



Promoting Cooperative Solutions for Space Sustainability

Emerging Challenges to Space Stability and Security

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Note: This briefing is compiled entirely from public, unclassified sources



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SWF – A Quick Primer

- Secure World Foundation (SWF) *is a private operating foundation* that promotes cooperative solutions for space sustainability
- **Our vision:** The secure, sustainable, and peaceful uses of outer space that contribute to global stability on Earth
- **Our mission:** Secure World Foundation works with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve the secure, sustainable, and peaceful uses of outer space benefiting Earth and all its people





















SWF's Key Focus Areas

- **Space Sustainability:** Ensuring that all of humanity can continue to use outer space for peaceful purposes and socioeconomic benefit over the long term
- **Space Policy and Law Development:** Promoting and assisting in the development of international and national norms, laws, and policies to foster responsible behavior by States and private sector actors
- **Human and Environmental Security:** Promoting improved governance and international cooperation in the delivery of information derived from space systems

SWF's Counterspace Threat Assessment

- Space domain undergoing significant changes
- Existence of counterspace capabilities is not new, but the circumstances surrounding them are
- Discussions of space capabilities often veer quickly into classified territory
- *Global Counterspace Capabilities: An Open Source Assessment*
 - Significant research and development of a broad range of kinetic (i.e. destructive) and non-kinetic counterspace capabilities in multiple countries: direct ascent, co-orbital, electronic warfare, directed energy, cyber
 - US, Russia, China, Iran, North Korea, India, France, and Japan
 - ***Only non-kinetic capabilities are actively being used in current military operations***
- <https://swfound.org/counterspace>; NB that there is a Spanish-language version of the executive summary available

Russia Overall 2020 Assessment

	R&D	Testing	Operational	Use in Conflict
LEO Direct Ascent			-	
MEO/GEO Direct Ascent		-	-	
LEO Co-Orbital			-	
MEO/GEO Co-Orbital		-	-	
Directed Energy			?	
Electronic Warfare				
Space Situational Awareness				?

Legend: none  some  significant  uncertain "?" no data "-"

China Overall 2020 Assessment

	R&D	Testing	Operational	Use in Conflict
LEO Direct Ascent	●	●	●	●
MEO/GEO Direct Ascent	●	●	-	●
LEO Co-Orbital	●	?	-	●
MEO/GEO Co-Orbital	●	-	-	●
Directed Energy	●	●	-	●
Electronic Warfare	●	●	●	?
Space Situational Awareness	●	●	●	?

Legend: none ● some ● significant ● uncertain “?” no data “-”

U.S. Overall 2020 Assessment

	R&D	Testing	Operational	Use in Conflict
LEO Direct Ascent	●	●	-	●
MEO/GEO Direct Ascent	-	-	-	●
LEO Co-Orbital	●	?	-	●
MEO/GEO Co-Orbital	●	?	-	●
Directed Energy	●	●	?	●
Electronic Warfare	●	●	●	●
Space Situational Awareness	●	●	●	●

Legend: none ● some ● significant ● uncertain “?” no data “-”

New Entrant to the ASAT Club: India

- Historically, Indian space program focused on civil applications
- Changes in recent years have given its military a larger role
- March 2019 held a DA-ASAT test – Mission Shakti
- Started its Defence Space Agency in April 2019
 - Intended to coordinate efforts of three branches of its armed forces and work on space protection policies for its space assets
- Established its Defence Space Resource Organisation in June 2019
 - Will conduct research and provide technical support to the DSA
- Held a tabletop exercise – IndSpaceEx – in July 2019 to game out space warfare possibilities and identify gaps/weaknesses in its space security
- ISRO began Project NETRA (Network for space object Tracking and Analysis) in September 2019, which is intended to give India its own SSA network by bringing together radars, telescopes, data processing, and a control center



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Very Limited Iranian Space Program

- Space program in early stages
- Unlikely to have the capacity to build on-orbit or direct-ascent ASAT weapons
- Minimal SSA capabilities
- Demonstrated ability to interfere with commercial satellite signals



Extremely Limited DPRK Counterspace Capabilities

- May have some limited direct-ascent ASAT capability, but not threatening yet
- Minimal space launch vehicle and satellite capabilities
- Counterspace not mentioned by DPRK officials
- C2, SSA capabilities minimal
- Multiple public reports of GPS interference and jamming
- EMP unlikely

France's Counterspace Beginnings

- July 2019 release of Space Defense Strategy
 - Seeks to improve SSA around French space assets, provide the assets with some sort of active defense
 - Would do so via ground-based lasers (to dazzle) and space-based inspection satellites
- Macron announced July 2019 that the Joint Space Command within the French Air Force will become a full Space Command
- French Ministry of Defence allowed to conduct activities in space
- Parly discussed lasers on nanosatellites, which would be technologically challenging
- No plans for a DA/ASAT capability at this time
- GRAVES radar, some other assets that have SSA as their secondary mission; looking to build on joint French/German assets

Japan's Counterspace Considerations

- August 2019 announced would be investigating whether to develop a satellite that could intercept foreign threat satellites
 - If decided it did, wanted the ability to field it by mid-2020's
 - Could include cyber, RFI, and robotic arms
- No DA-ASAT capability officially, but does have the SM-3 system that the US has tested in an ASAT capacity
- Is considering jamming capabilities that could interfere with both airborne warning and control system (AWACS) planes (possibly by the mid-2020's) and then foreign satellites
- JAXA has SSA capabilities to monitor LEO and GEO; Japanese MoD working to develop its own SSA capabilities
- Will establish its Space Domain Mission Unit (SDMU) in April 2020

Cyber as a Counterspace Option

- Space capabilities become an attractive target for counterspace efforts
 - Kinetic attacks less likely option
 - Electronic warfare/cyber attack seen as more usable
- Destabilizing because laws of armed conflict for space are unclear
 - International law and military rules of engagement still being worked out

- Possible cyberattacks: jamming, spoofing, attacks on ground infrastructure
 - Can be done by state and non-state actors
- Already seeing interference with satellites
- New entrants to space means new entry points for attacks
- Blurring of lines between different types of satellites means hard to ensure resiliency
 - Example: hosted national security payloads on commercial launch vehicles

- Many satellites are old and based on even older technology
- Increased use of commercial-off-the-shelf allows for possible entry
- Internet of Things (IoT) means that a lot more devices are going to be connected

U.S. Space Policy and Doctrine

- National Space Policy of 2010 still official U.S. space policy
 - Emphasis on international cooperation and cooperative initiatives
 - Willingness to consider arms control measures for space activities
- Trump administration
 - SPD 1: Reinvigorating America's Human Space Exploration Program
 - SPD-2: Streamlining Regulations on Commercial Use of Space
 - SPD-3: National Space Traffic Management Policy
 - SPD-4: Establishment of the United States Space Force
- USG officials talk of space being a war-fighting domain
- SSA sharing agreements: 20 countries, 2 IGOs, over 80 commercial partners
- Defense Space Strategy released June 2020

State of the Space Force

- Dec. 20, 2019, U.S. Space Force (USSF) became 6th branch of the U.S. armed forces via the enactment of the FY2020 National Defense Authorization Act (NDAA)
 - AF Space Command was redesignated the USSF
- Mission: “organize, train, and equip military space forces of the United States to provide: freedom of operation in, from, and to the space domain; and prompt and sustained space operations”
- USAF will provide 80% of foundational and infrastructure support for USSF
- Complication: Space Development Agency and milspace acquisition
- Messaging about the role and goals of Space Force have been mixed

- Existed 1985-2002
- Congress passed legislation reestablishing Space Command in FY19, and it was officially stood up Aug. 2019
- 11th unified combat command – geographic one, with AOR of 100 km and above
- Per Space Command head AF Gen. John Raymond, its mission is the 4 D's: **d**eterrence, **d**efend, **d**eliver warfighting capabilities globally, and **d**evelop warfighting cadre
- Space Force will train and equip war fighters; Space Command will focus on warfighting and identifying threats to U.S. space assets

Other Disruptions to the Space Domain

- The Air Force maintains a catalog of about 26,000 objects 10 cm or greater
 - As the Space Fence comes on-line this year, that number is expected to go to 100,000
- Active satellites: 2666, as of April 2020
 - Megaconstellations, which started launching in 2019, could add 100,000 *more* satellites
- New actors in orbit
- New uses of space and concerns about space resource usage
- Who's in charge?

STM Considerations in General (1)

- Should Space Traffic Management (STM) be civilian in nature or military?
 - What is its end goal?
- Should STM be undertaken from a top-down approach or a bottom-up?
 - Top-down: more political capital and leadership means better chance of being implemented...eventually, but also requires strong domestic capacity
 - Bottom-up: allows for a more organic development of STM capabilities but might have replication/gaps in capabilities
- Requires some sort of global governance mechanism to set rules and establish ways to trust STM guidance

STM Considerations in General (2)

- Smallsats and new space actors provide different STM challenges
- Anti-satellite tests that create debris stress current SSA capabilities
- Existing end of life norms for satellites are outdated and complicate STM
- The launch state is not always clear – who's liable?
- Active debris removal raises serious policy and legal concerns
- How do we achieve transparency in STM?
 - What role can norms play in establishing a stable and predictable environment?

Norms in Space Governance

- Much of the existing space governance framework is based on norms
 - Example: Freedom of overflight for satellite reconnaissance
 - Launch of Sputnik in 1957 helped set the norm that satellite overflight did not breach territorial sovereignty
 - By mid-1960s, freedom of overflight was a generally accepted norm
 - Was not codified into “hard law” until Outer Space Treaty of 1967
- Norms are likely going to be the main mechanism to address future challenges
 - Far more space actors than ever before, with diverse interests and goals
 - Increasingly challenging to get global consensus on new “hard law”

SWF Handbook for New Actors in Space

- **Goal:** Create a publication that provides an overview fundamental principles, laws, norms, and best practices for safe, predictable, and responsible activities in space
- **Two specific audiences:**
 - Countries developing space programs and/or having to oversee and regulate their first satellites
 - Universities and start-up companies that are developing/operating satellites



www.swfound.org/handbook



Development of OOS and RPO Capabilities

- On-orbit servicing (OOS) and Rendezvous and Proximity Operations (RPO) are key to enabling future of on-orbit activities
- Benefits and challenges
 - Greatly increase the viability of and benefits from space activities
 - Raises a number of diplomatic, legal, safety, operational, and policy challenges that need to be tackled
- OOS and RPO are not new, and are already international
 - 50+ years of experience in doing it with human spaceflight, but increasingly shifting to robotic/autonomous
 - Multiple countries/companies developing and testing RPO capabilities
- How to develop norms and standards to enable cooperative OOS/RPO and mitigate challenges?

DARPA and Satellite Servicing

- The Defense Advanced Research Projects Agency (DARPA) has had a long history with developing cooperative OOS technologies
 - Orbital Express, Robotic Servicing of Geosynchronous Satellites (RSGS)
 - Goal is to develop/demonstrate core technologies, and spin them off to industry
- Establishing norms and standards is essential to creating a vibrant commercial OOS industry
- Consortium for Execution of Rendezvous and Servicing Operations (CONFERS) program is meant to be a forum where industry and other stakeholders can engage to develop standards and norms



Advanced Technology International

- Prime, lead for consortium development



Secure World Foundation

- Lead for outreach and engagement



University of Southern California Space Engineering Research Center

- Conducting research into existing standards and practices



Space Infrastructure Foundation

- Space-related standards development expertise



CONFERS Objectives

- Leverage best practices from government and industry to research, develop, and publish non-binding, voluntary consensus standards (technical and operations) for cooperative OOS and RPO
- These standards would provide the foundation for a new commercial repertoire of robust space-based capabilities and a future in-space economy
- Be open to participation by private sector stakeholders in the satellite servicing community
- Initially supported by DARPA, CONFERS intends to transition to fully private-sector operations over a period of several years
- Information on membership application process is available on the CONFERS website at: www.satelliteconfers.org



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Other Commercial Norms Efforts

- Space Safety Coalition
- Satellite Industry Association's "Principles of Space Safety for the Commercial Satellite Industry"

Woomera and MILAMOS Manuals

- Woomera Manual on the International Law of Military Space Operations



Manual on International
Law Applicable to Military
Uses of Outer Space

- Challenging to accurately include all stakeholders because very state-centric
- Limitations of the Conference on Disarmament
- Space security discussions are stymied at the multilateral level
 - Subsidiary Body 3 of the UN Conference on Disarmament
 - GGE on further practical measures for the prevention of an armed race in outer space (PAROS)
 - UN Disarmament Commission Working Group 2
 - PPWT and NFP versus...????
- Example: KE-ASAT test guidelines
 - UNIDIR: no debris, low debris, notification

What are the LTS guidelines?

- In 2010, the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) established the Working Group on the Long-Term Sustainability (LTS) of Outer Space Activities
- The Working Group was tasked with producing a set of voluntary, non-binding guidelines for all space actors to help ensure the long-term sustainable use of outer space
- The Working Group's mandate ended in June 2018, at which point the UN COPUOS member States reached consensus on 21 guidelines and a context-setting preambular text.
- In June 2019, the COPUOS plenary officially adopted these 21 guidelines, and agreed to create a working group under the agenda item of on the long-term sustainability of outer space activities of the Scientific and Technical Subcommittee

LTS guidelines Working Group

- The Working Group considered current practices, operating procedures, technical standards, and policies relevant to space sustainability and safety; and took as its legal framework the existing UN treaties and principles governing space activities
- The Working Group established four expert groups to discuss specific topics, propose candidate guidelines, and focus on the following thematic areas:
 - Expert Group A: Sustainable space utilization supporting sustainable development on Earth;
 - Expert Group B: Space debris, space operations and tools to support collaborative space situational awareness;
 - Expert Group C: Space weather; and
 - Expert Group D: Regulatory regimes and guidance for actors in the space arena

The 21 LTS guidelines

- The 21 agreed guidelines comprise a collection of internationally recognized measures for ensuring the long-term sustainability of outer space activities and for enhancing the safety of space operations
- **92 Member States agreed on these guidelines**
- Full text of agreed guidelines available in UN document A/AC.105/2018/CRP.20. The four major sections:
 - Policy and regulatory
 - Safety of space operations
 - Cooperation and capacity-building
 - Scientific and technical R&D



Questions?

Thanks.

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