

framatome
Space

Powering the future of **space** **exploration**



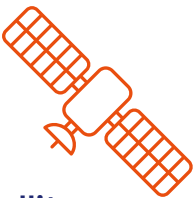
A new era of space exploration...

The space industry is making a spectacular comeback. In 2024, the number of active satellites surpassed 10,000—a sharp rise from just 2,000 in 2020. Humanity is embarking on a new chapter in space exploration.

NASA's ambitious Moon-to-Mars program aims to establish a long-term human presence on the Moon by 2030 and send the first humans to Mars by 2040. Meanwhile, Europe, through the European Space Agency (ESA), is enhancing its capabilities, striving for greater sovereignty and human launch systems.

Space tourism and commercial ventures are also booming. Private companies are making space accessible to a select few, turning the dream of space travel into a reality.

10,000 active satellites in 2024



The European Space Agency (ESA), has historically participated in NASA's ARTEMIS program.



Advancing the space industry with nuclear technology

Nuclear technology is set to revolutionize space travel and exploration. It contributes to the new space race in two main ways:



Nuclear propulsion

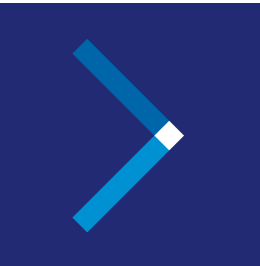
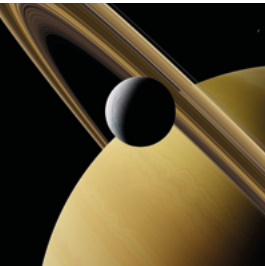
Faster and more efficient than chemical rockets, it reduces travel time to Mars and minimizes astronauts' radiation exposure.



Nuclear power sources

Ensuring a safe and reliable energy supply for spacecraft, rovers and habitats, crucial for long-term missions where solar power is limited.

By providing abundant energy, nuclear technology fosters a growing private space ecosystem with innovative orbital and lunar services.



... new challenges ahead

Missions to the Moon and Mars come with significant hurdles, particularly for extended stays. On the Moon, where each lunar night lasts 14 days and temperatures plunge to -130°C, a reliable, continuous power supply to sustain human life is required. Establishing a life base for long-term habitation hinges on solving these energy challenges.

A round trip to Mars could take up to 24 months, during which astronauts face prolonged exposure to harmful natural radiation.



Reducing travel time and ensuring access to long-lasting power sources are critical to making these missions viable.



KEY MILESTONES

- Transit IV-A (1961)
First nuclear-powered space mission.
- Apollo 12 (1969)
Used a radioisotope generator on the Moon.
- Mars Rovers (Curiosity & Perseverance)
Rely on radioisotope power systems (RPS) for sustained energy.
- Cassini-Huygens mission
Utilized RPS for deep-space exploration of Saturn and its moons.

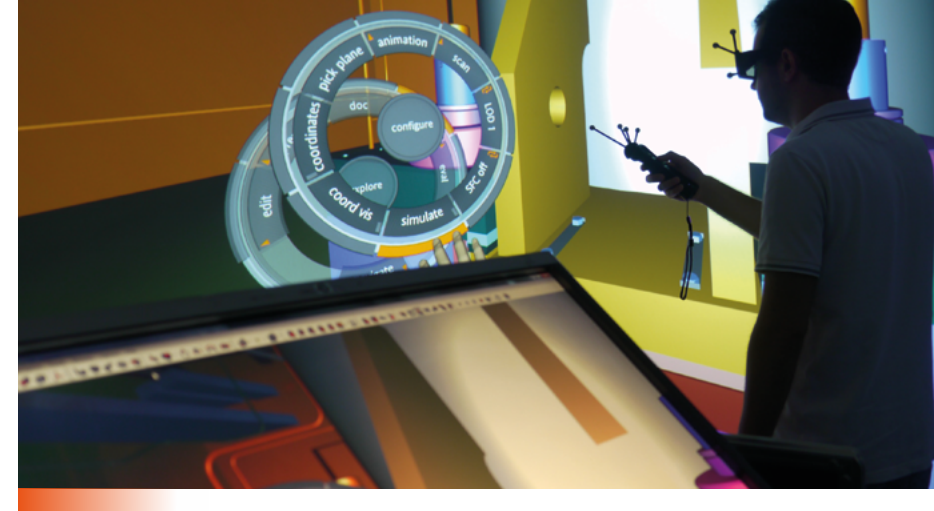


KEY NUCLEAR TECHNOLOGIES IN SPACE

- Radioisotope Power Systems (RPS): generate heat from radioactive decay, used in distant probes and rovers.
- Fission reactors: provide higher power levels for propulsion and electricity, adapted for extreme space conditions.

Our nuclear and industrial expertise at the service of the space industry

With 65 years of experience in the nuclear industry, Framatome Space is uniquely positioned to support the space industry and provide safe and competitive cutting-edge solutions that drive the next generation of space missions.



Nuclear innovations for space

- **Nuclear propulsion:** high-speed, efficient propulsion leveraging our nuclear experience.
- **Radioisotope supply:** reliable power solutions for spacecraft and space habitats, with our CERCA division and Isogen joint venture leading the field.
- **Nuclear space systems:** end-to-end design and industrialization of radioisotope and fission reactor systems, ensuring compliance with the highest safety standards.

Beyond nuclear

- **Advanced manufacturing:** production of critical space components like tank domes and high grade raw materials such as Titanium and Hafnium used for hardened alloys.
- **Research & Development:** continuous innovation to enhance safety and efficiency in nuclear technology for space missions.



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Framatome, a trusted international and industrial partner in the new race to space



65 years of experience in the design and manufacturing of complex nuclear systems

- Advanced reactor design
- Nuclear fuel design and fabrication
- Component manufacturing
- Critical instrumentation and control
- Material and component test and qualification
- Control and inspection



Innovation at the core

Continuous R&D investments to push the boundaries of what's possible in space energy solutions.



Unmatched industrial capabilities

Cutting-edge manufacturing, testing, and certification expertise.



20 000
employees



2.6 billion €
industrial
investment
over 4 years



158 million
per year in
Research &
Development



Serving
more than
380 nuclear
reactors
around the
world

Framatome is an international leader in nuclear energy recognized for its innovative, digital and value added solutions for the global nuclear fleet. With worldwide expertise and a proven track record for reliability and performance, the company designs, services and installs components, fuel, and instrumentation and control systems for nuclear power plants. Its more than 20,000 employees work every day to help Framatome's customers supply ever cleaner, safer and more economical low-carbon energy. Visit us at www.framatome.com, and follow us on X and LinkedIn.

Framatome is owned by the EDF Group (80.5%) and Mitsubishi Heavy Industries (MHI - 19.5%).

At Framatome Space, we are committed to bridging the gap between nuclear and space, pushing the boundaries of innovation and excellence to shape the future. Leveraging our extensive expertise in nuclear technology and our state-of-the-art facilities, our cutting-edge solutions and technological bricks advance the space industry. Our commitment to safety, performance, and reliability makes us a trusted partner in the new race to space.

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