



Today's Agenda



Welcome to July's Science Update!



The Apollo Mission Anniversary



Science we can do together



Science Updates: Lunar



Featuring NASA Projects



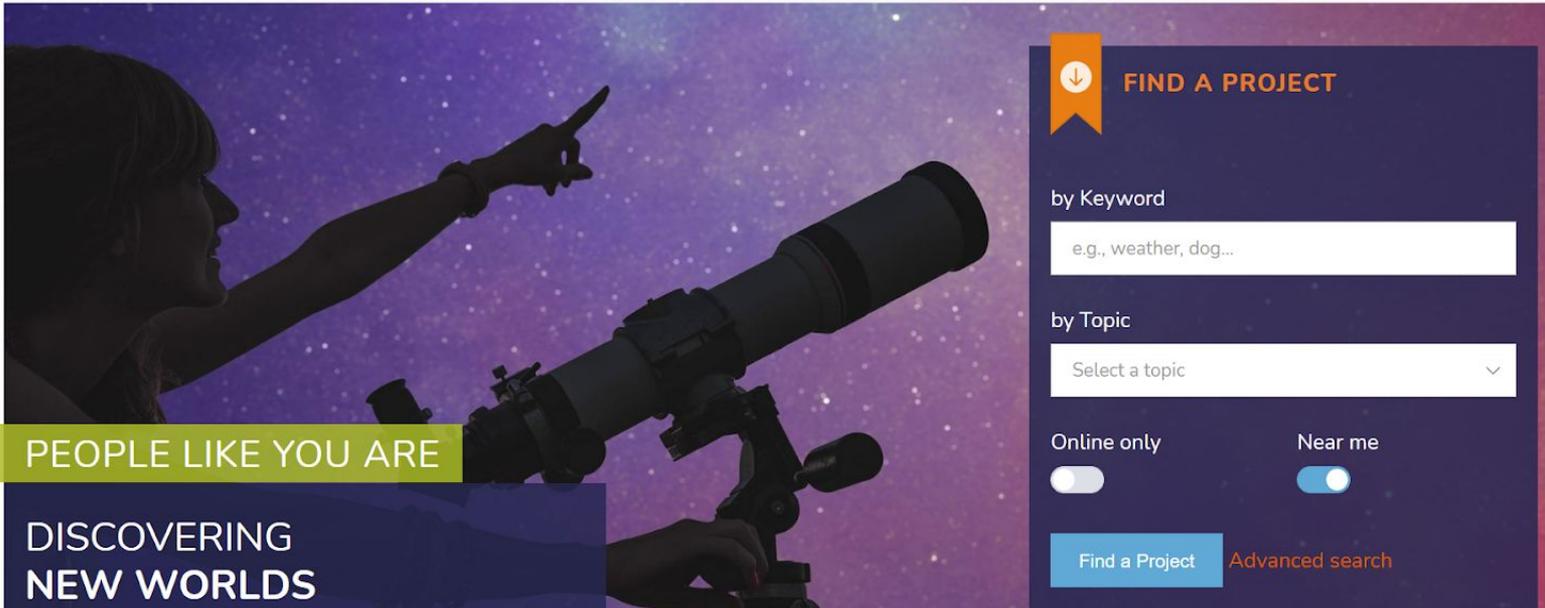
Questions/ Discussion



Thank you and Wrap up!



Welcome & Overview



PEOPLE LIKE YOU ARE

DISCOVERING
NEW WORLDS

FIND A PROJECT

by Keyword

by Topic

 ▾

Online only



Near me



Find a Project

Advanced search

**Visit
SciStarter.org**

SciStarter is a globally acclaimed, online citizen science hub where more than 1,600 projects from all over the world have been organized and made searchable!

Foundations of Citizen Science Tutorial

Start with the self-guided Foundations of Citizen Science Training and badge, a prerequisite for follow-on trainings. Learn the basics, participate in projects, and make the most of SciStarter.



Learn: The Foundations of Citizen Science

Learn the basics of citizen science and how to participate. Earn a personalized badge that shows off your new knowledge!



Explore & Engage: additional trainings

After completing the Foundations training, you will have access to all other trainings!

Projects for Grades PreK-2 and Up



SEEK

Get outside, explore and learn about the nature all around you!



THE GREAT SUNFLOWER PROJECT

Identify where pollinators are declining to help improve their habitats.



ANT PICNIC

Study the dietary preferences of ants.



BUDBURST

Help scientists by observing seasonal changes in plants.



Visit:
**SciStarter.org/
Education**

View curated citizen science projects with classroom materials and educator instructions listed by grade level

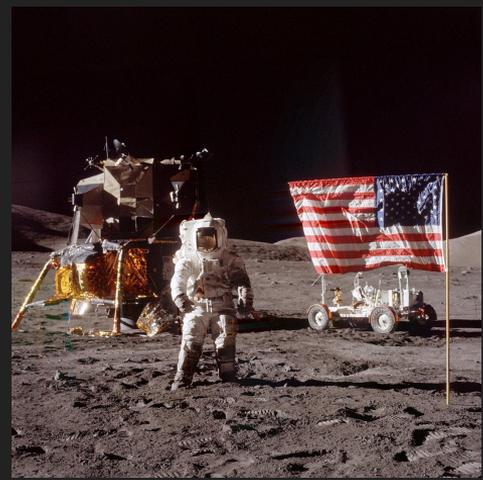
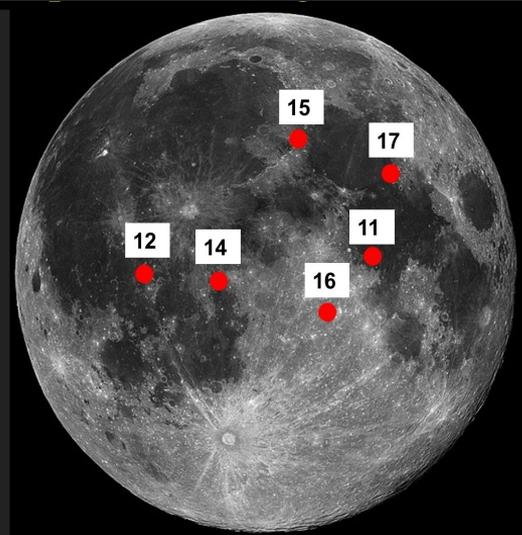


Apollo Program. Science and Exploration Discoveries that are Enabling Our Future in Space

Chip Shearer
CASA Moon-SSERVI
Institute of Meteoritics
Department of Earth and Planetary
Sciences
University of New Mexico
cshearer@unm.edu

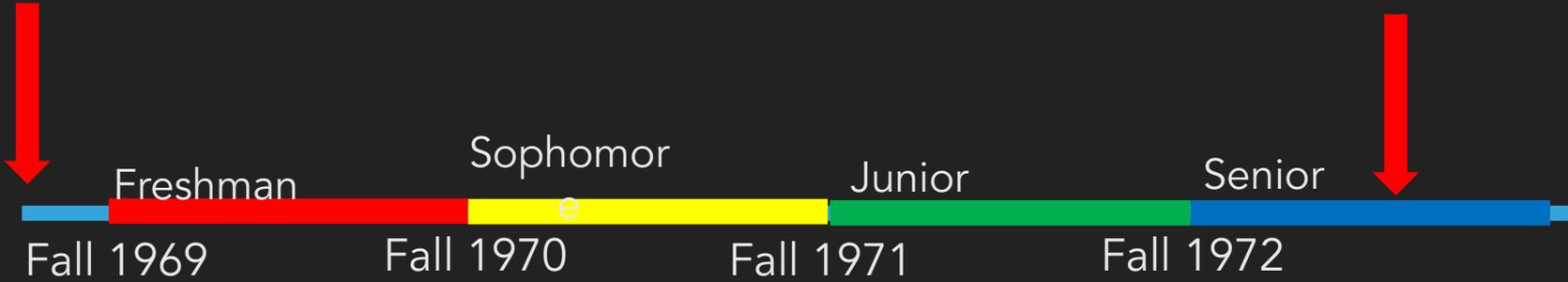


A short lived, but historic adventure.

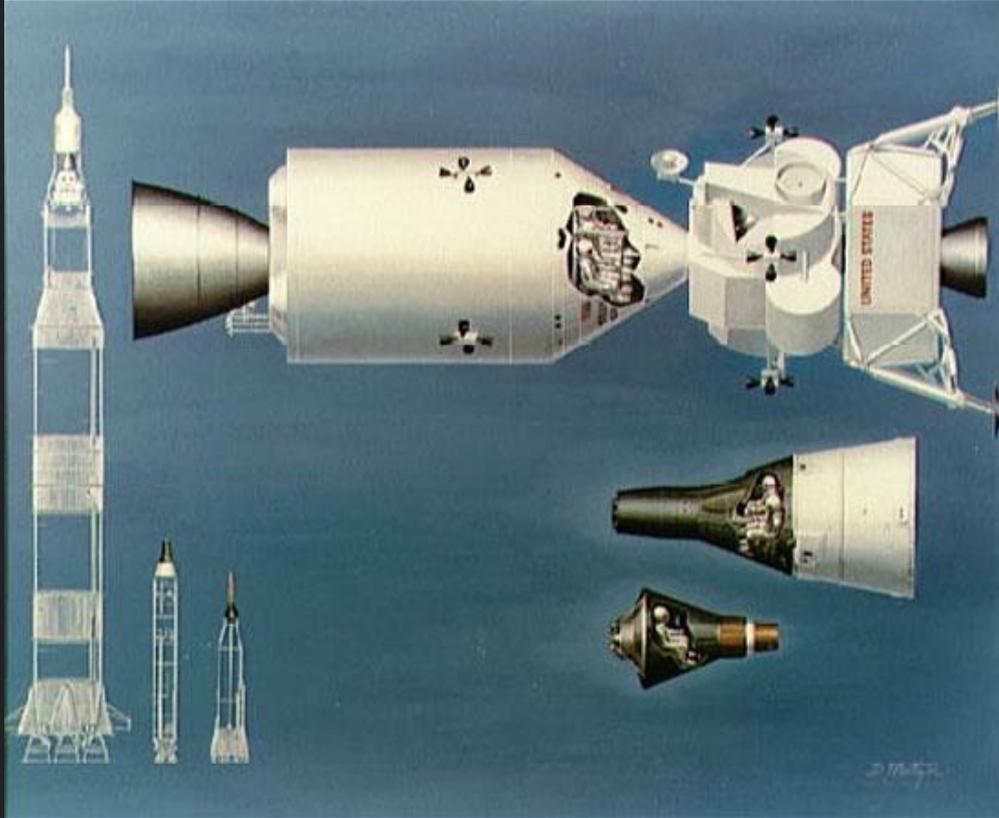


Apollo 11
July 16 to 24, 1969

Apollo 17
December 7 to 19, 1972



A decade of incredible technology growth



“The US should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth.”

Kennedy May 25, 1961

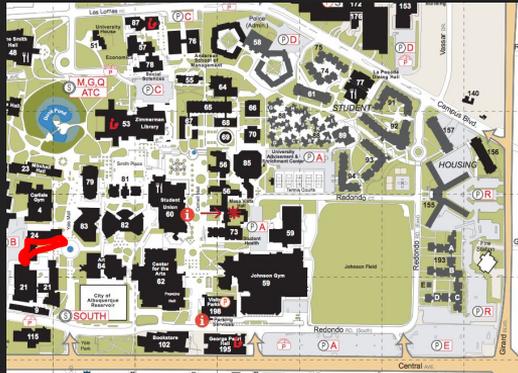
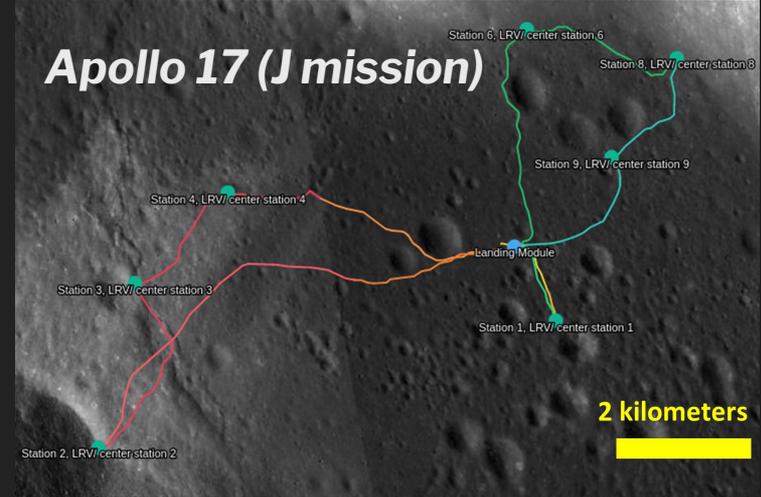
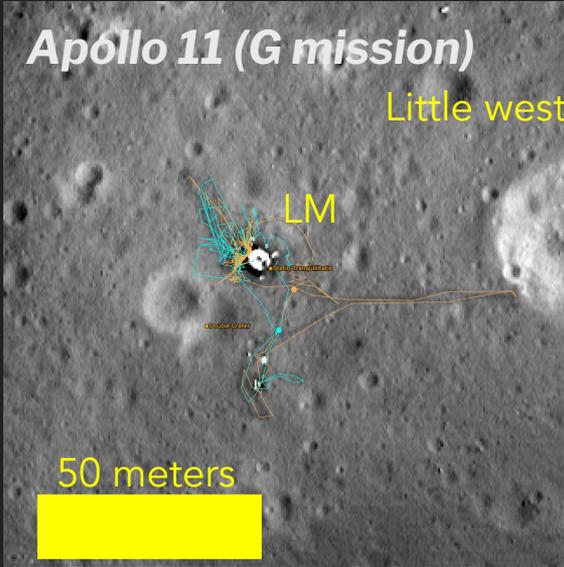
A Gallup Poll indicated that 58 percent of Americans were opposed.

**Project Mercury: Crewed flights (6)
May 1961-May 15-16 1963**

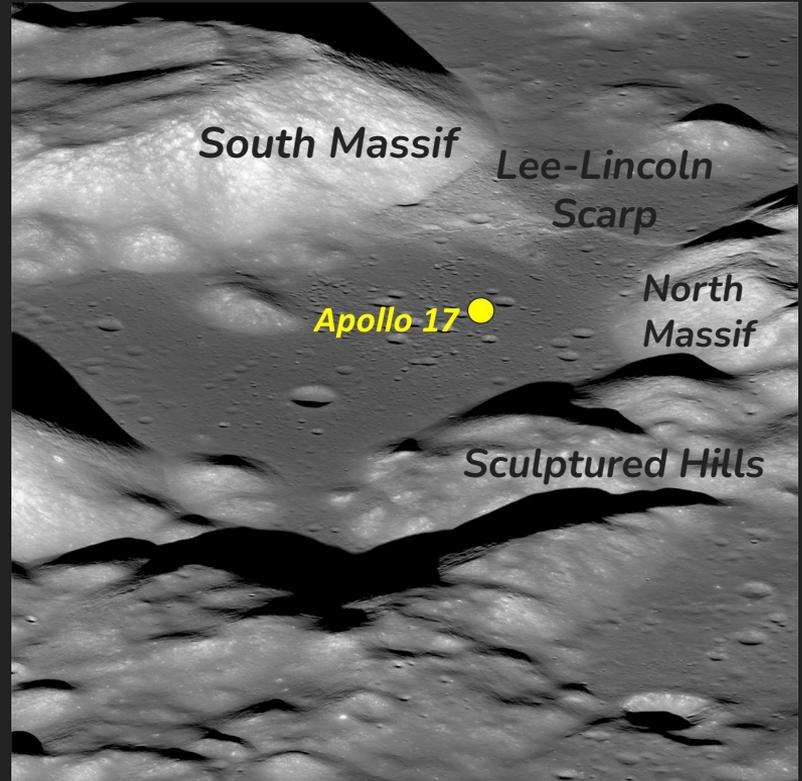
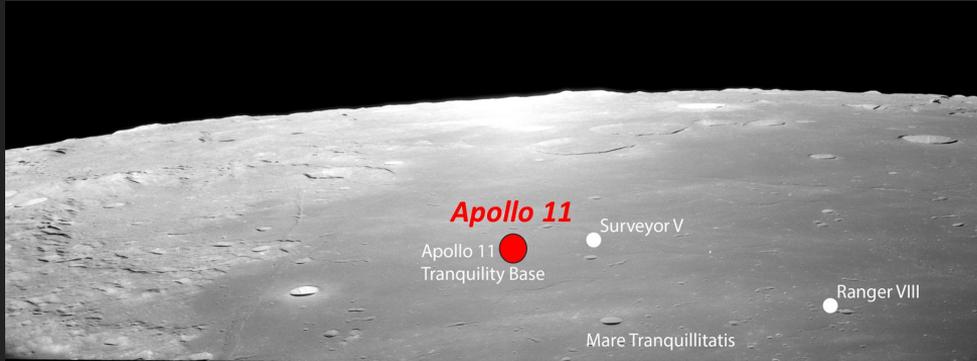
**Project Gemini: Crewed flights (10)
March 23, 1965-November 11-15 1966**

**Project Apollo: Crewed Lunar flights
(9, 27) December 1968-December 1972
(A8, A10, A11, A12, A13, A14, A15,
A16, A17).**

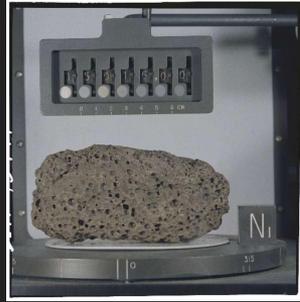
An evolution of surface capabilities. Mobility.



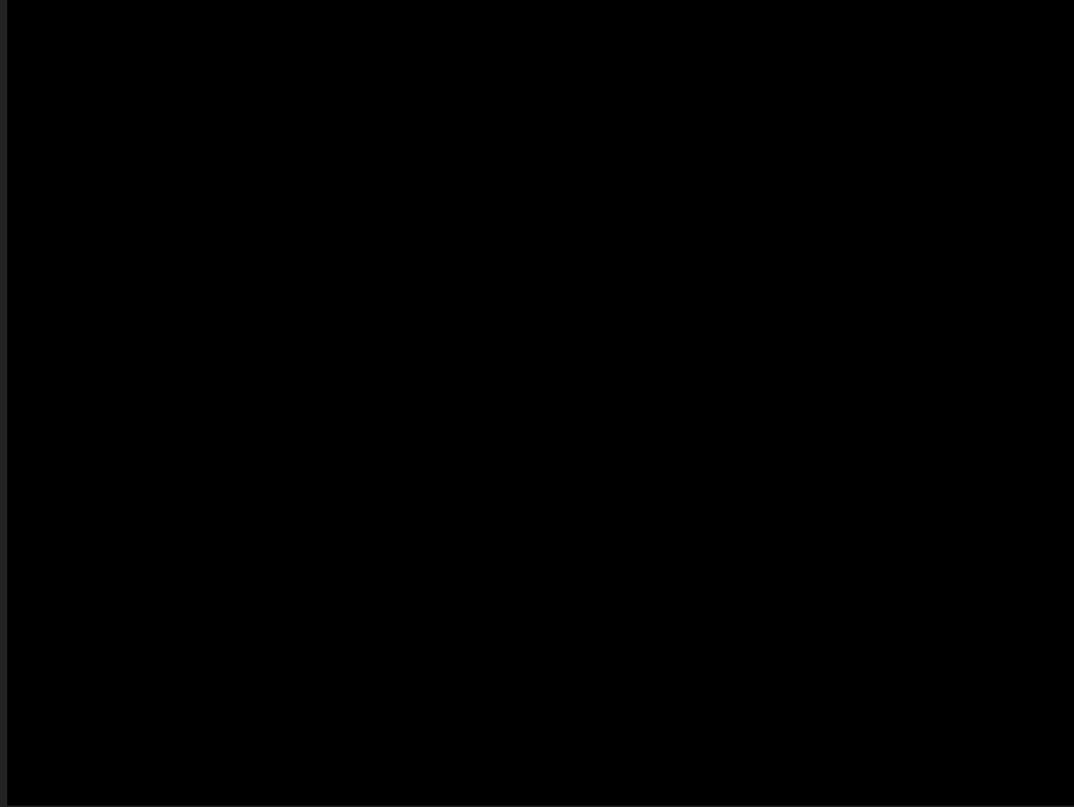
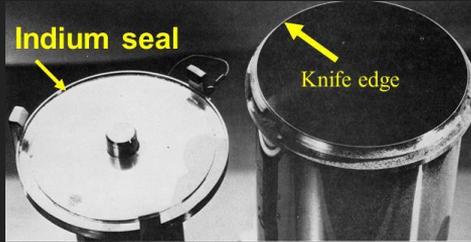
An evolution of surface capabilities. Precision landing capabilities



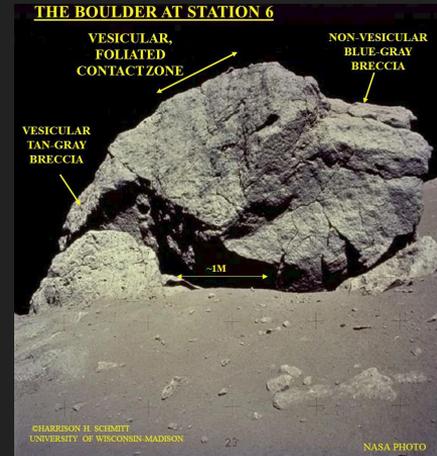
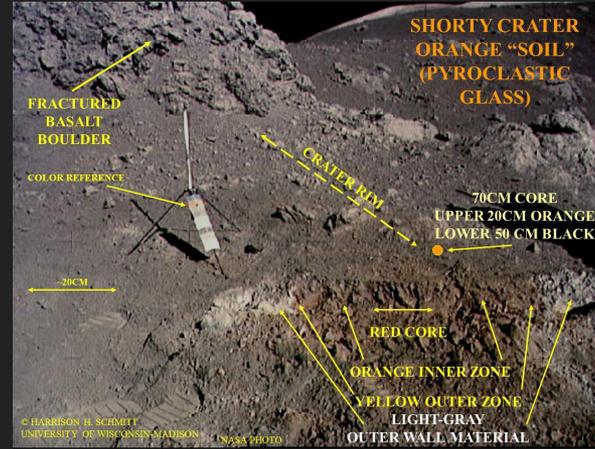
An evolution of surface capabilities. Sampling



Special samples

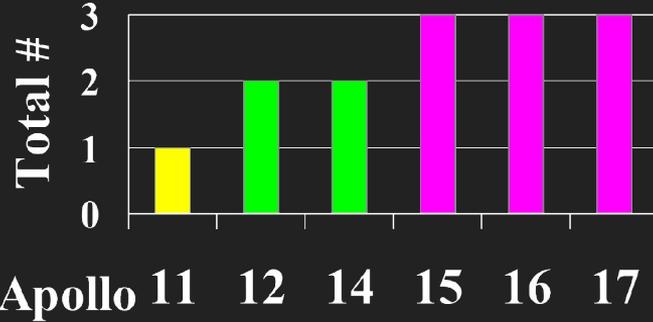


An evolution of surface capabilities. Surface exploration and geology.

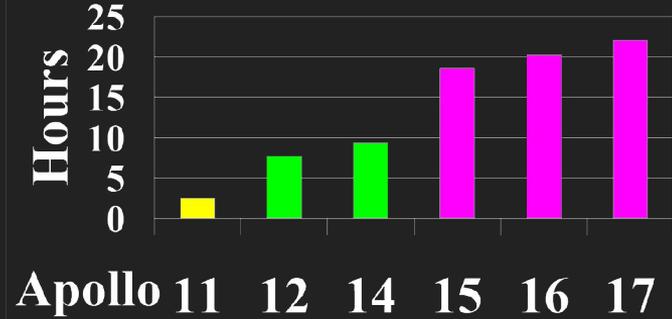


An evolution of surface capabilities. Summary

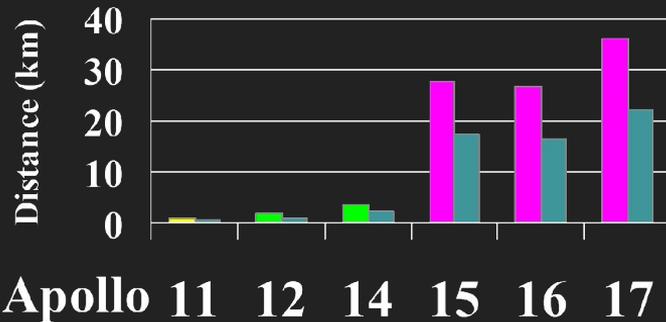
Number of EVAs



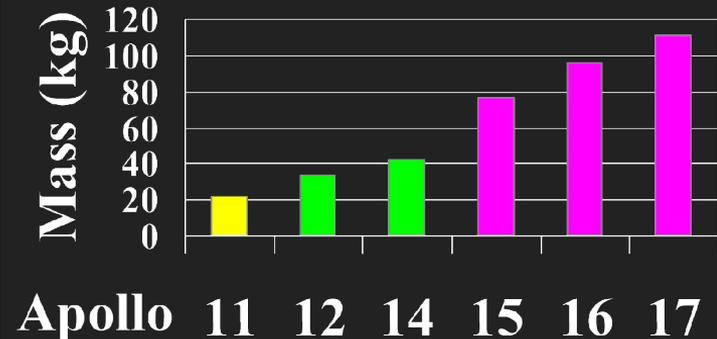
EVA Hours



EVA Distance



Sample Mass



Major Planetary Science Hypothesis Derived from Apollo Samples.



Image credit: SciTechDaily

Giant Impact Origin
for the Moon

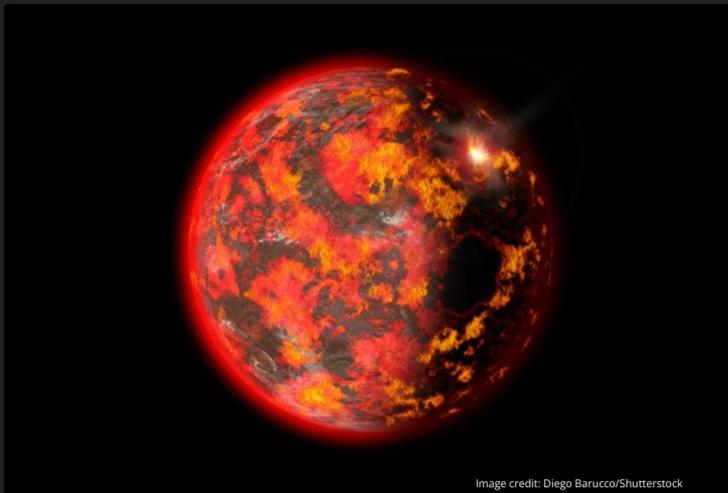


Image credit: Diego Barucco/Shutterstock

Lunar Magma Ocean

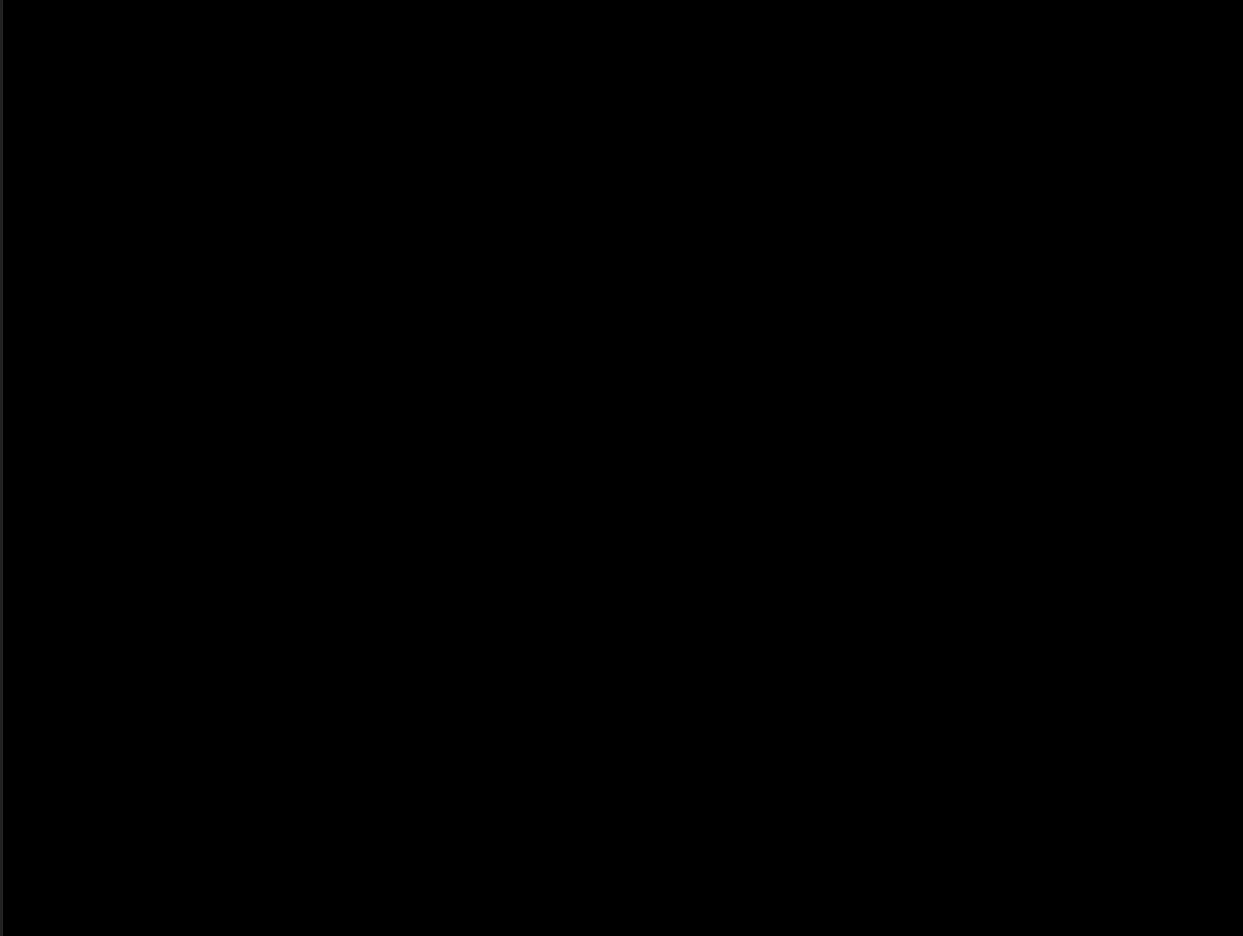


Image credit: Australian National University

Late Heavy
Bombardment

Preparing for Artemis

New observations from orbital assets (LRO).



Preparing for Artemis

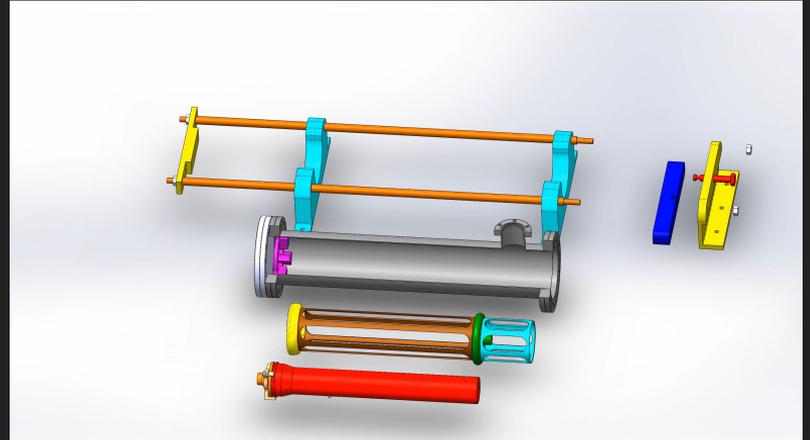
New tools and instruments



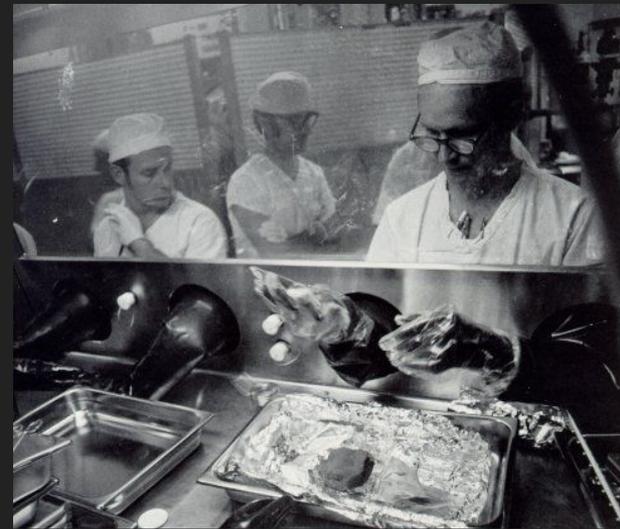
Preparing for Artemis New Tools



*linking generations of lunar explorers
from Apollo to Artemis*

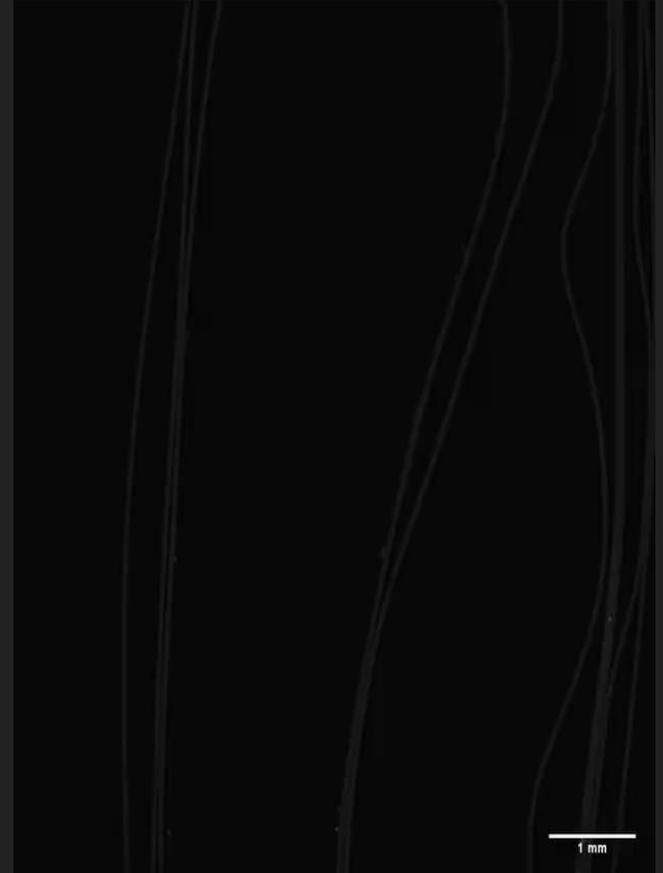
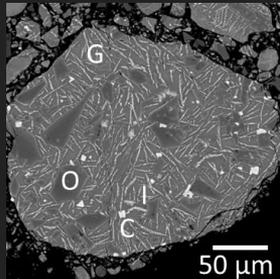
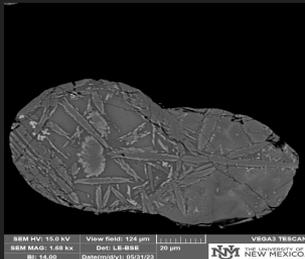
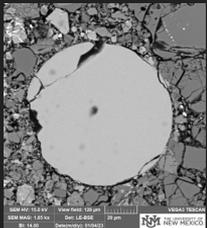
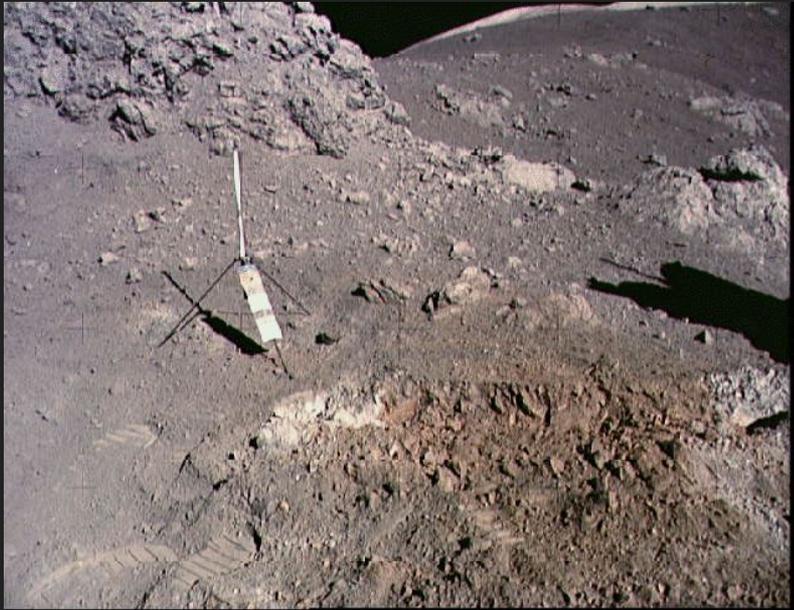


Preparing for Artemis. Linking Apollo - Artemis Generations



Preparing for Artemis. Citizen Science

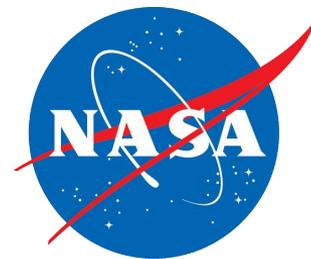
SSSERVI CASA Moon





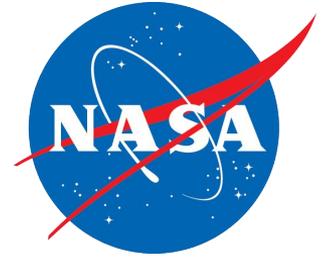
**The future is
here.**

Any questions?



NASA Volunteer Science

Marc Kuchner
NASA Citizen Science Officer



**...also known as
“citizen science” or
“participatory science”**

Marc Kuchner
NASA Citizen Science Officer



Lawyer



Mental Health Counselor



Data Scientist



Pulmonologist



High School Student



Chef/Entrepreneur



Stay-at-Home Mom



Retired Bioscientist



College Physics Major



Special Needs Educator w/Masters in Astronomy



Computer Technician

NASA works with more than 2 million volunteers from 167 different countries!

science.nasa.gov/citizenscience

- 37 projects open to the public
- 23 can be done by anyone, anywhere with just a laptop or cell phone



A screenshot of the NASA Citizen Science website. The browser address bar shows 'science.nasa.gov/citizenscience'. The page features a header with the NASA logo and the text 'NASA SCIENCE SHARE THE SCIENCE'. Below the header, there are six project cards arranged in a 2x3 grid. Each card has a title, a stick figure icon, and a representative image. The projects shown are: 'Landslide Reporter' (mountain landscape with red location pins), 'Floating Forests' (underwater kelp forest), 'Mapping Application for Penguin Populations...' (penguins on ice), 'Sungrazer Project' (red star with comet streak), 'Snapshot Wisconsin' (wolf in a forest), and 'Planet Hunters TESS' (satellite and planet). On the right side of the page, there is a vertical list of links and a 'Follow Us' section with Facebook and Twitter icons.

These volunteer projects are **held to the same rigorous standards as any NASA science project.**

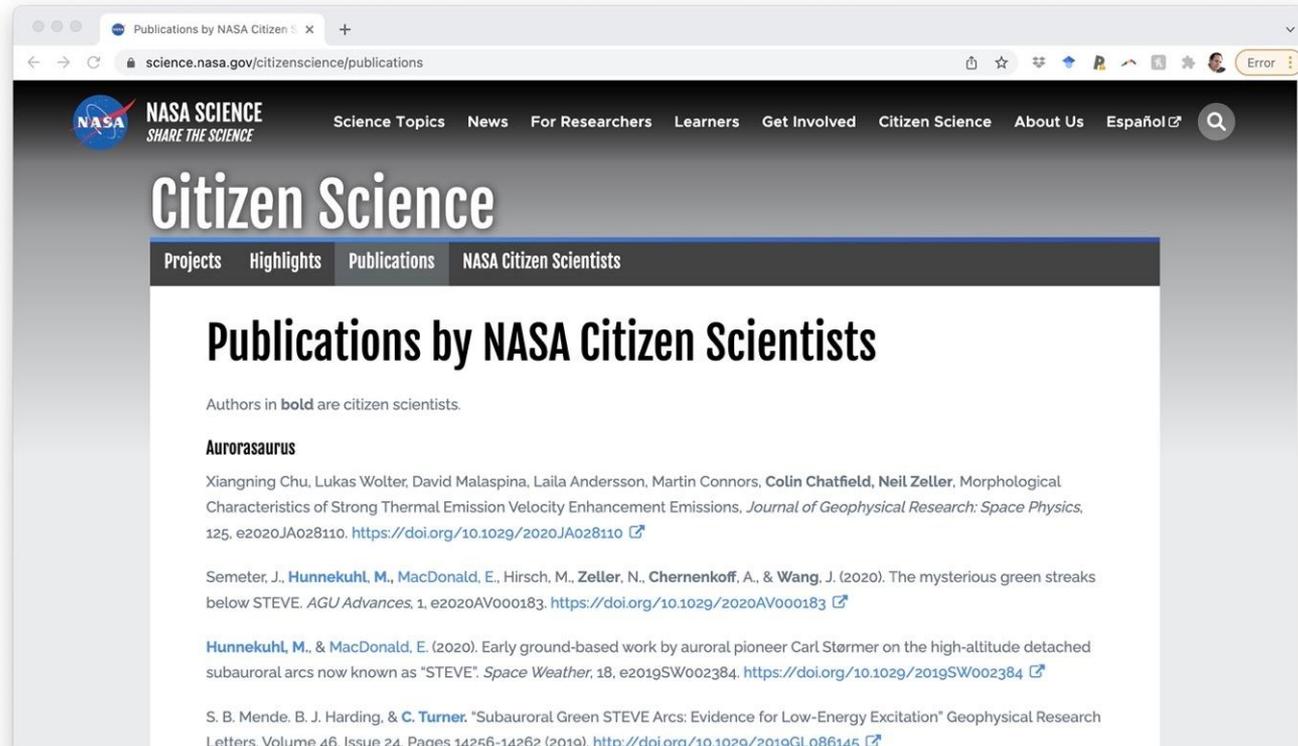
NASA volunteers have discovered:

- The “teepee tent” spectral signature from lightning at 15-30 MHz.
- The star-forming regions called “yellowballs”.
- A rare six-planet transiting system
- The first extreme T subdwarfs
- Zika virus in Peruvian cemetery vases
- The oldest white dwarf debris disk
- The “Dipper” star phenomenon
- The “Peter Pan” disk phenomenon
- Exocomets in Kepler Data
- The Meyer family of comets
- A transiting planet in a quadruple star system
- All of the known samples of extrasolar material
- Most of the known comets
- Most of the known ultracool brown dwarfs
- $\frac{1}{3}$ of Kepler’s long period exoplanets
- 400,000 Martian seasonal fans
- 283,000 emperor penguin nests
- 9120 candidate near-Earth asteroids
- 8900 mosquito breeding sites—and got rid of the mosquitos!
- 7 meteorites
- 1 new *kind* of aurora named STEVE



More than 450 NASA volunteers have become named co-authors on refereed published papers!

science.nasa.gov/citizenscience/publications



The screenshot shows a web browser displaying the NASA Citizen Science Publications page. The browser's address bar shows the URL science.nasa.gov/citizenscience/publications. The page features the NASA logo and the text "NASA SCIENCE SHARE THE SCIENCE" in the top left. A navigation menu includes "Science Topics", "News", "For Researchers", "Learners", "Get Involved", "Citizen Science", "About Us", and "Español". Below the navigation is a search icon. The main heading is "Citizen Science", with sub-navigation for "Projects", "Highlights", "Publications", and "NASA Citizen Scientists". The "Publications" sub-page is active, showing the title "Publications by NASA Citizen Scientists". A note states: "Authors in bold are citizen scientists." The first publication listed is "Aurorasaurus" by Xiangning Chu, Lukas Wolter, David Malaspina, Laila Andersson, Martin Connors, **Colin Chatfield**, **Neil Zeller**, et al. The second publication is by Semeter, J., **Hunnekuhl, M.**, MacDonald, E., Hirsch, M., **Zeller, N.**, Chernenkoff, A., & Wang, J. (2020). The third publication is by **Hunnekuhl, M.**, & MacDonald, E. (2020). The fourth publication is by S. B. Mende, B. J. Harding, & **C. Turner**.

At least 12 NASA Science Teams have Regular Meetings/Videocons/Calls Directly with their Volunteers

Stardust@Home: videocons on the 3rd Thursday of each month.

Radio Jove: regular phone calls with volunteers.

Planet Patrol, Disk Detective, and Burst Chasers: videocons once per week.

Backyard Worlds: three videocons per week.

HAMSci: 3-4 telecons per week

Planet Hunters: monthly Coffee Chats

GAVRT: monthly session with citizen scientists

Fresh Eyes on Ice: monthly meets during the frozen season

Growing Beyond Earth: monthly chats with scientists and virtual office hours.

Dark Energy Explorers: TBD

science.nasa.gov/citizenscience



Citizen Science | Science Missi x +

science.nasa.gov/citizenscience

NASA SCIENCE
SHARE THE SCIENCE

Landslide Reporter

Floating Forests

Mapping Application for Penguin Populations...

Sungrazer Project

Snapshot Wisconsin

Planet Hunters TESS

- > Science on a Sphere
- > Science on a Sphere Facebook Group
- > NASA Citizen Science Named as Cited Reference in Peer-Reviewed Publications
- > Refereed Publications Name Individual Citizen Scientists as Authors
- > Presentation: Building the Future of Citizen Science Conference Workshop
- > SMD Citizen Science
- > NASA Solve
- > Citizen Science Association
- > Join the NASA Citizen Science Listserv

Follow Us

Aaron Curtis

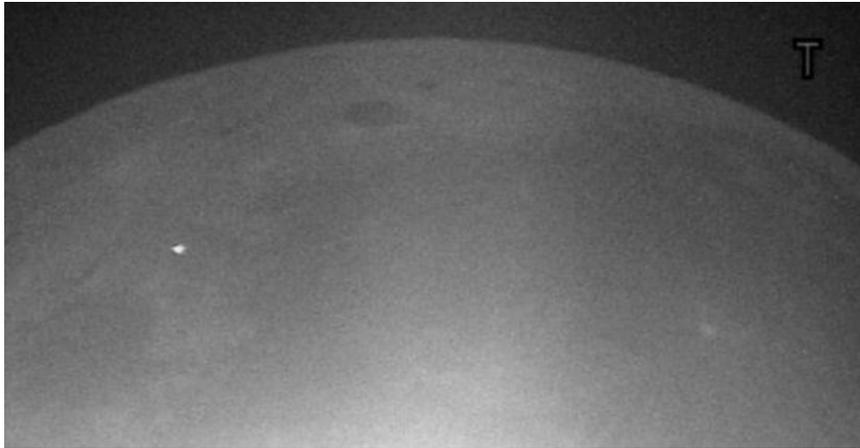
Jet Propulsion Laboratory,
California Institute of Technology



MOON
DUFF

MOONDIFF

<https://trek.nasa.gov/moondiff>



Meteoroid impact flash on the moon. Impacts cause new craters on the moon several time per month. From https://blogs.nasa.gov/Watch_the_Skies/2011/05/

- **Volunteers compare old and new lunar images from orbiting spacecraft**
- **Find new craters to constrain meteoroid flux, improve crater-count dating in the solar system**
- **Find spacecraft landing & crash sites to help improve landing technology, understand human impact on the moon**

NASA MOONDIFF

Drag to look around. If you see a difference, click a few times to draw a polygon around it.

Compare Images

Comparer: blink / fade

Crossfade:

Blink:

Blink speed:

Skip pair Pair done

aaron | sign out

0000 points

tour | Intro video



detections ▼

comments ▼

M1104273380RE ⓘ

Gamma:

Invert:

Autostretch:

M1180855200RE ⓘ

Gamma:

Invert:

Autostretch:



MOONDIFF

VOA beta

Compare images

Comparer:

Crossfade:

Blink:

Blink speed:

aaron | sign out
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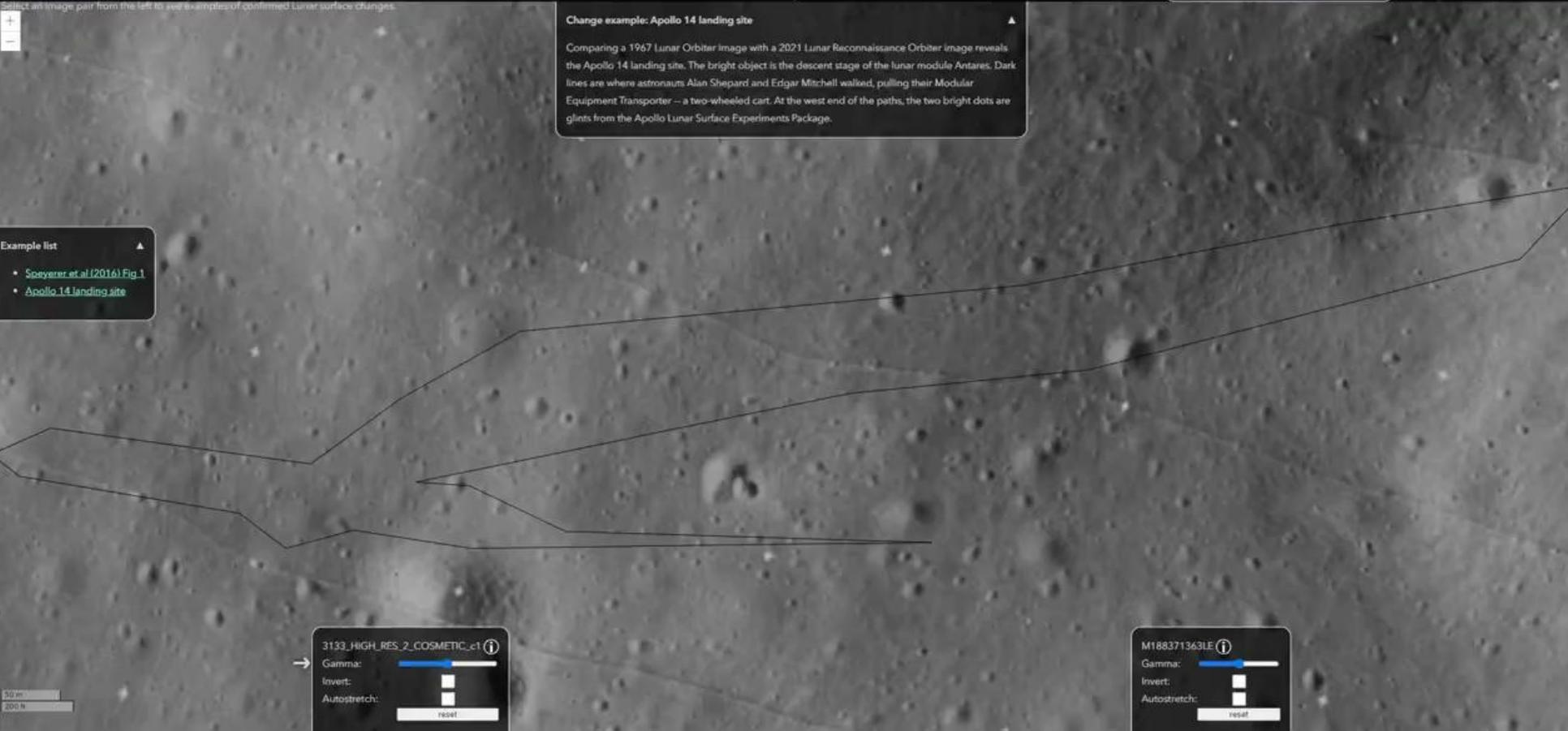
Select an image pair from the left to see examples of confirmed Lunar surface changes.



Change example: Apollo 14 landing site

Comparing a 1967 Lunar Orbiter image with a 2021 Lunar Reconnaissance Orbiter image reveals the Apollo 14 landing site. The bright object is the descent stage of the lunar module Antares. Dark lines are where astronauts Alan Shepard and Edgar Mitchell walked, pulling their Modular Equipment Transporter – a two-wheeled cart. At the west end of the paths, the two bright dots are glints from the Apollo Lunar Surface Experiments Package.

- Example list
- [Spayser et al \(2016\) Fig 1](#)
 - [Apollo 14 landing site](#)



50 m
200 m

3153_HIGH_RES_2_COSMETIC_c1

Gamma:

Invert:

Autostretch:

reset

M188371363LE

Gamma:

Invert:

Autostretch:

reset

MOONDIFF

<https://trek.nasa.gov/moondiff>

- **Join the beta test with signup code NSTA at**
<https://trek.nasa.gov/moondiff>
- **General availability launching Aug 1st**



GROWING BEYOND EARTH™

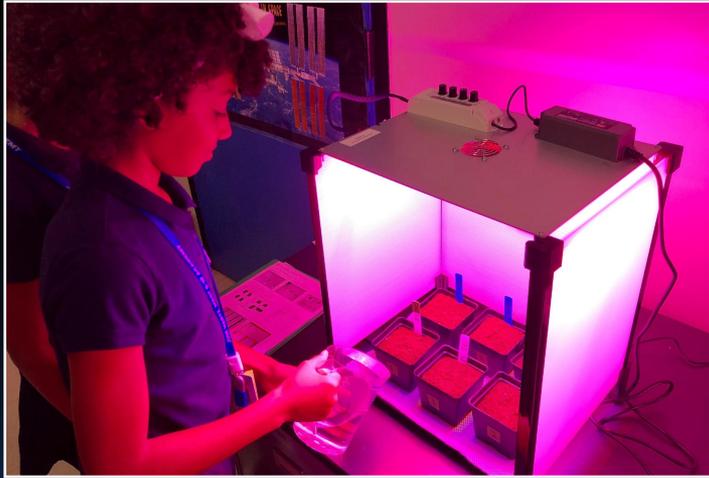
A PARTNERSHIP BETWEEN FAIRCHILD TROPICAL BOTANIC GARDEN & NASA

Amy Padolf

Director of Education
Fairchild Tropical Botanic Garden



Growing Beyond earth is based upon work supported by NASA Grant No. NNH217ZDA001N-SciAct. Any opinions, findings, conclusions, or recommendations expressed are those of the authors and do not necessarily reflect the views of the National Aeronautics and Space Administration.



Growing Beyond Earth® Challenge

Classroom citizen science project in partnership with NASA. Improving middle and high school STEM education while supporting plant research on the International Space Station.

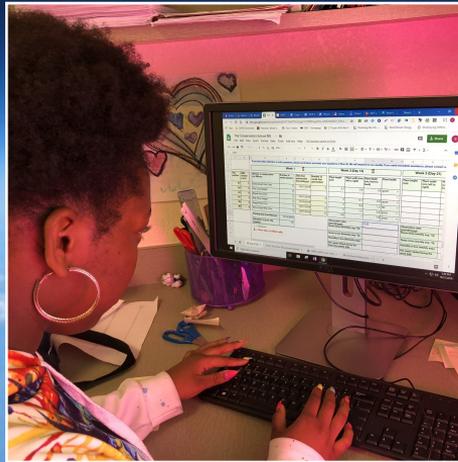
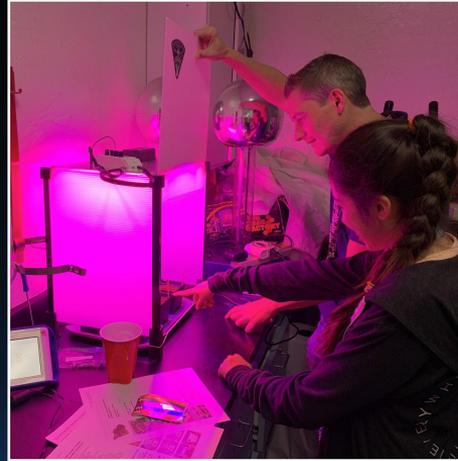




Growing Beyond Earth® Challenge

NASA Awards NNX16AM32G / 80NSSC21M0043

- Classroom citizen science program in over 450 middle and high schools nationwide with more than 40,000 students participating since 2015
- Supports current plant research on the International Space Station (ISS)
- Students run experiments using equipment similar to the plant habitats on ISS, testing new varieties of plants and growing techniques
- Students present their results to a panel of NASA scientists and administrators
- NASA uses student data to develop plant growing protocols for ISS
- Nearly 200 vegetable varieties studied to date, four have been grown on ISS based on student data.

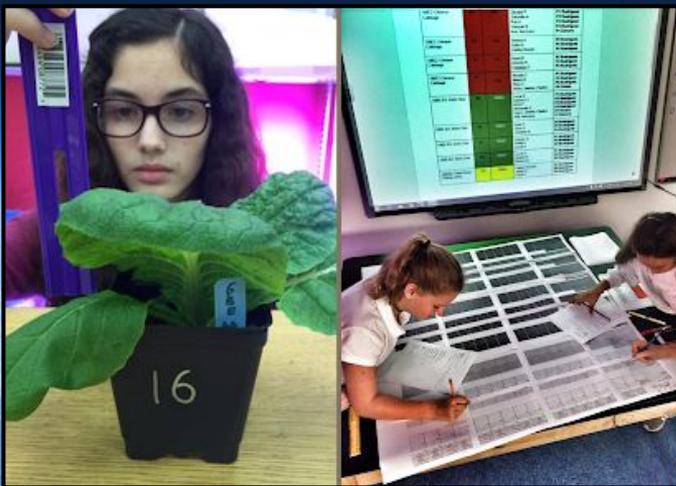




*[The] students' interest level was very high. This high-interest level led to students actively participating as well as asking higher-level questions. This led to students conducting their own research about the particular cultivars in order to learn more. Students also assumed a **sense of ownership** and therefore were **motivated to care** for the plants as well as examine them daily. They enjoy speaking about the plants to others. Clearly, their behavior demonstrated that they are growing to love this project.*



*-Teacher Participants
iMater High School
Hialeah, Florida*



Registration is Open
Register by September 1, 2023



Thank You!

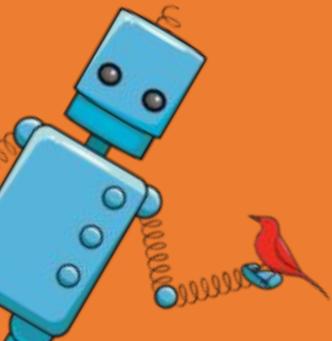
QUESTIONS?

Amy Padolf, Director of Education

apadolf@fairchildgarden.org or 305.663.8097

Thank you!

Questions?





Up Next:

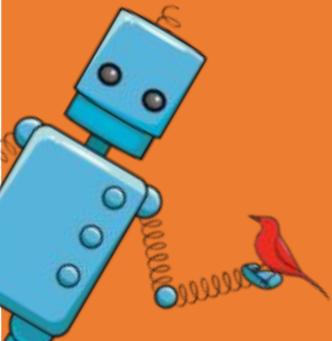
Prepare for the Eclipses!
Help NASA Discover What Happens
When the Sun Goes Dark and
Participate in the Helio Big Year

Did you know there will be two solar eclipses observable in the US next October and April? Learn about the various eclipse research efforts and join the eclipse preview show on:

September 19th, 2023 at 7pm ET/ 4pm PT

Register here: <https://scistarter.org/go/Do-NASA-Science-LIVE>

In partnership with:



CITIZEN SCIENCE
ASSOCIATION
CitizenScience.org | @CitSciAssoc



scistarter
Science we can do together.

To learn more and to find additional resources about participatory sciences, go to SciStarter.org and CitizenScience.org



Ask the Community

At the bottom of every SciStarter project page, you can leave a review or ask a question about the project.



Ask the Project Leaders

Send a message to a project's leaders with the "Message Project" button on each SciStarter project page.



Ask SciStarter

Email

Info@SciStarter.org
and we'll do our best to help you out!



Listen to the Podcast!

[SciStarter.org/podcast](https://www.scistarter.org/podcast)
Available also on Spotify, Google, Apple, Podbean, and Stitcher



Take a Training

At [SciStarter.org/training](https://www.scistarter.org/training), you'll find free, self-guided modules like our Foundations of Citizen Science course.



Find Your Next Project!

Ready for more?
Head back to [SciStarter.org/finder](https://www.scistarter.org/finder) and pick out your next project to contribute to!

Resources & More

If you ever get stuck or want a boost, try these!

If you registered for this event, we will email you these links.

Join us on **September 19th**
at **7 PM ET** for the next
Do NASA Science LIVE to
prepare for the Eclipses!

**Thanks for
watching!**

Reach SciStarter at Info@SciStarter.org

Register here:

