The Path Forward for Fission Power Systems

What Are The Critical Building Blocks?

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Introduction

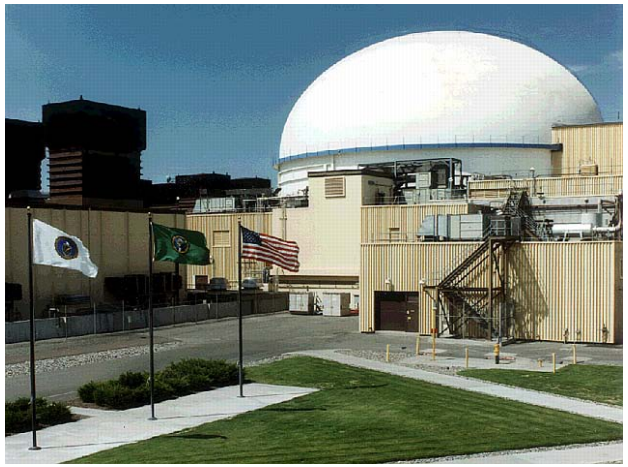
- Framing the Problem

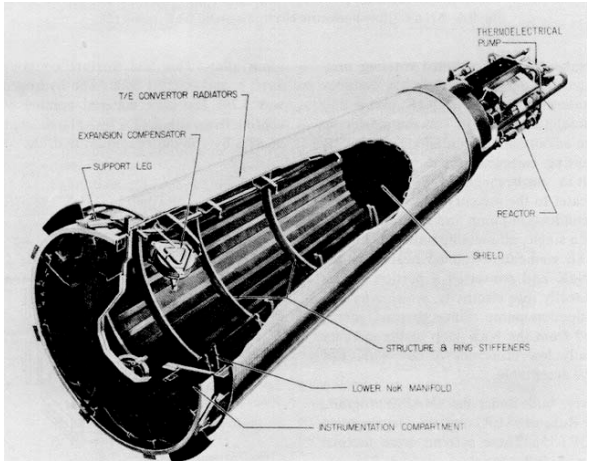
  Fission Power Systems

  - 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

APPROACH

- 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)

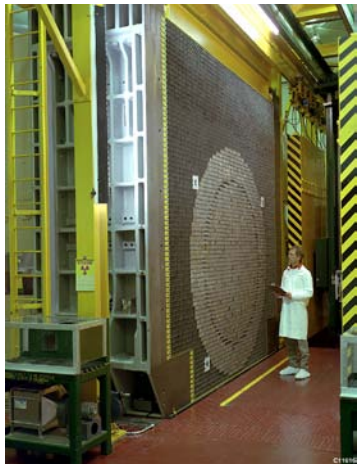
- **Benign System Requirements**
  - Corollary to above
  - Very high probability of success
  - Significant margins
- **Large Existing Data Base**
  - Nearly full test matrix
  - Minimize development program
  - Maximize probability of success

Critical Building Blocks (Cont)

- **<u>Use of SOA Design Methods</u>**

  > Validated against operating reactors

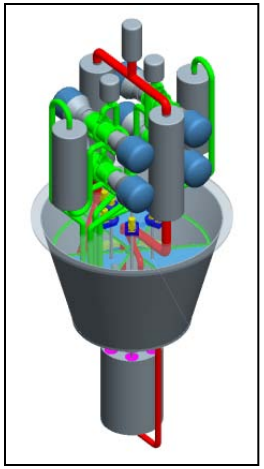
  >Use of latest computing/simulation



- **<u>Robust, Flexible Reactor Designs</u>**

  > Large Design/Safety Margins

  >Adaptable Control System



Critical Building Blocks (Cont)

- **Maximize Non-Nuclear Testing**

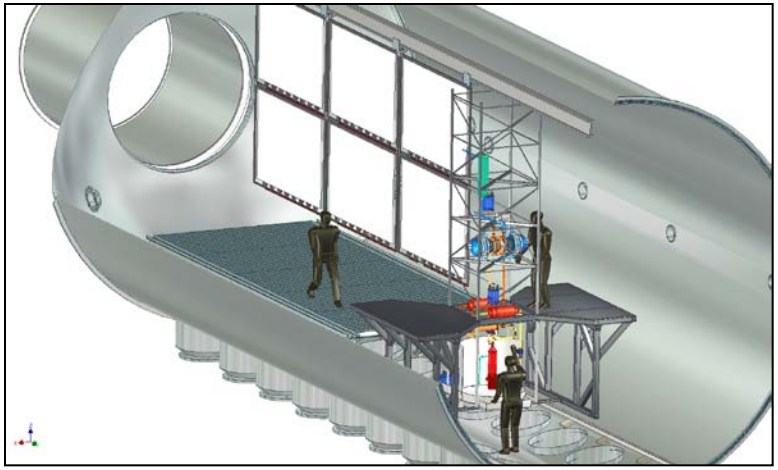
  > Component Development

  > 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)

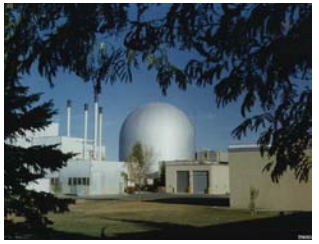
  Hot Criticals

  Acceptance Testing (Criticality, control motion)

- **Full-up Ground Test?**

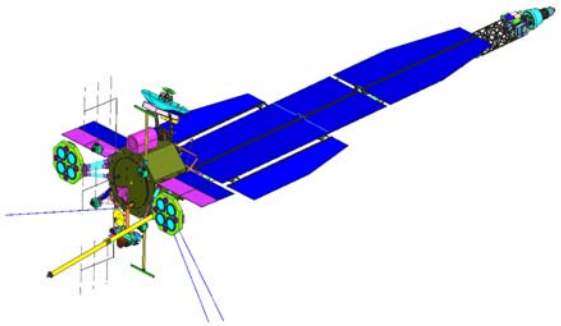
  Incremental data generation/risk reduction

  Incremental cost/risk incurred

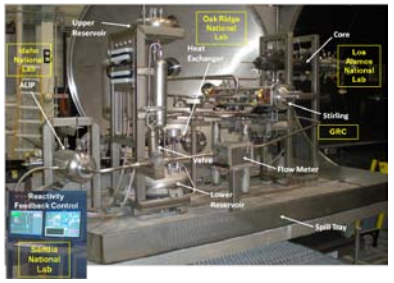


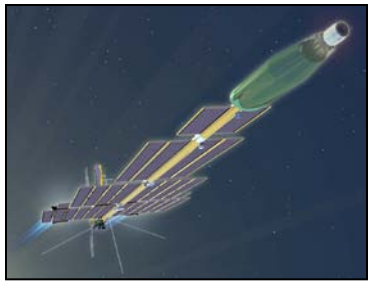
Critical Building Blocks (Cont)

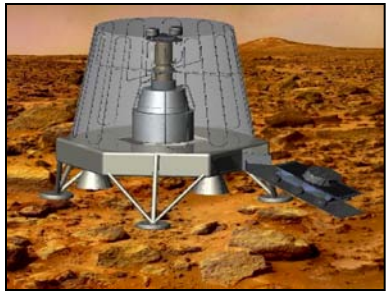
- **<u>In-situ Startup as part of Development</u>**
  - Methodical Approach-to-critical
  - Verify control/safety parameters
  - Fine tune control algorithms
- **<u>Use Subsequent Missions</u>**
  - Evaluate Operational Data
  - Incremental Technology Development
  - Bootstrap capabilities up



SUMMARY







- Use of Subsequent Missions
- In-Situ Startup Development Item
- Full-up Ground Test?
- Focused Nuclear testing
- Maximize non-nuclear testing
- Robust Flexible Reactor Design
- Use of SOA Design Methods
- Large Existing Data Base
- Benign System Requirements
- Modest Initial Mission
- Reformulate Strategy