

Curriculum Resource Guide for Educators



NCTA Online Program

OUTER SPACE POLICY

In U.S.-China Relations

Thursday, April 25th, 2024 | 4:30 - 6:30PM

Via Zoom



Compiled by: Ryan Hauck,
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& Emma Hansen

How To Use This Guide



Visual Media



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Lesson Plans

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Outlining Standards

A Note on Learning Standards Presented in this Guide

Three sets of standards have been linked to each of the learning objectives in this packet. The **Washington State K-12 Social Studies Learning Standards** and the accompanying Grade Level Requirements are the social studies standards for WA State.

The **College, Career, & Civic Life C3 Framework for Social Studies State Standards** are the standards published by the National Council for the Social Studies. Guiding the packet as a whole is the Framework for Global Learning created by the Asia Society and the Council of Chief State School Officers titled *Educating for Global Competence: Preparing Our Youth to Engage the World* (2011).

Cross-objective standards are listed at the beginning of the packet, and content-specific standards can be found after each learning objective.

The standards provided have been selected for relevance, but are not exclusive: many other standards, such as Common Core, may be applicable to the resources and learning objectives identified in this packet. The intention for this packet's organization is to provide educators with an idea of resources available and possible uses for resources. Users should feel free to create their own learning objectives and to select resources according to the specific needs of their classrooms.

The student understands and applies reasoning skills to conduct research, deliberate, and form and evaluate positions through the processes of reading, writing, and communicating.

SOCIAL STUDIES LEARNING STANDARDS SOCIAL STUDIES LEARNING STANDARDS

There are five EALRs in Social Studies, one for each of the discipline areas: civics, economics, geography, and history, and a fifth for social studies skills.

(1) Social Studies EALR 1: CIVICS

The student understands and applies knowledge of government, law, politics, and the nation's fundamental documents to make decisions about local, national, and international issues and to demonstrate thoughtful, participatory citizenship.

(2) Social Studies EALR 2: ECONOMICS

The student applies understanding of economic concepts and systems to analyze decision-making and the interactions between individuals, households, businesses, governments, and societies.

(3) Social Studies EALR 3: GEOGRAPHY

The student uses a spatial perspective to make reasoned decisions by applying the concepts of location, region, and movement and demonstrating knowledge of how geographic features and human cultures impact environments.

(4) Social Studies EALR 4: HISTORY

The student understands and applies knowledge of historical thinking, chronology, eras, turning points, major ideas, individuals, and themes on local, Washington State, tribal, United States, and world history in order to evaluate how history shapes the present and future.

(5) Social Studies EALR 5: SOCIAL STUDIES SKILLS

The student understands and applies reasoning skills to conduct research, deliberate, and form and evaluate positions through the processes of reading, writing, and communicating.

Outlining Standards

COLLEGE, CAREER, & CIVIC LIFE C₃ FRAMEWORK FOR SOCIAL STUDIES STATE STANDARDS

The C₃ Framework is organized into the four Dimensions, which support a robust social studies program rooted in inquiry.

The four Dimensions are as follows:

- (1) Developing questions and planning inquiries;
- (2) Applying disciplinary concepts and tools;
- (3) Evaluating sources and using evidence;
- (4) Communicating conclusions and taking informed action

DIMENSION 1: DEVELOPING QUESTIONS AND PLANNING INQUIRES	DIMENSION 2: APPLYING DISCIPLINARY TOOLS AND CONCEPTS	DIMENSION 3: EVALUATING SOURCES AND USING EVIDENCE	DIMENSION 4: COMMUNICATING CONCLU- SIONS AND TAKING INFORMED ACTION
Developing Questions and Planning Inquiries	<ul style="list-style-type: none"> • Civics • Economics • Geography • History 	<ul style="list-style-type: none"> • Gathering and Evaluating Sources • Developing Claims and Using Evidence 	<ul style="list-style-type: none"> • Communicating and Critiquing Conclusions • Taking Informed Action

Dimension 2 has four disciplinary subsections: **(1) Civics; (2) Economics; (3) Geography; (4) History**. Each disciplinary subsection has three to four additional categories, which provide an organizing mechanism for the foundational content and skills within each discipline.

C₃ Framework Organization

CIVICS	ECONOMICS	GEOGRPAHY	HISTORY
Civic and Political Institutions	Economic Decision Making	Geographic Representations: Special Views of the World	Change, Continuity, and Context
Participation and Deliberation: Applying Civic Virtues and Democratic Principles	Exchange and Markets	Human-Environment Interaction: Place, Religions, and Culture	Perspective
Processes, Rules, and Laws	The National Economy	Human Populations: Spatial Patterns and Movements	Historical Sources and Evidence
	The Global Economy	Global Interconnections: Changing Spatial Patterns	Causation and Argumentation

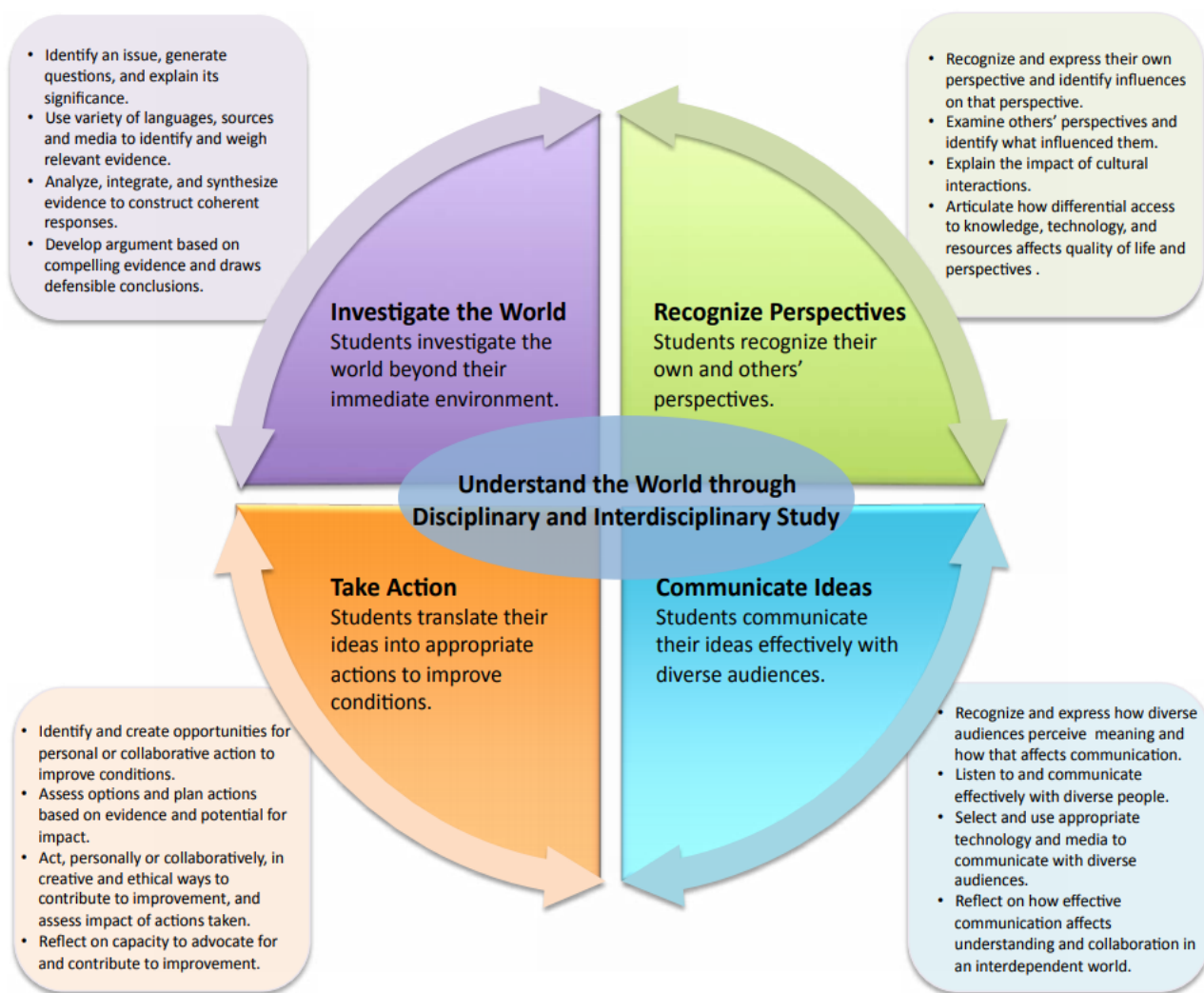
Educating For Global Competence

Frameworks taken from *Educating for Global Competence: Preparing Our Youth to Engage the World* (Asia Society and the Council of Chief State School Officers 2011).

“Global competence is the capacity and disposition to understand and act on issues of global significance” (Chapter 2).

Globally competent students are able to perform the following four competences:

1. **Investigate the world** beyond their immediate environment, framing significant problems and conducting well-crafted and age-appropriate research.
2. **Recognize perspectives** others’ and their own, articulating and explaining such perspectives thoughtfully and respectfully.
- 3 **Communicate ideas** effectively with diverse audiences, bridging geographic, linguistic, ideological, and cultural barriers.
4. **Take action** to improve conditions, viewing themselves as players in the world and participating reflectively.



Key Terms

[Outer Space](#): space immediately outside the earth's atmosphere.

[Satellite](#): artificial object launched into a temporary or permanent orbit around Earth. Spacecraft of this type may be either crewed or uncrewed, the latter being the most common.

[Space Exploration](#): investigation, by means of crewed and uncrewed spacecraft, of the reaches of the universe beyond Earth's atmosphere and the use of the information gained to increase knowledge of the cosmos and benefit humanity.

[Space Debris](#): artificial material that is orbiting Earth but is no longer functional. This material can be as large as a discarded rocket stage or as small as a microscopic chip of paint.

[Space Weather](#): conditions in space caused by the Sun that can affect satellites and technology on Earth as well as human life and health.

[Space Diplomacy](#): refers to the integration of science diplomacy knowledge, technology and legal linkages as applied to the expansion of space exploration. Since diplomatic relations are essential to mitigate various health, science, nature, and technology issues between nations, space diplomacy allows different nations to agree on what is fair with regard to space exploration and commercialization.

[Space Diplomacy Framework](#): outlines how State Department diplomacy will advance continued U.S. space leadership and will expand international cooperation on mutually beneficial space activities, while promoting responsible behavior from all space actors, strengthening the understanding of, and support for, U.S. national space policies and programs, and promoting international use of U.S. space capabilities, systems, and services.

[Global Space Economy](#): is growing and evolving, together with the development and profound transformation of the space sector and the further integration of space into society and economy. Today, the deployed space infrastructure makes the development of new services possible, which in turn enables new applications, in sectors such as meteorology, energy, telecommunications, insurance, transport, maritime, aviation and urban development leading to additional economic and societal benefits. The space sector is not only a growth sector itself, but is the vital enabler of growth in other sectors.

[Space Law](#): the body of regulations in international law that governs conduct in and related to areas of space above Earth's lower atmosphere.

Key Terms

[Space Domain](#): Space has recently been recognized by NATO¹ as the fifth operational domain for military operations and guarantees fundamental services and applications for all Armed Forces, strongly influencing the success of modern military operations. Space is now considered a physical domain on a par with sea, land, air and cyberspace but, unlike the first three, it is not heavily populated and, relatively speaking, not even trafficked. Therefore, it has previously been treated mostly as a mission, rather than a domain to occupy and protect. However, the situation is rapidly evolving.

[Space-Based Assets](#): (satellites and the terrestrial ground stations that communicate with them) provide critical support to military and civilian operations. They are vulnerable to unintentional damage and disruption, and to deliberate attack.

[Space Tourism](#): recreational space travel, either on established government-owned vehicles such as the Russian Soyuz and the International Space Station (ISS) or on vehicles fielded by private companies.

[Commercial Space Industry](#): products can be broadly classified into four categories: space launch services, communications and remote sense satellites, related satellite services, and necessary ground-based equipment.

Space launch services are largely focused on the delivery of satellites or spacecraft (the payload) to space, the transportation of cargo and astronauts to the International Space Station (ISS), and eventually sending passengers into space for space tourism.

[International Space Station](#): is a space station assembled in low Earth orbit largely by the United States and Russia, with assistance and components from a multinational consortium.

[Subnational Actors](#): are actors under the authority of a national government. In federal states, they can be states or provinces. Regions and municipalities are other examples of subnational governments.

[Planetary Protection](#): is the practice of protecting solar system bodies from contamination by Earth life and protecting Earth from possible life forms that may be returned from other solar system bodies.

[Kessler Syndrome](#): is a phenomenon in which the amount of junk in orbit around Earth reaches a point where it just creates more and more space debris, causing big problems for satellites, astronauts and mission planners.

[Space Force](#): a military service focused solely on pursuing superiority in the space domain.

Learning Objectives

- 1). Students will be able to identify and analyze the goals of the United States and China in outer space.
- 2). Students will be able to identify and assess how American and Chinese goals offer opportunities for innovation and collaboration between the two countries.
- 3). Students will be able to identify and explain the role, practice, and relevance of diplomacy in the international relations of space.
- 4). Students will be able to explain how and why different national and regional actors are forging diplomatic pathways to sustain space exploration, development and prosperity.
- 5). Students will be able to identify and analyze public awareness strategies to promote transnational collaboration and peace in the space arena.
- 6). Students will be able to assess the ways diplomacy opens opportunities in the global space economy for private actors.
- 7). Students will evaluate how space diplomacy can resolve commercial, legal and policy challenges across sovereign borders.

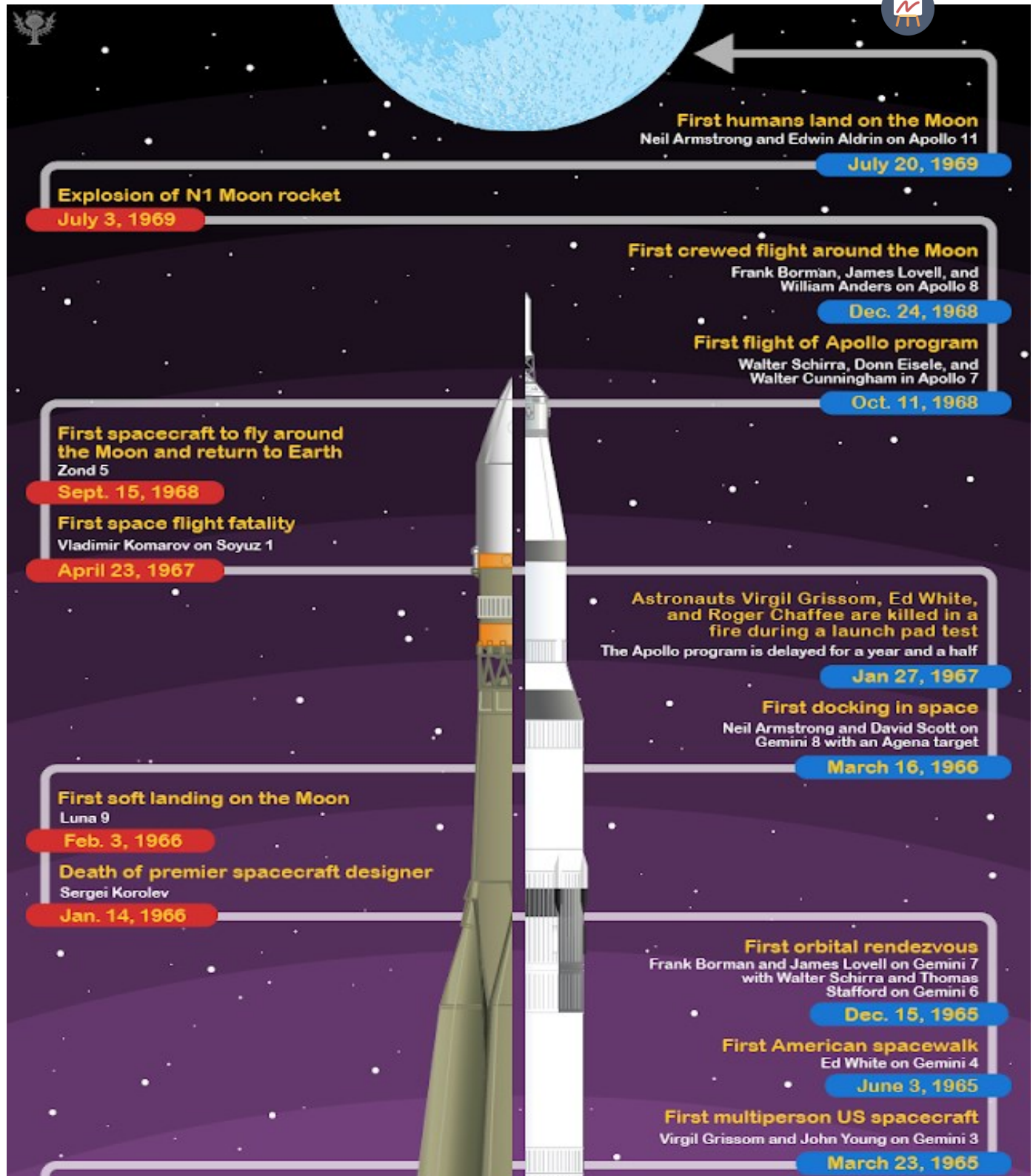


Brief History of Space Exploration



[Astronauts and Voyages into Space - A Look into Space Exploration](#)

"Students will learn about the history of space exploration; be able to define the terms: astronaut and cosmonaut; learn the requirements to be an astronaut; name famous astronauts and explain their contributions to space exploration; and describe notable space explorations in history."



Brief History of Space Exploration

First space walk

Aleksey Leonov on Voskhod 2

March 18, 1965

First multi-person spacecraft

Vladimir Komarov, Konstantin Feoktistov, and Boris Yegorov on Voskhod 1

Oct. 12, 1964

Soviet government gives go-ahead to two moon programs

A flyby and a landing program

August, 1964

First woman in space

Valentina Tereshkova on Vostok 6

June 16-19, 1963

First American in orbit

John Glenn on Mercury-Atlas 6

Feb. 20, 1962

First human in orbit

Yury Gagarin on Vostok 1

April 12, 1961

First cosmonauts selected

March, 1960

NASA announces first astronaut group

Mercury 7

April 9, 1959

First U.S. satellite

Explorer 1

Feb. 1, 1958

First animal on spacecraft

Dog Laika aboard Sputnik 2

Nov. 3, 1957

First artificial satellite

Sputnik 1

Oct. 4, 1957

1957—1969

SPACE RACE



U.S.S.R.



U.S.A.

Brief History of Space Exploration

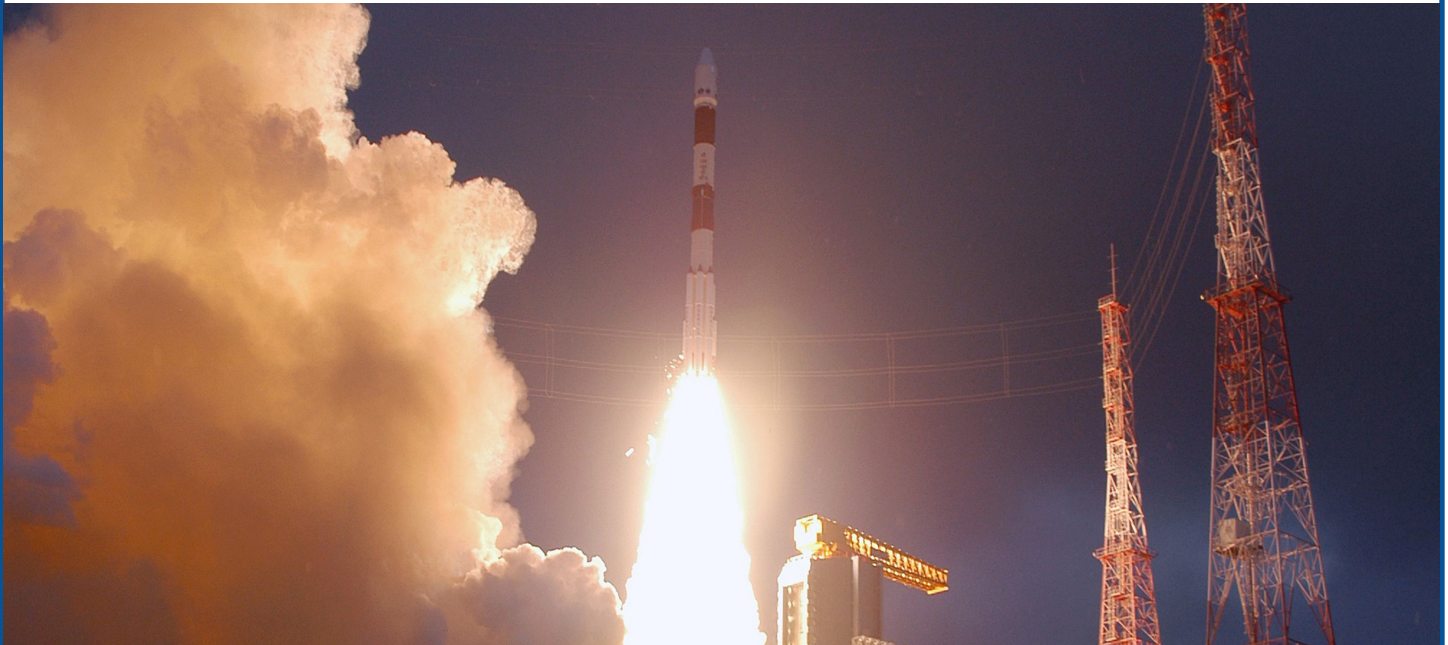
[China's Space Program in 2023: Taking Stock \(December 13th, 2023\)](#)

"As we come to the end of 2023, it is an apt time to revisit China's priorities for its space program. In President Xi Jinping's speech at the 20th Party Congress in October 2022, space infrastructure was identified as a critical component of the Chinese Communist Party's legitimacy. Space is also integral to China's strategic competition with the United States and a key component of its national power."



[A Look Back at Three Decades of China's Manned Space Program \(April 23rd, 2023\)](#)

"From its inception in 1992 until the completion of China's first space station in 2022, here's a quick look at the milestones of China's manned space program."



[China in Space | The Real Story \(May 21st, 2021\)](#)

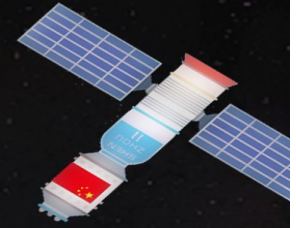
"China has successfully landed and operated a rover on the surface of Mars, a feat only previously achieved by the United States. It follows Beijing's successful robotic mission to the Moon to return lunar samples to Earth and comes just weeks after the launch into orbit of the first module of the country's very own space station. China only sent its first human into space in 2003, but since then its technological capabilities have multiplied. But so too have the controversies."

[Timeline: Major Milestones in Chinese Space Exploration \(December 2nd, 2020\)](#)

"China successfully landed a spacecraft on the moon's surface on Tuesday in a historic mission to retrieve lunar surface samples, Chinese state media reported. This makes China only the third country to have retrieved lunar samples, following the United States and the Soviet Union decades ago. Here is a timeline of key moments in Chinese space exploration."

Brief History of Space Exploration

HISTORY OF CHINA'S INTERNATIONAL SPACE COOPERATION



2021

CHINA RUSSIA

Signed MOU on joint construction of an international lunar research station

2019

CHINA FRANCE

Signed protocol for France to use Chang'e-6 lunar probe for lunar exploration missions



2019

CHINA US

China shared data on Chang'e-4 lunar mission with NASA



2018

CHINA UN

China offers cooperation opportunities for other countries in future space station missions



2017

CHINA ITALY

Signed agreement for manned space activities on the Chinese space station



2013

CHINA ITALY

Signed MOU on cooperation over Chinese electromagnetic monitoring satellite



2011

CHINA ITALY

Signed agreement on peaceful use of outer space



1988

CHINA BRAZIL

Signed protocol on joint development of Earth resources satellite



1991

CHINA ITALY

Signed protocol on cooperation in peaceful use and research of space



**GLOBAL
TIMES**

Source: Media reports
Editor & Graphic:
Wu Tiantong/GT



The New Space Race: The U.S. and China

[China and the US: Who Will Win Moon Race in New Space Era? \(January 20th, 2024\)](#)

"During the first space race, between America and the former Soviet Union in the 20th century, 12 Americans landed on the Moon's surface. Today, a new space race between America and China is fuelling ambitious plans by both countries, including constructing lunar stations that would host extended crewed missions. Both nations are targeting the same region of the Moon and have a similar timeline, with America hoping to land astronauts on the surface by 2026 and China aiming for 2030. No human beings have been to the lunar surface since the last Apollo mission in 1972 and new, more advanced technology is needed to ensure the new era of Moon exploration is safe and sustainable."

[In Moon Race with China, U.S. Setbacks Test Role of Private Firms \(January 12th, 2024\)](#)

"Two U.S. setbacks this week in the race to the moon with China illustrate the risks of NASA's plans to bet on a new strategy of relying heavily on private companies. Fresh delays in the U.S. space agency's Artemis moon program and a propulsion issue that doomed American company Astrobotic's recent robot moon lander illustrate the difficulties faced by the only country to have set foot on the moon, as it tightens budgets while carrying on its cosmic legacy."

[China Scores a Big Win in Race with US for Influence on the Moon \(December 7th, 2023\)](#)

"China notched a diplomatic victory in its race against the U.S. for influence in space, with Egypt agreeing to support Beijing's plan for a proposed project on the moon. The China National Space Administration on Wednesday signed a memorandum of understanding with the Egyptian Space Agency that will see them cooperate on the International



Lunar Research Station, a Chinese-backed base that's expected to begin operation around 2030. The agreement builds on their collaboration, which saw a Chinese rocket send an Egyptian satellite into orbit from a launch center in the Gobi Desert on Monday."

The New Space Race: The U.S. and China

[Will China Beat the United States Back to the Moon? It's Possible. \(November 13th, 2023\)](#)

"The stakes of the modern moon race are different from the Cold War contest between the Soviet Union and the United States, where the goal of the sprint to plant a flag in lunar soil was to claim moral and technological dominance for a political system. That motive still exists in the U.S.-China rivalry, but now both countries are working toward building an enduring presence on the moon and in cislunar space, the real estate between the moon and Earth. And who gets there first could set precedents for the next phase of lunar expeditions — where countries would mine resources such as water, establish settlements and pursue scientific discovery."

[The New Space Race: Mars, the Moon, and the New Political Frontier \(October 1st, 2023\)](#)

"In recent years, the business sector has picked up the gauntlet and the journey to Mars is back on the table, accelerating the geopolitical race globally, as China, the US, and India all vie for dominance."

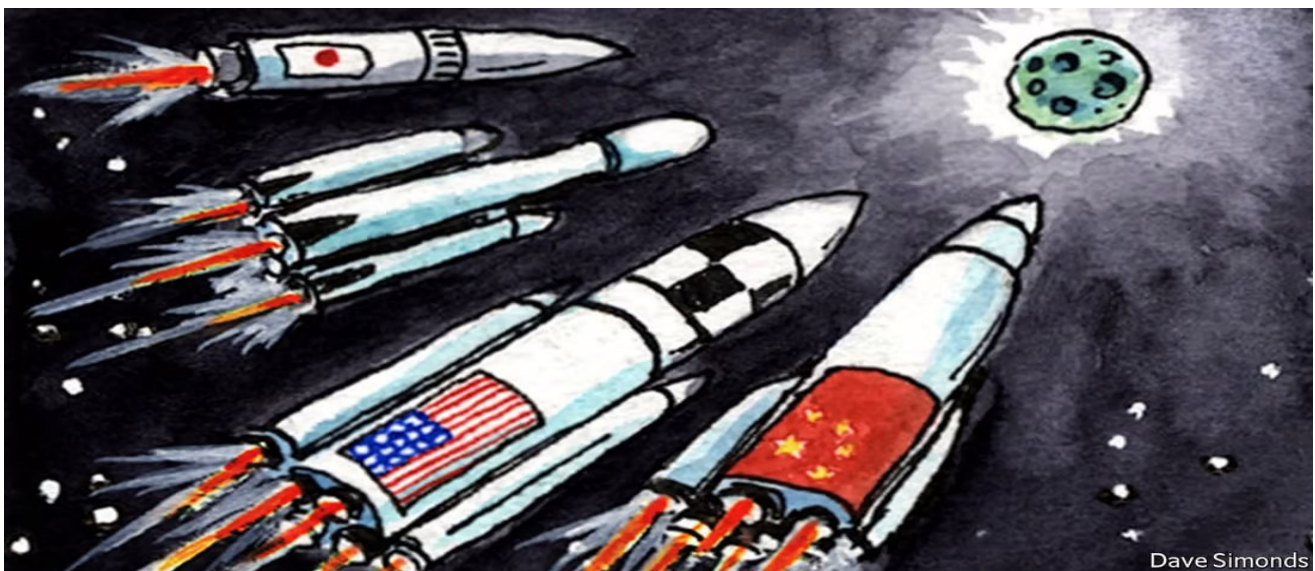
[In New Space Race, Commercial Companies Boost US Over China \(September 14th, 2023\)](#)

"The first space race was a contest between U.S. and Soviet government agencies to reach the moon's surface. But the new space race is much more muddled — and the stakes may be higher than ever. In this space race, it's not only governments that are competing. Private companies and state-owned enterprises are also accounting for more launches. India, Russia, and Japan all attempted landings on the lunar surface this summer, though only India was successful."

[The New Space Race Is On - And Everyone Is Headed To The Moon \(August 25th, 2023\)](#)



"A new space race is underway. But why exactly are we racing to the moon again? NPR's Scott Detrow speaks to space lawyer Michelle Hanlon to find out."



The New Space Race: The U.S. and China



[The New Space Race Is On, with More Players Than Ever Before \(August 24th, 2023\)](#)

"Once again, the United States is leading the charge to return to the Moon, thanks in large part to decades of experience operating in space. NASA's Artemis Program is ongoing, with the first uncrewed mission already in the bag, and Artemis II, the first crewed mission of the program, planned for launch in 2024. This time, however, the United States isn't going to the Moon alone."

[Space Race 2.0: Russia, India, China and the U.S. Are Heading for the Lunar South Pole \(August 17th, 2023\)](#)

"Roughly six decades after the Soviet Union and the U.S. raced each other to get to the moon, a new competition has emerged. This time around, the focus is on the lunar south pole, where scientists have detected traces of water ice."



[The New Space Age: Is a New Space Race Already Underway? \(June 1st, 2023\)](#)

"In this edition of Wilson Center NOW, we are joined by Christian Davenport, Public Policy Fellow with the Wilson Center's Science and Technology Innovation Program and Staff Writer at The Washington Post, covering the defense and space industries. He discusses where the U.S. space industry stands as private industry increasingly enters the market and China's space program continues its rapid expansion."

The New Space Race: The U.S. and China

[China's Space Dream Is a Legal Nightmare \(April 21st, 2023\)](#)

"In January, Hong Kong Aerospace Technology Group, a Chinese company, signed an agreement with the government of Djibouti to build a rocket launch facility in Obock, a small port town in the country's north. If completed, it would mark the first instance of a launch facility funded by China or a private Chinese company in foreign territory. Building a spaceport is a difficult endeavor, and building such a facility on foreign soil is even more complicated. While challenges may ultimately stall or scupper the arrangement, the potential site in Obock serves as an important case study for how China or other actors could expand their geopolitical playbook to circumvent the international space governance regime."

[Dueling Superpowers, Rival Billionaires. Inside the New Race to the Moon \(July 18th, 2019\)](#)

"Today, SpaceX is one of a handful of powerful players—starry-eyed billionaires and the world's two richest countries—competing in a race to set up shop on the moon. In the 1960s, it was a two-party sprint between the U.S. and the Soviet Union to be the first to get boots on the lunar surface, but this time around the U.S. finds itself in a bigger, multifront competition with private companies like SpaceX and Jeff Bezos' Blue Origin and international powers, most critically China."



[Programme and Development of the "Belt and Road" Space Information Corridor \(April 2019\)](#)

"Along the " Belt And Road", China will jointly build remote sensing data and application centers, communication satellite information ports and beidou navigation ground enhancement systems, Space information sharing network build several distributed satellite application and service platforms, and form a comprehensive service network."



China and Russia agreed to cooperate in building a dual-use Lunar Base.

China used Hong Kong-domiciled companies to circumvent U.S. export controls, e.g., Asia Satellite Telecommunications Holdings Ltd. and APT Satellite Co., Ltd.

China's multinational [Asia-Pacific Space Cooperation Organization](#) oversees a space surveillance project known as the Asia-Pacific Ground-Based Optical Space Object Observation System, which has near full coverage of Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO). Information and data are funneled through the Chinese Academy of Science's National Astronomical Observatory of China.

The [Belt and Road Space Information Corridor](#) is China's space element of the Belt and Road Initiative. Its political influence and greater access in the Western Hemisphere, complemented by its space technology may allow civilian space programs to also serve the PLA's purposes.

Understanding Space Diplomacy from the U.S. Perspective



[Space Diplomacy Could Ensure a Safer Earth \(2023\)](#)

“Our problems and challenges are no longer confined to our planet alone. The space race, which began in the mid-20th century as a competition between Cold-War rivals the United States and the Soviet Union, has not only intensified over the years, but also has grown into a much larger phenomenon. Now, nations and private entities are vying for supremacy in space, for varied reasons and through multiple means.”

[Space Diplomacy Lab - Rethinking Diplomacy \(July 6th, 2023\)](#)

“A new era of human space activity is unfolding every day before our eyes. An increasing number of nation-states and private sector actors are now capable of deploying a wide array of space technologies to low Earth orbit and beyond. The immense economic, scientific, and societal potential of today’s space renaissance has unlocked fresh opportunities for unprecedented innovation and international strategic cooperation beyond Earth’s atmosphere. But just like the turbulent nature of international affairs here on Earth, the very human proclivity to take actions endangering the promise of these giant leaps off our planet requires some form of Anticipatory Diplomacy. Without urgent risk mitigation to address a growing list of space security and regulatory challenges facing the global community, humanity’s burgeoning off-planet future could be grounded before it truly blasts off.”

[Space Diplomacy: Tools, Processes & Approaches in 2023](#)

“As of today, more than 70 countries in the world have some kind of space programme, and a dozen companies are having or planning to have some kind of ‘business’ in space. The value of the space industry is estimated at 350 billion dollars.”

Understanding Space Diplomacy from the U.S. Perspective

[United States Leads in Space with Diplomacy | PRESS STATEMENT \(May 30th, 2023\)](#)

"...the Department of State is releasing [their] first-ever Strategic Framework for Space Diplomacy, a groundbreaking initiative to advance U.S. global space leadership. Through this Framework, [the U.S.] will expand international cooperation on mutually beneficial space activities, including through the Artemis Accords, and commitments against destructive anti-satellite missile tests. [This Framework] will encourage responsible behavior, strengthen understanding and support for U.S. national space policies, and promote international use of U.S. space capabilities."



[A Strategic Framework for Space Diplomacy \(May, 26th, 2023\)](#)

"This first Strategic Framework for Space Diplomacy outlines how State Department diplomacy will advance continued U.S. space leadership and will expand international cooperation on mutually beneficial space activities, while promoting responsible behavior from all space actors, strengthening the understanding of, and support for, U.S. national space policies and programs, and promoting international use of U.S. space capabilities, systems, and services."



[Episode #17 | Space Diplomacy - Leiden University \(May 17th, 2023\)](#)

"Host Ilen Madhavji is joined by Mai'a Cross, co-editor of the new HJD Special Issues on Space Diplomacy, to explore how diplomacy operates in outer space. With the United States and China engaging in a "Space Race 2.0" we are often exposed to the security implications of space competition, but space diplomacy can give us confidence that collaboration can be an even stronger driving force for peace, development, and exploration for all of humankind."

[Space Diplomacy and the 'Overview Effect' \(April 27th, 2023\)](#)

"Astronauts looking at Earth from orbital or lunar missions often say they cannot see borders and boundaries that mean so much to surface dwellers, an essential feature of the 'Overview Effect', a term the author coined to describe the identity shift that takes place for many space travellers...Will the art of diplomacy change as nation-states send more residents to explore the rest of the solar ecosystem? This question seems more relevant than ever, while war rages, largely over borders and boundaries, in the heart of Europe. We consider how the 'Overview Effect' influences communication, persuasion, and bargaining among state and non-state actors active in determining the shape of our future space faring civilisation."

Understanding Space Diplomacy from the U.S. Perspective

[Introduction. Space Diplomacy: The Final Frontier of Theory and Practice \(March 23rd, 2023\)](#)

"[This] article [brings] together the fields of international relations and space studies to advance [the] understanding of space diplomacy in the scientific, economic and military realms...This special issue is the first in the field of international relations to use theories of diplomacy to bring to light the various ways in which experts, scientists, astronauts, space enthusiasts and professional diplomats, among others, have shaped the formal and informal interactions among states when it comes to this key area of foreign policy."

[Space Diplomacy – Future Perspective \(September 30th, 2020\)](#)

"A new type of diplomacy that has emerged in recent years is "space diplomacy," which is responsible for arms control and maintaining the "peaceful uses of outer space". Weaponization and the militarization of space are important and sensitive policy issues for states. The defense of space, and using space for defense, are issues that are now being discussed between diplomats worldwide. Many issues are also being negotiated by international space organizations. This article presents the new discipline of space diplomacy and examines its future by analyzing legal documents negotiated by the international community. The article is relevant to debates on the legal and political aspect of space security and the peaceful use of space for commercial purposes."

[Boosting Space Diplomacy at State](#)

"With ever-increasing speed, humanity is expanding the scope of its activities in outer space, thanks to private enterprise as well as via national pursuits. In the last two years alone, for example, the number of active and defunct satellites in low Earth orbit has increased by more than 50 percent, to around 5,000, with plans to add tens of thousands more in the coming years. Equally surprising, these satellites are owned and operated by nearly 100 different countries and organizations around the world—not just the small but growing number of nations with domestic satellite launch capabilities—and involve a wide range of commercial, scientific and security and defense endeavors. Dangers lurk, however, and U.S. diplomacy must be prepared."

Did You Know?

"Among state actors, the United States is the leader in both public space investment (at \$54.6 billion in 2021—almost 60 percent of global government investment in space) and private space investment in terms of the number of companies in the industry (the United States has almost ten times as many space companies as the next country—the United Kingdom)." <https://www.google.com/url?q=https://www.brookings.edu/articles/how-space-exploration-is-fueling-the-fourth-industrial-revolution/&sa=D&source=docs&ust=1702336366155479&usg=AOvVaw2ZPMDYAgOT5qswXe64EJNo>

Military Presence in Space

[China Reorganizes Its Military, Impacts Likely for Space Operations \(April 23rd, 2024\)](#)

“China has established a new force of the People’s Liberation Army, with the reorganization to have repercussions for how its space forces are commanded. Xi Jinping, China’s president and chairman of the Central Military Commission, launched the People’s Liberation Army’s (PLA) Information Support Force (ISF) April 19. The ISF is effectively replacing the Strategic Support Force (SSF), which commanded the PLA’s space forces. Xi stressed that the information support force is a new, strategic branch of the military and a key pillar in coordinating the construction and application of the network information system, Chinese state media reported.”

[Nasa Chief Warns China is Masking Military Presence in Space with Civilian Programs \(April 17th, 2024\)](#)

“The head of Nasa has warned of China bolstering its space capabilities by using civilian programs to mask military objectives, cautioning that Washington must remain vigilant. “China has made extraordinary strides especially in the last 10 years, but they are very, very secretive,” Nasa administrator Bill Nelson told lawmakers on Capitol Hill. “We believe that a lot of their so-called civilian space program is a military program. And I think, in effect, we are in a race,” Nelson added.”

[Advancing in Space, China Poses Growing Threat, USSF Leaders Warn \(March 28th, 2024\)](#)



“The People’s Republic of China’s rapid military advances in space mean the People’s Liberation Army no longer merely threatens American assets in orbit, but now has the space-based sensing and targeting capabilities to better enable its joint forces to threaten the U.S. on Earth, Space Force leaders warned March 27.”

[China’s Military is Taking a Strategic Approach to On-Orbit Refueling \(March 22nd, 2024\)](#)

“The People’s Liberation Army is working comprehensively on the technology and training tools for on-orbit satellite refueling for both peacetime and wartime scenarios. The People’s Liberation Army (PLA) is already integrating lessons learned into military doctrine and training tools, while a defense contractor has already demonstrated what it calls a space fuel tanker in geosynchronous Earth orbit (GEO), according to a report published by the China Aerospace Studies Institute (CASI) March 18. The report underlines that the PLA has a strategic focus on enhancing its on-orbit logistics capabilities and is integrating commercial enterprises into the space sector. These developments have potential implications for international space operations norms and should prompt action by the U.S. Space Force to attain similar capabilities and readiness.”

Military Presence in Space

[How China is Challenging the U.S. Military's Dominance in Space \(December 12th, 2023\)](#)

"China's rapidly growing arsenal of anti-satellite weapons could cripple America's military in a crisis and the U.S. is scrambling to shore up its defenses miles above the Earth. China is testing and developing an array of weapons and tools that could destroy, disable or hijack satellites that the U.S. military heavily relies on to operate around the world, Defense Department officials and experts say. In recent years, China has rapidly closed the gap with the U.S. in space. Beijing is ramping up the pace of its satellite launches and mastering capabilities that only the United States had a decade ago, experts say."



[How the U.S. Seeks to Militarize Outer Space \(July 27th, 2023\)](#)

"Space, once the final frontier, could one day become the next battlefield. Through DARPA, the Pentagon's defense research agency, Lockheed Martin has secured a contract to develop a nuclear-powered spacecraft named "Draco." Jaganath Sankaran, assistant professor at the Lyndon B. Johnson School of Public Affairs at the University of Texas at Austin, joined CBS News to discuss the future of armed conflict."

[Sovereignty in Space \(May 23rd, 2023\)](#)

"In a future where an orbiting space gateway, mining on the moon and colonization of Mars are envisioned, that military role is likely to change. One reason: a growing call to recognize the need for private ownership in some form to encourage the kind of entrepreneurial investment that will help humankind make the most of space. Under terms of the Outer Space Treaty, sovereign nations, to whom militaries attach, are the only players in space. It's time now to invite private and commercial entities to the table, too, many in the space community argue."



[The Strategic Military Importance of the Space Domain \(February 2nd, 2023\)](#)

"In this video, CIGI Senior Fellow and retired Canadian Armed Forces Brigadier-General Robert Mazzolin explains how, in recent years, militaries and alliances such as the North Atlantic Treaty Organization have established space and cyber branches to address these new operational domains. The current legal frameworks do not properly address these new threats or prevent warfare from spilling into outer space."



Military Presence in Space



[Inside U.S. Space Force As It Guards Against Potential Attacks \(2022\)](#)

"NBC News' Tom Costello gets an exclusive look inside the main Space Force Satellite Operations Center. The center keeps watch over America's military satellites and the world's GPS network operating in an increasingly hostile environment. Concern at the still relatively new military branch is focused on the growing presence of Russian and Chinese assets in space."



[The Militarization and Weaponization of Space \(March 25th, 2021\)](#)

"In this episode of the Space Security and Safety (SSS) program Informational Space Policy Video Series—the Strauss Center's Brumley Fellow for the SSS program, Alyssa Goessler, explains the weaponization and militarization of space, giving special attention to the distinctions between the two terms. Alyssa also explains various related concepts and technologies, including anti-satellite weapons (ASATs), rendezvous and proximity operations (RPOs), the "space arms race," and more. After describing the current state of play for the militarization of outer space, Alyssa also provides some policy and research recommendations for resisting this trend."

[Conflict and Controversy in the Space Domain: Legalities, Lethalities, and Celestial Security \(September 29th, 2020\)](#)

"This article assumes the inevitability of space exploration—including celestial body resource exploitation, weapon research and developments, and the human colonization of Mars—in an attempt to answer the question of how important the role is for American leadership of human expansion into space. The author explores the technologies available in today's space race environment, including potential future energy resources available in space, weapon systems designed for space warfare, the legal implications of each, and some potential consequences of different nations gaining the upper hand in the heavens."



[Space Force : Inside America's Newest Military Branch \(2020\)](#)

"The mission of protecting America's vulnerable orbital networks falls to U.S. Space Command and Space Force, which since December has the same status as the Army, Navy, Air Force and Marines."

Military Presence in Space

[The Space \(Innovation\) Race: The Inevitable Relationship between Military Technology and Innovation \(July 1st, 2019\)](#)

"Access to outer space is becoming more achievable by a wider array of state and non-state actors. This access is partly fuelled by the constant development of technology that brings down the cost of such access and makes actual space activities more varied and widespread. Associated with these developments is the correlative use of space by military forces, thus manifesting an enduring competition for strategic ascendancy. The combination of multiple actors, advancing technology and the ever-present reality of geopolitical contention in space has put pressure on the existing outer space treaty regime...This article argues that the time has come to reconcile differing legal regimes to craft solutions for the current space realities. Moreover, creative thinking in merging 'soft' international law with 'hard' domestic law, reaching past the inertia that current international decision-making bodies seem to exhibit, and rethinking interpretations of some Outer Space Treaty provisions by having regard to actual state practice, are areas which need to be fully explored. More strategically, creating a new appreciation and legal mindset for tackling the exponential growth of technology and civil-military space activity is required if space exploration and use is to be sustainably undertaken."



[What Does the Future Hold for the US Military in Space? \(May 31st, 2019\)](#)

"In this episode of the MWI Podcast, we're joined by Dr. Moriba Jah, an associate professor in the Department of Aerospace Engineering and Engineering Mechanics at the University of Texas at Austin. An expert in the science of orbital mechanics, he works to monitor space and track thousands of objects orbiting Earth. During the conversation, Dr. Jah describes why it's so important that we have an accurate understanding of what is in space and where those objects are—especially for the military. As he explains, when the US government first started launching things into orbit, there wasn't much else there. But since then, with more countries launching their own satellites and now private companies becoming increasingly involved, space is much more crowded. and as you'll hear in the episode, that has important implications for the US military."

Did You Know?

"U.S. Space Force-operated Defense Support Program (DSP) satellites are a key part of North America's early warning systems. In their 22,300-mile, geosynchronous orbits, DSP satellites help protect the United States and its allies by detecting missile launches, space launches and nuclear detonations. " <https://www.spaceforce.mil/About-Us/Fact-Sheets/#:~:text=U.S.%20Space%20Force%20operated%20Defense,space%20launches%20and%20nuclear%20detonations.>

Military Presence in Space



Fast Fact

"The U.S. Space Force was established on Dec. 20, 2019, when the National Defense Authorization Act was signed into law, creating the first new branch of the armed services since 1947. The establishment of the USSF resulted from widespread recognition that space is a national security imperative. When combined with the growing threat posed by strategic competitors in space, it became clear that there was a need for a military service focused solely on pursuing superiority in the space domain." <https://www.spaceforce.mil/About-Us/About-Space-Force/>

[Space 201: Thinking About the Space Domain Space Tourism & Commercial Space Initiatives The Future of Space Exploration & Development \(2018\)](#)

"Over the past three decades, the role of outer space in military operations has risen

steadily. From the inception of the space age, America's activities in space have included a large national security component. The development of satellites was not only a matter of national prestige in the ideological competition of the Cold War, but also an effort to monitor military and other developments from the strategic high ground of space. Many of the earliest satellites were engaged in the gathering of intelligence."

[About the Space Force | United States Space Force](#)

"The U.S. Space Force was established on Dec. 20, 2019, when the National Defense Authorization Act was signed into law, creating the first new branch of the armed services since 1947. The establishment of the USSF resulted from widespread recognition that space is a national security imperative. When combined with the growing threat posed by strategic competitors in space, it became clear that there was a need for a military service focused solely on pursuing superiority in the space domain."

Peace and Security in Outer Space

[China Space Threat Growing at 'Breathtaking Pace': Space Command Chief \(March 1st, 2024\)](#)

"U.S. Space Command head Gen. Stephen Whiting said Thursday that space has become an "expanding security challenge" and warned that China is growing its military space abilities at a "breathtaking pace." Speaking before the Senate Armed Services Committee, Whiting told lawmakers that space is "now central to all-domain security activities."

[China and Space: The Next Frontier of Lawfare \(August 2nd, 2023\)](#)

"The People's Republic of China (PRC) is one of the most thoughtful practitioners of legal warfare or "lawfare." For PRC planners, especially those in the People's Liberation Army (PLA), legal warfare is an integral part of the larger effort of "political warfare." Indeed, legal warfare is embedded in the Chinese conception of political warfare. From the Chinese perspective, political warfare, including legal warfare, is seen as a form of combat. Military combat preparations include the development and innovation of military political work, alongside more kinetic forms of operations."

[China and Strategic Instability in Space: Pathways to Peace in an Era of US-China Strategic Competition \(February 9th, 2023\)](#)

"Recent defense white papers published by the Chinese government refer to outer space as the "commanding heights" in international strategic competition, and the United States has explicitly identified space as a warfighting domain. While current strains in the US-China relationship have made managing potential conflict in space difficult, it is not impossible. This report identifies several areas in which the United States and China, as two of the world's three most formidable space powers, urgently need to improve communication and manage differences."



Peace and Security in Outer Space

Did You Know?

"NASA is...collaborating with the private sector for its Artemis program, which aims to put astronauts, including the first woman, on the moon by 2024. In April 2020, NASA announced that the human landers for the program would be developed by SpaceX; Blue Origin, owned by Jeff Bezos, founder and chief executive of Amazon; and the Alabama-based company Dynetics." <https://www.cfr.org/backgrounders/space-exploration-and-us-competitiveness>

[Cybersecurity and Outer Space \(2023\)](#)

"The dramatic expansion of space capabilities has transformed space systems into critical infrastructure for many aspects of human society and for national security. With opportunities for global societal benefits come risks. The global governance framework remains weak and contested. Vulnerabilities now exist with space systems, and these are especially pronounced in the face of cyberthreats. We now confront a volatile "space-cyber nexus," which this essay series explores across a diverse and wide range of perspectives. The series is organized around three themes: space security and risk; international governance challenges; and global perspectives and the pursuit of inclusivity."

[Breaking the Impasse Over Security in Space \(September 2023\)](#)

"As the international use of space has become more complicated since the end of the Cold War, multilateral discussions about ensuring the security of this shared domain have stalled because of circular arguments. Yet, the need to address this challenge is acute because space security continues to grow as a factor in overall global stability and, in fact, has become more relevant, given that many more countries are interested in the benefits that come from space assets and in counterspace capabilities."



[EU SST: Ensuring Space Safety and Sustainability \(July 21st, 2023\)](#)

"With increasingly congested orbits, it is critical to ensure the safety of space operations and space sustainability in the long term. Watch this video to learn how [EU Space Surveillance and Tracking] works in practice to provide space safety services."

[Official Details Space-Based Treats and U.S. Countermeasures \(April 26th, 2023\)](#)

"Space plays a critical role in the nation's security and America's prosperity," said John F. Plumb, assistant secretary of defense for space policy. "For the Department of Defense space is essential to how we compete and fight in every domain. It provides us with a missile warning and missile tracking critical to defending our homeland. It provides position navigation and timing to strike targets with precision. And it provides communication in austere environments to support global command and control. To put it simply, space-based missions are essential to the U.S. way of war," he said."

Peace and Security in Outer Space



[Space Warfare and the Weaponization of Outer Space \(2023\)](#)

"In this episode, we go into outer space. We don't just stay in the low earth orbit (LEO) of the international space station, but move all the way to high (HEO), geostationary orbits (GEO) more than twenty-six thousand miles (35,786



km) above the Earth's equator, where some of our most valuable and vulnerable satellites operate. We look at what the United States, China, and Russia are doing in the area of space warfare. We look at what our militaries are doing to weaponize outer space...The implications of space warfare are catastrophic, and yet, the public is largely unaware of the dangers orbiting right above our heads. It's high time we take notice."



[Space Diplomacy - UN Committee on the Peaceful Uses of Outer Space \(April 21st, 2022\)](#)

"In this episode, Robin Dickey, policy analyst at the Center for Space Policy and Strategy, will interview Peter Martinez, executive director of the Secure World Foundation and the former chair of the UN COPUOS Working Group on the Long-Term Sustainability of Outer Space Activities. This episode will focus on the history of space diplomacy in COPUOS, some of the major current efforts to keep space safe and sustainable, and future challenges and opportunities for international space cooperation and diplomacy in the UN."



[Threats, Challenges, and Opportunities in Space \(April 6th, 2020\)](#)

"This live streaming event explored the threats and challenges facing the United States and others in the space domain. Dr. Chris Ford, Assistant Secretary of State for International Security and Nonproliferation, delivered a keynote address and answered questions from the online audience on the U.S. administration's approach to meeting the evolving challenges to U.S. interests in outer space. The keynote was followed by a presentation and panel discussion featuring Brian Weeden and Victoria Samson of the Secure World Foundation and Todd Harrison, Kaitlyn Johnson, Thomas G. Roberts, and Makena Young of CSIS."

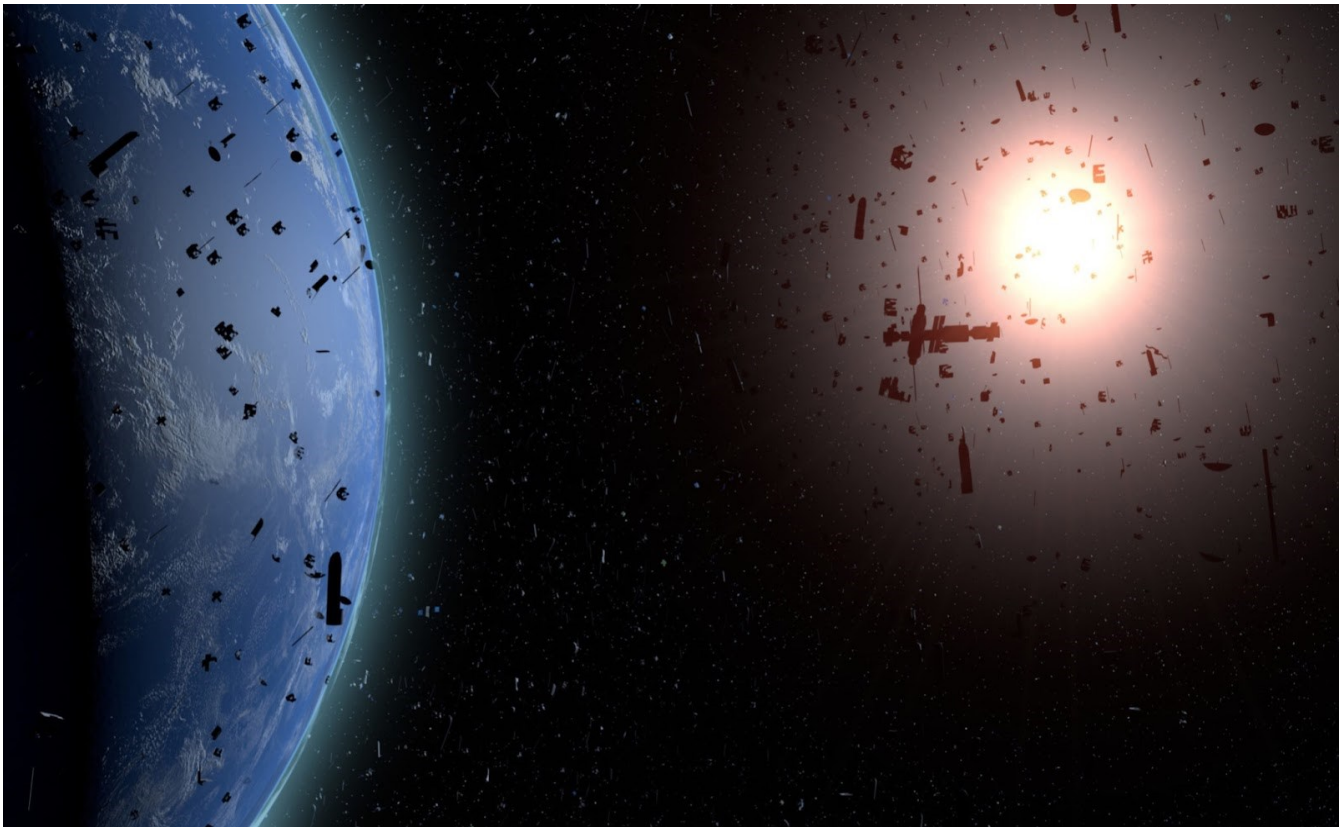
Peace and Security in Outer Space

[Challenges for Ensuring the Security, Safety and Sustainability of Outer Space Activities \(June 2019\)](#)

“The 50th anniversary of the first human landing on the moon presents an opportune moment to reflect on the security, safety and sustainability challenges that humankind will have to confront as we expand the sphere of human economic, political and social activity beyond low Earth orbit over the next 50 years. Three overarching challenges are identified: the challenge of governance; the challenge of information sharing; and the challenge of maintaining strategic stability in the military uses of outer space in order to preserve outer space for peaceful use and exploration.”

[Outer Space SARPs: A Mechanism for Implementation of Space Safety Standards \(June 2019\)](#)

“Over the past few decades significant effort has been devoted to increasing the safety of space operations. This has resulted in significant technical progress such that the rate of failures and accidents has been reduced from the early days of space exploration. However there has been little progress in establishing an international legal framework to adopt and standardize these technical safety standards. Despite significant efforts of the Inter-Agency Debris Committee (IADC) and the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), international guidelines remain non-binding and unevenly applied. There is no legal obligation for States to adopt and conform to any particular set of international standards. Individual space operators (both private and government) are obligated to abide not by international standards, but by the national regulations set by each individual State, which can vary widely.”



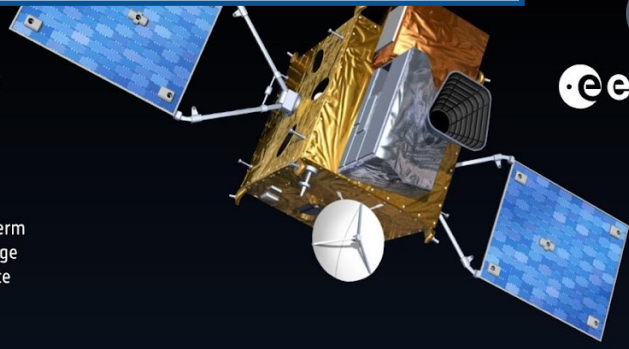
Peace and Security in Outer Space



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SPACE SAFETY & SECURITY APPLICATIONS

We live in an ever-changing world, with immediate, emerging and long-term dangers. Space is required in order to adequately avoid, mitigate or manage most risks to our society and economy – here are some examples of space safety and security applications.



STATE AND COLLECTIVE SECURITY



Civil protection



Border and maritime surveillance and control



Tackling terrorism and organised crime

ACCESS TO RESOURCES



Sustainable food production and distribution



Safe drinking water and sanitation



Managing energy supply

SECURITY OF PEOPLE



Ensuring health, education and democracy



Monitoring and fighting climate change



Predicting and preventing natural and anthropogenic disasters

CRITICAL ECONOMIC ACTIVITIES



Maintaining maritime, aviation, road and rail transport



Reducing technological hazards



Protecting critical infrastructure

#ApplyingSpaceSafety

www.esa.int/safetyandsecurity

[International Law and Security in Outer Space: Now and Tomorrow \(April 1st, 2019\)](#)

“Once the domain of a few spacefaring nations, outer space has exploded with new actors, state and private, in recent years. New actors and activities bring new potential threats and concerns for new and existing actors alike. In this complex environment, where mistrust and misunderstanding often prevail, international law can play an important role in bridging gaps and creating predictability, clarity, and consistency. Although new treaty law is unlikely, the ordinary incremental international law processes of state practice, opinio juris, and international jurisprudence will help to resolve critical questions about the content and application of international law in outer space over time.”

[Outer Space: Weapons, Diplomacy, and Security \(2010\)](#)

“In the fifty years since the United States and Russia raced to launch the first weapons into outer space, the military, commercial, and scientific development of space has advanced at a rapid pace. While space has not transformed—yet—into a new field for armed conflict, its potential for militarization makes cooperation between nations an urgent global priority.”

Democratization on Earth and in Space

[The Implications of a Space Democracy \(April 19th, 2024\)](#)

“Throughout our reign as Earth's dominant species, there have arisen many unique visions for economic and social order. These distinct approaches have, in part, shaped and driven the most vital characteristics of our collective existence — from trade and foreign policy to security and health, to education and entertainment. Now, as humankind converges on an increasingly tangible space ecosystem with space-based infrastructure, a new prospect has emerged at an ideological crossroads: space governance”

[The Empire Strikes Back: Comparing US and China's Structural Power in Outer Space \(October 2023\)](#)

“This article assesses the structural power of the United States and China in the field of space governance. While much of the literature on space power focuses on their technologies and capabilities, we take a complementary approach and explore their capacity to shape the regulatory landscape. Possessing structural power has far-reaching implications for global power projection as well as for various industries, such as telecommunications, transportation, and remote sensing.”

[Space Governance: Who Speaks for Earth? \(April 12th, 2022\)](#)

“As space science matures and accelerates, the time has come for a democratically accountable UN to moderate human activity beyond Earth. In his best-selling book *Cosmos* astronomer Carl Sagan asks: “Who speaks for Earth?” As humanity continues to explore the universe, a UN space agency could provide much stronger international oversight of space activities than the relatively weak treaty regime under which spacefaring nations currently operate.”

[The Second Space Race: Democratic Outcomes for the Future of Space \(January 25th, 2022\)](#)

“The Second Space Race primarily concerns economic and national security, and although many nations hope to contribute to the development of this space economy as well as to the establishment of norms and regulations for the future of space, China is currently taking the lead. However, the consequences of a China-led space order include a system that will be influenced by authoritarian values, with long-term strategic consequences for access to space and its resources. In response, the United States must adopt a space policy vision that prioritizes space development and space resource utilization, taking a leadership role for an inclusive future.”

[The Politics of China's Space Power \(June 14th, 2021\)](#)

“The Diplomat author Mercy Kuo regularly engages subject-matter experts, policy practitioners, and strategic thinkers across the globe for their diverse insights into U.S. Asia policy. This conversation with Dr. Lincoln Hines – research scholar at the Department of Government at Cornell University – is the 276th in “The Trans-Pacific View Insight Series.”

Democratization on Earth and in Space



[Commercialization and Space: Democracies Can Fly in Space \(May 4th, 2021\)](#)

"In 1995, W.D. Kay authored a book, *Can Democracies Fly in Space?* Observing the problems that NASA experienced in carrying out its ambitious mission set, Kay argued that the vagaries of democratic governance including multiple policy areas and leaders, a difficult task environment, a large and diverse group of interested businesses and organizations, and uncertain budgets all contributed to NASA's challenges and difficulties. Since the publication of Kay's book, however, there have been significant developments in space, particularly, the rise of space commercialization. This paper reassesses Kay's argument given these changes finding that democracy may not directly smooth the path for space exploration, but does provide the opportunity for private companies to do so. Given this, the paper highlights a research agenda moving forward that focuses on the intersection of government, business, national security, and normative concerns that take advantage of a growing number of states and companies who are undertaking space exploration. Indeed, through the view of space commercialization, democracies can fly in space."

[The China Challenge, Democracy, and US Grand Strategy \(February 2019\)](#)

"The rise of China and the persistence of deep, internal challenges across open societies have created tremendous headwinds for democracy and liberal values globally, threatening U.S. alliances, liberal economic order, and even the political identity of the United States and its democratic partners and allies. Beijing's "flexible" authoritarianism abroad, digital tools of surveillance and control, unique brand of authoritarian capitalism, and "weaponization" of interdependence may in fact render China a more formidable threat to democracy and liberal values than the Soviet Union was during the Cold War."

Commercial Space Exploration

[Space, Diplomacy, and Beyond: Insights@Meridian with Chirag Parikh \(January 11th, 2024\)](#)

"In an era marked by rapid technological advancements in a globalized, interconnected world, the exploration and use of space has become increasingly prominent. Both nations and private entities alike are investing significantly in space exploration



missions, satellite deployments, and advancements in space technology. This heightened focus on space activities not only fosters new scientific discoveries and expands our understanding of the universe, but also presents new opportunities for international collaboration, commercial ventures, and the potential for human settlement beyond Earth. Within this dynamic landscape, the significance of space diplomacy has become increasingly apparent, as fostering it is crucial for ensuring peaceful cooperation, preventing conflicts, and collectively addressing complex issues that transcend national boundaries."

[In the Wild West of Corporate Space Travel, Humans Could Return to the Moon. But Does It Bring Diplomatic Challenges? \(January 10th, 2024\)](#)

"When Pittsburgh-based company Astrobiotic Technology launched its fuel-efficient, NASA-backed flight to the moon, hopes were high that it would be the first U.S. moon landing in more than 50 years. But a fuel leak resulted in the company pulling the plug on the landing and in NASA delaying its plans to return humans to the surface of the moon by a year as part of its Artemis program. The failure of Astrobiotic's landing is a reminder that even though space exploration is now spearheaded by companies, not countries, the challenges of space travel remain the same. But Mai'a Cross, dean's professor of political science, international affairs and diplomacy and director of the Center for International Affairs and World Cultures at Northeastern University, says it should also show the public how important space diplomacy is in what she says is a Wild West age of corporate moon launches."

Commercial Space Exploration

[The Space Report 2024 Q1 Finds Growth in U.S. Space Workforce, Record 2024 Launch Pace, Leaps in Commercial and Civil Spacecraft Technology \(April 9th, 2024\)](#)

"Space Foundation, a nonprofit organization founded in 1983, offering education, collaboration and information for the global space ecosystem, today released The Space Report 2024 Q1, which shows steady job growth and better performance metrics in launch and payload activity amid growing U.S. budget threats and international tensions. The number of private sector space workers in the United States jumped 4.8% in 2023, with a strong employment forecast for the sector promising more work ahead, especially in the growing commercial space market. Total employment in the U.S. space sector, including NASA employment and military roles, grew to 222,300 positions from 201,000 in 2022."

[DoD Releases 2024 DoD Commercial Space Integration Strategy \(April 2nd, 2024\)](#)

"Today, the Department of Defense released the 2024 DoD Commercial Space Integration Strategy. In line with the National Security Strategy and the 2022 National Defense Strategy, this strategy seeks to align the Department's efforts and drive more effective integration of commercial space solutions into national security space architectures. This strategy identifies four top-level priorities that the Department will pursue to maximize the benefits of integrating commercial space solutions."



[Creating a Future for Commercial Space Exploration \(January 29th, 2024\)](#)

"Intuitive Machines' new headquarters was designed and built to support NASA missions that will reestablish U.S. presence on the moon. Burns & McDonnell Chair and CEO Leslie Duke sits down with Steve Altemus, president and CEO of Intuitive Machines, and Jack Fischer, vice president of production and operations at Intuitive Machines, to discuss the future of space exploration and the growing commercial space industry in Houston."



Commercial Space Exploration



[Space Tourism \(November 7th, 2023\)](#)

"Since the flight of the world's first space tourist, American businessman Dennis Tito, on April 28, 2001, space tourism has gained new prominence as more suborbital and orbital tourism opportunities have become available."



[Space Tourism: The Next Great Leap | CBS Reports \(October 3rd, 2023\)](#)

"In the aftermath of the Titan submersible tragedy, extreme travel has come under fresh scrutiny. But one industry stands out for both its allure and the lack of regulation protecting participants' safety: space tourism. CBS Reports explores the next great leap for humankind and whether regulators and industry stakeholders are striking the right balance between encouraging innovation and ensuring safety."

[Virgin Galactic's First Space Tourists Had a 'Surreal Experience' \(August 23rd, 2023\)](#)

"Billionaire Richard Branson founded Virgin Galactic in 2004, and it built up a backlog of 800 paying passengers. After years of missed deadlines, the company finally started delivering on its long-promised journeys with an inaugural commercial launch in June funded by the Italian air force."



[Watch: Virgin Galactic Launches Its First Space Flight for Tourists \(August 10th, 2023\)](#)

"Virgin Galactic took its first paying customers on a rocket to reach the edge of space on Thursday, completing its second commercial space flight."



Commercial Space Exploration

[The Environmental and Moral Implications of Human Space Travel \(January 15th, 2023\)](#)

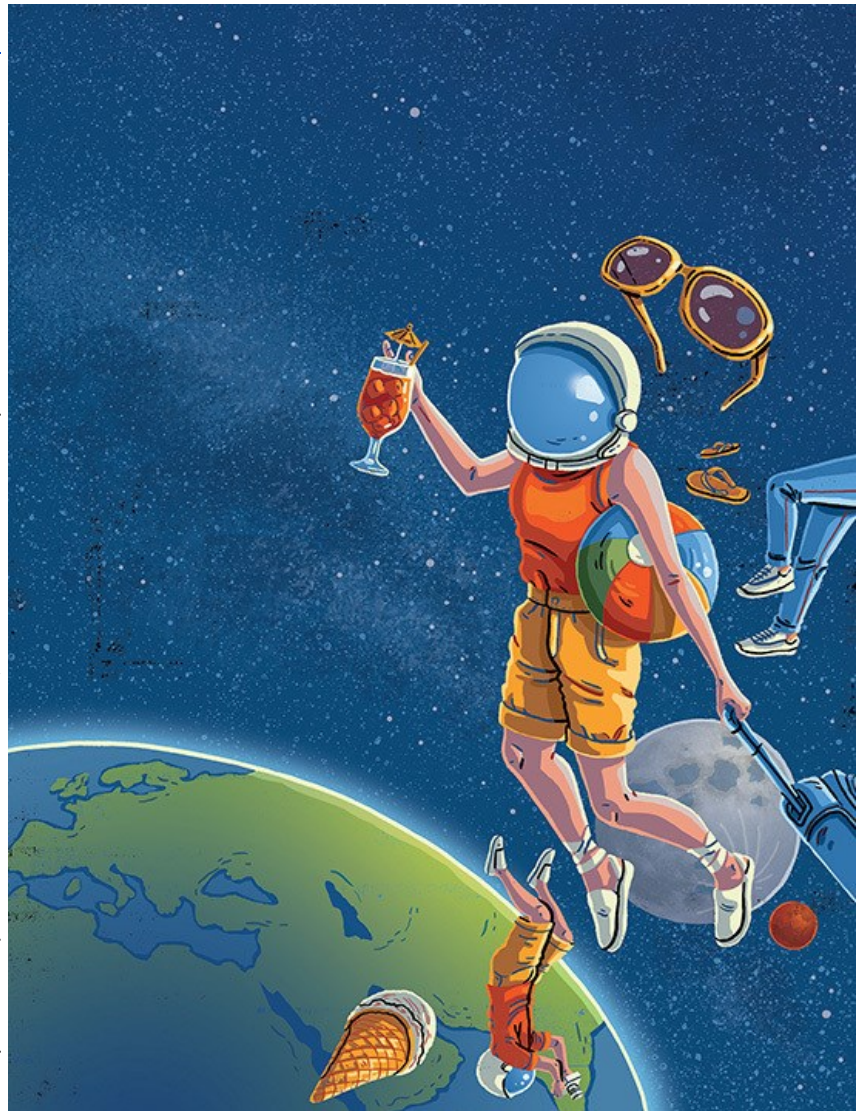
"Humans have long dreamed of traveling to space. In response to the recent increase in commercial space flight, this paper evaluates environmental impacts of human space travel, both past and present, to shed light on the large environmental footprint of such activities. This environmental impact also has a moral component, since most of the global population will never be able to participate in such activities, yet still must bear the cost. Ironically, instead of a space future acting as a relief valve on Earth's resources, few activities exact a heavier burden on our planet's resources than the space pursuit, for the number of people it serves."

[The Future of Space Tourism Is Now. Well, Not Quite. \(May 7th, 2022\)](#)

"From zero-pressure balloon trips to astronaut boot camps, reservations for getting off the planet — or pretending to — are skyrocketing. The prices, however, are still out of this world."

[The Commercial Space Age Is Here \(February 12th, 2021\)](#)

"There's no shortage of hype surrounding the commercial space industry. But while tech leaders promise us moon bases and settlements on Mars, the space economy has thus far remained distinctly local — at least in a cosmic sense. Last year, however, we crossed an important threshold: For the first time in human history, humans accessed space via a vehicle built and owned not by any government, but by a private corporation with its sights set on affordable space settlement. It was the first significant step towards building an economy both in space and for space. The implications — for business, policy, and society at large — are hard to overstate."



Commercial Space Exploration

[Space Tourism and Commercial Deep Space: Humans Going to and Beyond Low Earth Orbit \(2021\)](#)

"After some 60 years of highly trained astronauts going into space, the related technologies and costs have altered to the point where increasing numbers of private citizens can be-



come space tourists, initially suborbital for minimal times and Earth orbital for up to the order of two weeks. There has also developed a rapidly improving digital reality/immersive virtual presence technology providing space tourism experiences at minimal cost and available essentially to everyone. The safety aspects of physical space tourism need further development, but those that relate to the space environment are tolerable for a few weeks from the 60 years of manned space flight experience. As space tourism over the years expands beyond earth orbit to the moon, Mars, asteroids, other planets, etc., the safety issues will need to be seriously addressed. Tourism is only a portion of what will become major opportunities and expansion of commercial space beyond earth utilities into deep space, enabled by the ongoing major reductions in the costs of space access."



[Space Tourism and Commercialization \(August 2nd, 2019\)](#)

"Mike Read, International Space Station Commercial Space Utilization Manager, discusses NASA's new directive that further opens up the station for commercialization and space tourism with the goal of developing a robust economy in low-Earth orbit."



[Lesson Plan for English Teachers - Space Tourism](#)

"This lesson is based on an article about the growing space tourism industry. The text focuses on the different companies that will be operating in this market, including Richard Branson's Virgin Galactic, as well as the future costs and environmental impact of commercial space flights. The grammar section features reported speech: statements and questions. At the end of the lesson, students discuss whether they believe space tourism could become a huge market."

Space Diplomacy for a Better World: Competition and Collaboration

[United Nations Office for Outer Space Affairs \(UNOOSA\)](#)

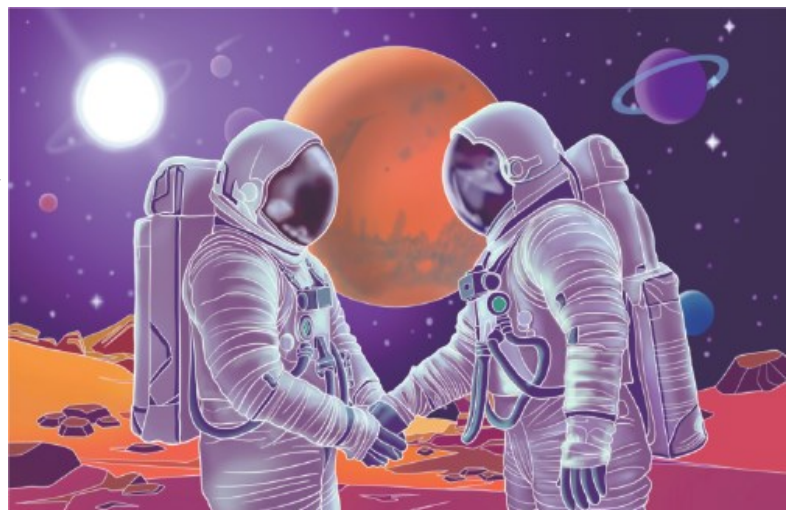
“The United Nations Office for Outer Space Affairs (UNOOSA) works to promote international cooperation in the peaceful use and exploration of space, and in the utilisation of space science and technology for sustainable economic and social development. The Office assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities and strengthens the capacity of developing countries to use space science technology and applications for development by helping to integrate space capabilities into national development programmes.”

[FACT SHEET: Vice President Kamala Harris Launches Call to Action to Bring the Benefits of Space to Communities Across America \(April 8th, 2024\)](#)

“Under Vice President Kamala Harris’s leadership of the National Space Council, the U.S. is continuing to steward the responsible and sustainable use of space to protect our national security interests, address the climate crisis, foster a thriving commercial space sector, and more. In 2022, the Vice President announced commitments to inspire, prepare, and employ the space workforce and ensure that the U.S.’ future in space remains strong. Today, the Vice President issued a call to action for both the private and public sectors to bring the benefits of space to communities across our Nation. As part of this call to action private and public organizations and institutions are announcing commitments to help achieve that aim.”

[China’s Space Ambitions Are Fueling Competition and Collaboration \(October 31st, 2022\)](#)

“At 3:37 a.m. ET on Monday, China launched the last key component of its space station, the latest step in the country’s efforts to become a leading space power...As competition grows, China and the U.S. are accusing each other of militarizing outer space. The Chinese space program’s opaque ties to the People’s Liberation Army fuels Washington’s concerns over using civilian facilities for surveillance and intelligence, even though NASA has a history of working with U.S. defense agencies. Citing security issues, the U.S. in 2011 passed a law barring China from joining the ISS and requiring FBI approval for any space information exchange with the country. Most recently, NASA Administrator Bill Nelson accused China of planning to colonize the moon, stealing tech and using the Tiangong to study how to destroy other satellites, a claim China has vehemently denied.”



Space Diplomacy for a Better World: Competition and Collaboration

[A Shared Frontier? Collaboration and Competition in the Space Domain \(June 15th, 2022\)](#)

"In the realm of space, the race to the most advanced technology is a fierce one. Countries across the world compete to employ the best and brightest scientists to work on projects like anti-satellite weapons (ASATs), launchers, and probes, which are crucial to achieving military, economic, and scientific dominance in space. However, the interests of scientific researchers, the creators of these technologies, and national governments, the users of these technologies, aren't always aligned: the scientific community benefits greatly from open collaboration with international colleagues, while governments would prefer to keep new developments guarded. With that in mind, how might states best balance national security interests with constructive (and necessary) scientific collaboration?"

[Space Diplomacy Through the International Visitor Leadership Program \(IVLP\) \(November 28th, 2023\)](#)

"Through collaboration, cooperation, and diplomacy, the United States and our space partners are advancing science, addressing global societal challenges, and exploring and using space to benefit all humankind. This year, the U.S. Department of State's Bureau of Educational and Cultural Affairs has implemented three International Visitor Leadership Program (IVLP) initiatives to enhance peaceful space cooperation and foster lasting connections between Americans and space professionals around the world. By working together, we discover more and go farther."

[Outer Space Must Be a Place for Peace and Cooperation, Not an Arms Race, Speakers Affirm, as Fourth Committee Takes Up Space Matters \(October 24th, 2023\)](#)

"Outer space must become an arena for international cooperation for global sustainable development, and not a theatre for an arms race, the Fourth Committee (Special Political and Decolonization) heard today as it began its consideration of international cooperation in the peaceful uses of outer space."

[The Outer Space as a Domain of Competition and Collaboration from the Cold War to Today \(September 21st, 2023\)](#)

"In the 20th century, breakthroughs in technology and science enabled remarkable space exploration. The Soviet Union launched Sputnik-1, the first artificial satellite, in 1957, signaling the beginning of a new phase called the Space Age. The dominant view during the Cold War era was to view space activities from a military perspective, while seeking arms control at the international level. In the end, it turned out to be a geopolitical competition between the United States and the Soviet Union... This thesis examines how space exploration has evolved and progressed from the Cold War to the present. It also examines how global competitive dynamics are shaping space policy in the 21st century. It suggests that competition in space is likely to increase."

Space Diplomacy for a Better World: Competition and Collaboration



[Great Power Competition and/or Cooperation in Space: The State of Play \(2022\)](#)

"Space is becoming a critical determinant of how states behave in the arena of international relations... Considering these factors and recent events, what has changed, if at all, as competition and cooperation move into space? How do they affect allies' and adversaries' views of space-related capacities, and how have strategic alignments changed and adapted to new realities?"

[Space Exploration and U.S. Competitiveness \(September 23rd, 2021\)](#)

"[This article explores how] U.S. space exploration inspired a generation of students and innovators, but NASA's role has diminished, and the number of global space competitors is growing."



[The Space Race: From Competition to Collaboration \(2020\)](#)

"In 1957 Sputnik launched, marking the start of a Space Race between the Soviet Union and the USA. Less than 20 years later they were working together on the first international space mission. 40 years since the beep heard around the world, 15 nations worked together to build the ISS. 60 years later we're looking to work together to go back to the Moon to stay."



[The 21st Century Space Race: Geopolitical Competition or Cooperation?](#)

"In this fourth episode of Wisdom of the Crowd, we take a look at geopolitics, but not just how geopolitics play out here on earth. We're going to zoom out a bit – looking at how space continues to operate as a stage for geopolitical competition, long after the Cold War of the last century. Today, new technologies and global powers, alongside private giants like SpaceX and Blue Origin, are re-shaping the space race. We will hear new perspectives and ask important questions about both the strategic opportunity and immense risk that comes with space exploration and colonization."

Space Diplomacy for a Better World: The Future of Space Technology

[60 Years and Counting - The Future](#)

"NASA's future will continue to be a story of human exploration, technology, and science. We will go back to the Moon to learn more about what it will take to support human exploration to Mars and beyond. We will continue to nurture the development of a vibrant low-Earth orbit economy that builds on the work done to date by the International Space Station. NASA engineers will develop new technologies to improve air transport at home and meet the challenges of advanced space exploration. Our scientists will work to increase an understanding of our planet and our place in the universe. We will continue to try to answer the question, "Are we alone?"



[Advances in Space Technology: Everything You Need to Know | Complete Series | FD Engineering \(June 11th, 2023\)](#)

"A revolution in space technology is unfolding. New players in the launch industry are radically cutting the cost of access to space and our understanding of the universe is growing exponentially thanks to space-based research. This 13-part series examines all things space, from Jupiter to space communication. What are the most recent discoveries, and what technology made them possible?"

[How Space Exploration is Fueling the Fourth Industrial Revolution \(March 28th, 2023\)](#)

"In 2022, the first images from the National Aeronautics and Space Administration's (NASA) James Webb Space Telescope were released, capturing the world's attention with breathtaking vistas of thousands of stars, planets, and galaxies, including the most distant galaxies ever detected. These discoveries only scratch the surface of what will come from the telescope, thanks to decades of investment and partnership between NASA, the European Space Agency (ESA), and the Canadian Space Agency (CSA), and continuous advancements in science, which are the backbone of this unprecedented discovery. Beyond the Webb Telescope, further discoveries in space are rapidly accelerating, creating an exciting new paradigm for space that includes new players, trends, opportunities, and challenges, all propped up by the convergence of advanced technologies that are a part of the ongoing, broader Fourth Industrial Revolution (4IR)."

Fast Fact:

"NASA is developing technologies to drill into regolith (space word for "soil") on the Moon, Mars, and asteroids and to convert it into oxygen, drinkable water, other products to support human and plant life, consumables, and fuel sources." <https://www.nasa.gov/specials/60counting/future.html>

Space Diplomacy for a Better World: The Future of Space Technology

[The Future of Space Technology and How It May Benefit Humanity \(Spring 2022\)](#)

“The initial question posed for this paper was “What is the future of space technology? What benefits will humanity derive from the growing accessibility of space and the space economy?” This paper refocuses the question from “benefits” to “effects” for while space technology will certainly benefit humanity, it will likely present challenges as well. Even so, this paper takes a more optimistic view of the impact of space technologies perceiving the latter in terms of creating opportunities rather than vulnerabilities.”

[Aerospace In Morocco: Building A Sustainable Country \(March 5th, 2022\)](#)

“Through its high dependency on agriculture, fishing activities, tourism, the vulnerability of key resources such as water and forestry, and an important coastal industrial activity, the Moroccan economy is especially exposed to the impacts of climate change due to its geographical location, and is prone among others to more frequent extreme weather events, water scarcity, declining agricultural production, and rise in sea level. To combat these changes and strengthen the country's infrastructure and ecosystems, the aerospace sector in Morocco is leading the charge in creating innovative sustainable advancements in farming, fishing, solar energy, ports/coastal infrastructure, and more. This curriculum resource guide is perfect for students, educators, and community members interested in learning about Morocco's aerospace sector and the current initiatives, policies, and projects

supporting Morocco's climate change response, centering the ways space technology is helping Morocco strengthen its infrastructure and economy; protect its people and ecosystems; and become a sustainable country.”



RESOURCE GUIDE FOR EDUCATORS

WORLD AFFAIRS COUNCIL
Celebrating 70 Years

**AEROSPACE IN MOROCCO:
BUILDING A SUSTAINABLE
COUNTRY**

SATURDAY, MARCH 5TH, 2022
9:00 - 10:00 AM PT



Space Diplomacy for a Better World: The Future of Space Technology

Water is a vital natural resource without which life would cease to exist. Water conservation and resources management represent some of the most critical environmental issues currently facing

Space technology and applications play a key role in understanding global water cycles, mapping water courses, and monitoring and mitigating the effects of floods and droughts.

Image Source: ESA.



[IQT Explains: The Future of Space Technology \(September 21st, 2021\)](#)

"In the final episode of our three-part space podcast series, host Vishal Sandesara is joined by Kristi Bradford, Tom Gillespie, and Clayton Williams to explore the future of space. Hear from these domain experts as they discuss how the space industry can help shape the future of national security and beyond, including trends they've seen based on recent activity in the domain."

[Space for Water](#)

"In 2016, the United Nations Office for Outer Space Affairs (UNOOSA) and the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) signed an agreement to collaborate on their common goal of promoting the use of space-based technology for increased access to water."



[NASA: Episode 50: Futuristic Space Technologies](#)

"NASA Innovative Advanced Concepts Program Executive Jason Derleth discusses visionary concepts that could transform future space missions."



[How Space Exploration Is Helping Us Save the Environment | Yakob Reed | TEDxDonauinselSalon \(January 12th, 2018\)](#)

"Space stations and rockets make us better at leaving our planet, but they might help us stay here too. Youth speaker Yakob Reed explains how space programs have been making humanity more sustainable through technology, and what this means for the future of our home. Yakob Jake Reed is a high school senior at the American International School in Vienna who hails from the United States and Malaysia. His interests in school involve theater arts, jazz guitar, journalism, and public speaking. His academic focuses are in Mathematics and Physical and Chemical Science. Jake hopes to study Aerospace Engineering at university. This talk was given at a TEDx event using the TED conference format but independently organized by a local community."

The Future Brought to You by



America is beginning an exciting new chapter in space exploration. To enable the future, NASA has developed a set of roadmaps to define the key new technologies required for our human and robotic explorers to safely venture into deep space, to better understand how our own solar system evolved, and to unravel the mysteries of our universe.

The map you see here is a graphical representation of the NASA Space Technology Roadmaps, serving as a portal to the various technologies that NASA is developing. Let this technology portal serve as a starting point for your adventures beyond the bounds of Earth...

To learn more visit
www.nasa.gov/oct



TA05 Communication & Navigation

TA06 Human Health, Life Support & Habitation Systems

TA07 Human Exploration Destination Systems

TA08 Science Instruments, Observatories & Sensor Systems

TA09 Entry, Descent & Landing Systems

TA10 Nanotechnology

TA11 Modeling, Simulation, Information Technology & Processing

TA12 Materials, Structures, Mechanical Systems & Manufacturing

TA13 Ground & Launch Systems Processing

TA14 Thermal Management Systems

TA04 Robotics, Tele-Robotics & Autonomous Systems

TA02 In-Space Propulsion Technologies

TA03 Space Power & Energy Storage

TA01 Launch Propulsion Systems

TA02

TA01

TA08

TA04

TA07

TA11

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TA12

TA10

TA06

TA09



Space Diplomacy for a Better World: Planetary Protection



[Planetary Protection](#)

"NASA's Planetary Protection policies and requirements ensure safe and verifiable scientific exploration for extraterrestrial life. The main objectives are to carefully control forward contamination of other worlds by terrestrial organisms and organic materials carried by spacecraft in order to guarantee the integrity of the search and study of extraterrestrial life, if it exists and rigorously preclude backward contamination of Earth by extraterrestrial life or bioactive molecules in returned samples from habitable worlds in order to prevent potentially harmful consequences for humans and the Earth's biosphere."

[Accelerators: A Vision and Call For Action | Protection of Space Assets \(2023\)](#)

"Europe must develop operational systems to enable the detection, identification, and avoidance of natural and human-made space hazards. There is an urgent need to enhance space sustainability by applying zero debris principles and developing a new European commercial capacity to provide innovative in-orbit services, such as deorbiting, repairing and refuelling active satellites, thus creating a circular economy in space."



[Protect Space from Debris and Space Weather \(November 24th, 2023\)](#)

"Today's world is becoming ever more dependent on space-enabled technologies. The protection of space assets accelerator aims to keep space-enabled technologies safe from hazards such as space debris and space weather."

3 CHALLENGES

TO SPACE SUSTAINABILITY

1 SPACE JUNK

Number of Debris Objects by Size



Source: U.S. Space Command, European Space Agency, NASA

2 ORBITAL CROWDING

Examples of Planned Satellite Constellations*



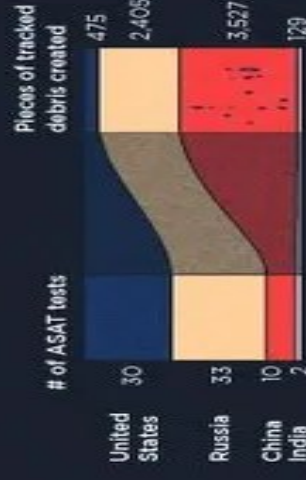
Collisions



*as of August 10, 2021
Source: NewSpace Index, Lynk Global

3 SPACE SECURITY

Debris Generated by Anti-satellite (ASAT) Tests



Source: Secure World Foundation



Space Diplomacy for a Better World: Planetary Protection



[Podcast: Childhood Illness, Planetary Protection, and Sustainable Finance \(August 23rd, 2023\)](#)

"Improving planetary protection – How do we make sure we don't contaminate other worlds with our space missions, or contaminate Earth with samples returned from elsewhere in the Solar System? We speak to Professor Mark Sephton about a new project to make better risk assessments and improve planetary protection."



[Answering Evolution Questions, Planetary Protection, Part 2 \(August 4th, 2023\)](#)

"For decades, people have been trying to figure out how to avoid contaminating other planets as they explore them—an idea called planetary protection. As missions venture forth to places such as Mars or Jupiter's moon, Europa, the need to protect worlds that could support life becomes more critical. And at the same time, as space programs begin to bring samples back to Earth from places like Mars or asteroids, planetary protection becomes a concern in another way—the need to protect Earth from potential unknown life forms from the cosmos."

[Protecting the Planet: Planetary Protection vs. Planetary Defense \(October 14th, 2022\)](#)

"Although both Planetary Protection and Planetary Defense programs at NASA include the word "planetary" and aim to protect the planet, that's where similarities end. These two vital efforts oversee very different aspects of the agency's role in protecting Earth, and in some cases, other planets."

Space Diplomacy for a Better World: Planetary Protection



[NASA Releases New Planetary Protection Standard \(August 31st, 2022\)](#)

"NASA's Office of Safety and Mission Assurance released NASA-STD-8719.27, Planetary Protection Standard, effective Aug. 30, 2022. The standard is a follow-on document complementing NPR 8715.24, Planetary Protection Provisions for Robotic Extraterrestrial Missions. It addresses and is relevant to both crewed and robotic missions and covers the technical details a mission should consider for the design and execution of the Planetary Protection mission throughout the project life cycle. It is relevant starting in the Mission Concept Review and System Requirements Review phase by defining the Planetary Protection categorization to end-of-mission disposal reporting."

[Kessler Syndrome and the Space Debris Problem \(July 14th, 2022\)](#)

"The Kessler Syndrome is named after former NASA scientist Donald Kessler, who laid out the basic idea in a seminal 1978 paper. In that study, titled "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt," Kessler and co-author Burton Cour-Palais noted that the likelihood of satellite collisions increases as more and more spacecraft are lofted to orbit. And each such smashup would have an outsized impact on the orbital environment."

[European Space Agency \(ESA\)](#)

The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world.

Did You Know?

"Because of the high speeds at which objects orbit Earth (up to 8 km [5 miles] per second), a collision with even a small piece of space debris can damage a spacecraft. For example, space shuttle windows often had to be replaced because of damage from collisions with debris smaller than 1 mm (0.04 inch)." [https://](https://www.britannica.com/technology/space-debris)

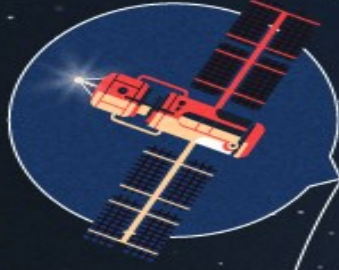
www.britannica.com/technology/space-debris



SPACE SUSTAINABILITY

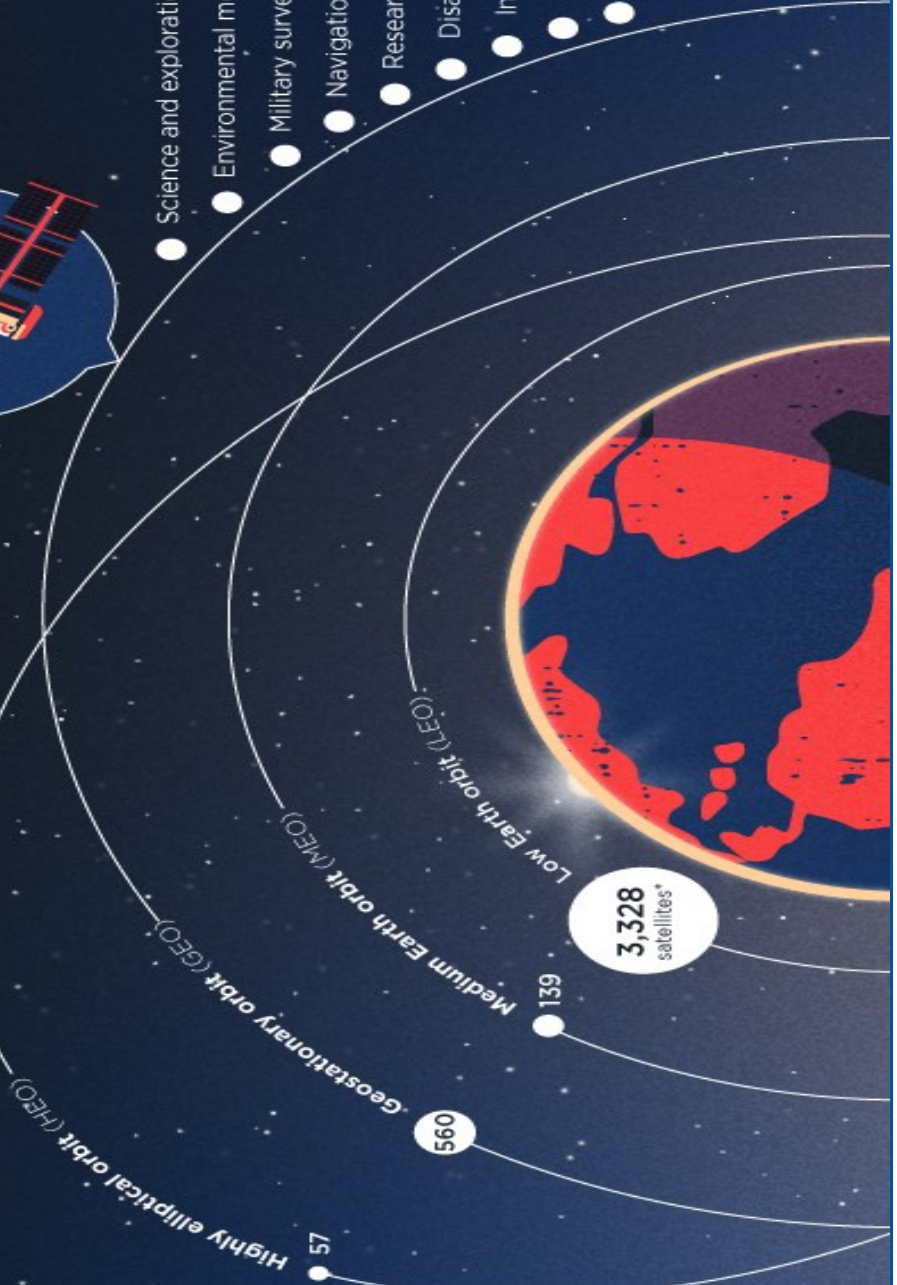
Space holds vast benefits to humanity that we leverage through satellites.

PRESERVING THE USABILITY OF OUTER SPACE



As of May 2021, there were 4,084 operational satellites in space, with several applications:

- Science and exploration
- Environmental monitoring
- Military surveillance
- Navigation
- Research and development
- Disaster management
- In-orbit satellite servicing
- Missile warning systems
- Satellite broadband



Space Diplomacy for a Better World: Planetary Protection

[The UN's Role in Planetary Protection \(January 31st, 2022\)](#)

“Planetary protection is defined as protecting extraterrestrial environments from Earth-based contamination (forward contamination), as well as protecting Earth from extraterrestrial contamination (backward contamination). Satellites and space rovers are often sterilized at high temperatures before being launched to ensure that no Earth-based organisms are accidentally introduced into outer space. It is akin to protecting ecosystems on Earth from invasive species. For example, when entering protected waterways, boats are encouraged to flush out their ballast water and rinse external surfaces to prevent non-native species from infiltrating the native ecosystem.”

[Planetary Protection Policy: For Sustainable Space Exploration and to Safeguard Our Biosphere \(November 4th, 2020\)](#)

“The search for the origin of life amongst the planetary bodies in our solar system is a driving factor in space research. However, the simple act of sending a spacecraft to explore in situ solar system objects can potentially compromise their environments and cause harmful contamination when returning to Earth. Avoiding such biological contamination of planetary bodies (forward contamination) is essential in the scientific exploration of our solar system, as is protecting Earth’s environment from the introduction of extraterrestrial matter (backward contamination) from planetary missions. COSPAR, the Committee on Space Research, through an international panel of scientists regularly reviews the latest scientific research to provide guidelines and categorisation of space missions so as not to jeopardise future research and scientific investigation of celestial bodies.”



Connecting the Local to Global: Space and the Puget Sound Region

[Space Foundation, Global Space Report](#)

“Space Foundation is a nonprofit advocate organization founded in 1983, offering a gateway to education, information and collaboration for space exploration and space-inspired industries that define the global space ecosystem. Our mission, deeply rooted in a 40-year heritage, is guided by three core values: Trust, Teamwork and Excellence. These values serve as our compass, directing us as we tirelessly pursue our commitment to the global space community.”

[Washington State Space Economy: 2022 Update \(February 2022\)](#)

“The central Puget Sound region is positioned to be a leader in commercial space exploration and development into the future, given longstanding activity in the aerospace sector, high-tech manufacturing resources, information technology assets, and a strong pool of talent. However, promoting successful competition in areas of the space economy will depend on a regular review of assets, strengths, challenges, and gaps in the field. This report is intended as an update to a study published in 2018 by the Puget Sound Regional Council (PSRC) that examined the regional and statewide space sector. Even over the past four years, there has been considerable change across the regional space economy and providing a revised outlook on the regional landscape can help to guide future efforts in supporting businesses involved in the space economy in the region.”

[Seattle, Washington: Satellite City](#)

“Washington State, and the Puget Sound region in particular, is an emerging hotbed of space industry entrepreneurship and activity. With a rich tradition of aerospace excellence, a large base of hardware and software engineering talent, a robust community of entrepreneurs and investors, and visionary space



leaders who call this area home, the Pacific Northwest is a center of excellence and an engine of innovation for the new, entrepreneurial space age. In particular, the Seattle area is the global leader in small satellites and mega constellations, with several of the top satellite constellations based here. Also, as cloud computing and satellite networks converge, the top two global cloud service providers, Seattle's Amazon Web Services and Microsoft Azure, have entered the space industry.”



Washington State's Space Ecosystem



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