Centennial Challenges
NASA TECHNOLOGY INNOVATION PRIZES

www.nasa.gov/challenges

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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?

• **Stimulate innovation in ways unlike contracts or grants**
  – Reward achievement, not effort. *Competitors are not paid until goals are achieved.*

• **Achieve returns that outweigh investment**
  – High ratio of private investment to prize value at *fraction of the cost of traditional procurement.*
  – Almost all funds go to prize purses

• **Reach new sources of innovation, new talent**
  – Multiple teams & multiple approaches to same problem

• **Stimulate new commercial ventures**
  – New startups, new partners, more commercial competition

• **Educate, inspire, and motivate the public**
  – Train the future workforce; Inclusion, not exclusion
  – Increase awareness of science & engineering
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.
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 can reprogram.
• Prizes can only go to US citizens, permanent residents or US entities but anyone can compete.
• Participants cannot be supported by government funding to compete.
• Federal Employees cannot participate if within scope of employment.
• Competitors can retain intellectual property.
• ~$15 M appropriated for prizes 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)
• Power Beaming - $900K awarded (2009)
• 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
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.
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.
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
- Competition June 15-18, 2012 in Worcester, MA.
- 11 Teams Registered.

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 June 2012
  • “First to Demonstrate” Competition opens in Jan 2013.

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 September 2012
• Competition in Spring 2013

PRIZE PURSE: $1.5 Million

http://NightRover.org/
Lessons Learned

Centennial Challenges Program

Lessons Learned
Centennial Challenge
Process Model

Inception  Formulation  Execution
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Inception Stage

• Collect ideas for possible Challenges. Draft Criteria for Winning, competition rules, and prize award structure.
• Analyze, Prioritize, and Recommend to Senior Management
• Select New Challenges and preferred Management Approach (NASA or private, non-profit entity)

Lesson #1
Identify and contact many sources for prize ideas
• Many won’t be interested.
• Prizes for R&D are not that common.
Requires significant education of idea submitters.
• Why should I pay attention to this?
• What’s in it for me?
• Provide Templates and Examples

Lesson #2
Senior Management may need education too.

Lesson #3
Coming up with ideas is actually easier than developing the competition requirements. (Complex interplay of factors.)
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 (many solutions are possible).
  – Best suited to applied research and development rather than basic science research.
• Prizes work best when a field isn’t already flooded with funded research.
• 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.
Criteria For Assessing Challenge Concepts

• Relevant to NASA mission needs or commercial aerospace opportunities
  • Technically valuable and interesting
• Relevant to national and global needs
• Relevant to NASA educational goals and may attract student teams
• Practical
  • Not overly constrained – multiple solutions possible
  • Right degree of difficulty and appropriate for the prize amount
  • Competition logistics not too complex or costly
• Compelling to the public
  • High technical risk, high potential payback
  • Interesting to observe or follow
  • Futuristic
• Multiple competitors likely
• One or more NASA organizations willing to advocate
  • Provide expertise to guide competition
  • Actively seek technology infusion and partnerships
  • Remain involved through life of competition
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Formulation Stage

• Identify and Execute Agreement with an Organization to manage the challenge effort.
• Officially announce Challenge and initiate competitor engagement efforts.
• NASA and Managing Organization finalize –
  - Criteria for winning, competition rules, and prize award structure.
  - Detailed Schedule and Challenge Execution Plans.
  - Detailed Media & Outreach Plans.
  - Fundraising Plans for Managing Organization (if needed).
Lessons Learned

• #4 Selecting the Right Management Partner is Critical
  – Do they have the necessary skill set?
  – Are they committed and passionate?
  – Do a “Background Check” and check references
  – Clarify expectations

• #5 Announcement Planning
  – Set Clear Goals and Develop Strategies – may be best opportunity to capture media attention.
  – Establish policies
  – Have initial set of FAQ

• #6 Identify and Leverage Internal and External Assets
  – Subject Matter Experts
  – Media Experts
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Execution Stage

• Register competitors.
• Conduct Challenge and determine if there are prize winners.
• Pay the Winners or schedule next competition.
• Follow competitors “After the Challenge”

Lesson #7
What seemed like a great challenge idea may not work out.
• Insufficient prize or business opportunity to attract innovators.
• Managing Partner Problems
  Fund Raising Difficulties
  Personnel Changes
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Concluding Thoughts

- Everything will take longer than you think it will.

- Be prepared for –
  - Lack of interest
  - An accident
  - A protest

- Prize Competitions can be a powerful tool - but they are not a panacea.