Summary Report | 26th SSF Security Talk: «Resilience from Space»

Keynote Presentation 1
Major General Michael Traut, Commander of the German Armed Forces Space Command

Major General Michael Traut opened his presentation with a scenario designed to illustrate the vulnerability of modern societies to disruptions affecting space-based systems. In a tense geopolitical situation, disruptions to satellite communications, GPS jamming, attacks on ground stations or targeted approaches by foreign satellites to existing systems could occur simultaneously. Such developments would, within a short space of time, have a significant impact on transport, energy supply, communications and economic processes. Traut emphasised that many of these events were by no means hypothetical – numerous examples had already been observed and were technically feasible at any time. Space had therefore long since become a contested domain and, at the same time, represented an Achilles' heel for modern societies.

The German Space Commander distinguished between two dimensions of security in space. Whilst the German language uses only the term 'Sicherheit', the English language distinguishes between 'safety' and 'security'. 'Safety' refers to the safe operation of space-based services, whereas 'security' refers to the protection and defence of these systems against deliberate threats. In view of current geopolitical developments, both aspects must be considered together. Russia is waging war in Europe, China is pursuing global power-political ambitions, and international conflicts are becoming increasingly complex and difficult to categorise. Military force, or the threat thereof, has once again become an accepted means of asserting political interests – a development that also affects space as an integral part of military operations.

Space systems encompass far more than just satellites in orbit, Traut emphasised. A large part of the infrastructure is located on the ground – ranging from the manufacture of launch vehicles and satellites, through launch infrastructure and control stations, to the analysis and utilisation of the data collected. Overall, a significant proportion of a space system's value creation and vulnerability arises outside of orbit.

Space-based services are now an integral part of our everyday lives. Navigation, weather forecasts, financial transactions, electricity grids and communication systems are now heavily dependent on satellites. At the same time, competition for orbital positions and radio frequencies is intensifying. There are already over 14,000 active satellites in operation worldwide, with more being added almost daily. Those with a presence in orbit occupy strategic spaces and thereby also gain influence over information flows.

Against this backdrop, Traut explained the concepts of 'Resilience from Space' and 'Resilience in Space'. 'Resilience from Space' means safeguarding the decision-making and operational capabilities of states and societies through robust and sovereign space capabilities. 'Resilience in Space', on the other hand, describes the ability to maintain one's own presence and effectiveness in space even under pressure.

Resilience therefore begins right from the design stage of the systems. Satellites and infrastructure must be physically hardened and electronically secured. Cyber security and so-called zero-trust architectures are fundamental prerequisites in this regard. Furthermore, it is crucial to be able to quickly restore lost capabilities – for example, through flexible launch options or so-called 'Responsive Space' concepts. Building satellite constellations rather than relying on individual high-value targets can also reduce vulnerability.

Traut emphasised that cooperation with commercial providers and international partners is therefore of central importance. The protection and defence of space infrastructure can only be achieved today through the collaboration of various state and private actors. Resilience therefore also stems from cooperation and prepared alternatives. In this context, he quoted a phrase frequently used by the US armed forces: 'Space is a team sport.'

Another key factor is strategic deterrence. This need not necessarily take place in space itself, but must form part of a comprehensive military defence strategy. The aim is to deter potential adversaries from attacking space-based systems – either because an attack would be unlikely to succeed or because the consequences for the attacker would be too severe.

In conclusion, Traut referred to the paradigm shift in security policy in Germany. The Federal Government had decided to invest around 35 billion euros in space security by 2030, in conjunction with the first national space security strategy, which includes numerous concrete measures. The protection of space-based capabilities is thus explicitly understood as an integral part of national security preparedness.

However, resilience in space cannot be achieved through unilateral national action. International cooperation remains crucial, including with partners outside of alliances. Neutrality does not mean isolation in this context. Ultimately, the decisive question is not whether states can afford resilience in space – but whether they can afford to do without it.

Keynote Presentation 2
Colonel Ludovic Monnerat, Commander of the Space Competence Centre, Swiss Armed Forces

In his presentation, Colonel Ludovic Monnerat began by focusing on the concept of resilience. Resilience, he explained, is closely linked to what is known as 'degradability' – that is, the ability to continue fulfilling a mission despite the loss of individual elements. This requires appropriate preparations to be made right from the design stage of systems, for example through hardening, redundancies or flexible structures. As a practical principle, Monnerat referred to the PACE model ('Primary, Alternate, Contingency, Emergency'), which originated in the USA. According to this model, several solutions should be provided for each key function: a primary solution for normal operation, an alternative solution, a prepared contingency solution and an emergency solution. It is crucial, he said, to be mentally prepared for potential losses – for example, in terms of data, services or operational capabilities.

Monnerat then went on to discuss the role of space in the context of modern conflicts. The vulnerability of many ground-based systems has changed significantly in recent years. Attacks are increasingly directed against infrastructure, industry and society, not just against military forces. Examples from Ukraine and the Middle East show that stationary ground-based systems can be disrupted or destroyed relatively easily unless they are protected or mobile.

Space differs in this respect to some extent. Whilst the number of satellites is rising steadily, orbital mechanics prevent the immediate execution of many offensive actions. Approaches between satellites can be observed and offer a certain amount of warning time – in contrast to attacks on ground targets, which often take place very rapidly. In this sense, space may in certain cases even offer greater protection than systems on the ground or in the air. This relative security is contributing to the fact that infrastructure outside Earth is increasingly being considered.

A key aspect is the question of which functions need to be particularly resilient. Monnerat emphasised, above all, the importance of what is known as situational awareness. Decision-makers must know at all times what is happening in the various operational domains and what developments can be expected. Space-based systems provide key information for this purpose – both on activities in orbit and on events on the ground, in the air or at sea. At the same time, the speed of information transmission has become a decisive factor. Operational decisions are now often made within seconds or minutes.

Furthermore, space is indispensable for the synchronisation of numerous systems, for example through navigation and timing signals. However, it is precisely these functions that are frequently targeted by disruptions such as jamming or spoofing. For military operations, it is therefore crucial to know when one's own forces are being observed from space and how quickly this could result in operational consequences.

Monnerat also emphasised that space-based services must be understood as comprehensive systems. Every satellite is part of a larger network connecting orbit, ground segments and users. In principle, every satellite transmits data – at the very least, telemetry data on the status of its own platform. Space infrastructure therefore constitutes, above all, a network for the exchange of information and services.

Looking to the future, Monnerat identified two key developments. Firstly, access to space is set to change significantly. Reusable rockets and new launch technologies would reduce the cost of space launches considerably – by a factor of between five and fifty. Cheaper and more frequent access to orbit would, in the long term, make space as accessible as airspace.
Secondly, data centres could in future be established directly in orbit. Due to the high levels of solar energy constantly available, energy efficiency there is significantly higher than on Earth. Such orbital data centres could become particularly attractive for artificial intelligence applications that continuously process and analyse large volumes of data.

Against this backdrop, Monnerat argued that the strategic 'centre of gravity' could increasingly shift towards space. Actors possessing high-performance systems there could gain decisive military and economic advantages in the future.

The development of offensive capabilities in space is already underway. Consequently, in the long term, it will not be sufficient to take defensive measures alone. At the same time, space must be more closely monitored and protected in future. Just as with air or maritime policing, mechanisms are needed in space for monitoring, securing and, where necessary, intervening. At the same time, international transparency and cooperation are crucial to avoiding misunderstandings and escalations. Only through such a combination of surveillance, cooperation and credible capabilities can long-term stability in space be guaranteed and resilience from space be ensured.

Keynote Presentation 3
Renato Krpoun, Head of Space Division, State Secretariat for Education, Research and Innovation SERI

In his presentation, Renato Krpoun outlined Switzerland's long-standing role and expertise as a true space pioneer nation. For many decades, the focus was primarily on civilian space applications. Fortunately, this has changed in recent years, with cooperation between civilian space actors and the Swiss Armed Forces having intensified significantly. Closer cooperation between civil authorities, universities, industry and the Swiss Armed Forces' Space Competence Centre has the major advantage of enabling programmes to be viewed and integrated increasingly as a whole.

A key element of Switzerland's space activities is the national space policy adopted in 2023. On the one hand, this policy aims not to pursue space activities in isolation, but to deploy them specifically for the benefit of society, the economy and security. Space activities are thus intended to make a concrete contribution to the welfare and security of the population. At the same time, there is still considerable untapped potential in many areas. A second priority of Swiss space policy is the promotion of science and technology, with a view to developing and harnessing bottom-up potential.
The third focus is on forward-looking action. This involves, in particular, striking a balance between the necessary expansion of space infrastructure and sustainability considerations. The deployment of satellite constellations must be carried out responsibly, for example through strategies for the disposal of satellites at the end of their service life and for limiting space debris.

A key feature of Swiss space policy is international cooperation. Space programmes can hardly be carried out by individual states alone today; rather, they require cooperation between government institutions, industry and international partners. A current focus in this regard is also on security-related applications, which encompass both civil and military aspects. Within the framework of the European Space Agency (ESA), Switzerland has in recent years increased its participation in programmes of a dual-use nature.

Krpoun then went on to discuss an important institutional development: the draft of a new Swiss Space Act, which was recently submitted to Parliament for consideration. The background to this is the fact that Switzerland ratified various international space treaties of the United Nations some fifty years ago. These treaties obliged our country to assume responsibility for activities in space originating from its national territory or carried out by Swiss entities. However, until now, there have been no national regulations governing key aspects such as authorisations, supervision, the registration of space objects or liability issues. With an increasing number of companies developing or operating satellites, a legal framework is becoming ever more important.

In addition to legal issues, he said, it was also a matter of ensuring the importance of long-term investment in science and research. These form the basis for technological innovations and new economic opportunities in the space sector. In this context, he referred to developments in the so-called 'Future Space Economy'. Major advances in reusable launch systems would significantly transform access to space in the future. Companies such as SpaceX were already working on concepts involving very high launch frequencies, which would lead to significantly lower costs per unit of mass transported. As a result, considerably larger quantities of material could be placed into orbit in the future.

For a comparatively small country such as Switzerland, this therefore raises the question of what role it could play in this rapidly developing space economy. Close cooperation with the ESA remains a key approach in this regard. Switzerland invests a large proportion of its civil space funding in ESA programmes and has deliberately chosen not to establish its own large space agency. It is important that the money invested flows back into industrial and technological developments in Switzerland. At the same time, the ESA has the advantage of providing us with direct access to international projects, procurement programmes, data and technological capabilities.

Krpoun emphasised that Europe possesses significant capabilities, particularly in areas such as navigation and Earth observation, whilst in recent years the US ' ' have made enormous progress in launch systems. Nevertheless, European cooperation also opens up the possibility for smaller states to participate actively in major space programmes.
In conclusion, Krpoun presented several examples of contributions made by Swiss industry to international space programmes. These included, amongst other things, components for launch vehicles, high-precision atomic clocks for navigation satellites in the European Galileo system, and innovative satellite and antenna technologies from Swiss companies. These examples illustrated how research, industry and international cooperation could work together – from technological development right through to subsequent use by civil and military actors.

Panel discussion

In the concluding panel discussion, moderated by Fredy Müller, Managing Director of the Swiss Security Forum, Colonel Ludovic Monnerat and Renato Krpoun, together with Didier Manzoni, Deputy CEO & General Manager Space at APCO Technologies, and Franz Posch, Managing

Director of Airbus Defence and Space Switzerland, on the importance of space and the associated technological, industrial and security policy challenges.

Franz Posch

Franz Posch began by emphasising the central importance of space technologies for modern societies and armed forces. Space travel, he said, is no longer a luxury but is used constantly in everyday life. For military applications, situational awareness capabilities are particularly crucial, as decisions are made and operations are directed on this basis.

In the field of communications, Posch referred to alternative satellite-based systems alongside well-known offerings such as Starlink. As an example, he cited OneWeb, a satellite communications system comprising around 600 satellites, which is specifically designed to provide secure communications for military and government users. Fundamentally, a distinction must be made between whether a state wishes to operate its own satellites or whether it relies on so-called 'Space-as-a-Service' models. For smaller states in particular, the latter represents a sensible and cost-effective solution. He cited the example of Austria, which, 15 to 20 years ago, acquired a small stake in the Pléiades satellites and thereby gained access to high-resolution satellite imagery without having to operate a complete system itself.

Posch also discussed the business model of large satellite constellations. Whilst Starlink has a strong presence in the public consciousness, SpaceX's economic focus lies primarily in the civilian market. At the same time, this model demonstrates that the future will be heavily shaped by satellite constellations. Such constellations also enhance resilience, as individual satellites can be disrupted or taken out of action relatively easily, whereas a large number of systems operating simultaneously are significantly more robust.

Posch also addressed procurement processes in the context of security policy. Drawing on his many years' experience with defence programmes, he highlighted the importance of intensifying dialogue between contracting authorities and industry at an early stage. He noted that it is often difficult for government bodies to specify complex systems precisely, whilst the necessary technical expertise is frequently available within industry. An early exchange of views could save a great deal of time here and enable more realistic requirements to be set. At the same time, Posch pointed out that government-funded programmes are, by their very nature, subject to different framework conditions than privately funded projects such as Starlink. When companies invest their own funds, they can experiment repeatedly and even accept failures, whereas publicly funded projects are subject to significantly greater pressure to succeed.

Posch then outlined the current structural changes in the European space industry. Several large companies had begun to consolidate their activities more closely in order to become more competitive with the US. By concentrating resources and research funding more effectively, duplication of effort could be reduced and technological progress accelerated.

In conclusion, Posch emphasised that Europe already possesses a capable space industry. However, it is crucial to make consistent use of these capabilities and, when it comes to security-related systems, not to base decisions solely on the cheapest bid, but on the solution that makes the most sense in the long term.

Didier Manzoni

Didier Manzoni began by highlighting Switzerland's long tradition in European space exploration. Switzerland had been involved right from the founding of the European Space Research Organisation, the predecessor organisation of today's ESA. Swiss companies had already contributed to early satellite projects and, for example, developed and built structures for the first European satellites. Swiss industry has also been involved in European launch vehicle programmes for decades, including various generations of the Ariane rockets.

Over time, the Swiss space industry has diversified significantly. Expertise has been built up in areas including electronics, mechanics, optics, radar and radio-frequency technology. As a result, Switzerland now boasts a broad industrial spectrum covering essential components and systems for satellites and launch vehicles. In addition to engineering services, production capacities have also been established, such as cleanrooms and specialised facilities for the manufacture of complex space systems.

Manzoni also emphasised the importance of the scientific and academic environment. Strong space ecosystems have developed in Switzerland, particularly in the Zurich and Lausanne regions. Universities such as ETH Zurich and EPFL in Lausanne train highly qualified specialists and work closely with industry. This enables the sector to recruit qualified specialists relatively easily.

At the same time, Manzoni also addressed structural challenges in Europe. Traditionally, many space projects have been organised through institutional procurement systems, particularly via the ESA and national space agencies. Whilst these processes ensure a very high level of system reliability, they are often time-consuming. New initiatives within Europe are therefore aimed at simplifying procurement processes and involving new players more closely.

Finally, Manzoni emphasised the role of collaboration between industry, universities and start-ups. Innovation often arises from joint research projects, for example as part of Master's or PhD theses. At the same time, partnerships between established space companies and younger firms can create important synergies: whilst large companies contribute experience, stability and industrial capacity, start-ups provide new ideas, technological approaches and additional innovative momentum.

Colonel Ludovic Monnerat

Colonel Ludovic Monnerat began by explaining Switzerland's military activities in the field of so-called Space Situational Awareness, or Space Domain Awareness. The aim, he said, was to

obtain as comprehensive a picture as possible of activities in space. One example of these efforts is the 'Polaris' application, which has been under development for several years. Such systems make it possible to compile and continuously update a picture of the situation in space.

Monnerat emphasised that Switzerland is home to a number of highly qualified specialists, some of whom serve within the army's militia system. Some of these experts have set up their own companies specialising in the observation and analysis of satellites. As an example, he mentioned a partner company that had succeeded in precisely observing and documenting the break-up of a Russian satellite over a period of several hours. Such capabilities demonstrate that, despite its size, Switzerland possesses considerable expertise in the field of space observation.

Another key focus of his remarks concerned the military use of space data. Satellites are now used worldwide for optical, radar and electronic reconnaissance. It is therefore crucial to know when such satellites fly over specific regions and what capabilities they possess. This has concrete operational implications, for example regarding the movement of troops or the deployment of equipment. Particularly vulnerable phases – such as the transport of vehicles by rail – must be carefully coordinated to account for potential surveillance. Such planning is now virtually impossible without the appropriate software solutions.

Monnerat also addressed structural challenges in Europe. A key problem, he said, is the lack of mass production of satellites and associated systems. Whilst companies such as SpaceX have achieved a very high production rate, Europe is still significantly slower in this area. Industrial scaling, however, is crucial for building large satellite constellations and remaining competitive on the international stage.

Finally, Monnerat emphasised the importance of space in terms of security policy. Modern defence is now almost inconceivable without space-based systems. At the same time, space is undergoing a phase of intensive utilisation and increasing competition. As with previous phases of global expansion, it will be necessary in the long term to develop international rules and regulatory mechanisms to structure the activities of state and private actors in space.

Renato Krpoun

Renato Krpoun once again highlighted Switzerland's historic role in space exploration.
Swiss scientists and institutions had been involved in international programmes from an early stage. A well-known example is the Solar Wind Composition Experiment, which was installed on the Moon as part of the Apollo missions and was one of the first scientific instruments to be deployed there. Such projects had contributed significantly to the development of a Swiss and European space sector ecosystem.

Today, these initiatives have given rise to a broad industrial and scientific landscape. In Switzerland, around 1,500 people are directly employed in the space sector, spread across several hundred companies. These activities are closely linked to universities and research institutions and form an important innovation ecosystem.

Krpoun also emphasised the economic significance of European space policy. Within the ESA, the so-called 'geo-return' principle applies, whereby the aim is to achieve a long-term balance between national contributions and the industrial contracts awarded. In addition, space applications generate significant societal benefits, for example in meteorology or Earth observation.

Renato Krpoun also emphasised how crucial the speed of innovation and development cycles is. Shorter development cycles enable faster technological progress, for example in commercial rocket programmes or large satellite constellations. Europe must therefore find ways to shorten development cycles and implement innovation more quickly in order to remain internationally competitive.

In November 2025, the ESA Council of Ministers therefore set out two key strategic directions: firstly, the strategic framework for a resilient and competitive Europe in space; and secondly, funding for key space programmes for the coming years, amounting to 22.1 billion euros. These decisions should also be seen as a political signal that Europe intends to continue playing an active role in space. This also ensures that the security challenges posed by space exploration are given the attention they deserve, for example through programmes aimed at European resilience in space and through closer cooperation between civil space agencies and military actors.

In conclusion, Krpoun emphasised that the future development of space exploration would increasingly be shaped by private investment. Falling launch costs and new business models were opening up economic prospects that went beyond traditional government programmes. The decisive factor would be whether Europe and Switzerland succeeded in positioning themselves early on in this emerging space economy.

Questions from the audience

Following the panel discussion, the audience had the opportunity to put questions to the panellists. Topics such as sustainability in space, the future role of the Moon and the challenges posed by space debris were discussed in particular.

On the subject of sustainability, Didier Manzoni explained that European space companies are subject to strict environmental standards, in particular the European REACH regulation. This stipulates which materials and chemicals may be used and regularly forces companies to develop alternative solutions. At the same time, increasingly environmentally friendly technologies are being incorporated into development, such as electric propulsion systems for satellites instead of chemical systems.

On the role of the Moon, Renato Krpoun explained that Switzerland is participating in the European exploration programme through the ESA. Swiss contributions will include, amongst other things, components for the European service module of the Orion spacecraft, as well as future logistical capabilities for lunar missions. At the same time, Krpoun expressed the hope

that, as the number of lunar missions increases, a Swiss astronaut might also take part in such a mission in the future.

Ludovic Monnerat added that the Moon would also gain in importance in the future from a geopolitical and economic perspective. In particular, resources such as helium-3 are regarded as potentially relevant for future technologies, for example in connection with quantum computing. Against this backdrop, increased competition between major spacefaring nations is already emerging and is set to intensify further in the coming decades.

In response to a question about potential space constraints in orbit caused by space debris, Monnerat also explained that, whilst space is fundamentally vast, certain orbits are being used increasingly intensively. The situation becomes particularly critical when objects change their trajectory in an uncontrolled manner. A particular problem is posed by the large quantity of very small debris, which is virtually impossible to detect from the ground. Consequently, space debris is a risk that must be continuously monitored and kept under control as far as possible.

Conclusion

The event clearly demonstrated that space-based services are now central to the infrastructure of modern states and will become enormously important in the coming years, both for state actors and for business and science. For Switzerland, this means it is necessary to continue coordinating its space-related activities closely with international partners – particularly within the European framework – whilst at the same time systematically expanding its own expertise in research, industry and security applications.