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Reactors on Bases, Reactors in Orbit: Challenges and Opportunities for Nuclear Power Applications in the Space and Defense Sectors

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INTRODUCTION

Recent federal policy is putting renewed focus on nuclear power, and that focus now reaches beyond the terrestrial grid into space. Two needs are driving such policy. As space exploration proceeds, sustained operations require reliable power even when solar energy is unavailable. On the ground, critical military infrastructure requires secure power that does not depend on frequent refueling, a vulnerable grid or diesel backup. Strategic competition, such as the announcement of a planned China-Russia lunar reactor, has added urgency for both.[1]

Executive action and interagency initiatives have turned these needs into concrete mandates through several federal space and military nuclear power development programs.[2] As a result, nuclear power for such innovative applications is moving from the laboratory to the procurement pipeline, creating new opportunities across U.S. space and defense sectors.

KEY INITIATIVES

1 https://www.nasa.gov/wp-content/uploads/2025/08/nasa-fsp-directive-aug42.pdf.

2 *See, e.g.*, https://www.whitehouse.gov/wp-content/uploads/2026/04/NSTM-3-2026_04_14-corrected.pdf.

Power and Propulsion in Space. While power generated by the decay of radioactive isotopes has long been used for space missions, there is growing interest in recent years in using nuclear fission to generate larger amounts of power for sustained operation in space, both for stationary applications on the moon (known as "fission surface power" or "FSP"), and for nuclear propulsion.

The U.S. has been actively pursuing FSP since at least 2022, with multiple contracts awarded to potential suppliers.[3] The National Aeronautics and Space Administration ("NASA") and the Department of Energy (the "DOE") signed a memorandum of understanding in January 2026 renewing their mutual commitment to jointly develop a lunar fission surface power system.[4] In the area of nuclear electric propulsion ("NEP"), the Space Force and Air Force are pursuing the Joint Emergent Technology Supplying On-Orbit Nuclear Power ("JETSON") program.[5] NASA also plans a late-2028 demonstration as part of a mission to Mars. This mission, Space Reactor-1 Freedom, will use a NASA-designed reactor fueled with high-assay low-enriched uranium ("HALEU").[6]

Earlier this year, at the direction of the President, the White House Office of Science and Technology Policy announced the National Initiative for American Space Nuclear Power.[7] Key elements include:

- NASA's development of a **20 kilowatt-electric reactor**, with a lunar FSP variant ready for launch by 2030 with an option for an NEP variant;
- Deployment by NASA of **higher-power reactors by the 2030s** by leveraging private innovation and narrowing the field to no more than two designs within a year; and
- Development by the Department of Defense (the "DOD"; now also called the Department of War) of a **mission-enabling space reactor** by 2031, subject to funding.

Power for Terrestrial Military Bases. In August 2026, the Army and the DOD's Defense Innovation Unit (the "DIU") selected several companies to own, build, and operate microreactors at five domestic military installations as part of the Janus Program, a public-private initiative to provide secure, constant, and off-grid power to the Army.[8] Separately, the DIU is working with the Air Force under its Advanced Nuclear Power for Installations initiative to partner with private companies and build the Air Force's microreactor capabilities.[9] Most recently, the Navy announced the selection of Radiant to deploy its microreactor to supply power at a base in Indiana.[10]

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3 *See, e.g.*, https://www.nasa.gov/news-release/nasa-announces-artemis-concept-awards-for-nuclear-power-on-moon/; https://info.westinghousenuclear.com/news/westinghouse-awarded-nasa-doe-contract-to-continue-development-of-space-microreactor-concept.

4 https://www.energy.gov/articles/us-department-energy-and-nasa-develop-lunar-surface-reactor-2030.

5 https://www.world-nuclear-news.org/articles/nuclear-companies-sign-up-for-space-technology-mis.

6 https://world-nuclear-news.org/articles/nasa-aims-for-nuclear-powered-mars-mission-in-2028.

7 https://www.whitehouse.gov/wp-content/uploads/2026/04/NSTM-3-2026_04_14-corrected.pdf.

8 https://www.world-nuclear-news.org/articles/us-army-selects-five-microreactor-vendors-to-power-bases.

9 https://breakingdefense.com/2026/04/department-of-air-force-picks-bidders-for-nuclear-microreactors-assigns-locations/.

10 https://world-nuclear-news.org/articles/radiant-microreactor-selected-for-deployment-by-us-navy.

Why it matters: Across these initiatives, the government is turning to private companies to design, build and, in some cases, own and operate reactors. As these programs develop, so do the opportunities for the private sector.

SUPPLY CHAIN CHALLENGES

The availability of adequate nuclear fuel is a principal supply-chain constraint for both terrestrial and space initiatives. Along with most advanced reactor designs for terrestrial applications, space nuclear power designs rely on HALEU, which provides more power for a given weight of fissile material, yet Centrus Energy ("Centrus") is the only U.S. producer of such fuel.[11] With Centrus's capacity at about one metric ton per year against DOE-projected demand of up to 50 metric tons per year by 2035, DOE is working with Centrus to increase domestic HALEU production.

REGULATORY AND LEGAL CONSIDERATIONS

Regulatory Jurisdiction. Which agency has jurisdiction depends on the nature of the project. The Nuclear Regulatory Commission (the "NRC") licenses commercial reactors and nuclear materials and is comprehensively revising its regulations in response to Executive Order 14300. The DOD and DOE generally retain jurisdiction over their own projects, although the Air Force has chosen to rely on NRC licensing for its microreactor project at Eielson Air Force Base.[12] On October 22, 2026, the NRC finalized a rule which will allow applicants for commercial licenses to leverage prior DOE or DOD reviews in applications for NRC licenses for commercial operations.[13]

Export Controls. The NRC licenses exports of reactors, components, and material, and the DOE controls exports of nuclear technology. Items designed for military or space use may also be subject to the International Traffic in Arms Regulations (the "ITAR"), and dual-use items are subject to the Export Administration Regulations (the "EAR").

Nuclear Liability. For potential nuclear accidents, the DOE has authority to indemnify its contractors under the Price-Anderson Act, but other agencies, such as NASA and the DOD, have more limited authority under Public Law 85-804. There is as yet no precedent for applying these authorities to space fission power systems, and there are no clear and established processes for handling nuclear liability for privately sponsored space missions.

Approval Jurisdiction for Space Missions. The U.S. government has regulatory processes for space nuclear projects, but applying such processes to fission power systems will raise novel questions of application. In general, for U.S. government space projects, National Security Presidential Memorandum-20 ("NSPM-20") establishes an Interagency Nuclear Safety Review Board, with representatives from the DOD, the DOE, the Department of State, the Federal Aviation Administration (the "FAA"), the Environmental Protection Agency, NASA, and the NRC.[14]

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11 https://www.reuters.com/business/energy/us-federal-grants-help-jumpstart-nuclear-fuel-supply-chain--reeii-2026-02-24/; https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-fuel-cycle.

12 https://www.eielson.af.mil/microreactor/.

13 https://www.nrc.gov/docs/ML2629/ML26295A067.pdf.

14 https://www.nrc.gov/education-regulatory-research/research/navigating-space-nuclear-safety-the-role-of-the-nuclear-regulatory-commission.

NSPM-20 also sets a three-tier launch authorization process tied to the system's characteristics, the level of potential hazard, and national security considerations.[15] For example, for fission systems, missions fueled with:

- **Low-enriched** uranium **(including HALEU)**: generally require middle-tier interagency review; and
- **Other fuels (including highly enriched uranium)**: require highest-tier review and presidential approval.

The FAA licenses commercial space nuclear launches, but may consult with the NRC and other agencies, while the possession of nuclear material on the ground remains subject to traditional regulation under the Atomic Energy Act, either by the NRC itself or through delegation to an Agreement State.[16]

Why it matters: Regulatory jurisdiction, export classification and indemnity availability can each affect project timing and risk allocation. Space fission systems add further uncertainty: processes that are well-established for radioisotope power systems are likely to raise practical and regulatory issues of first impression when applied to fission, and it remains an open question how treaties assigning responsibility for radioactive waste to the country of origin will apply.

OPPORTUNITIES

Increased Capital Flows. Government commitments are now large enough to anchor private investment. The Janus Program alone carries up to $2.2 billion in milestone-based funding over fiscal years 2027 through 2031, with individual private awards worth up to $750 million.[17] The Idaho National Laboratory has estimated that achievement of NASA's FSP initiative will require up to $3 billion in investment over five years.[18] Private capital is following. Nuclear fission companies raised a record $1.3 billion in equity by the third quarter of 2025, mainly for small modular reactors and microreactors.[19] As of late July 2026, global venture funding for fission and fusion startups had exceeded $4.5 billion, on pace to surpass 2025's $6.2 billion record.[20] Several companies specifically involved in space nuclear activities have also raised substantial capital in the past year.[21]

Expanding Market Participation. The resulting transaction universe is broad, drawing a wide range of companies into the market. Key participants include:

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15 https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-launch-spacecraft-containing-space-nuclear-systems/.

16 https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1042239.

17 https://www.militarytimes.com/industry/techwatch/2026/08/26/us-army-taps-5-firms-to-build-on-base-microreactors-in-nuclear-energy-push/.

18 https://inl.gov/content/uploads/2023/07/strategic-options-space-nuclear-leadership.pdf.

19 https://www.powermag.com/advanced-nuclear-developers-raise-new-capital-as-2025-investment-hits-record-levels-and-demonstrations-near/.

20 https://www.axios.com/2026/07/28/nuclear-energy-venture-capital/.

21 https://finance.yahoo.com/news/nano-nuclear-energy-closes-400-162000444.html; https://www.bloomberg.com/news/articles/2026-04-24/amazon-backed-nuclear-firm-x-energy-raises-1-02-billion-in-ipo.

- **Reactor designers and** suppliers, both established and emerging, who are scaling up;
- **Aerospace and defense contractors**, who are competing for prime and subcontract roles, including developing and supplying control and power conversion modules for transportable reactors;
- **Nuclear service companies**, including those involved in supply chain, operations and maintenance, transport, and decommissioning, who are drawing strategic and sponsor interest; and
- **Specialty component makers**, such as those for specialty-alloy products, who are acquisition targets.[22]

New Capital Needs. As these companies multiply and expand, they also need significant outside capital. Among capital providers, private equity and infrastructure sponsors are already active, and fourteen major banks and financial institutions have endorsed the goal of tripling global nuclear capacity set out in COP28's Declaration to Triple Nuclear Energy.[23] With these recent developments in nuclear power across the U.S. space and defense sectors, investors and lenders who move early will be in the best position to capture these opportunities.

This note is provided for informational purposes only and does not constitute legal advice.

[22] https://energycapitalhtx.com/pelican-energy-veridiam-acquisition.

[23] https://www.prnewswire.com/news-releases/14-major-global-banks-and-financial-institutions-express-their-support-for-effort-to-triple-nuclear-energy-by-2050-302255609.html.

If you have any questions regarding this client alert, please contact the following attorneys or the Willkie attorney with whom you regularly work.

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