

How To Establish A Mission Pull

The Path Forward for Fission Power Systems

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Definition of Mission “Pull”

- A situation where a mission (or set of missions) needs a new technology or system because it can not be accomplished without that critical or enabling technology (or set of technologies)
 - Implies that the mission(s) is seeking a solution to a difficult/intractable problem
- Opposite of technology “push” (aka, “if we (technologists/developers) build it, they (mission planners/designers/project managers) will come”)
 - Implies a solution in search of a problem to solve

Why is Mission Pull So Difficult to Establish?

- Mission planners and mission decision makers
 - In most cases are unaware of technology advances that may benefit them and their missions
 - Are risk averse
- Limited mission budgets
- Who pays for taking a promising enabling technology from Technology Readiness Level (TRL) 6 to TRL 9 (bridging the so called “Valley of Death”)?



Here Lies Technology (INSERT YOUR TECHNOLOGY NAME HERE)
“It would have enabled a lot of missions if someone had funded it!”

JIMO Was an Example of Mission Pull (Kind-of)

- The Jupiter Icy Moons Orbiter (JIMO) was a proposed spacecraft designed to explore icy moons of Jupiter
 - The main target was Europa (still today a primary target for planetary scientists)
 - Ganymede and Callisto were also targets of interest for the probe.
- The use of nuclear propulsion (in this case, nuclear (fission) electric propulsion (NEP)) was the only solution to accomplish the ambitious JIMO objectives
 - The only way to reach and orbit all three targets in a single mission/spacecraft
 - Providing a thousand times the electrical output of RPS based power systems, the fission reactor was expected to open up opportunities like flying a full scale ice-penetrating radar system and providing a strong, high-bandwidth data transmitter.
- Once developed, future missions using nuclear propulsion and power were expected to open up unprecedented opportunities for future planetary science exploration

Nuclear propulsion (in this case NEP) was recognized as a “game changer”: as a system capability that would revolutionize both where a spacecraft could go and the amount and kinds of science that could be obtained

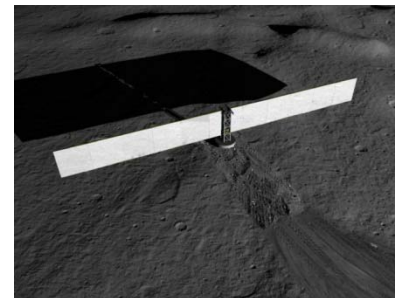
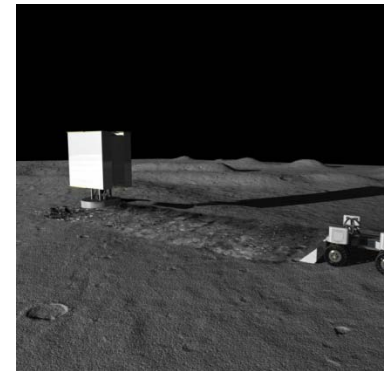
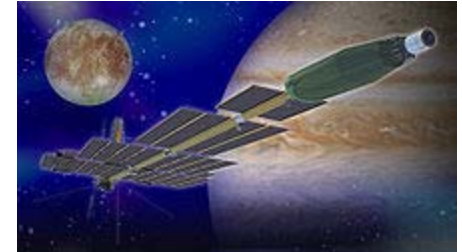
Why Was JIMO Different?

- Systems/mission analyses indicated the benefits and vastly superior science yield from implementing a nuclear propulsion system
- Senior leadership recognized the revolutionary, game changing potential of a nuclear fission system
- Those same leaders were willing to take the risk and provide the resources to develop the nuclear system
- Trusted and respected mission project managers, who also recognized the impact of nuclear systems, were willing to lead the charge

The above offers some clues
on how to obtain mission
“pull”

What are the possibilities (missions) for Fission Power?

- **Outer Planetary Science Missions**
 - Power source
 - For science instruments
 - For high data rate communications
 - Nuclear Electric Propulsion for Flagship science missions (ala JIMO)
- **Human Exploration**
 - Planetary surface power
 - Habitats
 - In-situ Resource Utilization
 - Power rich environment for human habitation and exploration
 - Nuclear Electric Propulsion for large cargo transfers



Observations

How to Establish a Mission Pull

- The benefits of the nuclear system must be shown in the context of a mission architecture
 - Those benefits must be overwhelming and compelling
- Development costs must be “affordable”
- Senior leaders need to be educated in the nuclear systems and be made aware of the benefits derived from them
- The nuclear developers need to work closely with the mission developers in the very earliest stages of mission formulation
- Mission project managers must be totally committed to the development and use of the nuclear system