I. Summary

1. This paper aims to:
   (a) Position the role of space in an age of global competition;
   (b) Identify the key threats to space security;
   (c) Recognise the current and well-established international law applying to PAROS;
   (d) Propose criteria for new measures on PAROS;
   (e) Suggest further effective approaches to achieving the aims of PAROS via norms of responsible space behaviours.

II. The space domain in an increasingly competitive age

2. The human population relies on space and space infrastructure more and more every day. Space-related services, data and activities are key to our, functioning of economies, welfare of citizens, weather forecasting, crisis response, military operations, and the running of every day modern life.

3. The international security environment has changed drastically in the past few decades. We are now seeing increasing competition, conflict and instability in Europe and beyond. In a volatile and contested world, the space domain is one of the strategic arenas where competition will be most influential to a State’s core national interests, and the international order. We have recently seen the domain become increasingly congested as a result.

4. The international arms control and security architecture is also being undermined by non-compliance and withdrawal from key agreements. There is an increasing risk that competition will spill over into conflict. With less effective tools available to mitigate the risks of escalation, it is now more important than ever to implement new and creative measures that reduce the risk of conflict in space and achieve the aims of PAROS.

III. The threat to space security

5. As threats and volatility in the international sphere grow, we recognise the importance of maintaining a peaceful, rules-based, outer space environment. Given the reliance and dependency of all states on space-related services, it is in our common interest to promote
measures that prevent conflict and support the sustainability of the space domain. Miscalculation, misunderstandings and unintended escalation in the space domain could lead to actions that cause significant impacts that are detrimental to all states and populations, with far reaching consequences, including for strategic stability between nuclear-armed States. Furthermore, a conflict in space risks generating orbital debris, limits access to space, and impacts the long-term sustainability of space.

6. Threats to, in and from space are diverse and growing. An increasing number of States possess a range of space-based and ground-based capabilities capable of denying, disrupting or destroying space systems and assets. Many of these capabilities can serve both benign and malign purposes. This poses challenges in terms of threat perception and escalation risks. It also means we need normative solutions to mitigate the threatening uses of space capabilities, both ground based and space based, without constraining their beneficial uses.

IV. Existing International Law and PAROS

7. There is a substantial body of international law that helps further the objectives of PAROS. Key examples include:

   (a) The Outer Space Treaty. This is the cornerstone of the legal framework applicable to space. It places a range of specific obligations on state parties, including not to place in orbit around the Earth any objects carrying nuclear weapons. This duty is fundamental to the preservation of international peace and security and any violation of it would threaten strategic stability and all our interests;

   (b) The UN Charter. The obligations on states under the UN Charter to refrain from the threat or use of force, and to settle their disputes by peaceful means, apply in space as they do on earth;

   (c) International Humanitarian Law – In the context of any armed conflict, wherever it takes place, states must comply with the relevant rules and principles of IHL, including military necessity, humanity, distinction, and proportionality. IHL affords legal protection to civilian space objects in the context of armed conflicts.

8. As we conduct our work to prevent an arms race in outer space, a vital first step is to protect the integrity of the current legal framework and ensure States are clearly committed and adhering to it. States that have not yet done so, should accede to the Outer Space Treaty.

V. Criteria for new measures on PAROS

9. It is clear there is an existing legal framework that must be considered when proposing additional legally binding measures to PAROS. We encourage states to ensure any new proposals for PAROS instruments support and further enhance the current framework. They should avoid, for example, confusing and unhelpful duplication of the UN Charter’s prohibition on the threat or use of force, which already applies to space.

10. PAROS instruments should also be based on a common understanding of threats and consequences of actions in space and remain fit for purpose. The dual-use nature of space systems makes it challenging to define a ‘weapon’ in space, rendering a prohibition on the placement of weapons in space difficult to apply. Not all capabilities can be defined as a threat, which would unfairly impose limitations on the use of existing capabilities and the development of new space capabilities.

11. PAROS instruments should contain measures that reduce the drivers of an arms race, whilst not stifling innovation and novel solutions to space related challenges – such as active debris removal. We need to bear in mind the complex nature of the various space structures, and avoid a one-size fits all approach, requiring a more tailored, flexible, and nuanced approach to space security and PAROS.

12. Proposals for new legally binding instruments on PAROS should respect long-standing UN consensus that arms control agreements be subject to adequate and effective verification. The nature of space-based systems i.e. the incredibly fast orbital speeds, distance
of thousands of kilometres from Earth, and difficulty in conducting inspections, makes verification a significant challenge. Potential PAROS mechanisms cannot be wholly effective until this challenge can be overcome. Adequate and effective verification standards are defined by their ability to build confidence that States are complying with any agreement. Without this mutual trust, we cannot achieve the aim of PAROS, which is to maintain international peace and security. Please read the annex for more detailed views on the critical question of verification.

VI. Responsible Space Behaviours as an alternative or combined approach

13. An adaptive and comprehensive approach is required when developing new mechanisms on PAROS. Reliance solely on legally binding instruments will not deliver feasible results, garner mutual confidence, or match the needs of space-based systems.

14. The nature of the space environment means space capabilities are hard to define and categorise between ‘threatening’ or ‘safe’. Therefore, mechanisms that only regulate capabilities are unable to achieve the required impact of reducing space threats. Instead, an approach that focuses on regulating behaviours, based on accepted norms, rules and principles is a more viable method of reducing risks in space.

15. Norms, rules and principles describing responsible behaviours would identify the types of conduct and activities in space that are perceived as ‘threatening’, providing a guardrail for actors to avoid escalation. The complex nature of space requires us to consider not just the placement of weapons in space, but the behaviours of states in relation to all space systems and assets: including the ground link, and space segments.

16. We see the benefits of adopting a comprehensive approach to achieving the aims of PAROS, consisting of complementary and supporting mechanisms of both legally binding instruments and norms-based principles, each addressing a different aspect of space threats. The full range of tools available should be considered, such as transparency and confidence building measures, norms of responsible behaviours as well as the existing legal framework.
Annex

Verification of legally binding measures for the prevention of an arms race in outer space (PAROS)

Key points

- Adequate and effective verification of compliance with legally binding controls on space capabilities or activities/behaviours supports the achievement of international peace and security.
- The nature of the space domain and space technologies, means it would be virtually impossible with existing technologies to adequately verify compliance with a prohibition on the placement of weapons in space.
- Transparency and confidence building measures related to States’ space capabilities and activities cannot substitute for legally binding verification measures but can help reduce risks of misperception and misunderstanding.
- Compliance with some norms of responsible space behaviours can be confirmed or verified with current technologies for the observation and monitoring of space activities.

Detail

1. When countries enter into legally binding agreements to control or limit the production, deployment, testing, stockpiling or transfer of weapons, it is generally the case that the countries participating in such agreements require assurances of each other’s compliance with the relevant obligations. Such assurances are usually obtained through a process of verification, which varies depending on several factors such as the nature of the weapons, the nature of the obligations in the agreement and the technologies available for verification and monitoring and the level of trust.

2. The importance of effective verification has been recognised since the inception of the PAROS agenda. The UN General Assembly’s 1978 special session on disarmament, which called for appropriate international negotiations on PAROS, also emphasised that disarmament and arms limitation agreements should provide for adequate measures of verification satisfactory to all parties concerned to create the necessary confidence and ensure that they are being observed by all parties. This helps to ensure the security of States and avoid a situation in which a State or group of States is placed at a disadvantage relative to others.

3. A decade later, the UN Disarmament Commission (UNDC) unanimously agreed some specific principles of verification (1988). These included the following three key principles, and which should be applied to any proposed legally binding agreement on PAROS:
   - “Adequate and effective verification is an essential element of all arms limitation and disarmament agreements.”
   - “Verification should promote the implementation of arms limitation and disarmament measures, build confidence among States and ensure that agreements are being observed by all parties.”
   - “Adequate and effective verification arrangements must be capable of providing, in a timely fashion, clear and convincing evidence of compliance or non-compliance. Continued confirmation of compliance is an essential ingredient to building and maintaining confidence among the parties.”

4. Although technologies (for weapons or verification) and situations change, the fundamental purpose and principles of verification remain the same. The UN Group of Governmental Experts (GGE) consensus report on verification in all its aspects (2007) built
on the work of the UNDC and remains relevant to today's challenges, including in outer space. Some of the report's key points are:

- Effective design: Non-proliferation, arms control and disarmament treaties should be defined in a way that they can be subject to effective verification (Recommendation 1).
- Dual-use: multilateral, treaty-bound verification is a desirable goal but may not always be appropriate or feasible, for example, it may be impossible to verify non-compliance with obligations in certain circumstances, such as dual-use capabilities.
- Early detection: verification arrangements should be able to detect non-compliance at an early enough stage to deny the benefits to the transgressor of non-compliance and thus avoid impacts on the security interests of the other states.
- Differentiated responses: verification arrangements should enable differentiated responses to deliberate or accidental non-compliance with obligations.

5. We can use the consensus conclusions and recommendations of the various UN documents on verification as a framework to assess the feasibility of various possible measures to prevent an arms race in outer space. Although there is no consensus at present on what measures could best achieve PAROS, it is virtually impossible to conceive of effective verification arrangements that could enable a ban on the placement of weapons in outer space to be instituted in way that meets these principles and recommendations agreed by UN Member States.

6. This can be illustrated with an example. A satellite designed to remove debris from orbit or to repair or service another satellite could also be used as a weapon against other satellites. Even if one could verify that a capability is not a weapon per se, it doesn’t address the problem that the capability could still be used as a weapon once placed in orbit thus illustrating the dual-use challenge identified in the 2007 GGE consensus report on verification.

7. The argument may be made that there are some capabilities which have no peaceful uses and are clearly identifiable as weapons and that a verification regime, even if imperfect, could at least detect non-compliance with obligations to prevent the placement of these in space. However, even space-based capabilities intended as weapons are not easily distinguished from other technologies. For example, offensive space-based jammers could look like high-powered communications payloads, and offensive lasers could be portrayed as experimental deep space laser communications terminals. Orbital kinetic kill vehicles, designed to collide with other satellites, will have features that could allow them to be realistically described as inspector satellites. Even missiles could look very different in space compared to those used on Earth.

8. Pre-launch inspections are likely to be impractical or ineffective. Modern construction rates and increasingly short integration times for putting satellites on rockets make on-site inspections very challenging. As satellites become increasingly ‘reprogrammable’, functionality could change after launch, rendering the on-site inspection ineffective. Limited volumes available in the fairing of most space launch vehicles means most satellites perform some degree of on-orbit deployment from a folded state. It would be easy to design a concealed deployment mechanism for space weapons. Post-launch inspections do not offer a complete solution either. Inspector satellites could provide some indication of the functionality of some satellites but not necessarily distinguish weapons from dual-use technologies or identify concealed capabilities.

9. Adequate verification needs to be built into new arms control agreements, such as banning weapons in space, from the start. We must be confident that space arms limitation measures are in principle verifiable, and that adequate verification techniques and technologies are available. Experience shows that trying to bolt on verification later is fraught with challenges. For example, a decades-long effort to introduce verification procedures to the Biological and Toxin Weapons Convention, which came into force in 1975, has so far failed to bear any fruit. This is a situation we should seek to avoid with respect to space given the strategic importance of space systems to States and the likely significant consequences to States’ core security interests if compliance obligations cannot be assured.
10. Effective arrangements to verify compliance with binding measures to prevent the placement of weapons in space would be very challenging to devise. However, risks of misperception and misunderstanding with respect to space can be reduced through transparency and confidence building measures (TCBMs), which could be formally built into treaties or be composed of supplementary measures. A key advantage of supplementary TCBMs is that they can be adapted and added to as technological circumstances and levels of trust change. Their continued implementation can be easily observed and checked through minimal institutional consultative mechanisms to be established, as per the recommendations of the 2013 GGE consensus report.

11. The consensus report4 of the GGE on space TCBMs agreed that a TCBM should fulfil certain practical criteria:

- Be clear, practical and proven, meaning that both the application and the efficacy of the proposed measure have been demonstrated by one or more actors;
- Be able to be effectively confirmed by other parties in its application, either independently or collectively;
- Reduce or even eliminate the causes of mistrust, misunderstanding and miscalculation with regard to the activities and intentions of States.

12. Sticking with the example of debris removal and on-orbit servicing, a country could be transparent about the deployment and use of such capabilities by providing detailed technical and visual information in advance of launch concerning the nature of the capability as well as advance information (e.g. timing, location etc) concerning any on-orbit operations. This would fulfil the criteria listed in point 34 of the GGE report on TCBMs because (a) the actions of the state would be clearly communicated, (b) can be confirmed through the use of radar and telescopes and, (c) would help reduce mistrust and misunderstanding (although it wouldn’t necessarily eliminate mistrust and misunderstanding as the capability still has the potential to be used as a weapon).

13. Given the difficulty of effectively verifying measures to prevent the placement of weapons in outer space, taking a broader view of the scope of PAROS may help States devise other measures (legally binding or otherwise) to address the threats we face to, from and in space. For example, instead of seeking to ban the placement of weapons in space, we could seek to regulate the use of States’ space capabilities (whether in orbit or on the ground) in a way that reduces the risk of misperception, misunderstanding and escalation, while preserving the ability of States to use those capabilities for legitimate civilian and defence purposes. The recent UN Open-Ended Working Group (OEWG) on addressing space threats through norms, rules and principles of responsible behaviours provides an illustration of the potential options in this regard.

14. One of the advantages of a behavioural approach is that States’ space activities (in space or on the ground) can, often better than the nature of space capabilities, be monitored with existing technologies, which can help increase the level of trust. For example, it was proposed during the UN OEWG that States should commit not to conduct destructive tests of direct ascent anti-satellite (DA ASAT) missiles and many states have now made such a commitment. Some States have called for this to be a legally binding obligation. Non-compliance with such a commitment or obligation can be verified because missile launches and destruction of objects in space are readily detectable with space-based and ground-based radars and telescopes and can be attributed to the perpetrator.

15. However, there are also examples of behavioural norms for which it would be difficult to confirm compliance or for which compliance could be confirmed but that doesn’t eliminate the threat perception. For example, it would be possible in principle to establish norms for the way in which Rendezvous and Proximity Operations (RPO) are conducted in relation to the space objects of other countries. While compliance with such a norm may be confirmable because the manoeuvres of satellites are observable with radars and telescopes, it doesn’t necessarily eliminate the threat, if one cannot also verify whether the space objects are capable of interfering or colliding with each other. Nevertheless, establishing norms or standards for RPOs could still be useful for distinguishing between threatening and non-threatening behaviours and thus may deter the former.
16. UN Member States have recognised the importance of monitoring and verification for norms of behaviour and have included consideration of this topic in the mandate of the newly established follow-on UN OEWG on responsible space behaviours. A consideration of monitoring and verification from the outset is important for informing States of the feasibility and effectiveness of any measures that they could agree upon.