answers can be based on certain realities in a continuous transformation.

We can only speculate the future global order. We can create only alternative scenarios.

What are the future potential threats? How can we protect ourselves from such threats? Hence, the vision of tomorrow's world.

There is a very important question whose answer could offer us the key, the information about the future threats, the most appropriate solution protecting all of us in front of such threats in tomorrow's world.

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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.

Drawings diagrams and charts will be separated by a free space from the text and be printed as close as possible to the first reference. Their width will not exceed that of the column they belong to. Should this be impossible to achieve then they will be printed across the whole breadth of the page either at the top or the bottom of the page. Diagrams and charts will be numbered by using Arabic figures and will be accompanied with captions. Ordinal numbers and figure captions will be printed leading of free space 12 pt below the drawings, centered, font 12 pt. Ordinal numbers and the charts explications will be printed above the chart, right alignment, and font 12 pt.

Characters of mathematical formulae will be Times New Roman straight: Full - 12 pt.; Subscript / Superscript - 9 pt.; Sub-Subscript / Superscript - 7 pt.; Symbol - 16 pt.; Sub-Symbol - 12 pt. They will be printed 6 mm left alignment. Ordinal numbers will be printed within round brackets right alignment. Long mathematical formulae will be broken up so as not to be wider than the column or they can be printed integrally on the whole width of the page either at the top or bottom of the page.

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