National Aeronautics and Space Administration

NASA

Technology & Innovation Committee

NAC Advisory Council

Dr. Bill Ballhaus, Chair
March 9, 2012

Technology & Innovation Committee

“The scope of the Committee includes all NASA programs that could benefit from technology research and innovation.”

Questions for NASA Administrator

- What is the appropriate percentage of NASA's budget that should be devoted to technology investment?
- What fraction of that allocation should be organizationally fenced off as "seed corn" and crosscutting investment?
- How is NASA managing its technical, critical core competencies?

T&I Committee Participants
March 6, 2012 Meeting

- Dr. William Ballhaus, Chair
- Dr. Matt Mountain, HST Institute
- Mr. Gordon Eichhorst, Aperios Partners, LLP
- Dr. Susan Ying, The Boeing Company
- Dr. Dava Newman (call-in), MIT
- Committee will have an additional four members joining in Spring 2012

T&I Committee Meeting Presentations

- Office of Chief Technologist Update – Dr. Mason Peck, NASA Chief Technologist
- Update and Discussion of NASA's FY 2013 Budget Request for Space Technology Program – Dr. Michael Gazarik, Director, NASA Space Technology Program
- NRC's NASA Technology Roadmap Report – Dr. Raymond Colladay, National Research Council
- NASA Response Plan to NRC Report and Discussion – Dr. Mason Peck, NASA Chief Technologist
- Update on HAT Technology Planning – Mr. Chris Culbert, NASA Johnson Space Center
- Technology and the JWST program – Mr. Rick Howard, Program Director, JWST
- Annual Ethics Briefing – Ms. Kathleen Teale, NASA OGC
- Remarks by NAC Chair Dr. Steve Squyres

National Research Council Report

T&I Committee OCT Observations

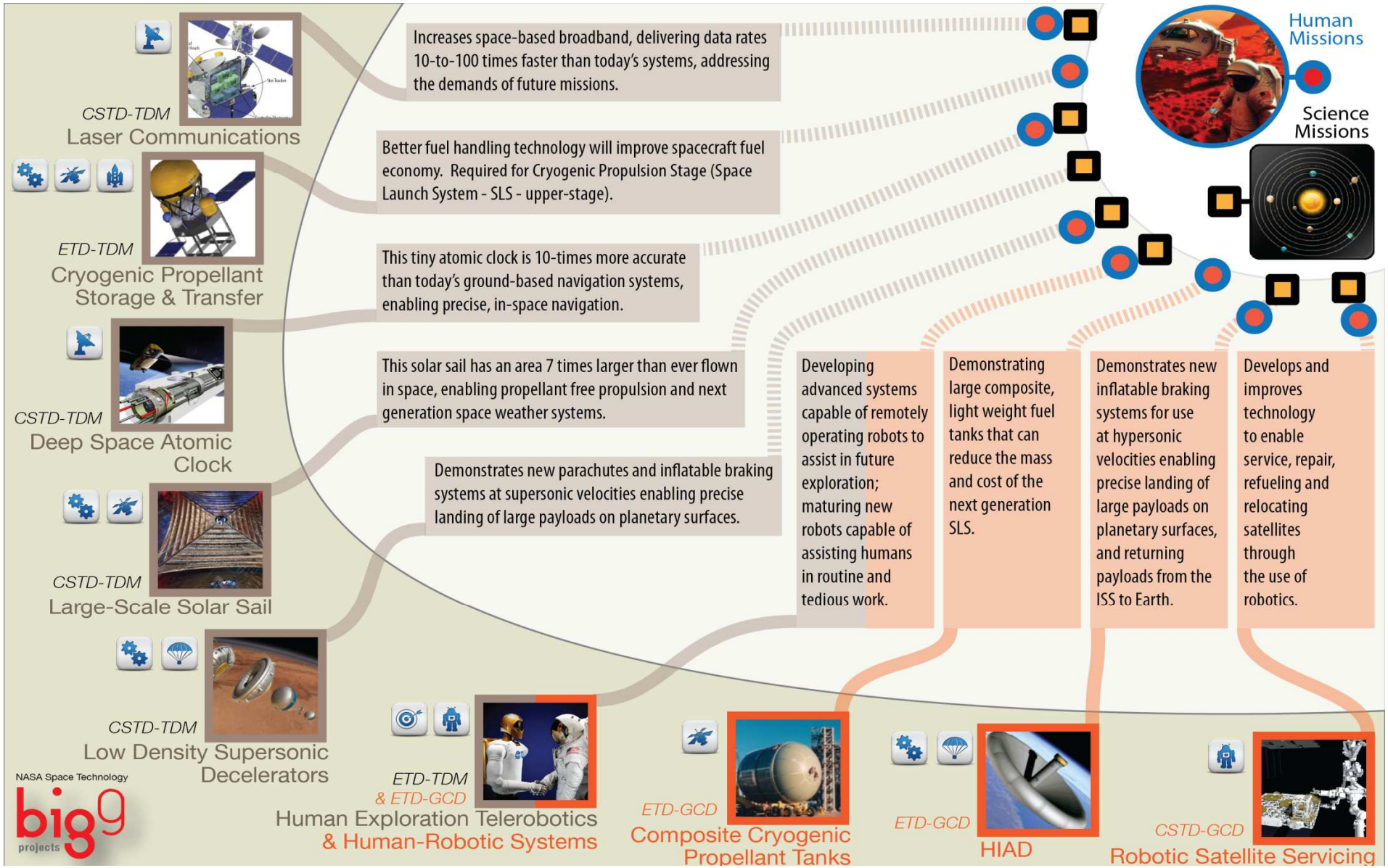
Major positive progress has been made within the Space Technology Program and OCT over the past two years.

- Space Technology Program budget appropriated $575 million in FY2012
- Over 1,000 technology projects underway
- Five Space Technology Solicitations in FY2012
  - Space Technology Research Grants
  - Game Changing Technology
  - Technology Demonstration Missions
  - Edison Small Satellites
  - NASA Innovative Advanced Concepts

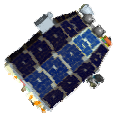
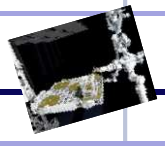
Space Technology FY 2013 President's Budget Request

Budget Authority ($M)	FY 2012 Appropriation	FY 2013	Notional FY 2014	Notional FY 2015	Notional FY 2016	Notional FY 2017
FY 2013 President's Budget Request	**573.7**	**699.0**	**699.0**	**699.0**	**699.0**	**699.0**
Partnership Development and Strategic Integration	29.5	29.5	29.5	29.5	29.5	29.5
SBIR/STTR	166.7	173.7	181.9	187.2	195.3	206.0
Crosscutting Space Technology Development	187.7	293.8	272.1	266.6	259.7	247.0
Early Stage Innovation	39.8	59.0	61.0	61.0	61.0	61.0
CSTD Game Changing Technology	61.5	66.7	73.7	69.1	58.4	58.4
CSTD Technology Demonstration Missions	65.3	128.9	103.4	102.5	106.3	93.6
Edison/Franklin Small Satellites	11.2	24.2	19.0	19.0	19.0	19.0
Flight Opportunities	10.0	15.0	15.0	15.0	15.0	15.0
Exploration Technology Development	189.9	202.0	215.5	215.7	214.5	216.5
ETD Game Changing Technology	111.2	104.0	70.5	79.8	85.9	90.9
ETD Technology Demonstration Missions	78.7	98.0	145.0	135.9	128.6	125.6

“Big 9” Projects



"Big 9" FY 2012 Milestones

Projects	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sept-12
Composite Cryotank Tech and Demo							PDR		Develop 2m-Tank Fab. and Deliver to MSFC		2m Pressure Tank Test; Develop 5m Demo. Unit	
Hypersonic Inflatable Aerodynamic Decelerators			IRVE-3; Delta CDR	System Tests		NFAC Tests	MRR; KDP-E; Launch	Build-to-Print Fab. Complete		Wind Tunnel Test	LCAT Test	Wind Tunnel Test
Human Robotic Systems					Integrate Software on Rover			Complete Design Drawings	Complete Rover Cannon Assembly			Multiple Tests
Low Density Supersonic Decelerators				SDV 1 Test		PDR	SDV 2 Test; KDP-C		SDV 3 Test	CDR		
Deep Space Atomic Clock					SRR	KDP-B						
Mission Capable Solar Sail				SRR; MDR; Tubes Test; Sail Test			Mechanism Test				PDR	
Cryogenic Propellant Storage and Transfer							MCR	KDP-A				
Laser Comm. Relay Demo.									MCR			
Robotic Satellite Servicing		RFI Released		RFI Complete		RRM OPS		Workshop				

Key
- KDP
- Launch
- Testing
- Development
- Review
- Critical Event

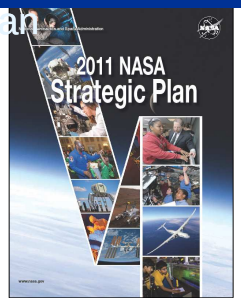
T&I Committee OCT Observations

OCT Actions in Process

- Finishing accounting process of Agency-wide technology investments portfolio
- Analyzing NRC Report
  - Already investing in all 16 highest priority technologies
  - Some adjustments will be necessary as a result of NRC Report findings (under-investing in some areas)
- Preparing Strategic Technology Investment Plan

NASA Strategic Technology-Investment Plan

NASA Strategic Plan



Strategic Technology-Investment Plan

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

NASA Space Technology Roadmaps

NRC Roadmap Analysis & Priorities

and Other Govt. Agency Partnership Opportunities

DoD, NRL, FAA, NRO, Space Command, DoE, AFRL, DARPA

ARMD

HEOMD

SMD

STP

Creating the 4-Year NASA Strategic Technology-Investment Plan

OCT SI will coordinate development of NASA Strategic Technology-Investment Plan with support from MD and Center Chief Technologists.

- Finalize MD Technology priorities
- Generate list of current Agency technologies development activities/projects
- Identify budget constraints
- Identify Center technology capabilities/facilities
- Identify (OGA, commercial) partners with interest in gap areas
- Identifying gap areas
- Integrate roadmaps, NRC priorities and recommendations
- Prepare 4-year plan to fund technologies in gap areas

T&I Committee Agency-Level Observations

NASA "grand" missions are technology-enabled.

- JWST, MSL, ISS—type of work NASA should be doing
- Demonstrates NASA/U.S. technical leadership

"Future U.S. leadership in space requires a foundation of sustained technology advances…NASA's technology base is largely depleted." –NRC Report

T&I Committee Agency-Level Observations

What is the appropriate percentage of NASA's budget that should be devoted to technology investment? Ten percent?

- We couldn't find accounting that told us what percentage of NASA budget is technology investment. *(Although effort under way by OCT to determine this.)*
- Three Categories
  - Mission Support/Pull (mission specific or vehicle/architecture specific, mid-high TRL)
  - Crosscutting (mid-high TRL)
    - e.g. cryogenic fluid management in space, solar electric propulsion
  - "Seed Corn" (low-mid TRL)
    - Disruptive
    - Developing people, as well as ideas/maintaining core competencies

T&I Committee Agency-Level Observations

- A number of astute administrators, including present, have organizationally fenced off the budget for “seed corn” and crosscutting investments that includes research and technology and system-level demonstrations to preserve options for the future.
  - When “seed corn” investment isn’t organizationally fenced off, it gets eaten!
  - e.g. Constellation eating tech budget to fix development issues
- What fraction of the technology budget should be set aside for “seed corn”?

T&I Committee Agency-Level Observations

"NASA needs a disciplined system analysis for management of the space technology portfolio."
–NRC Report

- Systems analysis is critical for assessing the value of particular technologies on overall future systems' performance.

T&I Committee Agency-Level Observations

Challenging missions require that NASA maintain an essential set of technical core competencies.

- Technology
- Technically educated/experienced people
- Facilities
- Labs (e.g. NRC Report on NASA labs)
- Who is accountable for maintaining these core competencies? Is this a governance issue?

Questions for NASA Administrator

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