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Technology and Architecture for Chip Satellite Missions

ChipSat Workshop

February 18, 2010

Brown University, Providence, Rhode Island

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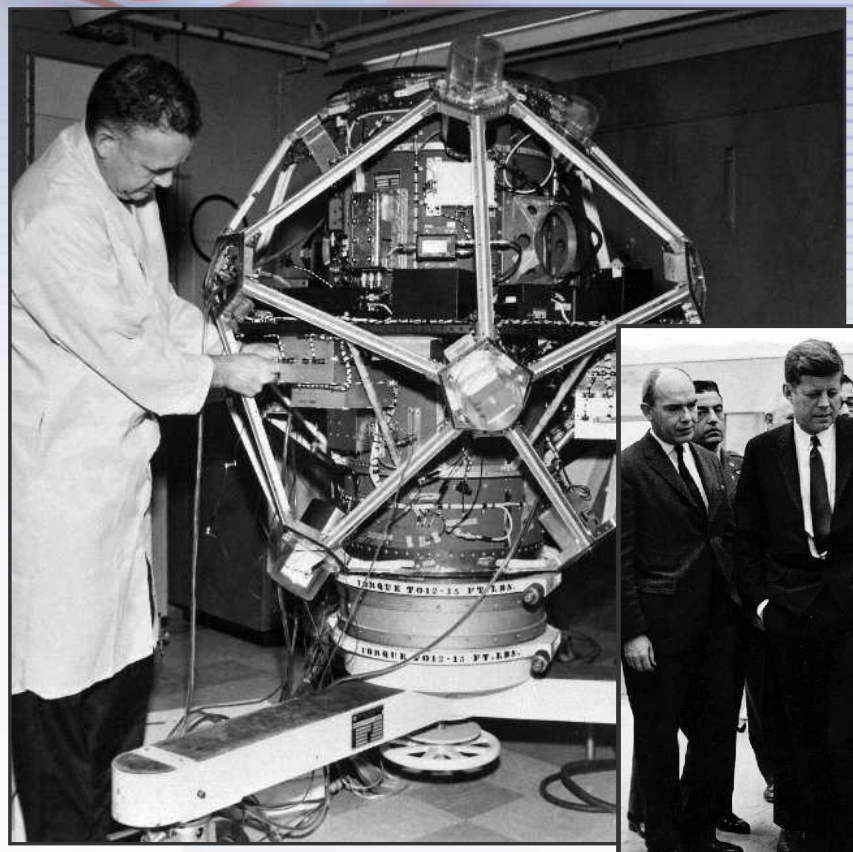
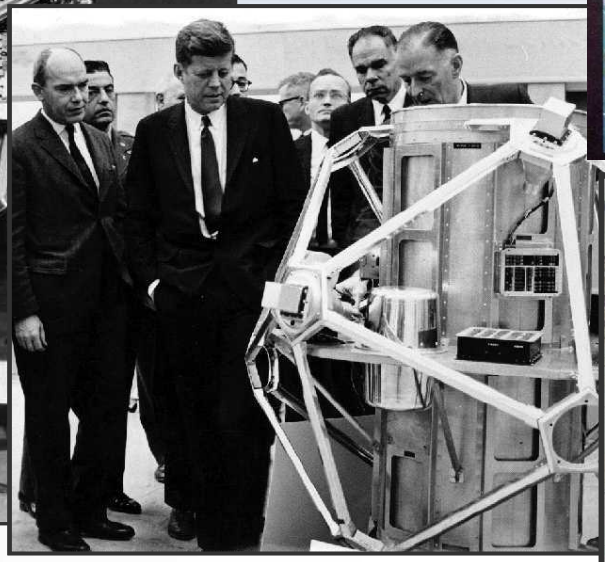
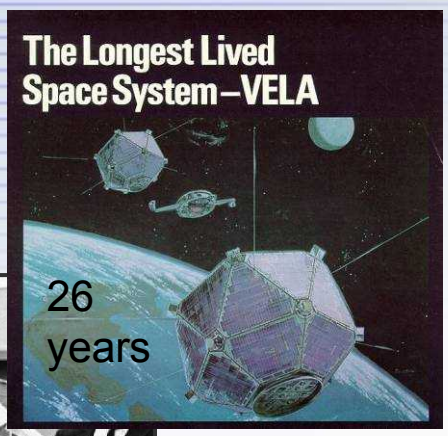
Outline

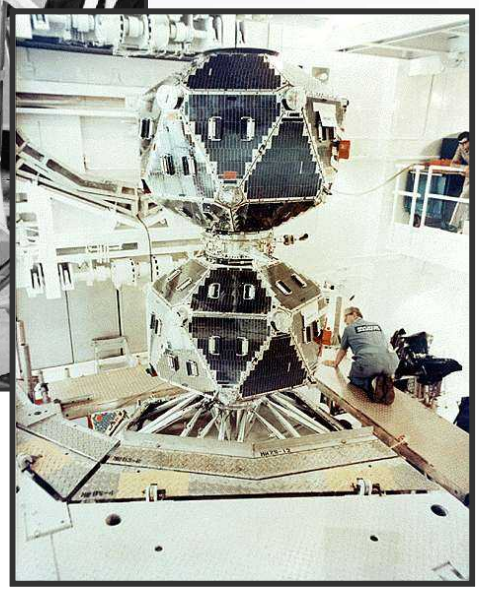
- National Laboratories' Interest
- Technology Bubble Diagram
- Roadmapping Approach
- Research Plan

VELA-Hotel: The Origin of the Satellite Remote Sensing Program at Sandia









Mission: Nuclear Proliferation Monitoring

Sensors: 10 x-ray detectors, 6 Gamma-Ray detectors & 1 neutron detector

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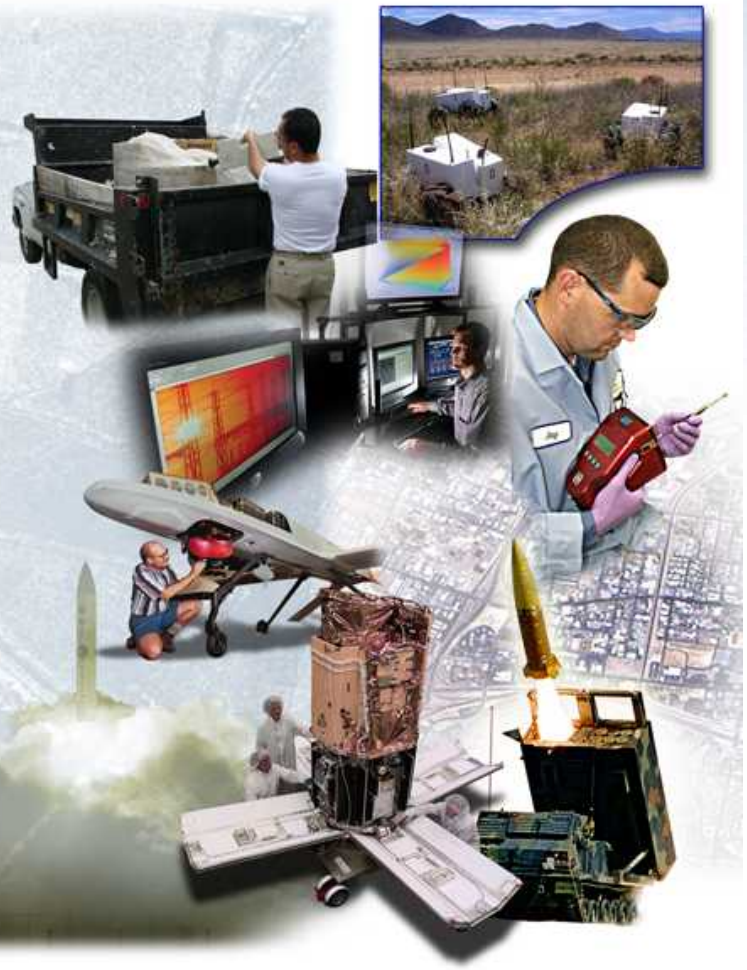
Defense Systems & Assessments Programs

- Proliferation Assessment
- Remote Sensing and Verification
- Space Mission Programs
- Surveillance and Reconnaissance
- Integrated Military Systems
- Information Operations
- Industrial Relations
- Science & Technology Products



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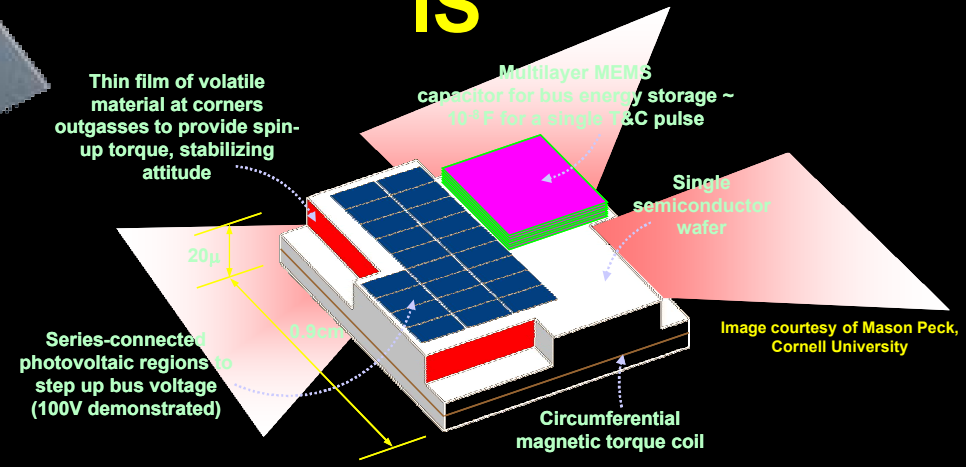
Radical Miniaturization Challenge

WAS

IS

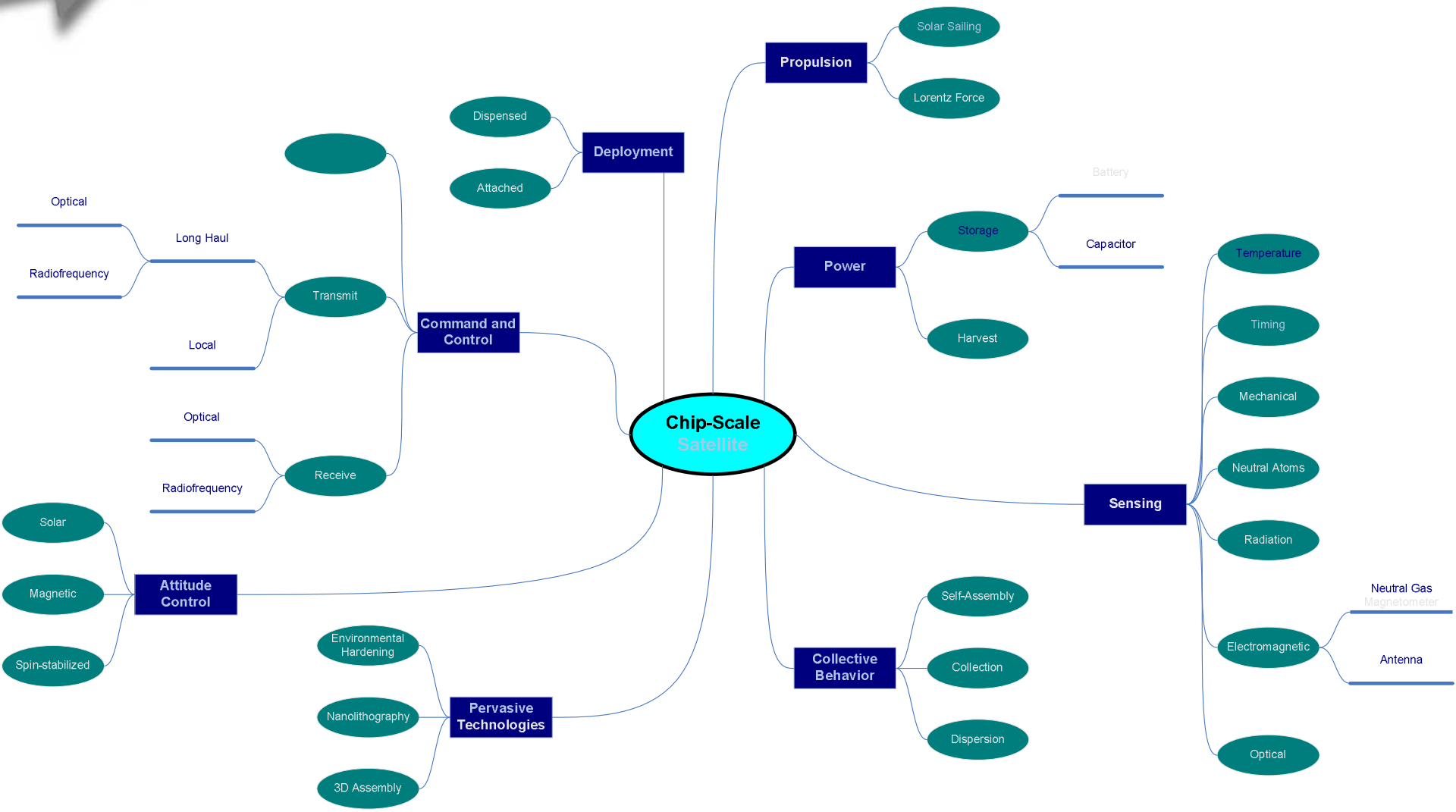


- Must handle basic spacecraft functions
  - Deployment, Power harvesting and storage, Command and control, Attitude Control, Propulsion
- Must handle complex tasks and behaviors
  - Sensing, Collective Behaviors

…all in a milligram form factor!

- Size target based on dynamics: 1 cm^2, 20 μm thick

Chip Satellite Technology Challenges



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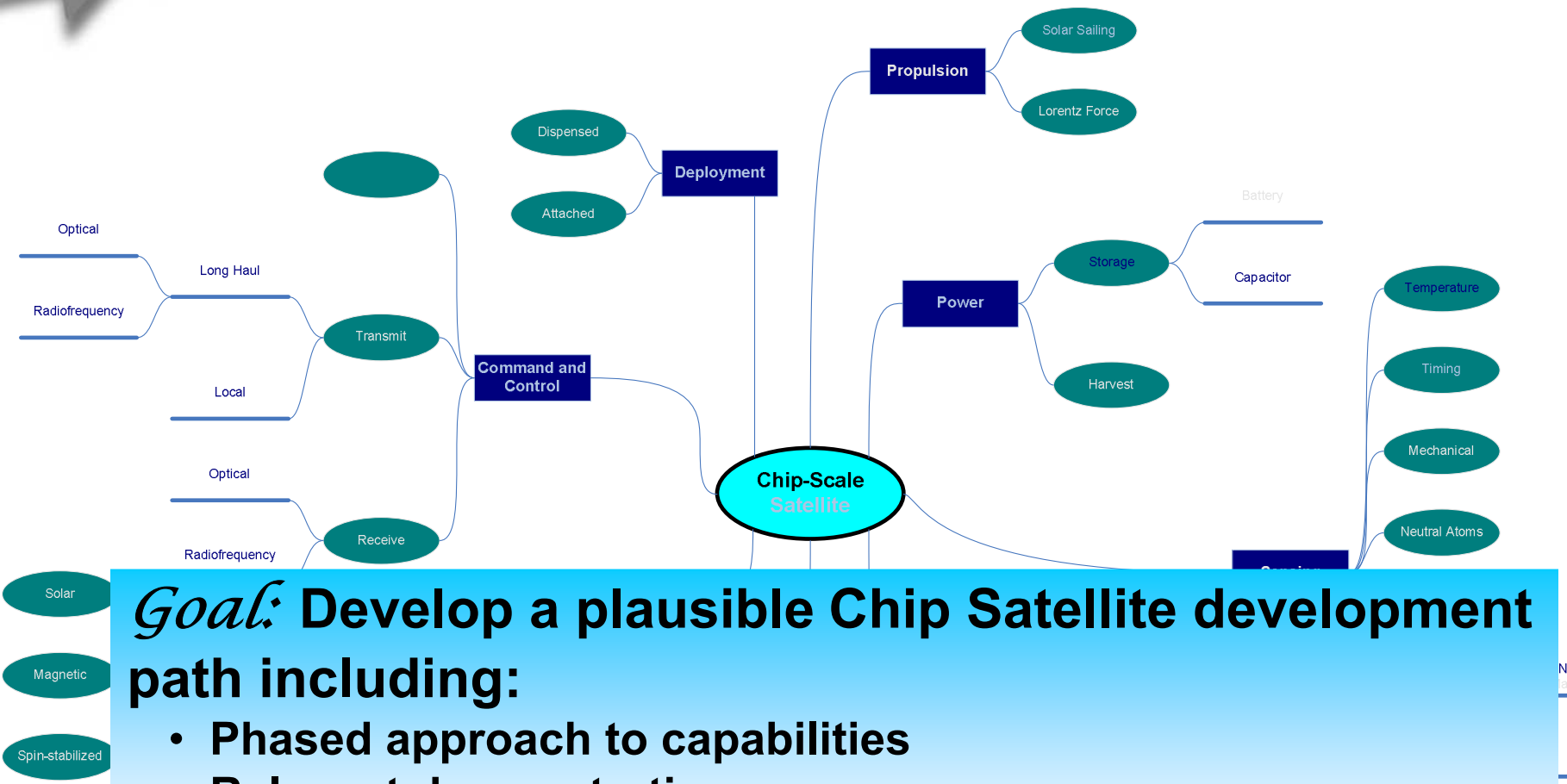
Chip Satellite Technology Challenges



Goal: **Develop a plausible Chip Satellite development path including:**

- **Phased approach to capabilities**
- **Relevant demonstrations**
- **End-state which cannot be reached by conventional spacecraft**

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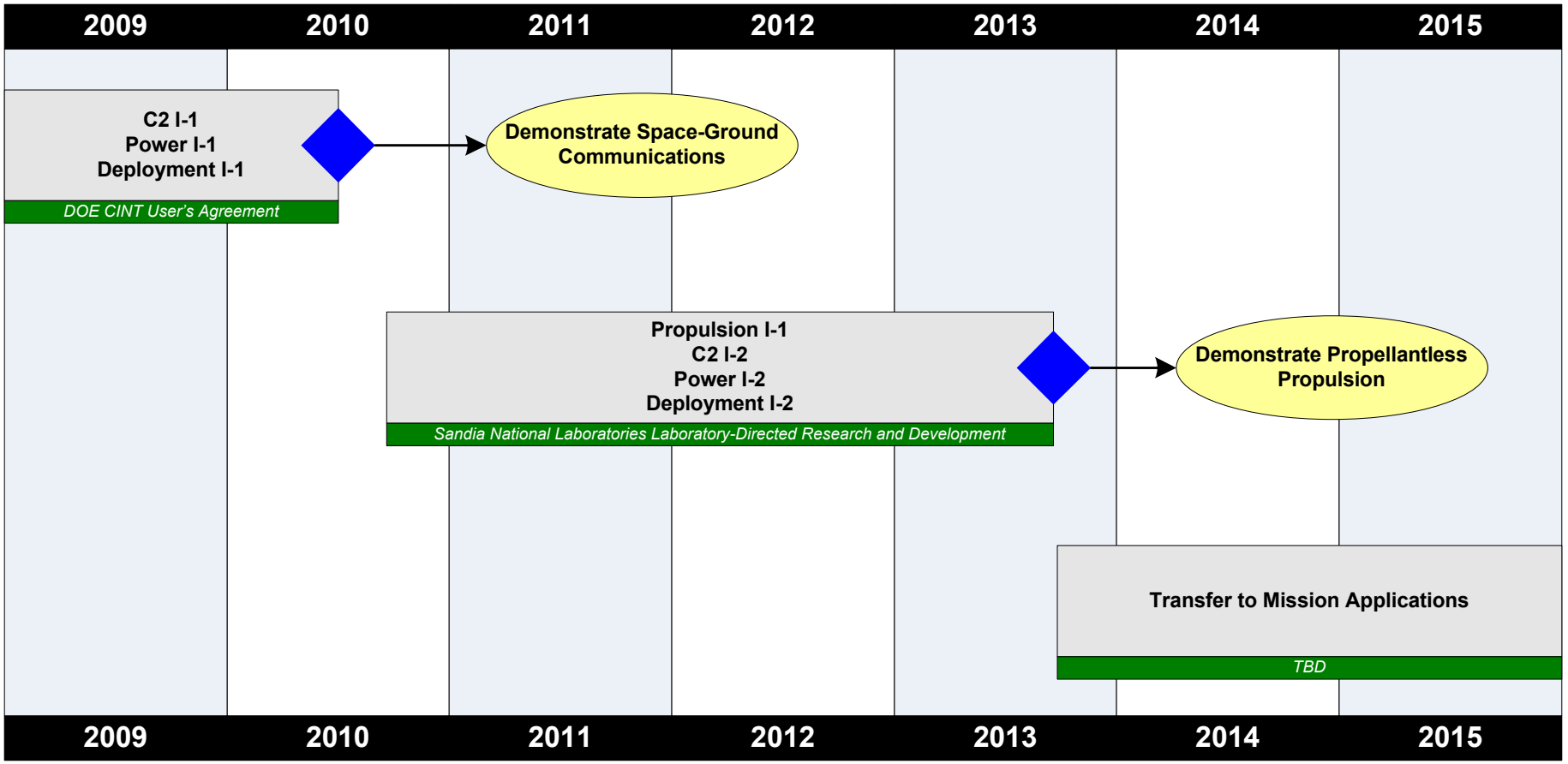
Chip Satellite Technology Roadmap



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Research Plan

- **Space-Ground Communications**
  - **Prove Commercial solutions with existing ground infrastructure**
- **Power**
  - **Storage technologies**
- **Propulsion**
  - **Plasma dynamics**
  - **Creating and maintaining desired charge**
- **Mission Research**

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