

Comments of

TechFreedom

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In the Matter of

NASA's Low Earth Orbit Microgravity Strategy

Draft Goals and Objectives (August 2024)

Request for Comment

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INTRODUCTION AND BACKGROUND

On September 27, 2024, TechFreedom filed comments in response to NASA's Low Earth Orbit Microgravity Strategy, Draft Goals and Objectives.¹ The form of input was a series of input boxes in a web page (now closed). Each submission box was limited to 2,500 characters (roughly 450-500 words). The comments below are a concatenation of TechFreedom's responses, with the "Additional Feedback" section appearing here first so as to provide overall context to these comments. The feedback form also allowed only for ASCII characters, no graphics, and no ability for footnotes. As such, these comments will look a little different from the normal comments TechFreedom files, due to these external constraints. We responded to many, but not all, of the six identified goals and objectives related to those goals, limiting our comments to areas which impact on the overall legal authority of NASA to conduct this research and interface with the commercial sector to accomplish these goals.

Founded in 2011, TechFreedom is a nonprofit think tank dedicated to promoting the progress of technology that improves the human condition. To this end, we seek to advance public policy that makes experimentation, entrepreneurship, and investment possible, and thus unleashes the ultimate resource: human ingenuity. Wherever possible, we seek to empower users to make their own choices online and elsewhere.

TechFreedom, and the undersigned author, have almost 40 years' experience in outer space law and policy. A short list of our work includes:

- Prior Comments to NASA on its Lunar Non-Interference Questionnaire;²
- Prior Comments to NASA on its Technology Shortfalls;³
- Prior Comments to NASA on its Moon to Mars Objectives;⁴

¹ NASA, LOW EARTH ORBIT MICROGRAVITY STRATEGY: DRAFT GOALS AND OBJECTIVES (Aug. 2024), <https://nasa.gov/wp-content/uploads/2024/08/2024-08-lms-draft-goals-and-objectives-1.pdf?emrc=2ef059> ("Microgravity Strategy").

² Comments of TechFreedom on Non-interference of Lunar Activities (June 7, 2024), <https://techfreedom.org/wp-content/uploads/2024/06/TechFreedom-Non-Interference-Zones-NASA-6-7-24-v2.pdf>.

³ Comments of TechFreedom on Technology Shortfalls for NASA Space Technology Mission Directorate (STMD) (May 13, 2024), <https://techfreedom.org/wp-content/uploads/2024/05/TechFreedom-Technology-Shortfalls-for-NASA-Space-Technology-Mission-Directorate-May-13-2024.pdf>.

⁴ Comments of TechFreedom on Moon to Mars Objectives (June 3, 2022), <https://techfreedom.org/wp-content/uploads/2022/06/TechFreedom-Comment-Moon-to-Mars-6-3-22.pdf>.

- Testimony before the House and Senate on space issues;⁵
- Amicus briefs in key court cases related to outer space law and policy;⁶
- Law review and scholarly articles addressing key issues of space law;⁷
- Presentations at scientific conferences on outer space law and policy, including on issues related to orbital debris;⁸

⁵ *Continuing U.S. Leadership in Commercial Space at Home & Abroad: Hearing Before the H. Comm. on Space, Sci., & Tech.*, 118th Cong. (2023), <https://techfreedom.org/wp-content/uploads/2023/07/Space-Governance-Testimony-July-13-2023.pdf>; *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space: Before the S. Comm. on Commerce, Sci., & Transp. Subcomm. on Space, Sci., & Competitiveness*, 115th Cong. (2017) (written testimony of James E. Dunstan & Berin Szóka), <https://www.commerce.senate.gov/services/files/A9AD88B2-9636-4291-A5B0-38BC0FF6DA90> (for video of the hearing, see *Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space*, S. COMM. ON COMMERCE, SCI., & TRANSP. (May 23, 2017), <https://www.commerce.senate.gov/2017/5/reopening-the-american-frontier-exploring-how-the-outer-space-treaty-will-impact-american-commerce-and-settlement-in-space>).

⁶ Brief for TechFreedom as Amicus Curiae Supporting Fed. Commc'ns Comm'n, *The International Dark-Sky Association, Inc. v. Fed. Commc'ns Comm'n*, No. 22-1337 (D.C. Cir. Ct. App. 2023), <https://techfreedom.org/wp-content/uploads/2023/06/TF-22-1337-International-Dark-Sky-Association-Inc.-v.-FCC.pdf>; Brief for TechFreedom as Amicus Curiae Supporting Respondent, *Viasat, Inc. v. Fed. Commc'ns Comm'n*, 47 F.4th 769 (D.C. Cir. 2022) (No. 21-1123), <https://techfreedom.org/wp-content/uploads/2021/09/File-Stamped-TechFreedom-Amicus-Brief-Viasat-v-FCC.pdf>.

⁷ See J. Dunstan, *Regulating Outer Space: Of Gaps, Overlaps, and Stovepipes*, THE CTR. FOR GROWTH AND OPPORTUNITY (July 10, 2023), <https://www.thecgo.org/research/regulating-outer-space-of-gaps-overlaps-and-stovepipes/>; J. Dunstan, "Space Trash:" *Lessons Learned (and Ignored) from Space Law and Government*, 39 J. SPACE L. 23 (2013); J. Dunstan, *Toward a Unified Theory of Space Property Rights*, in *SPACE: THE FREE-MARKET FRONTIER* (2002); J. Dunstan et al., *The Geostationary Orbit: Legal, Technical and Political Issues Surrounding Its Use in World Telecommunications*, 16 CASE WEST. RESERVE J. INT. L. 223 (1984).

⁸ J. Dunstan & Bob Werb, *Legal and Economics Implications of Orbital Debris Removal: Comments of the Space Frontier Foundation*, DARPA Orbital Debris Removal (ODR) Request for Information for Tactical Technology Office (TTO), DARPA-SN-09-68 (Oct. 30, 2009); J. Dunstan et al., *Doing Business in Space: This Isn't Your Father's (or Mother's) Space Program Anymore*, SPACE MANUFACTURING 13 (2001); J. Dunstan, *Earth To Space: I Can't Hear You; Selling Off Our Future To The Highest Bidder*, SPACE MANUFACTURING 11 (1997); J. Dunstan, *Generating Revenues in Space: Challenging Some of the Economic Assumptions of Space Exploitation*, Proceedings of the NASA Symposium on Lunar Bases and Space Professional Activities in the 21st Century (Apr. 1988).

- Comments in agency proceedings on a variety of space-related issues;⁹
- Submissions to Congress and the White House on key space law and policy issues;¹⁰

We are therefore well-versed in issues related to space law and policy and welcome the opportunity to comment on NASA’s Microgravity Strategy.

I. NASA Must Adhere to its Statutory Authority in Creating a LEO Microgravity Strategy

NASA’s LEO Microgravity Strategy is flawed in several ways.

First, it fails to acknowledge the limits of its statutory authority. The 1958 NASA Act sets forth Congress’s intent.¹¹ Section 102 established NASA with responsibility over “aeronautical and space activities,” which are defined in Section 103 as “(A) research into, and the solution of, problems of flight within and outside the earth’s atmosphere, (B) the development,

⁹ TechFreedom has commented in matters such as: Space Innovation & Facilitating Capabilities for ISAM, IB Docket Nos. 22-271 & 22-272 (Apr. 29, 2024), <https://techfreedom.org/wp-content/uploads/2024/04/TechFreedom-FCC-ISAM-Comments.pdf>; Revision of the Big LEO Spectrum Sharing Plan, RM-11975 (Apr. 25, 2024), <https://techfreedom.org/wp-content/uploads/2024/04/TechFreedom-Comments-SpaceX-Petition-1-6-GHz.pdf>; Mitigation Methods for Launch Vehicle Upper Stages on the Creation of Orbital Debris, Docket No. FAA-2023-1858 (Dec. 22, 2023), <https://techfreedom.org/wp-content/uploads/2023/12/TechFreedom-comments-Mitigation-Methods-for-Launch-Vehicle-Upper-Stages-on-the-Creation-of-Orbital-Debris-12-22-23.pdf>; Development of a National Spectrum Strategy, Docket No. NTIA-2023-0003 (Apr. 17, 2023), <https://techfreedom.org/wp-content/uploads/2023/04/Comment-NTIA-RFC-4-17-23.pdf>; National Science and Technology Strategy for U.S. Activities in Cislunar Space (July 20, 2022), <https://techfreedom.org/wp-content/uploads/2022/07/TechFreedom-Comment-OSTP-Cislunar-Economy-7-20-22.pdf>; Allocation of Spectrum for Non-Federal Space Launch Operations, ET Docket No. 13-115 (Sept. 10, 2021), <https://techfreedom.org/wp-content/uploads/2021/09/TechFreedom-Reply-Comments-13-115-9-10-21.pdf> (allocation of spectrum for non-federal space launches); Letter from TechFreedom to Fed. Comm’n Comm’n (Nov. 2, 2020), <https://techfreedom.org/wp-content/uploads/2021/03/TechFreedom-Letter-to-FCC-11-2-20.pdf> (warning of danger of FCC granting “market access” to a company proposing very large satellites and licensed by a government (Papua New Guinea) which is not a signatory to the Liability Convention).

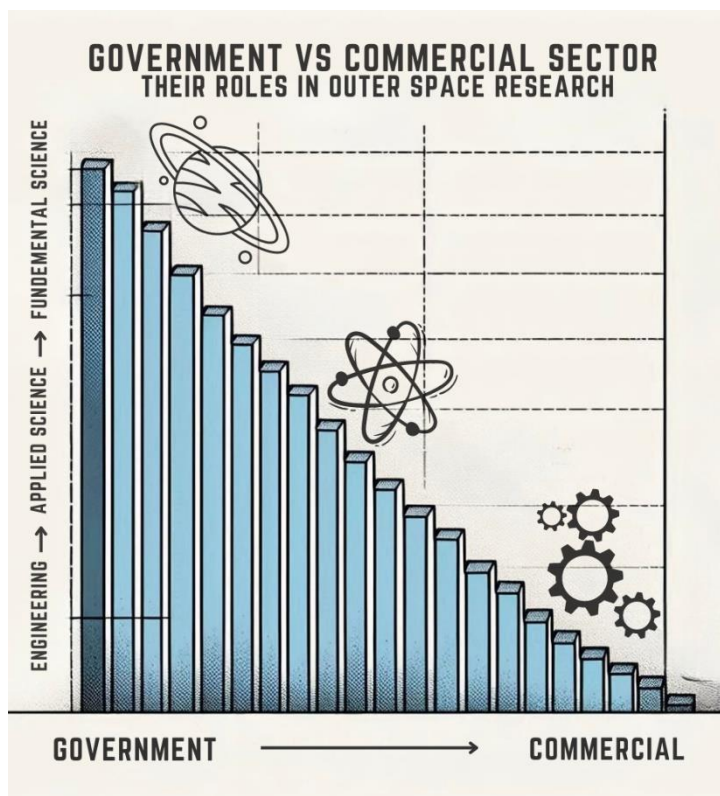
¹⁰ Comments of TechFreedom on OSTP Request for Comment on National Orbital Debris Research and Development Plan, 86 Fed. Reg. 61335 (Dec. 31, 2021), <https://techfreedom.org/wp-content/uploads/2022/01/TechFreedom-Comments-OSTP-Orbital-Debris-Strat-Plan.pdf>; Letter from TechFreedom to S. Subcomm. on Space & Sci. (July 21, 2021), <https://techfreedom.org/wp-content/uploads/2021/07/Letter-to-Senate-Space-Subcommittee-7-21-21.docx-1.pdf> (concerning the loophole of allowing U.S. companies to get “flag of convenience” licenses from foreign jurisdictions).

¹¹ NASA Act, Pub. L. No. 85-568, 72 Stat. 426 (1958) (codified at 42 U.S.C. § 2451 et seq.).

construction, testing, and operation for research purposes of aeronautical and space vehicles, and (C) such other activities as may be required for the exploration of space.”¹² Supreme Court precedent has made clear that Section 103(c)’s “catchall” must be read narrowly and within the context of other sections.¹³ Further, agency decisions are no longer protected by *Chevron Doctrine* deference.¹⁴ Especially as it relates to both international cooperation and regulation of commercial activities, NASA’s statutory authority is quite limited.¹⁵

Second, a corollary to this shortfall is that the Strategy assumes that NASA will be the “driver” of all aspects of this strategy, rather than a strategic partner which can lead in some aspects of the strategy, but which must defer to other agencies, or to the private sector, where its statutory authority is weakest.

The Strategy also conflates pure science research and engineering projects. NASA’s authority and value are greatest when it engages in pure scientific research. Its power is weakest when it engages in actual engineering, which is best accomplished by the private sector. We suggest NASA self-assess its LEO Strategy against this continuum.



¹² *Id.*

¹³ See *Whitman v. Amer. Trucking Ass’ns*, 531 U.S. 457, 468 (2001) (“[Congress] does not, one might say, hide elephants in mouseholes.”). See also *West Virginia v. Env’tl. Prot. Agency*, 597 U.S. 697, 723 (2022) (“Agencies have only those powers given to them by Congress.”).

¹⁴ See *Loper Bright Enters. v. Raimondo*, No. 22-451, slip op. at 35 (June 28, 2024) (“Courts must exercise their independent judgment in deciding whether an agency has acted within its statutory authority, as the APA requires. Careful attention to the judgment of the Executive Branch may help inform that inquiry.”).

¹⁵ See J. Dunstan, *Regulating Outer Space*, *supra* note 77.

II. Topic I: Biological Science

NASA's stated goal under this topic is to "Advance understanding of how biology responds to the unique environment of low Earth orbit."¹⁶

Unfortunately, as has been true of several past requests for input, NASA has structured this response in such a way that that it is virtually impossible to provide a robust response to NASA's proposed LEO Microgravity Strategy. This response sequence dives directly into weeds without allowing respondents to provide a full context for their responses. The major context for these comments is that NASA's core responsibilities and statutory authority within the overall space exploration and development ecosystem are at their highest in two areas: 1) pursue scientific research as it relates to space; and 2) conducting research into technologies that further space research. NASA's role is weakest when it comes to engineering solutions to specific space development problems, which is always best left to the private sector, which can innovate and drive down costs far better than NASA's top-down bureaucracy. Having said that, the biological sciences involve core fundamental scientific research (thus falling further up the Y axis of the curve in the infographic above), in an area NASA should inhabit. This research is within NASA's core mission and competency, and it has conducted biological science research since the beginning of its existence. The question remains, however, as to whether we are reaching diminishing marginal returns in terms of the money spent specifically on human biology experiments. To date, almost 650 humans have been in space, with more than 600 of those reaching orbit. This totals nearly 30,000 person-days, or 77 years. We have a huge data set of human experience in space. Have all the data sets on all those flights been fully plumbed for information? Are we conducting repeat biological experiments on humans in space just to have something to do? For every new experiment conducted, NASA should be asking whether it is more cost-effective to conduct the experiment, or review existing data sets. Sometimes it appears that experiments are conducted because, simply, it's some scientists "turn" to have his/her experiment conducted. That's an expensive way to employ scientists.

A. Biological Science Objective 1 (BS-1)

BS-1 seeks to: "Understand the effects of short- and long-duration exposure to the microgravity environment on living systems."¹⁷

See general response above.

¹⁶ Microgravity Strategy at 9.

¹⁷ *Id.*

B. Biological Science Objective 2 (BS-2)

BS-2 seeks to: “Identify alterations in biological mechanisms required for organisms to survive the transition and adapt to living in space, and understand the changes required to re-acclimate to life on Earth.”¹⁸

Insufficient effort and resources have been dedicated to understanding biological reactions, including plant, animal and human systems, to gravitational fields between microgravity and Earth-normal gravity. We have 77 person-years of data on the impacts of microgravity on human biology. We have roughly 160 hours of human experience in lunar gravity (Apollo Missions 11, 12, 14-17), but no experience of the impact of lunar gravity on plant or animal biology. We have zero hours of human experience in Martian gravity. There remains significant concern that NASA’s Artemis program (and its follow-on to Mars) will be nothing more than another “flags and footprints” stunt conducted solely for national prestige and to fully employ government workers. Concrete steps can be taken to understand how humans will *live* on the Moon and Mars in reduced-gravity environments, complete with the full panoply of plants and animals necessary to sustain human life off-planet. This research could pay dividends to demonstrate that NASA is serious about the human future in space. To learn if humans can spend long durations on the Moon or Mars, we must conduct experiments in these gravitational fields. There are engineering solutions to performing these experiments, the most promising of which is to simulate both Moon and Mars gravity through spinning spacecraft in orbit. To date, these efforts have been nothing more than paper studies. It is time to develop variable gravity laboratories in orbit and conduct this vital research.

C. Biological Science Objective 3 (BS-3)

BS-3 seeks to: “Investigate how genetic diversity and life history influence physiological adaptation to the space environment.”¹⁹

While this appears to be part of NASA’s core mission, the Microgravity Strategy document fails to articulate exactly what this means. Without further specificity, it is hard to think that this sub-objective under Biological Science will garner wide public support or taxpayer funding. As it, it looks like someone’s pet project.

¹⁸ *Id.*

¹⁹ *Id.*

D. Biological Science Objective 4 (BS-4)

BS-4 seeks to: “Discover how communication between cells, tissues, and organisms is affected by spaceflight.”²⁰

See response to BS-2 related to work necessary for biological life habitation of Moon and Mars. NASA should more clearly articulate the specific experiment(s) it intends to run to further this research, given the 77 person-years we’ve already spent in space. What haven’t we done in this area that we could do that would result in breakthrough results for the money spent? Or does this sub-objective represent a self-licking ice cream cone where the results revealed in experiments naturally lead to further incremental experiment in a costly cycle of ever diminishing marginal returns of scientific knowledge? Great if you’re the scientist getting the government contracts to fly your experiment after a decade of full employment. A much tougher sell to the public and taxpayers.

III. Topic II: Physical Science

NASA’s stated goal under this topic is to “Use the unique environment of low Earth orbit to probe phenomena hidden by gravity or terrestrial limitations.”²¹

This is within NASA’s core mission, and research should continue in this area. As with many of the sub-objectives in the Biological Sciences section, however, the Draft Goals and Objectives document fails to either summarize the state of existing research or provide an adequate roadmap for future research that can gain general public and taxpayer support. Further, there is no discussion of whether this research is best conducted in microgravity (i.e., in orbit), versus on the Moon or Mars. This analysis is necessary to determine where this category of research fits into the Artemis Program or the prior Moon to Mars Objective exercise. If it is truly orthogonal to Artemis, then this goal becomes either a drag or a direct competitor for funding for Artemis. If it is on the path to Moon and Mars, it needs to be better articulated and demonstrated that it on that pathway. NASA historically has suffered from “scientists eating their own” – scientists competing for the same public dollar going out of their way to try and discredit research that might gain traction and reduce their budgets. That’s a lose-lose scenario we’ve seen far too many times. Showing integration into a larger roadmap would be helpful in gaining public support and additional taxpayer-supported funding.

²⁰ *Id.*

²¹ *Id.* at 10.

A. Physical Science Objective 1 (PS-1)

PS-1 seeks to: “Understand the fundamental principles that organize the structure and functionality of materials, including soft and active matter.”²²

See the response to the Physical Science Goal above.

B. Physical Science Objective 2 (PS-2)

PS-2 seeks to: “Investigate the fundamental laws that govern the behavior of systems that are far from equilibrium.”²³

See the response to the Physical Science Goal above.

C. Physical Science Objective 3 (PS-3)

PS-3 seeks to: “Advance understanding of the mission-relevant chemical and physical properties and phenomena that govern the behavior of fluids and combustion in space environments.”²⁴

The term “mission-relevant” needs more explanation. Is that Artemis mission-relevant, or overall NASA statutory authority mission-relevant? This sub-objective also is further down the continuum depicted in the infographic above, meaning that some of this work is better conducted by the private sector than by a large government program. Significant private R&D investment is being made on propellant/oxidizer transfer and other engineering solutions to problem of on-orbit refueling. NASA can be a catalyst for this type of research by providing early-stage research money to private sector researchers. In this area, however, NASA needs to take a hard look at revamping its SBIR/STTR/follow-on funding structure, which requires an entire overhaul. In addition to claims of mismanagement, waste, fraud and abuse,²⁵ the entire structure of funding of private research with public money needs a thorough review. Key takeaway from industry has been two-fold. First, there is “The Cycle of Death” of SBIR/STTR, where individuals and companies end up spending more internal time and dollars chasing and fulfilling Phase I and Phase II grants than they actually receive, requiring them to chase the next SBIR/STTR to make up for their “loss” on the last one, leading to a cycle where the entire existence of the individual and/or company becomes both dependent

²² *Id.*

²³ *Id.*

²⁴ *Id.*

²⁵ See Peter Tartaglione, *Fraud, abuse found in NASA research funding to small companies*, CTR. FOR PUB. INTEGRITY (Dec. 13, 2010), <https://publicintegrity.org/accountability/fraud-abuse-found-in-nasa-research-funding-to-small-companies-2/>.

on, and killed by, the SBIR/STTR process. Second, there is “The Valley of Death,” characterized by the massive gap in funding between Phase II and Phase III awards. Phase II awards are theoretically designed to set up the individual or company for commercialization under Phase III. Phase III awards properly require companies to contribute substantial private money to demonstrate a commercialization path. But the money available in Phase II is insufficient to allow the individual to both meet the technical challenges of commercialization, and time and financial breathing room to go out into the private markets (debt or equity) to obtain the necessary matching funding to survive “The Valley of Death.” NASA should work with other research agencies and with the private sector to identify ways to avoid these two “Deaths,” and advocate for legislative change to these research programs.

D. Physical Science Objective 4 (PS-4)

PS-4 suggests that NASA: “Seek new discoveries in physics, including particle physics, general relativity, and quantum mechanics, that can only be discovered by experiments carried out in space.”²⁶

We have significant concerns as to whether this is within NASA’s direct mission or statutory authority.²⁷ Section 102 of the NASA Act established NASA with responsibility over “aeronautical and space activities,” which are defined in Section 103 as “(A) research into, and the solution of, problems of flight within and outside the earth’s atmosphere, (B) the development, construction, testing, and operation for research purposes of aeronautical and space vehicles, and (C) such other activities as may be required for the exploration of space.” NASA needs to better articulate how “particle physics, general relativity, and quantum mechanics,” drive space exploration. If NASA’s role here is to provide the “ride” for scientists to study these issues of fundamental physics, NASA should explain why this research should be funded out of NASA’s budget as opposed to from some other government program. Further, as stated in response to the general Physical Science Goal, the Draft Goals and Objectives document fails to either summarize the state of existing research in this area or provide an adequate roadmap for future research that can gain general public and taxpayer support. Finally, this objective appears to have limited relevance to either the Artemis Program and/or Moon and Mars Objectives, thus subjecting it to the “scientist eating their own” conundrum.

²⁶ Microgravity Strategy at 10.

²⁷ See *supra* Sec. I.

IV. Topic III: Space and Earth Science

NASA's stated goal under this topic is to "Leverage opportunities provided by human-enabled platforms to address high priority space and Earth science questions."²⁸

NASA, especially within the last decade, and certainly during the current administration, has placed great emphasis on "Earth Science," and specifically in monitoring and identifying sources of climate change. As noted in the "Additional Feedback" section below, however, NASA has never clearly explained how researching "Earth Science" is consistent with its statutory mandate contained in Sections 102 and 103 of the NASA Act to conduct research into the problems of space travel.²⁹ It is further unclear whether Congress, in amending NASA's authority in 2010 to conduct "upper atmosphere" research,³⁰ granted the necessary authority for NASA to conduct full "Earth Science" research, given that 51 U.S.C. § 20162 defines "upper atmosphere" as "that portion of the Earth's sensible atmosphere above the troposphere." NASA should provide a more detailed analysis of whether it has statutory authority to conduct the full panoply of "Earth Science" research subsumed within this goal.³¹

V. Topic X: International Cooperation

NASA's stated goal under this topic is to "Champion broad and aspirational international participation in low Earth orbit by a diverse set of providers and users (government and non-government) to foster innovation, achieve NASA science and exploration goals, and maintain a strong, U.S.-led international presence in low Earth orbit."³²

NASA's statutory authority as it relates to foreign relations, diplomacy, and international cooperation in space is limited.³³ The 1958 NASA Act, Section 205, states: "The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to the Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate."³⁴ All too often, NASA has considered itself the master of the domain of outer space

²⁸ Microgravity Strategy at 11.

²⁹ NASA Act, Pub. L. No. 85-568, § 102-3, 72 Stat. 426 (1958) (codified at 42 U.S.C. § 2451 et seq.).

³⁰ Pub. L. No. 111-314, § 20161, 124 Stat. 3354 (2010).

³¹ TechFreedom did not provide responses to the two objectives under this category.

³² Microgravity Strategy at 18.

³³ *See supra* Sec. I.

³⁴ NASA Act, Pub. L. No. 85-568, § 205, 72 Stat. 426 (1958) (codified at 42 U.S.C. § 2451 et seq.).

and has conducted international diplomatic operations beyond this authority.³⁵ TechFreedom initially was critical of the Artemis Accords, because NASA was moving out without a clear directive from the White House and the State Department to craft this multilateral agreement.³⁶ In that instance, the State Department conducted a masterful “back and fill” campaign, and have now embraced the Artemis Accords, essentially adopting them as their own.³⁷

NASA should not make the same mistake of thinking that it can conduct directly foreign policy missions as part of its LEO Microgravity Strategy. Instead, it must work through the White House, and via direction from the National Space Council and the State Department, in all matters related to foreign cooperation and diplomacy. Its failure to do so could produce disastrous results.

A. International Cooperation (IC-1)

IC-1 seeks to: “Define new pathways to partnership in low Earth orbit: government-to-government, industry-to-industry, and government-to-industry, and ensure these pathways are adaptable as low Earth orbit activities evolve over time.”³⁸

Consistent with the general response above, NASA must be careful not to overstep its statutory authority. For instance, NASA’s ability to engage in government-to-government “partnerships” is wholly dependent on the location of such a partnership. On the ISS, NASA is one of the “cooperating agencies” under the ISS Intergovernmental Agreement (IGA).³⁹ But that position was a direct delegation of the role from the United States government as a whole and is clearly embodied in that document.⁴⁰ For facilities other than the ISS, however, NASA does not have such a clear delegation, and thus lacks statutory authority to directly engage

³⁵ See, e.g., Matt Berg, *Meet Washington’s shadow diplomat. Spoiler ... it’s NASA*, POLITICO (Nov. 11, 2023), <https://www.politico.com/news/2023/11/11/meet-washingtons-shadow-diplomat-secret-its-nasa-00125298>.

³⁶ See Press Release, TechFreedom, *Artemis Accords: One Small Step for NASA, Not So Giant a Leap for Space Law* (May 15, 2020), <https://techfreedom.org/artemis-accords-one-small-step-for-nasa-not-so-giant-a-leap-for-space-law/>.

³⁷ See *Artemis Accords*, U.S. DEP’T OF STATE, <https://www.state.gov/artemis-accords/> (last visited Oct. 3, 2024).

³⁸ Microgravity Strategy at 18.

³⁹ International Space Station Intergovernmental Agreement, art. 4, Jan. 29, 1998, T.I.A.S. 12927, <https://www.state.gov/wp-content/uploads/2019/02/12927-Multilateral-Space-Space-Station-1.29.1998.pdf> (“IGA”).

⁴⁰ See, e.g., IGA art. 12 (“The United States, through NASA”).

in “government-to-government” relations without “the foreign policy guidance of the President.” Indeed, NASA is not even mentioned in the Artemis Accords (other than on the signature line, which brings into question whether the document has any legal authority).

When it comes to “government-to-industry” relationships, NASA must continue to follow policies that clearly identify the roles of government and industry and not allow the government to compete directly with industry.⁴¹

B. International Cooperation (IC-2)

IC-2 seeks to: “Cultivate mutually beneficial government-to-government international partnerships that enhance the effectiveness of NASA programs and advance U.S. national interests.”⁴²

See response to prior objective.

C. International Cooperation (IC-3)

IC-3 seeks to: “Drive the creation of robust low Earth orbit capabilities by encouraging international governments, industry, and research organizations to engage with U.S. industry.”⁴³

NASA plays a vital role as a catalyst and rapporteur for outer space development. That is within its core statutory authority to conduct “research into, and the solution of, problems of flight within and outside the earth’s atmosphere.”⁴⁴ Because NASA has spent so long as the center of gravity of outer space exploration, it can bring together others to further the goals of space development. NASA should continue to hold workshops and other gatherings to bring together world experts. Remember, NASA was formed during the U.N.’s International Geophysics Year (IGY) in 1958, an unprecedented time for scientific development. Continuing this approach is within NASA’s core mission. Conducting space operations, and especially attempting to mold a space economy, strays further and further away from this mission and statutory authority. Also, having attended many of these workshops and meetings, NASA often dominates the conversation and its speakers often are on “broadcast only” mode, extolling the virtues and benefits NASA brings to the table. NASA needs to spend more time in listening mode. Most of the next generation of great ideas for space development will come from industry, not from NASA’s top-down bureaucracy. Ignore the incredible work being

⁴¹ See Moon to Mars Comments, *supra* note 44.

⁴² Microgravity Strategy at 18.

⁴³ *Id.*

⁴⁴ NASA Act, Pub. L. No. 85-568, § 103, 72 Stat. 426 (1958) (codified at 42 U.S.C. § 2451 et seq.).

done by industry, and NASA will slip further down the relevance chain of a growing space economy.

D. International Cooperation (IC-4)

IC-4 seeks to: “Inform the development of laws and regulations in the U.S. and support global legal and regulatory harmonization to enable safe and sustainable collaboration in low Earth orbit.”⁴⁵

The key term here is “inform.” It is not “drive.” It is not “lead.” NASA can play a critical role in providing the technical expertise necessary to develop the critically necessary laws and regulations for the next generation of commercial outer space development.⁴⁶

Take, for instance, the amazing work that has been done over the past few decades by NASA’s Orbital Debris Program Office.⁴⁷ It has “informed” and developed key standards that are being widely adopted throughout the world, such as the U.S. Government Orbital Debris Mitigation Standard Practices (“ODMSP”),⁴⁸ and the development of its Debris Assessment Software (DAS).⁴⁹ The NASA DAS has been adopted by the FCC as the standard metric for demonstrating orbital debris compliance.⁵⁰ Similarly, NASA has played a critical role in the Inter-Agency Space Debris Coordination Committee (IADC).⁵¹

Such technical expertise is clearly within NASA’s “wheelhouse” and part of its statutory authority. It also comports with Congress’s intention for what has now become the National Space Council.⁵² NASA’s statutory authority to craft regulations more broadly that impact

⁴⁵ Microgravity Strategy at 18.

⁴⁶ See generally Continuing U.S. Leadership Testimony, *supra* note 55.

⁴⁷ See *Orbital Debris Program Office*, NASA, <https://orbitaldebris.jsc.nasa.gov/> (last visited Oct. 3, 2024).

⁴⁸ U.S. GOV’T ORBITAL DEBRIS MITIGATION STANDARD PRACTICES, NOV. 2019 UPDATE, https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf.

⁴⁹ *Debris Assessment Software (DAS) v. 3.2.6*, NASA TECH. TRANSFER PROGRAM, <https://software.nasa.gov/software/MS-26690-1> (last visited Oct. 3, 2024).

⁵⁰ See *Orbital Debris*, FED. COMM’NS COMM’N (Feb. 21, 2024), <https://www.fcc.gov/space/orbital-debris> (“NASA’s Debris Assessment Software (DAS) provides a tool, ideally used during spacecraft design, that enables applicants to address many of the requirements in the Commission’s rules.”).

⁵¹ See *What’s IADC*, INTER-AGENCY SPACE DEBRIS COORDINATION COMM., https://iadc-home.org/what_iadc (last visited Oct. 3, 2024).

⁵² NASA Act, Pub. L. No. 85-568, § 201, 72 Stat. 426 (1958) (codified at 42 U.S.C. § 2451 et seq.).

commercial space operations and the development of a space economy is far less clear. While Section 203 of the NASA Act provides authority to “make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law,” courts, in interpreting the extent of this authority must now analyze what “powers vested in it by law” means. Given the limited overall scope of NASA statutory authority under Section 103, courts could well determine that NASA’s regulatory authority take the form of “housekeeping” rules, i.e., rules that impact NASA’s internal operations.⁵³

CONCLUSION

TechFreedom appreciates the opportunity to respond to NASA’s Microgravity Strategy. In crafting its overall strategy, however, NASA must be mindful that its statutory authority is not unlimited. It, like every other agency, must adhere to its statutory mandate.

We will remain engaged in this process and look forward to providing future input on these critical issues which are vital to opening the space frontier.

Respectfully submitted,

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⁵³ See J. Dunstan, *Regulating Outer Space*, *supra* note 777, at 44.