THE MILITARY HIGHER EDUCATION SYSTEM TRANSFORMATIONS IN THE NEW SECURITY CONTEXT

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Abstract: The contemporary security context is very complex nowadays, passing through living history, facing the toughest challenges from the past 8 decades dominated in the background by the global order rebalancing from a polarized world to a deglobalized multipolar international texture, with regional poles of power, speaking now in clear about the "west global" and "south global". Between all the focal points of security imbalances, Black Sea region is concerned as one of the most critical, the consequences of Russian-Ukrainian conflict being nowadays the most impacting vector of security in the region with complex consequences, drawing up a new model of war. The new warfare model on land, air and naval operations becomes more technological, valorising the new technologies, from digital space to the artificial intelligence, enforcing the new approach also against the military educational and training system. The article focus is connected to the real transformations happening nowadays, in such dynamic and volatile environment, depicting in particular the topic of the Military Higher Education System transformations in the new security context, admitting as prerequisite, that the new conflict developments in the regions and crisis scenarios evolvement will definitely influent and change the face of the educational and training processes in the Defence Higher Education System.

Keywords: military higher education; security; system; crisis scenario; Black Sea; transformation

1. The role of Military Higher Education

As known so far, the European Military Higher Education is built under 3 structural models of education and training: the first is focused on vocational type of education, the second is focused on shadow universities and the third one kept as an academic model, with distinctive accredited higher education institutions as organized in the Black Sea Region, or in Poland, France, Portugal and Greece. Moreover, from functional point of view, in particular, the Navy Higher Education system is either integrated in National Defence Universities in the cross-services approach, or organized distinctively on each service, Air, Land and Navy, as the Black Sea region respectively. For Romania, Poland, Bulgaria and Ukraine, Baltic to Black Sea region, the Navy Military Higher education is based on academic model, implementing in the curricular development both national and European Qualification Framework, and in particular, the Sectorial Qualification Frameworks for the Military Profession, as developed under the aegis of European Security and Defence College.

Consequently, in relation with the present security context, the Navy Higher Educations Institutions become versatile in the national strategic perspectives, proving itself a valuable asset in the updated security and defence context, as a relevant adaptive pillar, for at least following reasons as described in below points (with the respective explanations of good practices on the Romanian Naval Academy, where the case).

a. First and most important difference from the past times, on a strategic level, in case of shortage of conscripted military staff (reserve troops), as often met especially in the Central and East European countries, the existence of an extensive system for education and training would provide **a substitution solution for recruiting/conscripting and developing military human resource on a multiplicative scale** when the case of a conflict or war crisis situation, covering during a short period of 6 – 12 months, the gap between the operative troops and reserve troops – afterwards, either the active reserve consistent in addition to regular troops, or a strong basis development on education and training facilities to provide as alternative solution, on a short run the required human resources. Then, now, the investments in a diverse system for education and training, would make a lot of sense, as strategic solution for a low level for maintaining a high level of operational troops. As suggestive example, on the level of lower active military staff for Romanian Navy, the Naval Academy kept the civilian speciality with a strategic reason, being able to increase the scholarship capacity from 500 cadets to 3500 in just few weeks, according to the mobilisation scenario, proving its utility as recruitment center and fast lane for staff training on operation level.

b. Second, the higher military system can provide a **flexible, consistent, and adaptive framework for the alliance perspective enhancement of integration** in the level of troops instruction, **in contact both with the latest NATO policies and procedures**, or in relation with newest **European Security and Defence Policies**, being able to actively contribute to a faster and effective harmonization of the training programs with the newest changes in the allied tactical doctrines and procedures. As example, the Romanian Naval Academy had opened an accredited NATO classified work-point with full access to the Alliance tactical and operational documentation, being ready to provide the tactical and strategic level of command with the respective capabilities of real time exchange of information within the Alliance and in relation with the recruitment and training system. This access to the real-time documentation on confidential area provides a great advantage in keeping the training resources fully up-to-date.

c. On the third stage, closer to its academic vocation, the Military Higher Educations is very relevant in **facilitating the process of implementing new weaponry systems and installation, new warfare technologies and equipment, or new warfare tactical approaches**, being able to contribute in adapting the military endowment to the war or crisis scenario by designing reliable and timely training programs or by contributing in further technical or technological operations. In this regard, the Military higher education system preserved the engineering profile, which allows the dynamic update in relation with the latest technical progress in military equipment and combat systems and facilities, using in its routine educational practices the ITC facilities, the Artificial Intelligence applications, the Virtual Reality and Augmented Reality facilities – within very complex and well-developed simulating facilities. As example, in case of Romanian Naval Academy, developing the navigation simulator integrated with engine room and further connected to the tactical simulator, could provide a more complex environment for and inter-departamental training under an integrative manner. Even now, fastening the process of adaptation to the new security context, the Romanian Naval Academy has concluded the procurement and installation of the first bridge simulator for riverine navigation, dedicated to the Danube and Danube Delta sector, with capabilities in mine sweeping scenarios, then being capable to provide the Romanian Navy with complex simulation about the future crisis operation scenarios.

d. The Navy Higher Education Institutions kept its **vocation of academic research capabilities, being involved in scientific research projects**, **dedicated to the military sector** and not only, including the initiative valo-

rised through European Defence Agency, European Defence Funds, Horizon or based on the National Defence Research Plan, offering innovative platforms developed with the qualified and experience personnel and endowed with complex and modern facilities. As all partner universities at least in the Naval Education System, the Romanian Naval Academy is strongly involved in the past years in the Defence Research Plan execution, as in the Permanent Structured Cooperation (PESCO) initiative, providing the operational structures, with the innovation and research services, when required. Differently from the previous years, the Navy is fully connected now to the Naval Academy research infrastructure, the scientific research on demand providing tailored services for operational structures – example, by Turbonav project I and II stages, the Romanian Naval Academy, in joint with 2 companies (Turbines COMOTI; ICPECA – Bucharest; ROMAERO Bucharest) had improved the speed of 222 Class Frigate with 4 knots, the same projects continuing today with the turbines efficiency enhancement for Corvette class ships. Also, after the mines incidents in the territorial waters of the Black Sea, Romanian Naval Academy had timely pursued with 2 scientific projects, to provide Navy operational structures with a valid "*System based on autonomous, aerial and maritime vehicles, for the identification of sea mines and for the support of the intervention team in the neutralization mission – ASMINES*" project. Moreover, to conduct the real-time monitoring of the coastal areas, on demand research, Naval Academy had implemented the second project inquired by Navy, namely the "*Digital system based on augmented reality technologies, for remote technical assistance, management of stocks and goods from the inventory of a military ship – ARMMS*". Then, if in the previous year the focus was sometimes divergent to the Navy needs, nowadays the connection become very strong, the Naval Academy becoming one of the most important providers for innovation and military engineering services.

e. Not in the last, due to its cross-services approaches, but also to its internationalization vector, the Military Higher Education system is due to build **military leaders**, **under a flexible and adapted policy**, defined by interrelated competencies and with transversal skills and abilities, being prepared to play multiple roles in the military structures, based on so-called "multi-role type of military leaders". Even is still plenty of things to do on this matter, the approaches in leadership profile development should be differentiated, being necessary to be properly and effectively adapted considering the internal and cultural features, due to the differences nurtured by the development discrepancies in the Allied Armed Forces development, or even more by the Esprits de Corp values

or determined by societal perceptions, or by the national/cultural ethos. In this case, the leadership model should be based on the adaptive table of competencies, built in relation with the basic Alliance values but harmonized with the national features.

In this perspective, for the Romanian Naval Academy, the wide number of exchanges are very important to identify what makes to difference as what keeps the Allied military staff together in the core of values. Moreover, we can remind here that all the strategic partnerships, initiated among the Naval Academies found out even more sense in being implemented under Erasmus+ framework and contributing to the leaders formation and harmonization process of competency building for Navy officers (i.e. SeaMentors or MarsNet projects). The most recent project initiative already approved, due to start next month, to be implemented in the next 2 years, on a budget of 250000 Euro, is entitled "*International Naval Semester Development Applying the Intelligent Technologies and the Innovative Tools in the European Navy Defence System – NAVY-INS-Tech*", and have foreseen the next results in fully agreement with the above priorities: developing 1 joint harmonized curriculum consisting in 8 engineering courses using intelligent technologies and 4 humanities courses cantered on EU and NATO culture and values.

2. Adaptive requirements in future curricular developments for military higher education

considering the new realities in the regional and global security context, as the certain trends in the military higher education and training system evolution, in order to provide consistency to the above future lines of development, **the next adaptive requirements in future curricular developments are to be embraced and fully implemented in the next years**, as coherent reply to the up-to-date technologies and warfare operational and tactical adaptation, with an inter-services and inter-operability approaches under integrative Allied framework:

a. Become essential **the implementation of intelligent weaponry tools and systems based on USV - Unmanned System vehicles** – all types of drones' applications as UAV, USV – underwater, sea and air drones in the academic curriculum, as an important pre-requisite for future academic and training programs, in all services.

Max Boot, a military columnist of the American newspaper "The Washington Post", pointed out that technologies that will be used in future military

conflicts are being tested during the war operations in Ukraine. In his opinion, the West is supplying Ukraine with more and more new weapons and is monitoring their effectiveness. Boot noticed that: … *militaries around the world are closely watching the fighting in Ukraine to gain insight into 21st century warfare, knowing they are watching the testing of technologies that will become more common and important in future conflicts*".

The use of aerial/surface/underwater drones (UAV, USuV, UUV) was specifically designed to be carried out within independent missions, during which these means operated automatically/semi-automatically and autonomously/guided, directly following the instructions stored on board (in the memory of the tactical and navigation computers) or/and executing the commands transmitted in real time, from the ground, from the command-control centers/stations, by the human operators. In the near future, becomes certain that the surveillance, aerial reconnaissance, electronic warfare and strike missions, still mostly performed by specialized, manned means, will be largely taken over by USV systems, for which reason the dedicated curricular approach in the Military Higher Education and Training System become essential.

Most of the current analysis appreciates that the current USV systems still require serious refinements in terms of operational equipment, both with C2 systems and with active search and strike systems, not to mention the radical improvement of survivability in hostile environments. But, if we refer specifically to the USV, in the maritime area of operations, they can perform the entire range of missions of surveillance, reconnaissance, ensuring the security of certain perimeters of particular importance by carrying out air/surface/underwater patrol, retransmission of data, as well as providing data necessary for decision-making and the execution of attacks/strikes with dedicated systems, consisting of means with or without human crew on board. Within this range of missions, USV systems are capable of detecting, identifying, and locating threats, posed by surface and underwater assets, including the discovery of drifting mines.

b. **Enrichment of curricular approaches in relation with the electronic warfare and monitoring and surveillance capabilities** – implementing early warning systems and monitoring capabilities for building an effective and timely response to different tactical threats. The following new realities should be considered in our curriculum as to be included in future instructive approaches: a) the jamming actions detected especially but not limited to Russian-made radio stations using the so-called "kill switch" or the pre-implemented "viruses"; b) the interception of communications (radio research – SIGINT / electronic support

measures – ESM) – this actions took place both on campaign radio links and on civilian communications by mobile phone, up to a depth of 30 km from the contact line; c) goniometer actions of the transmitters, aiming to identification and location of radar stations for detecting artillery systems location; d) the jamming, widely used against classic radio stations, on frequencies in the 137 – 180 MHz and 400 – 470 MHz bands and e) jamming of GPS navigation signals, the electronic action on navigation receivers via GPS satellites also included spoofing, i.e. the alteration of navigation data within the received signals. Then, the graduates should be clearly aware about the electronic warfare realities in order to face the current situations, in crisis management operations, no-matter the assigned service.

c. Basic instructions in **cyber defence and data protection** are already widely recognized as one of the most important components of the hybrid warfare, beside hacking actions or misinformative activities as fake news spreading. It is important for all future militaries to be instructed in these curricular learn - ing outcomes, at least on inductive level, as to be aware from the leadership positions about the importance of information value and data management relevancy for a mission success.

d. **Implementing the intelligent technologies applications in military operations** valuing up-to-date smart capabilities as: **Artificial Intelligence, Virtual Reality capabilities combined with Augmented reality features** these innovative tools comprising the future trends in the military equipment developments.

e. Building a more **effective training infrastructure for a smooth insertion in the theatre of action**, by an **extensive usage of simulation facilities** for equipment handling, weaponry systems, tactical warfare scenarios and crisis management operation – there is an imperative to be enriched and largely implemented in the curriculum design as a modern tool of training and instruction, the Navy Higher Education representing a model in this perspective.

f. **Improving the leadership skills and abilities** for military graduates, **making the leadership competency a fundamental professional value** for tactical, organizational, and strategic levels, based on critical thinking, tactical action autonomy, multimedia leadership tools, modern communication tools. The attributes and competencies of the military leaders, as the team approach and field procedures for action in theatre of operation, are essential for a coherent crisis management operation, the contribution of the academic system being significant.

3. The recommended competencies to be designed for Naval Officer and Marine Engineer

In fully compliance with the described priorities for future curricular developments, the following table of competencies are recommended to be designed for Naval Officer and Marine Engineer as per European Skills, Competences, Qualifications and Occupations ESCO format[1], prior divided into **essential skills** and competences and **optional competences**:

Essential Skills and Competences (ESCO):
EC1. applying the operating procedures specific to the Navy
EC2. coordination of humanitarian aid missions
EC3. coordination of rescue missions
EC4. coordinates the ship's crew actions
EC5. the conception of military tactics
EC6. ensures compliance with weaponry types
EC7. ensures public safety and security
EC8. give instructions to the staff
EC9. use surveillance equipment
EC10. identifying security threats
EC11. lead the military troops
EC12. conduct military operations
EC13. training of subordinate crew
EC14. uses different communication channels
EC15. adjust product designs
EC16. advise superiors regarding military operations
EC17. defines technology strategy
EC18. designs technical components
EC19. examine technical principles
EC20. monitor the use of military equipment
EC21. monitor technology trends
EC22. ensures quality control
EC23. oversees the maintenance of military equipment

b. Optional skills and competences (ESCO):
OC1. analysis of ship operations
OC2. assess danger in risk areas
OC3. coordinate patrols

OC4. ensure the safety of the ship
OC5. giving battle orders
OC6. maintaining operational communications
OC7. managing troop deployment
OC8. patrol
OC9. perform search and rescue missions
OC10. provide humanitarian aid
OC11. the use of geographic information systems

The process of curricular updating for military academic programs to the latest advanced combat systems/concepts used or in various stages of implementation according to the conceptual framework and operational, using the premises mentioned above, are presented in the table below (table 1), in relation with the identified list of disciplines where the respective skills and abilities have been introduced to be further develop in the graduates' profile.

Table 1

#	***Advanced warfare system and operations***	***Conceptual definition of LO content***	***Topics/subjects***	***ESCO competencies***
1.	Unmanned Air Vehicles (UAVs)	UAVs, including armed drones, have become increasingly important in modern warfare. They can be used for reconnaissance, surveillance and even targeted strikes Surface	Combat Systems (CS); Underwater Combat Systems (UCS); Combat use of CS; Use of UCS in battle.	*EC21.monitor technology trends; OC2. evaluates the danger in risk areas; EC9 uses surveillance equipment; EC5 the design of military tactics.*
2.	Counter-drone systems	As drones become more widely used, counter-drone technology is critical to protecting military assets.	Electronic Warfare 1; Radio electronic and naval communications equipment; Radar systems.	*EC21.monitor technology trends; OC4. ensure the security of the ship; EC9 uses surveillance equipment.*

3.	Electronic Warfare (EW)	Advanced electronic warfare systems are used to disrupt enemy communications, radars, and other electronic systems.	Electronic warfare 1	OC6. maintaining operational communications; EC10 identification of security threats; EC14 uses different communication channels;
4.	Cyber warfare	Cyber warfare capabilities continue to evolve, covering a wide range of activities from cyber espionage to attacks on critical infrastructure.	Electronic warfare 2	*OC6. maintaining operational communications; EC10 identification of security threats; EC14 uses different communication channels;*
5.	Artificial Intelligence (AI)	AI is being used for various purposes within the military, from improving autonomous systems to data analysis and decision support.	Applied informatics	*EC5 the design of military tactics; EC16.advises superiors regarding military operations*
6.	Advanced communi-cation systems	Secure and resilient communications networks are critical to modern military operations.	Radio electronic and naval communications equipment	*OC6. maintaining operational communications; EC14 uses different communication channels; monitor technology trends.*
7.	Satellite technology	Advanced satellite systems are crucial for communication, navigation, reconnaissance and monitoring.	Radio electronic and naval communications equipment	OC6. maintaining operational communications; EC14 uses different communication channels; EC21.monitors technology trends.

8.	Stealth technology	Advanced stealth aircraft such as the F-35 Lightning II and B-2 Spirit are designed to evade enemy radars, making them difficult to detect and attack. Similar concepts are used by submarines.	Radar and sonar systems.	*EC1. application of operating procedures specific to the navy; OC11. the use of geographic information systems.*
9.	Hypersonic missiles	Hypersonic missiles travel at speeds in excess of Mach 5, making them extremely difficult to defend against.	Surface Combat Systems (SCS); Combat use of SCS;	*OC4. ensure the security of the ship; EC9 uses surveillance equipment; EC16.advises superiors regarding military operations.*
10.	Autonomous weapons	Development of autonomous and semi-autonomous weapons is underway, with the potential for drones and robots to play a larger role on the battlefield.	Electronics and automation; Electronic warfare.	*EC17 defines the technology strategy; EC19. examine technical principles; EC16 advises superiors regarding military operations.*
11.	Robotics and exoskeletons	Robots are used for logistics, demining and other tasks, while exoskeletons can enhance soldiers‘ physical capabilities.	Electronics and automation; Combat use of SCS; Combat use of CS;	*EC12. conduct military operations OC7. managing the deployment of troops OC2 assesses danger in risk areas*
12.	Directive Energy Weapons	These include high-powered lasers and microwaves that can be used for precision targeting and missile defence.	Electrical engineering and electrical machinery; Surface Combat Systems (SCS); Combat use of SCS;	*OC4. ensure the security of the ship; EC9 uses surveillance equipment;*

13.	Electro-magnetic guns (railgun)	Electromagnetic cannons use electromagnetic energy to launch projectiles at extremely high speeds, providing greater range and accuracy.	Electrical engineering and electrical machinery; Surface Combat Systems (SCS); Combat use of SCS;	*OC4. ensure the security of the ship; EC5 the design of military tactics.*
14.	Leadership in military operations	The leadership competency is pursued on 3 levels: first line, organizational and strategic leadership.	Basics of Leadership – leader development; Organizational Leadership – leading the Team; Strategic Leadership - critical thinking and decision making process; Navy Leadership - Field manual for operations.	*EC11. lead the military troops EC12. conduct military operations EC13. training of subordinate crew EC14. uses different communication channels*

4. Conclusions

The Military Higher Education System in general, but also the Navy Higher Educations in particular, **are urged to maintained their vocation as poles of knowledge, science and innovation**, keeping itself always adapted in connection with the latest technological insertion in the military tactical, operational and strategic domains, preserving its responsibility to remain an important link in the dynamic process of curricular harmonization, by pursuing the next ongoing actions:

– to conduct the **practical stages and training programs in strong relation with the operational structures** and in the field of military operations, to maintain the professional adjustment level of the graduates within superior margins;

– to connect the curricular developments to the Armed Forces and Navy needs in the field **knowledge, skills/abilities and competencies design**;

– to respond timely and fully committed to the Armed Forces and Navy needs for research to become a **dynamic vector of generating innovative solutions in military engineering and technology**;

– to **promote the international activities** in all levels and with a large pool of partners, in order to enhance the exchange of good practices, not only in education and training, but also in field of technology and military sciences, being one of the most effective tool for international cooperation for the Armed Forces;

– to **continue developing the educational infrastructure** and to maintain the high levels of operational capability, as an effective alternative solution for generating operational troops from active reserve or by conscription if the situation will inquiry.

The European Military Higher Education will then continue to remain a fundamental asset for Security and Defence System and an important variable and alternative for balancing the need of military professionals but also the need for assuring an adaptive proficiency in engineering and technological capabilities.

NOTES

1. https://esco.ec.europa.eu/en/classification/occupation?uri=http://data.europa.eu/esco/occupation/262f21a3-ae78-46f4-a5f9-5a1f502caa90

2. The relevance of the active leisure sector & International Qualification Framework to the EQF (SIQAF). http://www.ehfa-membership.com/sites/europeactive-euaf-fairs.eu/files/projects/SIQAF/Full_PATHWAY_report.pdf

3. COUNCIL OF THE EUROPEAN UNION, 2017. European Qualifications Framework for lifelong learning (2017/C 189/03). Brussels: *Official Journal of the European Union*.

4. EUROMIL, 2018, February. *United in Military Diversity. How to Accommodate Diverging.*

5. MILITARY CULTURES. [Online]. http://euromil.org/wp-content uploads/2018/03/1803_FNF_EUROMIL_Policy_Brief_on_European_Military_Culture.pdf

6. EUROPEAN COMMISSION, 2018. [Online]. *European Skills, Competences, Qualifications and Occupations*. https://ec.europa.eu/esco/portal

7. New Skills Agenda for Europe. [Online]. http://ec.europa.eu/social/main.jsp?-catId=1223&langId=en

8. Terminology of European education and training policy. [Online]. https://www.cedefop.europa.eu/files/4117_en.pdf.

9. Understanding qualifications, CEDEFOP. [Online]. http://www.cedefop.europa.eu/en/themes/understanding-qualifications.

10. Identifying skills needs, CEDEFOP. [Online]. http://www.cedefop.europa.eu/en/themes/identifying-skills-needs.

11. European Skills, Competences, Qualifications and Occupations (ESCO). [Online]. https://ec.europa.eu/esco/portal.

12. EUROPEAN COMMISSION. Skills in the defence sector. [Online]. http://ec.europa.eu/growth/sectors/defence/industrial-policy/skills_en.

13. European Quality Assurance in Vocational Education and Training (EQA-VET). [Online]. https://www.eqavet.eu/About-Us/Mission

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