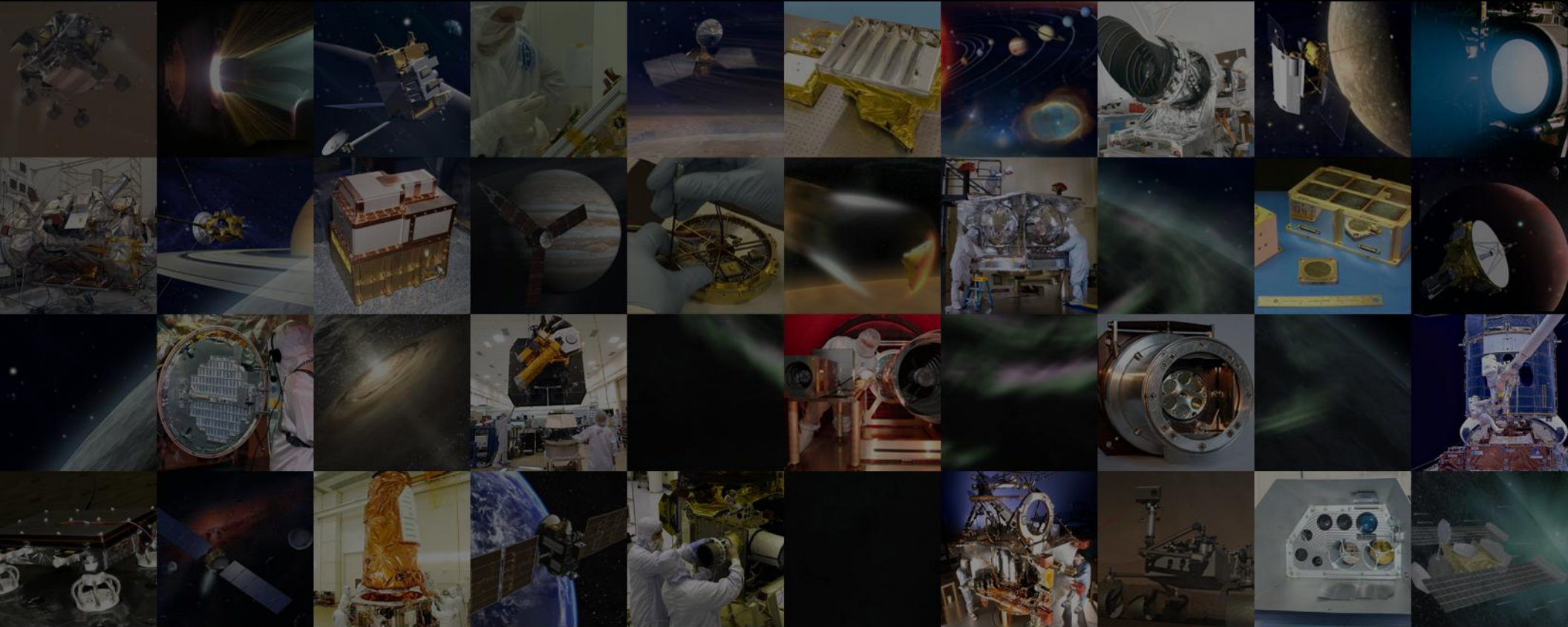




# The Planetary Science Technology Review Panel Final Report Summary



# Outline

- Panel Purpose
- Team
- Major Issues and Observations
- Major Recommendations
- High-level Metrics

# Purpose

- The primary purpose of the Planetary Science Technology Review (PSTR) panel and its advisors was to:
  - Assist the Planetary Science Division (PSD) of NASA Headquarters in developing a coordinated and integrated technology development plan that will better utilize technology resources
- The panel recommends process, policy, and structure changes
  - Helps answer the how questions
- The panel relied on the Planetary Decadal Survey to identify what technologies PSD should invest in
- The panel coordinated with the PSS SR&T review team

The full charter of PSTR can be viewed online <http://spaceflight systems.grc.nasa.gov/PlanetaryScience/>

# Team

- Panel members were:

- Peter Hughes, NASA GSFC
- Tibor Kremic (chair), NASA GRC
- Brad Perry, NASA HQ
- James Singleton, AFRL

- Advisors were:

- Pat Beauchamp, JPL,
- John Clarke, Boston University
- Ralph Lorenz, APL

- NASA HQ POC was:

- Gordon Johnston

- Technical Support by:

- Waldo Rodriguez, NASA LaRC
- Linda Nero, NASA GRC

# List of Major Observations and Issues

<b>Issue Number</b>	<b>Observation/Issue</b>
<b>Strategy</b>	
S-1	No overall strategy or accountable manager
S-2	No clear path for technology maturation from TRL 0-9
S-3	Limited engagement of other NASA OCT, ESMD, and ESD technologists
S-4	Technology should be perceived as more than just hardware development
S-5	Efforts by external stakeholders are not worked into PSD strategy
<b>Process/Structure</b>	
P-1	Programs are not consistent and do not have clearly defined processes
P-2	Technology managers are overloaded and often oversee flight projects
P-3	Inconsistent and inaccurate TRL and heritage assessments
P-4	Limited processes that encourage interaction between stakeholders
<b>Resources</b>	
R-1	Technology budgets are unpredictable
R-2	Technology budgets are insufficient
R-3	Inadequate leveraging of others' investments
<b>Culture/Communication</b>	
C-1	Technology investments have not yielded all the benefits they could have
C-2	Inadequate communication (in & out)
C-3	Projects are too risk averse to new technology
C-4	Tenuous commitment by top management
C-5	Need to better sustain capabilities

# Summary of Major Recommendations

<b>Major Recommendation</b>
<b>Management</b>
MR-1) Establish a dedicated Director position with overall responsibility for PSD technology
MR-2) Establish a small supporting program office
<b>Strategy</b>
MR-3) Develop a comprehensive strategy for PSD technology
MR-4) Strategically allocate resources (guidelines are provided by PSTR)
MR-5) Actively pursue a strategy of leveraging opportunities within and outside NASA
<b>Process</b>
MR-6) Develop a more consistent and accurate TRL assessment process
MR-7) Develop clear, transparent, and consistent decision and review processes
MR-8) Develop a more structured and rigorous process to create interactions between technologists, scientists, and missions
<b>Culture and Communication</b>
MR-9) Develop an overall communication plan and technology database
MR-10) Foster a culture that advocates for and defends technology
<b>Resources</b>
MR-11) Dedicate stable funding at the higher end of the decadal suggested range - 8%

# Recommendations - Management

**MR-1)** Establish a Technology Program Director (TPD) position who reports directly to PSD Director. Consolidate technology management under the TPD as much as practical\*. TPD responsibilities include:

<b>Responsibilities of the Technology Program Director</b>
<b>Strategy /Leadership</b>
Develop and maintain an overall PSD technology strategy with clear priorities
Formulate technology budgets and plans
Develop a strategic technology communication plan and act as POC for PSD technologies
Integrate PSD technology needs and efforts into a coordinated roadmap
Serve as the Program Executive of the supporting program office
Advocate for technology needs and communicate accomplishments and highlights
<b>Implementation</b>
Develop and oversee decision processes for priority setting, gate keeping, and program reviews
Ensure the integrity of the selection processes
Ensure all technologies are either making steady progress toward maturation, being infused, or getting terminated
Ensure that the proper technology related data and status is easily available to the right person, at the right time, and at the level of detail needed.
Oversee the processes that leverage and/or influence stakeholders within, or outside, NASA
Ensure all PSD technology efforts are traceable to PSD science goals

\* In special cases where a *dedicated* program executive and program office already exists it may be more appropriate to keep the existing structure. In that case the TPD can provide higher level guidance and coordination.

# Recommendations - Management

**MR-2)** Establish a small Planetary Technology Program Office to assist the TPD and PSD in implementing and managing technology efforts

- The program office should coordinate the expertise and leadership in the areas of a) instruments, b) spacecraft systems, c) mission / technology support systems, and in d) planning, documenting and communications. Include a strong system engineering position with mission experience
- The program office will assist the TPD in
  - » implementing the overall strategy
  - » developing roadmaps
  - » developing tools for capturing, communicating, and maintaining technology data
  - » implementing reviews and workshops
  - » a host of other duties on behalf of the TPD



# Recommendations - Strategy

## MR-3) Develop a comprehensive overall technology strategy

- All the needed elements of a strategy were not developed by the panel, but a simple tool was offered that captures PSD technology in dimensions of maturity and area. The tool can assist PSD in balancing and prioritizing resources and program content

Technology Area	Critical Capabilities/ Facilities, etc	TRL 0-1	TRL 2-3	TRL 4-6	TRL 7+	Recommended Total Percent
Instruments						
Spacecraft Systems						
		System Level Maturity Low to High				
Mission Support						
Planning/ Documentation/ Communication						

- Mission support is inclusive of non-hardware technologies, such as astrodynamics, mission design and planning tools, unique facilities, etc.
- PSD has unique environmental and technology needs and must step up to initiating unique, long-range, and/or high-risk technologies

# Recommendations - Process

## MR-6) Develop a more consistent and accurate TRL assessment process and communicate that to the community

- The process needs to be standardized and rigor increased all the while considering the application(s)
  - » Difficult challenge due to the variety of planetary environments and the mission selection processes
- a) Develop a standardized TRL assessment process for PSD technologies, managed at the TPD/program level (leverage new agency TRL standardization initiatives as practicable)
- b) The assessment process should include a simple approach, perhaps leveraging existing tools and/or questionnaires, to assess low TRL levels and evaluate annual maturation progress\*
- c) For critical or maturing technologies, an individualized development plan should be created identifying specific tests/analysis and the test levels to be completed to claim a TRL\*

\* It is expected that all TRL assessments will include interactive discussions between the TPD/program, the technologists, and if available, missions users.

# Recommendations - Process

Assessing TRL for technologies developed for competed missions and yet unknown environments:

- PSD should develop one or more “standard” reference missions that bound representative environments for destination classes. These should be made available to the science and technology communities as pseudo requirements during technology development and testing. Once mission parameters are known delta activities can be undertaken, if needed
  - » The decadal studies may be a good starting point for developing enveloping requirements
- When specific mission requirements are not known, TRL claims will be assessed against the environment set(s) released through the PSD process described above.

# Summary of Major Recommendations

<b>Major Recommendation</b>
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# High-Level Metrics

- PSTR developed high-level metrics (goals) for the overall technology program. The objective of the high-level metrics is to provide PSD a relatively simple way to assess overall program success
- PSTR did not attempt to create detailed performance metrics or specific metrics for specific technologies
  - » Will be developed by the TPD and supporting program
- Metrics address several areas including Technology Maturation and Infusion, Leveraging, Communicating, and Programmatic

# Summary of High-Level Metrics

Metric/Goal	Metric/Goal
<b>Technology Maturation and Infusion</b>	
G-1a	10-30% of TRL 1-2 technologies make it to TRL 3 (Adjust metrics over time)
G-1b	40-60% TRL 3-4 technologies make it to TRL 6 (adjust over time)
G-1c	Infusion to flight for technologies that achieve TRL 6 should be > 80%
G-2	Develop a maturation schedule for each technology and ensure the technology is making the progress it should. Review on an annual basis
G-3	Each technology should have specific technical requirements and maturation milestones to achieve. Review on an annual basis
<b>Leveraging</b>	
G-4	Attract leveraging support of technologies suitable to PSD and track it as a percentage of total PSD technology investment. Work towards developing a specific goal based on initial experiences
<b>Communication</b>	
G-5	Implement at least one PSD technology focused workshop annually
G-6	All technology development efforts are described in conference proceedings or peer reviewed publications and results are documented in a standard final report
<b>Programmatic</b>	
G-7a	Establish a responsible technology program director (TPD) by end of FY12 and the supporting office/structure by end of FY13
G-7b	Create, document, and communicate an overall technology strategy by middle of FY13
G-7c	Establish a TRL assessment process for PSD technology developments and identify representative environments that can become pseudo requirements for technology development projects by middle of FY13
G-7d	Roadmaps for all technology developments are developed and linked to the overall strategy, the decadal survey, and expected mission needs by end of FY13
G-8	Timely and adequate funds are provided in needed technology developments. The goal is to fund technology efforts at levels needed to achieve desired readiness as identified in the respective technology's roadmap.