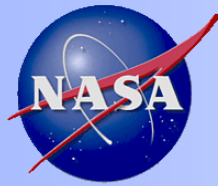


Eyes on a Climate Prize

Environmental Law and Policy Annual Review

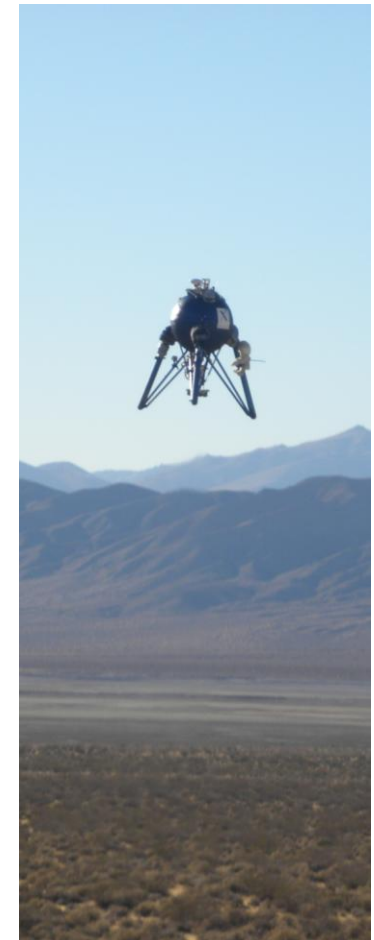
April 13, 2012

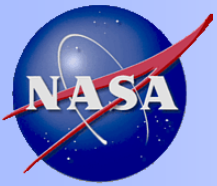
**Larry Cooper
Program Executive
NASA Centennial Challenges Program**



What's the Big Deal with Prizes?

- ✓ **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 a 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*





Are Prizes Right for GHG Mitigation?

- ✓ 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.

Will there be economic return that will draw attention of competitors?

- ✓ Selective areas likely-such as those tied to energy efficiency or sale of outputs.



Present Status

- There is an emerging federal Community of Practice for Prizes - spurred by earlier successes and extension of Prize Authority to all Executive Agencies. (America COMPETES Reauthorization 2010).
- Despite benefits of prize competitions the safe approach is to continue to use traditional tools such as contracts and grants.
- Broad use of prizes is likely several years away unless there are top down directives to utilize them.



The Prize Proposal

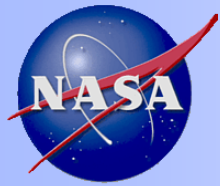
- Author's Suggested Approach –
 - Setting aside a specific amount of appropriations for prizes and then figure out what to do.
 - How much?
 - Work expands to fill the budget?
- Alternative Approach -
 - Determine what are the best areas for the use of prizes.
 - Determine the specifics and the prize amounts
 - Appropriations follow well planned effort. Opportunity to contrast costs of technology development with contracts/grants/prizes.



Centennial Challenges

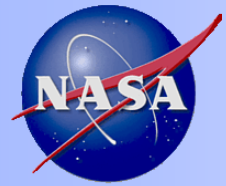
Criteria For Assessing Challenge Concepts

- Relevant to NASA mission needs or commercial aerospace opportunities
 - Technically valuable and interesting
 - Relevant to national and global needs
- Practical
 - Not overly constrained – multiple solutions possible; Multiple competitors likely
 - 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
- 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

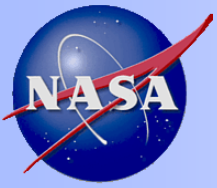


High-Priority Technologies (NRC Study)

Technologies included in the final prioritization, listed by TABS number	National Needs	Commercial Needs
2.2.1 Electric Propulsion	⊙	⊙
2.2.3 Thermal Propulsion	⊙	○
3.1.3 Solar Power Generation (Photovoltaic and Thermal)	●	●
3.1.5 Fission (Power)	○	○
4.2.1 Extreme Terrain Mobility	○	○
6.3.2 Long-Duration (Crew) Health	⊙	○
8.1.1 Detectors & Focal Planes	⊙	⊙
8.1.3 (Instrument and Sensor) Optical Systems	⊙	⊙
8.2.4 High-Contrast Imaging and Spectroscopy Technologies	⊙	⊙
8.3.3 In Situ (Instruments and Sensor)	○	○
14.1.2 Active Thermal Control of Cryogenic Systems	⊙	⊙
X.1 Radiation Mitigation for Human Spaceflight	○	○
X.2 Lightweight and Multifunctional Materials and Structures	⊙	⊙
X.3 ECLSS	○	⊙
X.4 GN&C	⊙	⊙
X.5 EDL TPS	⊙	⊙
Key	Substantial	●
	Significant	⊙
	Minor	○



Backup Charts



Centennial Challenges

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

Completed

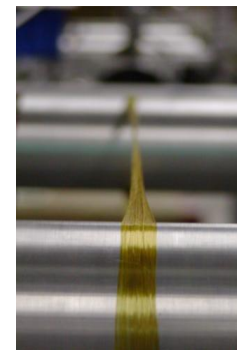
- *Regolith Excavation* – \$750K awarded (2009)
- *Lunar Lander* – \$2M awarded (2008/2009)
- *Astronaut Glove* – \$550K awarded (2007/2009)
- *Power Beaming* - \$900K awarded (2009)
- *Personal Air Vehicle* - \$250K awarded (2007)
- *General Aviation Tech* - \$97K awarded (2008)
- *Green Flight* – \$1470K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

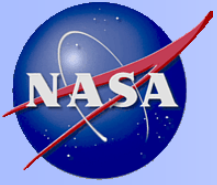
Under Way

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

In Planning

- *ARMD UAS* - \$500K available

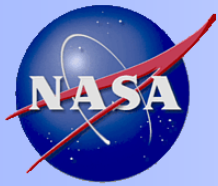




Centennial Challenges

- *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 from FY04-10.*
- *\$5M requested for new Challenges in 2013.*

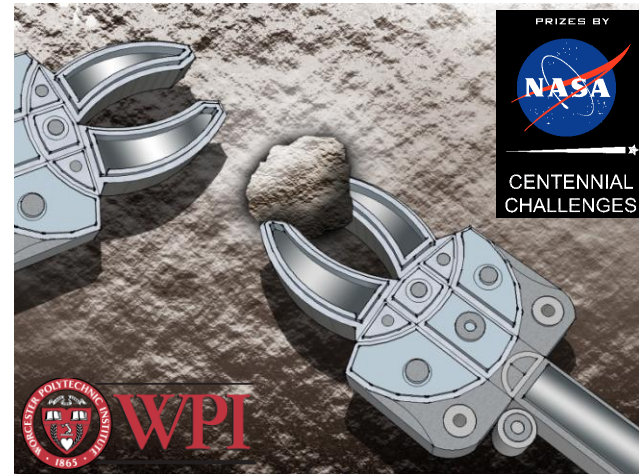
*Centennial Challenges Program is one of ten Space Technology programs in the Office of Chief Technologist.
<http://www.nasa.gov/challenges>*



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

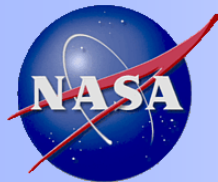


PRIZE PURSE: \$1.5 Million

Status

- Competition June 15-18, 2012 in Worcester, MA.
- 11 Teams Registered.

<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

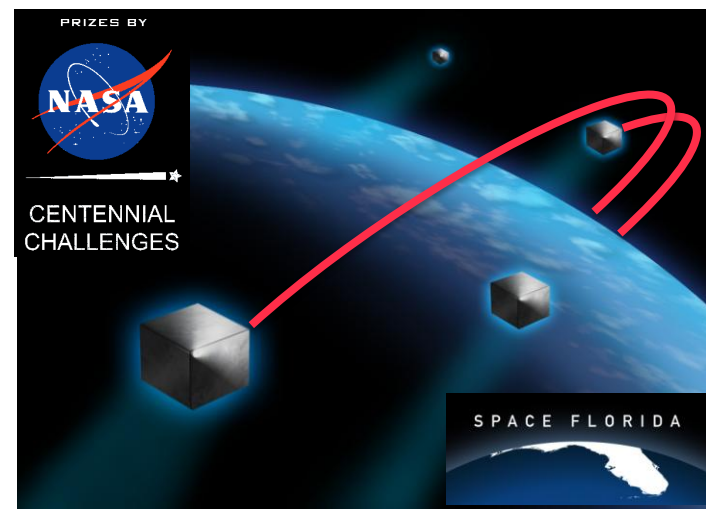
Satellite dimensions

- at least 10 cm cube

Must complete at least one Earth orbit

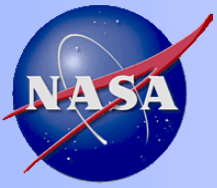
Status

- 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)

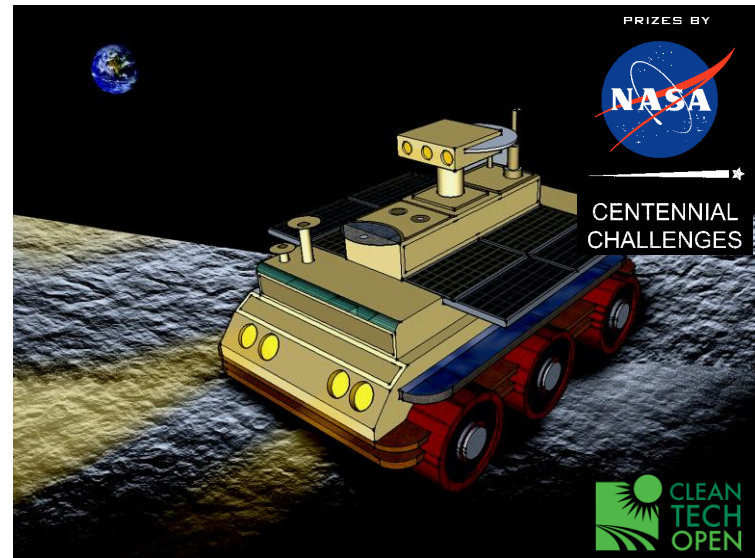


To stimulate innovations in energy storage technologies of value in extreme space environments and in renewable energy systems on Earth-- demonstrate a high energy density storage systems that will enable a rover to operate throughout lunar darkness cycle

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

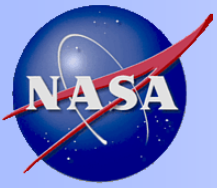
Status

- Rules Under Development
- Expect Registration to open in September 2012
- Competition in Spring 2013



PRIZE PURSE: \$1.5 Million

<http://NightRover.org/>



Night Rover Challenge *(managed by CleanTech Open)*

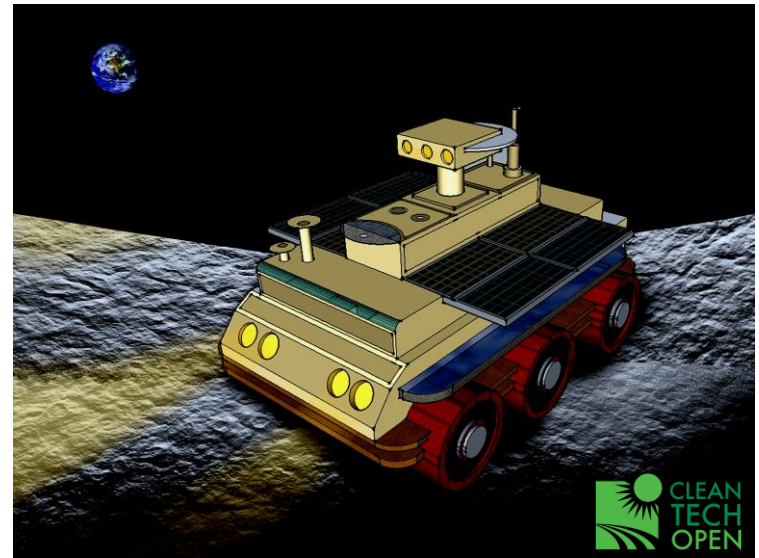


To stimulate innovations in energy storage technologies of value in extreme space environments and in renewable energy systems on Earth-- demonstrate a high energy density storage systems that will enable a rover to operate throughout lunar darkness cycle

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

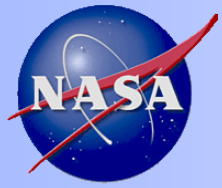
Status

- Rules Under Development
- Expect Registration to open in September 2012
- Competition in Spring 2013



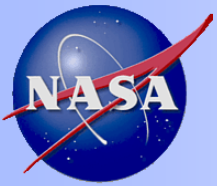
PRIZE PURSE: \$1.5 Million

<http://NightRover.org/>

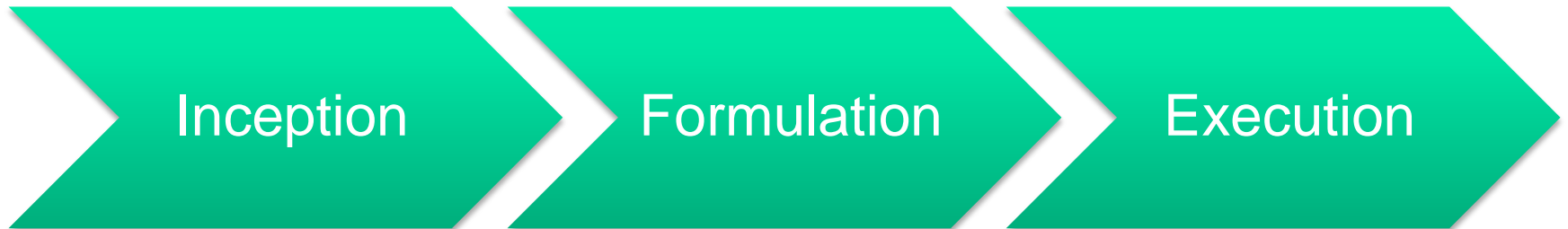


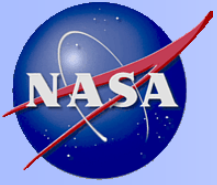
Centennial Challenges Program

LESSONS LEARNED



Centennial Challenge Process Model





Centennial Challenges 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.

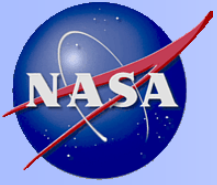
- Why should I pay attention to this?
- What's in it for me?
- Provide Templates and Examples

Lesson #2

Senior Management may need education too.

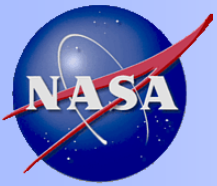
Lesson #3

Coming up with ideas is actually easier than developing the competition requirements. (Complex interplay of factors.)



Centennial Challenges 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 – likely the best opportunity to capture early media attention.
 - Establish policies
 - Have initial set of FAQ
- **#6 Identify and Leverage Internal and External Assets**
 - Subject Matter Experts
 - Media and Outreach Experts
 - Fundraising Experts



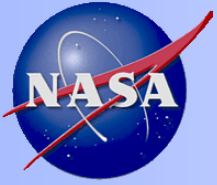
Centennial Challenges Execution Stage

- 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



Centennial Challenges 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.