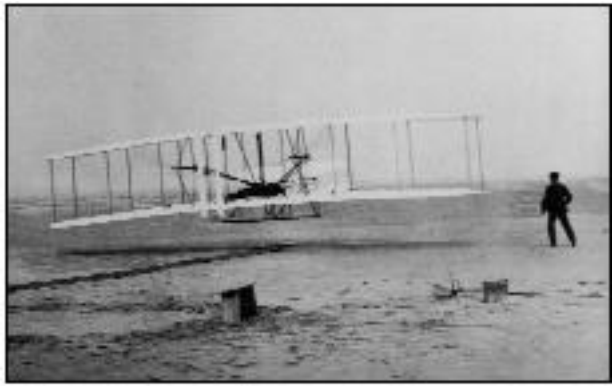
Centennial Challenges

NASA TECHNOLOGY INNOVATION PRIZES



www.nasa.gov/challenges

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Office of the Chief Technologist
NASA Headquarters
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THINK DIFFERENT

Innovation Inducing Prizes

Recent Technology Inducement Prizes

- Ansari Prize - $10M prize for first non-government organization to launch a reusable manned spacecraft into space twice within two weeks. Won in 2004 by Scaled Composites, SpaceShipOne.
- Google Lunar Lander Prize - successfully launching, landing, and operating a rover on the lunar surface. The prize awards $20 million to the first team to land a rover on the moon that successfully roves more than 500 meters and transmits back high definition images and video. 29 registered competitors.
- The L Prize competition - first government-sponsored technology competition designed to spur development of ultra-efficient solid-state lighting products to replace the common light bulb. $10 million cash prize, as well as L Prize partner promotions and incentives. 60w bulb replacement won by Philips Electronics in 2011.

What's the Big Deal?

Prizes as Alternative to Standard R&D Funding

- The Prize Funder sets the requirements but, unlike grants and contracts, does not pay competitors until goals are achieved.
- Increases likelihood of success – accesses more competitors with different approaches.
- Can attract external funding – successful teams often spend more than they win.
- Avoids costs of compliance with Federal Acquisition Regulations

Centennial Challenges

- Prize Authority enacted by Congress in 2005, expanded in 2008.
- Authorized NASA to offer prize purses up to $50M
- Funds do not expire – allows multi-year competitions and reprogram
- Prizes can only go to US citizens, permanent residents or US entities
- Competitors cannot be supported by government funding
- Federal Employees cannot participate if within scope of employment.
- Competitors can retain intellectual property
- ~$16 M appropriated from FY04-10
- $5M requested for new Challenges in 2013

Centennial Challenges Program is one of ten Space Technology programs in the Office of Chief Technologist.

http://www.nasa.gov/oct

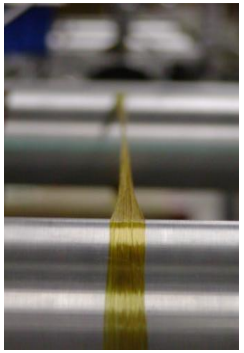
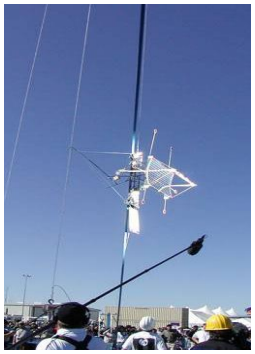
Centennial Challenges

Since 2005, 22 competitions held in 8 Challenges,
~$6.0M in prizes awarded to 15 different teams

Completed

- Regolith Excavation – $750K awarded (2009)
- Lunar Lander – $2M awarded (2008/2009)
- Astronaut Glove – $550K awarded (2007/2009)
- Power Beaming - $900K awarded
- Personal Air Vehicle - $250K awarded (2007)
- General Aviation Tech - $97K awarded (2008)
- Green Flight – $1470K awarded (2011)
- Strong Tether – No awards




Under Way

- Sample Return Robot - $1.5M available
- Nano-Satellite Launch - $3.0M available
- Night Rover (Energy Storage) - $1.5M available

Green Flight Challenge

Embry-Riddle Aeronautical University, EcoEagle aircraft takes off during the 2011 Green Flight Challenge, sponsored by Google, at the Charles M. Schulz Sonoma County Airport in Santa Rosa, Calif. on Monday, Sept. 26, 2011.

2011 Collier Prize Nominee

Team Lead Jack Langelaan (Penn State) poses for a photograph next to the Pipistrel-USA, Taurus G4, aircraft which won the 2011 Green Flight Challenge, sponsored by Google. The all electric Taurus G4 aircraft achieved the equivalency of more than 400 miles per gallon.

Sample Return Robot Challenge
(managed by Worcester Polytechnic University)

To encourage innovations in robotic navigation and sample manipulation technologies -- demonstrate a robot that can locate and retrieve geologic samples from a wide and varied terrain without human control.

- Autonomous robot
- Easily identified samples
- Terrain maps provided but no use of GPS or other aids

Status

- Registration is open – 11 Teams!
- Competition June 15-18, 2012 in Worcester, MA.

PRIZE PURSE: $1.5 Million

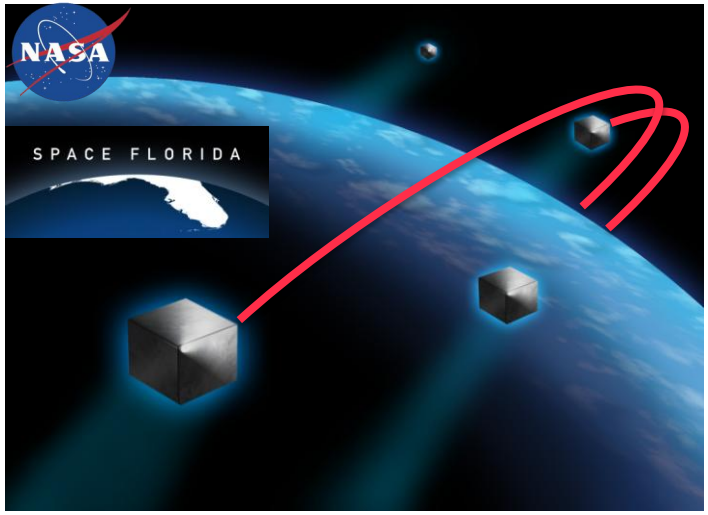
http://wp.wpi.edu/challenge/

Nano-Satellite Launch Challenge

(managed by Space Florida SSRC)

To stimulate innovations in launch technology & encourage creation of commercial nano-sat delivery services--place a small satellite into Earth orbit, twice in one week.

Satellite mass - at least 1 kg
Satellite dimensions
- at least 10 cm cube
Must complete at least one Earth orbit



Status

- Rules under Development
- Expect Registration to open in Spring 2012

PRIZE PURSE: $3.0 Million

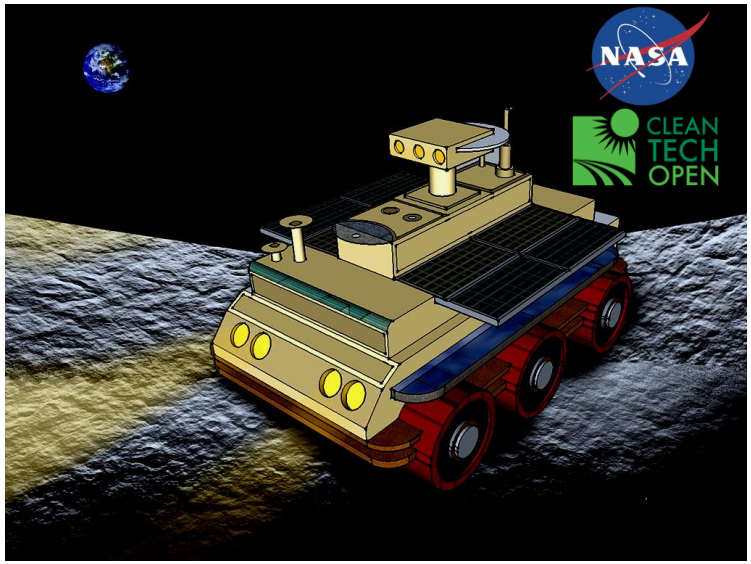
http://www.spaceflorida.gov/nano-sat-launch-challenge

Night Rover Challenge

(managed by CleanTech Open)

To stimulate innovations in energy storage technologies of value in extreme space environments and in renewable energy systems on Earth--demonstrate a high energy density storage systems that will enable a rover to operate throughout lunar darkness cycle

Goal:
Demonstrate storage system with at least 300w-hr/kg energy density.



Status

- Rules Under Development
- Expect Registration to open in Spring 2012

PRIZE PURSE: $1.5 Million

http://NightRover.org/

Ideas for Prize Competitions?

We're Building the FY13-FY18 Centennial Challenges Plan Now!

What competition will your institution want to participate in either as lead or as partners with other innovative groups?

Contact Larry.P.Cooper@nasa.gov for a Challenge Submission Form

Centennial Challenges Business Process

- **Collect ideas for possible Challenges.**
- Analyze, Prioritize, and Select New Challenges.
- Identify and Execute Agreement with an Organization to conduct an effort.
- Develop draft competition rules and prize awards.
- Officially announce Challenge and initiate competitor engagement efforts.
- Register competitors.
- Conduct Challenge and determine if there are prize winners.
- Pay the Winners or schedule next competition.
- Follow winners “After the Challenge”

Q & A Time

-

Backup

2004 Workshop Ideas

Precision Lander	Deployable Telescope
Astronaut Glove	Aerocapture
Mobile Power Breakthrough	Autonomous UAV Cargo Hauler
Micro ReEntry Vehicle (suborbital)	Human Radiation Shielding
Micro ReEntry Vehicle (orbital)	Solar Sail Race
Robot Triathlon	Rover Survivor
Lunar Processing Demo	Planetary Surface Power Transmission
Quantum Computer	Extreme Environment Computer
Lunar Landing	Mars Comm/Nav Micromission
Telerobotic Race	Autonomous Drill
General Aviation	Nanotube Tether
3-Dimensional Detector	In-Situ Life Detector
Autonomous Earth Analog Sample Return	Asteroid Mission
Long-Duration Cyrogenic Propellant Storage Tank	Miniature Robotic Flyer
Perpetual (30-Day) UAV	Human Space Flight - Orbiter Technology
High Efficiency GA Aircraft Engine	Human Space Flight - Suborbital Flight
	Human Space Flight - PVT Apollo 8

Challenge Rules of Thumb

- Prizes are useful tools for solving problems for which the objective is clear, but the way to achieve it is not.
- Prizes work best when a field isn't already flooded with funded research and the challenge is more to create a clever application of technology than a technology itself.
- By attracting diverse talent and a range of potential solutions, prizes draw out many possible solutions, many of them unexpected, and steer the effort in directions that established experts might not go but where the solution may nonetheless lie.

Ideas for New Prize Competitions

- Are Relevant to NASA Programs
- The Simpler, The Better
  - Rules should be simple, unambiguous, and easy to understand.
- Have the Right Level of Difficulty
  - Successful prize competitions are exciting and ambitious yet doable.

Ideas for New Prize Competitions

- Have Follow-On Business Opportunities
  - Prize Challenges that lead to potential commercial opportunities are more attractive.
- Have Competitor and Funding Interest
  - In general, low barriers to entry, lead to larger number of entrants, resulting in a more exciting and competitive challenge.
- Build Public Interest and Excitement
  - The challenge and benefits should be easy to explain to the public.

Ideas for New Prize Competitions

- The prize award can be no more than $10M. It should be scaled to the anticipated R&D expenses to achieve the challenge and business potential:
  - Little to no potential - prize bigger than investment
  - Significant potential - prize smaller than investment
- Length of time for challenge should allow sufficient time for innovation, competition, refinements, and a few re-competitions. The maximum duration is 5 years.

Submit an Challenge Idea

- Fill out Challenge Submission Form and send to Larry.P.Cooper@nasa.gov

Centennial Challenges

The Centennial Challenge Program (CCP) directly engages the public at large in the process of advanced technology development that is of value to NASA's missions and to the aerospace community.

CCP offers challenges set up as competitions that award prize money to the individuals or teams to achieve the specified technology requirements. Seeks solutions from non traditional sources and only pays for success!

Innovation

- Find innovative solutions to technical challenges through competition.

Communication

- Share Challenge results so the larger technical community can learn.
- Provide a forum for public outreach for advanced technology.

Opportunity

- Leverage technology advancement from challenge competitions for further development and infusion into NASA missions.
- Enable Challenge competitors to develop and/or expand business models and business base.

Post Challenge Success Stories

After the Challenge – Success Stories

Astronaut Glove

•Peter Homer won a total of $450K in 2007 and 2009. He went on to found FlagSuit LLC and in 2007 contracted with Orbital Outfitters to supply gloves for their IS3C suit for use by XCOR. In 2011 FlagSuit signed a sole source, prime contract with NASA to develop improved space suit glove assemblies.

•Latest FlagSuit venture is the development of a hyperbaric suit to be used for the treatment of mild-traumatic brain injuries in particular for frontline soldiers who otherwise appear unharmed.

Power Beaming

•Tom Nugent and Dr. Jordan Kare of Laser Motive won the level 1 prize of $900K in 2009. They founded the company in 2007 for the sole purpose to compete in this Challenge.

• They've expanded their business to alternate applications and started offering services for Unmanned Aerial Vehicles and Ground Based Point to Point Power Links.

• LaserMotive is working on NASA "Ride the Light" Game Changing Space Technology Project for Future Missions

After the Challenge – Success Stories

Lunar Lander

• Masten Space Systems and Armadillo Aerospace won $1.15M and $750K respectively in the 2008/2009 Lunar Lander Challenge. Both companies were founded before the Lunar Lander Challenge was announced and both have taken advantage of the ability to compete and leverage their Challenge success.

• Both received contracts in 2011 along with 5 other companies to provide NASA with sub-orbital payload integration and delivery.

• Armadillo has gone on to expand in the commercial space world contracting with Space Adventures to provide civilian access to suborbital space. Masten is in discussions with the DOD for suborbital access as well.

Green Flight Challenge

Synergy Aircraft was a registered competitor (but did not fly) of the Green Flight Challenge who has continued in his endeavor to build a revolutionary aircraft design that is highly efficient. Synergy's goal is to have their three seat aircraft ready to fly and demonstrate by late 2012 with the intent to manufacture the aircraft for sale as turn key and kits.