Open-Ended Working Group on PAROS in all its aspects
Topic: Trends in development of co-orbital and other space-based capabilities

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Thank you for the invitation, I am grateful for the opportunity to contribute to discussions this week. I will be speaking in my personal capacity.

The first part of my presentation will highlight trends and concerns regarding co-orbital and other space-based capabilities concepts. The second part will propose possible steps towards restraint.

I. Trends in co-orbital and other space-based capabilities

(i) Co-orbital capabilities

These refer to capabilities placed in orbit which maneuver to attack a target system. The attack may entail an interceptor or pellets to collide with the target, or alternatively employ a harpoon or robotic arm to attack.

Maneuvring a co-orbital capability close to its target requires the ability to conduct precise rendezvous and proximity operations (RPOs). However, RPOs have diverse applications including civilian ones; for instance, RPOs enable servicing and maintenance of satellites. They can be used for Active Debris Removal, which as the name indicates, is a remediation measure for space debris. Because of their multiple purposes, RPO capacity by itself does not necessarily mean that a state has an active co-orbital ASAT capability. For example, a state may conduct an RPO to maneuver its inspector satellite close to an adversary's system to collect intelligence - this may be considered 'unfriendly' but does not entail an attack.

Nonetheless, RPOs represent a significant technological advancement that is a prerequisite for co-orbital ASATs. For this reason, maneuvers involving space systems of adversaries, particularly without clear intent, prior notification or communication, can be highly escalatory. Similarly, technology demonstrations with limited information can stoke concerns among rivals.

Notably, RPOs can refer to different types of maneuvers, and we have no consensus on terminology for these. A rendezvous occurs when two or more satellites match plane, altitude and phasing, aiming to eventually connect. A proximity operation, as the name suggests, involves two or more space objects which maneuver and remain close to each other. Each of

these maneuvers may involve different parties. Sometimes they may involve systems from the same state, which may be viewed as 'unusual' - particularly if they involve spacecraft with unclear objectives. And sometimes proximity operations can involve systems of different states with or without prior coordinaton and communication procedures. Such close approaches without prior communication are referred to by some as 'non-consensual' or 'uncoordinated' RPOs, and can be perceived as threatening, especially if they involve rival actors. Reports indicate concerns about the frequency of such operations.

Notably, these developments dovetail with growing interest among certain states in pursuing 'bodyguard' satellites which claim to provide defence against perceived threats in orbit.

(ii) Nuclear weapons in orbit

A major growing concern, evident in this week's exchanges. US officials reported in 2024 that Russia was developing a nuclear capability intended to target satellites (one that is not actively deployed). Russia has denied US claims. These developments sparked a series of proposed resolutions at the UN Security Council which were not adopted. Eventually, concerns led to UNGA Resolution 79/18 on WMD in outer space, adopted by a wide majority, which reaffirms the prohibition against placement of WMD in orbit under Article IV of the OST, and further encourages states not to develop such weapons. The resolution is a reminder of the decades-long taboo on nuclear detonations in orbit, the indiscriminate effects of a detonation in space - even potential impact of critical infrastructure on earth - and of course, the highly escalatory nature of nuclear detonations as they could raise consideration of nuclear use in response.

(iii) Space-based interceptors

There were earlier reciprocal restraints on development, testing and deployment of such interceptors between the US and Soviet Union through the 1972 ABM Treaty (which included measures for national technical means of verification and commitments not to interfere with these). However, following US withdrawal from the treaty, and now with introduction of Iron Dome for America (renamed Golden Dome), concerns about space-based interceptors have been reinvigorated. Per US announcements, Golden Dome aims to defend the US against all types of missiles from all adversaries, and intends to introduce a layer of space-based interceptors. If implemented, these would have inherent co-orbital ASAT capacity. Technical impracticality of space-based missile defence is well-established. However, for adversaries, this may not matter. Golden Dome has already triggered concerns about undermining strategic stability, including possibly stimulating an arms race for similar capabilities, potentially impacting nuclear arsenals, and further weakening mutual trust.

(iv) Space-based directed energy weapons

Other concerns have been raised about space-based directed energy capabilities, particularly lasers. Laser technology can offer potential benefits in space activities (eg. communications). However, depending on the specific capability, lasers can disrupt and blind optical sensors of

satellites. There is limited open-source evidence on operational status of these capabilities, but reports suggest growing interest in their pursuit.

(v) FOBS

There have also been allegations about development of fractional orbital bombardment systems (FOBS), which are weapon-delivery systems that partially enter orbit and then, rather than completing a full rotation, deorbit to reach the target.

This overview highlights that there is a wide range of capabilities that can undermine space systems with possible effects and consequences. There are also varying levels of political acceptability and legal certainty for each type of capability. In terms of potential escalation and how these capabilities may be perceived, what matters as well, is the specifics of each case - including the space system under perceived threat, strategic significance of that system for the states in question, and the overarching political context. For example, if a system were to make a close approach involving an NC3 satellite of a rival without clear intent or notification, that state may view its NC3 infrastructure as under threat, and could act accordingly.

We therefore need a common understanding of potential escalation risks regarding each of these capabilities and consider related scenarios.

II. Potential measures on restraint

Certain measures could help introduce more predictability, clarify intent and provide initial steps towards restraint.

(i) Articulating objectives

While states may agree on the need for measures, there are different elements being articulated, even through this week's exchanges. For instance: 'conflict-prevention', 'mitigating impacts of potential conflict' or 'slowing arms-racing dynamics' - these goals may overlap, but they focus on different aspects. States should discuss a shared vision for what stability in space looks like, especially in today's geopolitical environment. This will inform a more clear agenda for restraint on behaviours and capabilities.

(ii) Legal certainty

Article IV of the OST prohibits placement of WMD in orbit. However, governance of other capabilities is not so clear. RPOs in particular, highlight gaps under the current legal and normative framework: the need for specific, defined, communication procedures, as well as discussion on what may be considered 'appropriate distance' for close approaches - especially for maneuvers involving different actors.

There is also lack of common understanding on interpretation and application of the UN Charter on use of force, and how space activities can be conducted in a manner fully compliant with these provisions. Similarly for the right of self-defence, including the mandatory crtieria of necessity and proportionality. Indeed, the kinetic destruction of a satellite would be considered a clear use of force, and there is a long-standing taboo against such intentional kinetic destruction of another state's active space system. However, legality is less clear for various types of interference (cyber, electronic) and maneuvers. There is high potential for misunderstandings and miscalculations - including for example, conduct incorrectly justified as lawful 'pre-emptive' or 'anticipatory' self-defence. Legal certainty to guide activities to ensure compliance with these critical provisions of the UN Charter is therefore essential.

There are additionally major questions regarding governance of industry and commercial actors. Article VI of the OST obliges the responsible state to authorize and exercise ongoing supervision over their non-governmental entities. However we are yet to have dedicated exchange of views on the rights and obligations of such entities, including for military operations.

(iii) Shared terminology for RPOs

As mentioned, we are often referring to different types of maneuvers involving various entities under the broad umbrella term "RPOs". We need to approach this more systematically, clarify related terminology and categories of RPOs, as we still lack consensus on what is perceived as threatening. The lack of shared vocabulary otherwise paves the way for incorrect and often inflammatory rhetoric that can further aggravate tensions.

(iv) Enhancing information-sharing

"Information-sharing" - including on a unilateral basis is needed to clarify intent and reassure entities regarding space activities. Measures should not be considered solely reciprocity-based. States can engage more in information-sharing on national basis and utilize the opportunity to set an example for best practices. This could translate into unilateral commitments or pledges to notify entities for specific maneuvers and communicate in a timely manner. Further, enhancing transparency through effective implementation of the Registration Convention is needed - including sharing more information on mission parameters and objectives.

(v) Commitments on 'interference', 'irreversible damage' or 'debris-creation'

States could undertake commitments to avoid 'interference'- a term that may be understood as broader than 'attack' to include cyber, electronic and even disruption from directed energy weapons - against critical systems. This could include those essential for humanitarian/civilian

missions, and also for strategic assets, for instance, NC3 of nuclear-armed states. These could be explored on multilateral or bilateral bases in the appropriate forums.

Alternatively, states could consider commitments not to be the first to conduct actions that cause irreversible damage to another state's space systems.

We have also seen over the last two days and in the previous GGE and OEWG, that intentional destruction and debris-creation is a major concern. Commitments in this regard expanding the scope of the DA-ASAT resolution 77/41 would be welcome.

Finally, each of these commitments (interference, irreversible damage, debris-creating acts) could be a means of exhibiting "due regard" to the corresponding interests of other states under Article IX of the OST. A dedicated exchange on what actions may be considered as demonstration of due regard could be discussed in upcoming sessions.

Conclusion

The current landscape exhibits that means of undermining space systems can be wide-ranging, with varying effects, consequences, political acceptability and legal certainty. These developments are occurring in a shifting geopolitical environment characterized by multidomain interactions, amid high mistrust and uncertainty. Measures for restraint will therefore require a series of steps at the multilateral, bilateral and unilateral level, to ensure stability in outer space.

Thank you, and look forward to your questions.