NASA Big Data

What is NASA doing with Big Data today?
Introduction
What is Big Data?
NASA’s Big Data Challenge
Current Approaches
  Managing and Processing
  Storage
  Archiving and Distribution
  Analysis
  Visualization
  Commercial cloud computing services
Real World application of what NASA is doing with Big Data
A Big Data Opportunity
Open Data
  Introduction
data.nasa.gov
  NASA's data.gov Working Group
  Big Data at NASA
Data from NASA's Missions, Research, and Activities
Global Change Master Directory
About data.nasa.gov
  Data.gov Data Catalog
  NASA
  Directory
    NASA Thesaurus View
    Venus Crater Database View
      Venus Crater Database
        README file for Release 3 of the Venus Crater Database ("release3.*")
    Entities
    NEXT
NASA Open Government Plan

Executive Summary
Introduction
Welcome
Framework
  Openness Overview: Part of NASA’s DNA
  Framework for Open Government
  Cross-cutting Objectives
  Conclusion
Flagship Initiative
  NASA Web Environment
Major Initiatives
  Prizes and Challenges
    Centennial Challenges
    NASA Tournament Lab
    Open Innovation Service Providers
    NASA@Work
Citizen Science
  GLOBE at Night
  HiWISH
  Lunar Impact Observations
  My NASA Data
  Night Sky Network
  Citizen Science Software Tools
Education Infrastructure Division
  Freedom of Information Act
  IT Labs
  Zero Robotics
  PhoneSat
  Center of Excellence
  Scientific & Technical Information
Collaborative Spaces
Tools for the Citizen Scientist
Plain Text Version
  Social Network Metrics
  Timeline
  FOIA Requests in FY 2011
  Data Sets Released Publicly on data.gov
Project Statuses
FY 2011 Synopsis

Footnotes

Citizen Engagement Directory

Highlighted Activities

Technology Accelerators

  International Space Apps Challenge
  LAUNCH
  Random Hacks of Kindness

Open Data

data.nasa.gov
NASA's data.gov Working Group
Big Data at NASA

Open Source Software

code.nasa.gov
Collaborative Code Repository
Open Source Summit

Directory of Projects

MAPPER
Flight Opportunities Program
Eyes on the Earth
Eyes on the Solar System
The NASA Innovation Pavillion
SpaceUp
NASA WISE
Game Changing Development Program
NASA Green Flight Challenge
NASA Engineering Design Challenge: Lunar Growth Chamber
SpaceTech Engineering Design Challenge
High Res Imaging Experiment (HiRISE)
NASA Online Partnering Tool
NASA Tournament Lab
NASA Chat
NASA Social
NASA: Challenge.gov
Night Sky Network
Celestia

DASHlink

http://semanticommunity.info/Data_Science/NASA_Big_Data
Updated: Fri, 18 Sep 2015 23:17:25 GMT
Powered by mindtouch
Flight Analogs Project
Radio JOVE
FERMI
NASA Quest
High Energy Astrophysics (HERA) Tool
RealWorld-InWorld (RWiW) NASA Engineering Design Challenge
The Edison Small Satellite Demonstration Missions Program
NASA Facilitated Access to the Space Environment for Technology Development and Training (FAST)
NASA Centennial Challenges
NASA TechFinder
Request For Information (RFI) for Intellectual Property (IP) Services
NASA Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs
ISSLive!
Space Technology Research Opportunities for Early Career Faculty
Desert Research and Technology Studies (DRATS) Education Program
Space Alliance Technology Outreach Program (SATOP)
NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)
HUNCH
Teaching From Space
Microgravity University Systems Engineering Opportunity
Microgravity University Student Flight Program
Reverb
Land Processes Distributed Active Archive Center
Global Leveraged Integrated Data Explorer for Research (GLIDER)
EOS Clearing House (ECHO)
Gravity Recovery and Interior Laboratory (GRAIL)
YouTube SpaceLab
The Space Calendar
Small-Body Database Search Engine
HORIZONS System
Fragile Oasis
Center for Educational Resources (CERES) Project
Solar System Ambassador Program
Rock Around the World
EarthKAM (Earth Knowledge Acquired by Middle School Students)
Observable Comets
Lunar Impact Monitoring
What is NASA doing with Big Data today?

Source: http://open.nasa.gov/blog/2012/10/04...ig-data-today/

Introduction

In the time it took you to read this sentence, NASA gathered approximately 1.73 gigabytes of data from our nearly 100 currently active missions! We do this every hour, every day, every year – and the collection rate is growing exponentially. Handling, storing, and managing this data is a massive challenge. Our data is one of our most valuable assets, and its strategic importance in our research and science is huge. We are committed to making our data as accessible as possible, both for the benefit of our work and for the betterment of humankind through the innovation and creativity of the over seven billion other people on this planet who don’t work at NASA.

In version 2.0 of our Open Government Plan, we scratched the surface in terms of the work that the Agency is involved in around “big data” but there is much more to explore.

Recently, I had the opportunity to participate in a panel hosted by CBS TechLines called “Big Data Debunked — Finding the Data Signals.” I was joined by Michael Cavaretta of Ford, Katrina Montinola of Archimedes, Christine Twiford of T-Mobile, James Kobielus of IBM and ZDNet editor-in-chief Larry Dignan. We discussed the challenges and opportunities big data poses for organizations today. I was humbled by their vision and so inspired by the examples that they shared, that I wanted to share more about what NASA is doing. Because there is so much to write about and no way to fit it into one post, our tour of the big data universe at NASA will be split out into three parts.
What is Big Data?

The whole idea of big data is still relatively new and most discussions or presentations around the subject start off with a definition of what big data really is. Definitions are certainly helpful, especially when the topic is still relatively new, and so we'll start there ourselves. Big data is very simply a collection of data sets so large and complex that your legacy IT systems can not handle them. When organizations get to the point where their volume, velocity, variety and veracity of data exceed storage or computing capacity, there are some big challenges that need to be addressed. You know you have a big data challenge when your traditional data management systems and analysis tools are overwhelmed and it becomes difficult to process your data using the analytic or visualization tools you currently have. Approaching the big data challenge often necessitates advanced algorithms, infrastructure and frameworks – and it can all seem very daunting for those just starting out – but the reality for information-age-based organizations is that our success is throttled by our our ability to rapidly and comprehensively navigate the big data universe.

But of course, big data is relative. In the end, big data by itself has no value – it's meaningless. It's what you do with the data that matters most. Today's big data discussion is often centered around how to target advertisements or customize a user experience, which makes sense given that the growth in the market place is so closely tied to fact that how we interact with the physical world is more and more dependent on the pervasive use of mobile devices that are connect to the work through sensors. Having the ability to leverage our rich history of data and combine it with new data we are receiving is a huge asset in making our missions successful.

If you are still trying to wrap your head around the difference between petabytes, exabytes, zetabytes, and yottabytes, check out this overview presentation titled “What is Big Data and why does it matter” by Tom Soderstrom, the Chief Technology Officer for IT at NASA JPL. MY NOTE: I heard this presentation!

NASA’s Big Data Challenge

NASA’s big data challenge is not just a terrestrial one and it goes beyond the stereotypical challenge. Many of our “big data” sets are described by significant metadata, but on a scale that challenges current and future data management practice. We regularly engage in missions where data is continually streaming from spacecraft on Earth and in space, faster than we can store, manage, and interpret it. NASA has two very different types of spacecraft. We have deep space spacecraft that sends back data in the order of MB/s. Then we have earth orbiters that can send back data in GB/s per second. In our current missions, data is transferred with radio frequency, which is relatively slow. In the future, NASA will employ technology such as optical (laser) communication to increase the download and mean a 1000x increase in the volume of data. This is much more then we can handle today and this is what we are starting to prepare for now. We are planning missions today that will easily stream more then 24TB’s a day. That’s roughly 2.4 times the entire Library of Congress – EVERY DAY. For one mission.
It's still very expensive to transfer just one bit down from a spacecraft so we want to make sure we collect what is most important. Once the data makes its way to our data centers, storing, managing, visualizing and analyzing it becomes an issue. To give you an idea of what we are dealing with, the size of the Climate Change data repositories alone are projected to grow to nearly 350 Petabytes by 2030. 5 PB’s is equivalent to the total number of letters delivered by the US Postal Service in one year!

One great example of the unique challenge that we face with managing space data is just starting to be demonstrated by the Australian Square Kilometer Array Pathfinder (ASKAP) project which is a large array made up of 36 antennas, each 12 meters in diameter, spread out over 4,000 square meters but working together as a single instrument to unlock the mysteries of our universe. The array, which will officially be turned on and open for business tomorrow Friday, October 5, 2012, is able to survey the whole sky very quickly and offers an ability to perform research that could never have been done before. Check out this great time lapse video showing off the new telescopes capabilities! The array is a precursor for the larger Square Kilometre Array telescope that will open in 2016 and will combine the signals received from thousands of small antennas spread over a distance of more than 3000 km. When operational, as much as 700TB/second of data will flow from the Square Kilometre Array! This is a big data challenge.

And of course, spacecraft are not the only source of our data, thanks to an ever-growing supply of mobile devices, low-cost sensors, and online platforms. As an article in Harvard Business Review this month put it, “each of us is now a walking data generator.” The scale of the big data challenge for NASA, like many organizations, is daunting.

As you can probably imagine, the increasing data volumes are not our only challenges. As our wealth of data increases, the challenge of indexing, searching, transferring, and so on all increase exponentially as well. Additionally, the increasing complexity of instruments and algorithms, increasing rate of technology refresh, and the decreasing budget environment, all play a significant factor in our approach. Fortunately, the entire federal government has turned their attention towards the growing challenge. In March 2012, the Obama administration announced the Big Data Research and Development Initiative to “greatly improve the tools and techniques needed to access, organize, and glean discoveries from huge volumes of digital data.” The goal is to transform government’s ability to use big data for scientific discovery, environmental and biomedical research, education, and national security.

Current Approaches

Developing new approaches to understanding, analyzing, and visualizing the data we have en masse is of vital interest to NASA. Within government, there is a push to get ahead of big data from both the top down and bottom up. We outlined many of the big data activities and approaches from the perspective of the Mission Directorates (Science, Human Space Exploration and Operations, Aeronautics, and Technology) in Version 2.0 of the NASA Open Government Plan. Below are six world-class examples of how we manage, store, archive, analyze, visualize, and apply our big data efforts.
Managing and Processing

NASA’s approach to managing and processing data is demonstrated by the Mission Data Processing and Control System (MPCS) which was recently used by the Curiosity rover on Mars. MPCS interfaces with NASA’s deep-space network, and in turn the Mars Reconnaissance Orbiter, to relay data to and from Curiosity and process the raw data in real time, a process which previously took hours if not days to accomplish. The system produces custom data visualizations that are used by the flight operations team.

Storage

The NASA Center for Climate Simulation (NCCS), which is primarily used by NASA’s Global Modeling and Assimilation Office and the Goddard Institute for Space Studies, demonstrates the Agency’s approach to storing big data. The NCCS focuses on climate and weather data and currently houses 32 petabytes of data, with a total capacity of 37 petabytes (source). The center also has advanced visualization tools, such as it’s 17-by-6-foot visualization wall which allows for one high-resolution surface on which scientists can display still images, video and animated content from data housed in the system.

Archiving and Distribution

Two examples of how NASA approaches processing and archiving are demonstrated by the Atmospheric Science Data Center (ASDC), which is focused on Earth science, and the Planetary Data System (PDS), which is focused on planetary science. The Atmospheric Science Data Center at NASA Langley Research Center is responsible for processing, archiving, and distribution of NASA Earth science data. It specializes in atmospheric data important to understanding the causes and processes of global climate change and the consequences of human activities on the climate and includes petabytes of climate data collected over decades. The Planetary Data Systems archives and distributes scientific data into one website from NASA planetary missions, astronomical observations, and laboratory measurements. It offers access to over 100 TB of space images, telemetry, models, and anything else associated with planetary missions from the past 30 years.

Analysis

NASA’s Pleiades supercomputer is used to help analyze the challenging projects, from solar flare and space weather scenarios to detailed space vehicle designs. Pleiades was recently used to process massive amounts of star data gathered from NASA’s Kepler spacecraft, leading to the discovery of new Earth-sized planets in the Milky Way galaxy. More than 1,200 users across the country rely on the system to perform large, complex calculations. It was also used to generate the Bolshoi cosmological simulation which explores how galaxies and the large-scale structure of the universe has formed over billions of years.
Visualization

The NASA Earth Exchange (NEX) is a virtual laboratory that integrates supercomputer, data system, data visualization, large amount of online data, models and algorithms, with social network and collaborative technology. Prior to NEX, scientists were required to invest tremendous amounts of time and effort to develop high-end computational methods rather than focus on important scientific problems. Now, scientists can use the supercomputer to visualize large Earth science data sets as well as run and share modeling algorithms and collaborate on new or existing projects. Recently, a research team from around the U.S. used the NEX environment to adjoin an atmospherically correct mosaic of 9,000 Landsat Thematic Mapper scenes and retrieve global vegetation density at a 30-meter resolution. The entire processing of the nearly 340 billion pixels in the the composite took just a few hours on the Pleiades supercomputer, allowing the team to experiment with new algorithms and approaches with ease. We’ve also invested in a number of collaboration and knowledge-sharing platform for the Earth science community that combine supercomputing, Earth system modeling, workflow management and NASA remote sensing data feeds to enable a holistic view of our work for researchers. More information on NEX.

Commercial cloud computing services

The recent Mars Science Laboratory mission demonstrates how NASA is modernizing its approach to Big Data by utilizing cloud computing and commercially available cloud storage solutions. In less than four months, NASA engineered and migrated legacy content management system and websites to Amazon Web Services. MSL relied heavily on mission-critical applications that could sustain failure of over a dozen data centers, while delivering over 150 Gigabits per second of traffic to a global community of operators, scientists, and general public. The team developed a solution that would download raw images and telemetry directly from Curiosity and place them into Amazon S3 storage buckets. As the data streamed in, every image from Mars was uploaded, processed, stored, and delivered from the cloud. The data was then catalogued in highly available and scalable databases and exposed to applications and users via a Restful interface. This allowed the content managers for the Mars Web sites to easily create informative Web pages with powerful real-time images. This modern approach allowed NASA to deliver 120 TB of dynamic content and 30 TB of static content the first night, and meet the demands when over 8 million hits were requested of their websites in less than one minute. It also allowed the team to take advantage of the JPL Galaxy and JPL Nebula supercomputers which ran close to 200 24-hour Monte Carlo simulations at 20 GB each during the mission.

Real World application of what NASA is doing with Big Data

The benefits of what NASA is doing in big data are not limited to just the government! In fact, this work has very real implications for you. One real world example of how NASA leverages its expertise in big data, and directly affects your life, is in the field of airline safety. NASA is involved in analyzing data collected from planes to study safety implications, which in turn will help with commercial airlines’ maintenance procedure improvements and potentially prevent equipment failures. Using advanced algorithms, the agency helped tease out relevant information from a mountain of unstructured data.
data to help predict and prevent safety problems. Using the open-source Multiple Kernel Anomaly Detection (MKAD) algorithm, the agency determined how two continuous data streams or networks are similar, and then analyzed them using a single framework to detect patterns to automatically discovering precursors related to adverse events while an airplane is in flight.

**A Big Data Opportunity**

From analyzing the real-time solar plasma ejections and monitoring global climate change to optimizing large scale engineering designs and modernizing the way we approach mission operations, NASA is a leader in the application of big data. At NASA we are continuing to experiment with new ways to harness this shifting environment and tackle the many challenges it poses to government and the way we do business. Although we are just in the beginning stages of in exploring the big data universe, the opportunities are truly limitless.

The Open Government Plan outlines a number of specific actions we are taking to drive innovations in technology around big data. We’ve created data.nasa.gov as a starting point to engage with our data, but this is simply a directory of all the wonderful data NASA makes available. We will also continue to leverage data.gov to enable users to locate relevant high quality data and easy to use tools and applications.

We set a goal to “create new opportunities for enhanced coordination across NASA’s Big Data activities, and expanded cooperation with other agencies” with the intention of encouraging citizens to utilize raw datasets and create applications relevant to NASA’s mission. Yesterday, NASA joined the National Science Foundation and the Department of Energy’s Office of Science to announce the "Big Data Challenge", a series of competitions which will be hosted on the TopCoder platform. Competitors will be tasked with imagining mobile apps that find new value hidden in discrete government information domains and then describing how they may be shared as universal, cross-agency solutions that transcend the limitations of individual silos. This is a fresh new opportunity to work with us and help conceptualize new and novel approaches that are critical to the future success of government and we encourage you to check it out.

*Special thanks to Tom Soderstrom and Chris Mattmann from NASA/JPL, Sean Herron and Sasi Pillay from the NASA/ HQ, and Madi Sengupta from Princeton University, all who contributed research and insight to this post.*

---

**Open Data**

Source: [http://open.nasa.gov/plan/open-data/](http://open.nasa.gov/plan/open-data/)
Introduction

The open data movement at NASA is multifaceted, including further release of data sets, publishing data sets to data.gov, and developing strategies to process large data sets. NASA will continue to develop its single portal for NASA data (data.nasa.gov) and leverage data.gov to enable users to locate relevant high quality data and easy to use tools and applications. The Agency will also continue to encourage users to utilize raw datasets to perform analysis, experiments, and learning as well as to leverage the efforts of external developer communities who create applications relevant to NASA’s mission.

data.nasa.gov

NASA’s commitment to open data expands the audience for the vast body of knowledge captured in nearly 100 years of U.S. aeronautics and space data. Developers, technologists, entrepreneurs, citizen scientists and many others can contribute directly to the exploration of space and Earth by helping to create new ways of looking at this data. Additionally, the release of administrative and procedural information from within NASA enables researchers and analysts to understand more about the inner workings of NASA as well as allow our own employees to better understand other functions of our Agency.

As part of the Open Government Initiative, the Agency is working to improve accessibility to this data and incentivizing the use of government data by citizens. To address the ever-increasing amount of tools and data catalogs that are publicly available on NASA’s many websites, this directory lists publicly available datasets and serves to streamline the process for posting these datasets on data.gov. The directory includes information and direct links to more than 1000 datasets, and this is just a small beginning.

Initiative goal:

Continue to build the internal directory with an additional 500 datasets, including every NASA center and representing as much of NASA’s internal work as possible, with an increased percentage of data graduated up to data.gov. (2 years)

NASA’s data.gov Working Group

Data.gov was created in 2009 as a step toward implementing a more open and accountable government. Each Agency participates by providing support and recommendations to the architecture of the site as well as populating data.gov with
For NASA, as a mission-driven Agency, data is at the heart of what we do, and the Working Group functions as a liaison between data.gov and NASA’s data curators as well as participating in the evolution of the platform. The Working Group embraces the opportunity to reach out to new stakeholders via data.gov, including application developers, social scientists, researchers, citizen scientists, and data enthusiasts. We believe that the data.gov platform will facilitate even greater usage of our existing Web services which will provide incentive for us to find additional information to make available for download.

**Initiative goal:**

Release an additional ten new high-value datasets or information holdings to data.gov that have never been released to the public before. Upon release of each dataset or information holding, we will issue a rationale for why it is high-value. (1 year)

### Big Data at NASA

Exploring innovative approaches to extremely large datasets is of vital interest to NASA. In line with its extensive amounts of science data, and commitment to making large datasets accessible to the public, the Agency continues to encourage users (internally and externally) to utilize raw datasets in new ways to perform analysis, experiments, and learning. NASA also partners widely across government agencies to support sharing of best practices and cross-agency planning.

The variety of NASA’s current Big Data activities and approaches include:

- **Science Mission Directorate** (SMD) is committed to Big Data research and development that is focused on specific NASA science needs and missions. SMD is currently soliciting for new awards in 8 Big Data areas in its Research Opportunities in Space and Earth Sciences (ROSES) – 2012 and partners with DOE, NOAA, USGS, USAF, EPA, NIST, DOD, and NSF on a variety of Big Data activities.

- NASA's **Human Exploration and Operations Mission Directorate** (HEOMD) has a number of innovative approaches to advancing Big Data, including the Lunar Mapping and Modeling Activity and the NASA Center of Excellence for Collaborative Innovation.

- NASA’s **Aeronautic Research Mission Directorate** (ARMD) open data activities includes the DASHlink virtual laboratory, a tool for scientists and engineers to disseminate information on the latest data mining and systems health algorithms, data, and research, and collaborate on research problems for aeronautics systems. DASHlink connects researchers working in similar areas by making public data sets, open-sourced algorithms, and non-proprietary research results more accessible. Participants can upload technical projects to disseminate, collaborate, and innovate more easily both within NASA and beyond.

- NASA’s **Technology Program** includes large-scale data management and analysis in its NASA Technology Area 11 (Modeling, Simulation, and Information Technology & Processing) and specifically identifies Intelligent Data Understanding as a technology need area. Though no solicitations are planned for 2012 in this area, the Office of Chief Technologist does have annual solicitations in its Game Changing Technologies, NASA Innovative Advanced Concepts (NIAC) and SBIR/STTR programs, where proposals addressing Big Data would be welcome.

**Initiative goal:**

NASA will create opportunities for enhanced coordination across NASA’s Big Data activities, and expanded cooperation with other agencies. (1 year)
Data from NASA's Missions, Research, and Activities

Source: http://www.nasa.gov/open/data.html
02.04.10

NASA has a long history of placing large amounts of data online for members of the public to use. Recently, on January 22, 2010, we provided three new datasets and 18 other tools, widgets and catalogs to Data.gov. Of the 18 new widgets and catalogs, three of which stand out as chosen descriptive tools indicative of NASA's products:

- **NASA World Wind** is a web service and open source project with nightly builds which allows people to zoom from satellite altitude into any place on Earth, leveraging satellite imagery and mission data, and thus experience Earth terrain in visually rich 3D. NASA World Wind Java is also a plug in to allow third party users to customize their own information through the World Wind Java widget;

- **Global Change Master Directory** is an integrated platform with continuously updated information about the planet's vital signs, including the rising global temperature, size of the ozone hole, the rising sea level, and the amount of carbon dioxide in the atmosphere;

- The **Planetary Data System** is an archive of data products from NASA planetary missions, and it has become a basic resource for scientists around the world.

The three new datasets provided to the "raw" data catalog are available in a machine readable format and updated as new data is received from NASA's spacecraft:

- **On Earth** is the most current, near-global image of the earth available, updated each day in a KML format. Taken from the MODIS instrument on the Terra and Aqua spacecraft, this data will improve our understanding of global dynamics and processes occurring on the land, in the oceans, and in the lower atmosphere. MODIS is playing a vital role in the development of validated, global, interactive Earth system models able to predict global change accurately enough to assist policy makers in making sound decisions concerning the protection of our environment;

- **Tropical Surface Current Velocity** is a dataset of estimates of the horizontal near-surface currents of the Tropical Pacific ocean. The near-surface velocity is directly derived from sea surface height, wind velocity and sea surface temperature. This data provides an unfiltered velocity field, on a 1deg X 1deg grid with a 5day resolution;

- **Land Surface Temperature at Night** is a global map which shows the temperature of Earth's lands during the nighttime. Taken with the MODIS instrument on the Terra and Aqua satellites and aggregated into monthly datasets in a KML format, this temperature dataset is a measure of how warm or cold Earth's lands are at night. This dataset is useful for understanding where it is too hot or too cold for food crops to prosper, and general influences on weather or climate patterns.

NASA has provided public insight into its operations for many years, from publishing its employee directory online to providing human capital information query-able in many ways. Since NASA's inception, we have publicly archived all of its data received from spacecraft projects, including over 4TB of new Earth Science data each day. There are tools and geodata catalogs available to allow scientists and the public to access NASA's raw data. When accessed through these Distributed Active Archive Centers (DAACs), tools and catalogs, the user gets more value out of the aggregated data than it would alone. NASA is committed to receiving public and employee ideas for additional high-value datasets, particularly datasets from the institutional and procedural realms of NASA activities and providing new datasets to the raw data catalog on data.gov giving greater insight into the inner workings of the U.S. space program.

Additional sources of NASA data include:

**NASA on Data.gov**
Earth Science Data

- Earth Observing System Data and Information System (EOSDIS)?
- Goddard Earth Sciences Data and Information Services Center?
- NASA's HEASARC Web-based Tools?
- Global Change Master Directory?
- Goddard Institute for Space Studies Earth/Climate Change Data?
- CEOS International Directory Network?
- USGS/NASA Landsat Data on New Earth Explorer
- Ocean Color?
- On Earth?
- Gateway to Astronaut Photography?
- NASA Earth Observations?
- Visible Earth?
- NASA Earth Observatory?
- LandSat 7 Datasets for MultiSpec?
- Earth Plus?
- International Space Station EarthKam?
- Physical Oceanography DAAC?

Space Science Data

- National Space Science Data Center (NSSDC)?
- National Space Science Data Center (NSSDC) Master Catalog?
- Planetary Data System (PDS)?
- FERMI Mission Data?
- HelioViewer (beta)?
- Virtual Solar Observatory?
- Sun Grazing Comets from SOHO/STEREO?
- Space Weather Action Center?
- Multiwavelength Milky Way?
- Observable Comets?
- Solar System Dynamics?

Data for Educators

- My NASA Data?
- NASA Quest QNA Database?
- NASA on the National Science Digital Library?

Desktop Data Tools
Hello Dr. Niemann, Thank you for your interest in the Global Change Master Directory. The GCMD database keywords are available in csv format from our Keyword Management System (see information below on how to sign up for a password to access the keywords): http://gcmd.gsfc.nasa.gov/Resources/valids/archives/keyword_list.html

You are welcome to access the Global Change Master Directory keywords through our new Keyword Management System (KMS). Please review the "Terms of Use" before accessing the system. http://gcmd.nasa.gov/l/l/TermsOfUse.

Accessing the GCMD Keyword Management Service (KMS):

1. Create a user account to access KMS.

https://urs.eosdis.nasa.gov/

2. The science keywords are available using this link:

http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/sciencekeywords?format=csv

(Change csv to XML, rdf, or owl to view in semantic web structures)

Additional Information and documentation available online:

http://gcmd.gsfc.nasa.gov/Connect/

Thanks GCMD Staff

About data.nasa.gov

Source: http://data.nasa.gov/about/

Last Updated: 22 December 2011
The Open Data project is part of the NASA Open Government Initiative, and is intended to improve access to NASA data. This data catalog is a continually-growing listing of publicly available NASA datasets.

In pursuit of its exploration mission, NASA has generated, collected and compiled vast amounts of digitized data that has helped us better understand Earth, other planets in our solar system, and the depths of space through the eyes of satellites, telescopes, robots, and through the cameras of astronauts. With each passing decade, advances in technology made images clearer, the information coming back from space richer, and the world smaller.

NASA has a long history of placing large amounts of data online for members of the public to use. Since NASA’s inception, the agency has publicly archived all of its data received from spacecraft projects, including over 4TB of new Earth Science data each day, and continues to make a large amount of this raw data open for public exploration.

NASA’s commitment to open data expands the audience for the vast body of knowledge captured in nearly 100 years of U.S. aeronautics and space data. Developers, technologists, entrepreneurs, citizen scientists and many others can contribute directly to the exploration of space and Earth by helping to create new ways of looking at this data. Additionally, by releasing information about administrative and procedural information within NASA, researchers and analysts can understand more about the inner-workings of NASA as well as allow our own employees to better understand other functions of our Agency.

NASA has a lot of data. For example, just one mission – the NASA’s Earth Observing System Data and Information System (EOSDIS) – has stored more than 3 petabytes of data since 2005 in a geographically distributed mass storage system. This is the same amount as the estimated total data size of the Library of Congress. EOSDIS is now downloading more than 7,000 GB a week. Another mission, the NASA Solar Dynamics Observatory (@NASA_SDO) receives 1.5 TB of data per day. That’s roughly equivalent to 500,000 mp3s each and every day.

As part of the Open Government Initiative, the agency is working to improve accessibility to this data and incentivizing the use of government data by citizens. In 2010, NASA provided three new datasets and 18 other tools, widgets and catalogs to Data.gov – but that was just a start. To address the ever-increasing amount of tools and data catalogs that are publicly available on NASA’s many websites, we have created this directory of publicly available datasets. The directory includes information and direct links to more than 500 datasets, and this is just a small beginning. We’ve initially grouped the data into 9 broad categories and have generously used tags to make the directory searchable.

Aeronautics: Data related to the study, design, and manufacturing of flying machines

Earth Science: Earth science and physical earth observations

Space Science: All types of planetary or astronomical data; anything outside of the Earth and the Earth’s atmosphere

Life Science: Life sciences and human data, including space medicine and human factors.

Climate: Atmospheric and environmental data

Engineering: Engineering data, charts, or specifications

Operations: Mission operations data relating to flight programs, mission control, or on-orbit operations
**Institutional:** Data related to the historical and administrative functions of NASA as an Agency

**Catalogs:** This category points to external NASA catalogs on data.gov

We welcome public input on how to make this site better and encourage everyone to help us identify additional high-value datasets to add to the directory. Most importantly, by providing access to government data archives, we hope that citizens will be able to add value to raw data through the development of new mobile and web applications that re-use public data in innovative ways. We encourage you to explore and leverage the zettabytes of NASA raw open data and share with us what you discover and create!

### Data.gov Data Catalog

https://explore.data.gov/Other/Data-...alog/pyv4-fkgv (XLS)

An interactive dataset containing the metadata for the Data.gov raw datasets and tools catalogs.

### NASA

**Source:** [https://explore.data.gov/catalog/raw...Administration](https://explore.data.gov/catalog/raw...Administration)

<table>
<thead>
<tr>
<th>Name</th>
<th>Popularity</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Surface Temperature at Night</td>
<td>2,692 views</td>
<td>Science and Technology National Aeronautics and Space Administration, ...</td>
</tr>
</tbody>
</table>
| MODIS (or Moderate Resolution Imaging Spectroradiometer) is a key instrument aboard the Terra (EOS AM) and Aqua (EOS PM) satellites. Terra's orbit around the Earth is timed so that it passes from north to south across the equator in the morning, while Aqua passes south to north over the equator in the afternoon. Terra MODIS and Aqua MODIS are viewing the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths (see MODIS Technical Specifications). This map shows the temperature of Earth's lands during the nighttime. Temperature is a measure of how warm or cold an object is. During the day, the Sun's rays warm Earth's lands. At night, the lands typically cool off. Landscapes cool off at night because they release their warmth to air above while they are no longer receiving sunlight. Scientists can measure the temperature of Earth's lands from space using instruments carried on satellites. Scientists want to know the land's temperature for many important reasons. For example, in places where it is too hot or too cold food crops may die. Temperature also influences weather and climate patterns. So, mapping the temperature of Earth's lands helps scientists to better understand our world. The colors on these maps represent temperature patterns of the top millimeter (or skin) of the land surface including bare land, snow or ice cover, urban areas, and cropland or forest canopy as observed by MODIS in clear-sky conditions for the time period indicated. Yellow shows the warmest temperatures (up to 45°C) and light blue shows the coldest temperatures (down to -25°C). Black means "no data."
| https://explore.data.gov/download/dg3h-giyg/KML (KML) |

Updated: Fri, 18 Sep 2015 23:17:25 GMT
Powered by MindTouch
On Earth Science and Technology Goddard Space Flight Center, biology, oceans, ...

MODIS (or Moderate Resolution Imaging Spectroradiometer) is a key instrument aboard the Terra (EOS AM) and Aqua (EOS PM) satellites. Terra's orbit around the Earth is timed so that it passes from north to south across the equator in the morning, while Aqua passes south to north over the equator in the afternoon. Terra MODIS and Aqua MODIS are viewing the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths (see MODIS Technical Specifications). These data will improve our understanding of global dynamics and processes occurring on the land, in the oceans, and in the lower atmosphere. MODIS is playing a vital role in the development of validated, global, interactive Earth system models able to predict global change accurately enough to assist policy makers in making sound decisions concerning the protection of our environment.

https://explore.data.gov/download/wgr9-dymw/KML (KML)
3. Tropical surface current velocities (HOLD) Broken Link! Science and Technology currents, oceans, climate, JPL, ..., These data are estimates of the horizontal near-surface currents of the Tropical Pacific ocean, from October 1992 to current. https://explore.data.gov/download/4867-iiet/CSV

Showing 3 of 3

Directory

NASA Thesaurus View

Source: http://www.sti.nasa.gov/sti-tools/#thesaurus

The NASA Thesaurus contains the authorized NASA subject terms used to index and retrieve materials in the NASA Aeronautics and Space Database (NA&SD) and NASA Technical Reports Server (NTRS). The scope of this controlled vocabulary includes not only aerospace engineering, but all supporting areas of engineering and physics, the natural space sciences (astronomy, astrophysics, planetary science), Earth sciences, and the biological sciences. The NASA Thesaurus contains over 18,400 subject terms, 4,300 definitions, and more than 4,500 USE cross references.

The Thesaurus is available in multiple formats, including PDF, RDF/SKOS, RDF/OWL, ZThes-1.0, and CSV/TXT (CSV)

MY NOTE: THIS was not useful!

Venus Crater Database View

http://www.lpi.usra.edu/resources/vc/vchome.html

This web page leads to a database of images and information about the 900 or so impact craters on the surface of Venus by diameter, latitude, and name.

Venus Crater Database

Source: http://www.lpi.usra.edu/resources/vc/vchome.html

At right: Radar image of Venus colored by topography. See larger version.

This web page leads to a database of images and information about the 900 or so impact craters on the surface of Venus. The database was compiled by Robert Herrick (herrick@lpi.usra.edu). Please read the README file if you are going to use the database extensively. It has descriptions, references, acknowledgements and caveats regarding the database. If you use the database for research, I do ask that you reference the appropriate work as described in the README file. If you find an obvious error, please let me know about it. The database and its description can be downloaded in various formats (see below).

Accessing the Database

• Craters by Image Map
• Craters by Descending Diameter
• Craters by Descending Latitude
• Craters by Name
• Multi-floored craters and crater fields by Descending Diameter

Ringed craters by Descending Diameter

Downloading the Database

• Description of database: HTML Ascii Text MS Word Applix StarOffice
• Explanation of entries in database: HTML Ascii Text MS Word Applix StarOffice
• Discrepancies with other databases: Ascii Text MS Excel Applix StarOffice
• All three "sheets" of database in one file: Excel MY NOTE: Downloaded and Cleaned Up This File (Excel) Applix StarOffice
• Main database: Tab-delimited text Excel Applix StarOffice
• Database of multi-ringed craters: Tab-delimited text Excel Applix StarOffice

Database of multiple impacts (formed by incoming meteoroid breaking and separating in atmosphere): Tab-delimited text Excel Applix StarOffice

Hot links to other crater databases

• USGS database compiled by Gerald G. Schaber

README file for Release 3 of the Venus Crater Database ("release3.**")

Source: http://www.lpi.usra.edu/resources/vc/README.html

This is the 3rd release of a database of Venusian craters. You have your choice of 4 file formats: StarOffice, Applix, Excel, or tab-delimited text. The first row gives detailed column headings, and the third row gives symbols for the column headings. **There is an accompanying document called "entries.**" that gives details on the entries in the database. MY NOTE: See Below

Many people have had input into this database at one time or another and the resulting product has benefited from their input. Among them are: Roger Phillips, Buck Sharpton, Noam Izenberg, Maribeth Price, Nori Namiki, Bob Grimm, Nick Stacy, Gerry Schaber, Jeff Plaut, and Sasha Basilevsky.

For further information regarding this database please contact Robert Herrick at the Lunar and Planetary Institute, herrick@lpi.usra.edu.

Appropriate References

The original version of the database (release 1) was used for an article by Robert R. Herrick and Roger J. Phillips (1994, Implications of a global survey of Venusian impact craters, Icarus, v. 111, 387-416).


Other Available Crater Databases for Venus

This does not represent the only database of impact craters for Venus. Others are found in the following:


A more detailed listing of parabolic features is in Campbell et al. (1992, JGR, v. 97, 16,249). The parabolic features listed in our database are a subset of those in Campbell et al. We have only included those that are undisputable parabolic features, that are obviously related to the crater, and that show up clearly in the SAR imagery.

A database of emissivity features associated with craters can be found at Lawson and Plaut (1994, LPSC XXV, 781-782).


Another data set of ring spacing is Alexopoulos and McKinnon (1994, Large Meteorite Impacts and Planetary Evolution, GSA Spec. Paper 293, p. 29). Their measurements are quite similar to ours where the databases overlap, but they have classified many craters as peak ring craters that we classified as multiple peaks.

A data set of craters on tessera terrain can be found in Gilmore et al. (1997, JGR, v. 102, 13,357). That paper has very specific guidelines for defining the terrain for a crater location that involve classifying only the terrain superposed by the rim of the crater. In the database I present here the terrain classification is a description of the prominent terrain type in the general area surrounding the crater.

A very different view from mine of volcanic embayment of craters is presented in Collins et al. (1999, JGR, v. 104, 24,121), and that paper contains their database of volcanically embayed craters.

Entities

Source: http://www.lpi.usra.edu/venus/craters/entries.html

Revisions from previous version
The correct and final IAU names are listed for all craters.

I reconciled the database with other existing crater databases and I list discrepancies.

I removed some of the entries that I thought were either not useful or too difficult to consistently categorize.

I updated the database to correct errors and to include craters missed in previous version.

**Entries in Main Database**

Below I summarize measurements made on each crater in the database. Parentheses indicate notation used in tables. In the tables, blank entries indicate that not enough data was available to make the measurement. An "x" as an entry indicates the feature does not exist or cannot be measured. All distance and location measurements were made with digital images at C1-MIDR resolution (225 m/pixel). The minimum possible error of any distance measurement is therefore 122.5 m. However, the choice of endpoints for a particular measurement is subjective, and the repeatability of this choice dictates the true error in a measurement. To assess this I repeated the analysis several times for a subsample of the database and then found the standard deviation for each measurement type. If the error was constant with increasing crater diameter then we give the absolute average standard deviation below. However, some measurements had errors that systematically increased with increasing crater diameter, so that it is more appropriate to give the average percentage deviation.

Reference number (#). For reference purposes, each crater is assigned a different number.

Name. Official IAU name.

Latitude (Lat) of crater center. Error is ± 0.05°.

Longitude (Lon) of crater center. Error is ± 0.05°.

Rim-to-rim diameter (D). Value is diameter of a circle with an area equivalent to the crater's. I measured the area digitally by outlining the rim and counting the number of enclosed pixels. For craters with terracing, the rim is defined by the outermost boundary of the observable terraces. Most previous studies on other planets were made with photographic products rather than digital data, and typically involved measuring diameter using a set of rim-to-rim measurements or by fitting circle templates to the craters. In most cases the end result is nearly the same. Error is ± 2%.

For crater fields, the equivalent single crater diameter (SD) entry of the multiple impacts database is used for D.

Confidence level (Co) that structure is an impact crater. Possible values are 1 (almost certain, 80 to 100% confidence), 2 (probable, 30% to 80% confidence), and 3 (cannot be ruled out as an impact structure, <30% confidence). Confidence levels are subjective, but are generally based on the presence or absence of such features as "hummocky" ejecta, well-defined ejecta deposits, rough walls, terracing (larger craters only), and a central peak or peak ring (larger craters only). Volcanic structures, the features most often confused with impact craters, usually are steep-sided, have smooth inner walls, and have smaller, less complete (if any) ejecta deposits than impact craters.

Elevation (Ev) of surrounding terrain. Made by taking 4-point average of global topography data (5 km/pixel sampling) located 3 diameters away from the crater center.
Crater density at a crater's location (Rho). Value is the density of craters in the neighborhood of the specified crater. This is calculated by counting the number of craters (including the specified crater) within a 1000 km radius circle, and normalizing to give the number of craters per $1 \times 10^6 \text{ km}^2$.

Twenty-five pixel averages of the DN values (an 8 bit, unsigned integer for each pixel in the SAR image) of a representative location on the crater floor (dni) and a location in the terrain surrounding the crater (dno). A representative location in the crater floor is similar in brightness to the majority of the crater floor. A representative location in the terrain surrounding the crater is a piece of terrain near the crater that is similar in character to the terrain that the crater formed on but that is unaffected by the crater. Within the crater we chose a piece of floor that appeared to be similar in brightness to the majority of the floor material. The difference between these values (dnd) gives an estimate of the relative radar brightness of the crater interior. Individual DN values can be converted to radar cross section in decibels by the formula

$$
\text{The average DN is the average of the logarithm of the backscatter at each pixel location. This calculation was only made for craters > 16 km in diameter.}
$$

Maximum distance of radar-bright continuous ejecta (Ce) from the rim. This does not include ejecta that was obviously emplaced as long run-out flows. Error is $\pm 0.9$ km.

Maximum distance from rim of all flow units (Fl) extending from the ejecta blanket. Error is $\pm 0.3$ km.

Approximate diameter of dark halo (Dh) surrounding crater. Error is $\pm 5\%$.

Completeness of ejecta deposits (Ec) around the rim as a fraction of 1. Error is $\pm 0.05$.

Completeness of the rim (Rc) as a fraction of 1. Error is $\pm 0.05$.

Planform of the crater rim (Pl): (c)circular, (e)longate, (i)regular, and (p)olygonal

Morphologic class (Mo) : (1) bowl-shaped; (2) knobby base; (3) central peak; (4) multiple peaks; (5) peak rings; (6) multiple rings; and (0) indistinguishable flat-floored feature, albedo line, etc.

Central structure diameter (Cd). Value is actually diameter of a circle with an area equivalent to that encompassing any central structure; measured in the same manner as rim-to-rim diameter. Previous studies have measured peak ring diameter by fitting a circle to the peaks of the ring massif (e.g., Pike and Spudis 1987, EM &P, v. 39, 129). For the sake of interplanetary comparisons in the text we also used this older technique to measure peak ring diameters for single- and double-ring basins. Peak ring diameters using this second technique are in the separate sheet. Error for central peak or peak ring diameter using the equivalent area technique is $\pm 6\%$. Error for peak ring diameter using the circle-fitting technique is $\pm 1.7$ km.

Wall (Wa) terracing. Denotes whether the wall appears (u)nterraced or (t)erraced at C1-MIDR resolution.

Wall width (Ww) (Fig. 10). To minimize distortion resulting from SAR effects, horizontal distance from rim to floor was measured in the N - S direction. If no clear break between wall and floor could be discerned, this measurement was not made. Error is $\pm 10\%$. 

http://semanticommunity.info/Data_Science/NASA_Big_Data

Updated: Fri, 18 Sep 2015 23:17:25 GMT

Powered by mindtouch
Multiples (Mu). Impact event is classified as either a (s)ingle crater, one with (m)ultiple floors and a single rim, or a (f)ield of craters.

Floor reflectivity (Fr). In qualitative terms, does the floor appear (b)right, (i)ntermediate or (d)ark.

Parabolic feature (Pf) associated with crater -- yes, no, maybe. We used only definitely parabolic features in SAR images that could not be attributed to processes other than crater formation.

Apparent projectile direction of travel (Pd). A qualitative assessment based on crater shape and orientation of ejecta deposits.

Multiple asteroid (Ma). A few impact craters are unusually close together, but too large and too far apart to be from a single impactor. These are assumed to be the result of binary (or more) asteroids (or comets) striking simultaneously. The individual craters of these events are listed separately, but are linked by an identical number in this column.

Terrain type that crater lies on: undistinguished plains (p), fractured plains (pf), Lakshmi planum (lp), tessera and mountain belts (t), corona (c), volcanic regions (v), ridge belt (r), and rift (ri).

Interior flat floor (If) -- yes, no, maybe. The crater floor has an areally extensive flat surface as if emplaced by a fluid that then cooled in situ, without obvious breaching or overflowing of the rim by exterior processes.

Embayment and/or filling of crater or its ejecta blanket by obviously exterior processes (Ee) -- yes, no, maybe.

Tectonic deformation (T) of crater by exterior processes -- yes, no, maybe.

Degradation state (De) as defined in Basilevsky et al. (1987, JGR v.92, 12,869): (1) pristine, apparently intact ejecta deposits; (2) degraded, small amount of ejecta; and (3) highly degraded, can barely tell it's a crater.

Entries in Multiple Impacts Database

Some entries are taken directly from the main database. See above for descriptions of Name, Lat, Lon, Co, Mo, and Mu. The other entries are as follows, and were only measured for Confidence Level (Co) 1 and 2 craters:

Diameter (D). An equivalent diameter of the entire area encompassed by the multiple-floored crater or crater field. Measured as D is for the main database. NOTE: For crater fields, the equivalent single crater diameter (SD) is used for D in the main database and the HTML version of the Multiple Impacts database.

Properties (Pr). Properties of the ejecta blanket and shape of the crater(s) indicative of impact angle: (1) asymmetric ejecta blanket (45-60 degrees), (2) missing ejecta uprange (30-45 deg.), (3) partially missing ejecta downrange (15-30 deg.), (4) butterfly ejecta pattern (0-15 deg.), (5) steepening of crater walls uprange (15-30 deg.), (6) elongate crater shape (0-15 deg.), (7) ricochet fragments (0-15 deg.), and (8) single ricochet crater (0-15 deg.). Classification based primarily on Gault and Wedekind (1978, Proc. LPSC 9, 3843).

Impact angle (Ia). Based on properties of the ejecta blanket and crater shape, Impact angle is assessed in 15 degree increments: (1) 0-15 deg., (2) 15-30 deg., (3) 30-45 deg., (4) 45-60 deg., (5) > 60 deg..
Largest crater's diameter (Ld) and other craters' diameters (2-6).

Equivalent single crater diameter (SD). Using the diameters of the individual craters and a simple crater scaling law, calculates the equivalent diameter crater that would have been produced had the incoming meteoroid not broken apart.

Maximum downrange separation (Md) of craters.

Maximum crossrange separation (Mx) of craters.

Maximum total separation (Mt) of craters.

Number of crater farthest downrange (Dr).

Number of crater farthest from the largest crater (Cf).

Diameter of crater farthest from the largest crater (Fd).

Entries in Rings Database

This database lists the measurements of ring diameters for peak-ring craters and multi-ring basins. Ring diameters are measured from the diameter of the best-fit circle that runs along the rim crest of craters. As described in the main database, we also measure the area encompassing the central structure and calculate an equivalent diameter (Cd).

NASA Open Government Plan

Source: http://open.nasa.gov/plan/print

Version 2.0

Executive Summary

Source: http://open.nasa.gov/plan/executive-summary/

NASA is committed to the Open Government Initiative. Building on our founding legislation in 1958 which directed NASA to “…provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof,” we continue to take a focused approach to expanding the level of openness within the Agency. This same legislation directed NASA to “…arrange for participation of the scientific community…” as part of our mission; we recognize this as a constantly evolving task to collaborate in ways not yet imagined at the Agency’s inception. Our Plan
reflects the success stories and lessons learned from living out the principles of Open Government embedded in NASA’s operations and culture for more than half a century. Included in the Plan is a Flagship Initiative, three additional major initiatives, ten highlighted activities and a directory of more than 100 additional Agency activities that exemplify the Open Government Directive at NASA. The initiatives and activities in this Plan highlight specific efforts at NASA that meet and, in many cases, exceed the requirements of the Open Government Directive. Our Flagship Initiative for nasa.gov defines the intersection of NASA’s policy, technology, and culture, acting as a catalyst for openness inside and outside of the Agency.

NASA has identified activities and success stories that embody values of transparency, participation, and collaboration and seeks to build upon them. Open Government principles are already evident in numerous activities underway throughout the Agency; therefore, this revision of the Plan captures these activities in one place for the benefit of all.

The revised Plan will be entirely online, creating a platform where activity owners may update their activities according to their own timeline, where site visitors can comment and interact, and where other applicable articles and sites can be interconnected and cross-linked. The online platform will also permit Portable Data Format (PDF) snapshots of the current content at any time.

The revised Plan will continue to be guided by a strong multi-dimensional framework, addressing technology, policy, and culture, in order to meet the Agency’s mission, vision, values, and goals. It reflects the Agency’s ongoing commitment to its original five guiding principles from version 1.0 of the NASA Open Government Plan:

1. Increase Agency transparency and accountability to external stakeholders
2. Enable citizen participation in the NASA mission
3. Improve internal NASA collaboration and innovation
4. Encourage partnerships capable of creating economic opportunity
5. Institutionalize Open Government philosophies and practices at NASA

The Plan is based on a perspective of continuous learning; integration of policy, technology, and culture; and the rapidly changing external environment. We believe that integrating Open Government Principles into existing systems (e.g., governance councils and performance management system) provides the best framework for success.

The Open Government Directive calls on NASA to do what it does best—innovate. In our history, we have achieved seemingly impossible goals, from reaching the Moon to advancing fundamental knowledge about our place in the universe. In the past we would create the technologies to achieve these goals through internal teams and collaborations. NASA must now innovate on how we innovate, focusing on technologies that advance humanity into space while more directly involving citizens and public-private partnerships. The Open Government Directive also calls on us to become a twenty-first-century space program for a twenty-first-century democracy.

Introduction

To reach for new heights and reveal the unknown
so that what we do and learn will benefit all humankind.

It has been over two years since NASA released the first version of its Open Government Plan. The first Plan represented a bold step toward becoming an even more transparent, participatory and collaborative agency and
included 147 goals across 22 organizations at NASA. Admittedly, the goals we set out to achieve were difficult – we are proud that we accomplished an enormous amount of what we set out to do!

As we move forward, the revised Plan is an opportunity to build on what we have learned during the implementation of the first two years of the Initiative. The framework of NASA’s new Plan remains the same, but the many activities associated with the Plan will change. As we close out our first three Flagship Initiatives, we will introduce a new Flagship Initiative that focuses our resources on creating an accessible, participatory and transparent web environment based on open and interoperable standards. This effort will provide a new Agency-wide capability to create, maintain, and manage the nasa.gov web environment and associated services which represent what Open Government at its best can and should be. In addition to the Flagship, we will expand our Open Data and Open Source efforts, and add a new category of activities called “Technology Accelerators.” These key efforts collectively represent NASA’s commitment to engaging citizens in the space exploration and aeronautics mission.

As openness becomes even more pervasive throughout the Agency’s culture, both at the organizational and individual levels, we recognize the unique challenge we have in collecting the widespread activities and success stories related to Open Government at NASA. Accordingly, we have updated our Plan with this in mind and have created a new directory of participatory, collaborative and transparent activities that represents how Open Government continues to evolve at NASA.

Overall, the NASA Open Government Plan provides a strong multi-dimensional framework of technology, policy, and culture, creating new and leveraging existing platforms for transparency, participation, and collaboration – all to better support the Agency’s mission to pioneer the future. The updated Plan represents our latest efforts in working together – with YOU – to enable us all to reach for new heights and reveal the unknown.

Welcome

Dear Friends and Family of NASA,

It has been two years since we released the first version of NASA’s Open Government Plan. Since that time, we have been hard at work implementing the original Plan with the ultimate goal of embedding Open Government principles deeper into all levels of our organization. Today, as a direct result of the Open Government Initiative, NASA is an even more transparent, participatory and collaborative agency.

NASA continues to embrace the Open Government challenge. With the release of the second version of our Plan, we are building on the successes and lessons learned and thinking about the next generation of Open Government. The framework of NASA’s Plan will remain the same, but the many activities associated with our Plan will change. We will also continue to evolve and experiment with new ways of partnering with the public.

As we noted in the first version of the Plan, the adoption of new technology, protocols, procedures, and policy takes time. However, we continue to believe that the Open Government Initiative is an opportunity to strengthen NASA, and in turn, strengthen democracy. With this in mind, the second version of our Plan aims to particularly focus on opportunities for participation.

This is important work that cannot be accomplished without you. We hope you will join us!
Openness Overview: Part of NASA’s DNA

NASA’s founding legislation, the National Aeronautics and Space Act of 1958, addresses the role NASA should play in ensuring the general welfare of the United States, with language directly applicable to the principles of Open Government:

Sec. 203. (a) The Administration, in order to carry out the purpose of this Act, shall—
(1) plan, direct, and conduct aeronautical and space activities;
(2) arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations;
(3) provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof;
(4) seek and encourage, to the maximum extent possible, the fullest commercial use of space; and
(5) encourage and provide for Federal Government use of commercially provided space services and hardware, consistent with the requirements of the Federal Government.
— NASA Space Act (as Amended), Section 203

As the Space Act articulates, there is a strong linkage between transparency, dissemination of information, and the commercial uses of space (or economic development). For more than a half-century, we have created policies and processes to carry out our legislated mission.

Examples include:

- The availability of raw science data archived by all NASA missions, for open use.
- Inclusion of the international scientific community in road mapping and strategic planning, mainly through the National Academies of Science and other working groups.
- Use of full and open competition, including NASA centers, academia, and industry, to implement activities that help fulfill mission requirements.

Examples are given in more detail in the sections about specific initiatives.

Openness is fostered from the organizational level to the level of individual employees. Our employees have incentives and sometimes even requirements to be open and collaborative, and leadership development training promotes a culture of openness and collaboration at every level. Each leadership level requires competencies in communication and advocacy, knowledge management, and customer, stakeholder, and partner relationships. For NASA’s science community, publishing research is often required for career advancement within the Agency.
Finally, we continue to employ many approaches to operations that already embody transparency, participation, and collaboration, such as:

- Strategic planning with external stakeholders.
- Employing collaboration tools to improve communication with our scientific and technological communities.
- Seeking partnerships for mission success.

**Framework for Open Government**

NASA is a community of scientists, engineers, and other professionals who explore the Earth and space for the benefit of humankind. As we uncover increasing knowledge about the universe and solve difficult engineering challenges, we are continuously experimenting in labs, workshops, and offices. We gather and analyze information about our universe, requiring perseverance and creativity to solve unique challenges. Unlocking the complex systems of the cosmos does not come with an operating manual. Instead, we create hypotheses, conduct experiments, and refine our mental models and conceptual frameworks based on evidence and experience.

Open Government presents similar challenges as we work to improve our performance and responsiveness to the Open Government Directive. Accordingly, the NASA Open Government Plan is not a manual. By recognizing current initiatives that exemplify the values of Open Government, this Plan is intended as a model for change throughout the Agency. Applauding these successes creates a social incentive for our workforce to innovate, encouraging them to continue looking for ways to be more efficient, to further enhance our relationships with existing stakeholders, and to create new partnerships. The guidance contained in the Open Government Directive creates cultural and procedural opportunities for new initiatives, including those described here. We believe that this is a continuous learning process, and thus have chosen to couch our Open Government efforts as a framework in which to experiment and learn over time.

The Open Government framework strives to be multi-dimensional in its approach, addressing technology, policy, and culture. When all three of these tenets are targeted for improvement, greater possibilities present themselves and momentum builds.

The Open Government Initiative is a movement within government to adapt to the changing external environment, embrace new technologies, engage with our citizens, and encourage collaborations and partnerships. This is the result of the government recognizing that we can be more relevant for our stakeholders and intentionally create a culture of openness as we evolve into a twenty-first century democracy. At NASA, we are in the midst of a massive change ourselves. The external environment of the aeronautics and space sector is undergoing a shift in how business is conducted, and the core of NASA’s strategy for extending humanity into the solar system recognizes the ingenuity of citizens as a rich resource to develop more capable and innovative technologies and to create a thriving commercial space sector.

The Open Government Initiative provides a perspective to ensure that we are open in our processes, we generate data products of utility for the space sector, and we enter into partnerships across the US government, with industry, other nations, and the public.

**Cross-cutting Objectives**

NASA has developed the following five principles to guide its efforts to integrate Open Government into the Agency:
1. Increase Agency transparency and accountability to external stakeholders.
2. Enable citizen participation in NASA’s mission.
3. Improve internal NASA collaboration and innovation.
4. Encourage partnerships that can create economic opportunity.
5. Institutionalize Open Government philosophies and practices at NASA.

These are directly aligned with the Plan components articulated in the Open Government Directive. As stated earlier, there is no prescribed way to be an Open Government agency. We believe it is the responsibility of each office, program, and employee to make this vision become a reality.

Conclusion

Open Government principles are already evident in many activities underway throughout NASA. Through the Open Government Initiative, we continue the dialogue across the Agency on how to infuse Open Government principles into even more of our daily operations. These conversations allow us to see new opportunities to strive for greater transparency, participation, and collaboration as our strategic directions focus on the opportunities for the twenty-first century and beyond.

Our approach has been to find the activities and anecdotal successes that embody values of openness, participation, and collaboration so that we can celebrate and build upon them. In this update of our Plan, we aim to collect the result of these conversations in the directory of participatory, collaborative and transparent activities.

The underlying motivation behind the Open Government Initiative marks a shift in the way we interact with the public and conduct information resource management. As such, we will face inevitable challenges as we transition from the current state of operations to the Agency-wide adoption of policies and tools designed to increase transparency and enhance collaboration both internally and externally. We recognize the need to understand and plan for such challenges in order to sustain Open Government practices throughout NASA.

No one is an expert in Open Government. We are taking an experimental approach to Open Government, and we recognize the long-term nature of this movement. Finally, we believe that the Flagship Initiative we have chosen is a key catalyst for change. All these efforts will transform NASA into an even more transparent, participatory, and collaborative Agency and ease our transition into a twenty-first-century (and beyond) space program.

Flagship Initiative

NASA Web Environment

NASA’s web environment is well known for providing an unparalleled wealth of information to the public and is critical in fulfilling the agency’s statutory requirement to disseminate information about its programs “to the widest extent practicable.” To external audiences, NASA’s Web capabilities provide direct access to agency programs and information, allowing them to participate in the excitement of research and exploration. Internally, NASA personnel use web sites and services to support NASA’s core business, scientific, research, and computational activities.
The first NASA web sites appeared in the early 1990s, and the Agency’s primary site, NASA.gov, has evolved since then through four major iterations. The most recent version of the public website represented a big step for the Agency in becoming more collaborative, participatory and transparent through the adoption of a variety of social features. Today, the main portal, NASA.gov, is the main touch point for millions of people around the world regarding the agency’s space exploration and aeronautics mission and attracts 600,000 unique visitors per day. The NASA portal alone generates more than 140,000,000 visits a year. NASA.gov also currently serves as a hub for NASA’s social media presence which includes over 250+ accounts across social media sites such as Twitter, Facebook, Flickr, Foursquare, Google+, YouTube, UStream, and Slideshare.

NASA.gov is only one part of NASA’s entire website infrastructure. The current infrastructure provides development and hosting of approximately 140 internal and external web applications and websites, which are developed using various technology stacks. Our external audience includes not only the interested public, media, students, and educators, but also researchers, industry partners and government partners. As NASA continues to adapt to today’s complex, interlinked and fast-changing environment, NASA recognizes that effectively and efficiently creating, researching, managing, preserving, protecting, and disseminating the information required to achieve the objectives of research and space exploration, as well as other NASA missions, is vital to its continued mission success.

As the Flagship Initiative for the second version of NASA’s Open Government Plan, the Agency will take a fresh look at its web architecture and processes to manage content in order build an accessible, participatory and transparent web environment based on open and interoperable standards. This effort will provide a new Agency-wide capability to create, maintain, and manage the nasa.gov websites and associated services. The Agency will aim to leverage open source software, as well as cloud computing technologies, and take an integrated approach to search, video, and social media. The goal of this effort will be to provide a consistent, capable and agile, cloud-based enterprise infrastructure that provides a Platform as a Service (PaaS) and Software as a Service (SaaS) supported Infrastructure as a Service (IaaS) for internal and external web applications and a majority of the 1590 external websites using an interoperable, standards-based and secure environment.

Our hope is that NASA.gov will continue to represent the latest in online innovation and serve as an example of how NASA is rethinking the way its services are delivered online. The new architecture aims to keep NASA relevant across all audiences by creating a flexible platform that can respond to rapidly changing technologies and citizens’ expectations.

Specifically, the new architecture will:

- Strive for vendor independence through the use of Commercial Off-The-Shelf (COTS) Technology with a preference for Open Source, Government Off-The-Shelf (GOTS) Technology, and then proprietary solutions over custom-built solutions. This includes cloud offerings.
- Utilize open standards based solutions over closed proprietary solutions.
- Strive to deliver business value through the use of incremental, iterative development processes.
- Liberate NASA data and content through published API’s and functional interfaces.
- Develop applications that are capable of migrating to the cloud

Initiative Goals:

- Release an RFP for NASA’s information technology services (1 year)
• Begin a pilot activity to demonstrate the capability of an Open Source Software Content Management System (1 year)
• Consolidate multiple blogging infrastructures to an Open Source Software Content Management System (1 year)
• Transition NASA.gov’s current proprietary content management system to a new open platform. (1 year)
• Develop an API for NASA.gov public content (1 year)
• Migrate other NASA websites into new web infrastructure (2 years)

Major Initiatives

Prizes and Challenges

As an early adopter of challenge approaches, NASA continues to offer diverse opportunities for citizen participation in meeting technology needs – promoting public involvement and awareness of the United States space program while creating an environment where one person can make a substantial difference. These models are inherently participatory, as large and diverse communities of solvers around the world may pose a potential solution to a challenge. Depending on the type of need, solvers may collaborate on a solution or establish a partnership with NASA to develop the proposed deliverable. This process facilitates cross-discipline synergies, and provides NASA with the opportunity to supplement its internal expertise with a broad community of experts it otherwise would not be able to access.

NASA will continue its Centennial Challenges Program with the recent announcement of new challenges. In addition, NASA has established a new position, the Prizes & Design Challenges Executive, to coordinate, monitor and evaluate the agency’s prizes and design challenges. The official in this new position reports to the Office of Chief Technologist (OCT), and provides Agency-wide strategic leadership and representation within government-wide “community of practice” working groups as identified in the Executive Office of the President’s memorandum providing “Guidance on the Use of Challenges and Prizes to Promote Open Government.”

Centennial Challenges

In September 2011, NASA awarded the largest prize in aviation history with the Green Flight Centennial Challenge ($1.35m for first place). Created to inspire the development of more fuel-efficient aircraft and spark the start of a new electric airplane industry, the first and second place teams achieved twice the fuel efficiency required in the competition, flying 200 miles using just over a half-gallon of fuel equivalent per passenger. For 2012 and beyond, OCT announced the following challenges as a part of their Centennial Challenges Program: Nano Satellite Challenge, Night Rover Challenge, and Sample Return Robot.

Activity goal:

Launch of 2 challenges over the next fiscal year. (1 year)
NASA Tournament Lab

NASA has partnered with Harvard Business School and TopCoder to create the NASA Tournament Lab (NTL), which will enable a community of coders to compete amongst each other to create the most innovative, most efficient, and most optimized solutions for specific, real-world challenges being faced by NASA researchers.

The NTL provides an online virtual facility for NASA researchers with a computational or complex data processing challenge to post ideas for potential algorithmic or software development challenges. These ideas can then be discussed, refined, and voted upon by peers. Chosen problems will be converted into problem statements and run as competitions within the NTL community. Software developers, algorithmists, and mathematicians will compete with each other to create a winning solution, as measured by internal code quality, performance against benchmarks, and the ability to be integrated into NASA systems.

Activity goal:

Completion of twenty challenge tournaments over next 2 years. (2 years)

Open Innovation Service Providers

NASA Innovation Pavilion

NASA has partnered with InnoCentive to provide the public with the opportunity to solve difficult challenges facing the U.S. space program through the use of crowdsourcing methodologies. Solutions to the challenges on the NASA Innovation Pavilion will not only benefit space exploration, but may also further the development of commercial products and services in other industries. Posted challenges attract thousands of potential solvers from many different countries. The open innovation challenges aid NASA’s efforts to become a more transparent Agency while also diversifying the number of potential external collaborators for NASA. This model is inherently participatory, as large and diverse communities of solvers around the world may pose a potential solution to a NASA challenge.

Technology Scout/Consortium

Unlike the crowdsourcing methodology, the technology scout approach employs a strategy that is focused on specific technological needs that require partnerships or consortiums of experts to help develop solutions or technologies instead of a developed solution. Similar to the crowdsourcing approach, the technology scout identifies potential partnerships from across the globe extending NASA’s technological reach and access to previously untapped solution spaces.

Activity goals:

• Completion of 3 Innovation Pavilion challenges. (1 year)
• Completion of 3 technology needs via consortium. (1 year)

NASA@Work

Based on the success of the external open innovation service provider programs, an internal crowdsourcing program entitled NASA@work was initiated. NASA@work is a web-based platform supported and developed by InnoCentive. Unlike external crowdsourcing, the objective of an internal crowdsourcing based platform, such as NASA@work, is to
leverage the breadth and depth of the expertise already present within the organization. NASA includes an extensive number of experts that are not only discipline diverse but are also geographically dispersed. This presents a challenge for NASA, specifically with being able to fully utilize its workforce and its resources across 10 centers agency-wide. The objective of the NASA@work is to connect the collective knowledge of individuals from all areas within the NASA organization via a private web based environment. The platform provides a venue for NASA Challenge Owners, those looking for solutions or new ideas, to pose challenges to internal solvers, those within NASA with the skill and desire to create solutions.

**Activity goal:**

Completion of 12 internal challenges within the next year. (1 year)

**Citizen Science**

Science Mission Directorate’s citizen engagement focus will utilize online platforms such as social media, live-streaming, and blogging to enable citizen participation in a variety of initiatives, including Earth Science Airborne campaigns, the Venus Transit, SOFIA Airborne Ambassadors and Kepler’s search for earth-like planets. Citizen scientists have helped answer serious scientific questions, provided vital data to the astronomical community, and discovered thousands of objects including nebulas, supernovas, and gamma ray bursts. These efforts will engage the public at the intersection of science and technology to encourage better solutions, broader scientific applications of NASA data, and enhanced STEM educational opportunities.

Current activities include:

**GLOBE at Night**

Calling all Earthlings! Take a few minutes to get involved in the GLOBE at Night campaign to preserve dark skies! GLOBE at Night is a citizen-science campaign open to people all over the world to raise awareness of the impact of light pollution by inviting citizen-scientists to measure their night sky brightness and report their observations to a website from a computer or smart phone. Light pollution threatens not only our “right to starlight”, but can affect energy consumption, wildlife and health. Through 2011, people in 115 countries contributed 66,000 measurements, making GLOBE at Night one of the most successful light pollution awareness campaigns to date. Please join us to participate in the 2012 campaign an hour after sunset till about 10pm April 11 through 20. For information and resources, visit us at [http://www.globeatnight.org](http://www.globeatnight.org).

**HiWISH**

You can help decide where the Mars Reconnaissance Orbiter will point its camera, HiRISE, next! Suggest a new target or browse the targets already in our database, including those for past HiRISE images. [Where should HiRISE take a picture?](http://semanticommunity.info/Data_Science/NASA_Big_Data)
Lunar Impact Observations

NASA needs your help to monitor the rates and sizes of large meteoroids striking the moon’s dark side. This data will help engineers design lunar spacecraft, habitats, vehicles and extra-vehicular activity (EVA) suits to protect human explorers from the stresses of the lunar environment.

My NASA Data

Mentoring and inquiry using NASAData for Atmospheric and earth science for Teachers and Amateurs (MY NASA DATA) is an activity to enable K-12 teachers and students, as well as citizen scientists, to explore the large volumes of data that NASA collects about the Earth from space. Students use scientific inquiry and math skills as they access and display microsets of the Earth System.

Night Sky Network

Whether you’re just getting started or observe the skies at every opportunity, you’ll find helpful this list of links from NASA’s Jet Propulsion Laboratory (JPL), http://www.jpl.nasa.gov/. The website includes resources for amateurs, students and educators.

Citizen Science Software Tools

JPL’s Solar System Dynamics Group provides the following software tools for the sky observer:

- Ephemeris Generator for all bodies in the solar system including comets and asteroids.
- Small Body Orbital Elements provides the orbital elements for numbered asteroids, unnumbered asteroids and comets.
- Object Identification – Given a date, location and region of sky, find all comets and asteroids matching the constraints within the region.
- What’s Observable Tonight? – Given an observation date, location and other constraints, find all asteroids and comets that are observable on that night.

Activity goal:

Increase the number of students and citizen scientists involved in Sun-Earth Day due to the synergy among the larger Transit of Venus community, including the amateur astronomers and the Goddard Space Flight Center. (1 year)

Education Infrastructure Division

The Office of Education will create a new Infrastructure Division to implement the principles of transparency, participation, and collaboration throughout all of its education activities. The division will work to improve education policy and decision-making, provide better education services, increase accountability and ensure more effective administration.

The Office of Education Infrastructure Division (OEID) will deliver subject matter expert (SME) services for NASA Education through a systematic approach and with a unified information and technology system. These services are
interconnected structural elements that provide Education Framework support. This support facilitates, enables, sustains, and enhances informed NASA Education management and policy decision-making.

The OEID is composed of Office of Education civil servants, contractors, and grantees:

- Operations and Information Exchange Team: The Operations and Information Exchange Team serves as the first point of entry to request OEID support services. The team also provides the following direct communications, event management, and resource facilitation services to internal and external NASA education audiences.
- Information Technology Systems Team: The Information Technology (IT) Systems Team of NASA Education’s Infrastructure Division brings a diverse set of skills and expertise to manage the Office of Education agency level IT systems’. System life cycle activities include system development, implementation, and operations and sustainment activities.
- STEM Workforce Support: Learners, Educators, and Institutions Team: The STEM Workforce Support Team facilitates implementation, collaboration, and coordination across NASA’s Education Portfolio.
- Evaluation Team: The Evaluation Team of NASA Education’s Infrastructure Division brings a diverse set of skills to support all stages of education programs, from program design through implementation and assessment of outcomes.

Activity goal:

The Office of Education Infrastructure Division (OEID) will complete the design and implementation of an organizational structure that employs a systematic approach to managing Information, Technology, and Communications within the Office of Education. (1 year)

Freedom of Information Act

NASA continues to improve the Agency’s FOIA program to improve the efficiency with which it provides the public access to Agency documents.

Enacted in 1966, The Freedom of Information Act (FOIA) (5 U.S.C. §552) provides an effective statutory right of access to Federal government documents. Since that time, Congress has regularly updated the original statute through legislative amendments. In 2007, Congress passed the OPEN Government Act, addressing several procedural issues that concern FOIA administration. NASA’s FOIA program is in the forefront of providing the public access to Agency documents. Each of NASA’s 13 Centers maintains a FOIA Web site with contact information, information on how to submit a FOIA request, and a host of other information that may be of interest to the public.

The NASA FOIA program is placed in the Communications/Public Affairs Offices. NASA’s decentralized FOIA program consists of a Principal Agency FOIA Officer who provides operational oversight of the program on behalf of the Chief FOIA Officer and one main FOIA office located at each of the 13 FOIA Centers, including Headquarters and the OIG. Each FOIA office receives and processes FOIA requests. In 2011, all FOIA staff began using a single FOIA tracking system for cradle to grave processing of requests; ultimately eliminating redundancy and duplication of effort. Although the FOIA offices are decentralized, the FOIA staff work together and when appropriate, one office will take the lead in responding to a requester who has submitted identical requests to more than one office. This business process has streamlined the program, providing a collaborative and consistent approach when responding to requests. This process has also enabled NASA FOIA staff to efficiently reduce the FOIA processing time without compromising the integrity of the program. As an example, in 2009, NASA received 1,226 FOIA requests, processed 601, and received 22 appeals. In 2010, NASA received 1058 requests, processed 1306 and received 33 appeals. In 2011, NASA received 1027 requests,
processed 1131 request and received 21 appeals. Significantly, the Agency FOIA backlog has constantly decreased over the last three years. In 2009, the FOIA backlog was 431; in 2010 the FOIA backlog was 117; in 2011 the Agency FOIA backlog was 34.

When a NASA FOIA Office receives three requests for the same document(s), the responsive documents are typically placed in the FOIA Library at the Center where the request was processed. In addition, all NASA Centers proactively update and post documents of public interest to their websites on a regular basis, alleviating the need for requesters to submit FOIA requests for the information. NASA continues to receive accolades for the proactive efforts in providing information and communication with the public.

The FOIA has and continues to be a key administrative avenue for the public to obtain Agency documents. NASA’s pro-active disclosure and media-centric approach has allowed the public greater access to information while reducing the need to submit FOIA requests. At the same time, NASA has met and exceeded the goal to reduce the Agency FOIA backlog. NASA FOIA staff strives to achieve a top-rated citizen-centric program.

Activity goal:

NASA’s FOIA office will continue to maintain a top-rated citizen-centric program and will continue to reduce the Agency backlog. (1 year)

IT Labs

NASA is an Agency of pioneers setting the agenda for the future of global technology. When NASA is taking on new grand challenges, it is imperative to stay engaged not just in Aerospace and Engineering technologies, but the enabling Information Technologies that can so elegantly support NASA’s missions.

The Chief Information Officer’s portfolio includes a wide range of infrastructure support services. With the accelerating dynamics of technological advances, NASA’s status as a global technology leader depends on the ability to efficiently evaluate, adopt, and adapt emerging information technologies. IT Labs is an innovation incubator, soliciting ideas from the greater NASA community and enabling them to be researched as part of a rapid, low-cost, low-risk process. IT Labs shares the results with all of NASA and supports the adoption of technologies or processes that can benefit larger user populations.

Activities are limited to a small scale and relatively short evaluation period (generally 90 days to one year). In addition, IT Labs works to build partnerships with internal groups—Mission Directorates, Centers and facilities—to pool resources in the pursuit of meaningful, cutting-edge technology solutions that can better meet NASA’s needs.

IT Labs represents a significant leap from how NASA traditionally evaluates new technologies. Often, innovative efforts are either burdened by multiple layers of documentation, evaluation, and approvals; or conducted separately, often in multiple NASA centers to fulfill similar and business needs. IT Labs provides a central collection point for innovative ideas, as well as alternative lightweight, low-cost methodology for research, proofs-of-concept and prototyping as appropriate given the mission requirements. Soon, the IT Labs Web site will enable the NASA community to benefit from research results and lessons learned, as well.
IT Labs strives to keep the amount of paperwork and oversight to the necessary minimum, removing institutional inhibitors to innovation and enabling the speedy evaluation of technologies that can help government agencies meet both their enterprise requirements and their strategic goals. The process is entirely transferable, but will likely require internal stakeholders to collaborate and cooperate across traditional boundaries.

**Activity goal:**

The IT Labs program will support at least 10 early/middle-stage innovations by FY14 with the goal of moving these innovations through the technology evaluation lifecycle, then piloting at least 2 of these processes/technologies. (2 years)

**Zero Robotics**

ZeroRobotics is a national competition to program the robotic Synchronized Position Hold, Engage, Reorient, Experimental Satellites (SPHERES) satellites inside the International Space Station (ISS). Finalists will participate in a championship competition where an astronaut will conduct the game in microgravity with a live broadcast from the ISS. This activity creates opportunities for students and crewmembers to interact in an environment that will foster collaboration, technology development, and excitement about STEM education.

SPHERES-Zero-Robotics provides dozens of high school students access to the microgravity environment for experimentation and analysis. Through the program, students design software to accomplish complex tasks in space; such as docking, assembly, and formation flight for the SPHERES system, which is currently on board the International Space Station (ISS).

Each season begins with the unveiling of a game motivated by a challenging problem of interest to NASA and Massachusetts Institute of Technology (MIT). During the competition, each team must complete a set of pre-determined tasks. During all phases, the students are challenged not only with programming, but also with the development of documentation and presentations to add to their engineering and communication skills.

SPHERES-ZeroRobotics students are truly engaged in space research. Starting at the high school age group, students view working in space as normal, with the expectation that they become inspired to push the limits of space exploration, engineering, and development. Additionally, the program provides a unique and valuable opportunity to maintain students interested in STEM (Science, Technology, Engineering and Mathematics) careers; even those who do not wish to pursue space careers see their lives affected by knowing their work can have an impact beyond the classroom. The ability of the students to participate in real engineering activities, beginning in high school, potentially encourages them to remain interested in those fields. SPHERES-ZeroRobotics also builds a critical base for engineering skills in students, such as problem solving, design thought process, operations training, teamwork, and presentation skills.

**Activity goal:**

Engagement of at least 1000 high school students in each of two seasons of competition over next 2 years. (2 years)

**PhoneSat**

The PhoneSat ‘skunkworks’ activity aims to remove cost as a barrier to entry for participating in space activities, with the goal of allowing anyone with space ambitions to launch their own satellite. The DIY satellite activity uses a commercial
grade Android mobile phone and the open source Android platform, in conjunction with other commercial off the shelf (COTS) components.

**Ethos**

The project has incorporated the Silicon Valley ‘release early, release often’ mentality. This applies at several levels. At a system level, the entire architecture is evolving with time to (a) add new functionality to the satellite with succeeding iterations and (b) incorporate the latest and greatest COTS hardware. Ideally the goal would be to have a launch of a new satellite every 3-6 months. At a micro level, the team plans and executes rapid technology evolution with weekly targets and problem solving.

**PhoneSat 1.0**

PhoneSat 1.0 is a satellite with minimal basic functionality — to stay alive in space for a short period and send back health and picture data — which has been tested to and passed NASA environmental testing specifications, and yet whose parts cost amount to $3500. The core systems on the satellite are the Nexus 1 phone sold by Google, external batteries, an external radio beacon and a watchdog circuit. The latter provides simple monitoring of the systems and reboots the phone if radio packets stop being sent. These are all housed in 1-U (10x10x10cm) cubesat shell. Three copies of the satellite are built and are manifested on and awaiting a Taurus II rocket set for a summer 2012 launch.

**PhoneSat 2.0**

PhoneSat 2.0 aims to build on and supplement the capabilities of PhoneSat 1.0. The aim is to have a completely functional satellite bus. The key ingredients of which that are not in PhoneSat 1.0 are a two-way radio to be able to command the satellite from the ground, solar arrays to enable it to be a long duration mission and a system of attitude control. The milestone is to have completed, launched and gathered data from the PhoneSat 2.0 satellite. PhoneSat 2.0 is currently set to launch mid-year of 2013.

**Beyond PhoneSat 2.0**

The current vision beyond PhoneSat 2.0 is two-fold: (1) to start using PhoneSat 2.0 bus to do science and exploration missions — i.e. start utilising the benefits of PhoneSat and (2) to continue to push forward breakthrough technologies that enable (a) an increase in capabilities and (b) a decrease in cost. There are several directions that each could take: dispersed sensor heliophysics missions, missions to do space qualification of components, debris or NEO tracking, low cost Earth observation, Lunar and other exploration missions, add GPS, foldable design. These can all lead to significant new performance. The GPS could enable an array of missions not possible without. The foldable design would entail compacting the PhoneSat bus into a smaller volume which folds out. This would enable multiple satellites to be launched per 1U size and since launch costs dominate, a lower overall mission cost. The PhoneSat 2 year milestone is to have iterated through several designs to produce a PhoneSat 3.0 which supports the vision beyond PhoneSat 2.0 with a primary focus on (a) dispersed sensors mission support and (b) a foldable design. The vision is to continue to decrease the cost AND increase the capability. Pursue both vectors simultaneously.

**Activity Goal:**

- The 1-year milestone is to have completed, launched and gathered data from the PhoneSat 2.0 satellite. PhoneSat 2.0 is set to launch in June of 2013. (1 year)
• The 2-year milestone is to have iterated through several designs to produce a PhoneSat 3.0 which supports the vision beyond PhoneSat 2.0 with a primary focus on (a) dispersed sensor heliophysics mission and (b) a foldable design. (2 year)

Center of Excellence

With a growing focus on a national government with a commitment to openness, NASA has proactively investigated, tested and demonstrated the effectiveness of new business models, tools, and strategies that support collaborative innovation and NASA’s mission. NASA’s experimentation and early results come with great responsibility to lead empowerment of the rest of the federal government through shared experience and collective expertise regarding collaborative innovation. The Center of Excellence for Collaborative Innovation is envisioned as a Government-led virtual CoE to unify and advance the efforts of multiple U.S. Government Agencies seeking to use distributed innovation models to improve government processes. This initiative will result in the development of innovative solutions for NASA and other government agency challenges, using a unified framework and leveraging the resources of each for the benefit of all.

The goals of the CoECI include:

• The creation of a translational Community of Practice
• The creation of a collaborative environment for cross Agency experimentation in collaborative innovation
• Models for implementation guidance in collaborative innovation
• The creation of a repository of best practices and applications of collaborative innovation methodologies

The three primary functions of the CoECI include:

• Education and best practice sharing
• Implementation guidance
• Measurement of impact

Innovation is an inherently social activity; the best ideas emerge when the questions that need to be asked are effectively identified and can be asked to a broad and diverse audience. The Center allows NASA to share its experience and facilitate broader impact across other federal agencies.

Activity Goal:

• To launch the CoE collaborative environment for cross-agency sharing of best practices, knowledge management, and collaborative project leadership. (1 year)
• Conduct 2 training workshops within the next year. (1 year)

Scientific & Technical Information

NASA’s Scientific and Technical Information (STI) program manages one of the largest collections of facts, analyses, and conclusions in the world resulting from scientific, technical, and related engineering research and development efforts, both basic and applied. This program is essential to help NASA increase productivity and avoid duplication of research by sharing information and to ensure that the U.S. maintains its preeminence in aerospace-related industries and education. The NASA STI Program acquires, processes, archives, announces, and disseminates NASA STI and acquires worldwide STI of critical importance to NASA and the Nation. This includes published results, such as technical
reports, journal articles, preprints, technical presentations, books, historical special publications, etc. and publishes this information online, in paper, multimedia and electronic form. STI resources include over a quarter-million full-text documents, and links to more than a half-million images and video clips. The main STI website is a resource for the public to locate, obtain, and publish NASA aerospace information and find national and international information pertinent to your research and mission.

Products of NASA’s STI program, designed to make NASA’s rich technical resources available internally and externally, include the NASA Aeronautics and Space Database, the NASA Technical Reports Server, RSS feeds, and an array of social media products that announce NASA’s STI.

Activity goal:

Over the next two years, NASA will modernize its systems and processes so that it can increase the amount of full-text searchable content on the public STI NASA Technical Reports Server as well as complete the digitization of the archived NASA and NACA (National Advisory Committee for Aeronautics) content. (2 years)

Collaborative Spaces

The Collaborative Spaces Activity supports the development of collaborative environments in physical spaces across the agency. This effort recognizes the need for communities at NASA to have physical interaction. Given the emphasis on travel budgets and electronic forms of communication, this effort also acknowledges the need for physical spaces which enable virtual interaction.

This activity focuses as much on the culture of how people collaborate as the technology used while doing it. The goal is to provide physical assets which enable communities to engage each other in the ways they prefer, while experimenting with new tools and techniques not normally provided by the traditional NASA workplace. Providing innovative spaces at and across centers offers alternative workspace for personnel, creative collaboration options for distributed teams, and actual equipment for modern techniques such as fast prototyping of hardware.

In addition to the facilitation of collaborative rooms and spaces at NASA, this effort looks to the culture of collaboration outside NASA as well. Advancements come from encouraging meet-ups, codeathon-style events, and community showcase events which naturally enable the exchange of techniques and use of a multi-protocol infrastructure. This allows other communities to shape collaboration trends within NASA, while giving citizens insight into the operations of their space program. Approaches could include a software approach to virtually connected physical collaborative workspaces, or a physical collaborative space which “straddles the fence” and allows access to on-site and off-site personnel equally.

Activity goal:

Establish at least 10 collaborative spaces throughout the Agency, with interconnectivity and data exchange enabled between Agency spaces. (2 years)

Tools for the Citizen Scientist

Source: http://open.nasa.gov/plan/progress/
NASA’s original Open Government Plan outlined 147 goals across 22 organizations to demonstrate how NASA is becoming an open government in its policy, technology, and culture. To celebrate two years of efforts toward the Initiative, NASA created an infographic to communicate its progress towards achieving the original goals in version 1.0 of the Agency’s Plan. As we release version 2.0 of the Plan, this infographic has been updated to reflect the final status of the original goals. Go to the end of this document for a plaintext version of the infographic.

Download the infographic: Tools for the Citizen Scientist

The NASA Open Government Plan provides a strong multi-dimensional framework of technology, policy, and culture, creating platforms for transparency, participation, and collaboration to better support the Agency’s mission to pioneer the future. NASA’s original Plan, released April 7, 2012, defined 147 goals across 22 organizations related to integrating Open Government into the Agency’s programs and projects. We set high goals, and we are proud of how far we have come in the first two years. All of these goals are fluid; you’ll see growth and movement as we work to determine the best path toward openness. This infographic conveys the progress NASA made toward the original goals in Open Government – our latest efforts in working together with you to enable us all to reach for new heights and reveal the unknown.

We hope this will clearly communicate our progress and keep you informed of new and exciting things within NASA. If you have any questions or comments, we encourage you to visit our NASA Open Government website at http://www.nasa.gov/open and share your ideas.

Plain Text Version

Social Network Metrics

- **209,967**: Pageviews at open.nasa.gov
- **114**: Blogposts at open.nasa.gov
- **152,380**: Foursquare Followers
- **1**: Internet Radio Station
- **29,556,976**: NASA TV YouTube Views
- **88,651**: Circled on Google+
- **95,552**: +1’s on Google+
- **1,529,665**: Astronaut Ron Garan’s Followers on Google+
- **1,050,400+**: Visits to science.nasa.gov
- **816,532**: Facebook Followers
- **29+**: Apps available online
- **2,047,512**: Twitter Followers
- **60+**: NASA Chats
- **82**: @NASA Klout Score
- **130+**: NASA Twitter Accounts
- **36**: Astronauts on Twitter
- **1,258,586**: @Astro_Mike Followers
• 19,362: @NASA Tweets
• 12.4: @NASA Tweets per Day
• 35+: NASA Tweetups/Socials
• 2500+: Participants in NASA Tweetups/Socials

Timeline
• April 2010: Release of the NASA Open Government Plan
• July 2010: NASA announces three new Centennial Challenges with a total prize purse of $5 million
• September 2010: Participatory Exploration Workshop to discuss the future of participatory exploration
• October 2010: Nebula Cloud Computing Platform operational for 250+ Users
• October 2010: Launch of new online NASA Tournament Lab platform for software challenges
• October 2010: NASA hosts an inter-agency collaborative event to discuss open data and the future of the open government community
• December 2010: Random Hacks of Kindness
• March 2011: NASA Technical Reports Server relaunched with full-text search
• March 2011: NASA hosts summit to discuss the future of open source development at the agency
• April 2011: Partnership strategy for NASA Education released publicly
• July 2011: NASA@WOrk Internal Collaboration platform launched with 8 challenges
• August 2011: NASA IT Summit held in San Francisco with integrated virtual participation
• August 2011: Release of http://data.nasa.gov
• September 2011: Green Flight Challenge
• November 2011: Office of the Chief Technologist received appropriations for forward work
• December 2011: Random Hacks of Kindness
• December 2011: Release of code.nasa.gov

FOIA Requests in FY 2011
• 35 outstanding from previous year
• 1027 received in FY 2011
• 1131 processed in FY 2011

Data Sets Released Publicly on data.gov
• 21 tools
• 512 Geodata catalogs
• 3 raw catalogs
• 17 Earth Science data directories
• 3 directories for educators
• 3 desktop data tools
• 2 HR directories
• 95 data sources added
• 11 Space Science data directories

Project Statuses
• 406 New Space Act Agreements
• 647 Software Usage Agreements
• 34 New Patent Licenses
• 547 Software Copyright Licenses
• 1500+ Partnerships with Outside Entities
• 28 Instances of Software Released Under Open Source License

FY 2011 Synopsis

All Projects: 85% Complete, 15% Partial
• Nebula: 88% Complete, 12% Not Complete
• Open Source: 75% Complete, 25% In Progress
• Participatory Exploration: 83% Complete, 17% In Progress
• Centennial Challenges: 100% Complete, 0% In Progress
• Citizen Engagement: 100% Complete, 0% In Progress
• Congressional Correspondence Processes: 100% Complete, 0% In Progress
• NASA TV: 100% Complete, 0% In Progress
• Space Act: 100% Complete, 0% In Progress
• Public Affairs & Web: 100% Complete, 0% In Progress
• Science Data Access: 100% Complete, 0% In Progress
• NASA Engineering Network & NASA Technical Reports Server: 94% Complete, 6% In Progress
• Data.gov: 94% Complete, 6% In Progress
• FOIA: 89% Complete, 11% In Progress
• Office of the Chief Information Officer: 83% Complete, 17% In Progress
• Open Innovation Projects: 83% Complete, 17% In Progress
• Procurement: 83% Complete, 17% In Progress
• Tech Transfer: 83% Complete, 17% In Progress
• Records Management: 81% Complete, 19% In Progress
• Financial Data Transparency: 78% Complete, 22% In Progress
• Education: 70% Complete, 30% In Progress
• Space Communications and Navigation: 63% Complete, 38% In Progress
• Declassification: 44% Complete, 56% In Progress
Footnotes

NASA’s Open Government Plan was rated highly by OpenTheGovernment.org, a group of organizations and advocates concerned with government transparency.

NASA received two “Leading Practices” Awards from the White House for achievement above and beyond the requirements of the Directive in the areas of “Participation and Collaboration” and “Flagship Initiative”.

Citizen Engagement Directory

As part of version 2.0 of it’s Open Government Plan, NASA has established an open directory of activities to actively involve individuals as contributors to and collaborators with NASA’s research, science, and exploration activities. At the time of publicication, the directory is populated with over 100 participatory, collaborative and transparent activities. The activities listed will encourage individuals to contribute their creativity and capabilities to NASA’s mission of discovery and invites them to share in the excitement of building our future. This may include contributing to the creation of new missions, supporting engagement with existing missions and data, or to contributing innovative ideas and solutions to grand challenges. As more aeronautics research and space exploration missions are conducted with public participation and public-private collaborations, NASA envisions a greater return on science and technology investment, potentially freeing up more resources for additional research activities. Active engagement of the public may inspire today’s scientists and engineers, as well as the next generation of explorers. It also reflects the increased relevancy of our activities to individuals.

One of our objectives in improving public participation is to encourage a broader segment of the population to become aware of and interested in the formal study and pursuit of a career in science, technology, engineering and math (STEM) as a method of promoting economic vitality. Additionally, giving individuals opportunities to participate in NASA missions gives them a first-hand look into the inner-workings of NASA.

Highlighted Activities

Technology Accelerators

The broad spectrum of NASA’s commitment to technology acceleration includes public-private partnerships, co-located spaces, citizen engagement and innovation mentoring – all in addition to making enormous amounts of open scientific data available for public use. The International Space Apps Challenge and Random Hacks of Kindness emphasize quick, collaborative development, while LAUNCH has developed a closely connected community of innovators that develops specific technology needs over a longer term. Both types of events offer immeasurable opportunities for hardware and software development, diverse participation, and validation of the immense value of spaceflight data to improving life on Earth.

International Space Apps Challenge

The International Space Apps Challenge is a technology development event during which citizens from around the world will work together to solve current challenges relevant to both space exploration and social need. NASA is leading the
global Challenge as a United States domestic commitment to the Open Government Partnership (OGP) – a new, multilateral initiative that aims to secure concrete commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance.

Participation in the Space Apps Challenge creates unique opportunities for NASA and the other global event partners:

- A visible demonstration of a government’s interest in using space data and technology, in partnership with others, to address global needs.
- An opportunity for citizens in countries with little or no investments in space technology to contribute to space exploration through open source, open data, and code development.
- A demonstration of commitment to the principles of the Open Government Partnership.
- Promote Science, Technology, Engineering and Mathematics (STEM) education by encouraging students from around the world to utilize space technology for solutions to global challenges.
- Demonstrate the value of space technology for addressing global needs of life on Earth.
- Encourage international partnership and mutual understanding.

The Space Apps Challenge offers the opportunity for focused software and hardware development via a truly international collaboration while emphasizing the vast potential of NASA’s open data for life on Earth and life in space.

**Initiative goal:**

To hold the International Space Apps Challenge in April 2012 in at least 10 global locations. (1 year)

**LAUNCH**

LAUNCH is a social entrepreneurship enterprise that breaks new ground with public/private partnerships to bring about innovative solutions to intractable sustainability challenges around the world. The concept of LAUNCH is based on a foundation of collaboration across non-traditional disciplines and organizations.

NASA partnered with U.S. Agency for International Development, the State Department and NIKE to form LAUNCH in an effort to identify, showcase and support innovative approaches to global sustainability challenges. LAUNCH searches for visionaries whose world-class ideas, technologies or activities show great promise for making tangible impacts on society in the developed and developing worlds.

LAUNCH creates three unique opportunities for NASA:

- Sharing the sustainability story of how living in space mirrors Earth — we have no natural resources in space which forces us to generate, collect, store, conserve, recycle, and manage our resources wisely — just like Earth but more extreme;
- Offering our problem-solving expertise and convening power of the NASA brand to host crucial conversations on sustainability-related topics with innovative problem solvers from around the world, and
- Promoting the emergence of transformative technology to solve problems that we share as global citizens of this planet, which may also address issues of long-duration life in the extremes of space.

The LAUNCH Accelerator phase follows each forum and provides critical support for each innovator’s LAUNCH journey. The LAUNCH team walks the Innovators through recommendations and insights shared by the Council, refines and crafts a forward strategy, and helps make connections necessary to solidify future support for each innovation.
Initiative goal:

To directly support at least one LAUNCH event each year. (1 year and 2 years)

**Random Hacks of Kindness**

Random Hacks of Kindness (RHoK) is a community of innovation developing practical open source solutions for social good. Developed in partnership between NASA, World Bank, Google, Microsoft, Yahoo!, and HP, RHoK’s unique model builds the capacity of subject matter experts and local stakeholders to identify problems where technology can help, volunteer technologists to understand these problems and create solutions, and event organizers to run events that bring these groups together for synergistic collaboration. NASA participates by encouraging the utilization of NASA’s immensely valuable open databases, which can serve as the content to many potential world-changing apps.

Random Hacks of Kindness creates many unique opportunities for NASA and global event partners:

- Offering NASA’s open data as a resource for solving global challenges
- Offering innovators opportunities to participate in NASA’s space exploration mission
- Offering NASA opportunities to work with citizens and learn from the experience and entrepreneurial spirit of those outside the government, helping to facilitate even more open policy, technology, and culture.

RHoK is an activity of the Open Government Initiative within the Office of the Chief Information Officer. The Open Government team is part of the core strategy team for RHoK and attends some of the physical RHoK events and also participates in the online RHoK community year-round. Membership in the global RHoK community now includes more than 4000 people in more than 45 cities, with 180+ partners having worked on more than 100 events.

Initiative goal:

To directly support two Random Hacks of Kindness events each year. (1 year and 2 years)

**Open Data**

The open data movement at NASA is multifaceted, including further release of data sets, publishing data sets to data.gov, and developing strategies to process large data sets. NASA will continue to develop its single portal for NASA data (data.nasa.gov) and leverage data.gov to enable users to locate relevant high quality data and easy to use tools and applications. The Agency will also continue to encourage users to utilize raw datasets to perform analysis, experiments, and learning as well as to leverage the efforts of external developer communities who create applications relevant to NASA’s mission.

data.nasa.gov

NASA’s commitment to open data expands the audience for the vast body of knowledge captured in nearly 100 years of U.S. aeronautics and space data. Developers, technologists, entrepreneurs, citizen scientists and many others can contribute directly to the exploration of space and Earth by helping to create new ways of looking at this data. Additionally, the release of administrative and procedural information from within NASA enables researchers and analysts to understand more about the inner workings of NASA as well as allow our own employees to better understand other functions of our Agency.
As part of the [Open Government Initiative](http://semanticommunity.info/Data_Science/NASA_Big_Data), the Agency is working to improve accessibility to this data and incentivizing the use of government data by citizens. To address the ever-increasing amount of tools and data catalogs that are publicly available on NASA’s many websites, this directory lists publicly available datasets and serves to streamline the process for posting these datasets on [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data). The directory includes information and direct links to more the 1000 datasets, and this is just a small beginning.

**Initiative goal:**

Continue to build the internal directory with an additional 500 datasets, including every NASA center and representing as much of NASA’s internal work as possible, with an increased percentage of data graduated up to [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data). (2 years)

**NASA's data.gov Working Group**

[Data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data) was created in 2009 as a step toward implementing a more open and accountable government. Each Agency participates by providing support and recommendations to the architecture of the site as well as populating [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data) with its data. For NASA, as a mission-driven Agency, data is at the heart of what we do, and the Working Group functions as a liaison between [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data) and NASA’s data curators as well as participating in the evolution of the platform. The Working Group embraces the opportunity to reach out to new stakeholders via [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data), including application developers, social scientists, researchers, citizen scientists, and data enthusiasts. We believe that the [data.gov](http://semanticommunity.info/Data_Science/NASA_Big_Data) platform will facilitate even greater usage of our existing Web services which will provide incentive for us to find additional information to make available for download.

**Initiative goal:**

Release an additional ten new high-value datasets or information holdings to data.gov that have never been released to the public before. Upon release of each dataset or information holding, we will issue a rationale for why it is high-value. (1 year)

**Big Data at NASA**

Exploring innovative approaches to extremely large datasets is of vital interest to NASA. In line with its extensive amounts of science data, and commitment to making large datasets accessible to the public, the Agency continues to encourage users (internally and externally) to utilize raw datasets in new ways to perform analysis, experiments, and learning. NASA also partners widely across government agencies to support sharing of best practices and cross-agency planning.

The variety of NASA’s current Big Data activities and approaches include:

- [Science Mission Directorate](http://semanticommunity.info/Data_Science/NASA_Big_Data) (SMD) is committed to Big Data research and development that is focused on specific NASA science needs and missions. SMD is currently soliciting for new awards in 8 Big Data areas in its Research Opportunities in Space and Earth Sciences (ROSES) – 2012 and partners with DOE, NOAA, USGS, USAF, EPA, NIST, DOD, and NSF on a variety of Big Data activities.

- NASA’s [Human Exploration and Operations Mission Directorate](http://semanticommunity.info/Data_Science/NASA_Big_Data) (HEOMD) has a number of innovative approaches to advancing Big Data, including the Lunar Mapping and Modeling Activity and the NASA Center of Excellence for Collaborative Innovation.
• NASA’s Aeronautic Research Mission Directorate (ARMD) open data activities includes the DASHlink virtual laboratory, a tool for scientists and engineers to disseminate information on the latest data mining and systems health algorithms, data, and research, and collaborate on research problems for aeronautics systems. DASHlink connects researchers working in similar areas by making public data sets, open-sourced algorithms, and non-proprietary research results more accessible. Participants can upload technical projects to disseminate, collaborate, and innovate more easily both within NASA and beyond.

• NASA’s Technology Program includes large-scale data management and analysis in its NASA Technology Area 11 (Modeling, Simulation, and Information Technology & Processing) and specifically identifies Intelligent Data Understanding as a technology need area. Though no solicitations are planned for 2012 in this area, the Office of Chief Technologist does have annual solicitations in its Game Changing Technologies, NASA Innovative Advanced Concepts (NIAC) and SBIR/STTR programs, where proposals addressing Big Data would be welcome.

Initiative goal:

NASA will create opportunities for enhanced coordination across NASA’s Big Data activities, and expanded cooperation with other agencies. (1 year)

Open Source Software

Open Source can bring numerous benefits to NASA software efforts, including increased software quality, reduced development costs, faster development cycles, and reduced barriers to public-private collaboration through new opportunities to commercialize NASA technology. This inherently transparent, participatory, and collaborative approach is revolutionizing the way software is created, improved, and used. Although open source release has already provided numerous benefits to NASA, the full benefits of open source can only be realized if NASA is able to establish the processes, policies, and culture needed to encourage and support open source development. This will require expanding open source activities beyond releasing software only after completion and finding new ways to support two-way collaboration with an open development community throughout the entire software lifecycle.

NASA Open Source initiatives give the public direct and ongoing access to NASA technology. NASA’s adoption of open source helps lower the barrier to entry into space by enabling private industry to better make use of NASA investments. NASA will continue to make new software available through the portal for NASA open source software, code.nasa.gov. It will also work to establish the processes, policies, and corporate culture to favor open source development.

Open Source was a Flagship Initiative in version 1.0 of the NASA Open Government Plan, and NASA has already made strides in advancing its development at the Agency. In the past year NASA pushed forward open source development by:

1. Establishing agreements that allow NASA open source to be hosted on SourceForge and GitHub, two of the most popular public hosting sites.
2. Releasing software under multiple open source licenses including the NASA Open Source Agreement (NOSA) and the Apache 2 license.
3. Starting the process to develop a Contributor License Agreements (CLA), which will enable third party contributions to be made to NASA open source projects.
4. Experimenting with crowdsourced open source development.
NASA launched an early alpha of its code directory code.nasa.gov in January 2012 as the latest member of the open NASA web family. The website will continue to unify and expand NASA’s open source activities, serving to surface existing activities, provide a forum for discussing efforts and processes, and guide internal and external groups in open development, release, and contribution.

In our initial release, code.nasa.gov is focused on providing a home for the current state of open source at the Agency, including guidance on how to engage the open source process, points of contact, and a directory of existing activities. In this way, NASA hopes to lower the barriers to building open technology in partnership with the public.

Phase two will concentrate on providing a robust forum for ongoing discussion of open source concepts, policies, and activities at the Agency. The third phase will focus on software tools to improve and speed open source development, including distributed version control, issue tracking, continuous integration, documentation, communication, and planning/management. During this phase, NASA will create and host a tool, service, and process chain to further lower the burden to going open. The ultimate goals include creating an awareness of open source development efforts at the Agency, creating a highly visible community hub that will infuse open concepts into the formulation stages of new hardware and software efforts, and help existing activities transition to open modes of development and operation – a “default open” agency.

Initiative goal:

To increase the number of organizations present on code.nasa.gov and deploying discussion forums. (1 year)

Collaborative Code Repository

To continue, encourage, and highlight open source NASA activities, NASA has created an initial public repository on a web-based social code host and revision control application. Our first public repository houses NASA’s popular World Wind Java activity, an open source 3D interactive world viewer. In addition, we are actively reaching out to other open source software activities within NASA and encouraging them to make use of this and similar resources. We hope that highly visible and coordinated hosting of activities will stimulate development and awareness and make the platform the default repository for new open source software releases.

In parallel, the Agency has setup a pilot activity to test an Agency-wide private enterprise collaborative repository. The tool interfaces with its hosted repositories to provide developers and activity managers with tools for Team Management and Collaboration, Activity Wikis, Integrated Issue Tracking, Milestone Definitions, Advanced Searching, Code Review, and Branch Analysis. The tool also extends Social Interaction for the Developers through Activity Streams, Developer Profiles and Following, Code Exploration, Network Graphs, and a Fork Queue to merge changes on the web. This tool will promote developer collaboration, code reuse, knowledge capture, and transparency. Importantly, due to the nature of this source control system, users will be able to seamlessly move private efforts to public repositories if and when they clear the software release process, including all development history (if desired).

Initiative goal:

Implement a public and private collaborative code repository. (2 years)
Open Source Summit

NASA hosted its first Open Source Summit in March 2011 at Ames Research Center, setting the stage for the future of Open Source at NASA. The highly successful event brought together over 700 registered participants, 545 of them who participated online. The summit was an attempt at something new and revolutionary – reaching out to the public and actively involving them in an evolving conversation related to NASA’s mission.

Initiative goal:

Hold a second Open Source Summit in summer 2012. (1 year)

Directory of Projects

MAPPER

The Pavilion Lake Research Project (PLRP) has been investigating the underwater environment of Pavilion and Kelly Lake in British Columbia, Canada with DeepWorker submersible vehicles since 2008. Now with MAPPER, you can work side-by-side with NASA scientists to explore the bottom of these lakes from the perspective of a DeepWorker pilot.

The PLRP team makes use of DeepWorker subs to explore and document freshwater carbonate formations known as microbialites that thrive in Pavilion and Kelly Lake. Many scientists believe that a better understanding of how and where these rare microbialite formations develop will lead to deeper insights into where signs of life may be found on Mars and beyond. To investigate microbialite formation in detail, photos of the lake bottom are recorded by PLRP’s DeepWorker sub pilots, which must be analyzed to determine what types of features can be found in different parts of the lake.

Ultimately, detailed maps can be generated to help answer questions like “how does microbialite texture and size vary with depth?” and “why do microbialites grow in certain parts of the lake but not in others?” But before these questions can be answered, all the photos must be analyzed and tagged.

After creating a free account at http://getmapper.com, you’ll be asked to take a brief tutorial that helps you learn how to tag photos in the PLRP dataset. Tagging is easy — if a feature like sediment, microbialites, rocks, algae, etc, are found in a photo, just click the corresponding tag and continue to the next photo. As you make progress, you’ll score points, earn downloads, track your ranking on the leaderboard, and review the coolest photos that have been tagged by you and other participants.

To learn more, visit http://getmapper.com or watch the overview video (http://youtu.be/6aBkL7Q-Rlo).

Facebook: http://facebook.com/getmapper

YouTube: http://youtu.be/6aBkL7Q-Rlo

Flight Opportunities Program

The Flight Opportunities Program hosts solicitations for organizations to develop & fly space technologies to be demonstrated and validated in relevant environments while fostering commercial space. This program intends to mature towards flight readiness status by creating new cross cutting technologies that advance or enable multiple future space
missions. To facilitate this goal, NASA is providing access to certain flight opportunities available to the Agency, on a no-exchange-of-funds basis, to entities that have technology payloads meeting specified criteria.

The Flight Opportunities Program combines the FY 2010 Facilitated Access to the Space environment for Technology (FAST) and Commercial Reusable Suborbital Research (CRuSR) efforts previously managed by the Innovative Partnership Program Office. The integration of these efforts provides the technology community with access to relevant near-space environments via a broad range of platforms. Click on http://flightopportunities.nasa.gov/af to learn more and view open solicitations.

Website: http://flightopportunities.nasa.gov/af
Twitter: @nasafo

Eyes on the Earth

Developed using a state-of-the-art, browser-based visualization technology, “Eyes on the Earth 3-D” displays the location of all of NASA’s 15 currently operating Earth-observing missions in real time. These missions constantly monitor our planet’s vital signs, such as sea level height, concentration of carbon dioxide in our atmosphere, global temperatures and extent of sea ice in the Arctic, to name a few.

The new “Eyes on the Earth 3-D” features are online at: http://climate.jpl.nasa.gov.

Visitors to “Eyes on the Earth 3-D” can ride along with a spacecraft, observing Earth as it sweeps below in accelerated time, view authentic data maps of ozone, sea level or carbon dioxide distribution, mapped onto the surface of the globe, compare the size of each satellite to a car or a scientist and blast through a global carbon dioxide map to uncover some of the world’s most populous cities.

Site: http://climate.nasa.gov/Eyes/eyes.html

Eyes on the Solar System

“Eyes on the Solar System” is a 3-D environment full of real NASA mission data. Explore the cosmos from your computer. Hop on an asteroid. Fly with NASA’s Voyager 2 spacecraft. See the entire solar system moving in real time. It’s up to you. You control space and time. To get started, click on http://solarsystem.nasa.gov/eyes.

Site: http://solarsystem.nasa.gov/eyes
Twitter: @nasa_eyes

The NASA Innovation Pavillion

The NASA Innovation Pavillion which provides Solvers the opportunity to develop innovative solutions to the unique challenges faced by NASA in achieving its mission to pioneer the future of space exploration, scientific discovery, and aeronautics research. Solutions to these Challenges will not only benefit space exploration, but may also further the development of commercial products and services in the fields of health and medicine, industry, consumer goods, public safety, computer technology, and environmental resources. Challenges and awards can be viewed at https://www.innocentive.com/pavilion/NASA.
SpaceUp

SpaceUp is a space unconference, where participants decide the topics, schedule, and structure of the event. Unconferences have been held about technology, science, transit, and even cupcakes, but this is the first one focused on space exploration. Everyone who attends SpaceUp whether they are NASA or non NASA employees are encouraged to give a talk, moderate a panel, or start a discussion. Sessions are proposed and scheduled on the day they’re given, which means the usual “hallway conversations” turn into full-fledged topics. A session can take a few different formats: a presentation with Q&A, a demo, a panel of experts, or a roundtable. Some of the most interesting sessions are proposed as open-ended questions. (“Should NASA continue developing hardware?” “What’s the cheapest way to do science in space?”) Project demonstrations make great sessions, too, especially when they’re hands-on. To participate in a city near you, check out http://spaceup.org.

Site: http://spaceup.org
Twitter: @SpaceUpConf
Facebook: https://www.facebook.com/spaceup
Photos: SpaceUp Flickr Pool

NASAWISE

WISE is a NASA-funded Explorer mission that provides a vast storehouse of knowledge about the solar system, the Milky Way, and the Universe. Among the objects WISE studies are asteroids, the coolest and dimmest stars, and the most luminous galaxies. This unmanned satellite carries an infrared-sensitive telescope that images the entire sky. As WISE sweeps along, a small mirror scans in the opposite direction, capturing an image of the sky onto an infrared sensitive digital camera which takes a picture every 11 seconds. Each picture has one megapixel at each of four different wavelengths that range from 5 to 35 times longer than the longest waves the human eye can see.

Data taken by WISE is downloaded by radio transmission 4 times per day to computers on the ground which combine the many images taken by WISE into an atlas covering the entire celestial sphere and a list of all the detected objects. This information is then released to the public to encourage analysis, leading to several significant discoveries. Access to WISE data products, including the Source Catalog and Image Atlas are available on the NASA/IPAC Infrared Science Archive (IRSA) at http://wise.ssl.berkeley.edu/astronomers.html.

Site: http://wise.ssl.berkeley.edu/index.html
Podcasts, slideshows, and images: http://wise.ssl.berkeley.edu/gallery_images.html

Game Changing Development Program

The Game Changing Development (GCD) program investigates novel ideas and approaches that have the potential to revolutionize future space missions and provide solutions to significant national needs. GCD will identify and rapidly mature innovative, high-impact capabilities and technologies and complement them with "new start" and competitively-selected projects by using a balanced approach of guided technology development efforts and competitively-selected efforts from across NASA, academia, industry and other government agencies.
The program will focus on taking technologies from proof of concept through component testing by investing in specific technology areas through component and subsystem testing. GCD work is done primarily in the laboratory with ground testing instead of space work. Successful technologies will transition to other program such as Technology Demonstration Missions or directly to flight missions. The Game Changing Opportunities in Technology Development research announcement is available through the NASA Solicitation and Proposal Integrated Review and Evaluation System website.

Site: [http://tinyurl.com/7xk52wa](http://tinyurl.com/7xk52wa)

**NASA Green Flight Challenge**

This annual opportunity provides a cash prize for constructing a solution that satisfies a need common to aviation and exploration. For example, the 2011-2012 University Challenge involves designing and simulating flight characteristics and direct operating costs for a large cargo aircraft that can meet NASA’s Environmentally Responsible Aviation and Unmanned Air Systems project goals. Requirements for submission can be accessed at [http://aero.larc.nasa.gov/era_univ/competitions_univ_era_req.htm](http://aero.larc.nasa.gov/era_univ/competitions_univ_era_req.htm).

Site: [http://www.nasa.gov/offices/oct/early_stage_innovation/centennial_challenges/general Aviation/index.html](http://www.nasa.gov/offices/oct/early_stage_innovation/centennial_challenges/general_aviation/index.html)

**NASA Engineering Design Challenge: Lunar Growth Chamber**

Plant growth will be an important part of space exploration in the future as NASA plans for long-duration missions to the moon. NASA scientists anticipate that astronauts may be able to grow plants on the moon, and the plants could be used to supplement meals.

In anticipation of the need for research into lunar plant growth, NASA and the International Technology and Engineering Educators Association, or ITEEA, present the NASA Engineering Design Challenge: Lunar Plant Growth Chamber. Elementary, middle and high school students design, build and evaluate lunar plant growth chambers — while engaging in research- and standards-based learning experiences. Students participate in the engineering design process and learn how to conduct a scientific experiment. Participants may engage in the challenge by choosing to design, build and/or evaluate a chamber at [http://www.nasa.gov/audience/foreducators/plantgrowth/home/index.html](http://www.nasa.gov/audience/foreducators/plantgrowth/home/index.html).

Site: [http://www.nasa.gov/audience/foreducators/plantgrowth/home/index.html](http://www.nasa.gov/audience/foreducators/plantgrowth/home/index.html)

**SpaceTech Engineering Design Challenge**

This challenge provides an invitation for students to design a technology that will help further space exploration and development. Students are free to select a task from the following list or propose one of their own.

Accepted areas for technology development (based on the Exploration Technology Development and Demonstration, or ETDD, Program):

- Autonomous Operations
- Entry, Descent and Landing
- Human Factors
- Power/Propulsion including for operation in space and on other planetary bodies
- Robotics (not related to in-situ lunar samples)
Challenge deadlines and submission information is available at [http://moontasks.larc.nasa.gov/challenge.html](http://moontasks.larc.nasa.gov/challenge.html).

Project: [http://moontasks.larc.nasa.gov/challenge.html](http://moontasks.larc.nasa.gov/challenge.html)

**High Res Imaging Experiment (HiRISE)**

The High Resolution Imaging Science Experiment (HiRISE) is a project to photograph hundreds of targeted swaths of Mars’ surface in unprecedented detail. HiRISE operates in visible wavelengths, the same as human eyes, but with a telescopic lens that will produce images at resolutions never before seen in planetary exploration missions. These high resolution images will enable scientists to resolve 1-meter (about 3-foot) sized objects on Mars and to study the morphology (surface structure) in a much more comprehensive manner than ever before.

User-friendly web tools will be available to both the science community and the public to view/analyze HiRISE images and to submit observation requests. Processed images will be released soon after acquisition to allow everyone to share in the scientific discovery process. Images and opportunities to partner or volunteer are available at [http://marsoweb.nas.nasa.gov/HiRISE/](http://marsoweb.nas.nasa.gov/HiRISE/).

Site: [http://marsoweb.nas.nasa.gov/HiRISE/](http://marsoweb.nas.nasa.gov/HiRISE/)

**NASA Online Partnering Tool**

Partnership has always been a vital component of NASA’s mission, whether it is through the infusion of new technologies into NASA, or the Agency transferring its technologies out for public benefit. Either one of these types of partnerships may be ideal for your organization, and both provide access to NASA’s world-class facilities, technical expertise, and technology transfer resources.

As you read through the Steps to Achieving a NASA Partnership, make note of programs, titles, and special projects that best apply to your areas of interests. After the steps, you will find NASA’s “Online Partnering Tool” ([http://octpartneringtool.nasa.gov/oct/](http://octpartneringtool.nasa.gov/oct/)) which will help you align your interests with the most appropriate experts at NASA. You will also be given the opportunity to further explain your specialized area of interest. All of this preparation ensures that NASA’s doors of technology will be opened to you and provide the best chance of a mutually beneficial partnership with the Agency.

Site: [http://octpartneringtool.nasa.gov/oct](http://octpartneringtool.nasa.gov/oct)

**NASA Tournament Lab**

NASA and Harvard University have established the NASA Tournament Lab (NTL), which with the enabling capabilities of the TopCoder community allow for competitions to create the most innovative, most efficient, and most optimized solutions for specific, real-world challenges being faced by NASA researchers. The NTL provides an online virtual facility for NASA researchers with a computational or complex data processing challenge to “order” a solution, just like they would order laboratory tests or supplies. Open competitions can be accessed on the official [NTL website](http://community.topcoder.com/ntl).

Site: [http://community.topcoder.com/ntl](http://community.topcoder.com/ntl)
Twitter: [@NASA_NTL](http://semanticonomy.info/Data_Science/NASA_Big_Data)
NASA Chat

NASA Chat is an ongoing opportunity to engage NASA employees and experts real time on multiple topics using instant messaging. Archived and upcoming chats are located at [http://www.nasa.gov/connect/chat/index.html](http://www.nasa.gov/connect/chat/index.html).

Site: [http://www.nasa.gov/connect/chat/index.html](http://www.nasa.gov/connect/chat/index.html)

NASA Social

NASA Social is the next evolution in the agency’s social media efforts. NASA’s Tweetups, which have brought thousands of people together for a unique social media experience into its programs of exploration and discovery, are aligning with the expanding online community. The highly-successful and widely recognized NASA Tweetup now will be known as NASA Social. A NASA Social is an informal meeting of people who engage with NASA social media accounts. Socials provide NASA followers with the opportunity to go behind-the-scenes at NASA facilities and events and speak with scientists, engineers, astronauts and managers. NASA Socials range from two hours to two days in length and include a “meet and greet” session to allow participants to mingle with fellow socialites and the people behind NASA’s social media accounts. Registration for NASA Socials will be announced on this page, [@NASA](http://twitter.com/@NASA) and [@NASASocial](http://twitter.com/@NASASocial).

Site: [http://www.nasa.gov/connect/social/index.html](http://www.nasa.gov/connect/social/index.html)

Twitter: [@NASA](http://twitter.com/@NASA) and [@NASASocial](http://twitter.com/@NASASocial)

NASA: Challenge.gov

NASA’s mission is to pioneer the future in space exploration, scientific discovery and aeronautics research. To do that, thousands of people have been working around the world — and off of it — for 50 years, trying to answer some basic questions. What’s out there in space? How do we get there? What will we find? What can we learn there, or learn just by trying to get there, that will make life better here on Earth?

To solve these questions, NASA has posted a broad range of challenges that include a cash prize for winning solutions to the agency’s most pressing problems. Check out [http://challenge.gov/NASA](http://challenge.gov/NASA) for upcoming deadlines and a description of current problems.


Twitter: [@ChallengeGov](http://twitter.com/@ChallengeGov)

Facebook: [www.facebook.com/ChallengeGov](http://www.facebook.com/ChallengeGov)

Night Sky Network

The Night Sky Network is a nationwide coalition of amateur astronomy clubs bringing the science, technology, and inspiration of NASA’s missions to the general public. The Network shares time and telescopes to provide you with unique astronomy experiences at science museums, observatories, classrooms, and under the real night sky. The Night Sky Network is sponsored and supported by several groups within NASA.

Applying for your amateur astronomy club’s free membership in the Night Sky Network takes just three steps:
1. Review and understand the Night Sky Network FAQ’s. These explain how the program works, the benefits to your club, and how your club maintains its membership.

2. Review the sample application form to collect the information you need to apply. This is a sample application in Adobe’s Acrobat® format that requires the free Adobe® Acrobat® Reader®. You must apply online.

3. Complete the online application form.

Site: http://nightsky.jpl.nasa.gov/index.cfm
Contact: http://nightsky.jpl.nasa.gov/contact.cfm

Celestia

Celestia is an open-source, photo-realistic, real-time, three-dimensional viewing of the solar system, the galaxy and the universe. Celestia is an easy to use, freely-distributed, multi-platform, open source, software package which has become a valuable tool for astronomy education. Used in homes, schools, museums and planetariums around the world, it also is used as a visualization tool by space mission designers. Versions are available for computers running Windows, Macintosh (Mac OS X) and Linux operating systems.

Although it is optimized for 3D astronomical visualization, Celestia can be used to display and explore other 3D environments, too. Celestia is an open-source project. As such, its source code is provided and is freely modifiable and redistributable as per the GNU Public License. To download, click on http://www.shatters.net/celestia/download.html

Site: http://shatters.net/celestia/
Forum: http://shatters.net/forum

DASHlink

DASHlink is a virtual laboratory for scientists and engineers to disseminate results and collaborate on research problems in health management technologies for aeronautics systems. Web-2.0-style content generation and social-software technologies, along with a community-moderated posting policy, make it easier and faster for NASA aeronautics researchers and research partners to share data and knowledge with each other and the general public. Participants can upload technical projects to disseminate, collaborate, and innovate more easily both within NASA and beyond. DASHlink connects researchers working in similar areas, permitting the upload of open-source algorithms and downloading of public data.

Site: https://c3.nasa.gov/dashlink/

Flight Analogs Project

Help NASA get astronauts to the Moon and Mars. Future space exploration will challenge NASA to answer many critical questions about how humans can live and work for extended missions away from Earth. Currently, researchers are working to reduce the effects of space flight on the human body. To accomplish this, researchers study healthy test subjects from the general population on Earth, in a way that causes some of the changes the body goes through while traveling in space without gravity. By eliciting on Earth physiologic responses similar to those experienced by the human body in space, scientists can test and refine theories and procedures to deepen our understanding and develop countermeasures to protect humans from the effects of space travel.
In the Flight Analogs Project investigations, volunteers are in a controlled research environment, spending various periods in bed to simulate spaceflight, in the Flight Analog Research Center located within the General Clinical Research Center at the University of Texas Medical Branch (Galveston, Texas). Individuals selected for screening will receive a physical examination at no cost. Once medically qualified, subjects will be compensated for their time spent for the required psychological assessment and any additional screening. Researchers monitor how the subjects’ bodies change over the course of the study and how quickly they recover once they are allowed to resume normal activities. Two primary goals of the studies are (1) to determine which systems in the body react to the simulated limited gravity environment in the same manner that the astronauts’ bodies change in space and (2) to develop new and novel ways of preventing the adverse changes seen in the flight analogs. The methods used to prevent these adverse changes are called countermeasures and if successful, they will lead the way to new methods of counteracting the adverse effects of space travel on our astronauts. Click on https://bedreststudy.jsc.nasa.gov/apply.aspx to apply.

Site: https://bedreststudy.jsc.nasa.gov

Radio JOVE

The Radio JOVE project is a hands-on inquiry-based educational project that allows students, teachers and the general public to learn about radio astronomy by building their own radio telescope from an inexpensive kit and/or using remote radio telescopes through the internet. Radio JOVE students and amateur scientists observe and analyze natural radio emissions of Jupiter, the Sun, and our galaxy. Participants also collaborate with each other through interactions and sharing of data on the network.

The Radio JOVE project began in 1998. Since then, more than 1100 teams of students and interested individuals have purchased our non-profit radio telescope kits and are learning radio astronomy by building and operating a radio telescope. This self-supporting program continues to thrive and inspire new groups of students as well as individuals. An application form and kit ordering are available at the website below.

Website: http://radiojove.gsfc.nasa.gov

FERMI

Fermi is a powerful space observatory that will open a wide window on the universe. Gamma rays are the highest-energy form of light, and the gamma-ray sky is spectacularly different from the one we perceive with our own eyes. With a huge leap in all key capabilities, Fermi data will enable scientists to answer persistent questions across a broad range of topics, including supermassive black-hole systems, pulsars, the origin of cosmic rays, and searches for signals of new physics.

Researchers are invited annually to apply as guest investigators to gain access to the The Fermi Science Support Center (FSSC) which runs the guest investigator program, creates and maintains the mission time line, provides analysis tools for the scientific community, and archives and serves the Fermi data. Details regarding the guest investigator program are available at http://fermi.gsfc.nasa.gov/ssc/proposals/.
NASA Quest

Meet the people of NASA and look over their shoulders as they make NASA’s goals a reality. Whether in the area of aerospace design or training for space walks, NASA Quest is a rich resource for educators, kids and space enthusiasts who are interested in meeting and learning about NASA people and the national space program. NASA Quest allows the public to share the excitement of NASA’s authentic scientific and engineering pursuits like flying in the Shuttle and the International Space Station, exploring distant planets with amazing spacecraft, and building the aircraft of the future. NASA Quest includes a full suite of online resources including:

- Profiles of NASA experts and stories about their work days.
- Several live interactions with NASA experts per month.
- Audio/video programs over the Internet.
- Lesson plans and student activities
- Collaborative activities in which kids work with one another.
- Background information and photo sections.
- A place where teachers can meet one another.
- A searchable QNA area with over 3,000 previously asked questions.
- An e-mail service in which individual questions get answered.

Website: [http://quest.arc.nasa.gov/about/index.html](http://quest.arc.nasa.gov/about/index.html)

High Energy Astrophysics (HERA) Tool

Hera is an interface to software and data provided by the High Energy Astrophysics Science Archive Research Center at NASA/Goddard Space Flight Center. The data are from satellites which detect x-rays and gamma rays from objects such as black holes, neutron stars, galaxies, and supernovae.

This interface has been adapted for use by students, educators, amateur astronomers and the general public, and allows them to use the same software that astronomers use on the same data sets that astronomers analyze. These data may be used for extensions of classroom lessons, science fair projects, research projects, etc. Downloads are available at [http://imagine.gsfc.nasa.gov/docs/teachers/hera/what.html](http://imagine.gsfc.nasa.gov/docs/teachers/hera/what.html).

Website: [http://imagine.gsfc.nasa.gov/docs/teachers/hera/what.html](http://imagine.gsfc.nasa.gov/docs/teachers/hera/what.html)

RealWorld-InWorld (RWIW) NASA Engineering Design Challenge

In this unique education initiative, students in grades 7-12 work collaboratively as engineers and scientists to solve real-world problems related to the James Webb Space Telescope and Robonaut 2. This work encourages students to explore and build skills essential for successful careers in Science, Technology, Engineering, and Math (STEM). The RWIW Challenge runs during the academic year in two phases of project based learning and team competition. Register now to join us and learn more about this unique opportunity at [http://www.nasarealworldinworld.org/Home.aspx](http://www.nasarealworldinworld.org/Home.aspx).

Website: [http://www.nasarealworldinworld.org/Home.aspx](http://www.nasarealworldinworld.org/Home.aspx)
The Edison Small Satellite Demonstration Missions Program

The Edison Small Satellite Demonstration Missions program will develop and operate a series of NASA-focused small satellite demonstration missions. This program is to accelerate the development of small spacecraft capabilities for NASA, commercial, and other space sector users. Specifically:

- identify candidate small spacecraft technologies with game-changing and/or crosscutting potential and mature these technologies for flight;
- regularly and affordably demonstrate these and other small spacecraft technologies in the space environment;
- improve or create new small spacecraft capabilities for lower cost and/or advanced satellite communication, remote observation, and space physics applications; and
- demonstrate new small spacecraft capabilities that constitute new satellite and spacecraft applications, such as biological and physical research, satellite servicing, space debris removal, and planetary investigations.

The Edison Program released a Broad Agency Announcement (BAA) requesting proposals for low-cost, flight demonstrations of small satellite technology on February 2, 2012. The topic areas of interest in this solicitation will be limited to demonstrations of communications systems for small satellites, proximity operations with small satellites and propulsion systems for Cubesat-scale spacecraft. Other technology and application demonstrations will be addressed in future solicitations. This will be a two-step solicitation with a mandatory Executive Summary due on March 4, 2012 and invited proposals due in May. Details and submission instructions can be found at: [http://tinyurl.com/7an7lcs](http://tinyurl.com/7an7lcs).

Website: [http://www.nasa.gov/offices/oct/crosscutting_capability/edison/index.html](http://www.nasa.gov/offices/oct/crosscutting_capability/edison/index.html)

NASA Facilitated Access to the Space Environment for Technology Development and Training (FAST)

The Facilitated Access to the Space Environment for Technology Development and Training (FAST) provides opportunities for emerging technologies to perform testing in the space environment. This includes:

- Technologies that support NASA’s missions but are not yet mature enough for adoption into on-going programs (see Technology Maturity below)
- Technologies that might not otherwise be tested due to lack of funding:
- Small businesses and individuals
- Universities and research institutions
- NASA projects in early development

FAST utilizes commercially available flight test capabilities such as the Zero Gravity Corporation aircraft for parabolic flights. The current focus is on testing in micro-gravity, reduced-gravity or variable-gravity conditions on parabolic aircraft flights.

In the future the FAST program expects to provide opportunities to test technology on suborbital and orbital flights when those services are commercially available. For information on Opportunities for Technology Testing on Reduced-Gravity Parabolic Flights go to: [http://go.usa.gov/rlq](http://go.usa.gov/rlq).

Website: [http://www.nasa.gov/offices/oct/crosscutting_capability/flight_opportunities/fast/index.html](http://www.nasa.gov/offices/oct/crosscutting_capability/flight_opportunities/fast/index.html)
NASA Centennial Challenges

NASA Centennial Challenges were initiated in 2005 to directly engage the public in the process of advanced technology development. The program offers incentive prizes to generate revolutionary solutions to problems of interest to NASA and the nation. The program seeks innovations from diverse and non-traditional sources. Competitors are not supported by government funding and awards are only made to successful teams when the challenges are met.

The Centennial Challenges seek to:

• Drive progress in aerospace technology of value to NASA’s missions
• Encourage the participation of independent teams, individual inventors, student groups and private companies of all sizes in aerospace research and development
• Find the most innovative solutions to technical challenges through competition and cooperation

Website: http://www.nasa.gov/challenges

NASA TechFinder

Welcome to NASA TechFinder – Bringing technology from NASA to the marketplace! NASA TechFinder contains data from all 11 NASA centers. NASA TechFinder is a resource that enables commercial and private users to perform searches or request more detailed information for technology opportunities, licensing opportunities, past success stories, and featured technologies leads.

Website: http://technology.nasa.gov/

Request For Information (RFI) for Intellectual Property (IP) Services

NASA IPP requests information from organizations interested in providing intellectual property (IP) management services (such as patent valuation, marketing, assessment and brokerage) to NASA under a no-cost arrangement that could allow for revenue sharing upon license execution. Seeking no-cost methods to further advance dissemination of NASA’s patent investment will provide the best value to the public through the introduction of new and efficient licensing processes and tools. NASA recognizes that there are many business models in the US for providing IP management services, such as patent brokering, using a variety of different transaction methods and platforms. NASA is issuing this request for information in an effort to better understand the range of possible models and services available for assisting NASA with the dissemination of NASA technology, at no additional cost to the taxpayer.

Website: http://www.nasa.gov/offices/oct/partnership/RFI_detail.html

NASA Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs provide an opportunity for small, high technology companies and research institutions (RI) to participate in Government sponsored research and development (R&D) efforts in key technology areas.
If you are a small business concern with 500 or fewer employees, or a non-profit RI, such as a university or a research laboratory with ties to a Small Business Concern (SBC), then NASA encourages you to learn more about these programs and significant sources of seed funding for the development of your innovations. The SBIR Phase 1 contracts last for 6 months with a maximum funding of $100,000, and Phase 2 contracts last for 24 months with a maximum funding of $600,000. Solicitations are posted at http://sbir.gsfc.nasa.gov/SBIR/solicit.htm.

Website: http://www.nasa.gov/offices/oct/early_stage_innovation/sbir_sttr/index.html

**ISSLive!**

After over 50 years of operation, NASA is about to permanently enter the world of instant (or near instant) information exchange with the general public in a new way that largely symbolizes one of the changing ways the premiere US space agency will interact with the public and disseminate information about science operations and real-time orbital operations on the International Space Station. Introducing ISSLive! – the International Space Station at your fingertips, located at spacestationlive.jsc.nasa.gov.

At its core, ISSLive! provides users with simplified console information readouts on public telemetry and timeline data for the International Space Station as well as current live tracking ability of the International Space Station, ISS MCC Houston over the shoulder"viewing opportunities, ISS crew timelines (broken up into daily increments), MCC console displays, and Acquisition of Signal (AOS) and Loss of Signal (LOS) indicators/predictors. Mobile apps also provide users with historical information on the assembly of the International Space Station, a full-fledge diagram of the current configuration of the orbital lab complex, open web content for ISS overviews, operational handbooks, and API, and the ability to create applications to integrate Live Data and Science from the International Space Station."

Website: spacestationlive.jsc.nasa.gov

**Space Technology Research Opportunities for Early Career Faculty**

NASA is seeking proposals from accredited U.S. universities on behalf of outstanding early career faculty beginning their independent careers. This inaugural Space Technology Research Opportunities for Early Career Faculty solicitation seeks to sponsor research in specific, high priority technology areas of interest to NASA.

Specific topic areas were selected because they can best benefit from early stage innovative approaches provided by U.S. academic institutions. The research will investigate unique, disruptive or transformational space technologies or concepts. NASA expects to award approximately ten grants this fall, funded up to $200,000 each per year, based on the merit of proposals received. Notices of intent to submit proposals are due March 30. The deadline for submitting final proposals is May 3. For information on the solicitation, including specific technology areas of interest and how to submit notices of intent and proposals, visit: http://go.usa.gov/P31

Website: http://www.nasa.gov/home/hqnews/2012/mar/HQ_12-078_Early_Career_Faculty.html

**Desert Research and Technology Studies (DRATS) Education Program**

The Desert Research and Technology Studies (RATS) education project allows students and classrooms to engage in exploration science and engineering field tests through participatory activities. This is a pilot project developed by the Astromaterials Research and Exploration Sciences (ARES) education team.
Students will create geologic maps from satellite images, select sites for scientific exploration to meet mission science objectives, plus plan traverses using images, topographic maps, and rover capabilities. These activities are designed to use before, during, and after the field event using real time data uploads that will come from the Desert RATS site in Arizona.

Workshops for educators will provide content knowledge and resources, prepare teachers to utilize the education resources, and provide strategies to engage students in a unique education experience. Apply at http://ares.jsc.nasa.gov/ares/drats/index.cfm.

Website: http://ares.jsc.nasa.gov/ares/drats/index.cfm

Space Alliance Technology Outreach Program (SATOP)

The Space Alliance Technology Outreach Program (SATOP) is a cooperative program between the states of Florida, New Mexico, New York, and Texas. SATOP is a FREE service designed to provide technical assistance and speed the transfer of space technology to the private sector. By giving FREE technology assistance to small businesses, SATOP helps them solve their challenges and increase their chances of succeeding.

The goal of SATOP is to help small businesses apply the technical expertise derived from the US space program. Made up of an Alliance of more than 45 space companies, universities, colleges, and NASA centers (Johnson Space Center – Texas, Kennedy Space Center – Florida, and White Sands Test Facility – New Mexico), SATOP finds professionals within theses companies who volunteer their time and expertise in solving the challenges brought forth by the inquiring businesses. Are you interested? Do you have a technical problem? Complete our online Request For Technical Assistance form to receive FREE technical assistance.

Website: http://www.spacetechsolutions.com/about.asp

NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)

Supporting research in science and technology is an important part of NASA’s overall mission. NASA solicits this research through the release of various research announcements in a wide range of science and technology disciplines. NASA uses a peer review process to evaluate and select research proposals submitted in response to these research announcements. Researchers can help NASA achieve national research objectives by submitting research proposals and conducting awarded research. This site facilitates the search for NASA research opportunities. Solicitations can be found at http://nspires.nasaprs.com/external/.

Website: http://nspires.nasaprs.com/external/

HUNCH

HUNCH is an instructional partnership between NASA and high schools and intermediate/middle schools. This partnership benefits both NASA and students. NASA receives cost-effective hardware, soft goods and educational videos that are produced by the students. The students receive hands-on experiences and in some cases, NASA certification in the development of training hardware for the International Space Station Astronaut crew members or ground support personnel. A spin-off of this teaming is the inspiration of the next generation.
NASA will provide the materials required for building the hardware and soft goods along with drawings and other documents needed to fabricate the items. NASA will also provide a quality inspection oversight role during the fabrication of the hardware.

The school will provide technical direction to the students, and provide a safe working environment. The school will teach the students how to use the tools needed to fabricate the hardware. The school will also provide pictures of the process. At the end of the school year, we recognize all of the students and teachers for their efforts, and display their hardware. Participate at [http://nasahunch.com/](http://nasahunch.com/).

Website: [http://nasahunch.com/](http://nasahunch.com/)

### Teaching From Space

NASA's Teaching from Space Office in partnership with the Reduced Gravity Education Flight Program at Johnson Space Center announces a Microgravity Experience for the K-12 education community. The Microgravity Experience begins with students and educators developing and proposing a reduced gravity experiment.

Selected teams of educators will then be engaged in a suite of activities that include online professional development on classroom resources for microgravity, collaboration with a NASA mentor, and a reduced gravity flight. With combined input from their students and mentor, educator teams will design and fabricate their experiments to be tested and evaluated aboard an aircraft that flies approximately 30 roller-coaster-like climbs and dips to produce periods of micro and hyper gravity, ranging from 0 g's to 2 g's. Apply at [http://microgravityuniversity.jsc.nasa.gov/tfs/index.cfm](http://microgravityuniversity.jsc.nasa.gov/tfs/index.cfm).

Website: [http://microgravityuniversity.jsc.nasa.gov/tfs/index.cfm](http://microgravityuniversity.jsc.nasa.gov/tfs/index.cfm)

### Microgravity University Systems Engineering Opportunity

This project offers a nationwide solicitation of student application aimed at addressing systems engineering challenges within a microgravity environment. NASA has identified ongoing projects that are systems engineering and reduced gravity related. Application for these projects are available to all undergraduate students and faculty (over age of 18, US Citizens and enrolled full-time in a college or university) as senior design projects. Up to 14 projects will be selected to participate in this opportunity.

The overall experience includes scientific research, hands-on investigational design, test operations and educational/public outreach activities. The students attached to the selected proposals work with a NASA principal investigator lead for that project, to prepare the experiment for flight. In addition to the student-based research, they will participate in a number of Digital Learning Network events (videoconferences). Incorporated as part of the NASA experience, and working in conjunction with other NASA and engineering organizations, student teams will participate in up to three videoconferences as part of a systems engineering design challenge through the Digital Learning Network (DLN). Application information is located at [http://microgravityuniversity.jsc.nasa.gov/se/index.cfm](http://microgravityuniversity.jsc.nasa.gov/se/index.cfm).

Website: [http://microgravityuniversity.jsc.nasa.gov/se/index.cfm](http://microgravityuniversity.jsc.nasa.gov/se/index.cfm)
**Microgravity University Student Flight Program**

The Reduced Gravity Student Flight Opportunities Program provides a unique academic experience for undergraduate students to successfully propose, design, fabricate, fly and evaluate a reduced gravity experiment of their choice over the course of four-six months. The overall experience includes scientific research, hands-on experimental design, test operations and educational/public outreach activities. Submission deadlines, requirements and an experiment archived are available at [http://microgravityuniversity.jsc.nasa.gov/](http://microgravityuniversity.jsc.nasa.gov/).

**Website:** [http://microgravityuniversity.jsc.nasa.gov/](http://microgravityuniversity.jsc.nasa.gov/)

**Reverb**

We are proud to announce the Operational release of “Reverb”, the next generation metadata and service discovery tool. Reverb has been developed utilizing modern web development technologies and presents you with a fresh new look and interface for discovering Earth Science data. We invite you to give it a try and let us know what you think. Reverb will be continually updated on a monthly basis taking into account your user feedback and other enhancements which are currently planned. Your feedback will be critical in us ensuring that you are able to find and access the data you need in the best way possible. Share your comments at [http://www.echo.nasa.gov/reverb/about_reverb.htm](http://www.echo.nasa.gov/reverb/about_reverb.htm).

**Website:** [http://www.echo.nasa.gov/reverb/about_reverb.htm](http://www.echo.nasa.gov/reverb/about_reverb.htm)

**Land Processes Distributed Active Archive Center**

The MODIS LDOPE software tools were developed by Sadashiva Devadiga, Yi Zhang and David Roy at the Land Processes Distributed Active Archive Center ([LDOPE facility](http://lpdaac.usgs.gov/tools/ldope_tools)) NASA Goddard Space Flight Center, to assist with the analysis and quality assessment of the MODIS Land (MODLAND) products. The tools have been developed with feedback from the MODLAND science team and incorporate the scientific knowledge, experience and insights gained during the substantial MODLAND product development period. These software tools are invoked as stand-alone executables from a command-line interface. The software is supported on Irix, Solaris, Linux, and Windows operating systems. There are no distribution or re-use constraints associated with this software, developers using or modifying this software are simply asked to credit the original authorship of these tools which can be found at [http://lpdaac.usgs.gov/tools/ldope_tools](http://lpdaac.usgs.gov/tools/ldope_tools).

**Website:** [http://lpdaac.usgs.gov/tools/ldope_tools](http://lpdaac.usgs.gov/tools/ldope_tools)

**Global Leveraged Integrated Data Explorer for Research (GLIDER)**

GLIDER is FREE tool to easily visualize, analyze and mine satellite imagery. GLIDER allows users to visualize and analyze satellite data in its native sensor view. Users can enhance the image by applying different image processing algorithms on the data. GLIDER provides the users with a full suite of pattern recognition and data mining algorithms that can be applied to the satellite imagery to extract thematic information. The suite of algorithms includes both supervised and unsupervised classification algorithms. In addition, users can project satellite imagery and analysis/mining results onto a 3D globe for visualization. GLIDER also allows users to add additional layers to the globe along with the projected image. Users can open multiple views within GLIDER to manage, visualize and analyze many data files all at once. Download GLIDER at [http://miningsolutions.itsc.uah.edu/glider/](http://miningsolutions.itsc.uah.edu/glider/).
EOS Clearing House (ECHO)

The EOS ClearingHouse (ECHO) is a metadata clearinghouse and order broker being built by NASA’s Earth Science Data and Information System (ESDIS). ECHO is an operational open system based on Extensible Markup Language (XML) and Web Service technologies. ECHO is composed of many layers that can interface with different clients and users through its series of Application Program Interfaces (APIs). The ECHO Team works closely with Data and Client Partners to enable the science community to exchange data, information and services.

The multi-organizational content of ECHO provides a valuable new service to a growing number of Earth science applications and interdisciplinary research efforts. ECHO streamlines access to digital data and materials and brokers orders and other services from Clients to Data Partners. ECHO provides tracking services for both the Provider and the Clients. Ordering information is available at [http://earthdata.nasa.gov/about-eosdis/system-description/eos-metadata-clearinghouse-echo/echo-systems](http://earthdata.nasa.gov/about-eosdis/system-description/eos-metadata-clearinghouse-echo/echo-systems).


Gravity Recovery and Interior Laboratory (GRAIL)

Gravity Recovery and Interior Laboratory (GRAIL) is NASA’s first planetary mission with instruments fully dedicated to education and public outreach.

While the twin GRAIL satellites orbit the Moon to learn more about its gravity and interior composition, MoonKAM will give students the unique opportunity to snap their own photos of the Moon’s surface using cameras on board the spacecraft.

Space is limited! Register your class now to secure your participation in the MoonKAM mission at [http://moonkam.ucsd.edu/](http://moonkam.ucsd.edu/). In the meantime, explore this site for fun resources, activities, and multimedia.

Website: [http://moonkam.ucsd.edu/](http://moonkam.ucsd.edu/)
Twitter: [http://www.twitter.com/GRAIL_MoonKAM](http://www.twitter.com/GRAIL_MoonKAM)

YouTube SpaceLab

YouTube and Lenovo, in cooperation with Space Adventures and space agencies including the National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), and the Japan Aerospace Exploration Agency (JAXA), today announced YouTube Space Lab, a worldwide initiative that challenges 14-18 year-old students to design a science experiment that can be performed in space. The two winning experiments will be conducted aboard the International Space Station (ISS) and live streamed on YouTube. Space Lab is part of YouTube’s larger commitment to highlighting and providing access to the wealth of educational content available on YouTube as well as Lenovo’s focus on equipping students with 21st century skills via information technology. More information can be found at [http://www.youtube.com/SpaceLab](http://www.youtube.com/SpaceLab).

Website: [http://www.youtube.com/SpaceLab](http://www.youtube.com/SpaceLab)
The Space Calendar

The Space Calendar covers space-related activities and anniversaries, including observation opportunities, for the coming year. Included are over 2,500 links to related home pages. This Calendar is compiled and maintained by Ron Baalke. Please send any updates or corrections to baalke@zagami.jpl.nasa.gov. The website, available at http://www2.jpl.nasa.gov/calendar, publically recognizes monthly contributors.

Website: http://www2.jpl.nasa.gov/calendar/

Small-Body Database Search Engine

JPL’s small-body database (SBDB) contains orbital elements and physical parameters for all known asteroids and most recent comets.

The Small-Body Database Search Engine can be used to generate custom tables of orbital and/or physical data for all asteroids and comets (or a specified sub-set) in our database. For example, a table of orbital elements for all near-Earth asteroids (NEAs) can be generated using this tool. Or, you could find out how many asteroids have a known mass or perhaps how many asteroids have an orbital eccentricity greater than 0.8. Output can be displayed in your browser or optionally downloaded in CSV-format for use in, for example, a spreadsheet program.

The Small-Body Database Browser can be used to view data for a specified asteroid or comet. For example, if you want to see the orbit diagram for an object, or it’s current orbital elements, or the discovery circumstances, or selected known physical parameters, you can use this tool.

Website: http://ssd.jpl.nasa.gov/sbdb_query.cgi

HORIZONS System

The JPL HORIZONS on-line solar system data and ephemeris computation service provides access to key solar system data and flexible production of highly accurate ephemerides for solar system objects (583589 asteroids, 3137 comets, 175 planetary satellites, 8 planets, the Sun, L1, L2, select spacecraft, and system barycenters). HORIZONS is provided by the Solar System Dynamics Group of the Jet Propulsion Laboratory.

The HORIZONS system can be accessed using any of the following methods:

- telnet (instructions)
- email (instructions)
- web-interface

Website: http://ssd.jpl.nasa.gov/?horizons

Fragile Oasis

It is very difficult to look at our beautiful Earth from space without being moved in some way. One of the main goals of Fragile Oasis is to share this orbital perspective and inspire people to go out and make a difference; to go out and somehow make life better for those with whom they share this fragile oasis. The Fragile Oasis community was established to unite in the common goal of sharing our humanity and improving our world. Let us inspire, recognize, and...
help each other in our collective quest to make life better on our planet. We invite you to submit a project to our website or join the community at http://fragileoasis.org/.

Website: http://fragileoasis.org/
Twitter: http://twitter.com/#!/FragileOasis
Facebook: http://www.facebook.com/FragileOasis

**Center for Educational Resources (CERES) Project**

Through funding from NASA, faculty at Montana State University and classroom teachers from across the nation have developed an extensive library of on-line and interactive K-12 science education materials for teaching astronomy. Closely aligned with the NRC National Science Education Standards, these web based lessons make maximum use of exciting on-line NASA resources, data, and images. In addition to classroom-ready materials using contemporary teaching strategies, CERES has developed several on-line NASA data search engines and two graduate level distance learning courses, available over the internet to K-12 teachers. Curriculum is available at http://btc.montana.edu/ceres/.

Website: http://btc.montana.edu/ceres/

**Solar System Ambassador Program**

The Solar System Ambassadors Program works with motivated volunteers across the nation. These volunteers communicate the excitement of NASA’s space exploration missions and information about recent discoveries to people in their local communities. Applications to become a Solar System Ambassador are accepted once a year during the month of September. Successful candidates begin their one-year, renewable term of service the following January 1.

The Solar System Ambassadors Program is sponsored by the NASA Jet Propulsion Laboratory in Pasadena, CA, an operating division of the California Institute of Technology (Caltech) and a lead research and development center for the National Aeronautics and Space Administration (NASA). To find a new New Horizons-trained Ambassador in your area or to become a volunteer, visit the Solar System Ambassador Program website.

Website: http://www2.jpl.nasa.gov/ambassador/index.html

**Rock Around the World**

Mars Scientists are asking students from around the world to help them understand the red planet. Send in a rock collected by you or your classroom from your region of the world and we will use a special tool like the one on the Mars Exploration Rovers to tell you what it’s made of. Instructions about which type of rocks can be analyzed and information that should be included with each sample can be found at http://ratw.asu.edu/program.html. On the website you will also find cool pictures of rocks and information collected to date.

Website: http://ratw.asu.edu/

**EarthKAM (Earth Knowledge Acquired by Middle School Students)**

EarthKAM (Earth Knowledge Acquired by Middle School Students) is a NASA educational outreach program enabling students, teachers and the public to learn about Earth from the unique perspective of space. During EarthKAM missions
(periods the EarthKAM camera is operational), middle school students around the world request photos of specific locations on Earth. The entire collection of EarthKAM images is available in a searchable EarthKAM image archive. This image collection and accompanying learning guides and activities are extraordinary resources to engage students in Earth and space science, geography, social studies, mathematics, communications and art. Educators may register to participate in EarthKAM missions and request photos of Earth at https://earthkam.ucsd.edu/register.

Website: https://earthkam.ucsd.edu/home
Twitter: @EarthKAM_Live
Facebook: http://www.facebook.com/issearthkam

**Observable Comets**

NASA and non NASA astronomers work collectively to maintain a list managed by the Minor Planet Center (MPC), which includes observable comets, comet ephemerides, orbit data and observation dates. The MPC is based at the Smithsonian Astrophysical Observatory and operates with support from the International Astronomical Union. This resource can be accessed at http://www.minorplanetcenter.net/iau/Ephemerides/Comets/.

Website: http://www.minorplanetcenter.net/iau/Ephemerides/Comets/

**Lunar Impact Monitoring**

NASA needs your help to monitor the rates and sizes of large meteoroids striking the moon’s dark side. This data will help engineers design lunar spacecraft, habitats, vehicles and extra-vehicular activity (EVA) suits to protect human explorers from the stresses of the lunar environment. Astronomers can help by using Earth-based observations of the dark portion of the moon to establish the rates and sizes of large meteoroids (greater than 500 grams or 1 pound in mass) striking the lunar surface. Observations are conducted at NASA Marshall Space Flight Center in Huntsville, Alabama at the Automated Lunar and Meteor Observatory (ALaMO) and are combined with data provided by the public. You can report your findings by providing impact flash observations that include the date, time, location of observatory, and location of the impact on the moon to NASA’s Meteoroid Environment Office at http://www.nasa.gov/centers/marshall/news/lunar/index.html.

Website: http://www.nasa.gov/centers/marshall/news/lunar/program_overview.html

**Random Hacks of Kindness (RHoK)**

RHoK is unique in the space of “apps competitions”, “hackathons” and “technology for social good”. RHoK’s model is to start from identifying, defining and refining problem definitions provided by subject matter experts and local stakeholders. This ensures that volunteer time is focused on solving real problems for real people. Partnerships are at the core of everything we do. Between the RHoK global partners (Google, Microsoft, Yahoo!, NASA, HP and the World Bank), between subject matter experts with problems and volunteers that work to address them, and between local event organizers and over 150 local organizations that support them. RHoK is a platform for partnerships, and our results depend on the quality of those partnerships. The RHoK community is open for anyone to join. We’re always looking for new problems to work on, and partners to work with us on them. For more information, please contact us.
GLOBE at Night

Calling all Earthlings! Take a few minutes to get involved in the GLOBE at Night campaign to preserve dark skies! GLOBE at Night is a citizen-science campaign open to people all over the world to raise awareness of the impact of light pollution by inviting citizen-scientists to measure their night sky brightness and report their observations to a website from a computer or smart phone. Light pollution threatens not only our “right to starlight”, but can affect energy consumption, wildlife and health. Through 2011, people in 115 countries contributed 66,000 measurements, making GLOBE at Night one of the most successful light pollution awareness campaigns to date. Please join us to participate in the 2012 campaign an hour after sunset til about 10pm on April 11 through 20. For information and resources, visit us at http://www.globeatnight.org.

Earth Science Data and Information System (ESDIS) Project

The Earth Science Data and Information System (ESDIS) Project is a part of the Earth Science Projects Division under the Flight Projects Directorate at Goddard Space Flight Center. The ESDIS Project manages the science systems of the Earth Observing System Data and Information System (EOSDIS). EOSDIS provides science data to a wide community of users for NASA’s Science Mission Directorate.

The ESDIS Project is responsible for:

- Processing, archiving, and distributing Earth science satellite data (e.g., land, ocean and atmosphere data products)
- Providing tools to facilitate the processing, archiving, and distribution of Earth science data
- Collecting metrics and user satisfaction data to learn how to continue improving services provided to users
- Ensuring scientists and the public have access to data to enable the study of Earth from space to advance Earth system science to meet the challenges of climate and environmental change.
- Promoting the interdisciplinary use of EOSDIS data, including data products, data services.

The NASA Acquisition Internet Service (NAIS)

Is your organization looking to solve problems or provide resources to NASA to aid in space exploration? The NASA Acquisition Internet Service (NAIS) is a World-Wide Web (WWW) service, from which industry has immediate access to current acquisition information over the Internet. Users may subscribe to receive email notifications on acquisitions of interest. NAIS is a feeder system for Federal E-Gov Systems like the Federal Business Opportunities (FBO). NAIS provides industry links to reference information such as Regulations, Clauses, Provisions, Handbooks and Guidance Documents. NAIS also provides industry a central location to find each NASA field Center’s Procurement home page.

Website: http://prod.nais.nasa.gov/cgi-bin/nais/faq.cgi
Near Earth Object Program

Observers, mission planners, and other interested users are invited to use a new tool to identify future observing opportunities for those near-Earth objects that may be well-suited to future human space flight round trip rendezvous missions. NEAs are discovered almost daily, and often the time just after discovery is also the optimal time to provide follow-up observations to secure their orbits and characterize their physical nature. These follow-up observations are particularly important for those NEAs that could become potential future mission targets. Hence, it is prudent to monitor these NEA discoveries daily and run an analysis to determine if any among them warrant additional study as they might become attractive mission targets. Users can customize and sort the table of accessible NEAs by specifying limits on total delta-V, mission duration, stay time at the asteroid, launch date interval, asteroid absolute magnitude, and orbit condition code. Website tool is available here.

Website: http://neo.jpl.nasa.gov/nhats/

NASA Haughton Mars Project (HMP)

NASA’s Haughton Mars Project (HMP) is part of an international interdisciplinary field research facility located on the world’s largest uninhabited island, Devon Island. This project uses the polar desert setting and harsh climate of the Canadian High Arctic to mimic the environmental conditions that crewmembers are likely to encounter on Mars and other planets.

Devon Island’s barren terrain, freezing temperatures, isolation, and remoteness offer NASA scientists and personnel a number of unique research opportunities. Other factors, such as the Arctic day and night cycle and restricted logistics and communications capabilities, offer fitting analogs for the challenges that crewmembers will likely face on long-duration space flights.

In addition to ongoing studies that focus on variables such as communications, equipment testing, and vehicular and extra-vehicular operations, Devon Island is also the site of the Exploration program, which aims to develop new technologies, strategies, and operational protocols geared to support the future exploration of the Moon, Mars, and other planets.

Website: http://www.marsonearth.org/
Twitter: @HMP
Facebook: https://www.facebook.com/groups/19183292384/
YouTube: http://www.youtube.com/HMResearchStation

SERVIR

SERVIR — the Regional Visualization and Monitoring System—helps government officials, managers, scientists, researchers, students, and the general public make decisions by providing Earth observations and predictive models based on data from orbiting satellites. The SERVIR system helps nations in Mesoamerica, East Africa, and the Himalayan regions cope with eight areas of societal benefit identified by the Group on Earth Observations (GEO): disasters, ecosystems, biodiversity, weather, water, climate, health, and agriculture.

Website: http://semicommunity.info/Data_Science/NASA_Big_Data
Updated: Fri, 18 Sep 2015 23:17:25 GMT
Powered by mindtouch
Decision makers use SERVIR to improve their ability to monitor air quality, extreme weather, biodiversity, and changes in land cover, and the system has been used over 35 times to respond to environmental threats such as wildfires, floods, landslides, and harmful algal blooms. In addition, SERVIR analyzes, provides information about, and offers adaptation strategies for nations affected by climate change. In a very real sense, SERVIR provides basic information for living on planet Earth. Data and collaboration details are available at http://www.servirglobal.net/.

Website: http://www.servirglobal.net/

The Pavilion Lake Research Project (PLRP)

The Pavilion Lake Research Project (PLRP) is an international, multi-disciplinary, science and exploration effort to explain the origin of freshwater microbialites in Pavilion Lake, British Columbia, Canada. Fossil microbialites represent some of the earliest remnants of life on ancient Earth, and were common from ~2.5 billion to 540 million years ago. Today, microbialites are found in environments where conditions are often too harsh for most organisms. However, the microbialites in both Pavilion and Kelly lakes have provided a new environment for the scientific community to study. These lakes demonstrate that large and uniquely shaped structures can also occur in non-extreme environments that also support fish, plants and other species. The microbialites of these modern lakes are relevant to our understanding of ancient microbialites that were once common and diverse on early Earth, as such, Pavilion Lake has become an exciting field site for Earth scientists and astrobiologists who are interested in the application of the PLRP research to the search for life in our solar system and beyond. Click here to join PLRP as a Remote Science Team Member and explore Pavilion and Kelly Lake with MAPPER! Tag photos.

Website: http://www.pavilionlake.com/
Twitter: @PavilionLake
Facebook: https://www.facebook.com/pavilion.lake
YouTube: http://www.youtube.com/user/pavilionlakeblog
Picasa: http://picasaweb.google.com/pavilion.lake

Asteroid Watch

With increasing regularity, we are discovering asteroids and comets with unusual orbits — ones that take them close to Earth and the Sun. Just a very few of these bodies are potential hazards to Earth. By understanding more about these space rocks now, we are better prepared to take appropriate measures in the future. NASA’s goal over the next few years is to discover at least 90 percent of all near-Earth objects with diameters larger than one kilometer (a little more than one-half mile ). Several teams around the world routinely search the skies for as-yet undiscovered asteroids and comets. With these additional observations, a better estimation of its orbital path usually occurs a few days after discovery, and the initial risk is then downgraded. This information allows scientists calculate the orbital motions of all newly discovered objects for 100 years or more into the future. Several resources to disseminate this information have been developed for you to explore at http://www.jpl.nasa.gov/multimedia/neo/neo_flash4.cfm.

Website: http://www.jpl.nasa.gov/asteroidwatch/images.cfm
Twitter: http://www.twitter.com/AsteroidWatch
Clickworkers

In 2000, NASA scientists created a small experimental project that uses public volunteers (nicknamed "clickworkers") for scientific tasks that require human perception and common sense but not a lot of scientific training. Originally used to count craters on celestial bodies, this technique crowdsources tasks to many people and statistical corrections aggregate the input into a format of scientific utility for researchers. The Clickworkers underlying technology has been used for crowd sourcing geological features on celestial bodies shown in the data received from Mars Global Surveyor, Dawn, and Mars Reconnaissance Orbiter (MRO) Hi-RISE camera. In 2009, NASA partnered with Microsoft Corp. to create an experience for the public to participate as citizen scientists and experience Mars through improving maps, taking part in research tasks, and assisting Mars scientists by counting craters. You can contribute by simply registering for an account.

Website: [http://beamartian.jpl.nasa.gov](http://beamartian.jpl.nasa.gov)
Twitter: [http://www.twitter.com/NASABeAMartian](http://www.twitter.com/NASABeAMartian)

Expedition Earth and Beyond (EEAB)

EEAB is a student involvement program that will allow teachers and their students in grades 5-14 to be actively involved in the excitement and journey of exploration, discovery, and the process of science. This program is facilitated by the Astromaterials Research and Exploration Science (ARES) Education Program, housed at NASA’s Johnson Space Center (JSC) in Houston, Texas.

EEAB is designed to facilitate student-driven, authentic research projects that study the Earth and if desired, compare Earth to other planetary bodies such as the Moon and Mars. Images of Earth acquired by astronauts on the International Space Station (ISS), requested and used by scientists within the ARES Image Science and Analysis Laboratory at NASA JSC, are the hook for getting students interested and involved in the program.

Website: [http://ares.jsc.nasa.gov/ares/eeab/eeab.cfm](http://ares.jsc.nasa.gov/ares/eeab/eeab.cfm)

Student Dust Counter

The Student Dust Counter (SDC) was designed and built by University of Colorado students, and is aboard NASA’s New Horizons spacecraft on its way to Pluto. SDC maps dust in the solar system to understand the density and variation of dust particles as the spacecraft travels across the solar system. SDC is a “secondary science payload” which is placed on the spacecraft as long as it doesn’t interfere with achieving the primary mission objectives. Successfully integrated and launched along with New Horizons, the instrument is now operated by the students. SDC is part of the education and public outreach plan for the New Horizons mission and is an example of participatory exploration. Information is available at [http://lasp.colorado.edu/sdc/](http://lasp.colorado.edu/sdc/).

Website: [http://lasp.colorado.edu/sdc/](http://lasp.colorado.edu/sdc/)
Facebook: [http://www.facebook.com/pages/The-Student-Dust-Counter/52817626641](http://www.facebook.com/pages/The-Student-Dust-Counter/52817626641)
Portal to the Universe

The Portal to the Universe (PTTU) provides a global, one-stop portal for online astronomy content, serving as an index and aggregator for astronomy content for laypeople, press, educators, decision-makers, scientists and more.

The site itself features news, blogs, video podcasts, audio podcasts, images, videos and more. Web 2.0 collaborative tools, such as the ranking of different services according to popularity, help the user to sift constructively through the wealth of information available and promote interactions within the astronomy multimedia community. A range of "widgets" (small applications) have also been developed to tap into all sorts of existing "live data", such as near-live pictures of the Sun, live positions of spacecraft or live observations from telescopes. Portal participants will find multiple ways to contribute as editors, content providers and/or advertisers. Additionally, we are looking for coding enthusiasts to code new widgets that fetch some of the hundreds of interesting pieces of live data floating around on the web. More information can be found at: http://www.portaltotheuniverse.org/participate/.

Website: http://www.portaltotheuniverse.org/participate/
Podcasts: http://www.portaltotheuniverse.org/podcasts/
Blogs: http://www.portaltotheuniverse.org/blogs/

Open Vehicle Sketch Pad (OpenVSP)

NASA has open sourced Vehicle Sketch Pad (VSP), a geometry modeling tool for conceptual aircraft design. The software rapidly models aircraft configurations without expending the expertise required for traditional Computer Aided Design (CAD) packages. Further development of OpenVSP software will stimulate economic opportunity in aviation and aerospace.

An aircraft shape is the natural starting point for multidisciplinary analysis and optimization (MDAO). The outer mold lines and structural layout are the drivers for and interface between aerodynamics, structures, mass properties, and all the physics that impact a vehicle’s performance. Parameterization facilitates design and optimization by reducing the problem dimensionality and improving descriptive expressiveness. The aerospace industry and designers in particular have long described aircraft geometry parametrically; familiar quantities such as aspect ratio, taper ratio, sweep angle, and thickness to chord construct a common vocabulary for aircraft shape. Vehicle Sketch Pad (VSP) is an aircraft geometry tool for rapid evaluation of advanced design concepts which was developed by NASA and is available to industry at large. A useful parametric geometry tool must not only depict the geometry, but it must translate the familiar description of an aircraft into a model which can be useful for engineering purposes such as CFD or FEA analysis.

NASA's open source release of OpenVSP demonstrates the power of open source software releases to stimulate economic development and scientific collaboration, as well as NASA’s investment into the aeronautics industry.

Website: http://www.openvsp.org/
Github: https://github.com/OpenVSP/OpenVSP

Yuri’s Night

Yuri’s Night is a global celebration of humanity’s past, present, and future in space. Yuri’s Night parties and events are held around the world every April in commemoration of April 12, 1961, the day of cosmonaut Yuri Gagarin’s first manned
spaceflight, and April 12, 1981, the inaugural launch of NASA’s Space Shuttle. Yuri’s Night events combine space-themed partying with education and outreach. These events can range from an all-night mix of techno and technology at a NASA Center, to a movie showing and stargazing at your local college, to a gathering of friends at a bar or barbecue. In 2011, the 50th anniversary of human spaceflight, over 100,000 people attended 567 officially-recognized events in 75 countries on all 7 continents, while thousands more watched the 12-hour live Yuri’s Night Global Webcast and participated online in the virtual world of Second Life. We hope you will join us on our adventure this year. We know you want to. Details regarding upcoming events and projects can be found at: http://yurisnight.net.

Website: http://yurisnight.net/
Twitter: http://www.twitter.com/YurisNight
Facebook: http://www.facebook.com/yurisnight
Flickr: http://www.flickr.com/groups/yurisnight/
Live: http://live.yurisnight.net/
RSS: http://rss.yur.is/YurisNight
YouTube: http://www.youtube.com/user/YurisNight

NEXT