Chapter 6

Great Power Competition in Space, 2025–2030

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Over the horizon of this decade, Great Power competition in outer space among the United States, China, and Russia will focus primarily on earth orbit but increasingly toward cislunar space. Earth orbit is destined to become very crowded and feature intensifying competition for commercial benefit and military advantage, motivated by an explosion of technologically viable small satellite constellations operated mainly by Great Powers and by second-tier powers. Minor states also will get into the act, motivated by the acquisition of international status. Cislunar space will become a new arena of intensifying competition, particularly the lunar South Pole. This contest will expand as the United States and China marshal their respective outer space allies and partners under the American Artemis Accords and Chinese International Lunar Research Station (ILRS) projects. Although a contemporary Great Power with a deep space pedigree, Russia will decline in stature, effectively becoming one of the junior allies appended to ILRS and other Chinese outer space aspirations. These dynamics will crystallize a second space race, mainly between the United States and China. It will differ from the first space race—between the United States and Soviet Union—in several ways, but most crucially in that it will be sustained over a longer period. Unlike the first space race, this one will be a marathon, not a sprint. The future of humans in outer space will be determined by whether a single Great Power prevails, or multiple Great Powers continue to joust in a framework of relative parity—the more likely outcome between now and 2030.

This chapter evaluates the status of Great Power strategic competition in outer space today and its likely trajectory through 2030. It considers outer space as a region of expansive commercial and security activities destined to intertwine Russia, and especially the United States and China, in an increasingly tense competitive environment over the near future and to set the conditions for future strategic rivalry that could involve confrontation at a more distant time. First, the chapter establishes a realist framework for analyzing intensifying activities by Great Powers—and lesser powers—in outer space. The realist approach understands state choices as those primarily involving the quest for power and prestige. The chapter next identifies the trajectory of Great Power outer space activities as those creating a second space race, primarily between the United States and China, and contrasts its emerging features with the ones in the first space race, between the United States and the Soviet Union.

The chapter then establishes the two main arenas for international competition in outer space over the next half decade: earth orbit and cislunar space. It explains how the primary arena for Great Power competition in outer space has been earth orbit. Long the focus for both commercial and strategic satellite activities, earth orbit is about to see an explosion of commercial satellite constellations for a variety of economic and security activities. It also will become host to a growing number of military-specific and joint-use satellites, including those with the potential to disrupt or damage others orbiting earth. Moreover, cislunar space will become increasingly valuable and a venue for intensifying Great Power competition over the remainder of the decade. Just as earth orbit has rewarded the three Great Powers with unique and important helpings of the four power resources of prestige, resources, markets, and strategic position, the next half decade should see the Great Powers move to harness the potential of the moon and perhaps Lagrange points 1, 2, 4, and 5 to secure a disproportional amount of those same four critical aspects of power in a whole new outer space arena.

The chapter concludes with a summary of Great Power trends anticipated in earth orbit and cislunar space competition over the coming 5 years, followed by seven major projections for Great Power competition in outer space over the remainder of the decade. It establishes that while a new space race between the United States and China differs in important respects from the first space race between the United States and Soviet Union, it matters for many of the same strategic reasons that underpinned that important element of the past era of bipolar Great Power competition.

Analytic and Theoretic Approaches

What ought to be anticipated soon for international relations in space? The response matters because the 2010s saw heightened competition in space between two of the three Great Powers—the United States and China—as well as the emergence of new spacefaring powers. The years ahead will likely see an intensification of those trends. Projecting the period from 2025 to 2030 calls for medium-term forecasting, and the means adopted in this chapter are more those of the "fox" than the "hedgehog"—that is, projecting based on many things rather than one great thing.[1] Thus, the analytic approach here is multidisciplinary, with information drawn from multiple sources and projections expressed in qualified language.[2] International relations theory determines which questions to ask and interprets the implications of the answers given. That matches the needs of successful foreign policymakers, who—according to political scientist Hal Brands—must be both foxes and hedgehogs.[3]

To better specify the inquiry about the future of Great Power strategic interactions in the extraterrestrial medium, this chapter conceptually disaggregates outer space into four constituent arenas of potential international competition:

- earth orbit

- cislunar space
- asteroids
- other celestial objects.[4]

Earth orbit is together composed of low-earth orbit, medium-earth orbit, elliptical orbit, intermediate circular orbit, and geostationary orbit. Earth orbit is extraordinarily strategically important for relative power—economic and military—of states because communications, global positioning, earth monitoring, and surveillance satellites are crucial to military operations and economic exchange. *Cislunar* space extends beyond geostationary orbit to encompass both the moon and the earth-moon Lagrange points 1, 2, 4, and 5. (Lagrange points are positions in space where objects that are sent tend to stay put.[5]) The moon matters for training crew for future exploration of other celestial bodies and as potential territory valuable for research, mining, and tourism. The earth-moon Lagrange points matter as locations for optimally fuel-efficient stationing of spacecraft (see figure 8.1).

Although asteroids appear impossibly distant to most international relations scholars, as did the moon only recently, they merit attention as locations for possible future mining beyond the 5-year horizon. So too do the exploration of Mars and other celestial objects, which will increasingly matter as a source of international pride and prestige for the Great Powers and aspirants. But given the 5-year range horizon of this strategic assessment, this chapter's analysis is focused exclusively on earth orbit and cislunar space. "Black swan" events—rare, unforeseen events—like those that motivate planetary defense are always possible. The destructive but noncatastrophic terrestrial impact of a near-earth object would excite intense but probably short-lived global public interest. Yet it would likely elicit little more than symbolic international cooperation in space before a return to the status quo ante of international competition. Thus, such events are excluded from this analysis as outside the scope of useful forecasting for interstate relations in outer space.

The international relations theoretical approach adopted throughout the chapter is a classical realist one. *Classical realism* directs analytic attention to the relative military and economic power of states—the Great Powers in particular—while recognizing the significance of leadership, political ideology, technological change, and geography (in this case, astronomy). Based on this approach, the potential for international conflict is anticipated from change in relative power between or among the Great Powers as reflected in greater activity in space to support their strategic ambitions, as the number and activity of second- and third-tier spacefaring states increase and as the unresolved problems of international governance in space become more difficult to avoid.

The principal alternative theoretical approaches—liberal internationalism and its elaboration in constructivism—direct attention to instruments of international law and official communications. The flaw—from focusing primarily on language rather than on capacity and behavior—is that humans use language systematically to deceive. Official communications may provide information about intention. However, as shown by the following claims made in a 2019 white paper issued by China's State Council Information Office, some of Beijing's declared policy seems likely to be sanctimonious, misleading nonsense: "History proves and will continue to prove that China will never follow the beaten track of big powers in seeking hegemony. No matter how it might develop, China will never threaten any other country or seek any sphere of influence."[6] China's interaction with its neighbors Taiwan and the Philippines clearly indicates the contrary. The language that states use to express their foreign policy intentions matters, but their capacity to act on foreign policy intentions matters far more.

Recognizing that international competition in space is inevitable runs afoul of the impulse to treat the universe beyond earth's atmosphere as sacrosanct or morally inviolable. Often such denial has its sources in religious belief that the skies are the abode of God or gods, in scientific misunderstanding resulting from entertainment media, in anxiety about losing control of technological advances, or in disappointment about the results of national space programs. Alternatively, denial of the inevitable in outer space may instead come from the belief that international law and institutions must protect space as a realm of pristine alien landscapes, or as a realm tabooed for all but scientific research, or as a realm whose economic benefits are redistributed to achieve equity and compensation for historical injustice, or as a stateless realm of free-market activity. Utopian impulses aside, the national interests of states—as understood by political decisionmakers—dominate foreign policymaking in every realm that technology allows our species to reach. Human nature, including our capacity for intermixing competition and cooperation, does not change in space.

Background

International competition to achieve "firsts" in space characterized the first space race, between the United States and Soviet Union. This bipolar Great Power competition resulted in the rapid development of satellites, space probes, and crewed spacecraft. Soviet firsts included launching a dog, man, and woman into space; the lunar probe and lunar rover; a Venus flyby and landing; and a space station. American firsts included launching a living creature, mammal, monkey, and ape; communications, weather, and reconnaissance satellites; an orbiting space telescope; and a space probe to return soil from the moon. Although criticized as wasteful by opponents of space programs and as dangerous by peace activists, this superpower rivalry clearly accelerated the pace of space exploration and discovery.

The negotiation of the 1967 Outer Space Treaty (1967 OST) resulted from fear that the Cold War between the United States and Soviet Union might become a hot war ignited by superpower competition in space, or that earth orbit and the moon might become battlegrounds.[7] This treaty remains the core instrument of the international legal regime for space. As an arms control agreement, the 1967 OST prohibits the deployment of weapons of mass destruction in orbit or on celestial bodies. It also prohibits establishing military bases or conducting military tests or maneuvers on celestial bodies. However, the treaty does not prohibit military personnel and precision weapons in space, the deployment of military satellites, or the passage of weapons of mass destruction through space.

As a core international legal instrument for the space regime, the 1967 OST designates all space an international commons—prohibiting "national appropriation by claim of sovereignty, by means of use or occupation, or by any other means"—and makes states responsible for activities in space by their respective governments and private entities such as business corporations or research institutes.[8] Treaty negotiators did not anticipate two major governance problems that today confront outer space relations: orbital congestion and the disincentive to explore and develop that would result from prohibiting the national appropriation of space.[9] Informed, perhaps burdened, by the assumptions of constructivist international relations theory and aware of the practical impossibility of revising the 1967 OST, some post–Cold War space policymakers and commentators have sought to ignore the plain meaning of the treaty's terms by urging the articulation of establishment of behavioral norms via codes of conduct to overcome treaty flaws.[10] Also important for the growing problem of orbital congestion is the role of the International Telecommunication Union (ITU), which regulates allocation of radio frequencies. The United States has benefited from the ITU's first-come, first-served allocation rule for frequencies used by satellites in geostationary orbit (GEO) and rationally opposes allocation made for or based on principles of equity that would benefit other states.[11]

Arenas of International Competition in Space

Orbital space has been an arena for international competition since the Soviet Union launched Sputnik 1 in October 1957, an event that won international acclaim and aroused intense anxiety in the United States. Dismissive of reports that such a Soviet satellite launch was imminent, Americans became alarmed both about their vulnerability to nuclear attack and about a scientific education program that seemed to be failing in comparison to that of the Soviet Union.[12] What many Americans soon realized was that their country's relative geostrategic security—provided by two oceans—would be dramatically reduced by two developments: intercontinental ballistic missiles that could deliver nuclear warheads, and reconnaissance (or "spy") satellites. America's superpower rival, the Soviet Union, soon realized that these same developments also compromised its own immense strategic depth. In both superpowers, national decisionmakers and military strategists fixated for decades on the possibility of preemptive nuclear attack.[13] In his memoir, Soviet Premier Nikita Khrushchev expressed the close connection between advances in space technology and national security:

> *Only by building up a nuclear missile force could we keep the enemy from unleashing war against us. As life has already confirmed, if we had given the West a chance, war would have been declared while* [John Foster] *Dulles was alive. But we were the first to launch rockets into space; we exploded the most powerful nuclear devices; we accomplished these feats first, ahead of the United States, England, and France. Our accomplishments and our obvious might had a sobering effect on the aggressive forces in the United States, England and France, and, of course, the* [West German] *government. They knew they had lost their chance to strike at us with impunity.*[14]

Beginning in the 1960s, the two rivals deployed nuclear-armed ballistic missiles together with fleets of large satellites, many of them dual-use (civil-military), dedicated to communications, global positioning, earth monitoring, and surveillance.

The first space race ended in just over a decade and in victory for the United States over the Soviet Union in 1969, with the first of six successful Apollo lunar landings. International cooperation soon replaced international competition. Human exploration beyond earth orbit was abandoned in favor of robotic exploration. Washington retired the Saturn V and canceled the remaining Apollo program missions. Moscow mothballed the Zond lunar missions. The new policy emphasis on the commercialization of space in the United States and the increasing economic weakness of the Soviet Union meant that crewed missions by the United States and Soviet Union/Russia would be restricted to earth orbit for decades. The United States flew and then retired a small number of space shuttles, while the Soviet space shuttle program was abandoned with the collapse of the Soviet Union.

This period of cooperation in outer space largely coincided with unipolarity in the international geopolitical system between the collapse of the Soviet Union in 1989 and the emergence of China as the principal Great Power rival to the United States in the 21st century. This era was characterized by a declining Russia that became largely subordinated to the American vision of space commercial collaboration and comity in the 1990s. Moscow's reliable Soyuz rockets and capsules became logistical vessels supplying the International Space Station (ISS) after Russia's remaining space shuttles were retired. But the seeds of another space race were even then being sown. Beijing was piqued at China's being excluded from participation in the ISS, finding it reminiscent of the disdain with which China and the Chinese were treated during the "century of humiliation." American space hegemony with Russian cargo support only reinforced the conclusion in Beijing that Washington had embarked on a policy of containment with an outer-space component.[15] Washington, in turn, ultimately concluded that Beijing's long-term geostrategic goal was for China to match or surpass the United States in relative power by 2049 and that Beijing pursued a two-decade program of space technology theft and misappropriation to enable this quest.

A second space race is evident in the behavior of the chief Great Power rivals. China has sought to match U.S. capacities for the most salient civil and military space technologies. Its achievements are varied and impressive. Chinese space activities and initiatives include Long March heavy-lift rockets, a growing fleet of satellites (among them BeiDou navigation satellites), the Shenzhou crewed spacecraft, the Tiangong space station, and the Shenlong uncrewed spaceplane in earth orbit, as well as a crucial first in space exploration: the Chang'e 4 uncrewed spacecraft, with the Yutu-2 lunar rover, landing on the far side of the moon.

Another indicator of the second space race is the parallel ambitions with respect to the moon. China's successful lunar missions and ambitious plans for a crewed base at the lunar south pole or International Lunar Research Station (ILRS) compelled the United States to elaborate its Artemis Accords/Lunar Gateway Program. Investment in reusable heavy-lift rockets by the United States and China signals the foreign policy intention of both Great Powers to prevent the other from monopolizing control over access to the "eighth continent."[16]

A third indicator of the second space race is that the rivals have reorganized their militaries to reflect the greater importance of outer space for national power. In response to Washington's 2019 decision to establish the U.S. Space Force as a fifth branch of the Armed Forces, Beijing in 2024 disbanded its Strategic Support Force and established the People's Liberation Army Aerospace Force as a separate arm with the mission of conducting military space launches and operations.[17]

The second space race differs from the first in other crucial respects. First, rather than competition between two superpowers—the United States and Soviet Union—in a bipolar international system, the new competition lies among three Great Powers in a multipolar international system. The United States acts as a status quo Great Power defending a rules-based liberal international order. China acts as a revisionist Great Power seeking to undermine and replace that liberal international order, which it perceives as a "'system of alliances' established when China was weak, with a 'system of partnership' or 'community of common destiny.'"[18] Russia acts as a revisionist Great Power in decline that seeks to regain geopolitical influence lost with the collapse of the Soviet Union. Beijing and Moscow have highlighted the multipolarity of the international system in official expressions of their effective alliance against the United States and its allies, perhaps to minimize the significance of the differences in their respective regimes.[19]

Although Russia poses the greater near-term geopolitical challenge to the United States, China poses the greater long-term challenge.[20] As the "least of the Great Powers," Russia is increasingly allied with China across multiple fronts.[21] Their largely undefended land border generates little friction, and their trade relationship is mutually beneficial. At the same time, Russia has continued its limited cooperation with the United States in space because of the economic value derived from its participation as a partner in the ISS. From 2006 to 2019, the National Aeronautics and Space Administration (NASA) purchased 70 seats on Soyuz launches to the ISS for approximately $3.9 billion.[22] Yet increasingly, Moscow partners with China rather than the United States for future space endeavors. On November 9, 2023, Vladimir Putin commented without elaboration that Russia and China would cooperate to develop new space weapons.[23]

Second, China has patiently matched the achievements of the United States rather than racing ahead as did the Soviet Union. Beijing's "second mover" approach reflects not only China's experience of learning from transfers of Soviet/Russian technology but also the rational exploitation of the investments in research and design by the United States. To date, ideological rivalry also appears to play a markedly smaller role in the second space race. China is clearly less motivated than the Soviet Union was to demonstrate the superiority of socialism over capitalism as an economic system through demonstrations of scientific and engineering triumphs. China has a mixed command and market economy that has raised the planet's largest population to middle-income status in a generation by conquering consumer export markets.

China's astropolitical interests differ from those of contemporary Russia because its maritime access is limited to the Pacific and is severely constrained by the so-called first island chain states allied with the United States in East and Southeast Asia.[24] By contrast, a warming Arctic Sea promises to permit Russia an escape from its traditional maritime imprisonment.[25] Developing its Arctic coast may draw some of Moscow's attention away from space. Moscow's effective alliance with Beijing and the international prestige from a space program will continue to make space important for Moscow, but the economic return from energy investment in the Arctic appears large enough to capture the attention of Russian decisionmakers when they make hard choices about where to focus scarce resources. By contrast, Beijing is motivated to continue developing the ultimate high ground for economic, security, and international prestige reasons. As the paramount leader whose government seeks to make China the most powerful of the Great Powers, and who inevitably is conscious of his personal legacy, Xi Jinping seems likely to press ahead with realization of plans for a permanent moon base.

Third, China is today more comparable to the United States in economic strength than was the Soviet Union. Where the Soviet Union's command economy made it militarily though not economically powerful, contemporary China's mixed command and market economy has made it economically powerful, and it is rapidly constructing a military to match its economy. Thus, unlike in the first space race, the United States is unlikely to win a contest for dominance in space by economically exhausting its rival. Instead, leadership in space during the second space race will depend on the ability to "effectively combine government direction with commercial dynamism."[26]

Fourth, both the United States and China have negotiated rival alliances to explore and develop the moon with other spacefaring states. A handful of second-tier spacefaring states have developed competencies in low-earth orbit that make them valuable as allies, and the number of third-tier spacefaring states has increased quickly. Extraterrestrial international relations now resemble terrestrial international relations to a far greater degree than in the past. More actors mean a potentially more complex drama will unfold.

Earth Orbit

International competition in outer space remains focused on earth orbit, where uncrewed spacecraft serve the military and economic needs of states or private operators. As of 2022, 70 states operated a total of 6,718 functioning satellites in earth orbit, with a total launch weight of 4.3 million kilograms.[27] Comprehensive figures are available for launch or "wet" weight, which includes fuel for those satellites that are maneuverable, but not for "dry" weight. Superficially, these figures suggest broadly that spacefaring in earth orbit is broadly international. On closer inspection of the figures for number and weight of satellites displayed in table 8.1, spacefaring in earth orbit is clearly dominated by just seven spacefaring states. Note that weight may now matter less as a reflection of capacity in low-earth orbit (LEO) because of the greater sophistication of individual satellites and satellite constellations. However, weight still appears important as a measure of capacity for satellites in GEO, but that too may lessen over time.

As of the same time frame, the United States operated 4,529 or 67 percent of all satellites, having a combined launch mass of 2.1 million kg, or nearly 50 percent of total launch mass. The disparity between the percentage of satellite numbers and the percentage of satellite launch weight for the United States is attributable to the 3,393 SpaceX Starlink commercial communication satellites in LEO. Of those Starlink satellites, 430 weigh 227 kg each and 2,963 weigh 260 kg each. The United Kingdom also operated a constellation of 516 OpenWeb communications satellites, each weighing 148 kg. The seemingly anomalous presence of tiny Luxembourg on the list is explained by its favorable regulation and tax environment for space businesses.[28] The European Space Agency, which operates numbers of satellites with a total launch mass comparable to that of India and Luxembourg, is not represented in the table because its member states do not act with the political unity of a state in international relations.

For the seven states that dominate spacefaring, operating large numbers of satellites represents an opportunity to develop competitive technological advantage though innovation. Innovation typically occurs through the interaction of specialists either trained in different disciplines or working in organizations asking novel research questions or recognizing unexploited development opportunities. Larger-scale operations together with multiplicity of operating entities—military branches or arms, other government entities, and commercial firms—increase the frequency of such interaction. Some of the 70 spacefaring states operate satellites with launch weights of less than 10 kg. Lithuania, for example, operates four communications and technology development satellites with launch weights ranging from 7 to 10 kg.

It may be overlooked in the era of large satellites weighing from 1,000 to 7,000 kg, but the first space race began with the launch of a small satellite—Sputnik 1 weighed a mere 83.6 kg.[29] Today it would be classified as a microsatellite, which can range between 10 and 100 kg.[30] Satellites are generally classified according by their mass. Larger small satellites include minisatellites of 300 to 500 kg and super-microsatellites of 100 to 300 kg. Satellites making even Sputnik 1 seem enormous in scale are also conceivable, from nanosatellites of 1 to 10 kg all the way down to yoctosatellites of less than 100 mg.

Smaller satellites allow ready access to earth orbital space that is faster and cheaper, though not necessarily better. For example, Planet Labs's constellation of Dove CubeSats was fast and cheap to launch, but the earth observation resolution that the satellites offered was inferior to that of the large and expensive Geostationary Operational Environmental Satellites (GOES) R, S, and T satellites, which are operated by the National Oceanic and Atmospheric Administration and each have a dry weight of 2,857 kg and a wet weight of 5,192 kg. Aspiring spacefaring states are likely to accept that trade-off in launching surveillance satellites because not only is launching a satellite prestigious, but also any additional increment in optical imaging information about opponents and allies may prove valuable. Small satellites may be launched into lower orbits, though that comes with the trade-off of reduced operational lifetime because of greater atmospheric drag.[31]

Intelligence agencies may also exploit very small satellites either to collect intelligence from or disrupt operations of the satellites of other states, with surveillance and reconnaissance satellites being priority targets. The threat of such disruption will grow as research and development on in-space propulsion for small satellites makes the future generations of small satellites maneuverable or more maneuverable.[32]

The recent surge in launches of constellations of small satellites almost certainly presages a dramatic increase in the number of planned satellite constellations.[33] Most notably, Amazon in the United States planned to launch 3,236 communications microsatellites as part of its Project Kuiper, and Guo Wang in China planned to launch 13,000 SatNet satellites.[34] Rwanda's Marvel Space filed an application with the United Nations' International Telecommunication Union for what would be an extraordinary constellation of 337,320 satellites.[35] LEO appears destined to become very crowded. Note that against a trend of quantity over quality, the European Union plans to launch a multi-orbit (LEO, middle-earth orbit, and GEO) constellation of 170 satellites via its Infrastructure for Resilience, Interconnectivity, and Security by Satellite.[36]

Beyond the daunting global-governance issues involved in LEO crowding, how might this congestion alter relative economic and military power?[37] Note that of the 70 states operating functioning satellites, 31 states operate 594 military satellites independently or jointly.

Thus, approximately 8.8 percent of satellites perform one or more of three military functions: communications, global navigation, and reconnaissance/surveillance. Ostensibly nonmilitary commercial imagery satellites also provide intelligence.[38] The United States shares information from 93 Global Positioning System (GPS) satellites as a global public good.

France and Italy operate satellites independently, but they also jointly operate Athena-Fidus and Syracuse 3C. Belgium is the only one of the 31 states to operate satellites jointly, operating Helios 2A and Helios 2B together with France and Italy.

Of those 31 states that operate military satellites, the three Great Powers operate 502, or 84.5 percent, of the total number. Examination of table 8.2 reveals that the United States remains dominant, but that the three countries are more comparable to one another in the number of military satellites than in the number of all satellites. Comparing the numbers of military satellites stationed in LEO—the orbital region crucial for reconnaissance and surveillance—shows that they approach parity. Note, too, that numbers alone do not reflect quality. Secrecy is an obstacle to assessing the qualitative value of these satellite fleets.

The importance of satellites in that arena to near-future international crises or armed conflicts may be likened to that of railroad and telegraph lines in conflicts from the mid-19th century to the early 20th century, such as the Franco-Prussian War.[39] For that reason, satellites present temptingly vulnerable targets for asymmetric warfare in the form of sabotage or disruption.[40] Satellite congestion in LEO from satellite constellation launches and the development of small satellites, together with the growing number of third-tier spacefaring states, may make such mischief easier. The vulnerability of satellites will likely prompt further research and development to make them more robust and to develop substitutes.

The good news is that although increased congestion poses a higher risk of what is known as the Kessler effect—cascading satellite collisions—the redundancy achieved with a larger number of easily launched, less-expensive small satellites may make these crucial space assets less vulnerable to hard attacks by antisatellite weapons (ASATs).[41] The United States, the Soviet Union/Russia, and China have all conducted multiple direct-ascent ASAT tests. India joined the ASAT club in 2019.[42] China's 2007 test against a derelict weather satellite drew international condemnation for leaving a large debris field that would be slow to de-orbit; India's 2019 ASAT test against a target microsatellite left a debris field that would de-orbit quickly.

The bad news is that the large number of small satellites may invite soft attacks on space assets through deployment of small satellites disguised as performing legitimate functions yet actually devoted to sabotage: "jamming, spoofing, and cyberattacks to disrupt reconnaissance, command and control, and communications systems."[43] *Sabotage* involves damaging or disabling functions. *Jamming* involves raising the noise floor in signals to prevent or interrupt transmission, while *spoofing* involves substituting false signals for authentic ones.[44] *Cyberattacks* include hijacking telemetry and tracking.[45] LEO is a hazardous environment characterized by temperature and energy extremes together with rapidly moving physical objects that include micrometeorites, nonfunctioning spacecraft, and debris from spacecraft. Accidents occur, and sabotage might be made to appear as an accident while intensifying interstate conflict. Spoofing is a threat to global navigation satellites, which are not only crucial to militaries for air and naval navigation and the targeting of precision-guided weapons but also crucial for targets of economic warfare, such as electrical power grids and global finance trading.

Covert action in space might be undertaken not only by Great Powers and second-tier spacefaring states but also by third-tier spacefaring states acting as proxies for a Great Power. Credible near-future scenarios include Israel and Iran targeting one another's satellites, China targeting the satellites of the Philippines, and North Korea targeting satellites of the United States with the unacknowledged assistance of China and Russia. China may be tempted to use North Korea as a proxy as the latter's technological capacity in space increases. North Korea launched its first successful satellite, Malligyong-1, in November 2023 and ended the year with a saber-rattling speech by Kim Jong Un. In the speech, Kim announced that reunification of the Korean Peninsula would be abandoned as a goal and announced the goals of launching three more surveillance satellites and constructing more nuclear weapons in 2024.[46] That North Korean national technological accomplishments in space science and nuclear weapons-building were thus substituted for the traditional nationalist focus on territory, albeit in bellicose rhetoric, is itself noteworthy. Pyongyang has proved so risk-acceptant that some observers have described it as presenting a "provocation-diplomacy cycle" to extract diplomatic or economic concessions from the United States and South Korea.[47] North Korea is likely to find the temptation to engage in covert action in space as the number and sophistication of its small satellites increase.

Recent news coverage of space and defense drew public attention to the reusable spaceplanes of the United Sates and China—respectively, the U.S. Space Force's X-37 and China's Shenlong, or Divine Dragon.[48] Valuable for intelligence-gathering during long missions, they can also deliver payloads to orbit that are hidden until deployed or serve as platforms for nuclear weapons. Deployments of larger fleets of such spaceplanes and operations beyond LEO by the United States and China are highly probable. In time, they may be joined by the European Space Agency's Space Rider, India's Reusable Launch Vehicle–Technology Demonstration Programme, Japan's Winged Reusable Sounding rocket, and the U.S. Sierra Space Dream Chaser. The Dream Chaser is promising because it could be refitted to deliver passengers as well as payloads to LEO.[49]

Paralleling the major accomplishments of a leading spacefaring state is one way to win international prestige. Being the only state to continue performing a role in space is another. Until recently the United States was embarrassed by its reliance on Russia to ferry personnel and provisions to the ISS. The planned decommissioning of the ISS may soon leave China with the only crewed laboratory in earth orbit.[50] That source of international prestige is unlikely to survive the construction of a lunar base or lunar orbiter.

Space stations and spaceplanes are, respectively, the most salient symbols of scientific and military capacity in earth orbit. Satellites, however, will remain the chief instruments of capacity—scientific, military, and, less glamorously, commercial—in that realm over the next 5 years. Comparing raw figures for military satellites indicates that China and Russia remain peers of the United States. Crucially, however, comparing figures for all satellites, which include constellations of communications satellites, indicates that the United States has gained an important lead over China and Russia, and those two nations must operate comparable constellations of communications satellites in the future if they are to remain Great Power peers of the United States.

Cislunar Space

Cislunar space is immense in area. At 38 million square kilometers, the surface of the moon is larger than Africa's 30 million square km. With diameters of 800,000 km, Lagrange points 1, 2, 4, and 5 each dwarf the 84,000 km diameter of earth orbit (see figure 8.1). That humans traveled these distances between 1969 and 1972 makes these locations conceivable as objects of international competition in a manner that is not yet true of the asteroids or other celestial objects. Although it is less remembered today than the launch of Sputnik 1 in 1957, the Soviet Union also beat the United States to the punch in 1959 by launching Luna 2 to the moon, marking it as an important object of international competition. The moon took on new significance with the soaring rhetoric of President John F. Kennedy's September 12, 1962, address at Rice University, in which he said that America's preeminence in space would determine whether "this new ocean will be a sea of peace or a new terrifying theater of war."[51] Kennedy meant that international competition with the Soviet Union was necessary to achieve future international cooperation.

Why was the moon and not Mars made the primary target of human exploration? The latter had preoccupied space pioneers for a generation. Although Kennedy named the moon eight times in his speech and mentioned Venus twice, he did not mention Mars at all. Much of the answer is that the moon's proximity to the earth and visibility in the sky made it an exciting yet technically plausible venture that would demonstrably surpass the achievements of the Soviet Union in space. Twelve years after the 1967 OST and 7 years after the last Apollo lunar landing, diplomats returned to the task of applying international law specifically to the moon, reinforcing its status as an international common. Although the 1979 Moon Treaty entered into force as international law in 1984, the refusal of the United States, the Soviet Union/Russia, and China to sign the agreement reduced it to irrelevance.[52] By implication, the Great Powers had apprantely reappraised the value of the moon, perhaps as territory to be annexed but certainly as the location for activities whose benefits need not be shared with the rest of the United Nations member states.

Why is cislunar space valuable? States open extraterrestrial frontiers for the same reasons they have historically opened terrestrial ones: prestige, resources, markets, and strategic position. Earth orbit has rewarded the three Great Powers with all four of these power resources. The moon and perhaps Lagrange points 1, 2, 4, and 5 will likely do so as well (see figure 8.2).

Among the most cited reasons for human exploration and development of the moon is that it is a crucial stepping stone to other celestial bodies. Apollo 17 Lunar Module Pilot, geologist, and former Senator Harrison "Jack" Schmitt captured the concept: "It's great that people are interested in Mars. . . . But I don't think that we'll go there until we go back to the moon and develop a technology base for living and working and transporting ourselves through space."[53] The moon is an optimal training ground because it is much larger than the confines of the ISS or the Tiangong space station for human explorers to learn to operate in an alien environment. That is achievable in part because the moon promises extraordinary opportunities for scientific research, extraction of resources (including minerals such as rare earths and volatiles such as water), and space tourism. Telerobotics is likely to play a crucial role in this development.[54] Learning to mine on the moon is preparation for eventually mining the predicted riches from some asteroids.[55] These opportunities will prove attractive not only to public and private entities in the Great Powers but also to second- and third-tier spacefaring states.

China's plans to land *taikonauts*—Chinese astronauts—on the moon and establish a crewed base on the lunar surface compelled the United States to accelerate the Artemis Accords program to return astronauts to the moon and, at least in principle, to land astronauts on Mars.[56] Unlike China, the United States appears, for the present, not to have prioritized constructing a lunar orbiter—the Lunar Gateway—over establishing a base on the lunar surface.[57] This probably reflects both scrupulous adherence to the nonappropriation language of the 1967 OST and a post hoc justification for NASA's institutional commitment to learning how to live and work in space on the ISS.[58] The obvious risk in that policy choice is that individual space scientists and engineers, entrepreneurs, and tourists will likely prefer the lunar surface to a lunar orbiter. Human physical presence rather than telepresence on the surface may also lessen the cybersecurity threat.

The less obvious risk is that China, as a revisionist Great Power seeking to undermine the liberal international order, may use occupation as the traditional basis for justifying territorial annexation.[59] That anxiety was expressed by the NASA administrator in comments in January 2023: "[W]e better watch out that [the Chinese] don't get to a place on the moon under the guise of scientific research. And it is not beyond the realm of possibility that they say, 'Keep out, we're here, this is our territory.'"[60] China has demonstrated a willingness to claim national sovereignty over one large international commons: the South China Sea. Based on maritime territorial claims to that body of water dating from the Han Dynasty (206 BCE–220 CE), China has undertaken reclamation and construction projects on several reefs in the Spratly Islands to create artificial islands. In effect, Beijing has occupied "geographic features that were not territory at all until China created them."[61]

The difference regarding cislunar space would be that the features to be claimed by occupation would be extraterrestrial rather than terrestrial. It is plausible that China might denounce the 1967 OST and declare the lunar south pole its sovereign national territory.[62] Alternatively, it might declare the same region to be an exclusive economic zone, much as Iceland did in the 1970s to protect its fisheries from overfishing by foreign trawlers. Note that Iceland ultimately prevailed over Great Britain in its struggle for those waters over the course of the three so-called Cod Wars.

Washington's Artemis Accords program and Beijing's International Lunar Research Station are the results of international competition for the moon. More than the scientific internationalism used to justify both rival projects, they are "work-around" responses to the prohibition against national appropriation in the 1967 OST. That prohibition arguably deprived spacefaring states of a crucial incentive to compete in space exploration. The programs differ in that Artemis is associated with normal articulation consistent with contemporary liberal internationalism and international relations constructivism, while the ILRS is not. As of the end of 2024, in addition to the United States, 51 states had joined the Artemis Accords.[63] Predominantly composed of liberal democratic and/or wealthy allies of the United States, the group includes four major second-tier spacefaring states: the United Kingdom, India, Japan, and Luxembourg. India's participation reflects its own Great Power aspirations, a response to being overshadowed by China in achievements in space.[64]

As of the same time frame, in addition to China, 12 states had joined the ILRS, including Russia, Venezuela, South Africa, Azerbaijan, Pakistan, Belarus, Egypt, Thailand, Nicaragua, Serbia, Kazakhstan, and Senegal. The decision of major non-NATO ally Egypt to join the ILRS—and the interest from NATO member state Turkey in joining—may be *bandwagoning*—in realist theory, the decision of a minor power to ally with a Great Power that appears to be gaining in relative power.[65] The United Arab Emirates is a partner in the Artemis Accords, while its University of Sharjah has also signed a memorandum of understanding to participate in the ILRS, a reflection of the extraordinary Emirati ambitions in space that its deep pockets permit.[66] South Africa's partnership in the ILRS rather than the Artemis Accords is attributable to Pretoria's historic tilt away from Washington toward Moscow and Beijing, but the partnership probably would not survive a general election that sees the centrist Democratic Alliance supplant the African National Congress. While Ethiopia and Kenya have not signed onto the ILRS, two of their institutions—Ethiopia's Space Science and Geospatial Institute and the Kenya Advanced Institute of Science and Technology—have done so.[67] Still missing from either list, however, are Morocco, Iran, Vietnam, Indonesia, and the Philippines. Diplomatic bidding wars are possible between the United States and China for a number of these potential space partners who have yet to join either group, especially Indonesia. Indonesia's space program has long failed to reflect the country's population size and economic capacity and might win much-needed status from associating with either Artemis or the ILRS.

In addition to NASA's planned Lunar Gateway, a space station orbiting the moon, the Defense Advanced Research Projects Agency is planning its own lunar project: the Novel Orbital and Moon Manufacturing, Materials, and Mass-Efficient Design (NOM4D, pronounced NOMAD) program.[68] The chief purpose of the project is in its title, but it might serve as the foundation for a U.S. base on the lunar surface. As such, it will inevitably attract the close attention of China.

Major Great Power Trends in Earth Orbit and Cislunar Space

Where the development of airpower added one new realm to assessments of relative international power, the ongoing development of spacepower in the early 21st century adds not one but two new realms: earth orbit and cislunar space. Enduring dominance by any of the three Great Powers in either of these space realms is now materially impossible because new investments that exploit fourth industrial revolution technologies allow these states and others to close or open gaps in relative outer space capacity. Only political decisions, such as conceding cislunar space for budgetary reasons or abandoning Great Power competition because of regime change, risk permitting a rival to attain or sustain lasting dominance.

Distinct strategic goals drive Great Power competition in outer space. As a status quo power, the United States seeks to maintain its lead over its two revisionist rivals. As a rising revisionist power, China seeks first to achieve parity and then to surpass the United States. As a declining revisionist power, Russia seeks to maintain its Great Power relevance by a robust outer space presence and as an increasingly useful partner with China. The advent of small satellites and the addition of new minor spacefaring states adds "friction and noise" to increasing multidimensional economic, scientific, and military competition in earth orbit. Cislunar space has higher barriers to entry, meaning that far fewer states will develop independent space programs focused there. Given Russia's noteworthy and growing national resource constraints, its options for relevance in lunar activities and cislunar space appear increasingly tethered to Chinese programs.[69] For China, the strategic constraints imposed by its terrestrial geography—maritime access constrained by the aforementioned first island chain—mean that China has the most to gain from adding cislunar space as a new realm of competition. The United States and its outer space partners will constitute China's major cislunar space competitor.

Five-Year Projection

- The second space race—mainly contested between the United States and China—will continue much longer than the first space race because the security and economic interests at stake are more important, because its chief rivals possess the resources for sustained competition, and because there is no obvious marker for victory, such as being first to land a human on the moon.
- Russia's role in the second space race from 2025 to 2030 is likely to increasingly become one of supporting China as the primary rival to the United States. Russian space technology and experience, together with that of its own junior allies, such as Kazakhstan and Belarus, make it a valuable collaborator.
- New classes of small satellites launched in large satellite constellations will result in growing congestion in LEO. The limitations and shortfalls in the international legal regime for space based on the 1967 OST and the ITU will probably prevent effective response via international regulation because Washington and Beijing are unlikely to agree on any common framework for moderating proliferation or competition.
- The new environment in LEO will result in many new third-tier spacefaring states and will invite covert action by third-tier spacefaring states acting as proxies for Great Powers.
- The United States and China will operate larger fleets of spaceplanes.
- The United States and China may accelerate their respective programs to land human crews on the moon. Where China appears likely to meet its 2030 goal, the United States appears to have slipped behind.[70] American public perception that the United States has fallen behind China in returning to the moon may intensify Washington's efforts.
- Diplomatic bidding wars for states that have yet to join either the Artemis Accords or ILRS are likely.

Conclusion

Although the second space race between the United States and China differs in important respects from the first space race between the United States and Soviet Union, it matters for reasons much like those identified by President Kennedy in 1962. Great Powers have inevitably competed with one another in every historical era, but the stark differences between regimes and ideologies since the middle of the 20th century make the outcome of their struggles ever more consequential. Preeminence or parity in outer space in the 21st century will be an important element in determining whether the human future will skew more liberal or authoritarian. Competition and emerging conflict for outer space ascendance will establish the rules, norms, and processes that inevitably will condition where humanity goes and what humanity becomes or fails to become over the next two centuries.

Although the advent of small satellites will increase the total number of spacefaring states in LEO, that does not mean "other countries can walk away from both America and China" with respect to space.[71] The three Great Powers will continue to vie with one another for military power in earth orbit by operating large numbers of military satellites. Two Great Powers—the United States and China—will continue to vie with one another for control over cislunar space. The other spacefaring states must reckon with such dominance.

What observers may anticipate over the period from 2025 to 2030 is detailed in the projections made in the previous section. International competition in space among the three Great Powers of this historical moment will overwhelmingly continue to occur in earth orbit. That is the realm where military advantage and commercial gain will be realized. Cislunar space should begin to emerge from the shadow of LEO, as decisionmakers and national publics become more familiar with the power resources available with its exploration and development.

Historical parallels are always imperfect, yet they permit reflection on the stakes involved in struggles between and among Great Powers. The decision to conduct or not conduct operations beyond LEO may be compared to the decisions made by Great Powers beginning in the 15th century. The Western European states that refocused some of their foreign policy efforts beyond their immediate environment increased in relative power and wealth, while their Middle Eastern, South Asian, and East Asian counterparts selected more parochial foreign policies and declined in relative power and wealth. By analogy, the failure of contemporary Great Powers to refocus some foreign policy attention beyond earth orbit and LEO forsakes gains in relative power and wealth, allowing their rivals to chart the future of our species.

Although the tragic results of imperialism and colonialism that began in the 15th century cannot be denied, they are irrelevant to expansion across the vast and unpopulated realms of space in this and the centuries to follow. What is relevant is the nature of the political regimes that govern the contemporary Great Powers. For the United States to concede the space beyond LEO to China risks condemning all of humanity to an authoritarian future. That we are today able to explore space is itself the result of individual freedom allowed to realize human potential by liberal regimes.

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Table 6.1. Great Power and Major Second-Tier Spacefaring Power Satellites

Country	# Satellites	Satellites (%)	Total Launch Mass (kg)	Total Launch Mass (%)
United States	4,529	67.41	2,145,880	49.8
China	590	8.7	465,773	10.8
Russia	174	2.5	256,737	6.0
UK	562	8.3	183,258	4.3
Japan	89	1.3	126,184	2.9
India	61	0.9	92,349	2.1
Luxembourg	44	0.6	130,841	3.0

Source: Union of Concerned Scientists Satellite Database, January 1, 2023, https://www.ucsusa.org/resources/satellite-database.
Note: Figures include the small numbers of jointly operated satellites.

Table 6.2. Great Power Military Satellites

Great Power	United States	China	Russia
Total Number	239	155	108
Total Number (%)	47.6	30.8	21.5
LEO Number	107	89	70
GEO Number	38	49	29
MEO Number	93	1	1
EO Number	1	16	8

Source: Union of Concerned Scientists Satellite Database, January 1, 2023, https://www.ucsusa.org/resources/satellite-database.