Space Technology FY 2013

Dr. Mason Peck,
Office of the Chief Technologist

ASEB
April 4, 2012
Technology at NASA

- NASA pursues **breakthrough technologies** to expand our frontiers in aeronautics and space
- **Advanced technologies are critical** for accomplishing NASA’s current missions, and today’s **technology investments are required** for the bold missions of NASA’s future
- These same investments **benefit the United States economy** through creation of new industries, products, services, scientific discoveries, and societal benefits
- NASA’s basic and applied research programs **span all of NASA’s mission areas**, and includes activities benefiting **other government agencies and the Nation’s aerospace industry**.
- NASA is implementing a portfolio of broadly applicable Space Technology programs to take the **best ideas** of our nation’s innovators **from concept to flight**
Office of the Chief Technologist

Integrates Technology Investment Across the Agency

Serves as Advisor to Administration

Direct Technology Management and Budget Authority for the Space Technology Program

Advocates Externally NASA’s R&D Programs

Demonstrates and Communicates Societal Impacts of NASA Technology Investments

Leads Tech Transfer, Partnerships and Commercialization Activities Across the Agency
Guiding Principles of the Space Technology Program

OCT’s Space Technology Program

• Advances broadly applicable technology to infuse solutions into applications for which there are multiple customers.

• Employs portfolio approach to capture the entire spectrum of technology readiness.

• Competitively selects research by academia, industry, and the NASA centers based on technical merit.

• Leverages the technology investments of our international, other government agency, academic and industrial partners.

• Coordinates with internal and external stakeholders, including academia, industry and other government agencies.

• Results in new inventions, new capabilities and the creation of a pipeline of innovators aimed at serving future National needs.

• Grows the Nation’s innovation economy
The Ten Programs of Space Technology

**Early Stage Innovation**
- Space Technology Research Fellowships & Grant Programs
- NASA Innovative Advanced Concepts (NIAC) Program
- Center Innovation Fund Program
- Centennial Challenges Prize Program
- Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) Program

**Game Changing Technology**
- Game Changing Development
- Franklin Small Satellite Subsystem Technology

**Technology Capability Demonstrations**
- Flight Opportunities
- Technology Demonstration Missions
- Edison Small Satellite Demonstration Missions
## Space Technology FY 2013
### President's Budget Request

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• The NRC study was released on February 1. It is a comprehensive report with important observations, analyses and priorities, including
  • Currently, available technology is insufficient to accomplish many upcoming missions in Earth orbit and beyond.
  • Success in executing future NASA space missions will depend on advanced technology developments that should already be underway.
  • NASA’s technology base is largely depleted. So, revitalizing technology investment at NASA is required if NASA is to achieve the challenges before it.
  • Technological breakthroughs have been the foundation of virtually every NASA success. In addition, technological advances have yielded benefits far beyond space itself in down-to-Earth applications.
  • Future U.S. leadership in space requires a foundation of sustained technology advances.
  • The NRC concurs with the design of NASA’s new Space Technology Program, with its cross cutting technology projects that span a range of technical maturity and include flight demonstrations.

• The NRC study emphasized 16 high-priority technology areas. NASA is currently investing in all 16 at some level.

• This assessment will help guide NASA’s technology investment priorities in the years to come, working across the agency to address the findings.
Strategic Perspectives and Process

### What NASA could do

**Draft ST Roadmaps:**
- 140 technical challenges (10 per roadmap)
- 320 technologies
- 20 year horizon

### What NASA should do

**NRC ST Roadmaps Study:**
- Gives priority to:
  - 100 top technical challenges
  - 83 high priority technologies (roadmap-specific)
  - 16 highest of high technologies (looking across all roadmaps)
  - Immediate 5 year horizon

### What NASA is doing

**Updated ST Roadmaps:**
- Incorporate NRC Study Results
- Update with Mission Plans and Technological Developments

**Internal Assessment to create Strategic Plan:**
- Compare to Current Investments
- Compare to Current Plans
- Analyze Gaps

### What NASA will do

Implement NASA Technology Portfolio Investments
- Technology Developments (across full TRL spectrum)
- Flight Demonstrations

Must reflect:
- Affordability
- Technical Progress and Performance
- Mission Needs and Commitments
- Stakeholder Guidance
NASA's strategic plan includes:

- Current Technology Investments
- MD Technology Priorities
- Budget Constraints
- Center Capabilities/Facilities

**Strategic Technology-Investment Plan**

**NASA Strategic Plan**

**NASA Space Technology Roadmaps**

**NRC Roadmap Analysis & Priorities**

**and Other Govt. Agency Partnership Opportunities**

**DoD**

**NRL**

**FAA**

**DoE**

**HEOMD**

**SMD**

**STP**

**AFRL**

**DARPA**
Big Nine Projects

- **CSTD-TDM Laser Communications**
  - Increases space-based broadband, delivering data rates 10-to-100 times faster than today's systems, addressing the demands of future missions.

- **ETD-TDM Cryogenic Propellant Storage & Transfer**
  - Better fuel handling technology will improve spacecraft fuel economy. Required for Cryogenic Propulsion Stage (Space Launch System - SLS - upper-stage).

- **CSTD-TDM Deep Space Atomic Clock**
  - This tiny atomic clock is 10-times more accurate than today's ground-based navigation systems, enabling precise, in-space navigation.

- **CSTD-TDM Large-Scale Solar Sail**
  - This solar sail has an area 7 times larger than ever flown in space, enabling propellant free propulsion and next generation space weather systems.

- **CSTD-TDM Low Density Supersonic Decelerators**
  - Demonstrates new parachutes and inflatable braking systems at supersonic velocities enabling precise landing of large payloads on planetary surfaces.

- **ETD-GCD Composite Cryogenic Propellant Tanks**
  - Demonstrating large composite, light weight fuel tanks that can reduce the mass and cost of the next generation SLS.

- **ETD-GCD HIAD**
  - Demonstrates new inflatable braking systems for use at hypersonic velocities enabling precise landing of large payloads on planetary surfaces, and returning payloads from the ISS to Earth.

- **ETD-GCD Robotic Satellite Servicing**
  - Develops and improves technology to enable service, repair, refueling and relocating satellites through the use of robotics.

- **Human Exploration Telerobotics & Human-Robotic Systems**
  - Developing advanced systems capable of remotely operating robots to assist in future exploration; maturing new robots capable of assisting humans in routine and tedious work.
## "Big 9" FY 2012 Milestones

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### Key
- KDP
- Launch
- Testing
- Development
- Review
- MCR
- KDP-A
- KDP-B
- KDP-C
- SDV 1 Test
- SDV 2 Test
- SDV 3 Test
- IRVE-3 System Tests
- NFAC Tests
- Build-to-Print Fab. Complete
- Complete Design Drawings
- Complete Rover Cannon Assembly
- Wind Tunnel Test
- LCAT Test
- Wind Tunnel Test
- Multiple Tests
- Multiple Tests
- RFI Released
- RFI Complete
- RRM OPS
- Workshop
Acronyms

- CDR – Critical Design Review
- Comm. – Communications
- Demo. – Demonstration
- DVT – Design Verification Test
- Fab. – Fabrication
- KDP – Key Decision Point
- LCAT – Large Core Arc Tunnel
- M – Meter
- MCR – Mission Control Review
- MRR – Mission Readiness Review
- MSFC – Marshall Space Flight Center
- NFAC – National Full-Scale Aerodynamics Complex
- PDR – Preliminary Design Review
- RFI – Request For Information
- RRM – Robotic Refueling Mission
- SRR – Systems Requirements Review
- TBD – To Be Determined
- Tech. – Technologies