SBIR/STTR Programs

James D. Stegeman
Space Operations Mission Directorate
NASA Glenn Research Center

National SBIR Conference
November 14, 2008 Hartford, CT

This presentation provides an overview of the NASA mission and overviews of both the IPP and SBIR programs and how they relate to each other and to the NASA mission. Examples are provided concerning NASA technology needs and how the SBIR program has not only enabled technology development to meet those needs, but has also facilitated the infusion of that technology into the NASA mission.

National Aeronautics and Space Administration

SBIR/STTR Programs
November 2008

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NASA Explores For Answers That Power Our Future

Inspiration

- NASA powers inspiration that encourages future generations to explore, learn, and build a better future.

Innovation

- NASA powers innovation that creates new jobs, new markets, and new technologies.

Discovery

- NASA powers discovery that enables us to learn more about ourselves, our world, and how to manage and protect it.

Inspiration + Innovation + Discovery = Future

NASA's Strategic Goals

- Fly the space shuttle as safely as possible until its retirement, not later than 2010.
- Complete the International Space Station in a manner consistent with our international partner commitments and the needs of human exploration.
- Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration.
- Bring a new Crew Exploration Vehicle into service as soon as possible after shuttle retirement.
- Encourage the pursuit of appropriate partnerships with the emerging commercial space sector.
- Establish a lunar return program having the maximum possible utility for later missions to Mars and other destinations.

Global Exploration Strategy

Human Civilization

Global Partnerships

Scientific Knowledge

Economic Expansion

Exploration Preparation

Public Engagement

Global Exploration Strategy

NASA Organization

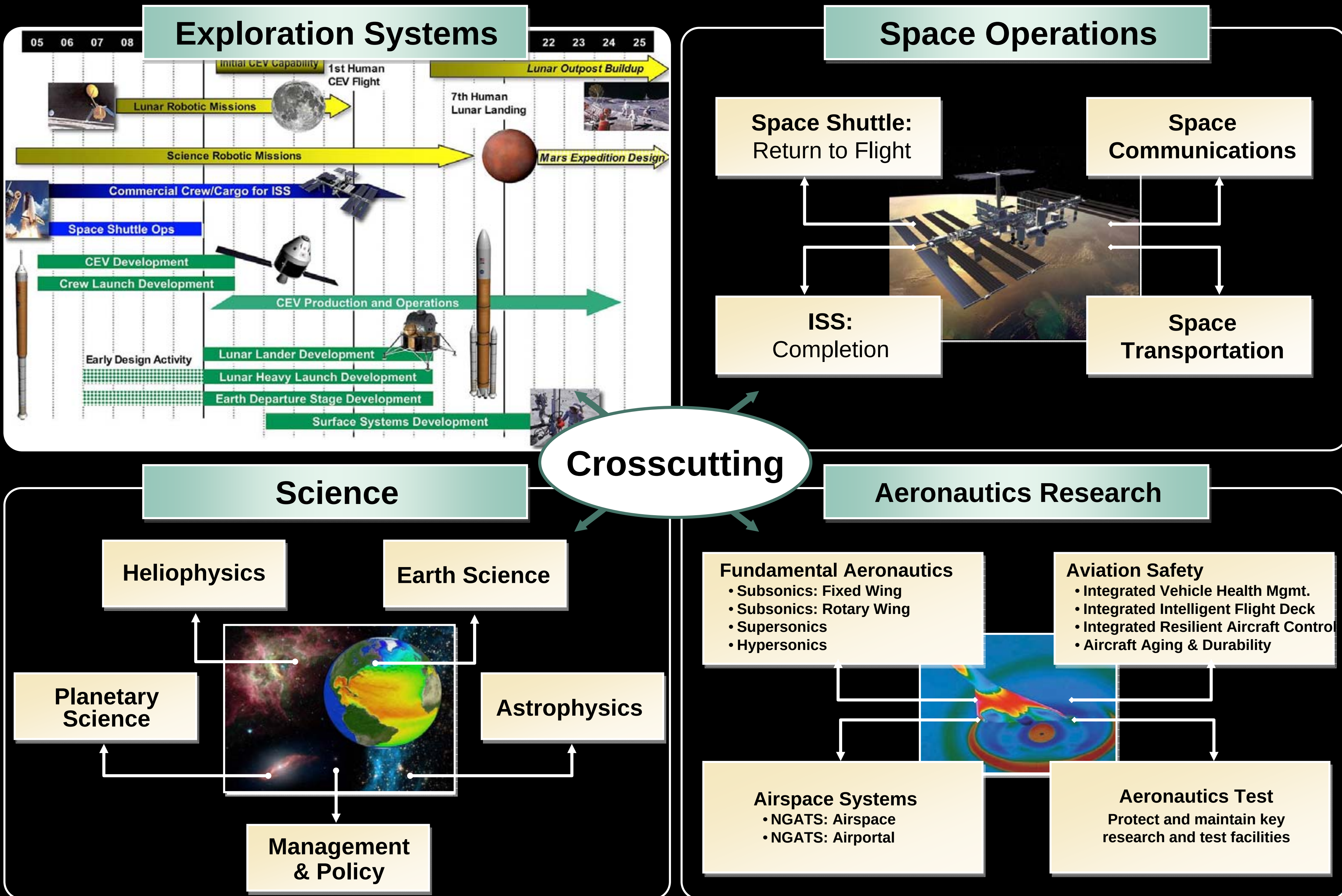
Space Operations Mission Directorate

Science Mission Directorate

Aeronautics Mission Directorate

Explorations Systems Mission Directorate

Agency Capability Roadmap



Sensors In Extreme Environments

High $\frac{\text{performance}}{\text{weight}}$

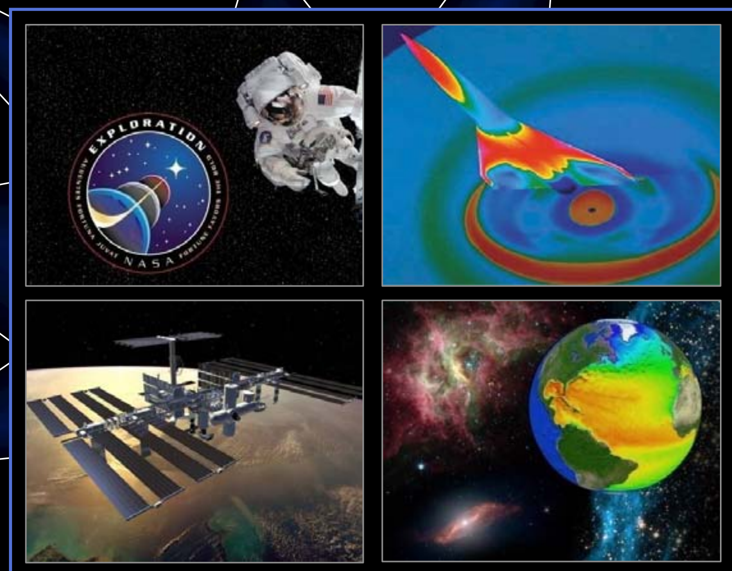
- Launch $
- Aeronautics Applications
- Human Habitats

Meteorite Impact & Dust Resistance

- Highly electrostatic
- Ultrafine
- Human Habitats

Multifunctional Intelligence

- Scientific Productivity
- Human "Amplifiers"
- IVHM



Extreme Radiation Resistance

- Mission to Europa:
  1-5 Mrads

Ultra-sensitive Signal capture

- Voyager:
  Signal From 9.3×10^9 mi

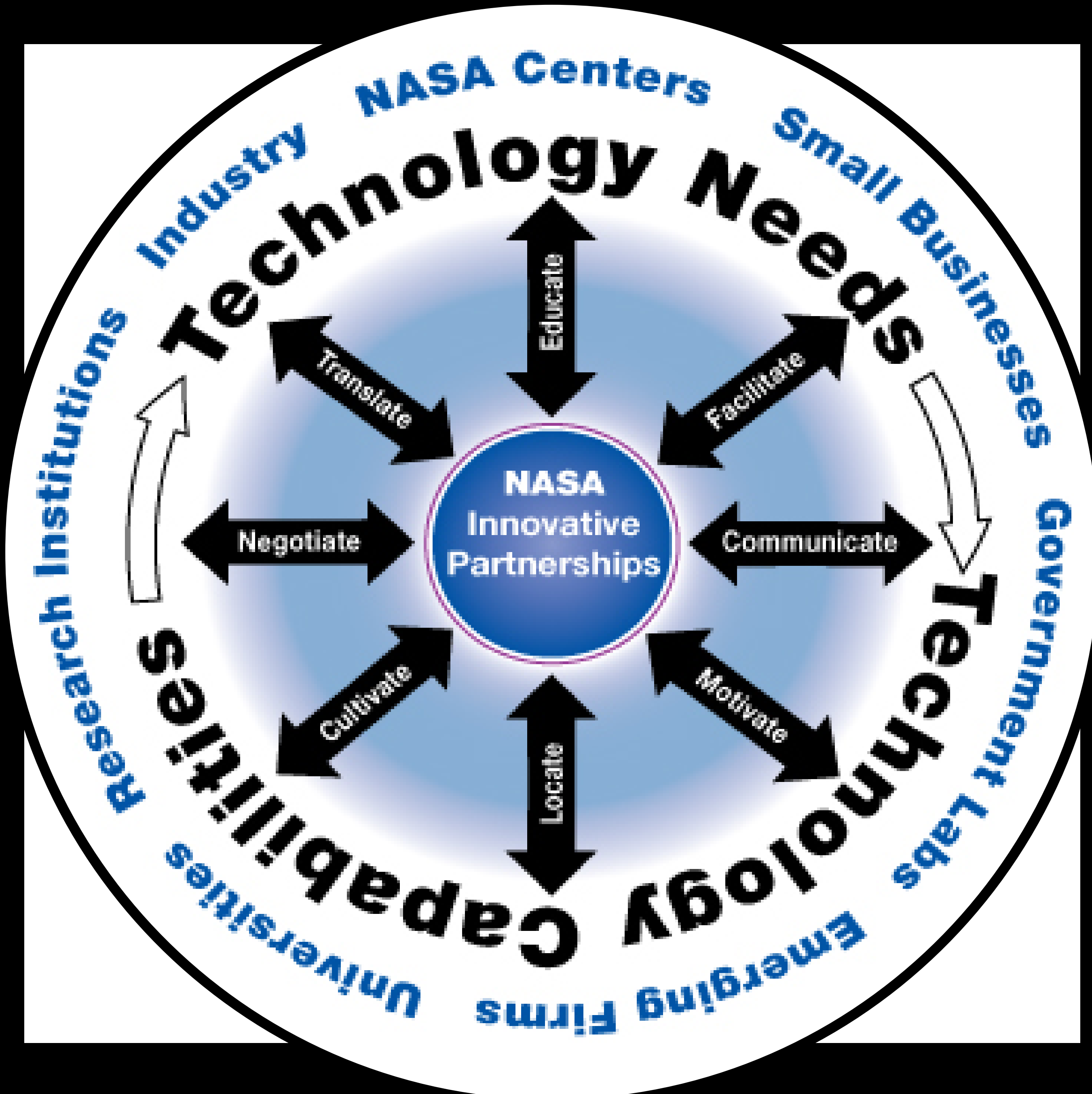
Extreme Temperature Resistance

- Lunar Surface:
  -233 °C to 123 °C
- Mars Surface:
  -87 °C to -5 °C

Innovative Partnerships Program

Matching Technology Needs with Technology Capabilities

IPP's Dynamic Innovation Process



Innovative Partnerships Program Elements

- Small Business Innovation Research (SBIR)
- Small Business Technology Transfer Research (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

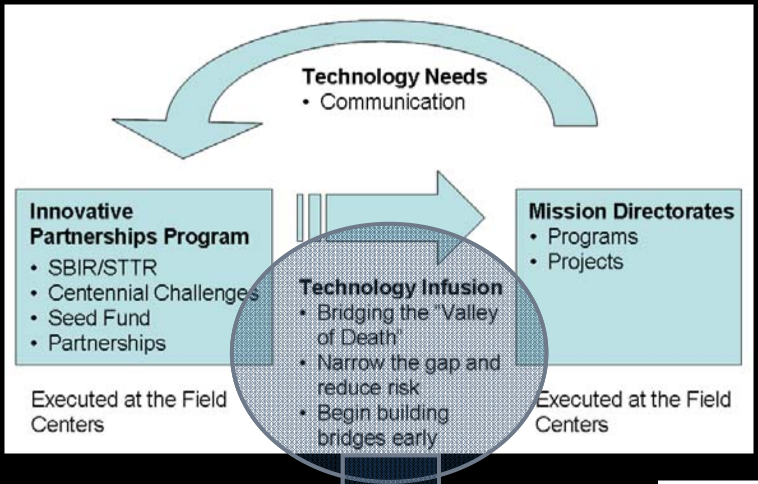
Executed at the Field Centers

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

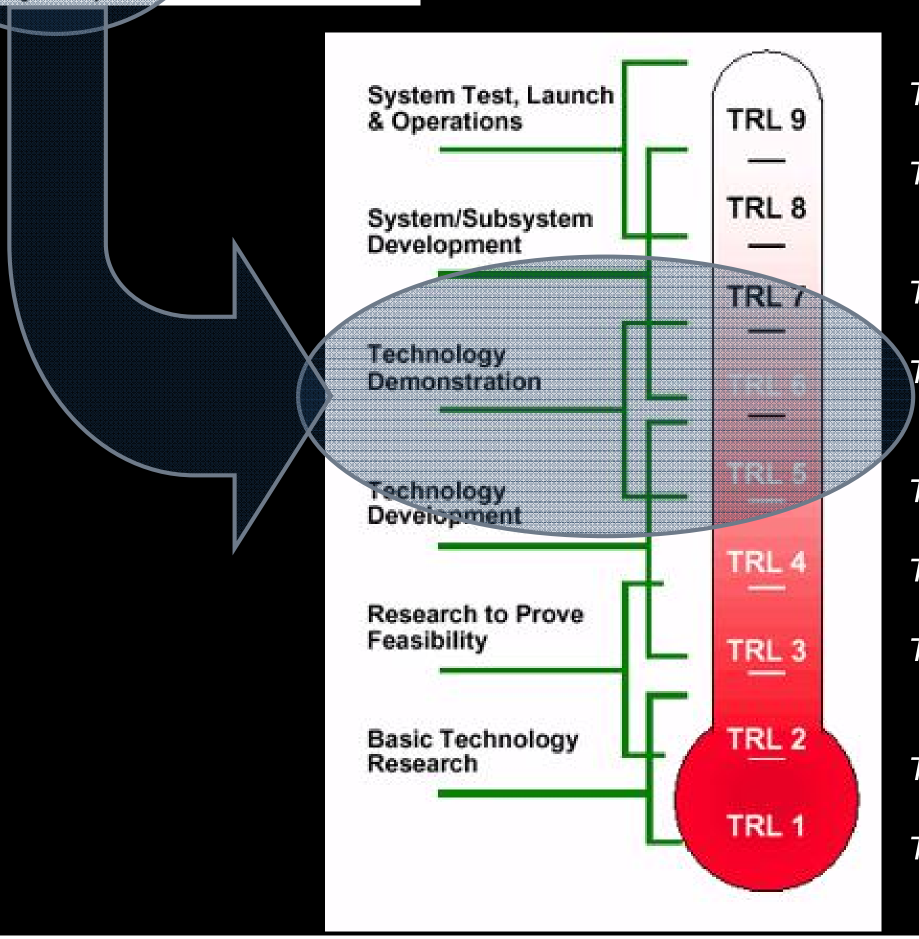
Mission Directorates
- Programs
- Projects

Executed at the Field Centers

Technology Demonstration is critical to Infusion



- As a rule of thumb, projects like technology to be TRL-6 by PDR
- Technology Demonstration in relevant environments is critical



TRL 9 Actual system "flight proven" through successful mission operations.

TRL 8 Actual system completed and "flight qualified" through test and demonstration (ground or space).

TRL 7 System prototype demonstration in a ***space environment***.

TRL 6 System/subsystem model or prototype demonstration in a ***relevant environment*** (ground or space).

TRL 5 Component and/or breadboard validation in ***relevant environment***.

TRL 4 Component and/or breadboard validation in laboratory environment.

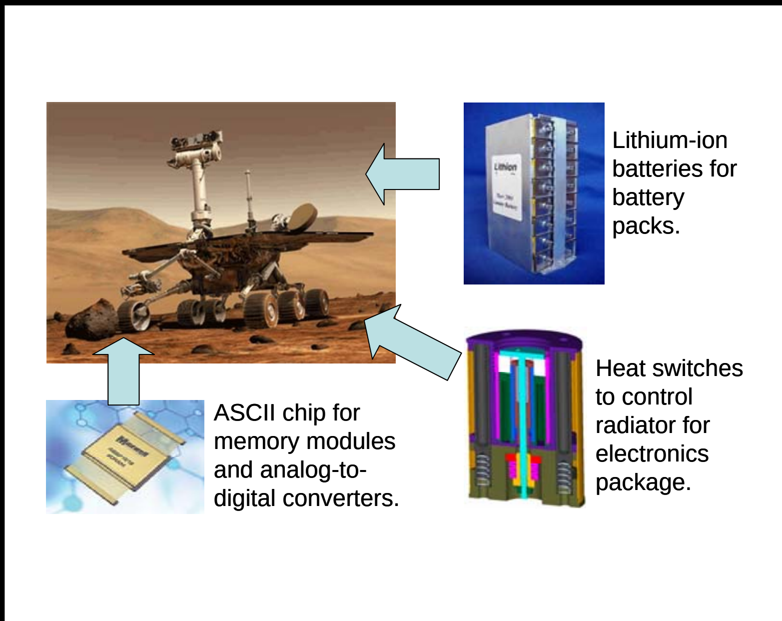
TRL 3 Analytical and experimental critical function and/or characteristic proof-of concept.

TRL 2 Technology concept and/or application formulated.

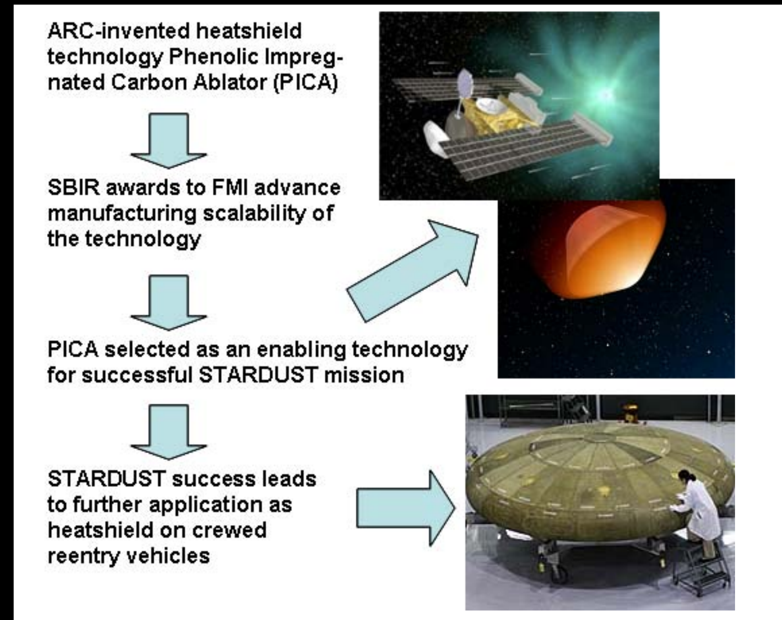
TRL 1 Basic principles observed and reported.

SBIR Technology Infusion Examples

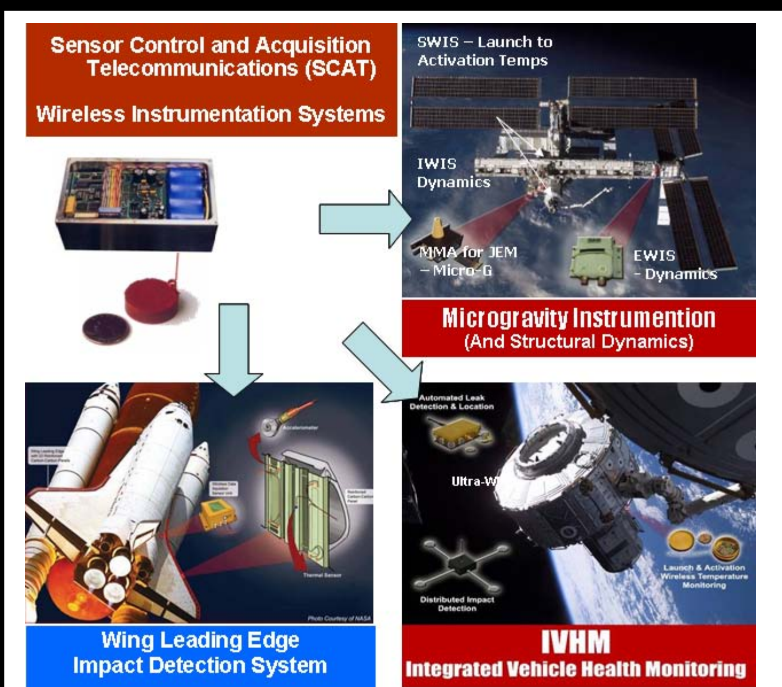
Mars Exploration Rovers



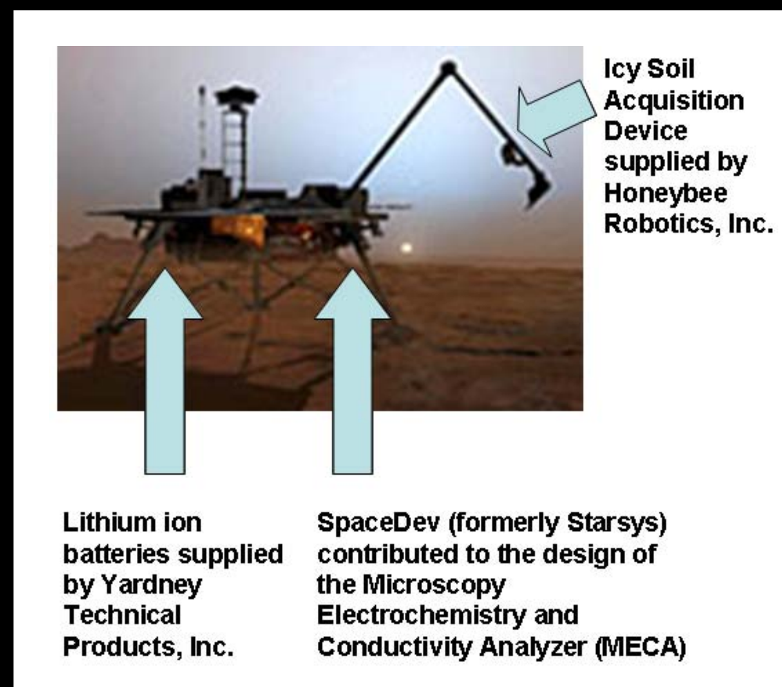
Stardust and Orion



Space Shuttle and ISS



Mars Phoenix Lander



Leak Detection System

1997

NASA space shuttle hydrogen sensors demonstrated on STS 95 and 96

1998

NASA X–33 RLV program validated hydrogen safety system MSFC STTR with Case Western Reserve University

1999

NASA Hypersonic X–43 validated hydrogen safety sensors MSFC STTR with Case Western Reserve University

2000

International Space Station hydrogen sensing system included on the water processing 0_2 generator

2001

Helios aircraft collaborative effort with AeroVironment and DFRC

2003

Ford Model U—Standard Hydrogen, Inc. (spin-off company) provides comprehensive hydrogen monitoring system

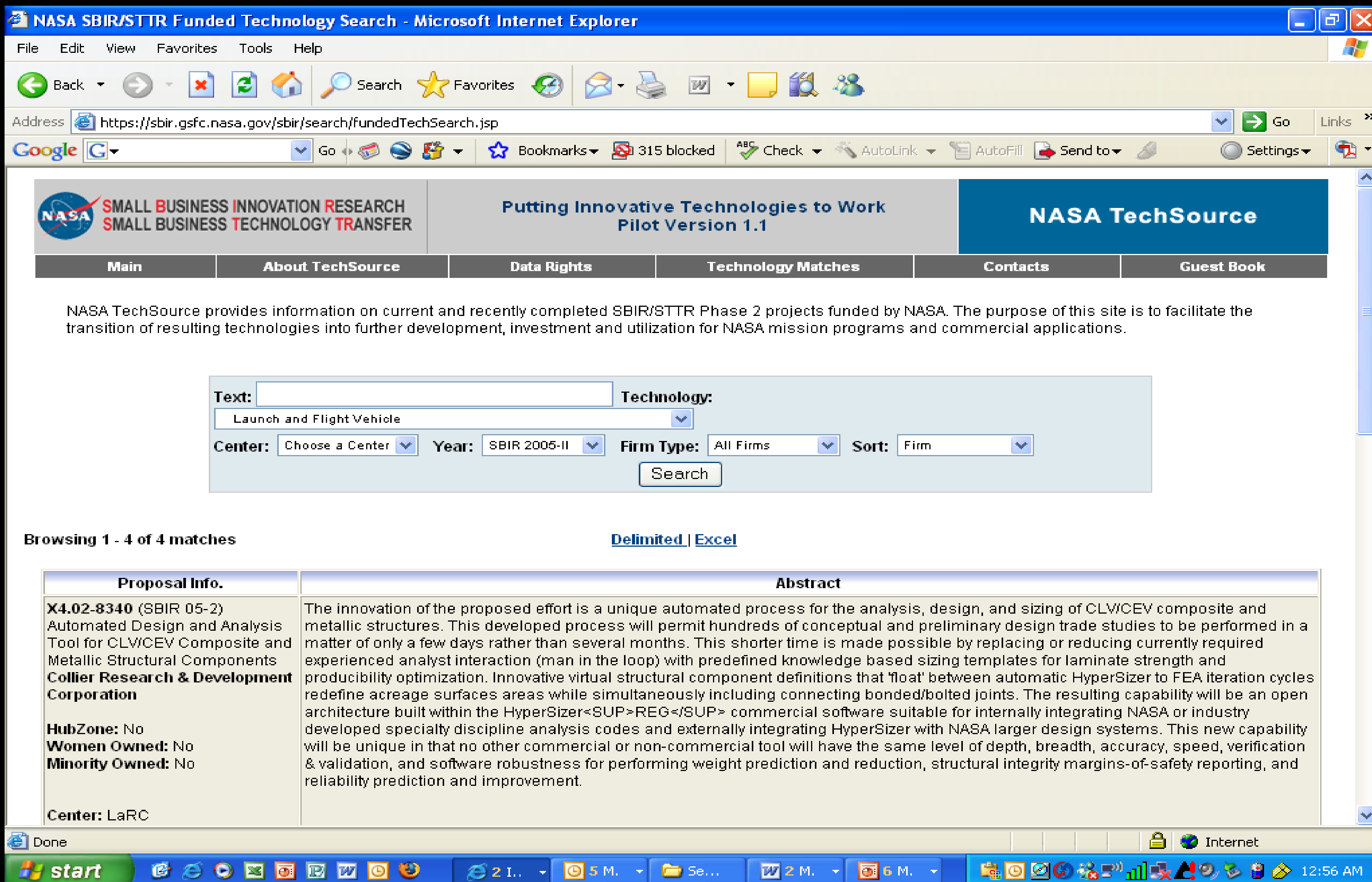
- KSC SBIR for sensor technology to detect hydrogen leaks
- $1.6M STTR Phase 3 follow-on effort from GRC to further develop next-generation hydrogen and oxygen miniaturized leak detection systems
- $700K Space Act Agreement with Glennan Microsystems/ Ohio State University for High Temperature Electronic Nose
- Received the R&D 100 Award in 2005

Aeronautics, Space Operations, and
Exploration Systems Mission Directorates

NASA Glenn Research Center
Gary Hunter • 216–433–6459

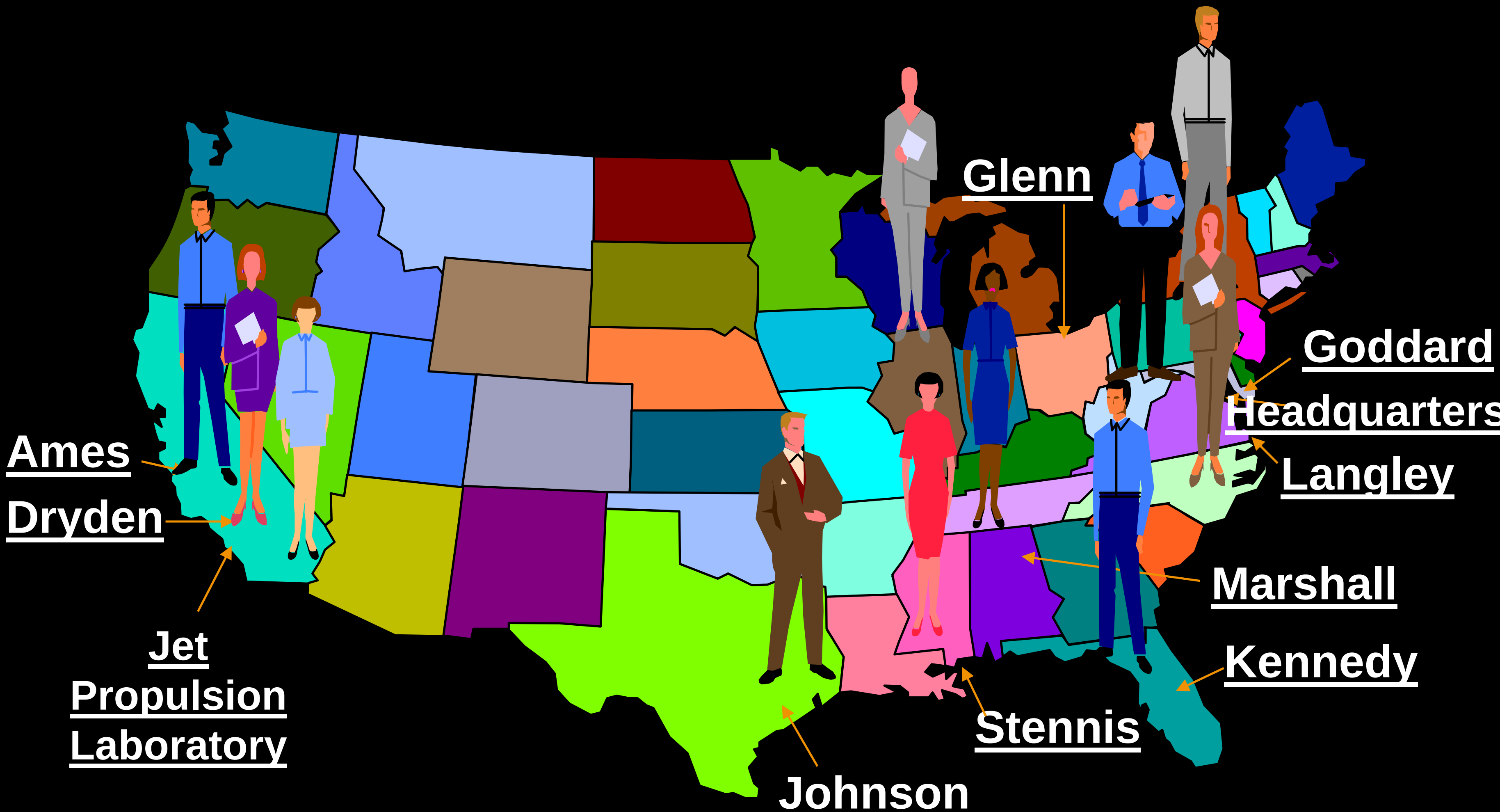
MAKEL ENGINEERING
Makel Engineering, Inc.
Darby Markel • 530–895–2770

Technologies and Firms are Searchable



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

NASA Centers



Field Center Missions

Ames Research Center: Research of new technologies

Dryden Flight Research Center: Flight research

Glenn Research Center: Aeropropulsion and communications technologies

Goddard Space Flight Center: Earth, the solar system, and universe observations

Jet Propulsion Laboratory: Robotic exploration of the solar system

Johnson Space Center: Human space exploration

Kennedy Space Center: Prepare and launch missions around the Earth and beyond

Langley Research Center : Aviation and space research

Marshall Space Flight Center: Space transportation and propulsion technologies

Stennis Space Center: Rocket propulsion testing and remote sensing technology

NASA SBIR/STTR Program

SBIR:

Phase I $100K (SBA $100K) / 6 months
SBC offeror: min. 67% work
subcontract: max. 33%

Phase II $600K (matching for additional $150K) / 2 years
SBC offeror: min. 50% work
subcontract: max. 50%

STTR:

Phase I $100K (SBA $100K) / 1 year
SBC offeror: min. 40% work
Research Institute: 30% - 60%
LBC: max. 30%

Phase II $600K (matching for additional $150K) / 2 years
SBC offeror: min. 40% work
Research Institute: 30% - 60%
LBC: max. 30%

SBC - Small Business Concern
LBC - Large Business Concern

NASA SBIR/STTR Program

NASA	SBIR	STTR
2007 Budget	$106.6M	$12.8M
Phase 1 Contracts	$100K 6 months: 259	$100K 1 year: 25
Phase 2 Contracts	$600K/$750K 2 years: 130	$600K/$750K 2 years: 18

http://sbir.nasa.gov/

SBIR/STTR Program Schedule

2008 Program Solicitation
Opening Date: 07/07/2008
Closing Date: 09/04/2008
Selections: Nov. 2008

http://sbir.nasa.gov

Inherent Challenges of Space Systems

- Surviving Launch Conditions: high g-load, vibration, payload fairing, deployment
- Functioning in Extreme Environments: radiation, temperature, gravity, vacuum
- Limiting Power Availability
- High Degree of Autonomy and Reliability
- Long Range Communication and Navigation

Proposal Review & Selection Criteria

Proposal Review

- Factor 1: scientific/technical merit and feasibility (50%)
- Factor 2: experience, qualifications and facilities (25%)
- Factor 3: effectiveness of the proposed work plan (25%)
- Factor 4: commercial merit and feasibility (adjectival)

Proposal Ranking and Selection

- NASA Project/Mission Alignment
- Value, Priority and Infusion Potentials
- Champion/Advocate

Who's Who in NASA Program

Program Management:
Program Executive - Source Selection Official (Headquarters)
Agency Program Management Office (Ames Research Center)
Field Center Program Offices

Technical:
Mission Directorate Representatives
Topic Managers/Subtopic Managers
Technical Reviewers

Resource Management:
Resource analysts

Procurement:
Contracting Officer (NSSC - NASA Shared Service Center)
Tech Monitor, Contracting Officer's Technical Representative (COTR)

Nature of NASA SBIR Contracts

- SBIR contracts are fixed price contracts to be completed on a best effort basis.
- Contractors own resulting intellectual property (data, copyrights, patents, etc.).
- Government has royalty-free rights for government use of intellectual property.
- Government protects data from public dissemination for four years after contract ends.
- NASA is a potential customer.

Program Focus

Goal: infusion to NASA missions, programs and projects

- Identify potential project(s) for infusion early.
- Achieve TRL 6: systems/subsystem model or prototype demonstration in a relevant environment (ground or space).
- Work closely with technical monitor (COTR) and his/her colleagues.
- Be proactive and responsive to various opportunities.

Secrets of Success

- Familiar with Federal and NASA SBIR/STTR program.
- Learn NASA missions and enabling technology needs.

  Proposals should show an understanding of one or more relevant space science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.
- Have niche capabilities: unique competitive edge. Also, know state-of-the-art and competing technologies.
- Be strategic: treat Phase I, Phase II and NASA infusion as a package.

  Research should be conducted to demonstrate feasibility during Phase 1 and show a path towards a Phase 2 prototype demonstration.
- Build relationships: champions and networking.

Approaches

- Review prior year solicitation: **http://sbir.nasa.gov/**.
- Search and identify specific technical areas (subtopics) and lead center(s) of your interest.
- Request subject matter expert contact information from respective field center program POCs.
- E-mail/Call technical POCs and initiate dialogues.
- Learn technology needs and priorities.
- Visit and make presentations, if necessary.

Simple Math

- SBIR and STTR are not taxes. They are set asides.
- **Extramural R&D:**
  100% = 2.5% SBIR + 0.3% STTR + 97.2%
- External Contractors = Primes + Small Businesses
- Prime = Internal + Small Businesses
- Opportunities = SBIR + STTR + Agency Projects
  + Primes + Other Agencies

SBIR/STTR Center Points of Contact

Ames Research Center (ARC)
Dr. Rich Pisarski, 650-604-5582, Ryszard.L.Pisarski@nasa.gov
Kim Hines, 650-604-5582, Kimberly.K.Hines@nasa.gov

Dryden Flight Research Center (DFRC)
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Glenn Research Center (GRC)
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Goddard Space Flight Center (GSFC)
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Jet Propulsion Laboratory (JPL)
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SBIR/STTR Center Points of Contact

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<u>Kennedy Space Center (KSC)</u>
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<u>Langley Research Center (LaRC)</u>
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<u>Marshall Space Flight Center (MSFC)</u>
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<u>Stennis Space Center (SSC)</u>
Ray Bryant, 228-688-3964, Ray.Bryant-1@nasa.gov

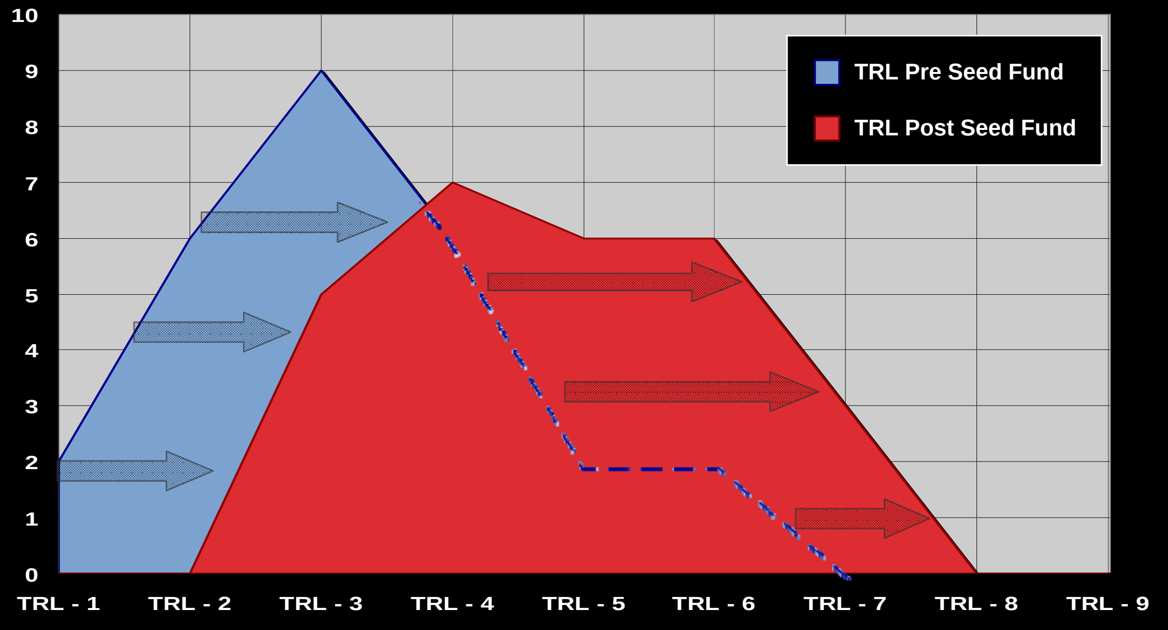
Questions?

Additional Information

IPP Seed Fund

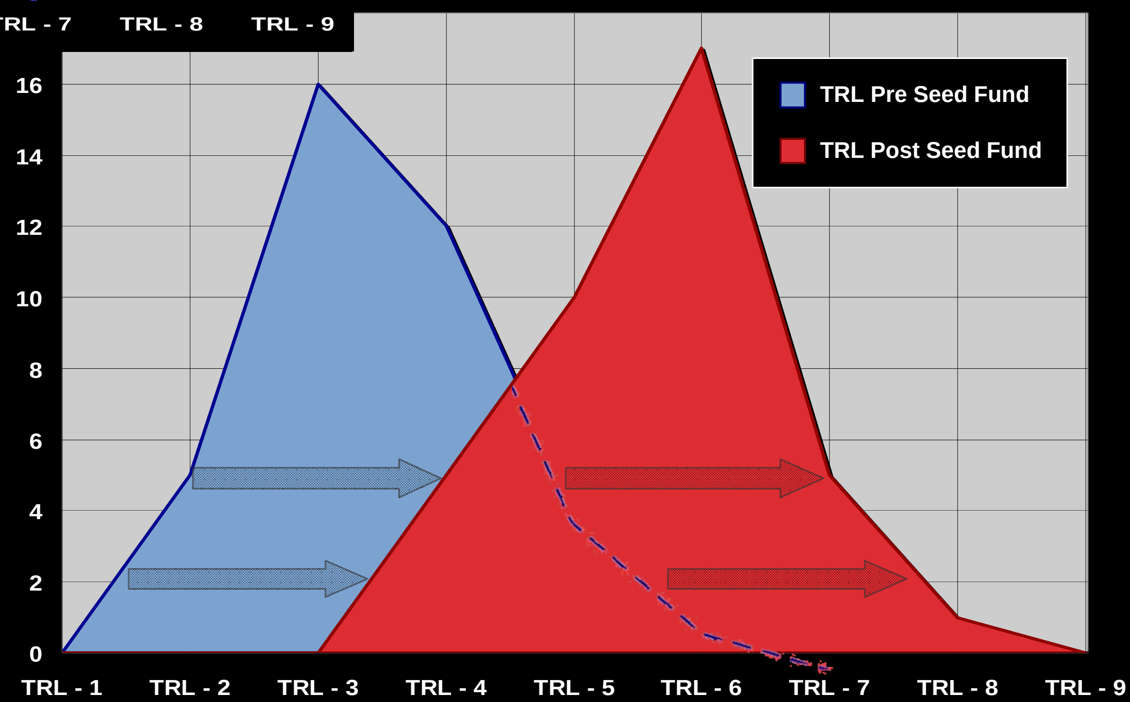
- **An annual process for selecting innovative partnerships to address technology barriers via cost-shared, joint-development projects.**
- **Enhances NASA's ability to meet the priority technology gaps of all four of NASA's Mission Directorates.**
- **The IPP Office at NASA HQ issues an annual Seed Fund call to all NASA Centers – they downselect and send to HQ for final selections.**
- **The 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.
- **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 TRL Advancement



FY06 Seed Fund Portfolio

FY07 Seed Fund Portfolio



Demonstration Highlights

Technology Demos

Cryostable Low-cost Mirror
(Deep Space Missions)

Inflatable Human Habitat
(Human Lunar)

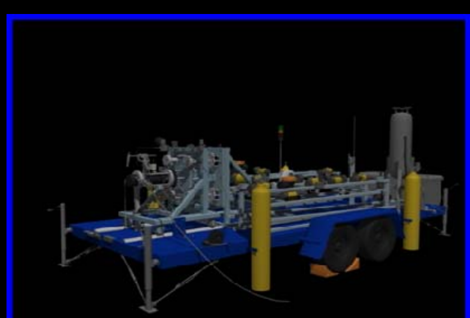
4D Flight Mgmt
(NGATS)

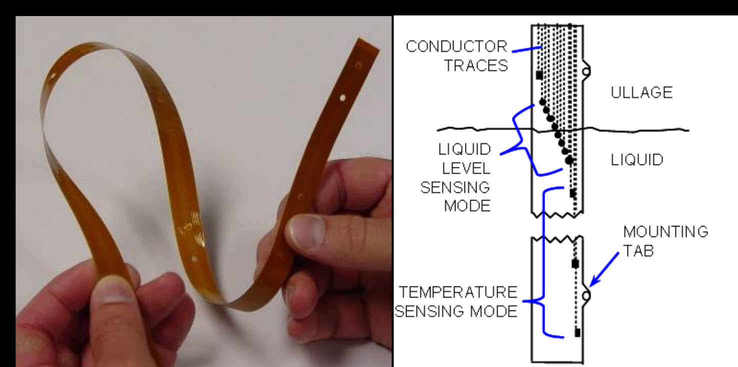
Li-Ion Battery for PLSS
(Human EVA)

Inflatable Decelerator
(AFL MARS and COTS)

Cryo-tracker Flight Qualification
(Atlas/Centaur Launches)

ISHM - Test Stand and J2X Engine
(Aries 1 Upper Stage)





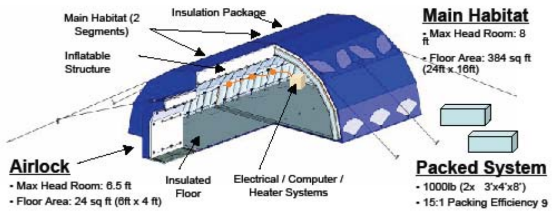
Antarctic Habitat Demonstrator

Antarctic Habitat Demonstrator

- NASA / NSF / ILC Dover Innovative Partnership Program (IPP)
- Test of expandable structures in Antarctic Analog to advance NASA knowledge base for lunar application
- Test of expandable structures to advance NSF knowledge and assess applicability to polar missions

System Requirements (NASA & NSF Combined) - Annotated

- Reconfigurable components
- Erected by 4 people in 4 hours
- Can withstand 100 mph winds
- High Packing Efficiency
- Can deploy on uneven ground
- Withstand the Antarctic winter
- Multiple cycle use
- Lighting/power/data acquisition
- Meet NSF building codes



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Antarctic Habitat Demonstrator Study Goals

Large Expandable Structures:

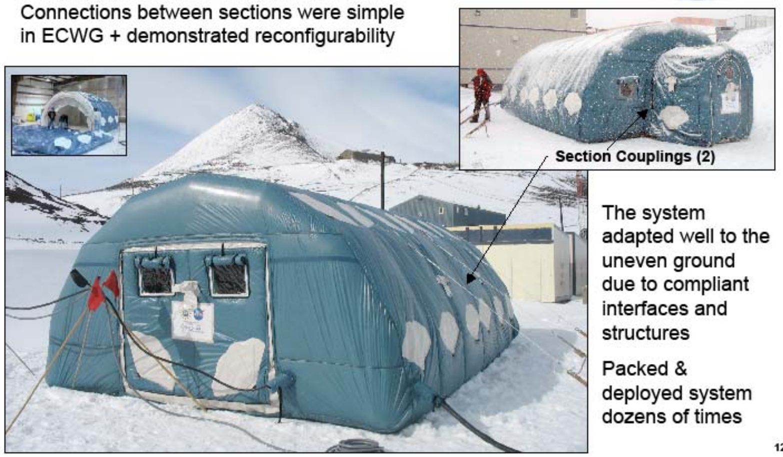
- ✓ – Packing efficiency & shipping/handling survival
- ✓ – Deployment operability in a gravitational environment and in polar gear (representing space suits)
- ✓ – Adaptability to uneven and rugged surfaces representing the lunar surface
- ✓ – Reconfigurability
- Ongoing – Performance in a harsh environment
- Partial – Deployment with integrated electronics (power, lighting, sensors, etc.)
- ✓ – Remote structural health monitoring over long periods of time
- ✓ – Use of in-situ materials for shielding from radiation
- ✓ – Lunar dust mitigation practices

ILC DOVER creating what's next

10

Reconfigurability Studies

Connections between sections were simple in ECWG + demonstrated reconfigurability



The system adapted well to the uneven ground due to compliant interfaces and structures

Packed & deployed system dozens of times

12

Radiation Protection Studies

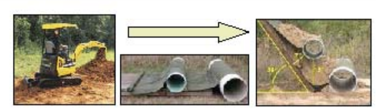
Researching ways to apply regolith to the walls of a structure for radiation shielding

Bags

Fill bags attached to structure

Blankets

Flexible PE blankets applied where required



Push regolith on deflated structure, inflate structure, capture regolith on walls

Regolith Lifter

ILC DOVER creating what's next

13

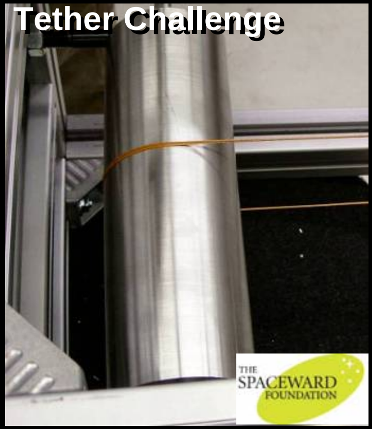
From briefing by Phil Spampinato, ILC Dover
At 3rd AIAA Space Exploration Conference, Feb. 27, 2008

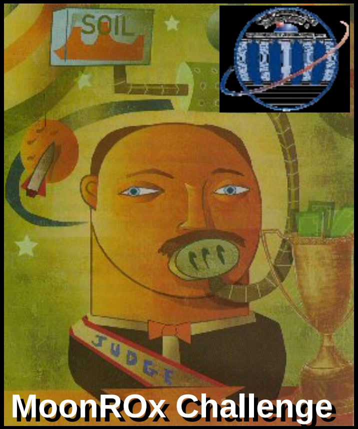
How Do Prizes Benefit NASA?

- 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	$750 K		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...

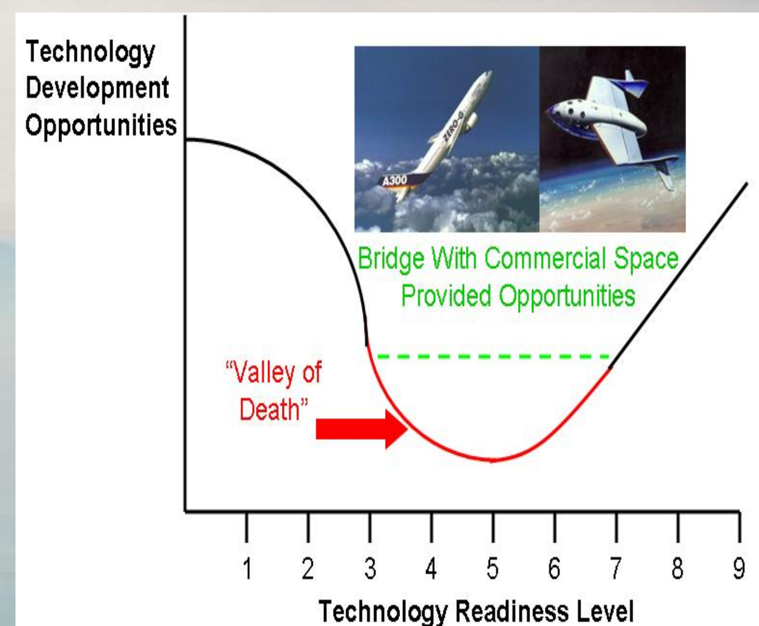
...Peter Homer

FAST

Facilitated Access to the Space environment for Technology development and training

<u>Objectives</u>:

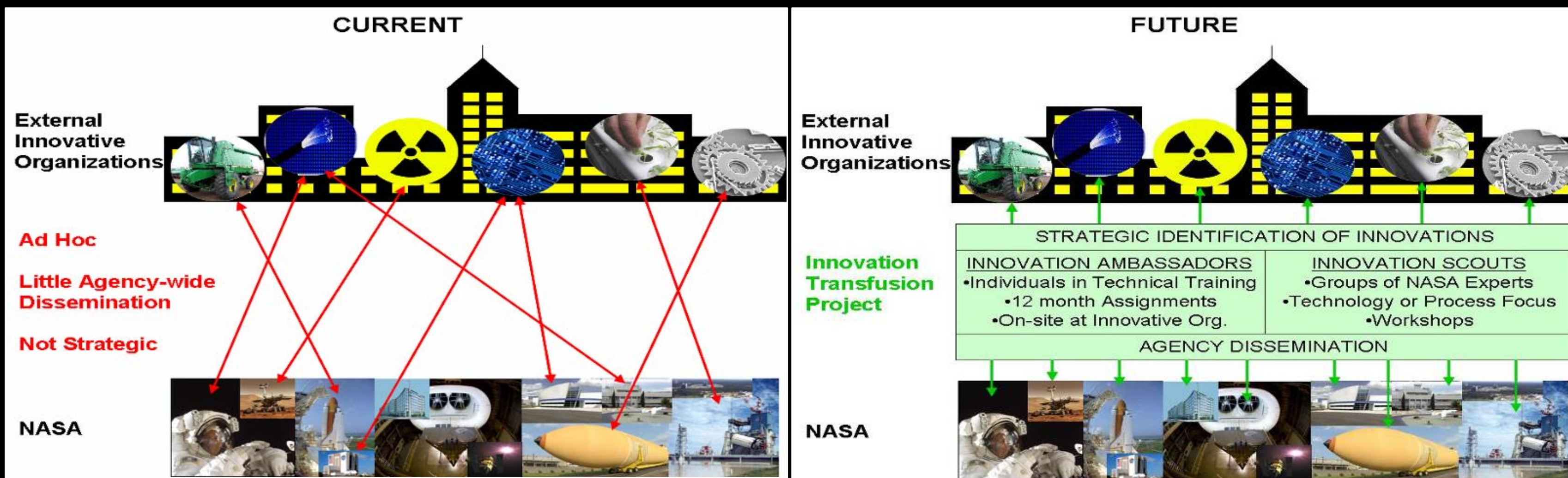
- **Advancing technology maturity to enhance technology infusion.**
- **Providing regular opportunities for access to unique environment .**
- **Demonstrating use of commercial services.**



Innovation Transfusion

Issue: 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

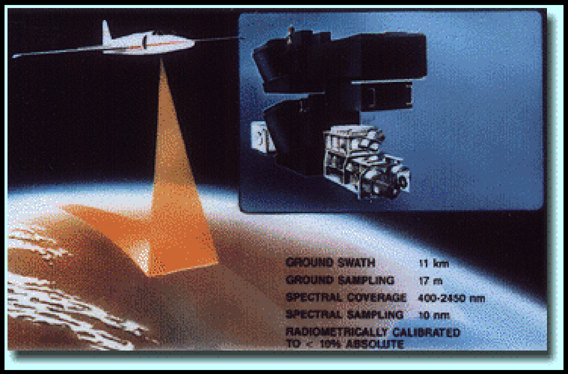
Technical training program for up to 1 year at an external organization

Workshops with NASA to external organizations focusing on specific innovations

Use existing mechanisms to communicate innovations

Spectral Imaging Partnerships

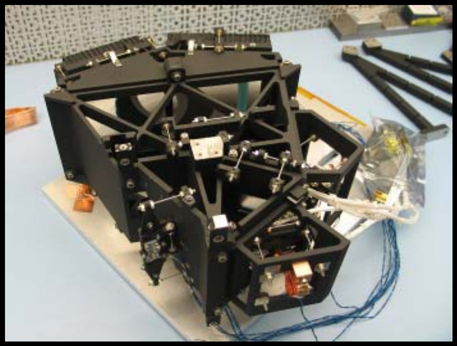
NASA Investment



Airborne AVIRIS Imager

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

Tech Transfer/Partnerships



Airborne Compact Imager

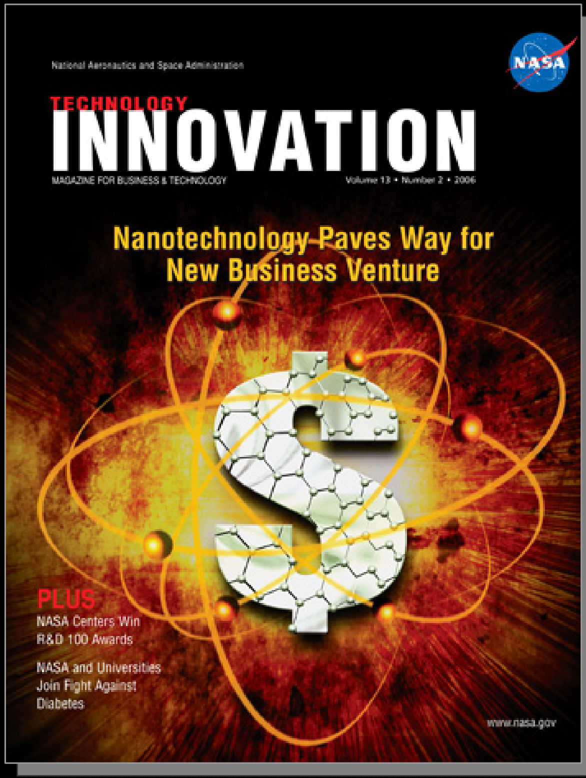
- Partnership with another agency to develop a new airborne spectrometer (MaRS)
- MaRS uses Offner and push broom design for improved performance metrics (radiometric precision, uniformity, simplicity, reliability)
- Partner provides $10M in funding to increase technology from TRL 3 to 7
- 24 month build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

Outreach & Publications



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

NASA @ Home & NASA City
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http://ipp.nasa.gov/innovation/index.html

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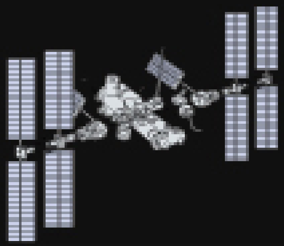
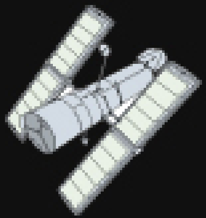
NASA Technologies Enhance Our Lives

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

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**

Interested in partnering with NASA?

Contact the relevant IPP Center Chief(s):

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