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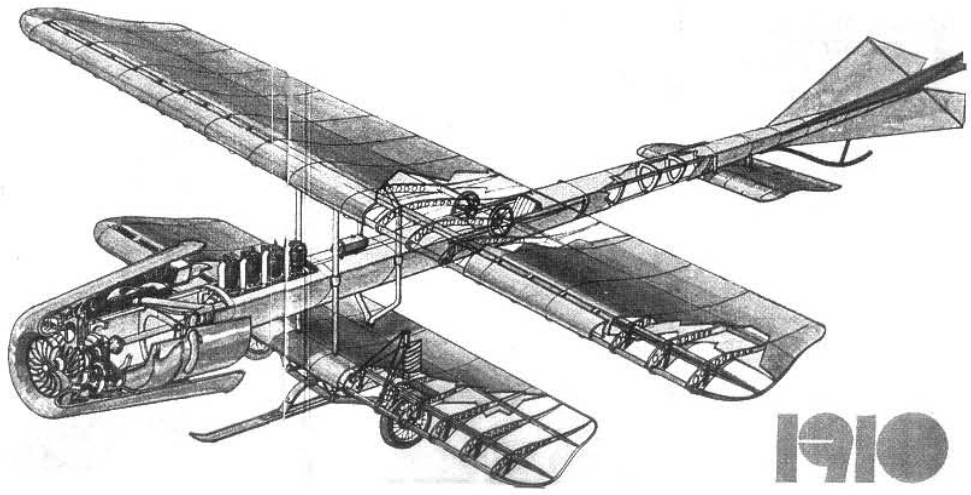

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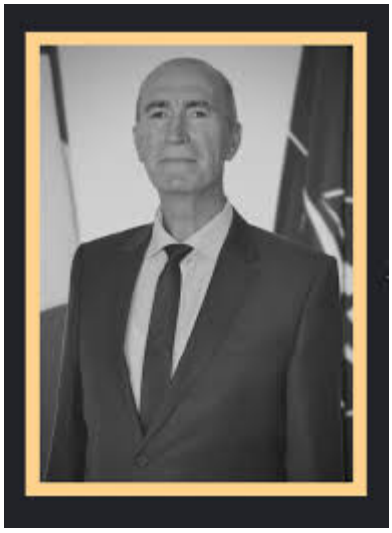
A star of Aerospace Engineering in Romania has gone out

Col. Prof. Eng. PhD Constantin ROTARU



On Friday, November 26, 2020, the community of “Henri Coandă” Air Force Academy put on their mourning clothes.

CONSTANTIN ROTARU, who was and will remain in our hearts the comrade and dear friend, the teacher so respected, esteemed and beloved, left us, called to His Divine Kingdom, up there, to the Military Aviation from Heaven, to continue in eternity the destiny of Romanian aeronautical education.

On October 11, 1958, in the commune of Comana de Jos, Brașov County, a beloved son was born to the family of the landlord Constantin Rotaru, to whom the stars had destined a very special future.

He had not turned 15 yet, when, in 1973, attracted by the military career, he competed for a seat and was admitted to the famous "Dimitrie Cantemir" Military High School of Breaza. He excelled in learning, bringing fame to his high school in the school Mathematics and Physics Olympiads, and due to his exceptional results, he obtained approval from his superiors to apply for the Military Technical Academy. He was admitted to this prestigious Institution, choosing to continue his career in the military as an aviation engineer, his student years being on the same coordinates of excellence.

Graduating from this top Romanian engineering school, as the head of the 1982 class, and holding a specialization in aircraft and aviation engines engineering, Constantin Rotaru followed his vocation of working with silver war birds as soon as he was assigned to the 67th Fighter-Bomber Aircraft Regiment of Craiova.

For 6 years, due to his professional skill and tenacity, he took care of the operation of the new Romanian attack aircraft IAR 93 and he occupied some important positions in the structures that took responsibility for the assurance of the aviation equipment maintenance.

Later on, he would change his path and get to be assigned to serve in the military aviation in important positions in the fields of aerospace research and higher military aeronautical education.

His exceptional career as a professor is inextricably linked to the Department of Aviation within the Military Technical Academy, where, through meticulous work and relentless training, he gradually occupied all of the teaching positions of the higher education, from the first stage of assistant professor to the highest degree of university professor, and management positions such as the Head of the Department of Integrated Aviation and Mechanical Systems.

Upon meeting the legal provisions, on September 30, 2014, Constantin Rotaru became a retired Aviation Reserve Colonel, without giving up his exceptional scientific activity.

His professional and moral qualities, unanimously appreciated within the Romanian Air Force, led to his being invited to join the academic community of "Henri Coandă" Air Force Academy of Brașov, to continue the activity of training new generations of aviation officers.

Until the sorrowful news of his sudden death, Constantin Rotaru held positions of the highest responsibility in a period of new and great challenges: Head of the Aviation Department, Dean of the Faculty of Aeronautical Management, Vice-Rector for Research. He had advanced to the highest academic position, that of a doctoral supervisor in the field of aerospace engineering and was a member of numerous commissions and teams in the field of national higher education management.

Professor Constantin Rotaru's professional career was based on a solid academic education, the professor being a graduate of some prestigious higher education institutions in the country and abroad, such as:

- Military Technical Academy, 1982;
- University of Bucharest, Faculty of Mathematics, 1989;
- Naval Military Academy, ENSIETA-Brest, France, 2001;
- Wright State University, Dayton, Ohio, USA, 2006;
- Numerous other training courses in the country and abroad.

Throughout his years of scientific research he wrote 11 specialized books, over 120 scientific articles, led 4 research projects as a Project Manager, participated as an official reviewer in 40 doctoral commissions and 20 competition commissions for awarding teaching degrees to professors and associate professors, organized the first International Conference "New Challenges in Aerospace Sciences-Incas", in 2013, led 12 French students in scientific research and was an expert for the aerospace engineering area under the National Agency for Quality Assurance in Higher Education (ARACIS).

For his exceptional merits and prolific research and teaching activity he was awarded with important national orders and decorations, respectively:

- Air Force Honor Emblem, 2014;
- Emblem of Merit "In the Service of the Romanian Army" class I, 2009;
- Emblem of Honor of the Romanian Army, 2008;
- Emblem of Merit "Military Science" class I, 2007;
- Honorary Sign "In the Service of the Fatherland" for 25 years of activity, 2006;
- Honorary Sign "In the Service of the Fatherland" for 20 years of activity, 2001;
- Honorary Sign "In the Service of the Fatherland" for 15 years of activity, 1996;
- National Medal "For Merit" class II, 1987.

Professor Constantin Rotaru's family: his wife, Mioara, and his son, Mihai Cristian, supported him with love and devotion in his complex mission of serving the interests of the country, the nation, the Romanian Army and Air Force. Right now, without anybody's capacity to understand why, when his soul projects were about to take shape, the big heart of Professor Constantin Rotaru stopped beating only one month after he had turned 62 years old.

The academic community of "Henri Coandă" Air Force Academy will never forget him; his personality and deeds will hold a place of honor in the Academy's Book of Honor, but, especially, in everybody's souls now overwhelmed by this heavy loss.

May God protect his smooth flight to Eternity!

Col. (AF ret.) Jănel TĂNASE

Vineri, 26 noiembrie 2020, Academia Forțelor Aeriene ”Henri Coandă” a îmbrăcat hainele de doliu.

A plecat, chemat la Împărăția Sa Dumnezeiască, acolo sus, la Aviația Militară din Ceruri, pentru a continua în eternitate destinul învățământului aeronautic românesc, cel care a fost și va rămâne în inimile noastre camaradul și prietenul drag, dascălul atât de respectat, stimat și iubit, CONSTANTIN ROTARU.

La 11 octombrie 1958, în comuna Comana de Jos, județul Brașov se năștea în familia gospodarului Rotaru Constantin fiul iubit, căruia astrele îi hărăzise un destin cu totul deosebit.

Nu împlinise vârsta de 15 ani când, în anul 1973, atras de cariera militară a candidat și a fost admis la celebrul Liceu Militar ”Dimitrie Cantemir” din Breaza. A excelat în activitatea didactică, aducând faimă liceului în cadrul olimpiadelor școlare de matematică și fizică, iar datorită rezultatelor sale excepționale a obținut aprobarea să candideze și a fost admis la Academia Tehnică Militară, alegând să continuie cariera armelor ca inginer aviator, parcursul profesional al tânărului student dezvoltându-se pe aceleași coordonate de excelență.

Absolvent ca șef de promoție în anul 1982 al acestei grandioase școli de inginerie românească, în specialitatea inginer aeronave și motoare de aviație, și-a luat zborul către vocația lucrului cu păsările argintii de luptă fiind repartizat la Regimentul 67 Aviație Vânătoare - Bombardament de la Craiova.

Pe parcursul a 6 ani, grație priceperii profesionale și tenacității a asigurat exploatarea noului avion românesc de atac IAR 93, fiind încadrat în cele mai importante funcții în structurile care asigurau mentenanța tehnicii de aviație.

Ulterior, va alege și va fi încadrat pentru a sluji aviația militară în importante funcții din domeniile cercetării aerospațiale și învățământ aeronautic superior militar.

Cariera sa excepțională ca dascăl este indisolubil legată de Catedra de aviație din cadrul Academiei Tehnice Militare, unde, prin muncă stăruitoare și pregătire fără răgaz a parcurs toate etapele profesionale universitare de la prima treaptă de asistent universitar, până la gradul cel mai înalt de profesor universitar, promovând pas cu pas până la funcția de Director al Departamentului de Sisteme Integrate de Aviație și Mecanică.

La îndeplinirea condițiilor prevăzute de lege, la 30 septembrie 2014, cu gradul de comandor, a trecut în rezervă, fără a renunța la activitatea sa științifică de excepție.

Calitățile sale profesionale și morale unanim apreciate în Forțele Aeriene Române au contribuit la invitarea sa pentru a se alătura comunității universitare la Academia Forțelor Aeriene ”Henri Coandă” din Brașov, pentru a continua activitatea de formare a noi promoții de ofițeri aviatori.

Până la dureroasa despărțire a încadrat funcții de cea mai mare responsabilitate într-o perioadă de noi și mari provocări: Director al Departamentului de Aviație, Decan al Facultății de Management Aeronautic, Prorector pentru cercetare. Avansase la cea mai înaltă treaptă universitară, cea de îndrumător de doctorat în domeniul ingineriei aerospațiale și era membru în numeroase comisii și colective din domeniul managementului universitar național.

Cariera profesională a Domniei Sale s-a sprijinit pe o pregătire academică deasăvârșită fiind absolvent al unor prestigioase instituții de învățământ superior din țară și străinătate, respectiv:

- Academia Tehnică Militară, 1982;
- Universitea București, Facultatea de Matematică, 1989;
- Academia Militară Navală, ENSIETA-Brest, Franța, 2001;
- Wright State University, Dayton, Ohio, SUA, 2006;
- alte numeroase cursuri de perfecționare în țară și străinătate.

În această perioadă a elaborat 11 cărți de specialitate, peste 120 articole științifice, a condus 4 proiecte de cercetare ca director, a făcut parte în calitate de referent oficial în 40 de comisii de acordare a titlului științific de doctor și 20 de comisii de concurs pentru acordarea gradelor didactice pe profesor și conferențiar universita, a organizat în anul 2013 prima Conferință Internațională ”New Challenges in Aerospace Sciences-ncas”, a condus 12 studenți francezi în stagii de cercetare științifică și a avut calitatea de expert ARACIS în domeniul inginerie aerospațială.

Pentru meritele Sale excepționale și prolifica activitate de cercetare și didactică a fost distins cu importante ordine și decorații naționale, respectiv:

- Emblema de Onoare a Forțelor Aeriene, 2014;
- Emblema de Merit ”În Serviciul Armatei României” clasa I, 2009;
- Emblema de Onoare a Armatei României, 2008;
- Emblema de Merit ”Știință Militară” clasa I, 2007;
- Semnul Onorific ”În Serviciul Patriei” pentru 25 de ani de activitat, 2006;
- Semnul Onorific ”În Serviciul Patriei” pentru 20 de ani de activitate, 2001;
- Semnul Onorific ”În Serviciul Patriei” pentru 15 de ani de activitate, 1996;
- Medalia Națională ”Pentru Merit” clasa a II-a, 1987.

L-au sprijinit cu dragoste și devotament în complexa misiune de slujire a intereselor țării, națiunii, Armatei și Forțelor Aeriene Române familia Domniei Sale, soția Rotaru (Nistor) Mioara și băiatul Rotaru Mihai Cristian, lovită necruțător și nemilos, când visele începeau să devină realități și repere pentru o viață care promitea multe și multe alte împliniri. Tocmai acum, fără să putem înțelege, când proiectele sale de suflet începeau să prindă contur, inima mare a profesorului Rotaru Constantin a încetat să mai bată la o lună după ce împlinise vârsta de 62 de ani.

Comunitatea universitară a Academiei Forțelor Aeriene ”Henri Coandă” nu-l va uita niciodată, iar personalitatea și faptele sale vor figura la loc de cinste în Cartea Noastră de Onoare, dar, mai ales, în sufletele noastre sărăcite de această grea pierdere

Dumnezeu Să-i ocrotească zborul lin către Eternitate!

Cdor (r) Jănel TĂNASE

C O N T E N T S

MODERNIZATION OF AIR FORCE EDUCATION – 'SYSTEMS FOR AERIAL SURVEILLANCE AND SECURITY' PROJECT

Ecaterina Liliana MIRON
"Henri Coandă" Air Force Academy, Brașov, Romania (liliana.miron@afahc.ro)
ORCID: 0000-0002-1665-5613

Zhivo PETROV
Bulgarian Air Force Academy, Dolna Mitropolia, Bulgaria (zhivo@abv.bg)

Daniela NAGY
"Henri Coandă" Air Force Academy, Brașov, Romania (daniela.nagy@afahc.ro)

Laurian GHERMAN
"Henri Coandă" Air Force Academy, Brașov, Romania (laurian.gherman@afahc.ro)
ORCID: 0000-0003-0315-629X

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Abstract: *The current paper presents an analysis of the 'Systems for Aerial Surveillance and Security' (SASS) project, carried out under the aegis of the European Union's Erasmus + [4] programme conducted by "Henri Coandă" Air Force Academy (AFAHC) in collaboration with partners from Poland and Bulgaria. The project aimed to initiate collaboration between the military universities of the European Union in order to establish common competences that the graduates in the field of aviation will acquire upon the completion of their education. One of the reasons for the development of this project was the need to modernize the education in the AFAHC and update the curricula in accordance with the new technologies equipping the military systems and with the modern teaching / learning methods in the civilian higher education. The running of the project and its finalization led to the design of an education curriculum of the Life-long learning type and an e-learning platform. The analysis of the project by means of various satisfaction questionnaires, applied following certain stages of the project, revealed controversial results.*

Keywords: *systems for aerial surveillance and security; Erasmus project; e-learning; modernization; strategic partnership; communication, satisfaction questionnaires*

1. INTRODUCTION

Romania, as an integral part of the various international institutions, must meet the performance standards imposed at this level and adjust its needs in this regard.

The national defence and security system is one of the systems most affected by changes in public policies through the need to modernize the technical defence systems. As a result, the military education institutions, the trainers of the future practitioners of the strategies and the technical systems in the field of security have to modernize their learning / teaching methods and develop efficient institutional models.

One of the simple methods to achieve this goal is to take over and adapt the models and methods of learning / teaching of the civilian educational environment.

Following the initiation of the collaboration with universities of similar profile in Europe, under the aegis of the Erasmus programme, a working group of professors from the War Studies University (WSU) in Poland and "Vasil Levski" National Military University (VLNMU) in Bulgaria was set under the leadership of AFAHC.

On first meetings, the working group members concluded that the focus of the project should be on such aspects as:

- modalities of professional development for the improvement of competences with regard to the use of the new approaches and technologies of the defense systems;
- teaching / learning modalities in the context of international cooperation between military academies and civilian universities.

Accordingly, the management of the military higher education institutions needs to modify the approach to education and to adjust it in accordance with the existing standards of the civilian institutions.

The development of the project aimed at the improvement of education within the AFAHC, WSU and VLNMU, in two directions:

- Designing a curriculum that will ensure common competencies for future employees in the air defense and security structures;
- Developing a modern learning / teaching system materialized in an e-learning platform.

2. DEVELOPMENT of SASS

From the standpoint of aviation, the airspace, both the controlled and the uncontrolled one, is divided by the civil and military air transport. There are organizations, both at national and international level, holding responsibilities in the field of drawing up the regulations necessary for the planning and supervision of the airspace activity.

The airspace surveillance is accomplished by air traffic controllers, backed up, in their activity by civilian or military radars.

A good use of the technical systems dedicated to these activities requires a good understanding of their structure and their mode of interconnection.

Considering the facts mentioned above, the project was intended to be a beginning in the uniformization of the competences obtained by the military students with the competences of the graduates of the civilian universities in the same field of activity. The final purpose of the project took into account the aeronautical regulations according to the ICAO.

The analysis accomplished by the project team considered the following aspects:

- The specializations necessary for the management of this field of activity (pilots, ATCs, Radar and Air Defence specialists);
- The amount of information and the speed of change of the operation techniques and technologies in any field of activity;
- Activity in international context and the interaction between people belonging to different cultures.

The results of the project materialized into:

- Development of a curriculum;
- Accomplishment of an e-Learning platform (meant for both learning and teaching activities)

2.1. DEVELOPMENT of the CURRICULUM

We observe a wide range of competences considered and enunciated by the project team, as a result of the large number of specializations involved in the activities in the above-mentioned field, of the airspace security:

• communicating intelligibly, meaningfully and appropriately in English in aviation context;

• applying aeronautical rules properly for achieving aviation safety;

• applying basic meteorological knowledge on daily basis aviation activities in order to maintain a good level of aeronautical safety;

• contributing to a genuine comprehensive approach to air force protection and safety management;

• analyzing data issued by navigation systems and radars.

These competences aim at a standardization of the specialists' competencies within the existing services on all airports, civilian or military.

The first stage of the project was finalized with a curriculum designed for an interval between 2 and 3 months, according with the plan of study and curriculum of each university involved in the project. This curriculum can be applied to any of the universities involved in the project, through a system of recognition of studies by transferable credits attributed to each discipline of the curriculum. It consists of 6 disciplines designed to cover the following competencies: Air Force Safety and Security, Safety Management, Aviation English, Basic Principles of Navigation, Air Law, Meteorology.

Initially, the curriculum developed by the project was thought to be achieved in English, as a common international semester during the Bachelor cycle of studies. In this case, the way of financing the students' mobilities and those of the teachers between the 3 partner universities of the project, but also of other possible participants, was discussed. The fact that the project was meant to be open to all those interested in improving and specializing in the field of security and military management was considered, too. Because a source of permanent funding could not be detected, alternative solutions were devised. In fact, the problem of financing and the viability of the semester had been identified as a possible drawback since the proposal phase of the project. The first solution was the implementation of this curriculum online, as a distance learning study plan. To achieve this goal, the e-Learning platform was developed.

The second solution was to transform the curriculum into a lifelong learning program. Thus, the completion of the project meant a new phase for the AFAHC, which continued and obtained the approval of the Ministry of Education for its transformation into a postgraduate study program of the lifelong learning type.

On the first stage of this accreditation, the program is open to graduates holding a Bachelor's Degree from Romania. For greater accessibility, we will try to obtain and meet, for the second solution – lifelong learning program, the requirements necessary for its development in English. This will allow all of the Romania's partner countries to participate in this program.

These steps were made following the opinion polls conducted throughout the 2 years of project development.

The opinion polls were applied to a number of about 70 people, within 5 activities. From this point onward there are presented only some of the questions pertaining to the opinion polls that indicate the connection between the areas of activity of the respondents with the objectives and results of the project.

According to Fig. 1, respondents perform their activities in the field of aviation.

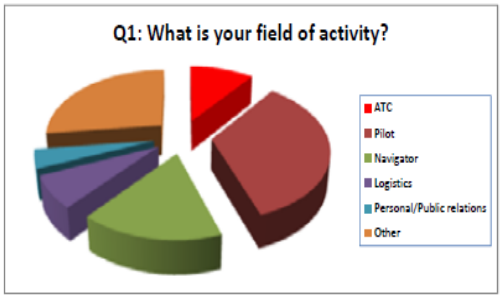


FIG.1 Field of activity

As a result, in figures 2, 3, and 4 it can be observed that the degree of satisfaction for the accomplishment of this educational plan at the beginning of the project, in the intermediate stages and at the end of it, does not undergo major changes, the percentage in which a positive answer (at least very good) was obtained ranging from 92.31 %, to 91.25% respectively 85.07%.

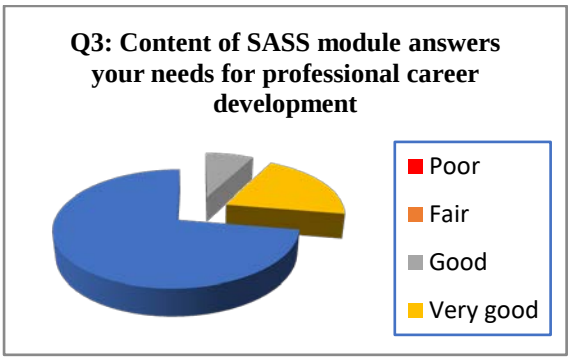


FIG.2 At the beginning of the project

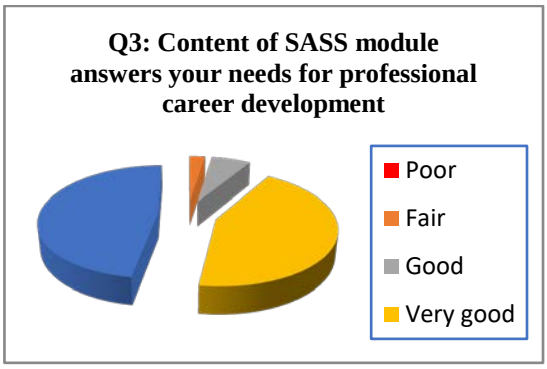


FIG.3 The intermediate stage

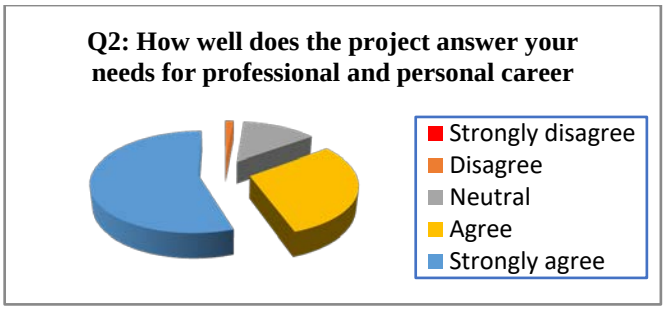


FIG.4 Final stage of the project

The percentage differences are the follow-up of the respondents' specializations, some of them not being directly involved in the field of aviation but in its related fields (Fig.1).

2.2. DEVELOPMENT of the E-LEARNING / TEACHING SYSTEM

In order to transfer curriculum in the virtual environment, an e-learning platform was set up to be managed by each of the 3 universities partnering in the project (figure 5).

The lessons for each discipline, respectively, the entire curriculum can be accessed by any university, any collaborator at national / international level of the 3 universities, but only with their approval.

The 6 disciplines that are part of the curriculum were shared between the 3 universities in the project. Each university was responsible for developing lectures and workshops for 2 disciplines through 2 specialist professors.

The initial existence of only one specialist for each discipline in the curriculum required the development of a training-the-trainers type of training. It was carried out in the second year of the project and aimed at training a specialized professor in each university, for each of the disciplines of the curriculum.

The e-learning platform allows the permanent updating of the courses destined to each discipline but also teaching processes through the conference system. The advantage of this system is given by the possibility of carrying out the teaching process without the physical presence of the teacher in the classroom.

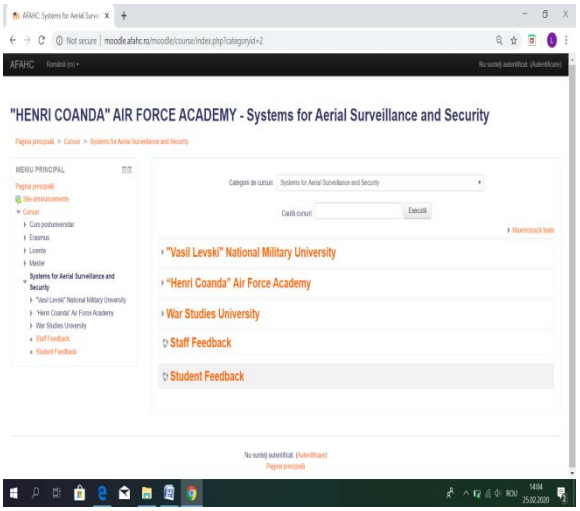


FIG.5 a. Capture of the platform managed by the three universities

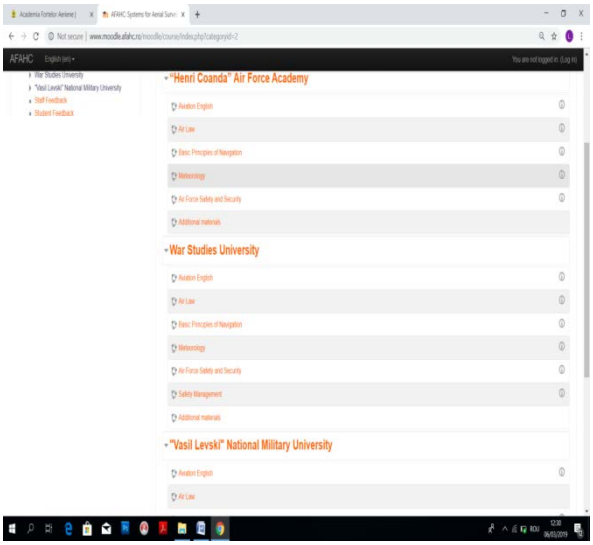
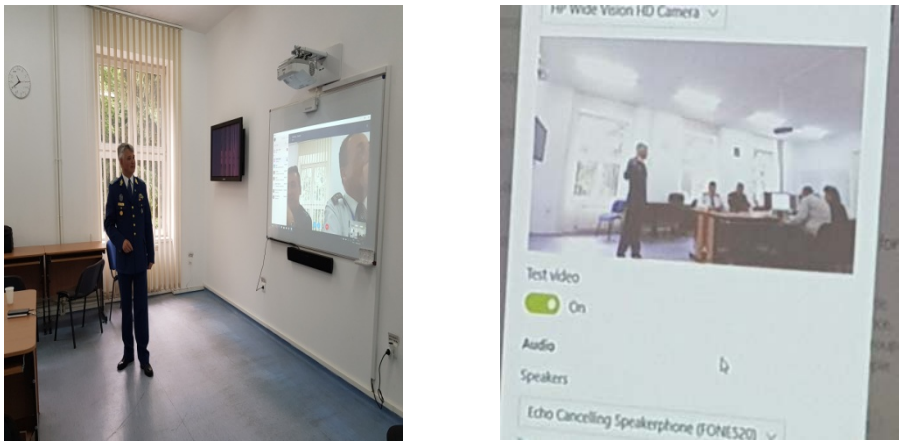


FIG.5 b. Capture of the platform managed by the three universities

In figures 6a and 6b there is presented the connection of the 3 universities through the conference system.

The connection between the 3 universities was made using the same e-learning system. All that was needed was a high-performance webcam with 360-degree view and internet connection.



a. b.

FIG. 6a./6b. Captures at the time of checking the videoconference system in 2 different universities.

Although widely used in civilian universities, the e-learning system is gradually entering military universities. It should be noted that there are still universities of this profile that have not implemented such a system.

The development and completion of the project required an evaluation process. This was carried out after the implementation of a blended mobility phase, which aimed to find the level of satisfaction among students and professors of the 3 universities partnering in the project but also at the level of their collaborators.

The implementation of the e-learning system allowed the online evaluation of the degree of satisfaction. Satisfaction questionnaires [1] uploaded on the platform were completed at the end of the online courses and had surprising results.

The question "How easy is it to use the e-Learning platform of the SASS project?" with possibilities of answers ranging from 1 (strongly disagree) to 5 (totally agree) was answered by both students and teachers and the findings are shown in fig. 7 (students) and fig 8 (teachers).

Regarding the use of the platform [2] the opinions of students differ from the teachers.

The students' opinion was divided between the two extremes, with an emphasis on the classroom teaching / learning style that has the advantage of interacting with teachers and colleagues (Fig. 7).

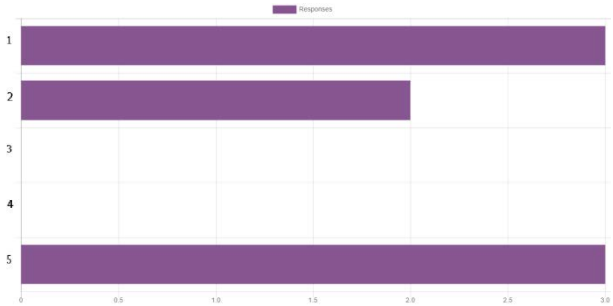


FIG. 7 Students' opinion – capture on the e-learning platform

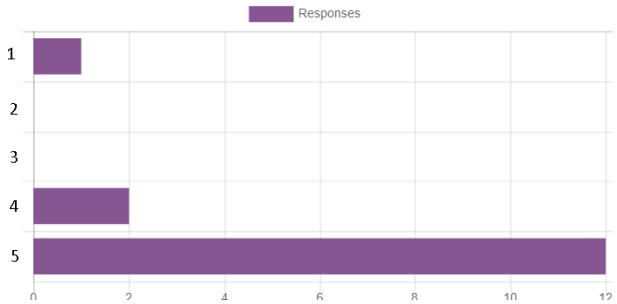


FIG. 8 Teachers' opinion– capture on the e-learning platform

In contrast, the teachers expressed a clear intention to adapt to the new teaching / learning techniques (figure 8). I liked most the opportunity to use modern teaching methods to deliver lectures and practical classes" was the most frequently obtained answer to the question" What did you like most about this event / project?" at the end of the "blended mobility" activity.

3. CONCLUSION

The project opened the way for joint curricula and it was an opportunity for teamwork at the level of students and professors and it granted the possibility of intercultural exchange owing to the team formed by the three universities from three countries.

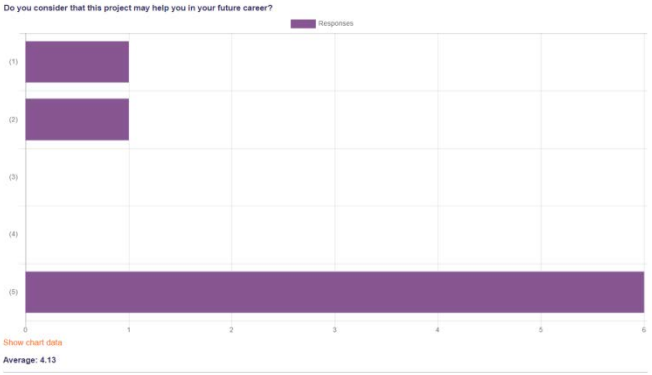


FIG. 9 Students' opinion – capture on the e-learning platform

Although the use of e-learning platforms is not absolute novelty, it has been observed that the military higher education is somehow reluctant to using them, perhaps due to the profile of the three universities. Students prefer the direct interaction and this assertion is supported by the answers to the questions in the satisfaction questionnaires.

The added value of the project was given by the answer to the question "Do you consider that this project may help you in your future career?", presented in figure 9.

The answer to this question is yes. However, there are different points of view on how the use of the e-learning platform influences the acquisition of technical skills and abilities.

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ANALYSIS OF THE VULNERABILITIES OF UNMANNED AERIAL VEHICLES TO CYBER ATTACKS

Grigore Eduard JELER
Military Technical Academy "Ferdinand I", Bucharest, Romania (eduard_jeler@yahoo.com)
ORCID: 0000-0002-8829-0027

Gelu ALEXANDRESCU
"Carol I" National Defense University, Bucharest, Romania

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Abstract: *Recently, the use of unmanned aerial vehicles (UAVs), also known as drones, has increased significantly and the technical advencements in the field have led to new possibilities in several fields, both military and civilian. Air drones help reduce human life risks and costs, and can be used to carry out dangerous and costly missions by replacing human operators. Unmanned aircraft have a wide range of use, from entertainment for enthusiasts to military operations. Large investments, especially in the field of robotics, electronic miniaturization, sensors, network communication, information technology and artificial intelligence help to accelerate and diversify areas of use. The operation of unmanned systems and the applications that use these systems depend, to a large extent, on the cyber systems that are used for data collection, storage, processing and communication. However, these systems also have certain vulnerabilities, which has led various (state or non-state) hybrid actors to develop methods of conducting cyber attacks on drones.*

Keywords: *cybernetic attack, UAV, Spoofing GPS*

1. INTRODUCTION

The modern world is changing rapidly with the development of revolutionary new technologies used in various fields. But along with significant benefits, there are many ways to use technology for malicious purposes. Unmanned Aerial Vehicles (UAVs) are not exempt from this either. They have been used by various military organizations for a decade, but in recent years, UAVs have demonstrated significant potential for use in commercial, industrial, security and entertainment applications. Drone testing is performed in applications such as pizza delivery, medical supplies delivery and emergency medical care.

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However, each technology can be used improperly, as in the case of drones. The rapid evolution of relatively cheap and easy to operate unmanned aircrafts is a new type of challenge for the public defence.

Whether the operator is a careless enthusiast or a malefactor, an undetected drone can pose a significant threat to safety and security. The continuous need to develop drones will lead to a new possibility of use, with extensions that can be mounted as shown in Fig. 1.

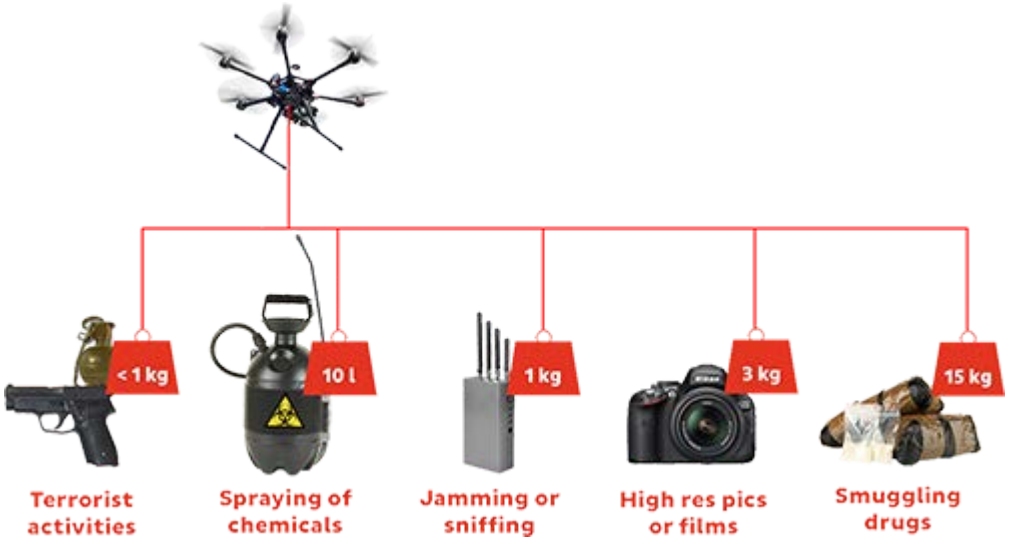

FIG.1 Useful loads that can be used for improper purposes [1]

Incidents with commercially purchased drones are reported almost daily in the international press. There have been situations in which drones have been observed in the vicinity of airports or even on the airways of aircrafts, at political events, spying over car test tracks, and even being used to smuggle drugs into prisons or transport them across the border, etc. [2]. The most spectacular use of autonomous systems in hybrid threats is the Houthi rebels' drone attack on Saudi oil facilities. Saudi Arabia has the most modern automated AA defense system under the name of Peace Sheild (17 American fixed radars AN / FPS-117, 6 American mobile radars AN / TPS-43, 5 E-3 A aircraft and 2 SAAB-2000 (AWACS), 10 medium-range missile batteries MIM-23 HAWK, 5 long-range missile batteries MIM-114 Patriot and dozens of Crotale short-range missile batteries and AA artillery. The attack had devastating effects on the economy of Saudi Arabia and the oil-rich sultanates in the Gulf area [3].

An attacker can be classified:

1. In terms of his location in the system:

- external location - An external attacker is more common. Because it is external to the system, it does not require authentication or authorization and can easily perform low-cost attacks.

- internal location - The internal attacker is a trusted person of the system (pilot, ATC controller, airport technician, etc.).

2. In terms of the physical position of the attacker:

- on the ground - This type of attacker is the most common. Against this type of attacker there are possibilities to counteract the attacks using different detection and attenuation techniques;

- aerial - This type of attacker, capitalizing on technological advances, may include drones, UAVs, autonomous activation of luggage devices or passengers with miniature devices capable of carrying out attacks.

3. According to the attacker's objectives:

- pranks - These types of attackers are the least dangerous but nevertheless, the impact on security can be considerably greater than expected. For example, attackers may be unprepared pilots, technology testers, and so on.

- abusive utilization - this type of attackers may have different motivations, including money, fame, messaging, paparazzi and, finally, pilots who intentionally abuse their access to ADS-B technology;

- criminal intentions - such attackers can have two main motivations - money and / or terrorism.

- military / intelligence - these attackers may be motivated at the state level, such as espionage, sabotage, etc. and may include military or intelligence-related agencies [4].

2.THE GENERAL STRUCTURE OF THE UAV SYSTEM AND POTENTIAL CYBER ATTACKS TARGETTING THE UAV

An overly simplistic perspective of an UAV is that it is an aircraft from which the human crew has been replaced by a computer system and a radio link. The aircraft is only one part, although an important part, of a total system. The entire system functions as a complete and includes, as shown in figure no. 2, the following components:

- a) a ground control station (CGS) that shelters the system operators, the interfaces between the operators and the rest of the system;

- b) the aircraft carrying the payload (video camera, various sensors, radar, etc.);

- c) the communication system between the CGS that transmits control inputs to the aircraft and returns the payload data and other data from the aircraft to the CGS (this is usually obtained by radio transmission);

- d) support equipment which may include maintenance and transport items [5].

Due to the fact that the UAV system contains systems that work together, cyber attacks on the UAS target in parallel both the aircraft in flight (flight controller, payload operation), GCS, and communications. Figure 2 shows examples of cyber attacks against various components of UAV systems, having as an effect the defective conduct of the drone mission, taking control or crashing them.

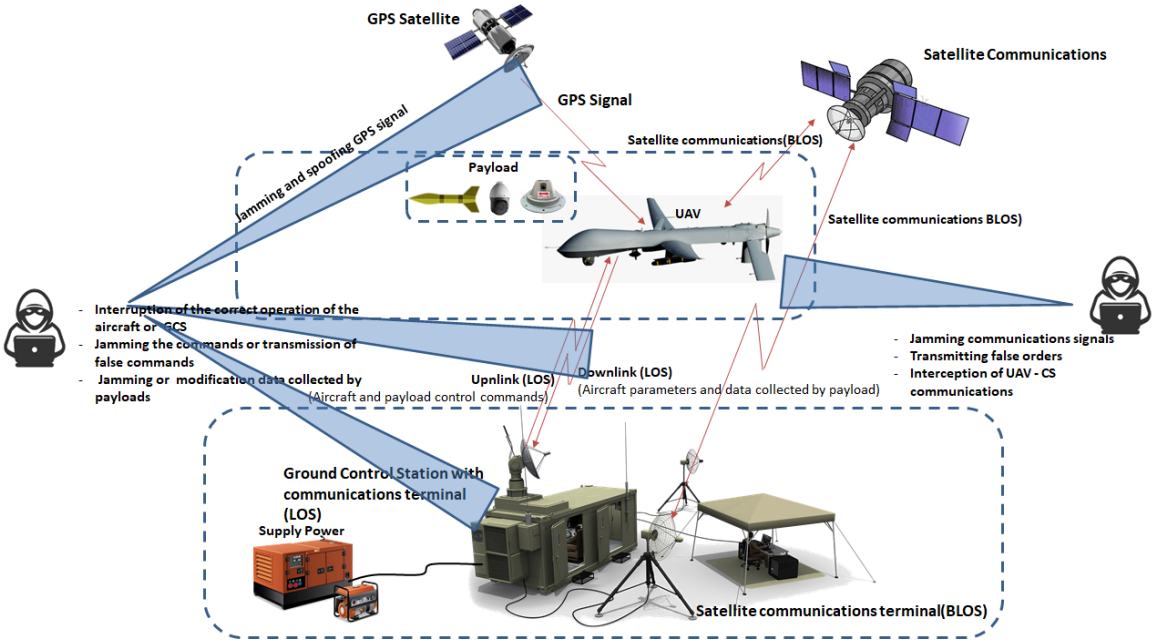

FIG. 1 Possible cybernetic attacks on UAV systems [6]

3. ATTACKS ON DATA LINKS

Communications within a UAV system are made through the following types of connections:

- GCS data link: data link between UAV and GCS (LOS)
- SatCoom data link: the connection between the GCS and the UAV via a communications satellite (BLOS)
- GPS data link: data link between UAS and GPS satellites

For a UAV to fulfill its mission successfully, it must communicate reliably with various entities in its network. These include CS, GPS navigation systems and satellite communications systems. However, these systems are vulnerable to various cyber-attacks such as packet data capture, message injection, message deleting, blocking and GPS spoofing. Attacks on communication systems can be classified as it follows:

1. Passive attacks (Packet data capture) are those in which the attacker tracks the data transmitted within the UAV system without interfering with them. This type of attack does not cause damage, has an increased risk (notice changes in the network - newly introduced equipment, changing configurations, etc.) and is difficult or even impossible to detect. These attacks can be performed by a variety of methods, such as surveillance of telephone or radio connections, exploitation of emitted electromagnetic radiation, routing of data through additional less protected nodes. Although they do not present direct risks, this type of cyber-attack is preparing to carry out active attacks on drones. The higher risks of passive attack, interception of network information (actual or identifying data) occur in wireless networks. Examples of passive attacks on UAV systems are presented below:

- packet sniffing (Passive attack by simple observation or "listening" to traffic). Thanks to the omnidirectional antennas used in Wi-Fi standards, Wi-Fi is susceptible to the packet sniffing attack.

In the UAV network, attackers can target communications between aircraft and other network nodes if the network is not or is poorly encrypted. Intercepting data via packet sniffing can be used as a first step to launch complicated attacks, such as GPS spoofing and attacks by injecting ADS-B messages [7]. The press reported that the Iraqi insurgents, using commercial software (Sky Grabber) that captures music and TV images, went live in video streams from American UAVs. Hacking was possible because the planes used unprotected communications to increase performance [8].

- Keylogger is a form of spyware developed to monitor user keyboard actions without user consent, so that hackers can access personal information, such as login details, passwords, etc. Keylogging software is usually installed on your computer through your own unintentional downloads, with someone physically installing it on your computer without your consent. In the case of UAVs, the virus records the keystrokes of pilots while controlling drones in military operations, being able to take over passwords, commands, etc.

Undetected passive attacks aimed at taking over the encryption keys represent a major risk for the network, because not knowing the compromised keys creates gaps in the information security system by encrypting the traffic [9].

2. Active attacks (because it changes the state of computer systems, data, or communication systems) are those attacks in which the intruder engages either in stealing messages, or in modifying or inserting fake messages, or by overloading the network with packets (flooding). This means that the attacker can delete, delay or modify messages, can insert fake messages, can change the order of the messages, either in a certain direction or in both directions of a logical channel. These attacks can be classified into:

- **DoS (Denial of Service):** In this attack, the attacker aims to prevent the communication systems in a network from transmitting and / or receiving data, sending numerous false signals to the targets, as shown in the figure no. 3. In any form, the DoS attack deprives beneficiaries of the right to the service or resource they are waiting for. In the case of UAS communications, a DoS attacker can send high-power wireless signals to block any of the data links. The attacker can also flood the communication channels by continuously sending known remote and control signals to consume bandwidth and interrupt the services provided by the network [7].

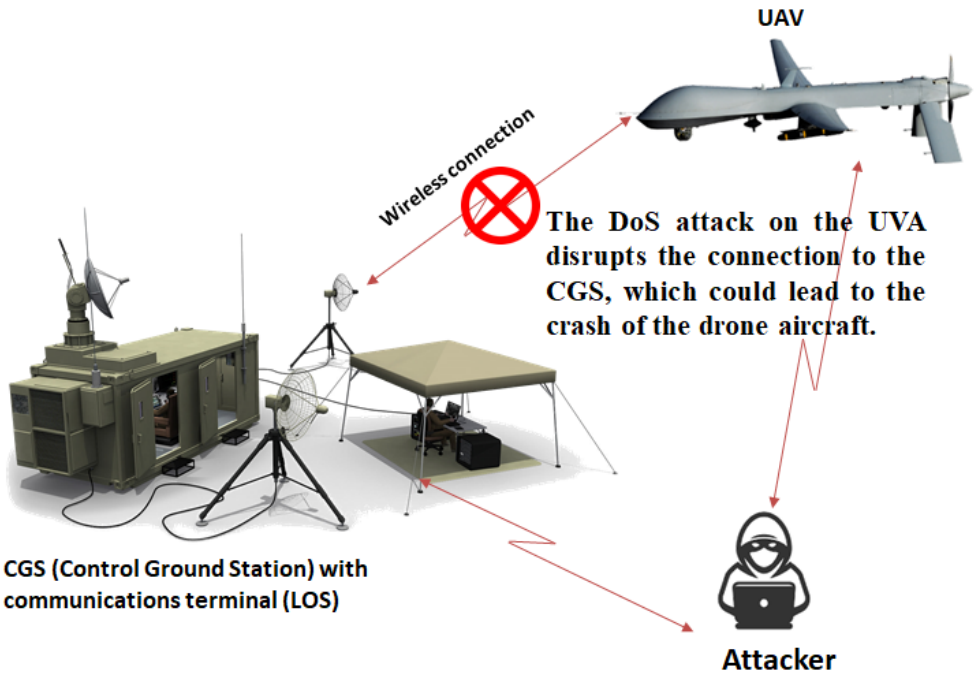

FIG. 3 DoS attack on a UAV [10]

The algorithm for performing a DoS attack is:

1. Compilation of vulnerable agents

- The network is scanned for potential vulnerabilities for the attacker to compile the list of agents to attack.
- There is the possibility of attacking systems by configuring automatic software to scan the network and take control of vulnerable agents.

2. Defusing

- Weak points in terms of security and vulnerability of systems are misused by the attacker.
- Software codes are used to automatically attack and disable the control system for the person responsible for the availability, security, maintenance, and support of the system.
- Actions taken by the attacker to protect the code deployed for DDoS startup.

3. Connection

- Protocols such as TCP or UDP used to connect to multiple agents and plan attacks according to a specific program.
- Attacks can be directed to either a single agent or to multiple agents [11]
- **MITM (Man-In-The-Middle)** – the attacker intercepts communications between the UAV and the control station and gains control of sensitive data, as shown in the figure no. 4. Users at the end are usually unaware of the attacker's manipulation.

A simple example of a MITM attack is the spoofing message disguised as a genuine email that misleads the user into a fake site. The user is then tricked into authenticating while the attacker listens to and collects credentials, such as passwords, usernames, and so on. The attacker falsifies the data and gains control over the communications network between the drone user and the remote-control device. The system details collected from the initial data capture help him to send the authentication commands to the drone as if it were the original user [12].

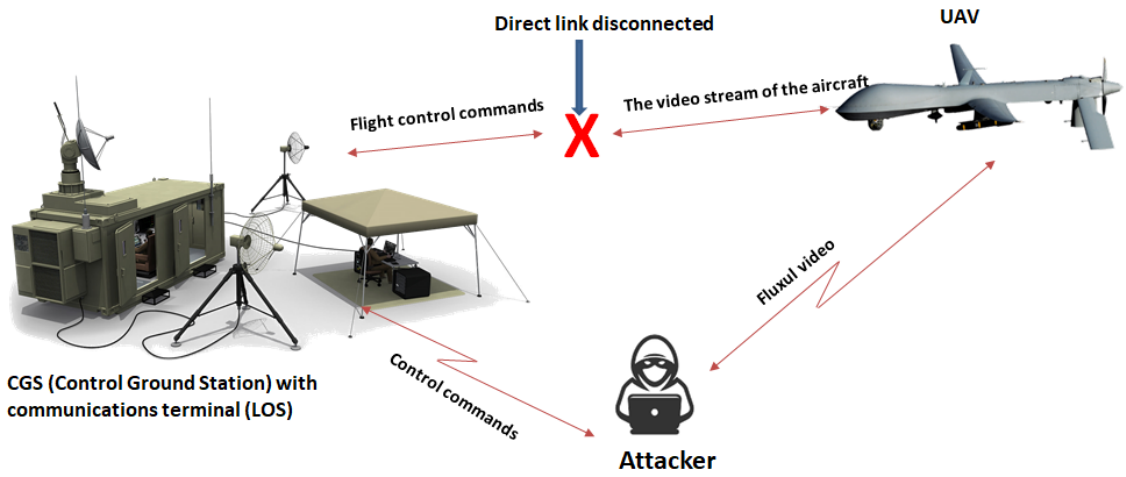

FIG. 4 MITM attack on a UAV [10]

If the wireless network is password protected, the authentication keys can be obtained by the methods that will be presented below. A password, sometimes called an access code, is usually an arbitrary string of characters, including letters, numbers, or other symbols, used to confirm a user's identity.

- a brute force attack: is a crypto-analytic attack, which can be used for any type of encrypted data. Brute force attacks are effective for breaking passwords with a shorter length. This method involves systematically checking all possible keys until the correct key is found. In the worst case, this method involves traversing the entire search space.

- dictionary - attacks: looks for open ports, which are similar to the "brute-force" type, but to break the password are used words from the dictionary, combinations between them and alphanumeric characters. The system will check if there are all possible permutations and combinations until the password is broken [13].

- aircracking: This exploit is used to decrypt wireless passwords, it is a free security application that can recover passwords from packets captured with other applications (CommView, Wireshark, etc.) [14].

8. ATTACKS ON THE AIRCRAFT AND GROUND CONTROL STATION

The operation of the flight controller depends exclusively on the information received from the ground control station via the data link and purchased by its environmental sensors. Due to the almost complete dependence of UAV operations on several inputs from the external environment, most attacks start with malicious external modifications of these inputs. In the following, we identify the attacks targeting the flight controller and GCS.

Trojan horse cyber-attack: It is a type of malicious code or software that looks legitimate but can take control of the computer from CGS or UAV and that actually allow unauthorized access to a computer, respectively copying files, and even controlling the commands of the penetrated computer. A Trojan is designed to damage, disrupt, steal or, in general, cause other harmful actions on data or network. A Trojan acts as a bona fide application or file that can trick you into loading and running malware on your device. Once installed, a Trojan can perform the action for which it was designed. Thus, cyber attackers are able to infect computers in the UAV system with a Trojan virus and force it to land or crash, its pilot unable to intervene, to engage the systems. electronic weapons of the enemy, to deactivate or deceive the electronic equipment of the aircraft [15].

Spoofing GPS:

GPS (Global Positioning System) refers to a group of satellites that provide signals from space that transmit positioning and synchronization data to ground receivers. Receivers then use this data to provide information to devices and vehicles, such as their position, timing, and speed. GPS satellites transmit both military (P-Code) and civilian signals [16]. The most common navigation method for a UAV is to use a system consisting of an inertial measurement unit (IMU) and a GPS receiver. A fundamental part of GPS is PRC (Pseudo Random Code), which is just a very complicated digital code or, in other words, a complicated sequence of “on” and “off” pulses. The signal is so complicated that it looks almost like a random electrical noise, hence the name “Pseudo-random.” GPS satellites transmit signals on two carrier frequencies: the L1 carrier has 1575.42 MHz and carries both the status message and a pseudo-random code for synchronization, the L2 carrier has 1227.60 MHz and is used for the much more accurate pseudo-random military code. There are two types of pseudo-random codes:

- C / A (Course Acquisition) code that modulates the L1 carrier. It repeats every 1023 bits and modulates at a rate of 1 MHz. Each satellite has a unique pseudo-random code. The C / A code is the basis for the civilian use of GPS.

- P code (Precise). It is repeated in a seven-day cycle and modulates both the L1 and L2 carriers at a rate of 10 MHz. This code is intended for military users and can be encrypted. When encrypted, it is called a "Y" code. Because the P code is more complicated than the C / A, it is more difficult for ground receptors to detect it. Therefore, many military receivers start by first purchasing the C / A code and then switching to the P code [17].

GPS signals can be falsified (spoofing - performed by using directed interference with digital coordinate transmission systems between GPS transmitters and receivers [18]. As previously presented if military GPS signals are encrypted, thus resistant to spoofing, civil GPS waveforms are unencrypted, unauthenticated and openly specified in documents available to the public [19]. The combination of the known signal structure and the predictability of the data bit makes the GPS receiver on the UAV an easy target for spoofing attacks, with devastating effects on the aircraft (capture, misleading and directing to collide with other targets). The signal coming from the satellite is weak. Therefore, if an attacker uses a local transmitter on the same frequency, this signal would be stronger than the original satellite signal. The driver receives authentic signals from the visible GPS satellite, decodes them, falsifies the code phase, carrier phase and Doppler frequency and transmits them to the UAV as legitimate signals. false positions for the target UAV. In this particular case, the UAV would then be hijacked and put on hold for the attacker's next command [20]. Figure no. 5 shows a GPS spoofing attack targeting a GPS-guided UAV aircraft.

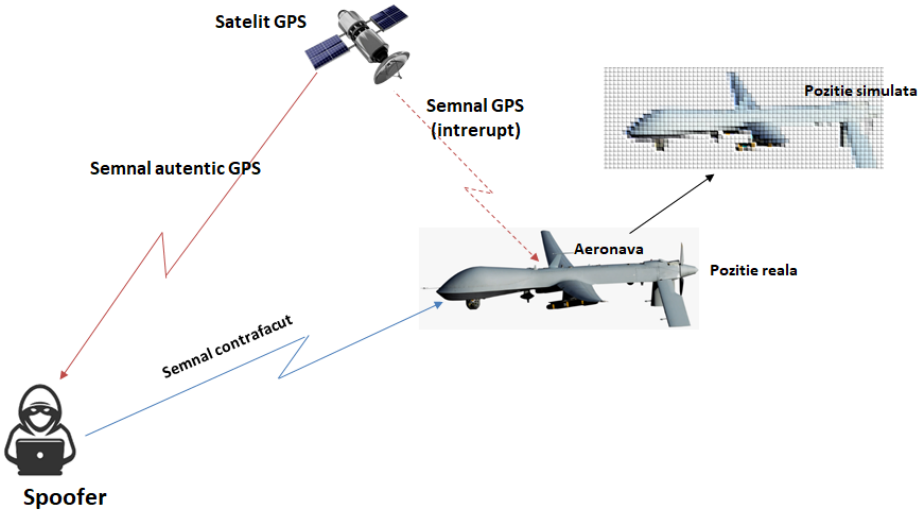

FIG. 5 Spoofing GPS attack on a UAV [21]

Attack on the ADS-B system (Automatic Dependent Surveillance Broadcast): It's a surveillance technology in which an aircraft determines its navigation position through satellite navigation and broadcasts it periodically, allowing for its tracking. The information can be received by the Air Traffic Control Stations, as a replacement to the secondary surveillance RADAR, since interrogation from the ground is not required. It can also be received by other aircraft in order to provide a situation report which is used to prevent collisions. ADS-B is automated, hence it doesn't require an external stimulus; it is dependent, because it relies on the on-board systems to provide surveillance information to other aircraft and control posts. Data is broadcasted, the original source doesn't know who receives the data and there is no interrogation or bidirectional contact [22]. The ADS-B can receive data manipulation attacks, capturing and modification of the ADS-B messages, the real ones can be deleted, false ones can be injected and certain entities' communication channels can be blocked [7].

Jamming of the GCS command and control signals: A foe which tries to take control over a drone will first try to deactivate the reception of GCS control-command signals to the UAV. Loss of said signals forces the aircraft to perform an uncontrolled flight. But UAVs are usually designed to be fitted with a lost connection protocol, which, once the communication from the ground is lost for a certain period of time, the drone could follow a procedure by itself, which can, for example, command the UAV to return to its base, relying on GPS navigation. But in general, if the drone is attacked, it is susceptible that the attacker will also block GPS signals as well, which forces the UAV to fly in an uncontrolled manner [6].

9. CONCLUSIONS

- Unmanned Aerial Vehicles (UAV) are not only military and scientific solutions. The extraordinary growth of drone usage has led to a new era of aviation in the civilian domain, but also in the military, offering several benefits, such as economic, commercial, industrial, mainly because of their autonomy, flexibility and ease of use, with low costs and low energy consumption. However, their usage has led to the rise of multiple security, safety and confidentiality issues, which manifested through different cybernetic attack, threats and challenges.

- Thanks to the omnidirectional antennas used in Wi-Fi protocols, they are susceptible to passive attacks such as sniffing packet or Keylogger. Passive attacks have the following common traits: they don't cause damage (don't delete /modify data), break the confidentiality rules by stealing network information, they're aided by the routing of packages in less protected, high risk network nodes, they observe network changes(new equipment, configuration changes, etc.), they're hard or even impossible to detect. Undetected passive attacks are a major threat to the network, ending in the reveal of the encryption keys and leaving the network vulnerable to active attacks. Precautions can be taken, such as redirecting and encryption, but the risk of interception is still high, since knowing the direction the signals come from is not required to intercept the signal.

- Most drones rely on GPS navigation systems. Predictability and knowledge of the GPS signal properties create the opportunity for attacker to take control over the UAV and use it for personal gain. For this reason, GPS spoofing is one of the major threats to the UAV's.

-The ADS-B system is destined to large scale implementation in air traffic surveillance systems including on UAV's. One of the objectives of ADS-B is to increase the safety of air traffic. But this system is very easy to penetrate for an attacker, even with a less advanced technology. Attacks may vary from passive(listening) to active attacks (message blocking, detouring) endangering air traffic.

To conclude, despite their various benefits, UAV's are vulnerable to attacks because they are equipped with various on-board data collection sensors that can expose them. To be more precise, in the absence of human control, attacker have access to sensitive information and can provide false information to the UAV. The drone can also be captured and reprogrammed to carry on clandestine missions which can cause severe damage.

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OPERATIONAL MEDICINE - AN IMPORTANT BRANCH OF ROMANIAN MILITARY MEDICINE IN THE CONTEXT OF THE EVOLUTION OF ARMED CONFLICTS

Ciprian CHIȘ
"Communications and Information Technology Command, Bucharest, Romania (chis.ciprian@yahoo.com)

Diana CHIȘ-MANOLACHE
"Carol I" National Defence University, Romania (dianamanolache88@yahoo.com)
ORCID: 0000-0001-9498-7720

DOI: 10.19062/1842-9238.2020.18.2.3

Abstract: *Operational medicine is a concept born from the necessity to adapt medicine to the new progressions in the evolution of conflicts. Taking into account the fact that the forces involved in current conflicts are aware of the new dimensions of warfare, it has also become necessary to reconfigure the medical services provided in an operations theatre or in a real battlefield. Therefore, the tacticians, doctors and other American specialists have penciled operational medicine as a sub-branch of military medicine and, respectively, classified it according to the type of conflict in which it is engaged, but also according to the military unit it serves. A careful analysis of this concept in its evolution clearly demonstrates that operational medicine has been welcomed by all the parties involved, as the concept was quickly understood and implemented as such, progressively by NATO member states followed by others. Sprung from necessity and emerging as a characteristic of an extremely vast field (that of national and global security),employing dedicated and highly trained people, operational medicine always proves its effectiveness, achieving the best results by saving human lives.*

Keywords: *operational medicine, medical echelon/ROLE, theatre of operations, first aid, medical evacuation.*

1. DEFINITION AND BASICS CONCERNING THE CONCEPT OF OPERATIONAL MEDICINE

Operational medicine is the act by which medical services or healthcare are provided in unconventional situations and environments, in situations where important resources that can easily be found in a regular medical-sanitary unit are significantly limited or restricted. At the same time, these limitations and/or restrictions may be represented by a restricted existence of the expertise of doctors specialised in different fields, by very short time intervals allocated to a medical intervention, by atypical or even inappropriate locations for the exercise of a fair and appropriate medical act or by climatic conditions which are not the most conducive to first aid or to carry out an emergency medical intervention.

At the same time, the operational medicine is that operational situation that gives medical-sanitary personnel a realistic picture of a battlefield in which one or more victims, with various traumas, can appear at any time, and these personnel, even under the conditions of the failure or destruction of the own medical equipment, with or without the necessary supplies, must improvise so as to provide first aid and save as many human lives as possible.

Therefore, the operational medicine involves medical care providing directly on the battlefield, in a specific context of an operations theatre, inside the urban patrol perimeter of a conflict zone, under tactical fire carried out by own troops for cover or under the enemy fire. It also involves the tactical administration of a particular medical care protocol for victims resulted from combat actions, as well as the fact that medical-sanitary personnel is able to move together with the military unit/subunit of which it belongs (group, platoon, company, etc.), to different places and areas and to form, also depending on the level of the military structure it belongs, to which the so-called victims' collection points, battalion-level first aid stations and forward surgical teams.

Given the first definitions and concepts of operational medicine, it is considered that, worldwide, the promoters of the operational medicine are some Americans military physicians and some specialists in the field from USA. They consider that the operational medicine is carried out in certain segments and is appropriate to specific levels of the place where the first aid is granted or the medical act is carried out. This is also based on the fact that the way in which, currently, an armed conflict or even a war take place is no longer a classic one, means that it is not characteristic of the period in which the two world wars took place, which is now experiencing new forms of deployment (e.g. urban fight or struggle).

We appreciate that operational medicine is designated both to soldiers and civilians injured during combat actions and also is characteristic for every level.

As we have said before, these levels are closely linked to the place where victims are treated, but also to the number of medical-sanitary specialists who can intervene, as a matter of urgency, to save the lives of wounded or injured soldiers or civil personnel.

It should be noted that the NATO Logistics Manual classifieds medical structures on 4 levels, as it relates strictly to military infrastructure and capabilities that can be managed to the maximum extent by the military institution [1].

With the definition of the 5 levels, the American specialists, about which I was talking above, implemented the term "ROLE" or "ECHELON" in order to describe the stratification of the levels in which the medical support is such organized so that first aid can be given, an adequate first medical treatment, the evacuation of the wounded from various places, the refueling or the replenishing specific materials. The two terms, "ROLE" and "ECHELON", are defined taking into account the capabilities and resources these structures are equipped with and which, generally, are not specific or do not correspond to classical medical facilities.

American specialists allocated the term "Role" to medical structures from Land Forces (or Army) and Air Forces, while the term "Echelon" used it for their Maritime Forces (Naval Forces, in the case of other NATO member states).

The treatment capacity of each Rol/Echelon is so designed as to constitute a superior treatment capacity compared to the lower medical level. That means that, a Role/Echelon-3 medical facility will have the capacity to perform Role/Echelon-2 functions and higher, but not vice versa. Each medical support level has the responsibility to strengthen the lower levels, either by providing specific materials or by providing medical assistance by redeploying medical staff or assisted by various means of communication.

When developing *the operational medicine concept*, American specialists designed these medical intervention/care levels so that the patient did not necessarily need to go through each medical/care echelon during treatment and/or evacuation procedure.

As a NATO member state, Romania has implemented this requirement at the force structure level of the Romanian Army, especially at the level of the military structures deployed in the theatres of operations, which participate at missions undertaken by our country within the NATO or ONU Alliance, such as: Force Protection Battalion, National

Support Element, UN Multidimensional Integrated Stabilization Mission in the Republic of Mali (MINUSMA) to which Romania contributed until 24 November 2020 when the official mission closing ceremony took place and so on. However, it should be noted that this requirement implementation at the level of the Romanian Army has been carried out with big efforts and difficulties. Also, these medical structures are not identical to those of the US Army or other NATO members, and these structures need to be adapted according to both the existing specialist personnel and their own logistics and infrastructure.

Currently, the research in this field is in full development, given that it is a field of novelty, being recently implemented in some NATO armies. Considering the fact that the first researches in the field and the first steps in the implementation of the concept were carried out in the USA, it is obvious that the American specialists are the ones who improve the implementation and management of this type of medicine. Also, they realize scientific studies that are specific to this field. The operational medicine is also part of a maximum actuality domain (a topical domain), which is able to open new horizons in terms of research.

2. A DESCRIPTION OF THE FIVE-LEVEL MILITARY MEDICAL STRUCTURE

Given that the medical-military structures we are discussing in this article are associated with the different military-fighting structures, it is normal to have a definition or classification of them. Because the army, in general, regardless of the state of which it belongs, is a stratified, well-ranked system, and these medical-military structures are so designed and created to be associated with military units, regardless of the level they are at (from level 1 to level 4 in the case of the Romanian Army). Next, in order to better understand them, we will define and explain these military medical levels, as they were thought of by those who implemented this concept.

2.1. Echelon/Role 1 military medical structures

The medical Echelon/Role-1 is located in the area of an independent company or a battalion level unit, where are established: a station or first aid point, medical points where medical and sanitary personnel carry out triage activities, take immediate measures to save staff lives or provide primary medical care for those in need.

Thus, at this medical level, it may be granted the first aid or it may be performed a summary medical intervention, or minor injuries are treated, and the soldiers thus treated may return to the battlefield or to the daily activities of the theatre of operations.

Also, at this Echelon/Role, patients with more severe lesions or wounds that cannot be properly treated will be properly stabilized and sent to a higher Echelon/Role for permanent specialist care. At the same time, the Echelon/Role 1 medical structures contribute to the maintenance of the unit staff health by providing information related to the diseases prevention, to the treatment of wounds that have not resulted from combat actions or information related to combating operational stress.

Therefore, the management of illness or injury minor cases and the carrying out of medical interventions that result in immediate staff return to work are the specific functions fo this medical care level.

At the same time, it should be noted that, in theatres of operations, Role 1medical structures accompany the fighting elements during the conduct of daily missions or patrols and on the battlefield during the combat actions. Thus, the Role 1 medical and sanitary personnel grant first aid to the injured soldiers, stabilize them and participate in their evacuation to the Role 2 medical structures.

In the Romanian Army, medical Echelon/Role 1 is represented by those elements or medical and sanitary microstructures from the military structures organization charts that are deployed in international theatres of operations. Typically, a Role 1 medical structure consists of a doctor (specialist or primary) confirmed in one of the following specialties: *family medicine, emergency medicine* (or *anesthesia and intensive therapy*, as was the case with the mission in Mali under the command of the Romanian Air Force General Staff), and one or more medical non-commissioned officers constituted in a medical support group/Role group.

As mentioned above, doctors and the sanitary personnel from Role 1 physically participate in daily patrol missions and combat actions carried out by own troops, precisely in order to be able to provide the first aid and to evacuate the wounded from the battlefield.

2.2. Echelon/Role 2 military medical structures

The medical Echelon/Role 2 shall be set up at brigade or division level (depending on the location situation and the number of military units in a given geographical area), and shall consist of a medical point where emergency medical assistance can be provided or more complex investigations and medical care can be carried out, advanced than those carried out at the level 1 medical Echelon/Role. Also, at this medical level, triage activities, resuscitation, specific treatment of patients until they are returned to service or discharged, as well as emergency dental treatment, are carried out.

At the same time, this medical Echelon/Role can serve as a medical station point for those troops that deflate to the conflict zone, usually for the next 24 to 72 hours. However, it should be noted that, usually, at this medical Echelon/Role, the general anesthesia or surgical activities involving anesthesia cannot be performed.

In some NATO states (but not in Romania), there are also several improved ROL 2 medical structures, called ROL 2+, where several light surgeries can be performed, which do not require intense post-operative activity or long-term medical recovery.

In USA Maritime Forces, Echelon 2 is equivalent to the Role 2+ Land Forces, as a surgical team is an integral part of this Echelon. In the USA, medical Echelon 2 is normally installed on most warships, on some larger logistics or support vessels, but also in some forward logistics sites (FLS).

Currently, in the Romanian Army, there are some Role-2 medical structures, but not in a very large number. They have a certain staffing and equipment, but in the event of terrorist attacks or disasters, these medical structures are intended to support other structures of the Ministry of National Defence or the Ministry of Internal Affairs. Here, we can exemplify the participation of the Role-2 Medical Formation of the Medical Directorate of the Ministry of National Defence, from 12 to 18 October 2018, in one of the largest national exercises in recent years, namely SEISM 2018, planned by the Ministry of Internal Affairs [2]. Within this important national exercise, the Ministry of National Defense participated, along with the national structures with responsibilities in the field of emergency management, with a large staff, and from a medical point of view, the Medical Directorate installed the Military Field Hospital (the extended Role 2 Module), near the Capital, in a polygon from Ilfov County.

This extended Role 2 Module provided all the hospital facilities necessary for intervention in civil emergencies: triage, laboratory, radiology, pharmacy, sterilization, operator module type A, operator module type B, postoperative module type A, postoperative module type B, recovery modules, as well as a communications and informatics module. It is obvious that the accomplishment of all these functions was achieved by the augmentation of this medical structure with specialists from several structures of the Ministry of National Defense.

Considering the dynamics of the military institution after joining NATO, as well as the ongoing Romanian Army restructuring process, in a first phase, these Role-2 medical structures were inserted in the organizational charts of different categories of army forces or support commands.

Finally, in order to achieve a unitary management and conception, these military Role-2 structures were placed under the subordination of the Medical Directorate, being administratively coordinated by this directorate, with the mention that they must respond to the operational needs and requirements ordered by the Defense General Staff, by reporting to the needs of the force structure and the requirements of NATO partners.

We must also state that, at present, only the Role-2 medical structure that we talked about above, actively participates in various national or international exercises, but in relation to the requirements of NATO partners, it must standardize both its level of staffing, as well as its own infrastructure and logistics. The other Role-2 medical structures of the Ministry of National Defense are to be aligned with the required standards, precisely in order to be able to support the combat missions of the military units that they augment in various situations.

However, considering the very broad dynamics of medical staff inflows and outflows into/from the Ministry of National Defense, in recent times, as well as the current global context generated by the coronavirus pandemic that demands the medical system extremely much, we appreciate that the operationalization of Romanian Role 2 military medical structures will extend over a longer period of time.

Regarding the theaters of operations, we must specify that the Romanian Role 2 military medical structures are found in the organizational charts of the fighting units that are deployed, by rotation, in the Theater of Operations in Afghanistan, in the organizational chart of the American Military Camp Hospital Role 2 in Afghanistan or in the organizational chart of the Romanian National Support Element generated by the Joint Logistics Command.

For clarification and detail, we mention that, at present, Romania has already provided over 10 rotations to ensure a medical microstructure for the Role-2 American Military Hospital in Afghanistan, all medical staff standing out by professionalism and constantly obtaining very appreciated results.

Usually, this medical team consists of a doctor confirmed in one of the following medical specialties: *family medicine*, *emergency medicine* or *anesthesia and intensive therapy* and/or a pharmacist and 4 sanitary non-commissioned officers. In general, they come from the medical and sanitary structures subordinated to the Medical Directorate and, only in extreme situations, they are selected from the force structure of the Ministry of National Defense.

Having a less significant history in the field of Role-2 military medical structures, we must mention that the Romanian medical detachment participating in the medical support mission for the Role-2+ TASK FORCE 21 MEDICAL Hospital, deployed in the Iraq Theater of Operations between May 17 and November 29, 2006, mission organized by the Medical Directorate, obtained very good results and was very appreciated by the foreign partner.

2.3. Echelon/Role 3 military medical structures

The medical Echelon/Role-3 is constituted at the level of the army corps and represents a very forward position in which an advanced preventive medicine is performed and where there are specialized doctors in different fields (dentistry, orthopedics, ophthalmology, etc.).

In the army, this Echelon/Role is called field hospital (formerly known as combat support hospital, with the role of treatment and evacuation or mobile army surgical

hospital - MASH). In the USA, for the naval troops, this echelon is represented by the fleet hospital, and for the Navy, it is represented by the hospital ships. At this level, specialists such as orthopedists or ophthalmologists use deployable medical systems or systems (DEMEDS), and they must include all the necessary equipment to examine an injured patient, a rapid diagnostic set (including ultrasound equipment), and in some locations, even a computed tomography device), but also equipment with which a large part of the surface lesions (in various forms), and not only, can be treated. These medical equipment's can include: a microscope equipped with operating room, emulsification unit, vitrectomy unit, various instruments for performing simpler surgeries, external sutures and magnets. For example, surgeons working in this medical Echelon/Role (especially those who are part of the Land Forces and Naval Forces) are trained and prepared so that they go with troops or combat units on the battlefield. Thus, all the equipment we talked about earlier must be easy to pack and transport, facilitating the rapid flow of operational units.

Also, at this level 3 medical Echelon/Role, the wounded soldiers can receive complete, definitive medical care, and from here, depending on the medical evolution of the patients, they are either evacuated to the upper echelon for advanced treatment or subsequent recovery and rehabilitation, or they are reinstated through evacuation and transport policies, thus being able to resume the duties of the positions in which they are employed. In the USA, the medical Echelon 3 belonging to Maritime Forces is equivalent to Role 3 belonging to the Land Forces or Air Forces. The Echelon 3 is found on large amphibious ships, on hospital ships, in fleet hospitals, at the level of forward logistics sites (FLS), but also at the level of advanced logistics support sites (ALSS).

In the Romanian Army, the Role-3 military medical structures are assimilated to the emergency military hospitals subordinated to the Medical Directorate of the Ministry of National Defense. Thus, the Romanian soldiers wounded during international missions, but not only these, are evacuated to these hospitals after being stabilized at the American Military Hospital Role-2 in Afghanistan (in the situation în which the mission takes place in this theatre of operations). This situation occurs only if the wounded has/have lesions or minor injuries that do not require their evacuation, transport and treatment to a Role-4 level hospital such as the NATO forces Military Hospital in Ramstein.

The staff of the Ministry of National Defense can call for almost any medical context to the medical services that these military hospitals can offer, and can benefit from a wide range of medical care. We should also note the establishment, within the Balneophysiotherapy and Medical Recovery Sanatorium “Dimitrie Cantemir” from Bălțătești (also, a military medical facility coordinated by the Medical Directorate), of a center with treatment capabilities of seriously wounded soldiers in theaters of operations.

As a history of the Romanian Role-3 military medical structures, we must mention the operation of the Military Campaign Hospital in Somalia, between June 1993 and October 1994, within the United Nation Organization Observation Mission (called UNOSOM-II). This mission is one of the greatest achievements of the military institution in our country, with many positive results, very well appreciated by the UNO.

Even if for the operation of this military hospital on the whole spectrum of medical specialties, it was necessary the augmentation with civilian medical staff from the medical units on the Romanian territory, the hospital was able to provide medical care in all specific medical fields, which led to the maintaining of very good health condition for both UNO staff and the civilian population in the conflict zone.

Also, we must mention the fact that the military hospital was very well dimensioned in relation to the needs and requirements of the UNO, but also to the features and climate of the area. The organizational structure of the military hospital was quite significant and

very well sized, being made up of 50 beds and having a staff of about 250 people - both medical, administrative and logistics staff.

Also, from the history of the Role-3 military medical structures carried out by the Romanian Army in the international theaters of operations, we can mention the Romanian Military Campaign Hospital deployed in Angola within the UN Verification mission in Angola, called UNAVEM III.

And this Romanian mission, carried out between May 1995 and June 1997, was very well appreciated by UN, and the operation of the military hospital on an organizational structure of 40 beds and a staff of 110 people, of which almost half medical staff, contributed to the maintaining of a good health of the staff and the population it served.

2.4. Echelon/Role 4 military medical structures

The level 4 medical Echelon/Role is usually represented by the military hospital located in a city (usually a more economically developed city), or within an extended military base, the hospital having a fixed position. In this case, the level 4 medical Echelon/Role is represented by the regional hospital, and it can provide multiple, complete medical services, definitive care and is equipped to intervene and treat any type of injury belonging to any medical specialization.

This military medical structure can also provide medical services specific to the field of nuclear medicine, oral and maxillofacial surgery, anatomical and pathological medicine or PET-CT investigations.

At this medical Echelon/Role, the level of care is very specialized, involves investigations and interventions that require a longer period of time and is normally provided in the origin country of the injured soldier. In atypical or unusual circumstances, this military medical care level can be established in a theater of operations.

The medical Echelon/Role-4 provides definitive care for patients for whom the necessary treatment is complex and involves capabilities that are not found in the Echelon/Role-3 structures.

In our country, it is considered that the only military medical capability of Role-4 is the Central Military Emergency University Hospital “Dr. Carol Davila”, which can currently offer the full range of medical services we talked about earlier.

Thus, as it has been observed over the last few years, due to the facilities and multi-specialized staff, this military hospital has taken over for treatment and healing several injured as a result of various accidents or accidents with multiple casualties, while also is a part of the Red Plan established at national level by state specialized structures.

2.5. Echelon/Role 5 military medical structures

In some American states, more economically developed, there are few Role-5 medical structures. This medical level is represented only by some military hospitals, but can also be found in some regional civilian hospitals. These hospitals are usually equipped with the latest and most advanced medical equipment can treat the most serious medical problems and can perform a range of very complex medical interventions, such as those specific to reconstructive surgery, neurosurgery, etc.

Also, at this medical level, medical rehabilitation services may be provided which include: spa medicine services, physical recovery services and/or psychiatric recovery services or recovery for post-traumatic stress disorder.

In Romania, at present, there is no implementation of this concept, the concept of Role-5 Hospital, but we tend to believe that by the possible establishment of future regional hospitals, this concept can be also implemented in our country.

3. GENERAL GUIDELINES OF STAFF TRAINING FOR OPERATIONAL MEDICINE

From the above, it is clear that the operational medicine is associated with theaters of operations in which military actions are carried out or military applicative exercises with national or international participation.

Before taking part in these international missions or in the military applicative exercises carried out in different polygons or tactical fields, the medical staff should take certain courses in which to simulate the performance of medical interventions in conditions as close as possible to those in a theater of operations. Also, the medical staff has to go through some specific modules in which they learn to stop a massive hemorrhage caused by the shooting of a soldier, to manage the unblocking of the airways also resulting from a wound produced by gunshot or to treat a head injury caused by shooting. The American partner symbolically calls the possession of this knowledge, as "the M.A.R.C.H. algorithm." [3] used to assess a patient in a traumatic situation: **M**-massive hemorrhage, **A**-airway, **R**-respiratory, **C**-circulation and **H**-hypothermia.

In addition to the medical care provided on the ground in a theatre of operations, competences gained by the medical staff by going through the operational medicine module, these personnel must know all the maneuvers that are performed for loading and unloading victims in/from different combat and transport aircraft (both helicopters as well as transport aircraft). Also, the medical staff should know how to carry out medical interventions on victims inside these aircraft, as well as providing medical care during the air transport, in the specially arranged spaces for this purpose, symbolically called air ambulances.

We must note that, during the medical evacuation of a victim or multiple victims, the team work and communication between team members are vital, so that the medical staff must be trained in this regard as well. Other courses that medical staff from the Ministry of National Defense should take in order to participate in international missions from theaters of operations, courses that contribute to the development of specific skills for the management of people wounded by gunshot would be: Combat Medic Advanced Skill Training, Combat Lifesaver Course Learning Modules [4] or Terrorism and Disaster Response Course and many other, organized by various NATO partners.

At the same time, the medical staff that participates in the daily actions of the military structures deployed in the theaters of operations must take into account, in the most serious way, the part of individual physical training.

This aspect should not be neglected because the participation in these daily actions involves both the transport of the military equipment and the medical equipment with which they must provide the first aid. Thus, they must take into account the fact that it is possible to carry on them, in addition to their weapon, cartridge magazines, bulletproof vest, safety helmet, ballistic goggles, transmission-reception equipment, the medical supplies necessary to provide the first-aid, and the transport of all these materials requires a very good physical training.

All the materials listed above weigh at least 30 kilograms, and their transport requires very good physical training. Also, the medical staff must take into account the fact that the provision of first aid in critical situations may involve totally atypical positions, inconsistent with those adopted in a doctor's office or classic intervention room, sometimes having to perform the medical act from the kneeling position next to the injured and maybe even from the lying position. And all these aspects require a high-level training.

4. OPERATIONAL MEDICINE - A NECESSITY IMPLEMENTED BY OTHER PRESTIGIOUS INSTITUTIONS IN THE FIELD OF GLOBAL SECURITY

Although it may seem hard to believe or imagine, the operational medicine service is found even at the level of a world-renowned institution, namely the FBI which owns the Operational Medicine Program [5]. A lot of people don't even realize that the FBI has an operational medicine program. Through this program, the FBI prepares and trains special agents who, among others, are graduates of medical studies, are paramedics or even doctors who can provide medical care in extreme tactical situations, which also require the existence of a high level of stress. For example, the training activities of these special agents include interventions in car accidents resulting in human casualties, interventions in cases where protected or target persons suffer heart attacks or exercises to evacuate victims by helicopter. These agents are not different from other FBI special agents because, above all, they have FBI agent status. Thus, they work regularly on various FBI cases like their other colleagues. The difference occurs when a certain situation requires it, in the sense that they must leave the role of case agent and must enter the role of agent who has medical knowledge, effectively putting them into practice.

For the training of such agents, the FBI organizes a course called Tactical Applications for Emergency Medical Technicians, and in this course special agents acquire various medical skills. Thus, after completing such a course, the agents are able to differentiate between a real normal situation and a real situation in which one or more people are medically affected. Therefore, they can intervene in situations where someone is suddenly hurt, in situations where someone suffers a mild heart attack or in situations where someone is saved from drowning. At the same time, in this course, FBI agents assimilate techniques and intervention procedures for situations in which a car accident occurs with one or more victims (they learn how the victims should be handled, how the victims can be safely removed from the damaged car, etc.). FBI agents are also prepared to recognize allergic reactions or anaphylaxis as easily as possible and treat them.

As we said before, the Romanian military institution is in a full process of operational medicine development, in the sense that the implied structures and the structures with responsibilities in the field made visible efforts to align with the standards required by NATO partners.

Although, at present, the specific endowments of operational medicine in Romanian military system are at the beginning of the road, the specialists in the system have started the specific stages of acquiring the material base that corresponds to the structures of level 1 and level 2operational medicine. For sure, in few years, every Romanian emergency military hospital will be able to self-generate a level 2 operational medicine structure both in terms of staff and material base. This aspect will represent the strengthening of a battalion's capability (or a brigade) to be ready for a battle or to be able to be quickly deployed in an international theater of operations.

Also, by transforming the Medical-Military Training and Development Section of the Medical Directorate into a Medical-Military Training Center, the military institution offers a more in-depth training of the medical-sanitary personnel, and this personnel will better serve the level 1 and the level 2 operational medicine structures in the theaters of operations.

5. CONCLUSIONS

In the context in which the current way of conflicts development has changed a lot, compared to the way in which the two world wars took place at the beginning of the twentieth century, it is clear that everything involved in these conflicts must change and adapt. In this sense, the way in which the medical act is carried out during these conflicts had to be changed and adapted, thus appearing the concept of operational medicine.

Considering that this concept has been implemented and works very well at the level of various NATO member states, as well as the fact that our country wants to meet the requirements of this organization, it is obvious that this concept has been implemented at the level of the Romanian military institution. Moreover, Romania proved that it understood the need and the importance of implementing this requirement, fact for which, in addition to the military medical elements which our state deployed in various theaters of operations, Romanian Army participated in several international exercises with a medical focus. Of these, perhaps the most important was that one from 2017, respectively "Saber Guardian", part of "Vigorous Warrior" exercise, in which the Medical Directorate of the Ministry of National Defense provided the real medical care for all Romanian and foreign soldiers deployed in our national territory and participated in the MASCAL (mass casualty) type action sequence which took place between July 10-17, at the Air Base in Mihail Kogălniceanu from Constanța [6].

It should also be noted that the MASCAL Medical Evacuation Exercise provided a close-to-reality scenario for hospital care training for the 30th U.S. Medical Brigade, which led the exercise and three NATO Role-2 hospitals (Field Hospital 212 of USA, Romanian Role-2 Medical Extended Module and Balkan Medical Team), all of these deployed to Mihail Kogălniceanu Air Base.

At the same time, MASCAL represented an event in which the number, the type or the severity of the victims' injuries exceeded the capacity and capabilities of a Role-2 medical team. Thus, the onset of MASCAL was not determined by the type or by the magnitude of the incident that generated the victims, but by the capabilities available at the level of the medical module.

Following this exercise, the Romanian side was very well appreciated, which indicates that the Romanian Army understood very well the concept of operational medicine and implemented it as such.

At the same time, we must also mention the fact that the Romanian military medical staff has the ability to assimilate and to synthesize everything that is new in the field of operational medicine and, even if the efforts made by this personnel will be special and will involve personal sacrifices, certainly the existing and current gap in this area between us and some NATO member states, will be recovered fairly quickly and our country will respond at the maximum level at every international requirement.

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PARACHUTING – THE AGE OF THE FIRST ATTEMPTS

Mihai DEAŞ
"Henri Coandă" Air Force Academy, Braşov, Romania (mihai_deas@yahoo.com)
ORCID: 0000-0002-9432-2136

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Abstract: *Paradoxically enoughthe age of the parachute precedes that of the flying machines by several centuries, so they actually emerge even before man managed to rise into the air.*

The idea of creating an "umbrella" that allows the descent of a human being from extreme heights is very old, as it is present in various legends and stories, with different populations.

This article aims to bring its readers closer to the age of the first trials in parachuting. Thus,it shows how the parachute appeared, what the trials of the greatest inventors were, and makes a necessary connection between parachutingand the beginnings and progress of aviation.

Keywords*: parachuting, inventors, aviation, history*

1. INTRODUCTION

This article aims to provide to its readers a history of two branches of aeronautics, parachuting and aviation. Even though countless works have been written about these two branches, I will try to compile the main moments in their history. Of course, a review could not be done without proper details on how all these flying means were created: parachute, balloon or plane.

Paradoxically, but the age of the parachute exceeds that of the flying machines by several centuries, so even before the man managed to rise into the air.

The idea of creating an "umbrella" that allows the descent of man from very large heights is very old, being present in various legends and stories, in different populations.

In the following I will address the emergence and development of parachuting and aviation worldwide, while a prospect of the emergence and development of the two branches at national level will be the subject of another article.

2. THE BEGINNING

Man, from ancient times, turned his gaze to heaven and wanted to detach??? himself from the earth, to be like the birds. That is why in the history of populations myths and legends that speak of these nations were preserved.

Perhaps the most famous example of this is the legend of Icarus, a name that has become the symbol of mankind's dream of flying. Icarus, son of Daedalus, was imprisoned with his father in the labyrinth palace by King Minos. This palace was built by Daedal at the request of Emperor Minos so that the monster with a human and bull's head, the Minotaur, could not get out. The Minotaur was killed by Theseus with Daedal' help. As a result, Daedalus and Icarus, imprisoned in the labyrinth, had to find a way out. The idea of getting out of the maze was to fly with some wings made of feathers and bird bones waxed by the hands of the two.

Icarus was warned by his father not to fly too low, not to get wet or too high to melt wax, but he did not listen.

As it spread to the high sea, Helios – the sun, melted the wax, the wings detached and Icarus found its end in the waters of the sea.

Thus, Icarus became a symbol of ego dualism - boldness, reasoning - courage. The discovery of the parachute is lost in the mists of time and it is not possible to determine with certainty who was the first paratrooper. Going back to the legend of Icarus we can ask ourselves whether he was the first aviator or the first paratrooper.

FIG. 1 The fall of Icarus, son of Dedal [1]

The first flight attempts or the first air field data of which certain evidence exists are those that were trying to find an appliance that actually lowers the crash speed.

The first documentary attestations in this respect were those in China. Here the first evidence of this area concerned shadows and kites. China had all the necessary materials to manufacture the two objects: bamboo for the construction of the frame and silk for the realization of the body.

As for the first manuscripts relating to the attempt of some to fly, I must recall that the first scientific reference to the possibility of flying man was made by Roger Bacon, an English Franciscan monk. In his book entitled "Secrets of Art and Nature", published in 1252, he refers for the first time in a chapter "About wonderful appliances" and the possibility of building a flying device in which a man could sit and who could fly acting wings that would beat the air like birds.[2]

FIG. 2 Leonardo da Vinci's parachute design [3]

If Roger Bacon brought to reality the man's desire to fly, by mirroring recorded documents, Leonardo da Vinci did the first scientific research on the flight. In his books "Codice Atlantico" from 1485 and "Codice sul volo degli Ucelli" from 1505 we encounter several sketches about this field: a sketch of a parachute, another about a device used for flying with swing wings that are driven by muscle force, another about the principle of operation of the helicopter. He is also the one who finds the right word for the helicopter, merging the Greek words "helix" which means "spiral-shaped" and "pteron" meaning "wing".

Around 1500 Leonardo da Vinci designed a parachute, as seen in the figure, shaped like a pyramid, the base being a square.

Next to this Leonardo made a note: If man has a tent of scrotum cloth, wide on each side of 12 cubits and 12 tall cubits he will be able to let go of any height, without anything bad happening to him. [4]

The parachute Leonardo designed was not put to trial until many years later. Although this type of parachute was thought not to work, the facts refuted this preconceived idea. In 2000 Adrian Nicholas, an English engineer, using Leonardo da Vinci's sketches, made a parachute with the materials that existed at that time. He wanted to prove that the parachute designed by Leonardo da Vinci can be built and it can work. Among the materials used were the canvas used by the painter as a support for his paintings. When he tried to experiment, he was struck by the refusal of the English authorities who considered this parachute extremely risky for real trial. Therefore Nicholas chose South Africa as the destination for experimenting with this parachute, a country where legislation in this area is much more permissive.

He rose with a hot air balloon to a height of 3000 meters from where he descended with an open parachute to a height of 600 meters. Here he expanded da Vinci's parachute and opened another parachute with which he came to land. When asked why he did so, Nicholas said: Not because I didn't trust a slow landing, but I was concerned about the weight of the parachute, which weighed 85 kg. Think about what would have happened on landing if it had come to my head? [5]

FIG. 3 Adrian Nicholas's jump with Leonardo da Vinci's parachute project [6]

Thus Nicholas proved that Leonardo da Vinci's calculations were as accurate as possible, and we can say without making a mistake that Leonardo da Vinci is the "father" of the parachute.

In order to reinforce the previous claim, I must also recall the jump made by the Swiss skydiver Olivier-Vietti Teppa. He was launched from a helicopter at a height of 650 meters with a parachute made according to da Vinci's model, but using topical techniques and materials. He landed safely in La Payerne, where the experiment took place. The figure shows us this leap and demonstrates once again Leonardo da Vinci's genius and his revolutionary ideas.

FIG. 4 Olivier-Vietti Teppa's jump with Leonardo da Vinci's parachute project [7]

But let's go back in time one hundred years after Leonardo da Vinci's project and check that the next document featuring the idea of parachute is that of Fausto Veranzio, a mathematician of Hungarian origin established in Italy. It describes the phenomenon of falling and the possibility of saving itself: "With a piece of square cloth, lying on a frame consisting of four equal poles, from which four ropes are caught in the four corners, a man can throw himself without any danger from the top of a tower, or from another high place. Even if the wind does not blow, the air will inflate the cloth and hold it, and the man will not collapse, but will slowly descend. Of course, the size of the surface of the blade must be chosen by man's weight." [8]

Looking at Veranzio's claims about "Volans Homo", "Flying Man" we realize that he had made a fairly accurate opinion about the fall of the bodies and the operation of the parachute. Although in some sources it is shown that Veranzio had done several experiments, jumping several times from a tower in Venice at the age of 61, this information is however not substantiated and it has been concluded that Veranzio has failed to carry out its trial project.

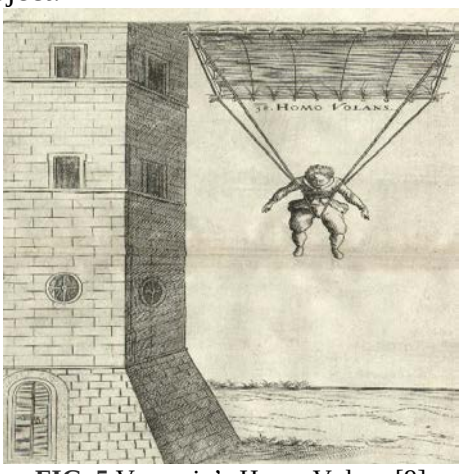

FIG. 5 Veranzio's Homo Volens [9]

Continuing through the mists of time and talking so far about aeronautical projects I should also mention the first balloon project. It belonged to Italian-born physicist Francesco Terzi Lana, who wrote in 1670 of a "flying boat caught by four metal spheres about 7 meters in diameter from which it had to be vacuumed by removing air by pumping." [10]

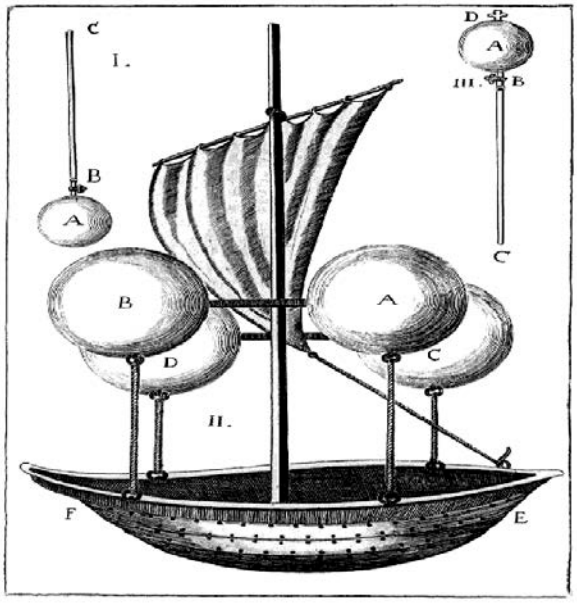

FIG. 6 Francesco Terzi Lana's project [11]

Although he has never been able to complete his project, Terzi Lana remains in history as the first researcher to use Archimedes' law in the idea of building an airline. Due to his revolutionary ideas Franceso was persecuted by the Inquisition, accusing him of witchcraft.

The 5th of June 1783 represents an important moment in this history of aeronautics, as the French brothers Joseph and Etienne Montgolfier launched the first hot air balloon. The hot air balloon was named Montgolfier, taking the name of these two inventors. There was a dispute on this event, which is the first flight of a hot air balloon. At the International Aeronautics Congress in 1889, Brazilian Rear Admiral Teffe challenged the Montgolfier brothers' flight as the first and provided evidence that the first flight of a balloon had been made by Brazilian priest Bartolomeo Laurenzo de Gusmao in 1709, at the court of King John V of Portugal and Queen Maria Anna. The evidence was rejected as insufficient and thus remained in history that the rise to a height of 1000 meters from June 5th, 1783 was the first flight of a hot air balloon.[12]

After Newton conducted air resistance research in the same year the launch of the first hot air balloon, 1783, French physicist Sebastien Lenormand conducted several experiments to launch several objects hanging from parachutes, from the observatory in Montpellier. His motivation was to try and uncover the necessary equipment to be used for people that would be trapped in high buildings engulfed in flames, where the only possibility of rescue would have been to leave them with objects to ensure their landing. Lenormand first used the term parachute, which is preserved to this day.

The word was born by merging two terms: "para" which means keeping or appearing in Greek – against and "chute" which means fall. If da Vinci is considered the "father" of the parachute, then Lenormand is its "godfather".

If we look at this parachute word, we could say that it is the wrong one to assign because this type of object does not block the fall or resists it, but only reduces the drop speed of an object to a non-hazardous speed.

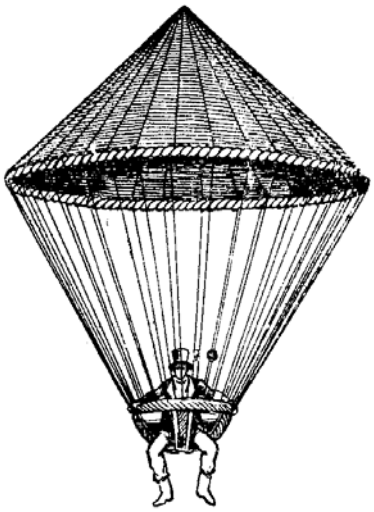

FIG. 7 Lenormand's parachute [13]

Lenormand trusted the calculations and experiments he had done, so on December 26 1783 he came down with his parachute open and landed safely from the tower of Montpellier astronomical observatory.

The same year, 1783 is also the year of the development of balloon ascents. On September 19 same year, the rise of the first passengers with a hot air balloon takes place. In the second balloon built by the Montgolfier brothers the passengers were a sheep and a duck. They landed safely after a flight of about eight minutes and an ascent of about 500 meters. This event was witnessed by the monarchs of France: King Louis XVI and Queen Maria Antoaneta. On November 1st, French physicist Jean Francois Pilatre de Rozier and Francois Laurent marquis d'Arlandes were the first passengers of a free balloon. By then the balloons were tied with a rope, but the two managed to rise by balloon at a height of 1000 meters and cross Paris for about 10 km.

Due to increasing growth, the development of aeronautics called for a new stage. Thus in 1797 Pierre Blanchard managed to launch by parachute a goat that lands smoothly, from a balloon in Hamburg

In the same year on October 22nd, Frenchman Andre-Jacques Garnerin becomes the first man to carry out the first parachute jump from a balloon. The launch height was about 600 meters, but the parachute had some rather large oscillations, close to 900, so the landing was quite harsh, with Garnerin ending up with a fracture. Garnerin received the help of astronomer Lalande who suggested to make a small hole in the center of the upper veil through which the excess air would leak, in order to make the parachute more stable. [14]

After making that slot at the top of the veil, Garnerin's parachute had stability and was presented before a French military commission on the Champs de Mars. This committee had no vision and only congratulated Garnerin and gave him a thank-you letter and nothing else. So, the military use of the parachute had to wait for long more.

Jeanne Genevieve Garnerin's wife accompanied him on many of his balloon trips and on November 10 1798 she was the first woman to carry a parachute jump from a balloon. The Garnerin family was an exceptional one and one full of records established in this area of aeronautics. Garnerin's niece, Elise, became the youngest parachutist, at only 16.

Garnerin continued his parachute activity until 1823, when he had a fatal accident.

The balloon age was in full swing. Even though they were hard to fly, the balloons were considered safe appliances. Accidents took place. After Kuparento's success in 1808, who managed to save himself by jumping from the flaming balloon over Warsaw, there was a new possibility of using the parachute, that of saving the lives of those that may have been in danger during their air journey.[15]

The period of skydiving stuns was characterized by the fact that many paratroopers were tempted by money prizes and risked their lives by usually performing jumps with parachutes that were either not initially tested or had no experience in this field or appropriate training. These parachute jumps executed by inventors, acrobats or even fearful were true shows.

At that time, the parachutist was sitting in the parachute nacelle and was tied to the balloon by a rope. The moment he wanted to make the jump, he'd cut that string and thus get down with his parachute open. This could have not worked, and that's why there was some reluctance to use parachutes.

Sometimes these attempts ended tragically, resulting in the death of the jailers. In this respect, examples of Englishman Robert Cocking and Belgian Vincent de Groof. On September 27th, 1836 Cocking crashed with his parachute, that had a form of an inverted cone. Due to the skeleton of the parachute in the wooden slats that gave way, the parachute closed after it was unlocked from the balloon. Vincent de Groof collapsed from a height following the disposal of his parachute "with wings."

The first to use harness instead of a nacelle was Captain Thomas Baldwin in 1887, one of the leading pioneers of American skydiving. He made a similar harness to the one that is used today.

The parachutes were big and bulky and tied to the balloon net. The next step in the development of the parachute is its folding. The acrobatic paratroopers Lattermann and Kathe Paulus were the first to use this idea, in which the parachute was folded into a compartment that was undone by the parachute's operation of a string.

Aeronautics developed more and more and the first flight attempts are emerging. There are a number of polemics about the award of the first flight. I'll just remember a few of these in the chronological order of events.

Clement Ader, a French engineer, said he flew with a device equipped with steam and wheel machines in 1897, about 50 meters from the ground. According to most historians, he apparently did not fly, but only ran, and the veracity of his words cannot be confirmed because there were no witnesses.

In 1903 Karl Jatho, a German engineer, allegedly made a triplane flight to Hanover at 75 centimeters over a distance of 18 meters. The shortcomings that expressed themselves as far as he was concerned were the fact that the planes were not stable and had no command elements.

Another example is the work of German Gustav Weisskopf. He arrived in the U.S., changed his name to Whitehead and executed several flights in 1901 and 1902, but there is insufficient evidence on this.

The Wright brothers' four flights, made on December 17th, 1903 to Kitty Hawk, a North Carolina beach with a Flyer biplane, are classified as the first flights made on a motor plane that instead did not take off by its own means, but with a device catapult type. Though being advertised, these flights had only five witnesses being present. One of them took a picture of one of the flights.

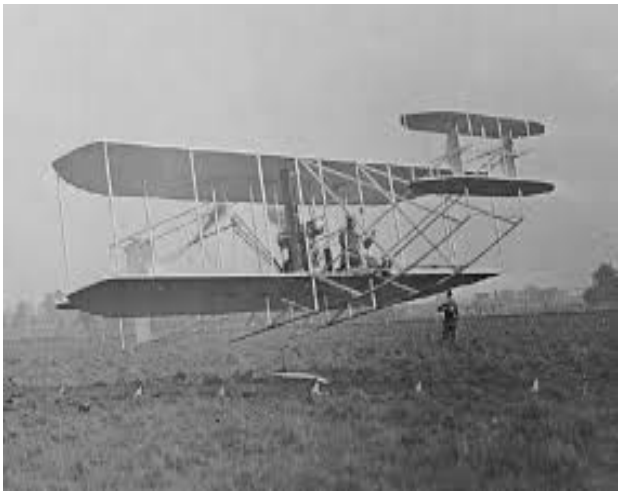

FIG. 8 The Wrights' brothers flight [16]

After motor planes appeared, the parachutes headed for another stage, that of saving the pilot in emergency situations, when it was necessary to leave the plane. The experiments were numerous, even though at first the idea of the balloons was taken up. This solution was not viable and that is why parachutes had to be adapted to the new conditions. Gleb Yevgenyevich Kostelnicov, a Russian inventor, developed in 1911 a metal knapsack???, fixed on the back of the paratrooper, in which the parachute was folded. When the opening command of the knapsackwas taken, some springs arranged inside the knapsack would throw the parachute out, which then opened. This principle is still preserved to this day.

One more important step took place when the first parachute jump was carried out from a plane. It was made by Captain Albert Berry in the area of Saint Louis, Missouri, on March 1, 1912. Shortly later, on 19 August 1913, French aviator Adolphe Pegoud became the first pilot of a plane to be rescued by a forced parachute.[17]

Next, I will make a brief comparison on the inventions and inventors in this area, of parachuting. I chose the pioneering period and of course the period when the evidence of these inventions materialized into documents written according to the rules. These inventions are quite numerous, but I have only stopped at some who, in my view, have made a greater contribution to this phenomenon. I chose to do this, in tabular form, adding images of those inventions, because as they say, a picture is worth a thousand words. In addition to the images, I will also add some explanations for these inventions. The period I chose is the end of the 19th century and the beginning of the 20th century.

TABLE 1 Parachute patents in the age of first attempts [18]

No.	Name of invention	Name of the inventor	Country of origin	Patent Date	Patent Number	Remarks
1.	Safety parachute-pack	Leslie L. Irvin	U.S.A.	December 2nd, 1919	267065	See fig.9
2.	Pilot parachute with automatique and fast deployment	Lemale L. Charles	France	January 19th, 1911	425038	
3.	Safety parachute sack	Balondrade M. Jules	France	January 25th, 1911	425222	
4.	Parachute	Stephan Banic	U.S.A.	August 25th, 1914	842645	See fig.10

No.	Name of invention	Name of the inventor	Country of origin	Patent Date	Patent Number	Remarks
5.	Parachute	Herman Ludtke	U.S.A.	May 14th, 1914	203702	
6.	Parachute	Ruff Wiliam	U.S.A.	September 14th, 1920	252309	
7.	Parachute	Tanner Joseph	U.S.A.	March 12th, 1912	605301	
8.	Parachute	Smith Floyd	U.S.A.	May 18th, 1920	246999	See fig.11
9.	Improvement in fire-escape	Oppenheimer Benjamin	U.S.A.	November 18th, 1879	221855	See fig.12
10.	Parachute	Van Vleet Charles	U.S.A.	December 19th,1905	143033	
11.	Improvements in parachutes	Mayer Carl Grimmer Ernst	Germany	April 21st, 1910	1640	
12.	Life-saving device	Rectanwald John	U.S.A.	November 8th, 1910	558387	
13.	Improvements in parachutes apparatus	Ulmer Calhoun	U.S.A.	March 23rd 1911	24167	
14.	Safety device for automatous parachute	Kotelnicoff Gleb	Russia	March 23rd 1912	438612	See fig.13

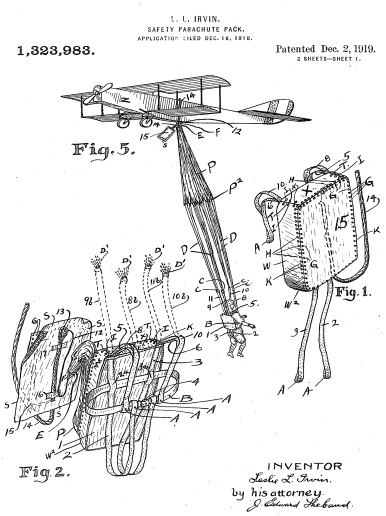

FIG. 9 Safety parachute-pack – Leslie L. Irvin -This invention relates to safety parachute packs, particularly to that kind which includes the systematically packed parachute and connections in a neat sack. [19]

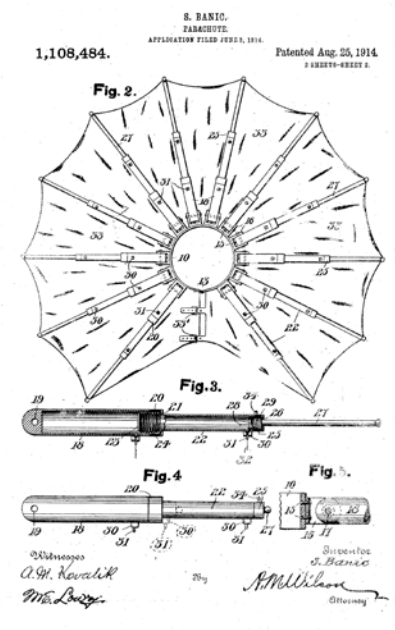
S. BANIC.
PARACHUTE.
APPLICATION FILED JUNE 3, 1914.
1,108,484. Patented Aug. 25, 1914.
Fig. 2.
Fig. 3.
Fig. 4
Fig. 5.
Witnesses
A. H. Kovalik
M. E. Lacey
Inventor
S. Banic
Attorney

FIG. 10 Parachute – Stephan Banic - This invention relates to a parachute of collapsible type which may be easily and quickly attached to the body of the wearer and readily distended to operative position when desired [20]

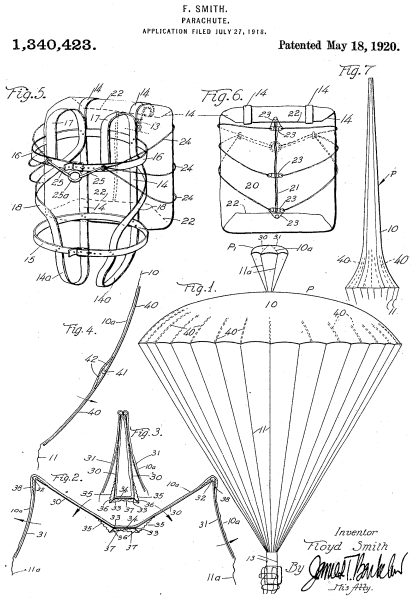
F. SMITH.
PARACHUTE.
APPLICATION FILED JULY 27, 1918.
1,340,423. Patented May 18, 1920.
Fig. 7
Fig. 5.
Fig. 6.
Fig. 1.
Fig. 4.
Fig. 3.
Fig. 2.
Inventor
Floyd Smith
By
Attorney

FIG. 11 Parachute – Smith Floyd - This invention provides a dependable means for causing the straightening out and opening of the parachute under all conditions, including certain conditions under which the present type of parachute is totally inoperative or deficient in operation [21]

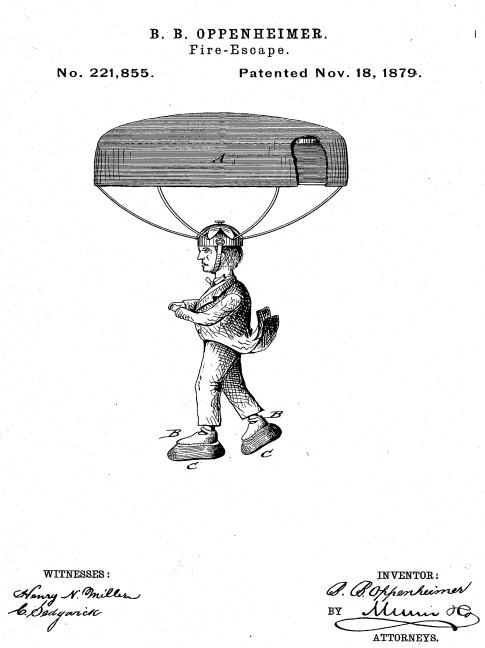
B. B. OPPENHEIMER.
Fire-Escape.
No. 221,855. Patented Nov. 18, 1879.
WITNESSES:
INVENTOR:
ATTORNEYS.

FIG. 12 Improvement in fire-escape - Oppenheimer Benjamin - This invention consists of a parachute attached, in suitable manner, to the upper part of the body, in combination with overshoes having elastic bottom pads of suitable thick mess to take up the concussion with the ground. [22]

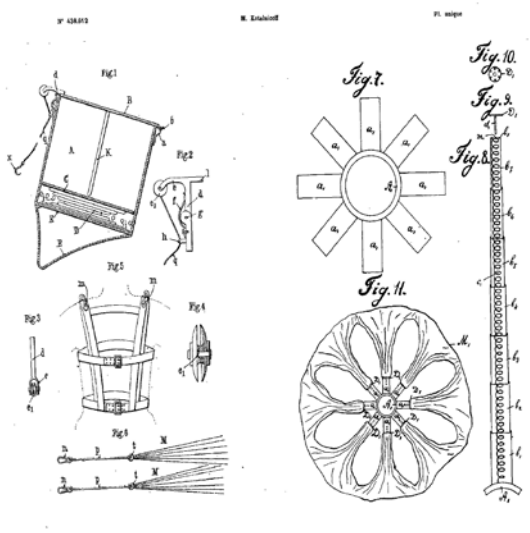
Fig.7.
Fig.10.
Fig.9.
Fig.8.
Fig.11.

FIG. 13 Safety device for automatous parachute - Kotelnicoff Gleb - This invention consists of a safety device where the parachute is closed and at the moment of pulling up the parachute is thrown out [23]

3. CONCLUSIONS

All the history I mentioned above is the skydiving pioneering period and its impact on the related field, aviation. The origins of these branches of aeronautics are intertwined, complemented and the development of one has also led to changes in the other field. Even though I have brought up certain facts which have happened recently, I have only strengthened the visionary and revolutionary genius of those personalities.

As you have noticed, I have not brought up any achievements made in the field of Romanian aeronautics. I intentionally omitted this because this topic will be treated separately, as a different topic of another article.

Achievements in these areas are not few and have been made with the sweat and even the ultimate sacrifice of many fearless pioneers. Thus, it seems only appropriate to close this overview with the following citation fromAlbert Einsteinas“Our mind is like a parachute: it only makes sense if it opens.” [24]

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[11]***https://en.wikipedia.org/wiki/Francesco_Lana_de_Terzi, accessed on 13.12.2020;
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[17] Tănase Mircea, *op.cit*., p.35;
[18]*** https://patents.google.com/?q=parachute&oq=parachute, accessed on 15.12.2020;
[19]*** https://patents.google.com/patent/US1323983A, accessed on 15.12.2020;
[20]***https://worldwide.espacenet.com/patent/search/family/003176676/publication/US1108484A?q=parachute%20Banic, accessed on 15.12.2020;
[21] *** https://patents.google.com/patent/US1340423?oq=246%2c999+smith, accessed on 15.12.2020;
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ABOUT THE TRAINING METHODS FOR OLYMPIC STUDENTS IN MATHEMATICS

Adelina-Loredana MANEA
Transilvania University of Braşov (adelina.manea@unitbv.ro)

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Abstract: *This paper aims to find the best training method for students who wish to obtain performance in mathematics. School, special curricula for the gifted and self-instruction are just some of the methods students choose in order to achieve excellence in mathematics. This research aims to outline a general method for efficient student training, also taking into account the anxiety generated by mathematical competitions (Mathematical Anxiety). The study is based on the author's ten years' experience in coordinating advanced mathematics training programs for students in Braşov, Romania.*

Keywords: *training methods, performance in Mathematics, Mathematical Anxiety.*

1. INTRODUCTION

In Romania, all partners involved in the educational process (teachers, students and parents) mutually agree with the necessity of over-average education, in particular, to prepare students for competitions.

The goal of competitions at every level (even in the classroom) is to develop the student's ambition, their desire to win and to be in the top, hoping that they will be able to identify those domains in which they could reach a high level of competence. Starting with primary school, children have the opportunity to participate in many contests, including many mathematical competitions. This technique, to participate in various competitions, searching for that field of knowledge in which a student could be in the top, could also lead to Mathematical Anxiety. This fear is caused by the level of proficiency required by Mathematical competitions, which is very high compared to the level of proficiency taught in schools. Here the math problem books have great importance in schools, helping teachers to provide additional training for gifted students. But sometimes this method is not enough.

Another method to develop students' abilities is called "early tracking". There are countries where the differentiation of talented students in different fields is done early, from the age of ten and there are studies that follow the long-term effect of this differentiation.

According to [1], "The central argument behind tracking is that homogeneous classroom s permits a focused curriculum and appropriately paced instruction that leads to the maximum learning by all students. In such a situation, the teacher does not have to worry about boring the fastest learners or losing the slowest learners. The arguments for ungrouped classrooms largely revolve around concerns that the lower groups will be systematically disadvantaged by slower learning environments that leave them far behind the skills of those in the upper groups."

In Romania's state education, the classrooms are not homogeneous. However, this situation has its own benefits: "heterogeneous classrooms might give rise to efficiency gains through nonlinear peer effects: the higher ability students lose nothing, but the lower ability students gain through the interaction (from motivation, better classroom discussion, and the like)."[1]

They conclude that "Our analysis provides reasonably strong support for the desexualizing effects of early tracking. Variation in performance, measured in a variety of ways, tends to increase across levels of schooling when a country employs early tracking." [1]

Public education standardizes the training of students, generally, not paying attention to advanced training, although the level required at school Olympiads (provided and organized nationally) is significantly above the level of class preparation.

There are in Romania some particular educational institutions, which aim to address this issue. They are recognized and accredited by the Ministry of National Education and they provide differentiated training for students, those with special skills in different fields having a customized study schedule and benefitting from additional training coordinated by teachers in that field. The students in these private schools usually reach most of the top positions in national competitions, which could prove the efficiency of such an education method. However, the fact that these schools are private generates great inequity, considering the students who do not have access to it.

Talking about competitions, heterogeneous classrooms are not the appropriate environment for students to train well. The only solution that appears to be valid in this situation for each student who finds an inclination towards one of the domains is to take private lessons, a type of training financially supported by parents. That is the reason why many teachers choose to invite mathematically gifted students to participate in special training programs. In some large cities, school inspectorates and some non-profit organizations have organized advanced training programs available to students free of charge, in their spare time, to provide them with further knowledge and help them improve the skills needed for high-level performance.

Nowadays, such programs are running in various fields: Mathematics, Physics, Computer Science, Nature Sciences or Humanities, as complementary training to the compulsory school program.

There are studies about the influence of parents in the academic achievements of students, proving that "parental involvement variables that show promises according to their correlations with academic achievement are: (a) reading at home, (b) parents that are holding high expectations/aspirations for their children's academic achievement and schooling, (c) communication between parents and children regarding school, (d) parental encouragement and support for learning" [2]

In the study [2], the authors investigated other 31 studies about the connection between parental involvement and student achievement in both mathematics and comprehension of written text for middle and high school students.

"Parental involvement in the form of valuing academic achievement and then reinforcing it has shown a significant positive association with students' mathematics achievement throughout high school, since parental control, which refers to excessive control and pressure on children, is negatively related to academic achievement. For example, students' evaluations of parental academic pressure negatively predicted their self-efficacy, mastery goal orientation, and achievement in math." [2]

We usually agree that "performance is an exceptional achievement that exceeds the level customarily achieved"[3]. Generally, parents consider that their children must perform as well as possible, in many areas.

Thus, a secondary school student (aged 11-14) or a high school student (aged 14-18) gets to work for his training for almost 10 hours a day, much more than the average daily working hours of an adult.

In this paper, we investigate the advantages of such an effort and the way in which students perceive this extra training, this "school after school" system.

According to [4], "Mathematics Anxiety" (MA) refers to feelings of tension, fear, and physiological reaction (i.e., negative affect) and self-deprecatory thoughts and worries about one's performance (i.e., negative cognition) that interfere with solving mathematical problems in ordinary life and academic situations. According to the reciprocal theory, past failure and negative experiences in mathematics performance may lead to MA, which subsequently leads to poorer mathematics performance and vice versa. […] The authors suggested that poor mathematics performance first boosts MA, which subsequently and negatively affects mathematics performance in a vicious cycle."

Moreover, students who participate in competitions are exposed to a high level of stress that can lead to the development of MA even though they have exceptional results at school.

We agree with the idea that "Mathematics is a living subject which seeks to understand patterns that permeate both the world around us and the minds within us", [5], and we consider that we need to change the perception of the students about it. "Although the language of mathematics is based on rules that must be learned, it is important to motivate students to move beyond rules and to be able to express things in the language of mathematics. This transformation suggests changes in both curriculum content and instructional style. It involves renewed effort focused on seeking solutions, not just memorizing procedures; exploring patterns, not just memorizing formulas; formulating conjectures, not just doing exercises."[5] The special programs for gifted students aim to offer them "the opportunities to study mathematics as an exploratory, dynamic, evolving discipline rather than as a rigid, absolute, closed body of laws to be memorized. […] to recognize that mathematics is really about patterns and not merely about numbers."[5]

We can conclude that "Engaging students in verbal communication or discourse about mathematics and encouraging students' use of appropriate mathematical language are therefore two specific instructional practices related to the engagement of students as mathematicians during instruction and development of a community of learners." [6]

2. PURPOSE OF STUDY

Starting from the previous ideas, the main purpose of our study is to analyze possible methods for students to achieve advanced performance in mathematics with reduced Mathematical Anxiety.

3. METHOD

The participants in the study were 61 fifth-to-twelfth graders from different schools and high-schools in Brasov, Romania. They were all participants in the advanced training program in mathematics, 65 % girls, 35% boys aged between 11-18. A number of 46 secondary school students (S-s-s) and a number of 15 high school students (H-s-s) participated in the survey.

A number of 36 parents of the students mentioned above (parents of the secondary-school students P-s-s-s and parents of the high-school students P-h-s-s, respectively) and 11 math teachers (T) were involved in this program (5 of them were women, the other 5 were men), based on the idea that "the exploration of the teaching-learning phenomenon from the viewpoint of all participants is necessary in order to establish an environment of open communication and understanding between teacher and students." [7]

The following methods were used in order for the aims of the paper to be achieved: the analysis of school papers, with the instrument the curricula of Mathematics (advanced mathematics training programs for students in Braşov), the identification of the main training methods used by the students and the study of the other related studies.

We also conducted a survey, having for an instrument a questionnaire addressed to secondary- and high school students, parents and teachers, all involved in this program. The questionnaire with 6 multiple-choice closed-ended questions (Q1-Q6) was based on students' experience in preparing for participation in Olympiads and other Math contests. The items were organized around the theme: the training methods of the Olympic student in Mathematics and the level of the Mathematical Anxiety. Questionnaires were administered to the participants in order to be filled in, in the last face to face meeting of the program, under the supervision of the author of the paper.

4. FINDINGS

For the purposes of this paper, the primary analysis of the results consisted of an examination of the 6 items regarding the different methods for training typically used the Olympic student in Mathematics.

The ability to perform greatly in mathematics could be a native gift, but this is not sufficient to obtain good results at local or national competitions. The scholar curriculum contains all the concepts are required in mathematical competitions. However, this curriculum is rather focused on teaching problem solving algorithms and computing techniques. We prepare our students two hours a week, teaching them how to use the concepts they have learned at school, in a creative way. Furthermore, we encourage students to work a lot on their own.

Concerning this idea, interviewees have been asked:

Q1: "Which is, in your opinion, the most important activity to obtain great performance in mathematics?

a) The daily intensive training.

b) The participation in a special program."

Most of the interviewees considered the both activities to be very important, with some minor differences, as we can see in the Fig.1.

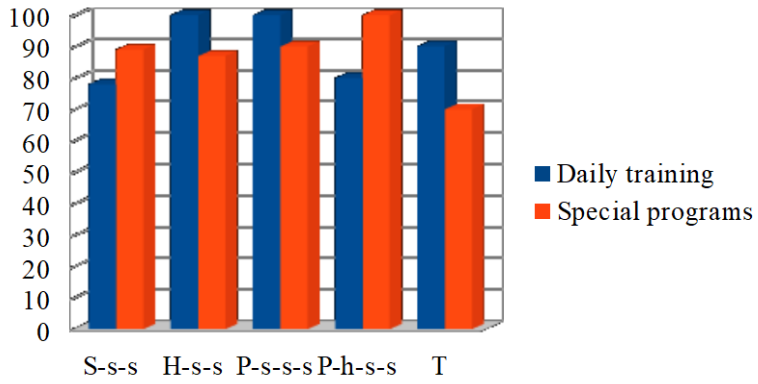

FIG.1. The most important activity

The high-school students, the parents of the secondary-school students and almost all teachers marked the daily training to be the best training method.

On the contrary, the secondary-school students and the parents of the high-school students appreciate the special program as a more useful method.

The explanation could be: in the case of secondary school students, some of parents probably are still able to recognize and to remember mathematics at that level and in many situations, they can help their children. So, they consider that all their children need to do is to work more than they already did, while the children feel that they need more specialized support, a teacher who could organized them work schedule.

In the case of high-school students, almost none of the parents are able to help their children at the level required by Olympiad-level tasks, so they consider that it is more beneficial to follow a special program, while the students know very well what they have to do, that the special programs are useless without a lot of individual work.

The following three questions come to detail these options.

Thus, the answers given in Fig.2 and the interpretation of the Q2 item, referring to the utility of school for students to obtain good performance in Mathematics, whose general statement is:

Q2: "How useful is the school training for the performance?"

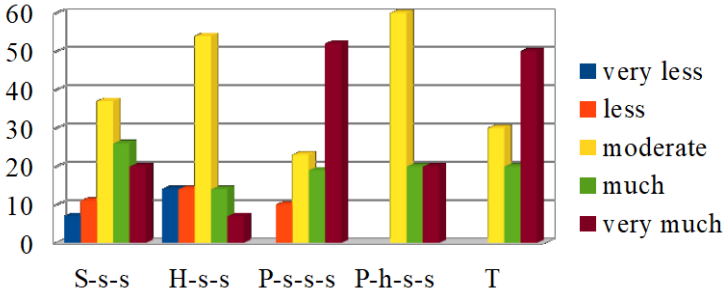

FIG.2. The usefulness of school training

show that school training is considered to have a moderate influence by students (37% S-s-s, 54% H-s-s) and by the parents of high-school students (60%), while the teachers (50%) and the parents of the secondary-school students (52%) consider that the school is very important. The basic preparation of the students is made during the school program, but many times the curricula of the Olympiads are more advanced than the usual curricula, and this difference must to be covered by the special programs.

The third item investigated the estimated impact of personal training for the knowledge required in Mathematical Olympiads. The Fig.3 contains the answers at the question Q3: "How useful is the individual training?".

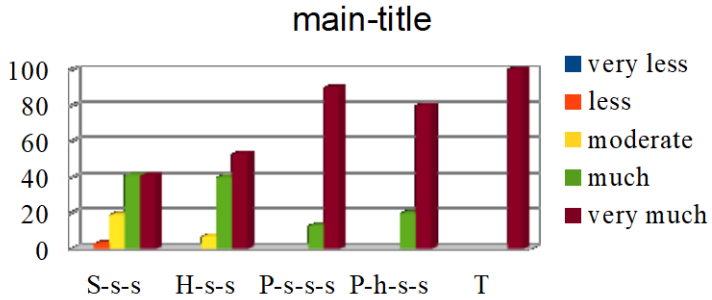

FIG.3. The usefulness of individual training

All the teachers agree that this method is the most important because the taught ideas could be fixed only by individual working. No matter how much information and work techniques a teacher transmits, students learn only through exercise and individual training. Most of the parents of students (80-90%) have the same opinion, while not all the students consider this method to be as much important, since only 41% of the secondary-school students and 53% of the high-school students marked it to be very useful.

The percent of 3% of secondary school students said that the individual training has no much importance in their mathematical achievements. They could be either those students very gifted which instantly understand and which can easily apply the notions and concepts, either students which do not agree hard working and which will not do performance in mathematics.

Finally, the third method, the special programs was the topic of the fourth item which study the impact level of this training method. The answers at the question

Q4: "How useful is the special training?" could be followed in Fig. 4:

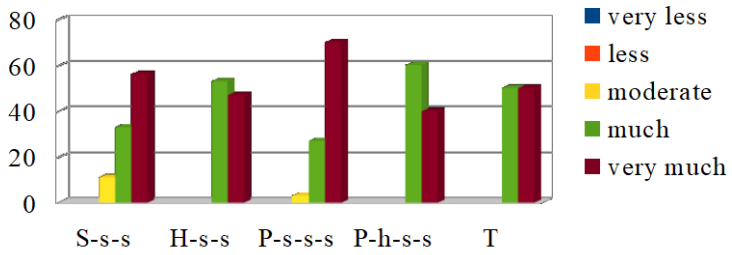

FIG.4. The usefulness of special training

The utility of a special programs is very appreciated by the secondary-school students and by their parents, 70% and 56% of them, respectively, marking this method of training at the maximum level. The high-school students and their parents think that this training method is not so important, this being a confirmation for their previous option about the utility of the individual working.

Some of the secondary school students and their parents (11% and 3%, respectively) said that this method has a moderate impact, while none of the following categories: high-school students, their parents and teachers chose that level (moderate) for the special programs of training in mathematics. A half of the teachers evaluate the special programs at a maximum level of importance for the students' training.

Another remark is about the parents of the secondary school students. They appreciate all the three methods to be important at a high degree, which means that they are very interested in the advanced training of their children, but this could also be a source of stress for the children.

The Mathematical Anxiety is evaluated by the last two items of the questionnaire.

There are some obviously effects of the Mathematical training: developing of the ability of logical thinking; forming a correct attitude towards hard work and, of course, obtaining of a high level of knowledge. Asking the participants, the following question

Q5: "Which are the advantages of the performing in Mathematics?

a) Ability of logical thinking

b) Good attitude to the hard work

c) High level of the knowledge ",

we obtained the answers from the Fig. 5.

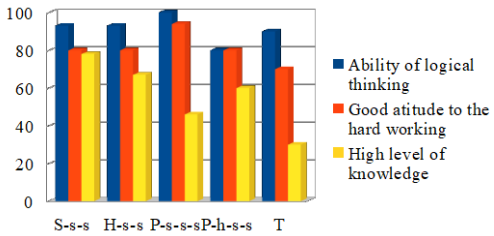

FIG.5. The benefits of advanced mathematical performance

All the participants agree with the formative effects, the development of the ability of logical thinking being the main advantage for 93% of the students, 90% of the parents and for all teachers. The formation of a positive attitude towards hard work was also voted as an advantage by 80% of the students, 80-90% of the parents and 70% of the teachers. The accumulated knowledge during the training for performance in Mathematics are concrete advantages which are not so important as the formative advantages, in the participants' opinion.

However, preparing for performance and participating in competitions in any field involves long hard work and exposure to stress. In Mathematics, the great difference of level between the school training and the contests increases also the Mathematics Anxiety, the necessary time for the training and the fatigue of the students. This is why many students give up advanced training in math and choose another field to perform.

The last item from the investigation questionnaire is about the disadvantage of the advanced training in math. Most of the parents (80% parents of the high school students and 71% parents of the secondary-school students) and 54% of the high-school students reported the accumulated fatigue as the main disadvantage, while the stress from the contests seems to be the main disadvantage for the secondary school students (60%) and for the teachers (50%).

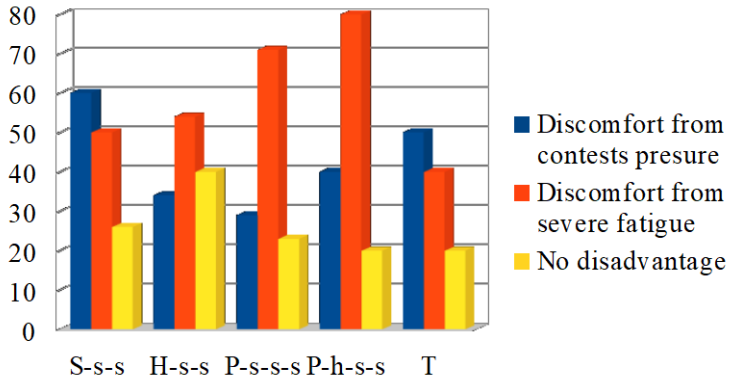

FIG. 6. Disadvantages of advanced mathematical performance

Even so, many of the participants agree that there is no disadvantage, mostly being high school students, those students which are passionate by mathematics and for who training in mathematics becomes a pleasure. It is also interesting the opinion of the high school students about the stress from the contests, only 34% of them choose that to be a disadvantage.

CONCLUSIONS

The results presented focus on two main provided answers to the purpose of the study.

The daily individual training and the participation at a special program of training are the main the methods that help achieve good performance in national and international Mathematics competitions. Concerning the best training method, the students and their parents have different opinions în some cases.

Thus, in the case of secondary school students, they consider that following a special program of training helps them to archive a better performance than the school program and the personal training. Their parents said that the individual training must to be the main method, thinking however that the fact that the participation at every kind of organized training is also very important.

In the case of the high school students, they chose the individual training to be the best method for obtaining performance in Mathematics, since the school program helps less to the advanced training and even the special programs do not assure the good achivements în contests. The most of their parents agree with the opinion towards the school and the individual training, but they consider the participation at the special programs to be the best activity for achievements of better results in the contests.

As a second conclusion, the quantitative analysis also revealed the fact that the Mathematical Anxiety is induced by two factors: the stress from the contests for the secondary school students and accumulated fatigue for the older students. This research revealed the necessity of an equilibrate effort since the students and their parents reported as a main disadvantage of the advanced training in mathematics the accumulated fatigue.

One final observation puts emphasis on the fact that all the participants appreciate that the advanced training of the students has a formative effect, the ability to logical thinking, which is considered to be the main advantage of this kind of activity.

Some limitations of this study are: the relatively small number of participants in the program and the fact that all the opinions referred to the same special training program.

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ASPECTS REGARDING THE LEVEL OF PERFORMANCE IN MATHEMATICS

Monica A.P. PURCARU
Transilvania University of Braşov, Braşov, Romania (mpurcaru@unitbv.ro)

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Abstract: *In the present paper addressing the issue of advanced performance in mathematics, we seek to answer to the following study questions: "What are the main factors that lead to the achievement of advanced performance?"; "Which is the profile of the teacher able to train the Olympic students in Mathematics?"; "Why do teachers want for their students to achieve advanced performance in mathematics?"; "Why do the students want to reach a high degree of performance in Mathematics?"; "What difficulties could significantly impede on student progress?"; "What is the connection between enthusiasm and advanced performance in Mathematics?"; "Why does an Olympic student participate in competitions?".*

Keywords: *advanced performance, students, profile of the Olympic students' teacher in Mathematics.*

1. INTRODUCTION

National education, achieved primarily through the education system, is one of the main levers of the development of the Romanian society. The current educational system in our country is the result of the creative valorization of the valuable traditions that have crystallized over a long historical evolution.

An important aspect of the educational process is its efficiency, which takes the form of school success or failure.

Performance in Mathematics is an old, but always present problem for students, teachers, as well as for parents.

In the performances of the students you can see the work of the teachers as well as the students, the material resources available to them, as well as the way in which the class is managed, giving the students an optimal environment for learning. By participating in competitions, these performances are made known and improved.

In the present paper, according to Ş. Mircea, we agree that "performance is an exceptional achievement that exceeds the level customarily achieved."[1]

Many authors study the possible factors for teachers to obtain with their students performance in Mathematics.

"Recent studies point to a positive correlation between student attitudes towards mathematics and student academic achievement."[2]

E.M. Anderman, J.S. Eccles, K.S. Yoon, R. Roeser, A. Wigfield, and P. Blumenfeld, affirm that:" the student level, positive changes in students' achievement values in mathematics were associated positively with self-concept of ability and the previous year's achievement values. Students experienced decrements in achievement values, after controlling for other student and classroom-level variables, in classrooms where performance-oriented instructional practices were used."[3]

There is an essential goal for educators to identify internal mechanisms which would determine a student to obtain performance in Mathematics. K.R.Wenzel and A. Wigfield consider that "students' social motivation, and their relations with teachers and peers, strongly influence their academic performance and general adjustment to school."[4]

T.Williams and K.Williams give another perspective about performance:"studies of the relationship between self-beliefs and performance tend to draw on this or related theories and usually endorse the notion of reciprocal determinism at a substantive–theoretical level. However, attempts to model this postulated mutual influence of self-beliefs and performance are few and are focused on the relationship between self-concept and performance. The reciprocal determinism of self-efficacy and performance seems to be without direct empirical support, probably because the longitudinal, repeated-measures data often considered necessary for this purpose are not available. It is possible, though, to model reciprocal effects with cross-sectional data."[5]

Also, according to W. Lee, M.-J. Lee, M. Bong, "Individual interest, as an affective motivational variable, could predict academic self-regulation and achievement, above and beyond what academic self-efficacy predicted. Academic self-regulation could be encouraged through the promotion of two distinct motivational sources, academic self-efficacy and individual interest."[6]

But where does the self-efficacy perception come from? Some objective measurements of a sudents' self-efficacy in mathematics could consist in his/her achievements at several competition, the attitude of the teachers, parents or classmates concerning his mathematical capabilities. The internal motivation which determines a student to make an effort to obtain mathematical achievements could be the passion for this subject or the desire to be a winner.

2. TEACHER-RELATED FACTORS

In the following we present some factors for teachers to obtain with their students performance in Mathematics.

The main factors that lead to the achievement of the performance are: logical thinking of students, sustained work, a special timetable at school, the results of competitions, parents' support and a good students' motivation in every possible ways: prestige of the school, with rewards, position in class, etc. In other words, the attitude of the students and their parents towards the school, the intellectual endowment doubled by the motivation for carrying out a sustained work, determination, perseverance and resistance to the intellectual effort of teachers and students alike, lead to obtaining very good results.

Other important factors that help teachers to obtain with their students good performance in Mathematics competitions are: the teacher-student relationship, the teacher should arouse students' interest and curiosity, respect their age particularities.

The teacher's grace and passion for Mathematics, the diversification of the teaching-learning methods, will also help to achieve performance. The teacher should work differentiated in class and in mathematics circles, use different problems, with increasing difficulty. Differentiated treatment of students at lessons, can be achieved both in the teaching and learning process, as well as in their evaluation. The teacher who has Olympic students should always create in the classroom a stimulating competition in solving difficult and beautiful problems, should appreciate and stimulate students who give outstanding answers, he should teach the students how to learn, he also should attract students to participate in performance centers, etc. At the same time, the teacher should create in the school a climate of assessing student performance, encourage students to constantly performance work and to achieving success.

The teacher's availability, that is, the time and patience involved in this activity, is also an important factor.

Another factor is the teacher's permanent concern to form the mathematical thinking of the students. The mathematical thinking at school level, the one that underlies the achievement of the performance, according to H. Banea, "is manifested by the fact that the student is good at mathematics, in all respects, that is, he understands quickly, retains easily, reproduces the learned theorems, solves the vast majority alone of the problems that are proposed and has the initiative of study and creative. "[7]

The teacher has the task of following the components listed above and then educate them aware. Thus, the students' understanding is reflected after H. Banea by: "equivalent forms or formulations for some accumulated knowledge, counterexamples for known notions, examples for new notions."[7]

In order to identify the students' knowledge, the same author suggests the teachers to establish: their extent (quantity, number of definitions, properties, theorems from a given topic), their depth (strings of implications made up of lemmas, theorems, corollaries, applications, generalizations, particular cases) and the quality of knowledge (associations caused by a notion, theorem, method.) [7]

The application can be tracked by the teacher by: "calculation technique, mathematical technique (typical reasoning, general methods, typical procedures), combined applications (from different chapters or branches, special methods, artifices)." [7]

According to the same author, the teacher can identify the special abilities of the students: "the ability to analyze and generalize (research of incorrect problems, with contradictory, additional, insufficient data, discussion of particular cases, generalization), imagination (realization of problems on a given topic), creativity (creating problems with a higher degree of originality, without an explicit order; or notes and articles)." [7]

H.Banea shows that: "mathematical thinking is about both qualities that can be developed, but also information. We do not see how thinking could manifest in the absence of a material to be practiced because not all problems or questions would concern only insight. (meaning that it would not require much knowledge). On the contrary, the presence of some knowledge facilitates the creation of associations, generalizations or may even be the foundation of the creative activities. "[7]

The existence of a total compatibility between the effort made by the teacher and his / her desire to obtain the performance with his students, is another factor that facilitates the achievement of the performance.

A final factor puts emphasis on the fact that teachers have to look for passionate, hardworking and logical thinking students for obtaining performance in mathematics.

3. THE PROFILE OF THE OLYMPIC STUDENT'S TEACHER

Any teacher who would like to achieve with his students performance in Mathematics should demonstrate that he is patient, persistent, ambitious, passionate about mathematics, motivated to achieve performance in mathematics, should demonstrate that he has solid, and rich knowledge of mathematics and applies various differentiated training strategies in his lessons. He should also demonstrate that he has a strong desire to help students achieve at competitions, is rigorous and serious in his work in the classroom, resistant to stress and interested in everything related to preparing its students participate in competitions: he must give immediate answers and indications to the questions of the Olympic students, provide them with consultations whenever necessary.

Seeing that a student can and wants to make extra effort in mathematics, the teacher teaches them knowledge in addition to the school syllabus, recommends the additional bibliography necessary for the preparation and helps in deciphering mathematical texts, he should also organize in school a mathematical circle, stimulate the students to participate in school competitions, send problems solved to the Mathematical Gazette, stimulate competition in the classroom, teach the Olympic student how to learn and indicate bibliographic sources, that is recommend them suitable auxiliaries and solve difficult problems in the classroom.

The teacher who has Olympic students should always show seriousness and rigor in teaching mathematical notions, he must teach correctly. He should approach the teaching of mathematics in the classroom taking into account the different learning styles of its students.

The teacher who has Olympic students should also have other qualities, including: love for the teaching profession, flexibility and empathy towards the students, the permanent desire for self-improvement, he should increase, in need, the degree of involvement in his didactic activity, the love and respect that he has over his own students.

The teacher who has Olympic students should make his students to say the same with C.F. Gauss: "Mathematics is the queen of science!"

There are certainly many other features that complete the profile of the teacher of the olympic students in mathematics but they are closely dependent on the situation in the classroom, on the specifics of the contest, and on the talent of the teacher.

4. CONCLUSIONS

Instead of conclusions, in the following, we will answer a few questions.

1.In order to answer to the question: “Why does the teacher want his or her students to achieve advanced performance?”, here are some ideas.

a.The teacher of an Olympic student wants to share the knowledge he has and to raise the level of the students in the field, he wants to be useful to the students.

b.By discovering students with potential in mathematics, the teacher wants to help them to confirm their passion for this difficult subject.

c.He wants to make the student work to achieve the performance so that in the future he has a profession in which he also performs, that is, the student learns to do things well, a habit that he will have all his life.

d.The teacher wants to achieve with his students performance in mathematics in order to have the satisfaction of the work done, the spiritual gratitude for guiding the student to success, from a passion for mathematics.

2.The answer to the question: Why do the students want the performance in mathematics? is given below.

a.Students would like to achieve mathematics performance in order to have the satisfaction of their efforts.

b.Students would like to achieve mathematics performance due to their extrinsic motivation: winning, prize, awareness of the importance of mathematics, passion for mathematics, for the obtained reputation, admiration, to bring satisfaction to parents.

3. As for the question: Who deals in the way of this performance activity?, the answer is:

a.persevering and successful students,

b.students who like competition,

c.students who have a solid knowledge base in the field,

d.students who are passionate about what they do,
e.students who are well motivated and not least,
f.students who are are preparing intensely.

4.Regarding the question:What difficulties could return the student from the ascension to performance? a point of view is given below. Difficulties may be:

a.increased difficulty of the problems,
b.lack of motivation and support from both parents and teachers,
c. not to appreciate the work of the student,
d.insufficient involvement,
e.lack of time needed for additional training,
f.lack of understanding of theoretical explanations or problem solving,
g.specific health problems or certain problems that intervene in the family and will not allow the student to focus, think,
h.the group of friends who will pull him down, or involve him in other activities, or convince him not to prepare for Math performance.

5. Another question is: What is the connection between passion and performance in Mathematics?

If we want to determine the connection between passion and performance in Mathematics, we could say on one hand that passion facilitates the performance, and on the other hand, that performance increases, supports passion.

Passion for mathematics is closely related to motivation, ambition, perseverance, to "a bit of madness", renunciation other activities, even sacrifice, desire to be good, the desire to surpass and many other connections.

Performance is closely linked to additional training, to the hereditary dowry, to previous results, to hard work, experimentation and sometimes why not to chance.

6. For the question: Why a student would like to do performance in Mathematics? some arguments are given below.

If we wondered why a student would like to do performance in Mathematics, we could find more answers:

a.out of passion for this queen of science, as Gauss asserted,
b.out of a desire to know as much about mathematics as possible,
c.to have a top perspective on the subject in the classroom,
d.to be convinced that it is doing something useful for its future,
e.to get good results in competitions,to be safe in exams,
f.to be able to reach a profession in line with passion,
g.to reach the best student.

7. A last question: Why an Olympic student participates in competitions?

An Olympic student participates in competitions for several reasons:

a.from the desire to win,
b.to realize what level he has,
c.from passion,
d.from ambition,
e.to training,
f.to reward the prize offered by the organizers, etc.

In conclusion, the teacher who has Olympic students is the one who shapes personalities and builds characters. Therefore, he is a major factor that influences the school success and further the life of each student.

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COMMUNICATIVE TASKS IN TEACHING MILITARY ENGLISH

Kinga KOLUMBÁN
The Main Foreign Language Learning Center Braşov, "Henri Coandă" Air Force Academy, Romania
(kolumbankinga@yahoo.com)
ORCID: 0000-0003-1373-6036

DOI: 10.19062/1842-9238.2020.18.2.7

Abstract: *Teaching English through genuine interaction in the target language has represented the trademark of communicative language learning, applied in most classrooms around the world. This approach has generated a shift from the perception of language as a system to the focus on more contextual and meaning-related features of language use. Such aspects are in perfect accordance with the needs of military professionals who use English in specific situations. This study explores some of the possibilities of applying the principles of this efficient approach in learning military English with classes of all levels.*

Keywords: *communicative approach, task-based teaching, information gap activities, military English*

1. INTRODUCTION

Development of communication strategies represents the primary aim of foreign language teaching and since English has become the *lingua franca* of our age, learners strive to acquire the ability to use it as a tool for their various enterprises. English has not only spread worldwide but it has also become the language of various professional categories, significantly diversifying the needs of learners. The development of fields like English for Special Purposes (ESP) and Content and Language Integrated Learning (CLIL) is a sign that teaching English needs to be more varied and learner-oriented.

The types of tasks presented here are designed in view of general parameters, yet, also observing practical aspects of language proficiency required by the special professional environment of the military. As the official language of NATO operations, the English spoken within the military – the armies of the multinational NATO forces – is the official professional language of a great number of military personnel that speaks English as a foreign language.

It is difficult to draw a line between what qualifies as general English and what is English for specific purposes. Even if part of 'specific purposes' may signify a certain professional jargon, its knowledge is irrelevant if the learner does not have the necessary linguistic skills to use them with. Beyond the jargon which is usually learnt on the job, what is more relevant in the case of professional groups, with the military among them, is the interaction with other colleagues within a multinational environment. This fact places the development of communicative proficiency to the forefront of such courses. Communicating in certain specific professional contexts does not necessarily imply the use of a special jargon but a sound command of linguistic skills.

Despite pronounced focus on communication, learning a foreign language covers a lot more than spoken interaction.

As a matter of fact, interactive activities cannot be carried out if learners don't acquire at least a minimal awareness of form and some basic vocabulary.

According to the classical structure of a learning session (presentation-practice-production), tasks would be placed in the production phase. Nevertheless, due to the potential complexity of a task, it may provide both practice and production and generally allows an increased flexibility for both learners and teachers to review or repeat elements of communication when needed. This study is restricted to the presentation of the interactive tasks themselves, without the detailed description of activities that precede or follow the task.

2. MILITARY AND GENERAL ENGLISH

As a category of foreign language teaching, military English is one domain of what is generally discussed as English for Specific Purposes (ESP). A general definition of ESP would be that of *"an umbrella term that refers to the teaching of English to students who are learning the language for a particular work or study related reason"* [2]. According to this definition, it is not the language itself that is 'special' but the requirements the students are learning it for.

When attempts are made to determine the boundary between 'General' and 'Special', there are two main perceptions. One is that there is a common core which covers all basic vocabulary and language completed by an additional specialized language. The alternative idea is that there is no boundary between a core and specialized varieties, since all uses of a language, regardless of the context are 'specific purpose' [1]. This discrepancy leads us back to the general definition and, in fact, to the very name of the category: 'special purposes' implies the contexts and the aim in which English is used is different from the general one, and not the language itself. This finding can easily be linked to the principles of the Communicative approach that emphasizes the primacy of the communicative situation in language learning and not the system itself.

Barnard and Zemach differentiate between two main types of ESP, one used in the professional (English for Occupational Purposes) and the other in the academic field (English for Academic Purposes). Further subcategories are constituted by the various branches in which learners operate. In the case of English for Occupational Purposes Barnard and Zemach talk about an English for General Purposes – English for Special Purposes continuum with increasing degrees of specialization, the last level being a highly specialized course. Fig. 1 is their example for a scale of the possible courses:

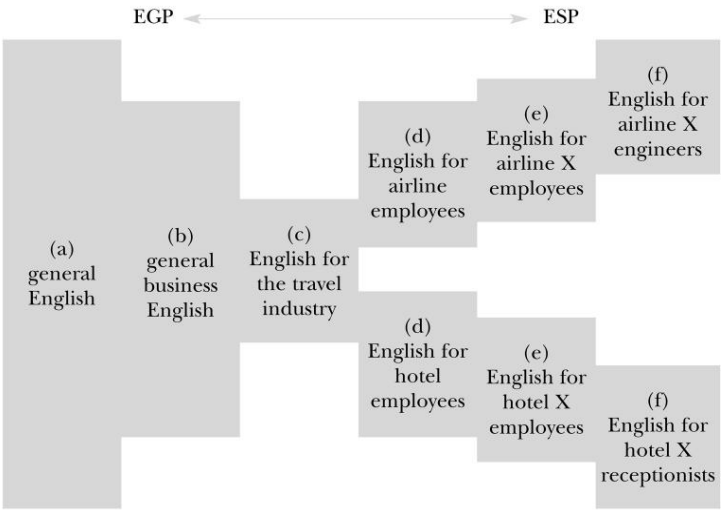

FIG.1 EGP-ESP continuum [2]

Some important points they make are that the more specialized the course, the more expertise it requires from the teacher, but no matter how high the degree of specialization is, there will be an amount of general English included into the content. Furthermore, the degree of specialization does not influence the methods and techniques used in the classroom which will obviously be chosen according to general teaching methodology.

In the case of military English there indeed exists a specific corpus of vocabulary and specific genres (types of texts and discourse) that would typically be used in the military. Terms like *commissary, tour of duty, peacekeeping, warrant officer, briefing* to give only a few examples, are not likely to occur in other contexts unless they serve as reference to the military, in a news bulletin, for instance. Yet, if we allow that these terms are part of the 'military English' corpus, what category can we include the vocabulary for aircraft engine spare parts or the specialized vocabulary for missile operations into, if not categories like Technical English or English for Aeronautical Engineering. Therefore, it is fair to establish that certain elements of Specialized Military English overlap with other domains.

Fig. 2 is the application of Barnard and Zemach's EGP-ESP continuum for the specific case of military English, in order to determine the nature of the communicative tasks described in this study.

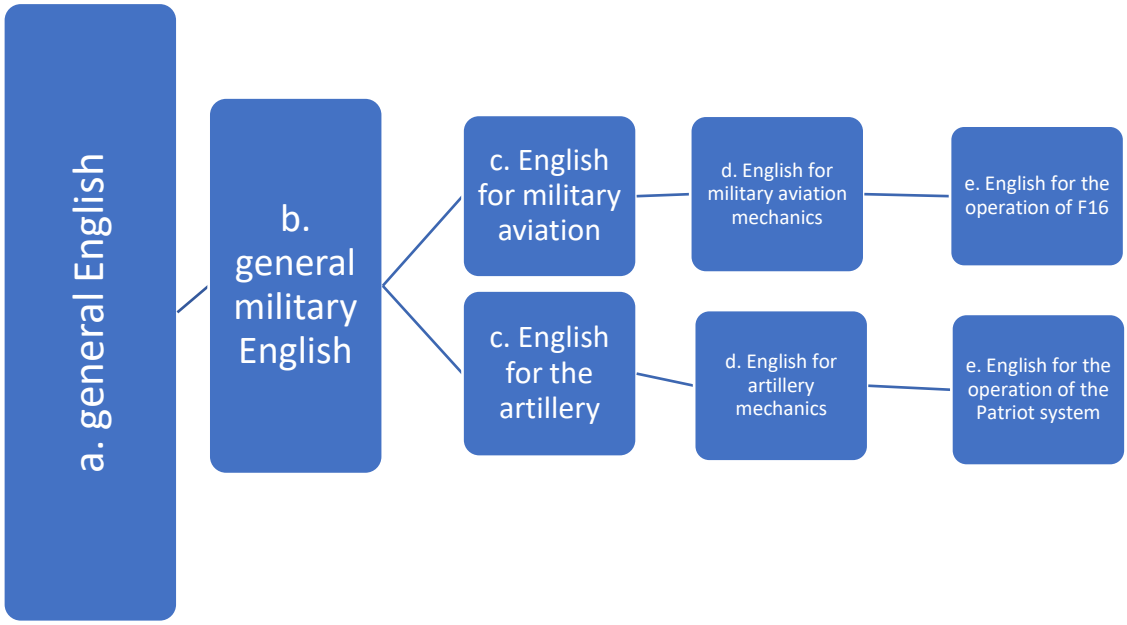

FIG.2 EGP-ESP continuum for military English

According to the points Barnard and Zemach make, the more specific the course, the more specialized the teacher should be, meaning that specialization courses for the operation of weapons systems are taught by military instructors. A highly specialized course contains the vocabulary pertaining to the object of study conveyed within the range of a few typical tasks like describing a process or making a description based on an image or map, or performing a dialogue that may occur in a regular situation at work (e.g. air traffic controllers and pilots).

These aspects relate mostly to the specialized contents of military training and are not part of the common core. They are in fact a technical jargon that service members use in their professional field depending on their service, job or rank.

The content and language that every member of the military uses in their missions and workplace is general military English: general English placed within the context of the military organization and used as a standardized tool of communication.

This context-specific language comes with a well determined practical utility: specific skills and functions, a specific range of contexts, situations and contents military personnel are likely to encounter during their professional activity such as speaking on the phone, addressing service members, giving/carrying out orders and instructions, completing forms, reading/writing correspondence and giving occasional briefings. The subject-matter is to a great extent regulated by the everyday situations like requesting/offering services, solving problems and engaging into standard conversations with peers and the tasks used in the classroom are created around these contexts. As mentioned above, the principles of the communicative approach are in accordance with the specific requirements of military English learners.

3. THE COMMUNICATIVE APPROACH

Communicative language teaching has become the norm in most classrooms around the world, focusing on developing the competence of communication rather than the knowledge related to the language as a system. Historically, its emergence is closely related to the socio-political developments after the Second World War when the US became a leader in both commercial and technological undertakings, with English featuring as a possible common language in an increasingly globalized and multicultural environment. As a result, starting with the 60s, efforts have been made to design courses that aimed to fulfill the linguistic requirements for all those involved in such activities. [2].

At the same time, in Europe, similar efforts were being made to design a frame of reference to be used in the case of all languages within the European Union [14]. The main beneficiaries of these efforts were those involved in the activity of the Common European Market, the general idea being to develop courses for adults who would be using English in their business and economic activities. Professional topics were not exclusive, though, since these courses were aiming to provide a well-rounded training that would include preparation for recreational and touristic activities as well [11]. What followed is today's Common European Framework widely used as a benchmark in describing and assessing linguistic level proficiency [7].

The principles applied in the foreign language class stem from viewing the use of language as *action*. Communication as competence entails not only knowledge of form and vocabulary but also a more practical ability of applying that knowledge in authentic contexts, shaped by a particular cultural milieu in which we make our presence felt and we *exist* through our verbal manifestations.

From a narrower, methodological point of view this idea materializes in the use of the target language in the classroom as much as possible, concentrating on the desired outcome: making the interlocutor understand. Interaction with other learners is a basic requirement; this is why pair and group work are favored to individual work. In the course of their interaction, learners usually 'play' themselves. This means, even when they perform a role play, they react and interact according to their personality, life experience, personal preferences, etc. Their behavior is genuine.

Most of the input (teaching materials) is authentic, modified as little as possible even in the case of beginners. This does not exclude the possibility of using abridged or simplified material if necessary, but it is essential that learners' reaction to it be genuine, meaning, it should be able to elicit authentic behavior [15].

Authenticity includes the choice of contexts as well. The topics and situations explored in the classroom pertain to what learners are likely to encounter in real life where they should be able to use the skills acquired in class [21, 22].

A question that often arises in connection with the communicative approach is the teaching of grammar. There are degrees of permissiveness towards form. A more 'radical' understanding of the principles standing at the basis of this approach, a theory of the so called 'strong' version [14] belongs to Stephen Krashen whose input hypothesis has attracted both popularity and controversy. Krashen vouches for a 'natural' way of learning a language, stating that language acquisition occurs when an individual learns subconsciously, just like children learn their native language in the first few years of their lives. According to Krashen's hypothesis, all learners need is a *comprehensible input*, meaning language that they can understand but which is slightly above their level represented by the formula i+1 where i is the input and 1 is the addition to the students' level [9]. This hypothesis leaves language learning to '*take care of itself*' [8] basically assigning teachers the role to expose their students to as much input as possible and wait for the best.

Stating quite the opposite, Widdowson attributes great importance to raising awareness on how language works, especially in the case of those learners who have the *'capacity or disposition for analytic self-reflection'*. In these cases, comparing the foreign language to their native one, for example, would *'increase motivation by giving added point to their activities, and so enhance learning.'* The key, Widdowson thinks, is to teach grammar in such a way that its *'intrinsic communicative character is understood and acted upon'* [15]. Such approaches belong to the 'weak' version of communicative teaching. It should be noted that activities focusing on grammar pattern are helpful with all levels but they are absolutely essential with beginners who need to become conscious of the sentence structure of the target language and to understand that the foreign language they are learning works differently from theirs.

Placed in a social context, the broader interpretation of acting through language posits the speaker as a '*social agent*', a member of society who accomplishes various tasks *'in a given set of circumstances, in a specific environment and within a particular field of action'*. Speaking is not an action if we don't place it alongside other *'cognitive, emotional and volitional resources'* through which the individual (ideally) achieves self-actualization [7]. As difficult as it may be sometimes to remember, this is ultimately the goal for learners and teachers.

4. TASK-BASED LEARNING

The teaching unit through which the principles of the communicative approach are put into practice is the *task*, its *"ultimate logical extension"* [10]. The definitions for task revolve around the same principles. According to Prabhu it is a '*meaning –focused activity'* [13]. David Nunan defines it as "*… a piece of classroom work which involves learners in comprehending, manipulating, producing or interacting in the target language while their attention is principally focused on meaning rather than form"* [12]. Jane Willis has a more technical explanation in store: *"...goal-oriented communicative activity with a specific outcome, where the emphasis is on exchanging meanings not producing specific language forms."*[16].

Both Nunan and Willis speak of manipulating, producing, interacting and exchanging language so that meaning is obtained. Widdowson explains the process of using a language by speakers as constant negotiation with the resources they have at their disposal, *"… manipulating the input so that it is optimally comprehensible"* [15].

Meaning for the participants to communication implies constant adjustment to their interlocutor and attempt to predict his/her intentions. Whenever a gap occurs in the flow of information, the participants to the dialogue fill in the blanks for each other [15]. This continuous interaction is the basis of communication that ends in consensus (on the meaning, at least).

Task-based teaching is not the ultimate method for the communicative approach which is much rather an umbrella term for the various classroom activities that align with the principles of learning language through various authentic contexts by using linguistic functions. As a matter of fact, task-based teaching is considered an approach on its own [17, 8]. Still, its relationship to the communicative approach is one of subordination since it employs communicative learning principles in order to work out a system based on a clear procedure. This comprises of pre-task activities, the task itself and language focus. Even if these phases of the procedure are well-established, the concrete activities used within each phase can be varied according to the needs of the class or the individual learners. In addition, there being no time limit for the discrete phases there can be incorporated as many activities as necessary in order to obtain the desired outcome. For instance, pre-task activities can include a revision of previous content in order to prepare learners for task completion, or language focus might as well consist of grammar exercises meant to raise language awareness, if necessary.

Various authors provide different classifications of types of tasks according to their functions (Willis), type of practice they offer (Nunan) or the operational principle behind the task (Prabhu). In order to describe the tasks used in the classroom for military English, Prabhu's classification allows a transparent and comprehensive classification according to level and complexity.

Prabhu classifies tasks into three categories [13]. The procedure in the case of an *information gap activity*, the least complex type, consists of the transfer of information from one person to another, typically based on materials like gapped tables (table completion), a picture lacking some details, or some other support that requires the completion of the missing information. The participants contribute with the data provided to them by the teacher (e.g. role cards) or use information that is easily accessible to them (e.g. personal details) conveyed through the language they can handle at their level.

The *reasoning gap activity* is similar to the information gap type but its complexity is increased in the way that the information the learner needs to find out is not identical with what is comprehended: based on the obtained information the learner needs to use inference, deduction, practical reasoning, perception of relationships or patterns in order to reach the desired outcome. The output that results from the task is the learner's own. S/he uses his/her own words for the reasoning whereas the information gap task provides the cue for the learner's answer. For example, learners can be given a task to work out the best solution for a particular situation. The classical example would be the activity entitled *Lifeboat* in which students have to decide which person should be saved first based on a set of information they have about them.

The *opinion gap activity* is different from the previous two in the fact that no preferred outcome is necessary. Learners are given some information based on which they complete a story, state their opinion and share their feelings related to that situation or issue, as in a debate or discussion. The open-ended nature of this type of activity may seem disorganized from the point of view of task-based learning since having a particular solution to the problem discussed usually gives a sense of security to learners. Yet, as Prabhu argues, advanced learners appreciate the possibility to express themselves without the constraints imposed by a task.

5. **LINGUISTIC LEVELS**

The task types outlined above are typical for the three main language proficiency levels, generally described as beginner, intermediate and advanced. Obviously, task complexity can always be tailored to the level of the class and the individual learners and adapted to further sub levels (false beginner, pre-intermediate, upper-intermediate, etc.).

The two relevant documents enumerating and describing in more or less complexity the functions that constitute each level are the STANAG 6001 descriptor for military English and the CEF (Common European Framework) for general English. The latter distinguishes two types of speaking skills. *Oral production* refers to the competence of delivering a monologue or discourse (with a complexity that depends on the level), for example, interconnected sentences, presentation, narration, description, etc. *Oral interaction* refers to the ability to participate to conversations, carry out various transactions or negotiate a position, just to name a few. The document describing the standardized language proficiency levels applied within NATO, the STANAG 6001 does not distinguish between the two types of oral competence but provides level descriptions which include oral interaction and presents examples for typical military tasks [7, 23].

The CEF marks the discrete levels with letters (A, B, C) and numbers to differentiate between sublevels (1 and 2 for each letter), A being the equivalent of the beginner and C that of the advanced. The STANAG marks levels by numbers (the ones relevant for this study are 1, 2 and 3), where 1 is the beginner and 3 can be considered as the equivalent of the advanced level. It should be emphasized that even if the NATO description can be used as a guideline for learning/teaching (if combined with the more complex CEF) its function is that of assessment. The descriptive elements of the two documents relevant for the communicative tasks described below will be presented for each level separately. The tasks used for the beginner and intermediate levels have been used in completion of lessons included in *Campaign 1 and 2,* textbooks [4, 5] used to teach general military English.

6. COMMUNICATIVE TASKS

As explained earlier, communication does not only imply knowledge of form in the target language but also the behavior and the context that requires a certain linguistic function. This entails the activation of various *routines* representing schematic knowledge (Widdowson, 1990: 103) related to the elements of discourse, cultural background, or socio-professional situation.

Information routines help speakers identify the right organizational elements when telling a joke or narrating a story. They consist in generic conventions that represent common knowledge within a culture. Another set of routines is used by speakers when interacting with each other and they help carrying out a conversation in its conventional pattern: e.g. the routine of buying a ticket, greeting a friend, inviting somebody to a party, etc. [6]. The role of pre-task activities is to activate these schemata for further use [3].

6.1 Tasks for beginners. The beginner level is described by both sources as the ability to ask and answer questions and communicate in the context of '*short social exchanges'* [7] or '*simple, short conversations*' [23]. Activities aimed at developing this ability can range from mere formulations of questions in the target language to simple role plays with a predictable scenario, like inviting a friend to a place, or making a simple transaction like buying an item. The additional military background is provided by placing these exchanges into the context of workplace interaction and routine.

Providing personal information is a typical task in this case, ensuing activities of raising language awareness and practicing the simple question patterns. Questioning a new visitor to the base is a possible scenario for this task with role play cards such as the following:

You are the on duty at the checkpoint. Your name is Sg. Smith. Ask the visitor: - Name Rank - His unit - Military ID nr. - By car? - License plate nr.	You are a visitor in Fort Blueville. Your name is Lt. Paul King. You are on a mission. You want to enter the unit. Answer the questions the sergeant asks. Unit 23009 Greentown Military ID nr. 33498700 Car HNY 5098

Similar cards are devised for each pair (depending on the number of students) and questions can vary according to the type of question that is being practiced or the general topic of the lesson. For example, pairs may be tasked to interrogate each other about their unit or about various military equipment. In the case of the latter a data card is probably necessary which contains information publicly available (It would probably be connected to the practice of question patterns like *how heavy…., how fast…, how big, etc.).*

6.2 Tasks for intermediate students. The interaction characteristic of this level pertains to '*every day and routine work-related matters'* [23] or '*familiar routine and non-routine matters*' like '*returning an unsatisfactory purchase' and* explain *'why something is a problem'* [7]. Typical tasks for the military field would be *'solving practical problems such as travel itineraries and accommodation'* or '*deliver/request information… to carry out assigned duties.'* [23]. Tasks that elicit interaction for this level would ideally be a combination between information gap and reasoning gap activities, where learners find out information in order to find solutions in various common situations and, to a certain extent, justify the choice they are making.

A scenario used for this level is related to organizing some sort of event in the military unit, like open gates day, national day (in a foreign mission), or, possibly a more complex activity, organizing a military exercise in a particular unit. Ideally, students in groups of three can come up with their version for the event and present it to the class afterwards. A stock image of a map is helpful to mark the various points of attraction in order for colleagues to understand the stages of the event. Below is a possible task card:

Your unit is organizing Open Gates Day next month and you have been tasked to organize the event. This year marks the 50th anniversary of your unit's existence, therefore, you need to prepare with a special program in addition to the usual ones. Make a plan for the various activities, include two original ones for this special occasion, and then make a schedule. Mark the location of the points of interest for visitors. Finally, present your plan in front of the class.

Another possible scenario revolves around the transfer/relocation from one unit to another, a situation in which certain rules and regulations are applied. As a pre-task activity a conversation about these regulations is in place, which does not only introduce the topic but provides an opportunity for learners to review language related to permission, obligation, probability, possibility, etc. In addition, they may need to be reminded or taught some of the expressions, typical questions and forms of address that occur in such conversations. After the students are divided in pairs, they can perform their tasks. Here is one example:

You are the commanding officer for C Coy. Your unit is preparing for an important exercise taking place next month. You are rather short of personnel and you need every man you've got. Sg. Richards is one of the NCOs you rely on.	You are Sg. Richards working in C Coy. Your wife has recently given birth to your third child so you would like to relocate to a unit closer to your hometown so that your parents can help with the baby. Go to the commander and discuss the issue.

6.3 Tasks for advanced students. The advanced level implies the use of '*formal and informal language for most social and professional situations'* which entails the ability to convey '*detailed arguments for and against different opinions*' [23]. Activities that develop this ability must offer learners the opportunity to '*argue a formal position*' [7]. This implies participating to discussions, simulated panels, debates, in which they not only develop a line of argument in favour or against the debated issue but they also perform a '*representative function'* [23] as spokespeople for an organization or various categories, or as representatives of the military unit or of the country (liaison officers, attaches, etc.). Such situations require a lot of schematic knowledge, therefore, pre-task activities, ideally listening and reading material should present various data on the issue, analyses and opinion pieces which allow learners to understand various points of view and extract enough data to be able to formulate some line of argument.

The following example is a simulated panel discussion, involving characters representing different categories in a debate that occurred a few years ago related to a controversy around high-ranking medals being awarded to drone operators. The discussion was prepared by various materials discussing the changes that have occurred in warfare due to technology and the psychological impact this may entail [18, 19, 20]. More concretely, the discussion revolved around the possibility that drone operators, who launch attacks remotely, from the physical safety of their units, may be regarded as equally contributors to war efforts with infantry or other categories carrying out dangerous missions on the actual location of warzones.

While preparing for the task (which involves the whole group, 8 to 10 students) the roles are distributed as follows: panel leader, Vietnam War veteran, army psychologist, author of a book on the changing ways of warfare, recruitment officer for drone pilots, fighter pilot, infantryman, drone operator and possible additions state official from Washington and Army economist. Ideally, learners should gather data while preparing for their role, from the materials they have at their disposal and, if necessary, from the internet. The discussion should be long enough to allow each participant to state their point of view and, ideally, make room for exchanges between those representing different points of view.

7. CONCLUSIONS

The success of using interactive activities in the foreign language class depends on their genuine communicative value which may motivate learners even with lower levels. Information gap activities should be used as early as possible in order to generate interactive situations in the classroom. Reliance on the students' personal experience and activities that require them to share information about themselves may generate situations in which real communication occurs. Despite the fact that lower levels need various types of assistance and can rarely engage in genuine production, these tasks help familiarize learners with language specifics and launch them on their way towards speaking.

Even if it hasn't been discussed at length in this study, it should be noted that elaborate and varied pre-task activities significantly contribute to task completion as they prepare learners. Language awareness activities should be used both before and after task completion in order for learners to understand the use of language and the significance of one or another technique. Speaking as a productive skill is merely the 'tip of the iceberg' when it comes to using the language. By the time learners can interact autonomously they will have acquired a solid language base.

Bringing professionally relevant material to class does not only motivate the learner through its authenticity or engaging nature but it must also convince through its significance for his/her goals. The learners participating to courses need to be certain that the activities they carry out in the classroom help them advance toward professional accomplishment. In order to encourage communication these activities should evoke or reproduce specific contexts that the military person recognizes as relevant for his/her activity. The best feedback a teacher can get is when her students identify these situations as genuine (as they have experienced or discussed it) and express certainty that next time they will be able to handle the situation better.

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CHALLENGES RELATED TO THE REGULATION OF THE STATUS OF AVIATION PERSONNEL IN THE POST-WAR REGULATORY LEGAL DOCUMENTS ISSUED BY THE ROMANIAN ROYAL AERONAUTICAL DIRECTORATEAND THE GENERAL INSPECTORATE OF AERONAUTICS

Cristian MANOLACHI
Human Resources Service, Air Force Staff, Romania
ORCID: 0000-0003-3181-8975

Jănel TĂNASE
"Henri Coandă" Air Force Academy, Braşov,Romania

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Abstract: *Even after the End of the First World War in the West, the Romanian people had to continue their struggle to achieve the goals for which they had decided to join the Entente in August 1916, namely to defend and impose – politically, diplomatically or by force – the decisions of the Plebiscite for National Union adopted by the governing bodies and the legitimacy of the Romanian Nation in Chisinau, Cernauti and Alba Iulia. The victorious campaign against Bolshevism in the East, North and West, together with the Decisions adopted by the Great Powers within the system of the Peace Treaties in Paris, agreed and recognized the new political-geographical reality of Greater Romania in the area designated roughly by the Danube and the Carpathians. And this great historical achievement had to be defended and consolidated, including by modernizing the Romanian Royal Aeronautics and perfecting the specific processes of training and developing human resources, able to set in motion the new operational challenges generated by the technological progress in air capabilities and new doctrines of use.*

Keywords*: Aeronautics, air weapon, aviation, air balloon, patent, air mission, air observer, pilot, flight.*

1. INTRODUCTION

The establishment of the Romanian unitary National State at the End of the First World War, a war that brought on the stage of European History a new configuration of states, imposed on national bodies fundamental decisions to set in motion new economic and social realities, but also to strengthen the State in order to protect its fundamental values.

Within the extensive process of development and reorganization of the military body to face the new mission of defending the borders of the entire Romanian State, but also based on the conclusions resulting from participating in the fierce confrontations of World War I, the modernization of the Romanian Royal Air Force took a distinct place, due to the assertion of the special role as a combat weapon, in the configuration of the Romanian Armed Forces a process that took place in the interwar period in three distinct stages: the development of the command structure under the form of the General Inspectorate of Aeronautics in 1924, the establishment of the Under Secretariat of Air in 1932 and the independent functioning of the Land Forces, Air Force and the Navy, during 1936-1940.

2. FIRST REGULATIONS RELATED TO THE STATUS OF AERONAUTICAL STAFF ADOPTED AFTER THE WAR

After the demobilization of the Romanian Armed Forces following the victorious campaign in Hungary, the first post-war measures were adopted for the reorganization of the air weapon, but also for correcting its extremely critical situation regarding the endowment with aeronautical equipment and staffing. The process was managed by the Aeronautics Directorate, established in the midst of the World War II, which submitted to the Ministry of War, on April the 30th 1920, Report no. 806 which proposed accelerated measures for the commissioning of the weapon in the fullness of its vital components, organization, endowment and last but not least, the aeronautical personnel [1].

The complex situation of the aeronautical personnel was taken into account, which involved hiring different specialties for the operation of aircraft: air navigation personnel (pilots, observers, snipers, etc.), technical personnel (mechanics, craftsmen, electricians, etc.), meteorologists, photographers, and other specialties required by the development of the weapon, personnel with special servitudes who were trained as a result of a laborious, long process and who came mostly from the aeronautical reserve or assimilated from other weapons, with uncertain legal status, which of the most often headed for careers in basic branches or looking for advantageous aeronautical professions in developing aeronautical enterprises, in constant search of specialized personnel [1].

It was also proposed, taking into account the special reality of aeronautics, which had functioned since the war, through regulations issued by Central Military Authorities, especially the General Headquarters, including in the complex field of training and development of aeronautical personnel, to promote a legislative initiative, the organization and post-war operation of the weapon, also supported by the General Staff, a law that was more necessary as, given the difficult conditions generated by the war and the danger of its decomposition and dismantling, it could ensure proper functioning and training, even in Peacetime, for a possible future war [2].

Following these measures, simultaneously with the establishment of new units that were to be equipped with imported aeronautical equipment, with the one repaired and built in their own units or war capture, the structure of training and improvement of aeronautical personnel was reorganized.

Thus, Aviation Instruction Group 4, the first aeronautical education institution in Greater Romania, established in 1918, was developed and transformed into a new structure, also based in Tecuci, the Aviation Training Center established by the Command Order no. 21 of June 16, 1920 [3] and the Report of the Aeronautical Directorate no. 1910 of July 4, 1920 (stating that the students who had passed the exam conducted at the Bucharest Aeronautical Directorate to attend the Pilot School, were to begin classes at the Aviation Training Center in Tecuci, on July 20, 1920 [4]).

The mission of the Aviation Training Center was to achieve the standardization of the training and application of aeronautical regulations at the level of basic structures, groups and aviation squadrons and, fundamentally, the training of all specialties of air navigation and non-navigation personnel, for the classification of combat units [5].

In order to accomplish its mission, the Aviation Training Center was provided with the organizational, material and infrastructure conditions necessary for a performance training process, within the specialized structures that were to operate in its staff, Pilot Schools, Observatories, Bombing, Fighting and Shooting [5].

The 6-month Pilot School provides theoretical and practical flight training and piloting, following the graduation exam, of student officers and non-commissioned officers.

The school of observers and bombers trained airborne personnel in the specialties of aircraft observers and bombers. The training program was complex with theoretical and practical training internships at the center but also at specialized units, at the end of school, by exam, students being patented as an observer on the plane, respectively a bomber on the plane [5].

The School of Combat and Shooting had the mission of training licensed pilots, observers and bombers for combat. The students of this school went through a very rigorous selection process, based on the complete knowledge of the candidates, the results and the daily efforts as air navigation personnel within trainings, professional background and, very importantly, the moral and professional qualities. The school curriculum was diverse and complex, including theoretical and practical courses in the school or combat squadrons, training exercises in the real conditions of air combat actions, at the end of which the staff was evaluated by giving coefficients to the skills of flight, air shooting, in and out of the air.

The school of specialists was intended to train non-navigating staff by selecting candidates from the lower ranks in the specialties of aircraft mechanics, engine specialists, gunsmiths, firecrackers specialists, electricians, car mechanics, photographers, laborers and designers, meteorologists.

The Aviation Training Center also ensured the specialized training of the staff in case of equipping the aeronautical units with other categories of equipment, airplanes or engines, through training courses with variable durations, depending on the complexity of the specialty categories [5].

In addition to the training of active personnel, the Aviation Training Center also ensured the training of reserve personnel, from all categories of personnel and specialties, according to the regulations elaborated at the level of the General Staff and the Ministry of War [5].

The Aviation Training Center, during its period of operation, revived the development of aeronautical activities in our country, given that the formation of new staff and specialties was required, by selecting the most valuable elements of the Armed Forces, given the specificity of the aeronautical service which could not and should not be open to all, which posed special risks and required special moral and professional qualities for staff.

3. REGULATIONS ISSUED DURING THE DEVELOPMENT AND CONSOLIDATION OF COMMAND AND COMBAT STRUCTURES, AND THE TRAINING OF THE ROMANIAN ROYAL AERONAUTICS PERSONNEL

With all these, the implementation of the Aeronautics Modernization Program approved by the senior military leadership forums also involved transforming the system to train, improve and ensure a thorough and motivating career for specialized personnel.

In 1924, a first step was taken to ensure the achievement of these goals, once established, at the proposal of the Secretary of State to the Department of War sent with Report no. 3336/1924, of the General Inspectorate of Aeronautics, by the High Royal Decree no. 2057 of June the 23rd, 1924. According to art. 1, the Inspector General of Aeronautics had the attributions of an Army General Inspector, in the other articles of the Decree being regulated some rights of the aeronautical officers, coming from other weapons, the rights and obligations of the officers sent to study abroad, measures for hiring civilian personnel from the engineering area, civil servants and craftsmen, the hierarchy of civilian craftsmen and military aeronautical foremen.

After the establishment of the command bodies, following the reviews and reports submitted by the General Inspectorate of Aeronautics with no. 434, of November the 1st, 1924, General Staff with no. 2773, of September he 5th, 1924 and the Ministry of War, with no. 436, of November the 4th, 1924, by the High Royal Decree no. 3761 of November the 10th, 1924, King Ferdinand approved the establishment, on November the 1st 1924, of the Schools for the training and improvement of the Romanian Aeronautics personnel, respectively the Preparatory and Special Schools of Aeronautics, based in Bucharest, for the training of navigation and technical officers, active and reserve, Piloting and Training Schools, located in Tecuci, for the training of airborne Non-Commissioned Officers, Aeronautics Training Center, based in Băneasa, for the training of other aeronautical specialties, observers, radio telegraphers, aerial photographers, aeronautical staff, meteorologists, meteorologists, School of Air Shooting and Bombing, based in Mamaia, for the training of air navigation personnel for shooting and shooting in and from the air, Technical School of Aeronautics, based in Mediaș, for the training of various specialties of aeronautical technical personnel [6].

The efforts to develop interwar aeronautical education continued, so that, at the proposal of the General Inspectorate of Aeronautics submitted with Report no. 564b of October the 25th 1925, by the High Royal Decree no. 3983 of December, he 31st 1925, starting with January the 1st 1926, in the structure of the Romanian Royal Aeronautics was established the Command of the Schools and Training Centers of Aeronautics which subordinated the Preparatory and Special Schools of Aeronautics (Bucharest), the Piloting and Training Schools (Tecuci), the Center of Aeronautics (Bucharest-Băneasa), the Technical School of Aeronautics (Mediaş) and the School of Shooting and Bombing (Constanţa) [6].

In the spirit of this trend of continuity and development, with Report no. 15184 of December the 13th 1927, the Ministry of War requested the High Regency to establish a specialized school for war pilots, located in Buzau. Based on the High Royal Decree no. 3578 of December the 13th 1927, was established, on October the 1st 1927, the Training School for warplane pilots, which aimed to complete the training of pilots for the use of warplanes and training as flight instructors [6].

Until the establishment of the Under-Secretariat of State for Air in 1932, the organization of aeronautics was legislated by the Law on the organization of the Army adopted by High Decree no. 1462 of April the 30th 1930 and by the High Decree no. 2041 of June the 7th 1930, the new Aeronautics Battle Order was approved, starting with June the 1st 1930. According to these regulations, in addition to the command and combat structures, the structure of aeronautics provided all the structures established after the war, respectively the Command of Schools and Training Centers of Aeronautics (Bucharest) with the Military Preparatory and Special Schools of Aeronautics "King Carol II -lea "(Bucharest), Aeronautics Training Center (Bucharest - Pipera), Military Flying School (Tecuci), Training School for warplane pilots (Buzau), School of Shooting and Air Bombing (Constanţa - Mamaia), Technical School of Aeronautics (Mediaş) [6].

For the development of this rigorous ensemble of aeronautical personnel training, the national experience was exploited, but also the developments that took place in other states in Europe and in the world, which had created such aeronautical personnel training institutions, taking into account the evolution of technology requiring in-depth expertise and technical knowledge, training of personnel in other weapons for aeronautics requiring longer training times [7].

This system of education designed by the doctrine provisions concerning the use of the weapon, supported by the General Inspector of Aeronautics, Prince Carol the IInd, had as coordinates the special doctrine of the weapon, with the overwhelming role played by the superior combat technique, which required personnel technical training and perfect specialty, but also a scheduled career development path, especially of officers, by going through several mandatory stages.

In the first stage, the aeronautical personnel were admitted and trained within the Preparatory and Special Schools of Aeronautics, which, after graduation, performed for a period of at least seven years the functions at the base of the military aeronautical pyramid, pilot and aerial observer in aviation or air station units. At this stage, the officers became familiar with the use of air means in combat and took various training courses, aerial shooting, bombing, aerial combat, etc. at the Aeronautics Training Center. At the end of this stage, the officers were promoted, being able to upgrade to the rank of captain, with the position of squadron commander or an airline company.

This stage was completed after a minimum of six years, being necessary for the training and completion of officers in the tactical and technical management of the structures they commanded, participation in exercises and training with units from other categories of weapons to become familiar with their cooperation and support, according to the concept of using Aeronautics in war.

In order to advance to the rank of major, it was necessary for officers to complete the Information Course at the Aeronautics Training Center, in order to crystallize and systematize the knowledge required of a senior aeronautical officer.

The period for the ranks of major and lieutenant-colonel was at least ten years, during which time officers were promoted to the positions of commander of an aviation or aerostatic group, in order to familiarize and train future aeronautical commanders for wartime corps levels.

At the end of this stage, the officers were advanced to the ranks of colonel and later general, without a certain internship in units and promoted, depending on the seniority in service at the command of large aeronautical units, the activity on these types of functions ensuring their training for military commanders in military warfare [7].

4. CONCLUSIONS

These developments in the first interwar decade generated comprehensive actions for the consolidation and establishment of a unitary system of management and administration of all means operating in the air, military and civilian fields. The constructive approach was adopted by the Law for the Organization of Aeronautics and the establishment of the Under-Secretariat of State for Air, promulgated by the High Royal Decree no. 1890 of 31st of May 1932.

For the present approach, the pioneering represented by this law is highlighted, which, through its internal organization, integration of all aeronautical components in a coherent whole, depth and legal clarity in defining the status of military and civilian aeronautical personnel in terms of military career, rights and the particular obligations of this category of personnel, an approach that is constituted and, certainly, will constitute a perennial source for the developments that will follow in air law and the related aviation laws.

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