

Track II: Fission Power and Propulsion

Panel Session: Path Forward for Fission Power Systems

Session Chair: L. Mason, NASA Glenn Research Center

Session Description: The history of space fission power systems has included many program starts and stops, and only one U.S. flight system launched into space. The object of this panel session was to tap the knowledge of several “grey beards” who have participated in these programs and to learn what steps should be taken to secure a successful outcome. The session will include short presentations by the panelists on establishing mission pull, essential building blocks for a successful program, the relationship of government and industry, and lessons from our past. Following the presentations, the audience joined in a lively discussion with the panelists to debate the best path forward for space fission power.

Panelists:

J. Nainiger, Alphaport Inc.

S. Bhattacharyya, RENMAR Enterprises Inc.

S. Bailey, Bailey Engineering and Management Inc.

A. Weitzberg, Consultant

Summary:

The session started with a short overview by the chair, Lee Mason, of three potential NASA applications for fission power including outer planet space science (1-10 kWe), fission surface power (10-100 kWe), and nuclear electric propulsion (100 kWe and above). This provided a requirements backdrop for the panelists to explore the programmatic and technical elements needed for a successful program.

Joe Nainiger led off the panel presentations with a review on how to establish mission pull. He started with a definition of “mission pull,” presenting the Jupiter Icy Moons Orbiter (JIMO) mission as an example. He identified several key factors that are needed:

- 1) overwhelming evidence of mission benefits,
- 2) affordable development costs,
- 3) responsive and educated senior leadership,
- 4) close collaboration between system developers and mission developers, and
- 5) fully committed mission managers.

He did note that JIMO satisfied most, but not all of these conditions, which may have contributed to its demise.

Sam Bhattacharyya followed with a summary of the required building blocks for a fission program. His advice was to follow a long term strategic vision and maintain a base research and technology effort that could adapt to mission priorities and budget realities. He described the concept of “off-ramps” to deploy systems that match mission needs. His primary message was to start simple, maximize the use of existing technology, and bootstrap the capabilities upward as experience is gained.

Sterling Bailey addressed the importance of a good relationship between government and industry in achieving a successful program. He described the role for government as leading technology maturation and architecture studies, and managing the use of Special Nuclear Materials. Industry's role would focus on detailed design, qualification, and production of fission systems including the proper amount of quality assurance/quality control. He explained that programmatic risks could be minimized by clear definition of roles, common goals, proactive management, and effective systems engineering.

Abe Weitzberg concluded the panel presentations with a history lesson, suggesting that the path forward is also the path backward. He explained that essentially all the technology that would be needed to field a fission power system has been worked previously. The principal challenges that remain are predominantly "non-nuclear" and lie in the areas of system integration, power conversion, and heat rejection. He explicitly renounced the need for a full power reactor ground test, stating that the data can be better obtained from hot and cold critical testing. He believes that the technical objectives for a full power reactor ground test have not been elucidated and that in-space operating conditions cannot be accurately duplicated given current testing constraints.

After the presentations, comments and questions were solicited from the audience. Some ideas that were expressed included:

- 1) the need for nuclear testing to help train the current generation of engineers,
- 2) the benefits of international collaboration in conducting a space fission program,
- 3) the potential and pitfalls of private sector funding, and
- 4) the critical role played by universities in supporting research and preparing students for the workplace.

The general consensus was that the panel session was very informative and thought-provoking.