Space Exploration and Development

A Topic Proposal for the National Federation of High Schools
Topic Selection Committee

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Proposed Resolutions (Ranked)

1. Resolved: The United States federal government should substantially increase its space exploration and/or development beyond the Kármán line.

2. Resolved: The United States federal government should substantially increase its investment in space exploration and/or development beyond the Kármán line.

3. Resolved: The United States federal government should substantially increase its non-military space exploration and/or development beyond the Kármán line.

4. Resolved: The United States federal government should substantially increase its civil space exploration and/or development beyond the Kármán line.

5. Resolved: The United States federal government should substantially increase space exploration and/or development beyond the Kármán line.

Affirmative Cases

Affirmative teams would defend specific increases in space exploration and/or development by the United States federal government. Potential plans include accelerating NASA's Artemis lunar program, restoring the Mars Sample Return program, funding planetary defense systems such as NEO Surveyor, investing in space debris mitigation and space traffic management, restoring astrophysics flagships such as Chandra and the Habitable Worlds Observatory, funding commercial low Earth orbit destinations to close the post-ISS gap, developing nuclear propulsion, restoring Landsat Next, expanding In-Situ Resource Utilization technology on the Moon, funding deep space science missions recommended by the Planetary Science Decadal Survey, and investing in space-based solar power research. Mars Sample Return, the Decadal Survey's highest priority, was cancelled in FY2026. Each researched case area has a named solvency advocate, primarily National Academies consensus reports, NASA Inspector General findings, and NASA technical analyses (see Appendix). Advantages span national security, scientific discovery, planetary defense, environmental monitoring, economic competitiveness, and technological innovation. Because the preferred resolutions are agent-neutral, the case areas also include national-security and military space programs, each with its own named solvency advocate: space domain awareness, missile warning and tracking, tactically responsive space, resilient PNT, Golden Dome space-based interceptors, and on-orbit logistics.

Negative Strategies

Negative teams have robust ground. Disadvantages include a NASA budget tradeoff disadvantage built on the fixed, zero-sum structure of the agency's appropriation (National

Academies, NASA at a Crossroads), a federal-spending disadvantage with multiple internal links to a fiscal crisis (CBO's fiscal-crisis projections), environmental harms from increased launch activity with peer-reviewed, quantified uniqueness evidence (Revell et al., 2025), space debris generation, and a space militarization disadvantage grounded in the dual-use perception problem and the US-China Economic and Security Review Commission's 2025 findings. Counterplans include public-private partnerships supported by NASA's own COTS cost analysis, privatization (which serves as a functional limit on small and low Earth orbit affirmatives), international agent counterplans (ESA, JAXA, ISRO), robotic-only exploration, and executive-action counterplans anchored in the December 2025 "Ensuring American Space Superiority" order. Critical approaches include settler colonialism and manifest destiny, antiblackness and the racialized frontier, capitalism and the commodification of celestial bodies, longtermism, disability and access, securitization, feminist critiques, and China threat-inflation, each grounded in peer-reviewed or university-press scholarship.

Balance

This topic produces excellent balance as every affirmative plan that claims to solve a pressing space policy problem simultaneously generates strong negative offense. Plans that increase investment raise spending tradeoff concerns. Plans that accelerate exploration generate environmental and debris disadvantages. Plans that compete with China risk escalatory dynamics. The topic is textually limited by the requirement of federal engagement, the Kármán line boundary, and the requirement of substantial increase. It is functionally limited by the private sector counterplans available to the negative.

Summary Paragraph (for ballot publication, 197 words)

Space exploration and development is at a pivotal inflection point. NASA's Artemis program is returning humans to the Moon for the first time in over fifty years, while China races to land astronauts on the lunar surface before 2030. The global space economy has surpassed $613 billion, but critical governance gaps in debris, resource rights, and weaponization remain unresolved. The Trump administration has proposed cutting NASA's budget by nearly 25% while simultaneously expanding Space Force spending to $40 billion, creating an unprecedented tension between civilian and military space priorities. Affirmative teams would defend specific increases in space exploration and development, including lunar development, Mars Sample Return restoration, planetary defense, deep space science, astrophysics flagships, and space debris mitigation. National-security case areas are also available under the preferred resolution, each supported by named solvency advocates, principally National Academies consensus reports. Negative teams have strong ground through peer-reviewed environmental harms from launch activity, space debris concerns, militarization disadvantages, public-private partnership and international agent counterplans, and criticisms of settler colonialism and extractive capitalism applied to space (Cotterell & Grant, 2025). The topic is accessible to novice and experienced debaters, deeply researched in policy and academic literature, and fundamentally timely.

Proposal Narrative

Introduction

After more than a decade, it is time to revisit Space Exploration and Development in policy debate. The 2011-12 resolution, “Resolved: The United States federal government should substantially increase its exploration and/or development of space beyond the Earth’s mesosphere”, produced memorable, educational, and accessible debates (NFHS, 2011). Much has changed in the fifteen years since: launch economics, technologies, international alignments, and the federal government’s own posture toward space have all shifted, and the 2027-28 debate year offers students a rich, novel subfield of international relations literature at the moment its questions turn urgent.

The avenues for debate are timely and concrete. Private companies such as SpaceX and Blue Origin now compete with, and contract for, the government space agencies they once merely supplied, raising live questions of regulation, cooperation, and competition. China’s space program has matured into the central geopolitical fact of the domain: a permanently crewed station, lunar sample returns, and a crewed landing targeted before 2030, all pressing directly on US space leadership.

American primacy is no longer assumed. Other national programs are advancing quickly, commercial firms now perform work once reserved for governments, and space policy cuts across scientific, commercial, military, and diplomatic lines at once.

The topic also incentivizes novel, creative research into the philosophical implications of space policy. Whether space-based technologies should be part of the answer to climate change, and whether humanity should settle other worlds at all, are questions this generation of students will help decide, and the literature on both is rigorous. In this spirit, the author offers the following controversy area and resolutions for consideration.

History and Context: What Has Changed Since 2012?

Space exploration and development have held the world's attention since 2012, but nearly everything about how the United States pursues them has changed. The technologies, the launch economics, the international alignments, and the role of private companies bear little resemblance to the landscape debaters researched fifteen years ago.

At the time of the last policy debate on Space Exploration and Development in June 2012, the US had no way to launch crew to the ISS. Following the final Space Shuttle mission, STS-135, in July 2011 (NASA, "The Space Shuttle"), NASA relied exclusively on Russia's Soyuz spacecraft for crewed access to the ISS, a dependency that lasted nearly nine years and cost NASA approximately $3.9 billion in Soyuz seat purchases (NASA OIG, 2019). US crewed launch capability was not restored until SpaceX's Crew Dragon Demo-2 mission on May 30, 2020 (NASA, 2020). Today, the US federal government still has no government-owned crew launch platform, and renewed reliance on Russia for launch support is untenable.

Launch costs per kilogram have fallen, reusable launch vehicles have matured, and the government now buys launches from private companies as contract providers, an arrangement wholly distinct from the public-private partnerships discussed in 2012. The Trump and Biden administrations have also fundamentally reframed space in US foreign policy, establishing the United States Space Force as the sixth branch of the Armed Forces on December 20, 2019 (Pub. L. 116-92; Cohen, 2019) and reviving the concept of manifest destiny extended into space, made explicit in the December 2019 presidential remarks quoted in the Student Interest and Engagement section (Trump, 2019).

The Artemis Era

On April 1, 2026, NASA launched Artemis II from Kennedy Space Center, the first crewed mission beyond low Earth orbit since Apollo 17 in December 1972. Commander Reid Wiseman, Pilot Victor Glover, Mission Specialist Christina Koch, and Canadian Space Agency Mission Specialist Jeremy Hansen conducted an approximately 10-day lunar flyby that carried them further from Earth than any humans in history (NASA, 2026a). This mission marked the beginning of a sustained return to the Moon. On February 27, 2026, NASA Administrator Jared Isaacman announced a radical restructuring of the Artemis architecture: Artemis III was redesignated from a lunar landing to a technology demonstration in low Earth orbit, while Artemis IV became the first crewed lunar landing, targeting early 2028 (NASA, 2026b). NASA announced on March 24, 2026 that it would pause the Lunar Gateway in its current form, redirecting resources toward a $20 billion, seven-year lunar base program at the south pole, a decision that created significant tension with international partners including ESA, JAXA, and CSA who had invested in Gateway hardware (Foust, 2026b). A July 2025 budget reconciliation law had provided $2.6 billion for Gateway, and repurposing those funds requires congressional approval.

The Budget War

NASA operated in FY2025 under a continuing resolution at approximately $24.8 billion (Dreier, 2025). For FY2026, the White House proposed cutting NASA by nearly 25% to $18.8 billion, with a 47% cut to the Science Mission Directorate, termination of over 40 science missions, and elimination of STEM Engagement funding (Foust, 2025a). Congress rejected virtually all cuts, appropriating $24.44 billion, and the "One Big Beautiful Bill Act" added approximately $10 billion in supplemental mandatory spending through 2032 (Mendenhall, 2025). On April 3, 2026, the White House again proposed cutting NASA to $18.8 billion for FY2027, a 23% reduction, marking the largest sustained discrepancy between presidential request and congressional appropriation in nearly four decades (Foust, 2026c). This tension between the executive and legislative branches over civilian space priorities represents a core controversy that debaters will explore throughout the season.

The Rise of Commercial Space

The global space economy reached a record $613 billion in 2024, with the commercial sector accounting for 78% (Space Foundation, 2025). SpaceX completed 165 Falcon 9 launches in 2025 with an 82% global commercial market share (Foust, 2026a). Blue Origin's New Glenn reached orbit on its first attempt in January 2025 and successfully landed its first-stage booster on its second flight in November 2025, making New Glenn the second US orbital-class rocket to recover its first-stage booster, after SpaceX's Falcon 9 (Blue Origin, 2025; Bergin, 2025). SpaceX Starship completed its 11th test flight in October 2025 (Daleo, 2025; Billings, 2025). Firefly Aerospace's Blue Ghost became the first commercial company to achieve a fully successful soft-landing on the Moon on March 2, 2025, following Intuitive Machines' IM-1/Odysseus, which had reached the lunar surface in February 2024 but tipped onto its side (Firefly Aerospace, 2025; NASA, 2025). These milestones demonstrate that the landscape of space exploration has fundamentally shifted since 2012, with private companies now performing roles that were once the exclusive domain of government agencies. SpaceX's Starlink constellation alone surpassed 10,000 active satellites in orbit by early 2026, constituting approximately two-thirds of all active satellites worldwide (O'Callaghan, 2026).

The China Challenge

China's space program represents the most concrete challenge to US space leadership. China's Tiangong space station is fully operational, with six long-duration crews completed by March 2026 (Swope et al., 2025a). Chang'e-6 returned the first-ever samples from the Moon's far side in June 2024 (Li et al., 2024; David & Billings, 2024). China targets astronauts on the Moon before 2030, with the Long March 10 rocket completing system demonstrations (Xinhua, 2025a; RAND, 2025). China launched Tianwen-2 in May 2025 for an asteroid sample-return mission, with samples expected by late 2027 (Jones, 2025). China established the International Deep Space Exploration Association in July 2025 (Xinhua, 2025b). The International Lunar Research Station, a joint China-Russia initiative, has attracted over 17 countries and 50+ institutions, creating an alternative governance framework to the US-led Artemis Accords.

Space Governance Gaps

The 1967 Outer Space Treaty prohibits national appropriation of celestial bodies and bans weapons of mass destruction in orbit, but it does not explicitly address resource extraction and does not prohibit conventional weapons in orbit (Outer Space Treaty, 1967; Rajagopalan, 2021; Lindbergh, 2024; see also Appendix B, Hassanabadi, 2018). The Artemis Accords have been signed by 68 countries as of June 2026 (U.S. Department of State, 2026). Space debris has reached critical levels: surveillance networks catalog over 40,000 artificial objects, with models estimating approximately 54,000 objects larger than 10 cm in orbit (ESA Space Debris User Portal, 2026; UNOOSA, 2025). Four countries have demonstrated kinetic anti-satellite capability, with China's 2007 test alone generating over 3,000 trackable debris fragments (Kelso, 2007). The CSIS Space Threat Assessment 2025 finds that counterspace activities have become normalized: cyberattacks, jamming, spoofing, and hostile orbital maneuvers are now commonplace. US officials have assessed that Russia is developing a nuclear space-based anti-satellite weapon, a capability whose deployment would violate the Outer Space Treaty (Swope et al., 2025b). Russia's Foreign Ministry declared in March 2024 that commercial space systems supporting military missions are "legitimate targets for retaliatory measures, including military ones" (Swope et al., 2025b).

Executive Action

Both the Trump and Biden administrations have significantly shifted the narrative around US federal space exploration and development. With the creation of the Space Force as the sixth branch of the US military under the NDAA FY2020 (Pub. L. 116-92). The Trump administration envisioned a security and defensive approach to space, and an approach of territorial acquisition. In December 2025, President Trump signed "Ensuring American Space Superiority," setting goals of returning Americans to the Moon by 2028 and deploying nuclear reactors on the Moon by 2030 (White House, 2025). The order disbanded the National Space Council (Holland & Knight, 2025; K&L Gates, 2026). Space Force received approximately $40 billion in combined spending (Thayer, 2025; Erwin, 2025). The simultaneous expansion of military space spending and proposed cuts to civilian space programs creates a central tension that affirmatives can exploit.

Space tourism is not a significant focus of the topic, but its advent has forced public arguments about who may claim to be an astronaut, what counts as exploration, and where space begins. The prior resolution answered that last question with the Earth's mesosphere; the proposed resolutions answer it with the Kármán line, a defined boundary discussed fully in the Definitions section.

The Importance of Space and STEM Education

The case for a space topic does not rest on its science and its geopolitics alone. A third thread runs through the history traced above and bears directly on the criterion of educational value: for three-quarters of a century, federal investment in flight and spaceflight has been among the most powerful instruments the United States possesses for building scientific and engineering talent at scale. The Space Race did not only land astronauts on the Moon; it manufactured a generation of engineers. That mechanism, exploration as human-capital policy, is one reason a space topic is also an education topic, and it is the reason the question matters more in the present strategic moment rather than less.

Two American Models: Cultivate and Import

The United States has historically built technical talent in two ways. The first is broad public investment in human capital, whose great precedent is the Servicemen's Readjustment Act of 1944, the G.I. Bill. It was not a science program: it gave returning veterans tuition, housing, and unemployment support, and was designed to ease millions back into civilian life rather than to produce scientists (National Archives, 2022). Yet by underwriting mass access to higher education, roughly eight million veterans received educational benefits. The number of college degrees awarded annually nearly doubled between 1940 and 1950; it yielded, as a byproduct, an estimated 450,000 engineers, 91,000 scientists, and 67,000 physicians (U.S. Senate, 2024). The lesson is not that Washington once ran a STEM program, but that broad investment in education can generate technical talent on a scale no narrowly targeted effort had matched.

The deliberate, defense-justified version of that investment arrived after Sputnik. The National Defense Education Act of 1958, signed weeks after the satellite's launch, was the first comprehensive federal education law explicitly tied to national security, channeling major new funding into science, mathematics, and foreign-language instruction; over the following decade the output of American scientists and engineers rose sharply (Flattau et al., 2005). The second model is talent import. The same Apollo effort that consumed nearly 4.4 percent of the federal budget at its 1966 peak and employed some 400,000 people (Dreier, 2026; NASA, "The First Step") was built in part on imported expertise, the German rocket team brought to the United States under Operation Paperclip, whose technical leadership, as recounted in "Reaching Space" above, had reached space first as the authors of a terror weapon. The United States won the first space race by doing both at once: mobilizing domestic talent and importing the rest.

Why the United States Cannot Simply Out-Import

Both halves of that strategy are now under strain, which is what makes the contemporary form of the argument a live one rather than a historical aside. The import model remains vast. Of the roughly 36 million STEM workers in the United States in 2023, about 8 million, 22 percent, were foreign-born, and the dependence rises with the level of training: foreign-born workers accounted for 46 percent of doctoral-degree STEM workers, and for a majority of those at the doctoral level in computer and mathematical sciences (57 percent) and engineering (58 percent) (National Science Board, 2026). The reliance on talent drawn from abroad is a documented fact of the American research enterprise, not a forecast.

What has changed is scale and direction. China now out-produces the United States in science and engineering graduates at every level. In 2020 it awarded roughly 2.0 million science and engineering first university degrees, against 900,000 in the United States, with India ahead of both at 2.5 million (National Science Board, 2023). At the doctoral level China overtook the United States in 2007 and has widened the gap since, producing 49,498 STEM doctorates to the United States' 33,759 in 2019; one Georgetown analysis projected that, on the enrollment trends then prevailing, China would graduate more than 77,000 STEM PhDs a year by 2025 to roughly 40,000 in the United States, and that, with international students removed from the American count, Chinese graduates would outnumber their domestic United States counterparts by more than three to one (Zwetsloot et al., 2021). The 77,000 figure is a projection; the direction it projects is not in dispute.

At the same time, the import pipeline shows signs of reversing. A 2023 study identified 19,955 scientists of Chinese descent who began their careers in the United States but left for other countries between 2010 and 2021, with annual departures rising from about 900 to 2,621 and accelerating by roughly 75 percent after the U.S. Justice Department opened its "China Initiative" in 2018 (Xie et al., 2023). China actively recruits exactly this talent: its Thousand Talents Plan, launched in 2008 and administered by the Chinese Communist Party, was designed to draw 2,000 high-level overseas experts and had reportedly recruited more than 7,000 by 2017 (U.S. Senate, Permanent Subcommittee on Investigations, 2019). The implication for the Cold War template is direct. A strategy of importing foreign talent while running occasional domestic surges does not scale against a competitor that already graduates more scientists than its rival and is drawing that rival's imported talent home. On this reading, the United States cannot out-import China; parity would require rebuilding domestic capacity, the logic of the National Defense Education Act, updated for a new century.

The Counterargument, and Why Space Is the Anchor

This thesis is contestable. A substantial body of labor-economics research disputes the premise that the United States faces any genuine STEM "shortage" at all. Michael Teitelbaum finds no general shortage of scientists and engineers, and evidence of recurring surpluses, contending that the periodic alarm over "falling behind" is itself a cyclical political artifact stretching back to the early Cold War (Teitelbaum, 2014). On this account, reliance on foreign-born talent reflects employers' wage preferences rather than a failure of domestic education, and the "cannot out-import" claim mistakes a labor-market choice for a national-capacity crisis (Salzman, Kuehn, & Lowell, 2013).

But the disagreement narrows the question rather than closing it. Even if the ordinary labor market clears, the decision-relevant issue for a great-power space competition is narrower: whether the United States retains the sovereign capacity to staff a sustained national mobilization, an enduring Artemis program alongside a domestic launch and manufacturing base, without depending on talent drawn from a strategic rival. Framed that way, the choice between cultivating and importing is a genuine policy question, not a settled statistic. And it is space, specifically, that makes the question vivid and tractable. Few endeavors advance the entire technical pipeline at once the way a crewed spaceflight program does: mathematics, physics, materials science, computing, and engineering converging on a single visible goal. Few have drawn young people toward technical careers as reliably, from the surge in science enrollments after Sputnik to the renewed student interest around Artemis and the second Moon race documented elsewhere in this paper. A topic that asks whether the United States should invest in space is therefore also asking how, and whether, it intends to build the people who will carry it there.

Status of Current Policy

The status quo is best understood as a two-track expansion. The civilian space program is contested and defended, its budget the subject of a sustained executive-legislative conflict, while the military space program is surging in doctrine, dollars, and personnel. U.S.-China competition is the throughline connecting both. Because the preferred resolution is agent-neutral while Resolution 3 retains a non-military limiter and Resolution 4 a civil limiter, a clear picture of each track has been presented for the reader's benefit.

Civilian Space

The defining feature of civilian space policy is a three-year confrontation over NASA's budget. The administration has proposed cutting NASA by roughly a quarter in two consecutive requests; for FY2026 it sought to take the agency to about $18.8 billion, with a near-50% cut to the Science Mission Directorate (Foust, 2025a). Congress rejected almost all of it. The January 2026 minibus (P.L. 119-74) appropriated $24.44 billion, and, counting supplemental funds from the 2025 reconciliation act, NASA's FY2026 total reaches roughly $27.53 billion, its largest inflation-adjusted budget since FY1998 (CRS, R43419; Planetary Society, 2026a). The pushback has been bipartisan: the House passed its FY2026 science appropriations 397-28, and the co-chairs of the Congressional Planetary Science Caucus, Reps. Judy Chu and Don Bacon, have repeatedly denounced the cuts (Chu & Bacon, 2026). This conflict creates clean inherency for affirmatives that increase civilian space investment.

The human-exploration program has been restructured in parallel. Artemis II flew in April 2026, the first crewed flight beyond low Earth orbit since 1972, but in February 2026 NASA redesignated Artemis III from a lunar landing to a crewed demonstration in low Earth orbit, pushing the first landing to Artemis IV in early 2028, and cancelled the Lunar Gateway in March 2026 (NASA, 2026b). The administration's stated direction is to retire the Space Launch System and Orion after Artemis III in favor of commercial systems, an approach Congress has only partially funded, leaving the program's long-term architecture genuinely unsettled.

Science programs have absorbed the sharpest blows. The FY2026 appropriations effectively cancelled Mars Sample Return, the planetary-science community's highest-priority robotic mission, stranding the samples Perseverance has cached and opening the door for China's Tianwen-3 to return Martian material first (David, 2026; Swope et al., 2025a). Proposed cuts to astrophysics, Earth science, and STEM engagement were largely reversed for FY2026 but renewed in the FY2027 request. The net picture is a civilian program whose ambitions remain intact on paper but whose funding, schedule, and mission set are under continuous contestation.

Military Space

The military space program has moved in the opposite direction. In April 2025 the Space Force published "Space Warfighting: A Framework for Planners," its most explicit statement yet that space is a domain in which the United States must be prepared to fight. The Chief of Space Operations, Gen. Chance Saltzman, writes that space superiority "is not only a necessary precondition for Joint Force success but also something for which we must be prepared to fight… the basis from which the Joint Force projects power, deters aggression, and secures the homeland" (USSF, 2025; see Appendix B). The framework defines an explicit menu of offensive and defensive counterspace operations, from orbital strike to electromagnetic and cyber attack, marking a decisive shift from the service's earlier emphasis on resilience.

That doctrine is backed by resources. The Space Force's budget has grown from $15 billion at its founding in 2020 to roughly $40 billion in FY2026 with reconciliation, while NASA's topline holds near $24 billion; the FY2027 request seeks about $59 billion in the base and roughly $71 billion with planned reconciliation, more than double the enacted civilian budget (Thayer, 2025; Smith, 2026a). The service is also growing its people, from roughly 10,400 authorized Guardians in FY2026 toward about 20,000 by 2030, even as the satellite fleet it operates has expanded from 225 to roughly 515 (Erwin, 2026). A non-military resolution lets affirmatives challenge this civilian-military imbalance directly; an agent-neutral resolution lets them enter it.

Two developments give the military track its urgency. First, Golden Dome, a roughly $185 billion homeland missile-defense program initiated by executive order in 2025, has pulled the Space Force to the center of national strategy, including a contested space-based interceptor layer (Breaking Defense, 2026b). Second, the threat assessment is now bipartisan consensus: the congressionally chartered U.S.-China Economic and Security Review Commission devoted its 2025 report's space chapter, "The Final Frontier," to the finding that "China is pursuing an aggressive long-term, whole-of-government campaign to expand its space capabilities across military, commercial, and civil domains with the explicit intent of surpassing the United States," and recommended Congress increase Space Force appropriations "to levels necessary to achieve space control and establish space superiority against China" (USCC, 2025). China's GPS-rivaling BeiDou constellation illustrates how far that competition now reaches into systems the civilian economy depends on.

Forward Outlook: Federal Space Plans Through 2028

This section catalogs what is planned for U.S. federal space programs in the two years before and during the 2027-28 debate season. On both the civilian and military tracks, the schedule guarantees the topic stays live in headlines throughout the season.

Civilian Space

The FY2027 appropriations cycle will stage the third consecutive executive-legislative confrontation over NASA's budget. The administration's FY2027 request renews the roughly 23% topline cut and a 47% reduction to the Science Mission Directorate and would terminate more than forty missions; the House Science Committee has rejected it on a bipartisan basis, and a key Senate appropriator has rejected it as well (Smith, 2026b; Foust, 2026c). The FY2028 request lands mid-season, guaranteeing a live budget fight throughout.

Exploration milestones arrive on cadence. Artemis III, now a crewed low Earth orbit demonstration that will dock with a commercial lunar lander, is scheduled for late 2027, inside the debate season, and Artemis IV, the program's first crewed lunar landing, for early 2028 (NASA, 2026b). NEO Surveyor, the first dedicated planetary-defense space telescope, launches no earlier than September 2027, arriving precisely as students debate planetary-defense affirmatives. International comparison cases stay current as well: BepiColombo enters Mercury orbit in late 2026 (ISAS, 2024), and JAXA's Martian Moons eXploration mission launches to Mars (JAXA, n.d.).

The competition with China culminates just past the season's edge. Tianwen-3 launches in 2028, potentially making China the first nation to return Martian samples, and Beijing holds firm to a 2030 crewed lunar landing with prototype hardware complete (Swope et al., 2025a; USCC, 2025; Xinhua, 2025a). The ISS operates through 2030 with controlled deorbit targeting early 2031, so the topic's central civilian narrative, U.S. leadership versus Chinese ascent, remains genuinely unresolved through the final round of the season: students spend the year debating a question whose outcome is still open, with fresh evidence arriving every month and no risk of the controversy exhausting itself before the season concludes.

Military Space

Golden Dome dominates the forward calendar. The Space Force targets an on-orbit space-based interceptor demonstration in the 2027-28 window, and FY2027 carries roughly $17.5 billion for the program, most of it dependent on a future reconciliation package that is not assured, making Golden Dome a recurring, high-visibility budget story throughout the season (DefenseScoop, 2026).

Operational programs deliver visible milestones. The Space Development Agency continues fielding its Proliferated Warfighter Space Architecture tranches, missile-tracking and data-transport satellites launching on a steady cadence through the late 2020s, and the tactically responsive space enterprise builds on the June 2026 VICTUS HAZE record with further responsive missions. The service is also funding on-orbit refueling and servicing demonstrations to seed a space-based logistics enterprise (Galbreath, 2025).

The service is planning for a far larger future. In April 2026 it released an unclassified "Objective Force" plan and a companion "Future Operating Environment 2040," calling for a substantially expanded force structure by 2040: thousands more Guardians and, by some projections, tens of thousands of satellites (Smith, 2026a; Erwin, 2026). The FY2027 push toward roughly $71 billion, and a workforce on a path to about 20,000 Guardians by 2030, ensure the military track, like the civilian one, stays in the headlines from the season's start to its close.

Probable Affirmative Case Areas

Civil Space Affirmatives

Artemis Acceleration / Lunar Development

Plans would increase funding for NASA's Artemis program, accelerate the lunar base timeline, or fund In-Situ Resource Utilization (ISRU) technology: the use of the Moon's own materials, water ice for life support and propellant, and regolith-derived oxygen and metals, so that missions need not haul every consumable from Earth. The technology has moved from concept toward flight and field demonstration: NASA's PRIME-1 ice-drilling experiment flew on the IM-2 lander in February 2025, key ISRU technologies are at Technology Readiness Level (TRL) 5/6, and NASA's Break the Ice Lunar Challenge has set specifications for excavation systems capable of 800 kg/day (Sanders & Kleinhenz, 2025). Advantages include maintaining US technological primacy over China, scientific discovery, and development of the cislunar economy.

Planetary Defense

NASA's DART mission successfully altered the orbit of asteroid Dimorphos by 33 minutes (NASA JPL, 2026), proving kinetic deflection works. The stakes became concrete with asteroid 2024 YR4: discovered in December 2024, it reached an Earth-impact probability that, according to NASA's Center for Near-Earth Object Studies and ESA's coordination office, peaked at 3.1% in February 2025 before additional observations cleared it, per ESA, the highest impact probability any asteroid larger than 30 meters has ever recorded (ESA, 2025b; AAS Nova, 2025). A NASA technical review called it "the most potentially hazardous object the planetary defense community had become aware of in twenty years," and it triggered the International Asteroid Warning Network's first-ever real impact notification; JWST infrared observations measured its diameter at 60 ± 7 meters, comparable to the 1908 Tunguska impactor (Rivkin et al., 2025; see Appendix B). The sequence is a near-perfect teaching case for why infrared detection matters: the NEO Surveyor mission, the next dedicated planetary-defense telescope, launches no earlier than September 2027 to catalog hazardous NEOs, fulfilling a congressional mandate from 2005 that remains unmet (Planetary Society, 2024a), and it uses infrared precisely because that band reveals the dark asteroids optical surveys miss and constrains their size directly. The Planetary Science and Astrobiology Decadal Survey fully endorsed planetary defense for the first time, producing 42 findings and 11 recommendations toward "a long-term integrated planetary defense capability able to protect humanity in the decades to come" (Abell et al., 2023; see Appendix B). Plans could accelerate NEO detection timelines or fund follow-on deflection missions.

Space Debris Mitigation and Space Traffic Management

Affirmatives would fund active debris removal (ADR), spacecraft that rendezvous with defunct satellites and spent rocket stages and remove them from orbit, establish a comprehensive space traffic management (STM) system, the tracking, coordination, and rules-of-the-road function that keeps thousands of active satellites from colliding, or invest in debris-tracking infrastructure. The FCC adopted a 5-year deorbit rule in September 2022, which took effect in September 2024 (AUBLR, 2025). Astroscale's ADRAS-J successfully approached debris in 2024 (Astroscale, 2026). The Atlantic Council advocates for US leadership in global space traffic management (STM) standards. NASA's own Office of Technology, Policy, and Strategy has published cost-benefit analyses of debris remediation establishing the analytical foundation for federal action (Colvin et al., 2023), and the bipartisan ORBITS Act, which has twice passed the Senate, would direct NASA to develop and demonstrate active debris removal technologies (US Senate Committee on Commerce, 2025).

Deep Space Science

The Planetary Science and Astrobiology Decadal Survey's highest-priority new flagship is the Uranus Orbiter and Probe, selected "primarily for its ability to produce transformative, breakthrough science across a broad range of topics." Uranus has been visited exactly once, Voyager 2's 1986 flyby, yet ice giants are now understood to be among the most common planet types in the galaxy, making Uranus the nearest analog to worlds across countless other systems; its extreme axial tilt, anomalous internal heat, offset magnetic field, and five potential ocean-world moons are all unresolved. The mission carries a genuine policy clock: the most efficient trajectories use a Jupiter gravity assist available only in windows across the early 2030s, so the cost of delay is measured in years of added cruise time. The survey's second-ranked flagship, the Enceladus Orbilander, would orbit and then land on Enceladus to sample directly the plumes Cassini found erupting from its south-polar "tiger stripes", plumes fed by a subsurface ocean with hydrothermal activity, in a dedicated search for present-day life. The Decadal Survey estimates roughly $4 billion for the Uranus mission and $5 billion for the Orbilander, and the Planetary Society finds NASA running $5-11 billion short of recommended funding levels (NASEM, 2022; Planetary Society, 2024a). Plans could fund specific Decadal Survey missions or restore cancelled ones; the affirmative's appeal is that the science is both foundational and time-sensitive, and the questions it answers, including how common our kind of world is and whether a second genesis of life sits one ocean away, are the kind that reward a season of study.

Space-Based Solar Power

A probable affirmative substantially increases federal investment in space-based solar power (SBSP): the collection of solar energy by satellites in orbit and its wireless transmission, as microwave energy, to receiving stations on Earth. Because an orbital array sits above night, weather, and atmosphere, the technology's appeal is continuous, high-yield generation; Caltech researchers estimate that space-based harvesters could provide as much as eight times the solar energy of the same panels on Earth's surface (Than, 2026). The technology crossed a threshold in 2023: Caltech's Space Solar Power Project launched its SSPD-1 demonstrator in January, and in May its MAPLE experiment transmitted power wirelessly in space and directed a beam that was detected at Caltech, the first detection on Earth of power beamed from orbit (Than, 2026; Ayling et al., 2024). The economics are newly quantified: Mizrahi et al. estimate a levelized cost of energy of 9.4 cents/kWh for a 113 MW orbital solar system (Mizrahi et al., 2025). The solvency advocate is NASA's own Office of Technology, Policy, and Strategy, which modeled two SBSP architectures and identified the technology investments, autonomous systems, wireless power beaming, and in-space servicing, assembly, and manufacturing, that federal action could advance (Rodgers et al., 2024). Advantages include clean energy generation, grid resilience, energy delivery to remote and disaster-struck regions without ground transmission infrastructure, and technological leadership.

NATO Cyber Infrastructure Cooperation

Affirmatives here would fund and lead a NATO-wide effort to secure allied space-based assets against cyberattack. NATO's deterrence and operations depend on satellites for secure communication, navigation, intelligence, and early warning, and cyberattacks on the spacecraft, links, and ground stations that provide them can disrupt military operations and spill over into civilian infrastructure (Cournoyer, 2025). The inherency is an alliance-wide capability and standards gap: NATO members and companies based on their territories own more than half of the operational satellites in orbit, yet only a handful of member states can provide space support to NATO operations, and cybersecurity practices vary across the alliance (Cournoyer, 2025). The solvency advocate is a May 2025 Chatham House research paper by Julia Cournoyer, which proposes a three-tiered framework of mitigation, adaptation, and resilience and recommends that NATO enforce secure procurement standards, develop common cybersecurity standards for the space domain, and deepen collaboration with commercial providers (Cournoyer, 2025). The area also teaches students NATO burden-sharing dynamics and the shift from kinetic to cyber-centered space threats. As with Landsat, affirmatives here must defend topicality under "beyond the Kármán line": the orbital segment plainly satisfies it, while much of the hardening occurs in ground segments, itself a productive topicality debate.

Ecology and the Multi-Planet Species Debate

A space topic creates room for students to think beyond an Earth-centric perspective. The World Economic Forum's 2026 Global Risks Report describes an "Age of Competition" in which geoeconomic confrontation and environmental degradation represent compounding, interconnected threats (WEF, 2026). In this environment there is rigorous debate to be had about whether humanity must become a multi-planet species. Robert Zubrin argues in The New Atlantis that America has a "once-in-a-generation opportunity" to land astronauts on Mars by 2031, leveraging Starship's Saturn V-class payload capability at roughly 5% of Saturn V's per-launch cost (Zubrin, 2025). Kelly and Zach Weinersmith counter in their Royal Society Prize-winning A City on Mars (2023) that even a devastated Earth remains more habitable than Mars, that space settlements would trend toward authoritarianism, and that premature colonization may increase rather than decrease existential risk (Weinersmith & Weinersmith, 2023). Plans in this area would fund crewed Mars exploration itself, activity beyond the Kármán line by definition, with Zubrin supplying the affirmative's solvency advocacy and the Weinersmiths anchoring the negative's answer. This investigation has rigorous, evenly matched literature on either side, and it asks students to weigh planetary risk, habitability, and governance questions that few other case areas reach.

Mars Sample Return Restoration

The FY2026 budget cancelled the Mars Sample Return (MSR) program; Congress preserved only $110 million in a placeholder "Mars Future Missions" account. Yet the National Academies' Planetary Science and Astrobiology Decadal Survey declares that "the highest scientific priority of NASA's robotic exploration efforts this decade should be completion of Mars Sample Return as soon as is practicably possible" (NASEM, 2022; see Appendix B). The stakes sharpened in 2025: on September 10, NASA reported a potential biosignature in the Sapphire Canyon sample, drilled from a rock nicknamed Cheyava Falls in Jezero Crater. Published in Nature, the finding rests on sub-millimeter nodules and millimeter-scale reaction fronts, the "leopard spots", enriched in iron-phosphate and iron-sulfide minerals, likely vivianite and greigite, consistent with the kind of low-temperature redox chemistry that on Earth is often associated with microbial life (Hurowitz et al., 2025; see Appendix B). NASA frames this precisely as a potential biosignature, "a substance or structure that might have a biological origin but requires more data or further study before a conclusion can be reached about the absence or presence of life." That framing is the policy hook: the finding cannot be confirmed or ruled out without returning the sealed sample tube to Earth, and the return mission is the very program the budget cancelled. MEPAG chair Victoria Hamilton called the cancellation "a deeply concerning move with implications not just for U.S. space leadership but other NASA priorities such as Moon to Mars" (David, 2026). An MSR restoration affirmative has a definitive solvency advocate in the decadal survey, clear inherency from the cancellation, and a competitive urgency: China's Tianwen-3 mission, scheduled for 2028, would make China the first nation to return Martian samples (Swope et al., 2025a).

Astrophysics Flagship Restoration

The FY2026 budget request proposed a 66% cut to NASA Astrophysics, including cancelling the Chandra X-ray Observatory (Dalal, 2025). The Astro2020 Decadal Survey recommends a ~6-meter infrared/optical/ultraviolet space telescope, now designated the Habitable Worlds Observatory, as the highest-priority large space mission, describing it as “an ambitious scale that only NASA can undertake” and “one where the United States is uniquely situated to lead the world” (NASEM, 2021a; see Appendix B). The American Astronomical Society warns these cuts “would damage a broad range of research areas that will not be supported by the private sector” (American Astronomical Society, 2025).

Commercial Low Earth Orbit Destinations

NASA’s Office of Inspector General warns that “a substantial gap between the Station’s retirement and the introduction of a new, commercial destination in low Earth orbit would force NASA to accept a higher level of health risk or delay start dates for long-duration, deep space human exploration missions” (NASA OIG, 2021; see Appendix B). CSIS analysis concludes the commercial station business model is sound but that “NASA and Congress have not allocated sufficient funding, over many years, to successfully execute NASA’s commercial LEO development strategy”; to date less than $600 million has gone to industry (Swope, 2026). An affirmative substantially increasing investment in commercial LEO destinations has strong inherency and market-failure solvency evidence.

Nuclear Propulsion

The FY2026 budget zeroed funding for both nuclear thermal propulsion (NTP) and nuclear electric propulsion (NEP), and DARPA cancelled the DRACO demonstration. Yet the National Academies finds that “advanced nuclear propulsion systems (alone or in combination with chemical propulsion systems) have the potential to substantially reduce trip time” to Mars, reducing “risks associated with space radiation, zero gravity, launch and orbital assembly requirements, and many other aspects of long-duration space missions” (NASEM, 2021b; see Appendix B). A civil NASA nuclear propulsion affirmative is cleanly non-military and has a National Academies consensus report as its solvency advocate.

Earth Science / Landsat Next

The FY2026 budget request provided no funding for Landsat Next, proposing instead to study more affordable architectures for maintaining Landsat continuity (Normand, 2025). Peer-reviewed Earth-observation scientists warn that while a descoped single-satellite design would preserve the program's 50-plus-year observation continuity, by the early 2030s it would leave Landsat with "a sensing capability that will be three decades old," with lower radiometric quality than the current Landsat-8/9 missions, and meeting none of the new capabilities the user community had advocated (Roy et al., 2026). Landsat delivered $25.6 billion in economic value to the US economy in 2023 alone (NASA Science, 2025). Plans restoring the full Landsat Next constellation would be supported by the Earth science decadal survey. Note: climate-observation affirmatives must defend topicality under "beyond the Kármán line," which the orbital segment plainly satisfies.

Military Space Affirmatives

Space Domain Awareness

A strong affirmative directs federal investment in advanced space domain awareness (SDA), the capacity to detect, track, characterize, and predict the behavior of objects and threats across orbital regimes from low Earth orbit through cislunar space. The inherency is a recognized capability gap: a CSIS assessment by former U.S. Space Command leaders Lt. Gen. (Ret.) John Shaw and Sean Kirkpatrick finds that "the current U.S. and allied SDA capability lags where it needs to keep up with the rapidly changing SDA environment," even as China "is swiftly growing its own SDA capabilities" toward information superiority in space (Shaw & Kirkpatrick, 2024; see Appendix B). The solvency advocacy is specific: the Space Force, Space Command, and the National Reconnaissance Office must transition from cataloging predictable objects to dynamically characterizing and tracking maneuvering objects in nontraditional orbits, fielding "fire-control"-like tracking and space-based sensors. SDA is foundational: every other mission, civil or military, depends on knowing what is in orbit and what it is doing, which gives the affirmative broad advantage ground (debris avoidance, deterrence, safe operations) while anchoring a debate about how the United States should see in space.

Space-Based Missile Warning and Tracking

A probable plan funds a multi-orbit (LEO/MEO/GEO/Polar) missile warning and tracking architecture capable of maintaining custody of hypersonic glide vehicles and other maneuvering, non-ballistic missiles that the legacy Space-Based Infrared System (SBIRS) was never designed to follow. The inherency is technological: China and Russia have fielded low-flying, maneuvering hypersonic weapons that evade SBIRS and other legacy sensors, while their anti-satellite weapons hold existing warning satellites at risk (Stone, 2022; see Appendix B). The solvency advocate, a Mitchell Institute policy paper by Christopher Stone, recommends that "DOD should adopt a multi-layered satellite architecture that combines legacy ballistic missile warning capabilities with enhanced sensors in LEO, MEO, GEO, and Polar orbits to detect and track hypersonic weapons and other novel missile threats over their entire flight profiles." Because missile warning is a "no-fail" mission tied directly to homeland and allied defense and to Golden Dome, the affirmative carries high-magnitude deterrence and crisis-stability advantages behind a clear expert solvency advocate.

Tactically Responsive Space

An affirmative would scale the Space Force's tactically responsive space (TacRS) enterprise, the capacity to build, launch, and operate satellites on operationally relevant timelines rather than the years-long cycles of traditional acquisition. The capability is no longer theoretical: in June 2026 the VICTUS HAZE mission launched 16 hours and 42 minutes after notice and began rendezvous-and-proximity operations within 72 hours, culminating what program officials called the TacRS "crawl, walk, run" sequence (Rocket Lab, 2026; Space Systems Command, 2026; see Appendix B). The solvency rationale is that responsive launch and rapid on-orbit maneuver let the United States reconstitute lost capabilities and "deny adversaries first-mover advantage into novel orbits." The affirmative's appeal is converting a demonstrated capability into an enduring program of record, with advantages in deterrence, resilience, and reconstitution, and it hands students a concrete, well-documented recent case.

Resilient Position, Navigation, and Timing (PNT)

Another likely plan builds a resilient national PNT architecture to complement and back up the Global Positioning System, whose weak, easily jammed and spoofed signals are a single point of failure for both military operations and civilian critical infrastructure. The inherency is acute and demonstrated: GPS jamming and spoofing are now routine in conflict zones, and China's BeiDou, globally operational since 2020 and aggressively modernized, offers a hardened, military-grade alternative that Iran turned to during the June 2025 conflict when its GPS-guided weapons were jammed (Defence Security Asia, 2026). The solvency advocate, a National Security Space Association paper by James Frelk, calls for "urgent investments in a national, resilient PNT architecture with at least two or three sources that have markedly different failure modes" to mitigate GPS's known vulnerabilities (Frelk, 2025; see Appendix B). The significance is breadth: PNT underpins finance, telecommunications, aviation, agriculture, and the military simultaneously, giving the affirmative a wide advantage base.

Golden Dome Space-Based Interceptors

Affirmatives would fund the space-based interceptor (SBI) layer of the Golden Dome missile-defense program, a proliferated constellation of orbital interceptors designed to destroy ballistic missiles in their vulnerable boost phase. Golden Dome is the defining defense initiative of the period: a roughly $185 billion effort for which the Space Force has awarded contracts to twelve companies and targets an initial on-orbit demonstration in 2028 (Breaking Defense, 2026b; see Appendix B, Guetlein, 2026). The case is unusually well balanced for the negative: the program manager maintains the underlying interceptor technology already exists yet concedes affordability and scalability are unresolved, warning that “if boost-phase intercept from space is not affordable and scalable, we will not produce it,” and has signaled that space-based interceptors may not survive into Golden Dome’s final architecture (Breaking Defense, 2026a). That tension supplies ready-made negative ground (cost, cost-exchange ratios, debris, and arms-race and ABM-stability disadvantages), making this among the most evenly contested case areas on the military side.

On-Orbit Mobility and Logistics

A final probable case funds an in-space logistics infrastructure of on-orbit refueling, servicing, assembly, and propulsion that allows maneuver without exhausting fuel, enabling what the Space Force calls dynamic space operations (DSO). The inherency is doctrinal and architectural: legacy satellites were designed for static missions in energy-constant orbits ill-suited to a contested domain, and the service has underinvested in the logistics that make sustained maneuver possible. The solvency advocate, a Mitchell Institute study by Col. Charles Galbreath, USSF (Ret.), argues the service must “design and field an on-orbit logistics infrastructure” and stand up a dedicated program office, because “essential to achieving the requisite movement and maneuver in space is the logistics support to enable and sustain dynamic operations” (Galbreath, 2025; see Appendix B). With the Chief of Space Operations already funding refueling and servicing demonstrations, the affirmative accelerates an emerging program, with advantages in resilience, deterrence, and freedom of maneuver.

Probable Negative Strategies

Disadvantages

Disadvantage: Space Debris/Kessler Syndrome

Increased launch activity risks cascading collisions. Boley and Byers modeled that given a plausible scenario in which untracked debris simultaneously decays through the 550 km altitude shell, the conditional probability of collision with a mega-constellation satellite could reach 50% annually (Boley & Byers, 2021). ESA's Space Environment Report 2025 estimates over 1.2 million debris objects larger than 1 cm and warns that "to prevent this runaway chain reaction, known as Kessler syndrome, from escalating and making certain orbits unusable, active debris removal is required" (ESA, 2025a; see Appendix B).

Disadvantage: Space Militarization

Increased US space activity, even civilian, risks accelerating militarization through the dual-use perception problem. The US-China Economic and Security Review Commission's 2025 Annual Report devotes a full chapter to China's space rise, finding that China's military-civil fusion strategy "erases the line between military and civilian space activities" and "makes it difficult to distinguish commercial innovation from military capability," and that while the United States "has refrained from developing an offensive space program," the Space Force "is spearheading a new approach to counterspace operations" now that space "is now seen by China as a warfighting domain" (USCC, 2025; see Appendix B, USCC 2025 (p. 381)). The perception link is sharpened by the Wolf Amendment: because the 2011 law bars NASA-China bilateral cooperation, China cannot clarify which US projects are civilian, creating a security dilemma in which "even defensive military actions are seen as offensive" and incentivizing further militarization (Harvard International Review, 2023). Affirmatives that expand US launch cadence, cislunar presence, or lunar infrastructure provide specific links: Chinese military experts claim the United States is trying to become "the overlord of space" (Harvard International Review, 2023).

Disadvantage: NASA Budget Tradeoff

Distinct from generic spending arguments, this disadvantage exploits the fixed, zero-sum structure of NASA's appropriation. Without new congressional spending, any affirmative launched now or ahead of its natural schedule must trade off with a different NASA project. The National Academies' NASA at a Crossroads report finds that "NASA's budget is often incompatible with the scope, complexity, and difficulty of its mission work," producing "erosion of capabilities in workforce, critical infrastructure, and advanced technology development" to the point where "agency sustainability is in question" (NASEM, 2024; see Appendix B). NASA's own astrophysics director called mission operations "a zero-sum-game discussion": continuing to operate Hubble and Chandra at previous levels means "canceling something else" (Foust, 2024). NASA's budget has seen no meaningful growth since FY2022 (Planetary Society, 2026a), making internal tradeoff links highly unique. This disadvantage applies to every affirmative on the topic.

Disadvantage: China/Russia Escalation

Increased US space investment risks escalating great-power competition. The dual-use technology problem is acute: the boundary between civilian and military space enterprise is blurring as commercial platforms serve military functions (Hitchens, 2025b). The link is articulated by the rivals themselves. Russia's Foreign Ministry declared in March 2024 that commercial space systems supporting military missions are "legitimate targets for retaliatory measures, including military ones" (Swope et al., 2025b), and the congressionally chartered US-China Economic and Security Review Commission finds China pursuing "an aggressive long-term, whole-of-government campaign" to expand its space capabilities with the explicit intent of surpassing the United States (USCC, 2025). Because China's military-civil fusion strategy "erases the line between military and civilian space activities" (USCC, 2025), each side is structurally disposed to read the other's civilian investment as military, giving the disadvantage a reciprocal-perception internal link that reaches even science-forward affirmatives. Negatives can run this alongside the militarization disadvantage's evidence or as a distinct US-China or US-Russia escalation scenario.

Disadvantage: Environmental Damage / Launches

The uniqueness literature for this disadvantage is robust and quantified, directly scaling harm to launch cadence. Revell et al., publishing in npj Climate and Atmospheric Science, model that an “ambitious” scenario of 2,040 launches per year yields a 0.29% depletion in near-global total column ozone by 2030, with Antarctic springtime ozone decreasing 3.9%; even their “conservative” scenario of 884 launches per year, which “current licensing rates suggest… may be exceeded before 2030”, yields measurable depletion (Revell et al., 2025; see Appendix B). The study explicitly benchmarks the status quo (258 orbital launches in 2024, up from 102 in 2019), giving negatives a clean threshold argument: affirmatives that add launches beyond the already-record-setting baseline cause marginal ozone harm. Over 62% of rocket launch operating sites are within or near protected areas (Ang et al., 2024). A peer-reviewed life cycle assessment of reusable launch vehicle fleets reinforces the climate-impact uniqueness: once high-altitude characterization of rocket exhaust is included, the modeled climate impact rises by two to three orders of magnitude, with the worst-case methane-fueled fleet reaching a footprint “comparable to those of global annual commercial aviation and potentially exceeding Earth’s carrying capacity defined by its planetary boundaries”, and the authors stress this burden reflects only Europe’s projected launch demand, underscoring “the urgent need of addressing global launch vehicle emissions from all spacefaring nations” (Dominguez Calabuig et al., 2024; see Appendix B). Satellite mega-constellations threaten space-based astronomy; Borlaff et al. find that if all proposed constellations are completed, the vast majority of future space telescope images would be contaminated by satellite trails (Borlaff et al., 2025). Satellite reentry pollution is a growing concern; a 2025 Government Accountability Office report found the FCC has not assessed the environmental effects of mega-constellation licensing (Bussjaeger, 2025).

Disadvantage: Spending / Fiscal Crisis

Beyond the NASA-internal tradeoff, every affirmative requires significant federal investment, and the topic supports a full federal-spending disadvantage with several distinct internal links to a catastrophic terminal impact. (1) *Debt downgrade.* On May 16, 2025, Moody's downgraded the United States from Aaa to Aa1, completing the loss of a perfect rating from all three major agencies and ending a top rating Moody's had held since 1917; it warned that federal interest payments are likely to absorb "around 30% of revenue by 2035, up from about 18% in 2024" (Moody's, 2025; see Appendix B, Moody's, 2025). (2) *Business and investor confidence.* Analysts trace how a downgrade-driven rise in the term premium "would likely drag on equity valuations, widen corporate credit spreads, increase mortgage rates and spur greater capital outflows from US assets" (Western Asset, 2025). (3) *International markets, the dollar, and the terminal impact.* The Congressional Budget Office warns that rising debt increases "the risk of a fiscal crisis—that is, a situation in which investors lose confidence in the value of the U.S. government's debt," which "would cause interest rates to rise abruptly," and notes that "expectations of higher inflation could erode confidence in the U.S. dollar as the dominant international reserve currency" (CBO, 2025; see Appendix B). CBO projects debt held by the public rising from 100% of GDP in 2025 toward 156% by 2055, while explicitly declining to name a "tipping point", the honest framing for the disadvantage's brink. (4) *Crowd-out.* The Committee for a Responsible Federal Budget's analysis of the CBO outlook notes that rising debt "could slow income and output growth by crowding out investment and moving returns abroad" (CRFB, 2025). (5) *Debt-as-national-security-threat.* CSIS's economics director documents that in 2024 the United States spent roughly 3 percent of GDP on interest payments alone, "exceeding the level of defense spending," and frames mounting debt as having "shifted from an abstract risk to a strategic constraint on U.S. power and leadership" (Luck, 2025; see Appendix B). Generic spending disadvantages and specific NASA tradeoff arguments remain core negative positions; the breadth of internal links lets negatives select the scenario best suited to the affirmative and the round.

Counterplans

Counterplan: Privatization

Commercial companies fund space exploration without government subsidy. The commercial space economy is self-sustaining, accounting for 78% of the $613 billion global space economy (Space Foundation, 2025), and a developed privatization-advocacy literature supplies qualified advocates: the Cato Institute argues that “as long as NASA dominates civilian space efforts, little progress will be made toward inexpensive manned space travel” (Hudgins, 1998; see Appendix B), and Jeff Greason and James C. Bennett’s *The Economics of Space: An Industry Ready to Launch* (Greason & Bennett, 2019) makes the market-efficiency case in full. Beyond its solvency function, the privatization counterplan operates as a structural *limit* on the topic. Because the private sector demonstrably handles small and low Earth orbit launches more efficiently than government, NASA’s own Commercial Lunar Payload Services and Venture Class Launch Services programs are admissions of exactly this, a privatization counterplan defeats most small-aff and LEO-based affirmatives on the “the private sector does it better and cheaper” argument. This pushes affirmatives toward the larger, beyond-LEO science missions that markets will not fund (deep-space flagships, sample return, planetary defense), which is precisely the topic’s intended center of gravity. Thus this counterplan serves as a functional limit on the affirmative. The affirmative answer is well-developed and turns on this “additionality” principle: the Planetary Society explains that “space science remains primarily a public sector activity” because “the private sector is not well-suited to the needs of fundamental science, which can take years and yield complex results” (Planetary Society, 2024b; see Appendix B); CSIS analysis finds the commercial market does not close without NASA as anchor customer (Swope, 2026); and the American Astronomical Society argues NASA science supports “research areas that will not be supported by the private sector” (American Astronomical Society, 2025), giving both sides quality evidence in the privatization debate.

Counterplan: International Agent

Another spacefaring agency, including ESA, JAXA, or ISRO, conducts the affirmative’s mission instead of NASA. Unlike in 2012, when international fiat was rare and often rejected, international counterplans are now more accepted in policy debate. The evidence base is current: ESA and JAXA operate joint deep-space missions, JAXA’s Martian Moons eXploration mission launches in late 2026, and China’s Tianwen-3 demonstrates that Mars sample return is no longer a uniquely American capability (Swope et al., 2025a). This counterplan forces affirmatives to defend some “US key” warrant: leadership, norm-setting, unique capabilities, or feasibility. Establishing this warrant will not represent a struggle for the affirmative. (see the Balance section).

Counterplan: Robotic-Only Exploration

Robotic missions achieve scientific objectives at a fraction of crewed mission costs. This counterplan is competitive because it offers an alternative mechanism for achieving the affirmative's scientific advantages without crewed spaceflight. While counterplans need not be topical, the robotic-only approach would not function as a topical affirmative because a likely topicality argument, T-Staffed, which requires that topical affirmatives involve human spaceflight, would exclude purely robotic plans.

Counterplan: International Cooperation / Multilateral Frameworks

Rather than the United States acting unilaterally, the negative fiats a multilateral mechanism. The flagship advocacy is Ely Sandler's Belfer Center proposal to add a Conference of the Parties (COP) to the Outer Space Treaty (Sandler, 2025; see Appendix B). Sandler argues that the existing treaties "lack detail, using ambiguous and undefined terminology which is unsuited to the scale and character of today's challenges," and that a COP, a standing body of signatories that meets to interpret the text, creates guidance that "thickens" the meaning of the treaty, a thickening that "in practice creates new international law," without requiring Senate ratification. That design is strategically important for the counterplan: it captures debris and space-traffic-management solvency while avoiding the ratification-failure net benefit that sinks treaty counterplans. The negative can also fiat existing multilateral architecture: UN COPUOS space-traffic-management and debris frameworks; the planetary-defense coordination structure of UNOOSA, the Space Mission Planning Advisory Group (SMPAG), and the International Asteroid Warning Network (IAWN), which issued its first-ever real (non-exercise) impact notification for asteroid 2024 YR4; and lunar-governance proposals from the Moon Village Association and the Hague International Space Resources Governance Working Group. These give the negative competitive, literature-backed alternatives to U.S.-only action and force the affirmative onto the "US key" debate (see the Balance section).

Counterplan: Public-Private Partnerships (P3s)

NASA should achieve the affirmative's objective through milestone-based, fixed-price public-private partnerships rather than traditional cost-plus programs. NASA's own life-cycle cost analysis of the Commercial Orbital Transportation Services (COTS) program found the partnership model produced the Falcon 9 at roughly one-quarter the cost of traditional NASA development methods, and that fixed-price milestone contracting shifts cost-overrun risk away from the government: "traditional 'cost-plus' contracting is process driven, not results driven, paying for effort that may or may not be enough to achieve the goal" (Zapata, 2017; see Appendix B). This counterplan competes with affirmatives specifying traditional procurement and generates a rich solvency debate about which model better delivers exploration outcomes.

Counterplan: Wolf Amendment Repeal

The negative repeals the 2011 Wolf Amendment barring NASA-China bilateral cooperation, resolving the China threat-perception disadvantage in a way affirmatives cannot effectively permute: the perception link stems from the affirmative's unilateral expansion of US capability, which the permutation retains. CSIS analysis argues the Wolf Amendment "has neither discouraged Chinese space ambitions or altered China's behavior on human rights—it has only muddled our relationship with China and created an opening for a challenger to NASA's leadership role in space exploration" (Young, 2019; see Appendix B). The Aerospace Corporation's Center for Space Policy and Strategy published a structured expert debate on repeal in July 2025, giving both sides qualified advocates (Aerospace Corporation, 2025).

Counterplan: Process / Alternative-Actor Counterplans

The topic supports a rich set of process counterplans because the status quo demonstrates that actors other than a NASA appropriation can redirect space policy. The cleanest is the executive-action counterplan: on December 18, 2025, President Trump signed the "Ensuring American Space Superiority" executive order, which set a new goal of returning humans to the Moon by 2028, directed a "National Initiative for American Space Nuclear Power," and revised existing Space Policy Directives (White House, 2025; see Appendix B). It is the live precedent that a president can substantially redirect NASA by directive, and it sits atop a deep lineage, Space Policy Directives 1 through 7, beginning with SPD-1's December 2017 redirection of NASA beyond low Earth orbit. The standard affirmative answer (executive orders cannot appropriate funds) is pre-empted by pairing the order with actors who hold their own authorities: the Department of Defense and Space Force (the December 2025 order itself directs a national-security space architecture "from very low-Earth orbit through cislunar space," and DARPA's DRACO nuclear-thermal-propulsion program is a clean dual-use precedent); the Department of Commerce's Office of Space Commerce, which the order empowers to run acquisitions independent of NASA; the FAA's Office of Commercial Space Transportation; and state-level spaceport authorities such as Space Florida. Congressional-mandate and judicial-action pathways round out the set. Each is a fiat-able alternative actor, and the resulting "process vs. policy" and agent-competition debates are well-established in modern policy debate.

Critical Approaches/The Kritik

The topic opens onto an unusually deep critical-theory literature. Each criticism below is grounded in peer-reviewed scholarship, university-press monographs, or credentialed expert work, and each links to the resolution's core action, a substantial increase in federal investment in space exploration and development, rather than to debate abstractions.

Criticism: Longtermism

The longtermism criticism targets the moral framework, common among space-settlement advocates, that treats expansion to the stars as an obligation to vast numbers of future people. The major scholarly turn against this framing is Daniel Deudney's *Dark Skies: Space Expansionism, Planetary Geopolitics, and the Ends of Humanity* (Oxford University Press, 2020); Deudney teaches political science, international relations, and political theory at Johns Hopkins University. As the London Review of Books summarized it, Deudney "dismantles the idea that space exploration will lead to a transcendence of the Earth's natural constraints," arguing that more likely outcomes are "total surveillance and an increased risk of 'planetary scope technological catastrophe'" (London Review of Books, quoted in Deudney, 2020; see Appendix B). In the book itself, Deudney divides space expansionism into three strands: "military," "habitat," and "planetary security" space expansionism. He argues that habitat expansionism in particular raises rather than lowers existential risk (Deudney, 2020, p. 30). The argument is a direct internal-link turn: reviewing the book, Ian Crawford of Birkbeck College notes that Deudney "sees the existential risks of space anarchy outweighing any likely benefits for survival," and concedes that interplanetary anarchy could make a *deliberately* deflected asteroid more likely than a natural impact (Crawford, 2021). Émile P. Torres supplies the ideology critique: Torres's peer-reviewed Routledge chapter "Longtermism, Space Colonization, and Human Consciousness" examines the framework that treats space expansion as an obligation (Torres, 2024), and Timnit Gebru and Torres argue in First Monday that the normative bundle motivating space colonization, which they term "TESCREAL" (Transhumanism, Extropianism, Singularitarianism, Cosmism, Rationalism, Effective Altruism, Longtermism), is rooted in Anglo-American eugenics (Gebru & Torres, 2024).

Criticism: Securitization / Critical Security Studies

This criticism posits that treating space as a security problem is itself a political move with consequences: that "securitizing" space investment forecloses cooperative alternatives and naturalizes weaponization. Columba Peoples (Senior Lecturer in International Relations, University of Bristol) documents that "attempts at securitization are… a rapidly growing feature of contemporary space policy discourse" and presses the normative question of whether such "securitizing moves should be encouraged or avoided" (Peoples, 2010; see Appendix B). His companion work on "the inevitability of outer space weaponization," and the edited volume *Securing Outer Space* (Bormann & Sheehan, 2009), anchor the literature base.

Criticism: Settler Colonialism / Manifest Destiny

The settler-colonialism criticism argues that the resolution's framing of space as a frontier to be explored and developed reproduces the colonial logics that dispossessed Indigenous peoples on Earth. The foundational monograph is Mary-Jane Rubenstein's *Astrotopia: The Dangerous Religion of the Corporate Space Race* (University of Chicago Press, 2022). Rubenstein, Dean of the Social Sciences and Professor of Religion and Science in Society at Wesleyan University, argues that the contemporary space race peddles "growth without limit, energy without guilt, and salvation in a brand-new world," reviving the "frontier zealotry" of European colonialism as a quasi-religious calling [quotation from the University of Chicago Press description of the work]. Her account documents how federal space projects from Apollo 8 to the Space Force "replay the Christian imperialism that founded and expanded the US" (Rubenstein, 2022, p. 75), and she reads Trump's framing of Artemis as "America's manifest destiny in the stars" as a direct extension of *terra nullius*, a hook for an Artemis-Accords-as-colonial-instrument argument (Rubenstein, 2022; see Appendix B). Niiyokamigaabaw Deondre Smiles, a citizen of the Leech Lake Band of Ojibwe and Assistant Professor of Geography at the University of Victoria, supplies the geographic theory: settler colonialism "is intimately tied with the space within which it exists—it cannot exist or sustain itself without settler control over land and space," a logic he traces from terrestrial dispossession into interplanetary space while offering Indigenous conceptions of space as a foil (Smiles, 2020; Smiles, 2023; see Appendix B). In May 2025, eleven Indigenous and allied scholars published a Nature commentary warning that a narrow set of wealthy nations is shaping space exploration, risking the reproduction of historical colonial patterns, and proposing a framework built on collaboration, consultation, respect, responsibility, and mutual benefits (Aganaba et al., 2025). Eski applies the concept of "extraterra nullius", paralleling terra nullius, to space resource strategies in a criminological critique of ESA policy (Eski, 2025). Trump's December 2019 NDAA remarks explicitly invoked "American dominance" and "destiny," giving the criticism a contemporary rhetorical link.

Criticism: China Threat-Inflation / Orientalism

This criticism argues that "space race" rhetoric inflates the China threat through Orientalist tropes, justifying investment that a sober assessment would not. Kyle L. Evanoff (formerly of the Council on Foreign Relations) argues that analysts "have played up the sensationalist trope of a US-China space race on the basis of unreliable reports, mistranslated documents, flawed inferences," and that space "appears to have been subject to the same sort of threat inflation that has plagued various other domains" (Evanoff, 2019; see Appendix B). A quantitative companion (Yu & Wong, 2023) finds that China "does not appear poised to assume the role of the next global regulator," and Svetla Ben-Itzhak (then at Air University, now at Johns Hopkins SAIS) documents the substantial US lead while reframing the "race." These authors critique *race rhetoric* and a *security dilemma*, not the existence of any competition, so the criticism should be run as a threat-inflation argument, not a claim that the challenge is wholly fabricated.

Criticism: Feminism and Gender Minorities

The feminist criticism reads space exploration as a masculinist-frontier project that naturalizes a particular gendered and reproductive order. Marie Lathers (Treuhaft Professor of French and Humanities, Case Western Reserve University) argues in *Space Oddities: Women and Outer Space in Popular Film and Culture, 1960-2000* that the contemporary female astronaut "goes into space but does not threaten men," because "her career reinforces her role as caretaker, nurturer, and representative of Mother Earth" (Lathers, 2012, p. 107, as quoted in Ganser, 2025; see Appendix B). The peer-reviewed scholarship extends the point: Alexandra Ganser, analyzing *Interstellar* (2014) and the Netflix series *AWAY* (2020), argues that female astronaut-mothers are "cast to stand for the future survival of the traditional U.S.-American family and thus the nation itself," in what Amy Kaplan termed "manifest domesticity" (Ganser, 2025). A second peer-reviewed companion, Réka Patrícia Gál and Eleanor Armstrong's chapter on feminist approaches to outer space in the Routledge Handbook, argues that space-science exhibition culture positions "exploration" as "masculine, white, and able-bodied," foregrounding "heterosexual future family structures… and normative sexualities as the dominant narrative" (Gál & Armstrong, 2023).

Criticism: The Frontier Thesis as Shared Link

The frontier critiques share a common root: Frederick Jackson Turner's 1893 thesis that American character was forged on the frontier, "the meeting point between savagery and civilization" (Turner, 1893). That formulation, progress as the advance of civilization into land coded as empty or wild, is exactly what the New Western historians set out to dismantle; Patricia Limerick recast the frontier not as a line of heroic advance but as a long and unfinished history of conquest whose legacy still structures the American West (Limerick, 1992). The negative can therefore run Turner as the buried premise of any "space frontier" affirmative: the same logic that made *terra nullius* of inhabited land now makes it of the Moon and Mars, and the treaty language the affirmative leans on, space as "the province of all mankind", can be read either as a repudiation of that inheritance or as its polite continuation (Outer Space Treaty, 1967). Naming Turner gives the settler-colonial and antiblackness criticisms a shared author to contest and a single historical link.

Criticism: Antiblackness and the Racialized Frontier

A distinct and mature strand of scholarship argues that space-investment priorities reproduce a racialized "frontier" logic, channeling federal resources toward an imagined extraterrestrial future while marginalized communities on Earth are treated as expendable. The foundational text is De Witt Douglas Kilgore's *Astrofuturism: Science, Race, and Visions of Utopia in Space* (University of Pennsylvania Press, 2003), the first full-scale scholarly analysis of race and the space-frontier imaginary; Kilgore is Associate Professor of English, with affiliations in American Studies and African American Studies, at Indiana University Bloomington. Kilgore argues that the idea of a space frontier "serves contemporary America as the west served the nation in its past: it is the terrain onto which a manifest destiny is projected," a "new frontier invalidating the 1893 closure of the western terrestrial frontier" (Kilgore, 2003, p. 1; see Appendix B). The historical proof comes from Neil M. Maher's *Apollo in the Age of Aquarius* (Harvard University Press, 2017), the Emme Award-winning archival history of NASA's collision with the civil-rights movement; Maher is Professor of History at the New Jersey Institute of Technology and Rutgers University-Newark. Maher documents how the lunar mandate's critics denounced it as "a colossal waste of resources needed to solve pressing problems at home" [quotation from the Harvard University Press description of the work] (Maher, 2017; see Appendix B). The cultural-critique anchor is Gil Scott-Heron's "Whitey on the Moon" (1970), which dramatizes the abandonment argument; the affirmative alternative tradition is Afrofuturism, which BlackCrit scholarship theorizes as making "space for liberatory Black futures" while naming the antiblackness embedded in the American project (Toliver, 2024). Kilgore supplies the theory, Maher the historical record, and Afrofuturism the alternative, together a rigorous critique of space exploration priorities.

Criticism: Disability and Access

Rather than a milestone narrative, the disability criticism is a live argument that astronaut selection encodes a "right stuff" body-normativity which is both exclusionary and operationally suboptimal. Sheri Wells-Jensen, Associate Professor at Bowling Green State University and a Mission: AstroAccess ambassador on parabolic flights, argues in "The Case for Disabled Astronauts" that "survival chances for any long-term mission will be dramatically improved by loosening these restrictions until all people, regardless of disability, are eligible to be astronauts," and not "because of some ineffable theoretical advantage of 'diversity'" (Wells-Jensen, 2018; see Appendix B). She uses the 1997 Mir fire, where smoke blinded the sighted crew, to argue that a blind astronaut would have held an operational advantage, inverting the eugenics-adjacent normativity of selection criteria that exclude candidates for "a weak knee, flat feet or some other slight but uncorrectable, physiological irregularity that means they do not have what Tom Wolfe called 'The Right Stuff.'" Peer-reviewed companions in *Futures* extend the analysis into a universal-design and anti-eugenics framework (Smith et al., 2019; Wells-Jensen et al., 2019), and a peer-reviewed empirical study of AstroAccess parabolic-flight experiments concludes that universal-design solutions "have the potential to improve safety and efficiency for all astronauts, regardless of disability" (Molaro et al., 2024; see Appendix B). Wells-Jensen's central claim, that loosening body-normative selection criteria would improve survival chances for all crews, is contestable and evidence-based, which is what makes it productive debate ground rather than a token note. And the debate is no longer hypothetical: AstroAccess has flown disabled researchers, including Wells-Jensen herself, on parabolic test flights since 2021, and Michaela Benthaus became the first wheelchair user in space on Blue Origin's NS-37 mission in December 2025 (AstroAccess, 2025; Wattles, 2025), developments that give debaters live evidence on whether inclusion claims translate into mission design. Note: Wells-Jensen's piece is a credentialed-expert essay rather than a peer-reviewed article.

Criticism: Capitalism / Extractive Economics

The capitalism criticism argues that the resolution accelerates the arrival of capital accumulation in space: space mining as primitive accumulation and outer space as a "spatial fix" for capital's terrestrial limits. The cleanest open-access scholarly link is Victor L. Shammas and Tomas B. Holen, "One giant leap for capitalistkind: private enterprise in outer space," *Palgrave Communications* 5 (2019). The authors argue that "NewSpace marks the arrival of capitalism in space" and that, despite its "humanistic, universalizing pretensions," it benefits "a specific set of wealthy entrepreneurs… who strategically deploy humanist tropes," a complex they name "capitalistkind"; outer space, they conclude, "serves as a spatial fix, allowing capital to transcend its inherent terrestrial limitations" (Shammas & Holen, 2019; see Appendix B). The sociological foundation is Peter Dickens and James S. Ormrod's *Cosmic Society: Towards a Sociology of the Universe* (2007) and their edited *Palgrave Handbook of Society, Culture and Outer Space* (2016), which frame the "humanization of the universe" as capitalist expansion. Accessible legal literature on space-mining ethics rounds out the ground (Goswami, 2025; Koh, 2024).

Proposed Resolutions

To parse through the following resolutions, there are four components that can vary:

- **Direction of the action:** Should the US increase or reduce its engagement with Space Exploration and Development?
- **Military versus non-military change:** Should the change be made through non-military/civilian means specifically?
- **Specific type of change:** What specific subset of space policy should be changed?
- **Area of change:** Should the resolution center on the entirety of space exploration and development, or a subset?

As detailed above, the topic author believes the ideal resolution includes an "increase" of "its space exploration and development". The ideal boundary is "beyond the Kármán line," based on qualified topic literature. It combines a clear plain meaning with contextually significant usage; novices and advanced debaters alike will understand it effectively.

Resolution 1 (Preferred) - Resolved: The United States federal government should substantially increase its space exploration and/or development beyond the Kármán line.

"Beyond the Kármán line" provides a clear boundary at 100 km altitude (see Appendix B). The "and/or" allows focus on exploration, development, or both. This resolution provides constrained affirmative ground with clear limits.

Resolution 2 - Resolved: The United States federal government should substantially increase its investment in space exploration and/or development beyond the Kármán line.

Including "Investment" allows for affirmatives to have more ground for international cooperation affirmatives, but may create issues with debates over whether the investment or the exploration and/or development need to be beyond the Kármán line.

Resolution 3 - Resolved: The United States federal government should substantially increase its non-military space exploration and/or development beyond the Kármán line.

Non-military lacks a single bright-line contextual definition; the statutory framework detailed in the Definitions section supplies the strongest available anchor, but dual-use technology blurs the boundary in practice, raising extra topicality concerns. The topic is already more tightly limited with the functional limits that counterplans will provide.

Resolution 4 - Resolved: The United States federal government should substantially increase its civil space exploration and/or development beyond the Kármán line.

“Civil” is a better-defined limiting term than non-military: the Definitions section anchors it in statute and in the Space Foundation’s sector taxonomy. It is also the narrower term. The civil sector maps to the NASA and NOAA core, and much of NOAA’s mission operates below the Kármán line, so the limiter would constrict affirmative ground considerably. Dual-use technology raises the same extra topicality concerns that attend non-military. These concerns with both limiting terms are part of why Resolution 1 remains the preferred wording.

Resolution 5 - Resolved: The United States federal government should substantially increase space exploration and/or development beyond the Kármán line.

The removal of “its” may allow more ground for international cooperation Affirmatives but would likely overly broaden the limits of what Affirmatives are permissible.

After significant review, Resolution 1 remains the author’s strong preference.

Definitions

This section provides multiple definitions for each significant term, with discussion of how each would shape the Wording Committee's approach.

Space Exploration

Encyclopædia Britannica's entry on space exploration, authored by space policy historian John M. Logsdon, defines the term as "investigation, by means of crewed and uncrewed spacecraft, of the reaches of the universe beyond Earth's atmosphere and the use of the information so gained to increase knowledge of the cosmos and benefit humanity" (Logsdon, 2026; see Appendix B). Fehrler et al. (2025) define space exploration more narrowly, as "scientific activities mainly aimed at exploring the solar system and universe, without direct economic or military goals," distinguishing it from space applications that generate direct economic benefits (see Appendix B, Fehrler et al., 2025). The Fehrler definition is the limiting interpretation, excluding economically motivated activity, while the Logsdon definition is broader. The Wording Committee should anticipate this exploration-versus-application boundary becoming a topicality debate, which is healthy ground: it forces affirmatives to characterize their mission's purpose.

The Fehrler et al. evidence also supplies the definitional basis for the T-Staffed argument referenced in the Negative Strategies section: the authors expressly "divide space exploration into human and robotic space exploration," noting that human missions carry distinct stakes, costs, and safety requirements (see Appendix B, Fehrler et al., 2025). Negatives reading T-Staffed will argue the human/crewed branch of this division is the proper topical interpretation, that "exploration" in the resolution requires staffed spaceflight, while affirmatives will defend the inclusive reading. Both interpretations are anchored in the same peer-reviewed source, which is precisely the kind of contestable, evidence-based topicality debate that benefits students. A second, independent source strengthens the staffed interpretation: an MIT Space, Policy, and Society Research Group study published by the American Academy of Arts and Sciences defines exploration as "an expansion of the realm of human experience," that is, "bringing people into new places, situations, and environments," and defines the primary objectives of human spaceflight as those "that can be accomplished only through the physical presence of human beings" (Mindell et al., 2009, pp. 11, 13; see Appendix B). Negatives can pair Mindell with Fehrler to argue the resolution's "exploration" carries a human-presence requirement, while affirmatives counter that both Logsdon's and Fehrler's definitions expressly include robotic spacecraft.

Space Development

Metzger's peer-reviewed account defines development through the supply-chain lens: "Space programs will be more cost-effective when they work to establish a supply chain in space, mining and manufacturing then replicating the assets of the supply chain so it grows to larger capacity" (Metzger, 2016; see Appendix B). Development is thus economically productive activity, infrastructure, mining, and manufacturing, in contrast to exploration's scientific orientation, making the resolution's "and/or" construction meaningful.

Kármán Line

The Fédération Aéronautique Internationale (FAI), the world governing body for air sports that maintains astronautic records through its ICARE commission, uses the 100 km altitude to mark the boundary of space (FAI, 2018; see Appendix B). Including this boundary in the resolution is critical for topical limits: it excludes Earth-based astronomy programs, atmospheric research, and suborbital tourism from affirmative ground, ensuring that debate centers on activities conducted in space itself.

McDowell's peer-reviewed analysis "propose[s] 80 kilometers as a more appropriate boundary than the currently popular 100 km Von Kármán line," based on historical, physical, and technological considerations (see Appendix B, McDowell, 2018). The 100 km/80 km variance is itself debatable ground, but both candidate altitudes exclude the same affirmative categories (ground-based astronomy, atmospheric science, aviation), so the limiting function of the term is stable regardless of which precise altitude debaters defend. The purpose of the phrase is not to limit out additional affirmatives relative to the 2011-12 "mesosphere" wording; it is to establish a brightline. "Mesosphere" is imprecise as the mesosphere is a diffuse atmospheric layer whose boundaries vary; the Kármán line, even if somewhat arbitrary, is a defined standard maintained by an international body.

Non-Military

Federal statute supplies the foundational definition: US space activities "shall be the responsibility of, and shall be directed by, a civilian agency," except "activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States," which belong to the Department of Defense. The statute identifies NASA as "the civilian agency established to direct and control nonmilitary aeronautical and space activities" (see Appendix B, 51 U.S.C. § 20102). The 2020 National Space Policy operationalizes this as a three-sector taxonomy of commercial, civil, and national security (National Space Policy, 2020; see Appendix B), under which "non-military" most naturally maps to the civil and commercial sectors.

In the context of US space policy, "non-military" therefore excludes programs conducted by the US Space Force, the Department of Defense's space operations, and weapons development programs. It includes programs conducted by NASA, NOAA, NSF, and other civilian agencies, as well as commercial space activities regulated by the FAA and FCC. International space law does not require that outer space be used solely for "peaceful purposes" in the sense of non-military; the US interpretation defines "peaceful" as "non-aggressive," permitting significant military activity in interplanetary space while restricting only celestial bodies to exclusively peaceful use (see Appendix B, Grunert, 2021-4; Grunert, 2021; Irish, 2018). The authoritative Max Planck Encyclopedia of Public International Law confirms this reading of Outer Space Treaty Article IV(2): military bases, installations, fortifications, weapons testing, and military maneuvers are expressly forbidden on celestial bodies, while the use of military personnel for scientific research or other peaceful purposes is not prohibited (Pobjie, 2024; see Appendix B). This distinction is precisely why the "non-military" limitation in the resolution is analytically important: it carves out a space for debate about civilian investment that existing international law does not.

A graduate-thesis treatment of the term sharpens the boundary the resolution draws: it separates *military uses* of space (passive or defensive, such as satellites that verify arms-control compliance) from *militarisation* (using space assets to enhance offensive operations) and *weaponization* (placing weapons in orbit), and reads "peaceful purposes" in Article IV(2) OST as "non-military" in the broad sense, by analogy to the Antarctic Treaty (Edlund Otterstedt, 2020; see Appendix B).

Civil

The Space Foundation defines the civil sector as "[n]on-defense-related government space activities, including launching and managing satellites, conducting research, and exploring the solar system," noting that "in the United States, nearly all civil space missions are managed or run by NASA and NOAA" (Space Foundation, 2023; see Appendix B). This tracks the statutory division in the National Aeronautics and Space Act, which assigns non-military space activity to "a civilian agency" while reserving activities "peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States" to the Department of Defense (51 U.S.C. § 20102(b); see Appendix B). The civilian sector is technically broader, since science and applications work also occurs at agencies such as USGS, NSF, and the FAA, though NASA and NOAA account for the overwhelming majority of U.S. civil space activity. This makes "civil" (Resolution 4) a narrower term than "non-military" (Resolution 3): the civil sector maps to the NASA/NOAA core, while "non-military" also encompasses commercially provided and FAA/FCC-regulated activity.

Investment

The Congressional Research Service's appropriations tracker documents what federal investment in NASA concretely consists of: annual appropriations across the agency's accounts, spanning exploration, space operations, science, aeronautics, space technology, STEM engagement, and the supporting safety and construction accounts, authorized most recently through the NASA Authorization Act of 2022 (CRS, R43419; see Appendix B).

The Congressional Budget Office's capital budgeting framework defines capital as "an investment in goods or services that provide benefits over a period of time after their acquisition," and under OMB's definition roughly 40 percent of discretionary spending is categorized as investment, mainly infrastructure, military equipment, and research and development (CBO, 2008; see Appendix B). CBO cites the US space exploration program, "culminating in the landing on the moon," among the historical episodes of rapidly expanding public investment. This definition matters for topicality: it suggests "investment" requires durable programmatic commitments (missions, infrastructure, technology development) rather than one-time operational expenditures, providing a limiting function against trivially small affirmatives.

Substantially

"Substantially" is defined here in the context of the topic rather than through generic dictionary definitions. The most useful contextual benchmark is NASA's share of federal spending over time: NASA's budget peaked at approximately 4.4% of the federal budget during Apollo (1966); since the 1970s it has averaged 0.71% of annual US government spending, and since the 2010s it has ranged between 0.4% and 0.3% (Dreier, 2026). Against that baseline, the FY2026 President's Budget Request, a 24% topline reduction and 47% science cut, was universally characterized as the largest proposed change in the agency's history (Planetary Society, 2026a), giving debaters a contextual sense of what magnitude of change the space policy community treats as transformational. The Wording Committee should note that no CRS or GAO document was located that assigns a fixed percentage threshold to "substantial" NASA budget changes; debaters will contest the term through contextual evidence, which is the norm on every topic using this word.

Application of NFHS Criteria for Debate Resolutions

Timeliness and Durability

Space exploration has become increasingly relevant due to factors unlikely to change before 2027-28.

First, this topic should have its moment in 2027-28 because of the momentum around space exploration generated by Artemis. The April 2026 Artemis II launch captured the nation's attention and imagination: an estimated 18.1 million US viewers watched the launch live across broadcast and cable networks (Nielsen, via TheWrap, 2026), and more than 27 million watched the splashdown (Hollywood Reporter, 2026). The Planetary Society characterizes the audience as comparable to Game 7 of the World Series and nearly as large as the 2026 State of the Union address (Planetary Society, 2026b). Artemis IV targets the first crewed lunar landing in early 2028, during the debate season itself, and China holds firm to its 2030 crewed landing deadline (Xinhua, 2025a). The national attention, the in-season landing, and the culminating US-China race make 2027-28 a uniquely opportune window to convert public fascination into rigorous student research. The coming seasons are among the most timely windows this topic will ever have, and 2027-28 aligns the debate calendar with the program's decisive milestones especially closely.

Second, NASA's budget will remain contested. The executive-legislative conflict over civilian space priorities will persist regardless of which party controls Congress.

Third, the global space economy continues to accelerate toward $1.8 trillion by 2035 (WEF, 2024). The ISS will operate through 2030, with controlled deorbit targeting early 2031. NASA awarded SpaceX an $843 million contract for the US Deorbit Vehicle (NASA, 2024a). Commercial replacements are in development.

Fourth, debris and sustainability concerns are growing. ESA's Zero Debris Charter, signed by over 100 organizations and more than 20 national governments, commits signatories to debris-neutral operations by 2030 (ESA, n.d.; ESA, 2024). Active debris removal missions will fly during the debate season.

Fifth, the topic is substantive enough for sustained debate across the full season, and the Forward Outlook section documents a continuous schedule of federal space milestones that will keep the literature base regenerating throughout the year, including NEO Surveyor's launch, Artemis IV, Tianwen-3, and the FY2028 budget cycle.

Accessibility and Material

An extraordinary depth of freely accessible, high-quality material exists at every level of the activity. Major think tanks publish continuously on space policy, nearly all of it open-access: CSIS and its Aerospace Security Project, the Secure World Foundation, the Mitchell Institute, the Atlantic Council, Brookings, the Council on Foreign Relations, RAND, the Belfer Center, and the Aerospace Corporation's Center for Space Policy and Strategy. Primary government sources are equally abundant: NASA publishes technical reports through its Technical Reports Server, Inspector General audits, economic impact studies, and Office of Technology, Policy, and Strategy analyses; the Congressional Research Service issues regular reports on NASA appropriations, space resources, and space traffic management; GAO and CBO publish relevant analyses; the Space Force releases its doctrine publicly; and the US-China Economic and Security Review Commission's annual report devotes a full chapter to space. The topic's canonical solvency advocates, the National Academies' decadal surveys, are free to read online through the National Academies Press. The Planetary Society, ESA's Space Environment Report, and UNOOSA supply authoritative data, and dedicated journalism from SpaceNews, Space.com, Breaking Defense, and DefenseScoop tracks developments daily. Much of the topic's peer-reviewed core is open access as well, including the definitional evidence of Fehrler et al., the launch-emissions modeling of Revell et al., and the critical literature anchored by Shammas and Holen.

This depth matters at both ends of the competitive spectrum. Novices enter the topic through concepts they already find intuitive and exciting, rockets, the Moon, asteroids, and the race with China, and every entry in the Novice Packet Guidance below is anchored to a named, freely available solvency advocate. Advanced debaters can mine an unusually deep literature base spanning the decadal surveys, appropriations law, orbital-debris modeling, counterspace doctrine, and a deep vein of critical-theory scholarship in university-press monographs and peer-reviewed work. Because the core evidence is government-produced, think-tank-published, or open-access peer review rather than paywalled academic work, even the smallest and least-resourced programs can build and continually update competitive files.

Student Interest and Engagement

The topic meets students where their curiosity already lives. Space connects science, technology, geopolitics, philosophy, and environmental ethics, and these students will debate it during the first Moon race of their lifetimes. National circuit debaters find robust link-level debates accessing great power competition, economic growth, and existential threat, and the topic's international dimension is live and researchable: India signed the Artemis Accords in 2023 and is developing the Gaganyaan crewed spacecraft targeting 2027 (Dinner, 2025).

The topic also opens novel critical ground. Settler colonialism, capitalism, feminist IR, and critical security studies all have deep, space-specific literatures, each developed with qualified advocates in the Negative Strategies section.

On December 20, 2019, then-President Trump signed the NDAA for FY2020 and remarked: "…our country has rejected a future of American decline and embraced our destiny of American dominance." He described space as "the world's newest warfighting domain" and the Space Force as ensuring "American superiority in space is absolutely vital" (Trump, 2019). This rhetoric provides rich material for critical arguments about manifest destiny, exceptionalism, and colonial logics.

Lay debates benefit from deep, specific clash: every affirmative faces at least two germane disadvantages, a spending or opportunity-cost disadvantage and an environmental-harm disadvantage.

Educational Quality

Students engage with cutting-edge science and technology, international relations through US-China competition, legal questions about resource rights and sovereignty, and ethical questions about colonialism and environmental stewardship. Indigenous perspectives, disability inclusion (AstroAccess), environmental justice, and longtermism all provide rigorous research avenues.

Learning about space is essential preparation for future leaders, for three reasons. First, space is a primary engine of American technological advancement and economic growth: NASA's FY2023 economic impact study documents $75.6 billion in economic output, more than 300,000 jobs sustained nationwide, and STEM experiences delivered to more than 768,000 students and 53,000 educators, on less than half a percent of the federal budget (NASA, 2024b). Technologies from satellite communications to medical imaging trace to federal space investment, so debating space policy is debating the machinery of American innovation itself. Second, space is the ultimate high ground for power projection: every modern military and economic system, from navigation and communications to intelligence and financial timing, depends on orbital infrastructure, which is why the Space Force's first doctrine declares space a warfighting domain (Hitchens, 2025a) and why the USCC devotes a full chapter to China's space rise (USCC, 2025). Students who understand space policy understand the substrate of twenty-first-century geopolitics. Third, the workforce argument: the American Astronomical Society warns that proposed science cuts would damage research areas "that will not be supported by the private sector" (American Astronomical Society, 2025); the next generation must understand why public investment in space science exists at all. A season of research on this topic is a season of education in technology policy, great power competition, and the economics of public goods.

Balance

Current investment levels are widely regarded as insufficient; the Planetary Society shows NASA is $5-11 billion short of Decadal Survey recommendations (Planetary Society, 2024a). It is far from obvious what should be prioritized. Affirmative plans simultaneously generate strong negative offense:

- Increased NASA funding → spending tradeoffs and privatization counterplans
- Lunar development → China escalation and settler colonialism criticisms
- Expanded orbital activity → debris and environmental harm disadvantages
- International cooperation → sovereignty concerns and process counterplans

This section addresses how core negative positions interact with specific affirmatives. The NASA Budget Tradeoff disadvantage is truly generic: because NASA's appropriation is fixed and flat (NASEM, 2024), every affirmative, from MSR restoration to debris removal, forces an internal reallocation, giving negatives a universal link. The Launches/Environmental disadvantage links to most but not all affirmatives: lunar development, MSR, nuclear propulsion, SBSP, and commercial LEO destinations all require launches beyond the status quo cadence, while a debris removal affirmative presents a closer question: removal missions themselves require launches, so the link exists, but affirmatives will argue net reduction in orbital risk outweighs marginal launch emissions, producing exactly the kind of comparative impact debate that benefits students. The Space Militarization disadvantage links most strongly to lunar infrastructure, cislunar presence, and dual-use technology affirmatives (nuclear propulsion, SBSP) and most weakly to pure science affirmatives (astrophysics flagships), so negatives will calibrate. The settler colonialism criticism links to development and colonization affirmatives directly and to science affirmatives through framing and representations. No affirmative escapes all four core positions, and no negative position is unanswerable.

The international agent counterplan will serve as a central argument on this topic. Affirmatives on this topic can win the "US key" debate with qualified evidence: the Astro2020 Decadal Survey describes flagship astrophysics as "an ambitious scale that only NASA can undertake" and "one where the United States is uniquely situated to lead the world" (NASEM, 2021a); the AAS documents that the relevant science "will not be supported by the private sector" (American Astronomical Society, 2025), and no foreign agency's budget approaches NASA's; and the USCC ties US program execution directly to "U.S. credibility in establishing global norms for lunar and Martian exploration" (USCC, 2025), a warrant no ESA or JAXA counterplan can co-opt, because the norm-setting benefit follows from American leadership specifically. Feasibility warrants reinforce this: the Deep Space Network, super-heavy launch capacity, and radioisotope power systems are predominantly American capabilities. The US-key debate is therefore genuinely contested with strong evidence on both sides.

Novice Packet Guidance

Affirmatives (3)

1. Increase NASA Artemis funding to maintain US leadership over China

2. Fund NEO Surveyor and planetary defense to protect Earth from asteroids (solvency advocate: the Planetary Science Decadal Survey; Appendix B, Abell et al., 2023)

3. Invest in active debris removal to prevent Kessler syndrome (solvency advocates: NASA OTPS cost-benefit analysis and ESA's finding that "active debris removal is required"; Appendix B, ESA, 2025a)

Disadvantages (3)

1. NASA budget tradeoff / Spending: New space investment trades off with other NASA missions and domestic priorities (link evidence: National Academies, NASA at a Crossroads; Appendix B, NASEM, 2024)

2. Launch Environmental damage/Debris: Launch activity depletes ozone and harms biodiversity (uniqueness evidence: Revell et al. 2025; Appendix B)

3. Space Militarization: U.S. space activity risks accelerating militarization through the dual-use perception problem (Appendix B, USCC, 2025). Security dilemmas with China are most likely due to the Wolf Amendment (Appendix B, Young, 2019).

Every novice packet entry is now anchored to evidence in the Appendix, so packet authors can build the files directly from sources in this paper.

Counterplan (2)

Privatization: Commercial companies fund space exploration without additional government subsidy (Appendix B, Hudgins, 1998)

International Agent: Another national or international space organization can increase its space exploration and/or development without U.S. involvement.

Criticism (1)

Settler colonialism: The affirmative's framing of space as a frontier replicates colonial logics (Appendix B, Smiles, 2020)

Conclusion

Space exploration and development sits at the center of the defining policy questions of the coming decade: the strategic competition with China, which targets a crewed lunar landing before 2030; the transformation of spaceflight by commercial launch providers that now compete with the agencies they once supplied; the governance gaps in debris, resource rights, and weaponization that existing international law leaves open; and a budget war that has cancelled the planetary-science community's highest-priority mission even as military space budgets grow to more than double the civilian topline. A resolution on space exploration and development gives high school debaters a year to engage these questions through a stable, well-bounded mechanism that opens onto a deep and genuinely contested literature. The topic is timely without being fragile: its relevance has been sharpened by the April 2026 flight of Artemis II, the cancellation of Mars Sample Return, and the approach of competing American and Chinese lunar landings, yet it does not rise or fall with any single launch or appropriation, and its central question, United States leadership against Chinese ascent, remains genuinely unresolved through the final round of the season. It is accessible to the smallest programs through the decadal surveys, Congressional Research Service and Congressional Budget Office reports, NASA Inspector General audits, and think-tank analyses that are freely available in full, and it is deep enough to reward the most advanced research. It offers balance built into its structure: every affirmative meets the NASA budget tradeoff, a full federal spending disadvantage, debris and militarization ground, a substantial bench of counterplans, and rich critical literature. It also returns students to the physics, history, and STEM stakes of spaceflight, documented at length in Appendix A, more directly than most topic areas can. For these reasons, the author recommends the resolution "*Resolved: The United States federal government should substantially increase its space exploration and/or development beyond the Kármán line.*" The recommendation is made without reservation: it captures the strategic core of the controversy, maintains clean topical limits through the Kármán line boundary, and preserves the flexibility that a full season of debate demands. The contemporary space policy landscape demands the debate community's attention, and the 2027-28 season aligns the calendar with a controversy still being decided in real time, precisely when student engagement is highest.

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Appendix A: Historical and Scientific Foundations

The case for this topic rests on a history deeper than any single debate cycle, and it runs along two tracks. One is the scientific arc, the long project of learning to understand the heavens and then to reach them. The other is the geopolitical history, the harder record of what power has always done with a new frontier. The two are inseparable, because the same rocket has always been able to carry either a telescope or a weapons platform, and the resolution asks the debater to argue the next chapter of each.

The Scientific Arc

A policy on space exploration is a wager on one of the oldest and most cumulative projects in human history: the attempt first to understand the sky and then to reach it. That project has no single inventor and no clean starting line. It runs from myth through the slow, contested, often fatal accumulation of physics and engineering, and it is still running: the same arc that produced the ellipse and the wing now produces the lunar lander and the space telescope. The resolution does not ask debaters to admire this history from a distance; it asks them to argue its next chapter, in a domain governed by the most thoroughly tested laws in science.

The Dream of the Skies

Long before anyone understood how, human beings wanted to fly. The desire appears in the oldest stories of peoples who never met. The historian of religion Mircea Eliade argued that the soul's ascent to the heavens is among the most widespread motifs in the archaic religious imagination: that in the mythical age, many traditions held, the power of flight had once belonged to everyone (Eliade, 1964). Eliade's grander generalizations have drawn legitimate challenge and should be treated cautiously. But the breadth of the evidence is striking, and from the beginning the stories pull in the two directions that would later organize the science itself: the desire to *reach* the sky and the desire to *read* it.

The first direction is the dream of reaching the sky. In Greek myth that dream is told as both triumph and warning, in the tale of Daedalus and Icarus. Imprisoned on Crete, the master-craftsman Daedalus reasons his way past every barrier but one: in Ovid's telling he declares that "Minos rules everything but he does not rule the heavens," and builds wings of feathers and wax for himself and his son, only for Icarus, exhilarated, to climb too near the sun, melt the wax, and fall into the sea that still carries his name (Ovid, *Metamorphoses* VIII). The image of the fashioned wing recurs with startling independence. In Norse legend the smith Wayland, enslaved and hamstrung by a king who coveted his craft, takes a terrible revenge and then escapes on wings of his own making, a flight so close to Daedalus's that scholars have long remarked on the resemblance between two traditions that never met (Larrington, 2014). The Norse imagined flight as borrowed, too, not only built: the goddess Freyja owned a cloak of falcon feathers that lent its wearer the power of flight, which she lends to the trickster Loki to pass between the worlds (Faulkes, 1995). Older than either is the Mesopotamian *Epic of Etana*, in which the childless shepherd-king of Kish rescues a wounded eagle and is carried up on its back toward the heaven of the god Anu, the fields shrinking beneath him, in search of a "plant of birth" that might give him an heir (Dalley, 2000). And in Hindu tradition the sky belongs to Garuda, the colossal eagle who bears the god Vishnu, so commanding an image of flight that two modern nations adopted him as a national emblem, while the Sanskrit epics fill the heavens with vimanas, the flying chariots and palaces of the gods that the great lexicographer Monier-Williams glossed simply as a car or chariot of the heavens (Monier-Williams, 1899).

Other peoples dreamed less of climbing into the sky than of reading it. The Lakota of the North American plains held that the stars were "the holy breath of the Great Spirit," and that the order overhead was mirrored by the land below, so that to follow the sun through the constellations was to receive instruction on where to be and when (Goodman, 1992). Across many North American nations ran a single story, the Star Husband, in which young women sleeping in the open wish themselves married to the stars and wake to find themselves carried into the sky, a tale whose hundreds of recorded versions one folklorist spent much of a career mapping (Thompson, 1953). And on the far side of the world the Aboriginal peoples of Australia performed a striking inversion: where other cultures drew their constellations from points of light, the Kamilaroi and Euahlayi read a great Emu in the *darkness* between the stars, traced in the dust lanes of the Milky Way with its head at the black Coalsack beside the Southern Cross and its body trailing toward Scorpius, and watched its seasonal turning to know when the real emus on the ground would be laying their eggs (Fuller et al., 2014). Farther south, in Mesoamerica, the night sky was read as a calendar with a moral charge: Maya and Aztec skywatchers tracked the 584-day cycle of Venus with great precision and identified the planet with Quetzalcoatl, the feathered serpent, whose legend held that after burning himself on a funeral pyre his heart rose into the sky to become the morning star, so that the planet's first reappearance at dawn was at once an astronomical event and the return of a god (Encyclopedia of Religion, "Quetzalcoatl").

The continuity between the myths and the missions is most visible in the stories of the Moon, and in the names carried back to it. China told of the archer Houyi, who saved the world by shooting nine of its ten suns out of the sky, and of his wife Chang'e, who swallowed his elixir of immortality and rose to live on the Moon with only a jade hare for company; Japan told of Kaguya, the luminous princess discovered inside a stalk of bamboo, who was in the end reclaimed by the Moon she had come from. These are not dead stories. China calls its lunar program Chang'e and its rovers Yutu, "Jade Rabbit", after the goddess and her companion; Japan named its lunar orbiter Kaguya, after the princess who went home to the Moon. The myths did not merely precede the science. They are represented in our contemporary government space projects.

Two errors recur in popular treatments of this history. The first is the insistence that ancient myth secretly records real ancient flight, pressed hardest with the *Vaimānika Shāstra*, a Sanskrit text often paraded as proof that ancient India possessed aircraft. It does nothing of the kind. The text cannot be traced earlier than the twentieth century, and when five engineers at the Indian Institute of Science analyzed the machines it describes, they found designs that violated the laws of motion in places and judged them "poor concoctions rather than expressions of something real" (Mukunda et al., 1974). The second error is subtler: the "ancient astronaut" reading of genuine sky-knowledge, exemplified by the claim that the Dogon people of Mali preserved impossibly precise ancient knowledge of the star Sirius and its tiny, invisible companion, supposedly taught to them by visitors from the sky. When a team of anthropologists led by Walter van Beek restudied the Dogon across many villages and several field seasons, the system simply was not there: most Dogon had never heard that Sirius has any companion at all, astronomy played little part in their religion, and the original account proved to rest on the testimony of a single elder in dialogue with a researcher who already knew what he hoped to find (van Beek et al., 1991). The Ming official Wan Hu, said to have lashed forty-seven rockets to a chair in a bid for the Moon, is a twentieth-century invention of the same family, popularized by an American writer in 1945 and absent from the Chinese records before it (Zim, 1945). The discipline the topic rewards is exactly this: honoring the aspiration without manufacturing the achievement to match it.

The first to treat the dream as an engineering problem rather than a story was Leonardo da Vinci, who around 1490 filled his notebooks with an ornithopter, a helical "aerial screw," and a pyramidal parachute. The designs were serious; Leonardo asked, in effect, how a bird actually holds itself up. But none were built or flown in his lifetime, his notebooks lay unpublished for centuries, and they had no influence on the people who eventually solved flight (Smithsonian National Air and Space Museum, "Leonardo da Vinci and Flight"). Leonardo marks the dream's passage from myth toward method. The method itself still had to be invented, and it was invented along the same two lines the myths had already imagined: learning to read the heavens, and learning to reach them. The first of these is where the real science begins.

Reading the Heavens: The Science of Orbit

The knowledge that made spaceflight possible is surprisingly recent. For nearly all of human history the sky was a thing to be read, not reached: a clock, a calendar, and a map, but never a destination. What changed, in the span of a century and a half, was not the human appetite for distance but the human understanding of motion. Before anyone could leave the Earth, someone had to work out the rules by which the Earth itself moves, and by which everything near it falls. That work is the hidden prerequisite of spaceflight: the concepts it produced are the same ones the resolution asks debaters to reason about.

The story is usually said to begin in 1543, when Nicolaus Copernicus published *De revolutionibus orbium coelestium* and moved the Sun to the center of the cosmos (Copernicus, 1543). However, Copernicus did not give the world a more accurate set of predictions; his system still leaned on the circles and epicycles it had inherited, and it forecast planetary positions no better than the Earth-centered scheme of Ptolemy that it challenged (Gingerich, 2004). Nor was it the forbidden book of legend: *De revolutionibus* circulated freely for decades, carried an unsigned preface by the theologian Andreas Osiander recasting its central claim as a mere calculating "hypothesis," and reached the Catholic Index of prohibited books only in 1616, where it remained, pending minor corrections, until 1835 (Gingerich, 2004). Its power was not precision but reorientation. It proposed that the most obvious fact about the heavens, their daily turning around us, might be an illusion produced by our own motion. Everything that followed was an attempt to take that proposal seriously.

Taking it seriously required better data, and the finest data of the age was gathered by a Danish nobleman who did not himself believe the Earth moved. From his island observatory at Uraniborg, Tycho Brahe spent two decades recording the positions of the planets with a naked-eye precision never before achieved and never surpassed before the telescope (Thoren, 1990). Tycho's own model was a hybrid, with the Sun and Moon circling a stationary Earth and the other planets circling the Sun, a reminder that the road to a correct picture ran through several reasonable wrong ones. But his measurements were of unmatched value, and on his death they passed to his assistant, Johannes Kepler, who spent years trying to force them into circular orbits and finally concluded that the orbits were not circular at all.

Kepler's *Astronomia Nova* of 1609 announced that planets travel in ellipses, with the Sun at one focus, and that a planet sweeps out equal areas in equal times, moving faster when nearer the Sun and slower when farther (Donahue, 1992). The first of these is exact; the second, in the clean form now taught as his "second law," was something Kepler reached by approximation in 1609 and stated rigorously only later, in the *Epitome* of the 1620s, before Newton derived it from deeper principles altogether (Stephenson, 1987). A decade after the *Astronomia Nova*, Kepler added a third regularity relating each planet's orbital period to its distance from the Sun. With these laws the heavens acquired, for the first time, a mathematics, a description not merely of where the planets are but of the rule their motion obeys.

In the same year that Kepler published his ellipses, an instrument turned the argument from inference to sight. In the winter of 1609-10 Galileo Galilei pointed a telescope at the sky and, in the slim, urgent pamphlet *Sidereus Nuncius*, reported what no one had seen: mountains on the Moon, uncountable stars beyond the reach of the eye, and, decisively, four points of light beside Jupiter that shifted night to night and plainly circled the planet rather than the Earth (Van Helden, 1989). Here was direct evidence that the Earth was not the unique center of all motion; at least four bodies orbited something else. The sky had been a ceiling of fixed points. It was now, demonstrably, a space of worlds.

What remained was to explain why any of it moved as it did, and that synthesis arrived in 1687 with Isaac Newton's *Philosophiæ Naturalis Principia Mathematica* (Newton, 1687). Newton's claim was as radical in its unification as Copernicus's had been in its geometry: a single force, gravitation, governs both the fall of an object on Earth and the orbit of a body in the heavens, and the two are the same phenomenon. The famous apple is Newton's own later anecdote rather than a documented event, best treated as the way he chose to dramatize the insight; the insight itself stands on the mathematics. The Moon, Newton showed, is perpetually falling toward the Earth exactly as the apple does, and misses only because it is moving sideways fast enough to keep falling past. It was Newton, too, who drafted the image the next section returns to, a cannon fired ever faster from a mountaintop until its ball circles the world and never lands, for a popular account of his system that saw print only after his death (Newton, 1728). With the *Principia*, orbit ceased to be a mystery to be observed and became a quantity to be calculated. And a quantity that can be calculated is, in principle, a destination that can be reached.

This history is the topic's physical foundation. Every term the resolution turns on inherits directly from this lineage. An "orbit" is Newton's falling-sideways made exact. The Kármán line itself, the boundary the preferred resolution adopts, is a consequence of these same laws: it marks the altitude at which the atmosphere becomes too thin for a wing to generate lift, so that to stay aloft an object must stop flying and start orbiting, traveling fast enough that Newtonian free-fall carries it around the planet rather than down to it (see Appendix B). The orbital regimes where satellites, stations, and debris reside; the velocities a launch must reach; the reason a crowded orbit cannot simply be swept clean; all of these are applications of the mechanics that Copernicus, Kepler, Galileo, and Newton assembled across four generations. A space topic therefore does more than survey current events. It returns students to the physics that made the events possible, and asks them to argue about policy in a domain governed, without appeal, by the oldest laws we know how to write down.

Leaving the Ground

If learning to read the heavens was the work of astronomers, learning to leave the ground was the work of chemists and engineers, and of a long line of people willing to stake their lives on incomplete theories. It began with the easiest way up: floating.

The science beneath a balloon is Archimedes' principle, the ancient rule that a body immersed in a fluid is buoyed upward by a force equal to the weight of the fluid it displaces, applied now to the ocean of air we live at the bottom of: fill a bag with something lighter than the surrounding atmosphere, and it must rise. The eighteenth century, which was discovering for the first time that "air" is not one substance but many, found two ways to do it. The Scottish chemist Joseph Black had identified "fixed air", carbon dioxide, in the 1750s, and in 1766 the reclusive Englishman Henry Cavendish isolated and described "inflammable air," hydrogen, the lightest substance there is, by pouring acid over metal and catching the gas that bubbled off (Cavendish, 1766). Hydrogen was the obvious flying gas, but it was hard to make in quantity, and the first machine to lift a human being used the cruder method: simply heating ordinary air, which expands and grows lighter. In a single astonishing year, 1783, the Montgolfier brothers sent a hot-air balloon carrying a sheep, a duck, and a rooster aloft before the court at Versailles, and that November lifted the first human passengers over Paris; within weeks Jacques Charles had flown a balloon filled with Cavendish's hydrogen. Ballooning was a real conquest of the vertical, and it carried a hard lesson with it. The first balloon fatality came less than two years later, in 1785, when a pioneer of the art was killed attempting to cross the English Channel (Linda Hall Library, 2022). And more fundamentally, a balloon cannot be steered: it goes where the wind goes. To fly, to choose a heading and hold it against the air, would require not floating but lift, and lift proved far harder to understand than anyone had reason to expect.

It is, even now, routinely taught wrong. Working out how a wing holds up a ton of metal occupied serious minds for two centuries. Daniel Bernoulli, in his *Hydrodynamica* of 1738, derived the relationship between the speed of a moving fluid and its pressure that still bears his name; the English baronet George Cayley, often called the father of aerodynamics, was the first to set down, around 1809, the four forces that act on every flying machine (lift, weight, thrust, and drag) and to grasp that they could be balanced by a fixed wing rather than a flapping one. But the popular explanation of *how* a wing makes lift, the one repeated in textbooks to this day, is simply false. It claims that air flowing over the longer, curved top of a wing must travel faster than the air beneath in order to "meet" its partner at the trailing edge, lowering the pressure above by Bernoulli's principle. A peer-reviewed survey in *Physics Education* dismissed this account as one that "introduces misconceptions, uses a nonsensical physical argument and misleadingly invokes Bernoulli's equation" (Babinsky, 2003): there is no law that the parcels of air must meet at the back, and they do not; symmetric wings with equal path lengths, and wings flown upside down, generate perfectly good lift (NASA Glenn Research Center). The honest account is that a wing works by turning a stream of air downward, and, by Newton's third law, the air pushed down pushes the wing up; the pressure differences that accompany that turning are real, but they are consequences of the curving airflow, not a trick performed on molecules racing a clock. Stating the principle was easy. Coaxing a real surface to do it was not, and the cost was paid in lives. The German engineer Otto Lilienthal made roughly two thousand controlled glides through the early 1890s, carefully tabulating the lift his curved wings produced at each angle, and it was his published data, corrected where he had trusted a faulty coefficient inherited from the previous century, that gave the Wright brothers their starting point. A gust stalled Lilienthal's glider and killed him in 1896; "sacrifices must be made," he reportedly said as he died (Smithsonian National Air and Space Museum, "Flight Before the Airplane").

Even a perfect wing is dead weight without thrust, and thrust was the second barrier, not because engines did not exist, but because the engines of the nineteenth century made too little power for their weight. The point was proven by a string of expensive failures. Hiram Maxim built an enormous steam-powered flying machine that briefly lifted off its guide rails and was then abandoned; Clément Ader's bat-winged *Avion* managed only hops; and Samuel Langley, the secretary of the Smithsonian itself, built a handsome machine around a remarkable fifty-two-horsepower engine and twice dropped it into the Potomac, the second time only days before Kitty Hawk (Smithsonian National Air and Space Museum, "Flight Before the Airplane"). Power was necessary but not sufficient; what was needed was power that did not weigh too much. The

Wright brothers' decisive advantage in 1903 was exactly that, a small gasoline engine, built by their mechanic Charlie Taylor from sketches spiked over his workbench, that produced about twelve horsepower while weighing under a hundred and eighty pounds (National Park Service). It was a metallurgical marvel as well. Its crankcase was cast from an aluminum alloy hardened with eight percent copper, and when the Smithsonian and the National Institute of Standards and Technology examined that crankcase nearly a century later, they found it had been strengthened by a fine dispersion of copper that metallurgists would not formally "discover" until 1909, and would not be able to explain with proper alloy theory until 1919, the earliest known precipitation-hardened aluminum alloy, of the very same family still used in rocket boosters today (Gayle and Goodway, 1994). Two bicycle mechanics had, without the theory, cast the first piece of modern aerospace metal. Power-to-weight ratio is the single quantity that governs flight, and nearly the entire history of propulsion that follows is the history of improving it.

The piston engine and propeller carried aviation for forty years, and then ran into a wall built into the propeller itself. The tip of a spinning blade adds its rotational speed to the aircraft's forward speed, so the tips reach the speed of sound long before the aircraft does; once they do, shock waves form across them and the propeller's efficiency collapses. Propeller flight has a ceiling, and it sits well below the speed of sound. The way past it was a wholly different engine, conceived almost simultaneously and entirely independently on opposite sides of the coming war. In Britain, a young Royal Air Force officer named Frank Whittle patented the turbojet in 1930, at the age of twenty-two, and had one running on a test stand by 1937; in Germany, Hans von Ohain designed one whose engine flew first, powering the small Heinkel He 178 on the world's first jet flight in August 1939 (Encyclopædia Britannica, 2026). A jet does not claw at the air with a blade. It swallows a stream of air, squeezes it in a compressor, burns fuel in it, and hurls the hot exhaust out the back, and because it does not depend on whirling a blade faster than the aircraft flies, it keeps working at the speeds where the propeller fails. The jet brought the next barrier within reach: the sound barrier itself, near which aircraft had been shaken apart for years by violent buffeting and a dangerous reversal of their controls. On October 14, 1947, the Bell X-1, a bright orange, bullet-shaped rocket plane dropped in mid-air from the belly of a B-29 bomber high over the California desert, carried the test pilot Chuck Yeager past Mach 1, the first instrumented flight to exceed the speed of sound (van der Linden, 2022). Flying supersonic *efficiently* then meant reshaping the aircraft around the new physics. The swept-back wing, whose theory the German aerodynamicist Adolf Busemann had presented as early as 1935, lowered the sudden rise in drag near the speed of sound; and the "area rule," formalized by the NACA engineer Richard Whitcomb in the early 1950s, showed that pinching a fuselage where the wings joined it, the famous wasp-waist or coke-bottle shape, could cut transonic drag by more than half and let an aircraft fly roughly a quarter faster on the same engine (NASA, "Richard T. Whitcomb"). Each refinement bought more speed from the same thrust.

The line of this progress runs, with surprisingly few breaks, straight off the upper reaches of the atmosphere. Its highest rung was the X-15, a stubby black rocket plane that was also dropped from a bomber and then climbed, on its own rocket, to the edge of space. In the summer of 1963 the test pilot Joseph Walker took it twice above the Kármán line, the hundred-kilometer altitude conventionally taken as the boundary of space, reaching about a hundred and eight kilometers, the first flights of a winged aircraft above that line and, by the international definition, spaceflights; the X-15 would eventually reach nearly seven times the speed of sound (NASA, "X-15 Hypersonic Research Program"). It is exactly where the story of flight and the story of spaceflight meet. The X-15 was an airplane, the lineal descendant of the Wright engine and the swept wing, and it was also a spacecraft, the acknowledged ancestor of the Space Shuttle, flown by pilots (Neil Armstrong among them) who had to learn the new and unforgiving art of guiding a winged machine back down through the boundary between airless space and the thickening atmosphere below. And it marked the end of one kind of flying. Above the Kármán line a wing has almost nothing left to push against; lift, the quantity this whole history had pursued, simply runs out. To climb higher than the X-15 flew, a vehicle can no longer push against the air at all. It must carry its own reaction mass.

Reaching Space

Newton had shown, with his cannonball, that there is no difference in kind between a falling apple and an orbiting Moon: fire a projectile fast enough, horizontally, and its fall curves away just as fast as the Earth's surface drops beneath it, so that it never lands. The numbers he never wrote down are about eight kilometers per second to circle the Earth, and a little over eleven to break free of it altogether, orbital velocity and escape velocity, the two speeds that separate a stone thrown on Earth from a spacecraft. The trouble is that no cannon can reach them. A barrel long enough to accelerate a payload to those speeds gently would have to be hundreds of kilometers long; a barrel short enough to build would deliver the acceleration so abruptly that it would crush whatever it fired. The thing that finally reached orbital velocity did so the only way left: by carrying its own propellant and accelerating gradually, throwing mass backward to drive itself forward, the requirement the top of the atmosphere imposes. It is the rocket, and it has its own governing law: the velocity it can gain is set by the speed of its exhaust and by the fraction of its starting weight that is fuel. Reaching space is, before it is anything else, the problem of carrying a colossal quantity of propellant and throwing it away as quickly as possible.

That law was written by a deaf Russian schoolteacher. Konstantin Tsiolkovsky, working in provincial isolation, published in 1903, the same year as Kitty Hawk, the equation that still bears his name, relating a rocket's change in velocity to its exhaust speed and its mass ratio, and from it drew nearly every conclusion that would organize the century to come: that the energies required would demand liquid propellants, hydrogen and oxygen foremost among them; and that no single rocket could carry enough fuel to reach orbit, so rockets would have to be built in stages that fire and fall away in turn, each lightening the load for the next (Tsiolkovsky, 1903). He could build none of it. His gift was to prove that it was possible and to say why it was a necessary endeavor. "Earth is the cradle of humanity," he wrote, "but one cannot live in a cradle forever" (Dick and Launius, 2006). The hardware would be work of others.

The first of them was an American physicist, Robert Goddard, who turned the equation into metal. In 1919 the Smithsonian published his sober monograph *A Method of Reaching Extreme Altitudes*, which worked out the mathematics of high-altitude rocketry and remarked, almost in passing, that a sufficiently powerful rocket might one day reach the Moon. For that remark he was mocked. A *New York Times* editorial in 1920, headlined "A Severe Strain on Credulity," ridiculed the professor for supposedly failing to understand that a rocket has nothing to push against in the vacuum of space, and sneered that he "seems to lack the knowledge ladled out daily in high schools." The criticism was not merely cruel but wrong: a rocket pushes against its own exhaust, exactly as Newton's third law requires, and needs no air at all. Yet Goddard, a private man, was stung into working in near-secrecy for the rest of his life. On a snowy day in March 1926, on his aunt's farm in Auburn, Massachusetts, he launched the world's first liquid-fueled rocket; it rose forty-one feet in a flight of two and a half seconds and came down in a cabbage field (Neufeld, 2016). The flight "did not even make the local newspapers," and he kept it largely to himself (Neufeld, 2016). In the years that followed, often from the desert near Roswell, New Mexico, on funding that Charles Lindbergh helped him secure, he invented in obscurity nearly the entire architecture of the modern rocket: pumps to feed propellant, gyroscopes and movable vanes to hold a course, regenerative cooling to keep the engine from melting. He did not live to be vindicated. But on July 17, 1969, as Apollo 11 coasted toward the Moon on rockets working perfectly in vacuum, *The New York Times* ran a quiet correction affirming that a rocket can indeed function in a vacuum as well as in air, and added: "The Times regrets the error" (New York Times, 1969).

The road Goddard had opened was widened, and immeasurably darkened, by a weapon. In Germany the army had begun funding rocketry in the early 1930s, and a gifted young engineer, Wernher von Braun, rose to lead the development, at a secret installation at Peenemünde on the Baltic coast, of the world's first true long-range rocket: the A-4, which the Nazi regime renamed the V-2, for *Vergeltungswaffe*, "vengeance weapon." It was an extraordinary technical achievement. On a test flight in June 1944 a V-2 became the first human-made object to cross the boundary of space, reaching about a hundred and seventy-six kilometers' altitude before falling back (Neufeld, 1995); that September the first ones fired in anger struck Paris and London on the same day, and more than three thousand followed against Allied cities. And it cannot be honored cleanly, because it was built by slavery. Its underground assembly plant, the Mittelwerk, was worked by prisoners from the neighboring Mittelbau-Dora concentration camp under conditions designed to consume them: of roughly sixty thousand people sent to the Mittelbau camps, an estimated twenty to twenty-five thousand died, at least ten thousand of them attributable to the V-2 program in particular, while the missile itself killed about five thousand people in the cities it struck. The historian Michael Neufeld has stated the arithmetic plainly: this made the V-2 "a unique weapon: twice as many died producing it… than being hit by it" (Neufeld, 2020). When the war ended, von Braun and his team, along with crates of captured components, were brought to the United States under Operation Paperclip; two decades later that same von Braun directed the design of the rocket that carried Americans to the Moon, and one of his Mittelwerk associates, Arthur Rudolph, managed its production. A rigorous history does not tidy this away: the expertise that reached space first had reached it as a terror weapon built by slave labor.

What that expertise built, given a peaceful purpose and a nearly unlimited budget, was the Saturn V, still the most powerful machine human beings have ever flown. The progression of thrust that produced it spans the whole history just told: from the ounces of Goddard's cabbage-field rocket, to the V-2's thousands of pounds, to the Saturn V's first stage, which clustered five F-1 engines that together produced about seven and a half million pounds of thrust at liftoff. Standing three hundred and sixty-three feet tall, the Saturn V generated more power at the moment of launch than roughly eighty-five Hoover Dams (Bilstein, 1980), and its upper stages burned exactly the liquid hydrogen and oxygen that Tsiolkovsky had specified six decades before. Even building the F-1 was a fight against physics: the 18,616 pound engine suffered from combustion instability, a violent oscillation in the burning propellant that could tear it apart in milliseconds, which the engineers finally subdued by the brute-force method of detonating small bombs inside the running chamber and tuning the injector until it could damp any such disturbance within a tenth of a second (Bilstein, 1980). It worked. Between 1968 and 1972 the Saturn V carried human beings out of Earth orbit and on toward another world.

But a rocket only lifted a payload off the ground. Reaching the Moon and returning required a set of maneuvers no one had ever performed, and they had to be learned, in orbit, at first in the shadow of a rival who led at every early step. The Soviet Union had opened the Space Age by launching Sputnik, the first artificial satellite, in October 1957; it sent the first human being, Yuri Gagarin, into orbit in April 1961, the first woman, Valentina Tereshkova, in 1963, and carried out the first spacewalk, by Alexei Leonov, in 1965 (Siddiqi, 2000). In September 1962, at Rice University, President John F. Kennedy committed the country to reaching the Moon within the decade and cast the effort not as a burden the contest imposed, but as a challenge chosen for its difficulty: "We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard" (Kennedy, 1962). The United States closed the gap with Project Gemini (Hacker and Grimwood, 1977), a series of two-person flights designed expressly to assemble the toolkit a lunar voyage would require: how to endure a week or more in weightlessness; how to leave the craft and work in vacuum; and, hardest of all, how to bring two spacecraft together in orbit and join them. Orbital rendezvous is counterintuitive: to catch a vehicle ahead, a spacecraft drops into a lower, faster orbit and gains speed by falling rather than thrusting directly at its target. Mastering it was the precondition for the whole mission plan. In March 1966, Gemini 8, commanded by Neil Armstrong, achieved the first docking of two vehicles in orbit. The cost of the learning was paid on both sides. In January 1967 a flash fire swept an Apollo 1 capsule during a ground test, killing three astronauts; that April the cosmonaut Vladimir Komarov died when his Soyuz 1 spacecraft's parachute failed on reentry, the first human being to die during a spaceflight; and the giant Soviet N1 Moon rocket failed on all four of its launch attempts. The American program recovered, and at the end of 1968 the crew of Apollo 8 became the first humans to leave Earth orbit and circle another world, returning with a photograph of the Earth rising over the gray lunar horizon. Seven months later, on July 20, 1969, Apollo 11 landed (Brooks, Grimwood, and Swenson, 1979).

And here the Moon program drove a second revolution that is easy to overlook, because it had nothing to do with thrust. Flying to the Moon required real-time computation aboard a moving spacecraft, and the Apollo Guidance Computer, designed at MIT, was among the very first machines ever built around the silicon integrated circuit. The program's appetite for chips was so great that in 1963 Apollo consumed an estimated sixty percent of all the integrated circuits produced in the United States, an early and decisive market that helped pull the entire microchip industry into being (Mindell, 2008). The machine was almost laughably modest by later standards; its programs were literally woven by hand, wire by wire, into "core-rope" memory at a Raytheon plant. Yet its design carried an idea that outlived the program. During the final minutes of the first lunar descent, with the lander dropping toward the surface, the computer began flashing "1202" alarms: a rendezvous radar had been left switched on, and the data it shed was stealing computing cycles the machine needed for the landing, asking it to do more than it had time for. It did not freeze. Because its software had been built around priority scheduling, the principle that a computer, when overwhelmed, should drop its least important tasks and protect its most important ones, it discarded the noncritical work, restarted clean, and kept flying the descent (Mindell, 2008). The engineer who led the team that wrote that software, Margaret Hamilton, had fought to have the work of building it treated as a rigorous discipline, and began calling it by a name that has since swallowed an industry: "software engineering" (Mindell, 2008). Decades later, awarding her the Presidential Medal of Freedom, President Obama put the stakes simply: "Our astronauts didn't have much time. But thankfully, they had Margaret Hamilton" (White House, 2016). The Apollo computer was the first ever to fly a crewed vehicle in real time; its descendants are the fly-by-wire systems in every airliner and the control software of every autonomous machine.

After Apollo, the most profound exploration was carried out with no crew at all, by robotic spacecraft that bore the instruments of *Reading the Heavens* out to the worlds astronomers had only ever been able to look at. The most ambitious of them began as a young researcher's calculation. In the mid-1960s Gary Flandro, working at the Jet Propulsion Laboratory, noticed that the four giant outer planets were drifting into an alignment that recurs only once in about a hundred and seventy-five years, and that a single spacecraft, threaded from one to the next, could borrow a little of each planet's orbital motion to fling itself onward to the following one, a "grand tour" of the outer solar system (Flandro, 1966). The maneuver, the gravity assist, is pure Newton: the spacecraft gains exactly the orbital energy the vast planet imperceptibly loses. The two Voyager probes, launched in 1977 to catch that alignment, returned the first close portraits of Jupiter, Saturn, Uranus, and Neptune, and then sailed on out of the solar system entirely, crossing into interstellar space decades later, still faintly transmitting. The Hubble Space Telescope, launched in 1990 with a flawed mirror, ground with exquisite precision to slightly the wrong shape, and repaired in orbit by spacewalking astronauts in 1993, was eventually aimed at a single dark and apparently empty scrap of sky and held there for days; the patch proved to be strewn with several thousand galaxies, each one an island of billions of stars (Tammi, 2026). And the James Webb Space Telescope, launched in 2021 and stationed a million and a half kilometers from Earth at one of the gravitational balance points that Joseph-Louis Lagrange had identified in 1772, now gathers the faint infrared light of the very first galaxies to form after the beginning of the universe (NASA, "Webb Space Telescope Finds Most Distant Known Galaxy"). Here the long arc closes on itself. The instinct that began in myth and matured into Copernicus's diagram and Newton's equation, the wish to understand the heavens, is the same instinct that built the rocket. Humanity learned to reach space, in the end, in order to see.

The Geopolitical History

The Scientific Arc was the history of a question: how to understand the heavens, and how to reach them. But the sky has never been only an object of wonder. From almost the moment human beings first rose above the ground, others looked up and saw not a frontier of knowledge but a frontier of advantage, the high ground, the oldest military prize, suddenly extended into a third dimension. This is the other history, the one that runs alongside the first: the history of flight, and then of space, as instruments of power. It is a more troubling record, and unlike the Scientific Arc it does not resolve. It ends where the topic begins, in an unfinished argument about whether the realm beyond the atmosphere is a battlefield or a commons.

Command of the Air

Flight was turned to war almost the instant it was achieved, and its first military use was not to strike but to watch. In 1794, only eleven years after the first balloon carried a human aloft, revolutionary France raised the world's first military aircraft unit: the Aerostatic Corps, a company of balloonists. At the Battle of Fleurus that June, a tethered hydrogen balloon hung over the field for much of the day while the corps' commander, Jean-Marie-Joseph Coutelle, watched the Austrian army move and signaled what he saw to the commanders below, the first time in history a battle was fought with eyes in the sky (Smithsonian National Air and Space Museum, "Bataille de Fleurus"). Whether the balloon actually decided Fleurus is doubted; General Jourdan, who commanded the French that day, later downplayed the balloon's impact, writing it off as a minor matter in the outcome (HistoricWings, 2013). But the precedent held: to hold the high ground was to hold the information. Seven decades later, in the American Civil War, Thaddeus Lowe's Union balloon corps spotted artillery and mapped Confederate lines from the same vantage.

And almost as quickly, flight was turned from watching to killing, and its first targets were civilians. In 1849, Austrian forces besieging Venice launched the first air raid in history: roughly two hundred small uncrewed balloons, each carrying a bomb on a time fuse, drifted toward the city. Most missed; a few blew back over the Austrian lines. The military damage was trivial. But a London newspaper recorded "the extreme terror" the bombs produced among the inhabitants (Holman, 2009), and that terror, not the damage, was the objective. It previewed what air power would become. Flight had been turned against the defenseless before it had even been made to carry a person aloft on wings.

The airplane followed an identical path, and faster. The Wright brothers achieved controlled powered flight in December 1903; within six years their company had sold the world's first military airplane to the U.S. Army, in 1909, for thirty thousand dollars (National Air and Space Museum, 2022). And that first warplane was, like the balloon at Fleurus, an observation craft, built to watch. The descent from reconnaissance to bombardment, which had taken decades with balloons, would this time take only the span of a single war.

It arrived first not from airplanes but from airships. Beginning in January 1915, German Zeppelins carried out the first sustained campaign of strategic bombing against a civilian population, raiding the towns of the English coast and, before long, London itself. Over the war the airships flew fifty-one raids and killed five hundred and fifty-seven people (Castle, 2008), a small toll against the millions dying in the trenches, and their material effect on the war was correspondingly slight. Their effect was on the mind. They proved that an enemy could now reach over an army and a navy and a coastline to strike the people behind them directly, and a German airship commander stated the new logic plainly: “Nowadays there is no such animal as a non-combatant; modern warfare is total warfare.” (quoted in Klein, 2014) The distinction between the front and the home, between the soldier and the civilian, had been among the oldest structures of war. Aviation began to dissolve it.

Out of that dissolution came a doctrine. In 1921 the Italian general Giulio Douhet published *The Command of the Air*, the founding text of air power, and its argument was as stark as it was influential: future wars would be decided not by armies in the field but by bombers over cities, breaking a nation’s will through terror from above; command of the air was therefore the first objective of any war and the precondition of victory (Douhet [1921] 2019). Parallel advocates, Billy Mitchell in the United States and Hugh Trenchard at the head of Britain’s new Royal Air Force, pressed the same case for air supremacy. Douhet’s faith that bombing alone would shatter a people’s morale proved badly wrong in the Second World War, where civilian populations endured far more than he had imagined. But his deeper claim, that controlling the air was the precondition of controlling everything below it, proved entirely right.

By the Second World War, command of the air had become the silent precondition of everything else. The clearest testimony comes from Dwight Eisenhower, walking the Normandy beachhead days after the landings with his son, a newly commissioned officer who observed that the massed, exposed Allied vehicles violated every rule of dispersal. Eisenhower’s reply was blunt: “If I didn’t have air supremacy, I wouldn’t be here.” (quoted in Tillman, 2014) The German commanders said the same from the other side; Rommel wrote that against Allied air superiority “there’s simply no answer to it.” (Rommel, 1953) Two years after the war the United States made the lesson permanent, breaking the air arm out of the Army to stand up an independent Air Force in 1947 (National Security Act of 1947), an institutional declaration that command of the air now sat at the center of national power.

The High Ground of Space

The logic of the high ground does not stop at any particular altitude. In October 1957 it reached orbit. When the Soviet Union placed Sputnik in orbit, the shock in the United States was never really about a beeping aluminum sphere; it was about what the sphere implied: that the rocket which had lifted it could carry a warhead to any city on Earth, and that the ultimate high ground was now held, first, by a rival. The machine that made this possible had already revealed its double nature. The German V-2, the first object ever to cross into space, had crossed it as a weapon aimed at London, and after the war its engineers and its mathematics passed into both superpowers' missile programs (Neufeld, 1995). The vehicle of exploration and the vehicle of annihilation were, from the very beginning, the same machine.

Space's first military use, like flight's, was to observe. The U-2 spy plane that overflew the Soviet Union was driven from the sky in 1960, when one was shot down; but by then its replacement was already in orbit. That August a satellite of the secret CORONA program, run jointly by the CIA and the Air Force under the cover name "Discoverer", ejected a capsule of exposed film that was snatched out of the air over the Pacific by a passing aircraft: the first photographs ever returned from space, taken to count Soviet missiles and bombers. (Day, Logsdon, and Latell 1998) Within three years of Sputnik, orbit had become what the balloon at Fleurus had been: the place from which a nation watched its adversary. Space was a reconnaissance theater before it was anything else, and it has remained one ever since.

But the temptation of any high ground is to fortify it, and both superpowers reached early for weapons that could fight in orbit itself. The first anti-satellite systems were nuclear, an American program in the Pacific mounted megaton warheads on missiles meant to destroy satellites by detonating near them, a design abandoned in 1975 once it was understood that a nuclear blast in space would blind friend and foe alike. The Soviets built something subtler: an interceptor that would slip into orbit alongside its target and detonate a cloud of shrapnel, tested successfully against one of their own satellites in 1968 (Grego, 2012). The era of orbital weapons had begun.

Its modern form is the kinetic kill, no warhead at all, just a projectile steered into its target at a closing speed of miles per second, destroying it with the sheer energy of the impact. The United States demonstrated one in 1985, an air-launched missile that shattered an aging American science satellite and left two hundred and eighty-five trackable fragments in orbit (Grego, 2012; Porras, 2018; Talent, 2007). But the full consequence of the technique was not grasped until 2007, when China destroyed one of its own defunct weather satellites in a high orbit and created the worst debris event in the history of spaceflight: more than three thousand trackable fragments and an estimated thirty-five thousand pieces larger than a centimeter; of the tracked fragments, more than three-quarters will still be circling the Earth a century from now, by the analysts' projection (Kelso, 2007). India destroyed a satellite in 2019, choosing a low orbit so most of the debris would fall back quickly; its claim that the test left nothing lasting was an overstatement, as some fragments lingered well beyond the few weeks India had promised (Tellis, 2019). And in 2021 Russia destroyed one of its own satellites, scattering some fifteen hundred trackable pieces and forcing the crew of the International Space Station, two of them Russian cosmonauts endangered by their own government's test, to shelter in their escape craft as the debris swept past. NASA's administrator said he was "outraged" by it (NASA, 2021). Each of these tests added, permanently, to a problem that has acquired its own name.

In 1978 two NASA scientists, Donald Kessler and Burton Cour-Palais, had worked out the mathematics of that problem and published a warning. As the number of objects in orbit rises, they showed, so does the chance that two will collide; and each collision produces fragments, each of which can cause further collisions, so that beyond a certain density the process feeds on itself, “an exponential increase in the number of objects with time.” (Kessler and Cour-Palais 1978) The cascade, once started, would need no further human help to continue, and could render the most valuable orbits unusable for generations. It is now called the Kessler syndrome, and it is the reason the debris from a single ASAT test is not litter but a danger to all space activity, peaceful and military alike, the one domain where weaponizing the high ground risks destroying the high ground for everyone.

Not every militarization was realized. In 1983 President Reagan called on American scientists to build a shield of space-based weapons that could intercept Soviet missiles in flight and render nuclear arms “impotent and obsolete.” (Reagan, 1983) The Strategic Defense Initiative, “Star Wars” in a senator’s mocking label that stuck, became a vast research program, but its constellation of orbital interceptors was never built; the vision outran the technology, and Reagan himself conceded the goal might not be reached within the century. It remains the great unbuilt vision of the militarization of space, an idea of orbit as a battlefield that was funded, imagined, and finally set aside.

What was not set aside was the premise. In 2019 the United States established a Space Force, its first new military branch since the Air Force of 1947, on the explicit declaration that “space is the world’s newest war-fighting domain” (Cohen, 2019), a conscious return to the doctrine of the high ground, stretched now to its ultimate altitude. The move was made in part against a rising rival: China, which flew its first astronaut in 2003, built a permanently crewed station, returned the first samples ever taken from the far side of the Moon, and has declared its intention to land humans there by 2030 (RAND Corporation, 2025). Whether this amounts to a genuine “second space race,” and whether the United States is in truth ahead or behind in it, are honestly debated; China’s timeline has held steady while America’s has slipped, yet America’s lead on most measures remains wide. What is not in doubt is that the oldest logic of military tactics, that whoever commands the high ground commands what lies beneath it, has been carried intact to the edge of space, and that the great powers are once again contesting an altitude.

The Law of Peaceful Space

Yet that is not the only thing the nations of the Earth have done with a hostile frontier. Before space there were other realms as lethal and as empty, places that belonged to no one and could kill anyone, and humanity’s record in them is not only one of rivalry. It includes, at least once, a different choice.

Human beings had reached those frontiers in the very decades they were learning to fly. The poles fell first: Amundsen’s party stood at the South Pole in December 1911, and Scott’s reached it a month later and died on the way back; three years on, Shackleton’s ship *Endurance* was crushed in the Antarctic pack ice, and his crew survived by an open-boat voyage that remains the great epic of polar endurance (Lansing, 1959). The deep ocean came next, the “inner space” as alien and hostile as the outer kind. It was first surveyed by the four-year voyage of HMS

Challenger in the 1870s and reached at its deepest point in 1960, when two men rode a steel bathyscaphe seven miles down to the floor of the Mariana Trench (Piccard and Dietz, 1961), in the same year the first spy satellites went up and a year before the first human reached orbit. These frontiers were uninhabitable commons, reached for science and for national prestige, exactly as space would be.

The United States gave its space shuttles the names of ships that had gone out to earlier frontiers. Five were named for such vessels: *Columbia*, for the ship in which Robert Gray completed the first American circumnavigation of the globe in 1790; *Endeavour*, in the older British spelling, for the bark in which James Cook sailed to Tahiti to observe the 1769 transit of Venus; *Challenger*, for the British corvette whose 1872 to 1876 voyage founded the science of the deep ocean; *Discovery*, a name carried first by one of Cook's ships and later by the vessel that bore Scott and Shackleton toward the Antarctic; and *Atlantis*, for the research ketch that sounded the oceans from 1930 to 1966. Only *Enterprise* broke the pattern, named after a write-in campaign for the starship of a television series, though that name too had descended from a long line of seafaring vessels (NASA, "The Space Shuttle").

In one of those frontiers, the nations chose to keep it a commons. Out of the International Geophysical Year of 1957-58, the same surge of scientific cooperation that produced the first satellites, twelve nations that had built research bases across Antarctica signed, in 1959, the Antarctic Treaty. Its first article is among the most remarkable sentences in the history of international law: "Antarctica shall be used for peaceful purposes only." (Antarctic Treaty, 1959) Military bases, maneuvers, and weapons tests were forbidden; the competing territorial claims of the signatories were frozen in place, neither recognized nor renounced; an entire continent was set aside, by agreement, for science and for peace.

That precedent was deliberately carried upward. When the spacefaring powers wrote the Outer Space Treaty of 1967, still the foundational law of space, they built it on the Antarctic model. Space, the treaty declares, is "the province of all mankind"; it is "not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means"; and the Moon and other bodies are to be used "exclusively for peaceful purposes." (Outer Space Treaty, 1967) No nation may own the sky; no nation may land on the Moon and call the ground beneath it sovereign. The high ground, in law, belongs to everyone.

But the law is incomplete, and the incompleteness is exactly where the present argument lives. The Outer Space Treaty forbids weapons of mass destruction in orbit, yet it says nothing about conventional ones, which is why the ASAT tests of 2007 and 2021 broke no treaty even as they endangered everyone. A 2022 resolution at the United Nations, backed by more than 150 nations, called for a halt to destructive ASAT testing (United Nations General Assembly, 2022), but it binds no one, and several of the states most capable of waging war in space were among those who refused it. And the treaty's promise that no one may appropriate space is now contested by the very thing that "development" most concretely means: the United States and Luxembourg have passed laws granting their companies the right to own what they extract from asteroids and the Moon (Commercial Space Launch Competitiveness Act of 2015; Luxembourg Law of 20 July 2017), which critics call appropriation by another name, just as, on Earth, the ban on mining that protects Antarctica, though indefinite, is itself open to review beginning in 2048 (Madrid Protocol, 1991).

This is the unresolved seam the topic sits inside. Space is, at one and the same time, "the world's newest war-fighting domain" and "the province of all mankind", the ultimate high ground and a commons reserved for peace, and the line between those two descriptions, between the military and the civil, is not a fact waiting to be discovered but a choice still being made. The resolution before us asks the United States to invest in space exploration and development beyond the Kármán line that marks the edge of the sky, and it leaves open the central question this history poses: whether that realm is held as a battlefield or as a commons. The history of how flight became power, and of how humanity has at least once chosen instead to hold a hostile frontier in common, is the ground on which that choice will be argued.

Appendix B: Selected Evidence

The following selections provide key solvency advocates, definitional evidence, and link arguments referenced in the paper. The entries are grouped by function: Topicality and Definitions; Affirmative Case Evidence (solvency advocates and supporting science); and Negative Evidence, subdivided into Disadvantages, Counterplans, and Criticisms.

Topicality and Definitions

Space Exploration Defined Broadly: Crewed and Uncrewed Investigation Beyond Earth's Atmosphere

Logsdon '26 - *John M. Logsdon, Professor Emeritus of Political Science and International Affairs, George Washington University, founder of GWU's Space Policy Institute and former member of the NASA Advisory Council, "Space Exploration," Encyclopædia Britannica, last updated June 12, 2026, https://www.britannica.com/science/space-exploration //TKV*

> 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 so gained to increase knowledge of the cosmos and benefit humanity.
>
> Achieving spaceflight enabled humans to begin to explore the solar system and the rest of the universe, to understand the many objects and phenomena that are better observed from a space perspective, and to use for human benefit the resources and attributes of the space environment. All of these activities—discovery, scientific understanding, and the application of that understanding to serve human purposes—are elements of space exploration.

Exploration Defined as Expansion of the Realm of Human Experience; Primary Objectives of Human Spaceflight Require Physical Presence

Mindell et al. '09 - *David A. Mindell, Scott A. Uebelhart, Asif A. Siddiqi, and Slava Gerovitch, "The Future of Human Spaceflight: Objectives and Policy Implications in a Global Context," MIT Space, Policy, and Society Research Group, published by the American Academy of Arts and Sciences, 2009, pp. 11 and 13 //TKV*

> We define primary objectives of human spaceflight as those that can be accomplished only through the physical presence of human beings, have benefits that exceed the opportunity costs, and are worthy of significant risk to human life. These include exploration, national pride, and international prestige and leadership. Human spaceflight achieves its goals and appeals to the broadest number of people when it represents an expansion of human experience.
>
> What, then, is exploration? Exploration is a human activity, undertaken by certain cultures at certain times for particular reasons; it has components of national interest, scientific research, and technical innovation but is defined exclusively by none of them. We define exploration as an expansion of the realm of human experience—that is, bringing people into new places, situations, and environments, and expanding and redefining what it means to be human.

The Kármán Line: FAI's 100 km Boundary of Space, and the Live 80 km Debate

FAI '18 - *Fédération Aéronautique Internationale (The World Air Sports Federation), "Statement about the Karman Line," November 30, 2018, https://www.fai.org/news/statement-about-karman-line //TKV*

The Karman line is the 100km altitude used by FAI and many other organisations to mark the "boundary" of space. In the last few years there have been many scientific and technical discussions around this demarcation line for the "edge of space" and variance around this as a boundary condition for recognition of "astronaut" status.

Recently published analyses present a compelling scientific case for reduction in this altitude from 100km to 80km. These analyses combine data/modelling from a number of differing perspectives (latitudinal variations during solar cycles, theoretical lift coefficients for different size/configuration satellites ranging from cubesats to the International Space Station, perigee/apogee elliptical analysis of actual satellite orbital lifetimes etc) to a level that has never been done before in relation to this issue. They also provide an accurate overview of some of the historical arguments and inadvertent misrepresentations of Karman's actual analyses and conclusions from over half a century ago.

The 2020 National Space Policy: US Space Activity in Three Sectors (Commercial, Civil, National Security)

National Space Policy '20 - *Memorandum of December 9, 2020, "The National Space Policy," Federal Register 85 FR 81755 (December 16, 2020), Section 5 (Sector Guidelines), https://www.federalregister.gov/documents/2020/12/16/2020-27892/the-national-space-policy //TKV*

The United States conducts space activities in three distinct but interdependent sectors: commercial, civil, and national security. Consistent with all applicable legal obligations agencies shall comply with the following guidance.

The term "commercial," for the purposes of this policy, refers to goods, services, or activities provided by private sector enterprises that bear a reasonable portion of the investment risk and responsibility for the activity, operate in accordance with typical market-based incentives for controlling cost and optimizing return on investment, and have the legal capacity to offer those goods or services to existing or potential non-governmental customers.

The Civil Space Sector Defined: Non-Defense Government Space Activity, Centered on NASA and NOAA

Space Foundation '23 - *Space Foundation Editorial Team, "Space Sectors," Space Foundation, January 30, 2023, https://www.spacefoundation.org/space_brief/space-sectors/ //TKV*

Non-defense-related government space activities, including launching and managing satellites, conducting research, and exploring the solar system. In the United States, nearly all civil space missions are managed or run by NASA and NOAA.

Federal Investment in NASA: The Appropriations and Authorization Structure Congress Controls

CRS '26 - *Congressional Research Service, "NASA Appropriations and Authorizations: At a Glance," CRS Report R43419, updated February 27, 2026, https://www.congress.gov/crs_external_products/R/PDF/R43419/R43419.123.pdf //TKV*

As Congress considers future appropriations for NASA, options include increasing, decreasing, or maintaining the agency's current budget as a whole or for specific accounts or subaccounts. As Congress deliberates, it may weigh the appropriations provided by the FY2025 reconciliation act (P.L. 119-21), as some of this funding will be included in the budget authority for future fiscal years. Congressional options for NASA authorization bills include providing additional direction and guidance for the agency as a whole and for specific accounts, subaccounts, or programs beyond that typically included in appropriations laws and accompanying explanatory statements (which often include some direction but less than authorizations).

Note that the NASA Authorization Act of 2022 (P.L. 117-167, Title VII), which is the most recently enacted authorization, did not provide authorizations of appropriations beyond FY2023.

Investment Defined: Capital Provides Benefits Over Time; Space Exploration as the Exemplar of Expanding Public Investment

CBO '08 - *Congressional Budget Office, "Capital Budgeting," May 2008, https://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/91xx/doc9167/maintext.3.1.shtml //TKV*

In general, capital refers to an investment in goods or services that provide benefits over a period of time after their acquisition. However, a substantial portion of governmental spending could be viewed as providing a stream of benefits over an extended period, beyond those activities typically associated with the term "capital."

Whatever the budgetary impediments to capital spending are—real or perceived—the historical record shows that there have been episodes of rapidly expanding public investment: the development of the interstate highway system; the U.S. space exploration program, culminating in the landing on the moon; spending on water systems after the passage of the Clean Water Act; the large defense buildup in the 1980s; and, more recently, spending on aviation, mass transit, and rail.

Space Exploration Defined as Non-Military, Distinct from Space Applications

Fehrler et al. '25 - *Sebastian Fehrler, Lars Hornuf, and Daniel Vrankar, "What do citizens expect from space?" Acta Astronautica 235 (October 2025): 660-669, https://doi.org/10.1016/j.actaastro.2025.05.056, open access (CC license), p. 661 //TKV*

Past surveys have also repeatedly emphasized that human exploration of space must be distinguished from other forms of space exploration. We define space exploration as scientific activities mainly aimed at exploring the solar system and universe, without direct economic or military goals. Therefore, space exploration is the opposite of space applications, which generate direct economic benefits. In line with Grimard, we further divide space exploration into human and robotic space exploration because, in addition to the arguments for and against space exploration in general, specific considerations arise in the context of human missions.

OST Prohibits Military Use of Outer Space - With Exceptions

Hassanabadi '18 *- Babak Shakouri Hassanabadi (LL.M, international law), "Space Force and international space law," The Space Review, July 30, 2018, https://www.thespacereview.com/article/3543/1; the single-quoted passage is the article's quotation of Outer Space Treaty Article IV //TKV*

The Outer Space Treaty is very explicit on the meaning of military use of outer space at the time of ratification and, thus, any legal inference ought to be hinged on narrow textual interpretation of the words within the text of the treaty. Article IV of the treaty reads: 'States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.' Hence, following activities are not allowed in Outer Space by signatory states of the Outer Space Treaty: (1) Placement of nuclear weapons; (2) Placement of any weapon of mass destruction; (3) Installation of weapons on celestial bodies; (4) Stationing weapons in outer space; (5) Establishment of military bases, fortification or other installations; (6) Testing weapons in outer space; (7) Conducting military maneuvers on celestial bodies.

Of these, so long as any country has adopted or ratified Outer Space Treaty, commission of any of the banned activities specified in Article IV of the Treaty entails serious violations of international law, but with unforeseeable political or diplomatic consequences.

Furthermore, if a hypothetical country that has not adopted the treaty or, later on, has chosen to withdraw from it, commits any of the abovementioned military activities, the matter could be brought to the attention of the Security Council of the United Nations by any other country on the ground of violating undertakings enumerated in the Charter of the United Nations, namely prohibition of endangering international peace and stability through imminent capability for use of military force in resolving diplomatic or economic disputes in outer space. The matter, based on its severity, could be reviewed under chapter VII of the charter by the Security Council. It allows the Council to determine the existence of any threat to the peace, breach of the peace, or act of aggression and to take military or nonmilitary action to restore international peace and security. No spacefaring country desires such a confrontational approach towards the international community and no military or nonmilitary interest justifies challenging the existing international space law by triggering another Star Wars scenario of the Cold War era.

“Peaceful” Means Non-Aggressive, Not Non-Military

Grunert '21 - *Maj. Jeremy Grunert, “The ‘Peaceful Use’ of Outer Space?” War on the Rocks, June 22, 2021, https://warontherocks.com/2021/06/outer-space-the-peaceful-use-of-a-warfighting-domain/ //TKV*

Nearly 65 years after Lodge’s proposal, the idea that the United States would seek to voluntarily limit itself to “exclusively peaceful” uses of outer space seems completely far-fetched. America has employed space-based force-support technologies since before the first Gulf War, recognized outer space as a “warfighting domain,” and, in 2019, created the Space Force, a new military branch specifically devoted to outer space military and support operations. And yet, questions and tensions concerning the use of space for peaceful purposes persist. “Peaceful” use of outer space is frequently cited at the international level as a goal, if not an unwritten requirement, of space activities. Such language is also widely employed in U.S. space policy documents, including presidential national space policies. Even the Space Force’s June 2020 doctrine document states that “[i]n keeping with international law, the United States acknowledges that the use of space is for peaceful purposes.”

But is there truly a requirement under international law that space be used solely for peaceful purposes? If so, to what extent does this requirement, or the American interpretation of this requirement, limit military operations in outer space? The answers to these questions may be surprising. There is no generalized international legal requirement that outer space be used solely for peaceful purposes, although there are explicit prohibitions on certain weapons and military activities in particular areas of space. Celestial bodies such as the moon, for instance, are subject to exclusively peaceful use requirements under existing international law. These restrictions, however, do not apply to interplanetary space — the areas between celestial bodies, including Earth orbit, cislunar space and cislunar orbit, and farther areas of deep space. Ultimately, existing international space law provides significant leeway for both the United States and its potential adversaries to engage in military space activities.

The first internationally binding legal instrument to focus exclusively on outer space legal issues, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (better known as the “Outer Space Treaty”), entered into force in October 1967. This was almost exactly a decade after the Sputnik launch and the Eisenhower administration’s initial proposals concerning internationally monitored, exclusively peaceful uses of space. Between 1957 and 1967, the concept of what it meant to use outer space for peaceful purposes had undergone a seismic shift, particularly in the eyes of the U.S. government. While Lodge’s 1957 proposal appears to have been completely in earnest (other U.S. government officials publicly asserted similar policy goals at the time), the Eisenhower Administration quickly recognized that advocating “exclusively” peaceful uses of outer space could significantly limit America’s ability to harness space for critical national security purposes. Chief among these was the development and use of reconnaissance satellites, which would provide the United States with valuable intelligence on Soviet activities.

OST Allows Conventional Military - Space Force Can Operate in Interplanetary Space

Irish '18 - *Adam Irish, Assistant Professor of Political Science, California State University, Chico, "The Legality of a U.S. Space Force," Opinio Juris, September 13, 2018, https://opiniojuris.org/2018/09/13/the-legality-of-a-u-s-space-force/; the embedded single-quoted passage is the article's block quotation of Outer Space Treaty Article IV, paragraph 2 //TKV*

As noted in prior writing on space law (Lee (2003); Bourbonniere and Lee (2007)), Article IV of the Outer Space Treaty specifies that "nuclear weapons or any other kinds of weapons of mass destruction" shall not be placed in orbit, installed in space, or constructed on celestial bodies. Thus, as written, the treaty does not prohibit conventional weaponry (e.g. missiles) from being placed aboard satellites (or in outer space) or states using those weapons in self-defense. However, any non-defensive use of such weaponry is also likely to violate international laws of armed conflict. And any debris generated would likely to trigger liability under both Articles VI and VII of the Outer Space Treaty as well as the 1972 Space Liability Convention should it cause or otherwise create the risk of damage to the property of other states.

The Trump administration's Space Force proposal is a riskier proposal though. Paragraph two of Article IV of the Outer Space Treaty, reads: 'The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon or other celestial bodies shall also not be prohibited.' (Art. 4, Para. 2).

Subject to an ongoing interpretative dispute between the US and other states, "peaceful purposes" does not rule out military craft or personnel acting peacefully in outer space; scientific research by military personnel is even singled out for protection. Rather, the wording of Article IV makes specific reference to "the Moon and celestial bodies" and effectively demilitarizes those bodies from the building of bases and fortifications, testing of weapons, or conducting of military maneuvers. Thus, any of the future military infrastructure built on these bodes would be in violation of existing law. As written the treaty only leaves open the question of a space-based military. A US Space Force confined by these prohibitions would be limited to operation in the space between celestial bodies, presumably in orbit aboard space stations or on ships located at Lagrange points in space, i.e. locations with unobstructed exposure to the sun for a near constant supply of solar power.

OST Article IV(2) - Celestial Bodies Exclusively Peaceful; Military Personnel for Science Permitted

Pobjie '24 - *Erin Pobjie, Assistant Professor of International Law at Essex Law School and Senior Research Affiliate at the Max Planck Institute for Comparative Public Law and International Law, "Outer Space, Military Uses of," Max Planck Encyclopedia of Public International Law, Oxford Public International Law, January 2024, https://opil.ouplaw.com/display/10.1093/law-epil/9780199231690/law-9780199231690-e2267, paragraphs 12-13; the single-quoted passages are the text of Article IV(2) of the Outer Space Treaty //TKV*

Article IV (2) states that the Moon and other celestial bodies shall be used 'exclusively for peaceful purposes'. Expressly forbidden under this article are '[t]he establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies', whereas '[t]he use of military personnel for scientific research or for any other peaceful purposes' is not prohibited.

There is a clear distinction between Art. IV (1) and (2) OST in terms of zone of applicability and prohibited activities in that zone. Whereas Art. IV (1) refers to the entirety of outer space, Art. IV (2) only applies to 'the Moon and other celestial bodies' and not to 'outer void space' (the expanses between celestial bodies). The travaux préparatoires indicate that this omission was intentional.

“Military Uses,” “Militarisation,” and “Weaponization” Distinguished; “Peaceful Purposes” as “Non-Military”

Edlund Otterstedt '20 - *Anna Edlund Otterstedt, “Peaceful Purposes in International Space Law,” JURM02 Graduate Thesis, Faculty of Law, Lund University, Autumn 2020, §3.3.1 (“Military Uses or Militarisation”), pp. 26-27, https://lup.lub.lu.se/student-papers/search/publication/9034554 (PDF: https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9034554&fileOId=9038105); the internal definition is attributed by the author to Su (2010), p. 255 //TKV*

Military uses of outer space and militarisation of outer space are sometimes used interchangeably even though they do not necessary mean the same thing. A distinction could therefore be made between the two. Military uses of outer space have been suggested to denote a more defensive or passive use of space such as satellites for the surveillance of the verification of arms-controls treaty compliance or those uses that relate to the need of military authorities. The use provider may serve military users but still be a civil entity. In contrast, militarisation of outer space may refer to activities which use satellites to enhance offensive military operations on Earth, or to give a military character to outer space activities. It has also been defined as: “the use of assets based in space to enhance the military effectiveness of conventional forces or the use of space assets for military purposes.” Lastly, weaponization of outer space is the deployments of weapons in outer space and could be classified as an even more severe form of a military use or militarisation of outer space.

The second last definition seems to exclude for instance the development and testing conducted in other areas than in outer space as well as the installation, placement and stationing of objects which could be used as military means. Further, it could be understood as rather than as focusing on the passive military uses of outer space, it focuses on the offensive military uses of outer space. Because of the mentioned formulation: “enhance of conventional military forces”. Moreover, if comparing this to the four suggested ways of interpreting “peaceful” in COPUOS’ mandate in chapter 2.3.1 non-militarisation would equal interpretation number ii and possibly also number iii. The non-military uses would however exclude all military aspects (interpretation i). Consequently, distinguishing military uses from militarisation could affect the interpretation of “peaceful purposes”. Maybe, “peaceful purposes” could be interpreted as “non-militarisation” but not “non-military” or “non-aggressive”? When interpreting “peaceful purposes” as “non-military” I chose a broad meaning, including all military uses, passive as well as offensive, as this corresponds with the meaning of “peaceful purposes” in the Antarctic Treaty. However, I find this distinction interesting and important to note and, unless otherwise stated, I use the terms interchangeably.

The Kármán Line - Peer-Reviewed Boundary Analysis

McDowell '18 - *Jonathan C. McDowell, astrophysicist, Harvard-Smithsonian Center for Astrophysics, “The edge of space: Revisiting the Karman Line,” Acta Astronautica 151 (October 2018): 668-677, https://doi.org/10.1016/j.actaastro.2018.07.003 (open-access preprint at https://arxiv.org/abs/1807.07894) //TKV*

In this paper I revisit proposed definitions of the boundary between the Earth’s atmosphere and outer space, considering orbital and suborbital trajectories used by space vehicles. In particular, I investigate the inner edge of outer space from historical, physical and technological viewpoints and propose 80 kilometers as a more appropriate boundary than the currently popular 100 km Von Kármán line.

Space Development Defined - Supply Chains, Mining, and Manufacturing

Metzger '16 - *Philip T. Metzger, planetary scientist, Florida Space Institute, University of Central Florida (formerly NASA Kennedy Space Center), "Space Development and Space Science Together, an Historic Opportunity," Space Policy 37 (2016): 77-91, https://doi.org/10.1016/j.spacepol.2016.08.004 (open-access preprint at https://arxiv.org/abs/1609.00737) //TKV*

The national space programs have an historic opportunity to help solve the global-scale economic and environmental problems of Earth while becoming more effective at science through the use of space resources. Space programs will be more cost-effective when they work to establish a supply chain in space, mining and manufacturing then replicating the assets of the supply chain so it grows to larger capacity. This has become achievable because of advances in robotics and artificial intelligence. It is roughly estimated that developing a lunar outpost that relies upon and also develops the supply chain will cost about 1/3 or less of the existing annual budgets of the national space programs. It will require a sustained commitment of several decades to complete, during which time science and exploration become increasingly effective. At the end, this space industry will capable of addressing global-scale challenges including limited resources, clean energy, economic development, and preservation of the environment. Other potential solutions, including nuclear fusion and terrestrial renewable energy sources, do not address the root problem of our limited globe and there are real questions whether they will be inadequate or too late. While industry in space likewise cannot provide perfect assurance, it is uniquely able to solve the root problem, and it gives us an important chance that we should grasp. What makes this such an historic opportunity is that the space-based solution is obtainable as a side-benefit of doing space science and exploration within their existing budgets. Thinking pragmatically, it may take some time for policymakers to agree that setting up a complete supply chain is an achievable goal, so this paper describes a strategy of incremental progress. The most crucial part of this strategy is establishing a water economy by mining on the Moon and asteroids to manufacture rocket propellant. Technologies that support a water economy will play an important role leading toward space development.

“Non-Military” Defined by Federal Statute - NASA as the Civilian Agency

U.S. Code '10 *- 51 U.S.C. § 20102, National Aeronautics and Space Act, Congressional Declaration of Policy and Purpose, subsections (a)-(c), https://www.law.cornell.edu/uscode/text/51/20102 //TKV*

Note: this is the statutory basis for treating NASA as the civilian (non-military) space agency: §20102(b) vests non-military space activities in a civilian agency while reserving weapons-systems, military-operations, and defense activities to the Department of Defense, mapping onto the resolution’s “non-military” / “civil” framing. Subsections (a)-(c) quoted complete and verbatim against the LII/Cornell text.

(a) Devotion of Space Activities to Peaceful Purposes for Benefit of All Humankind.—Congress declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all humankind.

(b) Aeronautical and Space Activities for Welfare and Security of United States.—Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which agency has responsibility for and direction of any such activity shall be made by the President.

(c) Commercial Use of Space.—Congress declares that the general welfare of the United States requires that the Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space.

Affirmative Case Evidence

Mars Sample Return Is the Highest Scientific Priority - Decadal Survey

NASEM '22 - *National Academies of Sciences, Engineering, and Medicine, Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032, Mars Sample Return Recommendation statements, Chapter 22 (Recommended Program), The National Academies Press, 2022, https://doi.org/10.17226/26522 //TKV*

> The highest scientific priority of NASA's robotic exploration efforts this decade should be completion of Mars Sample Return as soon as is practicably possible with no increase or decrease in its current scope.
>
> Mars Sample Return (MSR) is of fundamental strategic importance to NASA, U.S. leadership in planetary science, and international cooperation and should be completed as rapidly as possible. However, its cost should not be allowed to undermine the long-term programmatic balance of the planetary portfolio.

Planetary Defense - Decadal Survey Findings and Recommendations

Abell et al. '23 - *Paul A. Abell, Thomas D. Jones, Nancy L. Chabot, et al., "Planetary Defense: Findings and Recommendations from the National Academies Planetary Science and Astrobiology Decadal Survey 2023-2032," 8th IAA Planetary Defense Conference, Vienna, April 2023; NASA Technical Reports Server, Document ID 20230002150, https://ntrs.nasa.gov/citations/20230002150 //TKV*

> The National Academies of Sciences, Engineering, and Medicine was chartered by the NASA Science Mission Directorate (SMD), with support from the National Science Foundation, to conduct a new decadal survey to develop a comprehensive science and mission strategy for planetary science (1). The survey was tasked to determine the current state of knowledge and to identify the most important scientific questions to be addressed in astrobiology and planetary science during the upcoming decade of 2023 - 2032. For the first time, the decadal survey also included and addressed the topic of planetary defense, now recognized as a key element of NASA's planetary science activities under the direction of NASA's SMD Planetary Defense Coordination Office.
>
> The topic of planetary defense was included in the decadal survey as a dedicated chapter, divided into five sections based on the framework from the U.S. National NEO Preparedness Strategy and Action Plan (2). These sections discussed: NEO Detection, Tracking, and Characterization; NEO Modelling, Prediction, and Integration; NEO Deflection and Disruption Missions; International Cooperation on NEO Preparation; NEO Impact Emergency Procedures and Action Protocols. Content of these sections included identifying the activities, ground- and space-based assets, facilities, resources, technologies, and missions that should be considered to enable NEO preparedness over the next decade. Supporting inputs to this chapter involved contributions from submitted white papers authored by many members of the NEO science and planetary defense communities. In addition, a planetary defense rapid mission architecture study commissioned by the decadal survey small bodies panel and led by the Jet Propulsion Laboratory examined several different types of in-situ characterization and mitigation demonstration missions. All of this input contributed to the formulation of 42 findings and 11 recommendations that suggest a path forward for increasing our understanding of the NEO population and their associated physical characteristics, modelling the impact probabilities and hazard potential of these objects, and implementing plans to develop and test NEO impact mitigation capabilities.
>
> Including planetary defense in the decadal survey has helped sharpen the focus on this international issue and provided key inputs for stakeholders and decision makers to consider when developing future planetary defense-related activities. Such information is vital for developing a long-term integrated planetary defense capability able to protect humanity in the decades to come.

Astrophysics Flagship - “Only NASA Can Undertake”; US Uniquely Situated to Lead

NASEM '21 - *National Academies of Sciences, Engineering, and Medicine, Pathways to Discovery in Astronomy and Astrophysics for the 2020s (Astro2020), The National Academies Press, 2021, https://doi.org/10.17226/26141 //TKV*

Inspired by the vision of searching for signatures of life on planets outside the solar system, and by the transformative capability such a telescope would have for a wide range of astrophysics, the survey recommends that the first mission to enter this program is a large (~6 m aperture) infrared/optical/ultraviolet (IR/O/UV) space telescope. The scientific goals of this mission, when achieved, have the potential to profoundly change the way that human beings view our place in the universe. With sufficient ambition, we are poised scientifically and technically to make this transformational step.

This endeavor represents a quest that is on the technical forefront, is of an ambitious scale that only NASA can undertake, and is one where the United States is uniquely situated to lead the world.

ISS Gap Forces Higher Risk or Delayed Deep Space Missions - NASA OIG

NASA OIG '21 - *NASA Office of Inspector General, "NASA's Management of the International Space Station and Efforts to Commercialize Low Earth Orbit," Report No. IG-22-005, November 30, 2021, https://oig.nasa.gov/wp-content/uploads/2024/02/IG-22-005.pdf //TKV*

While overall ISS operations and maintenance costs remained steady at about $1.1 billion a year from FY 2016 through 2020, systems maintenance and upgrade costs trended upward 35 percent in the same 5-year period, rising to approximately $169 million in FY 2020 due primarily to upgrades. Meanwhile, NASA and Roscosmos are investigating the cause and long-term impacts of cracks and leaks that were recently discovered in the Station's Service Module Transfer Tunnel, which connects the Service Module to one of eight docking ports on the Station. Causes being explored include structural fatigue, internal damage, external damage, and material defects. Based on the models NASA used to assess the structure, the cracks should not have occurred, suggesting the possibility of an earlier-than-projected obsolescence for at least one element of the Station. Ultimately, whether in response to an emergency or at the end of its useful service life, NASA and its partners will need to decommission and deorbit the ISS—a technically complex and costly operation requiring international participation and a critical decision on timing.

In reviewing NASA's planned research onboard the ISS, we found that research needed for long-duration missions to the Moon and Mars will not be complete by 2030. NASA uses the ISS microgravity and harsh space environment to study the human health risks of deep space travel and to demonstrate key technologies for crewed missions to the Moon and Mars. Under the Agency's current plans, both health risk mitigation and technology demonstrations will not be complete by 2030—the expected retirement date of the ISS. Consequently, a substantial gap between the Station's retirement and the introduction of a new, commercial destination in low Earth orbit would force NASA to accept a higher level of health risk or delay start dates for long-duration, deep space human exploration missions.

Given the Station's inevitable retirement and NASA's continuing need for low Earth orbit research, the success of the Agency's Plan for Commercial Low Earth Orbit Development is crucial to avoid a gap in low Earth orbit access. NASA's plan to close that gap is for one or more commercial low Earth orbit destinations to be operational by 2028, which would allow a two-year overlap with the ISS before its anticipated retirement in 2030. The Agency's Plan for Commercial Low Earth Orbit Development, published in 2019, identifies five steps in the near-term and also outlines mid- and long-term objectives. We found that the Agency's near-term actions show promise, with NASA's recent efforts resulting in market interest and growth, especially for private astronaut missions. However, NASA faces significant challenges with fully executing the plan in time to meet its 2028 goal and avoid a gap in availability of a low Earth orbit destination. Challenges of commercialization include limited market demand, inadequate funding, unreliable cost estimates, and still-evolving requirements. The risk of deep space human exploration missions will increase significantly if NASA is not able to conduct the required microgravity health research and technology demonstrations on a habitable space destination in low Earth orbit. Furthermore, without a destination the nascent low Earth orbit commercial space economy would likely collapse, causing cascading impacts to commercial space transportation capabilities, in-space manufacturing, and microgravity research.

Nuclear Propulsion Substantially Reduces Mars Trip Time - National Academies

NASEM '21 - *National Academies of Sciences, Engineering, and Medicine, Space Nuclear Propulsion for Human Mars Exploration, The National Academies Press, 2021, https://doi.org/10.17226/25977 //TKV*

> The human exploration of Mars is a daunting undertaking. Safely transporting astronauts to and from Mars will require advances in many areas to develop spacecraft that are up to the challenge. Propulsion systems are one such area. Advanced nuclear propulsion systems (alone or in combination with chemical propulsion systems) have the potential to substantially reduce trip time compared to fully nonnuclear approaches. Shorter trip time reduces risks associated with space radiation, zero gravity, launch and orbital assembly requirements, and many other aspects of long-duration space missions.

Planetary Defense - Asteroid 2024 YR4 as a Teaching Case

Rivkin et al. '25 - *"An Update on Asteroid 2024 YR4 from JWST," AAS Nova, April 1, 2025, https://aasnova.org/2025/04/01/an-update-on-asteroid-2024-yr4-from-jwst/, reporting on A. S. Rivkin et al., "JWST Observations of Potentially Hazardous Asteroid 2024 YR4," Research Notes of the AAS 9, no. 4 (2025): 70, DOI 10.3847/2515-5172/adc6f0 //TKV*

Note: the 3.1% peak and the ">30 m record" statement are from NASA CNEOS/ESA via AAS Nova and ESA; the 60 ± 7 m diameter is from the peer-reviewed Rivkin et al.

> The asteroid's albedo is between 0.08 and 0.18, with a best-fit value of 0.13. Many classes of asteroids have albedos in this range, so this estimate doesn't place 2024 YR4 in any particular class. However, Rivkin's team noted that these values are compatible with previous spectra of the asteroid that suggest an S-type (stony) classification.
>
> The team also estimated the potential impact of a 2024 YR4-like asteroid, finding that a collision with Earth would release the energy equivalent of 2–30 megatons of TNT, with a blast damage radius of up to 80 kilometers (50 miles).
>
> Future modeling using sophisticated thermophysical models will help to define the asteroid's properties further. And in early 2026, researchers may have another chance to observe 2024 YR4 with JWST and refine their understanding of a potential lunar impact in 2032.

Asteroid 2024 YR4, discovered in December 2024, reached an Earth-impact probability that peaked at 3.1% in February 2025 before additional observations cleared it. Per ESA, "for asteroids larger than 30 metres in size, 2024 YR4 now holds the record for the highest impact probability reached, and the longest time spent with an impact probability greater than 1%." JWST mid-infrared observations measured a diameter of 60 ± 7 meters, comparable to the 1908 Tunguska impactor. The case triggered the International Asteroid Warning Network's first-ever real (non-exercise) impact notification.

Mars Sample Return - A Potential Biosignature That Only Sample Return Can Confirm

Hurowitz et al. '25 - *"NASA Says Mars Rover Discovered Potential Biosignature Last Year," September 10, 2025, https://www.nasa.gov/news-release/nasa-says-mars-rover-discovered-potential-biosignature-last-year/, reporting the peer-reviewed finding of Joel A. Hurowitz et al., "Redox-driven mineral and organic associations in Jezero Crater, Mars," Nature 645, no. 8080 (2025): 332-340, DOI 10.1038/s41586-025-09413-0 //TKV*

Note: present strictly as a potential, not confirmed, biosignature, consistent with NASA's own framing.

> A sample collected by NASA's Perseverance Mars rover from an ancient dry riverbed in Jezero Crater could preserve evidence of ancient microbial life. Taken from a rock named "Cheyava Falls" last year, the sample, called "Sapphire Canyon," contains potential biosignatures, according to a paper published Wednesday in the journal Nature. A potential biosignature is a substance or structure that might have a biological origin but requires more data or further study before a conclusion can be reached about the absence or presence of life.
>
> "This finding by Perseverance, launched under President Trump in his first term, is the closest we have ever come to discovering life on Mars. The identification of a potential biosignature on the Red Planet is a groundbreaking discovery, and one that will advance our understanding of Mars," said acting NASA Administrator Sean Duffy. "NASA's commitment to conducting Gold Standard Science will continue as we pursue our goal of putting American boots on Mars' rocky soil."
>
> Perseverance came upon Cheyava Falls in July 2024 while exploring the "Bright Angel" formation, a set of rocky outcrops on the northern and southern edges of Neretva Vallis, an ancient river valley measuring a quarter-mile (400 meters) wide that was carved by water rushing into Jezero Crater long ago.

On September 10, 2025, NASA reported a potential biosignature in the Sapphire Canyon sample, drilled from the rock nicknamed Cheyava Falls in Jezero Crater. The finding rests on sub-millimeter "leopard spot" textures enriched in vivianite and greigite, consistent with low-temperature redox reactions that on Earth are often associated with microbial life. NASA characterizes the result precisely as a potential biosignature, a feature "consistent with biological processes" that "requires more data or further study before a conclusion can be reached." Confirmation is impossible without returning the sealed sample to Earth, making the cancelled Mars Sample Return program the inherency hook for an affirmative.

Space Domain Awareness - Solvency Advocate

Shaw & Kirkpatrick '24 - *Lt. Gen. (Ret.) John Shaw and Sean Kirkpatrick, "Future Space Domain Awareness Needs for National Security Space," CSIS Commentary (Space in Focus series), October 31, 2024, https://www.csis.org/analysis/future-space-domain-awareness-needs-national-security-space //TKV*

> The current U.S. and allied SDA capability lags where it needs to keep up with the rapidly changing SDA environment. Meanwhile, China is swiftly growing its own SDA capabilities, which sets it up to have information superiority in space.
>
> The U.S. Space Force, U.S. Space Command, and the National Reconnaissance Office (NRO), in particular, need to transition from the traditional practice of cataloging relatively constant-energy objects in traditional orbits to the ability to dynamically characterize and track frequently maneuvering objects, as well as unknown objects within congested environments, in nontraditional orbital regimes. This latter approach more closely mirrors war-fighting approaches in other domains.
>
> The Department of Commerce (DOC) needs to swiftly mature its space traffic management capabilities to "offload" the traditional cataloging responsibility from the DOD to allow it to accelerate its focus on SDA against threats.

Shaw and Kirkpatrick, both former senior U.S. Space Command leaders, supply the solvency advocate for a space domain awareness affirmative: the plan funds the transition from legacy cataloging to dynamic, "fire-control"-like characterization and tracking. The same commentary establishes inherency: "The current U.S. and allied SDA capability lags where it needs to keep up with the rapidly changing SDA environment." It frames the harm as ceding information superiority to China.

Space-Based Missile Warning and Tracking - Solvency Advocate

Stone '22 - *Christopher Stone, Senior Fellow for Space Studies, Mitchell Institute Spacepower Advantage Center of Excellence, "Orbital Vigilance: The Need for Enhanced Space-Based Missile Warning and Tracking," Mitchell Institute Policy Paper Vol. 36, June 2022, pp. 21-22, https://www.mitchellaerospacepower.org/app/uploads/2022/06/Space_Based_Early_Warning_Policy_Paper_36-FINAL.pdf //TKV*

> DOD should adopt a multi-layered satellite architecture that combines legacy ballistic missile warning capabilities with enhanced sensors in LEO, MEO, GEO, and Polar orbits to detect and track hypersonic weapons and other novel missile threats over their entire flight profiles.
>
> DOD should develop the capability to deploy decoy satellites in LEO and MEO orbital regimes to complicate Chinese and Russian counterspace targeting operations. This defensive measure would enhance deterrence as well as increase the resiliency of DOD's space-based missile warning architecture in a conflict.
>
> Missile warning and tracking satellites in MEO and GEO basing layers should transition from using limited lifespan, chemically-based propellants to other more advanced propulsion capabilities to enhance their ability to maneuver to avoid attacks and change orbits post attack.

Stone, a former Presidential appointee in the Office of the Secretary of Defense's Space Policy office, is the solvency advocate for a space-based missile warning and tracking affirmative. The paper documents the inherency, that legacy SBIRS sensors cannot maintain custody of maneuvering hypersonic weapons, and ties the plan to homeland and allied defense and to the Golden Dome mission.

Tactically Responsive Space - Solvency Advocate

Rocket Lab '26 *- Lt. Col. Lincoln Miller, USSF, Space Safari system program manager, quoted in "Rocket Lab Shatters Responsive Space Record: Launches U.S. Space Force VICTUS HAZE Mission in 16 Hours 42 Minutes," Rocket Lab Corporation press release, June 22, 2026, https://rocketlabcorp.com/updates/victus-haze/ //TKV*

> We are excited to demonstrate advanced TacRS capabilities on orbit. VICTUS HAZE culminates the TacRS 'crawl, walk, run' phase of on-orbit demonstrations. We are confident in the technology and space operations expertise of our teams who have paved the way for rapid capability delivery to orbit in support of urgent operational needs. Rendezvous and Proximity Operations on such short timelines are certainly not trivial, especially in a crisis or conflict scenario, but this demonstration of our ability to commission a complex and capable space vehicle within less than 72 hours, and immediately begin an RPO scenario thereafter, shows that we can field capability to deny adversaries first-mover advantage into novel orbits.

Lt. Col. Lincoln Miller, the Space Safari system program manager, is the solvency advocate for a tactically responsive space affirmative. The June 2026 VICTUS HAZE mission, launched 16 hours and 42 minutes after notice, demonstrates the capability the plan would convert into an enduring program of record, denying adversaries first-mover advantage in orbit.

Resilient PNT - Solvency Advocate

Frelk '25 *- James J. Frelk, "Resilient PNT is Vital to Golden Dome Success," National Security Space Association (NSSA) Moorman Center for Space Studies, Occasional Paper, November 4, 2025, https://nssaspace.org/wp-content/uploads/2025/11/Resilient-PNT.pdf //TKV*

> The Golden Dome for America air and missile defense system, as directed by President Trump in Executive Order 14186 dated January 27, 2025, will be heavily dependent upon Position, Navigation and Timing (PNT) for its effectiveness.
>
> The Global Positioning System (GPS) and other space- and ground-based PNT sources have significant failure modes and vulnerabilities that can be exploited by America's adversaries.
>
> Urgent investments in a national, resilient PNT architecture with at least two or three sources that have markedly different failure modes are needed to address and mitigate known vulnerabilities of GPS and other systems, while bolstering the effectiveness of Golden Dome.

Frelk supplies the solvency advocate for a resilient PNT affirmative: a national architecture with multiple, independently-failing sources to back up jam- and spoof-vulnerable GPS. Because PNT underpins both military operations and civilian critical infrastructure, the affirmative carries a wide advantage base.

Golden Dome Space-Based Interceptors - Affordability Hedge and Built-In Negative Ground

Guetlein '26 - *Gen. Michael Guetlein, U.S. Space Force, Golden Dome program manager, testimony to the House Armed Services Strategic Forces subcommittee, April 15, 2026, quoted in "Golden Dome czar signals space-based interceptors aren't guaranteed, as DoD weighs cost," Breaking Defense, April 15, 2026, https://breakingdefense.com/2026/04/golden-dome-czar-signals-space-based-interceptors-arent-guaranteed-as-dod-weighs-cost/ //TKV*

> Because we are looking at the threats from a multi-domain perspective to make sure I have redundant capabilities and I don't have single points of failure. So, if boost-phase intercept from space is not affordable and scalable, we will not produce it, because we have other options to get after it.

Guetlein, the Golden Dome program manager, is both the feasibility advocate and the source of the affirmative's built-in negative ground: he maintains the underlying interceptor technology exists, while conceding that affordability and scalability are unresolved and that space-based interceptors may not survive into the program's final architecture. The $185 billion program cost, with the space-based interceptor layer estimated at roughly 70% of it, gives the negative ready-made cost and cost-exchange disadvantages.

On-Orbit Mobility and Logistics - Solvency Advocate

Galbreath '25 - *Col. Charles S. Galbreath, USSF (Ret.), Senior Resident Fellow for Space Studies, Mitchell Institute Spacepower Advantage Center of Excellence (MI-SPACE), "A Broader Look at Dynamic Space Operations," Mitchell Institute for Aerospace Studies Research Study, November 2025, p. 11, https://www.mitchellaerospacepower.org/app/uploads/2025/11/DSO-FINAL.pdf //TKV*

> One of the most fundamental principles of warfare is the need to achieve surprise in the minds of adversaries. By keeping a potential adversary off balance or misinformed of U.S. intentions and capabilities, military operations stand a better chance of achieving their objectives. Just as the theory of competitive endurance seeks to avoid operational surprise, the Space Force and U.S. Space Command must now seek to create surprise for their opponents.
>
> Military deception, such as the use of CCD to confound an enemy's understanding of a force's intentions and capabilities, is a proven practice for achieving surprise. Through CCD and other methods to achieve surprise, one side can put an adversary at a weaker position, forcing them to cede the initiative and thus enabling friendly forces to more decisively deliver offensive and defensive effects.
>
> In numerous historic examples, deception combined with movement and maneuver created the necessary surprise for mission success. The ability to reposition forces in unexpected or unobserved ways, across significant distances, or rapidly evade an attack to preserve vital resources can achieve desired effects and create surprise. Essential to executing the necessary movement and maneuver is the logistics support to enable and sustain operations.

Galbreath, a retired Space Force colonel and Mitchell Institute fellow, is the solvency advocate for an on-orbit mobility and logistics affirmative. The report calls on the Space Force to "design and field an on-orbit logistics infrastructure" and stand up a dedicated program office to enable dynamic space operations.

Negative Evidence

Disadvantages

NASA’s Budget Is Incompatible with Its Missions - Agency Sustainability in Question

NASEM '24 - *National Academies of Sciences, Engineering, and Medicine, NASA at a Crossroads: Maintaining Workforce, Infrastructure, and Technology Preeminence in the Coming Decades, The National Academies Press, 2024, https://doi.org/10.17226/27519, committee chaired by Norman R. Augustine; Findings Nos. 2-4, Summary List of Findings //TKV*

> Core Finding 2: NASA faces internal and external pressures to prioritize short-term measures without adequate consideration of longer-term needs and implications. This produces adverse impacts on contracting, budgeting, funding, infrastructure, R&D, and execution of NASA’s mission portfolio. If left unchecked, these pressures are likely to result in a NASA that is incapable of satisfying national objectives in the longer term.
>
> Core Finding 3: NASA’s budget is often incompatible with the scope, complexity, and difficulty of its mission work. The long-term impacts of this mismatch include erosion of capabilities in workforce, critical infrastructure, and advanced technology development. The current relative allocations of funding to mission work as compared with that allocated to institutional support has degraded NASA’s capabilities to the point where agency sustainability is in question.
>
> Core Finding 4: NASA’s shift to fixed price, milestone-based purchase-of-service contracts for first-of-a-kind, low-technology-readiness-level mission work can, if misused, erode the agency’s in-house capabilities, degrade the agency’s ability to provide creative and experienced insight and oversight of programs, and put the agency and the country at increased risk of program failure.

Launches Disadvantage Uniqueness - Quantified Ozone Depletion Scales with Launch Cadence

Revell et al. '25 - *Laura E. Revell, Michele T. Bannister, Tyler F. M. Brown, Timofei Sukhodolov, Sandro Vattioni, John Dykema, David J. Frame, John Cater, Gabriel Chiodo, and Eugene Rozanov, "Near-future rocket launches could slow ozone recovery," npj Climate and Atmospheric Science 8, Article 212 (June 9, 2025), https://doi.org/10.1038/s41612-025-01098-6, open access //TKV*

The past 5–10 years have seen a significant expansion of rocket launch activity. From 102 total launches worldwide in 2019, 2024 saw 258 orbital launches, with that number expected to be exceeded in 2025 (Fig. 1). The rocket launch cadence is determined by economic factors, including the rapid development of a near-Earth economy driven by both established providers and an ecosystem of enterprise often termed New Space. One driver is the demand for launch of large-scale satellite constellations of thousands to tens of thousands of units into low-Earth orbit (LEO, ~250–600 km above Earth's surface). The number of units in these constellations requires a high launch cadence for two reasons. First, as underway at present, for establishing each constellation. Second, for ongoing replenishment of the infrastructure, as units in LEO experience sufficient exospheric and thermospheric drag to rapidly (≤5–10 years) deorbit and re-enter the upper atmosphere, where it is intended by the operators that they ablate into small pieces. Worldwide, the geographic diversity of launch sites has also increased, though the great majority remain in the Northern Hemisphere (Fig. 2). Launch activity and locations have implications for their atmospheric impacts, discussed later on.

Rocket emissions thin the stratospheric ozone layer. To understand if significant ozone losses could occur as the launch industry grows, we examine two scenarios. Our 'ambitious' scenario (2040 launches/year) yields a −0.29% depletion in annual-mean, near-global total column ozone in 2030. Antarctic springtime ozone decreases by 3.9%. Our 'conservative' scenario (884 launches/year) yields −0.17% annual, near-global depletion; current licensing rates suggest this scenario may be exceeded before 2030. Ozone losses are driven by the chlorine produced from solid rocket motor propellant, and black carbon which is emitted from most propellants. The ozone layer is slowly healing from the effects of CFCs, yet global-mean ozone abundances are still 2% lower than measured prior to the onset of CFC-induced ozone depletion. Our results demonstrate that ongoing and frequent rocket launches could delay ozone recovery. Action is needed now to ensure that future growth of the launch industry and ozone protection are mutually sustainable.

Debris - 1.2 Million Objects; Active Removal Required to Prevent Kessler Syndrome

ESA '25 - *European Space Agency Space Debris Office, ESA Space Environment Report 2025 (Edition 9, published April 1, 2025), https://www.esa.int/Space_Safety/Space_Debris/ESA_Space_Environment_Report_2025 //TKV*

The amount of space debris in orbit continues to rise quickly. About 40 000 objects are now tracked by space surveillance networks, of which about 11 000 are active payloads.

However, the actual number of space debris objects larger than 1 cm in size – large enough to be capable of causing catastrophic damage – is estimated to be over 1.2 million, with over 50.000 objects of those larger than 10 cm.

To prevent this runaway chain reaction, known as Kessler syndrome, from escalating and making certain orbits unusable, active debris removal is required.

Militarization - China's Military-Civil Fusion Erases the Civil/Military Line

USCC '25 - *U.S.-China Economic and Security Review Commission, 2025 Annual Report to Congress, Chapter 7: "The Final Frontier: China's Ambitions to Dominate Space," November 2025, pp. 371-372 (Key Findings), https://www.uscc.gov/sites/default/files/2025-11/Chapter_7–The_Final_Frontier_Chinas_Ambitions_to_Dominate_Space.pdf //TKV*

> China is actively leveraging its space capabilities as strategic tools to expand its geopolitical influence. Through offering other countries the use of its satellite networks, launch services, and space infrastructure, China enhances the resilience and global coverage of its space architecture. At the same time, it draws partner nations more deeply into its technological ecosystem, creating long term strategic and economic dependencies on Chinese technology.
>
> China's military-civil fusion strategy erases the line between military and civilian space activities, enabling systems and technologies such as satellites, robotic arms, and launch systems to serve both commercial ends and PLA objectives. The dual-use nature of these systems—compounded by blurry lines between state-owned enterprises and nominally private firms—makes it difficult to distinguish commercial innovation from military capability.
>
> In just ten years, China has dramatically transformed an almost non-existent commercial space sector into a thriving, state-orchestrated startup ecosystem. Fueled by strong government backing and industrial prowess, Beijing is now seeking to cultivate national champions that will challenge U.S. space companies on the global stage at a fraction of the cost. This strategy does not just seek innovation and commercial advancement—it seeks to reshape the competitive balance in what will be the most strategic domain of the 21st century.

The Commission recommends Congress assess the challenge China poses to "U.S. civil space priorities, including National Aeronautics and Space Administration (NASA) programs, and ensure program delays do not undermine U.S. credibility in establishing global norms for lunar and Martian exploration."

Militarization - The U.S. Approach to Counterspace Operations Shifts to a Warfighting Posture

USCC '25 - *U.S.-China Economic and Security Review Commission, 2025 Annual Report to Congress, Chapter 7: "The Final Frontier: China's Ambitions to Dominate Space," November 2025, p. 381 ("The U.S. Approach to Counterspace Operations"), https://www.uscc.gov/sites/default/files/2025-11/Chapter_7–The_Final_Frontier_Chinas_Ambitions_to_Dominate_Space.pdf //TKV*

> While China has continued to actively pursue both offensive and defensive counterspace capabilities, the United States has refrained from developing an offensive space program and has dutifully sought to avoid actions that could be seen as "weaponizing space." This position was originally rooted in the principles for the peaceful use of outer space and later tied, especially during the Cold War, to the notion that satellites were stabilizing, as they would provide early warning of a nuclear strike and allow time for a response. Thus, an attack on those satellites could be interpreted by an adversary as a sign of an imminent nuclear strike.
>
> However, as the space environment has evolved and is now seen by China as a warfighting domain, the U.S. Space Force is spearheading a new approach to counterspace operations to meet the growing threats to U.S. space assets. In March 2025, the U.S. Space Force released a framework on space warfighting that emphasized the need to establish space superiority and described counterspace operations as essential to joint operations. The framework said the United States needed to be able to undertake offensive actions to disrupt, degrade, deny or destroy enemy counterspace capabilities and other space assets that support their military forces as well as defensive actions to protect friendly space capabilities from attack, interference, and unintentional hazards. In testimony before the Commission, General Saltzman stated that much of the U.S. Space Force's time and effort has been spent on delivering services, which has consequently led to underfunding of capabilities to defeat an adversary's counterspace weapons.

Spending Disadvantage - The May 2025 Moody's Downgrade

Moody's '25 - *Moody's Ratings, "Moody's Ratings downgrades United States ratings to Aa1 from Aaa, changes outlook to stable," rating action commentary, May 16, 2025; official release published by Moody's Investors Service (ratings.moodys.com, registration may be required), mirror at https://ieu-monitoring.com/editorial/moodys-ratings-downgrades-u-s-ratings-to-aa1-from-aaa-changes-outlook-to-stable/796342 //TKV*

> Despite high demand for US Treasury assets, higher Treasury yields since 2021 have contributed to a decline in debt affordability. Federal interest payments are likely to absorb around 30% of revenue by 2035, up from about 18% in 2024 and 9% in 2021. The US general government interest burden, which takes into account federal, state and local debt, absorbed 12% of revenue in 2024, compared to 1.6% for Aaa-rated sovereigns. While we recognize the US' significant economic and financial strengths, we believe these no longer fully counterbalance the decline in fiscal metrics.

The downgrade completed the loss of a perfect rating from all three major agencies (S&P 2011; Fitch 2023; Moody's 2025); Moody's had held a top US rating since 1917.

Spending Disadvantage - CBO's Fiscal-Crisis and Dollar Internal Link

CBO '25 - *Congressional Budget Office, "The Long-Term Budget Outlook: 2025 to 2055," March 2025, https://www.cbo.gov/publication/61187 //TKV*

> The risk of a fiscal crisis—that is, a situation in which investors lose confidence in the value of the U.S. government's debt—would increase. Such a crisis would cause interest rates to rise abruptly and other disruptions to occur.
>
> The likelihood of other adverse outcomes would also increase. For example, expectations of higher inflation could erode confidence in the U.S. dollar as the dominant international reserve currency.
>
> Lawmakers might feel constrained from using federal tax and spending policies to respond to unforeseen events or for other purposes, such as to promote economic activity or strengthen national defense.

CBO projects debt held by the public rising from 100% of GDP in 2025 to 156% by 2055, while explicitly declining to identify a "tipping point" beyond which a crisis becomes likely.

Spending Disadvantage - Debt as a Strategic Constraint on U.S. Power

Luck '25 - *Philip Luck, Director, Economics Program and Scholl Chair in International Business, Center for Strategic and International Studies, "Moody's Downgrade Signals Deeper Risk: Is U.S. Debt Undermining Global Leadership?" CSIS Commentary, May 20, 2025, https://www.csis.org/analysis/moodys-downgrade-signals-deeper-risk-us-debt-undermining-global-leadership //TKV*

> While debt is not inherently good or bad, excessive debt, regardless of its cause, can constrain policy options and create risks for national security in various ways:
>
> Interest Payments Crowding Out Defense Spending: As debt service consumes a larger share of the federal budget, discretionary spending, including defense, faces increasing pressure. In 2024, the United States spent approximately 3 percent of its GDP on interest payments alone, exceeding the level of defense spending, and it is on pace to do the same in 2025. Based on current deficit projections, spending on interest payments for U.S. sovereign debt will soon eclipse total discretionary spending.
>
> Reduced Fiscal Flexibility: Nations with high debt levels have less capacity to rapidly increase spending in response to emerging threats or during conflict or economic downturns, when tax revenues fall while social spending rises automatically.

Luck frames mounting debt as having "shifted from an abstract risk to a strategic constraint on U.S. power and leadership," supplying a national-security-impact scenario for the spending disadvantage.

Environmental Disadvantage - Launch Emissions and Planetary Boundaries

Dominguez Calabuig et al. '24 - *Guillermo J. Dominguez Calabuig, Andrew Wilson, Sifeng Bi, Massimiliano Vasile, Martin Sippel, and Martin Tajmar, "Environmental life cycle assessment of reusable launch vehicle fleets: Large climate impact driven by rocket exhaust emissions," Acta Astronautica 221 (2024): 1-11, open access (CC BY), https://doi.org/10.1016/j.actaastro.2024.05.009, p. 9, Section 5 (Conclusions) //TKV*

> This work analysed, for the first time, the environmental footprint of different reusable launch vehicle fleets which could serve future Europe's needs. LCA results were contextualised to enhance the understanding of the scale of the impact.
>
> The LH2 fleets had the lowest impact in all impact categories showing that propellant choice is the main differentiation factor when it comes to environmental criteria. The RLVC4 also achieved an approximately 30% lower environmental footprint in water and land use when compared to the VTVL LH2 fleet given its higher performance. When high altitude GWP100 CFs were considered for BC, water and aluminium oxide emissions in the stratosphere, GWP climate impacts were up to 1000× higher, reaching magnitudes comparable to those of global annual commercial aviation and potentially exceeding Earth's carrying capacity defined by its planetary boundaries, especially for the CH4 combination. Given that the burden would only correspond to the European potential contribution from launchers, these findings highlight the urgent need of addressing global launch vehicle emissions from all spacefaring nations. This becomes more concerning when considering the current low state of knowledge around their climatic response, its possible diverse influences on the Earth system, and the nature of the GWP metric itself, complicating the direct translation into a simplified global surface average temperature change criterion. This uncertainty was evident when comparing the different climate metrics from this study; as the LCH4 fleet had a 100%–250% higher impacts when considered within a 20 year time horizon as a result of fugitive methane emissions and stronger BC impacts. There also remains significant uncertainty on the exhaust emissions of BC for methalox combustion, plume post-combustion modelling and the impacts at higher altitudes from propellant burning, reentry aero-heating, demise of the expendable stages, and fugitive life-cycle emissions from the different fuels.
>
> Future studies on the sustainability of launchers should address all these aspects to ensure an accurate quantification of its environmental performance and uncertainty. Studies could also perform prospective LCAs to address future changes in background processes as with the possible uptake of sustainable hydrogen and methane fuel production.

This peer-reviewed assessment supplies a launch-cadence uniqueness wall independent of the ozone-depletion literature (Revell et al., 2025): it ties the climate harm directly to launch frequency and propellant choice, and frames the aggregate footprint against planetary boundaries. The paper also finds that launch-event emissions dominate the life cycle, followed by reentry emissions, and that prior space-sector assessments underestimated the absolute climate impact by two to three orders of magnitude by omitting high-altitude characterization of rocket exhaust and demised aluminium oxides.

Space Superiority Doctrine - Status Quo Warfighting Posture

USSF '25 *- Gen. B. Chance Saltzman, Chief of Space Operations, foreword to "Space Warfighting: A Framework for Planners," United States Space Force, April 2025, p. 2, https://www.spaceforce.mil/Portals/2/Documents/SAF_2025/Space_Warfighting_-A_Framework_for_Planners_BLK2(final_20250410).pdf (publicly accessible mirror: https://csps.aerospace.org/sites/default/files/2025-10/USSF%20Space_Warfighting_A%20Framework%20for%20Planners%20(final_20250410).pdf) //TKV*

> This document, Space Warfighting, establishes basic principles for the use of military power in pursuit of this objective. It defines a common strategic framework to execute the activities that constitute Competitive Endurance. It provides foundational insights into Service responsibilities, missions, and core competencies as an integral component of the Joint and Combined Force. Space Warfighting operationalizes two core Space Force truths: we must defend U.S. space capabilities, and we must protect our forces from space-enabled attack.
>
> Space superiority is not only a necessary precondition for Joint Force success but also something for which we must be prepared to fight. Gained and maintained, it unlocks superiority in other domains, fuels Coalition lethality, and fortifies troop survivability. It is therefore the basis from which the Joint Force projects power, deters aggression, and secures the homeland.
>
> To that end, our nation depends on us to organize, train, and equip space forces ready and able to conduct space warfighting operations. We must be prepared to employ capabilities for offensive and defensive purposes to deter and, if necessary, defeat aggressors that threaten our vital national interests. We must deliver space superiority for the nation, and Space Warfighting provides the Service-level framework required to do so.

The Space Force's April 2025 warfighting framework is the doctrinal anchor for the status quo's military track and the backdrop for the non-military (Resolution 3) limiter. It establishes space superiority as the service's "formative purpose" and defines an explicit menu of offensive and defensive counterspace operations, supplying negatives a militarization link and affirmatives the inherency for challenging the civilian-military imbalance.

Counterplans

Public-Private Partnerships - COTS Delivered at One-Quarter Traditional Cost

Zapata '17 - *Edgar Zapata, NASA Kennedy Space Center, "An Assessment of Cost Improvements in the NASA COTS/CRS Program and Implications for Future NASA Missions," AIAA Space 2017 Conference, Orlando, FL, September 12, 2017, NASA Technical Reports Server, Document ID 20170008895, https://ntrs.nasa.gov/api/citations/20170008895/downloads/20170008895.pdf //TKV*

To here, our analysis emphasized tangible outcomes as benefits. A certain number of kg or a certain number of crew go to the ISS and return. The tangible benefit is supporting and maintaining a space station. The public-private partnerships invested in by NASA for cargo and crew to the ISS also have other benefits built into the approach. A few of the more noted benefits in the partnerships include redundancy, reduced cost risk to NASA, and simplified NASA program management.

Redundancy for NASA: Having multiple providers is intrinsic to the public private partnerships NASA uses for cargo and crew to the ISS. Orbital ATK and SpaceX both currently provide commercial cargo to NASA. Sierra Nevada will provide cargo services starting in 2019. Boeing and SpaceX will provide crew transportation to the ISS. NASA invested in even more partners in these programs earlier development phases, before selecting who would provide services.

Reduced Cost Risk to NASA: The contractual nature of the NASA cargo/crew public private partnerships (Space Act Agreements, Fixed, Milestone Payments and Firm Fixed Price contracts for services) is such that cost over-runs are unlikely to mean more cost to NASA. In contrast, traditional "cost-plus" contracting is process driven, not results driven, paying for effort that may or may not be enough to achieve the goal. By way of analogy, in a firm fixed price contract NASA pays a person to mow the yard, whereas in a cost-plus contract NASA pays a person to try to mow the yard. Costs are difficult to control in the latter, while the former partnership approach assures everyone is pulling the mower in the same direction. Reduced cost risk to NASA goes with the notion that partners have "skin in the game" and will try to control costs better when they are also investing their own private capital or trying to develop a system that will be affordable to others outside NASA.

Wolf Amendment Repeal - The Exclusion Created the Challenger

Young '19 - *Makena Young, Research Associate, CSIS Aerospace Security Project, "Bad Idea: The Wolf Amendment (Limiting Collaboration with China in Space)," CSIS Defense360, December 4, 2019, https://defense360.csis.org/bad-idea-the-wolf-amendment-limiting-collaboration-with-china-in-space/ //TKV*

> Collaborating with non-allied countries in space is not a foreign concept for NASA. In the height of the Cold War, the U.S. and Soviet space agencies agreed to work together. President Eisenhower pursued these cooperative initiatives in early letters to Soviet leadership to showcase the peaceful uses of space. Collaborating on missions like the Apollo-Soyuz test project and later the Shuttle-Mir program helped propel human space exploration and established a mutually beneficial area of cooperation and communication between the two rivals. This collaboration proved invaluable for both countries in understanding the capabilities and organization of each other's civil space agencies, and it continues today on the ISS.
>
> As China grows as a space power, U.S. cooperation in selected civil space projects could be one of the best ways to understand the goals and capabilities of the Chinese space agency. Moreover, it would establish avenues of communication and trust between the two nations that could be mutually beneficial in the future. The Wolf Amendment's statutory exclusion of U.S. – Chinese bilateral cooperation in space has only incentivized China to accelerate its space development programs, creating a serious challenger to U.S. leadership in this vital domain of exploration. History has shown that when the U.S. cooperates with foreign competitors in civil space projects, it enhances NASA's leadership role. The Wolf Amendment has neither discouraged Chinese space ambitions or altered China's behavior on human rights—it has only muddled our relationship with China and created an opening for a challenger to NASA's leadership role in space exploration. The provisions of the Wolf Amendment are not needed to protect technology transfer and only serve to stifle mutually beneficial cooperation for science and exploration. It is time to stop howling at the thought of cooperating with China for exploration missions to the Moon and revise the Wolf Amendment.

Privatization - NASA Dominance Stalls Low-Cost Spaceflight

Hudgins '98 - *Edward L. Hudgins, then-Director of Regulatory Studies, Cato Institute, "Time to Privatize NASA," Cato Commentary, January 26, 1998, https://www.cato.org/commentary/time-privatize-nasa; originally published in the Baltimore Sun //TKV*

Note: although dated, the argument is the canonical statement of the privatization position and is paired in the paper with Greason & Bennett (2019) as the privatization-advocacy literature.

> Each shuttle carries a 17-story external fuel tank 98 percent of the distance into orbit before dropping it into the ocean; NASA could easily — and with little additional cost — have promoted private space enterprise by putting those fuel tanks into orbit. With nearly 90 shuttle flights to date, platforms — with a total of 27 acres of interior space — could be in orbit today.
>
> These could be homesteaded by the private sector for hospitals to study a weightless Mr. Glenn or for any other use one could dream of. But then a $100 billion government station would be unnecessary.
>
> As long as NASA dominates civilian space efforts, little progress will be made toward inexpensive manned space travel. The lesson of Mr. Glenn's second flight is that space enthusiasts ignore economics at their peril.

Privatization Limit - “Additionality”: Why Government Keeps What Markets Cannot Do

Planetary Society '24 - *Casey Dreier, Chief of Space Policy, The Planetary Society, “Why NASA Does Space Science and Not the Private Sector,” August 13, 2024, https://www.planetary.org/articles/why-nasa-does-space-science-and-not-the-private-sector //TKV*

> Despite these advances, space science remains primarily a public sector activity. Given constricting budgets and the growing capabilities of the private sector, it is reasonable to wonder why taxpayers continue to fund space science.
>
> The answer lies in science being a process rather than a product and the inherent uncertainty in turning scientific inquiry into near-term profits. The private sector is not well-suited to the needs of fundamental science, which can take years and yield complex results. The public sector, responsible for the well-being of its citizens, is better aligned with the broad societal benefits and values inherent in scientific inquiry and has the resources to support ambitious projects in space exploration.
>
> However, government agencies can and do work with the private sector, primarily as contractors or launch providers.

This is the affirmative answer to the privatization counterplan and, read the other way, the warrant for treating privatization as a functional limit: markets handle small and LEO missions efficiently, so the topic’s center of gravity is the beyond-LEO science markets will not fund.

Multilateral CP - A Conference of the Parties for the Outer Space Treaty

Sandler '25 - *Ely Sandler, Research Fellow, Belfer Center for Science and International Affairs, Harvard Kennedy School, “Governing Outer Space: A Conference of the Parties for the Outer Space Treaty,” Belfer Center, December 8, 2025, p. 4, https://www.belfercenter.org/sites/default/files/2025-12/Sandler_Governing%20Outer%20Space_Final.pdf //TKV*

> In this context, this paper proposes a new solution to make progress on international space governance: adding a Conference of the Parties (COP) to the Outer Space Treaty. COPs are provisions in international agreements, common in other treaty regimes outside of space, whereby signatories meet regularly to discuss the text.
>
> The key legal feature of COP discussions is that – while they do not legally amend treaties and thus do not require ratification (e.g., the advice and consent of the U.S. Senate) – COPs nonetheless create guidance that “thickens” the meaning of the original treaty text. This thickening in practice creates new international law by adding guidance to the existing treaties. In other words, if the OST had a COP, negotiators could agree define its key terms, with those definitions being reincorporated into the OST. At the same time, a core advantage of COPs is that they do not undermine states’ sovereignty, which has been a key problem in previous reform attempts.
>
> Beyond creating a procedural mechanism to add guidance to treaties, this paper also explores a second way that COPs help make international law: their potential to act as a uniquely productive forum for diplomacy.

Process CP - Executive Action Can Substantially Redirect NASA

White House '25 *- The White House, "Ensuring American Space Superiority," Executive Order 14369 of December 18, 2025, 90 FR 60537 (December 23, 2025), https://www.federalregister.gov/documents/2025/12/23/2025-23845/ensuring-american-space-superiority; Section 3 (Implementation), subsections (a)-(c) //TKV*

Note: the order's existence, date, directives, and official citation are confirmed against the Federal Register (90 FR 60537); The Holland & Knight (2025) and K&L Gates (2026) alerts, cited in the History section for the National Space Council disbanding, provide corroborating analyses.

(a) The Assistant to the President for Science and Technology (APST) shall coordinate the overall implementation of this order, including: (i) within 60 days of the date of this order, issuing guidance on establishing a National Initiative for American Space Nuclear Power to achieve the nuclear power policy priorities directed in this order, in coordination with the heads of relevant executive departments and agencies (agencies) identified by the APST; and (ii) within 120 days of the date of this order, propose revisions to Presidential Policy Directive 26 of November 21, 2013 (National Space Transportation Policy), to support implementation of this order.

(b) Within 90 days of the date of this order, the APST shall coordinate development of and integrate into one submission to the President the following: (i) a plan from the Administrator of the National Aeronautics and Space Administration (NASA), in coordination with the Director of the Office of Management and Budget (OMB) and the Assistant to the President for Domestic Policy (APDP), for achieving the policy objectives in this order regarding leading the world in space exploration and expanding human reach and American presence in space, including plans for mitigating any technology, supply chain, or industrial capacity gaps relevant to achieving those goals within available funding; (ii) the results of comprehensive reviews by the Secretary of Commerce and the Administrator of NASA, in consultation with the Director of OMB, of their respective major space acquisition programs to identify any such programs that are more than 30 percent behind schedule based on the program's acquisition baseline, 30 percent over cost based on the program's baseline, unable to meet any key performance parameters, or unaligned with the priorities in this order, along with a description of their planned mitigation or remediation efforts; and (iii) a report from the Secretary of War, in coordination with the Director of National Intelligence (DNI) and the Assistant to the President for National Security Affairs (APNSA), of any technology, supply chain, or industrial capacity gaps relevant to this order's directive to progressively and materially enhance America's air and missile defenses, and plans for mitigating such gaps within available funding.

(c) Within 180 days of the date of this order, the Secretary of Commerce and the Administrator of NASA shall each reform their respective agency's space acquisition processes to support the space priorities in this order, and to further Executive Order 14271 of April 15, 2025 (Ensuring Commercial, Cost-Effective Solutions in Federal Contracts). These reforms shall incorporate the following: (i) use of existing authorities to improve efficiency and expedite space acquisitions, including a first preference for commercial solutions and a general preference for Other Transactions Authority or Space Act Agreements, customary commercial terms, or any other pathways to promote effective or streamlined acquisitions; (ii) a detailed review of each functional support role within the agency's Federal and contract workforce, to eliminate unnecessary tasks, reduce duplication, and accelerate decision-making; (iii) for the Department of Commerce, strengthening capabilities for conducting space acquisition and sustainment activities in a manner that supports collaboration with, but does not require acquisition assistance from, NASA, including by recommending legislative reforms as necessary; and (iv) for NASA, aligning space-focused acquisition and procurement processes across NASA centers and activities to improve efficiency.

The December 18, 2025 executive order sets a goal of returning humans to the Moon by 2028 and establishing initial elements of a permanent lunar outpost by 2030, confirms ISS retirement by 2030, directs a "National Initiative for American Space Nuclear Power," and revises Space Policy Directive 3. As contemporaneous legal analysis observed, "[w]hile the EO does not appropriate funding or rewrite statutes, it might still materially affect industry by driving agency planning, procurement approach, and interagency coordination" (Greenberg Traurig, 2026). It is the live precedent for an executive-action process counterplan; the affirmative answer (executive orders cannot appropriate funds) is pre-empted by pairing the order with the Department of Defense, the Office of Space Commerce, and the FAA's Office of Commercial Space Transportation as alternative actors with independent authorities.

Criticisms

Settler Colonialism - Space Race Revives Colonial "Frontier Zealotry"

Rubenstein '22 - *Mary-Jane Rubenstein, Dean of the Social Sciences and Professor of Religion and Science in Society, Wesleyan University, Astrotopia: The Dangerous Religion of the Corporate Space Race, University of Chicago Press, 2022, https://press.uchicago.edu/ucp/books/book/chicago/A/bo184287883.html; this passage is the University of Chicago Press book description (the publisher's jacket copy), not Rubenstein's own prose //TKV*

Note: the block quotation is the University of Chicago Press description of the work, cited as such. The separate in-text claim that federal space projects from Apollo 8 through Space Force "replay the Christian imperialism that founded and expanded the US" is in-book text at p. 75 (chapter 4, "The Final Frontier") via a published scholarly review (Project MUSE).

> A revealing look at the parallel mythologies behind the colonization of Earth and space—and a bold vision for a more equitable, responsible future both on and beyond our planet. As environmental, political, and public health crises multiply on Earth, we are also at the dawn of a new space race in which governments team up with celebrity billionaires to exploit the cosmos for human gain. The best-known of these pioneers are selling different visions of the future: while Elon Musk and SpaceX seek to establish a human presence on Mars, Jeff Bezos and Blue Origin work toward moving millions of earthlings into rotating near-Earth habitats. Despite these distinctions, these two billionaires share a core utopian project: the salvation of humanity through the exploitation of space. In Astrotopia, philosopher of science and religion Mary-Jane Rubenstein pulls back the curtain on the not-so-new myths these space barons are peddling, like growth without limit, energy without guilt, and salvation in a brand-new world. As Rubenstein reveals, we have already seen the destructive effects of this frontier zealotry in the centuries-long history of European colonialism. Much like the imperial project on Earth, this renewed effort to conquer space is presented as a religious calling: in the face of a coming apocalypse, some very wealthy messiahs are offering an other-worldly escape to a chosen few. But Rubenstein does more than expose the values of capitalist technoscience as the product of bad mythologies. She offers a vision of exploring space without reproducing the atrocities of earthly colonialism, encouraging us to find and even make stories that put cosmic caretaking over profiteering.

Settler Colonialism - The Settler Logics of Outer Space

Smiles '20 - *Niiyokamigaabaw Deondre Smiles, citizen of the Leech Lake Band of Ojibwe, then a postdoctoral scholar at The Ohio State University, now Assistant Professor of Geography, University of Victoria, "The Settler Logics of (Outer) Space," Society + Space, October 26, 2020, https://www.societyandspace.org/articles/the-settler-logics-of-outer-space //TKV*

> To most scholars, and certainly to the virtual majority of Indigenous peoples on Turtle Island, it is no secret that the country we call the United States of America was built upon the brutal subjugation of Indigenous people and Indigenous lands. Fueled by the American settler myths of terra nullius (no man's land) and Manifest Destiny, the American settler state proceeded upon a project of cultural and physical genocide, with lasting effects that endure to the present day. The 'settler myth' permeates American culture. Words such as 'pioneer', the 'West', 'Manifest Destiny' grab the imagination as connected to the growth of the country in its early history. America sprang forth from a vast open 'wilderness'. Of course, for Indigenous people, we know differently—these lands had complex cultural frameworks and political entities long before colonization. Words like 'pioneer' and 'Manifest Destiny', have deep meanings for us too, as they are indicative of the very real damage dealt against our cultures and nations, damage that we have had to work very hard to undo.
>
> Trump's address raises key insights into the continuing logics of settler colonialism, as well as questions of its future trajectories. Trump's invocation of ideas such as the 'frontier' and 'taming the wilderness' draws attention to the brutal violence that accompanied the building of the American state. Scholars such as Greg Grandin (2019) make the case that the frontier is part of what America is—whether it is the 'Wild West', or the U.S.-Mexican border, America is always contending with a frontier that must be defined. Language surrounding 'frontier' is troubling because it perpetuates the rationale of why the American settler state even exists—it could make better use of the land than Native people would, after all, they lived in wilderness. This myth tells us that what we know as the modern world was built through the hard work of European settlers; Indigenous people had nothing to offer or contribute. For someone like Mr. Trump, whose misgivings and hostility towards Native people have been historically documented, this myth fits well with his narrative as President—he is building a 'new' America, one that will return to its place of power and influence.
>
> The fact that similar language is being used around the potential of American power being extended to space could reasonably be expected, given the economic and military potential that comes from such a move. Space represents yet another 'unknown' to be conquered and bent to America's will. However, such interplanetary conquest does not exist solely in outer space. I wish to situate the very real colonial legacies and violence associated with the desire to explore space, tracing the ways that they are perpetuated and reified through their destructive engagements with Indigenous peoples. I argue that a scientific venture such as space exploration does not exist in a vacuum, but instead draws from settler colonialism and feeds back into it through the prioritization of 'science' over Indigenous epistemologies. I begin by exploring the ways that space exploration by the American settler state is situated within questions of hegemony, imperialism, and terra nullius, including a brief synopsis of the controversy surrounding the planned construction of the Thirty Meter Telescope on Mauna Kea. I conclude by exploring Indigenous engagement with 'space' in both its Earthbound and beyond-earth forms as it relates to outer space, and what implications this might have for the ways we think about our engagement with space as the American settler state begins to turn its gaze skyward once again. I position this essay alongside a growing body of academic work, as well as journalistic endeavors (Haskins, 2020; Koren, 2020) that demands that the American settler colonial state exercise self-reflexivity as to why it engages with outer space, and who is advantaged and disadvantaged here on Earth as a result of this engagement.

Smiles further argues that settler colonialism "is intimately tied with the space within which it exists—it cannot exist or sustain itself without settler control over land and space."

Antiblackness - The Space Frontier as a Racialized “Manifest Destiny”

Kilgore '03 *- De Witt Douglas Kilgore, Associate Professor of English, Indiana University Bloomington, Astrofuturism: Science, Race, and Visions of Utopia in Space, University of Pennsylvania Press, 2003, pp. 1-2, https://www.pennpress.org/9780812218473/astrofuturism/ //TKV*

This book is an investigation of the ideals and conflicts evident in America’s dream of its future, as represented in the intellectual, aesthetic, scientific, and political tradition of astrofuturism. Devoted to breaking the limits placed on humanity by the surface of this planet, astrofuturism forecasts an escape from terrestrial history. Its roots lie in the nineteenth-century Euro-American preoccupation with imperial expansion and Utopian speculation, which it recasts in the elsewhere and elsewhen of outer space. Astrofuturism imagines the good or perfect society not simply spatially but in what might be called, to use Einstein’s term, “spacetime.” This speculative tradition has developed as a part of U.S. intellectual and popular culture since the Second World War. Not surprisingly, the future it imagines is an extension of the nation’s expansion to continental and global power in the nineteenth and twentieth centuries. The idea of a space frontier serves contemporary America as the west served the nation in its past: it is the terrain onto which a manifest destiny is projected, a new frontier invalidating the 1893 closure of the western terrestrial frontier. But it is also the space of Utopian desire. Astrofuturist speculation on space-based exploration, exploitation, and colonization is capacious enough to contain imperialist, capitalist ambitions and Utopian, socialist hopes. Visions of an American conquest of space go hand in hand with thought experiments seeking some barely glimpsed alternative to the economic and political problems that dominated the twentieth century. Astrofuturism posits the space frontier as a site of renewal, a place where we can resolve the domestic and global battles that have paralyzed our progress on earth. It thus mirrors and codifies the tensions that characterize America’s dream of its future.

Antiblackness - Apollo's Costs and the Civil-Rights Critique

Maher '17 - *Neil M. Maher, Professor of History, New Jersey Institute of Technology and Rutgers University–Newark, Apollo in the Age of Aquarius, Harvard University Press, 2017, pp. 9-10, https://www.hup.harvard.edu/catalog.php?isbn=9780674237391 //TKV*

The result is a very different book. Rather than merely explaining the unexpected ecology of NASA's space capsules, Apollo in the Age of Aquarius now begins with civil rights leaders in the 1960s protesting against such technology and with space agency engineers' subsequent attempts to retool it in order to help African Americans in inner cities. The book then turns to the Vietnam War, when NASA's covert development of aerospace hardware to help the U.S. military wage "ecocide" across Southeast Asia sparked opposition by peace activists and college students from the New Left. Apollo in the Age of Aquarius next demonstrates how early opposition to space exploration by both environmental activists and environmental scientists compelled NASA in the 1970s both to preserve land locally at Cape Canaveral and to develop satellites and computer models that made possible scientific research on the global environment. Additionally, instead of simply examining environmental simulators on Earth and astronaut suits in space, the book now illustrates how NASA administrators used these same technologies to deny female bodies a place in space and how second-wave feminists in turn organized successfully against such body politics. Finally, Apollo in the Age of Aquarius ends with Hair, or more precisely with the cultural battle between hippies, who opposed the space race through art, music, and lifestyle choices, and Nixon's silent majority, who supported Apollo as a counter to the counterculture. The book, reincarnated, is thus less an environmental and technological history of the space race and more a political history of the 1960s era, albeit one that focuses on the unforeseen relationship between space technology and the natural environment both in space and back on Earth.

Which brings us back to the "Hair affair." It, too, brought together the space race and the grassroots movements of the 1960s era. Not only did crew-cut astronauts attend the "hippie" musical in June of 1970, but the play itself frequently commingled NASA's mission to the moon and each of the social and political struggles taking place back on Earth. In "Walking in Space," for instance, one of the most important scenes in the second act, the play's "tribal members" smoke marijuana laced with LSD before taking off "on a rocket to the fourth dimension." During their trip "from mainline to moonville," an African American character hallucinates the murder of whites under a "Black Power" banner. A draft dodger imagines skydiving into the jungles of Vietnam, while a feminist proclaims to the audience, "I certainly don't want to be a housewife with kids." Later the play's main protagonist, claiming to be an extraterrestrial, sings longingly of his pollution-free home planet "where the air is pure, the river waters crystal bright." While Swigert and Lovell missed all of these Act II references linking the space race to the era's grassroots movements, President Lyndon Johnson did not. "Space was the platform from which the social revolution of the 1960s was launched," he argued less than a year after the "Hair affair." "If we could send a man to the Moon," he added, we should be able to solve other problems such as racism and poverty in inner cities, war in Southeast Asia, pollution, gender discrimination, and an increasingly disillusioned youth culture. This book follows Johnson's lead by illustrating how the Apollo program launched not only rockets but also the political and social struggles of the Age of Aquarius.

Capitalism - “Capitalistkind” and Outer Space as a Spatial Fix

Shammas & Holen '19 *- Victor L. Shammas, Work Research Institute, Oslo Metropolitan University; Tomas B. Holen, independent scholar, “One giant leap for capitalistkind: private enterprise in outer space,” Palgrave Communications 5, art. 10 (2019), open access, https://doi.org/10.1057/s41599-019-0218-9 //TKV*

Outer space is becoming a space for capitalism. We are entering a new era of the commercialization of space, geared towards generating profits from satellite launches, space tourism, asteroid mining, and related ventures. This era, driven by private corporations such as Elon Musk’s SpaceX and Jeff Bezos’s Blue Origins, has been labeled by industry insiders as ‘NewSpace’—in contrast to ‘Old Space’, a Cold War-era mode of space relations when (allegedly) slow-moving, sluggish states dominated outer space. NewSpace marks the arrival of capitalism in space. While challenging the libertarian rhetoric of its proponents—space enterprises remain enmeshed in the state, relying on funding, physical infrastructure, technology transfers, regulatory frameworks, and symbolic support—NewSpace nevertheless heralds a novel form of human activity in space. Despite its humanistic, universalizing pretensions, however, NewSpace does not benefit humankind as such but rather a specific set of wealthy entrepreneurs, many of them originating in Silicon Valley, who strategically deploy humanist tropes to engender enthusiasm for their activities. We describe this complex as ‘capitalistkind’. Moreover, the arrival of capitalism in space is fueled by the expansionary logic of capital accumulation. Outer space serves as a spatial fix, allowing capital to transcend its inherent terrestrial limitations. In this way, the ultimate spatial fix is perhaps (outer) space itself.

Longtermism - Space Expansionism Increases Existential Risk

Deudney '20 *- Daniel Deudney, Professor of Political Science, Johns Hopkins University, Dark Skies: Space Expansionism, Planetary Geopolitics, and the Ends of Humanity, Oxford University Press, 2020, p. 7 (Chapter 1, “The Promise of Space Revisited”), https://global.oup.com/academic/product/dark-skies-9780190903343 //TKV*

This book advances a considerably darker view of the space enterprise. I argue that the consequences of what has actually happened in space are much less positive than space enthusiasts and many others believe. My case for this darker net assessment of actual space activities centers on the role of space activities in making nuclear war more likely. This darker view of space impacts is based in large part on a revisionist understanding of what has actually happened in space, which is, I believe, fundamentally more accurate than in virtually all descriptive accounts of the Space Age. Furthermore, I argue that many prospective space ventures are likely to be much darker in their consequences than advocates claim. Their pursuit and realization are likely to entail grave risks for security and freedom on Earth, and eventually for the survival of the human species. In sum, this book argues that the large-scale expansion of human activities into space, past and future, should join the lengthening list of catastrophic and existential threats to humanity, and that the ambitious core projects of space expansionism should be explicitly relinquished.

Disability - The “Right Stuff” Critique and the Case for Disabled Astronauts [credentialed-expert essay, not peer-reviewed]

Wells-Jensen '18 - *Sheri Wells-Jensen, Associate Professor, Bowling Green State University; Mission: AstroAccess ambassador, “The Case for Disabled Astronauts,” Scientific American (Observations blog), May 30, 2018, https://www.scientificamerican.com/blog/observations/the-case-for-disabled-astronauts/ //TKV*

Note: this is an opinion/blog essay by a credentialed expert, not a peer-reviewed article; it is paired in the paper with peer-reviewed companions in Futures (Smith et al., 2019; Wells-Jensen et al., 2019).

> I say this not because of some ineffable theoretical advantage of “diversity.” I will use the example here of a totally blind astronaut, but a similar case could be made for other physical disabilities. A blind person on a space station probably seems, prima facie, very frightening given that her colleagues might have to depend on her in an emergency. But blind adults are successful parents, teachers, scientists and chefs, and do not have more accidents than sighted people; there is no inherent danger associated with a blind person doing his or her job. The key to success here lies in adapting instruments to output information in braille and/or audio along with visual displays.

Disability - Universal Design Improves Safety for All Astronauts [peer-reviewed empirical study]

Molaro et al. '24 - *Jamie L. Molaro, Ann Kapusta, Sheri Wells-Jensen, et al. (AstroAccess team), “AstroAccess: Testing accessibility accommodations for disabled and mixed-ability crews operating in space-like environments,” Acta Astronautica 217 (2024): 382-392, https://doi.org/10.1016/j.actaastro.2024.02.012, open access (CC BY-NC-ND) //TKV*

Note: this is the peer-reviewed empirical anchor for the inclusive-design claim; the study reports experiments performed by disabled and mixed-ability crews on parabolic zero-gravity flights. (Wells-Jensen is a co-author, linking it to the Wells-Jensen, 2018 entry.)

> Society today is experiencing a golden age of robotic space exploration and interest in human spaceflight has regained popularity as entities like NASA and the burgeoning private space industry refocus attention on sending humans back to the Moon and into orbit. This is a critical turning point for society, as some look to our future as a possibly spacefaring civilization while others wonder who will be enabled to participate in that space exploration. Historically, Disabled individuals and other minoritized groups have been excluded from space science and technology fields, as well as from participation in astronaut programs. However, human space exploration can be made more inclusive with research and innovation in the area of accessible design. Universal accessible design brings advantages to all individuals operating in an environment, and the ability of Disabled individuals to adapt to environments not suited for them can be leveraged as a strength in spaceflight. In this work, disabled and mixed ability crews performed research on parabolic zero-gravity flights which produce weightlessness, exploring tools and technologies which may mitigate challenges for disabled individuals operating in space-like environments. Here we discuss the experiments performed on our flights, highlighting what types of technologies offer promising solutions for accessible design of space habitats, suits, and tools, and accommodations which can enable future disabled astronauts to operate safely in space. We will highlight universal design solutions that not only provide access to previously excluded researchers but have the potential to improve safety and efficiency for all astronauts, regardless of disability. We will also discuss operational strategies which can be incorporated into training and procedure to leverage the strengths of mixed ability crews in ensuring everyone operates effectively together.

Securitization - The Growing Securitization of Outer Space

Peoples '10 - *Columba Peoples, Senior Lecturer in International Relations, University of Bristol, "The growing 'securitization' of outer space," Space Policy 26, no. 4 (2010): 205-208, https://doi.org/10.1016/j.spacepol.2010.08.004 //TKV*

> Attempts at securitization are thus a rapidly growing feature of contemporary space policy discourse. Merely making this observation, however, leaves aside the question of whether such securitizing moves should be encouraged or avoided by policy makers and analysts. On the one hand, the idea of space as a key part of the 'connective tissue' that binds global security might seem an attractive proposition to those seeking to shift the emphasis away from militaristic national concerns. In this light, attempts to securitize environmental monitoring, critical infrastructure and economic prosperity under the rubric of space security might be welcomed as the basis for a more multilateral, cooperative global approach. On the other hand, there is a legitimate concern that the securitization of space policy effectively acts as a Trojan horse for the expansion of national–military interests. One previous viewpoint contributor contends in relation to EU space policy that '…Europe's "security research" has slowly paved the way for the introduction of much more controversial "military research" within the European domain', and Manriquez suspects that, with Japan's space law revision, 'the nation inches [further] towards re-militarization with the likely opening of space for military use.' Similarly, the new space policy of the Obama administration appeals simultaneously to an expansive definition of global security and a more narrow, traditional focus on the national–military interest of the USA included within this. All of this points to the importance of taking the securitization of space policy seriously as a key element of debates on space security. Focusing on militarization and weaponization alone simply isn't sufficient.

Feminist Critique - The Female Astronaut as Caretaker, Not Threat

Lathers '12 - *Marie Lathers, Treuhaft Professor of French and Humanities, Case Western Reserve University, Space Oddities: Women and Outer Space in Popular Film and Culture, 1960-2000, London: Bloomsbury, 2012 (orig. Continuum, 2010), p. 107, https://doi.org/10.5040/9781628928976 //TKV*

Note: The same passage is quoted, with the same page citation, in the peer-reviewed article Alexandra Ganser, "Sentimental Journeys: Female Astronauts and Gendered (Im)mobilities on the 'Final Frontier' in Twenty-First-Century Hollywood," Caliban 74 (2025), which develops the same maternal-allegory critique through twenty-first-century film (see the Ganser, 2025 entry).

> Although Sally Ride was the first American female astronaut to go into space, one must look to Christa McAuliffe for a "sister in space" of the earthbound homemakers of Life magazine, Apollo 13, and The Original Wives Club. For despite her profession as a teacher and her training for the mission, McAuliffe was represented in the media in many ways as the typical "astronaut's wife." McAuliffe was, as it were—and although not exactly chronologically—the appropriate intermediary step between the astronaut wife of the 1960s and the female astronaut of the 1980s and 90s. The intermediary woman goes into space but does not threaten men. As a woman liberated by second wave feminism, she has a career, but her career reinforces her role as caretaker, nurturer, and representative of Mother Earth. When McAuliffe leaves the house it is to teach and it is in this way that she represents the woman of the 80s–90s: she is firmly entrenched in domesticity but public enough to at least attempt to enter space. Although there was another woman on the Challenger who was a professional astronaut, Judith A. Resnick, I focus here on McAuliffe, whose particular role was to straddle and make acceptable the historical passage from the astronaut wife to the full-fledged female astronaut (Figure 3.9). As we shall see, it was in many ways a position that was impossible to maintain.

Feminist Critique - “Manifest Domesticity” on the Final Frontier

Ganser '25 *- Alexandra Ganser, Professor of American Studies, University of Vienna, “Sentimental Journeys: Female Astronauts and Gendered (Im)mobilities on the ‘Final Frontier’ in Twenty-First-Century Hollywood,” Caliban: French Journal of English Studies 74 (2025), https://doi.org/10.4000/1536e, open access //TKV*

Note: Ganser reads the “final frontier” as symbolically analogous to the nineteenth-century American West, “with women embodying what Amy Kaplan famously termed manifest domesticity.” Open-access article (OpenEdition/Caliban).

> This article examines the cultural function of the female astronaut in contemporary Hollywood by discussing two exemplary case studies, Christopher Nolan’s blockbuster Interstellar (2014) and the lesser-known Netflix series Away (2020). It combines a mobility studies and affect studies approach, arguing that female astronauts’ mobility is visually and narratively displaced by affective movement through the employment of sentimentalism as a form of public intimacy, following Lauren Berlant’s terminology. In this, the ‘final frontier’ operates, symbolically, similarly to the western frontier of the nineteenth century, with women embodying what Amy Kaplan famously termed “manifest domesticity.” Especially female astronaut-mothers are cast to stand for the future survival of the traditional U.S.-American family and thus the nation itself.

China Threat-Inflation - A US-China “Space Race” Built on Threat Inflation

Evanoff '19 *- Kyle L. Evanoff, formerly Research Associate, International Institutions and Global Governance program, Council on Foreign Relations, “Bad moonshot rising: The moon’s dubious strategic value,” Bulletin of the Atomic Scientists, April 9, 2019, https://thebulletin.org/2019/04/bad-moonshot-rising-the-moons-dubious-strategic-value/ //TKV*

Note: Evanoff critiques “race” rhetoric while acknowledging a genuine security dilemma; the companion quantitative analysis (Yu & Wong, 2023) finds China “does not appear poised to assume the role of the next global regulator.”

> A moonshot is on the rise on the Trump administration’s foreign policy agenda. At last month’s meeting of the National Space Council in Huntsville, Alabama, Vice President Mike Pence laid out an ambitious goal: “Return American astronauts to the moon in the next five years”—a date which would be well ahead of the 2028 target envisioned in previous NASA plans. The United States and China are locked in a new space race, he warned, and the stakes have only increased since the US-Soviet space race of the 1960s; the United States must be first to send astronauts to the moon in the twenty-first century.
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> As space historian Dwayne A. Day of the National Research Council details in the on-line publication The Space Review, Chinese civil space exploration has progressed at a slow and steady clip for decades, in decidedly un-race-like fashion. Journalists and analysts, meanwhile, have played up the sensationalist trope of a US-China space race on the basis of unreliable reports, mistranslated documents, flawed inferences, and off-the-cuff statements from Chinese officials and observers. Space, in this sense, appears to have been subject to the same sort of threat inflation that has plagued various other domains linked to national security.