Space Applications and Supporting Services for Security and Defense: An Introduction

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Abstract

Use of space started with the Cold War, and even today the links between space technologies and military ones are still close. However, it has also contributed to peace. With time, space activities have become more and more oriented towards civil applications, while the ones dealing with military ones were enhanced. In this section of the handbook, the applications directly or indirectly connected to security and defense are exposed by specialists of each field.

30.1 Past Context and Current Situation

The interest for space rose in the middle of the twentieth century from the motivation to demonstrate the ballistic missiles capacities and thus consolidate the credibility of the nuclear deterrence. Very soon however, the operational use of space emerged in front of the limitations of the ground and airborne assets used

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so far. In that frame, space has been used to progressively offer services in the fields of Earth observation, telecommunications, and positioning.

Today, as this section demonstrates, numerous space operational applications routinely deliver indispensable fast and reliable services for security and defense, all dealing with **information**: observational and geographical data and telecommunications. In addition, a limited number of countries have developed other applications such as detection of missile launches or eavesdropping (see ▶ Chap. 6, "The Laws of War in Outer Space"). The final aim of all these services is always to **ease and multiply the effects of non-space assets**.

However, due to the associated large costs, only a few countries (about ten) have purely military systems out of about 50 having today's space assets. In addition, the sovereignty issues limit the cooperation and these assets are developed mainly in national frames. It is thus important to note the **contribution of the civil space services**, developed primarily as powerful tools to support the economic growth on Earth: in most of the cases, they are also largely used for security and defense applications, and some dual-use systems have been developed to provide both commercial and governmental services.

In terms of applications and services, space is indeed essentially the main global way of collecting, transmitting, and distributing information. This is the reason why it has become, in the communication age, a major component of the security and defense systems, as demonstrated by the articles of this section.

30.2 Space for Security and Defense: Services and Threats

Space allows to **collect information** for remote sensing purposes offering two types of applications for intelligence, surveillance, and reconnaissance (see ▶ Chaps. 1, "Introduction to International Space Security Setting" and ▶ 2, "Defining Space Security"). On the one hand, they have a strategic function. They can support, for example, diplomatic discussions in providing data on facilities related to nuclear weapons and verification of arms limitations agreements. In the civilian area, they can help to mitigate risk in identifying in advance potential critical situations. On the other hand, imaging satellites have an operational, or tactical, function since their sub-metric resolution, now available to many stakeholders, opens the possibility to permanent refreshing on the status of a given situation as well as on troop or rescue team deployments for the benefits of military users as well as for the management of natural resources.

Communication satellites are indispensable tools for **transporting information** to support command and control between a limited number of users (see ▶ Chaps. 3, "Obstacles to International Space Governance" and ▶ 4, "Security Cooperation in Space and International Relations Theory") and, therefore, are heavily used in military operations, requiring unique requirements for protected communications. The security operations also require such reliable communication services but without the same level of protection and thus rely

on commercial services. The interpenetration of the military and civilian space communication services, however, increases with, on the one hand, the needs to connect mobile assets such as unmanned aircraft and network ground forces requiring large bandwidth and, on the other hand, the growth of the commercial market, driven by the demand for broadband Internet services and video distribution. Indeed, the Pentagon is today the largest user of commercial capacities, and the European Defence Agency has launched a program to pool the national demands for commercial services.

Distributing widely information by space telecommunications between a very large number of users is also a basic service, and the most glaring example is direct television broadcasting. But in the recent years, satellites have been used for a new type of information distribution related to the users themselves: their own localization (see ▶ Chap. 5, "Spacepower Theory"), thanks, for example, to the Global Positioning System, initially reserved to military users, which benefits today to more than 800 million people. This classified system is now beneficial to the crowd, and mastering the distribution of localization is now viewed as a sovereignty issue. As a consequence, various space localization systems have been developed by Europe, Russia, and China in an uneasy cohabitation with GPS.

The current challenge is the operational merging of the previous basic services to provide **integrated applications**, delivering at user's level more reactive and complete services (see ▶ Chap. 7, "The Role of Space in Deterrence"). This requires a new approach based on the notion of system of systems, where the integration of the space systems with ground-based ones is a key element. Special attention is to be paid on the possible use of these powerful integrated services for illegal purposes, as demonstrated by the 2008 terrorist attack on Mumbai where images provided by general public portals, positioning data, and direct TV signals have been used by a very limited number of terrorists.

Unfortunately, space-based services are facing two important threats (see ▶ Chap. 9, "Space and Cyber Security"). The first one, particularly critical for military applications, is the possibility of **attack of the associated assets**. Planned destruction of spacecraft has been achieved since 2007 by China and the United States, and there is no doubt that various methods exist to eliminate an unwanted spacecraft. This capacity was well understood already in 2000, when Donald Rumsfeld warned the United States against the possibility occurrence of a spatial Pearl Harbor. The question of antisatellite warfare has to be considered as an unsettled worry. Therefore, some countries have developed strategies and means to secure their own space assets and to counter, limit, or deny the use of space-based services to potential hostile entities (see ▶ Chap. 8, "Responsive Space"). The second threat comes from the **growing number of debris**, fragments of launchers, and satellites staying in the frequently used orbits for a long time (see ▶ Chap. 10, "Space as a Critical Infrastructure"). Since 1957, about 20,000 tons of materials have been placed in orbit and 4,500 tons are still there. Collisions between such objects initiate a snowball effect generating an explosive increase of the number of debris. Furthermore, the number of active spacecraft is planned to augment with large fleets of small and tiny satellites launched in

constellation and clusters. The presence of these millions of debris could completely ban access to space in future.

In the very long term, whatever is then the political context, **space will still continue to play a key role as long as the debris issue is under control**. Indeed, in a situation of international tensions, the need of information superiority will be high while, in a situation of international peace, a large flow of information will be required for the surveillance of the application of the associated treaties, without speaking about the impact on security of the scariness of natural resources or global warming.

30.3 Conclusions

We can predict with a correct level of reliability that in the short and medium terms space military applications will be widely developed by a larger number of countries, with the risk to transfer in space the tensions occurring on the Earth. At the same time, rivalries for accessing to limited resources such as frequencies and orbital positions will be also increasing, adding another element for tension. However, these trends could be impacted by the worrying increase of space debris, today slightly under control by nonbinding guidelines. Within that frame, our hope is that it will not lead to one of the two following extreme cases: a real weaponization of space or a non-sustainability of space limiting de facto its use and impacting directly all mankind.