National Aeronautics and Space Administration

# Technology, Innovation & Engineering Committee Report
# NASA Advisory Council

**Presented by:**
**Dr. Bill Ballhaus, Chair**

**April 9, 2015**

# TI&E Committee Meeting Attendees
# April 7, 2015

- Dr. William Ballhaus, Chair
- Mr. Michael Johns, Southern Research Institute
- Dr. Matt Mountain, Space Telescope Science Institute
- Dr. Dava Newman, MIT
- Mr. David Neyland, Consultant
- Mr. Jim Oschmann, Ball Aerospace & Technologies Corp.
- Dr. Mary Ellen Weber, STELLAR Strategies, LLC

# TI&E Committee Meeting Presentations
# April 7, 2015

- Office of Chief Engineer Update
  - Mr. Ralph Roe, NASA Chief Engineer
- Update on NASA's Future Workforce: Gender and Diversity
  - Ms. Sherri McGee, Deputy Assistant Administrator, Human Capital Management
- Space Technology Mission Directorate Update
  - Dr. James Reuther, Deputy Associate Administrator for Programs, STMD
- SBIR/STTR Program Update
  - Mr. Bob Yang, Program Executive, STMD
- Office of Chief Technologist Update
  - Mr. Jim Adams, NASA Deputy Chief Technologist
  - Mr. Dan Lockney, Program Executive, OCT
- Centennial Challenges Program Update
  - Mr. Sam Ortega, Program Executive (Acting), STMD
- Annual Ethics Training
  - Ms. Katie Spear, NASA OGC

# Agency Capability Leadership Areas

**TECHNICAL CAPABILITY AREAS-DISCIPLINE LEVEL**

1. **Aerosciences**
2. **Avionics**
3. **Electrical Power**
4. **Flight Mechanics**
5. **GN&C**
6. **Human Factors**
7. **Life Support/Active Thermal**
8. **Loads and Dynamics**
9. **Materials**
10. **Mechanical Systems**
11. **NDE**
12. **Passive Thermal**
13. **Propulsion**
14. **Software**
15. **Structures**
16. **Systems Engineering**
17. **Space Environments**
18. **Cryogenics**
19. **Instruments and Sensors**
20. ***Others?***

**LEADERSHIP:**

- NASA Technical Fellows:
  - Agency resource for providing expertise, guidance and advice
  - Lead Capability Leadership/Technical Discipline Teams with membership from Centers
  - Currently recognized engineering disciplines (bold items on left) plus others as Agency Senior leadership identifies (italics items on left)

**GOVERNANCE:**

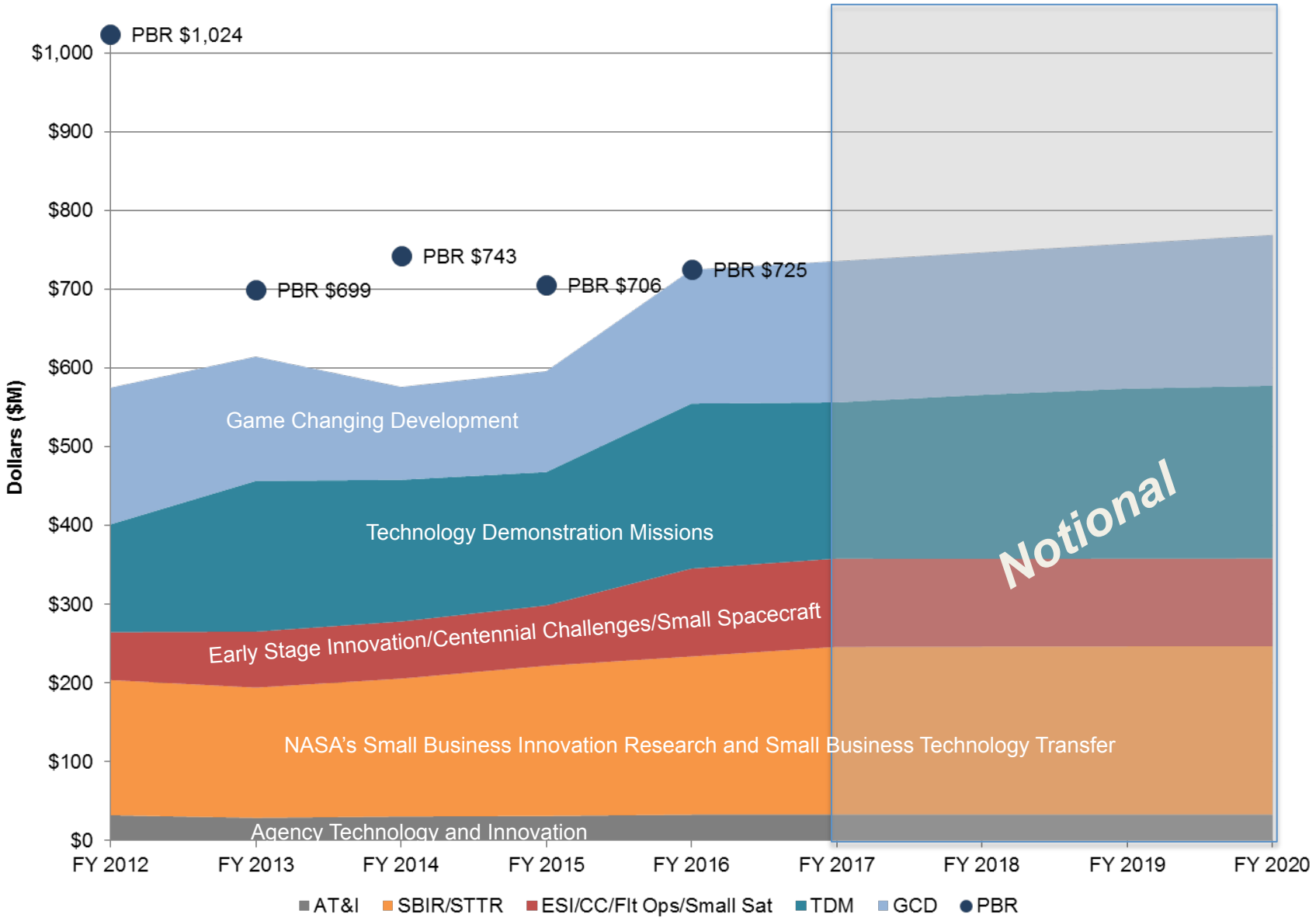
- NASA Technical Fellows resident at Centers and managed by NESC
- OCE administers discipline-level Technical Capability Leaders on behalf of Agency
- Capability Leadership plans will document team membership and relationships to other capability areas and Agency-level groups
- EMB (extended if necessary) ensures integration and coordination across all discipline-level Capability Leadership Areas
- Report annually to APMC and as needed for divest/invest decisions
- Issues can be brought to Deputy AA when lower level resolution cannot be reached

# TI&E Committee Finding #1

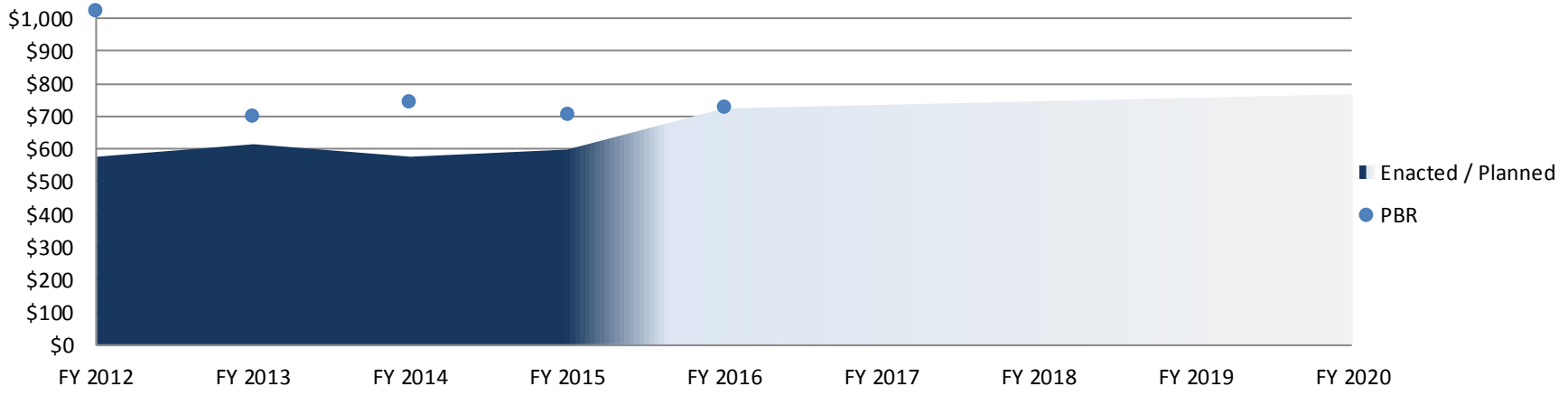
**NASA Workforce Gender Diversity Finding:**

- The recent OCE Tech Fellows selection resulted in only 1 female out of 15 Fellows.
- The Committee found that a gender diversity issue extends beyond OCE Tech Fellows.
- There is a need for NASA to follow best practices for future selections and to determine what additional steps should be taken to effect a more gender-diverse workforce. Supporting data:
  - Out of 138 S&E ST/SLs, 86% male
  - GS15 S&Es, 75% male
  - S&E SES, 81% male

# Space Technology Funding Transitions



# STMD FY 2016 President's Budget



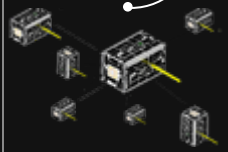

| | Budget Authority ($M) | Actuals FY 2014 | IOP FY 2015 | PBR FY 2016 | PPBE16 FY 2017 | PPBE16 FY 2018 | PPBE16 FY 2019 | PPBE16 FY 2020 |
|---|---|---|---|---|---|---|---|---|
| OCT | Agency Technology & Innovation | 31 | 31 | 33 | 33 | 33 | 33 | 33 |
| Space Tech Mission Directorate | SBIR and STTR | 175 | 191 | 201 | 213 | 213 | 213 | 214 |
| | Space Technology Research & Development | 370 | 374 | 491 | 490 | 500 | 511 | 522 |
| | Early Stage Innovation | 45 | | 73 | 75 | 75 | 75 | 75 |
| | Centennial Challenges | 1 | | 5 | 5 | 5 | 5 | 5 |
| | Flight Opportunities | 10 | | 15 | 15 | 15 | 15 | 15 |
| | Small Spacecraft | 17 | | 19 | 17 | 17 | 17 | 17 |
| | Game Changing Development | 118 | | 170 | 179 | 181 | 184 | 191 |
| | Technology Demonstration Missions | 180 | | 210 | 198 | 208 | 216 | 219 |
| | Space Technology Total | 576 | 596 | 725 | 736 | 747 | 758 | 769 |

|----------NOTIONAL----------|

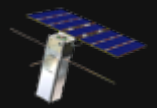
# CY Major Events & Milestones

2014 2015 2016 2017 2018 2019 2020 2021

Human Robotic Systems & Telerobotics



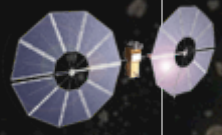
EDSN SmallSat Demo



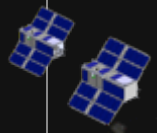
Integrated Solar Array

Evolvable Cryogenics (eCryo)

Laser Communications Relay Demonstration



SEP Demo Mission

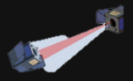


Cubesat Proximity Ops Demo

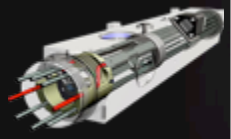
Maraia (Suborbital)

5.5m Composite Cryotank

Green Propellant



Optical Comm & Sensor Demo



Deep Space Atomic Clock

Composite Upper Stage

LDSD: Supersonic Inflatable Aerodynamic Decelerator

LDSD: Supersonic Inflatable Aerodynamic Decelerator

*Future Planning*

# STMD Program Impacts from Budget Reductions

**Space Technology has realized ~$800 million reduction from planning levels (based on FY 2012-15 President's Budget Request) to actual appropriations.**

**Funding reductions have resulted in the following example impacts**:

- HEOMD asked that STMD prioritize completing tech demos for Cryogenic Propellant Storage and Transfer (CPST), and Solar Electric Propulsion (SEP), while making progress on Advanced Life Support and Surface Power.
- SMD and HEOMD asked that STMD develop and demonstrate optical comm as well as Mars EDL.
- Forced to cancel the CPST flight demo project (~$400M LCC) and reformulate it as ground technology project (eCryo ~$60M LCC); will only get to TRL 5 vs. 7, without active cooling
- SEP Flight Demo funding profile has flattened with the flight delayed two years, however great progress on tech development and commercial infusion of advanced arrays have occurred

# STMD Program Impacts from Budget Reductions *(cont.)*

**Funding reductions have resulted in the following example impacts**:

- Significant progress on advanced life support but delayed progress on surface power
- Delayed and de-scoped Laser Communication Relay Demo by 18 months and have delayed the start of Deep Space Optical Comm demo by 3 years
- Delayed and de-scoped Low Density Supersonic Decelerator project reducing the number of flights from 4 to 3 and stretching the project by 2 years. Still significant progress on Mars EDL has occurred – HIAD, ADEPT, woven TPS, and LDSD
- Reduction in number of research grants Space Technology could support by approximately 45% and a reduction in the number of possible NIAC awards by 15% over the four years
- Reduction of approximately $30M in procurement available to the Center Innovation Fund. This changed the nature of the program by eliminating the ability for Centers to conduct larger technology initiatives that leverage Center talent and capabilities.

# TI&E Committee Finding # 2

**STMD Budget Finding:**

- Specific technology advances have been defined that enable NASA's future exploration missions.
  - Strategic Space Technology Investment Plan (2012)
- When Space Technology was established, a plan was formulated including well-defined deliverables and the necessary budget to execute the program.
- However, STMD has consistently lacked the sufficient discretionary resources to deliver all the technology developments required across the TRL spectrum to meet NASA's future mission goals.

# TI&E Committee Finding # 2

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***Is a human mission to Mars slipping year for year as a result?***

National Aeronautics and Space Administration

NASA

# Space Technology Mission Directorate

# Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Programs

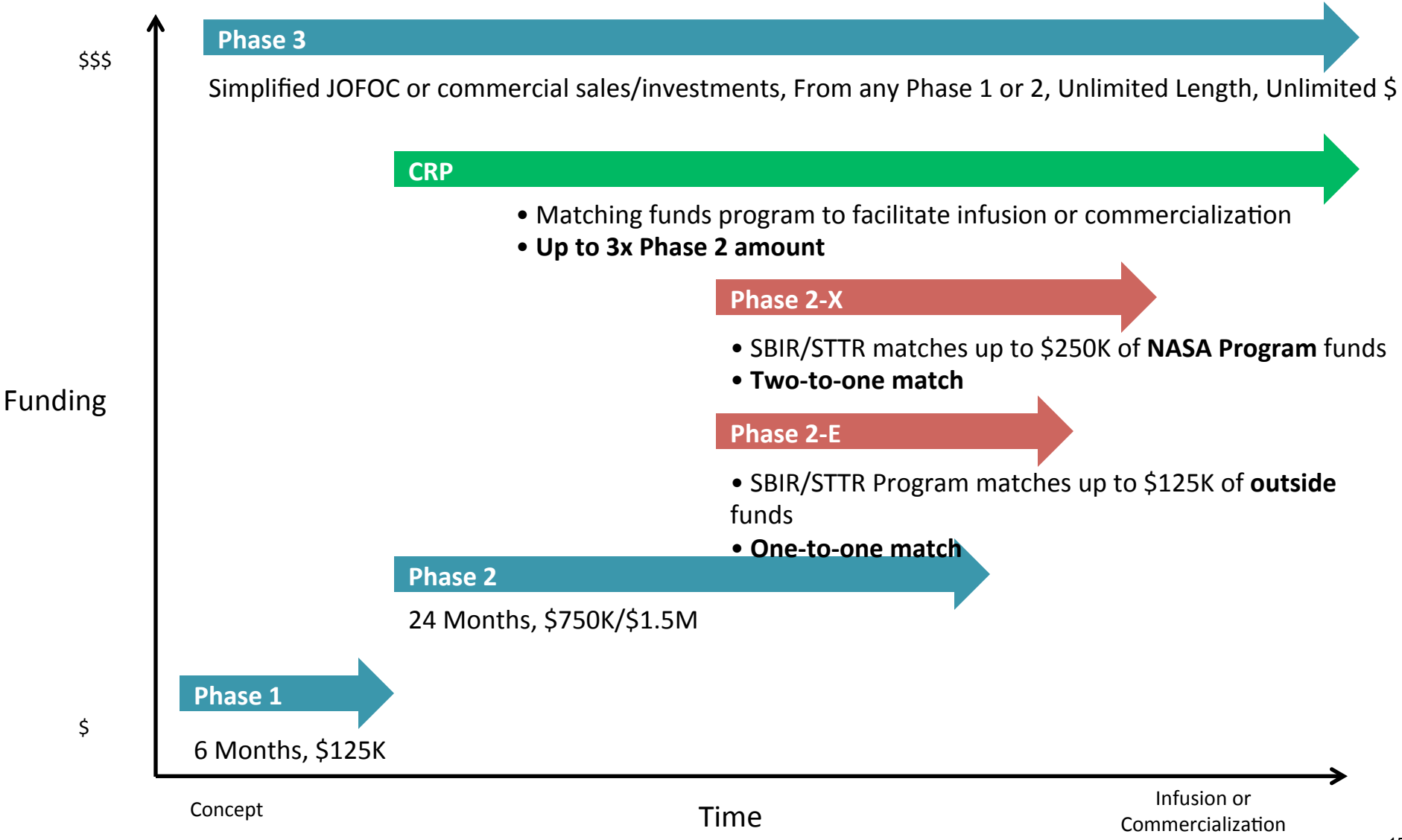
**Robert L. Yang**
**SBIR/STTR Program Executive**

***April 7*, 2015**

# SBIR/STTR Program Overview

- 1982 Small Business Innovation Development Act
  - Agencies with $100M in extramural research must have SBIR
  - Agencies with $1B in extramural research must have STTR
  - Competitively awards funding to small businesses
  - Focused on meeting governments' requirements for technology
- The program's goals are four-fold:
  - Stimulate technological innovation
  - Meet Federal research and development needs
  - Foster and encourage participation in innovation and entrepreneurship by socially and economically disadvantaged persons
  - Increase private-sector commercialization of innovations derived from Federal research and development funding

# SBIR/STTR Integrated Portfolio



# TI&E Committee Finding #3

**Impact of Congressionally mandated SBIR/STTR funding increases:**

- SBIR/STTR management/budgets are consolidated and well managed in STMD.
- However, as the STMD planned budget increases have not materialized, and as SBIR/STTR allocations have increased as mandated by Congress, STMD's primary programs have been severely impacted.
- Supporting data:

| | FY2012 | FY2015 |
|---|---|---|
| Total STMD budget | $574M | $596M |
| SBIR/STTR | $172M | $191M |
| Core Space Tech Programs | $402M | $405M |

# TI&E Committee Finding #4

**Pre-Solicitations for SBIR/STTR opportunities:**

- NASA does not currently conduct pre-solicitation interactions with industry in advance of SBIR/STTR solicitations. The value of SBIR/STTR proposals to NASA would be enhanced by conducting such interactions with industry to define NASA technology needs and priorities.
  - The Committee notes that DoD has an effective process for conducting pre-solicitation interactions that helps industry align proposals with agency priorities.

# Office of the Chief Technologist Update

*for NAC Technology, innovation and Engineering Committee*

**Jim Adams, Deputy Chief Technologist**

4/7/15

TECHNOLOGY DRIVES EXPLORATION

#321TechOff

# TechPort

National Aeronautics and Space Administration

- **TechPort has 2 main purposes and many uses**:
  1. Support portfolio analysis/management - documenting, tracking and analyzing technology investments
  2. Provide public information about NASA's current technology investments

- TechPort serves as the Agency's integrated technology data source, sharing the latest accomplishments and new and exciting technology projects from all of NASA's Mission Directorates, Centers and facilities.
- TechPort-beta makes a wide range of technology information available, so the public can search and find information relevant to their interests and specific needs.

- TechPort provides the capability to search and select NASA technology information by Technology, Project Description, Management Team, Technology Readiness Level (TRL) and many other descriptive attributes.

- See TechPort Primer for more information and potential uses of the system.

*The public release of TechPort information facilitates NASA compliance with the Executive Order -Making Open and Machine Readable the New Default for Government Information (May 9, 2013) and the Open Data Policy (Office of Management and Budget Memorandum M-13-13).*


**TechPort Released to Public 3/3/2015**

- **TechPort (NASA Internal) Released September 30, 2012 (operational 31 months)**
  - > 4,851 unique NASA visitors since FY2012
  - > 46,679 searches since Feb. FY2014
  - > 9,762 reports generated since Feb. FY2014

- TechPort Public Release March 3, 2015
  - Announced via Twitter
  - > 2,654 unique Public visitors (4,204 visits) in 4 first weeks
  - > 1,158 searches since March 3, 2015
  - > 952 reports since March 3, 2015
  - Public site is considered a beta version. The Public will be asked to comment on usability and content; and influence the future design of the public-facing website.

TechPort found at: http://techport.nasa.gov

# NASA Roadmap Update and Status

National Aeronautics and Space Administration

In 2010, NASA Teams generated 14 Technical Area Roadmaps; in 2014, we began an update to those existing roadmaps to incorporate:

- Advances in technology development
- New Human Exploration, Science and Aeronautics Mission Needs:
  - Human Exploration Mission Classes and Design Reference Missions Derived from Capability Driven Framework and Human Spaceflight Architecture Studies
  - Science Mission Classes and Design Reference Missions Derived from Decadals and Science Plans
  - Aeronautics Content Derived from Thrust Areas and Aeronautics Research and Development Plans
- Increased utility and ease of use by NASA and our external stakeholders

## Technology Roadmap Update

Will Consider:
- Updates in Science Decadal Surveys
- Human Exploration Capability Work
- Advancements In Technology

Will Include:
- State of the Art
- Capability Needs
- Performance Goals

Expanded Scope:
- ✓Aeronautics Technology
- ✓Autonomous Systems
- ✓Avionics
- ✓Information Technology
- ✓Orbital Debris
- ✓Radiation
- ✓Space Weather


***Public Release of the Roadmaps Soon***

TECHNOLOGY TRANSFER PROGRAM

BRINGING NASA TECHNOLOGY DOWN TO EARTH

# T2 Status and Initiatives
# Briefing to NASA Advisory Counsel

Daniel Lockney
Technology Transfer Program Executive
Office of the Chief Technologist
April 7, 2015

# FY2014 T2 Program Activity Summary

TECHNOLOGY TRANSFER PROGRAM

## Identify

**120** New Technology Report (NTR) Training Sessions Conducted

**3076** Active Contracts with New Technology Clause Tracked

**854** Contracts with New Technology Clause Closed

**1697** NTRs Processed and Certified

## Protect

**149** U.S. Patent Applications Filed

**80** U.S. Provisional Patent Applications

**124** U.S. Patents Issued

**8** PCT and Foreign Patent Applications

**0** Foreign Patents Granted

**1113** Active Patents

## Market

**413** Tech Briefs Published

**100** Technology Opportunity Sheets Created

**1008** Software Catalog Titles Published

**129** QuickLaunch Patents Advertised

**100,000+** Social Media Followers

## License

**1603** Software Usage Agreements

**4** Joint Ownership Agreements

**17** New Evaluation Licenses

**29** New Commercial Licenses

**4** New Licensing Initiatives

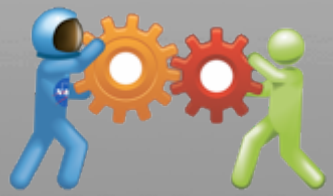
## Monitor

**309** Active Licenses Maintained

**$1,860,238** Royalties Collected

**44** NASA Spinoff Stories Published

**55** Patents Abandoned



**15** NASA Technology Transfer System (NTTS) Relational Database Upgrades

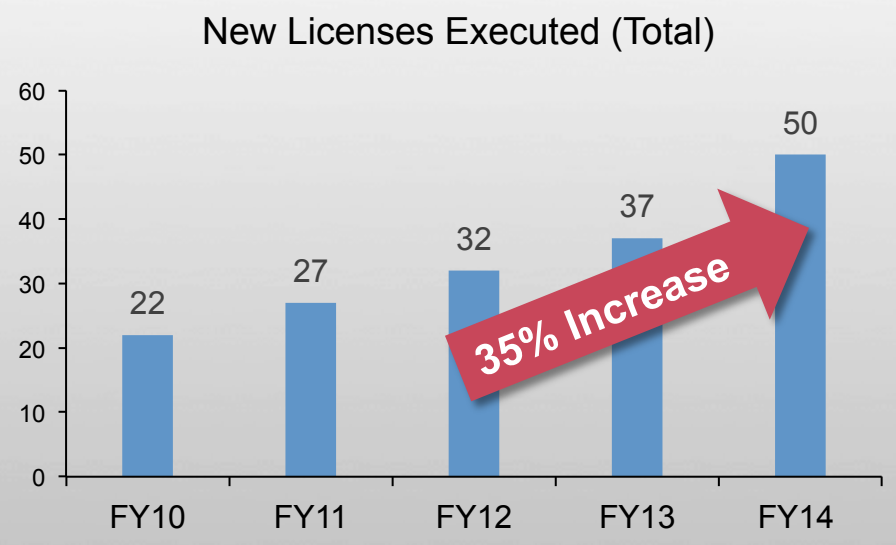
**146,637** T2 Portal Page Views Since September 2014 Redesign

**1,709,795** Spinoff Website Page Views in FY2014

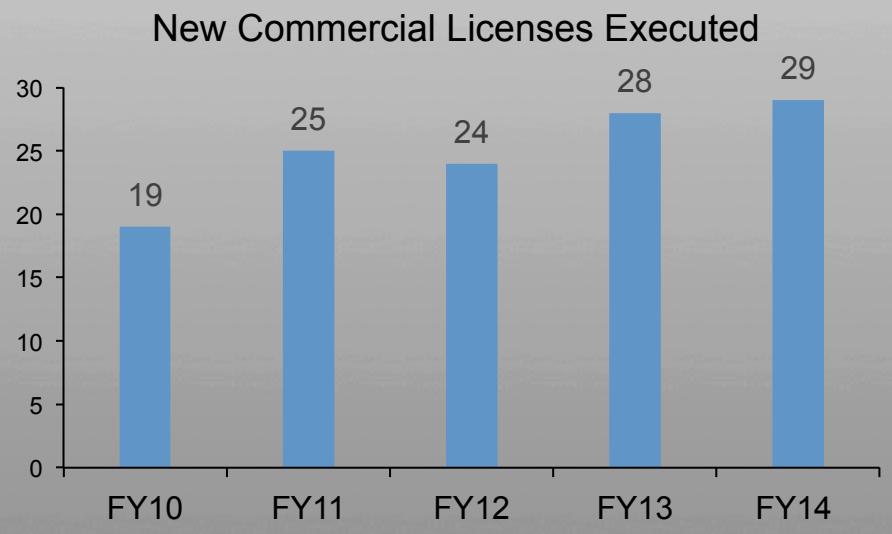
**105,585** Software Catalog PDF Downloads Since April 2014 Release

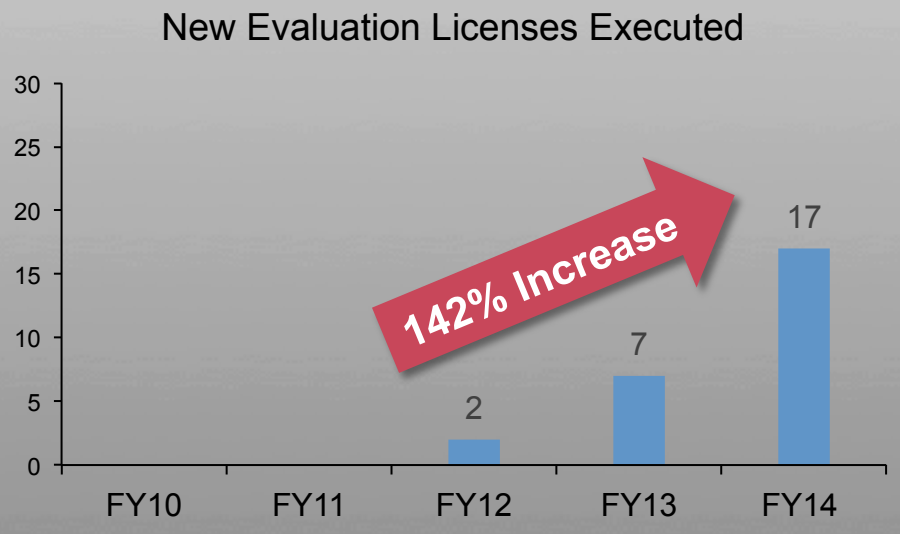
# New Patent Licenses

TECHNOLOGY TRANSFER PROGRAM




- Emphasis on Evaluation Licenses in FY14 resulted in a **142% increase** over last fiscal year
- Overall **35% increase** in Licensing for the agency!



National Aeronautics and Space Administration

# Centennial Challenges Program
## Space Technology Mission Directorate

NASA ADVISORY COUNCIL
OVERVIEW

APRIL 7, 2015

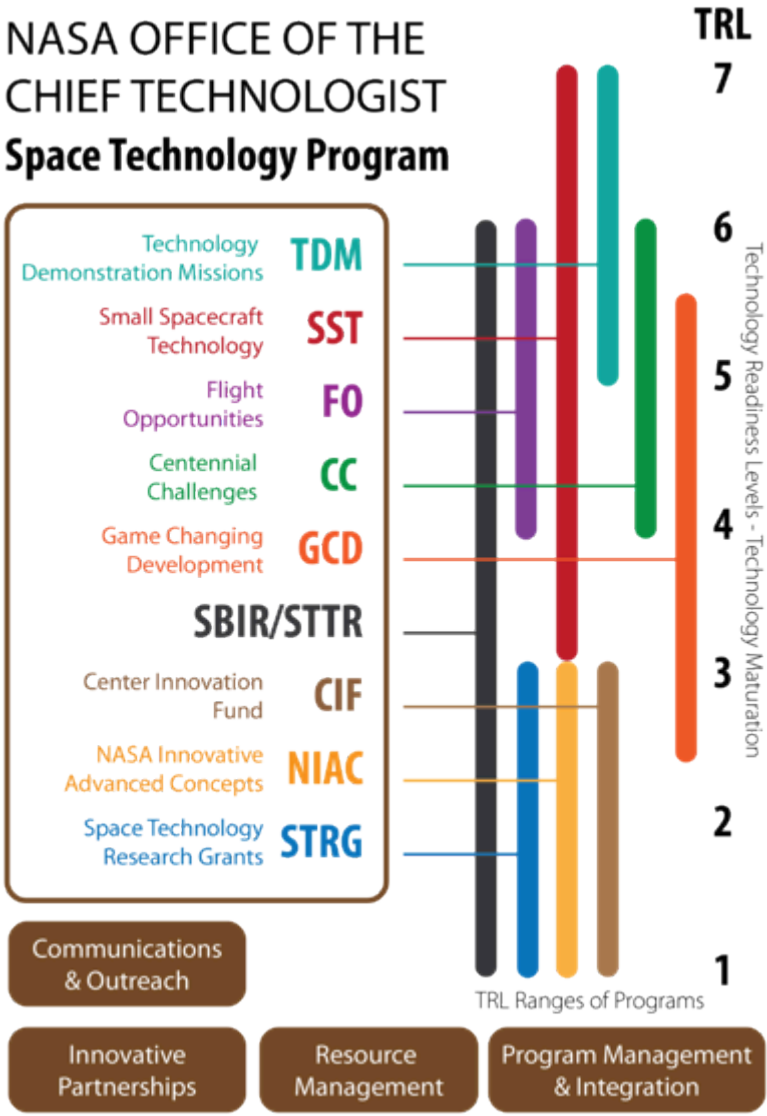
Sam Ortega
Program Manager

Eric Eberly
Deputy Program Manager

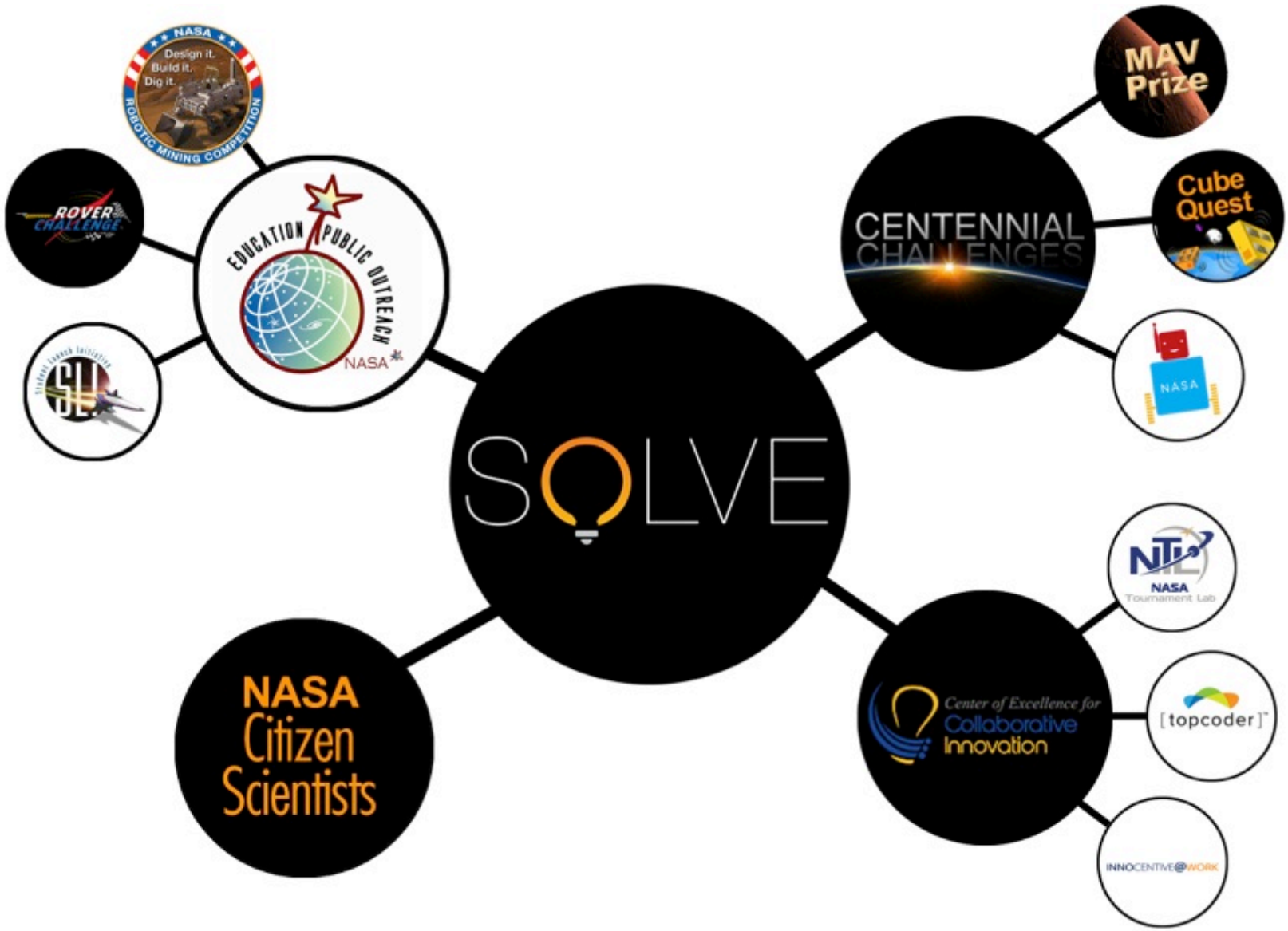
# Centennial Challenges

- Centennial Challenges Program is unique in Space Technology MissiCongressional on Directorate:
  - Uses Authorization to execute prize purse competitions
  - Prize funds can only go to US citizens, permanent residents, or US entities.
  - Primarily TRL 4-6
  - Competitors retain the Intellectual Property
  - Minimal reporting and government oversight

- *Space Act Authorizes CCP to offer prize purses up to $50M per challenge*
- *Funds do not expire-allows multi-year competitions and can reprogram.*
- *Federal employees cannot participate if within scope of employment.*



# Centennial Challenges Agency Fit

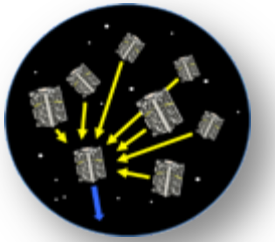


# Key Milestones in 2015-16

**Green Propellant:** demonstrates propellant formula, thrusters, and integrated propulsion system, for higher performing, safe alternative to highly toxic hydrazine. (Launch STP-2 NET 5/2016)

**Deep Space Atomic** New space clock improving navigational accuracy for deep space (Launch STP-2 NET 5/2016)

Purchasing major subsystems for **Solar Electric Propulsion and Laser Communications demonstrations**



**Small Spacecraft Technology:** Four small spacecraft demonstration missions:

- EDSN: Small spacecraft swarm operating as a network for distributed science observations.
- ISARA: Uses a deployed solar array as a Ka-band radio antenna reflector
- OCSD: Demonstrating in-space laser communications using 2 cubesats.
- CPOD: Proximity operations and docking demo with 2 cubesats

**Delivers Low Density Supersonic Decelerators**

- Conducts second supersonic flight demonstrations of a ring-sail parachute and a supersonic inflatable aerodynamic decelerator.