Space Technology Programs

- Game Changing Development Program
- Technology Demonstration Missions Program
- Small Spacecraft Technologies Program
- Space Technology Research Grant Program
- NASA Innovative Advanced Concepts (NIAC) Program
- Center Innovation Fund (CIF) Program
- Centennial Challenges Prize Program
- Small Business Innovation Research & Small Business Technology Transfer (SBIR/STTR) Program
- Flight Opportunities Program
Center Innovation Fund (CIF)
Center Innovation Fund (CIF) Program Objective:

To stimulate and encourage creativity and innovation within the NASA Centers

CIF seed funds support...
- New technologies
- Innovative approaches
- Creative ideas

Leveraging NASA Center talent and capabilities, as well as external partnerships
CIF Evaluation Criteria

- Innovation
- Relevance & Value to NASA and the nation
- Collaboration and Partnerships
- Progress Achieved

CIF solicitation and selection processes are run by the NASA Center Chief Technologists.

NASA Headquarters participates, and reviews annual progress, but does not direct individual CIF efforts.
Two Perspectives on CIF

Technology Readiness Level (TRL) Scope of CIF Program

Distribution of 2012 CIF Projects by NASA Technology Area (TA)

- TA.1. Launch Propulsion
- TA.4. Robotics
- TA.10. Nanotechnology
- TA.13. Ground/Launch
- TA.2. In-Space Propulsion
- TA.5. Comm./Navigation
- TA.8. Sci. Instr./Sensors
- TA.11. Modeling/Simulation
- TA.14. Thermal
- TA.3. Space Power/Storage
- TA.6. Human Health
- TA.9. Entry, Descent, Landing
- TA.12. Materials Structures
Exploring new concepts to expand aerospace possibilities

California Institute of Technology, San Jose State University, Santa Clara University, Stanford University, UC Berkeley, UC Santa Cruz, University of Southern California

University of Idaho

Brigham Young University

Kansas State University

University of Wisconsin

Illinois Institute of Technology

University of Michigan

University of Idaho

University of Colorado at Boulder

University of Southern Mississippi

University of New Orleans, Louisiana Tech University

Rice University, Texas A&M, University of Texas at Austin, University of Texas at El Paso

University of Alaska

University of Hawaii

Massachusetts Institute of Technology, University of Massachusetts

Bridgeport University, University of Connecticut

Stevens Institute of Technology, Princeton University

University of Maryland

North Carolina A&T University

University of Tennessee

Georgia Institute of Technology, Georgia State University

Embry Riddle Aeronautical University, Florida Institute of Technology, University of Central Florida, University of Florida
Project Summary:
Electrically-controlled extinguishable solid propellant (ESP) thrusters are inert unless ignited with an electric potential of appropriate magnitude. Once electrically ignited, burning rates can be increased by up to 20x (throttled) using electrical power and then switched off (extinguished) by removing the electrical power.

Innovation summary:
ESP is a revolutionary new capability for solid propellant systems, with the potential to replace multi-mode liquid propulsion systems.

NASA/Government Application:
Multiple applications for NASA and other agencies.
Project Summary:
3-D WTPS utilizes mature weaving technologies to manufacture preforms. Varying the material composition by controlling placement of fibers, and optionally infusing with resins, yields ablative TPS to meet a wide range of entry conditions.

Innovation summary:
A game changing approach to manufacturing thermal protection systems that use precisely engineered 3-D weaving techniques

NASA/Government Application:
Woven TPS could enable robotic missions that encounter extreme entry environments (e.g., Venus, Saturn, high-speed sample return), and human missions from beyond the Moon

3-D Woven TPS is being evaluated for a possible Lunar Flight test in 2017.

Resin infused, pre & post arc jet tested coupons, left and right, respectively. Condition: 0.625 atm & ~700 W/cm².
CIF Contact Information

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The NASA Center Chief Technologists

www.nasa.gov/offices/oct/about_us/cct_page.html

CIF
Website http://www.nasa.gov/offices/oct/stp/innovation_fund/index.html
NASA Innovative Advanced Concepts (NIAC)
What is **NIAC**?

**NASA Innovative Advanced Concepts**

A program to support early studies of innovative, yet credible, visionary concepts that could one day “change the possible” in aerospace.
NIAC Program Details

• NIAC supports early studies of visionary aerospace concepts
  – Aerospace architecture, mission, or system concepts (not focused tech.)
  – **Exciting**: offering a potential breakthrough or revolutionary improvement
  – **Unexplored**: novel, with basic feasibility and properties unclear
  – **Credible**: sound scientific/engineering basis and plausible implementation

• NIAC awards support 2 phases of study:
  – **Phase I**: up to $100K, ~9 months, for concept definition and initial analysis in a mission context
  – **Phase II**: up to $500K, 2 years, for further development of most promising Phase I concepts, comparative mission analysis, pathways forward

• NIAC networking, outreach, and inspiration are also key:
  – Fall & Spring Symposium: presentations by the NIAC Fellows
  – Conferences / Websites / Articles / Interviews / Radio Spots ...
Fraction of NIAC Award Funding
by Organization Type of Lead Proposer
(2011-2012)
NIAC is #1! (At least briefly)

What’s Next for NASA? 10 Wild Newly Funded Projects

NASA Innovative Advanced Concepts Program

By KEITH WAGSTAFF @kwagstaff August 7, 2012

What’s next for NASA now that Curiosity has touched down on Mars? For a sneak peak into what the space agency has in store, take a look at the 28 proposals for the NASA Innovative Advanced Concepts program, which gives out awards of $100,000 and $500,000 for ideas that have the potential to “transform future aerospace missions.” Here are 10 of the most fantastic projects that NASA hopes will be inspiring people long after Curiosity has finished exploring Mars.

PHOTOS: Seeing Red: 40 Years of Exploration on Mars

Next: Lunar Settlement

Related Topics: curiosity, Mars, NASA, space, Form + Function, innovation, News
2012 NIAC Studies: 5 Group Overview

**Revolutionary Construction**
- SpiderFab
- Orbiting Rainbows
- ISRU Robotic Construction
- E-M Deployment/Structures
- OCCAMS
- Printable Spacecraft

**Human Systems**
- Water Walls
- Solid State Air Purification
- V2Suit
- Magnetic Radiation Protection

**Sensing/Imaging**
- HOMES
- NIST in Space
- Atom Interferometry
- Ghost Imaging

**Autonomous Exploration**
- Super Ball Bot
- RAP
- Regolith Biters
- Venus Landsailing Rover
- EUROPA
- Cavehopping Planetary Tunnels
- Extreme Environmt. Sample Return

**Transportation/NEO Mitigation**
- NanoTHOR
- Plasma Aerocapture & Entry System
- SSEARS
- MAGNETOUR
- Bi-Directional Flying Wing
- Fusion Driven Rocket
- NEO Impact Threat Mitigation

*Blue denotes Phase II Studies*
ARTIFICIAL GRAVITY

PROLONGED EXPOSURE TO LOW GRAVITY CAUSES BONE LOSS AND MUSCLE ATROPHY, WHICH ASTRONAUTS FEND OFF BY EXERCISING 2.5 HOURS EACH DAY.

DEVICES DEVELOPED BY KEVIN DUDA AT DRAPER LABORATORY COULD BUILD FITNESS INTO SPACE SUITS. GYROSCOPES ATTACHED TO THE ARMS AND LEGS COULD PROVIDE RESISTANCE SIMILAR TO THE FORCE OF GRAVITY ON EARTH.

NIAC Fellows Kevin Duda & Dava Newman

NIAC Phase II Fellow Kevin Duda, Draper Laboratory

Variable Vector Countermeasure Suit (V2Suit) for Space Habitation and Exploration

NIAC Phase II Fellow Dava Newman, MIT

Astronaut BioSuit System for Exploration Class Missions

Credit: Popular Science, Kris Holland
NIAC & CIF Example (GFSC)
Atom Interferometry for Detection of Gravity Waves

Spin Off Potential:
Hunting gravitational waves on the atomic level could lead to technology for better steering of military submarines or aircraft

http://www.nasa.gov/topics/technology/features/atom-optics.html
<table>
<thead>
<tr>
<th>3-D Printing the Home of the Future</th>
<th>Emergency Construction for natural disasters, eradicate slums in developing countries</th>
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<tr>
<td>Improving Health With Spacesuit Technology</td>
<td>Medical rehabilitation and physical therapy for individuals affected by stroke, spinal cord injuries, brain injuries, and the elderly.</td>
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<tr>
<td>Bacterial Batteries</td>
<td>Novel Energy Source: Bacterial Microbes to power up robots</td>
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<tr>
<td>Space-Based Solar Power</td>
<td>Power transmission to Earth for use during power outages, after natural disasters, to those in remote areas or by the military.</td>
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<tr>
<td>Navigation</td>
<td>Gravitational waves on the atomic level could lead to technology for better steering of military submarines or aircraft</td>
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What Opportunities does NIAC Offer?

**Phase I Solicitation**
- Open to everyone (US)
- Date: early Jan. 2013

**Phase II Solicitation**
- Open after Phase I complete
- Date: late May 2013

**NIAC Spring Symposium**
- Open to everyone
- Location: Chicago, IL
- Date: March 12-14, 2013

**NIAC Fall Symposium**
- Open to everyone
- Location: TBD
- Date: November 2013

Open online access to presentations/studies at: [www.nasa.gov/niac](http://www.nasa.gov/niac)
• Please visit us at the NIAC booth
  9:30am – 3:00pm Wed

• Or Contact...
  – Jay Falker, Program Executive
  – Jason Derleth, Program Manager
  – Kathy Reilly, Outreach Coordinator
  – hq-niac@mail.nasa.gov
  – http://www.nasa.gov/niac
Conclusion

The Future Possibilities Depend on You

NIAC & CIF are among the most open-ended and far-reaching of NASA's technology programs

Stretch your imagination…

*Change the possible!*

www.nasa.gov/oct