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CONTENTS

	Page.
VASCO MONTEIRO, CARLOS PÁSCOA <i>COMPETENCY MODEL APPLIED TO THE PORTUGUESE AIR FORCE ACADEMY PRACTICAL STUDY FOR THE PILOTS COURSE</i>	7
VIOREL ILUC <i>INTRODUCTION TO CREW RESOURCE MANAGEMENT IN AVIATION</i>	13
MARIA-MAGDALENA JINGA <i>"COUP D'ÉTAT" IN NATO</i>	19
NICOLAS BERTONCINI, FEDERICO IVALDI <i>MANAGEMENT AND LEADERSHIP: TWO WAY OF DEALING WITH MODERN WORLD</i>	24
DOMINIK GARAI, PERUN PETER <i>THE INFLUENCE OF VARIANCE OF BULLET WEIGHT TO MUZZLE VELOCITY</i>	27
STEPHANY RADOVAN <i>BALLISTIC PROTECTION OF AN INDIVIDUAL BASED ON NON-NEWTONIAN FLUIDS</i>	32
CHRISTOS ANGELOPOULOS <i>SPACE AS A CRUCIAL DEFENSE TECHNOLOGY TO EU'S COMMON SECURITY DEFENSE POLICY</i>	40
ANDREI-MIHAI COȘA <i>HANDLING BURNOUT: A STUDY REGARDING THE INFLUENCE OF JOB STRESSORS OVER MILITARY AND CIVILIAN PERSONNEL</i>	43
OVIDIU STĂNICĂ <i>THE HUMAN MIND - THE ULTIMATE ENEMY OF THE FINANCIAL INVESTORS</i>	49
MIRELA DANIELA PETRE <i>THE RELATIONSHIP BETWEEN JOB SATISFACTION AND THE BIG FIVE PERSONALITY TRAITS</i>	54
EDUARD ONOFREI, VLAD-COSMIN SOFRONE <i>MILITARY OPERATIONS - WHAT'S IN A NAME?</i>	58
ALEXANDRU-IONUT BADEA <i>USING OF ARDUINO UNO DEVELOPING KIT INTO THE PROCESS OF DETERMINING THE ACCURACY AND RELIABILITY OF TEMPERATURE SENSORS</i>	61
MADALINA DONISAN <i>SYNOPTIC ANALYSIS OF THE LATE BLIZZARD OF APRIL 19-21, 2017. CASE STUDY</i>	66
RĂZVAN DUȚU <i>THE ION PROPULSION</i>	72

COMPETENCY MODEL APPLIED TO THE PORTUGUESE AIR FORCE ACADEMY PRACTICAL STUDY FOR THE PILOTS COURSE

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Abstract: *To fly is, in essence, the action of reaching free mobility in the atmosphere. Flying involves prior preparation and training to solve occurring emergencies, internal or external to the aircraft. That said, the desire to be a pilot, especially a military one, is not enough. A whole set of physical and psychological characteristics is required. Since modern Organizations are faced with very rough and dynamic environments, their human resources need to be prepared for this as well. Therefore, Competency management, which increasingly proves its importance in Human Resource Management, needs to be implemented in these Organizations. The Portuguese Air Force is no exception. Competency models can be applied in recruitment, selection, career progression and military courses. The present article presents the research carried out within the sphere of a master's dissertation, whose objective is to apply a competency model in a military course, namely a master's degree in Military Aeronautics for military pilots.*

Keywords: *Portuguese Air Force Academy; Competencies; Course Quality; Superior education; military pilot*

1. INTRODUCTION

Improving the quality of education is a crucial task for any educational institution. In a world where globalization and innovation are increasingly driving economic growth (Ross, 2016), it is crucial to have individuals with good educational backgrounds. Since the Portuguese Air Force Academy (PRT AFA) is an institution of higher education, but even more important, a house of values, it is of extreme importance not only to recruit the best of the best, but also to shape individuals according to strategic objectives of the Air Force (AF). It is not by chance that the motto of the Portuguese AF (PRT AF) is "Prepare today the Managers of Tomorrow". In this Institution of excellence, all Permanent Staff have military training. The difference between commissioned and non-commissioned officers is the ability of the former to commit to the organization indefinitely, usually until they are 50-60 years of age. Nevertheless, the focus of this ongoing investigation will be on the military Pilots, namely on the Masters in Military Aeronautics, Pilot specialty (MMAPA) course.

As the Air Force is an organization where values of hierarchy stand out, good management of Human Resources is considered essential, thus aiming to maximize human capital. In the current

organizational context the authors believe that management by competences is inevitable and necessary in order to respond to the organizational environment that we find today: complex, dynamic, uncertain (Ceitil, 2010).

Numerous studies on Competences have already been carried out in the Portuguese Air Force, as well as in the guidelines for the elaboration of an effective model, but no successful model has, so far, been implemented. The goal of this research is to provide, in the PRT AFA, in the MMAPA context, the scientific basis for competencies management, organized in transversal and specific competencies of Pilots in the exercise of activities related to the operation of aircraft and the exercise of leadership.

To be a Pilot of the Portuguese Air Force, an individual has to be able to do effectively two tasks: Fly and Lead. In addition, he/she also has to have basic knowledge in the areas of engineering (aeronautics and electronics), economics and management. Since man is not born a leader nor a pilot, he must learn how to become one. To do this, it is necessary to receive the proper education, firstly, through the curricular units taught throughout the course and secondly, through empirical experience acquired along the course. It is therefore through the PRT AFA that all pilots pass and learn how to Fly and Lead. It is also in the

PRT AFA that all future pilots are, constantly learning and dreaming that one day they will have the privilege to Fly and Lead. Therefore, the authors believe that this Institution should be the focus to apply an appropriate competency model in order to prepare students for the future, thus ensuring the quality of education.

Contextualizing everything described above, the ongoing research (Monteiro, forthcoming in 2019) points out the following problem: "**The quality assessment of the master course in military aeronautics, pilot specialty, does not relate the competences acquired with the competences required to be a military pilot**".

This problem raises the following research question:

Is the course properly structured to meet the competencies required by a PRT AF Pilot?

To strengthen the relevance of the problems mentioned above, in the last year of the course the student pilots are submitted to pilot training, a set of practical and theoretical tests, where the objective is to evaluate whether they have or not the skills needed to become pilots. What has been witnessed over the last few years is an average of one unfit student per year, and atypical years, such as the current year (2018/2019), when four students were considered unfit. All four students left the PRT AF, meaning that the Air Force lost its investment.

The **Methodology** used to solve the identified problem is the one proposed by Quivy and Campenhout (2008).

To frame the findings in the social sciences domain, authors also based the research on the fundamental principles of the scientific process, defined by Bachelard (1965): "The scientific fact is conquered (on the prejudice) and verified (in the facts)".

2. COMPETENCIES

The definition of competence has been shaped over time. White (1959), was the first to mention the word "competence" which he defined as "the ability to interact effectively in a given environment." Although he was the first to coin the term, White did not emphasize his real importance, for in his publication the great variable was motivation. The pioneer to give importance to the term "competence" was Robert McClelland (1973). In his article, he never defined the word however, the following concept can be understood: "Personal characteristic that, combined with other

characteristics, allows the execution of a certain task in a given organization, successfully."

McClelland made the distinction between competence/skill, ability to perform a good task; from aptitude, natural/born talent to accomplish a task; and even knowledge, a set of information gained through experience or education. It was this separation of concepts that opened horizons and allowed other authors to carry out deeper studies on this theme.

It is undisputed to say that business success and the fulfillment of its objectives depends essentially on the Human Capital that the organization holds. In this way, it is essential to attract and retain the most competent individuals, but to do so, it is necessary to define in a timely manner the profile that the organization wants employees to have or that the candidates have. Nowadays, in a modern and ideal Organization, the person with the most competencies to perform a certain task holds the position or function. According to Camara, Guerra, & Rodrigues, (2010) Human Resource Management systems are gradually based on competencies, so that what happens in organizations is the following:

- Recruitment is done in accordance with the profile of the positions to be filled;
- Individual performance is also evaluated according to the degree of achievement that the Employee reaches;
- Training focuses on correcting possible skill gaps;
- Rewards skills according to market values;
- Corrections are built around existing and developing skills.

With these new criteria, Organizations can now focus on the most essential aspects of the business and have at their disposal competent workers capable of giving flexibility, adaptability, innovation and creativity that Organizations look for. Military aviation has the same working logic, the individual with more specific flying qualifications is always the pilot in command.

2.1 Competency based models. A Competency model is a tool to manage human resources, according to their competencies. This model defines the recruitment and competency development policies of the organization. (Telha et al. 2016) Relevant to further separation of competencies, the study elaborated by Ceitil (2010) identifies five specific components that the authors consider fundamental so that an individual can develop the behaviors associated to the competences. These components are:

- **Knowledge:** It comprises the whole set of knowledge that allows the holder of a function to perform the behaviors associated with the competencies;

- **Know How:** It is related to the person's ability to put into practice the theoretical knowledge he possesses on a given subject, in order to solve problems that arise in the work context and perform the tasks effectively and efficiently;

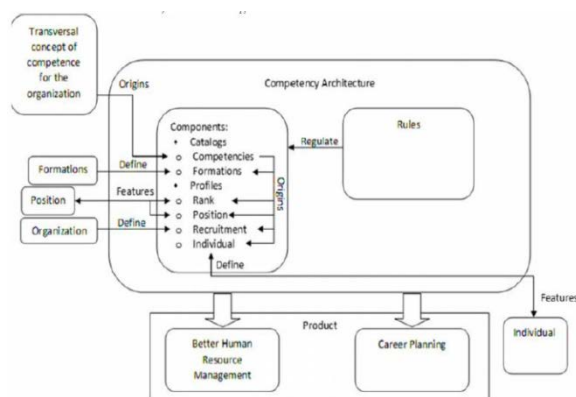
- **Behaving accordingly:** It consists of the set of behaviors that are aligned with the patterns of the organization in which the individual is inserted. Integrates the attitudes and interests of the role holder;

- **Motivation:** Related to the motivational aspects associated with the performance of functions. It reflects the willingness of the role holder to perform the behaviors that make up the competencies;

- **Readiness:** Availability of the subject to perform the various tasks, as well as the existence in the organization of the means and resources required to perform the behaviors associated with the skills.

Competency architecture is needed in order to implement a competency model in the PRT AFA. Competency architecture, according to Rodrigues (2016) and Telha et al. (2016), is “the set of all necessary competencies for the organization processes, their representation and explanation, the relations between them, how they are developed and the organizational positions in which they are required.”

The architecture has rules, components and products. Rules state the competency architecture and all its components, the components are the tools required to perform competency management and the products are the result of the competency



architecture:

Figure 1 - Competency architecture (Telha et al., 2016)

Competency architecture has been created to be applied to the PRT AF, in which competencies are managed within each rank the individuals occupy. The general idea of competency architecture will be used to adapt the concept to the PRT AFA and develop a new model.

2.2 Transversal Competencies. A Transversal Competency, as the name itself indicates, is a skill useful for any Organization. Ceitil (2010) states that transversal competences are not enslaved to a given context, constituting themselves as adaptable and transferable between the various organizational domains. In the authors understanding, the definition of Transversal Competence that fits best, within the aim of the ongoing investigation, is the one defined by Rodrigues (2016) and Telha et al. (2016) since it is harmonized with the PRT AF:

“Transversal Competency is any observable behavior associated with each and every individual belonging to the organization, intrinsic or developed in different organizational contexts, useful for the PRT AF.”

They also contributed to the elaboration of a profile of transversal Competences for the Organization.

2.3 Specific Competencies. Using the logic of the previous subchapter, the meaning of the word "specific" is strict, and useful only for a certain function, performed in a particular Organization. Ceitil (2010) states that specific skills are hierarchical and associated with a job or organizational position. Again, the authors understand that the most useful definition of Specific Competency is the one defined by Bonifácio (2017), since his investigation was for the PRT AF:

“An observable characteristic held by an individual of the organization which is essential for the performance of the technical function assigned to him/her and which can be developed by experience or by professional training.”

In his work, Bonifácio also traced a profile of Specific Competences for each technical function in the Air Force, including the Pilot one.

Santos et al (2017) and Páscoa et al (2019) proposed a digital competency based organization model for the PRT AF. The model considers the Organization as a digital entity, composed of organizational entities (intangible) and Organizational Positions (tangible).

3. MILITARY UNIVERSITY EDUCATION IN PORTUGAL

In Portugal, besides applying for civil public Universities, Portuguese citizens, under specific conditions, may also apply for a military university education institution. Currently the organ responsible for regulating military university education in Portugal is the *Instituto Universitário Militar* (translation, Military University Institute). This institute responds directly to the Chief of Staff of the Armed Forces and its mission is to develop teaching, research, community support, cooperation and exchange activities to train the officers and sergeants of the permanent staff of the Armed Forces and the National Republican Guard. This enables them to exercise the functions that are statutorily assigned to them, conferring the appropriate competencies to their performance and promoting the individual development for the exercise of command and leadership functions (IUM, 2018). At the moment the three university autonomous units are:

- The Naval School, which depends hierarchically to the Chief of staff of the Navy;
- The Military Academy, which depends hierarchically to the Chief of staff of the Army;
- The Air Force Academy, which depends hierarchically to the Chief of staff of the Air Force.

3.1 Military Pilot University Course. In the current legal proceedings, the Air Force Academy is responsible for "training officers of the Air Force's permanent staff, enabling them to carry out the duties assigned to them, giving them appropriate competences the accomplishment of the specific missions of the Air Force and promoting the individual development for the exercise of functions of command and leadership" (Portaria 23/2014). Since the military pilot function is exclusive to commissioned officers of the permanent staff, it is in the PRT AFA that the course is given. The predominant scientific areas of the military pilot course are Aeronautical Military Sciences and Piloting. However, analysing the curricular structure of the course as well as empirical experience, student pilots have basic formation in the scientific areas of Aerospace Engineering and Management (financial and human resources).

3.2 Quality assessment. The Portuguese Navy has a method of evaluating the quality of the courses given at the Naval School focused on competencies. The model crosses the transversal

competences of a commissioned officer of the Navy and specific competences of each function, with the course itself. This way, the Naval School guarantees that the courses given to the students are properly oriented towards the competences that they need to develop in the students. In PRT AFA, a commission led by the commander in 2017 identified the "need to evolve" the current Quality Assessment system, essentially based on the questionnaires made to the students that only evaluate student/professor interaction and class conditions, to a competency based model. That said, the authors consider that there is willingness by the Academy to implement a competency model and all efforts should be made towards this measure.

4. THE MODEL

Since the research is not completed, the method is not 100% developed. However, the model has already been created and it is believed that it is applicable to any master's course lectured at the PRT AFA. The literature review made in the previous chapter confirms the pertinence of the problem and strengthens the need to solve it:

- Firstly, an academic approach on the term "competency" and all its appliances was needed because the word is present in the vocabulary of organizations. Nowadays, an effective Management of Human Resources is based on competencies rather than functions / tasks;

- Secondly, a review into military university education was made since the PRT AFA is inserted in this context.

The model, designed by Monteiro (2019) and shown in figure 2, has the following attributes:

On the input side:

- Transversal competencies: Observable behaviours associated to any and every individual belonging to the Organization, intrinsic or developed in the various organizational contexts and useful to the Air Force;

- Specific competencies: Observable characteristics, held by an individual in the organization, which are essential for the fulfilment of the technical function assigned to them, and which can be developed through experience or professional training;

- Literature review: All the writings scrutinized and related to the management by competencies;

- Regulation: Set of laws and documentation, civil or military, that regulates superior education, and which the Academy must comply with;
 - Teachers: All teachers who give classes in the PRT AFA, civil or military;
 - Students: All students who are attending the masters in military aeronautics;
 - Interviews: Strategic vision and opinion of individuals belonging to the organization;
- Inside the model:
- Profile: A set of transversal and specific competencies, as well as the respective levels of proficiency required for a student who finishes the course;
 - Specific function: set of tasks associated with to a job carried out by an officer from the Air Force;
 - Level of proficiency: Degree of acquisition of a competence, transversal or specific, demonstrated by the individual. It consists of a quantifiable scale where the skill of the individual is perfectly defined;
 - Competency Map: A set of information that gives a comprehensive view of the contribution that the curricular units place on the identified competencies;
 - Course: set of all curricular units that compose a course;
 - Curricular Unit Sheets: Document showing the functioning of a curricular unit. In addition to learning outcomes, it includes the content, method of evaluation, etc.
 - Quality Assessment: Systematic evaluation of the teaching in the PRT AFA, carried out by the Evaluation and Quality Office. This evaluation needs to take into account the competences and their capacity to promote human capital;

Also inside the model we have three variables, Superior education, technical formation and empirical experience. Although the focus is on the

first one, the authors believe that all three are connected and related.

On the output side, the figure shows the results of a correct management by competencies in terms of organizational benefits. The architecture is shown in figure 2.

The present model incorporates entirely the “competence” concept in the PRT AFA. By applying the architecture showed above:

- Students will begin to know which competencies they need to develop;
- Teachers will know which competencies they need to train in their curricular units;
- The quality office will be able to evaluate the curricular units more effectively, with new variables;
- A standard profile will be traced, thus reducing ambiguities. The PRT AF will then know the exact level at which the students leave the academy.

Although the model is applied to the pilot master course, Monteiro (forthcoming in 2019) designed the architecture to be transversal to any academy course, simply by changing the specific competencies slot.

4. CONCLUSIONS

The paper presents an ongoing investigation related to management by competencies in the PRT AFA. The objective is to regulate education in the academy and improve its quality simply by focusing on the competencies developed in the curricular units. This attempt is going to be tested on the pilot course despite being applicable to all masters in the PRT AFA. To achieve that, the mindsets of all participants in the education process need to be changed.

Since the investigation is not complete, the current findings and planned work are:

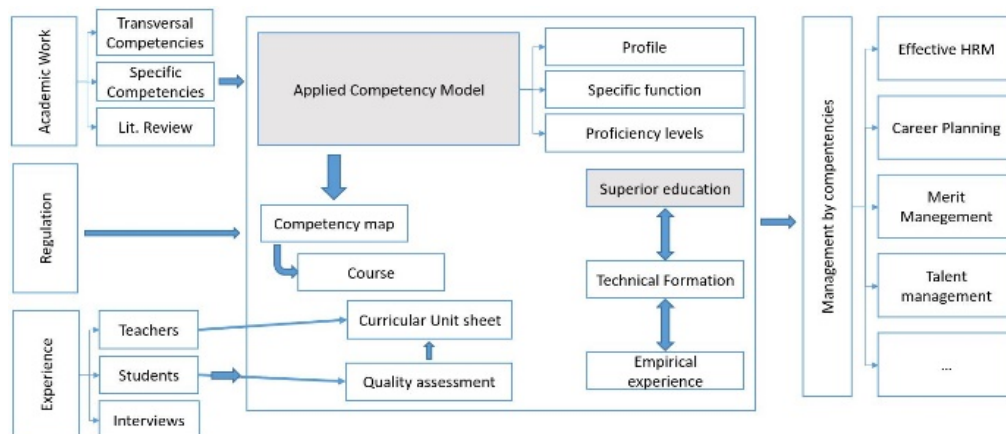


Figure 2 - Competency model applied to the PRT AFA courses (authors)

• It is essential to build a competency map of the pilot specialty which is meant to evaluate the quality of the course. To achieve that, current work involves tracing a profile of competencies for military pilots so that competencies developed in the curricular units can be cross checked.

• The comparison between the competency map and the contributions of the curricular units will allow to point out which competencies are not being developed, which competencies are excessively being developed and in a final instance, recommendations to improve the course itself.

• Competency management can be compared to a technological advancement and therefore many obstacles can appear. There is a reluctance regarding this topic in the PRT AF and some obstacles were encountered, namely the fact that the PRT AF does not manage its human capital according to competencies. Therefore, the research findings, now being applied to the Academy university courses, can also provide valuable contribution to the PRT AF itself by adopting the Model and applying it to human capital management.

Therefore, the answer to the research question is that the PRT AFA courses can benefit from the application of competency management logic.

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INTRODUCTION TO CREW RESOURCE MANAGEMENT IN AVIATION

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Abstract: *The main focus of this article is on introducing the core concepts of Crew Resource Management (CRM), as well as presenting the beginnings and the evolution of this extraordinary management system, which remodeled the world's leading airlines, military, police, corporate and government flight operations to a much safer, teamwork oriented and more coordinated work environment. In this article, I will exemplify the key concepts of CRM, along with the objectives of a CRM course, how they can be met, and discuss the requirements to consider to successfully implement it in any domain where the teamwork environment is a must. For the purpose of this article I will concentrate on CRM in aviation, but nonetheless, I will also bring to your attention some of the other popular uses of this management system. Furthermore, in the pages of the article, the reader will find exemplifications and explanations of the structure of a CRM course, as well as, succinct information about the systematic techniques used in teaching this type of course to trainee pilots.*

Keywords: *flight crew; communication; aviation accidents; human factors; human limitations; crew coordination.*

1. INTRODUCTION

Commercial air transport remains the safest means of transportation for people and goods from one place to another, but it was not always as safe it is today. One of the attempts for making aviation safer was the introduction and development of a new management system called Cockpit Resource Management by a NASA scientist, John Lubber, in the year 1979. (Figure 1)

From 1979 until now, Crew Resource Management has gone through several names, like Cockpit Resource Management, Flight Deck Resource Management, as well as Command, Leadership and Resource Management. However, the prevailing generic term, Crew Resource Management (CRM) was the widely adopted name.

Crew Resource Management encompasses a broad range of knowledge, skills and attitudes comprising of communications, situational awareness, decision making, problem solving and teamwork; together with all sub-disciplines which each of these areas entails.

CRM is used in a variety of different domains. Some of them are the medical domain and 1st responders (fire fighters) where CRM = Crisis Resource Management. In the first case it is used in high-acuity environments like operating rooms, intensive care units, or emergency rooms, in the

latter case it is used in fires, floods, natural disasters, etc. Actually, the domain where CRM is used does not make much of a difference in the way that it is applied, nor in the way people are trained for applying it. In the next chapter we will see the inner workings of CRM and why it is so effective, provided that it is applied adequately.

For the purpose of this article, I will focus on the aviation domain.

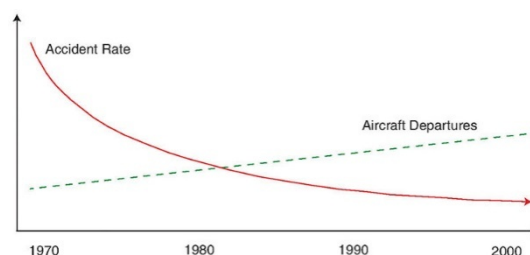


Figure 1 - Accident rate versus aircraft departures between the years 1970 and 2000

The roots of CRM are found in research which showed that the majority of aviation accidents occurred because of human error, and the main problems found were improper interpersonal communication, poor leadership skills and decision making in the cockpit. Pilots that are undergoing CRM training will improve their overall skills and attitudes including teamwork, problem solving, situational awareness, and decision making.

Crew Resource Management was developed for pilots working in crew environment weather that would be in the military, or with the airlines, bringing significant benefits to general aviation. Many CRM principles have been successfully applied to single pilot aircraft operations. This led to the development of the SRM – Single Pilot Crew Resource Management.

2. CRM & AVIATION

2.1. History. The pioneer of Crew Resource Management was the former Royal Air Force pilot David Beatty and later British Overseas Airways Corporation pilot who wrote his seminal book “The Human Factors in Aircraft Accidents” in the late 1950s. regardless of the considerable development and advancement of electronic aids since then, most of his principles are still relevant today.

CRM emerged out of the 1977 Tenerife Airport catastrophe, where two Boeing 747 passenger aircraft, KLM Flight 4805 and Pan Am Flight 1736 collided on the Tenerife Airport runway killing 583 people and remaining the deadliest airplane accident to date. A few weeks later, a workshop on this topic was held at NASA supporting this innovative training.

The formal beginnings of CRM were with a National Transportation Safety Board (NTSB) proposal made in the course of their investigation of the United Airlines Flight 173 crash. The cause of the crash was that the McDonnell Douglas DC-8 crew ran out of fuel over Portland, Oregon, USA while troubleshooting a faulty landing gear.

The term Cockpit Resource Management was created in 1979 by John Lauber, a NASA scientist. He studied the processes of communication in cockpits for several years and has found issues that needed immediate solving. The main concept behind his ideas was that while retaining a command hierarchy, the concept was designed to promote a less authoritarian cockpit culture, in which co-pilots were encouraged to respectfully question captains if they observed them making some mistakes, or anything out of the ordinary.

In 1981, United Airlines were the first to provide Crew Resource Management training for its pilot crews, but also to their flight attendants. The flight attendants were trained to use CRM conjointly with the pilots to produce another layer of augmented communication and teamwork. Studies have shown that by both groups using CRM simultaneously, communication barriers were reduced and obstacles could be passed more

efficiently, leading to much safer flights and an enhanced work environment. By the 1990s, CRM became a global standard.

2.2. CRM Defined. All the elements that comprise CRM are not new to the eye of the public. They have been recognized in one form or another since the beginnings of aviation, usually under more general titles such as ‘Airmanship’, ‘Captaincy’, or ‘Crew Co-operation’. In the past, however, these titles have not been structured, defined, or articulated in a formal way, and as a consequence, CRM can be seen as the attempt to remedy this deficiency.

Crew Resource Management is best defined as the management system which makes optimum use of all the resources - equipment, procedures, and people. The desired result is a safer and more efficient environment during flight operations. (Figure 2)

The deepest concerns are not focused so much on the actual skills and technical knowledge needed to operate and fly an aircraft, but rather on the soft skills needed to manage a flight within an organized system. Two of the utmost importance are the cognitive and interpersonal skills in managing and assuring a safe and pleasing environment while in the cockpit. In this context, cognitive skills are the mental processes which are needed for gaining situational awareness, making decisions and solving problems, while the interpersonal skills are more focused on efficient communication and good teamwork.



Figure 2 - Schematic Illustration of CRM skills

2.3. Cognitive Skills. Situational Awareness. Decision Making. The main concerns of Crew Resource Management are aimed towards the

cognitive and interpersonal skills of the pilot. Studies show that the main cause of the majority of aviation disasters is the lack of this type of skills.

Cognitive skills are the mental processes the mental processes that make gaining and maintaining situational awareness possible.

Situational awareness is defined as the conscious recognition of all factors – human, operational and technical – which affect the safe operation of the aircraft. Human beings absorb information through their 5 senses – touch, hearing, sight, smell, taste – and also intuitively or sub-consciously. All this information is transformed by our brain into a mental model of the situation, a process that is known by the name of perception. This product of our brain is not constructed of immediate sensations, but also of social and cultural influences acquired through our life-time experiences. Accordingly, because individuals lead different lives, and have different experiences, they will interpret situations differently. Furthermore, the human being can be influenced by false perceptions or illusions. Having these factors in mind, a high degree of situational awareness shall be achieved only when an individual's perception of events draws near to the reality of the situation.

For the pilot of an aircraft, most of the information from which situational awareness is obtained comes from navigational equipment and flight instruments on board. In the process of constructing an accurate mental image of the position of the aircraft, its condition, and the crew's condition, is subject to a number of devaluing influences such as stress, inattention, distraction, boredom, fatigue, etc. in these circumstance, confirming the individual's mental image with other crew members by sharing information about the situation, and by stating intentions, becomes of extraordinary importance in the safe and effective management of the flight mission. Nonetheless, sharing knowledge with other crew members not only helps avoid the more obvious incidents or accidents emerging from loss of situational awareness, such as controlled flight into terrain, but also lays a strong foundation for high quality decisions concerning the overall management of flight. (Figure 2)

Situational awareness is usually critical in the departure and landing phases of flight. Most of the Controlled Flight Into Terrain (CFIT) accidents occurred as a result of loss of situational awareness.

Careful and ongoing monitoring of the aircraft systems and a good technical knowledge will definitely help the pilot achieve and maintain situational awareness. The safety altitude and geographical position of the aircraft must be constantly monitored and crosschecked. Environmental influences like bad weather should be anticipated and a plan of action must be formulated in case the flight path has to be changed. A mental image of the position of the aircraft should be maintained the whole time during the flight.

A central aim of CRM is to ensure that high accuracy decisions are taken across the whole range of flight operation. In this context, thorough pre-flight planning is a must. It will provide the flight crew with the opportunity to successfully manage their specific areas of responsibility. Understanding the plan, allows individual crew members to contribute to decisions made in flight, in the most effective way. Therefore, is of paramount importance, as the flight progresses, that the Captain updates the crew members on any changes to the original plan, at regular intervals, so that they can maintain a high level of situational awareness. This is particularly important during operations where conditions affecting the flight are likely to change rapidly, such as in emergency situations. In these circumstances, each individual member of the crew will obtain a clear situational awareness, and can contribute in the most effective way to the decision-making process. (Figure 3)

Research shows that pilots with a vast flight experience use previous experience of comparable situations in order to shorten the decision making process. However, there are no two situations that are the same and it is very important to comprehend that the decision making process is driven by the way that the pilot assesses the situation.

There are many guides which are meant to assist the multi-pilot crew in the decision making process. In a general sense, most of them involve:

- Situation assessment and gathering data;
- Considering the possible options;
- Deciding on the best option;
- Communicating your intentions;
- Carry out the actions;
- Checking/Reviewing the situation;
- Adapting to new information or with changing situations.



Figure 3 - The Error Troika

2.4. Interpersonal Skills. The Interpersonal skills encompass communication, and a range of activities associated with teamwork. In aviation, these skill areas overlap with each other, and also, with the technical skills needed to fly an aircraft.

Effective communication between crew members is an essential requirement for good CRM. Communication not only helps develop a shared image of the problems which need to be attended during the course of the flight, but enables individual crew members to contribute effectively to the decision-making process. Furthermore, it enhances situational awareness amongst the flight crew, and allows problem solving to be shared between the individual members of the group. More importantly, it creates the interpersonal climate between the members of the crew and is, therefore, a key element for setting the tone for the management of the flight.

Successful teamwork is accomplished when the output of the team is greater than the summed efforts of individual crew members acting in isolation. This process is known as synergism. Synergism is produced by the interaction between the crew members, whereby each person is encouraged to contribute in the most effective way to the overall task of the team. In order to achieve interaction within the group, all members of the crew should fully understand their role and how this role may vary under different circumstances in which decisions are being made. In civil aviation, in most of the commercial airline transport companies, many crew members take part in a new team on every flight. Consequently, it is important that a climate in which good teamwork can flourish is fostered and encouraged by the organization culture. A healthy organization culture, which promotes CRM, will also benefit from good teamwork, since CRM and teamwork are closely

tied together in the realm of effective flight management techniques.

2.5. Goals of CRM. The primary goals of CRM are: increased situational awareness, leadership, self-awareness, decision making, adaptability, assertiveness, flexibility, event and mission analysis, and sound communication skills. Particularly, CRM aims to foster a culture where authority may be respectfully questioned by the co-pilot in the eventuality of a situation in which he observes something out of the ordinary, at any time while in the cockpit. CRM recognizes that usually, a discrepancy between what is happening now and what should be happening, in the most cases is the first indicator that an error is occurring in that instance. This is a very delicate subject especially in the organizations with traditional hierarchies, like the army, for example. In this case, the personnel in command must be taught appropriate communication techniques so they understand the fact that questioning authority does not need to be threatening for them. Also, subordinates need to be taught the correct and respectful way to question orders. (Figure 4)

Cockpit voice recorders of aircraft involved in various air disasters reveal the attempts of first officers and flight engineers to notify the captain of critical information in an indirect and ineffective manner. By the time the captain understood what was communicated to him, it was too late to avoid the disaster. In the aid of averting this type of situations, a CRM expert, Todd Bishop created a five-step assertive statement process that comprises inquiry and advocacy steps:

- Opening – Address the individual: “Hey Sam”, or “Captain Joe”, or “Hey chief”, or any name or title to get the person’s attention.
- State your concern – Express your thoughts about the situation in a direct manner while keeping a calm tone and posture: “I am concerned that the fuel might be low to fly around this clouds”.
- State the problem as you see it – “We have only 45 minutes of fuel left”
- State a solution – “Let’s land at the nearest airport and refuel”.
- Obtain agreement – “Does this sound good to you, sir?”.

For the majority of people these are difficult skills to master. They require significant changes in interpersonal dynamics, personal habits, and nonetheless, adjustments need to be made in the

organizational culture of the workplace in order for individuals to be able to adopt this type of behavior.

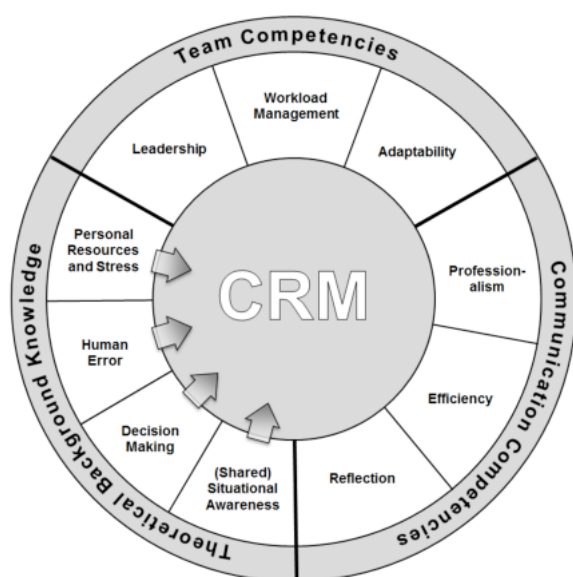


Figure 4 - Core Elements of Crew Resource Management

2.6. Single Pilot Crew Resource Management (SRM). In 2016, a new term named Single Pilot Crew Resource Management (SRM) was formally introduced. It encompasses the same principles as CRM, but a need was felt for the necessity of a management system that come to the aid of single-pilot flown aircraft.

SRM is defined as the art and science of managing all the resources available to the single-pilot to assure the successful outcome of the flight. Those resources are both on board the aircraft and from outside sources.

SRM receives an entire chapter in the FAA publication "Risk Management Handbook". As of June 15th 2016 both Private Pilot and Instrument Rating tests are now governed by the Aviation

Certification Standards, not the Practical Test Standards. While the task elements of the Practical Test Standards are still included, each task contains a knowledge, risk management, and skill section. A great way to think about each of these is that pilots need to demonstrate what they know, what they need to consider, which is the management, and what they must do for each task. This also applies to pilots undergoing evaluations for bi-annual flight reviews and instrument proficiency checks.

3. CONCLUSION

The concepts of CRM are not new. They are rather an attempt to put old axioms into a more coherent and structured frame. For successful safe and efficient flight operations not only the acquisition of sound technical skills and knowledge matter. The mastery of the cognitive and interpersonal skills by the crew forms the foundation of good CRM. Cognitive skills not only allow the individual to achieve greater situational awareness, but also to reach higher quality standards in problem solving and decision-making. In addition, the interpersonal skills encourage the creation of synergy and the establishment of good teamwork. Both cognitive and interpersonal skills cater for a good overall climate amongst the crew members, which is what CRM is all about.

CRM training is taught to trainees using a different methodology compared to the one used in their technical training. The technical training uses a more classical "chalk and talk" technique of teaching, while the CRM training usually takes place in a group environment, assisted by a trainer equipped with the skills, techniques and relevant knowledge to foster the learning process.

The CRM training process focuses around adding exquisite cognitive and interpersonal skills to the skillset of pilots, flight attendants, technical personnel, air traffic controllers, etc. This type of skills is mostly concerned with interpreting and understanding behavior, particularly the one which occurs in a group context. The best approach for teaching them is through experimental training. It is considered that successful experimental learning is achieved when an individual is able to reflect on his past behavior and gains enough insight to form a relational basis between past and present for behaving in a more effective manner the next time he is faced with similar circumstances in the future.

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“COUP D’ÉTAT” IN NATO

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Abstract: *We are now witnesses to a century mainly dominated by quietude, lawfulness and cordiality, free from disturbance. The truth is, perhaps, far from this semblance, as a chronic and endemic insecurity still endangers this peaceful time, gliding through the shadows in the backstage of 21st century Europe. The reason for this political and military instability is found in the depths of the everlasting desire of power combined with the anxiousness of being overtaken/ surpassed by another power. To what extent does this instability represent a threat to our apparently peaceful Europe? The answer is meant to be found in the present essay by giving a brief insight on a particular case: the disturbances in Turkey after an unfortunate series of events that also involved another frightful titan, Russia, and frustrations generated in all Europe as a result, touching the integrity of both the EU and NATO.*

Keywords: *coup; Turkey; NATO; putsch; alliance*

1. NATO

The North Atlantic Treaty Organization is home to 29 States which have vowed to respect the North Atlantic Treaty and the principles of the Charter of the United Nations.

This intergovernmental military alliance was founded in the middle of the 20th century, with the North Atlantic Treaty signed on the 4th of April 1949, treaty that also represents the legal and contractual base of the alliance. Its purpose is described within the 14 articles of the North Atlantic Treaty. The 29 States reiterate the desire of cohabiting in peace with all the nations and governments, respecting the principles of democracy, individual liberty, the letter of the law. The members are to unite their efforts in order to assure collective defense, value national security and maintain peace by using non-threatening ways to solve international problems and refrain from making use of force (the first article). The second article implements the agreement of maintaining peace by demanding ongoing development of the international relations marked by peace and amity. Another important aspect of the Treaty is focused on the support that is to be shared within the alliance by the parties. They are to develop their individual but also collective capacity of resistance in order to face an armed attack. NATO members are always in a consultative relationship.

An article demands that common consultations are needed in case a member feels threatened, because an attack has a big impact on the organization as an attack on a party is considered to be one against the entire organization. Given the desire of permanent seeking of peace, members of the alliance can invite any other European state that respects the strictness of the Treaty to adhere to these commitments. The unity of this Alliance is based on the values that guide the path of the members.

2. TURKEY IN NATO

In what concerns Turkey, our main subject in the present essay, it is known that, during the vast period of time that Turkey has been a part of NATO, its presence has been marked by controversies. Looking back to 1952, the year that holds NATO's first enlargement, including Turkey's adherence, one can consider that the threat having caused this enlargement consisted in the agendas of the new rising superpowers in Europe after the WWII. Hence, the adherence of Turkey was not just a need for power in face of a great enemy, but a step closer to an international normative order. The establishment of post-war institutions, based on the Wilsonian principles of peace and stability, democratic governments and free market economies, were meant to be the fundamentals of a new world order. Turkey's

entrance in NATO is marked by controversies as Turkey was, but also was not, as rumor goes, a historical necessity, while on the other hand, it didn't quite fit the normative principles that the Alliance demanded under the idea of a "western" identity.

Turkey is now the second power in NATO and stands out at the NATO "table" as a rather unstable member, finding its interests on other international levels. One important example is the priorities that the Alliance and Turkey are willing to consider when it comes to cooperative actions, as the latter is more into forging partnerships on its own terms with the Arab world, Russia, China, Central Asia and the Caucasus, working on the strategic management of regional interests, while the Alliance makes its decisions on whom to work with based on "normative" values, taking interest in "like-minded democracies", as Australia or Japan, which don't necessarily hold an interest for Turkey.

3. COUP D'ÉTAT IN TURKEY

3.1 That night in July.

For a better explanation of how the topic of this essay is related to NATO, a closer look must be taken at Turkey's political instability. Being given this country's power and importance for NATO, it is clear that anything remotely unstable about it affects NATO's integrity.

Forged in the shadows of the military power, a true massacre took place in several major places in Turkey while no one seemed to know exactly where the president was. The spirits of those whose 15th night of July started as a usual night were rattled by an attempted coup d'état, targeting state institutions, that shook the face of Turkey. Its focus was to topple the government and unseat President Recep Tayyip Erdoğan. Carried out by a faction within the Turkish Armed Forces, organized as the Peace at Home Council, the coup was defeated by forces loyal to the state.

The reasons cited for this movement where the "erosion of secularism, elimination of democratic rule, disregard from human rights and Turkish's loss of credibility in the international arena" [1]. That bloody night happened as Erdoğan left on holiday. Before nightfall, soldiers had already occupied important Bridges (the Bosphorus Bridge and The Fatih Sultan Mehmet Bridge) in Istanbul, F-16s were flying over Ankara, the bombs soon started to hit buildings and fire was open on civilians by armed soldiers. The news broadcasted the evolving events and managed to unite civilians

into a great force. This power managed to successfully face the coup. Erdoğan himself went live on television and called the people to take the streets. The coup was not supported by neither the main opposition parties, nor international organizations; different international leaders – speaking for the US, NATO, or EU – and other neighbouring countries have also sustained that respect is to be called for democratic institutions in Turkey and its elected officials [6]. In this major event that hit Turkey, the big question remained: who managed to gather a group within the army capable of such an attempt? Erdoğan blamed the "parallel state" for the coup, reference to his former ally, Fethullah Gülen, who was, at the time, in self-imposed exile in the US. Gülen is the leader of a religious movement known as "Hizmet" that owns foundations, associations, media, schools and other entities. The Turkish government made a serious decision accusing not just Gülen for being behind the coup, but also the United States for harboring him. Gülen strongly denied it, throwing the blame onto Erdoğan himself, claiming that the coup was actually a self-coup powered by the president and meant to enforce his dominance. A pro-Gülen group stated that the coup was rather "strange and interesting". This belief is shared among various people in Turkey.

The coup led to more than 200 deaths and more than 2000 people injured. With effects like these, mass arrests took place, at least 40000 people being detained, including at least 10000 soldiers and, for reasons yet unknown, more than 2000 judges. The educational side also suffered alterations as 21000 teachers working at private institutions had their licenses revoked and 15000 educational staff were suspended according to the governmental resolution stating that they were loyal to Gülen. This accusation about loyalty to Gülen led to 77000 people being arrested and over 160000 being fired from their jobs.

The coup's lack of success buries the blame of the leader's mistakes in organizing it because, after discovering that they had been put under surveillance, fear took over and the movement began prematurely, the group members then rushing to take action. This was not the only hindrance that made it difficult, but also the unforeseen power of the people. Thousands grieved at the funeral of the fallen, of those who stood against armed soldiers, tanks, outstod bombs and carried wounded or the bodies of dead strangers in their very hands. That night of July will be remembered as the bloodiest coup attempt in Turkey's history by the ones who have

lost parents, children, brothers, husbands on the streets trying to resist their own "protectors". The true power stayed in the hands of those who risked their lives and of those who lost it alongside loyalist soldiers and police forces, true martyrs of their time.

3.2 Turkey, broken.

The event that took place on 15th of July 2016 has led to a continuous state of frustration inside the borders of Turkey. Such a powerful coup managed to generate supposition and fear among the citizens and the leaders of the earlier mentioned state. While everybody was pointing fingers and acting under the pressure of treason, the one who had to suffer was the inside of the country. New conflicts appeared between Turkey and the USA as the latter refused to extradite Gülen. Acting as such, USA could only awake Erdoğan's claims of it being behind the coup. By protecting its former ally, one that is known for being in a powerful dispute with the president and reasonably blamed for wanting to unseat him, the USA only brought more hatred on itself. Actions were taken and Turkey raised accusations against different military officers of the US, which lead to burdening the cooperation between them. The conflict went forward with Erdoğan personally demanding for Gülen's extradition despite the USA complaining about the lack of evidence that Turkey could present against Gülen. Turkey's relationship with the USA is a victim to these conflicts which resulted in the president's believes that "the script" for the putsch was "written abroad" and also that the now retired US Army general, John F Campbell, was the "mastermind" behind it [9]. Of course, the US denied all accusations presented against them. What happened between the USA and Turkey is just an example of what this putsch had politically led to. In a country who suffered so much on behalf of treason, the mass arrest and punishment brought to the citizens gave birth to a radical restructuration of all Turkey, especially of the Headquarters and main structures.

It is difficult for a state to be reborn out of such a massive hit when one can trust no one and suspicions govern the lives of those whom the people are supposed to rely on. How difficult could it be to lead a country so unorganized, broken and traumatized after that rebellion in July? The answer is to be seen.

3.3 How and why? It was not Turkey's first encounter with failed coups; after 4 that had "succeeded", on 22nd February 1962, the first failed coup took place but only ended with the

resignation of one of the leaders as the main consequence. However, one year later, Talat Aydemir, the commander of the Military Academy, tried to organize another coup. This time it ended with the captain being brought to court and sentenced to death. At his trial he stated that: "If you set me free today, I'll organize a cup again".

It is still unclear how the National Intelligence Organization (Turkish: Millî İstihbarat Teşkilatı, MİT) failed to detect the preparation for this coordinated operation and why it failed to notify the president or the prime minister immediately once they had received intelligence on the plot. The answers to these questions have not yet been found. One can only make suppositions based on the political controversies that govern Turkey. Countless factors are to be taken into consideration in chasing the pavements to an explanation. In spite of the "greatness" of the coup, the putschists of July 15th ranked lower than their previous models as even the high ranking generals who were busted in plain event did not maintain an upright position, denying any implication in the coup. This is why a proper explanation can't be found: with no one to take full responsibility for such a thing and give answers, the coup was left for presumptions. Should the Gülen organization be blamed? Was it Erdoğan himself the generator of the coup to build his dictatorship? Was it the army? How about the MİT? What slipped from the analysis?

4. A NEW LOOK TO THE EAST

In this "peaceful" international context, the aspect that is currently raising eyebrows consists of the questionable bonds between Turkey-Russia-China-Iran.

The situation that is to be analyzed now concerns the "friendship" between Turkey and Russia. We made it clear that Turkey has undergone some serious problems within its borders because of the putsch and its consequences, but also abroad, the main concern being the USA on which part of the blame was thrown at. With this skeletal framework one can only imagine the vulnerable state in which Turkey now finds itself. In such a context, for it to regain a favorable balanced position above the gap between its power, affected by the current situation, and the other possible threats has to be brought, as much as possible, to a close. Russia's desire to weaken the force of the West in a key

region of civilization can be therefore materialized by luring Turkey closer to its side. Turkey is currently seeking for cooperative relationships with Russia, given the need for more protection in face of a potential threat that is the USA, its favorable position, its power and the fact that it is the one who warned it about the coup that was to come. By this, not only was Turkey more prepared, but the putsch suffered because it had to start prematurely, which contributed to its failure. This way, with Russia becoming more trustworthy in the eyes of Turkey, it is natural that, at times like this, the latter should develop a sudden interest for the Eastern side.

Turkey has become a country wanted by both the West and the East. Its actions are misleading as it looks like it cannot decide who to side with. For its military power and strategic position it is wanted by NATO, and maybe no more than that. Since 1999, Turkey's accession in the European Union has been continuously prolonged. Recent claims by German chancellor, Angela Merkel, and her challenger, Martin Schulz, that these membership talks should end are amplified by the still non-existent unanimous agreement on Turkey's membership.

Despite its reasons: economic development, free movement of people across the EU and so on, president Erdoğan stated the same year (2017) that from his point of view, accession to the EU is no longer needed. Europe is the one left to decide.

The continuous postponing was found offensive by Turkey which tends to distance itself from Europe. A good example is what is planned for 2019. Despite being warned by the Donald Trump Administration, Turkey signed a contract of \$2.5 billion worth for missile air defense system *S-400*. It would have been normal for it to purchase weapons that are compatible with the allied countries. This decision led to "consequences" as the Assistant Secretary of State for European and Eurasian Affairs, Wess Witchell, said during a meeting with the members of the US Senate. Consequently, Turkey might be unable to participate in the *F-35 Joint Strike Fighter* program.

5. WAS IT ACTUALLY YOU?

Conspiracy theories will never cease because people are always looking for answers and even when they are provided with some, it will never bring enough satisfaction. There is always room for more questioning. The same goes for the current topic.

On one hand, the idea that Russia is behind the putsch that took place in 2016 in Turkey is not to be ignored. By wanting to gain Erdoğan's trust, they could have put together this coup attempt only to reveal it, given that they are the ones who firstly gave information about it by intercepting and decoding Turkish military radio messages at Khmeymim airbase in Syria, warning about the dispatch of several helicopters meant to capture or kill the president. If Turkish trust was gained, and it was at a certain level, Russia would have on its side a country that holds the second military power in NATO and one that is rich in intel about it, being an early member. It is rumored that Russia is not scared of anything but that cannot stop it from wanting to grow in power and Turkey is a good choice for numerous reasons, but the thing that concerns the most is the fact that Russia can be a bigger threat to NATO by making Turkey a friend, reasons for which the unsuccessful coup that took place in Turkey could be considered an indirect coup aimed at NATO, a more valuable target.

On the other hand, Erdoğan is a controversial figure. Although he is the president, one can say that he does not enjoy a wide popular appreciation. Turkey is divided into right-wing (conservative, nationalist) and left-wing (non-religious, secularist, richer) political forces. The right wing is the one supporting Erdoğan because he is a conservative and before he got to power in 2002, secularists took many educational and working rights from them. The left wing is mainly the one who condemns him for being an authoritarian conservative president who is moving Turkey away from a Western aligned-orbit.

This is why it is a popular belief that the coup was a self-coup, maybe Erdoğan's desperation reached such a high pitch that he felt the need to enforce his grip on his position in this way. By merely destroying it, he would then be able to recreate the state the way he wanted it, almost from scratch. With the blame of the putsch thrown on whoever he pleased he could clean the country of the ones who meant a threat or even just an obstacle to him. Isn't it a bit curious that, immediately after the putsch, the lists for the mass arrests were done? It may look like they were already prepared because the talk is about hundreds of names and accusations.

This supposition can be found reasonable, but it does not however involve Russia, absolving them of any implication. The fact that they were the ones who discovered the coup was actually denied in the beginning.

6. CONCLUSION

Beginning with the title of my essay, I wanted to present another face of what happened in the last years between these great powers that were mentioned.

The main elements involved are: NATO, Turkey's position in NATO, the putsch from 15th of July 2016, the instability of Turkey's current relationships with the US and Russia's involvement. Of course, the political related actions that are brought to life via the media and such are filtrated, so we are only destined to make suppositions on what is actually happening behind the curtains.

"Call the bear uncle to help you cross the bridge", goes a Turkish proverb. After seeing the bigger picture, treating the problem separately, with focus on Erdoğan or Russia, something stands out. My personal regard is that Erdoğan could not have done this all by himself and neither could Russia, so they joined powers and organized something that could earn both of them what they want. Erdoğan got the best way to rebuild Turkey as close as possible to how he wished it, and Russia got itself a strategic ally who is already inclining the balance in their direction, rather than to the West, and more than that, it can also have a direct connection with NATO's core, which may very well be the real target of this action, via Turkey.

This cooperative relation between the two states is very likely to last, given the secret that is to be kept by both of them. If this were to be true, then we might just be witnessing a tragic story of someone willing to step on the bodies of its own people just to get a grasp on more power and, by doing so, that someone might also provide NATO's maybe most dangerous enemy with the chance to harm it.

It is unclear what the future may bring, but Mr. Putin's statement was perspicuous enough about his Eurasian wish in what concerns Turkey.

If so much can happen only with the implication of Russia, what about Iran or China? Is it even possible to talk about an alliance between them? The analysis is soon to come.

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MANAGEMENT AND LEADERSHIP: TWO WAY OF DEALING WITH MODERN WORLD

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Abstract: *The purpose of this paper is to provide a better understanding in what concerns the meaning of management and leadership, when it is more appropriate to apply one or the other and which of the two is more important for a future officer. To answer these questions we have analyzed the concepts of management and leadership starting from their meaning in Italian culture, and taking into consideration the differences between them.*

Keywords: *functions and dimensions; organization; influence; strategic; changing.*

1. INTRODUCTION

The purpose of this paper is to better understand the meaning of management and leadership, when it is more appropriate to apply one or the other and which of the two is more important for a future officer. To answer these questions we have analyzed the concepts of management and leadership starting from their meaning in Italian culture, and taking in consideration which are the differences between them.

2. MANAGEMENT

Management is a set of principles that are applied to the functions of planning, organizing, directing and controlling the application of principles themselves in harnessing physical, financial, human and informational resources efficiently and effectively in order to achieve organizational goals.

By an analysis of functions we tried to understand more about management:

1. *Planning:* the planning process identifies the goals or objectives to be achieved, formulates strategies to achieve them, arranges or creates the means required, and implements, directs, and monitors all the steps in their proper sequence.

2. *Organizing:* arranging several elements into a purposeful sequential or spatial (or both) order or structure, in order to assemble required resources to attain organizational objectives.

3. *Directing:* a basic function that includes building an effective work climate and creating opportunities for formation, motivation, supervising, scheduling, and disciplining.

4. *Coordination:* the synchronization and integration of activities, responsibilities, command and control structures to ensure that the resources of an organization are used most efficiently in pursuit of the specified objectives.

5. *Controlling:* the basic function of establishing benchmarks or standards, comparing actual performances against them, and taking corrective actions, if required.

Management in some form or another is a fundamental part of living and it is essential wherever human efforts are to be undertaken to achieve desired objectives. The basics of management are always involved, whether we manage our lives or our business.

Management and leadership differences

Someone might ask what the differences between leadership and management are.

Whereas the manager's aim is a good administration of resources under his responsibility, a leader needs to influence, orient and lead people with his behaviour.

Leadership should be a crucial part of management because it plays a vital role in managerial operations, while management is the necessary component of technical as well as social processes.

The practice of management is as old as human civilization. However, the study of management in a systematic and scientific way as a distinct body of knowledge has recent origins.

Nowadays, according to Giovanni Valotti (lecturer of “Organization and Human Resource in Public Administration” at Bocconi University), is quite easy to find a good manager but is even more difficult to find a leader. In fact many managers make speeches about how to do things, despite only few of them are coherent with what they say.

The majority of managers’ practice is based on taking compromises; maybe they can brilliantly administrate an enterprise, build a perfect structure, in terms of numbers and theory, but they are not able to motivate and orient the organization’s base: the employee. This is the reason why no one can define himself as a leader, in fact leaders are chosen by others.

It is mandatory for a leader to be empathic, competent, innovative. He has to take risks and responsibilities, as well as to have a clear vision and accept the comparison.

When we put in relation leadership and public administration, the honor and the will of serving the country are essential values.

The first aim of a public leader is the collective interest, sacrificing every personal ambition.

A recent study (Turrini – Valotti 2012) confirms this theory. In particular the research analyzes the application of different kinds of leadership to public administration, with the goal of finding which is the most functional in term of employee motivation.

“Integrity oriented leadership” achieves the most satisfactory results.

This kind of leadership means that the manager/leader is able to motivate people with his example of honesty, respect for rules by sanctioning incorrect behaviours.

Therefore the actions of a manager cannot be based only on sophisticated managerial techniques, that are surely important, but not essential like values system.

Here we identify a good manager as a person who ensures order and stability of administrative and operative processes, while a leader is a source of change and dynamism. He is also capable of defining and sharing a vision and aligning people’s goals to organization’s ones, promoting a controlled organizational disorder to encourage initiative of the individual and innovation of the whole.

3. LEADERSHIP

The current geopolitical, economic, social, cultural and technological scenario is marked by high volatility, uncertainty, complexity, ambiguity (VUCA) (Colonel (Ret) S. J. Gerras, *Strategic Leadership Primer*, Edition 2010, p.1) that make every context extremely indeterminate and difficult to be understood. Operating and making decisions in this rapidly changing environment, that presents non-linear and unpredictable dynamics, today, is the most relevant challenge that complex organizations such as the Air Force are called to face in order to achieve their objectives. Therefore it is of paramount importance that modern leaders (in every field) must be able to interpret external and inner environment of their organization.

3.1 What is leadership?

The Italian Air Force has defined leadership as: “*relation of influence between leaders and their co-workers at every hierarchical level, intended to pursue shared goals and to increase people’s value*” (General E. Vecciarelli, *SMA ORD-001 “La politica del personale dell’aeronautica militare”*, Edition 2017, p. 21)

This definition emphasizes that leadership is not a single person matter but it involves a mutual influence between who leads and his or her colleagues. As a matter of fact leaders influence others by communicating a vision, shaping climate, influencing culture, coaching, mentoring, teaching, embodying ideals, exemplifying appropriate behaviors and making decisions.

On the other hand followers influence their leader by providing information, feedback and essential elements of analysis for decision-making. Besides, this influence process is not only directed top-down and bottom-up but also horizontally, between co-workers.

The Italian Air Force bases its approach to leadership on 4 dimensions: self, team, organizational and strategic leadership.

1. *Self leadership* concerns self awareness, in other words to understand one’s own emotions and to deal with them. It also involves Self Management and Self Development.

2. *Team leadership* is about team working. Since the ancient times human beings were in need of team work in order to face problems which, due to their complexity, cannot be solved by one single person.

3. *Organizational leadership* that firstly concerns the awareness of one’s own organization’s ethical values, general objectives

and mode of operation. It is strictly related with Human Resource Management.

4. *Strategic leadership* focuses on the organization's vision, and it is meant to direct policy and strategy. It is based on strategic thought and represents the most complete expression of the command action. Therefore strategic leadership is performed by building consensus and by aligning the organization itself with a rapidly changing environment.

These 4 dimensions are not separated but they are concurrently used throughout all of a leader's career. Nonetheless each dimension would be exercised in a different percentage on the basis of acquired skills and responsibility level.

3.2 What is a good leader distinguished for?

Many researchers, such as Bob Johanson in his book "Leaders make the future" have tried to focus on which characteristics a good leader should have.

Many shared ideas point out some primary abilities of a leader. He must be an example for his followers, embodying those ethical values required by the organization. Besides, he has to be credible in his daily behaviour. Especially concerning team leadership, he must be able to motivate his followers, leading the group to its goals, and preserving empathic skills in order to manage interpersonal dynamics. Last but not least he must have a well-structured technical background, due to a complete knowledge about the organization and the environment, and he must tend to innovation. These characteristics might be defined as the traditional ones, owned by a good leader.

However, nowadays a leader must succeed in a VUCA environment. Previous listed skills are no longer enough, hence recent studies have found additional ones. A good modern leader must be a very good communicator: he must often repeat a clear and concise message many times, in many places, to ensure the vision cascades down through the organization. He must be able to communicate both with his followers and with his enemies, and actions speak louder than words. About that he has to take risks and responsibilities, being able to apply fast decision-making. Most of the times leaders operate outside their comfort-zone: this has not to be an obstacle but instead a good leader

must show the ability of turning disadvantages into opportunities. Most important is the ability to be forerunners of events, to see before others the consequences of decision-making processes and driving them to success.

4. CONCLUSIONS & ACKNOWLEDGMENT

In a modern military organization characterized by a high technological equipment branch it is easier to think that management capability is the best feature for a commander. Nevertheless the human component maintains a core position in the entire system.

In our opinion, this is the reason why leadership should be the preponderant aspect of a military commander. Considering also the public nature of the institution, it is mandatory for military personnel to operate making homeland the first purpose of their action.

The environment is a factor as well. Armed forces face dangers and circumstances which require a commander to be a leader and a model, ideally and physically at the frontline.

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THE EFFECT OF BULLET WEIGHT VARIANCE ON MUZZLE VELOCITY

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Abstract: *The goal of this work is to discuss the effect of bullet weight variance on muzzle velocity. I want to investigate the ways in which the weight of the bullet and its variance influences muzzle velocity. There are so many factors that influence muzzle velocity and on the other hand there are many factors that are influenced by muzzle velocity. There is also a thorough demonstration of how inner and external ballistics co-operate together during fire.*

In theoretical part I try to explain some facts about 5,56x45 NATO and 7,62 x 39 M43 bullets and give some basic information about them. Then, I describe some basic inner and external ballistic features and show how they influence muzzle velocity. Finally, I calculate muzzle velocity and try to determine how muzzle velocity is influenced by variance in bullet weight.

For the practical part, I use weight determination processes to identify the exact weights of the bullets to be able to count equations of muzzle velocities.

Keywords: bullet; muzzle velocity; bullet weight; equation; calculations

1. IMPORTANCE OF VARIANCE OF BULLET WEIGHT

Muzzle velocity of bullet is the speed of bullet in the moment when bullet is on the end of barrel. It influences the distance of shot, the impact on the target and also accuracy. These factors are very important in military ballistics. On the other hand, there are also features influencing the muzzle velocity. From category of inner ballistics features we can state the weight of bullet, length of barrel, weight of powder, other powder's characteristics, calibre etc. To completely understand to all features, let's see the equation of muzzle velocity.

To understand the importance of variance of bullet weight we have to know and understand features of weapon system and how they affect muzzle velocity. By increasing value of any of these parameters we can increase or decrease the muzzle velocity.

We also can not forget to think about safety because each weapon system must be in order to rules of usage. Despite the fact that in theoretical thinking weapon system may work, it does not necessarily mean that it is safe etc.

1.1 Parameters influencing muzzle velocity

- f = powder force
- s = cross-section area of the bore barrel

- α = covolume of powder gases
- δ = powder mass density
- m_q = projectile mass
- m_o = powder charge mass
- χ = coefficient of enlargement combustion chamber volume
- k_ϕ = coefficient of passive resistances against projectile motion in the barrel
- c_0 = initial volume of combustion chamber
- l_u = barrel length
- v_u = projectile muzzle velocity
- I_k = total impulse powder gases pressure
- K_c = ratio of specific heat of gases at constant pressure and volume

Powder force is the theoretical work, which would be done by explosion of 1kg of gun powder in normal pressure by increasing from 273K to explosive temperature. Powder force is often used to characterise effect of explosive by many other characteristics concurrently. The value of powder force is denoted in J/kg.

Cross-section area of the bore barrel is denoted in m^2 .

Covolume of powder gases is the lowest volume, which by given pressure assumes the molecules of gun powder gases of 1kg of gun powder.

Values of covolume of powder gases are pinpointed experimentally in manometric bomb. The value of covolume of powder gases is denoted in m^3/kg .

Powder mass density is the weight of volume amount by temperature of 15°C and atmospheric pressure. The value of powder mass density is denoted in kg/m^3 .

Projectile mass is denoted in kg.

Powder charge mass is denoted in kg.

Coefficient of enlargement combustion chamber volume affects by given starting volume of combustion chamber the length of combustion chamber and also the length of round. By small value of coefficient of enlargement combustion chamber volume it may occur the longer bullet, that may mean lower cadence of weapon. By big value of coefficient of enlargement combustion chamber volume it may occur that taper part can be trriioned. The value of coefficient of enlargement combustion chamber volume is denoted without unit.

Coefficient of passive resistances against projectile motion in the barrel spans excepting presentated energetical losses also losses of energy of gun powder gases, that by leakage flow away between shot and barrel and also the loss of energy that was used to deformation and amplitude of barrel. Coefficient of passive resistances against projectile motion in the barrel depends on the type of barrel weapon. The value of coefficient of passive resistances against projectile motion in the barrel is denoted without unit.

Initial volume of combustion chamber is the volume of combusting chamber behind the back part of shot lowered by value of cartridge. The value of initial volume of combustion chamber is denoted in m^3 .

Barrel length is measured between ground of loaded shot and muzzle of barrel. The value of barrel length is denoted in m.

Total impulse powder gases pressure is important ballistics parameter of powder gases, which can be qualified experimentally, for example in ballistics bomb and it can be used by solving the main task of ballistics. The value of total impulse powder gases pressure is denoted in Pa/s.

Ratio of specific heat of gases at constant pressure and volume is taken as a constnt by solving tasks of ballistics in the whole volume and is affected and also affects with other physical characteristics. The value of ratio of specific heat of gases at constant pressure and volume is denoted without unit.

1.2 The equation of muzzle velocity. The very first step was to import all basic equation to evaluate the final equation of muzzle velocity due to all parameters. Due to fact, that weapon system is very precious, importing all basic equations was very difficult. However, it can show us, how each parameter can possibly influence the muzzle velocity of bullet. However, we mainly aim at variance of bullet weight and all other parameters are counted precisely for used weapon. While calculation of muzzle velocity we used many equations that we need to solve the muzzle velocity.

$$\Delta = \frac{m_\omega}{c_0}$$

$$l_0 = \frac{c_0}{s}$$

$$\theta = \kappa_c - 1$$

$$\Lambda_{\dot{u}} = \frac{l_{\dot{u}}}{l_0} = \frac{l_{\dot{u}} * s}{c_0}$$

$$\varphi = k_\varphi + \frac{1}{3} * k_{\chi str} * \frac{m_\omega}{m_q}$$

$$k_{\chi str} = \frac{1}{\Lambda_{\dot{u}}} * \left[\Lambda_{\dot{u}} + \left(\frac{1}{\chi} - 1 \right) * \ln(1 + \Lambda_{\dot{u}}) \right]$$

$$c_q = \frac{m_\omega}{d^3}$$

$$m_{\omega r} = \frac{m_q}{d^3}$$

$$v_{lim} = \sqrt{\frac{2 * f * m_\omega}{\theta * \varphi * m_q}}$$

$$a = f * m_\omega$$

$$j = \varphi * m_q * v_k^2 = \varphi * m_q * \left(\frac{s * I_k}{\varphi * m_q} \right)^2$$

$$b = -\frac{\theta * j}{2 * a} = -\frac{\theta * s^2 * I_k^2}{2 * \varphi * f * m_q * m_\omega}$$

$$k = \frac{j}{a * b} = -\frac{2}{\theta}$$

$$l' = \frac{l_\Delta + l_1}{2} l_\Delta = l_0 * \left(1 - \frac{\Delta}{\delta} \right)$$

$$l_1 = l_0 * (1 - \alpha * \Delta)$$

$$z_m = -\frac{1}{b * (2 - k)} = \frac{\varphi * f * m_q * m_\omega}{s^2 * I_k^2 * (\theta + 1)}$$

$$v_k = \frac{s * I_k}{\varphi * m_q}$$

$$l_k = l' * [(1 + b)^k - 1]$$

$$v_{i'} = \sqrt{1 - \left[1 - \left(\frac{v_k}{v_{lim}}\right)^2\right] * \left(\frac{l_1 + l_k}{l_1 + l_{i'}}\right)^\theta}$$

1.3 Characteristic of 5,56x45 NATO.

In 1964 the US Army started using assault rifle M 16 with bullet 5,56x45. The shot with mark M 193 contains lead grain and it weighs 3,56g. Bullet with this shot was used in the US Army till 1984. Also other states in NATO were using this type of bullet. After experiences from Vietnam war the bullet was being developed.

The biggest succes had belgian company FN, which developed new shot, that was more efficient and its pushful effect was higher. The important feature was to change raise of bore to 177,8mm.

Since 1980 bullets 5,56x45 NATO have been made heavier- 4,00g, with tombak jacket and combined steel-lead core, marked SS 109.

Bullet used in military sector is made also for civiliaan sector, the cartridge is made of CuZn, but therecan also be found cartridges made of steel or alluminium. Training bullets also have plastic cartridge.

1.4 Characteristic of 7,62x39 M 43.

Soviet military bullet 7,62x39 M 43 was developed by N. M. Jelisarov and B. V. Semin during Second World War. It was introduced to army after war, firstly for self-reloading rifle SKS, then for worldwide known assault rifle AK-47 and machine guns RDP, RPK and RPKS.

This bullet was introduced to armament of armies of China, Finland, Cuba, Nicaragua, Czechoslovakia, states of Near East.

In literature there are inforamtion about ammount of constructed assault rifles AK-47 that are counted between 30 and 100 mil. of pieces. Itis dubtless that this bullet, despite it wasnot used in any world war, but in almost all local conflicts and wars after 2WW, is the bullet that can be placed to bullets with highest ammount of made pieces.

Cartridge of this bullet is mainly made of steel cladled with tombac, steel phosphated and lacquered and also of brass.

Shot of basic conduct is biogival, it's core is made of steel, and jacket is made of lead and steel. Shots are marked with colour stripes that mean the type of bullet.

2. WEIGHT DETERMINATION PROCESS

Importance of precious weight determination is very high because this work is aimed at bullet weight. We used different types of shots and we measured their weight to reach all possible weights of bullet. The variance of values of weight was pretty big despite the fact that shots are constructed in specific laboratories with emphasis to accuracy of prescribed values. Each milligram can cause differences in many parameters influenced by weight of bullet, for example our measured feature- muzzle velocity. During weight determination process we divided bullets into groups with same weights and then we were able to count theoretical values and then, after labouring, experimentally found values.

3. MUZZLE VELOCITY CALCULATIONS

After all parameters characterising gun powder, shot, weapon system etc. were found or calculated, we were able to calculate the values of muzzle velocity due to equations used above.

1. Calculation 5,56x45 NATO no.2

m_q	0,00363	kg
α	0,0009242	m ³ /kg
δ	1600	kg/m ³
χ	1,85	-
k_ϕ	1,1	-
c_0	0,000001877	m3
$l_{i'}$	0,4255	m
I_k	150000	Pa/s
K_c	1,2332	-
d	0,00556	m
s	0,00002489	m ²
f	1013200	J/kg
m_ω	0,0014	kg

2. Calculation 5,56x45 NATO no.2

m_q	0,00365	kg
α	0,00009242	m ³ /kg
δ	1600	kg/m ³
χ	1,850	-
k_ϕ	1,1	-
c_0	0,000001877	m3
l_{ii}	0,4255	m
I_k	150 000	Pa/s
K_c	1,2332	-
d	0,00556	m
s	0,00002489	m ²
f	1 013 200	J/kg
m_ω	0,0014	kg

Results of calculations of bullet 5,56x45 NATO.

By calculation we stated that the influence of variance of bullet weight with 5,56x45mm NATO bullet has important impact on muzzle velocity, because the shot with weight 3,63g correspondingly to innerballistics calculations leaves the barell with muzzle velocity 871,382106m/s and the shot with weight 3,65g leaves the barell with muzzle velocity 867,320285m/s, which causes the difference of approximately 4m/s by weight difference of 0,02g.

3. Calculation 7,62x39 M 43 no.1

m_q	0,00797	kg
α	0,0009242	m ³ /kg
δ	1500	kg/m ³
χ	1,815	-
k_ϕ	1,2	-
c_0	0,000003521	m3
l_{ii}	0,448	m
I_k	100000	Pa/s
K_c	1,2299	-
d	0,00762	m
s	0,0000473	m ²
f	1063500	J/kg
m_ω	0,0016	kg

4. Calculation 7,62x39 M 43 no.2

m_q	0,00798	kg
α	0,0009242	m ³ /kg
δ	1600	kg/m ³
χ	1,815	-
k_ϕ	1,2	-
c_0	0,000003521	m3
l_{ii}	0,448	m
I_k	100000	Pa/s
K_c	1,2299	-
d	0,00762	m
s	0,0000473	m ²
f	1063500	J/kg
m_ω	0,0016	kg

Results of calculations of bullet 7,62x39 M 43.

By calculation we stated that the influence of variance of bullet weight with 7,62x39 M 43 bullet has important impact on muzzle velocity, because the shot with weight 7,97g correspondingly to innerballistics calculations leaves the barell with muzzle velocity 777,443317m/s and the shot with weight 7,98g leaves the barell with muzzle velocity 775,416598m/s, which causes the difference of approximately 2m/s by weight difference of 0,01g.

4. PRACTICAL MEASUREMENT OF MUZZLE VELOCITY

The very last step of this work was to construct rounds with agreement with all parameters and their values. Due to the fact that every single change of each parameter can affect the weapon, we had to do it precisely. After construction we were ready to go shooting and measure values of muzzle velocity, so we could compare them and make the decision, if variance of bullet weight can affect the muzzle velocity in important way. In practical part that was about labouring bullets and shooting, we used different shots than in the theoretical part etc. We used shots about cal. 5,56mm. This ammo is typical for NATO states and is commonly used during fighting in built-up areas.

Practically we stated the results that 3,63g shot was shot away from barrel with muzzle velocity of 877,649m/s and the 3,65g shot was shot away from barrel with muzzle velocity of 873m/s. It means that the influence of variance of bullet weight caused the difference of muzzle velocity of approximately 4m/s, that means the variance of muzzle velocity on 0,02g.

5. CONCLUSION

In this work I tried to show how variance of bullet weight influences the muzzle velocity as one of the most important measured and calculated feature of military ballistics. There are many other features in calculating the muzzle velocity that definitely influence it, however this work is about showing the importance of difference of bullet weight. In heavy machine gun ammo, the difference is not so important due to fact, that this type of weapon is not used for accuracy shooting. However, assault rifles can easily be less effective due to influence of bullet weight variance because of usage of them as weapons used for accuracy shots. The muzzle weight is definitely changeable due to variance of bullet weight and the influence of this fact definitely affects external ballistics features that are essential for military ballistics. Despite the fact that this work shows mainly affects of bullet weight variance to muzzle velocity by numbers, reader can easily found out that other parameters are at least explicated. In this work I tried to show and I hope I also showed that the variance of bullet weight definitely affects the muzzle velocity in very important way.

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BALLISTIC PROTECTION OF AN INDIVIDUAL BASED ON NON-NEWTONIAN FLUIDS

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Abstract: *Work on the topic of the Ballistic protection of an individual based on non-Newtonian fluids deals with the theoretical basics and the possibility of their real use in protection against the wounding effects of ballistic shells. The focus of the work was an attempt to prove the effectiveness of non-Newtonian fluids and their possible use in praxis, which would remove the negatives associated with the current ballistic protection of an individual such as high weight, price or reduced mobility of the wearer. The problem was conceived with the idea of using the lowest entry costs with the most effective deceleration or the overall stopping of different types of ballistic shells. Through several experiments, we have proven the efficiency of various types of non-Newtonian fluids to reduce the rate of different projectiles. Based on the experiments and the knowledge we have gained, we have indicated their possible use or other similar materials in the field of ballistic protection of an individual.*

Keywords: *Ballistic protection, non-Newtonian fluid, wounding effect, ballistic body, projectile velocity*

1. INTRODUCTION

The constructed work presents the knowledge of a ballistic protection of an individual from the area of non-Newtonian fluids. Based on their use, attempts have been made to experimentally verify the effectiveness of the fluids in order to prevent intrusion or complete penetration of the missiles through the target. The main authoritative factor for the evaluation of the protection system were the weight, effectiveness and the lowest possible influence on the mobility of the wearer. Various types of fluids or materials were used in the experiment itself, and the entire ballistic process was recorded by a high-speed camera.

2. BALLISTIC PROTECTION OF AN INDIVIDUAL

Ballistic protection (BP) is an artificial barrier with a certain resistance to intercept or bounce impacting ballistic bodies endangering a protected target. Ballistic bodies can be practically any bodies that have somehow gained high speed. These include, for example, bullets fired from firearms, explosion-accelerated shrapnel, parts of equipment such as secondary bullets, and so on. The primary importance of BP, as we are talking about ballistic protection of individual (BPI), is to most effectively reduce the severity of shooting injuries. In this case, it is necessary to avoid and almost completely eliminate the anomalies or

inaccuracies in the protective function of BPI, such as deformation and subsequent bullet penetration, the reflection of the missile in an inappropriate direction or the tearing on the rear of the BPI and consequently the injury caused by wearers own parts of the protective element. [1,2,4]

2.1 Dividing of ballistic protection

BP is divided into many categories. According to the fact that in this work we are dealing with specific ballistic protection of an individual, we omit the division groups according to protected object or the principals of protection and we will focus especially on the priority determination and the type of used material. [9,10]

Depending on priority determination:

- Against firearm bullets (common, pervasive, expansive)
- Against shrapnel
- Against other threats (stabbing, striking weapons ...)

Depending on material used:

- Metal (steel, aluminum, titanium...)
- Non-metal (textile, ceramics, plastic, rubber...)
- Combined (laminated, composite)

Ballistic protection of an individual

- Ballistic vests
- Protection suits
- Ballistic helmets
- Ballistic shields, panels

2.2 Non-Newtonian fluids (nNT)

Non-Newtonian fluid is a non-linear viscous substance which's rate of deformation is generally a function of time and is not proportional to the applied shear stress. These characteristics are caused by the interaction of the molecules of the particular fluid, which is appreciably different from the common interactions of molecules in Newtonian fluids. Due to the nonlinear dependence of the viscosity on the applied stress, its physical properties cannot be described by only one mentioned magnitude. It is necessary to add additional so-called rheological properties that allow us to describe nNT more exactly.

2.3 Newton's viscosity law

Newton's viscosity law, applied on Newtonian fluids, describes the relationship of stress and velocity of deformation as the direct proportional, where the proportionality constant is the dynamic viscosity.

$$\tau = \eta * \frac{du}{dx}$$

τ – shear stress=F/A

η – Dynamic viscosity

$\frac{du}{dx}$ – Rate of shear deformation (RG)

Even though we do not realize that nNT are common in households or anywhere else. These include, for example, honey, liquid soaps, lacquers or starch suspensions. The properties that nNT differ from regular Newtonian currents include, for example, the fact that at higher pressure points the resistance to mechanical density increases, which in some cases causes to allow running on any types of liquids. [14,16]

2.4 Different types of nNT

nNT can be divided into several groups in terms of their viscosity dependence on different factors. Depending on the behavior of the velocity gradient $\frac{du}{dx}$ (VG) as a result of Newton's viscosity law and the shear stress, different types of nNTs are divided:

pseudoplastic and plastic – their viscosity with increasing VG significantly decreases.

- Ketchup, mud, toothpaste

Bingham – liquid until certain point of stress applied, they have certain flow boundary

- Suspension of lime of chalk

Dilatant – their viscosity with VG increases

- Starch suspensions

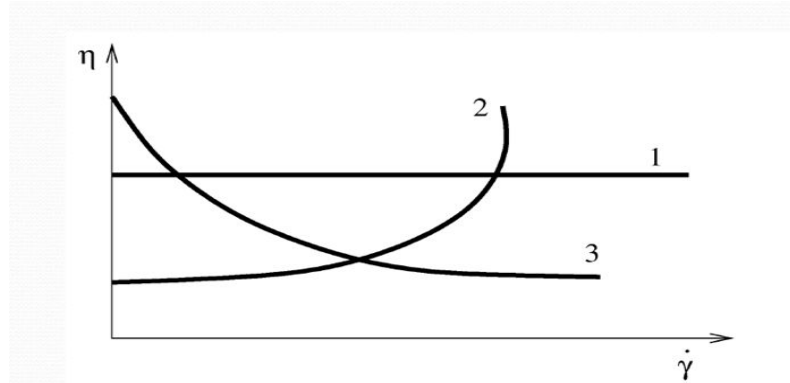


Figure 1 – Graph of Viscosity Dependent on Shear stress (1-Newtonian fluid, 2-dilatant fluid, 3-pseudoplastic fluid)

The next division of nNT is time-dependent, outgoing from the speed of deformation and stress.

$$D = D(\tau)$$

D – speed of deformation

τ – shear stress

Deformation speed may not only depend on the voltage but also the time duration at which the stress occurs. Based on changes in viscosity of nNT in time using this dependency, we determine two other groups:

Thixotropic fluids - the viscosity decreases the increasing time of stress effecting on the

substance (especially pseudoplastic and plastic fluids).

Rheopexy fluids – with the increasing time of application of the stress on the substance viscosity increases (dilatant liquids).

By applying shear stress, these materials change their structure, viscosity and flow properties. However, after the stress is over, their structure is not regenerated immediately but with a certain delay. This phenomenon is called hysteresis. [15,17]

3. USE OF NNT IN THE BALLISTIC PROTECTION OF AN INDIVIDUAL

Based on the abovementioned properties and utilization of nNT, it is currently possible to consider the implementation of similar substances in the field of ballistic protection of individuals (BPI). BPI as a special protective entity for the elimination of incident ballistic bodies is currently working with different materials - metals, non-metallic substances or a combination of these. It's essence and effort to maximize efficiency, however, provided by using these materials leads to the usage of extremely heavy and movement limiting clothing.

We also work on a protective element as a specific part of the garment. In the case of focusing on the vests, the possible application of nNT could result in the fulfillment of the required protection conditions, while at the same time increasing the mobility of the wearer. In the event of an ineffectiveness of nNT against bullets, consideration may be given to achieving an optimal solution by combining with other materials and ballistic protection elements.

3.1 Methodology of tests

The subject(s) of our research was an attempt to slow down or completely prevent the penetration of bullets, ballistic bodies shot from firearms. The reduction of velocity of the bullets was expected after the impact of the projectile shot on the dilatant nNT, which was theoretically expected to result in a decrease in the effectiveness and injurious effect of the bullet itself. Testing nNT itself was preceded by experimental shots to water barriers to assess the behavior of bullets after crashing and overcoming Newtonian fluids, and then comparing the results with projectiles fired to nNT. In the experiment there were three different concentration of starch suspensions and honey representing nNT with the aim of slowing down 3 types of bullets: a .22 Long Rifle bullet, a FMJ 9mm Luger, and an Action 5 of 9mm Luger caliber.

3.1.1 22 Long Rifle

.22 LR is long-term used bullet and referring to the number of units sold it is the most used cartridge in the world. There was a huge array of weapons for this type of bullet - pistols, revolvers, or rifles. The standard shot is homogeneous, leaded, ogival with an initial speed of 320 - 370

m/s, a weight of 2.56g and a powder loading of 0.08g. [20]

3.1.2 9mm Luger FMJ

9 mm Luger pistol cartridge with full metal jacket bullet, soft lead core and brazen CuZn30 casing. The metal jacket results in a lower susceptibility to the deformation of the bullet in the body or even to the impact of the element of ballistic protection. During the experiment, we used a shot with a top speed of 370 m/s, with a weight of 7.5g. [20]

3.1.3 9mm Luger Action 5

The 9 mm Luger Action 5 bullet is specially developed to keep in the body of a target after an intervention. This property resides in the shape of deformation of the projectile upon contact with the tissue. As a result, the projectile does not leave the body in the event of a collision and a gradual penetration, and at the same time it has a higher wound effect. The initial velocity of these projectiles was around 430 m/s, weighing 6.1g. [20]

4. EXPERIMENTAL VERIFICATION OF EFFICIENCY OF nNT

In the experiment, we shot into several types of nNT. The original shot was into the plain water as a representative of Newtonian fluid, three concentrations of starch suspensions as a dilatant nNT and honey. Different concentrations of starch solutions and honey behaved considerably differently under pressure-induced by projectiles.

4.1 Velocity measurement

A ballistic test was conducted at the University shooting range at Šumavská barracks and each penetration was recorded by a high-speed camera. All the shots were from the STZA 12 mobile firing rest with UZ-2002 universal ballistic breech. Samples of fluids were located at 5 meters from the muzzle and had a thickness of approximately 27.4 mm. Projectile velocities were measured at a distance of 2.5 meters by LS-06 Intelligent light gates, and the velocity of the samples after penetration was evaluated from the camera record. All the bullets were captured in the cotton-wool, where there was no further deformation, and we were able to conclude the deformation only caused by the layer of the sample.

Table 4.1 Results of 1st experiment

No.	Bullet type	sample	radar			gates	camera		sigma v		Δv [m/s]	ΔE [J]	$100 \cdot \Delta v / v_5$ [%]
			v_0 [m/s]	$v_{2,5}$ [m/s]	v_5 [m/s]	$v_{2,5}$ [m/s]	$v_{2,5}$ [m/s]	v_5 [m/s]	v_5 [m/s]	v_{out} [m/s]			
2	.22 LR	water	373,5	371,2	368	371,1	369,5	353,7	0,5	0,51	-15,9	-14,7	-4,3
3	.22 LR	starch 50%	370,3	368,3	365,2	368,2	367,3	344,5	0,77	1,02	-22,9	-20,8	-6,3
4	.22 LR	starch 65%	366,8	364,9	361,8	364,8	362,1	336,3	0,2	0,43	-25,8	-23,1	-7,1
5	.22 LR	starch 75%	369,2	366,1	363,3	366	364,3	329,7	0,2	0,65	-34,6	-30,7	-9,5
8	9mm FMJ	starch 75%	370	366,3	363,7	366,3	362,4	345,5	0,48	0,65	-16,9	-47,8	-4,6
9	9mm A5	starch 75%	430,6	424,8	421,3	424,7	420,9	303,6	0,22	7,32	-117,4	-259,4	-27,9
10	9mm A5	water	439,1	433,2	429,6	433	429,5	422	2,29	5,56	-7,5	-19,4	-1,7
11	9mm A5	honey	425,2	420,7	417,1	420,6	417,1	275,4	0,4	3,55	-141,8	-299,5	-34

Table No. 4.1 shows in which cases nNT had a significant part of slowing down bullet compared to water. As it is shown in the case with caliber .22 LR, the difference in the velocity of the shot between the water and the starch suspension is not essential. In the case of 9mm FMJ the difference cannot be judged. In the results of the Expansion Shots Action 5, the difference in velocity of the projectile after penetration is obvious and essential. The most significant change occurred with the honey sample, where the measured velocity of the projectile decreased by up to 34%. In the case of a starch suspension, we achieved a 27% deceleration. The effectiveness of nNT is confirmed by the deformation of the 9mm Luger Action 5 bullets themselves. By opening the front

of the projectile, a larger area was created, thereby we achieved increasing the environmental resistance. Therefore, and the energy of the projectile then decomposed to much larger area of barrier.

On the records from the high-speed camera, it is clear to see that the projectile is completely opened after penetrating the test samples. Inside the nNT during penetration processes diameter of A5 bullets is considerably increasing which means that slowing down of these types of projectiles is much more significant than in the case of the other 2 types. We observed the different opening of the A5 projectile which was due to different types of samples.

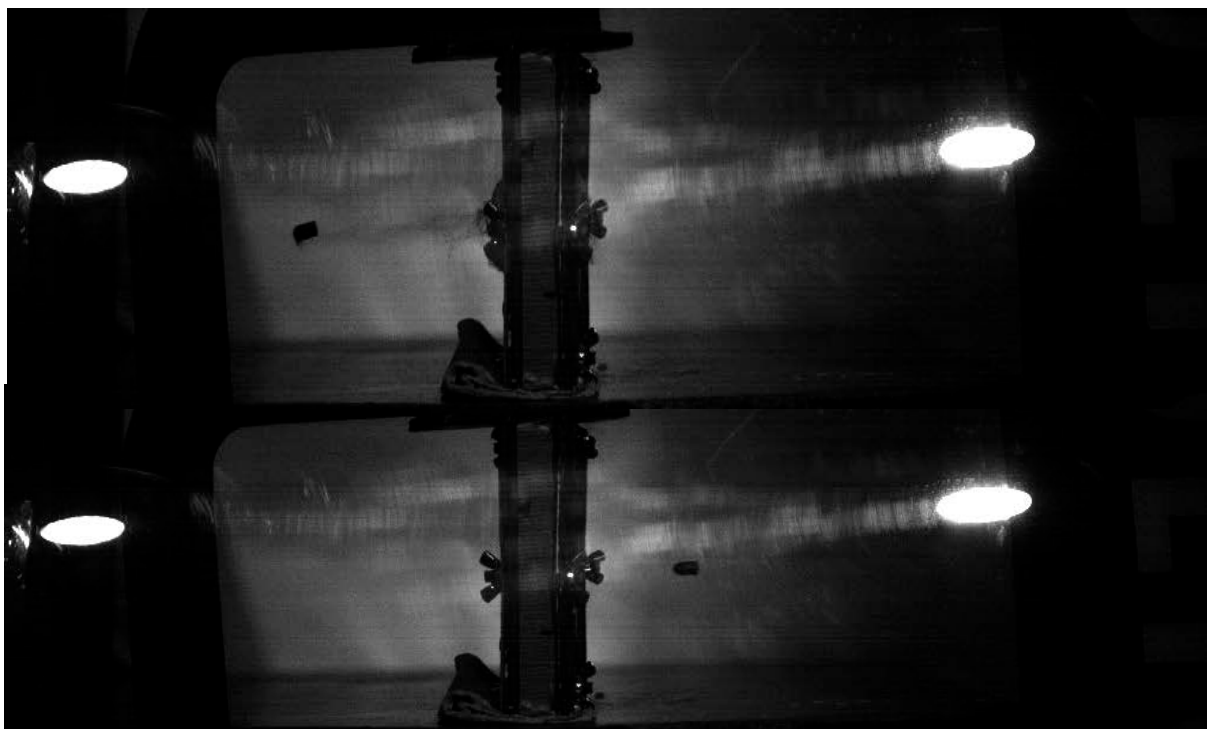


Figure 2. Destabilization of .22LR

Based on camera images, it is possible to evaluate slowing or susceptibility to changes in projectile stability after penetration through various types of barriers. As previously mentioned, all the projectiles were subsequently captured in the cotton-wool after the shots in order to prevent further deformation and ensure the possibility of comparing the deformations caused only by impact to the samples themselves. Regarding to the

change in stability after the penetration of nNT, the most noticeable was at case with .22 LR.

Picture No.3. shows deformation of 9mm A5 bullets after penetration by all tested samples and also 9 mm Luger FMJ after penetrating water compared to the shot thorough starch suspension. The difference of the opening is obvious at first sight but in the more detailed view of the FMJ there is also a slight deformation on the bullet No.2. which is a projectile fired into nNT.



Figure 3. Deformation of projectiles (1. FMJ water, 2. FMJ 75 starch, 3. A5 75 starch 4. A5 honey ,5. A5 water)

4.2 Combination of samples

Unlike the previous measurements in this case, only two types of ammunition were used - 9mm FMJ and 9 mm Luger A5. In the case of 9 mm FMJ, even when the thickness of the penetrated sample was increased, there was no significant

difference in the velocities between water and the starch suspensions. Similar results were also shown in case with 9mm A5 shot, where the difference in efficiency cannot be clearly determined either.

Table 4.2 Ballistic test of samples in plastic containers

No.	Subsidence velocity [m/s]	Excursion velocity [m/s]	Bullet	Barrier (1. sample 2. sample)	Note
1	380,3	361,3	FMJ	water	
2	383,2	360,0	FMJ	starch	
3	451,1	283,8	A5	water	
4	451,0	291,7	A5	starch	Excursion velocity estimated by emulsion cloud velocity
5	446,7	98,6	A5	water + starch	
6	453,1	138,0	A5	honey + starch	
7	460,4	110,4	A5	water + water	

To determine more accurate results and to better elucidate the forces involved in penetration process into samples, a 15% ballistic gel was used to capture bullets instead of cotton-wool. Thanks to the ballistic gel we were able to subsequently measure the penetration depth of the projectiles after contact with each of samples. In this case,

samples were placed in 2 plastic containers, tested against 9mm Luger A5 penetration, and three combinations of possibilities were examined, as shown in Table No.4.2. As for speeds, it is obvious that increasing the thickness of the test sample had a significant effect on its loss. After recording the velocity of the bullets after the penetration of 3

fluid combinations, different results were evaluated. The most obvious share of loosed projectiles velocities up to 78% was recorded with the combination of water as the 1st barrier and the starch suspension as the 2nd projectile barrier. On the other hand, the lowest efficiency in velocity differences occurred with the combination of honey as 1st barrier and starch suspension as 2nd barrier. Similar results also showed the measured penetration values of ballistic gel in Table No. 4.3.

Table 4.3 Ballistic test, depth of penetration to 15% ballistic gel

No.	Sample (1 st sample + 2 nd sample)	Penetration value[cm]
1	water + starch	20
2	honey + starch	>32 (whole penetration)
3	water + water	24

The penetration velocity of the test sample corresponds to the depth of penetration into the ballistic gel itself. In the case of a combination of water and starch suspension, the depth was approximately 20 cm resulting in an outgoing speed of 98.6 m/s. In the case of honey and the starch suspension, there was a complete penetration of the ballistic gel, which eliminates the effectiveness of this combination.

However, after a more detailed examination of the projectiles in the ballistic gel and captured in the wool for honey and starch, a fundamental fact was found. As previously mentioned, the 9mm Luger A5 projectile starts to deform when it comes to contact with the sample.

Complete opening occurred even when the water barrier was hit, but in the case of a combination of honey and starch, not only the projectile was opened but also the whole of the opening part part was completely torn off.

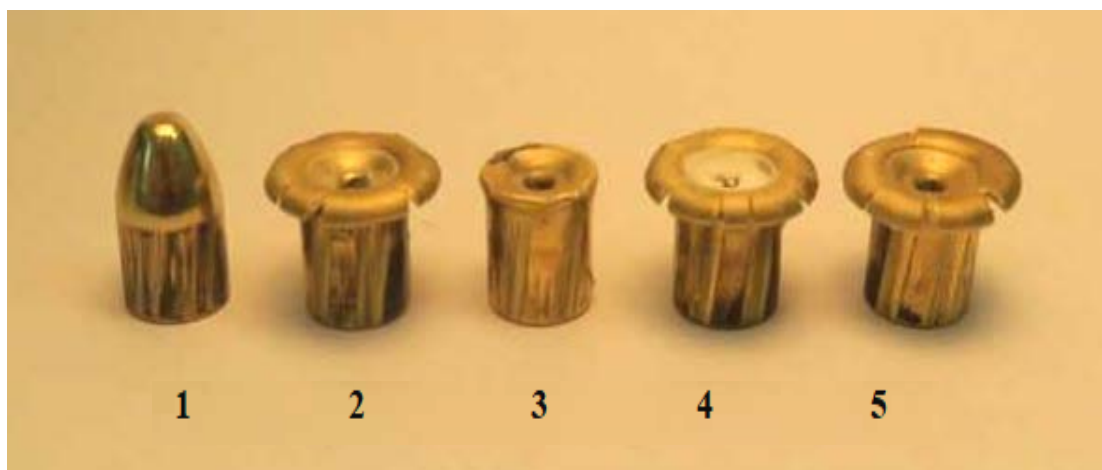


Figure 4 - Deformation of bullets after penetration through combinations of samples (1. FMJ water, 2. A5 water, 3. A5 starch + honey 4. A5 starch, 5. A5 water + water)

This discovery proves significant differences in the forces acting upon entering the foreign body into nNT and Newtonian fluid. Tearing off the opening part of the 9mm A5 projectile significantly reduced its diameter. The tear-off has already occurred in the first plastic honey container, which means that bullet penetrated through the entire thickness of the starch suspension and the ballistic gel with a reduced diameter. Therefore, it was not even possible to achieve a significant reduction in outgoing speed. The lack of velocity reduction and the much smaller diameter caused the bullet to penetrate whole thickness of combination of samples.

CONCLUSION

In the submitted work the theoretical basics and the bases of the functioning of the ballistic protection were represented. The actual aim of the activity was to experimentally verify the effectiveness of non-Newtonian fluids in the field of ballistic protection of the individual, define the possibilities of using these materials in current practice. There were performed several tests for the penetration resistance of several types of nNT compared to Newtonian fluids. Also, several types of ammunition were used in mentioned tests. Experiments included measurement of velocities,

ballistic penetration depths, destabilization and bullet deformation. In the case of the first test, we recorded the most significant changes in velocity and deformation with starch and honey samples. The sample thickness was 27.4mm, and the projectiles were captured in the cotton-wool for easy determination of their deformation after contact only with the samples. In the case of a 9 mm A5 bullet, there have been studied its expansion and also anti-penetration forces which were included during penetration process. The second test consisted of increasing the thickness of the samples, combining their types and at the same time capturing the projectiles in the ballistic gel. Samples were placed in 58,5mm thick plastic containers. We noticed the most significant change in velocities in the case of a combination of water and a starch suspension, but the greatest bullet deformation occurred by combining honey and starch suspension. In this case, the total opening part of A5 tore off. This resulted in a smaller reduction in outgoing speed. The result of the work itself is evidence of different actions in the field of ballistic protection in the case of nNT and common Newtonian fluids included, as well as an indication of the applicability of nNT into the field of ballistic protection of an individual.

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SPACE AS A CRUCIAL DEFENSE TECHNOLOGY TO EU'S COMMON SECURITY DEFENSE POLICY

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Abstract: *Space is a crucial asset for the security of modern nations, i.e. comprising military, economic, and citizen security. Space efforts have focused on defense operations missions that are crucial for land, maritime and air forces such as surveillance, communication, and navigation. This paper deals with how space has been gradually incorporated into the European Union's Common Security and Defense Policy.*

Keywords: *space; CSDP; ESP; Space Programme*

1. INTRODUCTION

What Is Space? Outer space is the area extended over airspace (~ 100 km). Traditionally it falls at the Air Forces' competency.

Space Era began during the Cold War in the 50's. Initial exploitation by US-USSR started as an arms race in space. In the end it proved to be a stabilizing factor as it increased the transparency. Satellite technologies are: Of dual use nature (both civilian - security & defence purposes) and capable of supporting various policies simultaneously.

2. THE DAWING OF EU SPACE RELATED POLICIES

In the 90s, it was recognized inside EU that space applications are tools for the achievement of civilian policy goals related to transport, environment, research etc. Then, the EU decided to pursue its ambitions as a global actor. First in 1993 with the Maastricht Treaty, EU defined the Common Foreign and Security Policy (CFSP). Then in 1999 the European Council launched the European Security and Defence Policy (ESDP, now CSDP) as the CFSP's operational branch.

Information from space minimizes uncertainty and increases the chances for prudent political decisions. Space assets constitute an essential segment of the defence capabilities needed. By fully integrating space capabilities into military operations, force commanders are better able to

tailor their campaign planning and operations to employ more effectively available forces and achieve objectives at the least risk and cost.

3. SPACE CAPABILITIES NEEDED FOR SECURITY AND DEFENCE

The space missions, that technology supports, comprise of three sectors; that is security/defence, scientific, and commercial. In the security/defence, domain, the main capabilities deal with a number of functions like Earth Observation (Imagery Intelligence and Meteorology-Mapping), Signal Intelligence, Positioning, Navigation & Timing, Communications, Early Warning (of incoming missiles) and Search and Rescue.

These space capabilities are essential at all levels of defence planning and operations.

4. RECOGNITION OF SPACE IN CSDP

Europe did not suddenly discover space, but its focus has been only for civilian scientific or experimental programmes and has not extended to defence related programmes. But the ambition of the EU to be a global power in international affairs pushed EU to address initially security and then defence dimensions of space.

Until 2000, the European Space Policies/strategies did not make any references either to CFSP or ESDP. The EU Hellenic Presidency (2002-03) pursued the initiative

“ESDP and Space”. This initiative resulted in two accomplishments:

2003 Council recognized for the first time the role of Space in ESDP. More specifically, the 19 May 2003 General Affairs and External Relations Council (GAERC) decision for the first time “recognised the importance of space applications and functions needed in order to enhance EU capabilities to carry out crisis management operations”.[1]

Then in 2004, the Council of the European Union’s decided the “ESDP and Space Policy”[2] which is the cornerstone of space activities in the security and defence domain.

5. EUROPEAN SPACE POLICY AND PROGRAMME

5.1 European space policy and programme

The current overall European Space Policy (2007) establishes a commonly accepted vision to strengthen Europe as a world-class space leader responding to the needs of European policies and objectives, in terms of applications, services and related infrastructures.

The ESP formally establishes a link between space activities and the European Security and Defence Policy. The ESP sets as a strategic objective of meeting security and defence needs with respect to space.[3] Specifically, ESP identifies Space and security as one of its priority areas and the fact that space technologies are often dual-use in nature and common between civilian and defence applications.

5.2 European space programme

The European Space Programme will implement the European Space Policy. It will constitute a common, inclusive and flexible framework on the basis of which space activities and measures would be taken by the European Union, the European Space Agency and other stakeholders.

The developing of the European Space Programme would also cover CSDP needs in a number of space domains, like earth observation, telecommunications, position, navigation and timing, search and rescue. But the exercise of developing an EU Space Programme is more complicated since there are so many actors involved.

5.2.1 Galileo. Gives position, navigation and timing for csdp

Galileo is a civilian system, but nothing prevents the Member States to use it for military purposes.[5] Currently 18 of its 30 satellites are operational. It provides more accurate navigation for citizens: The Open Service will offer a free mass-market service for positioning, navigation and timing in smartphones or in car navigation systems. Also, secure services for public authorities: fully encrypted service for government users during national emergencies or crisis situations. Galileo can support emergency operations: The Search and Rescue Service.

5.2.2 Copernicus earth observation programme

Copernicus is a civilian earth observation programme with 8 satellites currently operational. In its final form it will have 6 families of satellites, consisting of 30 satellites, which will last until the 2030’s. Its raw data and certain Services are free of charge. Amongst its services of special interest are the border surveillance to support the European Border Surveillance System (EUROSUR/FRONTEX) and the maritime surveillance service domain, supporting European Maritime Safety Agency’s (EMSA).

5.2.3. Space situational awareness

The objective of the Space Situational Awareness (SSA) programme is to support the European independent utilisation of, and access to, space for research or services, through the provision of timely and quality data, information, services and knowledge regarding the space environment, the threats and the sustainable exploitation of the outer space surrounding our planet Earth.[7] This objective is carried out by member states’s ground RADARs.

5.2.4. Satellite communications

Satellite communication is a key need for every European military actors involved in the conduct of national and CSDP operations. To address this requirement, EU decided to build a series of Governmental Satellite Communications (GOVSATCOM) through close cooperation between the Member States, the European Commission, the European Space Agency (ESA) and the European External Action Service (EEAS).

6. CONCLUSION

Space is a classic “force multiplier” which can support strategic decision making, operational planning and the preparation for the execution of EU missions and operations. EU and its Member

States should have their focus towards the exploitation of space for military purposes for the further serving of EU's interests.

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HANDLING BURNOUT: A STUDY REGARDING THE INFLUENCE OF JOB STRESSORS OVER MILITARY AND CIVILIAN PERSONNEL

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Abstract: Burnout is a popular phenomenon primarily involving employees who spend most of their time at work interacting with people and trying to solve their problems (Greenglass, E., & Burke, R. 1990). It is likely to set in when people are also affected by other symptoms of stress, like depression and anxiety, or when environmental pressures arise. This multidimensional concept has been defined as a psychological syndrome that occurs as a response to chronic emotional and interpersonal stressors on the job that appear when coping with a difficult work situation. The three core dimensions of burnout are emotional exhaustion, depersonalization and low personal accomplishments (C. Maslach, M.P. Leiter, 2016). It has been proved that organizational factors such as the lack of personal rewards, extra-work, lack of support, excessive demands can have a big impact on burnout occurrence (Cherniss, 1980). The purpose of the present study is to examine the problem of burnout in the military.

Keywords: stressors; exhaustion; depersonalization; syndrome

1. INTRODUCTION

Burnout has been studied in the workplace since the 1970s, especially in service industries. The term ‘burnout’ has been defined in many ways. According to Paine WS. (1982), burnout is a “commonly employed set of maladaptive coping reactions to high and continuing levels of perceived job stress and personal frustration”. An alternative definition is that burnout is a “syndrome of emotional exhaustion, depersonalization and reduced personal accomplishment that can occur among individuals who do “people work” of some kind”(Maslach C, 2003). It can be considered as a type of job stress because it arises from the interaction between the one providing the service and the receiver.

Individuals who are burned out start from being full of energy and willing to give their best in order to fulfill their job obligations. But they give so much of themselves that their batteries become drained, and they become exhausted, both emotionally and physically. They start to feel unhappy about their work, incapable to give anything of themselves to other people. Their emotional energy starts to decrease and their involvement with the problems of their clients is also reduced. This is called emotional exhaustion, the first dimension of burnout, which is the first response to the stress of job demands.

When emotional exhaustion sets in, people usually tend to reduce their involvement with

others. They minimize their contact with other people and respond to their needs in a strictly intellectual manner, using a minimum of their resources. Just like a computer that gives the right answer, they avoid getting emotionally involved with the person and trying to find out their real needs.

The second dimensions of the burnout is a process called depersonalization, which is an extremely negative attitude toward patients and co-workers. In the military, this is a major threat to the group cohesion, which is a vital aspect of the combat troops. Burned-out individuals often develop inappropriate behavior, forgetting about manners with their clients, treating them without respect and failing to provide a good response to their problems.

This dehumanized response for the stress might turn into a feeling of guilt about themselves, about the way they mistreated others, and they end up transferring all that negative energy that they spread to themselves. In the military, this might lead to a lack of self-esteem, which can reduce the effectiveness of the soldiers in combat and even a mental breakdown.

After this, the third aspect of burnout arises: the feeling of reduced personal accomplishment. Individuals tend to believe that their productivity is constantly decreasing and that they are not capable anymore to meet their job demands. They start to think that their work is worthless and is not as good as expected by them or by others, that can

drive them to failure. In fact, their perception is probably to become reality. According to Maslach C, Jackson SE.(1981), burned-out individuals are willing to take more breaks during their work and to absent more often.

2. GENERAL DESCRIPTION OF BURNOUT

2.1 Who VS what causes burnout?

We might think that people are responsible for their burnout. In fact, the environment in which they work plays a crucial role when it comes to this problem. The imbalance between demands and resources and between the nature of the job and the nature of the individual worker are signs that the job does not support the human side of the worker. But instead of focusing on the question „Who causes it?“ one should try to find out „What causes it?“. Rather than trying to find the mistakes made by the individuals, we have to analyze the situations that expose workers to burnout. Individuals have to respect the limitations of their job, consisting of rules or protocols, and that might be a serious impediment for task execution. By identifying the components of those bad situations, it becomes easier to identify the mismatches between the nature of the workplace and the nature of the individual worker.

2.2 Self-condemnation

Individuals tend to think that they are responsible for burnout occurrence. The feeling that they are not good enough or they are incompetent to handle all the tasks sets in and start using drugs to calm down. According to a study, burned-out people consume more nicotine and alcohol, and also their eating habits are badly influenced. (Grunberg NE, Baum A., 1985).

First of all, this syndrome appears to be caused by everyday stress, usually to individuals who work with other people and try to solve their problems daily. As the emotional pressure and the stress start to increase, caregivers might have problems while dealing with people, usually blaming themselves for all the problems. They think that if they managed the stress at the beginning of the job but now they can't, it's their fault. While attributing burnout to themselves, they try to hide their feelings from others and try to deal alone with them. The fear that others will judge their weaknesses makes them pretend that everything is fine, so co-workers won't have a bad opinion of them.

2.3 Putting the blame on others

Individuals don't always blame themselves for burnout. The fault might be also attributed to other people. Once we established that people around us are the reason behind our problems, it's easier to treat them badly in order to give them what they deserve. The other people are the ones who make mistakes and it's their fault for not correcting them.

In this case, the situational cause is again responsible for this problem. Blaming the victim is likely to occur when the real causes of the victim's problem are not clearly identifiable. For instance, the explanation for a family's economic condition can be the political structure of the society, that isn't respecting their rights

2.4 Burnout vs chronic combat stress

Chronic combat stress is a military stress reaction, accompanied by physiological hyperarousal, which is a symptom of posttraumatic stress disorder (PTSD), a chronic reaction to combat or another traumatic event. Burnout is comparable to the chronic combat stress reaction in this it's a state of hyperarousal that happens as a result of chronic exposure to stressors. The signs and symptoms of both syndromes are similar. Manifestations of chronic combat reaction are depression, paranoia, low social interaction, sleep disorders, weight loss, and abuse of alcohol and medicines. Burnout and chronic combat stress reaction differ in terms of the intensity of the stressors. The stress caused by combat engagement is much more intense than the one caused by the problems at the workplace.

2.5 Burnout as a self-perpetuating cycle

A theory suggests that burnout begins when a person increases the time spent at the workplace in order to impress co-workers, despite the fact that the job is unsatisfying for him. As the time spent at work starts to increase, more energy starts to drain from the individual. In the same time, the efficiency of the worker becomes less, and the reaction is to work more and more, which further increases exposure to energy draining. This process is likely to result in burnout unless the individual takes time away to recover. (Homer JB., 1985). This theory is based on Selye's description of the stress response (1946), in which extended exposure to stressors leads to the reduction of emotional resources, and finally to physical and mental exhaustion. □

According to some investigators, the process of burnout develops in stages. Golembiewski and Munzenrider defined eight stages of burnout, in

which depersonalization and a lack of a feeling of personal accomplishment developing in the first years, and emotional exhaustion occurring in the later stages.

3. OCUPATIONAL CHARACTERISTICS OF BURNOUT

3.1 Overload

Burnout is generally caused by working too hard for a longer period of time than one can handle. DePaepe J, French R and Lavay B. proved that teachers who have a bigger number of students are more exposed to burnout and emotional exhaustion in particular.

A study conducted by Wilcox VL, Garrigan J and Manning FJ. found that work overload has a different result on trainees compared to NCOs. Among trainees, the more hours they worked per day, the greater chance to increase emotional exhaustion. For NCOs, more hours worked per day indicated a greater feeling of personal accomplishment. But still, they reported emotional exhaustion due to insufficient time off. □

The explanation is that NCOs perceive their tasks as meaningful but trainees don't. Military leaders view the time spent by their subordinates as an indicator of the efficiency of their soldiers in combat, but trainees might consider long hours of training as meaningless, which increases the risk of burnout occurrence. To avoid that, leaders have to manage the subordinate's time efficient and to plan all activities and missions properly.

Maslach suggests that burnout occurs if the caregiver works for a long period of time in direct contact with patients, especially with those with difficult problems. It may not be just the amount of time spent with them, but the discontentment of the individual with the nature of the contact with clients or patients.

Kahn R. suggests that in addition to the direct contact with people, overload involving the responsibility of the safety and welfare of them may contribute to adverse health effects and burnout (for example, among ATC's).

3.2 Ambiguity of job tasks

Also known as "role ambiguity", this job-related factor appears when an individual is confused about his responsibility at the workplace. The person doesn't know the role expectation of the job and what are the rights associated with it, or how superiors evaluate work performance. This ambiguity can cause job discontentment, physical exhaustion, or even motivate employees to leave. Burnout can be avoided if the organization makes

sure that all workers know the rules and what superiors expect from them and what should they expect from the workplace. (Savicki V, Cooley A., 1987).

For example, in the US military, ambiguity may occur when the job description includes expressions like "other duties as assigned", causing confusion among soldiers. (Victoria L. Wilcox).

3.2 Role conflict

This occupational factor occurs when the individual is not able to fulfill the obligations of two or more roles at the job. For example, military leaders are in charge of completing mission tasks and ensuring the safety of their subordinates. Also, military medical staff may have difficulties trying to become adapted to both providing healthcare and obeying orders as military personnel. In comparison with civilians, military medical personnel who are in a combat situation don't treat the most severely injured persons, but the ones who still have a chance to recover and get back on the battlefield.

Role conflict is also when the organization doesn't provide the appropriate resources or sufficient funds, and they are still expected to complete the given tasks. Not only the lack of administrative support but lack of proper training can be an impediment for individuals at the workplace. □

The organization has to provide enough time for the workers to perform their family responsibilities. Wolfgang AP revealed that civilian medical personnel tends to complain that home duties often interfere with job responsibilities (1988).

3.3 Lack of control over the job responsibilities

Lack of job control is a sign that the worker and his responsibilities at work are mismatched. The caregivers want the chance to think and to use their ability to find a solution for problems. They want to decide what choices to make to meet their job demands, to be accountable but not constraint by their superiors or the organization's policies.

Rigid policies reduce people's chance to improve and make them feel they have no control over the outcome of their work. Mechanical management and close monitoring of the personnel leads to the mechanical performance of staff members and doesn't give them a chance to adapt and step forward. Close monitoring is not just a waste of time and energy for the superiors but also it makes the workers feel they are not reliable and they can't do anything by themselves.

3.4 Lack of fairness

Fairness should be a characteristic of each organization that respects the staff members and wants to confirm their self-worth. If lack of fairness occurs, workers lose their motivation to work and their trust in the organization. Lack of fairness is shown usually during the evaluation process or when persons that will be promoted are chosen. Unfairness is evident in daily interactions when people get the blame for no reason, or for something they didn't do. The organization may show unfairness when load unnecessarily the working hours of staff members or don't pay them enough for their work.

In human service occupations, an employee has to receive feedback for the effectiveness of his work from his superiors but also from his patients or clients. The absence of positive feedback may demoralize workers and can affect their performance at work. (Maslach C., 1997)

4. SOCIAL FACTORS ASSOCIATED WITH BURNOUT □

This chapter will highlight the importance of matching personality traits with the demands of the job and the working environment. Because of this emphasis on the job environment, it's important to know why some people experience burnout in some situations when other people are not affected by it.

The family is being recognized as a determinant of burnout, according to Maslach and Jackson (1982) research, reporting that low marital satisfaction can be related to an individual's burnout. □

At the same time, the morale of the workers has an important role in burnout occurrence. If the morale of the workers it's high, it is much easier for them to invest time and effort for the organization's benefit. They are more likely to keep their job for a long time and to believe in the organization's principles and objectives.

Sobel (1947) claims that soldiers exposed to burnout were the most dedicated and committed in their work, were good leaders and cooperated well with their colleagues. Moreover, many of them received awards for their performance. This study suggests that military personnel who work hard and give their best in order to accomplish all their tasks are vulnerable to burnout.

Despite this fact, another research shows that commitment can mitigate burnout and improves the ability to manage a stressful situation.

(Cherniss C, Krantz DL, 1983). Taken together, these results indicate that there is an optimal level of commitment that can increase burnout awareness depending on the personality of each individual.

Overall, commitment and high morale are not sufficient to prevent burnout if the person is not supported or is being frustrated by the work environment.

Cohesion is another important factor that increases susceptibility to burnout. In a cohesive environment, all members provide social support for each other. Co-workers can give information and instructions that help in the performance of a task or job demand and eliminate the possibility of role ambiguity. In a cohesive group, people assist each other in order to accomplish their common objectives and to mitigate work overload. Furthermore, co-workers emotionally support each other to decrease the impact of job stressors and provide feedback regarding one's performance in order to create a chance of improving job efficiency.

Increased resistance to burnout is based on the friendship and support between colleagues, the encouragement to get over their bad situations and good cooperation to solve problems or difficulties while executing tasks.

Leadership qualities are very important factors for creating a stimulating atmosphere for all persons in the workplace. Leaders that take care of the welfare of their subordinates don't use their authority to keep them under control but they rely on their capacity of accomplishing job demands.

Authoritarian leaders keep the pressure on their subordinates and control them in a way that creates low morale among them and decreases their efficiency during work. Leaders who appear more approachable and seem more open to discussing work-related issues, respect their subordinates and maintain permanent two-way communication is more likely to reduce burnout in the organization.

A study of nurses at a military medical facility revealed that those who were used to discuss to their superiors when faced with occupational stressors had a relatively low chance to develop emotional exhaustion. The result suggests that those who are high in the structure of an organization may help subordinates to handle their job responsibilities, to cope with a stressful situation, to care about their welfare, thus keeping burnout to a minimum. □

5. IDENTIFYING AND MITIGATING BURNOUT

The best way to avoid burnout syndrome is to be aware of the possibility to occur and to know what symptoms can lead to it.

Because superiors in the military are responsible for the welfare of their subordinates, they must know how to identify burnout symptoms among their subordinates and how to decrease them.

One instrument that has been created to assess burnout is the Maslach Burnout Inventory (MBI), which consists of items that provide frequency scores for identifying emotional exhaustion, depersonalization and personal accomplishment of human service providers. MBI was modified to be appropriate for use with more types of workers.

Another questionnaire devised for assessing burnout is the Tedium Scale, consisting of 21 items that identify physical, emotional and mental exhaustion. This questionnaire is easier to interpret but gives fewer data about burnout syndromes. □

Burnout is the result of work in an unpleasant and unsupportive environment. To cope with this syndrome, an individual should focus the energy on reducing workplace stress factors.

In order to reduce burnout, workers have to adopt healthy behaviours to be in good physical and mental health. For example, it's important to maintain a proper diet, reducing caffeine or alcohol consumption, to sleep enough and to be physically active. □

Because individuals can estimate if a situation will be stressful or not, military leaders should explain their subordinates how favourable will be the execution of a stressful task for successfully completing the mission. Putting stressful tasks into a relevant context can motivate individuals to give their best and to minimize burnout occurrence.

Burnout can be reduced among soldiers during training in which they are learned how to cope with stressful situations. Besides training in combat conditions, soldiers have to be prepared to manage peacetime stressors. They must be trained to resolve conflicts with colleagues or superiors, to improve communication between them and to make effective decisions during stressful situations. □

The social support can reduce the effect of stressful situations. Military leaders can provide clear tasks to their subordinates to reduce role ambiguity by communicating regulations and goals and can make sure that their tasks are meaningful and achievable to the subordinates. □

Sometimes military personnel work more than usual during a mission. They should receive time off so they can maintain an optimal level of energy for coping with the next stressful events that will occur. It is not possible to work longer and to be always productive, so extra work should be reduced.

Another way to avoid burnout is to minimize the negative conditions not by reducing them, but by focusing on positive events. Employees who receive positive feedback and rewards for their job performance are less likely to be exposed to burnout. (Chappel NL, Novack M., 1992)

6. CONCLUSIONS & ACKNOWLEDGMENT

Both social and occupational stress can cause burnout. Individuals are more exposed to burnout in an unsupportive environment, without the possibility to control or predict stressful events. Burnout in the military may negatively influence group cohesion and the mental and physical condition of the soldiers, and can be a threat to the outcome of the mission during combat but also in peacetime. Military leaders are responsible for creating a pleasant work environment based on permanent two-way communication, respect, and support. Subordinates have to receive not only clear information about their tasks but also a clear explanation for the purpose of the mission and why are their sacrifices so valuable for its outcome. The abilities developed during training must prepare them for making a decision by themselves during a stressful situation, minimizing burnout occurrence. □

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THE HUMAN MIND - THE ULTIMATE ENEMY OF THE FINANCIAL INVESTORS

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Abstract: *The financial markets have become increasingly popular during the last decades, not only for the fact that economics is such a discussed subject nowadays, but because it is now easier than ever to start diving into the sea of financial opportunities. From trading CFDs, binary options and stocks to trading currencies on the foreign exchange market, there is a place for each and every trader/investor to get to know how the money flows in the 21st century and to get to experience the largest market ever in motion. Whether the retail trader happens to find himself struggling with consistent profits on the stock, foreign exchange, commodity or indices market, we can start an entire discussion around the reason(s) why that is still a problem for such a large percentage of individuals. From having a "get-rich-quick" mentality to over-leveraging and risking more than the trader could lose, this vast area of issues is to be discussed in the following pages.*

Keywords: *financial; trader; market; investing*

1. THE MAIN FINANCIAL MARKETS

The financial market is a broad term describing any marketplace where trading of securities including equities, bonds, currencies and derivatives occur. Some financial markets are small with little activity, while some financial markets, like the New York Stock Exchange (NYSE) trade trillions of dollars of securities daily.

The term "stock market" often refers to one of the major stock market indexes, such as the Dow Jones Industrial Average or the S&P 500. Because it's hard to track every single stock, these indexes include a section of the stock market and their performance is viewed as representative of the entire market.

The term "forex" stands for foreign exchange and refers to the buying or selling of one currency in exchange for another. It's the most heavily traded market in the world because people, businesses, and countries all participate in it, and also because about 5 trillion dollars are part of its flow daily. On any occasion that you happen to exchange and convert your country's currency for another currency, you're participating in the global foreign exchange market. As long as the market's open and active, the demand for a certain currency will either push it up or down in value relative to other currencies.

I would like to focus mainly on the foreign exchange market, because this is my preference when it comes to trading and since it's the most traded market, I could offer a larger variety of examples.

2. WHY AND HOW DOES ONE GET TO TRADE/INVEST?

There are many reasons and purposes behind an individual's motivation to trade in any given market. However, for the purposes of this illustration, we don't have to know all the underlying reasons that compel any individual trader to act because ultimately they all boil down to one ultimate goal: to make money. We know this because there are only two things a trader can do: buy and sell, and there are only two possible outcomes for every trade: profit or loss (null profits still count as profits).

In order to be able to invest in the financial markets (trade), an individual must be at least 18 years old and register himself through one of the available brokers which is going to provide the necessary environment suitable for the specific type of market he/she chooses. This is the only way through which anyone can gain access to the wide variety of investing opportunities and markets. Unlike the previous century, or at least

the previous two-three decades, traders have no longer the need to call their brokers to take a position. Instead, a lot of professional systems have been developed, and now all that is needed to begin trading is either a cellphone or a laptop, provided that they are connected to the internet.

3. THE DIFFERENT TYPES OF TRADING AND TRADERS

3.1 The primary types of trading

First of all, there are a lot of ways in which a trader can start developing strategies and schemes for tackling the charts and phases of the various markets. The main methods through which a market can be analyzed are: technical analysis and fundamental analysis.

Technical analysts are traders who base their strategies on charts and diagrams which provide a historical view of the market's momentum and sentiment. Technical analysis also provides a series of indicators which, when applied correctly, can give additional insights to different aspects of the current market situation.

Fundamental analysts are traders/investors who base their speculations on the economic events that are taking place around the world, such as BREXIT, the Federal Open Market Committee meeting, the Non-Farm Payrolls or any other event that could have an influence on the volatility of the value of a specific currency, stock, commodity etc.

3.2 The primary types of traders

When it comes to the types of traders that are to be encountered between the ticks of the everyday charts, there could be as many examples as personality types and temperaments owned by each and every person here, on Earth. Since there are so many people on this planet and thus so many trading styles, the most widely used category for matching up the main examples would be that which is based on the duration of the trades taken by the respective trader. So we can distinguish between:

a. Scalpers – scalpers are traders who only hold their positions for a couple of seconds/minutes at a time, taking several positions throughout the day/night. This is an aggressive type of trading and it usually involves a high percentage of risk.

b. Day traders – these type of traders like to keep their positions running through the day, usually closing them before the beginning of the next trading day.

c. Swing traders – there are two ways in which a swing trader can be described: either a person who only trades highs and lows of ranging markets, or a trader who keeps his positions running for longer than a day, usually for a couple of days, up to a week.

d. Position traders – position traders are usually fundamental traders who like to keep a position alive for weeks, months, or even years at a time. This type of trading usually evolves to investing, given the amount of time required for the position to transform into a profit or a loss.

e. Hybrid traders – as the name may suggest, a hybrid trader is neither a scalper or a swinger, it is a person who trades based on the current market conditions, being easily adaptable to any type of change that may spontaneously occur. In my opinion, any type of trader who can now fit himself into one of the first four categories has also been stepping into this one through his journey, and this is completely fine, because it helps in choosing a preferred style based on one's personality. The most important issue with the trading style one chooses to follow is that it does not fit his/her personality.

4. THE MAJORITY LOSES MONEY

The most popular saying that runs in this business is that 95% of the retail traders lose money. Is it really 95%? Are the financial markets such a complicated and impossible-to-understand domain that only 5% of the involved individuals stay consistent in profits? Considering that the majority of brokers usually share the percentage of their customers that consistently lose money while trading through their platforms, I looked up a couple of them to see if I can get around to that 95% somehow. Here is what I found:

OANDA – 77% of retail investor accounts lose money when trading CFDs with this provider.

FOREX.COM - 74% of retail investor accounts lose money when trading CFDs with this provider.

XTB - 79% of retail investor accounts lose money when trading CFDs with this provider.

Plus500 - 80.6% of retail investor accounts lose money when trading CFDs with this provider.

City Index - 73% of retail investor accounts lose money when trading CFDs with this provider.

Out of this statistics, I found out that 76.72% of retail traders lose money while using these brokers' services. Not even close to that 95% I mentioned earlier, but it's still the problem of the

majority. So why do so many people struggle to stay consistent in this financial business?

5. THE MARKET IS DRIVEN BY EMOTIONS



The emotional response of disaster



Example of the diagram in the forex market

This examples can be found all over the charts, doesn't matter if it's the Euro, Dollar, TESLA, or the Crude Oil. The markets are driven by emotion and not just economic factors. In fact, the economy only plays its role temporarily and at specific times. This is the main reason why it is so hard to beat the odds; because it's human versus human on a battlefield operated by machines and probabilities.

6. THE PSYCHOLOGICAL BARRIERS OF RETAIL TRADERS

When it comes to reasons why most traders fail at keeping consistent profits or keeping their accounts on "the green", the first ones that come to anyone's mind tend to be those attached to the technical side of the problem, like the strategy, the market conditions, the broker etc. But in reality, they only mean a little for the overall aspect. I am not trying to pretend that the way the mind acts is more important than what we actually do in the markets, because I know just how important it is to develop a winning strategy, but I doubt it is going

to do anything without a winning mindset. So what is it that blocks a trader's mind and keeps him from developing the required mindset? Let's take a look at the most widespread issues every investor faces at least once in his career.

6.1 The gambling approach: A gambler is a person who gives their money away to the hands of luck/chance. Speculation and gambling are two different actions used to increase wealth. However, the two are very different in the world of investing. Gambling refers to wagering money in an event that has an uncertain outcome in hopes of winning more money, whereas speculation involves taking a calculated risk in an uncertain outcome. The fact that people cannot distinguish between these two concepts makes it very hard for them to adopt the right mindset which would allow them to profit from doing so. The main difference between the two mindsets is that for the speculative domain, there are more issues to take in consideration, like the fact that a speculation must be made based on a scientific approach, whereas in cases of gambling activities, there is usually no scientific approach that could predict the outcome. So entering the financial domain with the same attitude that one adopts when entering a casino may, most likely, lead to failure.

6.2 The greed: Possibly the most damaging issue of this entire problem, greed leads to the most disastrous trading stories ever. It could be an entire discussion around why greed leads to empty accounts, and even though it seems quite logical why a negative emotion related to money could lead to money problems, I want to adapt the issue particularly for this aspect. Let's take a beginner trader for example: he's just opened his account and starts trading with no former experience whatsoever. He starts taking his first trades and everything seems to work good. But then beginner's luck gets to an end. Losing trades start appearing. He lets the losing trades run in hope that they will turn around in his favor, but they never do. He closes the winning trades fast, because he wants to take everything that he can from the market before the market could take away anything from him. The deposit value starts decreasing and soon he finds himself in the need to refund the account. And so the cycle of doom starts, and as long as he does not change his feelings towards the market, he will continue staying in the middle of it.

6.3 The opinions/influences: Lots of people find it hard to start trading or investing in the financial markets. And while it is quite so, a considerable percentage of these people start

applying a rather easier method to earn money: profit from the innocence and misinformation of newbie traders. It is amazingly easy to create a demo account with a broker, start with a 50.000\$ deposit, make 3-5 winning trades and then brag all over the place. All you need is the “right” technique. So naturally, when you see the potential of this market, you really want to start investing right away so your account can start growing already. Fastest way to grow the account? A mentor. Fastest way to find a mentor? You can literally find a mentor even if you don’t want one. But finding one that really does want to help you... that is the hard part. I have been a victim of multiple scams myself. Many people found my name through community chats, because I like sharing my time with likeminded people, and started offering trading services with no proof of profits whatsoever. But luckily, no one can make you buy something that you don’t want to. The worst part about the fact that this business is such a popular and demanding one is the fact that anybody can have an opinion. Anyone can post their analysis online. Anyone can sell a course on financial investing. And the problem is that some people really know how to sell these types of courses. A retail trader can be easily tempted to buy a course just because the author said it made him millions of dollars. The wisest thing to do in this case is nothing at all. Nothing but just trying out different approaches and see which best fits your personality. In the long run, listening to other people will, most likely, lead to unsatisfying results, because one does not know why they started trading like “this” or why they started thinking like “that”, and so personal experience becomes the best teacher.

6.4 The absence of patience: The most important part of becoming successful in something, either if it’s a skill or an uncommon ability, is starting. Starting to practice it, to read about it, to develop the proper mindset that would lead to it being easier done every time. Everything that we now know how to do has had a beginning, a starting point. A point where we first tried it. Let’s take for example walking. When we start to walk, we don’t know that this is probably the most basic ability that every human needs to have. We simply do it because we feel obligated by our nature to do so and because our parents guide our evolution towards walking, and not crawling anymore. But has a toddler ever asked himself while stumbling “maybe this is not for me?”; “maybe I should keep crawling?”. Absolutely not.

Toddlers don’t know how much it’s going to take for them to start walking or if they will ever get the hang of it, but they do it because it’s fun and don’t have that failure mentality that we, adults, have. Trading encompasses a large set of skills. From mathematical capabilities to the power of observing and analyzing, there are a lot of areas which need development in order to succeed in the financial business. The journey takes different time spans for all of us, because we are all different ourselves. For some of us it may take years, for others just months. But eventually, in the long run, what matters most is that we never gave up. I believe that perseverance beats talent any day. And I cannot define the concept of “talent” in this domain. I only believe in perseverance, hard work and patience. Those who are not willing to put time and effort into developing certain skills related to the success in trading are doomed to fail.

6.5 Not having an edge in the markets: A trader can have it all: the risk management, the strategy, the nerves, the money etc. but if he does not possess the right edge over the house that he needs to keep himself in the game, it’s all going to be in vain. So what is an edge? A basic explanation of the edge would be: a formula that, applied over time, will provide positive results/will have a positive expectancy, generating money in the long run. For example, the trader’s built a mental framework that allows him to recognize a set of variables in the markets behavior that indicates when an opportunity to buy or sell is present. This is his edge and something he knows.

7. CONCLUSIONS & ACKNOWLEDGEMENT

I believe that trading is one of the hardest skills to master in the real world. It involves everything thrilling and exciting, it pays the bills (at least to say), it can lead you to glory or it can destroy your everything, but only if you’re willing to put in the effort, or you let it do so. As a retail trader myself, I can honestly say that everything I wrote here that’s not been inspired by any source has been adapted from my own experience and tested on my own mind and will be updated with every trade I may take. The ones that take this journey have a long way to go and, sadly, a trader’s path is mostly a lonely one. I came to the conclusion that only a handful of people are really glad to help others succeed. The rest of them either don’t care enough, or have switched sides with the “easy money” makers. I have been blessed with likeminded friends that are as aspiring as I am, so if I ever get discouraged, I get back on track as soon as

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THE RELATIONSHIP BETWEEN JOB SATISFACTION AND THE BIG FIVE DIMENSIONS OF PERSONALITY

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Abstract: *In this research, you will find about the link between job satisfaction, which is the employee's level of positive effect, cognitive and behavioral components towards his job, and the Big Five personality traits. The objectives are the correlation between the five personality traits and work satisfaction and if there is a difference between the five traits and the police specialization.*

The tests were applied on 60 policemen, from Braila, the lot being divided equally into borderline policemen and criminal police officers. The hypotheses have been confirmed, with the "openness" personality trait being the most significant in both cases.

Keywords (max.5): *community; intercultural context; communication*

1. INTRODUCTION

Job satisfaction is typically defined as an employee's level of positive effect on his job or job situation (Locke,1976; Spector,1997, apud Steve M. Jex). Along with positive effect, we can add both a cognitive and behavioral component to this definition. The addition of these two components is consistent with the way social psychologists define attitudes (Zanna and Rempel,1988, apud Steve M. Jex). Job satisfaction, after all, really is an employee's attitude towards his job. The cognitive aspect of job satisfaction represents an employee's belief about his job or job situation; that is, an employee may believe that his job is interesting, stimulating, dull, or demanding-to name a few options. The behavioral component represents an employee's behavior or, more often, behavioral tendencies toward his job. An employee's level of job satisfaction may be revealed by the fact that he tries to attend work regularly, works hard, and intends to remain a member of the organization for a long period of time. (Steve M. Jex, 2008:116).

Studies of the relations between personality constructs and job satisfaction indicate personality variables influence job satisfaction. These studies have examined the relationship of job satisfaction with the Big Five dimensions of personality.

Theories on personality traits may have influenced perhaps the evolution of psychological

assessment tools. This kind of theories is based on the fundamental statement that personality can be defined as a feature structure of characteristic modes of behavior, knowledge, reaction, and feeling. According to Allport (1991), a personality trait occurs through repetition of certain behaviors in agreement with internal motivation, behaviors that are valued by themselves (intrinsic motivation) or through the benefits, they bring to the subject (extrinsic motivation).

A personality trait can be understood as "any pattern of behavior (reactions chaining), common and lasting, which occurs in a variety of situations in which the individual is put "(Chaplin, 1985).

In 1988 Goldberg introduced the term "natural categories" starting from the idea that if one attribute refers to a feature of the personality and the more importance it has, it will have more terms to his name, there will be more synonyms and subordinate terms to delimit the different facets of that attribute. In 1936, Allport and Odbert extract from the English dictionary a list of 17,953 terms that are referring to personality traits, that would be later analyzed by Cattell and reduced to only 171 words.

According to Cranny, Smith, and Stone (1992), industrial/organizational psychology is increasingly becoming aware of the fundamental significance of the concept of job satisfaction. Mounting evidence suggests that "job satisfaction is the most robust antecedent of organizational

citizenship behaviors (i.e., cooperative/altruistic employee acts aimed at accommodating each others' needs) that contribute greatly to the effective functioning of an organization" (Hoath, Schneider, & Starr, 1998, p. 338). There are many important reasons why leaders of police organizations should also be concerned with officer satisfaction. Hoath et al. (1998) provide four of those reasons:

1. Negative worker attitudes, including officers who are not satisfied, may adversely affect job performance, that is, both the quantity and quality of the law enforcement service an organization provides.

2. Negative police attitudes may adversely affect the attitudes and views the public develops about a law enforcement organization and its officers, thus undermining police community relations.

3. A police organization has a moral obligation to demonstrate concern for its employees and promote positive work-related attitudes among them.

4. Job satisfaction promotes lower stress levels and, accordingly, fewer symptoms of stress (e.g., absenteeism, burnout, and alcoholism). (p. 339)

What is the Big Five personality test?

The Big Five was discovered by Tupes and Christal (1961) by reconstituting Catell's data with sets of bipolar adjectives. The five major factors identified were extraversion, conscientiousness, emotional stability, agreeability, and openness. In 1990 Costa and McCrae add 6 facets to each of the main five to show furthermore how they define a person's behavior.

1. Extroversion - it indicates how social and outgoing a person is, this trait being marked by pronounced engagement with the external world. A person who scores high in extraversion enjoys being with people, participating in social gatherings and are full of energy, while a person low in extraversion is less outgoing and is more comfortable working by himself. The sub traits of the extraversion domain are friendliness, gregariousness, assertiveness, activity level, excitement-seeking, cheerfulness.

2. Agreeableness - a person with a high level of agreeableness is defined by being warm, friendly, and tactful with an optimistic view of human nature and get along well with others. A person who scores low on agreeableness may put their own interests above those of others and tend to be distant, unfriendly, and uncooperative. The sub traits of the agreeableness domain are trust,

morality, altruism, cooperation, modesty, sympathy.

3. Conscientiousness - represents a high level of self-discipline and how a person controls, regulates and directs his impulses. These individuals prefer to follow a plan, rather than act spontaneously, their methodic planning and perseverance usually make them highly successful in their chosen occupation. Individuals with a high level of conscientiousness are good at formulating long-range goals, and working consistently to achieve them while a person who scores low is often unprepared and unorganized. The sub traits of conscientiousness are self-efficacy, orderliness, dutifulness, achievement striving, self-discipline, cautiousness.

4. Neuroticism/ Emotional Stability - Emotional stability is the ability to remain stable, balanced and calm while at the other end of the scale, a person who is high in neuroticism experiences easily negative emotions, are very emotionally reactive and they may find it difficult to think clearly and cope with stress. The sub traits of the emotional stability trait are anxiety, anger, depression, self-consciousness, immoderation, vulnerability.

5. Openness - it indicates how open-minded, imaginative and curious a person is. Individuals with a high level of openness have a general appreciation for unusual ideas and are imaginative rather than practical. They are close-minded, literal and enjoy having a routine. Individuals with a high level of openness have a general appreciation for unusual ideas and art. Individuals who score lower in openness more closed-off, resistant to change, and analytical. The sub traits of the openness domain are imagination, artistic interests, emotionality, adventurousness, intellect, liberalism.

2. OBJECTIVES AND HYPOTHESES

This research was realized in order to find if there is a link between the Big Five personality traits and job satisfaction. The first objective is to see if there is a correlation between the five personality traits and job satisfaction in policemen and the second one is to see if there is a difference in the five personality traits between the two specializations.

3. HIPOTHESIS

Hypothesis 1: It is assumed that there is a positive correlation between the openness level of policemen and work satisfaction.

Hypothesis 2: It is assumed that there is a significant difference in the degree of openness and the specialization of policemen.

4. DESCRIPTION OF THE LOT OF PARTICIPANTS AND THE USED METHODS

I applied the tests on a group of 60 policemen, predominantly male subjects. Thirty of them being border policemen and the other thirty criminal police officers, aged between 28 and 53 and having 6 to 30 years of work experience. To gather data for the study, the research instruments that were used are the Big Five personality test and the job satisfaction scale (SP1), which measures remuneration and promotion, leadership and interpersonal relationships, organization and communication and ultimately overall satisfaction.

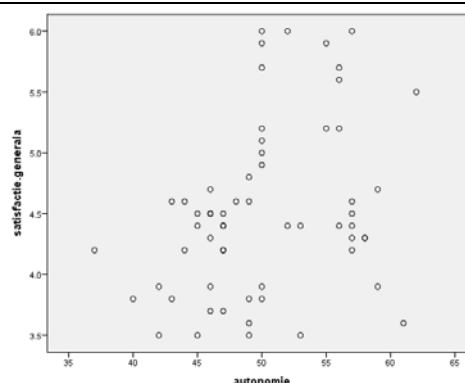
5. RESULTS AND DISCUSSIONS

1. It is assumed that there is a positive correlation between the level of openness of policemen and work satisfaction.

		autonomy	satisfaction general
autonomy	Pearson Correlation	1	.328*
	Sig. (2-tailed)		.011
	N	60	60
satisfaction general	Pearson Correlation	.328*	1
	Sig. (2-tailed)	.011	
	N	60	60

*. Correlation is significant at the 0.05 level (2-tailed).

From the correlation table analysis, we note that there is a poor positive correlation between the two variables analyzed autonomy and overall satisfaction at a significance threshold $p = 0.011$.



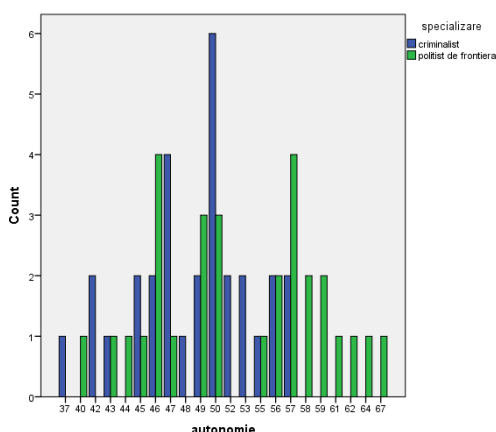
As you can see above, the hypothesis has been confirmed, which shows that there is a link between the Big Five features and work satisfaction. The feature that has had the greatest impact on work satisfaction is openness. This shows that policemen who have the freedom to express themselves and find their own ways to solve problems are happier doing their job than those who are under strict orders and procedures. This contributes to them working harder, with pleasure and being more loyal to their jobs since they are acknowledged for their own ideas and effort.

2. It is assumed that there is a significant difference in the degree of openness and the specialization of policemen.

3. Group Statistics

	Specialization	N	Mean	Std. Deviation	Std. Error Mean
autonomy	criminal police officers	30	49.03	4.781	.873
	border policemen	30	52.77	6.922	1.264

From the t test for independent samples we obtained $t = -2,431$ at a significance threshold $p = 0,018$ in the sense that border policemen (mean=52,77) have greater autonomy in the service than criminal police officers (mean=49,03) who when in work missions have more autonomy low.



The second hypothesis is also confirmed, with the borderline policemen having a higher score in openness than criminal police officers. Borderline policemen deal frequently with different types of people and have to be open-minded and creative in approaching them in order to have them cooperate. On the other way around, criminal police officers work alone both at the crime scene and in the laboratory while they analyze or reconstruct evidence following the required steps.

6. CONCLUSIONS & ACKNOWLEDGMENT

Both hypotheses have been confirmed, from the Big Five personality traits, openness being the most significant one, both in job satisfaction and in specialization difference. This might be due to the fact that criminal police officers have to follow a strict procedure when examining a crime scene, leaving no room for creativeness as they have to follow certain steps, while borderline policemen have to be creative and adapt depending on the situation and the people with whom they interact.

Job satisfaction is one of the most widely researched concepts within industrial/organizational psychology, much of which is aimed at enhancing operations within the world of business. It makes sense that employees who are satisfied with their jobs will be more motivated to perform necessary tasks, will have fewer absences, be more inclined to assist others, and more likely to commit themselves to the overall mission of the organization. In addition, a satisfied work force is a

critical component to an organization's ability to provide services both effectively and efficiently.

Similar to other professions, job characteristics within the police agency account for the overwhelming majority of variance found in job satisfaction. As with other professionals, police officers want to know they are making meaningful contributions as they carry out their duties. That is, policies, procedures, working conditions, assignments, and so forth, seem to have a more profound effect on perceptions of overall job satisfaction among officers than do carrying out actual duties and dealing with the public.

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MILITARY OPERATIONS. WHAT'S IN A NAME?

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Abstract: *Several series of military operations contain, as is natural, military secrecy, more precisely, coded names. Firstly, we will take a look at the definition of the key term: military operations. So, what is a military operation? It is a (military) state coordinated action as a response to an ongoing situation. Secondly, we will examine the process of naming them, which goes according to the purpose they served (for security reasons). Moreover, we will analyze the relationship between the names given to several operations carried out in different theaters of operations by the US Armed Forces, and their nature. Finally, we will draw several conclusions regarding the way military operations are “baptized”.*

Keywords: *military operations, US Armed Forces, Uncle Sam, codenames, war*

1. INTRODUCTION

According the dictionary, a military operation is “an activity by a military or naval force (as a maneuver or campaign); it was a joint operation of the navy and air force”. (1)

So as we found in the dictionary the definition of “military operations”, they are activity or activities made or effectuated by a military force (air, land or naval). But the big question is who has the idea for the first time for giving a name to these operations? Winston Churchill. He was a British politician, army officer and writer. He was Prime Minister of the United Kingdom from 1940 to 1945, when the UK was on the winners' part. During the World War II, British Prime Minister Winston Churchill urged military leaders to come up with valiant names for battles so no mother of a fallen soldier need say her son was killed “in an operation called ‘Bunny hug’ or ‘Ballyhoo’”. (2)

After 70 years, the US Armed Forces officials had faced a problem like the British one. They had a problem about naming the operations for the campaigns against Islamic State in Iraq and Syria and after these in Afghanistan and more. So, by the model of Winston Churchill, the Americans follow this idea and his guidelines and start naming their operations as well. (2)

The American effort was heavy but they did it. They created a computer system called NICKA which classified names. The US Armed Forces officers and officials feed it some information

about the operation and NICKA generates a name. (2)

2. WHAT'S IN A NAME?

After a long search in the US Armed Forces history, we selected a number of military operations such as:

2.1 Desert Storm

It started on the 17th of January 1991 after Iraqi Army invaded and occupied Kuwait. UN Security Council members condemned immediately with economic sanctions. The President of the USA from that time, George H.W. Bush sent US Forces in the zone. American soldiers were present at every step made in Iraq in this operation and support the others countries present there. The war in Iraq was the most powerful coalition after The Second World War. (3)

The reason why this operation was called “Desert Storm” is because the war was fought in a zone covered by dust and large lands and hot weather (desert), while the attack of the US Armed Forces actually generated a storm there.

2.2 Restore Hope

The operation started on the 6th of December 1992, when the U.S. Navy began reconnaissance operations in the proximity of the harbor and airfield for approximatively three days. On the 8th

of December 1992 the UNITAF started a psychological war by conducting leaflet drops over Mogadishu. On the 9th of December an amphibious attack took place but no counterattack has occurred. (4)

The US Armed Forces named it Restore Hope because of its humanitarian purpose: bring hope to underprivileged people in Africa's Horn.

2.3 Eagle Claw

This operation was one of the group Delta Force's first. It started on the 24th of April and finished on the next day, with a failure. It was an extraction operation ordered by US President Jimmy Carter to try to end the hostage crisis in Iran.(5)

The US Armed Forces named it Eagle Claw, because the eagle is the USA's symbol and the purpose of this operation was to extract some hostages held by the insurgents in Iran.

2.4 Praying Mantis

It was an attack on the 18th of April of the year 1988 as a retaliation after the sinking of the USS Samuel B. Roberts by an underwater mine in Persian Gulf at the end of the Iran-Iraq War.(6)

The US Armed Forces named it Praying Mantis because the mantis is a predatory insect that waits for its pray motionless with its forelegs folded like hands in prayer. Also, the adjective "praying" was chosen with reference to the Islamic practice.

2.5 Just Cause

It was an invasion from the mid of December to late January of Panama. It was ordered by US President George H.W. Bush and it had the intention of taking the control of the Panama Canal because of the bad intentions of the dictator Manuel Noriega. (7)

It was named Just Cause because the US Armed Forces had only good intentions for the world. They were fighting for a just cause.

2.6 Flaming Dart

It was an operation lead by the US and South Vietnam Army which had its origin on the 7th of February and ended on the 24th of the same month in 1965. It targeted North Vietnamese army bases and Vietcong logistics and communications near demilitarized zone. (8)

The codename came from "Flaming" because of the massive use of both fire and burning rockets, while "Dart" came from the dart's look.

2.7 Brother Sam

In 1964 took place the Brazilian coup d'état which meant a series of numerous events in Brazil from 31st of March to 1st of April that determined the Brazilian Armed Forces to take down the president with the help of the United States government. (9)

The US Armed Forces named it like this because the usual name the US goes by is Uncle Sam, but in this particular operation, the US was supposed to act in its capacity as a big brother.

2.8 Urgent Fury

The invasion of Grenada led by the United States started on the 25th of October 1983 and ended with a United States victory in only a few days.(9)

It was known as Operation Urgent Fury due to its speedy reaction and rage against the enemy.

2.9 Enduring Freedom

Operation Enduring Freedom (OEF) was the official name used for the US Government's fight with the terrorism in Afghanistan. It started on the 7th October 2001 as a response to the 09.11 attacks with President George W. Bush announcing it. On the 28th December 2014, President Barack Obama announced the end of OEF in Afghanistan by the US military forces. (11)

It is named like this because the mission that had the intention to set free Afghanistan by holding out against the threat for almost 13 years long. BEEN THERE, DONE THAT is their motto.

2.10 Neptune Spear

This operation is dedicated to the assassination of Osama Bin Laden, the leader of Al-Qaeda, the most significant terrorist formation of that time. This operation was led by SEAL TEAM SIX also known as DEVGRU. (12)

It was given the name of the ancient God of the sea because the operation was conducted by the Navy Seals and the reference to his spear was made in order to indicate the strength and precision of the attack inflicted on the enemy.

4. CONCLUSIONS & ACKNOWLEDGMENT

In conclusion, the naming of the military operations by the USAF has been chosen lately in a desire to make them more secretive and hard to decipher by the enemies.

Also, there are usually two-word names and these contain references to the operation purpose and to important concepts like freedom, hope, bravery and camaraderie.

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USING OF ARDUINO UNO DEVELOPING KIT INTO THE PROCESS OF DETERMINING THE ACCURACY AND RELIABILITY OF TEMPERATURE SENSORS

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Abstract: This essay presents some aspects referred to differences between analogic and digital temperature sensors. Based on the “Arduino UNO Starter Kit” DHT11 analogic temperature and humidity sensor and the DS18B20 digital temperature sensor, using a certain coding for each sensor, we will observe the advantages and disadvantages of them.

Keywords: sensor, temperature, humidity.

1. INTRODUCTION

This essay presents 2 available solutions of temperature and humidity sensors for the enthusiasts of DIY electronics using a standard building kit.

2. USING OF ARDUINO UNO KIT FOR DEVELOPING

2.1 Components

The Arduino UNO microcontroller board, which is based on the ATmega328P has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; you can connect it to a computer with a USB cable or power it with an AC-DC adapter and it's good to go.



Fig. 1 The Arduino UNO microcontroller board

Next, we have the 1602 LCD display. There is not actually very much to say about this module, it's a pretty basic and very commonly used in various devices and circuits. These 1602 LCD displays are the top choice for experimental devices and circuits over the seven segment displays, the main reasons for this being that they are easily programmable, they have no limitation of displaying special and even custom character, animations and so on.

The 1602 is a synonym to 16x2, which means that it can display 16 characters per line and there are 2 lines. This LCD has two registers called Command and Data.

The command register stores the command instructions sent to the LCD, and the data register stores the data to be displayed on the LCD.



Fig. 2 The 1602 (16x2) LCD display

The next component is the DS18B20 waterproof temperature sensor.

This is basically a programmable sensor which communicates using the 1-wire method. It has a temperature range from -55 to +125°C, and a unique 64-bit address which enables multiplexing.

This sensor is widely used to measure temperature in hard environments like chemical solutions, mines, soil etc. Each of the DS18B20 sensors have a unique address and requires only one pin of the MCU to transfer data, so it's a very good choice for measuring temperature at multiple points without compromising much of the digital pins on the microcontroller.



Fig. 3 The DS18B20 waterproof temperature sensor

Last, but not least, we have the DHT-11 temperature and humidity sensor.

This component can be either as a sensor or as a module. Either way, the performance of this module is absolutely the same. It has a serial data output, a temperature ranges from 0 to 50°C and a humidity range from 20 to 90%.

The sensor will come as a 4-pin package out of which only 3 of the 4 pins will be used whereas the module will come with 3 pins, as the one used in this project. The only difference between the sensor and the module will be that the module will have a filtering capacitor and pull-up resistor inbuilt, and for the sensor you'll have to use them externally if required.



Fig. 4 The DHT – 11 module

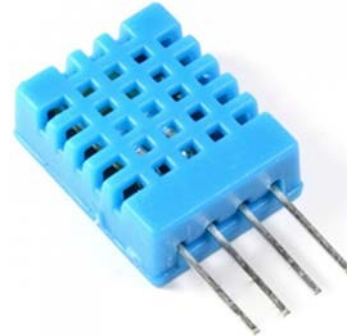


Fig. 5 The DHT – 11 sensor

2.2 Contents and schemes

For this project I have used two Arduino UNO developing modules, two MB-10 solderless breadboards, one screen 5V LCD1602 Yellow/Green Backlight, one screen 5V LCD1602 White/Blue Backlight, two Mini 10kOhm potentiometers, one 5kOhms resistor, one DS18B20 temperature sensor, one DHT11 temperature and humidity sensor and connecting wires.

For the first building up, with the DS18B20, you can see the diagram below:

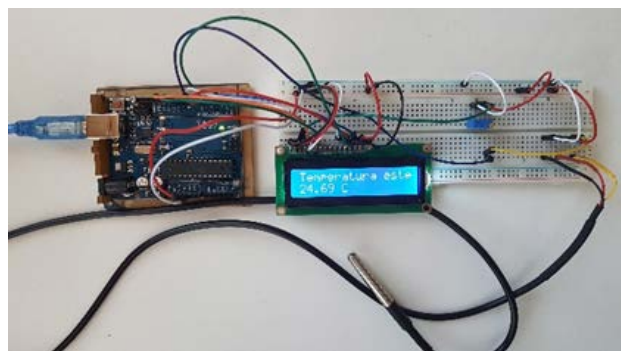


Fig. 6 Scheme for DS18B20 temperature sensor

The data is processed by the mainboard, using the code below:


```
cod_DS18B20 | Arduino 1.8.8 (Windows Store 1.8.19.0)
File Edit Sketch Tools Help
cod_DS18B20
#include<LiquidCrystal.h>
#include<OneWire.h>
#include<DallasTemperature.h>

#define ONE_WIRE_BUS 7
OneWire oneWire(ONE_WIRE_BUS);

DallasTemperature sensors(&oneWire);

float tempC = 01;

LiquidCrystal lcd(12,11,5,4,3,2);
const int inPin = 0;
void setup()
{
  sensors.begin();
  lcd.begin(16,2);
  lcd.clear();
  pinMode(3, OUTPUT);
  analogWrite(3, 0);
  Serial.begin(9600);
}
void loop()
{
  sensors.requestTemperatures();
  tempC = sensors.getTempCByIndex(0);
  delay(1000);
  Serial.println(tempC);
  lcd.setCursor(0,0);
  lcd.print("Temperatura este");
  lcd.setCursor(0,1);
  lcd.print(tempC);
  lcd.print(" C");
}
```

Fig. 7 Programming code for DS18B20 temperature sensor

You can observe on the above photo that we have the Arduino UNO board on the left which is connected to the breadboard on the right on which are placed the LCD display, the 10k potentiometer to set the contrast of the display, the temperature sensor and a 5k resistor put between the data pin connected to the digital input of the board and “+” pin of the sensor.

This build-up proves itself as being very versatile due to the high measuring range of the sensor (-55°C to +125°C) and the ~40cm length wire which allows you not only to measure the inside and outside temperature, but also to measure the temperature in certain closed environments, such as measuring the temperature of a hydraulic fluid from an drive system, or even watching the coolant temperature from a car’s cooling circuit.

All these “isolated” measurements can be made thanks to the fact that this sensor, the DS18B20 is WATERPROOF.

Finally, we have the build-up with the DHT11, which has the diagram below:

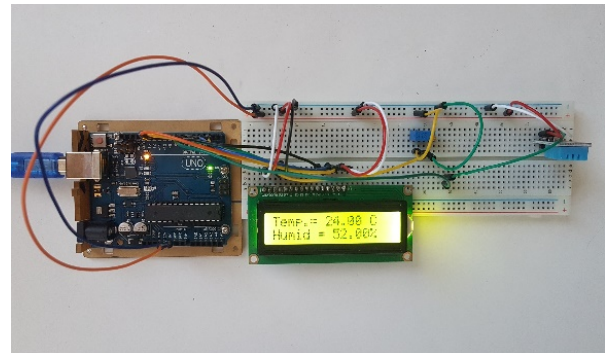


Fig. 8 Scheme for DHT11 humidity and temperature sensor

You can notice on the above photo that we have on the left, the other Arduino UNO board, and on the right, we have the breadboard on which are placed the LCD display, the 10k potentiometer for setting the contrast of the display with the temperature and humidity sensor.

Though this build proves itself to be better by the fact that it can also tell you the humidity of the environment, it’s not as versatile as you’d think.

Because the sensor is NOT WATERPROOF, it has a very small temperature range (0 to 50°C), and it can be used exclusively for in-door appliances. Its versatility is lowered even more by the fact that it’s a sensor placed on the PCB board, and even if you close your eyes at the waterproof thing, you still can’t take it out the window only if you have some wires to connect it to the breadboard, and there should be some pretty long wires to make the appliance better.

The best thing is that even if this humidity and temperature sensor is generally read on the analog interface, thanks to the numerous coding possibilities it can also be read just as accurate, or even better on the digital interface.

The data is processed by the mainboard, using the code bellow:



```

cod_DHT_bun | Arduino 1.8.8 (Windows St...
File Edit Sketch Tools Help
cod_DHT_bun
#include <dht.h>
#include <idDHT11.h>
#include <LiquidCrystal.h>

dht DHT;

#define DHT11_PIN 7

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup(){
  lcd.begin(16,2);
}

void loop()
{
  delay(3000);
  int chk = DHT.read11(DHT11_PIN);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Temp.= ");
  lcd.print(DHT.temperature);
  lcd.print(" C");
  lcd.setCursor(0,1);
  lcd.print("Humid = ");
  lcd.print(DHT.humidity);
  lcd.print("%");
}

```

Fig. 9 Programming code for DHT11 humidity and temperature sensor

2.3. Comparative analysis

Like any other appliances, unfortunately they all have their pros and cons.

Comparing the DS18B20 to the DHT11, you'll not be surprised when I say that the DHT11 is a pretty dull sensor compared to DS18B20.

The first and most important thing on this comparison is the sensor's measuring range; the DS18B20 has a range of $.01^{\circ}\text{C}$ and prints on the display from $.01$ to $.01$ if it's needed, but the DHT11 has a range of 1°C and can only print on the display from 1 to 1 degree. But maybe if we think a little bit, we can probably close our eyes on this obsolete range by the fact that the DHT11 compared to the DS18B20 can measure the humidity, and it's being incremented with an 1% step, starting from 20%.

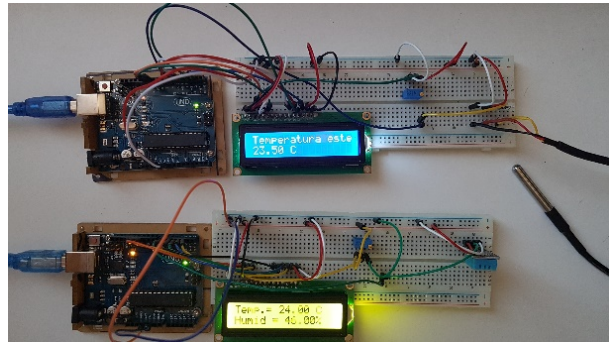


Fig. 1. The displays for sensors' accuracy demo

Given the upper facts, we can agree that the accuracy of the DS18B20 is superior to the one of the DHT11.

As it was last mentioned on the previous paragraph, the one about content and schemes, the two sensors can be equal on the data transmitting, as the DHT11 can also be coded to communicate via a digital pin of the board. This is a big and very good thing, because usually analogue data readings can be very hard to do, and if they are not made properly, they can be very mistaken.

The next thing at which the DS18B20 is better than the DHT11 is the refresh rate, which in code is translated into "delay". You can notice that the code for each sensor has a compulsory delay; for the first one it's 1000 (one second), and for the second one it's 3000 (three seconds). Why? Well, the DS18 doesn't face any difficulty in reading each second, thing that cannot be said about the DHT. I have decided to put the 3 seconds delay for the DHT because at first I put the same one second delay as the DS18 had, but it didn't work properly because with this setting, on the DHT's display the numbers would go from the real value to -999 each reading, and also the numbers would blink as fast as if it was some car with a broken turn light bulb, thing which is very disturbing.

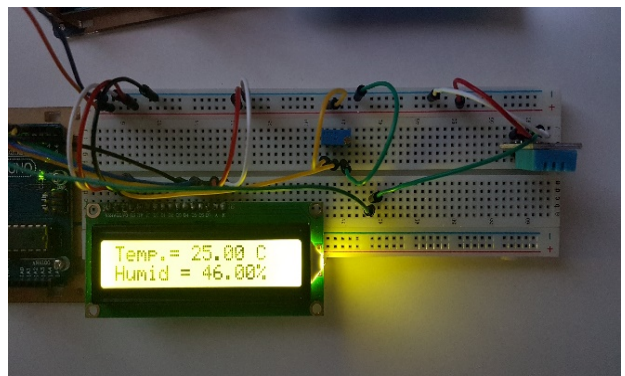


Fig. 11 The regular display behavior generated by the data read delay on DHT11

You can see below the behavior of the display for the DHT when the delay is set to 1000 (one second).

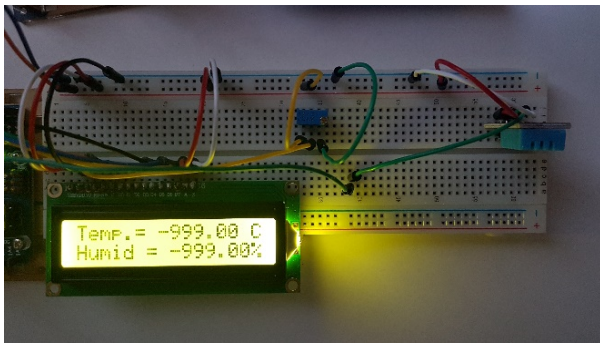


Fig. 12 The abnormal display behavior generated by a too small data read delay on DHT11

So, with proof, the display just switches from the first photo (figure 11) to the second one (figure 12) each second when the delay is 1000 on the DHT.

One of the greatest advantages of the DS18B20 is that it's a digital sensor. Maybe you're all wondering why is that the greatest advantage, and I'm telling you that because you can use as many digital sensors as you want on the Arduino board, the limit being high enough to not have any issues. Thanks to this, you can make even a weather station using the same components were used in my first build, everything that must be done is to add another identical sensor and a few more code lines to read the data from the second sensor. You can even use wireless modules and an external power source (usually a 9V battery) to transmit

wirelessly from the second sensor to the mainboard and display.

CONCLUSIONS

The main conclusion is that digital sensors are the best sensors you could use because of the multitude of sensors you can interconnect to one board and the complexity of appliances that you can code using these sensors. In other words, there are infinite possibilities.

On the other hand, we can conclude that the digital DS18B20 temperature sensor is one of the most superior sensors that you can use to determine a temperature.

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SYNOPTIC ANALYSIS OF THE LATE BLIZZARD OF APRIL 19-21, 2017. CASE STUDY

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Abstract: *This paper aims to analyze both the conditions having favoured the genesis and evolution of the blizzard that affected Romania's territory on April 19-21, 2017, and its impact on socio-economic activities in some regions of the country. Blizzard is the most representative climate risk for the eastern and southern regions of Romania in the cold season of the year. Annually, blizzard causes significant damage in the regions in which it occurs, especially when it turns to be a severe episode of early or very late blizzard. The reason for this case study is the extremely late occurrence period of this winter phenomenon. The blizzard that affected our country on April 19-21, 2017 is the most recent late blizzard recorded on large areas in the recent history of Romanian climatology. The synoptic analysis in this paper is based on satellite images and synoptic maps that define the distribution of atmospheric pressure at ground level. Essential elements that encouraged the genesis of this late blizzard could be discovered through its synoptic analysis. These could be useful to the improvement of future weather forecast of similar events, so to the reduction of risks associated with these hazardous phenomena.*

Keywords: *blizzard, Mediterranean cyclone, Romania, impact*

1. INTRODUCTION

The climate plays a dual role, both as a resource and as a risk to the geographic environment nowadays. Risk geographical phenomena result from climate change and may sometimes have disastrous consequences. The magnitude of damages of any kind are determined by numerous factors, such as: the phenomenon itself, the geographical position, the technological development of the affected society. Hazardous meteorological phenomena affect natural and human systems and regions, so they are a concern for both the Earth's sciences and the social sciences.

Blizzard is a „violent winter storm, lasting at least 3 hours, which combines freezing temperatures and very strong winds laden with blowing snow that reduces visibility to less than 1 km.” [1] During blizzard, the snow is blown above the earth surface, so its transport to the high followed by laid snow in sheltered places forms drifts that affect all transportation systems. Because of blowing snow and below freezing temperatures the agricultural crops can be uncovered, so they become exposed to winter

frosts. Moreover, blizzards can cause many material damages and even human casualties.

The southern and eastern regions of Romania represent the most exposed area for the occurrence of blizzard phenomenon. The largest annual average number of days with blizzard has been recorded in these regions due to the sewage effect caused by the orographic barrier of the Curvature Carpathians and the thermal barrier represented by the Black Sea. [2] Being a weather violent event, blizzard is the main subject of meteorological alert messages in the cold season.

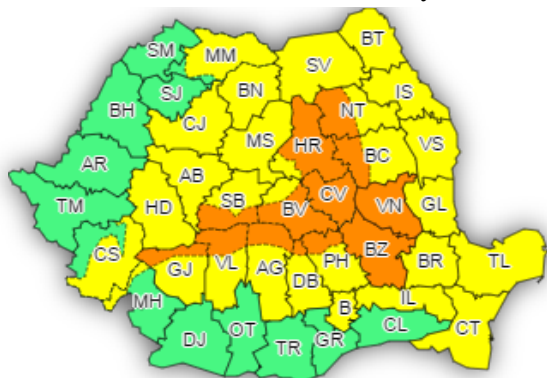
On April 19, 2017, at 14UTC, the no.39 meteorological message was issued on two periods of time (figure 2):

- April 19, 14UTC – April 20, 07UTC: *weather alert yellow code* for heavy snowfall and strong winds in the mountain regions, and on large areas in Moldova, Muntenia and Transilvania regions, in northern part of Oltenia and Dobrogea; *weather warning orange code* for heavy snowfall and wind gusts in Eastern and Southern Carpathians, and also heavy rainfall in Buzau and Vrancea counties. (figure 1)

- April 20, 07UTC – April 21, 12UTC: *weather warning yellow code* for heavy precipitations, mainly snowfall in central and

south-eastern regions of the country, strong winds and snow-layer in the mountain areas; *weather warning orange code* for snowfall, wind gusts and increase in thickness of snow-layer in the

Carpathians Mountains, and heavy snowfall in the entire region of Moldova. (figure 2) [3]



Alerted/warned areas on April 19, 2017

Figure 1. April 19, 14UTC – April 20, 07UTC

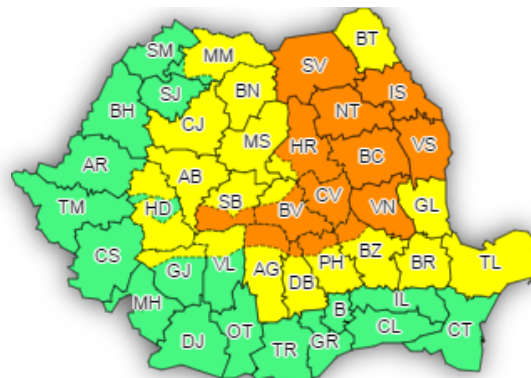


Figure 2. April 20, 07UTC – April 21, 12UTC

Caption:

- No hazardous weather phenomena predicted;
- Forecasted meteorological phenomena are common in the area, but they can become dangerous for certain activities temporarily;
- Dangerous weather phenomena of high intensity are forecasted.

On April 20, 2017, at 09UTC, the no.40 meteorological message was issued as an *update alert* on the same previous alerted areas.

•April 20, 07UTC – April 21, 12UTC: *weather warning yellow code* for heavy snowfall in Moldova, Transilvania, Dobrogea and Muntenia and wind gusts, snowfall and significant increase in thickness of snow-layer in the Carpathians; *weather alert orange code* for heavy snowfall, wind gusts and significant thickness of snow-layer in the mountains and along the Curvature Carpathians region, including Vrancea and Buzau counties. (figure 1)

On April 20, 2017, at 13UTC, the no.41 meteorological message was issued as a *weather alert update* on the same previous alerted areas.

•April 20, 13UTC – April 21, 12UTC: *weather warning yellow code* for heavy snowfall in Transilvania and in south-eastern region of Romania; *weather alert orange code* for snowfall, wind gusts and increase in thickness of snow-layer in the Carpathians Mountains, and heavy snowfall in the entire region of Moldova. (figure 2)

Both warning messages on April 20 include additional information regarding the extremely cold weather and the occurrence of hoar frost;

On April 21, 2017, the no.41 meteorological message was issued.

•April 21, 07UTC – April 21, 12UTC: the *weather warning orange code* is cancelled; *warning alert yellow code* for temporary wind gusts in eastern and south-eastern regions of the

country and in the mountains, together with snowfall increase in thickness of snow-layer. (figure 3) The message included additional information regarding the extremely cold weather in all regions, the occurrence of hoar frost and frost on the ground. [3]

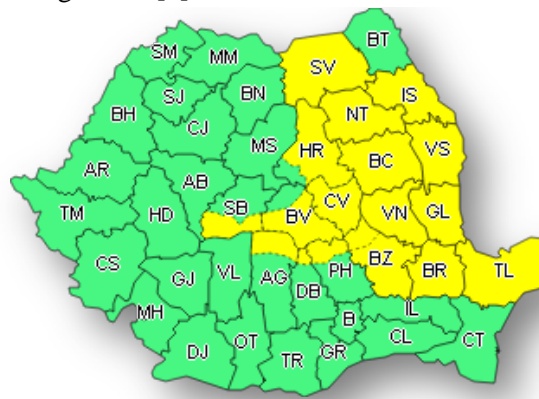


Figure 3. Alerted/warned areas on April 21, 2017

Caption:

- No hazardous weather phenomena predicted;
- Forecasted meteorological phenomena are common in the area, but they can become dangerous for certain activities temporarily;

2. SYNOPTIC-SCALE ANALYSIS

The analysis was performed using graphic materials from ECMWF and Deutscher Wetterdienst data archive. Four temporal sequences were chronologically analyzed, that surprised the evolution on synoptic scale of the

main baric centers that led to the occurrence of blizzard in the south-eastern part of Europe and, implicitly, on the territory of Romania.

2.1 Pre-blizzard stage

Synoptic conditions on April 18, 12UTC (figure 4), analyzed at European scale, describe the distribution of atmospheric pressure at ground level that is marked by the existence of two distinct baric systems: a high-pressure system extended over most of European continent, with pressure values exceeding 1020hPa and a low-pressure field, consisting of two cyclones developed over south and south-east Europe.

The first low pressure center (1010hPa) has its origins in the Gulf of Genova and it is marked by advection of air masses from low latitudes which causes a strong thermo-baric contrast. The penetrating cold air over western and central Mediterranean spurred cyclogenesis in this region.

The second cyclone (< 1005hPa), positioned in the vicinity of Romania, on the central northern shore of the Black Sea, does not affect our country, but it forms together with the other cyclone a low-pressure belt. [4]

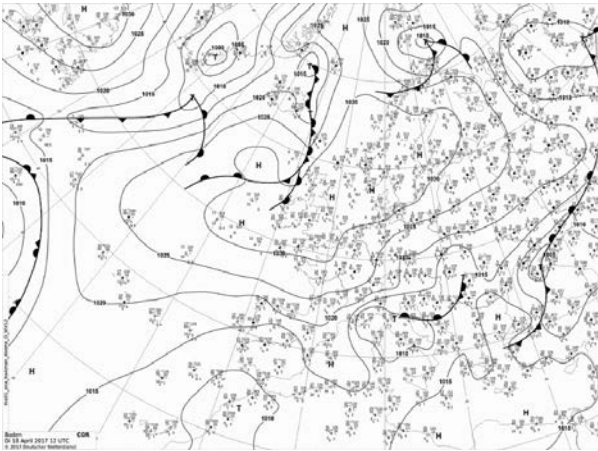


Figure 4. Analysis of atmospheric fronts at ground level (April 18, 2017, 12UTC)

2.2 The initial stage of blizzard

The Mediterranean cyclone follows its trajectory on east direction, continues to deepen, and it affects the western and south-western region of Romania while it moves to the east Europe. However, the northern part of the cyclone is still dependent on its origin core. (figure 5)

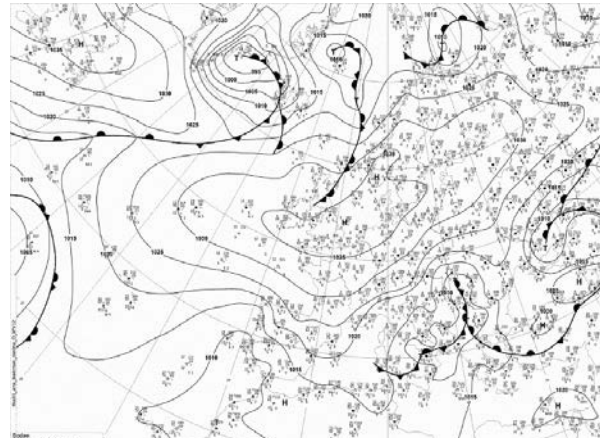


Figure 5. Analysis of atmospheric fronts at ground level (April 19, 2017, 06UTC)

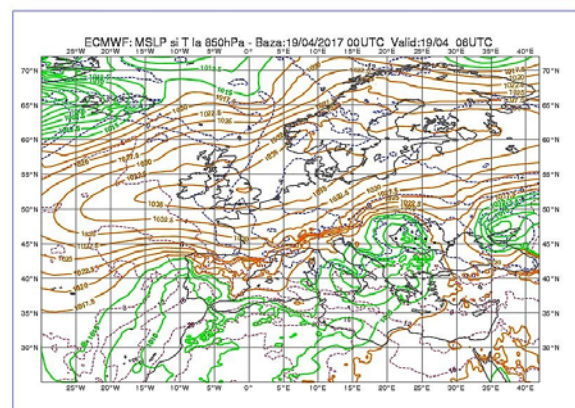


Figure 6 Pressure at ground level and temperature at 850hpa (April 19, 06 UTC)

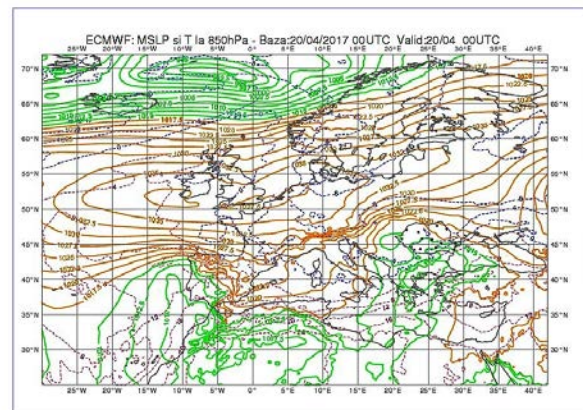


Figure 7. Pressure at ground level and temperature at 850hpa (April 20, 00 UTC)

At the same time, the anticyclone with high-pressure values above 1035hPa extends to lower latitudes and facilitates the advection of dense, cold air masses. (figure 6) Next, the Mediterranean cyclone detaches from its origin low pressure center and it starts to move on a north – north-east trajectory. (figure 7)

2.3. Occurrence of blizzard

During this stage, the pressure gradient increases on Romania's territory, varying from 10-15hPa/~ 1000 km to over 20hPa/~ 1000 km, due to both expansion of the high-pressure area over the European continent and movement of Mediterranean cyclone (1002.5hPa) toward the east. (figures 8, 9)

The south-eastern Romania represents the region where synoptic conditions describe "the coupling" continental anticyclone – Mediterranean cyclone arriving over the Black Sea.

2.4. Final stage of blizzard

In the final stage, pressure at ground level significantly increase and, at the same time, the occluded Mediterranean cyclone withdraw on a north-east trajectory. (10)

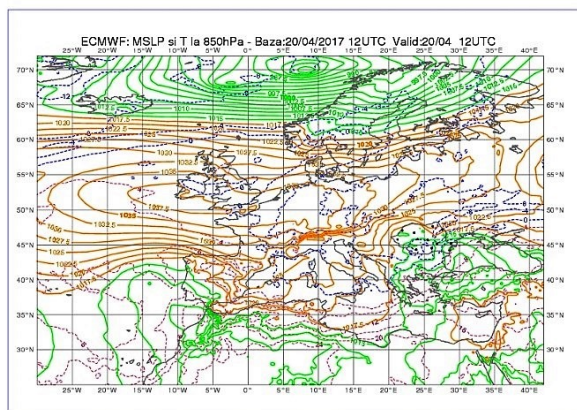


Figure 8. Pressure at ground level and temperature at 850hpa (April 20, 12 UTC)

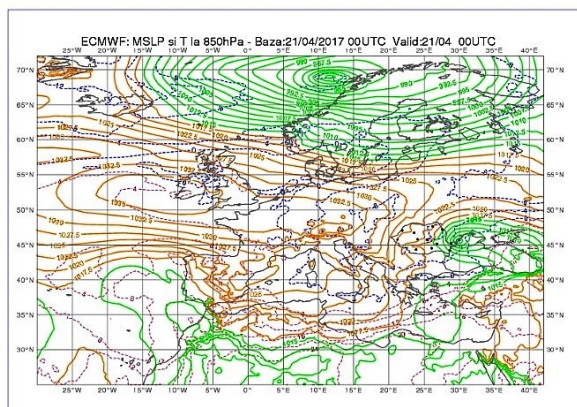


Figure 9. Pressure at ground level and temperature at 850hpa (April 21, 00 UTC)

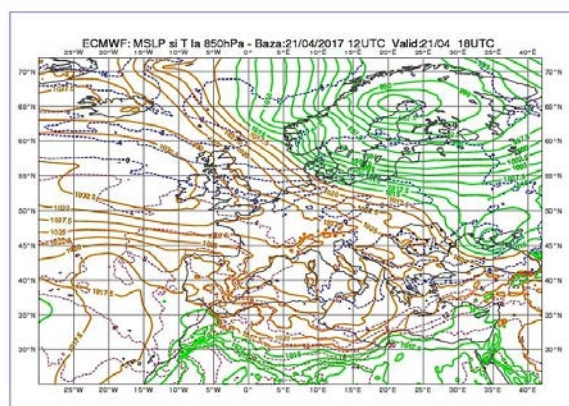


Figure 10. Pressure at ground level and temperature at 850hpa (April 21, 12 UTC)

Satellite images are used, on the one hand, in monitoring the evolution of cyclones, and on the other hand, for monitoring quick cyclogenesis and potential vorticity anomalies. Image 11 shows the penetration of the extremely cold polar air over the south-eastern Europe (shades of blue), and with red-orange shades a strong positive vorticity advection current is represented. In image 12, the extension of the cold air mass over the entire territory of Romania is shown. The extension is performed at the end of blizzard, as well as the reduction of precipitation potential.

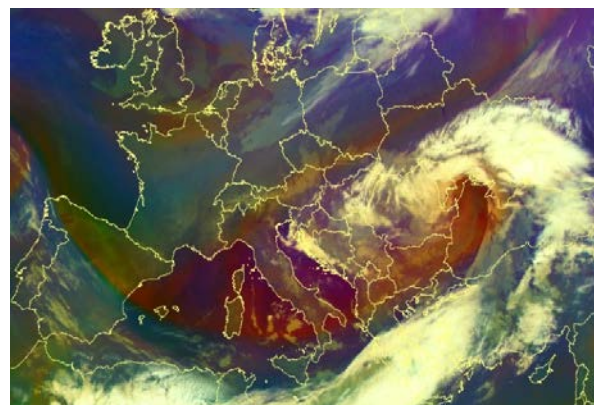


Figure 11. Satellite image EUMETSAT RGB_0018_RSS – April 21, 00 UTC

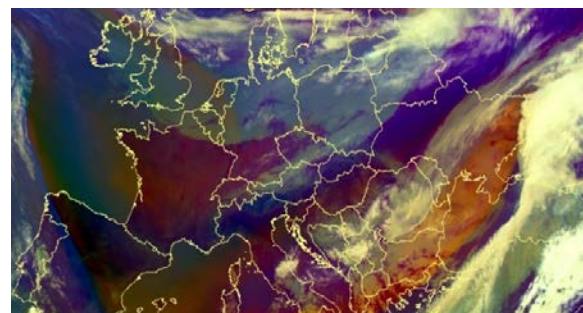


Figure 12. Satellite image EUMETSAT RGB_0018_RSS – April 21, 18 UTC

3. THE MAIN PARAMETERS CHARACTERIZING BLIZZARD

The next table shows the main "ingredients" of blizzard, such as negative temperature deviation, precipitation transformed into snowfall, strong winds. (figure 13) These parameters confirm, through the official data recorded at the meteorological stations (not only through the events and reports on the ground), the occurrence of this dangerous phenomenon, which is a real concern for the National Meteorological Administration.

Temperature:

Relative to the multiannual averages, the weather was particularly cold across the country, with negative deviations, generally higher than 10-15 degrees. On April 20 and 21, the values of temperature were extremely low, establishing negative temperature records at almost all meteorological stations in the affected area. The minimum temperatures went down to -2 degrees

on the night of April 20-21 and up to -9 degrees on the night of April 21/22. The maximum of April 20 frequently had values of 0...2 degrees.

Precipitations:

The sky was cloudy and significant amounts of precipitation occurred on extensive areas in the south-eastern region of Romania. There were records of precipitation around 20...25 l/sqm in northern region of Dobrogea and 40 l/sqm on restricted areas in Muntenia.

Wind:

During blizzard, wind intensity was mostly moderate, but strong winds and gusts occurred in eastern Romania, with a maximum wind gust speed up to 65 km/h. Because of the wind speed the snow was drifted, reaching a few meters heights in eastern and south-eastern Romania.

Snow layer: In the morning of April 21, the snow layer's depth had reached up to 17 cm in Muntenia and up to 2 cm in Dobrogea. Hoar frost was formed on isolated areas in Muntenia.

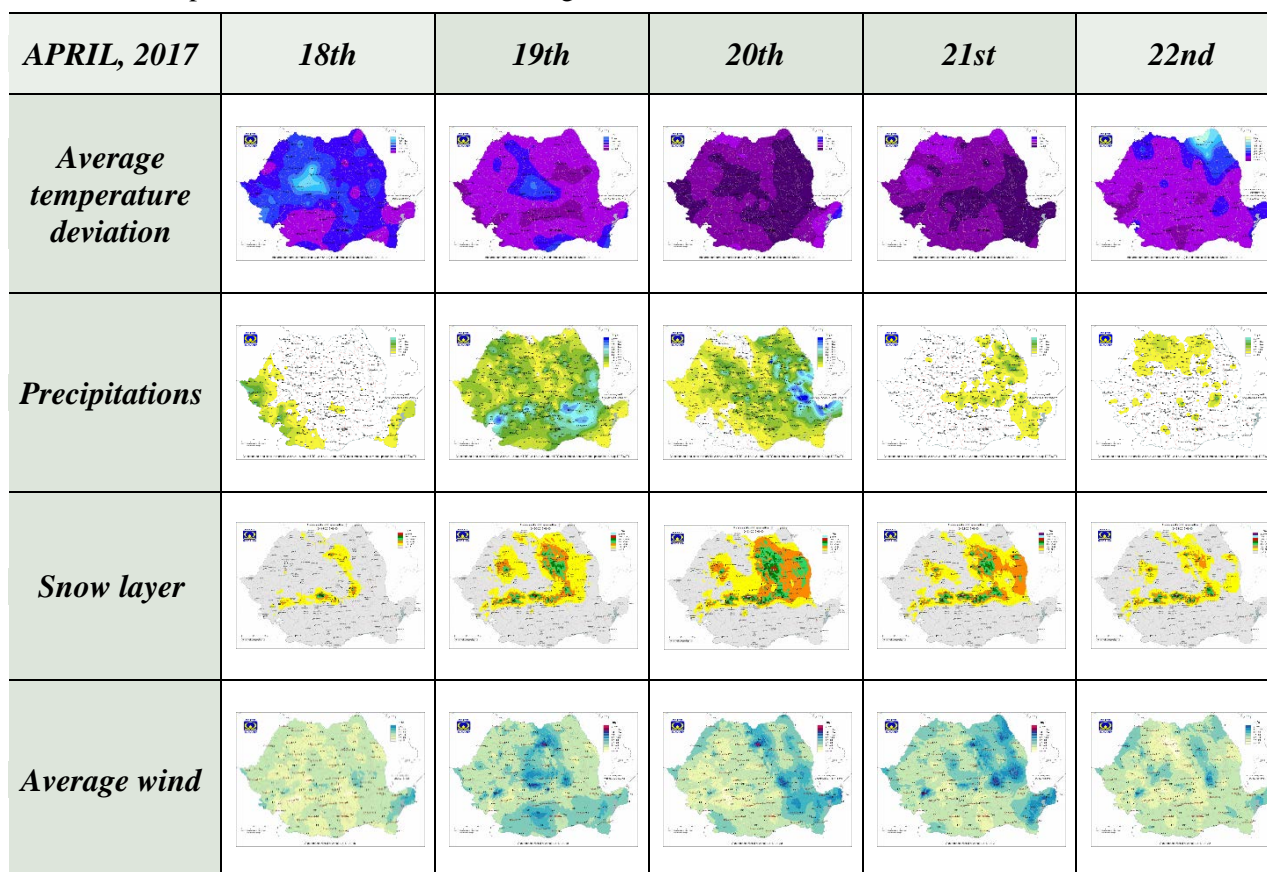


Figure 13. The main parameters characterizing blizzard

4. IMPACT OF THE BLIZZARDS

The effects resulted from this late episode of blizzard were some of the most diverse and they gradually affected almost all territory of the

country. Thus, the first consequences of blizzard occurred on night of April 19-20 in the mountain area of Romania, as expected, where the strong winds broke the trees that blocked not only the circulation on several roads (Rasnov-Brasov), but

also sections of railroad (between Predeal and Brasov). The area affected by winter weather phenomena started to extend, so many problems have emerged in other areas of the country.

On the morning of April 20, six air flights operated at Cluj International Airport had delays due to heavy snowfall, deicing processes being much hampered. The road traffic was difficult due to snow deposit on roads in Transilvania, Moldova and eastern counties. There was a high risk of avalanche in the mountain regions due to thickness of snow layer that reached over 150 cm in the Fagaras Mountains. Because of blizzard, the intervention for cleaning the traffic routes was much hampered, as the traffic was heavy.

However, the most significant damage was recorded in Moldova where the blizzard was violent, as the meteorologist predicted through the orange code warning for heavy snowfall, deposition of snow layer and strong winds. The power supply was interrupted in many counties. Rescue missions were performed to transport victims to hospitals, so they could benefit of medical care.

Blizzard also caused a serious damage on agricultural crops, which are sensitive to early autumn or late spring sudden temperature variations. On April 20 and 21, the temperature was extremely low, reaching negative temperature values at all weather stations. These negative temperature values, correlated with strong winds (which exceeded 15 m/s locally in Moldova and Dobrogea) were very harmful and damaging to plants. [5]

5. CONCLUSIONS

The consequences, sometimes dramatic, that the late blizzard of April 19-21, 2017 had on the natural environment and the economic activities justify the analysis of this extreme weather event.

The south-east Romania represents the region where synoptic conditions describe “the coupling”

continental anticyclone – Mediterranean cyclone arriving over the Black Sea. The studied case is generated by the interaction in the lower troposphere between a high-pressure system dominating Europe and a low-pressure field in the Mediterranean Sea and it represents a very late, severe blizzard that marked a record due to the period of time it occurred.

When deep cyclones develop over the warm Mediterranean Sea and move quickly on an eastern trajectory, pressure gradients are high and strong winds blow on the territory of our country. Pressure gradients between the continental anticyclone and the maritime cyclone above the Black sea can be reinforced by temperature gradients.

The occurrence of this hazardous meteorological phenomenon represents the main concern for meteorologist from National Meteorological Administration in the cold season of the year. They need to be able to elaborate warning codes when the parameters characterizing blizzard (negative temperature deviation, snowfall, strong winds) reach abnormal variations, to achieve the reduction of risks associated with blizzard.

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THE ION PROPULSION

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Abstract: The purpose of this article is to explain how the main types of ion thrusters work and to present their advantages and disadvantages. The concept behind the electric propulsion was first imagined as a future possibility 100 years ago. With hundreds of ion thrusters operating in orbit now, we can say that we are already living in the future. An ion thruster is a form of electric propulsion, a technology which aims to achieve thrust with high exhaust velocities, thus reducing the amount of propellant needed for a given mission. With less propellant onboard, the launch mass of a satellite or a spacecraft is significantly decreased, which leads to lower mission costs. The traction levels developed by the ion thrusters are small, compared to those created by conventional rocket engines. Given the fact that ion thrusters cannot work in the presence of the ions outside the engine, they can be used only in a vacuum. Ion thrusters are designed for different types of missions, from satellite station-keeping to propelling spacecraft in the outer space.

Keywords: space; rocket; engine; satellite; ions.

1. INTRODUCTION

The ion thruster is a form of electrical propulsion, in which the electricity is used to increase the propellant exhaust velocity. By using the ion thrusters, the modern spacecraft can travel faster, farther and cheaper, this technology being the apex of modern propulsion technologies that are currently available.

The ion thruster's performance is determined by the amount of thrust it creates, specific impulses, the change in the spacecraft's velocity during thrust periods and fuel efficiency.

These thrusters are used to keep the satellites in orbit or to propel the deep space probes. Spacecraft powered by an ion thruster can reach speeds up to 90 km/s, while the Space Shuttle can reach speeds up to 8 km/s. The main disadvantage of an ion thruster is that it develops low levels of thrust, current ion thrusters developing only 0.5 newtons of thrust. To reach those high speeds, the thruster must be operated for a long time. The ion thruster can use pulses instead of continuous thrust. However, if the destination is far away, it is recommended to use constant amounts of thrust over a long time, in order to shorten the travel times and to consume much less fuel. “Deep Space 1 used less than 159 pounds of fuel in over 16,000 hours of thrusting. Since much less fuel must be carried into space, smaller, lower-cost launch

vehicles can be used“[1]. Another major advantage of this form of propulsion over the conventional rockets and boosters is that inert gases are used for propellant, so, basically, there is no risk of explosion.

The first functional ion thruster was built by Harold Kaufman at the NASA Glenn Research Center in 1959. The first suborbital tests were conducted between 1960-1963, the engine being launched into space during the Space Electric Rocket Test 1 (Fig. 1), in 1964.

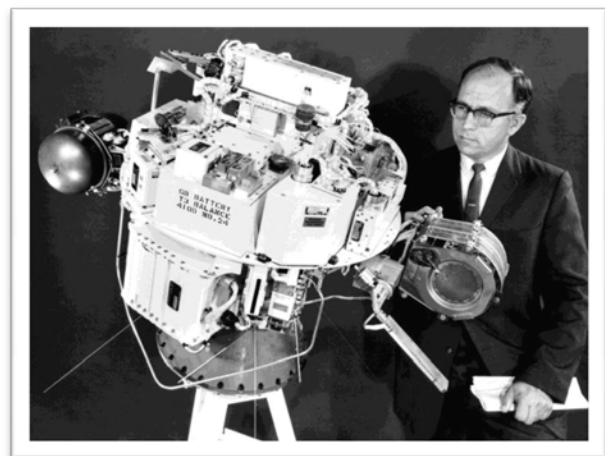


Fig. 1 Raymond J. Rulis, SERT-1 Program Manager, examining the SERT-1 spacecraft after its arrival at the NASA Lewis Research Center for pre-flight testing

2. THE ION THRUSTERS

2.1 The Hall-effect thrusters (Fig. 2). The Hall-effect thruster was studied both in the United States of America and USSR, between 1950-1960.

The concept of the Hall-effect thruster was developed in the USSR, the main project of the American scientists being the gridded electrostatic ion thruster. These thrusters were used to maintain the Russian satellites in orbit since 1972, they have been taken out of service in the late '90s. The design of the Russian ion thrusters has been implemented in the Occident in 1992, after a team of electric propulsion specialists visited the Soviet laboratories.

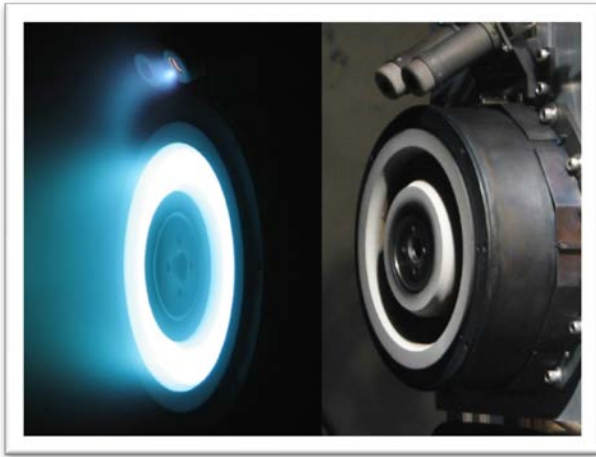


Fig. 2 The SPT-140 Hall-Effect Thruster

The Hall effect thruster consists in three main components: the magnetic field generator, the cathode and the discharge region. (Fig. 3)

The HET (Hall-Effect Thruster) accelerates ions by means of electricity between the anode and the cathode, which is made of plasma.

This thruster is named HET because the electrons are trapped with a radial magnetic field in a Hall current which moves around an annular ceramic channel. The propellant (Xenon) is introduced in the proximity of the anode and is ionized by the electrons within the Hall current, generating the ionized plasma, as the electrons are attracted by the cathode. As they accelerate, the ions pick up electrons and neutralize the beam, leaving the thruster with speeds up to 11 km/s. The ion thrusters eject positive ions, which can be attracted by the spacecraft, cancelling the thrust. To avoid that, a neutralizer cathode is located at the end of the downstream and emits electrons, in order to make the beam electrically neutral.

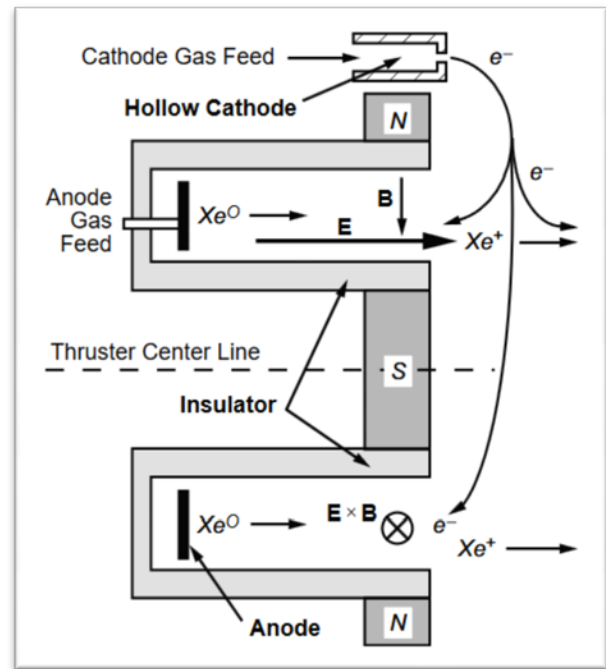


Fig. 3 Schematic of a Hall-Effect Thruster, showing the magnetic fields

The main disadvantage of the HET is that the interaction between the plasma and the edge of the nozzle erodes the magnetic system that creates the plasma. Modern thrusters have auxiliary magnetic systems that stop the erosion of the main system.

The benefits of a Hall-effect thruster are the increased lifetime, modern thrusters being able to create thrust for more than 50.000 hours and the improved efficiency, the energy loss being significantly reduced, thus improving the discharge efficiency.

2.2 The gridded ion thrusters (Fig. 4). The GID (Gridded Ion Thruster) was mostly studied in the United States of America and is the most efficient form of ion propulsion.

This ion thruster design uses high-voltage grids to generate the electrostatic forces and to accelerate the positive ions, creating thrust.

A gridded ion thruster has three components: the electrodes (two grids), the neutralizer cathode and a plasma generator. (Fig. 5)

A gridded ion thruster makes use of a wide variety of techniques to generate plasma. After the propellant is ionized, the electrons are extracted from the plasma by electric fields, which are generated by two biased grids, situated at the end of the downstream, accelerating them at voltages up to 25 kV with high speed.

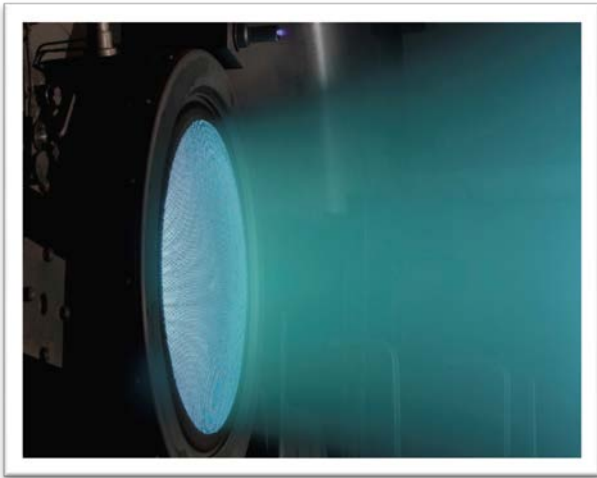


Fig. 4 NASA's NEXT Ion Thruster

The grids are placed close together and have thousands of apertures perfectly aligned with each other. Each pair of apertures accelerates the ions, acting like a lens.

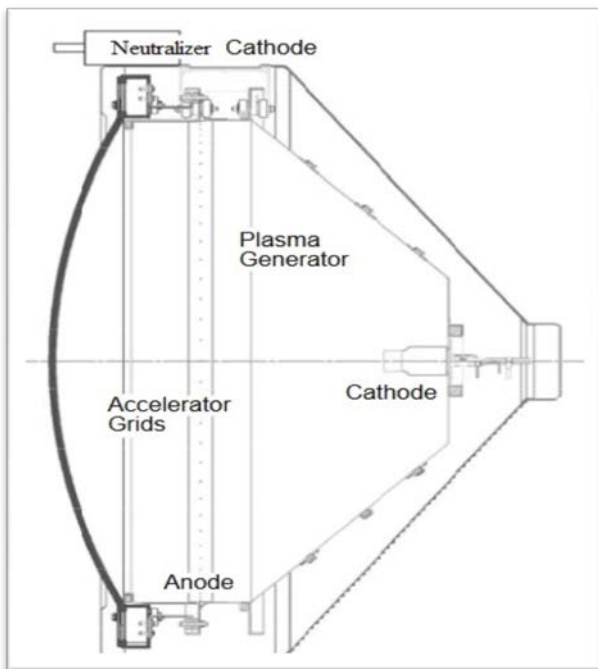


Fig. 5 Schematic of an electron-bombardment Gridded Ion Thruster

The ion thrusters built by NASA use a two-grid system, the upstream grid (screen) being charged highly positive, while the downstream grid (accelerator) is negatively charged. Given the fact that the ions are generated in a highly positive region, and the accelerator grid is negatively

charged, the accelerator grid attracts the ions and accelerates them through the apertures, generating the ion beam.

The exhaust speed of the ions depends on the potential difference between the two grids, so the top speed of an ion thruster is, theoretically, unlimited. The greater the potential difference, the higher will be the exhaust velocity.

The ion beam ejected by an ion thruster is positively charged. In order to prevent the attraction of the ion beam by the spacecraft, a neutralizer cathode is located at the end of the downstream and emits electrons, making the beam electrically neutral.

Compared to other thrusters, the gridded ion thrusters have very high specific impulses and are the most efficient type of ion thrusters.

3. THE FUTURE OF ION PROPULSION: THE MPD THRUSTER

To reach deep-space destinations, higher thrust is required and one of the most promising designs of thrusters is the MPD (magnetoplasmadynamic) thruster (Fig. 6), in which the electromagnetic (Lorentz) forces are applied to the neutral plasma. This is the most advanced type of thrusters and it is still tested and perfected by scientists.

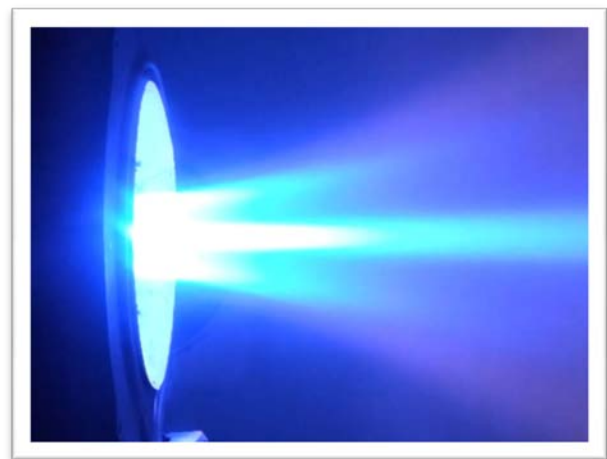


Fig. 6 The SX-3 Magnetoplasmadynamic Thruster

An MPD thruster has two components: the anode and the cathode. The MPD thruster has a cylindrical anode that surrounds the rod-shaped cathode.

The electric arc strikes between the two electrodes, heating up the cathode. As it heats up, it emits electrons, ionizing the propellant to create the plasma.

As the current returns through the cathode to the power supply, a magnetic field is generated, which interacts with the electric arc to produce a Lorentz force. This electromagnetic force pushes out the plasma from the engine and creates thrust. External magnetic systems can provide additional magnetic fields to stabilize the plasma discharge.

An MPD thruster can produce very high specific impulses, with exhaust velocities of up to 110 km/s. Tests also demonstrated that the MPD thruster can develop up to 200 newtons of thrust, being by far the highest thrust level developed by any form of ion propulsion.

4. CONCLUSIONS

An ion thruster is a form of electrical propulsion, these engines creating thrust by accelerating positive ions by means of electricity. Spacecraft will be propelled by ion thrusters in the future. These thrusters can only propel the spacecraft, as they are not suitable for boosting heavy vehicles. The thruster's operation begins only after the spacecraft has been placed into orbit.

The ion propulsion has two major advantages: the ion thrusters have high specific impulses and energy per unit of fuel so it the spacecraft can reach higher speeds, shortening the travel time, a crucial factor in piloted missions; high energy means low fuel consumption, thus meaning an

increased autonomy of the spacecraft. The ion propulsion also has disadvantages: the generated thrust and the acceleration are very small so, in order to reach high speeds, the ion thruster must be operated for a long time; an ion thruster can work only in near-vacuum condition.

If 100 years ago the idea of ion propulsion seemed to be impossible, nowadays we have several deep-space probes exploring the outer space and a few hundreds of satellites in the orbit, kept in the proper position by ion thrusters. The ion propulsion will surely take us farther than any other form of propulsion and it is definitely the future of space exploration.

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