



# Nuclear space power and propulsion systems

What is NASA's Space Nuclear Propulsion project?

NASA's space nuclear propulsion project is led by the agency's Space Technology Mission Directorate and funded through its Technology Demonstration Missions program based at NASA's Marshall Space Flight Center in Huntsville, Alabama.

Why are nuclear propulsion systems important?

Nuclear propulsion systems can also provide much higher power for onboard instruments and communication systems, which can be especially beneficial as the spacecraft travels farther from the Sun where the ability to harness solar power becomes impractical.

What is space nuclear propulsion (SNP)?

Space Nuclear Propulsion (SNP) is one technology that can provide high thrust and double the propellant efficiency of chemical rockets, making it a viable option for crewed missions to Mars.

Will NASA develop nuclear thermal propulsion technology in 2027?

"NASA will work with our long-term partner, DARPA, to develop and demonstrate advanced nuclear thermal propulsion technology as soon as 2027. With the help of this new technology, astronauts could journey to and from deep space faster than ever - a major capability to prepare for crewed missions to Mars," said NASA Administrator Bill Nelson.

Which DOE facilities support NASA's Space Nuclear Propulsion project?

The project, also at Marshall, collaborates with DOE to advance the key technologies needed for future human missions to Mars. DOE facilities supporting NASA's space nuclear propulsion project include Idaho National Laboratory, Oak Ridge National Laboratory, and Los Alamos National Laboratory.

How does space nuclear propulsion work?

Space nuclear propulsion draws energy from atomic fission reactions instead of traditional chemical reactions, thus providing comparatively unlimited energy and opening the door for robust and enduring access throughout the solar system.

Space Nuclear Power and Propulsion at USNC-Tech Paolo Venneri \* and Michael Eades USNC-Technologies Received January 30, 2021 ... (USNC-Tech) is an advanced nuclear company focused on developing space nuclear power and propulsion systems to enable high-impact science missions and the growth of a self-sustaining in-space economy. As a subsidiary ...

nuclear fusion space propulsion system concept was predicated on a spherical torus reactor, which enabled manned missions to the outer planets in less than one year. Moderate thrust levels (1,000's lbf) from direct



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nuclear fusion exhaust plasma via ...

Nuclear reactors have the potential to provide high energy density to enable sustainable surface power and advanced propulsion methods needed for human exploration activities at the moon and mars.

The first flight of a modern, useful space fission system will be a tremendous first step towards the development and utilization of highly advanced space fission systems - comparable to the evolution from the DC-3 to the super-fast, high-altitude, record-setting SR-71 Blackbird, the most advanced airplane ever built in relation to the ...

For a start, it is this author's opinion to limit future uses of space nuclear power and propulsion systems to strictly peaceful and civilian missions that involve contributions among many nations and that would benefit the citizens of the world. In addition, ensuring safe and acceptable end-of-life storage of the deactivated nuclear reactors ...

"Future nuclear power and propulsion systems will help revolutionize our understanding of the solar system and beyond and play a crucial role in enabling long-term ...

Space nuclear propulsion systems could enable shorter total mission times and provide enhanced flexibility and efficiency for mission designers. To keep the round-trip crewed mission duration to about two years, at a minimum, NASA is looking at nuclear-enabled transportation systems to facilitate shorter-stay surface missions.

If all goes to plan, Ultra Safe Nuclear will demonstrate EmberCore, a chargeable, nuclear radioisotope battery useful for propulsion and power. "This "next-gen" radioisotope system will be able to ...

Nuclear thermal propulsion (NTP) systems occupy a unique area in the space propulsion technology landscape due to their ability to combine moderate-to-high thrust systems normally seen in chemical propulsion systems with specific impulses that are closer to those observed in some electric propulsion systems.

o Space fission power and propulsion systems are game changing technologies for space exploration. o First generation NTP systems could provide significant benefits to sustained human Mars exploration and other missions. - Imagine Earth-Mars transit times of ...

Hot off the heels of the DRACO announcement in July 2023, Lockheed Martin was awarded \$33.7 million from the Air Force Research Laboratory (AFRL) for the Joint Emergent Technology Supplying On-Orbit Nuclear (JETSON) High Power program to mature high-power nuclear electric power and propulsion technologies and spacecraft design. The JETSON effort ...

The ability to use space nuclear power and propulsion (SNPP) systems safely, securely, and sustainably is



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vital to maintaining and advancing United States dominance and strategic leadership in space. SNPP systems include radioisotope power systems (RPSs) and fission reactors used for power or propulsion in spacecraft, rovers, and other surface ...

The first space nuclear applications worth mentioning are the radioisotope heater unit (RHU) and radioisotope thermoelectric generator (RTG), collectively referred to as radioisotope power systems (RPS). These applications utilize radioactive decay to provide heat and electricity, respectively, allowing spacecraft to operate longer under extreme conditions, such as those ...

NASA, the Department of Energy (DOE), and industry are also developing advanced space nuclear technologies for multiple initiatives to harness power for space exploration. Through NASA's Fission Surface Power project, DOE awarded three commercial design efforts to develop nuclear power plant concepts that could be used on the surface of the ...

command and control for power system functions and operations. Historical Review . Nuclear power systems for NEP applications have been studied extensively, dating back to 1955 when Ernst Stuhlinger published "Electric Propulsion System for Space Ships With Nuclear Power Source" in the Journal of the Astronautical Sciences (Ref. 2).

3 days ago; The newly formed Space Power and Propulsion for Agility, Responsiveness, and Resilience (SPAR) Institute brings eight universities and 14 industry partners--including Ultra ...

Compared with conventional chemical propulsion for the Saturn exploration missions, the payload of 400 kW nuclear power propulsion spacecraft is 8.5 times, and the mission time is less than 1/2 of the Cassini-Huygens spacecraft mission. The nuclear power propulsion spacecraft has a noticeable performance advantage.

The ability to use space nuclear power and propulsion (SNPP) systems safely, securely, and sustainably is vital to maintaining and advancing United States dominance and strategic ...

The government team has selected three reactor design concept proposals for a nuclear thermal propulsion system. The reactor is a critical component of a nuclear thermal engine, which would utilize high-assay low-enriched uranium fuel. ... national technical director for space nuclear power and director of the Space Nuclear Power and Isotope ...

NASA wants to send astronauts to Mars, and they could do it with nuclear-powered rocket engines. Nuclear thermal propulsion (NTP) systems aren't new, but they could significantly reduce travel times and carry greater payloads than today's top chemical rockets; -- giving humans a great chance of exploring deep space.

Space Nuclear Propulsion Statement A: Approved for public release; distribution is unlimited. 11



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Conclusions: Why Nuclear, Why Now? o Space fission propulsion systems are game changing technologies for space exploration and cis-lunar mobility. o First generation NTP systems provide significant benefits to

Future Mars transfer vehicles will need around 400kW-2 megawatts of power to successfully ferry our astronauts or cargo to and from the Red Planet. We're still exploring vehicle and propulsion concepts for Mars, including a combination of nuclear electric and chemical propulsion and other emerging options like Nuclear Thermal Propulsion.

NASA announced Wednesday that it is partnering with the US Department of Defense to launch a nuclear-powered rocket engine into space as early as 2027. The US space agency will invest about...

National Aeronautics and Space Administration Versatile Nuclear Thermal Propulsion (NTP) 3. Potential Nuclear Thermal Propulsion (NTP) Benefits o NTP can reduce cadence and total number of SLS launches. o NTP has potential for reducing cost, increasing flexibility, and enabling faster response times in cis-lunar space. o NTP-derived space ...

Power conversion technologies relevant to space power systems have been identified in a myriad of system studies and development programs at a range of power levels over decades. The most relevant power conversion technologies are as follows: ... A History of Space Nuclear Power and Propulsion in the United States, LLCINL/EXT-15-34409, Idaho ...

"Future nuclear power and propulsion systems will help revolutionize our understanding of the solar system and beyond and play a crucial role in enabling long-term human missions to the Moon and Mars." Space nuclear power to explore the deepest, dustiest, darkest, and most distant regions of our solar system and beyond. ...

A primary driving force is the National Strategy for Space Nuclear Power and Propulsion's (SNPP) Space Policy Directive (SPD)-6 issued on December 16, 2020, ... use of advanced nuclear power and will be a stepping-stone for space nuclear propulsion systems. This report has been prepared in response to Executive Order (EO) 13972, "Promoting ...

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