



Emerging and Disruptive Technologies (EDTs)¹: Space Technologies and Military Implications

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Space begins at an altitude of 90-100 kilometres above sea level. Space technologies constitute the technology area where military and commercial capabilities and investments for this purpose overlap the most among Emerging and Disruptive Technologies¹. While there are different numbers about satellites and space vehicles around the world, it would not be wrong to say that there are more than 5400 satellites in orbit around the earth today. More than 3500 of these satellites belong to the US, and more than 500 belong to China². China has increased its activities in space in the last three years. In 2022, China placed a total of 150 satellites and two spaceplanes in various orbits in 64 launch attempts, two of which were unsuccessful. Other important actors in space are Russia and India. Currently, 90 countries operate in space. It is expected that space technologies will reach a value of 1.25 trillion dollars by 2030³. It is estimated that 24,500 more satellites will be launched into space in the next 10 years. However, it should be strongly emphasized that, just like in the oceans, space pollution and waste are also increasing serious concerns for the future⁴.

The increasingly powerful low-orbit small satellites, satellite constellations, and satellite swarms pose significant political and legal problems. As technology develops and costs decrease, it makes space more accessible, but also exacerbates the aforementioned problems. These legal and political challenges include conflicts between commercial, academic, and military use; the governance of global (space) commons; and the potential uncontrollable increase in the military use of space. Indeed, on November 15, 2021, Russia demonstrated an example of this by destroying an old satellite it owned (Figure-1).

¹ For definitions and more information: <https://www.linkedin.com/pulse/askeri-a%25C3%25A7%25C4%25B1danyeni-ve-geli%25C5%259Fmekte-olan-teknolojiler-edts-cemokyay/?trackingId=c4%2BdbFBLscaOq1tX83I22A%3D%3D>

² Center for Strategic and International Studies, Space Threat Assessment 2023. <https://www.csis.org/analysis/space-threat-assessment-2023>

³ Center for Strategic and International Studies, Space Threat Assessment 2023. <https://www.csis.org/analysis/space-threat-assessment-2023>

⁴ https://en.wikipedia.org/wiki/Space_debris

Russia's anti-satellite test should lead to a multilateral ban



Space debris in orbit around planet earth. Photo: Adobe Stock

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On 15 November, Russia conducted a direct-ascent anti-satellite (DA-ASAT) test, destroying one of its own space objects, a defunct satellite, in low-earth orbit. The test captured international attention and was quickly and widely condemned as threatening and irresponsible—not least for the cloud of lethal, uncontrollable debris it created, which will endanger both space assets and human spaceflight for years to come.

Figure 1 Russia's DA-ASAT Test Source: <https://www.sipri.org/commentary/essay/2021/russias-anti-satellite-test-should-lead-multilateral-ban>

On the other hand, the military importance of space is indescribable. The space dimension of the Russia Ukraine war, which is explained on pages 22-24 of the Space Threat Assessment 2023 published by the US-based research institute CSIS (Center for Strategic and International Studies) is quite remarkable. It contains clues and lessons to be learned about the future of wars such as Ukraine, which has no satellite, commercially procuring space-based reconnaissance, surveillance, intelligence, and communication capabilities, Russia's cyber warfare against it, Elon Musk and his Starlink getting involved in the war in a way, etc.

It seems that also NATO is taking significant steps to enhance its space capabilities and address the growing importance of space in military operations:

- ✓ The adoption of the Overarching Space Policy in 2019 with an emphasis on complete compliance
- ✓ with the international legal framework,
- ✓ The decision to the establishment of the NATO Space Centre in ACC Ramstein, Germany in October 2020,
- ✓ The recognition that attacks at or from space could trigger Article 5 of the Alliance's founding treaty at the Brussels Summit in 2021,
- ✓ The integration of space into the new Strategic Concept 2022, and
- ✓ The recent announcement of the Alliance Persistent Surveillance from Space (APSS) initiative in February 2023,

demonstrate NATO's commitment to enhancing its space capabilities and ensuring the Alliance's readiness for the future.

The prediction regarding the military use of space technologies is presented in Figure-2 of the document where the NATO Science and Technology Organization analyzed the trends of Emergent and Disruptive Technologies between 2020 and 2040. These capabilities are clustered in the areas of Positioning, Navigation, Timing and Velocity Information; Threat Assessment, Environmental

Information Provision, Communication, Intelligence, Surveillance and Reconnaissance. There is no goal to placing weapons in space.

Space Capability	NATO Use and Effects
Position, Navigation, Time (PNT) & Velocity	Precision Strike Force Navigation Support to Personnel Recovery (PR)/Combat Search and Rescue (CSAR) Network Timing
Integrated Tactical Warning and Threat Assessment	Force Protection Attribution Missile Warning
Environmental Monitoring	Mission Planning Munitions Selection Weather Forecasting
Communications	Command and Control Unmanned Aerial Vehicle Ops Beyond-the-Horizon communications
Intelligence, Surveillance and Reconnaissance	Coverage of Operation Execution (in the operations centre) Battle Damage Assessment (BDA) Intelligence Targeting

Figure 4 Space Capabilities and their NATO Use Source: NATO STO Science and Technology Trends 2020-2040

The Impact of Space Technologies on Military Concepts and Platforms

In future-oriented military documents, the space domain has already been expressed as one dimension of the operational space conceptually, but developing technology and its implications have integrated the space dimension into military thinking. The US and some countries have established Space Commands, while China has formed the Strategic Support Command responsible for space, information, and cyber duties.

The space dimension has primarily expanded the content of situational awareness. Now, space itself must be observed from a military perspective just like the open seas or airspace, actors and activities within must be monitored. According to the description of situational awareness in the Joint Military Terminology Dictionary, an activity sequence that continuously answers the questions of "what is happening?", "why is it happening?", "what could happen next?", and "what should we do?" must be included in daily routines for space.

The development of capabilities related to space has also brought about developments in counter capabilities. Planning must be made from today for the necessary ones among the capabilities listed below to be included in the inventory of the Armed Forces in the future:

- Kinetic Physical
 - Direct Ascent Anti Satellite Weapons
 - Co-orbital ASAT Weapons
 - Ground Stations Attacks
- Non-Kinetic Physical
 - Lasers
 - High Powered Microwave
 - Nuclear Weapons (Banned by the international law.)
- Electronic Countermeasures
- Cyber Countermeasures

Another noteworthy fact related to space is that it is not possible to completely eliminate the enemy's space capabilities despite the weapons and measures developed against satellites. Therefore, as seen in the Ukraine War, it is no longer very likely for strategic forces to be concealed.

Such a reality, in conjunction with Emerging and Disruptive Technologies, especially Big Data, Artificial Intelligence, Autonomy, and Hypersonic weapons, leads to the conclusion that the future battlefield will involve an overwhelming operational tempo. Forces must be developed in hybrid force structures with unmanned platforms and superior self-defence capabilities. Therefore, the revision of current military concepts, organizations, command, and force structures will be necessary (this topic will be discussed in another article). At this point, the self-defence issue, which is the last link in the gradual defence to be carried out strategically, regionally, and collectively, should be among the indispensable qualities of projects such as TCG Anadolu, I-Class Frigates, National Combat Aircraft, and Altay Tank, evaluated by the threats arising from these Emerging and Disruptive Technologies.