

Dangers From Regulatory Vacuums in Outer, Inner, and Near Space



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The Main Points

Outer space is becoming accessible, useful, and habitable. New opportunities include bridging the Digital Divide with ubiquitous and affordable broadband, tourism, mining asteroids for scarce and valuable minerals, and even colonization of the Moon and Mars.

Abandoned launch stages, end of life satellites, and debris fields created by indiscriminate anti-satellite weapons testing risk an Outer Space Tragedy of the Commons. Weaponizing space adds risk, cost, fear, uncertainty, and doubt.

Without significant amendment to space and spectrum resource management treaties, the United Nations and International Telecommunication Union will continue to lack authority to require mitigation of space debris and to resolve emerging conflicts triggered by space commercialization.

The five Space Treaties, circa 1960s-70s, commit nations to peaceful uses for the benefit of all. Private ventures not anticipated.

Spacefaring nations and private ventures need financial incentives to mitigate space debris and foreclose a domino effect that would render space too risky for investment and insurance underwriting.

Recent Space Headlines

NASA Confirms Where the Space Junk That Hit a Florida House Came From

Space law just got a little more complicated.



Debris Gives Space Station Crew Members a 29,000-M.P.H. Close Call

A Dead Russian Satellite Broke Into More Than 100 Pieces in Space

The space station just dodged debris from a 2007 Chinese weapons test.

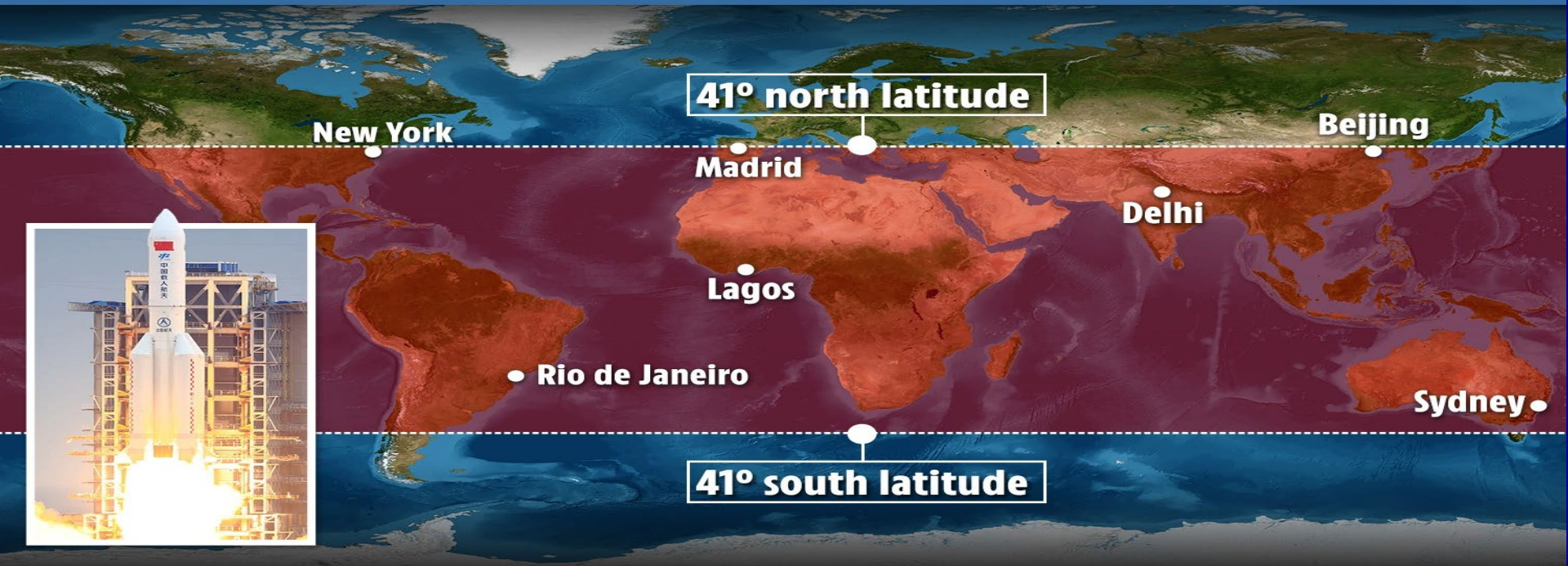
A piece of debris whizzes past the Crew Dragon

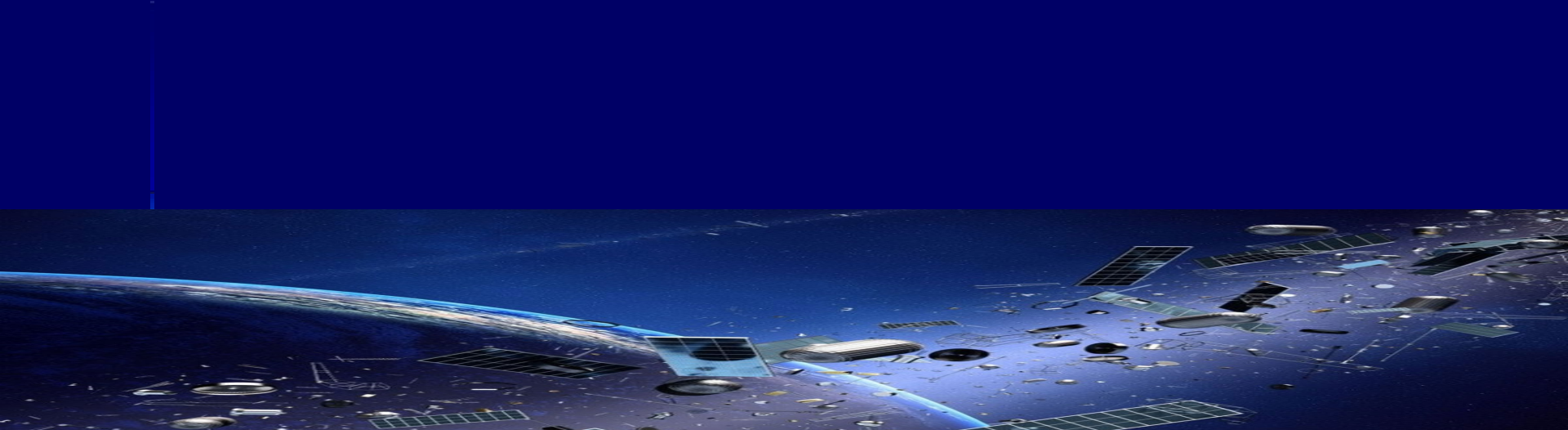
23 tons of space junk (a Chinese rocket booster) fell without much tracking certainty



HUGE CHINESE ROCKET FALLING TO EARTH

Long March 5b could land on a number of cities





Russian direct-ascent anti-satellite missile test creates significant, long-lasting space debris

By U.S. Space Command Public Affairs Office

PETERSON SPACE FORCE BASE, Colo. – Russia tested a direct-ascent anti-satellite (DA-ASAT) missile on Nov. 15, 2021, Moscow Standard Time, that struck a Russian satellite [COSMOS 1408] and created a debris field in low-Earth orbit. The test so far has generated more than 1,500 pieces of trackable orbital debris and will likely generate hundreds of thousands of pieces of smaller orbital debris.

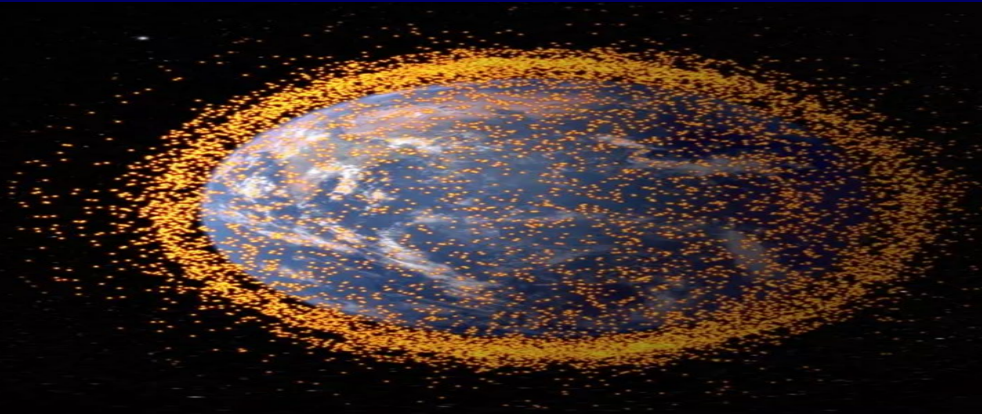
“Russia has demonstrated a deliberate disregard for the security, safety, stability, and long-term sustainability of the space domain for all nations,” said U.S. Army [Gen. James Dickinson](#), U.S. Space Command commander. “The debris created by Russia’s DA-ASAT will continue to pose a threat to activities in outer space for years to come, putting satellites and space missions at risk, as well as forcing more collision avoidance maneuvers. Space activities underpin our way of life and this kind of behavior is simply irresponsible.”

USSPACECOM’s initial assessment is that the debris will remain in orbit for years and potentially for decades, posing a significant risk to the crew on the International Space Station and other human spaceflight activities, as well as multiple countries’ satellites. USSPACECOM continues to monitor the trajectory of the debris and will work to ensure all space-faring nations have the information necessary to safeguard their on-orbit activities if impacted by the debris cloud, a service the United States provides to the world, to include Russia and China.

“Russia is developing and deploying capabilities to actively deny access to and use of space by the United States and its allies and partners,” Dickinson added. “Russia’s tests of direct-ascent anti-satellite weapons clearly demonstrate that Russia continues to pursue counterspace weapon systems that undermine strategic stability and pose a threat to all nations.”

Media queries should be sent to U.S. Space Command Public Affairs Office at 719-554-3478 or USSPACECOM.PA.MEDIA@us.af.mil.

Chinese righteous indignation at the near collision between a SpaceX satellite and the Tiangong space station.



United Nations

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General Assembly

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**Committee on the Peaceful
Uses of Outer Space**

**Information furnished in conformity with the Treaty on
Principles Governing the Activities of States in the
Exploration and Use of Outer Space, including the
Moon and Other Celestial Bodies**

**Note verbale dated 3 December 2021 from the Permanent Mission
of China to the United Nations (Vienna) addressed to the
Secretary-General**

Chinese government claims an off-course weather satellite did not violate U.S. sovereignty as it flew over Alaska and CONUS, including military installations



**WEATHER
BALLOON**



**SPY
BALLOON**

Canada Is Not Exempt

On Jan. 24, 1978, a Soviet nuclear-powered satellite, Kosmos 954, re-entered the Earth's atmosphere and exploded over northern Canada. Radioactive debris spread across the eastern part of the Northwest Territories, the western part of what's now Nunavut, and into northern Alberta and Saskatchewan.



Research Questions

Ongoing work addresses two research questions:

- 1) In light of space commercialization and substantial technological change, can the UN and ITU effectively manage space and radio spectrum resources?
- 2) What treaty amendments are necessary to foreclose Outer Space ruin caused by a cascade of proliferating space debris?

The Five Space Treaties

- 1) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies; 18 U.S.T. 2410 (1967), 610 U.N.T.S. 205 (1967);
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.
- 2) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space; 19 U.S.T. 7570 (1968), 672 U.N.T.S. 119 (1968);
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/rescueagreement.html>
- 3) Convention on International Liability for Damage Caused by Space Objects; 24 U.S.T. 2389 (1972), 961 U.N.T.S. 187 (1972);
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/liability-convention.html>
- 4) Convention on Registration of Objects Launched into Outer Space; 28 U.S.T. 695 (1975), 1023 U.N.T.S. 15 (1975);
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html>
and
- 5) Agreement Governing the Activities of States on the Moon and Other Celestial Bodies. 1363 U.N.T.S. 3 (1979); <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/moon-agreement.html>.

Non-Enforceable Responsibilities

Article VIII of the Outer Space Treaty requires signatory nations to retain jurisdiction and control over any space object launched from their territory, and over any personnel while in outer space, or on a celestial object.

The Liability Convention specifies that a signatory nation shall provide compensation for damage caused by a space object it has launched. A nation also may incur liability for damages incurred in space for which it is at fault. Because the Convention does not define fault, it remains uncertain under what specific circumstances a launching country would incur liability.

The Convention also identifies voluntary procedures for the settlement of claims for damages.

The Space Treaties apply solely to national governments, not private ventures.

The Rising Risk of Ruin by Space Debris

The primary orbital slots for satellites are limited by physics and mission.

Geosynchronous satellites match the earth's orbital speed and operate in a stable, fixed orbit 22,300 above earth. Ideal for point-to-multipoint service, such as broadcast audio and video.

Low earth orbiting ("LEO") satellites operate 200-1200 miles above earth. A large constellation of small satellites necessary for global coverage, because of close proximity to earth; small, moving footprints.

Over 10,000 satellites currently orbit earth.

Individual satellite operators have little incentive to conserve space resources through space debris mitigation, e.g., recycling space launch stages, ejecting end of life satellites outward into deep space, or on a steep earthbound trajectory leading to vaporization.

The Tragedy of the Commons/Kessler Syndrome results when users of a shared and scarce resource incur little, if any consumption costs. They have an individual incentive to overuse, even though collectively such action can generate congestion, radio interference, collisions, and proliferating space debris.

The UN and ITU Lack Authority to Require Space Debris Mitigation by Nation States and Private Ventures

The Space Treaties appeal to the goodwill of nations to promote peaceful uses of Outer Space for the benefit of all.

The Treaties anticipate the potential for actions causing damage, but do not mandate compensation and sanction noncompliance.

The Treaties do not apply to private spacefaring ventures.

Without “skin in the game” (financial incentives or liability for polluting space), Nation States and private ventures have little incentive to conserve space resources and to refrain from actions that create a toxic environment, e.g., failing to remove no longer used space objects and irresponsible testing of ASAT weapons.

Space junk proliferation has a domino effect: More debris triggers the higher likelihood for more collisions of space objects that will cascade into a larger debris field resulting in even more collisions or emergency collision avoidance maneuvers using limited navigation fuel.

Types of Damages in Space and on Earth

Space Debris Collisions with Valuable, Operational Space Objects, e.g., 2009 Russian Cosmos 2251 collision with an Iridium LEO satellite; see

https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf

Two valueless space objects collide generating more space debris, e.g., the 1996 collision between the French Cerise military reconnaissance satellite and debris from an Ariane rocket.

Massive space debris proliferation from ASAT testing. Kinetic energy ASATs physically collide with satellites at high speeds, and can include ballistic missiles, drones, and explosives. Non-kinetic ASATs use non-physical methods to disable satellites, such as cyberattacks, jamming, or blinding satellites with lasers. ASAT technology can be earth-based or in-space.

Atmospheric pollution and incomplete vaporization of abandoned space objects, e.g., January 24, 1978, Russian Cosmos 954, with 50 kg of Uranium 235, contaminated 124,000 sq. km of northern Alberta and Saskatchewan. The government of Canada billed the Soviet Union over \$6 million for damages caused by the satellite, but only received \$3 million in compensation. See <https://www.rcinet.ca/en/2017/01/24/canada-history-jan-24-1978-soviet-radiation-across-the-arctic/>

Recommendations

The Five Space Treaties need substantial amendment creating enforceable rights and responsibilities for national governments and private ventures. Emphasis on clear and enforceable duties of care.

Few spacefaring stakeholders will agree to a moratorium on space and radio spectrum resource use, pending consensus building on a leisurely schedule like the 4-year cycle for ITU conferences.

If a private venture's owned and operated space object collides with, and damages another space object, the private venture specifically should bear financial responsibility to compensate the harmed public or private entity.

Ideally, public and private ventures owning and operating space objects, such as satellites, should incur the responsibility to eject end of life space objects into deep space or on a downward trajectory with 100% vaporization, or minor residue field at remote ocean locations.

Recommendations (cont.)

Nation States and private ventures should deposit funds into an account that could be tapped to compensate other parties harmed by a collision or impact from space debris abandoned by a known party. Such an escrow account also could provide a bounty for ventures that collect and dispose of space debris.

The UN should reiterate that space cannot be weaponized or colonized. Violators should face sanctions including the loss of privileges and rights conferred by the Space Treaties.

The UN and ITU need to improve coordination of individual and joint responsibilities and more proactively anticipate emerging conflicts. Their registration functions cannot remain passive and perfunctory.