

Forum: The First General Assembly

Issue: The question of communication and imaging satellites threats to international security

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Introduction

The Index of Objects Launched into Outer Space, released by the United Nations Office for Outer Space Affairs (UNOOSA), reports that there are 7,389 satellites in orbit as of April 2021. The Soviet Union had launched the first satellite in 1957, preceding the Space Race. With the United States leading in space technology, followed by Russia, China, Iran and Democratic People's Republic of Korea (DPRK), more than 40 countries have developed satellites since the first launch. A handful of notable organizations have proved crucial to the security of satellites, and in turn, international security as a whole.

The aforementioned satellites continue to revolutionize an exorbitant number of aspects of human life, including advanced satellite imagery that contributes to studies in regional planning, forestry, and geolocation, as well as satellite communications regarding radio signals powering telephones, television, radio, and the internet. Though satellites assist growing commercialism for business sectors, communication and imaging satellites are simultaneously engaged in military aid, which attributes to intelligence collection through data analysis- of which can both be beneficial to international security when used appropriately, and eminently dangerous when exploited.

The increased awareness of the benefits of satellites, and their role in life enhancement, accredits to the proliferation of space activities. With robust and capable space services comes the threat of misuse and risk of exposure, considering the volatility derived from increasingly complex devices. These satellites can be intercepted, disabled,

and even destroyed by both indirect or accidental occurrences of collisions and contact with space debris, as well as direct cyber-attacks that lend to the potential of space warfare. Satellites, if not handled appropriately, can compromise the privacy of sensitive information and international security.

Definition of Key Terms

Communications satellite

An artificial satellite that relays telecommunications via transponders and transceivers and provides links between various geographical points on Earth. The satellite may receive, amplify, and relay analogue and digital signals to carry voice, video, and miscellaneous data. Communication satellites are used for broadcasting and telecommunications and may be commercial or governmental, for television, mobile service, and radio, or private conversation within the military and to connect with external organizations. Communications satellites used for military purposes may also be considered reconnaissance satellites for intelligence gathering.

Imaging satellite

A satellite or aircraft that applies remote sensing technology to detect radiation and physical characteristics enabling an understanding of Earth topography, meteorology, agriculture and oceanography, and high-resolution observations of planetary bodies as a whole through satellite imagery. Photographic reconnaissance satellites refer to what is, essentially, military-use imaging satellites to dissect the tendencies of certain areas on Earth as well as to discover any unnatural or warning movements, typically relating to deployment by enemy forces.

Reconnaissance satellites

A satellite that is primarily commissioned by military/governmental forces that aim to gather intel for crucial action involving attack and defence. These satellites are often disguised as “dual-satellites”, where they are additionally used for civil purposes to not draw attention from enemies.

International security

Refers to global action taken by all nations and their leaders as measures to protect the privacy, safety, and well-being of the people.

Space debris

Occasionally called space junk, space debris encompasses both natural and artificial debris travelling through space at high speeds. Natural debris derives from meteoroids while orbital debris refers to any man-made object in space that no longer serves its purpose.

Space warfare

A scenario where weapons within space are utilized for combat amongst nations or organizations; an armed battle using satellites and counter space weaponry.

Key Issues

Lack of satellite security

With such a heavy reliance on satellites to provide a fulfilling lifestyle in the 21st century, it brings increased attention to the security of satellites. Satellites, including the communications and photographic satellites in question, are controlled, maintained, and monitored through systems on Earth that, despite evolving much since their origin in the 1960s, have been criticized for having interceptable entry-points that could compromise

the entire organization. Oftentimes, the framework of a satellite is designed using products off-the-shelf that can be easily replicated so as to save on finances. This risks the protection and quality of the satellite, as well as allows individuals to recreate and study the design to gain an understanding of the satellite's unprotected aspects.

Cyber attacks and hackers

When the radio signals of satellites are interrupted, they cause a ripple effect that jeopardizes the information that the satellite carries. This could lead to significant economic losses as well as data leaks. There have been multiple cases where hackers have disrupted satellites and managed to tap into the concerned organization's system- including upwards of 13 instances via NASA in 2011. These cyber-attacks may destroy an organization's digital ecosystem and foundation, potentially harming international security when discussing military and governmental satellites conveying confidential details. Hackers then hold the potential to eavesdrop on secure radio communications, access private files, alter any found information, and/or shut down the satellite entirely. Hackers may be able to trace the location of confidential valuables, have access to the history of communication within the party (including emergency services), or, in worse cases, modify information and use the satellite as a weapon. An example of a hacked reconnaissance satellite would be the US-German ROSAT X-Ray satellite of 1998, where hackers redirected the satellite toward the sun, frying its batteries and, thereby, rendering it futile.

Debris overload and collisions

According to observations from NASA, there are pieces of orbital debris travelling at speeds up to 17,500 mph, currently cluttering the orbit of satellites. NASA's Department of Defence (DoD) has prioritized the overseeing of debris and keeps track of all objects and debris in orbit that, as of May 2021, reports 27,000 objects. Satellites, however, rarely make intensive contact with debris as a result of meticulous positioning,

avoiding a colossal collision. There were only two significant instances where debris or a satellite collided with another satellite to lead to an explosion and diminish the satellite's purpose. Though this precision aids the issue at hand, it is apparent that the number of space debris is greatly rising, alongside the rise in satellites and spacecraft being sent in orbit. These statistics justify new problems. Debris of all sizes accumulates in space to an alarming extent, inviting more collisions into satellites. The ESA defines the 'Kessler syndrome' as an extreme scenario where collisions involving space debris will cause more debris, leading to more collisions and will inevitably make the Earth's orbit unusable. Space debris poses threat to the functionality of satellites powering day-to-day life and the foundations of international security. Josef Aschbacher, the ESA's director-general, states that "these particles are causing enormous danger to the spacecraft on which our services down on Earth depend — communications, weather forecasting and a lot of infrastructure." The rapid surge in debris will hinge on satellite health and global protection. Despite the plans to engage in a clean-up of the Earth's atmosphere, many organizations with high capabilities fear the magnitude and expenses of the task.

Space warfare and counter space threats

Considering the vast capabilities of satellites, issues arise regarding the weaponization of space. Former US President Ronald Reagan first proposed the idea of weapons in space in 1983 to defend against Soviet missiles. Governments and organizations have since comprehended the capability of utilizing satellites to threaten others. In particular, many actors and governmental bodies target the United States' space activities in intimidation of their control and to challenge their high-ranked position in space. The weaponization of space is a broad matter and has previously been targeted by the 1967 Outer Space Treaty, prohibiting any weapons of mass destruction to be in orbit. Many nations, including China, Russia, and Iran, have previously revised their doctrines to expand on the militarization of space and thereby promote the idea of space warfare.

Electronic warfare

Electronic warfare refers to the use of advanced technologies to purposefully interfere with and control the electromagnetic spectrum. Falling under the umbrella of electronic warfare are Directed Energy Weapons (DEW). DEW are used to attack and disrupt enemy devices with high-power radiofrequency. Nations have ventured into the use of anti-satellite (ASAT) missiles to destroy and/or intercept crucial satellites with mobile launch systems and deployments from aircraft. The proliferation in satellite usage correlates to the rise in nation-wide awareness of space competence and the nine countries with independent orbital capabilities, referring to the United States, Russia, France, Japan, China, India, Israel, Iran and North Korea. In the past, China had famously tested an ASAT ballistic missile on a United States weather satellite to observe its efficiency and impact, resulting in the explosion of the satellite with debris byproduct. Recent times have made it clear that a multitude of nations are well-equipped to begin space warfare.

Lack of defining laws

Like mentioned earlier, there exist very few widespread treaties and agreements with regards to the extent to which countries can exploit space for warfare. The Outer Space Treaty and UNOOSA as a whole define the space law and outline a broad restriction of orbital weapons that 23 countries have yet to ratify. This leads to ambiguity and open interpretation of the use of imaging and communication satellites as well as ASATS as the technology and abilities of satellites grow rapidly.

Major Parties Involved and Their Views

U.S.A

The United States holds the highest power in space technology, having been the first nation to launch a satellite into orbit after the Soviet Union with the Explorer 1. They hold a significant upper hand in the use of outer space for the foundations of security

within the country, having established communications, surveillance, navigation, alongside encrypted servers for various military occurrences. The USA began their extensive exploration into space during the Cold War along with the development of intercontinental ballistic missiles. According to Statista.com, the US has 1,897 satellites in orbit as of January of 2021 and has the highest military spending in the world, with an estimated 778 billion. We have seen the US evolve greatly in their examination and overseeing of space activities as time passes, particularly so with the reformed US Space Force (USSF) being integrated into the American military. The USSF serves to protect the nation from any threats in orbit and to provide a grander base for space operations. The United States' constant efforts in space-based projects has made leeway for numerous breakthroughs in astronomy until date. Home to committed space corporations NASA and SpaceX, both pursuing space exploration and the use of space to promote international safety, the United States constantly advances their military and civil operations with the maximization of space-based services as well as the preservation of space capabilities, prioritizing security.

Russia

Historically, Russia was heavily involved with initial discoveries into space and space travel, launching the Sputnik 1 as the first satellite in orbit and being the first nation to send living beings into space. Early Russian space technology, including shuttles, various types of satellites, and rockets, had revolutionized the scene in the Space Race of the 1980s. Currently, Russia is ranked the third country with the most satellites and space power, with 179 satellites in orbit by January 2021. Russia leads their space activities with the Russian Space Agency/Roscosmos and continues to develop a military doctrine that aims to achieve supremacy in space. Russia also holds the International Scientific Optical Network (ISON), a non-governmental organization equipped with one of the largest networks of astronomical facilities. Seeing the US as a military threat, Russia

enables counter space systems to help neutralize and gradually diminish the US advantage all while being determined to exploit space-provided services to their military benefit. This technology, though relatively volatile, continues to reinvent the standard of space security. Russia proceeds with their goals of robust space capabilities and conceptualizes the use of DEWs for military defence and attack. According to the Russian Defense Minister, Sergey Shoygu, “Only with support from space will it be possible for the Armed Forces to reach maximum effectiveness.”

China

China precedes the United States in holding the highest number of operational satellites, with 412 in orbit. Since their first satellite launch in 1970, China has been engaged in an advanced space program to lead the nation to modern militarization and absolute space power. Cyberspace technology was a prioritized interest in China's military reformation as they hoped to lead in counter space weapons, electronic warfare, and satellite communications. State Council's State Administration for Science, Technology, and Industry for National Defense (SASTIND) is a Chinese organization that drives China's space-based activities and aids in resources, research, and funding. China holds an array of highly functioning devices with remote-sensing, navigation, terrestrial marking, and intelligence collection and has incorporated imaging and communication satellites into their military arsenal. Despite the growing economic spending on space discovery and potential warfare, China's doctrine promotes the idea of space diplomacy and non-weaponization. That being said, China has ambitious plans for the militarization of space and its use in defence and attack.

NASA

Created in 1957, the National Aeronautics and Space Administration (NASA) is a civil agency of the United States that consolidates space-related activity. NASA works

closely with the US federal government, with an annual budget of 23.2 billion dollars in Fiscal Year 2021. NASA notably led Projects Gemini and Apollo, where man first travelled to the moon. NASA is also a space agency operating, alongside other organizations, on the International Space Station (ISS), a spacecraft home to astronauts and space laboratories that serve to obtain in-depth knowledge of spatial qualities and space exploration. NASA uses satellites to focus on the study of Earth and space along with its protection through intel gathering. Furthermore, NASA also prioritizes the tracking and depletion of space debris, working firmly with the Department of Defence to construct guidelines to diminish the worry of satellite collisions. NASA views the preservation of space to be of the highest importance, aspiring to investigate the full potential of space-based activities as well as the avoidance of disrupting behaviours in orbit.

ESA

The European Space Agency (ESA) is an intergovernmental organization intending on maturing Europe's space rigour. The ESA broadly serves to develop the European space programme and carry out its activities to revolutionize space technology and analysis. Funding for the ESA in 2021 reaches 6.49 billion euros and spans multiple sectors, including navigation, space transportation, Earth observation, and space safety. On the whole, the ESA serves as the driving space force in Europe and authorizes all space activities. Like NASA, the ESA is also an integral member of the ISS. The ESA's stance on international security outlines that any and all activities commissioned by the ESA must serve peacefully and respect all allies and international organizations.

United Nations Office for Outer Space Affairs

In December 13, 1958, the United Nations Office for Outer Space Affairs (UNOOSA) was founded as a result of resolution XIII passed by the General Assembly,

as the steady interest toward the benefits of outer space piqued amongst society. The office exists to aid countries in the pursuit of utilising outer space for sustainable and societal development on the basis of space law and space application. They directly associate with nations and offer resources involving training, workshops, conferences, and knowledge-sharing portals, alongside opportunities to display an expansion in space capabilities such as fellowships and competitive programmes.

United Nations Committee on the Peaceful Uses of Outer Space

An integral part of UNOOSA is its subsidiary company, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). The committee was established on December 12, 1959 and is the primary governing body in the exploration of space and its relation to peace, safety, and security. The principles on which the committee builds their interface has since been the driver in all international space activities and missions and provides a platform wherein space law and goals are evolved to fit the ever-growing standards. COPUOS works closely with the Fourth Committee of the General Assembly and poses annual resolutions to update and advance the use of space.

Development of Issue/Timeline

Date	Event	Outcome
04/10/1957	Sputnik 1 launch	The USSR made history with the launch of the first artificial satellite, Sputnik 1. Being one satellite in a series of three, the Sputnik project established methods of sending man-made objects into space,

		observations of pressurization and atmospheric change via satellite lifetime, and was the first plunge into the Space Race and the involvement of orbital bodies in the Cold War.
31/01/1958	Explorer 1 launch	The US followed the USSR with the launch of the Explorer 1, the second artificial satellite. The Explorer 1 was the first satellite to incorporate additional scientific instruments and carried advanced ray detectors to measure orbital radiation. While the satellite initiated the United States' presence in space, it also heavily aided discovery into the properties of the Earth's magnetic field.
29/07/1958	Founding of NASA	The National Aeronautics and Space Administration (NASA) was originally developed as a US governmental space agency to oversee space exploration activities. NASA initially

		served to react against the Sputnik 1 and to promote American intelligence in the Space Race. It has since contributed greatly towards space technologies. NASA continues to support missions to further research the behaviours of the solar system, alongside the means to protect the Earth against space threats.
18/12/1958	First communications satellite- SCORE	SCORE was a 35-day US-initiated operation that managed to relay and receive radio signals as the first communications satellite in orbit. The satellite was successful and was the first step in better global connection as well as nationwide communication.
28/02/1959	First reconnaissance imaging satellite- CORONA program	The CORONA program was the first image reconnaissance satellite commissioned by the Central Intelligence Agency that discreetly provided

		surveillance over the Soviet Union during the events of the Cold War. The CORONA, though originally unsuccessful, eventually obtained footage of Soviet territory and crucially contributed to the militarization of space.
13/12/1963	Adoption of Resolution XVIII- “Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space”	The General Assembly first acknowledged the legality of space-use with Resolution XVII. The Resolutions detailed guidelines clarifying that all space-related activities must be in accordance with the UN and should prioritize peace and international cooperation. This resolution proved vital in the recognition of the potential of outer space.
27/01/1967	UNOOSA’s Outer Space Treaty	The Outer Space Treaty forbids the deployment of nuclear weapons and weapons of mass destruction (WMD) into outer space. The Treaty prohibits any military action to

		<p>occur on celestial bodies while additionally reinforcing the preservation of international security. Though the Treaty has yet to be ratified by 23 countries, it continues to be the backbone of laws regarding space activities.</p>
30/05/1975	Founding of the ESA	<p>The European Space Agency is an intergovernmental organization formed to elevate space technology throughout Europe. Engaging with sectors ranging from human spaceflight to telecom and integrated applications to navigation, the ESA dedicates itself to leading space activities to all its member states.</p>
20/12/2019	Independence of the USSF	<p>The US Space Force is the only independent space force and is aiming to mature the national doctrine and gain space power. The USSF advocates the creation of external space forces and the</p>

		advancement of space systems for potential military action.
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Previous Attempts to Solve the Issue

Debris tracking and databases

The monitoring of space debris is imperative to the avoidance of damaging collisions to highly sensitive satellites. The US Department of Defense's global Space Surveillance Network (SSN) sensors, alongside the ESA Space Operations Centre's Database and Information System Characterising Objects in Space (DISCOS) system, provide an elaborate database of all trackable debris and objects in orbit. The SSN detects and categorizes space debris and spacecraft while the DISCOS system catalogues the recorded data. Though the SSN sensors and DISCOS do not directly work with one another, both are leading networks that observe and organize orbital entities. The DISCOS system has recorded approximately 22 000 objects and can translate orbital information into an array of astute data tables for in-depth analysis. This information has been critical to the operational processes of the ESA, NASA, and the International Space System, as it decides evasive actions and debris avoidance manoeuvres that protect functioning satellites from collisions. All debris management systems support research and discovery into the properties of objects in orbit and their interaction with the atmosphere and may increase awareness for the load of space junk and the necessity of clean-ups and careful deliberation of space activity. Although untrackable debris is of minuscule sizes, the extremely high speeds at which debris travels could lead to massive explosions when in the proximity of active satellites- which, thereby, bolsters the vitality of debris tracking to protect international security.

Warfare prevention guidelines and organizations

As previously stated, the United Nations Office for Outer Space Affairs (UNOOSA) and its triumphant 1967 Outer Space Treaty serves to define the Space Law and maintain peace in space activities. UNOOSA was inaugurated as per the passing of Resolution XIII on December 13th, 1958, and serves to assist all nations in the effective, sustainable, and accessible use of space. The UN-SPIDER programme of UNOOSA uses satellite imagery and remote sensing to alert and manage concerned nations in the event of unnatural occurrences in space. The UN-SPIDER fosters the potential to detect anomalies of potential dangers in orbit and handle the situation as per protocol. The UN-SPIDER programme becomes essential to the prevention of space warfare as UNOOSA grows traction.

The Outer Space Treaty firmly decides that space should be utilized diplomatically and in a non-destructive manner. Organizations and nations are not to practice weapons testing on celestial bodies and are forbidden from instituting military bases in space. Party to the Treaty by 111 countries and yet to be ratified by 23 countries, the Treaty also dictates that space shall be free for exploration and is not subject to a claim of sovereignty or national appropriation while additionally guaranteeing liability by responsible State for any abrasive or harmful action in outer space. The weaponization and destructive exploitation of space have been forbidden since the establishment of said guidelines, driving the protection of international security.

Possible Solutions

Internationally agreed on resolution

With the military doctrine of many principal nations in the Space Race adapting to be more inclusive of both attack and defence weapons in space, perhaps the most reasonable course of action would be for all nations to deliberate over a resolution or treaty that respects the policies and beliefs of every member state. The resolution may tackle the extent to which outer space may be militarized, the grounds on which a satellite

may be deemed as “misused”, the appropriate classification of cyber warfare and hacking, and the distinguishment and authentication required for both government and commercial satellites. The General Assembly may collate the views of all member states to ensure the resolution may be employed and comply with the regulations developed in the resolution. With this in mind, it also begs the consideration of bias and fairness. The resolution must not impede on the purpose and functionality of satellites since reconnaissance, governmental, and commercial satellites fuel the workings of many nations' lines of defence and technology. Bias shall be revoked as all member states have their interests integrated within the resolution so as to provide a most agreed-upon resolution. The resolution would define the complications around the use of space and the fruitful advancement of space technologies. This resolution would have the potential for more economically and technologically capable nations to make their stances on space warfare and the future of satellite usage clear. Member states with power in space may agree on counter space capabilities and the limits of space weaponization. This resolution would clarify the globally accepted regulations of satellites and the use of outer space and may build the foundation for total orbital security.

Space clean-ups

Though there have been many attempts at building strategies to remove orbital debris, like NASA's Orbital Debris Program, none have lifted off the ground to eliminate larger space debris, and rather, discuss techniques to minimize the amount of debris emitted by future spacecraft. In 2019, the ESA announced that they would be launching the ClearSpace-1 debris removal mission set for 2025, aiming to be the world's first space clean-up. The proposal for the mission shall be aided by ClearSpace, a company affiliated with the ESA focusing on On-Orbit Servicing and Debris Removal, who is continuing to work towards a final proposal. The ESA plans on actively contributing to the clean-up and reducing the space traffic of junk and inactive satellites to avoid

highly-volatile collisions. According to the ESA's official website, the mission involves what's called the ClearSpace-1 'chaser' that shall observe the debris and conduct critical tests prior to capturing the debris using robotic arms under ESA's approval. ClearSpace-1 sets an example for how organizations and nations can take initiative to eradicate debris overload through space junk removal practices and missions. Seeing that the ESA and ClearSpace have already proposed the technology and protocol behind the clean-up, other organizations may adapt the idea to be more impactful. Said organization may take similar concepts to the ClearSpace-1 mission and dilute them to be more achievable, without compromising on quality, with smaller teams of people or to be carried out more frequently than in larger loads. Large space powers can utilize their resources and potentially collaborate with one another to construct an effective plan to extract space junk out of orbit and to develop more comprehensive space technologies for further debris removal as time passes.

UN affiliated portal for satellites

Verification and legitimacy of satellites have often proved to be an issue with regards to protection and safety, where satellites developed for misconduct can greatly risk international security. This recommends a UN-governed portal, potentially part of UNOOSA, where all active satellites can be examined, approved, and monitored. Like UNOOSA itself, the portal may serve to provide a secure, efficient, and accessible service to those nations and organizations that wish to register their satellites. This portal may work with organizations directly to appropriately catalogue it with details such as the launch date, satellite type, and purpose. Upon its launch, the designated team may monitor the behaviour of the satellite and may contact the connected organization in the event of a strange occurrence, after which an investigation may be conducted. This portal may be subject to national approval as the regulations and policies must not infringe upon a nation's sovereignty nor disrespect an organization's beliefs. Once a consensus has been

met, the team may assume trust to certain organizations and open the portal for use that ensures peace in space. If a team is designed along with a portal, this may ensure that all issued satellites are in compliance with the Space Law and that the satellites themselves are additionally secure from unsolicited hacks thanks to the team overseeing the said satellite.

Satellite encryption

Threats of imaging and communications satellites being hacked stem from the fact that most satellites lack any sort of security or encryption, especially since hackers can pass firewalls. This calls for further authentication required to manage satellites and added encryption in mind when designing said satellites. Therefore, satellites are recommended to integrate network security architecture/cyber security architecture. Cyber security architecture refers to a framework that specifies the functional behaviour of the network, the organizational structure, and the policies- essentially ensuring that all IT aspects of the device are encrypted. The cyber security architecture of satellites may follow the “Zero Trust” model, which denotes the devices, people, data, networks, workload, automation & orchestration, visibility & analytics of the satellite so as to restrict access to it and encourage complete security. This would also promote authentication services at every stage of data transmission. Along with this, organizations are encouraged to perform a security audit prior to launching the satellite to certify that the satellite is safe for launch. These measures can be taken to develop the basic authorization required for satellites and to make sure that imaging and communications satellites carrying sensitive information, including emergency services, military and governmental use, and commercial use, can be secure from hacks that threaten international security.

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