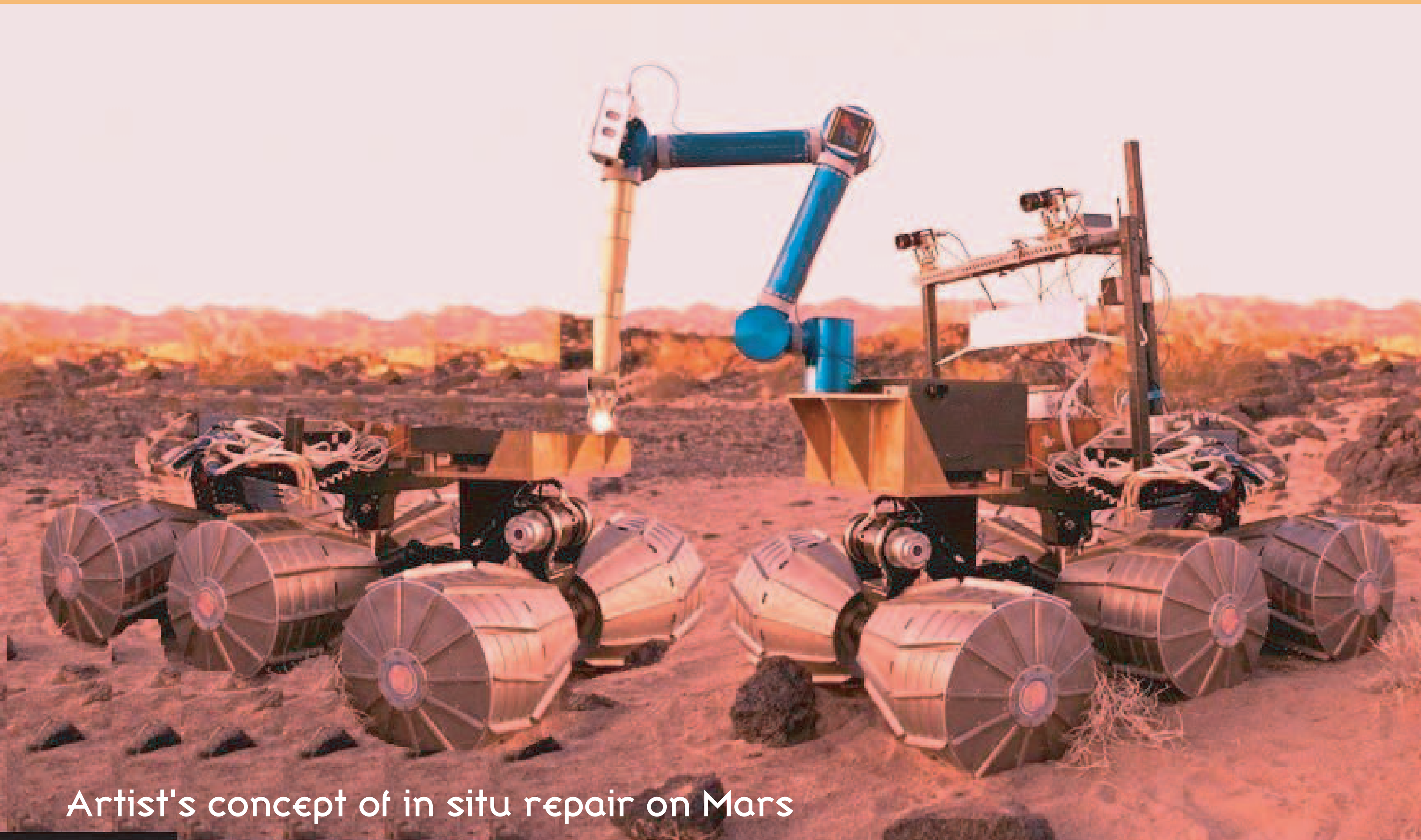


# In Situ Fabrication and Repair

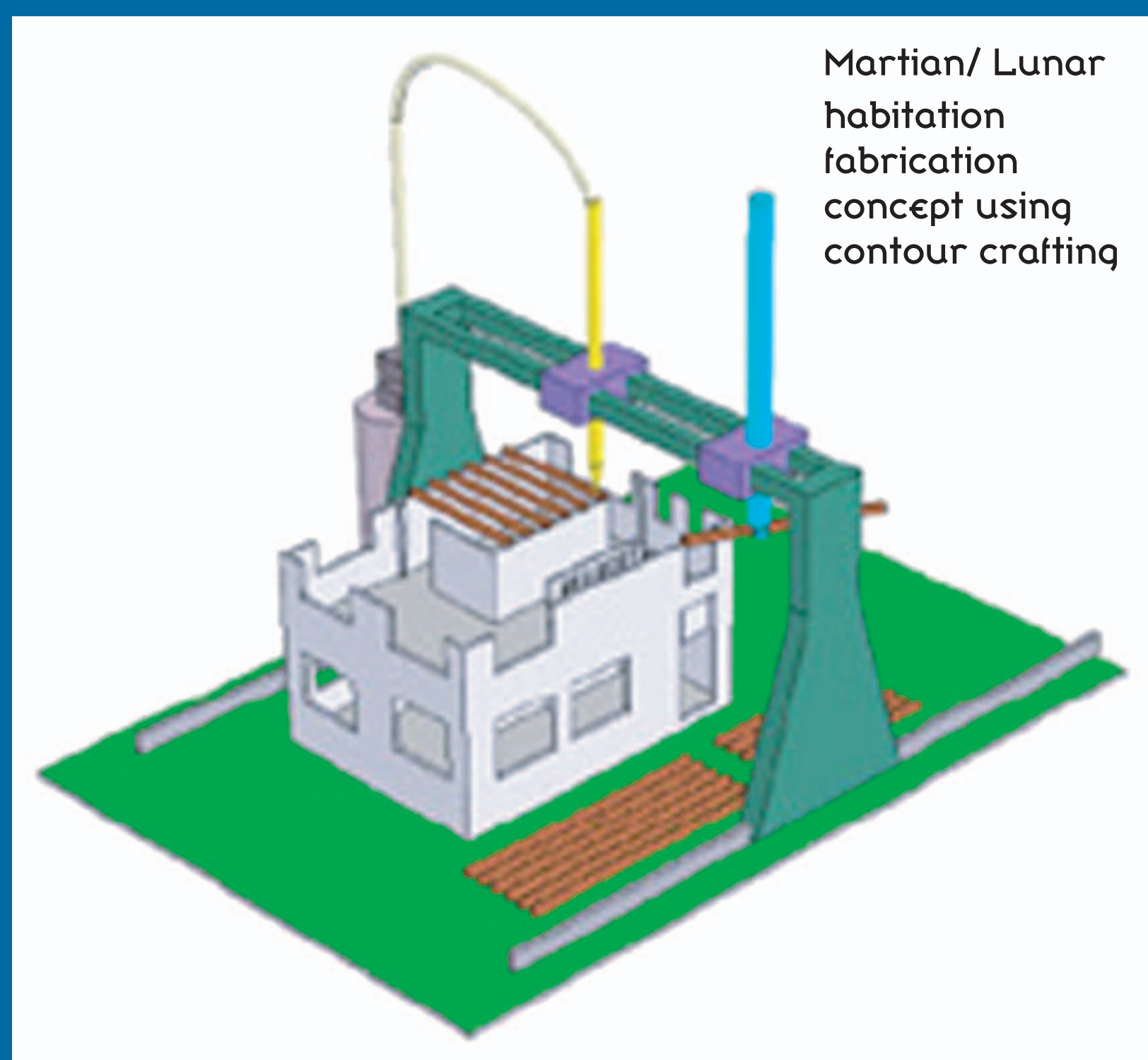
## Solid Freeform Fabrication



Artist's concept of in situ repair on Mars



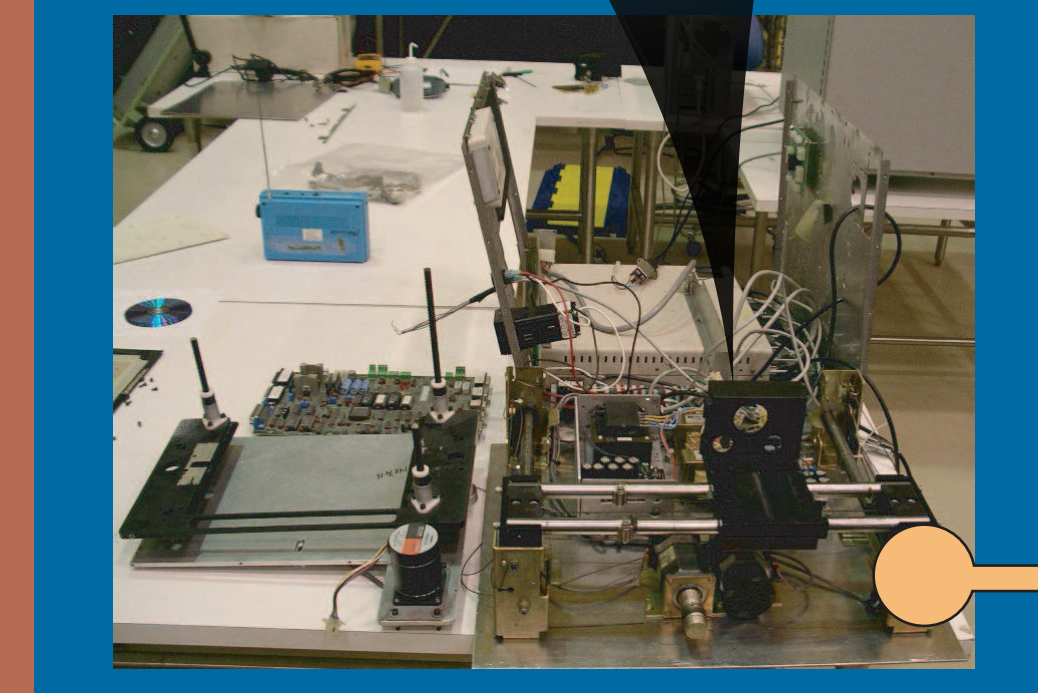
Range of objects produced by SFF deposition. Included are (clockwise from left) carbon-fiber composite turbine blade, a zirconia oxygen sensor, hydrogel, alumina, silicon carbide, silicon nitride houses. Sandia National Laboratories Thunderbird logos were prepared from alumina and Hershey's chocolate (lower left).



Martian/ Lunar habitation fabrication concept using contour crafting



Testing on KC-135



Progressive Miniaturization

### Customer Needs

- Fabrication or repair of components in space is essential to human exploration of distant planets in order to reduce resource requirements and spare parts inventory, and enhance mission security.
- A thorough understanding of materials processing under reduced gravity conditions is required to ensure sustained human presence in space.
- In-space fabrication simplifies operations and minimizes energy usage.

### Project Description

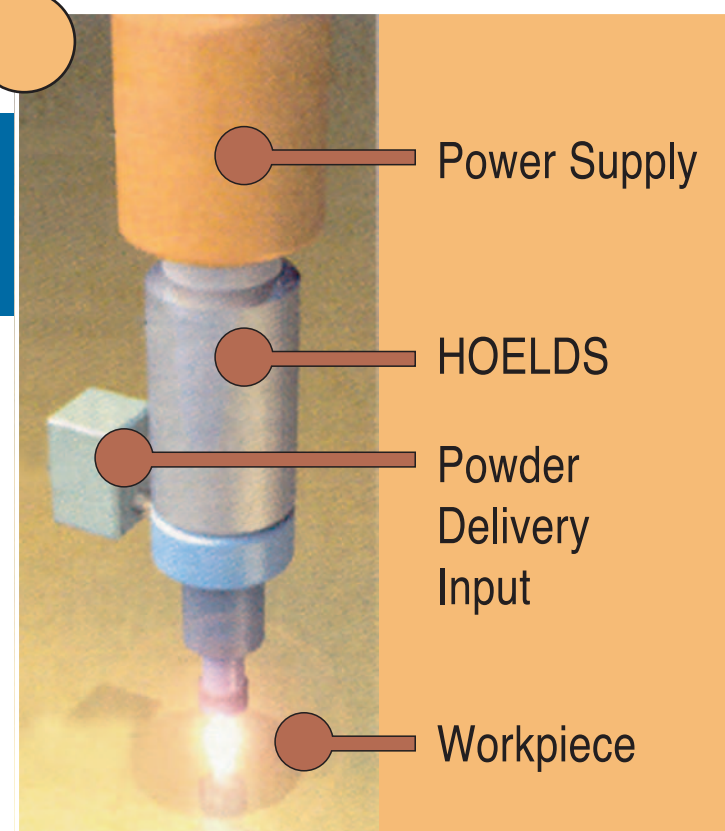
- Solid Freeform Fabrication (SFF)- SFF is an important developing technology that enables fabrication of any three-dimensional object directly from a computer data file, e.g. CAD data. Material usage includes plastics, metals, electronics, and composites.

### Existing MSFC SFF Activities

- Well Established Freeform Fabrication Capability in National Center for Advanced Manufacturing (NCAM/Bldg. 4707)
- Plastic solid Freeform Demonstration on KC135 performed in June 1999.
- SBIR Laser Activity: Holographic Optical Element Laser Diode Source (HOELDS) has power source high output laser for metal application (Phase 1 September 2004)

### Technology Challenges

- Miniaturization
- Spacecraft resource usage and interfaces
- Thermal constraints/cooling
- Electromagnetic Interference (EMI) shielding
- Vibro-acoustic constraints
- Materials Containment and Transport



### Microgravity Development Laboratory Capabilities

- Prototype Hardware Fabrication and Assembly
- Carrier Constraint Emulation
- Characterization against Interface Requirements
- Materials Fabrication and Inspection Capability (Composites, Polymers, Metals)
- Extensive microscopy and other quantification equipment

### Proposed Activities

- 2005 Workshop Aligning Scientific Research with In-Space Operation Goals
- 2006 ISS Plastics Technology Demonstration in Microgravity Science Glovebox (MSG)
- 2007 ISS Metals Technology Demonstration
- 2011 Lunar Production Units