National Aeronautics and Space Administration

Technology & Innovation Committee

NAC Advisory Council

Dr. Bill Ballhaus, Chair

July 26, 2012

Technology & Innovation Committee

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

T&I Committee Meeting Participants
July 24, 2012

- Dr. William Ballhaus, Chair
- Dr. Erik Antonsson, Northrop Grumman
- Dr. Randall Correll, Consultant
- Dr. Matt Mountain, HST Institute
- Mr. David Neyland, Office of Naval Research
- Dr. Mary Ellen Weber, Stellar Strategies, LLC
- Dr. Susan Ying, The Boeing Company

T&I Committee Meeting Presentations

- Welcome to GSFC and Q&A – Mr. Rick Obenschain, Deputy Director, GSFC
- Update and Discussion of Space Technology Program – Dr. James Reuther, Deputy Director, NASA Space Technology Program
- Office of the Chief Technologist Update – Dr. Mason Peck, NASA Chief Technologist
- Review of NASA's Draft Strategic Space Technology Investment Plan (SSTIP) – Ms. Faith Chandler, Acting Director, Program Management and Integration Office and Dr. Mason Peck, NASA Chief Technologist
- GSFC Technology Programs – Mr. Peter Hughes, GSFC Chief Technologist

IRVE-3 – July 23rd Successful Launch Profile

Updating to as-built mass properties

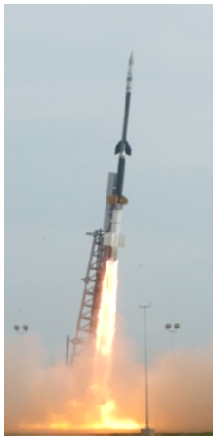
Apogee
366s, 476km

Coast…

Eject Nose Cone
132s, 242km

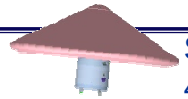
NIACS damps rates
91s to 131s

Separate RV & Nose Cone
From Brant & Transition
90s, 149km

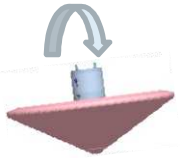


Yo-Yo De-Spin, 80s
Brant Burnout, 56.9s
Brant Ignition, 23.0s
Taurus Separation 21.0s
Taurus Burnout, 18.5s
Taurus Ignition, 15.0s
Talos Burnout, 6.4s
Spin Motor Ignition, 0.9s
Leaves Rail, 0.5s
Talos Ignition, 0s

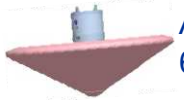
Launch on Black Brant-XI from WFF
940lb payload, El 84deg, Az 155deg



Start Aeroshell Inflation
478s, 423km (110s to 7.5psi)

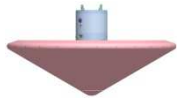


ACS Reorientation
588s, 266km (60s duration)



Actuate CG offset system
648s, 83km (1s duration)

Atmospheric Interface, 25Pa (649s, ~80km)

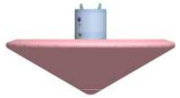


RV Peak Heat Rate 14-17W/cm2
673s, 49km, Mach 7 (peak Mach 10.2)

RV Peak Dynamic Pressure 5035Pa
678s, 41km, 20.8g's

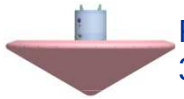
Reentry Experiment Complete at Mach < 0.7
(706s, 37km)

CG Offset Maneuvers



LOS by land radar & TM
12-29km altitude

Vent NIACS and Inflation System Gas

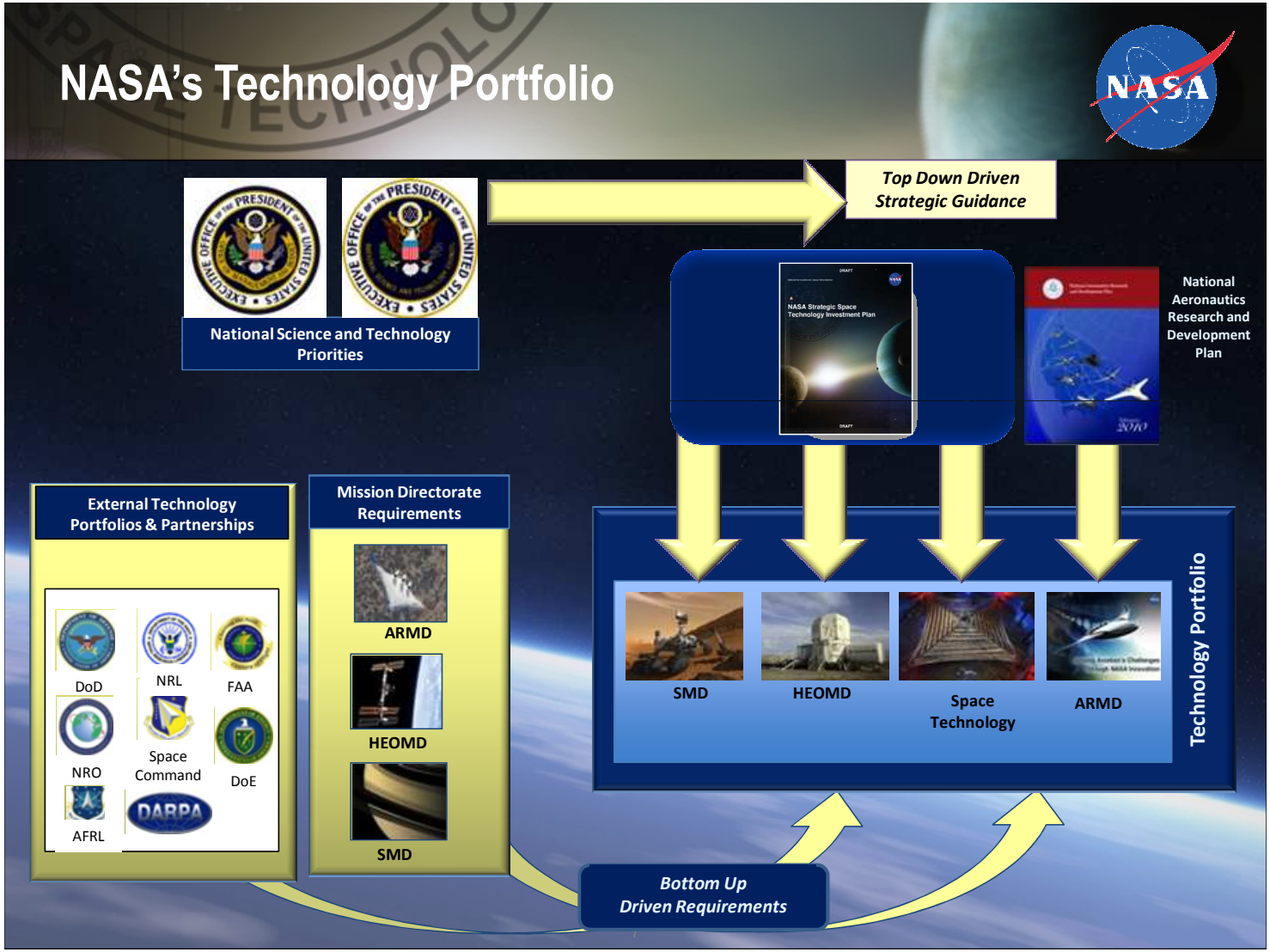


RV splashdown at 30m/s
383km downrange (1227s)

Recovery Attempt

SSTIP Briefing

SSTIP Briefing: NASA's Technology Portfolio



SSTIP Briefing: NASA's Space Technology Portfolio

2010

Space Technology Roadmaps

- 140 challenges (10 per roadmap)
- 320 technologies
- 20-year horizon

- Revised every 4 years

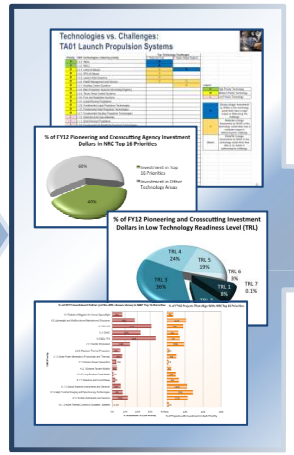
2011

National Research Council (NRC) Study

Prioritization:

- 100 top technical challenges
- 83 high-priority technologies (roadmap-specific)
- 16 highest of high technologies (looking across all roadmaps)

- Requested every 4 years



2012

SSTIP

Updated ST Roadmaps:

- Incorporate NRC Study Results

Developing a Strategic Space Technology Investment Plan:

- current investments
- current MD/Office priorities
- opportunities for partnership
- gaps vs. current budget and capabilities
- 20-Year horizon with 4-year implementation cadence

- Revised every 2 years

Execution

Investment Portfolio

- Technology Developments (across full Technology Readiness Level (TRL) spectrum)
- Flight Demonstrations
- Must accommodate:
  - Mission Needs
  - Push Opportunities
  - Affordability
  - Technical Progress
  - Programmatic Performance
  - Commitments
- Budgeted annually

SSTIP Briefing: Summary

Strategic Space Technology Investment Plan (SSTIP) Summary

- 20-year horizon, investment guidance for next 4 years
- 4 pillars of Agency technology investment, each pillar has:
  - A Goal
  - Capability Objectives
  - Technical Challenges
- 4-year investment approach (focus on subset of pillar content)
  - 70% - 8 Core technologies - Represent 12 of 16 NRC top priority recommendations across 4 pillars
  - 20% - Adjacent Technologies - Not part of the Core but are part of the NRC's 83 high priorities
  - 10% - Seeding Innovation - Smaller Investments in remaining technologies described in the pillars that were not part of the NRC's 83 high priorities.
- Governance – NTEC
- 6 Principles of Investment

CORE TECHNOLOGIES

1. Launch and In-Space Propulsion
2. High Data Rate Communications
3. Lightweight Space Structures
4. Robotics and Autonomous Systems
5. Environmental Control and Life Support Systems (ECLSS)
6. Space Radiation
7. Science Instruments and Sensors
8. Entry, Descent, and Landing

Technology: A Definition

A solution that arises from applying the disciplines of engineering science to synthesize a device, process, or subsystem, to enable a specific capability.

Recommendations for the NASA Advisory Council

Recommendation:

The Council recommends the NASA Administrator adopt a revised version of the Strategic Space Technology Investment Plan (SSTIP) as the Agency's space technology strategic plan moving forward, with the following input:

- The Council agrees with the content and strategy of the SSTIP.
- The Council offered two suggestions to a) simplify the description of the plan in the SSTIP and b) re-organize the SSTIP to emphasize what the plan is, and de-emphasize how it was derived.

Major Reasons for the Recommendation:

The Council believes that NASA should return to its innovative roots with a consistent level of technology investments in new transformational technologies to address future mission needs. The SSTIP identifies the framework for NASA's space technology investment, the approach to focus investments on critical areas, the governance for strategic decision-making in space technology, and six principles for executing the plan. The Council also believes the SSTIP is the much needed follow-on strategic planning document that addresses the findings and recommendations of the NRC's *NASA Space Technology Roadmaps and Priorities: Restoring NASA's Technological Edge and Paving the Way for a New Era in Space* report released in January 2012.

Consequences of No Action on the Recommendation:

Continued lack of focus and prioritization of transformational space technology efforts within the Agency and an inability of NASA to respond to both internal mission requirements and capabilities and external National priorities.

Recommendations for the NASA Advisory Council

Recommendation:

The Council recommends that NASA establish a basic research (engineering science) program relevant to its long-term needs and goals.

- The Council suggests that the Chief Technologist collaborate with the Chief Scientist and the Chief Engineer to establish formal guidance and seek funding for basic research in engineering science. The Council further suggests that NASA begin by managing the agency's basic research portfolio as a pilot activity that is funded separately from the Space Technology Program, similar to how OCT coordinates the agency's technology portfolio.

Major Reasons for the Recommendation:

The Council recognizes that the distinction has been established between basic research and technology. NASA's technology programs now have advocacy and, in the form of the Strategic Space Technology Investment Plan (SSTIP), strategic guidance. However, basic research (or engineering science) that may lead to the development of technology and engineering tools are no longer explicitly part of NASA's technology enterprise.

Consequences of No Action on the Recommendation:

Erosion of NASA's research and technology capabilities