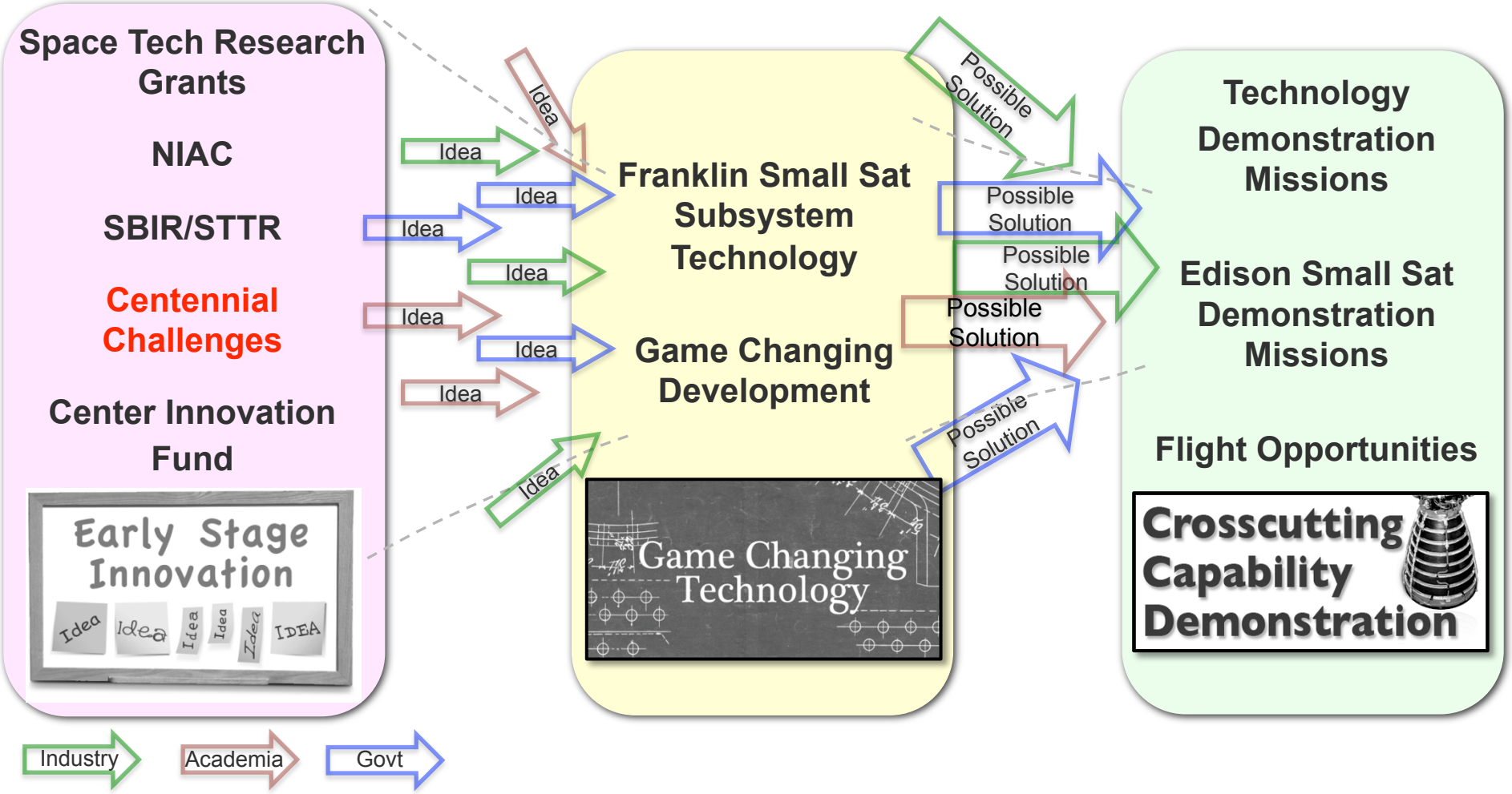
Centennial Challenges

NASA PRIZES FOR THE CITIZEN INVENTOR

Technology and Innovation Committee Meeting
August 3, 2010
Pasadena, California

Andrew Petro
Early Stage Innovation
Office of Chief Technologist
NASA Headquarters

OCT Program Overview



Participatory Research & Development

Incentive prizes to encourage novel solutions from non-traditional sources

Kansas City Space Pirates
NASA Dryden Flight Research Center
November 2009

Brian Turner
Kansas City Space Pirates
Power Beaming Team
New York Times Magazine
July 1, 2007

NASA Prizes for the Citizen Inventor

- Authorized by Congress in 2005
- NASA provides only prize money
- Administered by non-profit Allied Organizations
- Allied Organizations seek sponsors for operating funds
- Sponsors can add to prize money
- NASA concurs on rules and competition plans
- $10M appropriated in 2005
- $4M appropriated in 2010
- Funds do not expire – allows multi-year agreements
- Competitors cannot be supported by government funding
- Prizes can only go to US citizens, permanent residents or US entities
- Competitors retain their intellectual property

ALLIED ORGANIZATIONS 2005-2010

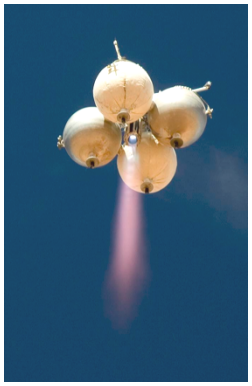
Centennial Challenges Status

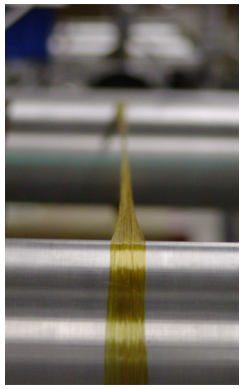
Since 2005, 19 competitions held in six Challenge areas, $4.5M in prizes awarded to 13 different teams

Completed
- Regolith Excavation – $750K awarded
- Lunar Lander – $2M awarded
- Astronaut Glove – $550K awarded

On-Going
- Strong Tether – $2M available
- Power Beaming – $900K awarded; $1.1M available in 2010
- Green Flight – $350K awarded; $1.65M available in 2011

New in 2010
Three New Challenges with $5M available





Model for Government-Sponsored Prizes

Photo: New York Times

"NASA's Centennial Challenges have triggered an outpouring of creative solutions from students, citizen inventors, and entrepreneurial firms for technologies such as lunar landers, space elevators, fuel-efficient aircraft, and astronaut gloves."

Memo to all Executive Departments and Agencies from Office of Management & Budget
Guidance on the Use of Challenges and Prizes to Promote Open Government,
March 8, 2010

2009 Highlights

Masten Space Systems and Armadillo Aerospace win Lunar Lander Challenge and as Space Entrepreneurs are honored as the "Persons of the Year"

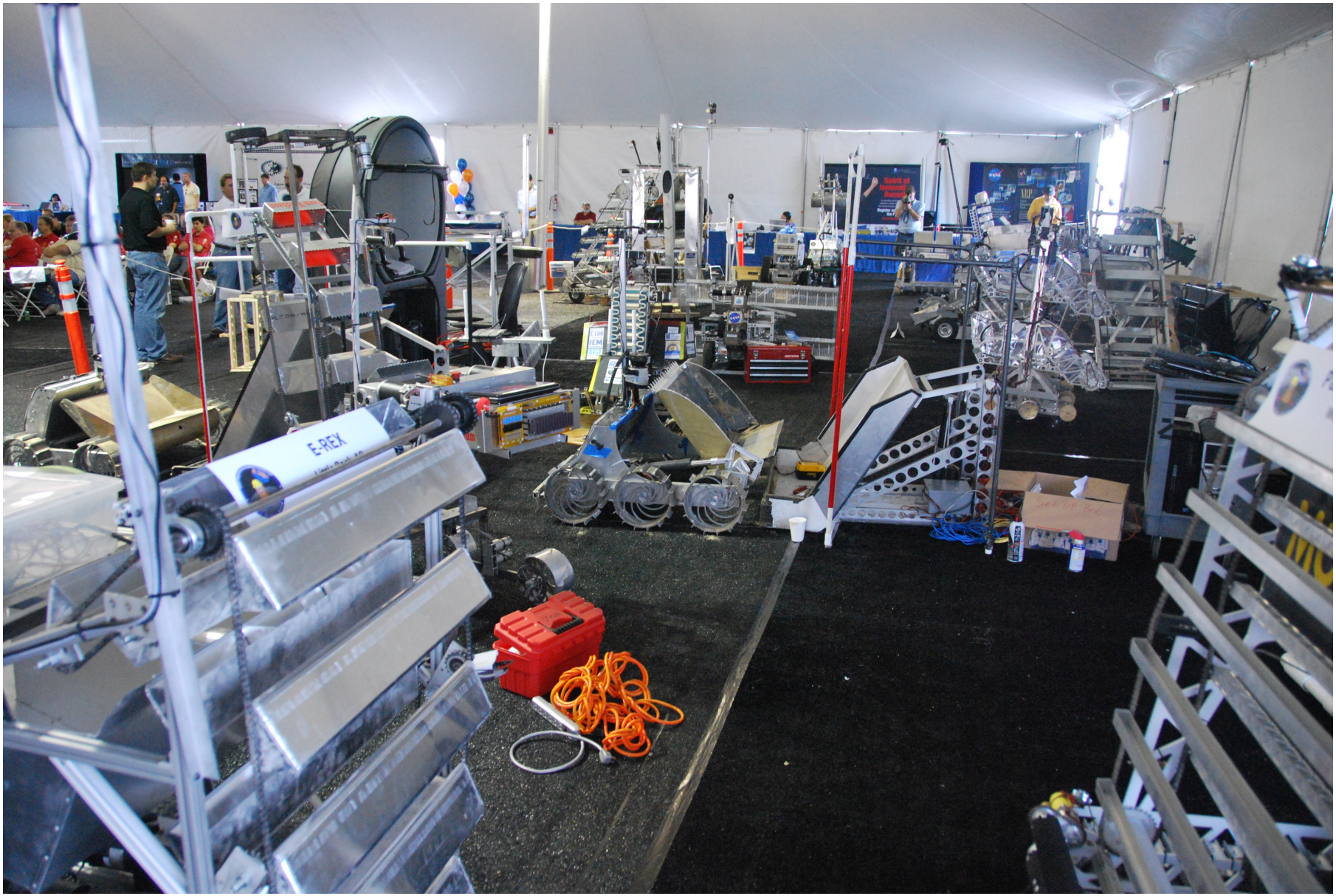
Paul's Robotics, a student team beats 22 others to win $500,000 in the Regolith Excavation Challenge

Ted Sothern and Peter Homer display their prize winning Astronaut Gloves

LaserMotive climbs to one kilometer with beamed power to win $900,000

Value of Prizes

- **Stimulate innovation in ways unlike contracts or grants**
  - Reward achievement, not effort
- **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
- **Achieve returns that outweigh investment**
  - High ratio of private investment to prize value
  - Almost all funds go to prize purses
- **Educate, inspire and motivate the public**
  - Train the future workforce
  - Increase awareness of science & engineering
  - Inclusion, not exclusion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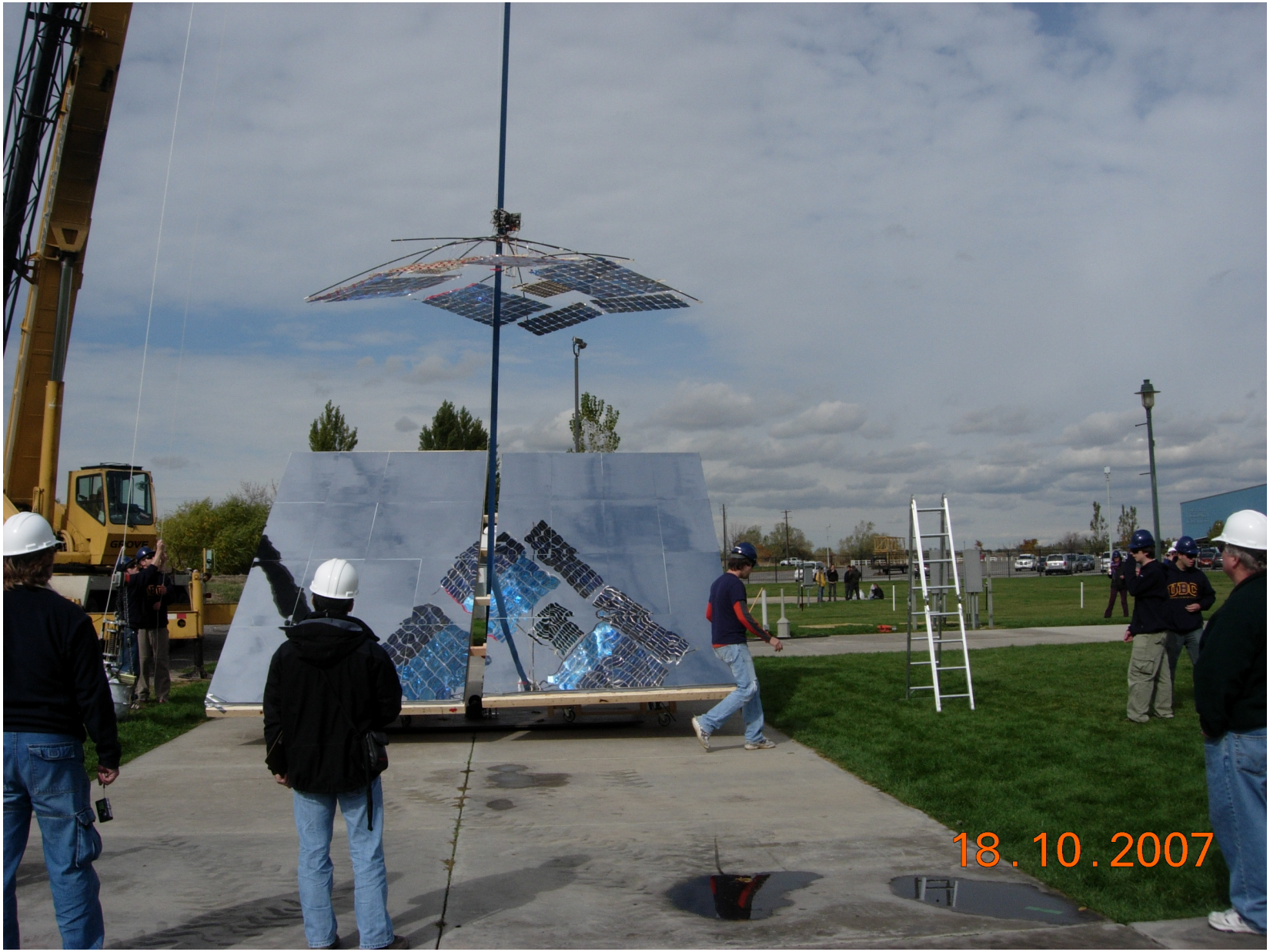
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Google
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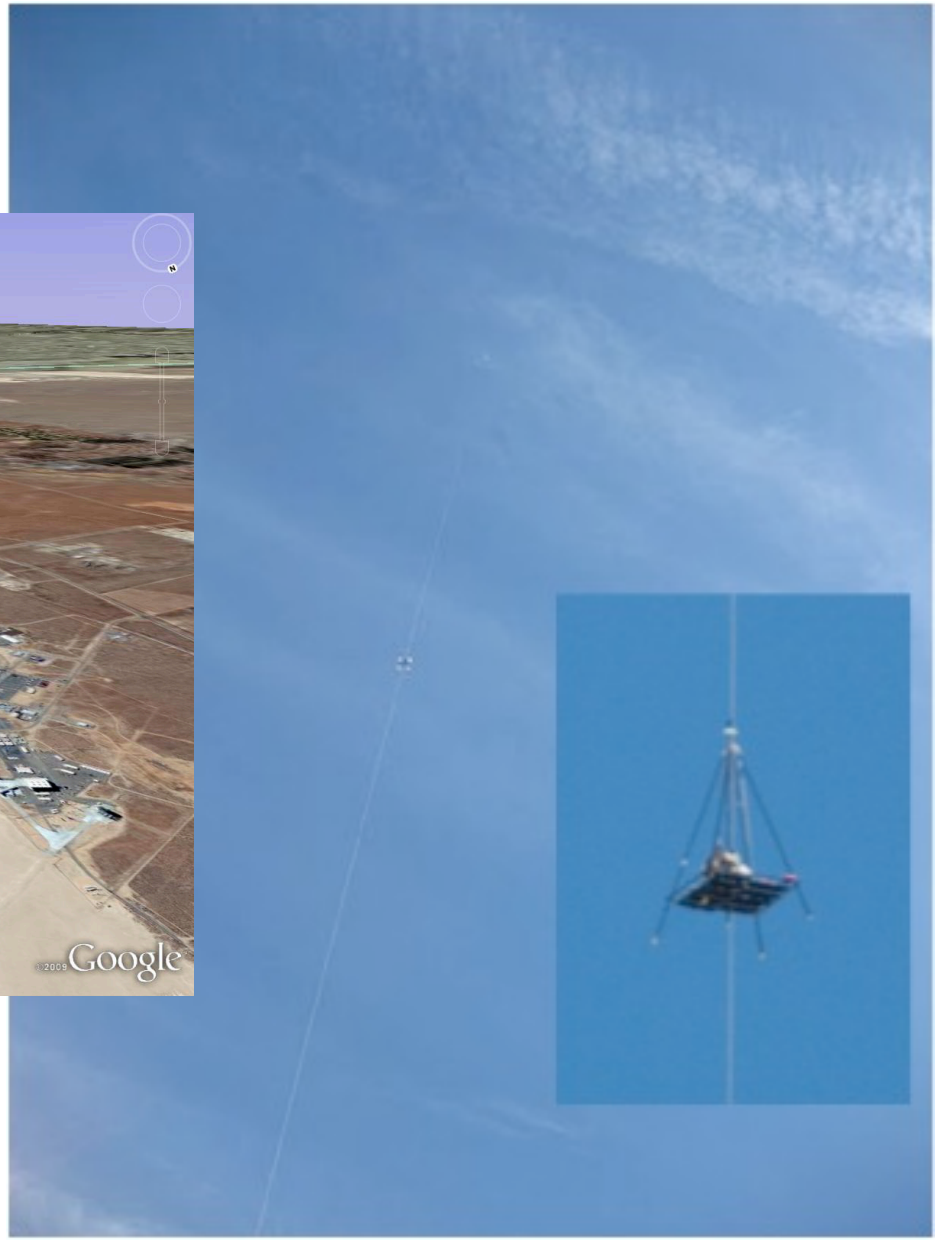

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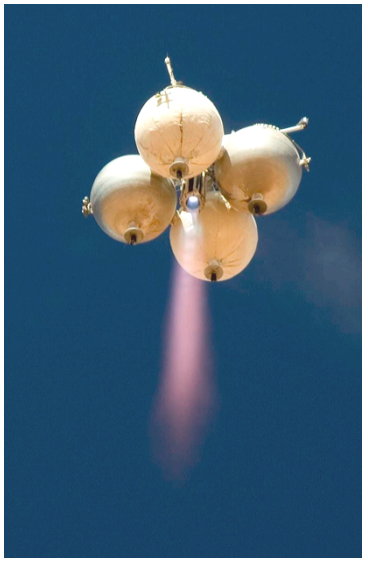
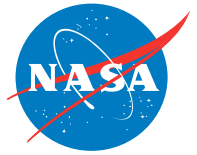


Centennial Challenges Competitions 2005-2009

CHALLENGE	LOCATION	PURSE	DATE	AWARDS
Power Beaming	Mountain View, CA	$50K	21-23 Oct 2005	
Strong Tether	Mountain View, CA	$50K	21-23 Oct 2005	
Lunar Lander	Las Cruces, NM	$2M	20 Oct 2006	
Power Beaming	Las Cruces, NM	$200K	21 Oct 2006	
Strong Tether	Las Cruces, NM	$200K	21 Oct 2006	
Astronaut Glove	Windsor Locks, CT	$250K	2-3 May 2007	$200K
Regolith Excavation	Santa Maria, CA	$250K	11-12 May 2007	
Personal Air Vehicle	Santa Rosa, CA	$250K	4-12 Aug 2007	$250K
Power Beaming	Salt Lake City, UT	$500K	13-21 Oct 2007	
Strong Tether	Salt Lake City, UT	$500K	13-21 Oct 2007	
Lunar Lander	Holloman AFB, NM	$2M	26-28 Oct 2007	
Regolith Excavation	San Luis Obispo, Ca	$750K	2-3 Aug 2008	
General Aviation Technology	Santa Rosa, CA	$350K	4-10 Aug 2008	$97K
Lunar Lander	Las Cruces, NM	$2M	24-25 Oct 2006	$350K
Strong Tether	Seattle, WA	$2M	14 Aug 2009	
Regolith Excavation	Mountain View, CA	$750K	17-18 Oct 2009	$750K
Lunar Lander	Various	$1.65M	July-Oct 2009	$1.65M
Power Beaming	DFRC, Edwards, CA	$2M	4-6 Nov 2009	$900K
Astronaut Glove	Titusville, FL	$400K	19 Nov 2009	$350K

Criteria For Assessing Candidates



- 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 likely to 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

Centennial Challenges Upcoming Activities

In 2010

- Preparation underway for Strong Tether, Power Beaming and Green Flight Challenges
- Three new Challenge topics selected
- New Allied Organizations will be selected – October

For FY2011

- As part of OCT, a Program Office will be established at the Marshall Space Flight Center – to enhance partnership opportunities and technology infusion
- Budget request is $10M each year through 2015
    - an average of 5 new challenges per year

Strong Tether Challenge

August 13, 2010

Microsoft Conference Center, Redmond, WA

Managed by: Spaceward Foundation

For advanced materials including practical carbon nano-tubes

On-going since 2005

$2M for strongest sample that exceeds strength of best commercially available material by 50% in pull test.

Prize	Length	Mass	Strength
$300,000	≥ 1 cm	≤ 0.01 g	5.0 MYuri
$300,000	≥ 10 cm	≤ 0.1 g	5.0 MYuri
$400,000	≥ 1 m	≤ 1.0 g	5.0 MYuri
$1,000,000	≥ 1 m	≤ 1.0 g	7.5 MYuri

1 MYuri = 1 GPa/(g/cc)

Power Beaming Challenge

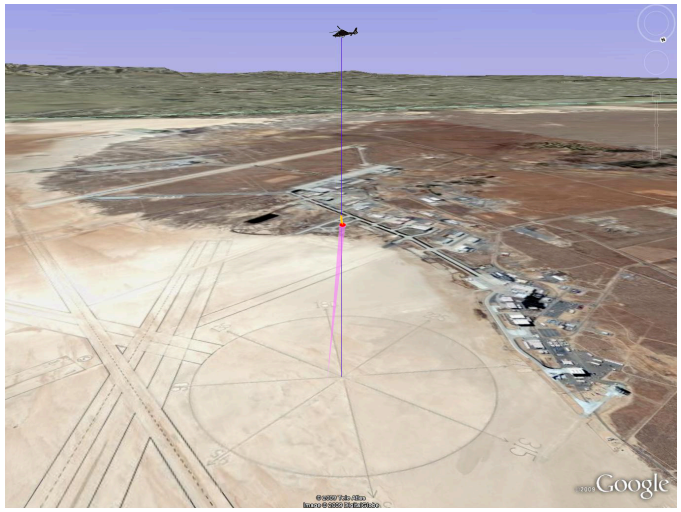
Fall, 2010

Managed by: Spaceward Foundation

REQUIREMENTS
Climb vertical cable to **1 km**
With beamed energy
Score based on speed and payload

PRIZES – **$1.1M** to be divided among teams based on score for teams that exceed 5 m/s speed

$900 K won by one team in 2009



Ground-based lasers, up to 8 kW, used with photovoltaic receivers and active tracking

Green Flight Challenge

July 2011

Sonoma County Airport, Santa Rosa, California

Managed by: Comparative Aircraft Flight Efficiency Foundation

REQUIREMENTS
≥ 200 mile range
≥ 100 miles/hour
≥ 200 passenger-miles/gallon
(energy equivalent with fuel or electricity)
Repeat flight on consecutive days

PRIZES
$1.5M to aircraft with best combination of efficiency and speed
$150K to best-performing bio-fueled aircraft

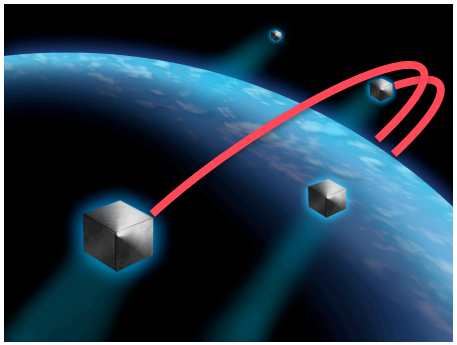
Three New Prize Challenges for 2010

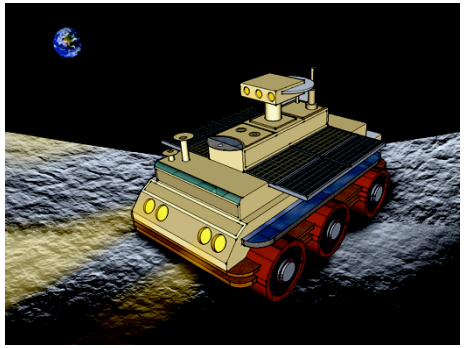
Total prize purse: $5 Million

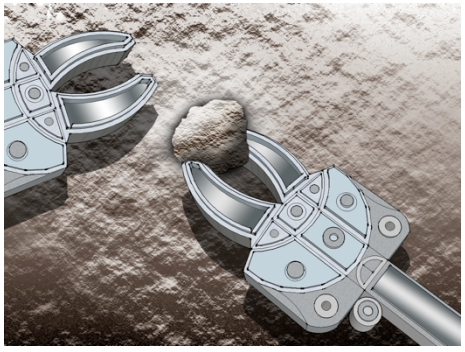
Student-Level competitions in each area

Announcement of Partnership Opportunities for new Allied Organizations - July 13, Proposals due Sept 13

Request for Information from Potential Sponsors posted in June







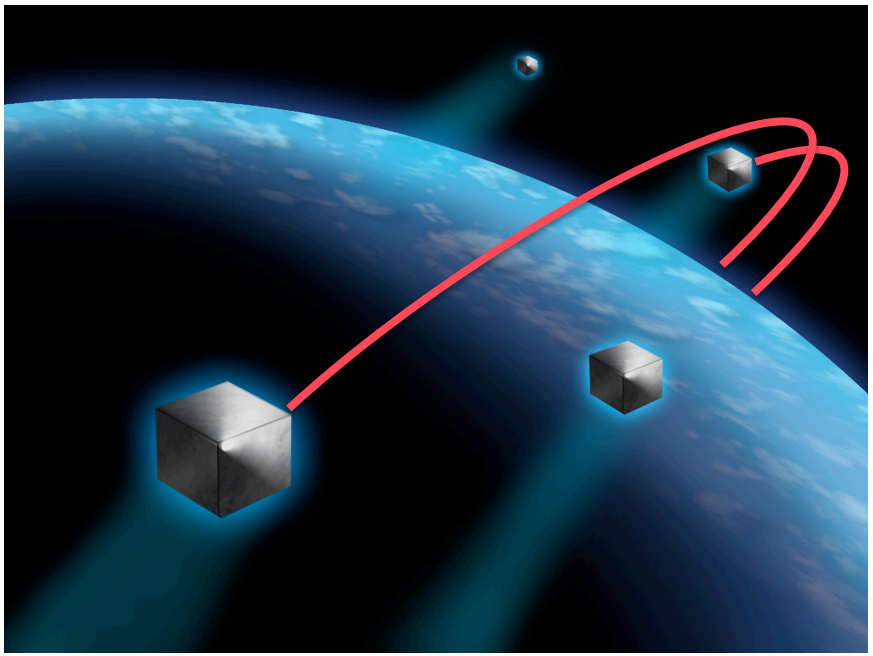
Nano-Satellite Launch Challenge

to place a small satellite into Earth orbit, twice in one week.

PRIZE PURSE: $2 Million

Satellite mass - at least 1 kg
Satellite dimensions
- at least 10 cm cube
Must complete at least one Earth orbit
Task must be accomplished twice in one week

To stimulate innovations in launch technology
To encourage creation of commercial nano-sat delivery services



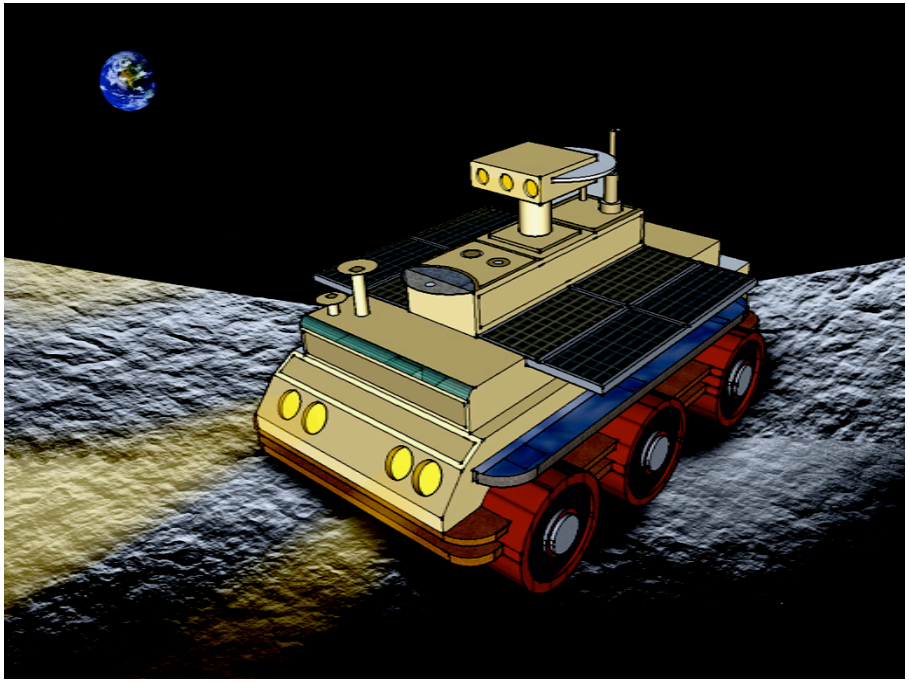
Night Rover Challenge

to demonstrate a solar-powered exploration vehicle that can operate in darkness using its own stored energy.

PRIZE PURSE: $1.5 Million

Vehicle generates and stores it own energy using a renewable source available on the Moon and operates over several daylight/darkness cycles

To stimulate innovations in energy storage technologies of value in extreme space environments and in renewable energy systems on Earth.



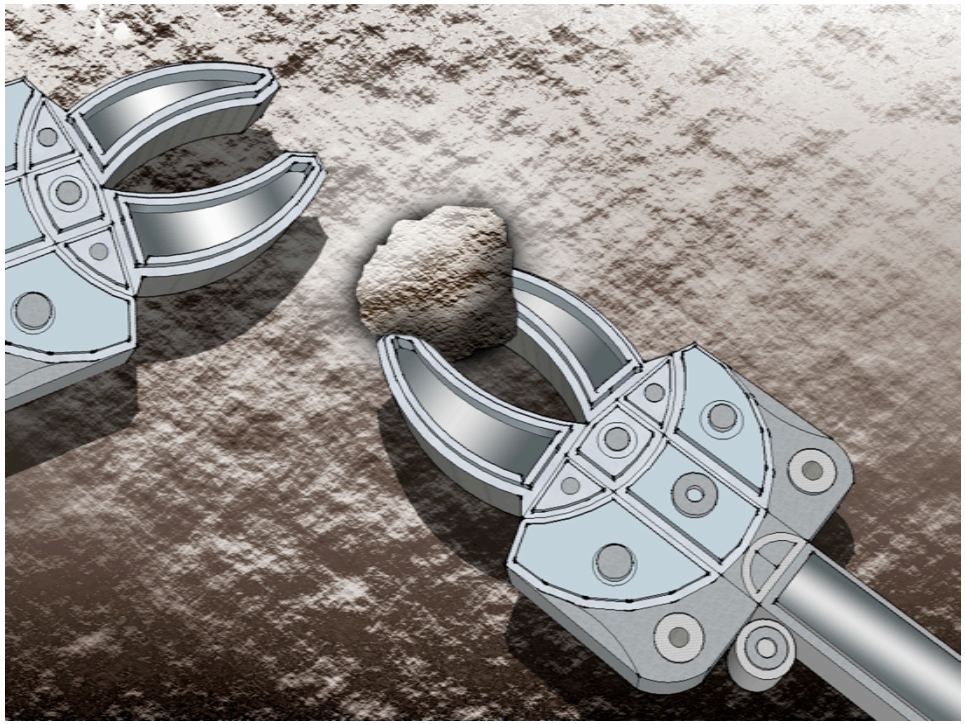
Sample Return Robot Challenge

to demonstrate a robot that can locate and retrieve geologic samples from a wide and varied terrain without human control.

PRIZE PURSE: $1.5 Million

Autonomous robot
Easily identified samples
Terrain maps provided but no use of GPS

To encourage innovations in robotic navigation and sample manipulation technologies



Centennial Challenges Summary

Participatory Research & Development with Opportunities for:

Competitors

entrepreneurs & other businesses, inventors, students

Allied Organizations

private organizations

and **Sponsors for Allied Organizations and Teams**

businesses, organizations, individuals

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www.nasa.gov/challenges ***Twitter: NASAPrize***