Innovative Partnerships Program (IPP)

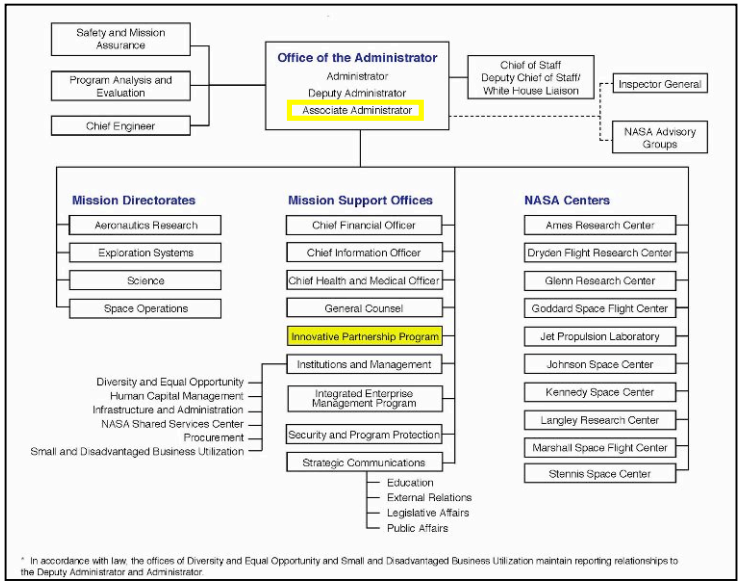
Overview and Opportunities

ESMD Technology Exchange Conference
Galveston, Texas

November 15, 2007

About the Innovative Partnerships Program

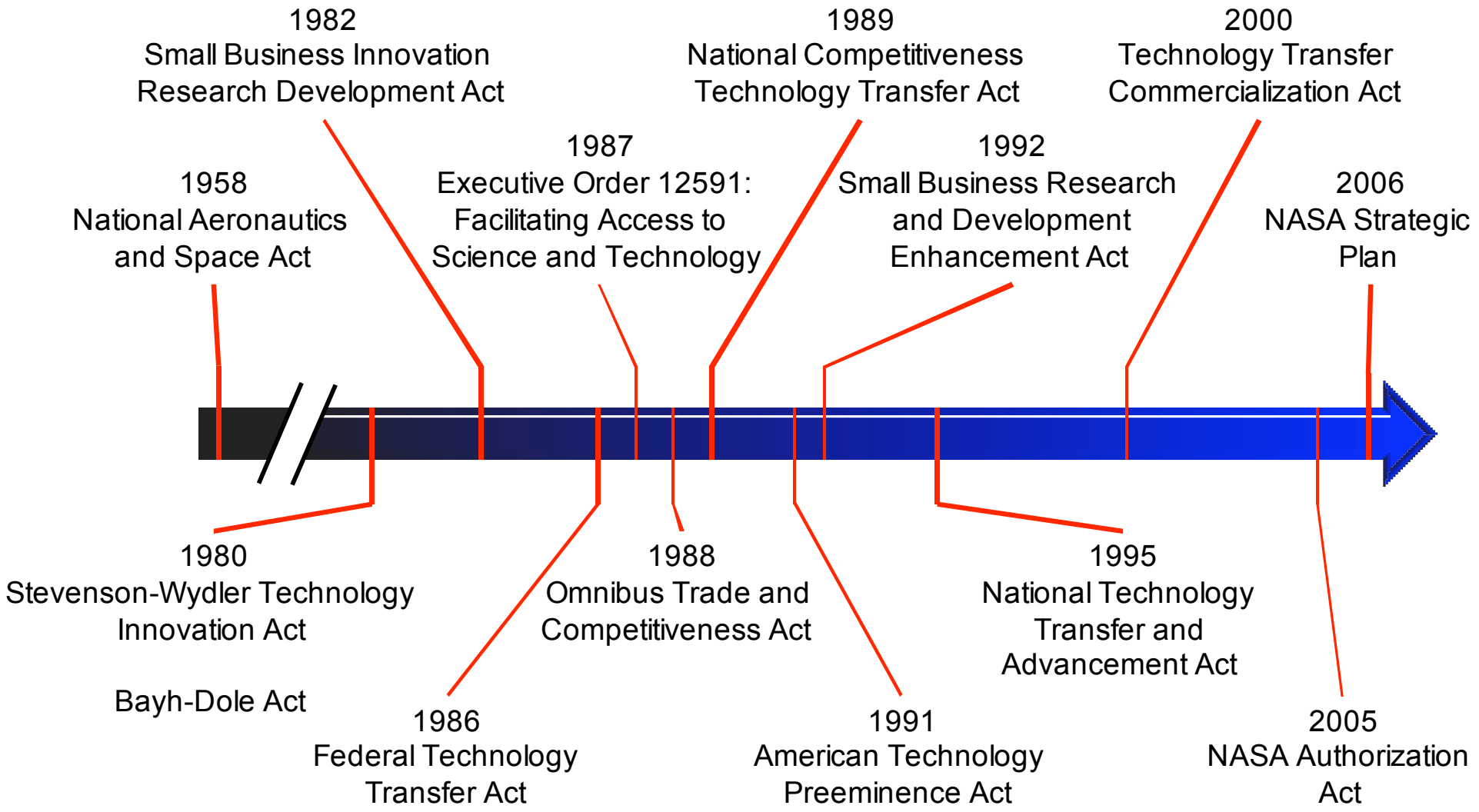
- **IPP is seeking to add value to NASA's Mission Directorates and their programs and projects, through technology development and infusion to meet mission needs.**
- **IPP seeks leveraged funding to address these technology barriers via cost-shared, joint-development partnerships.**
- **IPP Seeks to transfer technology developed by NASA for commercial application and other benefits to the Nation**
- **IPP seeks increased participation from new sources of innovation for addressing NASA's technology challenges.**
- **Facilitator**
  - Bringing parties together, both inside and outside the agency.
  - Bridging communication gaps.
- **Catalyst**
  - Acting as a pathfinder for implementing new things – change agent.
  - Creating new partnerships.
  - Demonstrating effectiveness of new approaches and methods.



Budget Authority (millions)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Science, Aeronautics and Exploration	**$10,650.6**	**$10,483.1**	**$10,868.4**	**$11,364.1**	**$15,386.5**	**$15,888.6**
Science	**$5,466.8**	**$5,516.1**	**$5,555.3**	**$5,600.6**	**$5,656.9**	**$5,802.7**
Planetary Science	$1,411.2	$1,395.8	$1,676.9	$1,720.3	$1,738.3	$1,748.2
Heliophysics	$1,028.1	$1,057.2	$1,028.4	$1,091.3	$1,241.2	$1,307.5
Astrophysics	$1,563.0	$1,565.8	$1,304.2	$1,268.9	$1,266.2	$1,393.8
Earth Science	$1,464.5	$1,497.3	$1,545.8	$1,520.1	$1,411.2	$1,353.2
Exploration Systems	**$4,152.5**	**$3,923.8**	**$4,312.8**	**$4,757.8**	**$8,725.2**	**$9,076.8**
Constellation Systems	$3,232.5	$3,068.0	$3,451.2	$3,784.9	$7,666.0	$7,993.0
Advanced Capabilities	$920.0	$855.8	$861.6	$973.0	$1,059.1	$1,083.9
Aeronautics Research	**$529.3**	**$554.0**	**$546.7**	**$545.3**	**$549.8**	**$554.7**
Aeronautics Technology	$529.3	$554.0	$546.7	$545.3	$549.8	$554.7
Cross-Agency Support Programs	**$502.0**	**$489.2**	**$453.5**	**$460.4**	**$454.7**	**$454.4**
Education	$167.4	$153.7	$152.8	$152.7	$149.8	$149.6
Advanced Business Systems	$97.4	$103.1	$69.4	$71.6	$67.6	$67.5
Innovative Partnerships Program	$215.1	$198.1	$197.2	$199.8	$200.0	$200.0
Shared Capability Assets Program	$22.1	$34.3	$34.2	$36.2	$37.3	$37.2
Exploration Capabilities	**$6,108.3**	**$6,791.7**	**$6,710.3**	**$6,625.7**	**$3,036.6**	**$2,978.0**
Space Operations	**$6,108.3**	**$6,791.7**	**$6,710.3**	**$6,625.7**	**$3,036.6**	**$2,978.0**
Space Shuttle	$4,017.6	$4,007.5	$3,650.9	$3,634.4	$116.2	$0.0
International Space Station	$1,762.6	$2,238.6	$2,515.1	$2,609.2	$2,547.5	$2,600.8
Space and Flight Support (SFS)	$328.1	$545.7	$544.3	$382.0	$372.9	$377.2
Inspector General	**$33.5**	**$34.6**	**$35.5**	**$36.4**	**$37.3**	**$38.3**
Inspector General	**$33.5**	**$34.6**	**$35.5**	**$36.4**	**$37.3**	**$38.3**
NASA FY 2008	**$16,792.3**	**$17,309.4**	**$17,614.2**	**$18,026.3**	**$18,460.4**	**$18,905.0**
Year to year increase		*3.1%*	*1.8%*	*2.3%*	*2.4%*	*2.4%*

***All fiscal year budgets shown are Full Cost Simplified**

Policy and Statutory Authority for IPP



Program Elements

Technology Infusion

- SBIR
- STTR
- IPP Seed Fund

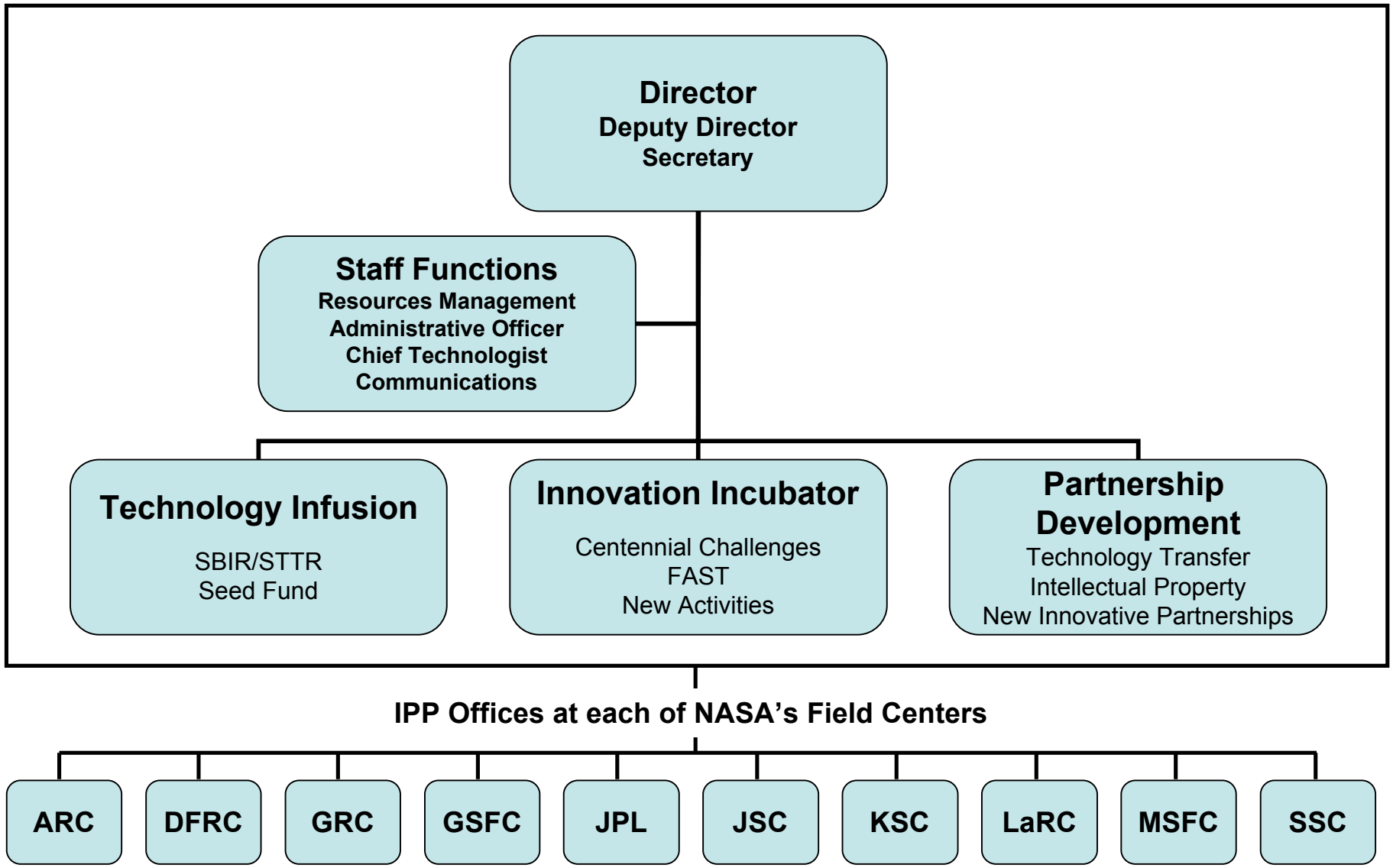
Innovation Incubator

- Centennial Challenges
- New Business Models
- Innovation Transfusion

Partnership Development

- Intellectual Property management
- Technology Transfer
- New Innovative Partnerships

Innovative Partnerships Program Office



IPP Partnerships

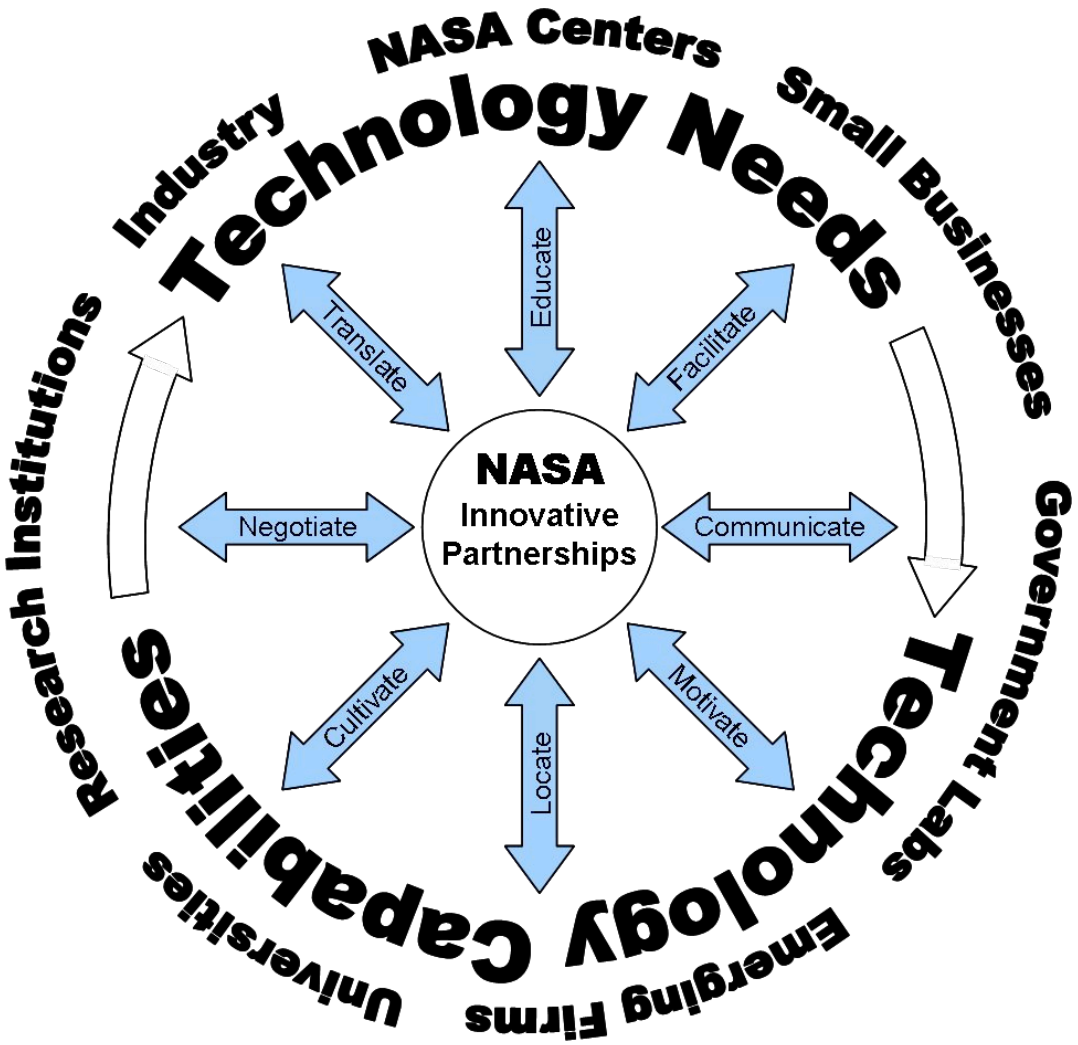
"The Innovative Partnerships Program (IPP) will facilitate partnering with the U.S. private sector, and leverage private sector resources, to produce technologies needed for NASA missions. The IPP and NASA's Mission Directorates will identify new opportunities to adopt technologies developed through innovative partnerships."

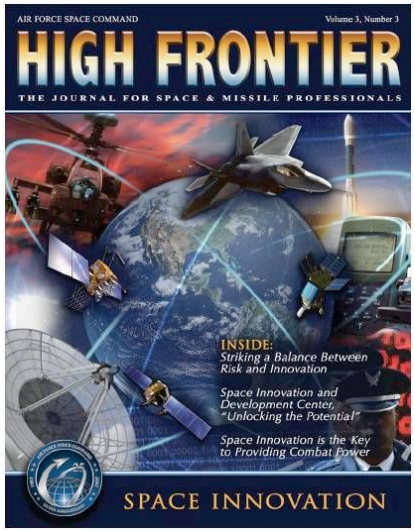
2006 NASA Strategic Plan

Looking For:

- **Win-Win-Win**
  - (NASA-Partner-Taxpayer/Public Good)
- **Complementary Interests (1+1>>2)**
  - Common Interests
  - Compatible Goals
  - Skin in the Game

IPP's Dynamic Innovation Process





Space Innovation

NASA's Innovative Partnerships Program: Matching Technology Needs with Technology Capabilities

Mr. Douglas A. Comstock
Director, Innovative Partnerships Program,
National Aeronautics and Space Administration

In the pursuit of mission objectives in aeronautics and space exploration, the National Aeronautics and Space Administration (NASA) is often pushing the boundaries of what has been done before, seeking many technologies to either enhance current capabilities or enable new capabilities. NASA's administrator, Michael Griffin, told the World Economic Forum on 26 January 2007, that "Necessity is the mother of invention, and I believe that we are at our most creative when we embark on bold ventures like the space program."

As a result of the technical advances needed to achieve these ventures, NASA missions often generate technologies which have applications beyond aerospace and can provide important benefits to improve the quality of life for the American public. As NASA's deputy administrator, Shana Dale, said at the 7th American Institute of Aeronautics and Astronautics Space Exploration Conference on 5 December 2006, "Of course, much of what we gain from exploring and settling the Moon will not be in what we find on it, or in the observations we make from it, but in the scientific and technological progress that will come in the process of doing it. And much of that will have direct economic and health benefits for those of us who remain behind on Earth."

NASA's Innovative Partnerships Program (IPP) is seeking to be a facilitator and catalyst for innovation in two directions:

Figure 1. NASA's Innovative Partnerships Program is engaged in a dynamic process to match technology needs with capabilities.

technology infusion to provide technical solutions to some of the challenges being faced by NASA's programs and projects, and technology transfer—or spinoff—to provide solutions to non-NASA technical challenges in the private sector or other government agencies with NASA-developed technology. IPP achieves these objectives through a network of offices at each of NASA's 10 field centers.

Innovation in this context is not a prescribed process, but rather an ongoing dynamic process with many simultaneous activities and organizations involved, seeking to match technology needs with technology capabilities, as shown in figure 1. In addition to the programs and projects at the 10 NASA field centers, organizations involved include small businesses, other government agencies and their laboratories, emerging firms seeking to address new markets including commercial space, universities and research institutions, and industry.

There are many activities undertaken to support this dynamic process. These activities are critical throughout the lifecycle of a partnership, from the initial state of identifying a need, locating potential sources of technology or innovation to address that need, facilitating the connection between potential partners and the negotiation that leads to an agreement. Once a partnership has been established, it must be cultivated with regular and ongoing communication, and success should be recognized and rewarded to create positive incentives that will continue to motivate innovation.

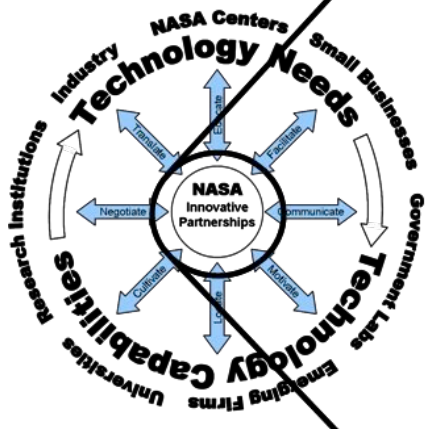
Communication is a critically important activity in this process. One of the premier tools NASA uses for communicating its technologies that are available for use outside of NASA is *Tech Briefs* magazine (figure 2), which is read by over 280,000 technology experts. Soon, *Tech Briefs* will also be used to feature some of NASA's current and future technology challenges in an effort to reach out to technologists who may have ideas or technologies available that can address those challenges.

Communication is also important to convey success stories. This type of communication not only helps advise our stakeholders as to how well we are doing, but also provides important case

Figure 2. Tech Briefs magazine provides several times a year to NASA's latest technical innovations for over 280,000 advanced technology subscribers.

http://www.afspc.af.mil/library/highfrontierjournal.asp

Partnership Model



NASA Offerings

- $ Funding
- Facilities use
- Technology use
- Expertise access
- Brand Association
- Product Validation
- Space Env't Access
- Intellectual Property
- Other

…

Partnership Mechanisms

- FAR Contracts
- Comm'l Contracts
- Grants
- Coop Agreement
- Space Act Agr
- MOU
- MOA
- Licensing
- Other
- …

Other…..
Academia
National Laboratories
Other Gov't Agencies
Industry

Partner Offerings

- Technology
- Services
- Innovation
- Expertise
- Intell. Property
- Outreach
- $ Funding
- Facilities
- Other

…

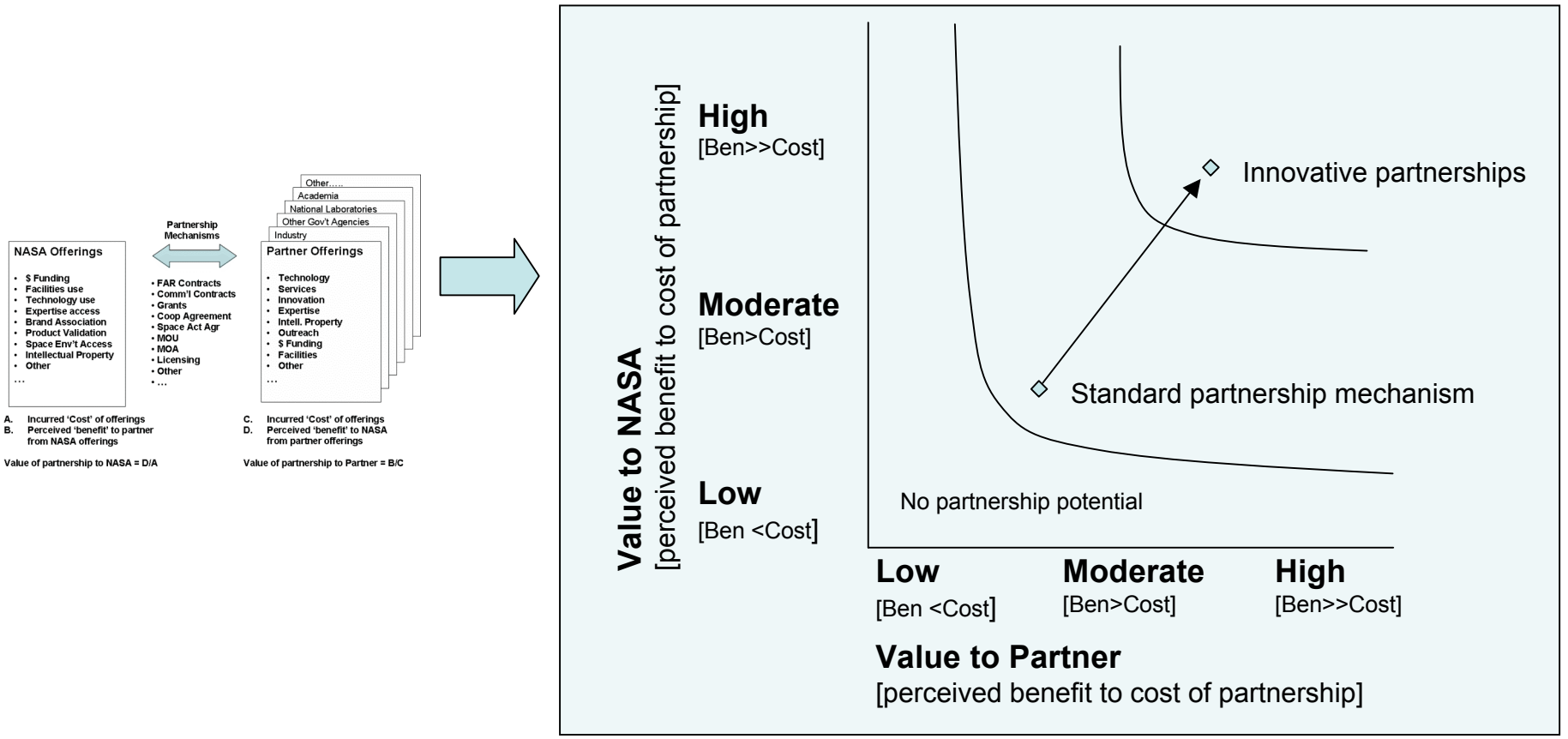
A. Incurred 'Cost' of offerings
B. Perceived 'benefit' to partner from NASA offerings

Value of partnership to NASA = D/A

C. Incurred 'Cost' of offerings
D. Perceived 'benefit' to NASA from partner offerings

Value of partnership to Partner = B/C

Partnership Model – Value Proposition



- **IPP objective should be to maximize partnership value for both NASA and partner.**
- **Refer back to the partnership model for value and ask:**
  - What impact will this aspect of the partnership have on value?
  - What are other opportunities to increase value?

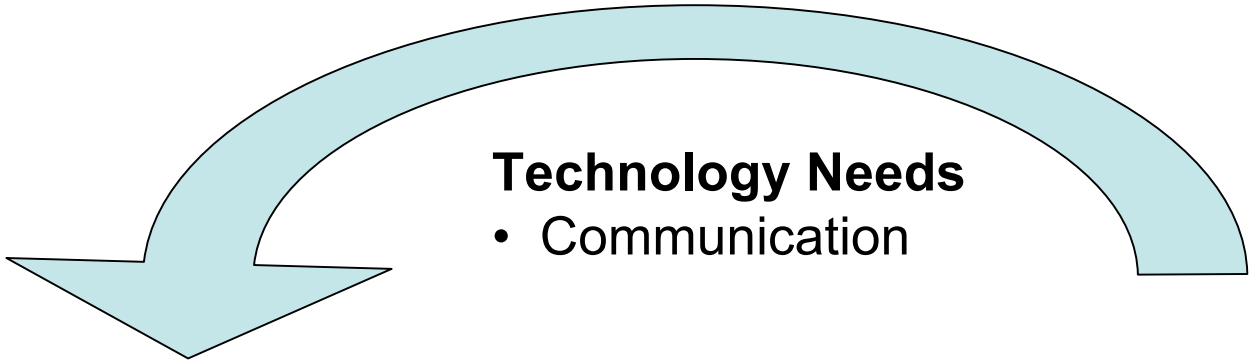
Program Elements

- SBIR
- STTR
- IPP Seed Fund

- Centennial Challenges
- New Business Models
- Innovation Transfusion

- Intellectual Property management
- Technology Transfer
- New Innovative Partnerships

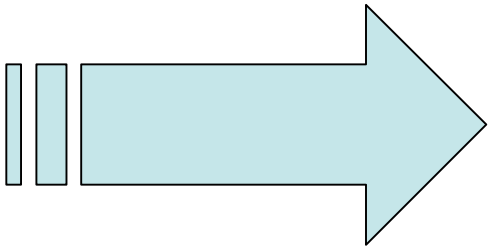
IPP Technology for Mission Directorates



Technology Needs
- Communication

Innovative Partnerships Program
- SBIR/STTR
- Centennial Challenges
- Seed Fund
- Partnerships

Executed at the Field Centers



Technology Infusion
- Bridging the "Valley of Death"
- Narrow the gap and reduce risk
- Begin building bridges early

Mission Directorates
- Programs
- Projects

Executed at the Field Centers

SBIR/STTR: 3-Phase Program

- **PHASE I**
  - Feasibility study
  - $100K award
  - 6 months duration (SBIR)
  - 12 months duration (STTR)

SBIR	FY03	FY04	FY05	FY06	FY07
Millions of $	107.3	107.5	110.0	105.6	106.6
Phase 1 Awards	267	312	291	267	259
Phase 2 Awards	155	139	142	186	130

- **PHASE II**
  - Technology Development
  - 2-Year Award
  - Up to $750K (SBIR/STTR)

STTR	FY03	FY04	FY05	FY06	FY07
Millions of $	6.4	12.9	13.2	12.3	12.8
Phase 1 Awards	45	40	35	27	25
Phase 2 Awards	18	26	17	22	18

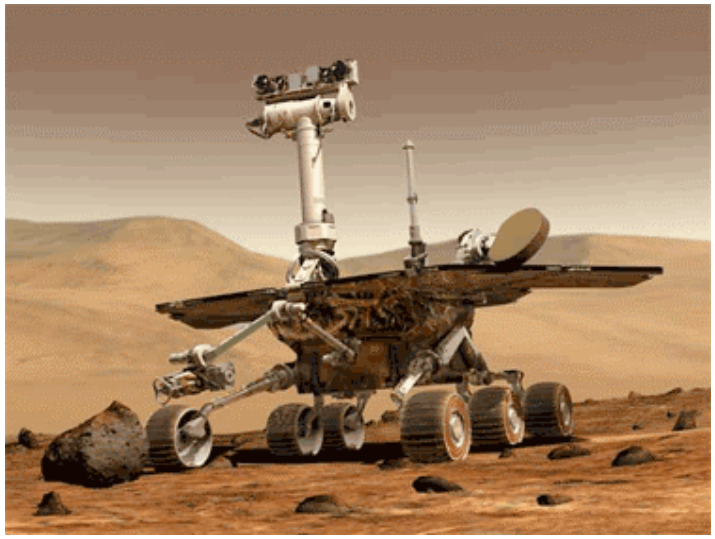
SBIR is 2.5% of extramural R&D, STTR is 0.3% of extramural R&D.

- **PHASE III**
  - Technology Infusion/Commercialization Stage
  - Use of non-SBIR Funds
  - Ability to award sole-source contracts without JOFOC based on specific SBIR authority – NASA and NASA primes.

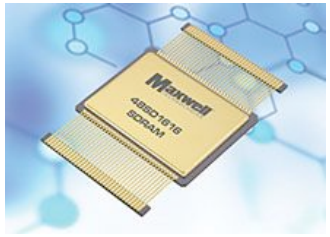
NASA SBIR/STTR Strategic Approach

- **Every technology development investment dollar is critical to the ultimate success of NASA's mission.**
  - Ensure alignment and integration with Mission Directorate priorities.
  - Investments should be complementary with technologies being pursued by:
    - Other IPP investments and partnerships,
    - Mission Directorate programs and projects,
    - Prime contractors, and
    - Other agency SBIR/STTR investments.
- **Ultimate objective is to achieve infusion of critical technologies into NASA's Mission Directorates and their:**
  - Flight programs/projects,
  - Ground or test systems, or
  - Other uses to advance NASA's mission
- **Mission Directorate establish high priority needs and existing gaps.**
  - High priority needs are developed into topics for the annual solicitation.
  - Subtopics may be clustered to support the development and maturation of critical technologies for infusion.

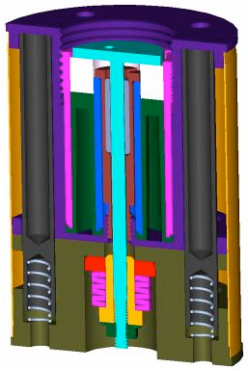
SBIR Technologies on Mars Exploration Rovers



Yardney Technical Products of Pawtucket, Connecticut developed lithium ion batteries with specific energy of >100Wh/kg and energy density of 240 Wh/l and long cycle life. Subsequently, they won a large Air Force/NASA contract to develop batteries for space applications. They are supplying the batteries for the 2003 Mars Rovers.

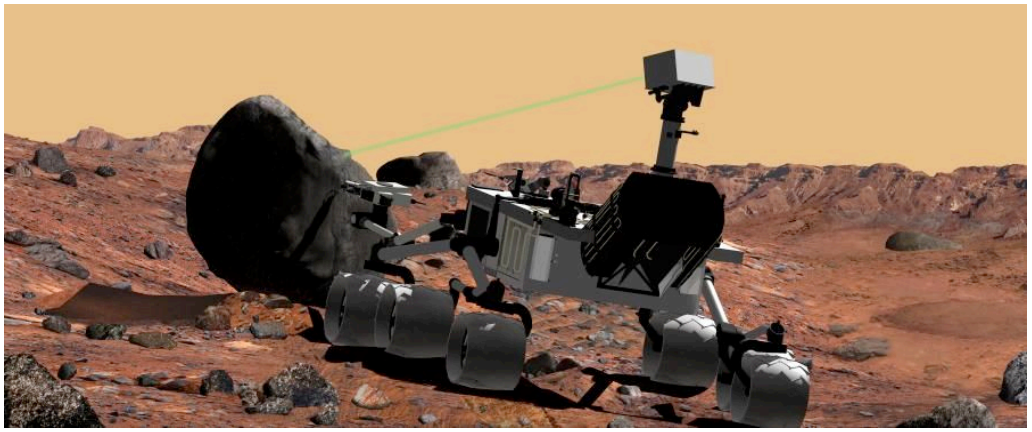


Maxwell Technologies of San Diego, California fabricated and tested an ASCII chip with single event latch up protection technology. Innovation enables the use of commercial chip technology in space missions, providing higher performance at a lower cost. Supplying A to D converter for Mars 2003 Rovers.

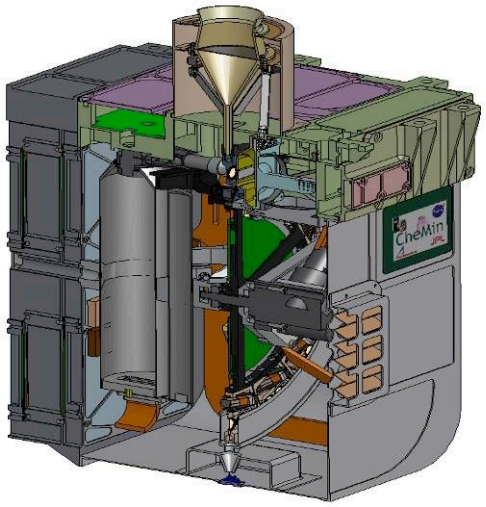


Starsys Research of Boulder, Colorado developed several paraffin based heat switches that function autonomously. Heat switches control radiator for electronics package on Mars 2003 Rovers.

SBIR technology contributions to MSL/CheMin

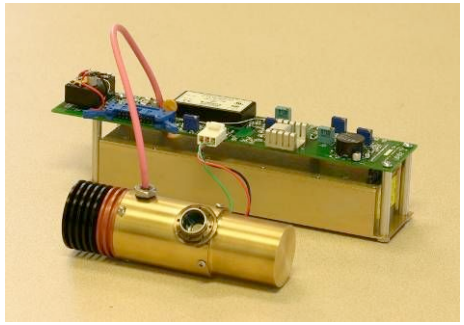


Microwave Power Technology of Campbell, California developed a small-format carbon nanotube field emission cathode (CNTFE) X-ray tube for CheMin. While a tungsten cathode was ultimately baselined for the flight tube, the form, fit and function of the flight tube was derived from this SBIR.

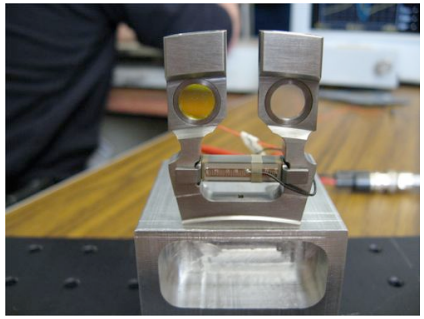


CheMin MSL '09
Flight Instrument

InXitu, Inc. of Mountain View, California developed a powder handling device for X-ray Diffraction Analysis based on Piezoelectrically- induced sample motion, and a miniature X-ray tube having a grounded cathode configuration is being developed to enable a further 2-fold reduction in the size of CheMin prototype instruments.

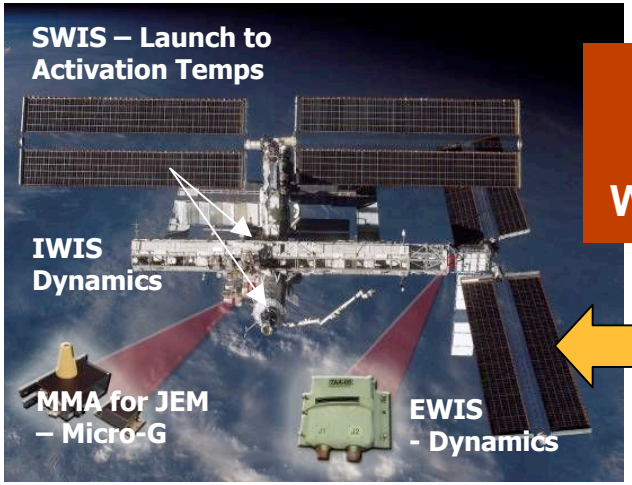


Miniature grounded-cathode X-ray tube and power supply



Dual-cell piezoelectric sample shaker

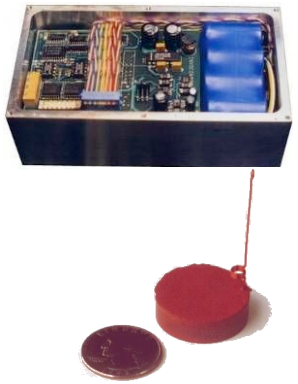
SBIR Contribution to Wireless Technology



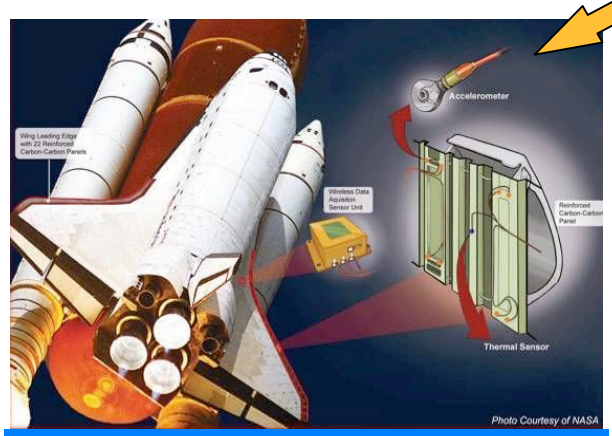
Microgravity Instrumention
(And Structural Dynamics)

Invocon, Inc.
2006 SBIR Tibbetts Award

SCAT SBIR
Sensor Control and Acquisition Telecommunications
Wireless Instrumentation Systems

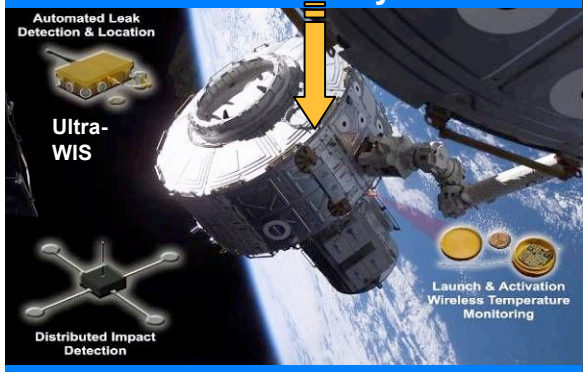


Development Flight Instrumentation

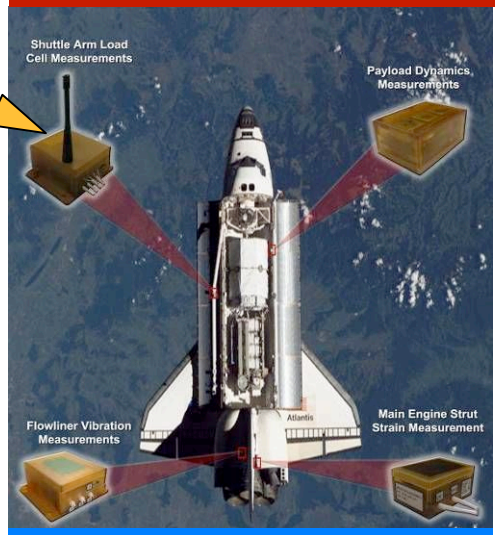


Wing Leading Edge Impact Detection System

Micro-Wireless Instrumentation Systems



Vehicle Health Monitoring Systems with Wireless Systems



Wireless Instrumentation and Data Recording

Advanced Flexible Thin-Film PV (FTFPV) UltraFlex (UF) Solar Array System

Initial UltraFlex solar array development conducted by AEC-Able under internal IR&D funding

Additional development under JPL contracts (UF selected for Mars '01 Lander and Mars Phoenix)

Further development and collaborative concentrator solar array efforts with Entech, Inc. (AEC-Able bought out by ATK)

UltraFlex-175 solar array selected as ST–8 validation experiment for flight in 2010 by NASA New Millennium Program for eventual use on science missions

SBIR

NASA GRC SBIR Phase I and Phase II funding for UltraFlex FTFPV solar array development

FTFPV and UF technology flown for 1 year in space on MISSE–5 Experiment (flight data feeds into UF array database)

UltraFlex design with multijunction photovoltaics baselined by Lockheed Martin to power the NASA Orion Service Module

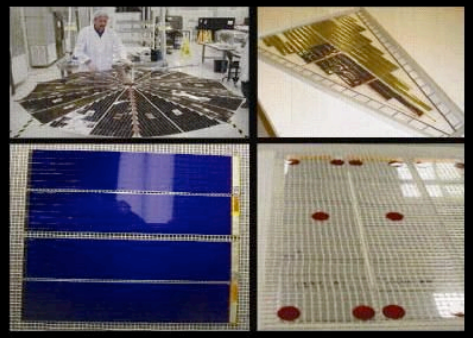
NASA Glenn SBIR contracts with AEC-Able/ATK Space Systems on UltraFlex FTFPV develop a near-term, low-risk approach for applying thin-film solar cell technology to a lightweight array structure in order to increase system performance for specialized mission needs.

Science Mission Directorate

Exploration Systems Mission Directorate

www.nasa.gov

NASA Glenn Research Center
Michael F. Piszczor 216–433–2237



Additional Phase III funding of $154K was added for inclusion & testing of CIGS thin-film cells into a fully functional gore assembly.

MISSE–5 flight experiment (1 year exposure on ISS) provides important data on durability of UltraFlex components for NASA missions.

ATK Space Systems
(formerly AEC-Able Engineering Co.)
Brian Spence 805–685–2433

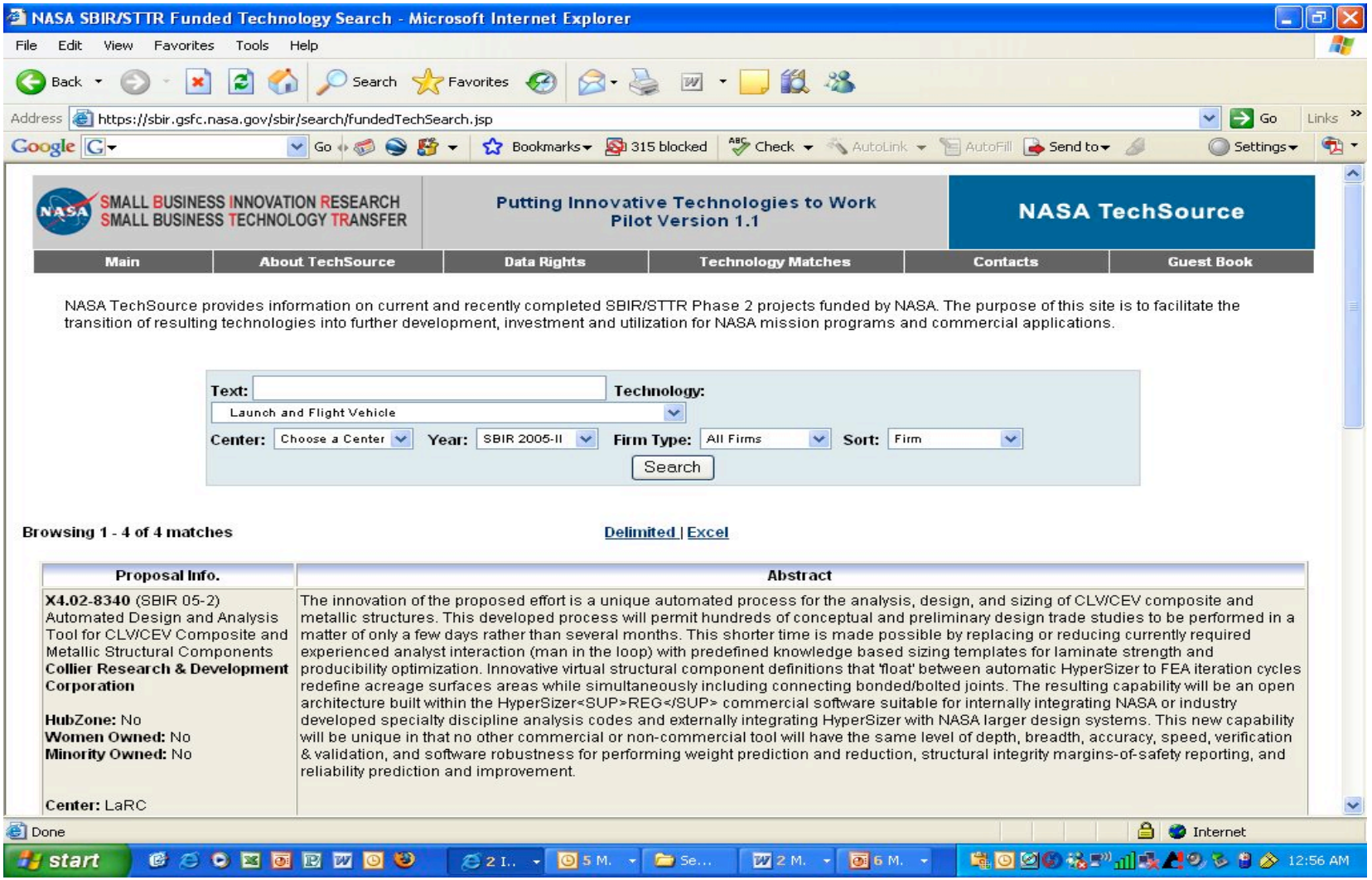
ATK

M–1897–0
Jun 07

SBIR State Information

- State Information Available on SBIR/STTR Website
- http://sbir.gsfc.nasa.gov/SBIR/states.htm

Technologies and Firms are Searchable



https://sbir.gsfc.nasa.gov/sbir/search/fundedTechSearch.jsp

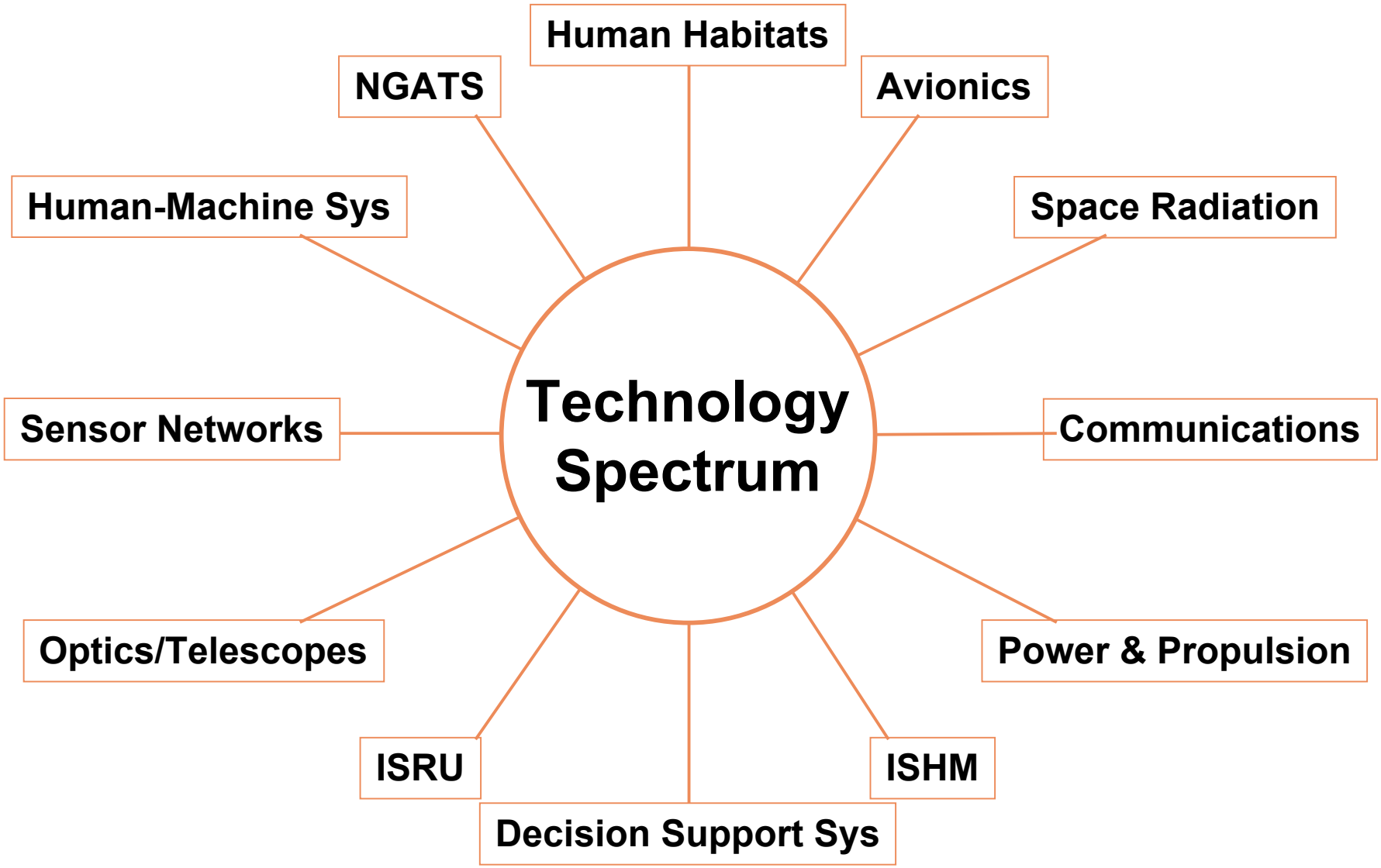
IPP Seed Fund Program

- **An annual process for selecting innovative partnerships for funding, to address the technology priorities of NASA's Mission Directorates.**
- **Enhances NASA's ability to meet Mission capability goals by providing leveraged funding to address technology barriers via cost-shared, joint-development partnerships.**
- **The IPP Office at NASA HQ provides an annual Seed Fund Announcement of Opportunity to all NASA Centers for selecting innovative partnerships for funding.**
- **The technology landscape covered by the successful proposals embraces the needs of all four Mission Directorates.**
- **Seed Fund operates through a collaboration of Center IPP Offices, NASA co-PI, and external co-PI.**
- **Proposals are evaluated against the following criteria:**
  - Relevance/Value to NASA Mission Directorates.
  - Scientific/Technical merit and feasibility.
  - Leveraging of resources.

IPP Seed Fund Results

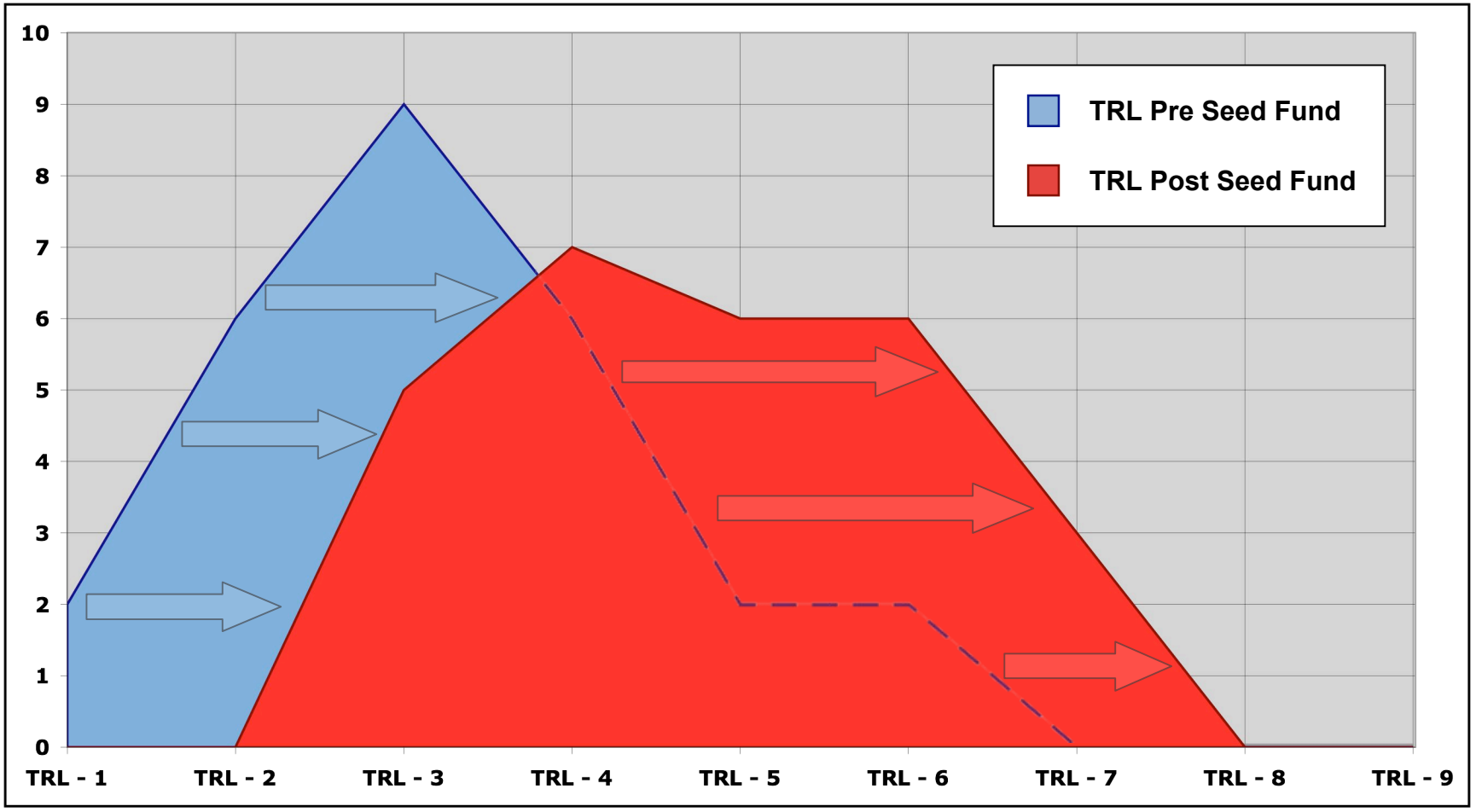
- **2006 Seed Fund results:**
  - 76 proposals received, evaluated by IPP and Mission Directorate experts.
  - 29 projects selected, providing $28.3 million for the advancement of critical technologies and capabilities.
    - $6.6 million IPP Office funds.
    - $7.5 million program, project, Center funds.
    - $14.2 million external partner funds.
- **2007 Seed Fund results:**
  - 75 proposals received, evaluated by IPP and Mission Directorate experts.
  - 38 projects selected, providing $33.9 million for the advancement of critical technologies and capabilities.
    - $9.3 million IPP Office funds.
    - $12.1 million program, project, Center funds.
    - $12.6 million external partner funds.
- **In the last two years, an investment of $15.9 million by IPP facilitated the generation of 67 partnerships and was leveraged by a factor of four, providing a total of $62.2 million for the advancement of critical technologies and capabilities for the Agency.**

Seed Fund Technology Spectrum

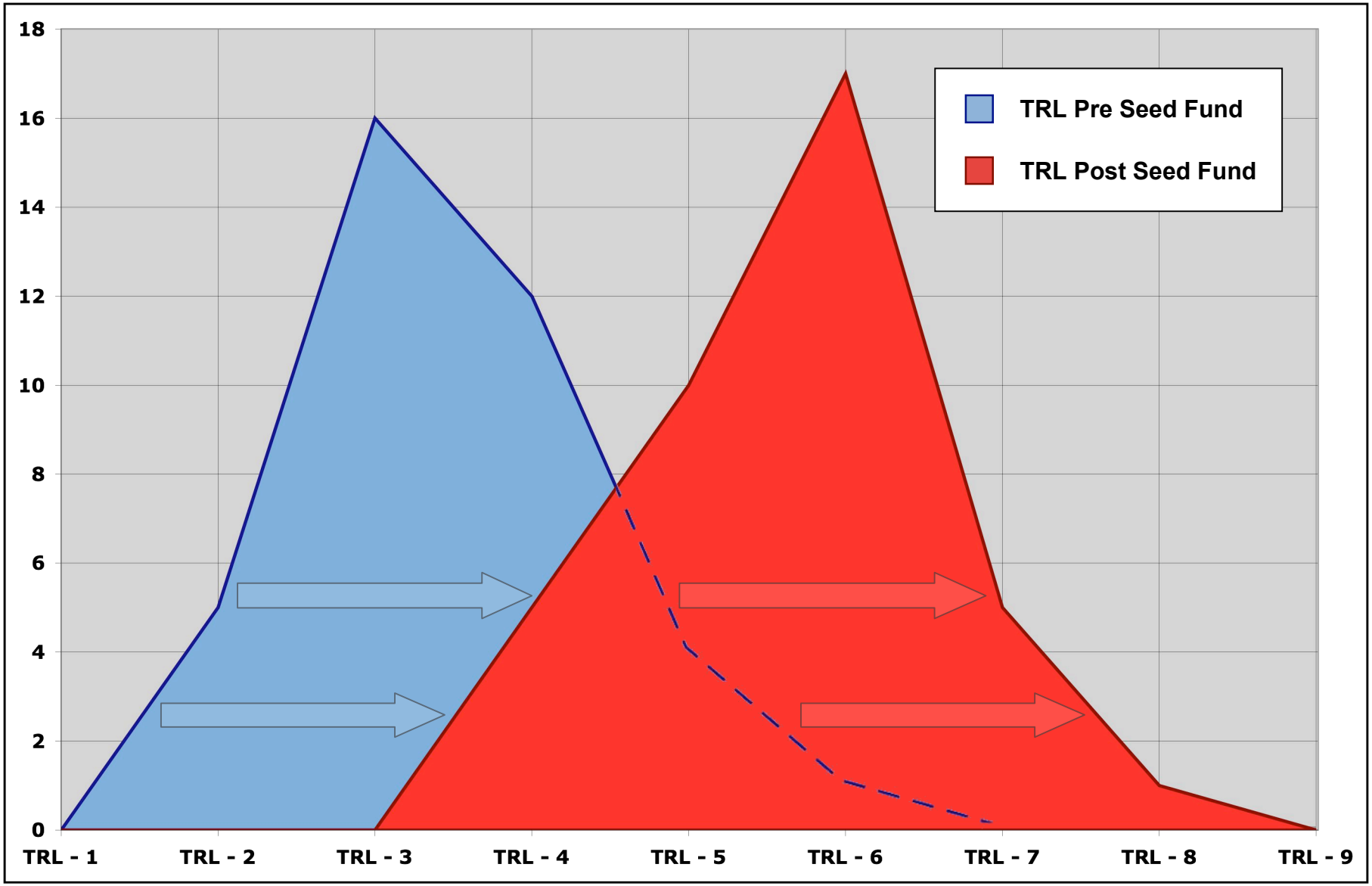


http://www.nasa.gov/home/hqnews/2007/oct/HQ_07232_IPP_Seed_Fund.html

FY06 Seed Fund TRL Advancement

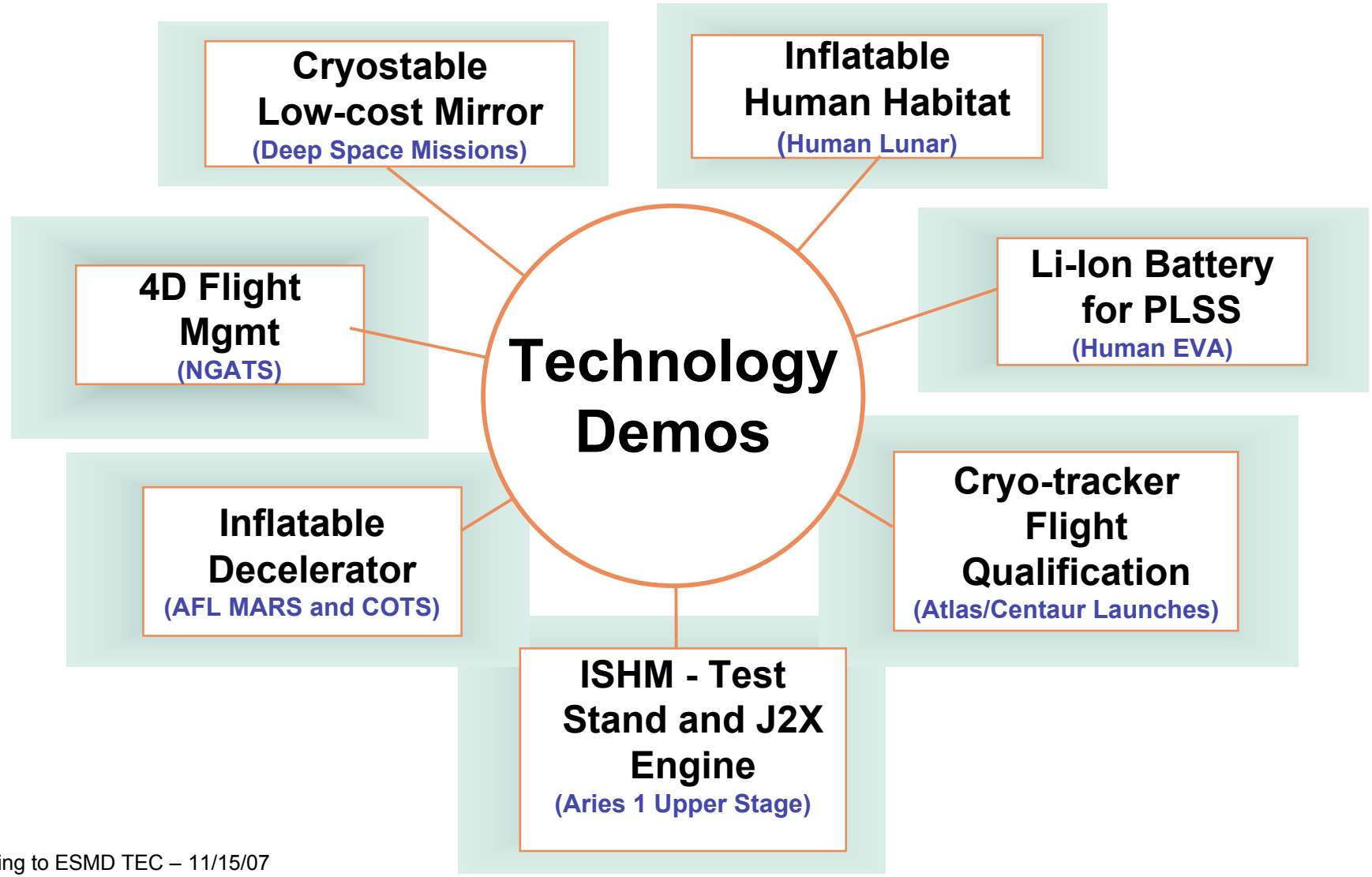


FY07 Seed Fund TRL Advancement



FY06 Demonstration Highlights

http://www.nasa.gov/home/hqnews/2007/nov/HQ_M07159_inflatable_habitat.html
http://www.nasa.gov/home/hqnews/2007/nov/HQ_07251_Inflatable_Lunar_Habitat.html

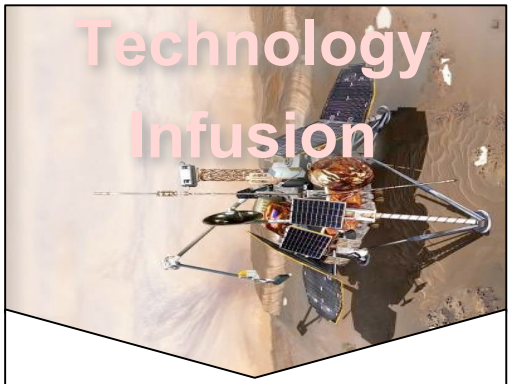


Program and Project Benefits

- **This letter expresses my personal appreciation for the support that your Innovative Partnerships Program Office (IPPO) has provided to the Exploration Launch Office (ELO) at the Marshall Space Flight Center (MSFC) during FY06.**
- **Thanks to the support, we have been able to attract external partners to work with us in advancing technologies that would otherwise not have been pursued. These technologies will certainly enhance our ability to meet the challenges we face in meeting the goals of the Agency.**
  - Hardware Maturation and Cryogenic Testing of an Optical Cryogenic Mass Flow Sensor
  - Magnetostrictive Regulator Development
  - Thermal Stir Welding (TSW) Development
  - Validation of Cryogenic-Composite Over-Wrapped Pressure Vessels
  - Prototype Development and Technology Demonstration of Apparatus for Reading Two-Dimensional Identification Symbols Using Visual and Sensing Technologies

Steve Cook, Manager, Exploration Launch Office

Program Elements



- SBIR
- STTR
- IPP Seed Fund

- Centennial Challenges
- New Business Models
- Innovation Transfusion

- Intellectual Property management
- Technology Transfer
- New Innovative Partnerships

Commercial Space Policy & Guidance

- **Section 203 of the 1958 National Aeronautics and Space Act, as amended, states that NASA**

  "...in order to carry out the purpose of this Act, shall... seek and encourage, to the maximum extent possible, the fullest commercial use of space; and... encourage and provide for Federal Government use of commercially provided space services and hardware, consistent with the requirements of the Federal Government."

- **The Commercial Space Act of 1998 stated that**

  "a priority goal of constructing the International Space Station is the economic development of Earth orbital space." The law further states that "competitive markets... should therefore govern the economic development of Earth orbital space."

- **In the "Vision for Space Exploration", President Bush charged NASA to**

  "promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests."

- **The NASA Authorization Act of 2005 states that**

  "In carrying out the programs of the Administration, the Administrator shall … work closely with the private sector, including by … encouraging the work of entrepreneurs who are seeking to develop new means to send satellites, crew, or cargo to outer space."

- **The President's Science Advisor and OSTP Director, Dr. John Marburger, made the following remarks at the 44th Robert H. Goddard Memorial Symposium on 15 March 2006**

  "As I see it, questions about the vision boil down to whether we want to incorporate the Solar System in our economic sphere, or not. Our national policy, declared by President Bush and endorsed by Congress last December in the NASA authorization act, affirms that, 'The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program.'"

- **The fifth of six strategic goals in the 2006 NASA Strategic Plan states that NASA will**

  "Encourage the pursuit of appropriate partnerships with the emerging commercial space sector."

ESMD Commercial Development Policy (ECDP)

- **Purpose**
  - Provide ESMD with a set of best practices, ideas, and concepts which all ESMD programs, projects, and activities should be cognizant of and work toward with respect to encouraging commercial space capabilities.
- **Applicability**
  - The ECDP applies to the evaluation and execution of tasks and activities for all ESMD programs and projects. The ECDP should be addressed by all proposals for ESMD programs and projects tasks and activities.
- **Objective**
  - The objective of the ECDP is to encourage the development of commercial space capability industries that can accomplish NASA exploration mission goals at a lower cost and cost risk to NASA through “fixed price” acquisition of commercial goods and services.
- **Goals**
  - To encourage the development of commercial space capabilities and markets.
  - To encourage “Buy Commercial” instead of “Government Provided” decisions.
  - To encourage commercial representation and opportunities in NASA’s exploration architectures.

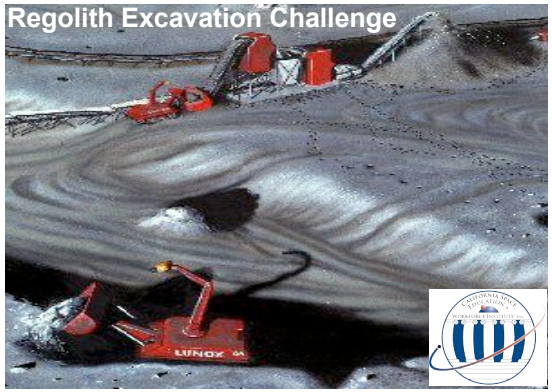
Approved by ESMD DPMC and signed by AA Horowitz in October, 2007.

How Do Prizes Benefit NASA?

- **Increased Participation by New Sources of Innovation.**
- **Leveraging of Tax-Payers' Dollars.**
- **Innovative Technology Development to Meet NASA's Needs.**
- **Increased Awareness of Science and Technology.**
- **Hands-on Training for Future Workforce.**

Funded Centennial Challenge Competitions

Competition	Total	2006	2007	2008	2009	2010	2011
Astronaut Glove	**$1M**		250	350	400		
Regolith Excavation	**$750K**		250	500			
Personal Air Vehicle	**$2M**		250	300	400	500	550
Beam Power	**$2M**	200	300	400	500	600	
Tether	**$2M**	200	300	400	500	600	
Lunar Lander	**$2M**	2,000					
MoonROx	**$1M**	250	750				

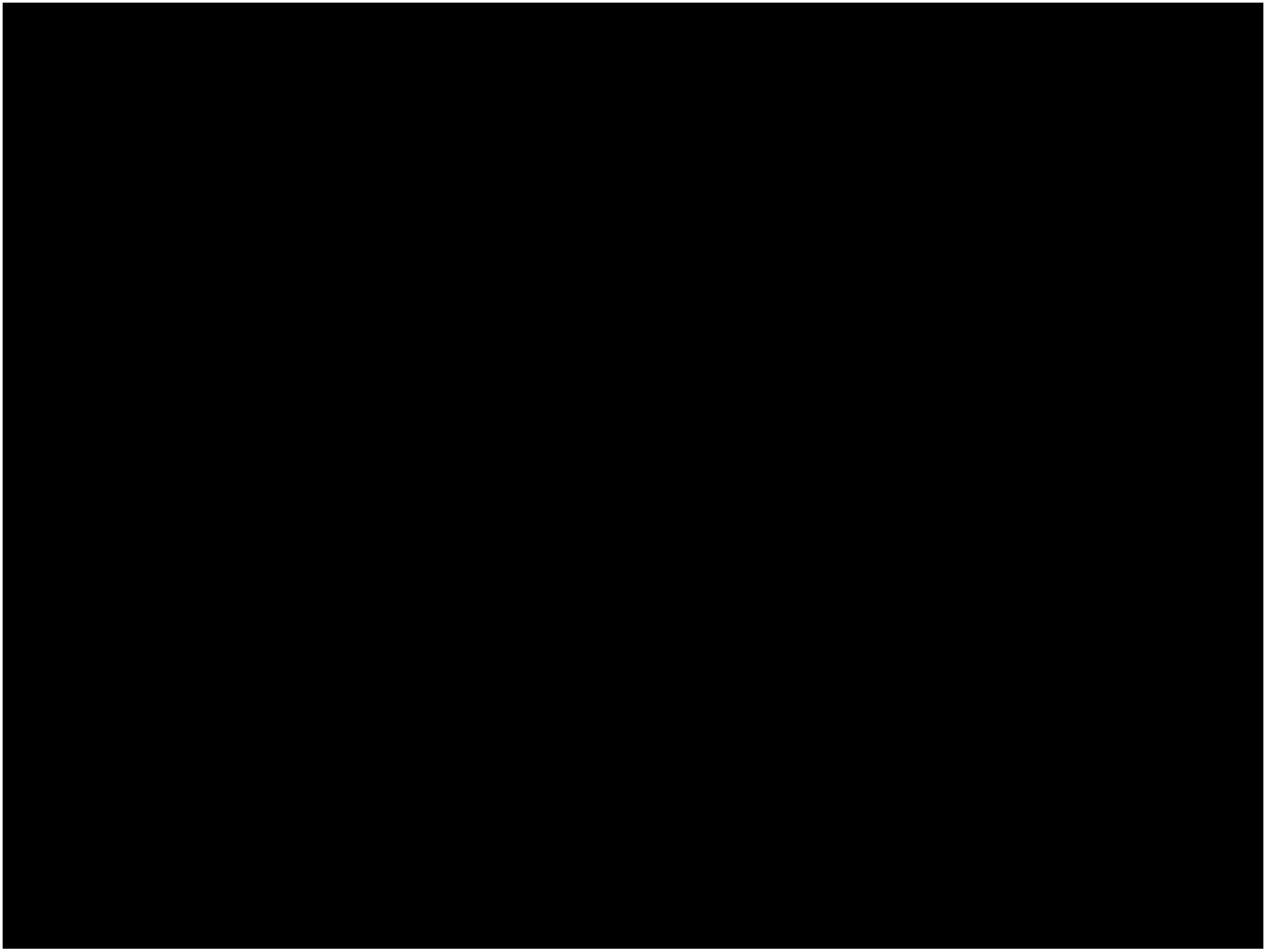


And The Winner Is...

...Peter Homer

Lunar Regolith "Sandbox"

Dimensions: 4m x 4m Regolith: 8 tons, 25cm (avg)



Centennial Challenges 2007 Competitions

Past Competitions	Event Dates	Purses	Winners
Astronaut Glove	**2-3 May '07**	**$250K**	• **Peter Homer/$200K**
Regolith Excavation	**11-12 May '07**	**$250K**	• **None**
Personal Air Vehicle	**4-12 Aug '07**	**$250K**	• **Vance Turner-$100K Vantage Prize** • **Dave and Diane Anders / $50K Noise Prize** • **John Rehn / $25K Handling Qualities** • **Vance Turner / $25K Shortest Runway Prize** • **Vance Turner / $25K Efficiency Prize** • **Dave and Diane Anders / $15K Top Speed First Prize** • **Vance Turner / $10K Top Speed Second Prize**
Beam Power	**13-21 Oct '07**	**$500K**	• **None**
Tether	**13-21 Oct '07**	**$500K**	• **None**
Lunar Lander	**26-28 Oct '07**	**$2M**	• **None**
MoonROx (First to Demonstrate)	**Exp. Jun '08**	**$1M**	• **No Registrants to date**

Narrowing the Gap

- **Rule of thumb for technology infusion is TRL 6 by PDR.**
  - TRL 6 requires system/subsystem model or prototype demonstration in a relevant environment.
- **IPP has been tasked to demonstrate the purchase of services from the emerging commercial space sector for parabolic aircraft flight and suborbital flight.**
  - IPP is working with NASA's Shared Capability Assets Program (SCAP) and the Glenn Research Center (GRC), to use the pending IDIQ contract for parabolic aircraft services.
  - IPP is establishing an activity for Facilitated Access to the Space Environment for Technology Development and Training (FAST).
  - IPP's FAST activity will offer funds and seek leveraging through partnerships to access parabolic aircraft services as first step.
  - This will demonstrate the business model for purchasing services and advance technology readiness for NASA's research and technology needs (SBIR/STTR and other technologies).
- **By narrowing the gap, risk is reduced, and infusion is more likely.**

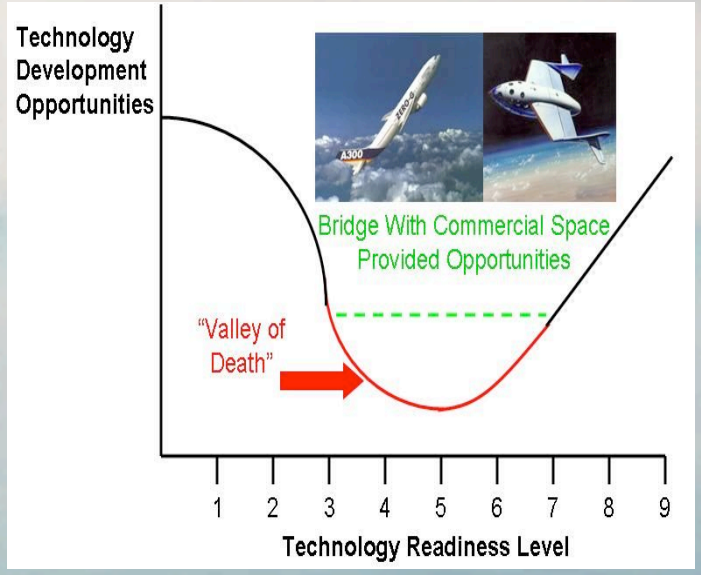
FAST

Objective: Advancing technology maturity to enhance technology infusion.

- **Problem = Mid-TRL "Valley of Death".**
- **Lack of opportunities to test in microgravity environment.**
- **Key Element to achieving TRL 6 is demonstration of prototype in relevant environment.**

Provide access to commercial microgravity flight services to advance NASA technologies, reducing risk levels to enable more infusion. Also demonstrates procurement of commercial space services by NASA for successful Agency use.

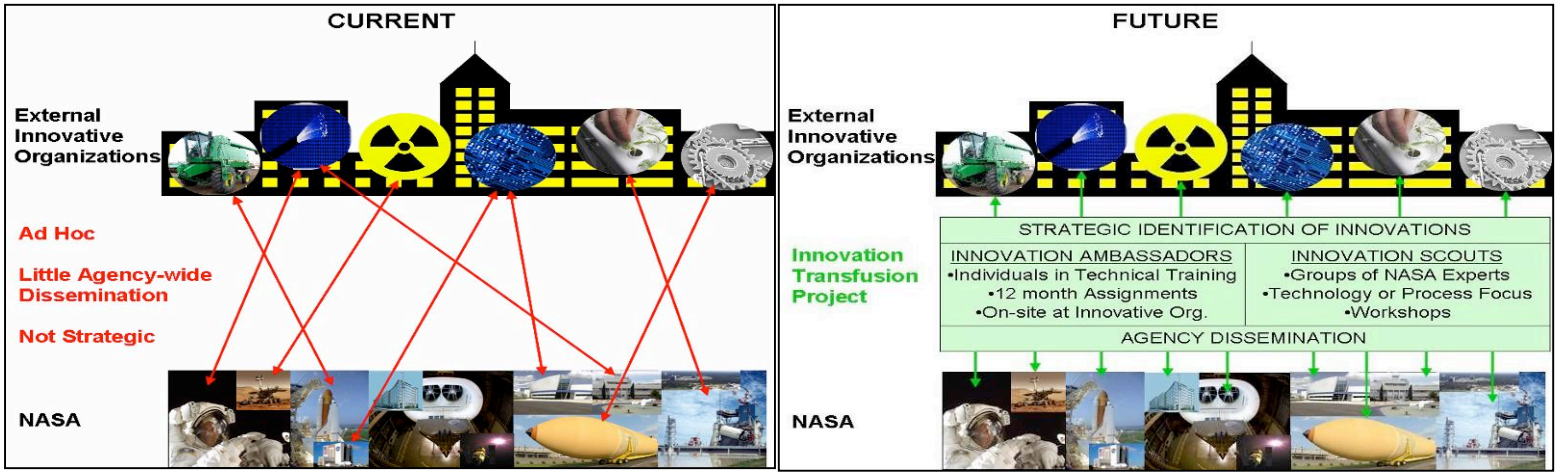
- Targeted at needed Technologies that would benefit from microgravity testing.
- IPP portfolio (SBIR/STTR, Seed Fund, etc.) and other technologies.
- Leverage Funds for Technology Demonstration in Parabolic Microgravity Flight Testing.
- Competitive process modeled after "IPP Seed Fund".
- **Status:** Microgravity Services procurement pending.
- Release FAST solicitation November 2007; Awards March 2008; Initial Flights May 2008.



Innovation Transfusion

Problem: **There is significant potential for NASA to learn and benefit from innovative technologies, processes and practices occurring outside the Agency; some potential currently realized on ad hoc basis.**

Goal: Create strategic connections between innovative external organizations and NASA for increased Agency benefit from external creativity.



Project Components

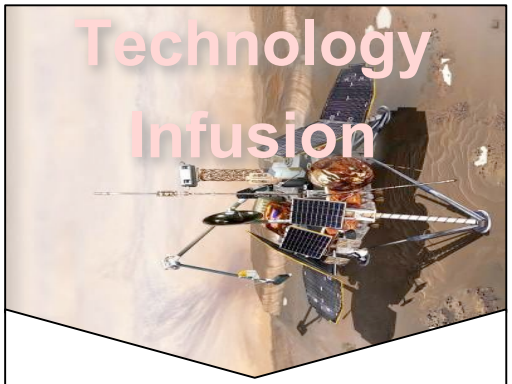
Technical training program for ~1 year at an external organization focusing on identifying innovations

Workshops with NASA to external organizations focusing on specific innovations

Use existing mechanisms to communicate innovations (APPEL, ASK magazine, IPP website, etc.)

- **Partnering Organizations:** Office of Human Capital; Office of Chief Engineer.
- **Status:** Release Innovation Ambassador solicitation Nov/Dec [Assignment 2008].

Program Elements



- SBIR
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- New Business Models
- Innovation Transfusion

- **Intellectual Property management**
- **Technology Transfer**
- **New Innovative Partnerships**

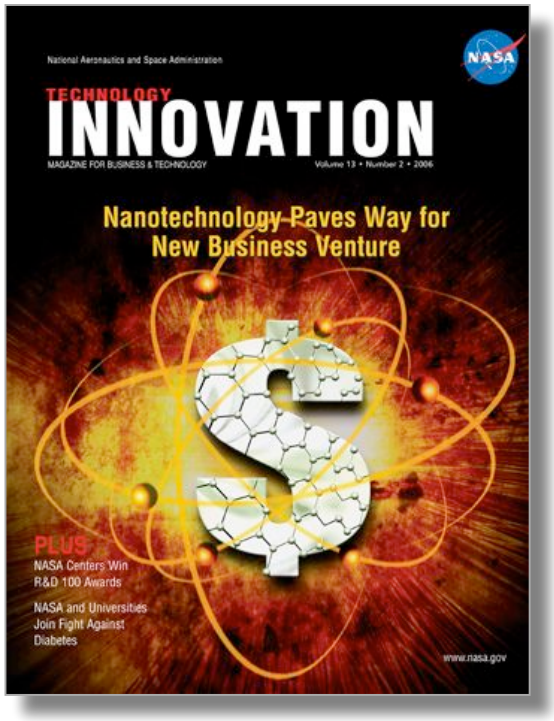
Partnership Connections – IPP Publications

http://www.techbriefs.com/

Electronics & Computers
Semiconductors & ICs
Mechanics
Information Sciences
MaterialsSoftware
Manufacturing & Prototyping
Machinery & Automation
Physical Sciences
Bio-MedicalTest & Measurement

http://www.sti.nasa.gov/tto/

http://www.sti.nasa.gov/spinoff/searchrecord

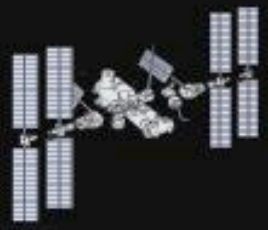


http://ipp.nasa.gov/innovation/index.html

http://ipp.nasa.gov/

NASA Technologies Enhance Our Lives

International Space Station



Space Telescopes and Deep Space Exploration

Satellites and Imaging Technology

Innovative technologies from NASA's space and aeronautics missions (above) transfer as benefits to many sectors of society (below).

Each benefit featured in *Spinoff* 2007 is listed with an icon that corresponds to the mission from which the technology originated.

Health and Medicine

- Improves CPR
- Detects cardiovascular disease
- Assists patients with cognitive disorders
- Evaluates nerve function
- Fights acne
- Broadens cellular analysis
- Enhances diagnostic imaging

Transportation

- Eases air traffic management
- Advances rotorcraft design
- Improves flight safety
- Boosts helicopter performance
- Protects general aviation aircraft

Public Safety

- Detects potential threats
- Sharpens views in critical situations
- Cleans air and water for indoor environments

Consumer, Home, and Recreation

- Restores artwork
- Enhances education and recreation
- Reduces fat while improving flavor
- Transforms paint into insulation
- Protects machines and the environment

Space Transportation

Astronaut Life Support

Aeronautics Research

Environmental and Agricultural Resources

- Maps, monitor, and manage Earth's resources
- Provides environmental data
- Saves energy and prolong motor life
- Prevents corrosion in steel and concrete structures

Computer Technology

- Simplifies analysis and design
- Translates 2-D graphics to 3-D surfaces
- Improves health and performance monitoring
- Enables smarter content management
- Validates system design

Industrial Productivity

- Strengthens structures
- Boosts data transmission
- Enhances precision fabrication
- Broadens sensing horizons
- Resists extreme heat and stress
- Develops ultra-hard steel
- Saves time and energy
- Streamlines production
- Controls noise and vibration
- Advances thermal management

Partnership Activities in FY06

- **During FY 2006, the Innovative Partnership Program (IPP) facilitated many partnerships and agreements, as summarized below:**
  - Over 200 partnerships with the private sector, federal and state government, academia, and other entities for dual use technology development and reimbursable use of NASA facilities.
  - Over 50 license agreements with private entities for commercial and quality of life applications of NASA developed technology.
  - Reporting of more than 750 new technologies developed by NASA civil servants and contractors, and evaluation for patent protection.
  - More than 400 agreements for commercial application of software developed by NASA.

Summary of Partnering Tools

	Contract	Cooperative Agreement Grant	Space Act Agreement	Patent License	Enhanced Use Lease	CRADA
Purpose	Used by NASA to acquire goods, services, or both.	Used by NASA to sponsor activities that relate to a public purpose (generally R&D).	Used by NASA for collaborations, excess capacity, leases, property loans, or any combination.	Used by NASA to transfer specific rights associated with a NASA-owned invention.	Used by ARC and KSC to lease under-utilized real property assets.	Rarely used by NASA for cooperative research and development.
Competition Required?	Generally, Yes	No	No	No	No	No
Notable Requirement(s)	-Goods or Services -Mission Need	-Public Purpose -NASA Substantial Involvement (for Cooperative Agreement)	-No Formal "Requirements" -NASA does have "Guidelines"	-Intellectual Property -Royalty-Based Commercialization	-Real Property	-Federal Lab -R&D
NASA Cash to the Non-NASA Party	Yes	Yes	Yes, but it's very rare.	No	No	No
Process Owner	Office of Procurement	Office of Procurement	Technology Transfer Office	Office of General Counsel*	ARC and KSC	Undefined at this time.
Notable Advantage	$$$	$	Flexibility	Possible Exclusive Rights to an Invention that may be Patentable	In-Kind Consideration for Real Property	Advanced Licensing of Inventions Not Yet Invented
Notable Disadvantage	Standard Regulations and Provisions	Standard Regulations and Provisions (but not nearly as large as the FAR)	Historically, SAAs are contain less rigor vs. a procurement contract.	Royalty Payments as Consideration	Limited to Two NASA Centers	No Cash Contribution Allowed From NASA
Authority	Space Act; 31 USC 6303; 10 USC 2302	Space Act; 31 USC 6304; 31 USC 6305	Space Act	35 USC 207	Space Act; 42 USC 2459j	15 USC 3710a
Regulation	Federal Acquisition Regulations	Grant and Cooperative Agreement Handbook (14 CFR Part 1260)	No Formal Regulation; NASA has "Guidelines" documented in an SAA Guide	37 CFR Part 404, also referred to as the "Licensing Regulations"	No Formal Regulation	No Formal Regulation

NRO/AIAA Space Launch Integration Forum
Innovative Technologies for Space

Invocon, Inc.

Karl Kiefer, President & CEO

- **Wireless Instrumentation Systems – Sensor Control and Acquisition Telecommunications**

Qualtech Systems, Inc.

Dr. Krishna R. Pattipati

- **Supportability Engineering & Intelligent Health-Management for NASA Exploration Systems**

General Atomics

Meera Venkatesh

- **First Stage Highly Reliable Reusable Launch System**
- **Integrated Systems Health Monitoring**

Sierra Lobo, Inc.

Mark Haberbusch

Director of Research & Techology

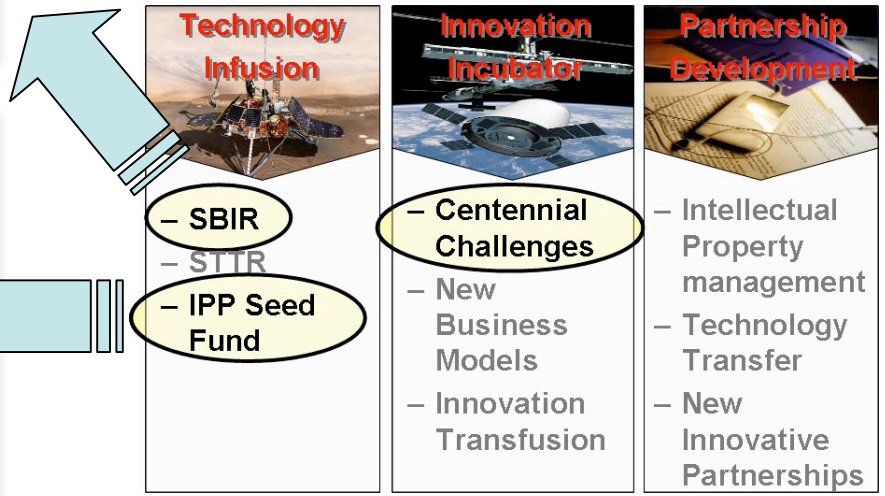
- **Cryo-Tracker® Mass Gauging System**

Armadillo Aerospace

Neil Milburn

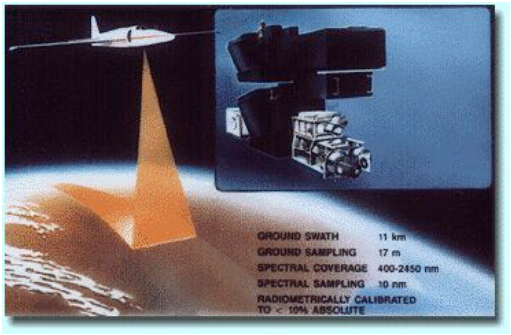
VP, Federal Liaison & Program Manager

- **Modular Vehicle Approach to Responsive Space Access and Fractionated Space Architecture**



Spectral Imaging Partnerships

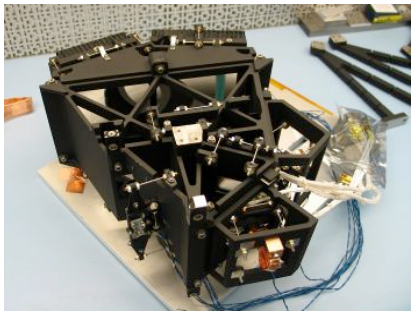
NASA Investment



Airborne AVIRIS Imager

- NASA funded airborne whisk broom spectrometer
- Built in 1989 and operated through present

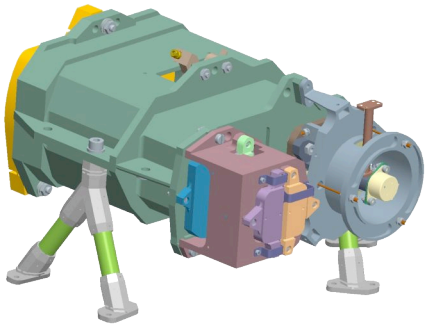
Tech Transfer/Partnerships



Airborne Compact Imager

- Partnership with another agency to develop a new airborne spectrometer (MaRS)
- MaRS uses Offner and push broom design for improved performance metrics (radiometric precision, uniformity, simplicity, reliability)
- Partner provides $10M in funding to increase technology from TRL 3 to 7
- 24 month build
- Demonstrated in 2006

Benefits to NASA



Airborne Compact Imager

- NASA selects advanced push broom, compact spectrometer (Moon Mineralology Mapper) for joint NASA/ISRO experiment
- Based on MaRS design
- 24 month build
- Launch in 2008

GPS Technology Transfer and Industry Partnership Sample of Return on Investment at JPL

NASA Seed Investment

- **GPS science receiver**
  1990's: ~$0.5M/year for developing BlackJack receiver
- **Real-Time GIPSY (RTG) software**
  Mid 90's: ~$0.5M total for software development
- **Global Differential GPS (GDGPS) System**
  2000-2002: $500K/year for a prototype

Partnership highlights:

Non-NASA funding, 96-06: ~$20M
Software royalties, 96-06: ~$5M;
Space Technology Hall of Fame, 2003

Tech Transfer/ Investment from Outside NASA

Technology transfer to industry enabled low-cost, COTS receiver. Investment by industry ~$10M

1995-2000: $0.5M/year from FAA to mature RTG, support WAAS.

2001-present: ~$8M from industry and DoD for operational GDGPS System.

Investment by Industry outside JPL in GDGPS-related infrastructure and services:
~ $20M

Broad Benefits to NASA

Industry provides BlackJack-based science receivers to Jason, ICESat,OSTM, COSMIC

RTG is NASA Software of the Year 2000; RTG powers GDGPS

- Real time sea height Jason-1
- Free global access to GDGPS corrections through Inmarsat ($1M/year value)
- Real time airplane positioning enables UAV-SAR mission
- TDRSS Augmentation Service for Satellites (TASS) enabled
- Real-time atmospheric sensing from COSMIC constellation

Y. Bar-Sever, S. Lichten JPL. January 2007

What Can IPP Provide?

- **Funding or Leveraged Resources**
  - NASA SBIR/STTR funds several hundred small businesses
  - IPP Seed Fund seeks partnerships to leverage resources with the private sector and other Federal labs
  - Centennial Challenges offers millions in purses
- **Technology and Software**
  - Access through licensing or other partnerships
- **Facilities**
  - Access to NASA's facilities through partnerships
- **Expertise**
  - Access to NASA's technical expertise through partnerships
- **Facilitation to enable partnerships**
- **Advocacy as a change agent to try new things**

Summary

- **IPP is seeking to add value to NASA's Mission Directorates and their programs and projects, through technology development and infusion to meet mission needs.**
- **IPP provides benefits to NASA's programs and projects through several sources.**
  - There is a track record of success, but we are aggressively pursuing better integration and more infusion.
  - IPP is working to better identify priority needs across the agency, to help in shaping our portfolio of investments and partnership opportunities.
- **There is tremendous potential, and with technology resources so scarce we are working diligently to harness that potential.**
- **IPP will continue to transfer NASA's technology for public benefit and integrate successes into NASA messaging.**
- **IPP has a highly dedicated workforce at each of the ten Field Centers, they are working to build stronger connections to programs/projects at their center to better understand needs, build working relationships and increase infusion.**

Interested in partnering with NASA?

Contact the relevant IPP Center Chief(s):

Center	Name	Email	Phone
ARC	Lisa Lockyer	Lisa.L.Lockyer@nasa.gov	(650) 604-0149
DFRC	Gregory Poteat	greg.poteat@dfrc.nasa.gov	(661) 276-3872
GRC	Kathy Needham	Kathleen.K.Needham@nasa.gov	(216) 433-2802
GSFC	Nona Cheeks	Nona.K.Cheeks@nasa.gov	(301) 286-8504
JPL	Ken Wolfenbarger	james.k.wolfenbarger@nasa.gov	(818) 354-3821
JSC	Michele Brekke	michele.a.brekke@nasa.gov	(281) 483-4614
KSC	Dave Makufka	David.R.Makufka@nasa.gov	(321) 867-6227
LaRC	Marty Waszak	m.r.waszak@nasa.gov	(757) 864-4015
MSFC	Jim Dowdy	Jim.Dowdy@nasa.gov	(256) 544-7604
SSC	Ramona Travis	Ramona.E.Travis@nasa.gov	(228) 688-1660