IAEA
International Atomic Energy Agency
Atoms for Peace and Development

(Webinar) Atoms for Space: Nuclear Systems for Space Exploration

Virtual Event

WebEx

15–16 February 2022

Ref. No.: EVT2106125

Agenda

Tuesday 15 February 2022, 15:00–17:00 CET Recording link

15:00–15:30 Progress towards space nuclear power objectives | Mr Vivek Lall (General Atomics Global Corporation)

Plentiful energy will be key to future space exploration and chemical fuel and solar panels are limited in their ability to meet the demands of human deep space exploration. Use of nuclear fission reactors, carrying out continuous chain reactions for many years, is inevitable both for space propulsion and for extraterrestrial surface power. General Atomics was founded in 1955 on the premise of using atomic energy for peaceful purposes, and since our inception, we have been developing nuclear reactors for research, education, radioactive isotopes, power generation and space exploration. At IAEA Atoms for space webinar, we will provide an overview of the space nuclear technologies being pursued by various government agencies in the United States and the significant contributions General Atomics is making towards the advancement of these technologies that will be foundational to the future of operations in space.

15:30–16:00 Developing the VASIMR® Engine Historical Perspective, Present Status and Future Plans | Mr Franklin R. Chang Díaz (Ad Astra Rocket Company)

This talk will cover the technical milestones in the development of the Variable Specific Impulse Magnetoplasma Rocket (VASIMR®) from its early origins in the 1980s at MIT, through its formative years as a NASA project, to its technological maturation at Ad Astra Rocket Company. I will discuss its present status, major challenges, and the company's current plans for full commercial deployment of the technology in support of a rapidly emerging space market.

16:00–16:30 Application of Space Nuclear Power Sources in Moon and Deep Space Exploration Missions in China | Mr Hui Du (Beijing Institute of Spacecraft System Engineering)

An introduction on the application of space nuclear power sources in moon and deep space exploration missions in China will be given. Concepts on innovative missions that can be supported by space nuclear power sources will be proposed. Safety practices of space nuclear power sources in China will be briefly introduced. Challenges of applying space nuclear power sources in moon and deep space exploration missions will also be discussed.

16:30–17:00 Q&A

Wednesday 16 February 2022, 15:00–17:00 CET Recording link

15:00–15:30 Promises and Challenges of Nuclear Propulsion for Space Travel | Mr William J Emrich (NASA)

Crewed interplanetary missions of the future will almost certainly require propulsion systems with performance levels greatly exceeding that of today's best chemical engines. A strong candidate for that propulsion system is the Nuclear Thermal Rocket. Nuclear Thermal Rockets operate by using a nuclear reactor to heat hydrogen propellant to extremely high temperatures and expelling the resulting exhaust through a nozzle to produce thrust. In the early 1970's, a nuclear rocket program was instituted in the United States called Rover/NERVA which resulted in the construction of a number of prototypical nuclear engines, most of which operated quite successfully. While great strides forward were made during the Rover/NERVA program, there surfaced a number of material and thermal problems that were never completely resolved. To operate at maximum efficiency, fuel forms are needed which can withstand the extremely hot and corrosive environment present during nuclear engine operation. Research is currently underway by a number of organizations in the US and elsewhere to address these fuel element design challenges. Work is also underway to investigate ways in which a nuclear reactor may be integrated into an overall rocket engine system that can safely and quickly transport spacecraft throughout interplanetary space.

15:30–16:00 Fusion Propulsion and Power for Advanced Space Missions | Ms Stephanie Thomas (Princeton Satellite Systems)

Fusion power is the key to scaling up space exploration into the multi-MW level, allowing larger payloads to reach destinations faster and powering industrial-scale settlements and operations. Our talk will give an overview of missions enabled by nuclear fusion propulsion including human Mars missions, lunar base resupply, asteroid resource utilization, and missions into deep space including interstellar. We will also discuss Lunar and Mars surface power plants. Fusion systems for space need to be compact, and as an example we will introduce Direct Fusion Drive, a fusion propulsion technology based on the compact Princeton Field Reversed Configuration. The talk will cover all of the critical subsystems including superconducting coils and power conversion as well as the current status of the technology and future plans.

16:00–16:30 NASA Investments in Space Nuclear Fission Technology | Mr Anthony Calomino (NASA)

Nuclear fission technology offers a wide range of capabilities to support NASA space missions and active investments for power and propulsion are planned for near-term and future missions. Nuclear powered systems are considered enabling for space missions and offer critical capability where conventional forms of energy production are impractical or impossible due to mass constraints, mission duration, or distance from the Sun. Radioisotope powered devices have been used by NASA for over sixty years on several human and robotic applications resulting in successful missions that have led to new discoveries in space and on other planetary surfaces. Future missions will need higher power levels where fission results in lower mass and higher energy density systems having the potential for a sustained human presence in space. Nuclear propulsion offers propellant efficient spacecraft for cis-lunar and deep-space missions, and fission power system will enable long-duration lunar surface operations with extended application for Mars.

16:30–17:00 Q&A