



Open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours

Geneva, 9 – 13 May 2022

Item 6(b) of the agenda

**Reducing space threats through norms, rules and principles of responsible behaviors:
To consider current and future threats by States to space systems, actions, activities and omissions that could be considered irresponsible**

Security risks, threats, and irresponsible behaviors undermining stability in outer space

Submitted by the Federal Republic of Germany and the Republic of the Philippines

1. The safe and secure use of outer space for all nations is intrinsically linked to regional and global security and stability. Space-based services increasingly underpin socio-economic and sustainable development as well as security and defense. Due to their critical relevance and high vulnerability, space assets and infrastructures become a potential target in future conflicts, with potentially severe impacts also on civilian life.
2. Work on norms, rules and principles of responsible behaviors to reduce space threats as part of wider efforts towards preventing an arms race in outer space should be based on a comprehensive assessment and common understanding of security risks and threats.
3. Germany and the Philippines understand security risks to be conditions and actions that may lead to an increased likelihood of misunderstandings, misperceptions, and miscalculations, which could escalate tension and may lead to conflict in outer space and on Earth. Security threats, on the other hand, are understood to be the acute harmful effects of deliberate actions.
4. Actions constituting threats can include the use of counter-space capabilities to hold at risk, interfere with, damage, or destroy space systems. In view of the inherent dual-use nature of many space technologies, however, threats cannot be derived from capabilities alone. For instance, rendezvous and proximity operations or capture mechanisms for active debris removal may be misused for destroying or impairing space assets of a potential adversary. It is in this context that Germany and the Philippines find the emphasis placed by the U.N. Open-Ended Working Group (OEWG) on behaviors apt.

I. Security risks and threats in outer space

5. Outer space is increasingly contested and congested, impacting international security and strategic stability. There is an urgent need to analyze and address the conditions and actions that lead to growing threat perceptions by many States and to persistent risks of misunderstanding, misperception, and escalation. They pose a continued challenge to strategic stability in the space domain and could induce the development and testing of counter-space capabilities, thereby creating incentives for States to engage in arms races. Such security risks include:



- (a) Insufficient understanding about the purpose and use of certain space assets and technologies: The dual-use nature of space objects could cause underlying risks of misperceptions if the intentions behind their development and use are unclear to other States. As outlined above, many space technologies could be used for both peaceful and malign purposes. Moreover, while the launch, position and movement of a space asset can be observed remotely by other States, the components of a satellite – which determine its possible applications and mission – are much harder or even impossible to observe remotely. Concerns about the real purpose of certain space assets can be further aggravated by insufficient registration practice and deviations from typical patterns of behavior.
- (b) Insufficient understanding of mutual threat perceptions: States assess the degree of their dependence on space systems – for instance in terms of national security or economic relevance – differently. Such differences lead to divergent threat perceptions. A lack of understanding of the kind of behaviors that another State deems threatening or escalatory could lead to an increased risk of miscalculation.
- (c) Lack of channels of communication: Communication channels for regular coordination of spacecraft maneuvers are underdeveloped, making it difficult to clarify and address potential concerns regarding such maneuvers or to deconflict operations in space.
- (d) Lack of transparency on national space programmes, space security and defense policies, strategies, and doctrine: In view of the growing relevance of outer space for security and defense, many States develop national space programmes and space defense policies or establish dedicated military structures such as space commands with varying degrees of transparency. Lack of transparency may obfuscate the overall nature of a space programme as well as the intent behind specific patterns of behavior, thereby increasing risks of misperception and miscalculation.
- (e) Absence of clear and internationally-understood standards and norms of behavior: Risk reduction requires a shared understanding of standards and norms against which to gauge the behavior of another spacecraft in the vicinity of one's own. Such standards and norms evolved over centuries in the context of the law of the sea, and over decades in the air domain. They make it possible to distinguish between innocuous patterns of behavior and potentially worrying deviations from the norm. In space, the lack of such standards, along with a lack of knowledge on the intent of a certain State, could lead to an increased risk of misperception and reduce the chances for a successful escalation management.

6. Security threats to the free and unhindered access and use of space are the result of deliberate actions which – directly or indirectly, actually or potentially – lead to harmful effects on the safe operation of space systems, the long-term sustainability of outer space, the provision of key space-based services to the public, and the use of relevant national-security space-based services, further elaborated below:

- (a) Threats to the safe operation of space assets and to the long-term sustainability of the outer space: While the destruction or infliction of irreversible damage to a satellite – once completed – could constitute an internationally wrongful act, any action that may lead to these outcomes is prone to misperception and escalation. The same applies to behaviors, which do not necessarily cause irreversible damage but impair or lead to a loss of the ability of an operator to control a satellite. Such behaviors greatly increase the risk of collisions and permanent damage to the affected satellite or other satellites, and could cause the creation of debris, which leads to an overall deterioration of the space environment and is detrimental to its long-term sustainability. In addition, activities, such as the destructive testing and use of direct ascent anti-satellite

missiles, that generate excessive or long-lived debris, threaten the preservation of a safe and secure space environment affecting all States.

- (b) Threats to the provision of critical space-based services to the public: Such critical services include positioning, navigation and timing as well as Earth observation and satellite communication used for civil aviation, shipping, emergency response and rescue services, communications, energy supply or other critical infrastructures. Impairment or disruption of these services could surpass a critical threshold and therefore lead to loss of life or damage to property, considering that many civilian activities depend on accurate provision of positioning, navigation and timing or communications services. A particular case in point are systems for disaster response. For natural hazard-prone countries such as in the Indo-Pacific region, space systems are crucial in preparing for, responding to and mitigating the adverse impact of natural disasters that are now further exacerbated by climate change. Reliable and real-time space data and communications enable timely response to calamities with the aim of preventing casualties, reducing the economic and material impacts of disasters, and also prove to be valuable to frontline responders during relief and rehabilitation efforts.
- (c) Threats to the use of space systems and services for national security: States rely on space systems for situational awareness, reconnaissance, navigation, communication, indications and warning, as well as for the conduct of military activities and operations. Impairment or disruption of command-and-control systems and space systems used for early warning, positioning, navigation and timing or intelligence, surveillance and reconnaissance, can – to varying degrees – lead to substantial risks of unwanted escalation. Situational awareness both in space and on Earth plays a crucial role for risk reduction and stability. Loss of early warning functions, for instance, will most likely be considered profoundly escalatory and threatening while impaired means for assessing sudden changes in force postures or observing military maneuvers may stoke fears of preparations for conflict. At the same time, there can be a legitimate need for States to resort to short-term and reversible means to counter reconnaissance and surveillance.

7. In addition to these security threats, irresponsible behaviors can have negative implications on all States' efforts to utilize outer space in pursuing their Sustainable Development Goals, including, among others, the following:

- (a) Conduct of scientific research and development: Space is a valuable asset to the conduct of scientific and technological activities in areas of human research, space medicine, life sciences, biotechnology, physical sciences, astronomy and meteorology. Impairment or disruption to space laboratories and space science missions slows down the delivery of important information, discoveries or technologies that could have been used in advancing astronautics, development of drugs for treatment of diseases, conduct of material science, and astronomical studies with potential Earth-based applications, amongst others.
- (b) Use of space systems and services for climate change adaptation and mitigation: Space is a powerful vantage point for monitoring of the Earth and changes in its climate system, as many key climate variables can only be measured from space. Access to space has enabled technology-based adaptation solutions to reduce climate risks under global warming. Impairment or disruption of space-based services for this purpose would not only severely impact our societies, but also limit our capability to understand and mitigate the greatest existential threat to the protection of the Earth and preservation of its resources for the future generations.

II. Counter-space capabilities and dual-use concerns

8. The offensive use or threat of use of counter-space capabilities profoundly undermines security and stability in outer space. Threats arise primarily from the combination of capabilities and behavior that undermines stability.

9. As the following categorization shows, there is a broad spectrum of counter-space activities, namely operations and activities from space to space, from ground to space, and from space to ground:

- (a) Kinetic direct-ascent anti-satellite missiles: Among our primary concerns is the testing and potential use of Ground-/Air-/Sea-based Direct-Ascent Anti-Satellite Missiles (DA-ASAT). DA-ASAT either directly hit a space asset or detonate a warhead in its close proximity. The resulting debris could threaten other space assets or even harm humans (for example astronauts aboard the International Space Station). It could also render certain orbits unusable for long periods of time.
- (b) Co-orbital kinetic anti-satellite capabilities: Equally concerning are co-orbital ASAT capabilities or activities, i.e. the kinetic destruction of satellites via other satellites that can close in on the target. Several options are conceivable: a satellite deliberately colliding with another satellite, a satellite coming into close proximity with another satellite and interfering with or disrupting its normal operation such as when the targeted satellite is forced to maneuver into safety, satellites inflicting damage with robotic arms to other satellites, or satellites firing projectiles or similar objects targeting other satellites within its range. Dual-use concerns are most relevant for co-orbital ASAT capabilities. Rendezvous and close-proximity operations (RPO), for instance, are essential for maintenance, repair, fueling of spacecraft or docking of space capsules. At the same time, mastering RPOs is an essential precondition for developing co-orbital ASAT capabilities. Likewise, satellites with robotic arms, harpoons, nets, 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, such mechanisms could also be used for manipulating, damaging or destroying other satellites.
- (c) Directed-energy capabilities: The use of lasers, high-powered microwave (HPM), and electromagnetic pulse (EMP) capabilities 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 system, e.g. by dazzling or blinding sensors or degrading solar panels, and even disable a satellite or render it uncontrollable. The use of non-kinetic physical means is harder to observe and more difficult to attribute than kinetic ones.
- (d) Radiofrequency capabilities: Activities in the radiofrequency spectrum affect 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, relatively inexpensive and thus accessible to state and non-state actors. Both jamming and spoofing are difficult to attribute. Because certain space systems are used for civil and military purposes, jamming or spoofing of such systems may result in unintended consequences.
- (e) Cyber intrusion: Cyber-attacks target the data itself and systems that use this data. They aim at monitoring data or 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 necessarily require significant resources and may even be conducted by non-state actors. Moreover, they are difficult to attribute in an accurate and timely manner.

III. Irresponsible and threatening behavior in space

10. Germany and the Philippines are of the view that the following deliberate behaviors can – to varying degrees – be considered irresponsible or even threatening:

- (a) Destructive testing or actual use of direct ascent anti-satellite missiles.
 - (b) Approaching and/or following (“shadowing”) an active satellite without prior coordination and holding it at risk with a co-orbital anti-satellite or a dual-use capability which could destroy or damage the satellite.
 - (c) Conducting rendezvous operations with active satellites of another State without prior consultation and consent.
 - (d) Conducting proximity operations that impair the safe operation of another space asset, or during an orbital maneuvers of the approached satellite without prior consultation, or after the affected State has requested consultations or a cessation of the maneuver.
 - (e) Launching of space launch vehicles without issuing pre-launch notification in accordance with the Hague Code of Conduct Against Ballistic Missile Proliferation (HCoC) as well as without prior coordination with potentially affected countries including those identified as potential drop zones of the uncontrollably re-entering debris (e.g. rocket stages) from the launch that pose a potential risk of injury to people, damage or destruction to property.
 - (f) Releasing objects such as sub-satellites or ejecting projectile-like fragments in the immediate vicinity of or pointing at other satellites without prior consultation and consent.
 - (g) Interfering by cyber or electromagnetic means with the sensors or command and control of space systems leading to the impairment or loss of operational control.
 - (h) Interfering by cyber or electromagnetic means with space-based services in the realm of positioning, navigation and timing-signals or communications, which severely affects or even harms civilians.
 - (i) Interfering with space-enabled early warning and military command and control.
 - (j) Interfering with systems used for space situational awareness or intelligence, surveillance and reconnaissance to conceal harmful activity in space or preparations for escalation and conflict.
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