United States of America
National Submission to the United Nations Secretary General
Pursuant to UN General Assembly Resolution 75/36
Reducing space threats through norms, rules and principles of responsible behaviours

"*Encourages* Member States to study existing and potential threats and security risks to space systems, including those arising from actions, activities or systems in outer space or on Earth, characterize actions and activities that could be considered responsible, irresponsible or threatening and their potential impact on international security, and share their ideas on the further development and implementation of norms, rules and principles of responsible behaviours and on the reduction of the risks of misunderstanding and miscalculations with respect to outer space;"

Introduction

Outer space provides many benefits to humanity, and space-based capabilities are integral to modern life in the United States and to countries around the world. Space activities provide national benefits, with new technologies and services creating new economic opportunities in established and emerging markets. Space exploration has brought benefits to humankind from basic science research to greater understanding of the Earth, the solar system and the universe. On Earth, space systems are relied upon for critical missions like communications, weather prediction, navigation, ocean monitoring, and climate modeling. Space systems are also used for early warning and situational awareness to preserve international peace and security. For decades, States Parties to arms control treaties, including the recently extended New Strategic Arms Reduction Treaty (New START), have relied on space-based national technical means of verification to monitor compliance.

The December 2020 U.S. National Space Policy states that it is the policy of the United States that "[a]ll nations have the right to explore and to use space for peaceful purposes and for the benefit of all humanity, in accordance with applicable law." In that regard, the United States believes that it is in the shared interest of all nations and all space actors to act responsibly in space to ensure the safety, stability, security, and long-term sustainability of outer space activities. Responsible space actors operate with openness, transparency, and predictability to maintain the benefits of space for all humanity. The National Space Policy further directs us to "[l]ead the enhancement of safety, stability, security, and long-term sustainability in space by promoting a framework for responsible behavior in outer space, including the pursuit and effective implementation of best practices, standards, and norms of behavior." As such, the Interim National Security Strategic Guidance, issued by President Biden in March 2021, affirms that the United States will lead in promoting shared norms and forge new agreements on outer space.

1. Existing and Potential Threats and Security Risks to Space Systems

Space is a naturally hazardous environment and is increasingly congested, contested, and competitive. Space assets face many threats, both natural and man-made. Natural threats to satellites include solar activity, radiation, and natural orbital debris, whereas examples of man-

made threats include satellite launch debris, radiofrequency interference, malicious cyber activity, and anti-satellite (ASAT) weapons such as directed energy systems, or direct-ascent missiles.

Some States are developing, operationalizing, and stockpiling a variety of ASAT weapons that could be used to, or have the potential to, deny, disrupt, degrade, or destroy civil, commercial, or national security space capabilities and services. Some of these anti-satellite weapons could be used to deny or disrupt space services temporarily, while others are designed to permanently degrade or destroy satellites.

These threats against satellites and their supporting systems can generally be divided into four categories: 1) ground-space; 2) space-space; 3) ground-ground; and 4) space-ground. Within these categories, the threats can be described as 1) reversible, which include temporary effects such as interference with radiofrequency signals or dazzling of remote sensing systems, or 2) irreversible, which include measures that degrade or destroy a satellite. The consequences of all categories of threats could include loss of mission data; decreased lifespan or capability of space systems or constellations; the loss of positive control of space vehicles, potentially resulting in collisions that could impair systems or generate harmful orbital debris; or damage to or destruction of the space system.

Ground-Space: In this category, an anti-satellite weapon is based terrestrially, either on the ground, in the air, or on the sea, and is designed to be used against objects in orbit. This vector has seen the greatest proliferation of anti-satellite capabilities as a result of the ease of access to mature technology and the significant advantages that accrue to systems based on the ground, such as line-of-sight access to multiple overhead targets.

Space-to-Space: In this category, an anti-satellite weapon is based in outer space and is designed to be used against other objects in orbit. Unlike ground-based systems, there is no easy access to the systems once they are launched, there are limits to the power that can be generated by the satellite; and size and weight are a factor that must be taken into account in order to launch a satellite into orbit. Anti-satellite weapons placed in orbit must be able to maneuver into position relatively close to their target to conduct their mission and such systems have a finite operating lifetime while in orbit.

Ground-Ground: In this category, weapons are terrestrially based and are designed to be used for attacks against the terrestrial infrastructure that supports satellite operations or the user segment. These types of attacks can include malicious cyber activity or physical strikes on ground systems such as command and control (C2) systems, data reception stations, or launch infrastructure. This category can also include threats to the user segment, which is also susceptible to spoofing, denial of service, or malware.

Space-Ground: In this category, weapons are based in orbit and are designed to be used against targets on the land, at sea, or in the air. Although there are many conceptual proposals for such space-to-ground weapons, this is one of the least developed areas in terms of actual capabilities.

Some examples of threats to space systems within these categories include, but are not limited to:

Radiofrequency Interference: Used to disrupt, deny, deceive, or degrade space services including satellite communications and positioning, navigation and timing (PNT) services. Purposeful interference may prevent users from receiving intended signals and can be accomplished by two primary methods: uplink jamming or downlink jamming. Uplink jamming is directed toward the satellite, and must operate at the same frequency and approximate power level as the target signals. Effects can be widespread. Downlink jamming is directed at users on the ground, and its effects are more localized.

Directed Energy Weapons (DEW): Anti-satellite DEWs are designed to produce reversible or non-reversible effects against space systems by emitting highly focused radiofrequency or laser energy. Types of DEWs could include lasers, microwaves, and particle beams. Reversible effects include temporarily blinding optical sensors, which may deny the ability to locate, monitor, and track objects. Non-reversible effects include permanently damaging or destroying sensors or other satellite components.

Cyber Threats to Satellite C2: Satellite command and data distribution networks could expose space systems, ground infrastructure, users, and the links connecting these segments to cyber threats. Malicious cyber activities from ground-based sites directed at satellite C2 links could range from disrupting data, or sending unauthorized commands to potentially take over operational control of a satellite or its payload from its authorized owner/operator.

Attacks on Terrestrial Space Infrastructure: Physical attacks against ground sites and infrastructure that support space operations, such as data centers, power plants or space launch sites, could also threaten satellite services.

ASAT Missiles: ASAT missiles could be launched from on-orbit spacecraft or from systems on the ground, in the air, or at sea for the purpose of degrading or destroying targeted satellites. ASAT missiles could use explosives, kinetic impact, or other means to degrade or destroy a satellite.

Robotics and Other In-Orbit Threats: Concepts for space-based anti-satellite systems vary widely and include designs that use satellites placed in Earth orbit to carry anti-satellite missiles (as noted above) or spacecraft subsystems capable of producing reversible and nonreversible counterspace effects. These capabilities could include space robotics systems, chemical sprayers, and other concepts.

Nuclear Detonations/Weapons Placement: Nuclear detonations in outer space could be used to directly damage or destroy satellites, and also could be used to create harmful electromagnetic effects that could also degrade and destroy satellites as well as damage terrestrial infrastructure. The 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, which is sometimes called the Limited Test Ban Treaty (LTBT), already prohibits any nuclear weapon test explosion, or any other nuclear explosion, in outer space. Moreover, Article IV of the 1967 Outer Space Treaty prohibits placing nuclear weapons or other weapons of mass destruction in orbit around the Earth, installing such weapons on celestial bodies, or stationing

such weapons in outer space in any other manner. As such, nuclear weapons or other weapons of mass destruction are prohibited from being placed in orbit for any type of attack.

Dual-Use Challenge:

Many space capabilities and technologies are inherently dual-use, which presents both practical and conceptual problems when attempting to identify and respond to potential threats. All satellites with maneuvering capabilities, if launched into the proper orbit, could technically be used to attempt to collide with another satellite, even if not optimized to do so.

Currently, States and commercial entities are developing on-orbit servicing satellites and active debris removal capabilities. On-orbit servicing satellites could allow for the extension of the life of satellites, and in the future may be able to repair and build satellites in orbit. Active debris removal systems may have the ability to deorbit non-operational satellites, rocket bodies and other debris, thereby helping to preserve the outer space environment. Both on-orbit servicing and active debris removal satellites would require various mechanisms to grab or attach themselves to their target satellites. Some on-orbit demonstrations have included the use of a net, harpoon or magnet to accomplish this task. Robotic arms could also be used for this type of activity. This capability to grapple another satellite is inherently dual-use – such a capability could be used to repair or service another satellite, or to degrade or destroy another satellite.

Table 1 below summarizes the various types and capabilities that could be used as anti-satellite weapons, the threat categories, and whether that capability could potentially provide beneficial, dual-use functions. It also looks at whether the capability could be considered to create effects that are considered reversible, non-reversible or both. This is not meant as an exhaustive list, but as an example of how the threats, risks and challenges arising from these systems could be considered.

Table 1: Summary of Anti-Satellite Weapons Types or Weaponizable Capabilities

Capabilities	Category	Dual-Use	Damage Type
Kinetic ASAT	Space-Space, Ground-Space	No	Non-Reversible
Robotic Arm ASAT	Space-Space	Yes	Both
Radiofrequency Interference	Space-Space, Ground-Space	Yes	Reversible
DEW Low Power ASAT	Space-Space, Ground-Space	Yes	Reversible
DEW High Power ASAT	Space-Space, Space-Ground, Ground-Space	No	Non-Reversible
Nuclear Weapon	Ground-Space, Ground-Ground	No	Non-Reversible
Orbital Bombardment	Space-Ground	No	Non-Reversible
C2 Interference	Ground-Space, Ground-Ground	Accidental/non-malign possible	Both
On Orbit Servicer	Space-Space	Yes	Both
Active Debris Removal	Space-Space	Yes	Both

Malicious Cyber Activity	All	No	Both

Distinguishing between the civil, commercial and/or national security uses of these systems -- combined with the challenge of discerning the operators' intent -- make it extremely difficult to craft a meaningful definition of what constitutes an "anti-satellite weapon." The way these systems are operated will be an important consideration in whether States perceive a threat from them. If the pattern of life of a satellite, for example, is consistent with that of its stated intent, then there will likely be less concern about its operations. However, even if a system is operated in ways consistent with the typical pattern of life for its stated mission, operating in a relatively transparent manner, or limiting its proximity operations to those requesting support, then such a system might still be perceived as a threat.

2. Categories of behaviors, efforts, or measures that could be considered during further development and implementation of norms, rules, and principles of responsible behaviors

States must be committed to maintaining a peaceful and secure outer space environment. In that regard, the United States offers a selection of general points and factors that could be considered or evaluated during further discussions of norms, rules and principles regarding national security-related activities in outer space.

Compliance with International Law: International law, including the law of armed conflict applies to activities in outer space. In particular, the Charter of the United Nations, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967); the Agreement on the Rescue of Astronauts, the Return of Astronauts, and Return of Objects Launched into Outer Space (1968); the Convention on International Liability for Damage Caused by Space Objects (1972); and the Convention on Registration of Objects Launched into Outer Space (1975) provide the foundation of the space international legal framework for outer space.

Development and Implementation of Transparency and Confidence-building Measures (TCBMs): The international community has recognized the importance and usefulness of TCBMs, which can significantly contribute to the promotion of peace, security, and disarmament. According to the consensus report of the UN Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities (A/68/189), "States should implement TCBMs to the greatest extent practicable, consistent with their national interests and obligations." TCBMs can be developed and implemented by States and intergovernmental organizations unilaterally, bilaterally, regionally, and multilaterally.

Enhancement/Improvement of Communication: Developing or improving communications between satellite operators, especially national security satellite operators, facilitates efficient and timely sharing of information, consultations and coordination related to potentially urgent matters. Exchanging appropriate information about on-orbit spacecraft operations may facilitate effective responses to orbital collisions, orbital break-ups, and other events that may ultimately

pose a risk to human lives, property, and/or the environment. Such communications could contribute to risk reduction by helping to avoid misunderstandings and miscalculations.

Types of, Conduct of, and Actions Relevant to, Space Operations: Further work is needed by States with respect to elaborating best practices and responsible behaviors for security-related satellites and operations in peacetime. Key to this effort is the understanding of national security space actions or operations resulting in perceived threatening behavior, apparent interference, or attacks. The following is a non-exhaustive list of some space actions or operations that may warrant additional discussion.

- Conduct of Satellite Operations: How spacecraft interact with one another, including the degree to which their operations are transparent and predictable, affects the potential for misinterpretation and miscommunication. Unpredictable or non-transparent operations conducted in deliberate proximity to other spacecraft may be viewed as posing a safety risk or a threat, due to the potential for collisions or other interference.

- Radiofrequency Interference: Interference with radiofrequency transmissions of satellites by space-related information and communication technologies (ICTs) could disrupt services such as environmental monitoring, communications and positioning, navigation, and timing that support vital public safety functions. Moreover, the effects of jamming conducted against PNT satellites is unlikely to be localized within the borders of the State conducting the interference. States already have certain existing obligations to avoid harmful radiofrequency interference under the provisions of relevant treaties such as the Constitution and Convention of the International Telecommunication Union (ITU) (1992), as amended, and the Radio Regulations of the ITU (1979), as amended. The ITU has also further considered how ITU Member States may contribute to these efforts with regard to space-based radiocommunication services through Plenipotentiary Resolution 186, "Strengthening the role of the ITU with regard to transparency and confidence building measures in outer space activities," (Resolution 186 (Rev. Dubai, 2018)).

- Interference with Security-related Space Systems: Security-related space systems can provide several important strategic functions: command and control of nuclear forces; strategic missile warning or attack assessment; and national technical means of verification. Each provides important early warning, intelligence, and situational awareness of terrestrial and space activities that can contribute to preventing conflicts, avoiding misperception and misunderstandings, and the reduction of tensions. Some of these capabilities, such as space-based national technical means, have underpinned the verification and credibility of successful implementation of generations of arms control treaties. Actions that interfere with these systems either temporarily or permanently could undermine efforts to maintain international peace and security.

- Interference with Command and Control: Activities that compromise the ability of space operators to issue commands and maintain control of on-orbit objects, for example, a satellite's telemetry, tracking and control (TT&C) system, could result in the unrecoverable loss of control of another State's spacecraft, and may constitute a hazard to the safety of space operations.

- Weapons Testing: Tests or simulations of attack of ASAT weapons in the direction of, or close proximity to, another State's satellite could cause misperceptions and misunderstandings and increase tensions or lead to conflict between States.

- Debris Generation: Failure to mitigate generation of space debris, especially long-lived space debris, during ASAT tests or other activities, would impact the outer space environment and could negatively affect the ability of States to use space for peaceful purposes.

3. Norms, Rules, and Principles of Responsible Behaviors With Respect to Outer Space

Voluntary, non-legally binding norms, rules, and principles of responsible State behavior with respect to outer space can reduce risks to international peace, security, and stability, including by playing an important role in increasing predictability, enhancing operational safety, and reducing risks of misperceptions, thus contributing to the prevention of conflict. All stakeholders should use space systems in a manner that does not endanger international peace and security. The United States believes it is possible to reduce the risk of conflict in outer space by cooperating in the development and implementation of voluntary, non-legally binding norms of responsible State behavior with respect to outer space that strengthen the stability and security of the outer space environment. The United States believes that States should examine and develop ideas for responsible behaviors that would maintain outer space as a safe, stable, secure, and sustainable environment.

The United States believes there are advantages to focusing on voluntary, non-legally binding norms of responsible behavior with respect to outer space, such as the ability to adapt quickly to changing circumstances or technologies, allow new and novel uses of space to be explored, and to allow civil and commercial operators to have more of a voice in their development. That does not mean that States should cease engaging on and discussing space security issues at the Conference on Disarmament or in other international fora. Taken progressively, these could be a first step to addressing mistrust arising from misunderstandings between States. As such, confidence building measures and "norms, rules, and principles," may lay the foundations for arrangements and agreements on outer space in the future.

In addition to the expectation that States will comply with their obligations under international law, the United States offers the following for consideration as a concise set of starting points toward developing more specific voluntary, non-legally binding "norms, rules and principles of responsible behavior" for space operations, intended to complement the existing international legal framework pertaining to national security space activities:

- Reaffirm commitment to international law, including the Charter of the United Nations and relevant outer space treaties.

- Communicate and make notifications to enhance the safety and stability of the outer space domain.

- Operate national security spacecraft with due regard to others and in a professional manner.

- Maintain safe separation and safe trajectory when operating national security spacecraft.

- Limit the purposeful generation of long-lived debris.

Table 2 below summarizes how the concepts discussed in this section can be applied to some of the areas for consideration in Section 2 of this submission, "Categories of behaviors, efforts, or measures that could be considered during further development and implementation of norms, rules, and principles of responsible behaviors."

Table 2: Summary of concepts and areas for further consideration

Starting Point	Areas for Further Consideration
Respect for international law	States could reaffirm their commitment to complying with their obligations under international law, including the Charter of the United Nations and existing treaties relating to outer space activities to which they are parties.
Respect for international law	States could encourage efforts to promote respect for the application of international law in outer space, including efforts to encourage accession to and implementation of relevant outer space treaties.
Respect for international law	States could promote information sharing among States about State practice with regard to the implementation of international law in outer space.
Communicate and make notifications	States, along with intergovernmental organizations, could consider developing and implementing TCBMs, unilaterally, bilaterally, regionally, and multilaterally.
Communicate and make notifications	States could consider bilateral and multilateral exchanges of information on national security space activities and policies, or exchanges of information on national security space activities of specific concern.
Communicate and make notifications	States could consider developing best practices and responsible behaviors that enhance communications, especially regarding national security satellite operators.
Communicate and make notifications	States could consider developing common definitions and understandings of operational terms and concepts.
Operate with due regard and in a professional manner	States could consider elaborating best practices or responsible behaviors for the safe and professional operation of national security satellites, with due regard in order to avoid potential collisions or other harmful interference.
Operate with due regard and in a professional manner	States could consider elaborating best practices or responsible behaviors that avoid using ICTs in a manner that impacts space operations.

Operate with due regard and in a professional manner	States could consider elaborating best practices or responsible behaviors in order to avoid interference with security-related space systems.
Operate with due regard and in a professional manner	States could consider elaborating best practices or responsible behaviors that avoid purposeful interference with satellite command and control systems.
Maintain safe separation and safe trajectory	States could consider elaborating best practices or responsible behaviors that avoid simulating or testing ASAT weapons in the direction of, or in close proximity to, another State's satellite.
Limit the purposeful generation of long-lived debris	States could consider elaborating best practices or responsible behaviors for ASAT tests or other activities in order to avoid the purposeful creation of long-lived debris.

The United States reaffirms that the "norms, rules, or principles of responsible behavior" that are the subject of these discussions do not replace or alter States' obligations or rights under international law, but rather provide additional specific considerations on what constitutes responsible State behavior related to outer space.

In addition, regular dialogue is critical to enhancing shared objectives of strengthening international peace and security and the prevention of conflicts in outer space. Regional, cross-regional and inter-organizational exchanges can establish new avenues for collaboration, cooperation, and mutual learning regarding space threats and responses to those threats.