OBPR Product Lines, Human Research Initiative, and Physics Roadmap for Exploration

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Ulf Israelsson

Jet Propulsion Laboratory
California Institute of Technology

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AGENDA

JPL

- *Changes since last year*
- *OBPR Product Lines*
- *Human Research Initiative*
- *Fundamental Physics for Exploration Roadmap*
- *Conclusions*

Changes since last year

- *OBPR Implications from President's Exploration Vision*
  - *OBPR WILL deliver methods and technology to assure human health and performance extra-terrestrially*
  - *OBPR WILL deliver advanced life-support systems and technology that are reliable, capable, simpler, less massive, smaller, and energy efficient*
  - *OBPR MAY provide other necessary expertise in areas such as low-gravity behavior*
- *Focus on products – not research*
- *No FORMAL direction yet, but..*
  - *LTMPF and PARCS ISS flight projects slated to terminate in October 2004*
  - *All flight investigations returned to ground program and phased out by end of FY07*
  - *Physics ground program intact – for now, but to survive must shift ~ 50% of research to support exploration*
- *Other disciplines basic research program being cancelled*

- **Human Health and Countermeasures**
  - Guy Fogleman, NASA HQ Point of Contact
- **Human Life Support Systems**
  - Eugene Trinh, NASA HQ Point of Contact
- **Radiation Protection and Countermeasures**
  - Terri Lomax, NASA HQ Point of Contact

- ***Exercise Systems***
- ***Behavioral Health***
- ***Pharmacology Immunology Nutrition***
- ***Artificial Gravity/Gravity Thresholds***
- ***Technology for Research***
- ***Autonomous Medical Care***
  - ***Monitoring***
  - ***Prevention***
  - ***Diagnosis***
  - ***Treatment***

- ***Advanced Life Support (ALS)***
- ***Advanced EVA Systems (AEVA)***
- ***Advanced Environmental Monitoring & Control (AEMC)***
- ***Advanced Food Technology (AFT)***
- ***Space Human Factors***
- ***Fire Prevention, Detection, and Suppression***
- ***In Situ fabrication and Repair***
- ***In Situ Resource Utilization***

- ***Mission & Operations Requirements***
- ***Shielding Solutions***
- ***Risk Assessment & Projection***
- ***Biological Countermeasures***
- ***Measurement Technologies***

Identified areas where Fundamental Physics can contribute

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- ***Human Health and Countermeasures***
  - ***Low-gravity simulators to determine gravity thresholds for biological processes and systems***
  - ***Non-invasive medical sensors based on SQUID technology***
  - ***Advanced NMR/MRI concepts***
- ***Human Life Support Systems***
  - ***Remote resource location technology (gravity gradient, magnetic)***
  - ***Advanced Sensor technology***
  - ***Low-gravity simulators to validate designs for Space, Moon, and Mars fluid systems***
- ***Radiation Protection and Countermeasures***
  - ***Neutron detectors and other sensors***
  - ***Low-gravity simulators to investigate possible interactions between low-gravity effects and radiation damage***
- ***Cross-cutting technology***
  - ***Clocks, Navigation, and Communication technology***

Human Research Initiative

- *New initiative to fill in perceived funding gaps to ensure human safety and productivity in space.*
- *Approximately $90M annually of directed research funding*
- *Solicitation is limited to NASA centers in the first year*
  - *Universities must team with JPL or other centers to participate*
- *Future years solicitations may be more open*
- *Proposals are solicited at a high summary level with points of contacts identified to work through*
  - *Funding expected to be in the $1–10M range*
- *Solicitation released April 1*
- *Proposals are due May 15*
- *Selection process goes through June*
- *Funding start in October*

Fundamental Physics for Exploration Roadmap

- ***Draft Roadmap discussed at last years PI conference***
- ***Initial Roadmap completed in December 2003. Strong community participation.***
- ***Publication was placed on hold pending rumored changes to a NASA exploration focus.***
- ***Following the President's announcement in January, the Roadmap is undergoing some minor changes to point more clearly to how fundamental physics research can and does support exploration***
- ***JPL will use the new Roadmap to argue for support for fundamental physics research not just to Code U, but to Code S and Code T as well***
  - *We enlist the support of the physics community in this endeavor*

Fundamental Physics for Exploration Roadmap

Old Roadmap Goals:

1. ***Discover new physics beyond today's knowledge of fundamental laws governing matter, space, and time***
   - A. *Determine the range of validity of Einstein's relativity theories*
   - B. *Discover evidence for New Physics beyond the Standard Model*
   - C. *Find answers to questions of cosmological significance*
2. ***Understand organizing principles of nature from which structure and complexity emerge***
   - A. *Acquire a deeper understanding of organizing principles in condensed matter systems and incorporate in new advanced technologies*
   - B. *Discover new knowledge about interactions in cold gasses of atoms and incorporate in new advanced technologies*
3. ***Apply physics results to enable technologies that allow human space exploration far beyond what is possible today***
   - A. *Demonstrate benefits of novel physics technologies to solve human space exploration challenges*

New Roadmap Goals:

1. ***Apply physics technologies to solve today's human space exploration challenges***
   - A. *Develop physics-based advanced communication and navigation products for Moon, Mars, and beyond*
   - B. *Develop physics-based advanced resource-location products for human and robotic exploration in the solar system*
   - C. *Develop physics-based tools for enhanced studies of living systems*
2. ***Understand organizing principles of nature from which structure and complexity emerge and apply to tomorrow's exploration needs***
   - A. *Acquire a deeper understanding of organizing principles in condensed matter systems and incorporate in exploration technologies*
   - B. *Discover new knowledge about interactions in cold gasses of atoms and incorporate in exploration technologies*
3. ***Discover new physics beyond today's knowledge of fundamental laws governing matter, space, and time to enable exploration far beyond what is possible today***
   - A. *Determine the range of validity of Einstein's relativity theories*
   - B. *Discover evidence for New Physics beyond the Standard Model*
   - C. *Find answers to questions of cosmological significance*

Conclusions

- ***The pace of change has increased at NASA***
- ***OBPR's focus is now on the Human interface as it relates to the new Exploration vision***
- ***The fundamental physics community must demonstrate how we can contribute***
  - *If we do, it is likely that our basic research program will continue*
- ***Many opportunities exist for physicists to participate in addressing NASA's cross-disciplinary exploration challenges***
  - *Physicists can contribute to elucidating basic operating principles for complex biological systems*
  - *Physics technologies can contribute to developing miniature sensors and systems required for manned missions to Mars*
- ***NASA Codes other than OBPR may be viable sources of funding for physics research***