SCUSA 72: Space: The Final Frontier

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Given that so much of the world’s economy, communication, and way of life is underpinned by satellites and other space-based technology, in 2019 the United States created the Space Force to protect and advance America’s interests in this domain. In what ways are countries vying for power and influence in this final frontier and how will this competition impact the United States’ ability to advance a national agenda in this domain? Should the United States support the establishment of an international institution to regulate the space activities of states and private actors, including exploration, commercialization, and weaponization? How might the militarization or de-militarization of space look over the next decade? Will the initiatives of the private sector to explore and monetize space travel help or hinder the space agendas of the U.S. government? To what extent is America’s status as the global leader in higher education in space-related technologies faltering or will the US maintain its competitive edge?

Introduction

On July 11, 2021, billionaire Richard Branson traveled to space and set off a new era of “space tourism,” or space travel by civilians for recreational purposes. Branson, along with three crewmates and two pilots, traveled 50 miles above Earth’s surface and experienced several minutes of weightlessness before traveling home. Less than two weeks later, billionaire Jeff Bezos and three others boarded Blue Origin’s space vessel New Shepard and traveled 62 miles above Earth’s surface. Bezos’s flight 62 miles above Earth’s surface reached the Kármán Line, or the boundary generally accepted by the international community as where Earth ends and outer space begins.

While 2021 marks the dawn of recreational activity in space, this decade also represents an increase in military activity in space. On December 20, 2019, the United States Congress signed the “birth certificate” of the U.S. Space Force (USSF), creating a sixth branch of the Armed Forces and the first new branch since 1947. A primary task of the USSF is to monitor the over 30,000 objects in space today, both satellite and debris, and defend and protect U.S. and allied interests in space. Thirty thousand objects is an ever growing number given the explosion of commercial and private activity in space over the last several decades. The increasing use of space also creates a greater potential for the militarization of space, as activities in space by the United States, Russia, and China suggests. In 2020, Russia conducted multiple anti-satellite (ASAT) tests, continuing to develop and constitute its counterspace capabilities, and in 2021, China launched astronauts into space for the first time in five years following a succession of successful space activities including landing on the far side of the moon, developing plans to travel to Mars, and preparing for a Chinese International Space Station to be called Tiangong, or Heavenly Palace.

Today, there are 60 spacefaring nations, compared to only two spacefaring nations—the United States and Soviet Union—during the Cold War. Space exploration during the Cold War
was deemed a space race, but American activity sought scientific evolution over the perpetuation of political objectives. The same does not hold true today. Given the number of spacefaring nations, the number of objects in space, and the increasing reliance on space for daily economic activity, states cannot separate scientific evolution in space from political objectives. Space is the “ultimate high ground” required for economic growth and military advantage.

This paper will address the importance of the final frontier in three parts. First, it will explain why the international community cares about space, with a focus on how the commercialization of space has opened the frontier. Second, it will evaluate which states matter in space today by describing the capabilities of two of the United States’ greatest adversaries, Russia and China. Finally, it will discuss efforts to regulate and govern space. The paper concludes with a list of resources for further information.

Why does the international community care about space?

Space matters because its use impacts two key domains: the economy and national security. Space-based systems allows for or enables the following critical functions: precision, navigation and timing (PNT), primarily through the global positioning system (GPS), which is the U.S.-owned and operated Global Navigation Satellite Systems (GNSS); television broadcast; voice communication and mobile communication services; internet service; security surveillance; terrestrial, air, and maritime awareness; climate research and weather monitoring; nuclear non-proliferation monitoring; and intelligence collection. Emerging space-based capabilities could also reduce dependence on Earth’s natural resources. Space-based solar power could capture more of the sun’s energy and therefore energize functions on Earth and in space, and space-based mining technologies may be able to extract ice from the Moon and asteroids, utilizing underlying oxygen to fuel rockets and support human life in space. Given the range of activities currently conducted in space and those which may exist in the near future, the U.S. Chamber of Commerce estimates the value of commercial activity in space will increase from $385 billion in 2020 to at least $1.5 trillion in 2040.

The international economy is heavily reliant on the above-stated capabilities: consider daily activities from an individual person and business organization perspective without having access to some mobile phone services, GPS, weather data, and so forth. The 21st century marks a significant evolution of the space economy. When space exploration began during the Cold War, space benefits largely came at the cost of the government and its state-sponsored programs. In the United States today, the space economy has largely transitioned from the government to private companies and commercial industry. Much of this transition is the result of a deliberate change in policy. In 1984, the Commercial Space Launch Act opened space activity to the private sector pending specific regulations. Pleased with progress and advancements provided by the private sector, the United States further relaxed regulatory standards for space companies in 2004, hoping to encourage private firms and commercial industry to become more active and innovative in the space arena.

With relaxed policy and encouragement from the government to invest in space programs, the private sector has jumped headfirst into the space industry developing satellites,
rockets, and launch vehicles. A satellite is a moon, planet, or machine that orbits a planet or star. Earth has a natural satellite, the moon, and man-made satellites that are generally comprised of a power source and antennae with a set mission. Satellites are launched into space on rockets and establish an orbit based on intended capability or mission. There are four different orbits for satellites. Most satellites, including the International Space Station (ISS), reside in low earth orbit (LEO); satellites that service a specific area of the earth and need to stare at the earth reside in geosynchronous orbit (GEO); satellites that provide global coverage like GPS reside in medium earth orbit (MEO); and satellites with other specific missions reside in highly elliptical orbit (HEO).

“Deep-pocketed” visionaries like Elon Musk of SpaceX, Jeff Bezos of BlueOrigin, Paul Allen, and Richard Branson have created a new industry of small, low-cost rockets that can launch a few microsatellites at a time. Satellites are now more plentiful, cheaper, and designed more like mobile phones. Further, SpaceX’s development of reusable rockets slashed the cost of space launch for everyone, including the U.S. government.

Today, there are over 2,000 satellites in space with the majority of them in LEO. The other 28,000 objects in space are primarily debris from satellite explosions (both deliberate and accidental). For example, in 2007, China conducted an anti-satellite test on one of its own satellites that resulted in an exorbitant amount of space debris. The USSF tracks any piece of debris that is softball size or bigger; however, estimates show that up to 96% of space objects are untracked and the number of satellites in orbit could increase four to ten times in the next decade.

Commercial success in the space economy has two important takeaways. First, space activity is now much cheaper than it once was. Second, a corollary of the first, is that space is now incredibly congested. Congestion of space is a problem. Called the “Kessler syndrome,” space could reach a point at which debris from one collision sets off continuous collisions and safe space operations become no longer viable.

The congestion of space also leads to greater militarization of space as states need to protect their own assets, terrestrially andorbitally. States can militarize easily given the cheapness of launches and satellite development. The militarization of space references a multitude of space activities that seek to both defend one state’s national security and / or threaten the capabilities of another state in space. First, the increase in satellites means that overhead surveillance has become persistent and unblinking. Satellites blanketing the Earth allow states or private companies to track people and objects with extreme precision. This may result in a dramatic expansion of time-sensitive targeting. Second, technology author Christian Brose writes that, “It is hard to imagine that strategic and military competition will remain confined to Earth.” As the number of satellites and launch vehicles increases at cheaper rates, moving to and from outer space will become easier and more common. Militaries could view space travel as little different than flying or sailing around the planet. Although against the current Outer Space Treaty, militaries could use space to establish bases in orbit to pre-position forces and capabilities, manufacture reinforcements during a conflict, and deliver those machines where they are needed on Earth in a matter of minutes. Third, there is a host of newer
technologies that can be used to threaten the space domain: kinetic physical counterspace weapons that include direct-ascent ASAT weapons, co-orbital ASAT weapons, and ground-station attacks; non-kinetic physical counterspace weapons such as high-altitude nuclear detonation, high-powered lasers, laser dazzling or blinding, and high-powered microwaves; electronic warfare such as uplink and downlink jamming and spoofing; and cyber-attacks such as data intercept or monitoring, data corruption, and seizure of control. The bottom line is best understood through the words of USSF Commander General John Raymond: “Space is no longer a benign environment.”

Who does the international community care about in space?

The United States is the dominant and most advanced actor in space today. China and Russia are the next two most advanced actors in space. Other states with advancing space capabilities include Iran, North Korea, and India, followed by France, Israel, Japan, South Korea, and the United Kingdom. This paper will focus on China and Russia as former Secretary of Defense Mark Esper said in 2020 that “in space, Moscow and Beijing have turned a once peaceful area into [sic] a warfighting domain.”

China

If the Cold War space race was between the United States and the Soviet Union, then today’s space race is with China. China aims to become the world’s preeminent spacefaring nation and to seize the “lunar high ground,” not only for the economic benefits that come from space but also to better compete with the United States. China launched a manned mission in June 2021 for the first time since 2016, became the first nation to land an unmanned spacecraft on the far side of the moon in 2019, and began assembling its space station, Tiangong or Heavenly Palace, in April 2021. Tiangong’s assembly is particularly significant as the International Space Station (ISS), which denied access to China, is set to decommission in 2024 given the predetermined loss of funding from the U.S. Congress and other international partners.

The organization of Chinese space assets and missions has both civilian and military components. Similar to the U.S. National Aeronautics and Space Administration (NASA), China has the China National Space Administration (CNSA) for research and development. The difference, however, is that all astronauts (called taikonauts in China) are members of the People’s Liberation Army (PLA), the armed wing of the Chinese Communist Party (CCP). While there is a strong relationship between the military and civilian community in U.S. space programs, in China “the degree of military control, lack of potential civilian intermediaries, specific chain of command, and broader “military-civil fusions” mission of some civilian institutions give China’s space program a significantly stronger military bent.”

The concern over the PLA’s active role in China’s space program centers on the potential dual-use of all Chinese space capabilities: for any economic space capability, there is also an associated military capability. For example, in 2020 China launched its final BeiDou satellites. BeiDou is a constellation of 35 satellites that makes up China’s GPS services and provides PNT capabilities to 120 countries. BeiDou is a significant component in China’s Belt and Road
Initiative (BRI) that provides necessary investment in Asia and increases Chinese economic growth, while simultaneously allowing China greater influence and control over countries receiving investment. Providing PNT capabilities to 120 countries may also allow China to surveille and monitor the activity of those countries.

Finally, China does have significant kinetic physical counterspace weapons. It can threaten any U.S. satellite in LEO, and likely those in MEO and GEO. Unconfirmed information suggests that China has a laser weapon system that can target satellites through non-kinetic physical means. And although no publicly acknowledged reports suggest China has used cyber capabilities to attack other states’ space systems, India accused China of jamming Indian satellites to hide PLA movement in the disputed territory known as the Line of Actual Control in Ladakh, between India, Pakistan, and China.

**Russia**

Russia is falling behind in the space race between the United States and China but is still a critical state to consider given its historical experience in space and willingness to conduct bold actions against its adversaries particularly when it comes to testing, exploring, and maneuvering ASAT capabilities. Russia is planning a crewed mission to the Moon in 2030, followed by a permanent lunar base in 2035. Russia is also working to solidify cooperation with China in space, including through a joint research base on the Moon and assistance in deep space endeavors. Russia’s space launch vehicle program, Angara, includes vehicles to launch heavy and light satellites, and another program currently in-progress would build satellites for other countries by 2023.

Like the United States and China, Russia’s space program has military and civilian components. Roscosmos is the civilian component, with military space activities falling under the Russian Aerospace Forces (RAF). Roscosmos is estimated as a $1 billion industry responsible for satellites, launches, and launch vehicles in Russia. Prior to U.S. government investment in commercial space through companies like SpaceX and Boeing, the United States would pay Roscosmos $80 million a seat to launch astronauts to the ISS. Similar to BeiDou, Russia has its own PNT system known as GLONASS that consists of 27 satellites. Russia uses the military site Plesetsk to launch its satellites.

Russia does not have a technological edge over the United States or China as sanctions against domestic state-owned companies have left its commercial satellite market severely underdeveloped. Nevertheless, Russia consistently tests counterspace weapons. In April and December 2020, Russia tested a direct-ascent ASAT system and in July 2020, it conducted a co-orbital ASAT test. The USSF reprimanded Russia on all accounts given safety concerns for other satellites in space and suspicion about the motivations behind ASAT space capabilities. Russia also maintains an earth-to-space missile capability, potentially a gun that can be fired in space, non-kinetic physical laser capabilities, growing electronic counterspace capabilities, and disruptive cyber capabilities.
Other Actors

India is the fourth country, after the United States, China, and Russia, to have developed a successful kinetic counterspace weapon. Iran and North Korea are working to develop counterspace weapons, but currently have greater success in cyber and electronic warfare than kinetic counterspace weapons. Other countries of note include France, Israel, South Korea, Japan, and the United Kingdom, which have all recognized the need for an active role in space.47

What is the future of space governance?

As noted above, commercial industry has made space activity cheaper, faster, and easier. This includes military activities in space, particularly as a large number of commercial capabilities are dual-use. As the number of satellites and space capabilities increases, there is an ever-increasing need to protect space capabilities. Unfortunately, few internationally accepted norms and regulations currently help govern acceptable and unacceptable behavior in space.

The primary international space treaty is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty or OST), signed in January 1967 by 110 countries. The OST broadly encourages the free exploration of space by states and peaceful uses of space, and includes other principles such as no claims of sovereignty in space and no nuclear weapons in space.48 The OST’s language is broad and vague. Russia and China proposed an updated treaty to prevent the placement of weapons in outer space and to prevent the use of force in space, but the United States rejected the treaty for lacking verification mechanisms and presenting no restrictions on ASAT capabilities.49 The European Union then introduced a non-binding Code of Conduct for Outer Space Activities in 2008, working to address trust and confidence building measures that would encourage peacefulness and transparency in space. This was updated in 2013 with a United Nations report that laid out four categories of information sharing in space. The UN report was heralded as a success, but its implementation is voluntary.50

The international community needs to continue efforts to regulate space to address space situational awareness and traffic management given the congestion of space, debris mitigation, ASAT testing, rendezvous and proximity operations, and the difference between safety and security in space.51 There are many challenges to installing rules to reduce uncertainty and facilitate reciprocity. States do not want to sign treaties that limit their ability to defend themselves, and the divide between state and private interests in space is hard to reconcile (pursuit of security versus pursuit of revenue). The lack of a legal framework makes enforcement difficult, especially given vague language and evolving capabilities.52

Despite these challenges, the United States is paving the way by establishing a set of norms for military activity in space. In June 2021, Secretary of Defense Lloyd Austin signed a memorandum of “Five Tenets of Responsible Behavior” for Department of Defense space operations. These tenets aim to make activity in space safer, limit long-term debris in space, avoid the creation of harmful interference, and communicate clearly when it comes to the safety and stability of space.53
Recommended Resources

- **Space Threat Assessment 2021 | Center for Strategic and International Studies (csis.org)**
- **Defense Against the Dark Arts in Space: Protecting Space Systems from Counterspace Weapons | Center for Strategic and International Studies (csis.org)**
- **Congressional Research Service Reports - Space Policy (fas.org)**
- **Responsible Space Behavior for the New Space Era: Preserving the Province of Humanity | RAND**

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5. Ibid.
16. Ibid.
17. McCall, “Challenges to the United States in Space.”
18. Brose, 71
19. Brose, 65
21. Ibid.
22 Ibid.
23 McClintock, Feistel, Ligor, and O’Connor, “Responsible Space Behavior for the New Space Era.”
24 Ibid.
25 Brose, 167
26 Ibid., 110
27 Ibid., 171
28 Ibid.
35 Ibid.
36 Harrison, Johnson, Moye, and Young, “Space Threat Assessment 2021.”
37 Ibid.
38 Ibid.
40 Harrison, Johnson, Moye, and Young, “Space Threat Assessment 2021.”
41 Pavel Luzin, “Russia is behind in military space capabilities, but that only drives its appetite.”
43 Pavel Luzin, “Russia is behind in military space capabilities, but that only drives its appetite.”
44 Ibid.
45 Ibid.
46 Harrison, Johnson, Moye, and Young, “Space Threat Assessment 2021.”
47 Ibid.
48 McClintock, Feistel, Ligor, and O’Connor, “Responsible Space Behavior for the New Space Era.”
49 Ibid., 17.
50 Ibid., 8.
51 Ibid., 12.
52 Ibid., 22.