



# NASA's Crowdsourcing Journey

NASA Center of Excellence for Collaborative Innovation

Steve Rader

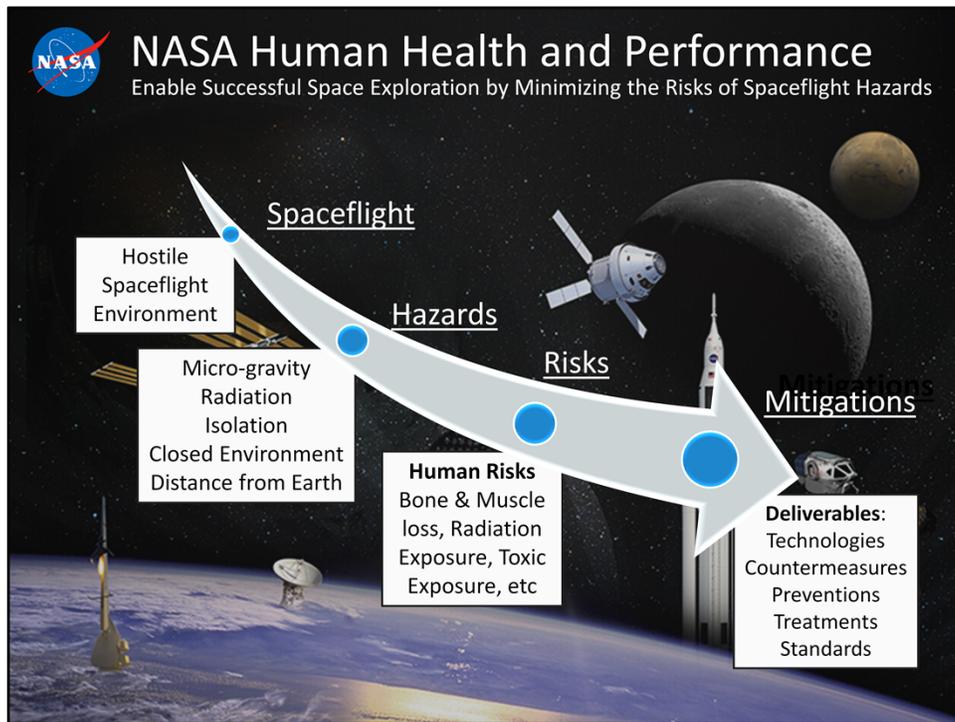
January 14, 2014

Good morning (or afternoon for some on the east coast). As Norah said, my name is Steve Rader, I'm the deputy manager for NASA's Center of Excellence for Collaborative Innovation (or as we refer to it "CoECI").

Today I'd like to walk you through the story of crowdsourcing at NASA.

A journey I might add, that we are still on.

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This journey started back around 2005 with Jeff Davis – head of what was then the Space & Life Sciences Directorate at Johnson Space Center. Now the Human Health and Performance (HH&P) Directorate.

So, generally speaking, this organization focuses on the health and performance of the humans NASA puts in space..... <Explain the chart>.

**Hostile Spaceflight Environment**

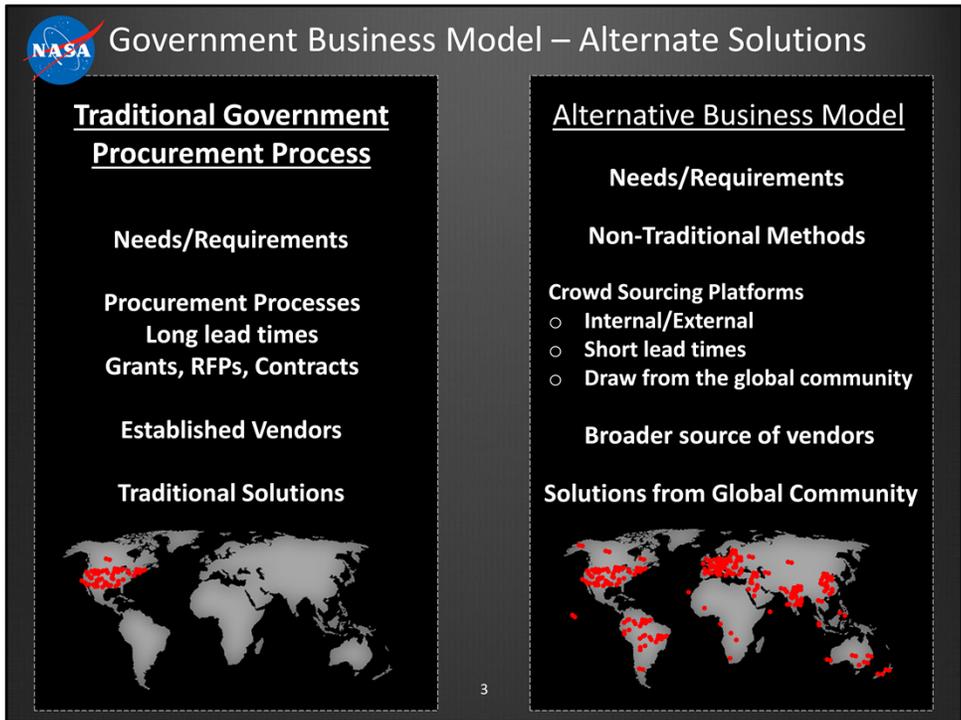
Creates **Hazards** (micro-gravity, radiation, isolation, closed environment, distance from Earth)

Which are effectively **risks to Humans** (bone/muscle loss, radiation exposure, toxic exposure, etc)

Risk Mitigation: 42 human system risk identified for mitigation for space flight (medical, environmental, physiological)

And this organization is responsible for **developing systems & techniques** to mitigate these risks (so we can ultimately use humans to explore, live, & work in Space).

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So at the time, NASA was going through a period where **Budgets got severely reduced – 40% reduction for R&D**, and our traditional model (refer to chart) was becoming less effective at yielding results.

Jeff took a Harvard Business School class on collaborative innovation models & got to know Karim Lakhani and some of the work he had been doing in this area, ...and started to see and embrace some of the new Alternate Business Models of open innovation and crowdsourcing



## Human Health & Performance Strategy

- The Mission Statement
  - To optimize human health and productivity for space exploration
- The Strategy
  - Manage balanced internal/external portfolio - Change our business model to be more flexible, resilient and cost-effective
  - Drive health innovations
- The New Ingredient
  - Open innovation experiments (Pilots)

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So given the directorate's mission statement... To optimize human health and productivity for space exploration

Jeff worked to develop a strategy to try and change the business model to be more flexible, resilient and cost-effective  
AND to really intentionally DRIVE health innovations.

Initially, his team started benchmarking with other organizations such as P&G, General Mills, GE etc.

Seeing companies like P&G: Connect & Develop – Extending open innovation  
10 to 23 brands (billion \$ ones) – without increasing their R&D staffing

So in addition to these benchmarking efforts, Jeff set off on the course of bringing open innovation to his organization. ..

The new Ingredient was the Open Innovation Pilots.

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## Portfolio Gaps Seeds a Fertile Pilot

- **Food packaging** to maintain quality for 5 years
- **Compact exercise device** (one cubic foot, 20 pound) for capsules
- **Solar proton event predictive capability** for 24 hours
- Coordinated **sensor swarms** for planetary research
- Accurate **tracking of medical consumables** in flight
- **Motivational enhancement for exercise**
- In-flight **laundry** system

Pilots conducted on four platforms – NASA Innovation Pavilion (Innocentive), Yet2.com, TopCoder (Harvard Univ.), and NASA@Work (Innocentive)

NASA embarked on a series of challenges.

Listed here are the 7 pilot challenges that were launched on Innocentive <highlight chart>

Additionally, NASA ran several pilot challenges on Yet2.com and TopCoder... and began looking at internal platform options like NASA@work.

<NEXT CHART>

REFERENCE IF NEEDED:

JSC's success piloting a TopCoder challenge:

Algorithm challenge: Optimize algorithm that supports medical kit design. The competition lasted 10 days and 2800 solutions were submitted by 480 individuals. The challenge team actually incorporated results from this competition into the Integrated Medical Model.

The team felt this process was more efficient than strict internal development efforts.



## Innocentive Pilot Results

Challenge Title	Ctr	Posted	Deadline	Proj Rms	Sub	Award Date	Award Amount
Improved Barrier Layers ... Keeping Food Fresh in Space	JSC - SLSD	12/18/2009	2/28/2010	174	22	5/7/2010	\$11,000
Mechanism for a Compact Aerobic Resistive Exercise Device	JSC - SLSD	12/18/2009	2/28/2010	564	95	5/14/2010	\$20,000
Coordination of Sensor Swarms for Extraterrestrial Research	LRC	2/27/2010	4/26/2010	423	37	6/4/2010	\$18,000 (3)
Medical Consumables Tracking	GRC	5/17/2010	7/27/2010	365	56	10/28/2010	\$15,000 (3)
Augmenting the Exercise Experience	JSC - SLSD	5/27/2010	7/27/2010	229	18	9/20/2010	\$10,000
Simple Microgravity Laundry System	JSC - Eng	5/27/2010	7/27/2010	598	108	9/21/2010	\$7,500
<b>Data-Driven Forecasting of Solar Events</b>	<b>JSC - SLSD</b>	<b>12/22/2009</b>	<b>3/22/2010</b>	<b>579</b>	<b>11</b>	<b>5/13/2010</b>	<b>\$30,000</b>

JSC=Johnson Space Center, SLSD=Space & Life Sciences Directorate, LRC=Langley Research Center, GRC=Glenn Research Center, Eng=Engineering

I just wanted to flash up some details on the pilots we ran on the Innocentive platform:

As you can see... broadly,

- we gain experience working with different organizations across NASA...
- Most of our challenges ran for just a couple of months
- We had really great responses with hundreds of project rooms/solvers and lots of submissions.
- You can also see, we got these great results with relatively modest prize amounts ranging from around \$7K up to \$30k.
- I should note that these durations and costs are only for the challenges and that additional time and resources were used to develop the challenges.

The improved **food packaging** challenge closed with 174 total project rooms representing 33 different countries. A total of sixteen proposals were reviewed and a partial award went to one proposal submitted by a Russian scientist. The solution was utilization of graphite foil as a barrier in food packaging to extend the shelf life of food products. This solution has really advanced NASA's thinking about food packaging materials.

The **compact resistive exercise** challenge closed with 564 project rooms representing 52 countries. A total of 60 individual proposals were received and one proposal from a mechanical engineer in Massachusetts was chosen for full award. The solution was for a compact pneumatic suction exercise device similar to an exercise device that is currently on the International Space Station (ISS), the Advanced Resistive Exercise Device (ARED). However, the proposed device is much more compact, lighter weight, and novel in terms of how the exercise device and its components were packaged.

The **sensor swarming** challenge closed with a total of 423 project rooms representing 49 individual countries. A total of 22 individual proposals were reviewed and three proposals from solvers in Italy (2) and California (1) were awarded partial awards. The solutions were novel ideas for how sensor nodes could make decisions autonomously and without coordination with other swarms. The ideas also helped re-characterize the original problem statement for future research and collaboration efforts.

The **medical consumables tracking** challenge closed with a total 365 project rooms and 36 proposals representing 16 different countries.

The **augmented exercise experience** challenge closed with a total of 229 project rooms and 18 representing nine different countries.

The **simple microgravity laundry system** challenge closed with a total of 598 project rooms and 70 representing 20 different countries. Note that this was one challenge where we did NOT really find a solution, but learned a lot about appropriate scoping of challenges.

The Data Driven Forecasting of Solar Events...

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## NASA Challenge: Data-Driven Forecasting of Solar Events

TAGS: Engineering/Design, Computer Science/Information Technology, Math/Statistics, NASA, RTP

STATUS: **Awarded** | ACTIVE SOLVERS: 579 | POSTED: 12/22/09

- Important for protecting health during space flight
- Previous work to extend prediction capability beyond 1-2 hours not successful
- Challenge:
  - 4-24 hour prediction
  - 2 sigma confidence interval
- Result:
  - 8 hour prediction
  - 85% accuracy
  - 3 sigma confidence interval

Over 3000 Participants

\$20,000 Prize

Winning solution submitted by retired radiofrequency engineer

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Energetic particles emitted by the sun during Solar Particle Events (SPEs) increase exposure above background levels and could be mission limiting.

No current method to predict SPE...Multiple observational platforms currently exist to monitor solar activity.

Of particular interest for mission operations is the ability to predict or forecast periods from 4 to 24 hours of low probability of having an SPE, i.e., an **'All-Clear' forecast**

<Click to ANIMATE>

This challenge had over 3000 participants (the power of NASA brand)  
579 total project rooms representing 53 different countries  
95% of the solvers had never worked on a NASA project.  
\$20K prize.

A total of four individual proposals were selected for final review, and one proposal from a retiree in New Hampshire was chosen for a full award.

The solution was a mathematical model that predicted Solar Particle Events (SPE) using ground based data.



## Meanwhile based on HH&P Efforts

What is NASA Tournament Lab?  
Operational Virtual Facility developed  
between NASA, Harvard, and TopCoder



### Two Objectives

1. Create novel, high quality working software for algorithmic / computational Challenges
2. Contribute towards the development of empirically validated science of innovation tournaments



[TOPCODER]

Utilize the principles of innovation to allow participants worldwide to contribute to solving mission challenges by developing innovative computational algorithms.

Meanwhile, Jason Crusan at NASA HQ had met Jeff and become interested in these methods and began working with TopCoder.

Jason Crusan is currently the Director of NASA's Advanced Exploration Systems.

He formed the NASA Tournament Lab (NTL) by initiating a contract with Harvard who then subcontracted with TopCoder.... To start using and studying these new innovation approaches.

This NTL has been a very good platform for both studying and executing challenges.



# NASA Tournament Lab (NTL)



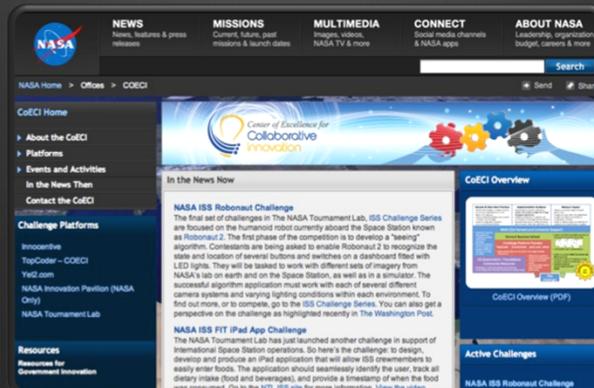
- Engage existing community to solve real-world problems through competition
  - Image, landscape, motion detection
  - Modeling and prediction
  - Cost-path problems (logistics)
  - User interface design
  - System architecture and implementation
- Investigating
  - Competition structure and incentives
  - Problem selection
  - Problem design
  - Solution integration
  - Principal Investigator: Prof. Karim Lakhani, HBS
  - Chief Economist: Prof. Kevin Boudreau, LBS
  - NASA Lead: Jason Crusan





## Continuing to Build on Success

- Pilots lead White House Office of Science and Technology Policy (OSTP) Request for NASA to serve as a resource for other Federal Agencies
- NASA Center of Excellence for Collaborative Innovation established November 2011.



Visit [www.nasa.gov/offices/COECI/](http://www.nasa.gov/offices/COECI/) for more information

Together, Jeff and Jason began promoting these methods both inside and outside of NASA.

(in fact, one of my first exposures to these groups was at NASA's Program Management Challenge in Feb 2011 where they were showcasing the results of the pilots and bringing in these platform vendors to talk.)

The White House Office of Science and Technology Policy (OSTP - who was also interested in getting some of these new approaches working in the Federal Gov't) requested that NASA establish a Center of Excellence for Collaborative Innovation (COECI) for all U.S. federal agencies to share in best practices and results of challenges and prize competitions conducted across a wide range of disciplines to spur innovation.

And thus NASA stood up the Center of Excellence for Collaborative Innovation in November of 2011 with NASA management approval.

I should note that Jason Crusan and Jeff Davis are the Director and Deputy of CoECI.



## Center of Excellence for Collaborative Innovation

- CoECI serves to advance the use of open and distributed innovation methodologies to improve government missions
- The CoECI provides guidance to other agencies on implementing open innovation initiatives from problem definition, to incentive design, to post-submission evaluation of solutions.
  - Consultation with Food & Drug Admin (FDA), Dept. of Homeland Security (DHS), State Dept., Central Intelligence Agency (CIA), Dept. of Transportation (DOT), Dept. of Justice (DOJ), National Inst. Of Standards & Technology (NIST)
- The CoECI provides guidance and support to internal NASA programs, projects, and offices, including use of the NASA Tournament Lab and NASA@Work platforms
- Through the use of its Crowd Sourcing & Tech Scout platforms other agencies can leverage infrastructure and expertise to rapidly pilot the use of incentive prizes

**Quick Facts about CoECI:**

- Challenges: CMS, USPTO, EPA, OPM, USAID, NSF/NITRD, DOE
- Visit [www.nasa.gov/offices/COECI/](http://www.nasa.gov/offices/COECI/) for more information







So, over the past 2 years, we've been working across NASA and several federal agencies to run help the organizations run challenges and really make these methods part of their "toolbox" for finding innovative solutions.

CoECI (As we call it), currently has several contracted platforms that we use.

NASA@work - Internal INNOCENTIVE

NASA PAVILION on INNOCENTIVE – open innovation

NASA TOURNAMENT LAB (NTL) NASA/Harvard/TopCoder

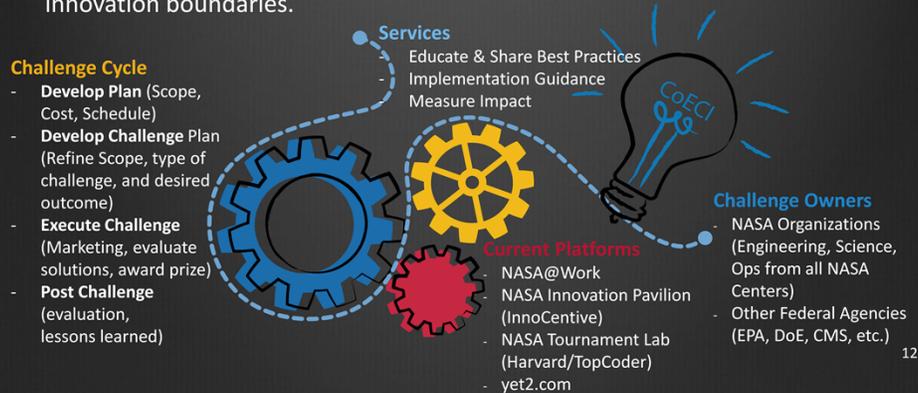
YET2.COM (technology portfolio matching)

We are currently working on follow-on contract mechanisms that will allow us to expand the number and type of open innovation platforms available.

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## Why CoECI? (Center of Excellence for Collaborative Innovation)

CoECI helps NASA generate ideas and solve important problems. By using challenges, we can readily increase our creative capacity and reach by tapping into diverse talent from around the world. As a pioneer and active user of open innovation methods and tools, the NASA CoECI provides organizations with a cost-effective and complementary means of extending their innovation boundaries.



This is our official “About page” for CoECI... but we mainly facilitate the planning and execution of challenges at NASA and across the federal government.

This includes some education and outreach... some contract management, and a lot of working with individual and organizations to help them successfully leverage these new approaches.

## The CoECI Organization

**Director - Jason Crusan**    **Deputy Director – Jeff Davis, MD**  
Director, Advanced Exploration Systems, HEOMD    Director, Human Health and Performance  
NASA Headquarters    NASA Johnson Space Center

**Manager - Lynn Buquo**    **Deputy Manager – Steve Rader**  
Human Health and Performance    Human Health and Performance  
NASA Johnson Space Center    NASA Johnson Space Center

**Strategist – Elizabeth Richard**    **Business/Innovation Architect – Karl Becker**  
Human Health and Performance    Advanced Exploration Systems, HEOMD  
Wyle - Johnson Space Center    Stellar Solutions – NASA Headquarters

**Program Integration – Carolyn Woolverton**    **Technical Integration - Michael Ching**  
Human Health and Performance    Advanced Exploration Systems, HEOMD  
NASA Johnson Space Center    Stellar Solutions – NASA Headquarters

**NASA@work Lead - Kathryn Keeton, Ph.D.**    **Technical Integration – Carol Galica**  
Human Health and Performance    Advanced Exploration Systems, HEOMD  
Wyle - Johnson Space Center    Stellar Solutions – Glenn Research Center

*For more information, go to: <http://www.nasa.gov/offices/COECI/>*

Here is our org... and you'll notice that our director and deputy are in fact the original advocates of open innovation.

So, let me shift gears now and walk you through each of the platforms we use and a few of the challenges that we've run on each.

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# NASA@work: NASA's Internal Platform



## NASA@work Community

As of 12/06/13

**Solvers**                    **10,805**

**Active Solvers\***        **561**

## NASA@work Challenges

FY12: Ran 16 Challenges (53 winners)  
(~40 submissions on average)

FY13: Ran 19 Challenges (94 winners)  
(~42 submissions on average)

2-4 Active challenges posted at any one time;  
new challenge posts every ~2-3 weeks

\*Participants who submitted a solution and/or posted to a discussion of a challenge

### Growth of the NASA@work Community since October 2012



<Run through the basic chart elements>

From Oct 12 to Oct 13, our registered users have gone from 8100 to 9906 (22% growth)

But we are really excited that in that same time, our active users have gone from 305 to 536 (76% growth)

Note that active just means they log on the site.... They all get emails describing the latest challenge... so we assume that it is mainly those that have some interest (skill) in the challenge click on through to the site.

One of the things we've learned with crowds is that you don't necessarily want lots of responses (typically means you have the statement too broad)... but rather a few solutions from people that really have good stuff. Some of our challenges have just 2-3 submitted solutions (but almost all of them are valuable).



## NASA@work Challenges

- Display Format Development System for Deep Space Human Spacecraft
- Ideas for New Technology Demonstration Prize Competitions
- As Good as Dollars: Incentives for NASA@work that Count!
- Solutions on the Use of Thorium Instead of Uranium
- Packing Foam Alternatives Challenge
- Determining Urine Volume in Microgravity
- Hands-On Tutorial for Reed Solomon Encoding Method
- A Durable/ Permanent Anti-Fog for the Space Suit Helmet
- Lab Equipment Obsolescence: Cytometer
- Reduce Waste in Space: Creating Feedstock for Additive Manufacturing (3D Printing)
- Advanced Exercise Concepts for Long-Duration Space Flight
- Inflight Calcium Isotope Measurement Device
- Protection of the Human from Galactic Cosmic Rays Challenge
- Group On-Call Notification Alternatives

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Here are just some of the challenges that we've run on our NASA@work platform over the last year (and a couple are still running).



## NASA@work: Highlights

### Type: Solution Seeking

**Problem:** Need an easier and more accurate way to collect dietary data from astronauts in flight

Posts: 100  
Unique Solvers: 70  
Winners: 1

**Solution:** Idea for an iPad app. Resulted in ISS Food Intake Tracker (FIT) app developed via a NASA Tournament Lab (NTL) Challenge

Seeking Efficient Method to Collect Dietary Data in Space



### Type: Knowledge Seeking

**Problem:** Seeking internal proposals for the next Centennial Challenge. Winners eligible for funding of an engineer for six months.

Submissions: 29  
Unique Solvers: 21

**Solution:** Challenge currently "Under Evaluation;" largest number of new active participants to date

Seeking Ideas for New Technology Demonstration Prize Competitions



### Type: Expertise Seeking

**Synopsis:** Need to identify expertise and tutorial tools to understand a specific encoding method

Posts: 18  
Unique Solvers: 9  
Winners: 4

**Solution(s):** Identified viable tools and experts at two different centers (outside his own center)

Seeking Hands-On Tutorial: Reed Solomon Encoding Method



**InnoCentive Challenges**

**Non-invasive Measurement of Intra-Cranial Pressure**  
 \$15K Award  
 2 Awards: Both Potential Solutions

**Kevlar Strain Measurement**  
 \$20K Award  
 26 Solutions Considered  
 3 Awards: similar solutions

"So simple, so elegant how could we NOT have thought of this ourselves."

In addition to all of the great results that we got out of the innocentive Pilots I shoed earlier, we have also continued to get great results from our Innocentive Challenges:

Two key NASA challenges on Innocentive that I want to highlight were

Non-Invasive Measurement of Intra-Cranial Pressure –

This is important for us in spaceflight due to the changes in the way body fluids work in Zero-G (ref...bloated faces). Eyesight

We are still understanding the affects of this and have needed a way to measure the intra-cranial pressure.

**There is no validated tool to quantify intracranial pressure *non-invasively*.**

- Clinical Gold Standard methods are invasive
  1. Lumbar puncture
  2. Cranial implant
- Accurate pre-, in-, and postflight ICP measurements are required to prove or disprove the intracranial pressure hypothesis and quantify the extent and time course of ICP changes.
- Techwatch and market surveys indicated that the current state of technology was insufficient to meet NASA's research needs.

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# Intra-Cranial Pressure Challenge Solution Mechanisms Explored

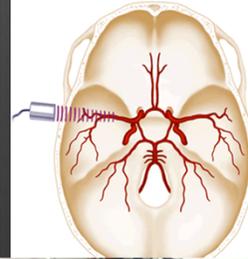
Challenge	Solution Mechanisms	Outcomes	Results
How to measure intracranial pressure (ICP) non-invasively	 NASA WORK	Top 3 NASA "winners" directed us to take a second look at developers we were already aware	
	 INNOCENTIVE Potential \$15K Award	638 Solutions Submitted 581 Rejected by Innocentive 11 Rejected by NASA 46 Reviewed by NASA	2 New Potential Solutions
	 yet2com™	81 Leads Identified 63 Rejected High Interest Solutions: 3 Other Interesting Solutions: 5 Potential Complementary Technologies: 6	2 New Potential Solutions



## Intra-Cranial Pressure Challenge *Innocentive Results*

### UCLA's Non-invasive Intracranial Pressure Calibration Framework (NICF)

- Algorithm developed from a database of cerebrovascular parameters, non-invasive and invasive ICP measurements. Developed under NIH grant.
- UCLA is populating a database of individual input/output models between invasive ICP and nICP signals from non-astronaut population.
- Cerebral blood flow velocity signal measured at the middle cerebral artery using conventional Transcranial Doppler (TCD) ultrasound and arterial blood pressure signals
- We can get TCD with existing Ultrasound on the International Space Station (ISS).





## Intra-Cranial Pressure Challenge *Innocentive Results*

### Thinker: An Intelligent Intracranial Pressure Monitor

- Miniature physiological data acquisition system.
- Algorithm that predicts ICP from digitized pressure waves, i.e. plethysmography.
- Commercial digital technology with innovative sensor architecture, electronics and software/firmware techniques. Bluetooth, RF
- Utilizes MIMIC II database with ICU patient data.
- Algorithm needs work.

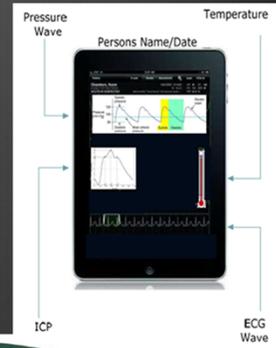


Figure 10 Thinker's Photoplethysmography Mechanical Housing

**InnoCentive Challenges**

**INNOVATION PAVILION**

You Are Viewing: NASA X

Show Challenge Types:  All  Ideation  Theoretical  RTP  eRFP

Title	Posted	Deadline	Award	Solvers
 <b>NASA Challenge: Non-invasive Measurement of Intra-cranial Pressure</b> TAGS: Engineering/Design, Life Sciences, Physical Sciences, NASA, Theoretical-licensing <a href="#">View More</a>	12/17/12	Awarded	\$15K Award	636
<b>PREMIUM CHALLENGE</b>				
 <b>NASA Challenge: Strain Measurement of Vectran and Kevlar Webbing</b> TAGS: Engineering/Design, Physical Sciences, NASA, Theoretical-IP Transfer <a href="#">View More</a>	10/25/12	Awarded	\$20K Award	348
<b>PREMIUM CHALLENGE</b>				

Non-invasive Measurement of Intra-Cranial Pressure  
 \$15K Award  
 2 Awards: Both Potential Solutions

Kevlar Strain Measurement  
 \$20K Award  
 26 Solutions Considered  
 3 Awards: similar solutions  
 "So simple, so elegant how could we NOT have thought of this ourselves."

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Kevlar Strain Measurement out of Langley: 3 winners (\$10K, \$5K, \$5K) where they were really happy with their results and it is helping them to solve a key problem that we've had with testing inflatable modules that use this Kevlar webbing.

Overall, we ended up with a preferred solution that the challenge owners described as "So simple, so elegant how could we NOT have thought of this ourselves."

Note that we also ran a challenge for USAID on Innocentive dealing with preventing genocide.

One thing to note about Innocentive is what a great platform for really getting "innovation" via a diverse community.

As most of you probably know, there are some great studies that have been done on this platform that show that most of the really innovative ideas, come from outside the technical domain of the problem (solution seeker).

The image shows a promotional banner for the ISS Challenge Series. At the top left are the NASA and NTL (NASA Tournament Lab) logos. The main title is "ISS Challenge Series". Below it, a paragraph reads: "Welcome to the ISS Challenge Series sponsored by the NASA Tournament Lab! The ISS Challenge Series is comprised of three TopCoder Challenges that look to explore and improve the International Space Station. Check out the challenges below for more information and to participate." To the right is a stylized illustration of the ISS. Below the banner are three video thumbnails: "LONGERON" showing solar panels, "ISS-FIT (FOOD INTAKE TRACKER)" showing astronaut Don Pettit with a small robot, and "ROBONAUT" showing a humanoid robot in a spacesuit. A small number "22" is centered below the thumbnails.

On our NTL platform, we have mainly been software & algorithm challenges that benefit from a more specialized platform community (since TopCoder is mainly made up of software and algorithm developers).

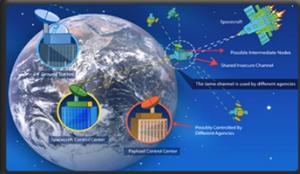
- Longeron – solar array power optimization
  - ISS-FIT – Food Intake Tracker – iPad App for the crew (astronaut Don Pettit shown here)
  - Robonaut 2 – machine vision algorithms.
- Note that additionally, we leverage the **Harvard component** of the NTL to better understand the mechanisms and incentive models that work best in this new area.



## Challenge Highlights

- **Collective Minds & Machines Exploration**
  - Machine learning algorithms based on crowd tagged imagery.
- **Asteroid Image ID**
  - Machine learning algorithms based on crowd tagged imagery.
- **Lunar Mapping and Monitoring Project (LMMP)**
- **Ka-Band Objects Observation & Monitoring (KaBOOM)**
  - Optimized algorithm for tracking multiple asteroids with an array of antennas.
- **Disruption/Delay Tolerant Network (DTN)**
  - Attempting to solve a problem with distributing security keys in a disrupted/delayed network.
- **QuakeFinder**
  - Algorithm for validating the use of magnetometers for detecting earthquakes.
- **HEC Climate Model Virtual Hosting**
  - Working to improve climate modeling with diverse data sets.
- **Planetary Data System (PDS) 3**
  - Providing improved API access to planetary data





<Go through the list>

Additionally in other agencies:

EPA – Mobile app for Cyanobacteria, Toxcast

DOE – Wave Energy

CMS – A number of apps

OPM – Payment app

DoD – Possible Exoskeleton

DOJ – Possible crime pattern algorithm



# Results

- To date, CoECI has run a total of 60+ challenges since starting in Nov. 2011
  - 35 Internal Platform: NASA@work
  - 13 NASA challenges (with 10 more in work for 2014 with 8 additional proposals)
  - 13 challenges with other agencies (with 5 more in work)
  
- Successful outcomes
  - Generate ideas – Tracking astronaut nutrition intake
  - Driving to a specific solution – Langley Kevlar Strain Measurement
  - Validating a model – Pipeline safety
  - Knowledge capture and dissemination: NASA@work
  - Finding and connecting with subject matter experts for future exchanges: Intra-Cranial Pressure
  - Promote space exploration: Longeron Challenge
  
- Methods have proven to be a very effective method to discover novel technologies and approaches to solving problems.
  
- NASA is transitioning from “test driving” to “normal use”

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13 pilots – 6 Yet2.com + 7 Innocentive (topcoder??)  
 35 NASA@work (per status chart w/ summaries for 12 and 13)

#### NASA

1. Detecting Impact Craters
2. Big Data Challenge
3. PDS
4. HEC-1
5. Kevlar
6. ICP
7. Robonaut
8. Longeron
9. ISS FIT
10. DTN-DTPC
11. DTN-LTP
12. DTN-SK
13. Collective Minds & Machines
14. USAID – Atrocity Prev
15. USAID – Secure Comm
16. USAID – Identifying Indicators of Vulnerability (MODEL)
17. USAID – Atrocity Prev Model
18. OPM – SCRD
19. CMS – Medicare provider enrollment screening
20. CMS – Fraud Prevention
21. CMS – Open Payments
22. USPTO – Patent Algorithm
23. USPTO – Patent Labeling 2 Algorithm
24. EPA – Cyano Bacteria App
25. EPA – Toxcast
26. DOE – WARP
  
27. KaBOOM
28. SMG
29. Asteroid
30. LMMP
31. Earth Science API
32. CFS Code Review
33. PDS Cassini
34. Robonaut 2 – TBD
35. HEC 2
36. Mars Ballast (Innocentive)
37. DTN – Exchange
38. DTN – Killer App
39. DTN – BP Interop
40. DTN – Configuration
41. DTN – Multi-Domain Routing
42. DTN – Firewall
43. DTN – Penetration Testing
44. CFS - DTN

Other Agency Possible:  
 DoD – Talon/Exoskeleton  
 DOJ - ??  
 Intel?  
 DoE – Sunshot Initiative

Pilots or others??  
 Laundry system  
 Augmenting the Exercise Experience  
 Medical Consumables Tracking  
 Zero Robotics (Spheres)  
 Zero Robotics STEM Video Challenge



## Lessons Learned

- Spend adequate time **defining the problem** you are trying to solve.

“If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.” – Albert Einstein

- **Infusion/adoption is greatly aided by management advocates**
  - Particularly one's that fund the projects and can use that leverage to encourage early adoption.
- Setting up **contracts and legal guidance** for organizations to leverage is crucial to infusion/adoption.
- Dedicated **facilitators** (like CoECI) are helpful in bringing new organizations up to speed on using new platforms.
- Consider **final implementation** up front (how will you deploy the solution).
  - Otherwise, solutions tend to have a hard time making it the last mile.
- **Pathfinder challenges** are useful for gaining valuable organizational buy-in and experience.
  - If measuring, cost/schedule, make sure and estimate prior to challenge.

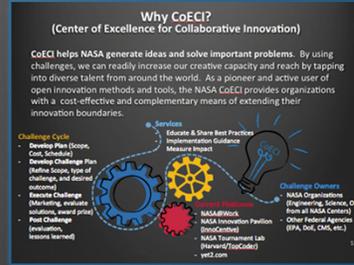
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<Animation.... Click each point>



# Center of Excellence Best Practices

- Serve in a facilitator & integrator role.
  - Bring customer organization together with platform vendor with challenge experience.
- Work out procurement and legal strategies.
- Provide opportunities for education and sharing between practitioners.
- Track and share results (including costs, lessons learned, etc.).



- Ensure challenge owners do not underestimate the investment required (make the up front investment).
- Execute a clear communications strategy.

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Facilitation

<click>

Procurement & Legal

<click>

Education & Sharing

<click>

Tracking Results

<click>

Don't underestimate the investment required...

<click>

Clear Communications Strategy – web/social media...etc. (really focus on both communicating with challenge owners... but also outreach to our solver community.



## Conclusion

- NASA's crowdsourcing journey has been very successful in driving open innovation.
- CoECI is working to infuse open innovation methods and tools across NASA and the Federal Government.
- As we continue into the future, we are hoping to make these methods and platforms part of the normal research and development toolbox.



# Questions?

1. Regarding your NASA@Work program, what support do you offer internal project managers?
2. What are some near and short term adjustments the CoECI team is doing in 2014?
3. You originally engaged in Open Innovation due to budget pressures, what are the reasons you continue with it?