

CITIZEN SCIENCE: Tools for Advancing NASA Research and Discovery



**Presentation to NAC Science Committee
November 2, 2015**

Overview

- What is citizen science? Why citizen science?
- USG attention to citizen science
- Citizen science at NASA – now
- Citizen science at NASA – moving forward

Citizen science defined

The participation of the public in the scientific process to address real-world problems in ways that include:

- Identifying research questions
- Designing/conducting investigations
- Collecting data
- Analyzing data
- Developing data applications
- Developing technologies to advance science
- Solving complex problems



Citizen science employs many open innovation methodologies including crowdsourcing, community-based research, challenges, prizes, gaming, and making.

Citizen science is booming!



ZOONIVERSE
REAL SCIENCE ONLINE

planethunters.org

THE MILKY WAY PROJECT

GALAXY ZOO HUBBLE

SOLAR STORMWATCH

MOON ZOO



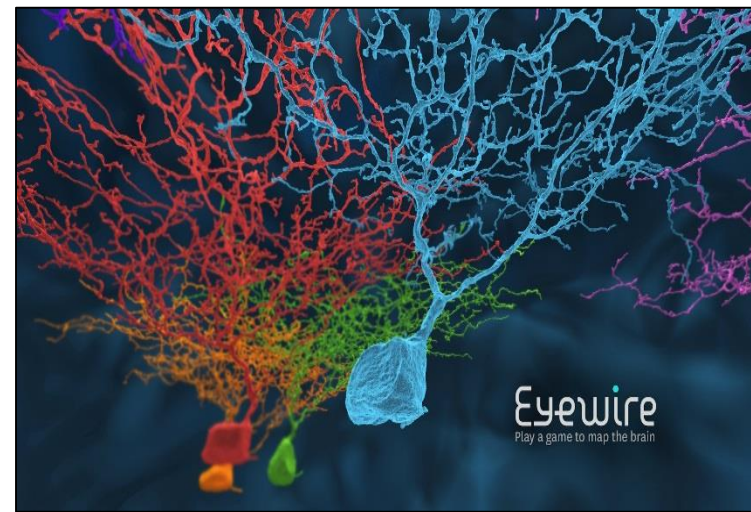
CoCoRaHS
Report rainfall and snowfall for your area!
Join CoCoRaHS today!



Air Sensor
Measure · Learn · Share

Citizen Science Toolbox

EPA



Eyewire
Play a game to map the brain

Citizen science's value proposition

- Foremost, citizen science can help get more science done more efficiently
 - Collect data with improved spatial/temporal resolutions
 - Analyze Big Data more rapidly and where computer algorithms don't suffice
 - Generate new ideas for data applications/technologies
 - Citizen science results are appearing in published scientific papers, while some projects have received standard research funding.
- Citizen science also facilitates other goals, including education; public awareness of scientific developments, methods, and agency missions; and public scientific literacy/interest

Citizen science can be valuable when scientific problems are decomposed properly and when projects are designed properly. It is another approach to advance science.

Enthusiasm for citizen science is growing across the U.S. government

- Federal Community of Practice for Crowdsourcing and Citizen Science
- Open Government Initiative emphasizes public participation
- FY17 EOP R&D budget memo encouraged citizen science activities
- Released on September 30:
 - Federal citizen science toolkit
 - OSTP/Holdren memo promoting agency citizen science use
 - NSF has made citizen science a core priority area
 - Sen. Coons introduction of Crowdsourcing and Citizen Science Act



NASA's citizen science universe

- + NASA-funded but not NASA-led
- ^ Uses NASA data/assets but not NASA-designed
- * Completed/defunct

Disk Detective

- +Target Asteroids
- +Asteroid Mappers
- *Asteroid Data Hunter Challenge
- Citizen science Asteroid Data, Education, and Tools (CADET)
- Apophis 2029

*Cassini Rings Challenge

+Stardust@home

Aurorasaurus
Meteor Counter

+Mercury Mappers

+Moon Mappers
^Moon Zoo

*Open NASA Earth Exchange Challenges
NASA S'COOL
NASA/USGS Adopt-a-Pixel
GLOBE

*3D Space Challenges
*ISS Longeron Challenge

*Mars Balance Mass Challenge
Mars Ascent Vehicle Challenge
+Mars Mappers
*Clickworkers
^Planet Four

Ecological forecasting using crowdsourcing
*Climate Resilience Data Challenge

*Astrobiology Citizen Science
*MAPPER

International Space Apps
challenges (many)



Citizen science successes at NASA



- 130,000+ observations from all 50 states and 50+ countries on cloud type, height, and cover helping NASA validate atmospheric data gathered by satellites



- Participant discoveries of interstellar particles in aerogel containing samples returned to Earth
- 1.5 million classifications of 278,121 disk candidates in 19 months (plus researching targets for follow-up observations, analyzing follow-up data, translating website into foreign languages)



- Awarded \$20,000 for idea to study Martian atmosphere by releasing material that could be seen and studied by other Martian spacecraft in orbit and on the ground

Recent NASA citizen science programmatic developments

- NASA policies endorsing citizen science (2014 NASA Strategic Plan recognizes individual citizens as NASA partners; NPD 1090.1 encourages use of open innovation approaches)
- OCS leading steering/coordinating committee, in partnership with SMD, OCT, et al.
- NASA citizen science forum and list serve
- Internal efforts to create internal awareness of citizen science as a research tool
- New project solicitations/awards
 - Citizen science Asteroid, Data, Education, and Tools solicitation in ROSES
 - OCS Science Innovation Fund – 2 citizen science awards
 - SMD E/PO CAN awards with citizen science elements
- NASA Solve “one-stop-shop” for public to find opportunities

Efforts in progress

- Considering new avenues to create internal awareness and knowledge of citizen science and crowdsourcing tools
- Considering inclusion of more science-based opportunities through the International Space Apps Challenge (April)
- Examining potential of inviting citizen science solicitations via ROSES
- Ongoing discussions with SMD to assess how/where citizen science could advance NASA science and other goals