

SATELLITE COMMUNICATIONS SYSTEM - A PERSPECTIVE ON NATIONAL SECURITY

Daniel DOICARIU

“Carol I” National Defense University, Bucharest, Romania
(doicariu.daniel@unap.ro)

DOI: 10.19062/2247-3173.2022.23.2

***Abstract:** The potential offered by space is enormous, and Romania should appear on the map displaying space services and capabilities at national, NATO and EU level. The opportunities that arise from the implementation of a national space telecommunications program are in the governmental, civilian, commercial and military domain. The Romanian Army must ensure its autonomy and freedom of action by using space capabilities safely.*

***Keywords:** resilience; space program; satellite system; satellite communications.*

1. INTRODUCTION

The issue of increasing the resilience of critical infrastructures to ensure the stability of national security in the context of regional threats, to which the communication and information system has to adapt and update easily, led me to reiterate the need to implement a national space program. The dynamics of the current period regarding the development of communication and information system are based on the development of the information technology sector, as well as the need for society to evolve from the information age to emerging and disruptive technologies.

Space is an area where the economic and military areas intersect more and more aggressively. Ahead of the NATO summit in London, Secretary General Jens Stoltenberg said in a press release that it had been agreed at the North Atlantic Council meeting at the level of Foreign Ministers that “*space should be a new operational domain for NATO - alongside air, land, sea and cyber. Space is part of our daily life here on Earth. It can be used for peaceful purposes. But it can also be used aggressively*”[1]. As an extension of the statements of NATO Secretary General Jens Stoltenberg, Romanian army specialists mentioned in 2019 that “*...outer space can also be a future theater of confrontation between countries or world organizations to ensure the supremacy of information and action, as well as testing technical capabilities in the field of advanced technologies*”[2].

As an obvious consequence of the increased and aggressive interest in space, at the NATO summit in London in 2019, in the context of the security and safety of the Alliance, space was declared as: “*... an operational domain for NATO, recognising its importance in keeping us safe and tackling security challenges, while upholding international law*”[3].

The recognition of outer space at NATO level as a new operational domain is a consequence of the shift in interest from **observation** and **exploration** to **militarization** and even its **conquest**.

The issue of space at the international level is changing day by day, due to the aggressive competition between the great powers of the world, the emergence of new actors with ambitions in space, the involvement of the private sector and awareness of trade effects. The joining of digital technologies supported by space information opens up new opportunities in both the civilian and military domain.

2. THE NEED TO IMPLEMENT A NATIONAL SATELLITE SYSTEM

Outer space is becoming more and more congested, contested and competitive as space technologies allow for the full development and exploitation of space resources, as well as the proliferation of counter-space weapons (ASATs – *Anti-satellite*) aimed at spying, interfering with or degrading adverse space capabilities.

The international situation

Due to the development of space technology, the need for various purposes and domains such as government, commercial, civilian and military, along with significant cost reductions have led to a very large number of satellite launches in recent times. In the *Satellite Database* developed by UCS (Union of Concerned Scientists) there are 4852 operational satellites in the orbits of LEO, MEO, HEO and GEO arranged around the Earth.

In Fig. 1 we have highlighted the situation of the operational satellites of the *major players* in the space.

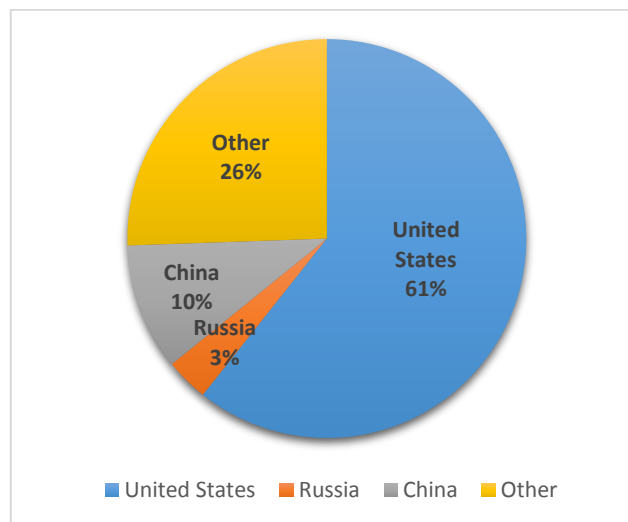


FIG. 1 The situation of operational satellites worldwide.
The graph was made using the UCS Satellite Database [4]

The United States (2944 satellites) has consolidated its position as a world leader with more than half of its operational space capabilities. China (499 satellites) has recently accelerated the process of expanding space capabilities in an attempt to consolidate its second position. Russia's efforts (169 satellites) to keep in touch with its leaders in the domain have also strengthened its position in outer space, including its anti-satellite capabilities. Other countries that stand out in this area are: UK (349), Japan (93), India (61), Germany (46) and France (30).

Returning to Europe, Table 1 shows the European states that have operational satellites and the orbits in which they are positioned. It should be noted that this situation also includes partnerships between 2 or more states and those of ESA (European Space Agency).

Table 1. Numerical situation of operational satellites at European level

Country	Orbit				Total satellites
	GEO	HEO	MEO	LEO	
Austria				1	1
Belarus	1			1	2
Belgium				2	2
Bulgaria	1			1	2
China/France				2	2
China/Italy				1	1
Czech Republic				3	3
Denmark				4	4
ESA	1	7	24	28	60
ESA/USA				1	1
ESA/USA/Russia		1			1
Switzerland				13	13
Estonia				1	1
Finland				15	15
France	2	2		13	17
France/Belgium/Sweden				2	2
France/Israel				1	1
France/Italy	2			1	3
France/Italy/Belgium/Spain/Greece				2	2
France/USA				1	1
Germany	2			42	44
Greece	2				2
Greece/United Kingdom	1				1
India/France				2	2
Italy	2			12	14
Lithuania				2	2
Luxembourg	32			8	40
United Kingdom	19		20	306	345
United Kingdom /ESA	1				1
United Kingdom / Netherlands				1	1
Norway	3			5	8
Netherlands	7			8	15
Poland				2	2
Russia	31	11	29	94	165
Russia/USA				2	2
Slovenia				2	2
Spain	10			12	22
Sweden	1			1	2
USA/France				1	1
USA/Germany				2	2
USA/Sweden				1	1
USA/United Kingdom/Italy				1	1
Turkey	4			5	9
Ucraina				1	1
Hungary				1	1
Total satellites	122	21	73	604	820

The table was compiled with information extracted from the UCS Satellite Database, updated Jan 1, 2022 [4].

Remarkably, a large number of European countries have developed this sector, which is considered essential in the context of the resilience of national security. From the analysis of the above table, it is observed that the trend is to launch satellites mainly in the Low Earth Orbit (LEO).

The difference in approach between NATO and the EU on space capabilities is due to the fact that NATO does not currently have its own satellite system, unlike the EU which is involved through the *European Defense Agency (EDA)* and the *European Space Agency (ESA)*. The table above shows the EU's implications for space by launching 60 of its own satellites (1 GEO, 7 HEO, 24 MEO and 28 LEO) and 3 satellites in partnership with the US, Russia and the UK (1 GEO, 1 HEO, 1 LEO). Satellites launched in partnership are used for government and / or commercial purposes and are aimed at space science, satellite communications and technological development.

Two of the European countries that have launched GEO satellites are Greece and Bulgaria, which we could take as an example and with which we could cooperate on the planning, preparation, financing and support of a satellite project.

Greece launched its first GEO satellite called Hellas Sat 2 in 2003 with Ku-band coverage over Europe, the Middle East and South Africa, offering high-power transmissions, video streams and Internet access services. The project cost about \$ 178 million, including satellite, launch rocket and insurance. In 2017, Greece launched the second GEO satellite with the UK, called Hellas Sat 3 to expand satellite capabilities and replace some of the services used by Hellas Sat 2. Hellas Sat 3 provides FSS and BSS services in Europe, Ka-band in Europe and Ku-band in the East Middle and South Africa. Hellas Sat 4 was launched in 2019 providing Ku-band coverage in the Middle East and South Africa providing increased redundancy and backup capabilities to secure the DTH (direct-to-home) network [5].

Bulgaria launched its first GEO BulgariaSat-1 satellite in 2017, which provides broadcasting and telecommunications services to South East Europe. BulgariaSat in cooperation with Space Systems / Loral received \$ 235 million in funding for the satellite project, including its acquisition, launch and operational delivery into orbit, ground systems and insurance [6].

The national situation

At national level there is the Government Decision no. 36 of January 27, 2017 on the organization and functioning of the Ministry of Communications and Information Society (current Ministry of Transport, Infrastructure and Communications) which is designated “*to ensure the efficient management and use of the orbital positions assigned to Romania*” [7].

Starting from the desideratum that the National Defence Strategy is “*the document that provides the basis for national defense planning*”[8], this is achieved through the coherent integration of areas such as: information, air traffic management, air defense, civil emergencies, C3 - command, control, communications, etc. One of the important national objectives is “*ensuring the security and protection of communications infrastructures and information technology with critical values for national security, as well as the awareness, prevention and countering of cyber threats carried out on them by actors with strategic motivation, extremist-terrorist ideology or financial*”[9]. This national security objective highlights the importance of critical communications and IT infrastructures that ensure national security.

The Defence White Paper, a defense planning document at the departmental level, states that for the development of capabilities, the Romanian army will focus its efforts on a number of directions of action, including “*continuation of the project of*

the military satellite telecommunications system”[10], simultaneously with “modernization of C4ISR infrastructure, networks and systems at a tactical, operational and strategic level and their interconnection with those of SNAp and NATO”[10]. The Defence White Paper is prepared by the Ministry of Defense to meet the objectives of the National Defence Strategy and is in line with the provisions of the NATO Strategic Concept, which states that this course of action is a priority to align ourselves with NATO’s efforts and to recover the technological advance of many European states.

Another reference document is the Military Strategy of Romania (2021) elaborated in accordance with the National Defence Strategy (2020-2024) and The Defence White Paper - edition 2021. The Military Strategy of Romania states that in the period 2021- 2024, in addition to other projects of great interest in the field of emerging technologies, there is the priority to “...launch of projects: *military telecommunications satellite system, UAS systems, combat vehicles and high-performance tactical transport vehicles to ensure increased mobility and protection for personnel, NATO-type weapons system, ground-based air defense system”[11]. The realization and development of the national telecommunications satellite system project would make a major contribution to national defense and the support of civilian authorities.*

Romania's accession to the European Space Agency in 2011 allowed us access to state-of-the-art technologies, the accumulation of much-needed expertise in the perspective of implementing our own satellite program, as well as the connection with the profile industry at European level.

3. RESILIENCE OF NATIONAL SECURITY THROUGH THE IMPLEMENTATION OF A NATIONAL SPACE PROGRAM

In view of the allocation of the two geostationary orbital positions, in conjunction with national security and defense needs and the requirements of society as a whole, consideration should be given to “...the opportunity for Romania to operationalize a satellite communications system capable of ensuring the resilience of critical terrestrial, civil and governmental communications and to increase the degree of interconnection, through redundancy between the systems of national public operators and governmental and defense structures”[12].

In order to ensure the redundancy of the communication and information systems necessary for the critical infrastructures in Romania, the orbital positions assigned by the regulations of ITU (International Telecommunication Union) should be exploited. Based on the principle of equitable access to geostationary orbital positions according to Appendices 30 / 30A (1977) and 30 / 30B (1988), each ITU Member State has been assigned one GEO orbital position in each appendix. Romania ratified the Constitution and the Convention of the International Telecommunication Union, signed in Geneva on December 22, 1992 by Law no. 76 of November 8, 1993 [13], which was published in the Official Gazette part I, no. 272 of November 25, 1993 and benefits from 2 GEO orbital positions represented generically in Fig. 2.

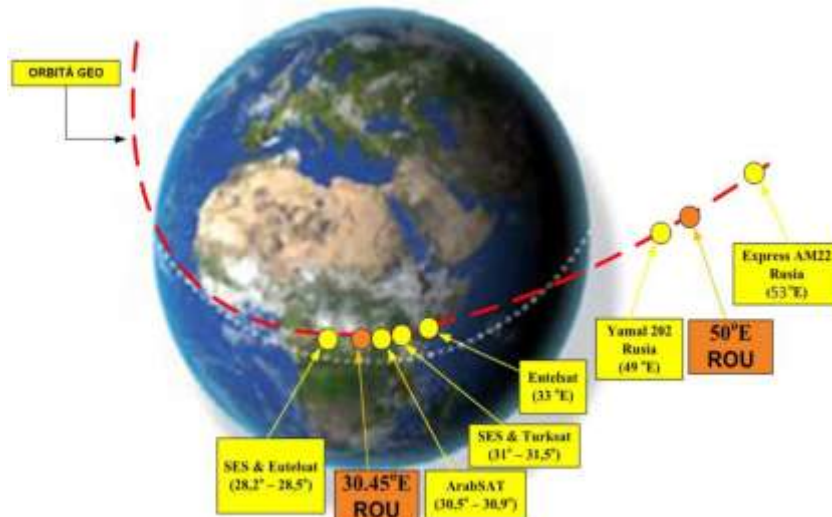


FIG 2 Graphical representation of geostationary orbital positions allocated to Romania [12].

In the *Final Acts WRC-15* [14] at the World Radiocommunication Conference held in Geneva in 2015, Romania's orbital positions were reiterated with a longitude of $30,45^{\circ}\text{E}$ for Fixed Satellite Services (FSS) and a position with a longitude of 50°E for Broadcasting Satellite Services (BSS).

The main objectives of the satellite telecommunications program for the National Security System “*strengthening Romania's role in NATO and the EU, reducing its dependence on satellite service providers, gradually developing its own satellite system to ensure the mission needs of the Ministry of National Defense and state institutions in times of peace, crisis and war, as well as and ensuring the redundancy of nationally organized terrestrial communications networks, which may be severely affected in special, emergency or calamity situations*”[15].

The need to develop a national satellite system is argued by military specialists in this domain [12], as follows:

- ensuring independence from external satellite service providers;
- ensuring the protection of satellite links;
- elimination of the contracting of satellite services from external providers;
- ensuring communication skills, with national and international coverage;
- active involvement in geopolitical relations;
- development of national industrial and space research sectors;
- economic and strategic opportunities by leasing unused bandwidth capacity to NATO and EU partners.

The arguments regarding the implementation of a national space program lead to the consolidation of Romania's position in NATO and the EU, but also to the openness to the provision of satellite services in the region. At present, Romania needs more and more satellite flows: in the military for the execution of missions in theaters of operations and for multinational and joint exercises, governmental for political decision-makers, intervention and civil protection structures, central and local administrations in situations of crisis or natural disasters, civil and commercial for the development of the economy by providing services to private operators of television, mobile communications, internet, etc. For example “*The Ministry of National Defense, in the period 2009-2018, spent approximately 7,500,000 euros for the rental and provision of satellite communications services*”[15], as it is shown in a press release of

the MoD. The national satellite system could ensure the resilience of critical communications by ensuring the redundancy of communications links at the governmental level, national defense, public operators, etc. in situations of crisis, war, calamity or natural disaster.

At the level of the Romanian army, the operationalization of a space system could support several components, among which:

- ISR (*Intelligence, Surveillance and Reconnaissance*) through Earth Observation (EO) and synthetic aperture radar (SAR) through space sensors;
- SATCOM (*Satellite Communication*), providing X-band military communications satellite services (7 - 10 GHz);
- GEOINT (*Geospatial Intelligence*) through Earth Observation capabilities;
- SSA (*Space Situational Awareness*) early warning of ballistic missile threats through SAR and space sensors.

4. CONCLUSIONS

There should be no delay in carrying out this national project in the context in which we see that the needs of military SATCOM are important in this tense period near the borders of Romania. In order to respond effectively to the specific challenges of hybrid conflicts, the military must be resilient, adaptable and visionary in developing capabilities and services specific to communication and information systems. By operationalizing a national space telecommunications program, Romania's national defense system is creating new capabilities to support the planning and conduct of military actions.

It is obvious that the geostationary orbital positions allocated to Romania by the ITU are resources that must be capitalized and exploited as soon as possible. The frequency spectrum used in these orbital positions must be protected from interference and ensure maximum efficiency. I believe that efforts to implement the national space program must be supported by a *Strategy for Space* through clear regulations at national level, economic and diplomatic efforts to create partnerships with strong and experienced states in the space industry and to develop training programs for specialists, experts and future leaders in the field of space operations.

A platform like *Systems Tool Kit* - STK would be useful for simulations, modeling, testing or designing hypothetical architectures in space issues. This would require military research and education for modeling, specialization and training.

Even the development of small-scale projects such as *CubeSat* can be a solution in education, leading to an increase in expertise in education and space research. CubeSat is a nanosatellite of a standard cube-shaped, where a 1 U (unit) have dimensions of 10 cm x 10 cm x 10 cm. A CubeSat system can be composed of a maximum of 27 U. According to ITU-R it has a mass of 1-10 kg, a lifetime of 1-3 years and is launched in the orbit of LEO or HEO.

Another form of training can be performed at NATO or EU level for the development of military instructors and experts to represent the core of specialists, in the exploitation of future space capabilities.

Space technology is an indispensable presence in today's society, providing fast and secure information on emergencies such as floods, earthquakes, fires, allowing the emergency structures appropriate cooperation by providing telephone services, GPS positioning, high resolution satellite imagery, communications satellite. It also supports

the efforts of the authorities on issues such as migration, border security, pollution, meteorological activity, transport safety, etc.

We can see that most European countries have launched at least one satellite, which is why Romania should neither delay the launch of the first GEO satellite nor the development of all related technologies to ensure monitoring, operation, security, maintenance, etc. Romania needs to ensure its independence from this essential resource.

REFERENCES

- [1] https://www.nato.int/cps/fr/natohq/opinions_171022.htm, accessed on 17.02.2022;
- [2] General-maior dr. Valentin BECHERU, maior Adrian STAN, *Omenirea, de la explorarea pașnică a spațiului cosmic la cucerirea acestuia prin intermediul forțelor spațiale și tehnologiilor avansate*, Revista de Științe Militare, Volum 19, nr. 2 (55), 2019, București, pp. 70, 58, 77, 49-50;
- [3] https://www.nato.int/cps/en/natohq/official_texts_171584.htm, accessed on 17.02.2022;
- [4] <https://www.ucsusa.org/resources/satellite-database>, accessed on 17.02.2022;
- [5] <https://www.hellas-sat.net/>, accessed on 17.02.2022;
- [6] <https://spaceflight101.com/falcon-9-bulgariasat-1/bulgariasat/>, accessed on 17.02.2022;
- [7] <https://legislatie.just.ro/Public/DetaliiDocument/186343>, accessed on 27.02.2022;
- [8] <https://legislatie.just.ro/Public/DetaliiDocumentAfis/170048>, accessed on 27.02.2022;
- [9] *** Administrația prezidențială, *Strategia Națională de Apărare a Țării pentru perioada 2020-2024 „Împreună, pentru o Românie sigură și prosperă într-o lume marcată de noi provocări”*, București, 2020, p. 15;
- [10] *** Ministerul Apărării Naționale, *Carta Albă a Apărării*, București, 2021, p. 40;
- [11] *** Ministerul Apărării Naționale, *Strategia militară a României*, București, p. 30;
- [12] Gl. mr. dr. Valentin BECHERU, mr. dr. Benedictos IORGA, mr. Gheorghe Adrian STAN, cpt. ing. Laurențiu CHIOSEAU, lt. Valeria LINCĂ, *Studiu privind interconectarea operațională și tehnică a sistemelor de telecomunicații și IT ale armatei cu cele ale serviciului de telecomunicații speciale și cu cele ale operatorilor privați, în scopul creșterii viabilității și continuității în funcționare în caz de calamități naturale și în alte situații periculoase*, Editura AOSR, București, 2020;
- [13] <http://legislatie.just.ro/Public/DetaliiDocumentAfis/3247>, accessed on 27.02.2022;
- [14] https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.12-2015-PDF-E.pdf, p. 155 și p. 169, accessed on 28.02.2022;
- [15] https://www.mapn.ro/cpresa/16132_Proiectul-programului-satelitar-de-telecomunicatii-destinat-Sistemului-National-de-Securitate,-in-discutie-la-M.Ap.N, accessed on 28.02.2022.