

German national contribution to the Secretary General in reference to the Resolution 75/36 on norms, rules and principles of responsible behaviours in outer space

UN General Assembly Resolution A/RES/75/36 on ‘Reducing space threats through norms, rules and principles of responsible behaviour’ encourages Member States to study threats and security risks to space systems and share their ideas on the further development of responsible behaviours in outer space with the Secretary General who will submit a substantive report to the General Assembly at its upcoming session. This paper represents the national contribution by Germany on threats and security risks, actions that could be considered irresponsible or threatening and first ideas for principles of responsible behaviour.

1. Why space matters to all of us: the growing relevance of security in outer space

Space assets and the services they provide underpin our way of life as well as the prosperity, safety and security of nations in an unprecedented manner. Outer space services and applications are drivers of scientific-technological as well as socio-economic development. Germany, like most other States, is increasingly dependent on outer space.

Satellite-based communications allow access to television, mobile communication, and the internet across the globe, in particular in areas which are not connected to respective cable-based terrestrial infrastructures. Navigation of land, sea and air vehicles relies on space-based positioning, navigation and timing services (PNT) like GPS, Galileo, Glonass or Beidou, which also enable the synchronisation of energy distribution, international information and telecommunication networks and the global banking system. Earth observation satellites provide data for weather forecasts, land survey, mapping and the monitoring of environmental and climatic changes.

Space science and technology also play a role in achieving the 2030 Agenda for Sustainable Development. They are instrumental in optimising the sustainable use of natural resources, a better timing of harvests, water and air quality monitoring, urban planning as well as provision of health care and education to remote and isolated communities. Space assets provide valuable early warning of imminent natural disasters and enable coordination of disaster relief in stricken areas. The smooth functioning of police, emergency and rescue services is in many cases reliant on satellite communication and navigation. Programmes such as UN-SPIDER and the International Charter Space and Major Disasters empower authorities, especially in emerging and developing countries, to access and use such space-based services.

In our globalized and integrated world, the reliable and secure provision of space services matters to everyone and all States.

Moreover, outer space is of increasing relevance for security and defence. Space-based services, ranging from Earth observation to space-based communication, are key to carry out operations safely and successfully and play a decisive role on the strategic, operational and tactical level. Unimpeded space-based services, in particular reconnaissance and early warning as well as uninterrupted communications and PNT services, are essential for assessing and responding to risks and threats to national security, for crisis management, and for military operations.

The use of space and the number of active satellites and of debris is growing at an accelerating pace, which leads to increased risks of collision. The launches of mega-constellations for satellite-based internet will significantly improve communication and connectivity. At the same time, the steep increase in the number of satellites further exacerbates congestion. Aspects of safety have thus become an issue under active consideration within the international community. The 2007 Space Debris Mitigation Guidelines of the UN Committee on the Peaceful Uses of Outer Space (COPUOS) seek to reduce the creation of space debris and the 2019 Guidelines for the Long-term Sustainability of Outer Space Activities of COPUOS encompass guidance on mutual information exchange, registration of space objects and collision warning. Further efforts are being made to explore approaches towards a framework for space traffic management. They seek to ensure the safety and sustainability of outer space for current and future use. However, they do not specifically address emerging security risks and threats to space systems. Here, the current regulative and normative framework is insufficient to address the threats and risks to security and stability in and related to outer space.

The increasing dependence on space assets of the civilian, but also the military sector enhances the relevance of outer space for security, stability and defence. Due to their exposure and high vulnerability, space assets and infrastructure may become a target in future conflicts. Preventing an arms race in outer space and preventing conflicts from extending to outer space are essential for strengthening international security and stability, and for safeguarding the use of the space environment for peaceful purposes in the long run. In the same vein, the prevention of misunderstandings regarding threats in outer space needs to be a high priority for all States.

Germany observes with great concern the development and testing of counter-space capabilities threatening essential civilian and military space systems and services. Along with real or perceived threats to space systems comes a high risk of misperceptions and unwanted escalation. In addition, some civilian space technologies, developed to sustain the use of space, such as active debris removal, may be perceived as threatening, if not communicated and explained properly.

Space is a global commons to be used for the benefit and in the interest of all humankind. As the benefits of space activities expand in number and improve in quality, it becomes increasingly important to preserve free access and use of outer space for all States. A destabilized space environment and decreasing outer space security carry a negative impact on all States depending on outer space services. Therefore, international consideration of threats and risks to outer space systems as well as measures to mitigate and reduce them is necessary. Agreeing on norms, rules and principles of responsible behaviour will be the first, pragmatic step.

2. Threats and security risks to space systems

It is in our joint interest to ensure a safe and secure access to and use of space, and a space environment that is sustainable, peaceful, and free from conflict. However, threats and security risks to our essential space infrastructure are growing and are not yet dealt with efficiently within the international framework. Being aware of the large overlap and blurry line between civil and military use of outer space the following sections will focus on the threats or perceived threats to security and stability in space.

2.1. What impedes a secure and sustainable access to and use of outer space?

From a security perspective, the unhindered access to and use of outer space can be undermined by a number of **deliberate** actions, most notably those actions, which may directly or indirectly, actually or potentially lead to:

- Destruction or infliction of irreversible damage to a satellite. While such actions – once completed – could constitute internationally wrongful acts, we consider that any action that may lead to these outcomes, such as holding a satellite at risk, significantly increases the risk of misperceptions, undermines the overall stability in space and may lead to further escalation and conflict in space.

- Loss of the ability of an operator to control a satellite. While such a behaviour may not immediately cause irreversible damage, it greatly increases the risk of collisions, permanent damage to the affected satellite or other satellites and thereby the creation of debris which leads to an overall deterioration of the space environment.
- Disruption or impairment of critical space-based services to the public. Such behaviour may ultimately entail surpassing a critical threshold, such as the risk of loss of life or damage to property as many civilian activities, as e.g. shipping or aviation, depend on accurate provision of PNT or communications services.
- Disruption or impairment of command and control of satellites, early warning and nuclear command and control functions, and PNT signals, since this leads to a substantial risk of misperceptions and unwanted escalation.
- The avoidable creation of space debris caused by deliberate acts or by neglect.

Any action, operation or activity that deliberately causes the impacts described above and as such impede the free access and use of outer space (assets) will be perceived as a threat to stability and security and carry the risks of miscalculation and unwanted escalation.

2.2. Counter Space Capabilities and Dual-Use Concerns

2.2.1. Counter-space capabilities

Security and stability in outer space are predominately jeopardized by the use of or the threat to use counter-space capabilities in a way that is inconsistent with a defensive posture. It is essential to underline that it is **the combination of capabilities and behaviour** that constitutes a threat and undermines stability

With an increasing relevance of outer space for security and defence, the incentive to develop counter-space capabilities is regrettably growing. A combination of rapidly developing technology, proliferation of space-capable actors, and lack of trust lead States to aim for counter-space capabilities, and an increasing number of States is looking into acquiring such capabilities to enhance their military capabilities and national security.

As the following categorization will show, counter-space activities concern a broad spectrum: attacks or hostile action, operations and activities from space-to-space, from ground-to-space, and from space-to-ground:

(1) Ground-/Air-/Sea-based kinetic Direct-Ascent ASAT

Among our primary concerns is the rapid development of Direct-ascent anti-satellite (DA-ASAT) capabilities. Using DA-ASAT can lead to the kinetic destruction of satellites by ground-, air- or sea-based missiles that either directly hit a space asset or detonate a warhead in close proximity to a satellite, creating debris that could harm other satellites in similar orbits.

(2) Co-orbital kinetic ASAT

Equally concerning are co-orbital ASAT capabilities or activities, i.e. the kinetic destruction of satellites via other satellites or mechanisms that are in orbit and that can close in on the target. Several options are conceivable: satellites directly destroying another satellite by their kinetic impact, satellites with robotic arms inflicting damage on a satellite, or satellites firing projectiles or similar objects targeting other satellites. Some of these capabilities require manoeuvres that allow one satellite to get into close proximity of another satellite.

(3) Directed Energy Weapons

The use of lasers, high-powered microwave (HPM), and electromagnetic pulse (EMP) may result in reversible or irreversible physical effects on satellites and ground stations without making physical contact. It can damage or degrade sensitive components of a space -systems e.g. by dazzling or blinding sensors or degrading solar panels and even disable a satellite or make it uncontrollable. The use of non-kinetic physical means is less visible and more difficult to attribute than physical ones.

(4) Electronic warfare

Electronic counter-space activities target a space asset of an adversary by affecting signals or content-data of signals. Jamming (interference with radio frequency communications) and spoofing (deceiving by producing a fake signal) may lead to reversible / temporary as well as irreversible / permanent impairments. Jamming and spoofing of satellite signals is already widespread on earth. The technology is commercially available and relatively inexpensive and thus accessible to state and non-state actors. Both are difficult to detect and attribute. Due to the civil-military dual-use character of some space-based services, they may result in the disruption of civil space services such as communication or navigation systems.

(5) Cyber intrusion

Cyber-attacks target the data itself and systems that use this data, aim at monitoring data, but also at inserting false or corrupted data. Cyber-attacks may result in data loss, widespread disruption, the seizure of control and even permanent loss of a satellite. They do not require significant resources and may even be conducted by private groups or individuals. Moreover, they are difficult to attribute in an accurate and timely manner.

The capabilities described above with no claim to completeness are not fiction. Several tests, activities and operations in outer space in recent years have demonstrated that actors have the capability to potentially use the above-mentioned means and instruments.

2.2.2. Dual-use concerns

Deriving threatening behaviour from capabilities and attributing intent is further complicated by the inherent dual-use nature of space technologies. In this context, dual-use does not refer to the usual distinction of civil versus military use as known for instance from export control. Regarding outer space, dual-use concerns reflect the ambivalent use of capabilities:

Capabilities and technologies that are essential for preserving the free and sustainable use of outer space might also be misused with the aim to destroy or impair space assets of a potential adversary. Here, we focus on two specific examples:

- Rendez-vous and close proximity operations (RPO) are essential for maintenance, repair, fuelling of spacecraft or docking of space capsules. At the same time, mastering RPOs is an essential precondition for developing co-orbital ASAT capabilities. In turn, it allows the use of highly manoeuvrable space-craft not only for the purposes they were designed for but also for potentially damaging other satellites.
- Satellites with robotic arms or other capture mechanisms are currently under development for the active removal of space debris in order to preserve a sustainable outer space environment. At the same time, those mechanisms might be (mis)used to manipulate, destroy or damage satellites.

More generally, most space assets and capabilities can to a varying degree be used to target, disable or even destroy objects in space although not all were originally designed for such purposes.

2.2.3. The argument for a behavioural approach

In view of such dual-use concerns, **threats in outer space cannot be deduced from objects or capabilities alone, but from a combination of capabilities and behaviour or from the observation of actual actions, operations and activities.** As a consequence, traditional arms control approaches such as **prohibiting specific types of objects in outer space** are inadequate and do **not solve the security problem.**

This underlines that the most pragmatic and realistic way to increase security and confidence in outer space is to **agree upon norms, rules and principles on responsible behaviour.**

Behaving responsibly in outer space includes, in addition to cooperative means such as increased communication, consultation, information exchange and transparency, **refraining from actions, operations and activities that either pose a real threat to security and stability or that might be perceived** as such. What is of significance is attribution and the knowledge or recognition of intent – for instance by observing and detecting deviations from the normal pattern of life (the usual movement) of a satellite – added by sufficient means of notification, communication and means for conflict resolution.

2.3. *Threats and perceived threats to space security*

2.3.1. Risks of misperception, miscalculation and escalation

The high dependence on the free access and use of space assets for civil but also military purposes comes along with increased risks of miscalculation and escalation. States are getting more concerned about the security of their satellites due to counter-space capabilities developed, tested or already in operation. Thus, developing, testing and fielding counter-space capabilities, which are not in line with a defensive posture, triggers threat perceptions that may result in misunderstanding, miscalculation and escalation spirals and an increased development of counter-space capabilities (“counter-space capabilities race”).

As laid out before, threats cannot be derived solely from the existence or availability of such capabilities or technologies. Rather, a lack of information on the function, mission, intent, along with insufficient communication or coordination and a lack of transparency (including outer space strategies and doctrines) increase the risk of misunderstanding, miscalculation and unwanted escalation, including conflict in outer space. These risks are further increased by a lacking common understanding on what actions, operations and activities, what behaviour in and around outer space is irresponsible or even threatening.

2.3.2. Irresponsible and threatening behaviour in space.

We believe that the following behaviours are irresponsible or even threatening. Examples of such behaviour are:

- **Demonstrating a DA-ASAT capability to hold space assets of other States at risk.** The targeted and persistent development and testing of a DA-ASAT capability demonstrates a State's intent to acquire capabilities of targeting and destroying satellites of a potential adversary. This might include satellites of crucial importance, for instance for military command and control, navigation or communication and therefore poses a threat to national security. We consider the development of DA-ASAT capabilities as well as a lack of transparency on missile tests problematic. If such tests lead to the creation of debris, this sends an even more threatening signal, and moreover, impedes the sustainable use of outer space, for all States.
- **Approaching and/or following another satellite and holding it at risk.** If a satellite is approaching and following a satellite of another State without consent, explanation, or consultation, the affected State(s) cannot exclude the possibility that the other satellite's conduct aims at interfering or even damaging its satellite. While such concerns need to be balanced with the free access and use of space, we see a clear need for transparency and mutual consideration. In particular, if the Rendez-vous and proximity operation is continued after the approached satellite has changed its orbit or mode of operation and/or after the affected State has requested consultations or a cessation of the manoeuvre such behaviour may be considered threatening. In addition, risky co-orbital manoeuvres can lead to the inadvertent damage or destruction of a satellite. That again causes the creation of long-lived debris.
- Related concerns can emanate from the uncoordinated **release of objects such as sub-satellites** or the ejection of projectile-like fragments in the immediate vicinity of or pointing at satellites of another State.
- **Interference with** the generation, provision, reception and processing of PNT-signals such as Jamming and Spoofing. As civil aviation, maritime navigation and other civilian activities depend on the reliable provision of PNT-services any unexpected disruption may potentially lead to loss of life or damage to property. We therefore consider interference in such critical services to the public irresponsible. The same applies to a cyber intrusion with equivalent effect.

3. Proposals to mitigate threats and security risks

The aim of defining principles for responsible behaviour in space is to prevent misunderstandings, misconceptions and miscalculations and thus to reduce the risk of unintended escalation. They are distinct from and without prejudice to binding norms of international law. Intended to form the basis for first realistic, pragmatic and non-legally binding norms, they reflect the expectations of the international community to set accepted practices of responsible behaviour and allow the international community to assess activities and intentions of states.

Safety and security are equally important for preserving outer space as a peaceful, safe, stable, secure and sustainable environment for the benefit of humankind. Whereas best practices of safety are a baseline requirement for responsible use of and free access to space, principles for responsible state behaviour need to go beyond safety and address security aspects. Defining principles for responsible state behaviour should aim at establishing a common understanding against which to judge state activities and react to actions not in line with this understanding.

The following draft principles for responsible state behaviour outside armed conflict represent our initial set of ideas, and serve the purpose of contributing to the international debate in the context of the further implementation of UN GA Resolution A/RES/75/36 on ‘Reducing Space Threats through norms, rules and principles of Responsible Behaviour’.

1 Considerations with regard to launches

States should conduct launches of missiles and space launch vehicles in a way which ensures maximum possible safety for the operation of satellites, including crewed space stations.

States should exchange pre-launch notifications including data on the generic class of the - missile or space launch vehicle, the planned launch window, the planned launch area and the planned direction.

2 Avoidance of debris

States should not purposefully or by negligence, in particular not by disregarding generally accepted rules and best practices of operational safety¹, cause, risk or knowingly-support the creation of debris, in particular when launching ballistic missiles or space launch vehicles,

¹Including but not limited to the Space Debris Mitigation Guidelines (2007) and Guidelines for the Long-Term Sustainability of Outer Space Activities (2019) of COPUOS

releasing payloads into orbit, conducting orbital rendez-vous and proximity operations or through deliberate kinetic impact.

3 Considerations in relation to rendez-vous operations

States should not conduct or knowingly-support rendez-vous operations unless a State has reasonable grounds for the rendez-vous operation and the affected other State has given consent. States should notify such rendez-vous operations to affected States and should submit a request for consent to these States in advance of the manoeuvre. Notifications leading to consultations should include at least the planned timing, trajectory and objective of the manoeuvre.

4 Considerations in relation to proximity operations

States should not conduct or knowingly-support proximity operations which impair the safe manoeuvrability of the approached spacecraft. To reduce the risk of misperceptions and misinterpretations States should aim for greatest possible transparency regarding relevant proximity operations.

5 No interference in the control of space systems and critical services

States should not conduct or knowingly support cyber or electromagnetic interference that damages space systems, leads to a loss of operational control over or permanent loss of the space system or impairs the provision of critical space-based services to the public.

6 National point of contact for de-confliction

States should establish a national point of contact which is operational 24/7 and which allows other states to contact or relay information to any satellite operator in order to coordinate and de-conflict spacecraft manoeuvres and frequency usage and clarify questions of space traffic coordination. This would serve as a communication and de-confliction measure, and thus will reduce the risk of miscalculations.

7 General measures for transparency and information sharing

States should seek to make national space security policies, strategies and doctrine publicly available, and share open-access space situational awareness data and catalogues to the greatest extent possible.

8 Involvement of national private-sector space actors

States should adopt and implement appropriate measures, including by establishing a regulatory and supervisory framework, to ensure that their national private-sector space actors follow these principles of responsible behaviour.

In parallel to work on principles of responsible state behaviour we aim for the following **measures for security and confidence-building** regarding outer space in order to implement, strengthen and enforce such principles:

- *Establishing **best practices for transparency and information exchange**;*
- *Mechanisms for **consultation and conflict resolution with the aim of implementing and operationalizing these principles of responsible state behaviour** but also offering a forum for broader exchange and debate;*
- ***Verification and attribution** of activity in space on the basis of reliable and comprehensive **space situational awareness providing effective data from a variety of sources**; as such, SSA allows to receive a complete picture of the operating environment and to observe, attribute, and call out deviating patterns of life that may potentially be perceived as concerns or threats.*
- *Strengthening **existing regimes with relation to outer space, above all the Outer Space Treaty, the UN Register on Objects Launched into Outer Space, but also the Hague Code of Conduct against Ballistic Missile Proliferation (HCoC) and the Missile technology control regime (MTCR), and their implementation.***
- *Collecting **best practices** from current operations in outer space as well as from other domains with certain similarities such as cyber or maritime security.*

4. Way Ahead

Germany regards outer space as a global commons to be used for the benefit of all States. Satellites and other space-based assets are vital for the functioning of today's societies and the global economy and trade, for the prosperity, safety and security of our nations. At the same time, outer space is an area where we are observing new and growing challenges to our security.

It is key to strengthen the current normative and regulative framework. Politically binding measures will be the most pragmatic and realistic way forward at this stage. We need to increase transparency and predictability of space activities, to build trust and confidence between States, to reduce the risks of misunderstanding and miscalculation, and to establish a common understanding of responsible behaviour in outer space. Ultimately, this might even pave the way for a comprehensive, effective and verifiable legally-binding instrument designed to cover all relevant threats related to outer space.

Germany has proposed first ideas for principles of responsible behaviours and confidence-building measures in this paper. However, we see the national contributions of States and the subsequent Report of the UN Secretary General only as a starting point, not the end of a process to address threats and risks and to increase security and stability in outer space. The international community needs to work together in seeking and agreeing on norms and principles assessed to be most appropriate to address the threats and risks identified by nations regarding outer space and that are not yet sufficiently dealt with within the existing normative or legal framework.

In a joint and inclusive effort, the international community should aim at:

- reaching a better joint understanding and awareness of threats and risks to outer space security, including threats and risks from space to earth, from space to space and from earth to space;
- reaching a common understanding among States on which behaviour is responsible and which is in contrast irresponsible or even threatening;
- proposing on the basis of the Report by the Secretary General and further work principles, rules and norms of responsible behaviours and further measures for security and confidence-building related to outer space that are widely accepted among the international community;

- deciding on how to best facilitate the universal consideration and support of those principles, rules and norms, and confidence-building measures;
- considering to make better use of existing or to establish additional fora for communication and dispute resolution;
- proposing measures to strengthen the application and implementation of the Outer Space Treaty, and other regimes related to outer space security.

The Conference on Disarmament in Geneva as well as the UNGA First Committee in New York play an important role in addressing and debating these questions. Against this background, Germany sees great merit in establishing a GGE or OEWG for further exchange and discussion of threats to the security of outer space and principles of responsible behaviour in a constructive and inclusive manner.

Given our common interests in space, Germany will continue to engage actively in the various UN processes first and foremost in Geneva, and in New York. We see it as our shared responsibility to safeguard the continued peaceful and sustainable use of outer space for current and future generations.

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