The Path Forward for Fission Power Systems

What Are The Critical Building Blocks?

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Introduction

• Framing the Problem
  Fission Power Systems
    - Demonstrated to work on Earth
    - Have been operated in Space
    - Known to enhance exploration/base capabilities

So why have they not been used?

• Need to understand and address issues
MAJOR ISSUES

• Demanding Requirements Imposed
• Long time-constant for Nuclear Development
• No “base technology” program
• No “compelling” missions; public indifference
• No sustained space nuclear program
• Perception of increased risk with nuclear
• Government Funding Complications
• No High Level Champion
APPRAOCH

• Ideally
  Follow a long term strategic vision
  Sustained technology development
  Off-ramps to deploy systems to match mission needs
  Feedback from operational experience
  Continuous upgrade of capabilities

• Practically
  Adapt to realities of priorities, budgets
  Use Critical Building Blocks in scaled down vision
Critical Building Blocks

• Reformulate Strategy
  Long term view and commitment
  Start Modest
  Bootstrap capabilities upwards

• Modest Initial Mission
  Goal is to initiate process
  No attempt to prove all attributes
Critical Building Blocks (Cont)

• **Benign System Requirements**
  
  Corollary to above
  
  Very high probability of success
  
  Significant margins

• **Large Existing Data Base**
  
  Nearly full test matrix
  
  Minimize development program
  
  Maximize probability of success
Critical Building Blocks (Cont)

- **Use of SOA Design Methods**
  - Validated against operating reactors
  - Use of latest computing/simulation

- **Robust, Flexible Reactor Designs**
  - Large Design/Safety Margins
  - Adaptable Control System
Critical Building Blocks (Cont)

- **Maximize Non-Nuclear Testing**
  - Component Development
  - Mechanical/thermal properties
  - Reactor Thermal Simulator
  - Thermo-mechanical Couplings
  - Integrated Systems Tests
Critical Building Blocks (Cont)

• **Focused Nuclear Testing**
  - Confirmatory fuel/clad/materials irradiations
  - Confirmatory materials rad exposure
  - Cold Criticals (criticality, control worths etc)
  - Hot Criticals
  - Acceptance Testing (Criticality, control motion)

• **Full-up Ground Test?**
  - Incremental data generation/risk reduction
  - Incremental cost/risk incurred
Critical Building Blocks (Cont)

• **In-situ Startup as part of Development**
  Methodical Approach-to-critical
  Verify control/safety parameters
  Fine tune control algorithms

• **Use Subsequent Missions**
  Evaluate Operational Data
  Incremental Technology Development
  Bootstrap capabilities up
SUMMARY

Reformulate Strategy

Focused Nuclear testing

Benign System Requirements

Large Existing Data Base

Use of SOA Design Methods

Robust Flexible Reactor Design

Maximize non-nuclear testing

In-Situ Startup Development Item

Full-up Ground Test?

Use of Subsequent Missions

Modest Initial Mission

Reformulate Strategy

Use of Subsequent Missions

In-Situ Startup Development Item

Full-up Ground Test?

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Maximize non-nuclear testing

Robust Flexible Reactor Design

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