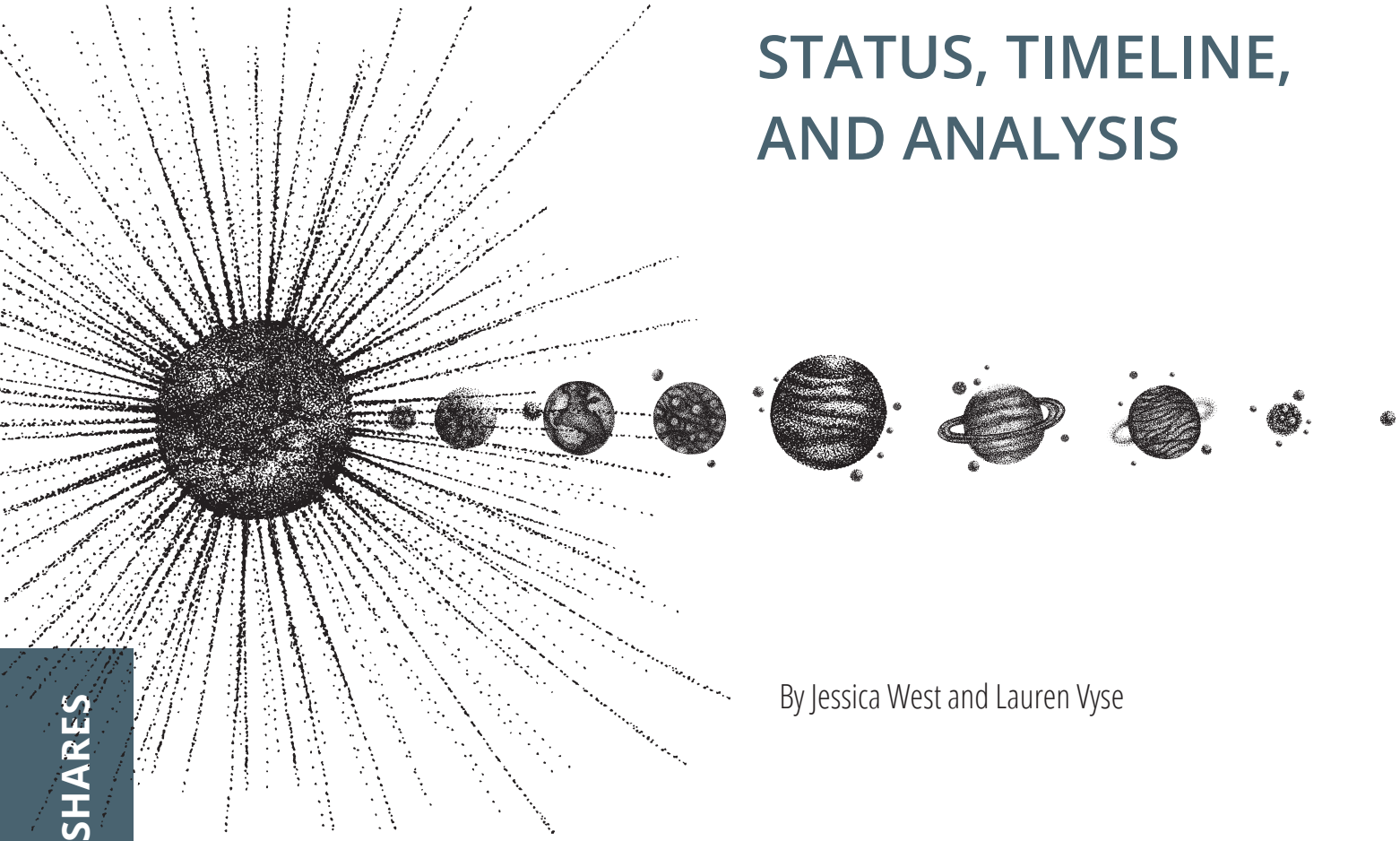
PLOUGHSHARES
REPORT

ARMS CONTROL IN OUTER SPACE
STATUS, TIMELINE, AND ANALYSIS



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ACRONYMS AND ABBREVIATIONS

ABM	Anti-ballistic missile
ASAT	Anti-satellite weapon
CD	Conference on Disarmament (UN)
COPUOS	Committee on the Peaceful Uses of Outer Space (UN)
EU	European Union
FOBS	Fractional Orbital Bombardment System (USSR)
GGE	Group of Governmental Experts (UN)
GPALS	Global Protection Against Limited missile Strikes (US)
IHL	International humanitarian law
IS	Istrebitel Sputnikov (satellite destroyer; USSR)
MIRACL	Mid-Infrared Advanced Chemical Laser (US)
OST	Outer Space Treaty
PAROS	Prevention of an arms race in outer space
SDI	Strategic Defense Initiative (US)
START	Strategic Arms Reduction Treaty
SWF	Secure World Foundation
TCBM	Transparency and confidence-building measure
UK	United Kingdom
UN	United Nations
UNDC	United Nations Disarmament Commission
UNGA	United Nations General Assembly
UNIDIR	United Nations Institute for Disarmament Research
US	United States of America
USSR	Union of Soviet Socialist Republics (Soviet Union)

Contrary to popular imagination, outer space is not a "Wild, Wild West" of lawlessness. Human activities in outer space are governed by international law, including the United Nations Charter, international humanitarian law (IHL), and, most critically, the 1967 Outer Space Treaty (OST), which sets out broad principles on how states are to conduct themselves in this domain, including commitments to registration, due regard, responsibility, liability, and non-contamination.

Efforts to prevent the escalation of conflict and the use or placement of weapons in space are longstanding but remain incomplete. While the OST is often referred to as a non-armament treaty, its arms control provisions – although essential – are minimal. Building on the 1963 Partial Test Ban Treaty, which restricts the testing of nuclear weapons in space, the OST bans the placement, installation, and stationing of nuclear weapons and other weapons of mass destruction in outer space or on celestial bodies. The OST also mandates that such bodies, including the Moon, shall be used "exclusively for peaceful purposes." However, there are no comprehensive prohibitions on the development, testing, deployment, or use of conventional weapons either in or from space, or against objects in outer space.

Additional arms control provisions that touch on space include The Hague Code of Conduct, which requires participants to implement certain transparency measures. As well, the Environmental Modification Convention bars engagement in "military or any other hostile use of environmental modification techniques" that involve changing "the dynamics, composition, or structure of the earth … or of outer space" as a means of injury to another state party.

Numerous bilateral arms control agreements originally between the Soviet Union/USSR and the United States included provisions related to space-based capabilities, indicating the important role of space in strategic stability. Among the most important was the now defunct Anti-Ballistic Missile (ABM) treaty, which restricted ground-, sea-, air-, and space-based anti-ballistic missile systems.

All the above agreements, plus other efforts that address gaps in arms control and introduce other bilateral and multilateral military restrictions in space are outlined in the timeline that follows. The list is lengthy, indicating both the continuing pertinence of the issue to a wide range of stakeholders, as well as the lack of consensus on long-term solutions.

Our timeline attempts to be comprehensive in its coverage of space-related arms control activities. For narratives related to specific elements of this work, see articles by Aaron Bateman on bilateral negotiations and coverage of PAROS at the Conference on Disarmament by UNIDIR (another short history here).

Because it is important to put these diplomatic efforts at arms control in context, the timeline includes developments in national weapons policies, as well as the development, testing, and deployment of new weapons systems. But because our focus is on arms control, we have restricted the number of contextual events. Additional information on weapons-related programs can be found in the annual counterspace reports by the Secure World Foundation and the Center for Strategic & International Studies, the SWF database on ASAT tests, and the History of ASATs by the Union of Concerned Scientists.

Combined, this timeline reveals the dangers of the ongoing stalemate on arms control initiatives in outer space.

DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
US President Eisenhower adopts the "freedom of space" principle based on the right of free use of, and passage through space (NSC 5520).	1955	
Launch of the first artificial satellite, Sputnik, by the USSR, puts the 'freedom of space" principle into practice. The US proposes at the UN that space be used exclusively for peaceful purposes and that the development of missile technologies be subjected to oversight and inspection.	1957	
The USSR proposes at the UN that space be under UN control and that military uses of space and rockets be banned. A temporary moratorium on nuclear tests – including in the atmosphere – is adopted by the US, UK, and USSR.	1958	The first high-altitude nuclear test is conducted by the US.
UN Resolution 1348 (XIII) establishes the ad hoc Committee on the Peaceful Uses of Outer Space (COPUOS), mandated to consider legal questions and facilitate international cooperation in outer space activities.	1959	The US conducts its first ASAT test using an air-launched ballistic missile as part of the Bold Orion Program. The USSR establishes an ASAT program.
UN Resolution 1721 (XVI) "International cooperation in the peaceful uses of outer space" acknowledges the application of international law, including the UN Charter, to outer space and the principle of freedom of space; calls on states to inform the UN about objects launched into space.	1961	The USSR unilaterally ends the moratorium on atmospheric testing of nuclear weapons. The USSR conducts its first high-altitude nuclear test.
The US statement to the UN First Committee is the first public expression of the view that 'peaceful uses' mean 'non-aggressive' and 'beneficial' uses, including by the military; it cites challenges with dual-use technology and distinguishing the purpose of some tech. UN Resolution 1962 (XVII) "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space" allows all states to explore outer space within limits set by international law and the UN Charter; establishes broad principles on responsibilities, jurisdiction and control of launched objects, re-entry, landing and return of astronauts and vehicles, and liability for injury or damage caused by space vehicles.	1962	The US Starfish Prime high-altitude nuclear test destroys multiple satellites and reveals the damaging effects of nuclear weapons on space systems.
The Partial Test Ban Treaty signed by the US, USSR, and UK bans tests of nuclear weapons in outer space and other domains. Representatives of UN COPUOS, the US, and the USSR first meet to codify legal principles for outer space.	1963	The first US ASAT test using a modification of the US Nike Zeus nuclear-tipped anti-ballistic missile system takes place.

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
UN Resolution 1884 (XVII) "Question of general and complete disarmament" calls on states to "refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, installing such weapons on celestial bodies, or stationing such weapons in outer space."	1963	The USSR conducts its first ASAT test (Polyot 1), a prototype for the satellite destroyer "Istrebitel Sputnikov" (IS) co-orbital ASAT system.
	1964	The US conducts the first flight test of its Program 437 ground-based, nuclear-tipped ASAT system using a Thor missile.
	1965	The USSR conducts the first flight test of its R-36-O intercontinental ballistic missile as part of the development of the Fractional Orbital Bombardment System (FOBS).
The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty) is signed. It remains the cornerstone of international law as well as arms control and security in space.	1967	The USSR conducts the first test of its co-orbital ASAT system. Almost 40 tests are conducted between 1967 and 1982.
	1968	The USSR declares FOBS operational.
The "Agreement on measures to reduce the risk of outbreak of nuclear war," signed by the US and USSR, requires that the other party be notified immediately if "signs of interference" with missile warning systems or their related communications facilities are detected. The Hotline Modernization Agreement, signed by the US and USSR, requires the parties "to take all possible measures" to protect the reliable operation of the US-Soviet Direct Communications Link.	1971	US National Security Advisor Henry Kissinger directs a study to evaluate responses to the USSR ASAT program. The USSR IS co-orbital ASAT system enters experimental operations; it becomes fully operational in 1973.
The US and USSR sign the ABM Treaty, which restricts ground-, sea-, air-, and space-based anti-ballistic missile systems. They also sign the Strategic Arms Limitation Talks (SALT) 1 agreement. Both agreements limit interference with "national technical means of verification," widely interpreted to mean reconnaissance satellites.	1972	
The Convention on Registration of Objects Launched into Outer Space (Registration Convention) is adopted by the United Nations General Assembly (UNGA). It requires states to provide information on national space objects to the UN register.	1974	

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
	1975	The US deactivates its ground-based nuclear-tipped ASAT system (Program 437). The USSR resumes testing of its co-orbital ASAT system.
	1976	A US review of its anti-satellite policy (Buchsbaum panel) concludes that satellites would be key assets during wartime, declares that it is "neither enforceable, nor verifiable to treat space as a sanctuary." Nonetheless, it finds value in pursuing limited ASAT restrictions related to the targeting of higher-altitude nuclear command and control and early warning systems (Aaron Bateman).
	1977	US National Security Decision Memorandum 345 decrees that the US should develop non-nuclear anti-satellite capabilities. It announces that the US will "vigorously pursue development" of an anti-satellite capability. Development of US air-launched anti-satellite missile ASM-135 is approved.
The International Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (Environmental Modification Convention) enters into force. France proposes an international satellite monitoring agency to verify arms control agreements at the UN Special Session on Disarmament. The US declassifies the fact of photographic reconnaissance from space and acknowledges its use to verify arms control agreements. A series of talks between the US and USSR on control of ASAT weapons begins; talks are suspended in 1979. The UN Conference on Disarmament (CD) is recognized as a "single multilateral disarmament negotiating forum of the international community."	1978	US Presidential Directive/NSC-37 "National Space Policy" indicates that the US "will pursue Activities in space in support of its right of self-defense."
The US and USSR sign the SALT II Treaty. It prohibits placing in Earth orbit nuclear weapons or any other weapons of mass destruction, including fractional orbital missiles. (The US never ratifies this treaty.) The UNGA adopts the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), which reserves those bodies exclusively for peaceful purposes and prohibits the threat or use of force on them. This treaty has not entered into force. Italy proposes an Additional Protocol to the Outer Space Treaty to prevent an arms race in outer space.	1979	

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
The USSR submits a "Draft treaty on the prohibition of the stationing of weapons of any kind in outer space" to the UN Secretary-General. UN Resolution A/RES/36/97C "Prevention of an arms race in outer space" calls for the CD to establish an ad hoc working group to negotiate an "effective and verifiable agreement" that prohibits ASAT systems. UN Resolution A/RES/36/99 "Conclusion of a Treaty on the Prohibition of the Stationing of Weapons of Any Kind in Outer Space" calls on the CD to negotiate a treaty based on the 1981 USSR proposal.	1981	The US announces its intent to test the Air-Launched Miniature Homing Vehicle (ASM 135) ASAT system.
The USSR, Mongolia, and France submit draft treaties at the CD that ban either weapons in space or ASATs. UN Resolution 37/83 "Prevention of an arms race in outer space" is the first on PAROS. It asks the CD to establish an ad hoc working group to negotiate a PAROS agreement. The resolution continues to be presented each year. PAROS introduced as an agenda item at the CD. The US Senate Subcommittee on Arms Control, Oceans, International Operations, and Environment begins hearings on space weapons and arms control. A follow-up workshop on ASATs organized by the Office of Technology Assessment in 1984 recommends 'rules of the road.'	1982	The USSR begins dismantling its FOBS program.
The USSR announces a unilateral moratorium on co-orbital ASAT tests. The USSR tables a draft "Treaty on the Prohibition of the Use of Force in Outer Space and from Outer Space Against the Earth." UN Resolution 38/80 "International co-operation in the peaceful uses of outer space" asks COPUOS, in coordination with the CD, to consider questions on the militarization of outer space. The US Senate Committee on Foreign Relations urges President Reagan to pursue a verifiable agreement with the USSR to ban ASATs and space-based weapons systems. Canadian Prime Minister Pierre Trudeau's peace Initiative proposes a ban on high-altitude and anti-satellite weapons.	1983	In a televised speech, US President Reagan announces a new Strategic Defense Initiative (SDI), an anti-ballistic defence system intended to make nuclear weapons "impotent and obsolete."
The US Congress first calls for a mutual and verifiable ban on weapons designed to attack objects in space.	1984	The US formally establishes the Strategic Defense Initiative (SDI) Organization to oversee development of a defence system that includes space-based interceptors.

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
US President Reagan reports to Congress on US policy on ASAT arms control. US National Space Policy (1982) stipulates that it "will consider verifiable and equitable arms control measures" should they be compatible with national security. Challenges identified include verification, breakout, disclosure of information, attacks on ground-stations, and non-weapons threats.	1984	The USSR approves programs D-20 and SK-1000 to compete with SDI, demonstrating "a major commitment to development of a broad range of missile defense and space weapons technologies" (Pavel Podvig).
The US Congress bans further testing of the KE-ASAT system.		The US tests its KE-ASAT (ASM-135) system against a satellite.
The CD ad hoc committee on PAROS is established "to examine … issues relevant to the prevention of an arms race in outer space"; 74 working papers are submitted. The US and USSR begin nuclear and space talks in March. Soviet proposals include no withdrawal from the ABM treaty for 10 years, defining terms related to the treaty's prohibitions, and a ban on testing of space-based elements of defence systems. Talks end in 1986 with no agreement.	1985	
The US and USSR sign the Intermediate-Range Nuclear Forces (INF) Treaty, which eliminates nuclear and conventional ground-launched ballistic and cruise missiles with a range between 500 and 5,500 km. The treaty prohibits interference with all national technical means of verification. At the CD, Canada presents the PAXSAT initiative, which uses satellites to monitor and verify the absence of weapons in space. At the CD, the USSR proposes an international space inspectorate to conduct on-site inspections of launch sites before each launch.	1987	National Security Decision Directive 258 mandates the US Department of Defense to explore new ASAT options. The US Brilliant Pebbles concept for space-based missile defence interceptors is introduced. The USSR launches a space laser demonstrator that fails; funding is cancelled.
	1988	The US Congress votes against extending the ASAT testing ban; the US Air Force plans a ground-based laser system.
France proposes an international trajectography centre (UNITRACE) for collecting data to update registrations, monitor space objects, and conduct real-time calculations of the trajectories of space objects as a transparency and confidence-building measure (TCBM).	1989	The US pursues a more limited form of SDI: GPALS (Global Protection Against Limited missile Strikes), which is based on Brilliant Pebbles.
UN Resolution 45/55B "Confidence-building measures in outer space" authorizes a study of these measures. A UN Group of Governmental Experts (GGE) studies the role of the UN in verification, including in space.	1990	The USSR-backed Albatros missile system's 'Naryad-V' and 'IS-MU' begin flight tests. The USSR conducts a sub-orbital interceptor ASAT test. The US Congress bans tests of the Mid-Infrared Advanced Chemical Laser (MIRACL) system.

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
The US and USSR sign the Strategic Arms Reduction Treaty (START), which includes a Telemetry Protocol for data sharing of missile tests.	1991	The US cancels all space-based missile defence research and development until 1995; Brilliant Pebbles is officially cancelled in 1994.
Russian President Yeltsin reinforces support for the ABM treaty, proposing a "global defence system" to replace SDI, and the elimination of existing ASAT systems on a reciprocal basis.	1992	
A UN GGE studies confidence-building measures in outer space.	1993	Russia decommissions its co-orbital ASAT system.
Two open-ended consultations are held at the CD: one on terminology and other legal aspects of PARSO, and one on confidence-building measures, including 'rules of the road.' States are divided on both issues.	1994	
	1997	The US Air Force commissions a test using the MIRACL and Sea Lite beam director to illuminate a satellite.
At the CD, Canada proposes a new ad hoc committee to negotiate a convention on the non-weaponization of outer space; the plan is not taken up.	1998	
China urges the CD to negotiate a new "international legally binding instrument" to stop the weaponization of space.	2000	
	2001	The US Commission to Assess United States National Security, Space Management and Organization determines that "the security and economic well being of the United States and its allies and friends depend on the nation's ability to operate successfully in space" and introduces the concept of space control.
The US withdraws from the ABM Treaty. The Hague Code of Conduct against Ballistic Missile Proliferation (Hague Code of Conduct) is signed and enters into force. This voluntary agreement is intended to control the spread of weapons of mass destruction. It requires members to implement transparency measures, including annual declarations and pre-launch notifications. At the CD, Russia and China present a working paper that contains possible treaty elements to prohibit the placement of objects containing weapons in Earth orbit.	2002	

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
The UNGA adopts UN Resolution A/RES/58/32, which establishes a GGE to examine the impact of information and communications technologies on national security and military efforts.	2003	
Russia initiates a diplomatic initiative seeking political commitments in support of no first placement of weapons in outer space; Armenia, Belarus, Brazil, Indonesia, Kyrgyzstan, Sir Lanka, and Tajikistan are the first to sign on.	2004	
The UNGA adopts Resolution A/RES/60/66, which promotes "transparency and confidence-building measures in outer space activities."	2005	
The UNGA adopts Resolution A/RES/ 61/75 "Transparency and confidence-building measures in outer space activities," which invites concrete proposals on TCBMs.	2006	China reportedly illuminates a US satellite with a ground-based laser.
A working group on PAROS is formed at the CD.	2007	China destroys its own defunct satellite with a direct-ascent ASAT.
The Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT) is proposed by Russia and China. The European Union (EU) adopts a draft International Code of Conduct for Outer Space Activities (17175/08), consisting of "voluntary" confidence-building measures that promote "a peaceful, safe and secure outer space environment" and initiates talks with the US, Russia, and China.	2008	The US intercepts its own defunct reconnaissance satellite (Operation Burnt Frost).
Canada introduces the paper, On the Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security at the CD.	2009	
The UN releases report A/65/123 "Transparency and confidence-building measures in outer space activities." The US issues a new National Space Policy that "will consider proposals and concepts for arms control measures if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies."	2010	The new US National Space Policy focuses on the need to "develop capabilities, plans, and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack U.S. or allied space systems." It also states that the US takes the view that "purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights."
The CD establishes the working body "Prevention of an arms race in outer space" to discuss all issues related to an arms race in outer space.	2011	

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
The GGE on TCBMs in Outer Space issues recommendations in a consensus report.	2013	
Russia and China submit a revised version of the PPWT. The EU hosts multilateral talks outside of the UN to finalize the Code of Conduct; no agreement is reached. UNGA Resolution A/RES/6932 "No first placement of weapons in outer space" is adopted.	2014	
	2015	Russia conducts the first successful flight test of its direct-ascent ASAT system Nudol.
The Special Report by the Inter-Agency Meeting on Outer Space Activities (A/AC.105/1116) includes findings on the implementation of the report by a GGE on TCBMs. The UN Disarmament Commission (UNDC) sets up Working Group II to prepare recommendations to promote the practical implementation of TCBMs in outer space activities to prevent an arms race in outer space. TCBMs are on its three-year agenda for 2015-2017, and renewed for 2018-2020.	2016	
EU member states issue a statement to the CD Working Group on the "Way Ahead," proposing a multilateral, non-legally binding instrument on space security. The UN Secretary-General's report A/72/65 on TCBMs related to space activities is released. UN Resolution 72/250 "Further practical measures for the prevention of an arms race in outer space" is adopted. It creates a GGE tasked with "considering and making recommendations on substantial elements of an international legally binding instrument on the prevention of an arms race in outer space, including, inter alia, on the prevention of the placement of weapons in outer space."	2017	
The UN Secretary-General presents Securing our Common Future: An Agenda for Disarmament, which includes a discussion on the security and sustainability of outer space. The UN GGE on further practical measures for the prevention of an arms race in space discusses four main issues associated with PAROS; talks conclude in 2019 without consensus.	2018	Public information suggests that Russia is developing an air-launched ASAT system using MiG-31 aircraft.

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DIPLOMATIC INITIATIVES AND MILESTONES IN ARMS CONTROL IN OUTER SPACE	YEAR	SELECT MILESTONES RELATED TO WEAPONS AND DEFENCE
Nigeria submits working paper Recommendations to promote the practical implementation of transparency and confidence-building measures in outer space activities with the goal of preventing an arms race in outer space on behalf of the African Group. The EU launches the Safety, Security, and Sustainability (3SOS) diplomatic initiative to promote ethical conduct in space.	2019	India conducts an ASAT test in Low Earth Orbit. The North Atlantic Treaty Organization (NATO) declares outer space an "operational domain," recognizing its increasing importance for "the Alliance's and Allies' security and prosperity." France publishes its Space Defence Strategy, which includes an "active space defence."
Canada recommends modest measures to advance PAROS at the CD, such as an end to ASAT tests that cause significant debris. UN Resolution 75/36 "Reducing space threats through norms, rules and principles of responsible behaviours" is adopted.	2020	The US and UK accuse Russia of testing a co-orbital ASAT system that releases a 'projectile' (thought to be linked to the Burevestnik ASAT system).
The UN Secretary-General reports on states' submissions on threatening and reassuring behaviours in space and opportunities to advance norms, rules, and principles. The US Department of Defense releases Tenets of Responsible Behavior in Space UN Resolution 76/231 "Reducing space threats through norms, rules and principles of responsible behaviours" is adopted, establishing an open-ended working group to recommend possible norms, rules, and principles of responsible behaviours that relate to threats by states to space systems.	2021	China tests what appears to be a combination of an orbital bombardment system and a hypersonic glide vehicle. Russia conducts a direct-ascent kinetic ASAT test against one of its own inoperable satellites using what is believed to be the Nodul system.

OBSTACLES TO ADDITIONAL ARMS CONTROL MEASURES IN OUTER SPACE

While the timeline indicates that the past half-century has seen a proliferation of arms control initiatives, gaps remain in the current arms control regime related to outer space. The need to fill these gaps is made more urgent by ongoing technological developments linked to weapons systems that are either in space or that target objects in space.

The key challenges that have hindered effective negotiation of additional arms control measures for outer space will now be examined.

The absence of a universal meaning of "peaceful purposes"

The principle of peaceful purposes is central to outer space governance and arms control. However, the idea has remained vague and its meaning has stretched over time.

Initially, both the United States and Soviet Union stated that outer space should be preserved for exclusively peaceful purposes. In practice, both have long used space for non-aggressive military functions. Meanwhile the 1967 Outer Space Treaty preserves only the Moon and other celestial bodies exclusively for non-military, peaceful activities.

While there is broad agreement about peaceful purposes in principle, its substance is disputed. There are competing definitions of "peaceful purposes" and a variety of views on the objective of arms control, with some states wanting to ban military activity, while others focus on weaponization and preventing an arms race, and still others view space as a domain of warfighting. The result is that states are not all engaged in the same discussion, nor do they seek the same outcome.

The integration of space into terrestrial arms competition

Further complicating matters, arms control in space isn't just about space. A recent UNIDIR report argues that the current arms race in outer space is an extension of terrestrial arms races. Indeed, military and nuclear rivalries on Earth have been manifested for decades in the development of space-based military capabilities for reconnaissance, early warning, and strategic command and control of weapons systems. Early bilateral strategic nuclear arms control treaties between the United States and Soviet Union included agreements not to interfere with the other state's "national technical means of verification" – widely understood to mean reconnaissance satellites. This growing dependence of terrestrial systems on space capabilities has made agreements to restrict military uses of outer space complex.

For example, in the late 1970s and early 1980s, bilateral arms control discussions between the United States and Soviet Union, which included a possible ban on ASATs, were held in the context of other strategic arms control issues and were further complicated by the pursuit of ballistic missile defence (BMD) programs. This period saw various unilateral moratoria, but also the ongoing development and testing of new systems, as well as the eventual abrogation of the ABM treaty. The entanglement between ASATs and BMD has been one of the greatest obstacles to further arms control measures.

Different technological interests and priorities

The integration of space into terrestrial weapons capabilities also means that states have different strategic interests and priorities regarding arms control in space.

Arms control efforts in outer space focus on three different types of weapons systems: space-to-space, space-to-ground, and ground-to-space. Each system offers different technological advantages and vulnerabilities in outer space and control of each has been prioritized by different states.

ASATs or weapons in space?

Competing arms control priorities are evident in 1981 UN General Assembly Resolutions. Specifically, A/RES/36/97C "Prevention of an arms race in outer space" called for the CD to consider "the question of negotiating effective and verifiable agreements aimed at prevent-

ing an arms race in outer space" and "prohibit[ing] anti-satellite systems." In contrast, A/RES/36/99 "Conclusion of a treaty on the prohibition of the stationing of weapons of any kind in outer space" prioritized an "international treaty, to prevent the spread of the arms race to outer space."

Long the state actor most dependent on space, the United States, with the support of its allies, has consistently prioritized the threat posed by anti-satellite weapons and the use of force against space-based objects. In contrast, Russia and its allies, concerned about ballistic missile defence and the ability to maintain a nuclear deterrent, have been more concerned with the potential orbiting of weapons in outer space, including those that could strike objects on Earth.

This strategic divide has persisted despite the introduction by Russia and China of the draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT), which expressly responds to threats to objects in space. Some states are concerned about how the draft defines "weapons" and "use of force" (see more detail below).

Behaviour or hardware restrictions?

There is also disagreement over what should be regulated/restricted: certain weapons systems (hardware) or the behaviours of actors in space and how they use specific hardware capabilities? Many states that advocate for a behavioural approach do so, in part, because they see technical challenges in a more traditional focus on hardware restrictions, as noted below.

However, hardware and behaviour are closely linked. For example, although there is no formal proposal currently at the United Nations, interest is growing in pursuing an international agreement that would restrict or ban any test or use of kinetic ASAT weapons in space that creates space debris. Here the focus is on limiting the effect of a behaviour or use of specific hardware in outer space. Noting a strong international commitment to the sustainability of the space environment, Canada has proposed such an agreement as one way forward on space security discussions at the Conference on Disarmament. Drawing on the model set by the Partial Test Ban Treaty in 1963, an international letter coordinated by the Outer Space Institute to present to the UN Secretary-General is currently collecting signatures from experts and concerned citizens from around the world.

The use of force or the escalation of below-threshold activities?

In 2021, the United Kingdom introduced a process to develop "norms, rules, and principles of responsible behaviour in space." In contrast to the focus on space weapons, this initiative is aimed at reducing opportunities for misunderstandings and miscalculations that can lead to unintended confrontation or conflict. This objective implies a focus on activities and behaviours in space that would fall below the threshold of the use of force, such as rules about jamming, lasing, non-cooperative rendezvous-and-proximity operations, and other non-destructive actions in outer space.

How to develop rules to prevent an arms race in outer space

States have also presented conflicting preferences for the types of rules that are needed to enhance the arms control regime in outer space.

A treaty or voluntary rules

The objective of PAROS is to achieve a new legally binding treaty to address perceived gaps in the existing legal framework governing outer space, specifically the use or orbiting of conventional weapons in outer space. The first such draft treaty was presented to the UN Secretary-General in 1981 and to the Conference on Disarmament in 1983 by the Soviet Union. A subsequent draft PPWT was presented to the CD in 2008 and again in 2014. A Group of Governmental Experts met in 2018-2019 to discuss the possible elements of such a treaty, but was unable to arrive at a final consensus report.

However, many states prefer voluntary – not legally binding – rules to govern activities and control threatening behaviours in outer space, with priority given to rules that prevent miscommunication and misperception, thus de-escalating unintended conflict in space. Many advocates of this approach contend that current international law – including the OST, UN Charter, and IHL – offers adequate regulation. Others have concerns about the technical feasibility of arms control proposals (see below). One significant example of this sort of effort is the draft code of conduct proposed by the EU in 2014, which failed to garner sufficient international support.

It should be recognized, however, that these two types of instruments are closely linked and many states see the value of both. By increasing and shaping transparency and confidence-building measures, voluntary rules can lead to a legally binding instrument. The current UK-led process on norms of responsible behaviour in outer space – structured as an open-ended process that could ultimately lead to a new legal agreement – reflects this spirit.

TCBMs

TCBMs are essential for the success of voluntary rules. They are also a critical component of treaties. UN General Assembly resolutions supporting TCBMs in outer space date back to the 1990s. A GGE report titled "Study on the application of confidence-building measures in outer space" was released in 1993. A second GGE study with recommendations on TCBMs was released in 2013. Efforts to identify practical measures to implement these recommendations are discussed at the UN Disarmament Commission. However, no practical initiatives or processes have yet been adopted.

Unilateral measures

Russia has co-sponsored an annual "no first placement of weapons in outer space" resolution that seeks political declarations by individual states not to be the first to place weapons in outer space. Some states object to it because it does not clearly define "weapons" or "placement" and is silent on the use of anti-satellite weapons based on Earth. Unilateral

moratoria on the testing of anti-satellite weapons have had some success in the past. Such initiatives can also serve as TCBMs.

How to regulate specific weapons

Finally, there are obstacles that relate primarily with how legal restrictions are assigned to specific weapons or hardware in space. There is no universal, clear definition of a 'space weapon'. It is not clear how to account for dual military and civilian uses of specific capabilities in outer space. And in the absence of such clarity, verification remains challenging.

While these challenges are not unique to outer space, attention must be paid to the particularities of the space capabilities and operations within the space environment.

Defining space weapons

The draft PPWT defines a space weapon as "any outer space object or its component produced or converted to eliminate, damage or disrupt normal functioning of objects in outer space, on the Earth's surface or in the air, as well as to eliminate population, components of biosphere important to human existence, or to inflict damage to them by using any principles of physics." Some states find this definition too broad and ill-suited to verification, especially when the dual-use nature of much space-based technology is considered. Other definitional challenges extend to behaviours in space and include such concepts as an armed attack in outer space and placement of weapons in space, which bring their own complexities.

Dual-use

Some states argue that almost any object in space could be used as a weapon and thus see insurmountable challenges in banning space weapons. While it seems obvious that most objects in space make poor weapons, it is certainly true that being able to distinguish among the uses of similar types of hardware is necessary for arms control.

Verification

Verification refers to the capability of states parties to determine if other states parties are complying with the agreement.

It is difficult to verify the nature or capability of any object once it is in outer space and too far from Earth to be closely observed or inspected by terrestrial-based instruments. However, some clues can be found by observing orbital parameters and orbit behaviours, which can be tracked with existing capabilities for space situational awareness.

Among the numerous studies and proposals that address this challenge are the following:

- Canada's proposal at the CD of PAXSAT, using satellites to monitor and verify the absence of weapons in space;

- A proposal by the USSR for an international space inspectorate to conduct on-site inspections of launch sites before each launch;
- France's proposal to create a UN International Trajectography Centre (UNITRACE) that collects data to update registrations, monitor space objects, and conduct real-time calculations of space objects.

None have progressed.

A GGE on the role of the UN in arms control verification, including in space, was initiated in the 1990s, but concluded that there is insufficient support for a global verification organization. Instead, most arms control agreements include their own processes and mechanisms for verification.

The challenges with verification are both technical and political. On the technical side, the collection of orbital information through space situational awareness – which today includes robust commercial capabilities – has advanced significantly, especially in monitoring the behaviour of objects in orbit. But inadequate data sharing and global access to sufficiently detailed information, as well as the interpretation of such information, remain political obstacles.

Institutional challenges

The Conference on Disarmament was established as "a single multilateral disarmament negotiating forum of the international community" in 1979, and a PAROS resolution that asked the CD to establish an ad hoc working group to negotiate a PAROS agreement was first introduced in 1982. But the CD, which operates on the basis of both substantive and procedural consensus, has been largely deadlocked since August 1996 (except for 1998 and 2009).

Effort to discuss issues related to military activities in outer space at the UN Committee on the Peaceful Uses of Outer Space (COPUOS) have likewise been blocked by a strict interpretation of the Committee's mandate and the operational requirement of consensus.

In an effort to navigate around these roadblocks, the EU sought to negotiate its international code of conduct for space activities outside these UN bodies, but it ultimately failed. The current Open-Ended Working Group on norms of responsible behaviours falls under the mandate of the UN General Assembly First Committee on Disarmament and International Security.

CONCLUSION

Arms control is urgently needed to ensure that outer space remains a peaceful domain that can be freely used for the benefit of all. The issue is complex and efforts to agree to specific arms control measures, either legally binding or voluntary, have been unsuccessful for decades. But the challenges themselves – including approach, scope, focus, and method – are not unique to space. Indeed, many of these challenges are inherent to arms control in general, and have been addressed through various means elsewhere. We can and should learn from these experiences.

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