2019

SPACE SECURITY INDEX

EXECUTIVE SUMMARY

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INTRODUCTION

Space Security Index 2019 is the 16th annual report on developments related to safety, sustainability, and security in outer space. It is part of the broader Space Security Index (SSI) project, which aims to improve transparency on space activities and provide a common, comprehensive, objective knowledge base to support the development of dialogue and policies that contribute to the governance of outer space as a shared global commons.

The Space Security Index is the only comprehensive assessment of outer space security. The current volume covers the period January to December 2018.

WHAT IS SPACE SECURITY?

The definition of space security guiding this report reflects the intent of the 1967 Outer Space Treaty that outer space should remain accessible for all to use for peaceful purposes now and in the future:

The secure and sustainable access to,
and use of, space and freedom from space-based threats.

The key consideration in this approach to space security is not the interests of particular national or commercial entities, but the security and sustainability of outer space as an environment that can be used safely and responsibly by all. This definition encompasses the sustainability of the unique outer-space environment, the physical and operational integrity of humanmade objects in space and their ground stations, as well as security on Earth from threats and natural hazards originating in space.

WHY DOES SPACE SECURITY MATTER?

Outer space is a global commons that is central to military, environmental, socioeconomic, and human security on Earth, as well as science, exploration, and discovery. The ability to access and use outer space is critical to the well-being of all nations and people. Resources in outer space support applications from global communications to financial operations, farming to weather forecasting, and environmental monitoring to navigation, surveillance, and treaty monitoring. It is imperative that all humankind can access and enjoy its many benefits today, and that this use is sustainable in the future. But maintaining the safety, security, and sustainability of outer space is challenging.

THE DYNAMICS OF SPACE SECURITY

The outer space environment is fragile and threatened by the accumulation of debris that results from all human activities, but which is exacerbated by accidental collisions and the intentional destruction of objects in orbit. Even the smallest pieces of debris can be harmful to satellites operating in space. At this moment, we don't have sufficiently precise information on what exactly is in outer space, where it is, and how it is moving through orbit to ensure that the objects and people that we send there remain safe.

This environment is also a scarce natural resource with limited abilities to support human activity, including available orbital positions, and radiofrequency spectrum to communicate data back to Earth. It is a harsh environment where safe operations are threatened by natural occurrences such as space weather.

And this environment is increasingly congested. The access and use of outer space is growing rapidly. There are currently more than 2,000 operational satellites in orbit owned by more than 70 countries, and thousands more are planned to provide new services such as space-based Internet and 5G connectivity. These new activities are expanding the number of global stakeholders who have an interest in maintaining the security of outer space and contributing to global well-being. Renewed interest in space exploration—particularly of the Moon—is inspiring a new generation of exploration and science, and possibly the discovery of new resources. But this activity, if not well governed, also adds pressure to equitable access to and sustainability of this environment.

As on Earth, activities in outer space are subject to cooperation, competition, and conflict. Sometimes these dynamics advance access to space through technological transfers and capacity building, and the agreement of new governance rules, such as the recent guidelines on the long-term sustainability of outer space. Sometimes, competition encourages wider access to space by spurring innovation in launch technology and new satellite services. But, sometimes, it hinders the ability to enhance security by, for example, encouraging competition and secrecy linked to orbital data. And, increasingly, competition—particularly military competition—risks escalating into conflict.

The prospect of conflict in space is accelerating as more states come to rely on space assets to support a broad array of military purposes, such as precise positioning, navigation, and timing; surveillance, reconnaissance, and intelligence gathering; strategic and tactical communications; and missile early warning and tracking. In this context, some states now consider outer space to be a domain of warfare. No hostile antisatellite attacks have been carried out against an adversary; however, development and demonstration of capabilities to interfere with or physically damage space systems are accelerating.

Governance is not keeping up. While there is widespread international recognition that the existing regulatory framework is insufficient to meet current and future challenges facing the outer space domain, the development of an overarching normative regime has been slow. While some progress has been made related to sustainability and safety, it remains insufficient. Questions related to national security uses of space and the dynamics of conflict and arms control remain unresolved.

WHAT ARE THE GOALS OF THE SPACE SECURITY INDEX?

In this context, project partners and sponsors strive to produce a resource that will serve as both a reference source for education and capacity building, and as a tool to grow trust, transparency, and dialogue in the pursuit of policies that enhance the safe, sustainable, and secure use of outer space for all users.

WHO IS SPACE SECURITY 2019 FOR?

Both experts and those new to the topic will find this report useful. It is an excellent resource for educators, journalists, students, government officials, diplomats, industry members, civil society, and anyone interested in outer space, its safety, security, sustainability, and governance.

WHAT'S INSIDE?

Inside this report, you will find contextual information and annual updates on 17 indicators of space security, organized under four broad themes. This arrangement is intended to reflect the increasing interdependence, mutual vulnerabilities, and synergies of outer space activities.

Space Security Index 2019 also includes a Global Assessment, which is intended to analyze and evaluate the effects of changing trends, critical themes, key highlights, breaking points, and new dynamics that are shaping the security of outer space and require international attention. The Global Assessment is prepared by a different expert on space security every year, to encourage a range of perspectives over time. The author of the current assessment is Dr. Brian Weeden, Director of Program Planning for Secure World Foundation. Respected and recognized as an international expert, Dr. Weeden has nearly two decades of professional experience in space operations and policy.

HOW IS THE REPORT PRODUCED?

The information in *Space Security Index 2019* is from a wide range of open-source materials from around the world. Initial research is assembled by senior students from several institutions, under academic direction and supervision.

Expert participation in the Space Security Index is a key component of the project. The primary research is peer-reviewed prior to publication through various processes, including the annual Space Security Working Group in-person consultation to review the draft text for factual errors, misinterpretations, gaps, and misstatements. This meeting also provides an important forum for related policy

dialogue on recent developments in outer space.

For further information about the Space Security Index, its methodology, project partners, and sponsors, please visit the website www.spacesecurityindex.org.

Comments and suggestions are welcome. Note that, unless specified, all monetary amounts are in U.S. dollars.

EXECUTIVE SUMMARY

DEFINITION OF SPACE SECURITY
The secure and sustainable access to, and use of, space,
and freedom from space-based threats

THEME 1 CONDITION AND KNOWLEDGE OF THE SPACE ENVIRONMENT

INDICATOR 1.1 Orbital debris

Space debris poses a significant, constant, and indiscriminate threat to the sustainability of the space environment and the operational integrity of all spacecraft. Traveling at speeds of up to 7.8 kilometers (km) per second, pieces of debris as small as 1 cm can destroy or severely disable a satellite upon impact; flecks as small as 5 mm can also cause system damage. Most space missions create some space debris, mainly rocket booster stages that are expended and released to drift in space along with bits of hardware. Serious fragmentations are usually caused by energetic events such as explosions. These can be both unintentional, as in the case of unused fuel exploding, or intentional, as in the testing of weapons in space that utilize kinetic energy interceptors.

The amount of space debris has increased steadily, accelerated by events such as the Chinese intentional destruction of one of its satellites in 2007 and the accidental 2009 collision of a U.S. Iridium active satellite and a Russian Cosmos defunct satellite. The U.S. Space Surveillance Network is currently tracking more than 23,000 objects larger than 10 cm, just over 2,000 of which are functioning satellites.

There is international consensus that debris is a problem that needs to be mitigated. Voluntary guidelines have been developed by the UN Committee on the Peaceful Uses of Outer Space (UN COPUOS) and endorsed by the UN General Assembly, but implementation remains a challenge that is further complicated by new technologies and practices. Capabilities for active removal of existing debris are being developed, but there is no consensus that it should be done, by whom, or how. Lack of consensus is linked in part to concerns that these capabilities could be used as weapons. Funding debris removal is another difficulty.

2018 DEVELOPMENTS

- Seven fragmentation events contribute new debris
- Debris threatens operational spacecraft, International Space Station
- Reentry and tracking of Tiangong-1 space laboratory and other objects
- UN COPUOS reinforces debris mitigation practices, but compliance rates remain uneven
- Proposals for large constellations of satellites raise questions about debris-mitigation plans
- First successful demonstration of debris-removal technology and other remediation efforts

INDICATOR 1.2 Radiofrequency spectrum and orbital positions

The growing number of spacefaring nations and satellite applications—as well as competition from terrestrial applications—is driving demand for access to radio frequencies and satellite orbits, which are scarce natural resources. Because radio waves broadcast irrespective of national borders, the use of spectrum needs to be managed internationally. While interference is not epidemic, it is a growing concern for satellite operators, particularly in crowded space segments. Issues of interference arise primarily when two satellite systems require overlapping frequencies within the same coverage zone on Earth. More satellites are locating in both Geostationary Earth Orbit (GEO) and Low Earth Orbit (LEO), using frequency bands in common and increasing the likelihood of interference. Competition for orbital positions, particularly in GEO, where most communications satellites traditionally operate, has caused occasional disputes between satellite operators. Demand for resources to support large and mega constellations of satellites in LEO is another source of significant pressure.

2018 DEVELOPMENTS

- 5G broadband, satellite constellations intensify competition for scarce radiofrequency resources
- DARPA Spectrum Collaboration Challenge seeks better way to manage spectrum, avoid interference
- Constellation plans linked to record number of satellites licensed to operate in LEO
- First unauthorized commercial satellite launch highlights regulatory gaps

INDICATOR 1.3 Natural hazards originating from space

Such hazards fall into two categories: Near-Earth Objects (NEOs) and space weather. NEOs are asteroids and comets in orbits that bring them into close proximity to Earth. By mid-2019 NASA's Center for Near Earth Object Studies had identified 20,449 known Near-Earth Asteroids, 2,000 of which were categorized as Potentially Hazardous Asteroids based on size and how closely they will approach Earth. Increasing international awareness of the threat posed by NEOs has prompted international discussions on the technical and policy challenges related to mitigation and the creation of an International Asteroid Warning Network (IAWN) and a Space Mission Planning Advisory Group (SMPAG). Ongoing technical research is exploring how to mitigate a NEO collision with Earth.

Space weather refers to a collection of physical processes, beginning at the Sun and ultimately affecting infrastructures on Earth and in space that support human activities. The Sun emits energy as flares of electromagnetic radiation and as electrically charged particles through coronal mass ejections and plasma streams. Powerful solar flares can cause radio blackouts and increase drag on satellites, lowering their orbital positions. Increases in the number and energy of charged particles can induce power surges in transmission lines and pipelines, disruptions to high-frequency radio communication and Global Positioning System (GPS) navigation, and failure or incorrect operation of satellites.

As space exploration accelerates, there is increasing attention to planetary protection, which involves practices to protect bodies in the solar system from biological contamination by Earth life and Earth from possible contamination when spacecraft return.

2018 DEVELOPMENTS

- Asteroid events reinforce need for improved detection capabilities
- Asteroid defense missions advance
- New policies, continued coordination on asteroid warning and preparedness strategies
- New space missions will enhance prediction of space weather, protection measures
- International and U.S. initiatives aim to coordinate space-weather data for preparedness and mitigation
- NASA process will review and revise policies for harmful contamination linked to space exploration

INDICATOR 1.4 Space situational awareness

Space situational awareness (SSA) refers to the ability to detect, track, identify, and catalog objects in outer space, such as space debris and active or defunct satellites, as well as to observe space weather and monitor spacecraft and payloads for maneuvers and other events. SSA enhances the ability to distinguish space negation attacks from technical failures or environmental disruptions and can thus contribute to stability in space by preventing misunderstandings and false accusations of hostile actions. Increasing the amount of SSA data available to all states can help to increase the transparency and confidence of space activities, which can reinforce the overall stability of the outer space regime. The Space Surveillance Network puts the United States far in advance of the rest of the world in SSA capability. Other states are developing additional SSA capabilities, but there is currently no global system for space surveillance or data sharing, in part because of the sensitive nature of surveillance data. Commercial actors are also developing comprehensive tracking capabilities and services.

SSA is also critical to the safety of collective operations in space and necessary for the development of any Space Traffic Management (STM) regulatory system, which could minimize the impact of growing congestion in space. Although widely recognized as important, STM is still at the discussion stage.

2018 DEVELOPMENTS

- Completed USAF Space Fence expected to produce more data, but ability to use could be limited
- National SSA capabilities and data sharing remain military priorities
- United States issues first policy directive on civilian space traffic management
- Expanding commercial capabilities for SSA data

THEME 2 ACCESS TO AND USE OF SPACE BY GLOBAL ACTORS

INDICATOR 2.1 Space-based global utilities

Global utilities are space assets that can be used by any actor equipped to receive the data they provide. The use of space-based global utilities has grown substantially over the last decade. Millions of individuals rely on space applications daily for functions as diverse as weather forecasting; navigation; surveillance of borders and coastal waters; monitoring of crops, fisheries, and forests; health and education; disaster mitigation; and search-and-rescue operations. Global utilities are important for space security because they

broaden the community of actors that have a direct interest in maintaining space for peaceful uses. Many, such as Global Navigation Satellite Systems (GNSS) and weather satellites, were initially developed by military actors, but have since become applications that are almost indispensable to the civil and commercial sectors. Space-based data is increasingly being provided as a means of monitoring global climate change and supporting socioeconomic development.

2018 DEVELOPMENTS

- Record number of GNSS satellites launched diversifies capabilities and services
- Initiatives that expand global connectivity face commercial limitations
- Commercial capabilities provide data for monitoring of weather, climate change, Earth science
- Tensions between open-data policies and commercial Earth observation
- Space-based data mobilized for sustainable development, supports disaster response and search-and-rescue

INDICATOR 2.2 Priorities and funding levels in civil space programs

Civil space programs can have a positive impact on the security of outer space. They constitute key drivers in the development of technical capabilities to access and use space, such as those related to the development of space launch vehicles. As the number of space actors able to access space increases, more parties have a direct stake in space sustainability and preservation for peaceful purposes. As well, civil space programs and their technological spinoffs on Earth underscore the vast scientific, commercial, and social benefits of space exploration, thereby increasing global awareness of its importance.

However, distinguishing civil space activity from other types of activity can be difficult. Capabilities developed by civil space programs often find dual applications in military sectors. Additionally, the rapid increase in access to and use of space creates greater impetus to manage the long-term sustainability and equitable use of the space environment.

2018 DEVELOPMENTS

- Seven agencies spend more than $1-billion; funding for new European Union Space Programme proposed
- Exploring the Moon, human spaceflight, and space-based natural resources
- Independent space capabilities, space launch remain priorities, but experience delays
- New space agencies, first satellites, and growing participation from Africa

INDICATOR 2.3 International cooperation and capacity-building in space activities

Due to the huge costs and technical challenges associated with access to and use of space, international cooperation has been a defining feature of civil space programs throughout the space age, with the International Space Station the most prominent example. Such cooperation facilitates access to space by pooling the significant financial resources and technical capabilities associated with space programs, and is a key component of global capacity-building. Several modes of cooperation and capacity building are coordinated through regional and UN bodies. Cooperation also enhances the transparency of certain civil programs that could potentially have military functions. As a source of technology transfer and influence,

cooperation can also advance strategic and political interests.

2018 DEVELOPMENTS

- 20th anniversary of the ISS marks expanding participation in space exploration
- Moon missions foster cooperative relationships
- UNISPACE+50 celebration linked to international cooperation in space
- Regional initiatives promote cooperation, access to space-based technology and services
- Space science remains a critical mode of international cooperation
- Emerging cooperation in space-based resource utilization

INDICATOR 2.4 Growth in commercial and private space activities

The role that the commercial space sector plays in the provision of launch, communications, imagery, and manufacturing services, as well as its relationship with civil and military programs make this sector an important component of space security. Recent growth in the commercial space sector has been driven by the pursuit of new satellite and launch technologies; new services related to communications and Earth observation; and the pursuit of new activities, including human space launch, exploration, and resource extraction. However, significant industry growth also poses problems such as orbital debris and interference, can add strain to national regulatory regimes, and is emerging in areas with few international rules for safety and sustainability. There is also growing private participation in outer space, financed by private money, often for private actors and purposes.

2018 DEVELOPMENTS

- First demonstration satellites for large constellations launched as plans expand
- More private investment funds new satellite and launch services
- Small satellites (smallsats) continue to drive changes in space access and use
- Proliferation of commercial launch vehicles and services, including first private rocket launches in China
- Commercial orders for space-based satellite servicing
- Interest in commercial space-based services remains nascent

INDICATOR 2.5 Public-private collaboration on space activities

There is a close relationship between governments and the commercial space sector. Governments support research and development, subsidize certain space industries, adopt enabling policies and regulations, and purchase commercial services. Some national space policies place great emphasis on maintaining a robust and competitive industrial base and encourage partnerships with the private sector. Many spacefaring states consider their space systems an extension of critical national infrastructure; a growing number view their space systems as inextricably linked to national security. By facilitating government access to space technology and capabilities, the private sector is closely embedded in questions of national security, including regulations to prevent the proliferation of sensitive technologies. Growing interdependence complicates space security by making commercial space assets potential targets of military attacks.

2018 DEVELOPMENTS

- State actors globally fund space startups
- Shift toward private activities on the ISS
- Public-private partnerships underpin future space exploration
- Commercial-military cooperation remains essential
- New trends in security regulations

INDICATOR 2.6 Space-based military systems

Space assets are being used for terrestrial military purposes by a growing number of states. The United States has dominated the military space arena since the end of the Cold War, and continues to give priority to its military and intelligence programs, which are now integrated into virtually all aspects of military operations. Russia maintains a large fleet of military satellites, many of which were developed during the Cold War. China does not maintain a strong separation between civil and military applications, and its rapidly growing program supports an increasing number of military functions, as does India's. Many actors use their civilian satellites for military purposes; however, the number of states with dedicated military satellites is increasing, as is cooperation among strategic partners. While the passive use of space assets for military purposes has long been accepted as peaceful, the prospect that conflict on Earth will spill into space is growing, because satellites have become a critical point of military vulnerability (see Theme 3).

2018 DEVELOPMENTS

- More efforts to reorganize U.S. military space capabilities to better pursue warfighting mandate
- Significant increase in U.S. military funding, capabilities focused on next-generation satellite services, missile defense
- Russia concentrates military spending and capabilities on missile warning, communications, reconnaissance
- China enhances full-spectrum defense capabilities to meet regional needs
- Regional security tensions spur new dedicated and dual-use military capabilities in India, Japan, South Korea
- Europe advances collective and independent military capabilities
- Progress made in filling capability gaps in the Arctic
- Emerging space programs prioritize dual-use Earth imaging for military reconnaissance

THEME 3 SECURITY OF SPACE SYSTEMS

INDICATOR 3.1 Electromagnetic and cyber vulnerabilities

Satellite ground stations and communications links are common targets for space negation efforts, including electromagnetic attacks using radiofrequency energy to interfere with or jam satellite communications, and cyber-attacks using software and network techniques to interfere with computer systems that operate satellites. Technology to interfere with satellite communication is mature and widely available and used,

even at a consumer level by non-state actors. Such attacks tend to be difficult to detect and to distinguish from unintentional interference; because they are generally temporary in nature, they are viewed as less escalatory. Military systems tend to be better protected than civil and commercial assets. New technological approaches to protection include the development of laser-based satellite communications, more secure ground stations and computer systems, and quantum encryption.

2018 DEVELOPMENTS

- Electronic warfare features in terrestrial conflict
- Steps toward more secure satellite communications
- More evidence of cyber vulnerabilities and intrusions, some protection efforts
- Quantum-encrypted communications progress and gain significant funding

INDICATOR 3.2 Reconstitution and resilience of space systems

Like satellite communications links and computer networks, the physical components of satellite systems are difficult to protect. Reconstitution and resilience of a space system involve the ability to rapidly rebuild that system in the wake of a space negation attack or to maintain the ability to withstand an attack; both could reduce vulnerabilities in space. Several advanced spacefaring states are pursuing enabling capabilities for resilience, which include rapid launch, the use of smaller and cheaper satellites, distributed systems, and redundant services and capabilities. As well, there are nascent state and commercial initiatives for space-based satellite servicing. However, such technical efforts could also enable space-based negation capabilities (see Indicator 3.4), particularly in the absence of transparency and global regulatory rules.

2018 DEVELOPMENTS

- Renewed U.S. emphasis on future resilient space design
- Capabilities for rapid launch slowly emerging
- Focus on resilience for assured access to positioning, navigation, and timing (PNT) capabilities
- Advancements and setbacks in on-orbit servicing

INDICATOR 3.3 Earth-based capabilities to attack satellites

Ground-based antisatellite weapons employing conventional, nuclear, and directed energy capabilities date back to the Cold War, but no hostile use of them has been recorded. Launching a payload to coincide with the passage of a satellite in orbit is the fundamental requirement for a conventional direct ascent, kinetic antisatellite (ASAT) capability. Tracking capabilities would allow a payload of metal pellets or gravel to be launched into the path of a satellite by rockets or missiles. Kinetic hit-to-kill technology, which involves interception and destruction of a target, requires more advanced sensors to reach the target. Targeting satellites from the ground using any of these methods has been described as more cost- effective and reliable than space-based options.

Many capabilities for terrestrial, physical attacks against satellites are embedded in other weapons systems, including intercontinental ballistic missile and anti-ballistic missile defense, and high-energy lasers. China, the United States, and India have each demonstrated the use of antiballistic missile systems against their own satellites. There is evidence of renewed development of dedicated ASAT capabilities,

including both kinetic and directed energy weapons. However, to the best of our knowledge, such systems have not yet become operational or deployed.

2018 DEVELOPMENTS

- Russia resurrects direct ascent antisatellite legacy programs
- Continued development and testing of dual-capability exoatmospheric missile intercept systems
- Development of ground-based directed energy capabilities for possible ASAT systems

INDICATOR 3.4 Space-based negation-enabling capabilities

No hostile use of space-based—or co-orbital—ASATs has been recorded; neither have there been dedicated weapons systems aimed at Earth placed into orbit, to the best of our knowledge. The capabilities for such systems would require enabling technologies much more advanced than those required for standard orbital launch, including precision on-orbit maneuverability and space tracking. It is important to distinguish tests of space-based systems that could have residual ASAT capabilities from tests of dedicated weapons systems. For example, autonomous rendezvous and proximity operations are essential building blocks for a space-based negation system, but they have dual-use for a variety of civil, commercial, and other military programs. While there is no evidence that they have been integrated into dedicated capabilities for space system negation, China, Russia, and the United States have demonstrated a variety of advanced on-orbit capabilities through opaque military programs.

2018 DEVELOPMENTS

- Inspector satellites, undisclosed spacecraft raise questions about co-orbital ASAT capabilities
- U.S. Department of Defense (DoD) directed to study space-based interceptor technologies, but no funding provided

THEME 4 OUTER SPACE GOVERNANCE

INDICATOR 4.1 National space policies, strategies, and laws

The development and publication of national policies and the strategies to implement them are conducive to greater transparency and predictability of space activities. Such activities describe the principles and objectives of national space actors with respect to access to, and use of, space. Common themes include the principles of peaceful and equitable use of space, the pursuit of space activities to achieve national socioeconomic and technological goals, and international cooperation. Strategic military competition in outer space is another underlying theme. However, few states publish comprehensive space policies that apply to all domestic civil, military, and commercial operators.

National space law is the primary vehicle for the implementation of international law, principles, and guidelines. More states are adopting regulatory measures as part of their international responsibility to license and oversee national space activities, including commercial actors. However, as space activities expand, some national laws and regulations are being established in the absence of international legal consensus.

2018 DEVELOPMENTS

- New national space policies and strategies clarify national goals and governance approaches
- National defense approaches reflect view of outer space as site of military action, warfighting
- More national regulations on space activities meet international legal obligations and practices

INDICATOR 4.2 United Nations forums for space security governance

The Outer Space Treaty represents the primary basis for legal order in the space environment, establishing outer space as a domain to be used by all humankind for peaceful purposes. Nonetheless, many technical issues related to the international governance of outer space security remain unresolved, including questions about the placement of conventional weapons or use of force in outer space, means of international cooperation and universal access, long-term sustainability of the space environment, space traffic management, and such emerging issues as the utilization of space-based mineral resources.

However, there is no single UN body responsible for the continued governance of outer space. The General Assembly First Committee on Disarmament and International Security and the Fourth Committee (Special Political and Decolonization) provide restricted mandates to the Conference on Disarmament (CD) and the Committee on the Peaceful Uses of Outer Space (COPUOS) respectively. New governance mechanisms have been achieved at UN COPUOS in the form of voluntary guidelines for the long-term sustainability of outer space. But at the First Committee and CD, consensus on additional measures to restrict the use of force in outer space has not been reached; a serious rift remains between states pursuing a legally binding arms-control framework and those in favor of voluntary rules. New initiatives are being pursued via a Group of Governmental Experts and the UN Disarmament Commission.

2018 DEVELOPMENTS

- Consensus erodes in UN General Assembly support for arms control in space
- No substantial results from discussions at Conference on Disarmament
- Group of Governmental Experts and Disarmament Commission begin new discussions on prevention of an arms race in outer space (PAROS) and transparency and confidence-building measures (TCBMs)
- UN Secretary-General's Disarmament Agenda calls for space to be preserved as a realm of peace
- UNISPACE+50 marks commitment to Space 2030 agenda
- UN COPUOS adds new members, adopts additional long-term sustainability guidelines
- Universalization of UN treaties makes progress, but registration of space objects lags

INDICATOR 4.3 Other initiatives

A growing number of diplomatic and governance initiatives relate to bilateral or regional collaborations in space activities. Examples include the work of the Asia-Pacific Regional Space Agency Forum, the Asia-Pacific Space Cooperation Organization, and the creation of an African space policy and agency. Groups of leading industrialized states such as the G7 and BRICS are becoming more engaged with questions of space governance, including non-weaponization. The UN Institute for Disarmament Research (UNIDIR)—an autonomous unit in the UN system—has also played a key role in facilitating dialogue among key space stakeholders. The Space Generation Advisory Council aims to bring the views of youth

and young professionals to bear on outer space governance.

Experts within civil society have supported various governance mechanisms, including proposals for arms-control treaties and responsible behavior in outer space. Currently, the McGill Manual on International Law Applicable to Military Uses of Outer Space (MILAMOS) and the Woomera Manual on the International Law of Military Space Operations are both under development. The Hague International Space Resources Governance Working Group is formulating governance recommendations and guidelines for space-resource utilization.

2018 DEVELOPMENTS

- Regional and bilateral government forums support coordination of space policy
- Experts focus on international space law related to military uses of space and resource utilization
- Private sector provides governance through industry standards, recommendations
- Civil society promotes governance for the sustainable exploration of the Moon
- Expanding societal engagement and participation in outer space

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