

Space Sustainability and Security: An Overview

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Presentation for NASA PreCollege Summer Institute (PSI)

July 19, 2023



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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 peoples



Space Sustainability Challenges

- A lot more activity happening in space
 - Growing number & diversity of space actors (governments and commercial companies)
 - Growing number & diversity of space activities
- Negative externalities could have widespread impacts for everyone
- Very few hard “rules” about what is and isn’t allowed

How can we ensure space is usable for future generations and users??



Space Governance

- Much of the existing space governance framework is based on norms
 - Example: Freedom of overflight for satellite reconnaissance
 - Was not codified into “hard law” until Outer Space Treaty of 1967
- Four main treaties: OST, Registration Convention, Liability Convention, Rescue Agreement
- Norms are likely going to be a major mechanism to address future challenges
 - Focus on identifying responsible behavior
 - Non-legally binding approaches like the Artemis Accords becoming popular



Human-Generated Space Objects

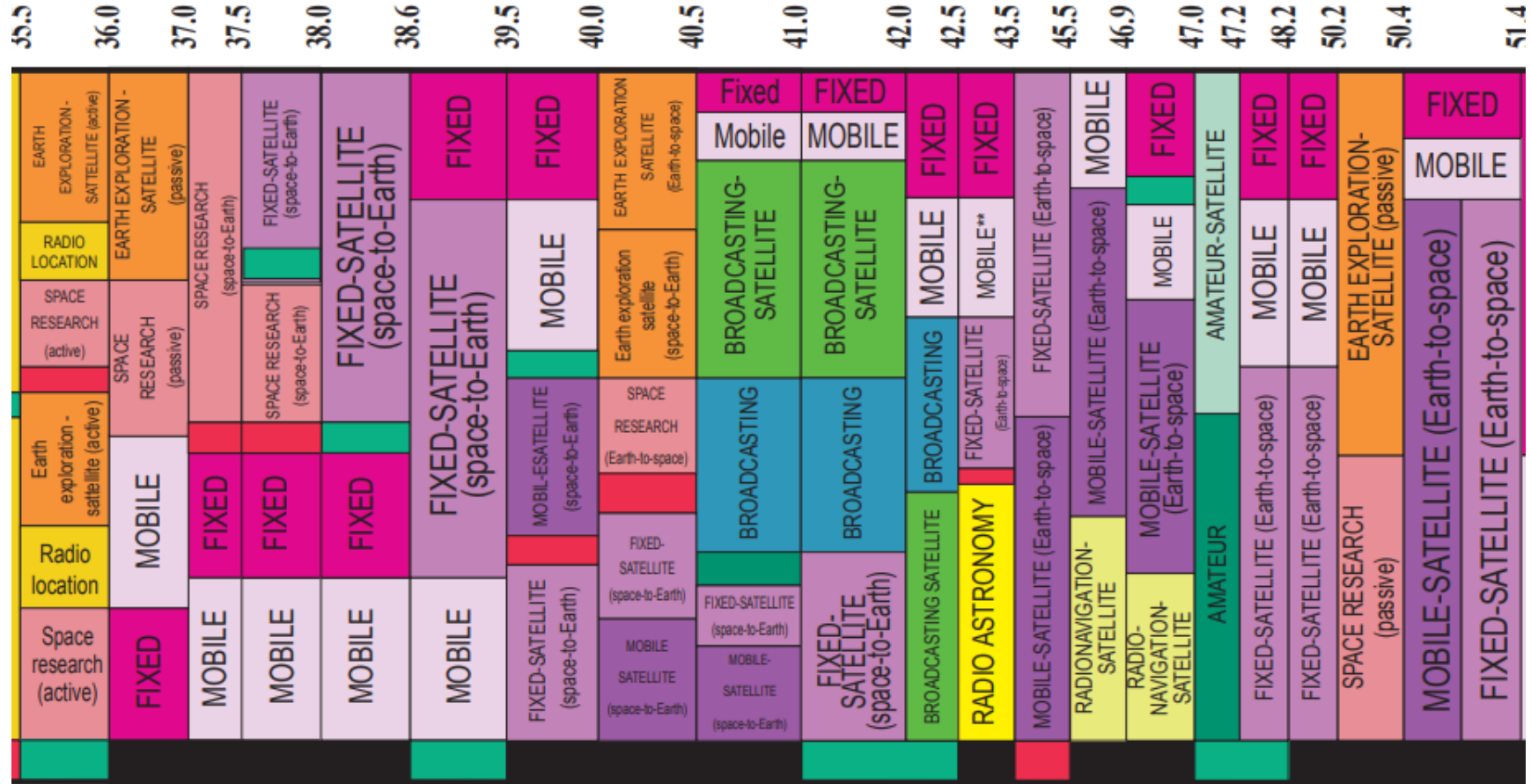
- Active satellites:
 - Total: 8400+
 - US: 5500
 - Russia: 240
 - China: 740
 - SpaceX' Starlink: 4450

Space Debris

Larger than 10 cm	~25,000	Sources of new debris
Between 1 and 10 cm	~700,000	Can cause major damage
Smaller than 1 cm	Many millions	Can cause minor damage



RF Spectrum Congestion



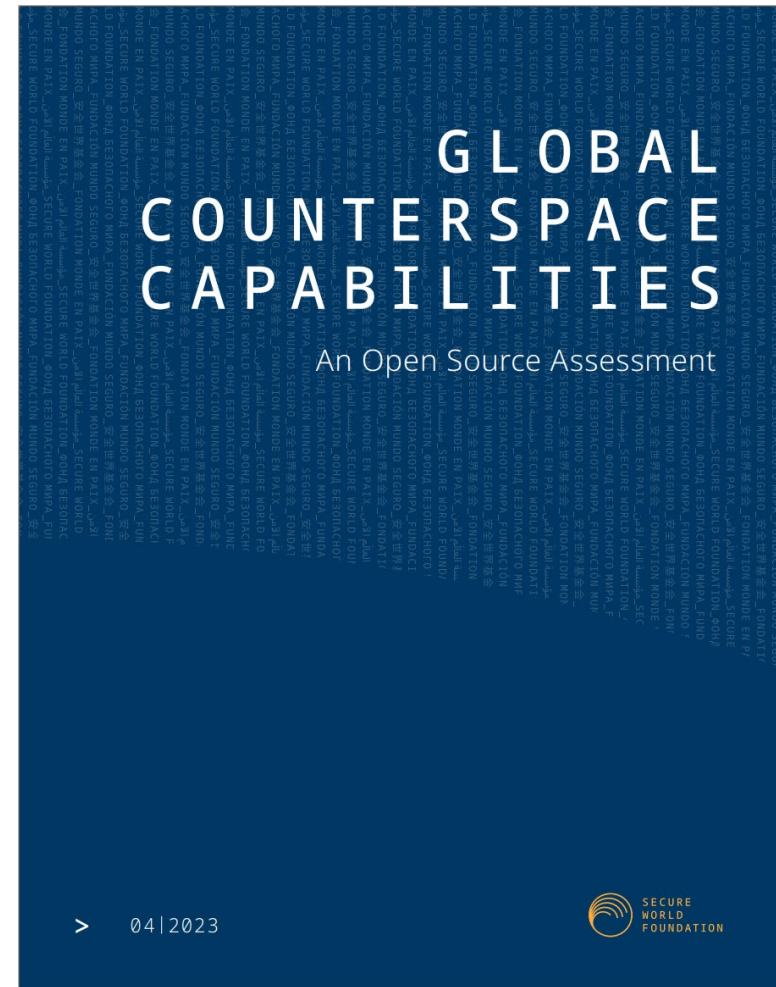


Congestion on and around the Moon

- 106 cislunar and lunar missions by 19 countries and one multilateral organization (ESA)
- Complications on Earth replicating on the Moon?
- Activities on the Moon changing
- Artemis Accords vs International Lunar Research Station?



- Existence of counterspace capabilities is not new, but the circumstances surrounding them are
- Significant R&D/testing of a wide range of destructive & non-destructive counterspace capabilities by multiple countries
- ***Only non-destructive capabilities are actively being used in current military operations***



<https://swfound.org/counterspace>

2023 Global Assessment

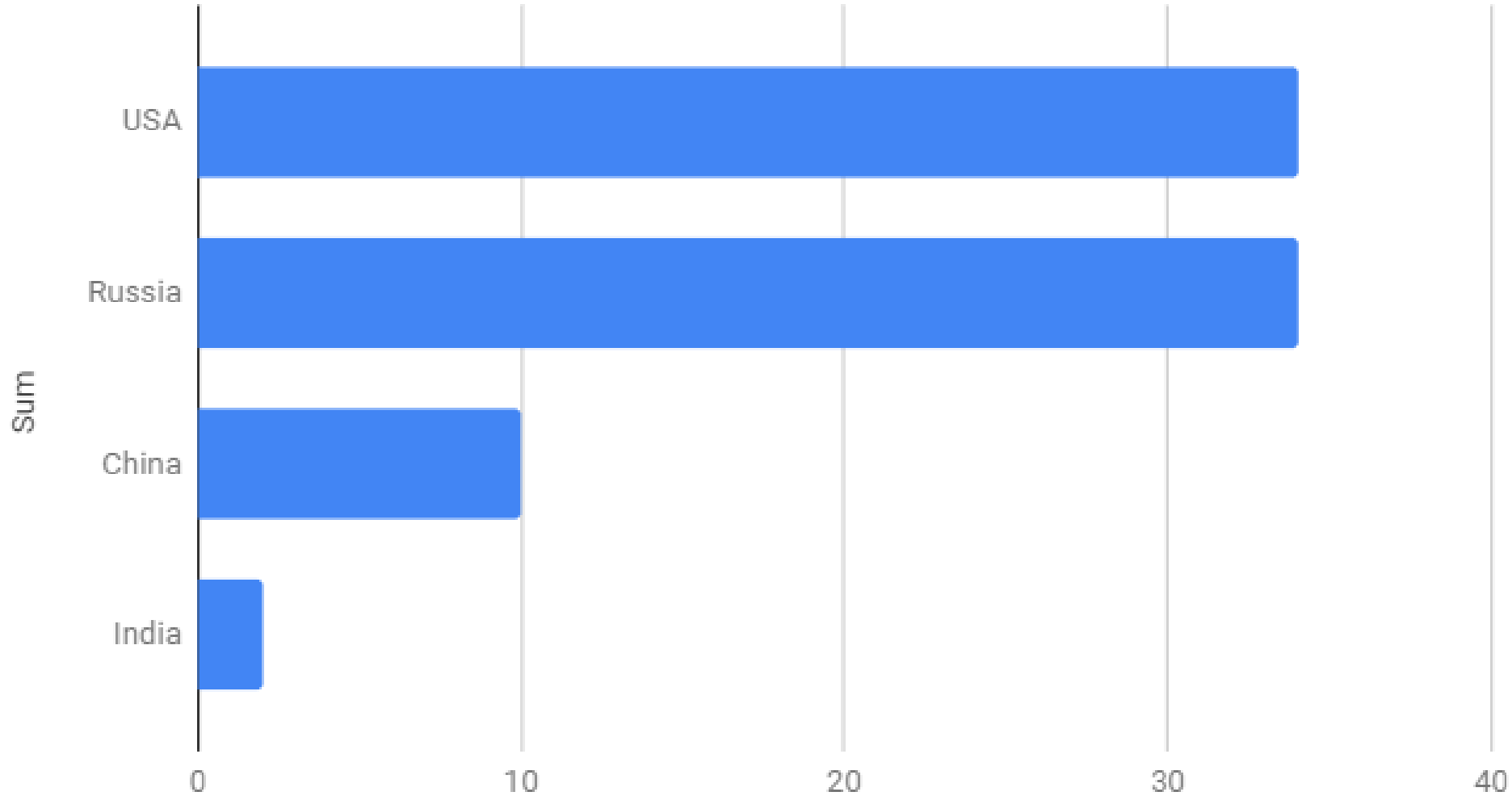
	U.S.	Russia	China	India	Aus.	France	Iran	Japan	North Korea	South Korea	U.K.
LEO Co-Orbital	some	significant	some	none	none	none	none	none	none	none	none
MEO/GEO Co-Orbital	some	significant	some	none	none	none	none	none	none	none	none
LEO Direct Ascent	some	some	significant	some	none	none	none	none	none	none	none
MEO/GEO Direct Ascent	some	some	some	none	none	none	none	none	none	none	none
Directed Energy	some	some	some	none	none	some	none	none	none	none	none
Electronic Warfare	significant	significant	significant	some	some	some	some	none	some	some	none
Space Situational Awareness	significant	significant	significant	some	some	some	some	some	none	some	some

Legend: none ● some ◻ significant ▲





ASAT Tests by Country





ASAT Tests by Year

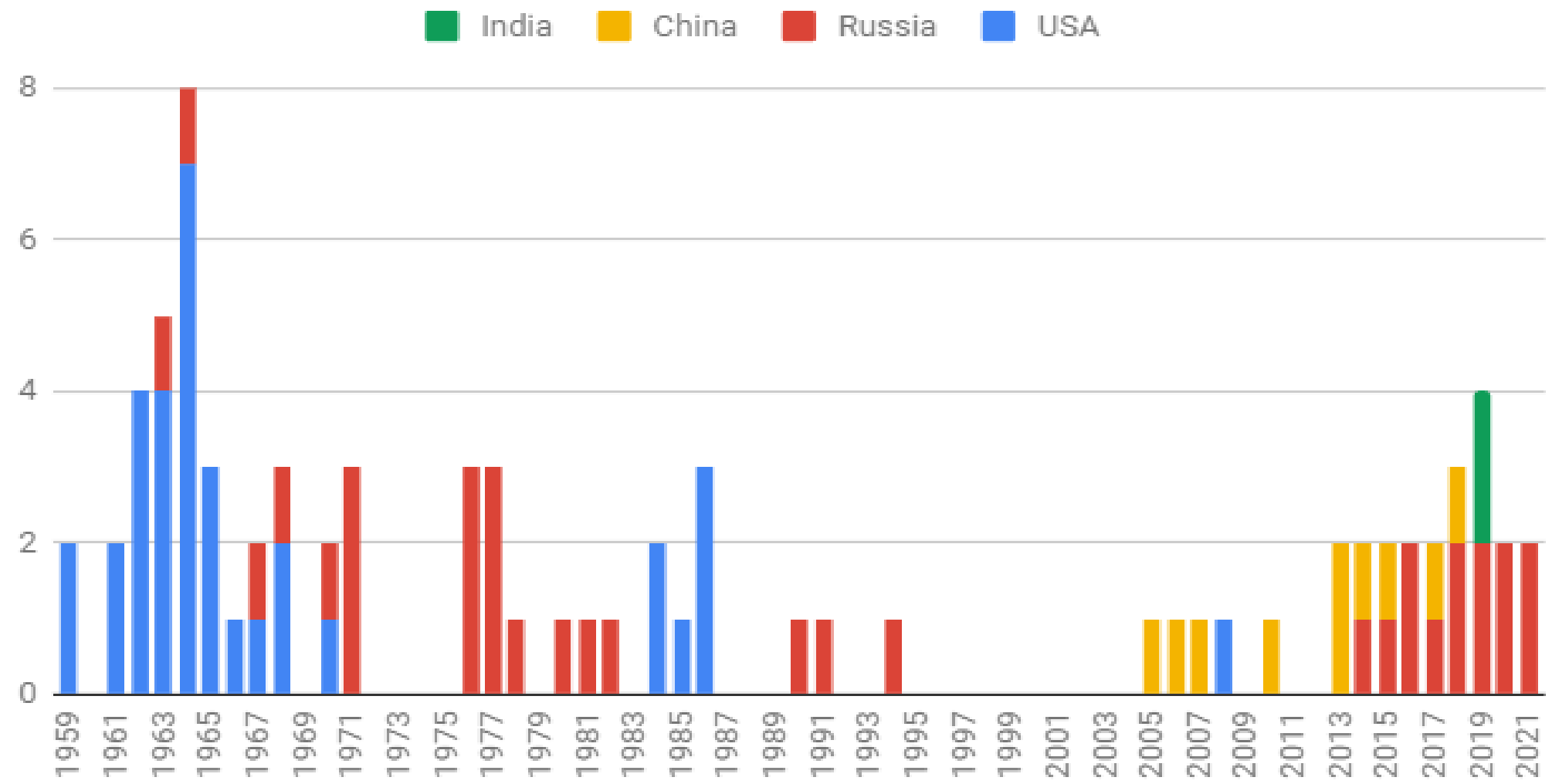




TABLE 5-1 – ORBITAL DEBRIS CREATED BY ASAT TESTS IN SPACE

DATE	COUNTRY	ASAT SYSTEM	TARGET	INTERCEPT ALTITUDE	TRACKED DEBRIS	DEBRIS STILL ON ORBIT	TOTAL DEBRIS LIFESPAN
Oct. 20, 1968	Russia	IS	Cosmos 248		252	79	50+ years
Oct. 23, 1970	Russia	IS	Cosmos 373		147	35	50+ years
Feb. 25, 1971	Russia	IS	Cosmos 394		118	45	50+ years
Dec. 3, 1971	Russia	IS	Cosmos 459		29	0	3.3 years
Dec. 17, 1976	Russia	IS	Cosmos 880		127	57	45+ years
May 19, 1978	Russia	IS-M	Cosmos 970		73	64	40+ years
Apr. 18, 1980	Russia	IS-M	Cosmos 1171		48	6	40+ years
Jun. 18, 1982	Russia	IS-M	Cosmos 1375		64	60	35+ years
Sept. 13, 1985	U.S.	ASM-135	Solwind	530 km	287	0	18+ years
Sept. 5, 1986	U.S.	Delta 180 PAS	Delta 2 R/B		17	0	< 1 year
Dec. 26, 1994	Russia	Naryad-V?	Unknown		27	24	25+ years
Jan. 11, 2007	China	SC-19	FengYun 1C	880 km	3536	2786	15+ years
Feb. 20, 2008	U.S.	SM-3	USA 193	220 km	175	0	1+ year
Mar. 27, 2019	India	PDV-MK II	Microsat-R	300 km	130	1	3+ years
Aug.-Dec. 2019	Russia	Cosmos 2535	Cosmos 2536		30	16	3+ years
Nov. 15, 2021	Russia	Nudol	Cosmos 1408	470 km	1790	300	Unknown
Total					6850	3472	

Questions?

Thanks.

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