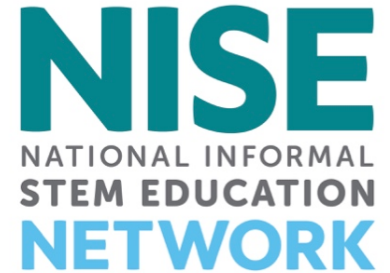


NISE Net Online Workshop

Celebrating the Moon, Our Nearest Neighbor in Space

Tuesday, October 9, 2018



Welcome!

Today's presenters are:

- **Andrea Jones**, NASA's Goddard Space Flight Center
- **Mark Robinson**, Arizona State University
- **Dave Prosper**, Astronomical Society of the Pacific
- **Brad Herring**, Museum of Life and Science

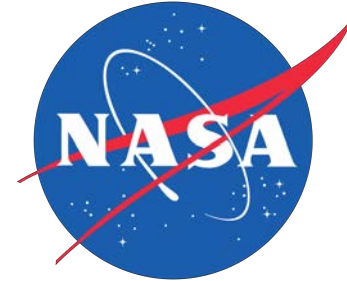


As we wait to get started with today's discussion, please:

Introduce yourself! Type your name, institution, and location into the Chat Box

Questions? Feel free to type your questions into the Chat Box at any time throughout the webinar or use the raise your hand function in the participants list and we'll unmute your microphone.

Today's discussion will be recorded and shared on nisenet.org at: nisenet.org/events/online-workshop



October 20, 2018

Andrea Jones
Director, International Observe the Moon Night
andrea.j.jones@nasa.gov



International Observe The Moon Night
Oman Astronomical Society
Oman - Muscat
19/09/2015

Photo credit: Oman Astronomical Society, Oman



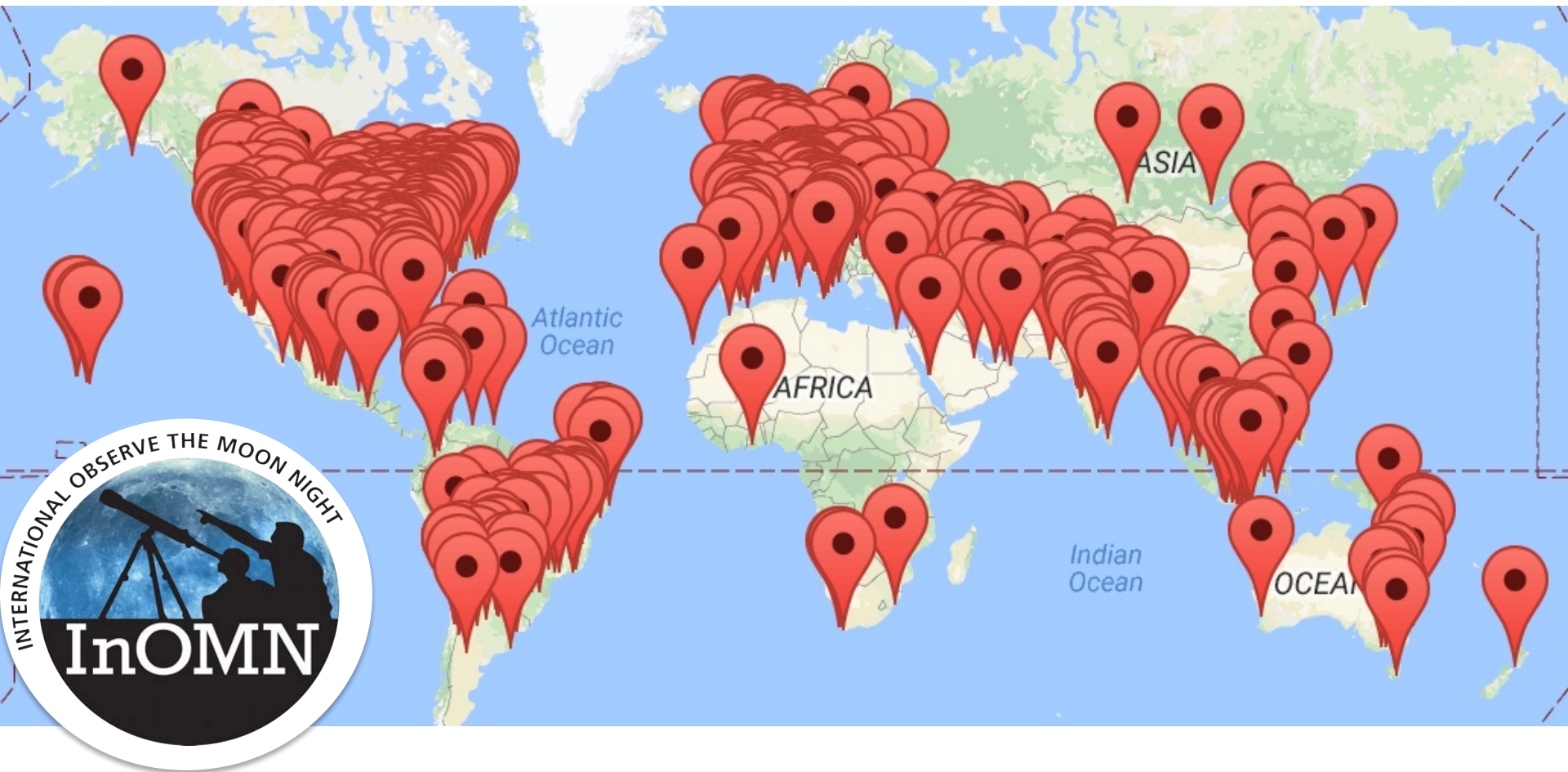
Photo credit: Jose Castro, CA



Everyone. Everywhere. Every year.

2017 InOMN Events

633 registered events were held in 51 countries and 46 US states, Washington DC, and Puerto Rico



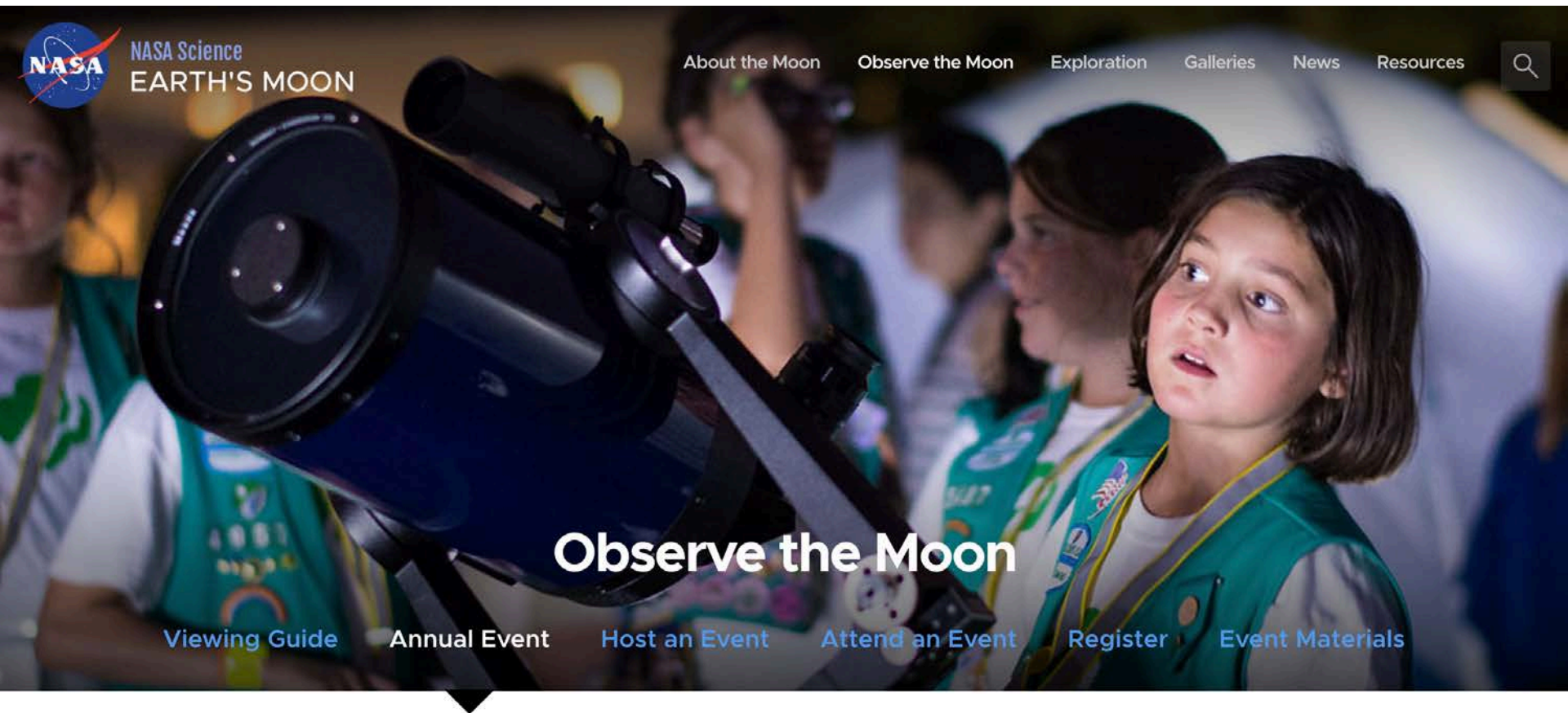
**100 countries and 50 US states (+DC + PR) have hosted
4,505 InOMN events since 2010**

Example Event: NASA GSFC



Photo credit for all images: NASA/GSFC

New Website!



moon.nasa.gov/observe

International OBSERVE THE **MOON** NIGHT 2018



Event Materials

International
OBSERVE THE
MOON
NIGHT



Social Media



International
OBSERVE THE
MOON
NIGHT
OCTOBER 20
2018

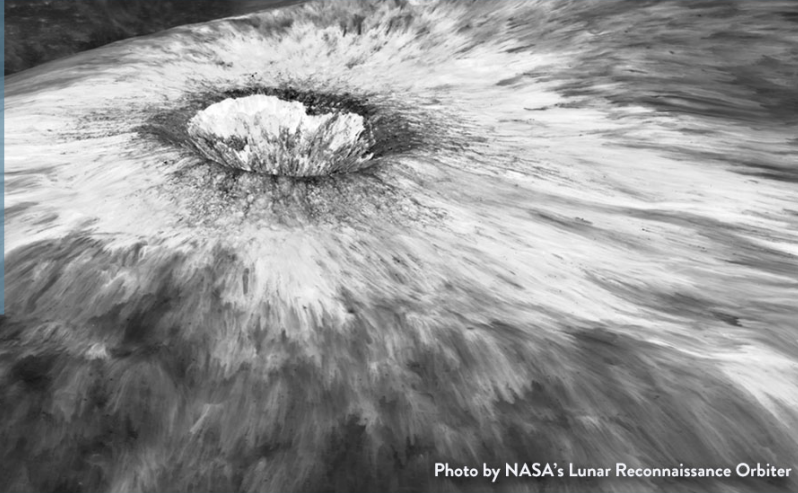


Photo by NASA's Lunar Reconnaissance Orbiter

#ObserveTheMoon

[MOON.NASA.GOV/OBSERVE](https://moon.nasa.gov/observe)

International
OBSERVE THE
MOON
NIGHT
OCTOBER 20
2018

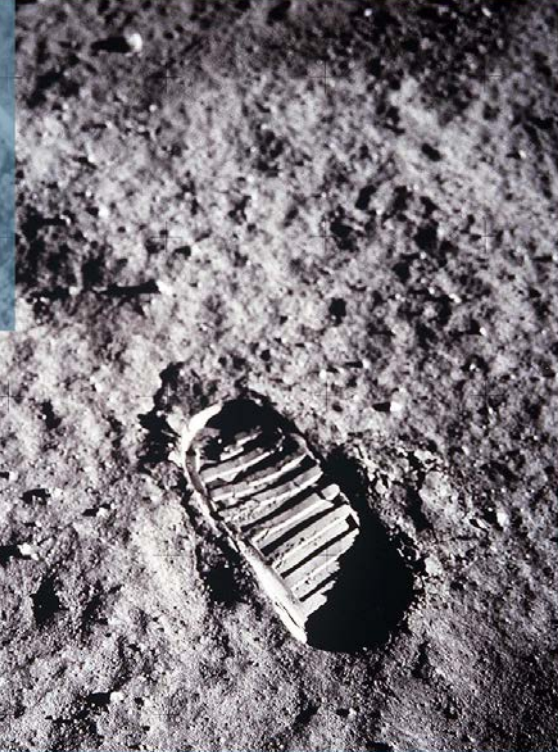


Photo by NASA's Lunar Reconnaissance Orbiter

#ObserveTheMoon

[MOON.NASA.GOV/OBSERVE](https://moon.nasa.gov/observe)

International
OBSERVE THE
MOON
NIGHT
OCTOBER 20
2018



#ObserveTheMoon

[MOON.NASA.GOV/OBSERVE](https://moon.nasa.gov/observe)

@NASAMoon

#observethemoon

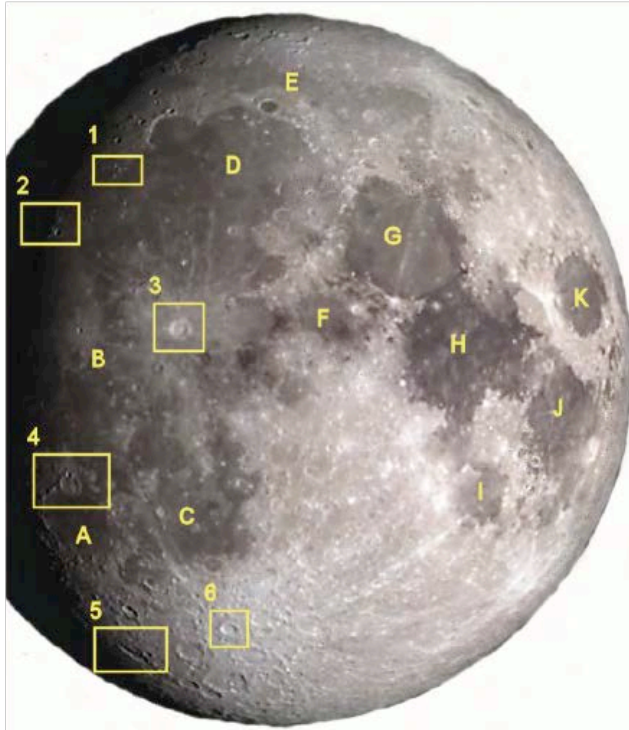
2018 Moon Map

International OBSERVE
THE **MOON** NIGHT 2018 *October*
SAVE THE DATE 20TH

Northern Hemisphere Moon Map: This map depicts the Moon as it will appear from the northern hemisphere at approximately 8:00 PM EDT and 5:00 PM PDT on International Observe the Moon Night, October 20, 2018. Many of the best views will occur along the terminator (the line between the day and night side of the Moon).

Lunar Maria (Seas)
You can see a number of maria tonight. Once thought to be seas of water, these are actually large, flat plains of solidified basaltic lava. They can be viewed in binoculars or even with the unaided eye.

- A. Mare Humorum
- B. Oceanus Procellarum
- C. Mare Nubium
- D. Mare Imbrium
- E. Mare Frigoris
- F. Mare Vaporum
- G. Mare Serenitatis
- H. Mare Tranquillitatis
- I. Mare Nectaris



Selected Telescopic Objects: Some of the more interesting lunar landforms that have favorable lighting for viewing tonight are identified here. Details for each are on the reverse side of this map.

- 1. Gruithuisen Domes
- 2. Aristarchus Plateau
- 3. Copernicus Crater
- 4. Gassendi Crater
- 5. Schiller Crater
- 6. Tycho Crater



MOON.NASA.GOV/OBSERVE

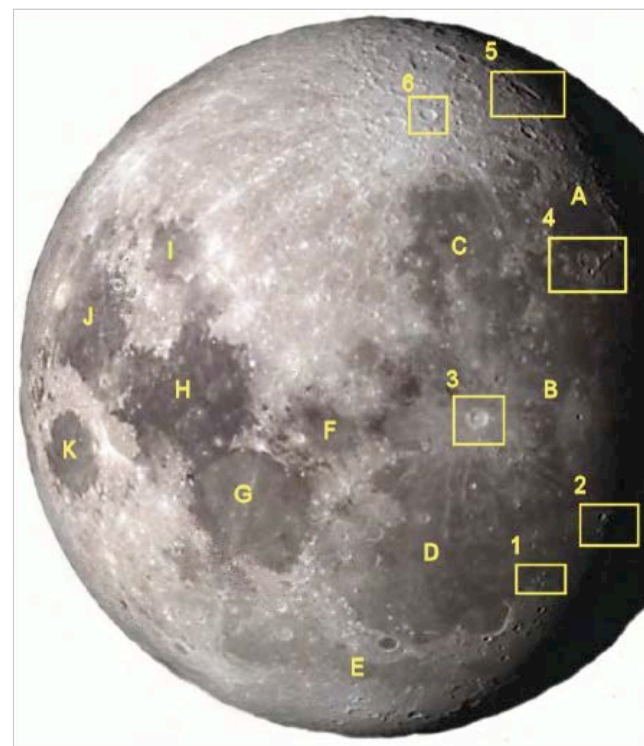
#observethemoon

International OBSERVE
THE **MOON** NIGHT 2018 *October*
SAVE THE DATE 20TH

Southern Hemisphere Moon Map: This map depicts the Moon as it will appear from the southern hemisphere at approximately 8:00 PM EDT and 5:00 PM PDT on International Observe the Moon Night, October 20, 2018. Many of the best views will occur along the terminator (the line between the day and night side of the Moon).

Lunar Maria (Seas)
You can see a number of maria tonight. Once thought to be seas of water, these are actually large, flat plains of solidified basaltic lava. They can be viewed in binoculars or even with the unaided eye.

- A. Mare Humorum
- B. Oceanus Procellarum
- C. Mare Nubium
- D. Mare Imbrium
- E. Mare Frigoris
- F. Mare Vaporum
- G. Mare Serenitatis
- H. Mare Tranquillitatis
- I. Mare Nectaris
- J. Mare Fecunditatis
- K. Mare Crisium



Selected Telescopic Objects: Some of the more interesting lunar landforms that have favorable lighting for viewing tonight are identified here. Details for each are on the reverse side of this map.

- 1. Gruithuisen Domes
- 2. Aristarchus Plateau
- 3. Copernicus Crater
- 4. Gassendi Crater
- 5. Schiller Crater
- 6. Tycho Crater



MOON.NASA.GOV/OBSERVE

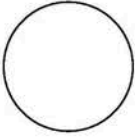
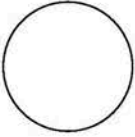
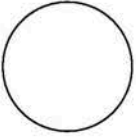
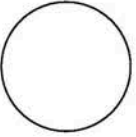
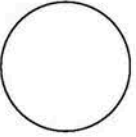
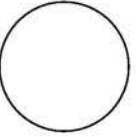
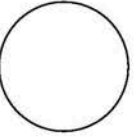
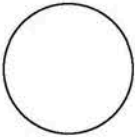
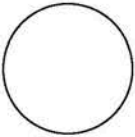
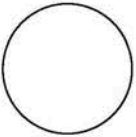
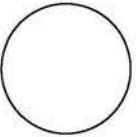
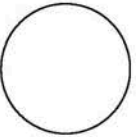
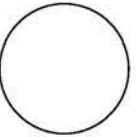
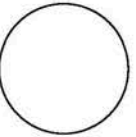
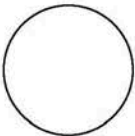
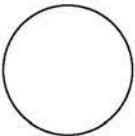
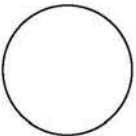
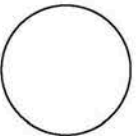
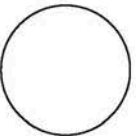
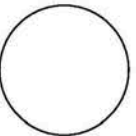
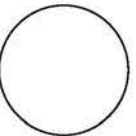
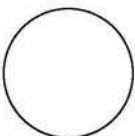
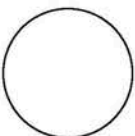
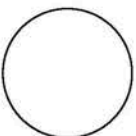
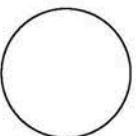
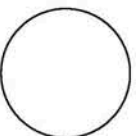
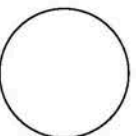
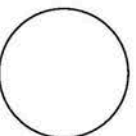
#observethemoon

Moon Observation Log

NAME _____



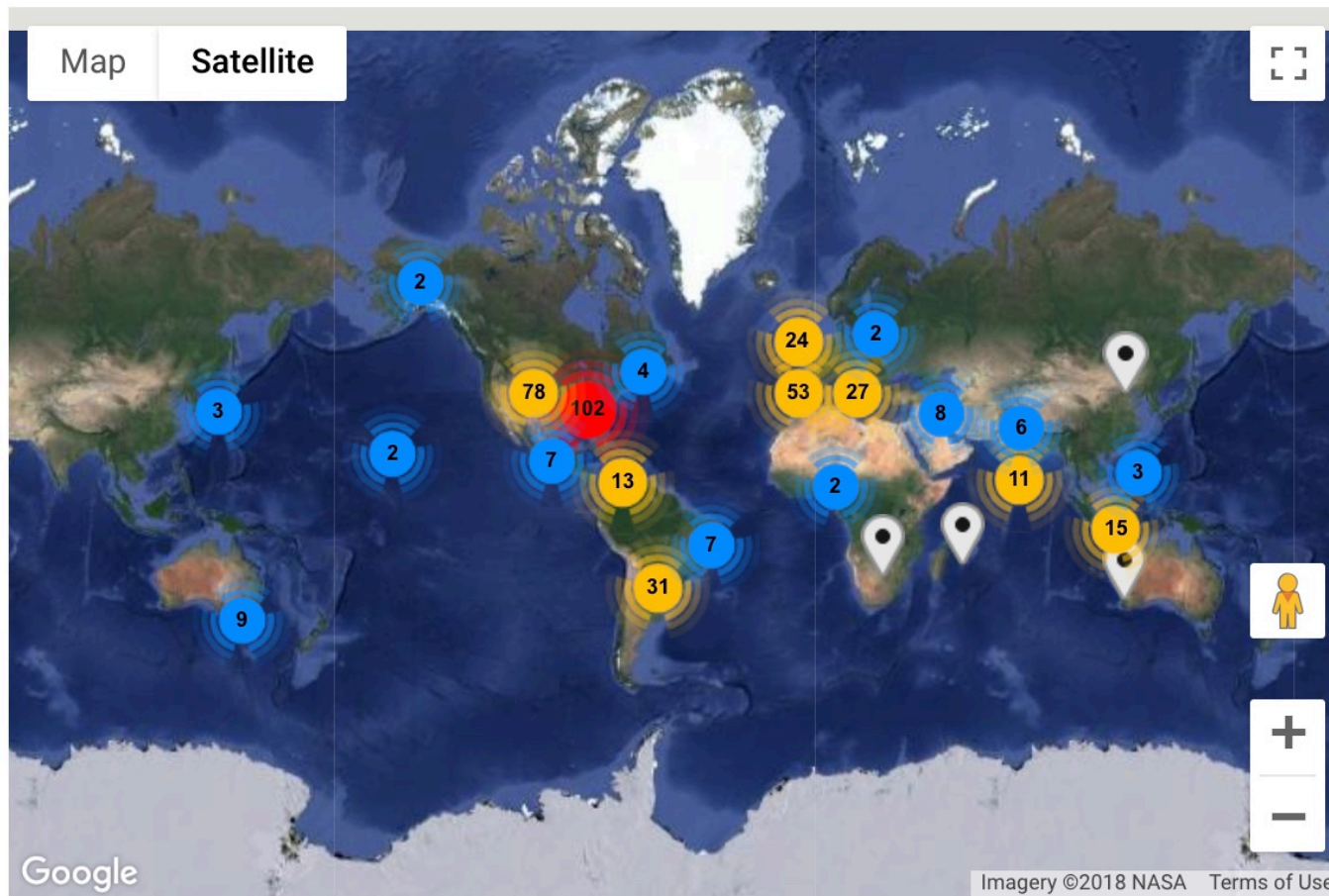
DIRECTIONS: Observe the Moon each day for one month. Write down the date and time you make each observation, and illustrate how the Moon looks each day by shading in the circles to reflect the shape of the Moon. For example, if you can see the whole Moon, you do not need to shade in any part of the circle. If you can only see half of the Moon, shade the side of the Moon that you cannot see in the circle for that day. If you cannot see the Moon at all on a day, indicate this on your journal and also write down why you could not see the Moon.

Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 
Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 
Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 
Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 	Date: _____ Time: _____ 

2018 Event

There are currently **413** events and participants.

Do you plan to observe the Moon for International Observe the Moon Night? Whether you are hosting an event or simply looking up, make sure to [register your participation](#) for full access to the latest resources and news. Find more astronomy events in the US for this night and all year long through the [NASA Night Sky Network](#).





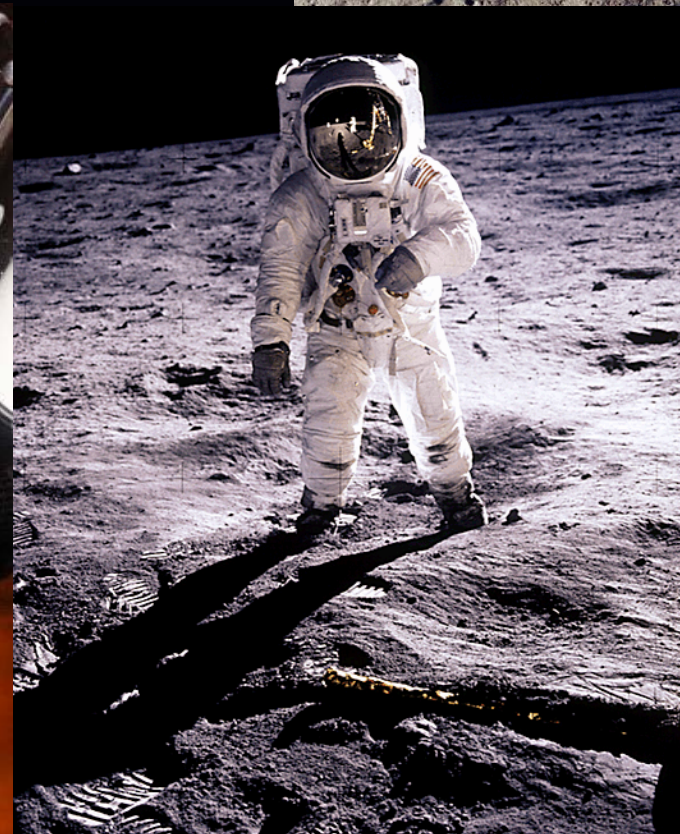
International Observe the Moon Night in 2018, and beyond



Photo credit:
A. Jones,
Homestead, NE

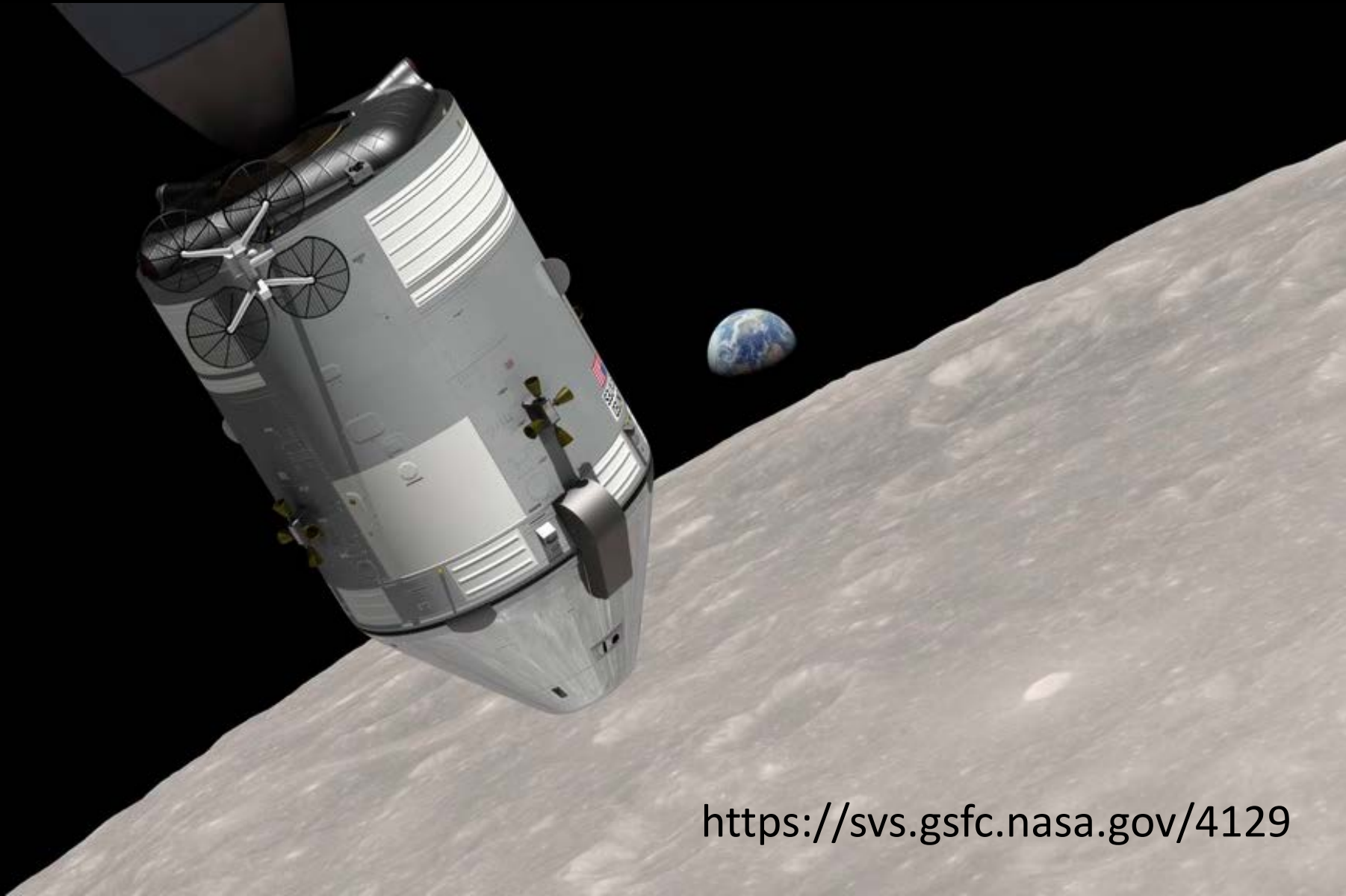


Photo credit:
rjcavallini2009,
São Simão, Brazil



Sustaining the interest, enthusiasm, and engagement in space science and observation inspired by the 2017 solar eclipse – and celebrating the 50th anniversary of the Apollo Moon landing

Earthrise: Recreated



<https://svs.gsfc.nasa.gov/4129>

The poster features a dark blue night sky with a full moon in the upper right. In the foreground, three silhouetted figures are observing the moon: one stands on the left holding a telescope, another sits in the middle pointing towards the sky, and a third child stands on the right using a large telescope mounted on a tripod. A path of light, resembling moonlight reflecting on water, leads from the foreground towards the horizon. The text 'October 20TH' is written in a large, light blue script font, with 'SAVE THE DATE' in a smaller, light blue sans-serif font below it. The event title 'International OBSERVE THE MOON NIGHT 2018' is on the right, and the hashtag and website are at the bottom.

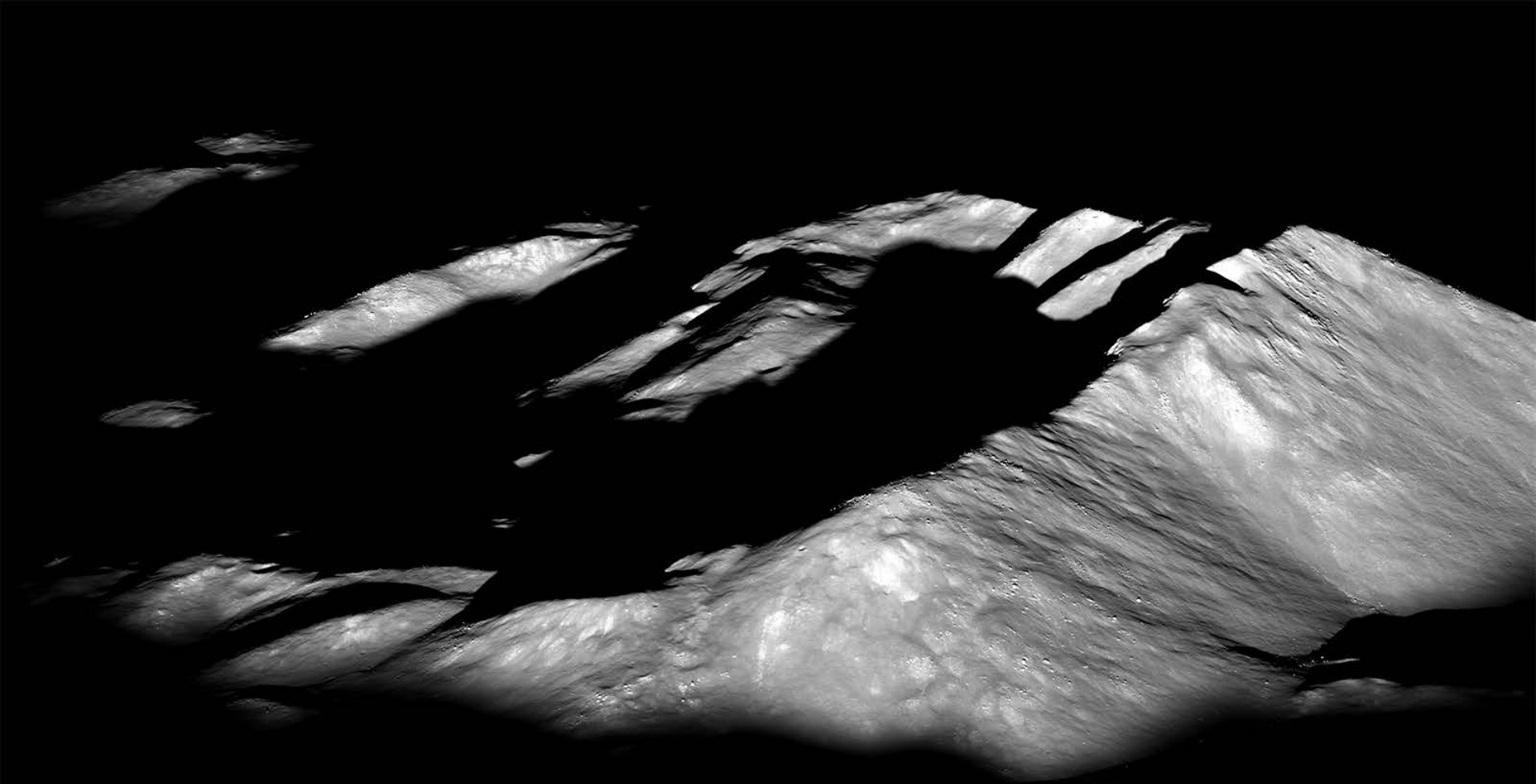
October
SAVE THE DATE 20TH

International
OBSERVE THE
MOON
NIGHT
2018

#observethemoon

MOON.NASA.GOV/OBSERVE

Plan ahead: October 5, 2019 September 26, 2020



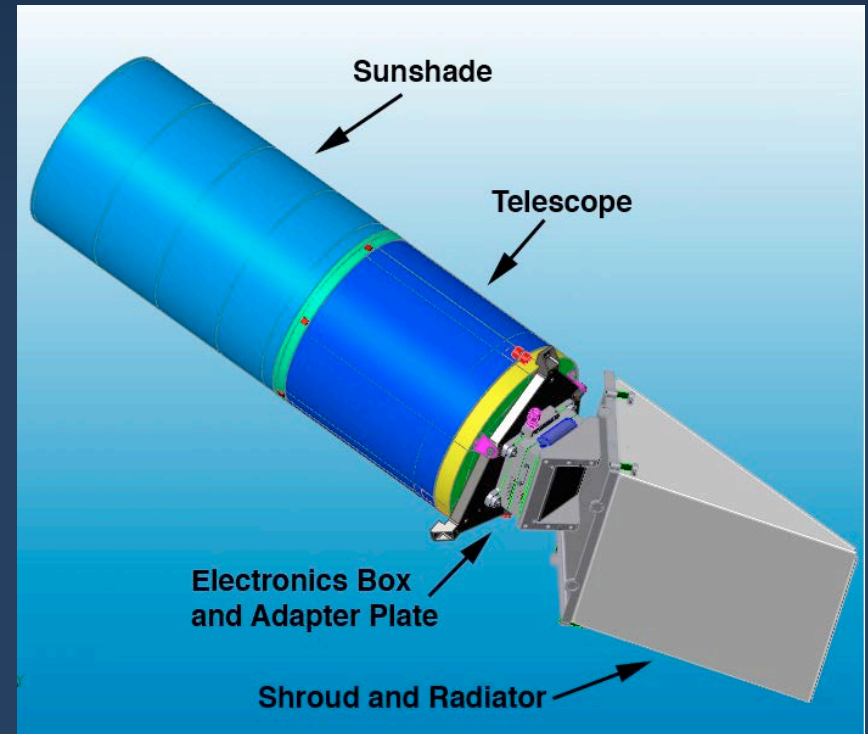
Lunar Reconnaissance Orbiter Camera Nine Years Exploring the Moon

October 2018, NISE Network Online Workshop
Mark Robinson, ASU School of Earth and Space Exploration



Narrow Angle Camera NAC

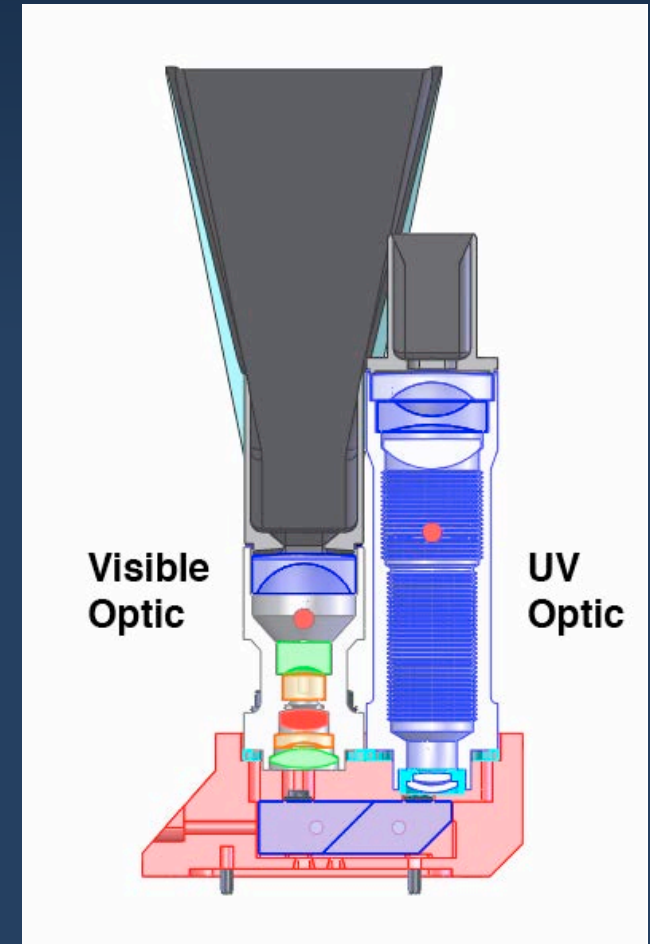
- 700 mm focal length, $f/3.59$, 2.86° FOV Richey-Chretien telescope
- 5000 pixel line array detector
- 0.5 meter/pixel at 50 km orbit
- 2 NACs provide double the swath width (5000 m total), precision geometry and redundancy
- SNR 40:1 worst case
- 7.6 kg (17 lbs), 8.8 W pk, 70 cm x 24 cm
- System MTF 0.2



50-cm BW images

Wide Angle Camera WAC

- Short focal length, FOV 90°
Visible, 60° UV (1.57, 1.05 radian)
- 1024 x 1024 pixel CCD (Kodak KAI 1001)
- 100 m/pixel at 50 km orbit (1.57 mradian IFOV)
- 7 filter bands (290 to 690 nm)
- Global coverage with all 7 WAC bands, mesh with Clementine IR coverage (750 - 1000 nm)
- 0.9 kg (2 lbs), 4 W, 15x9x8 cm
- System MTF 0.3

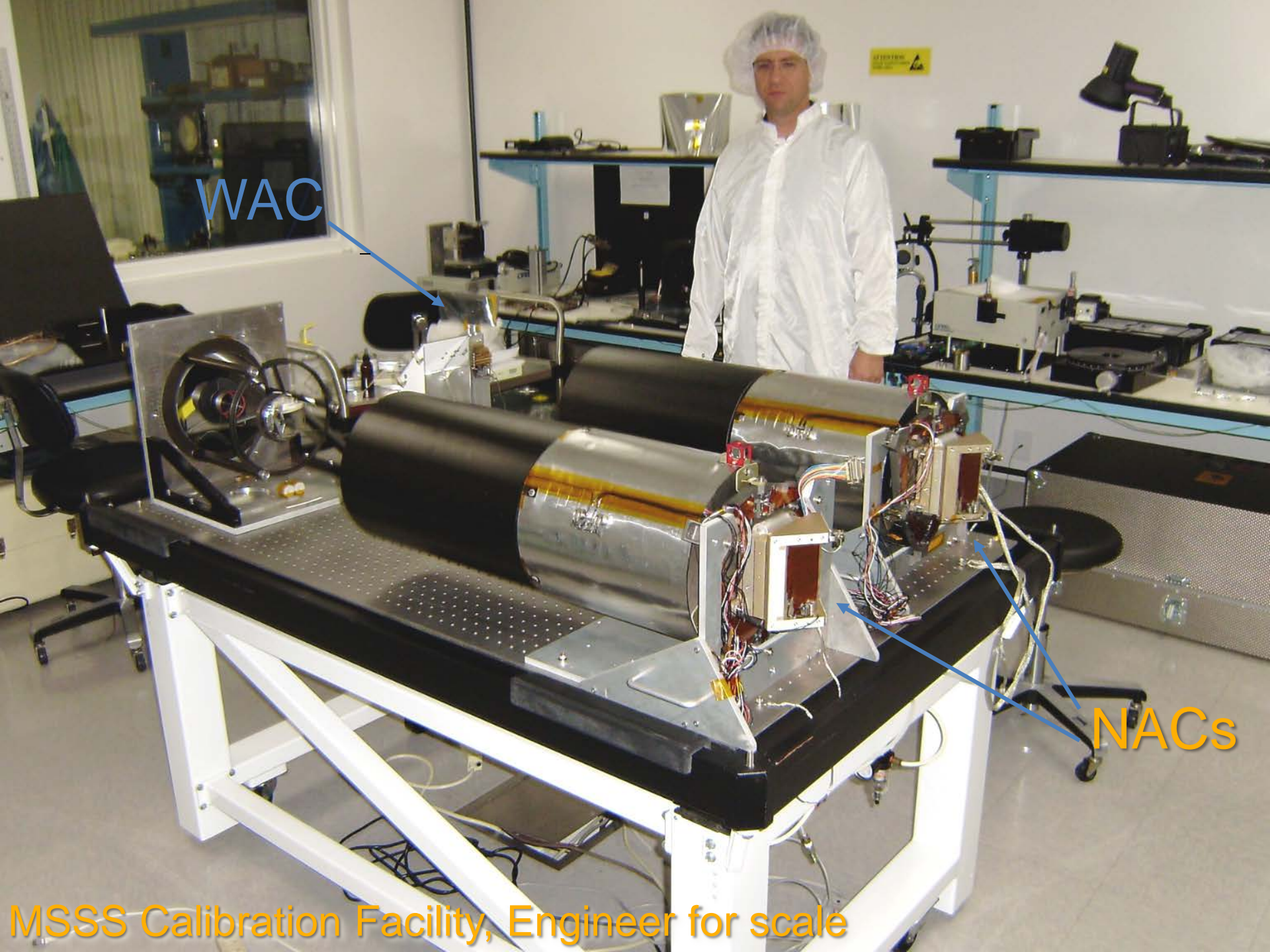


100 m global color

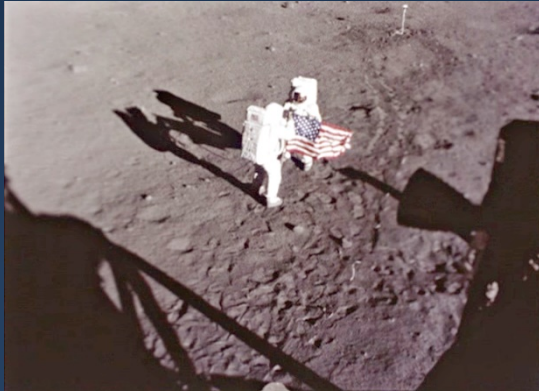
WAC

NACs

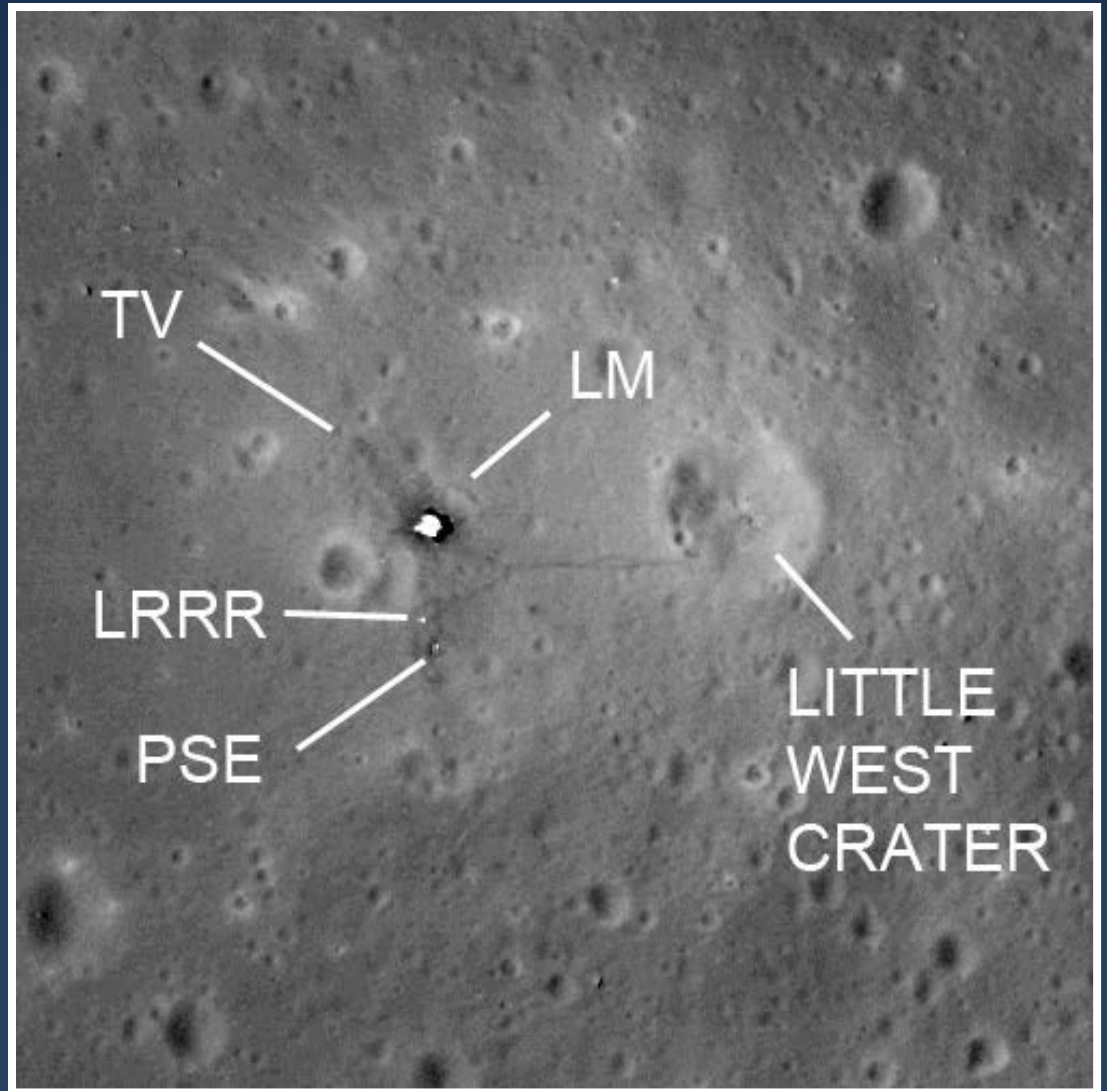
MSSS Calibration Facility, Engineer for scale



Apollo 11 Site

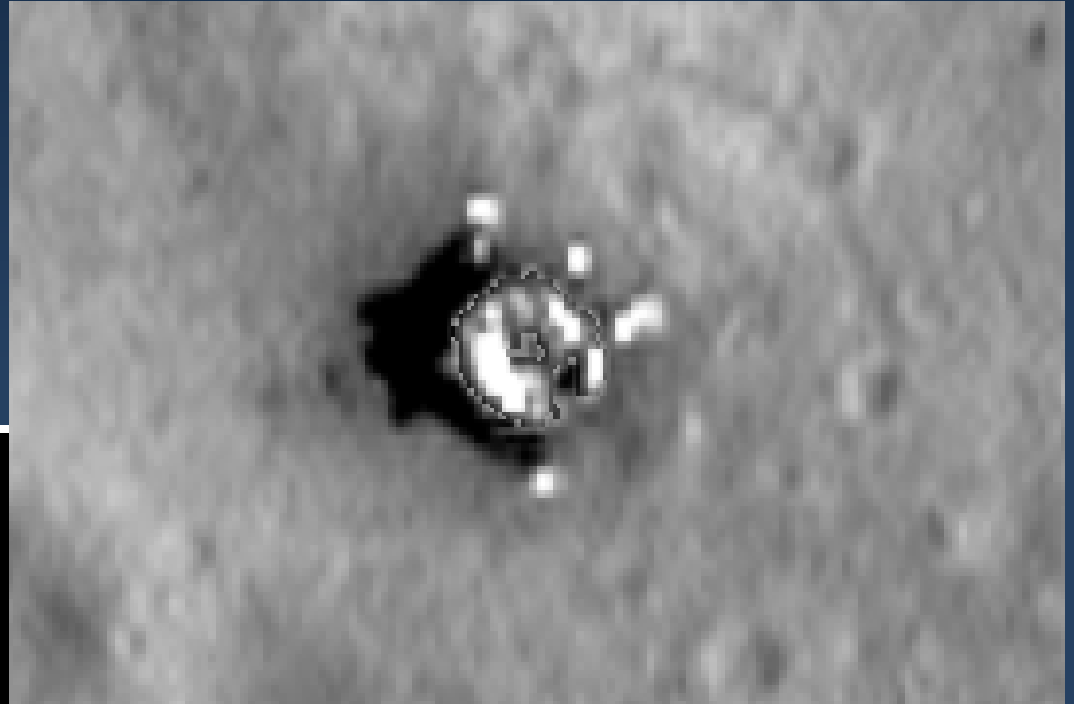
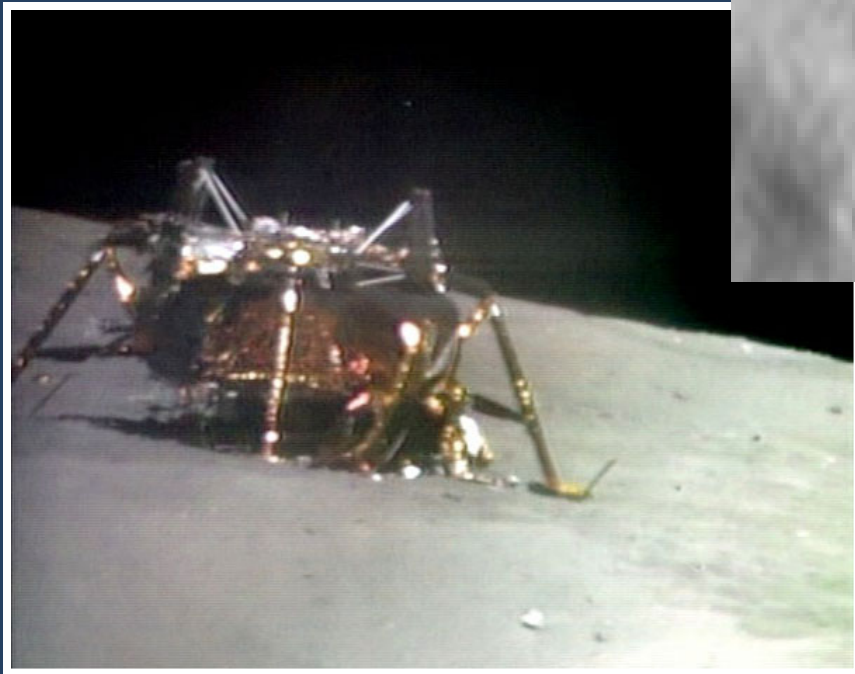


20 July 1969

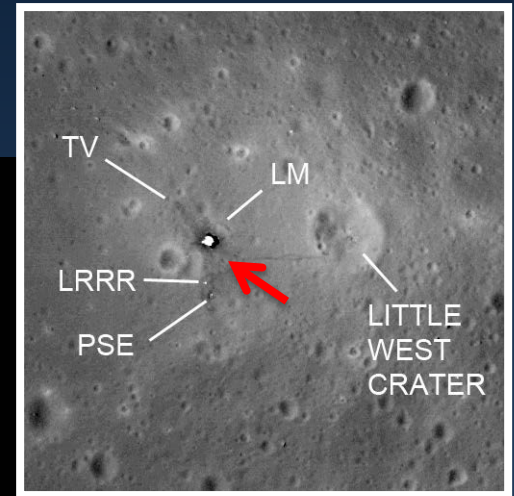
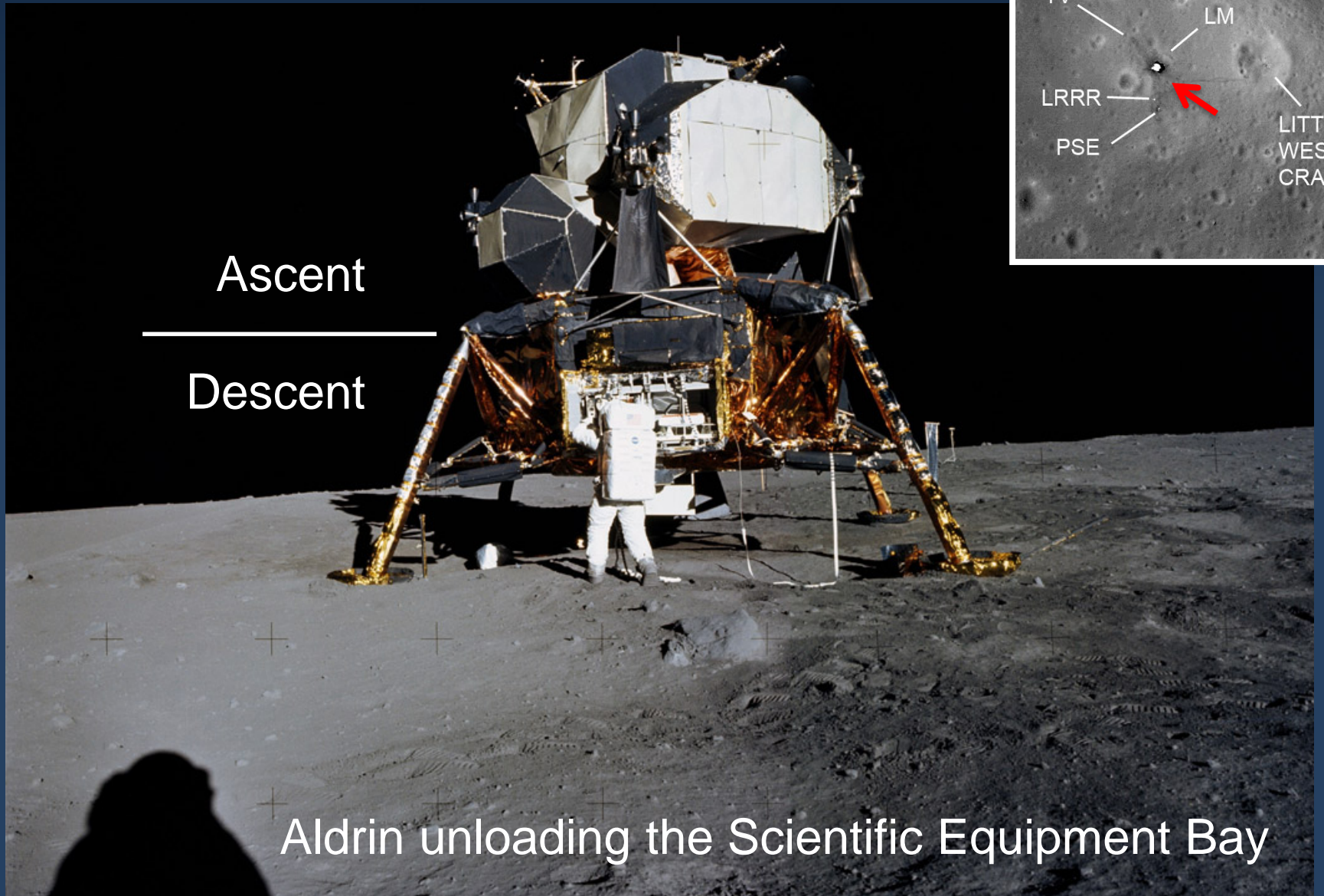


Apollo Descent Stage

Apollo 16 from LRV
camera



Looking straight down on
Apollo 11 Descent Stage



A Day On The Moon (14 Earth Days)

Repeat
imaging of
the Apollo 12
and Surveyor
3 landing
sites



View:

<https://youtu.be/r5dtcdmjOaE>

Download:

http://lroc.sese.asu.edu/images/videos#a_day_at_the_apollo_12_landing_site

Similar movies for all sites at the LROC webpage

Temporal Imaging

- Discovered hundreds of impact related changes since start of mission (NAC Before/After pairs)
- Twenty five resolved craters! So far...
- Significance
 - Refine rate of impacts
 - Seeing new complex ejecta patterns
 - Secondaries from small craters are extensive
 - Engineering constraints for future long lived assets

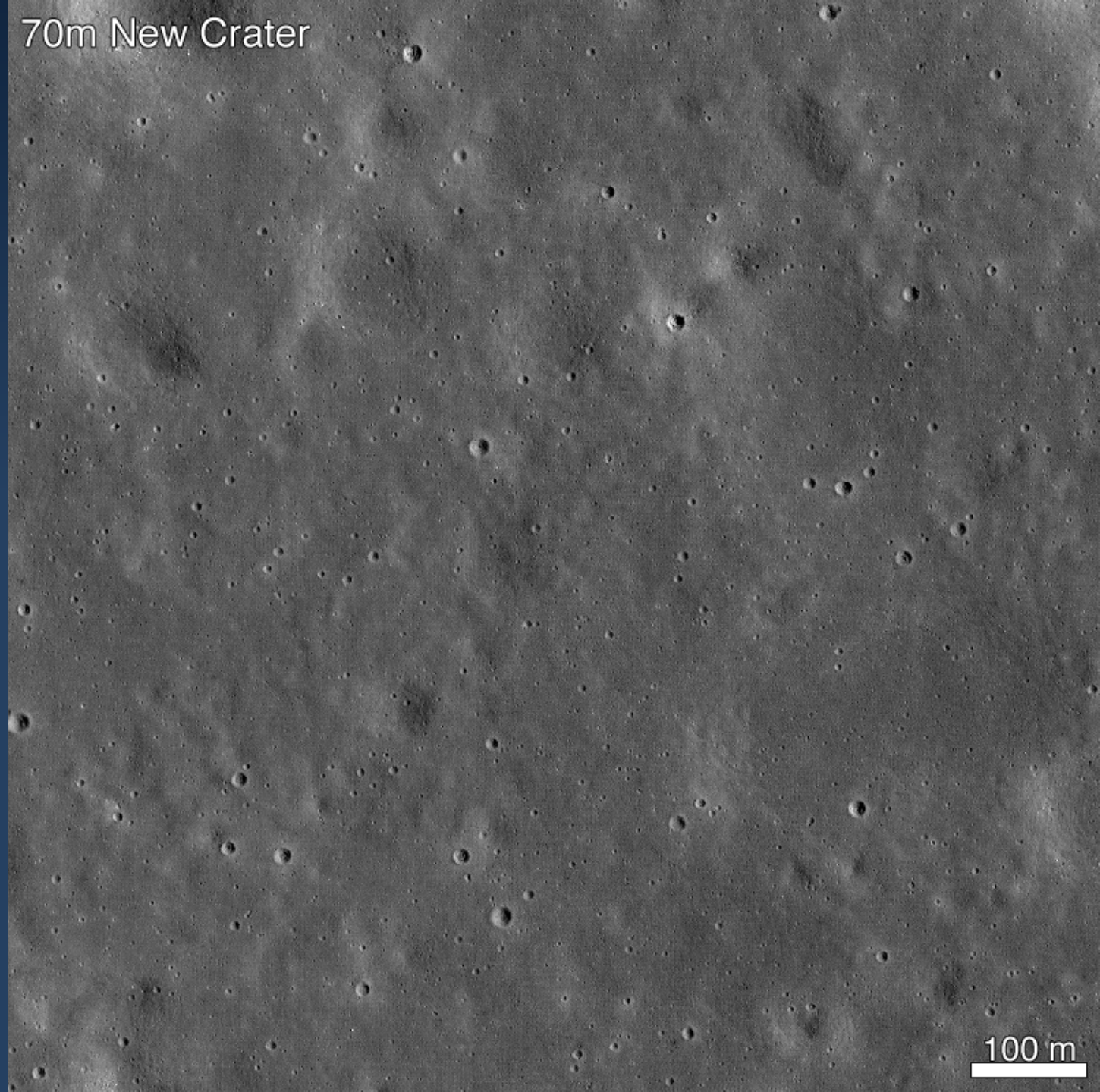


17 March 2013 impact, 18 m crater,
secondaries found >30 km distant

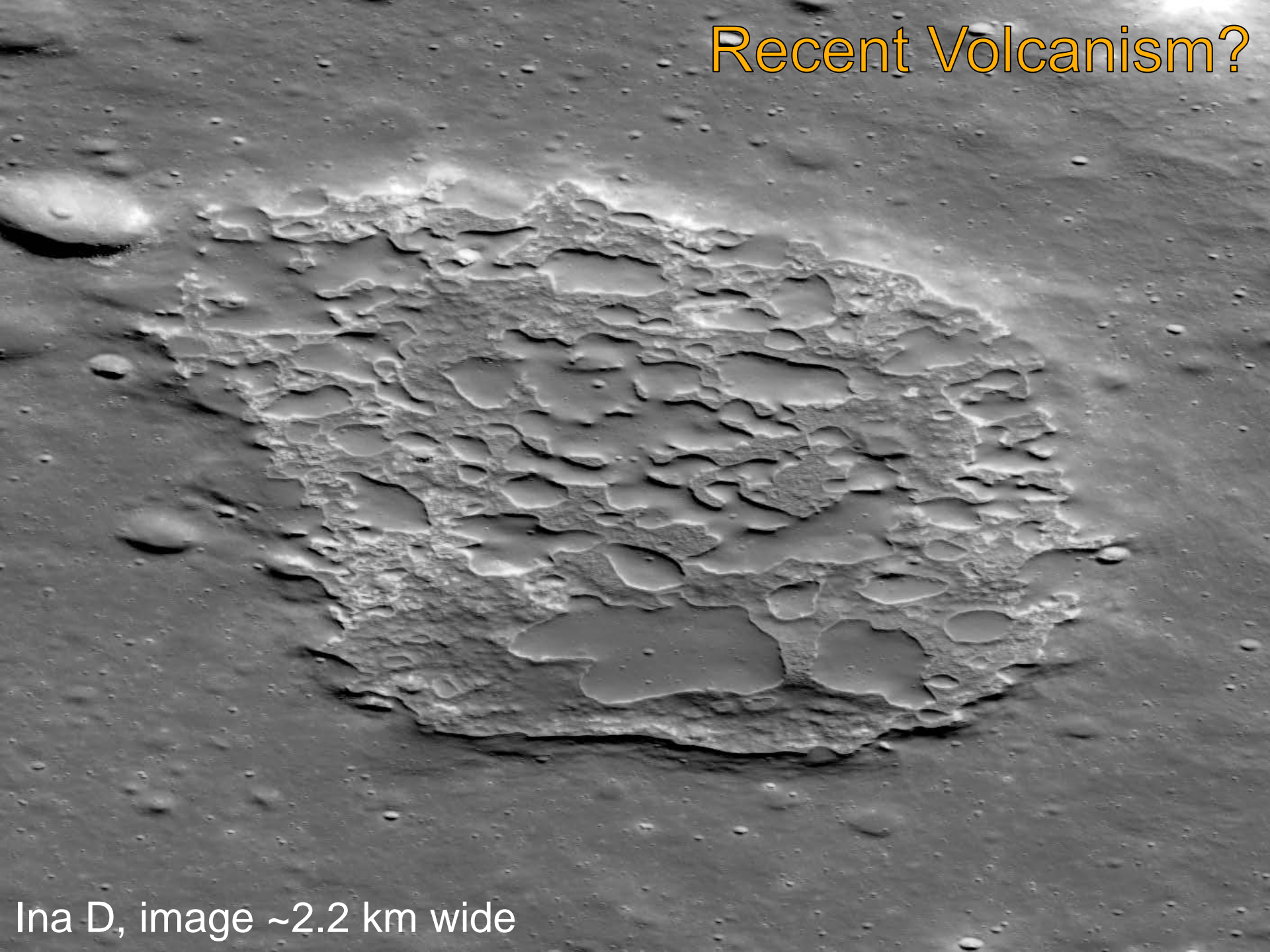
New 70 m Diameter Crater!

70m New Crater

Surface
modified for
distances
greater
than 10
crater
diameters!



Recent Volcanism?



Ina D, image ~2.2 km wide

depression

100 m

???

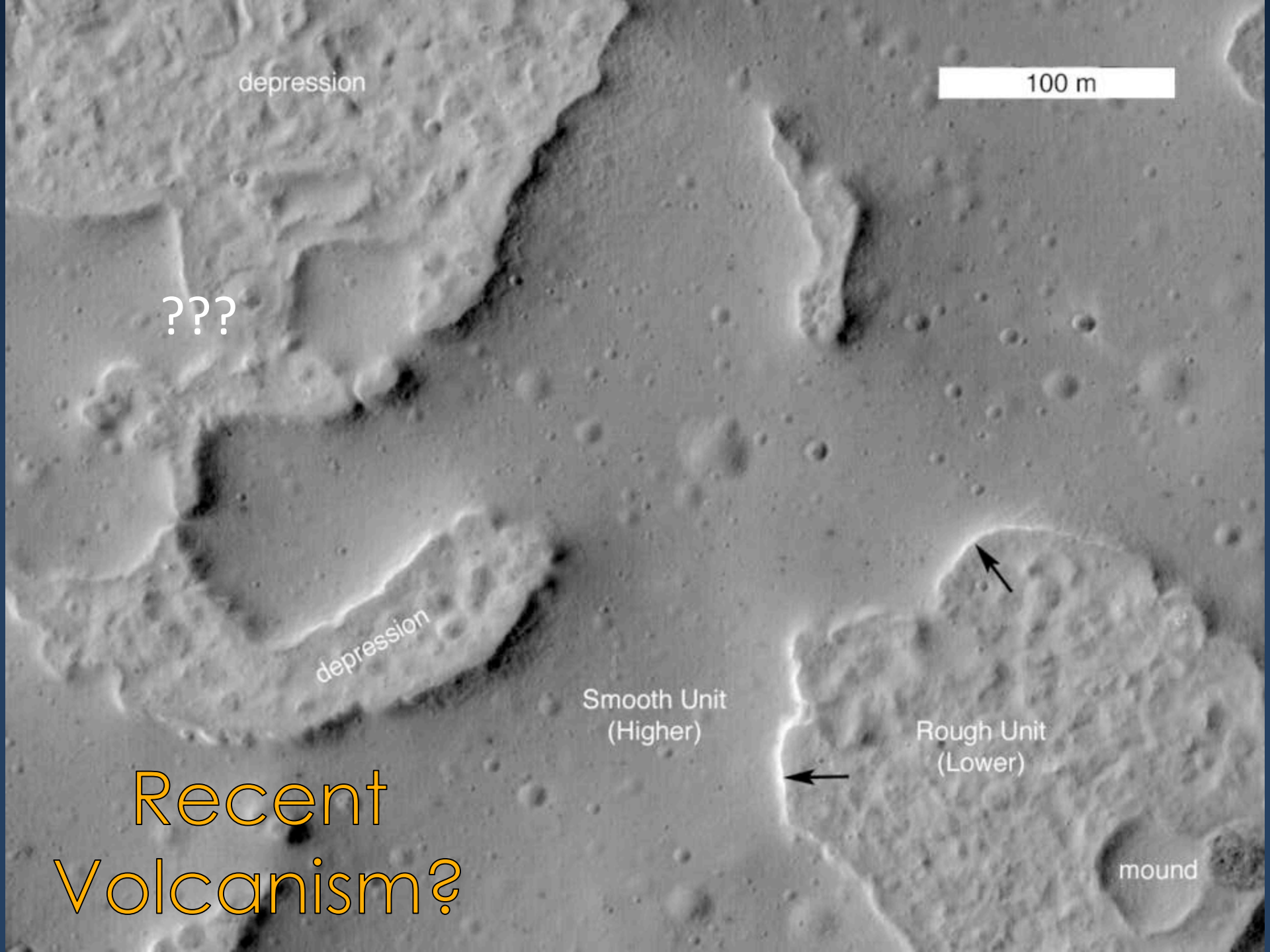
depression

Smooth Unit
(Higher)

Rough Unit
(Lower)

mound

Recent
Volcanism?

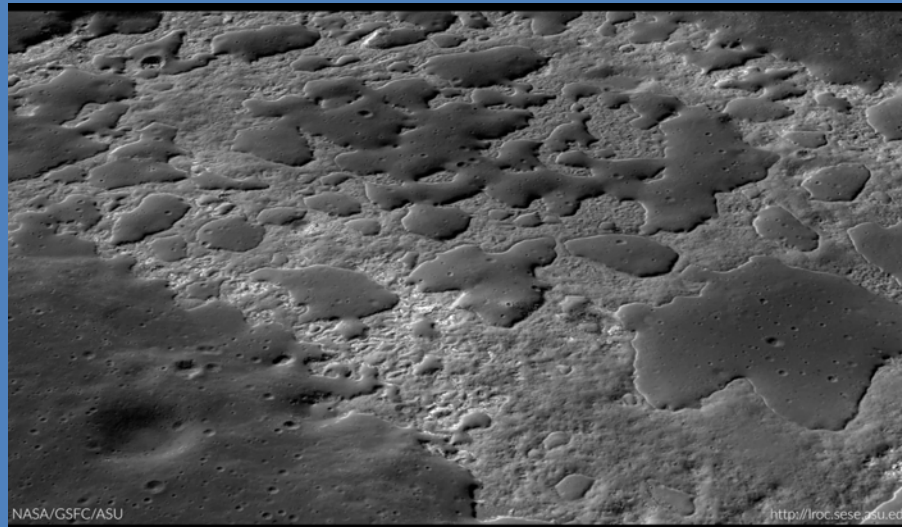


Irregular Mare Patches: Ina Movie

<https://youtu.be/uwBLwwUEWss>

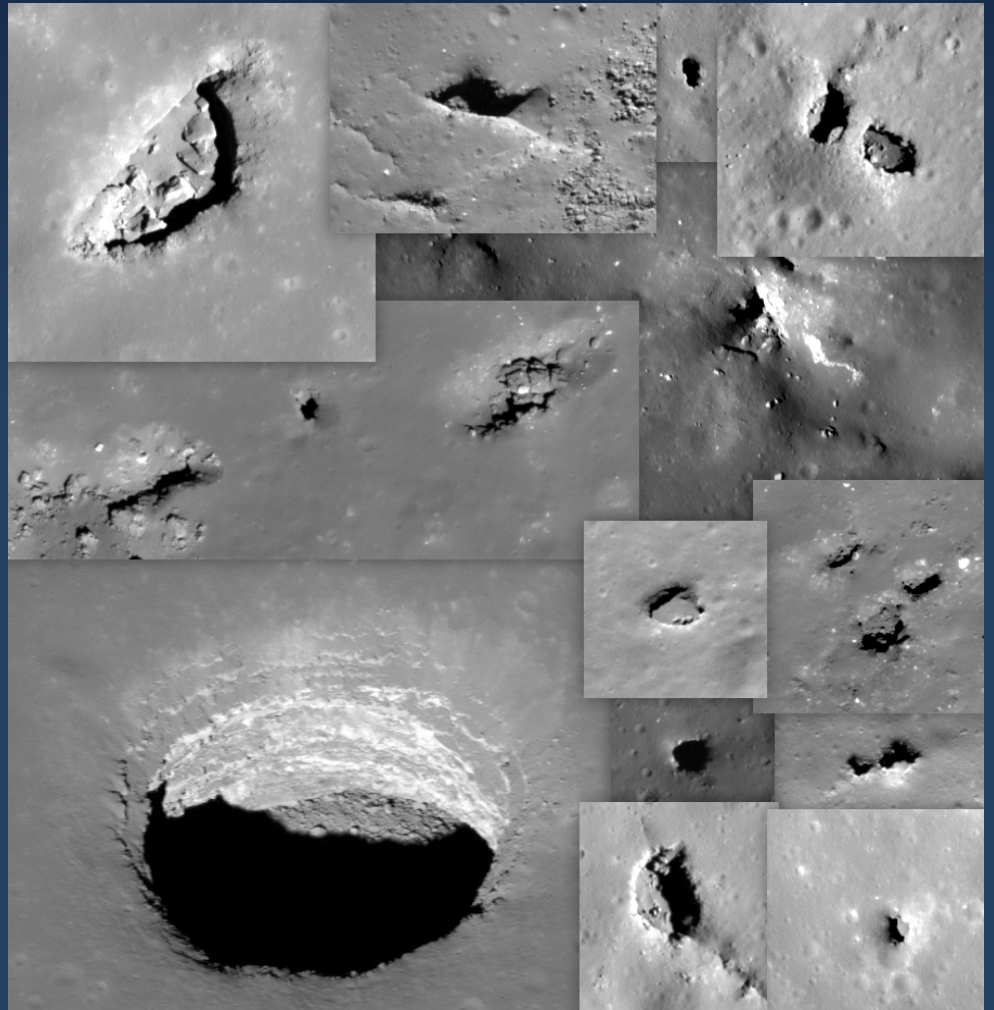
Download:

http://lroc.sese.asu.edu/images/videos#irregular_mare_patches:_ina



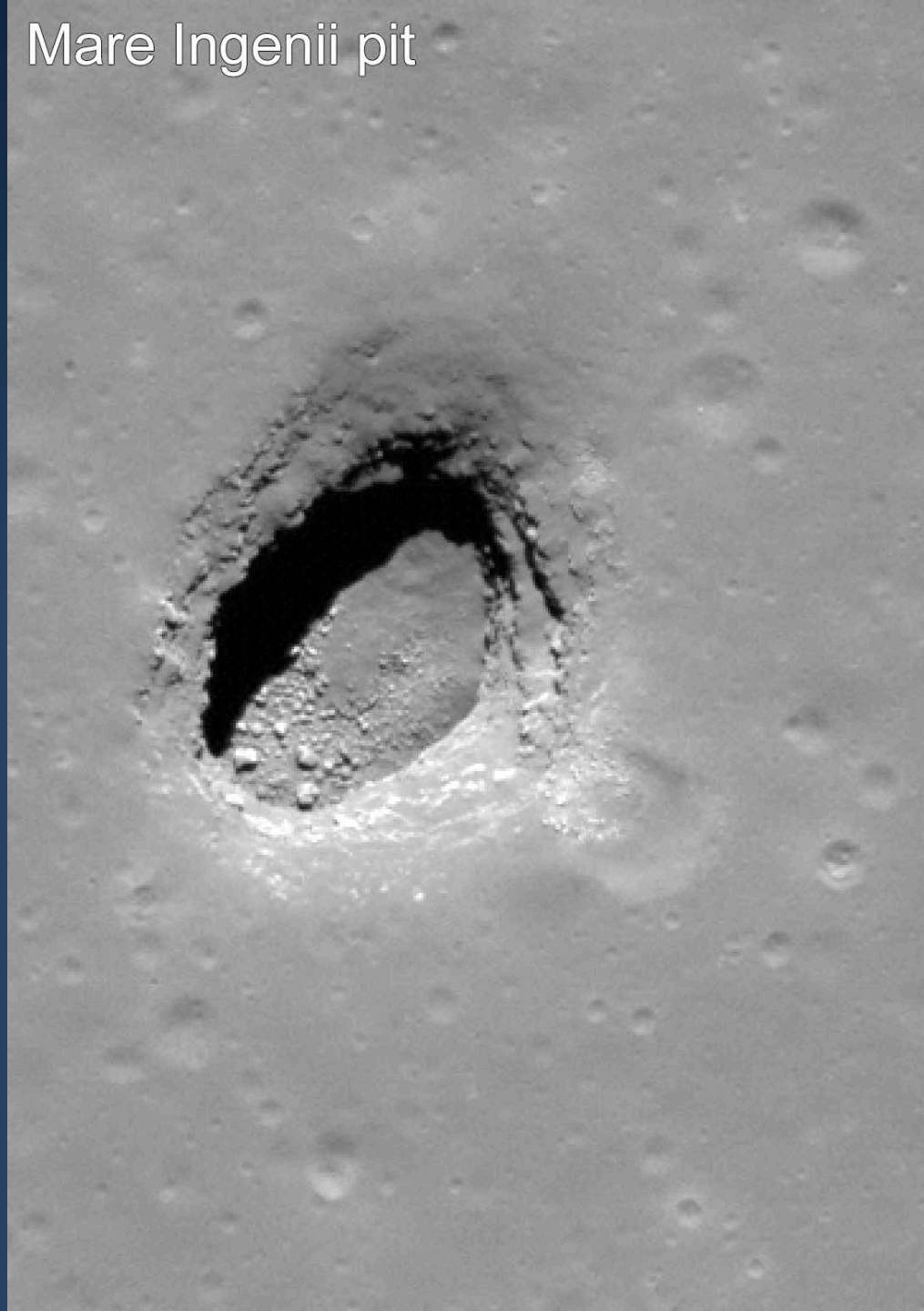
Lunar Pits

- Pre-2009: Speculation
- 2009: Three pits discovered in Selene images
- 2010-2014: LROC images reveal 5 more mare pits, >200 impact melt pits, and 2 apparent highland pits

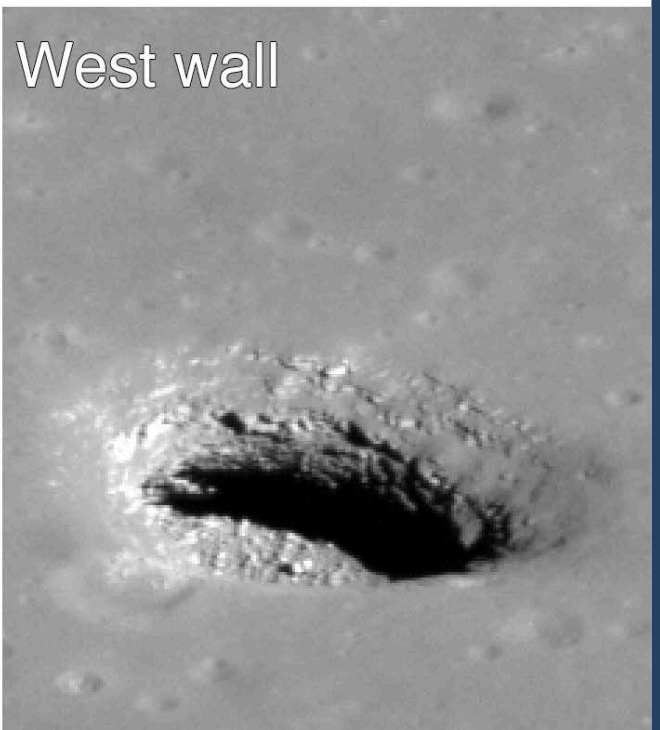


How did they form?

Mare Ingenii pit



East wall



West wall

Collapse of Lava Tube Roof

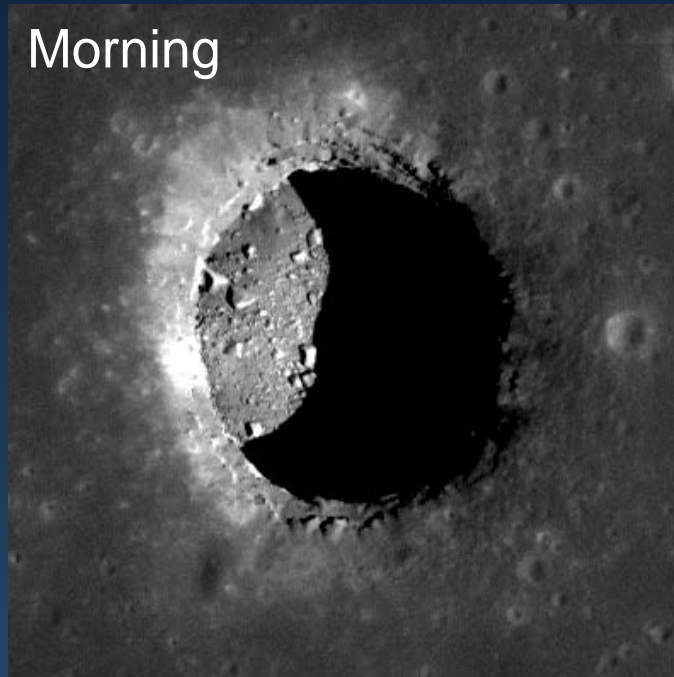


Are the lunar pits formed in same manner?

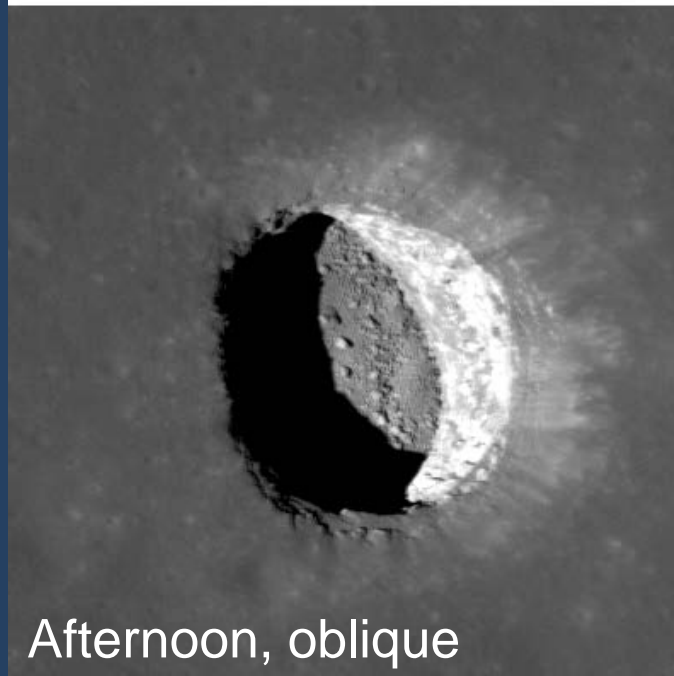
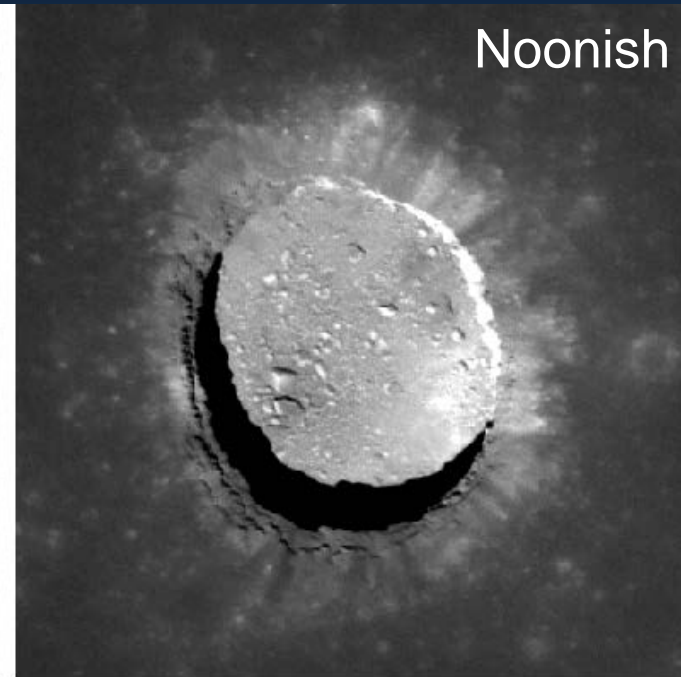
Mare Pit

- Mare Tranquillitatis pit
- Pit diameter 100 m
- Pit depth 107 m
- Are there extant sublunarean tubes?
- Oblique imaging!
- Answer is yes – but how far?

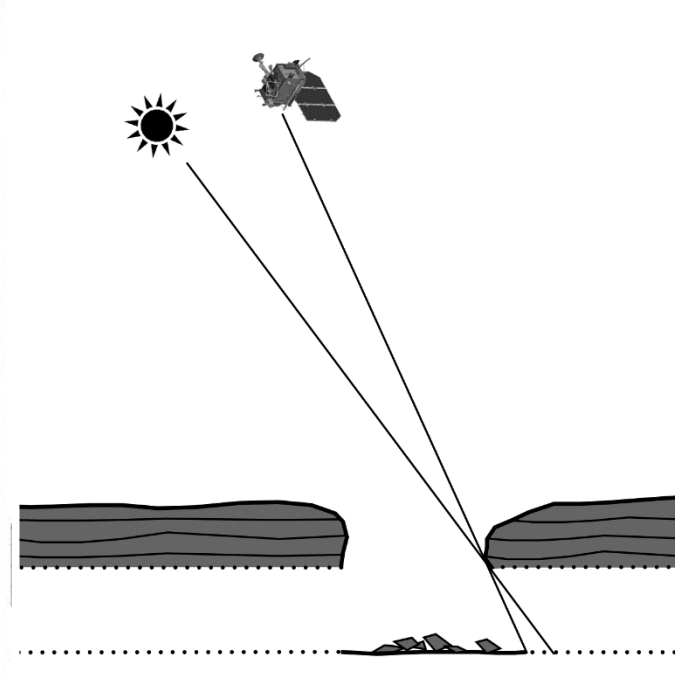
Morning



Noonish



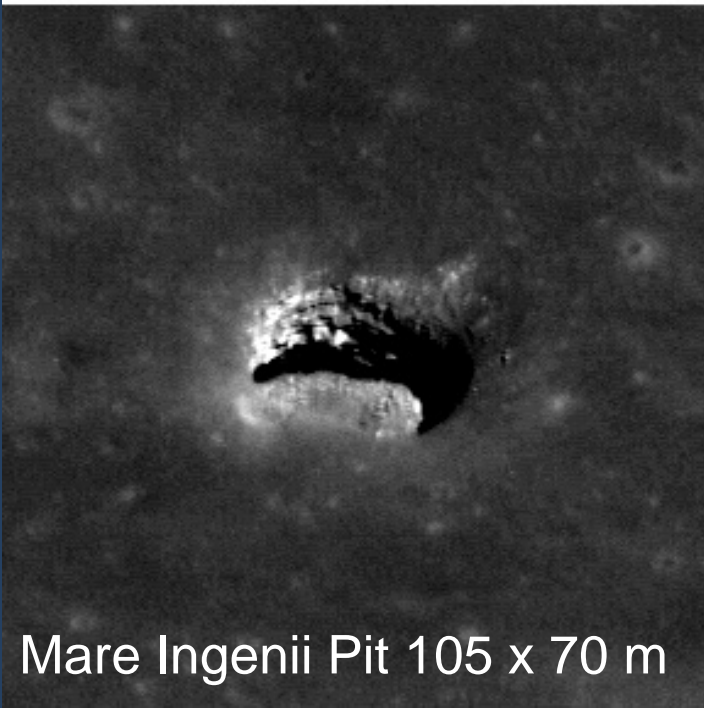
Afternoon, oblique



Marius Hills Pit 57 m D

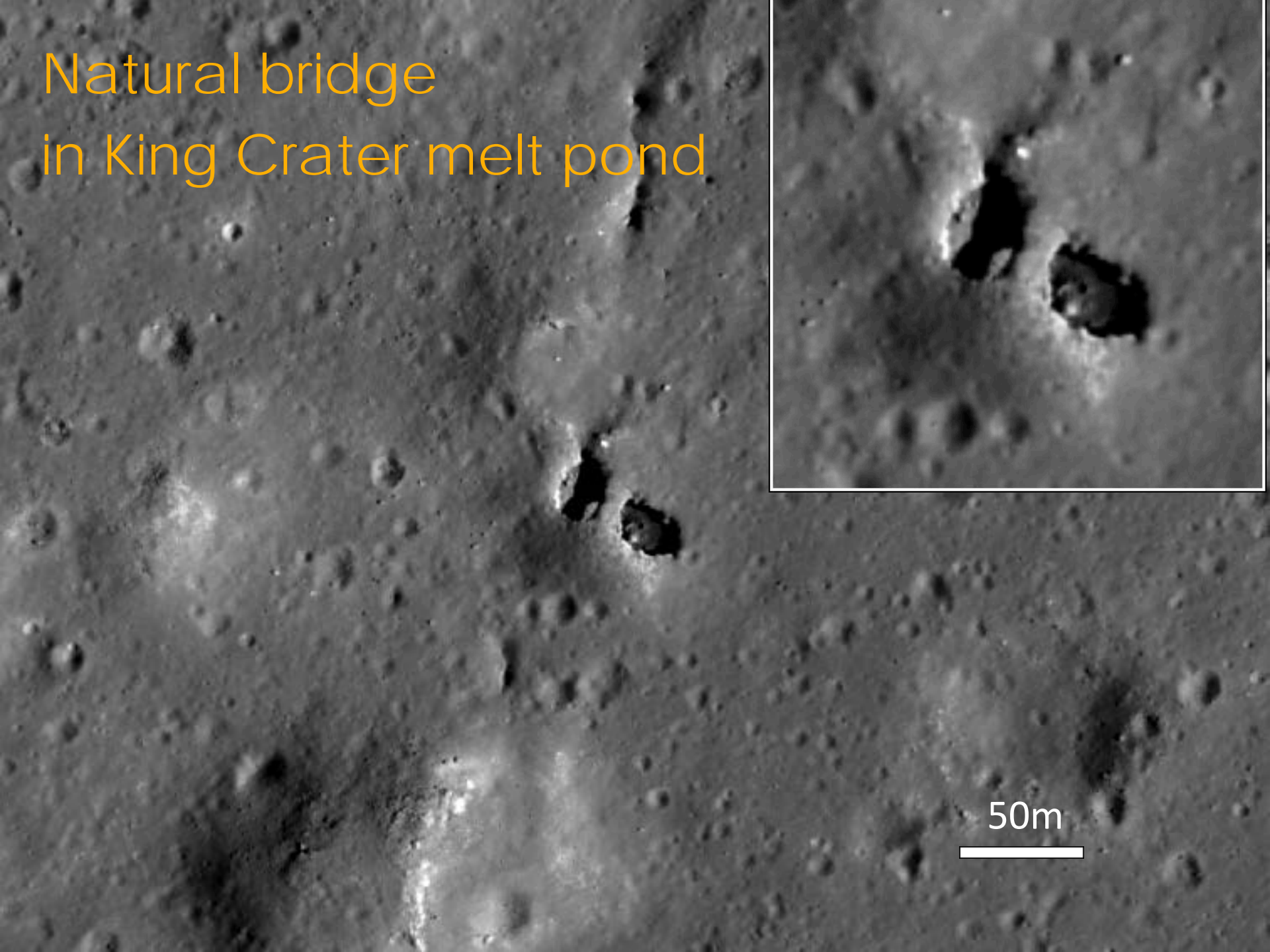


- Ready made shelter for future lunar explorers
- Show mare lavas emplaced as thin flows (5-20 m)
- Pristine preservation
 - Flow features
 - Sublimate minerals
 - Regolith? Solar Wind?
- How extensive are sublunarean passages?
- Possibly a spelunker's paradise!



Mare Ingenii Pit 105 x 70 m

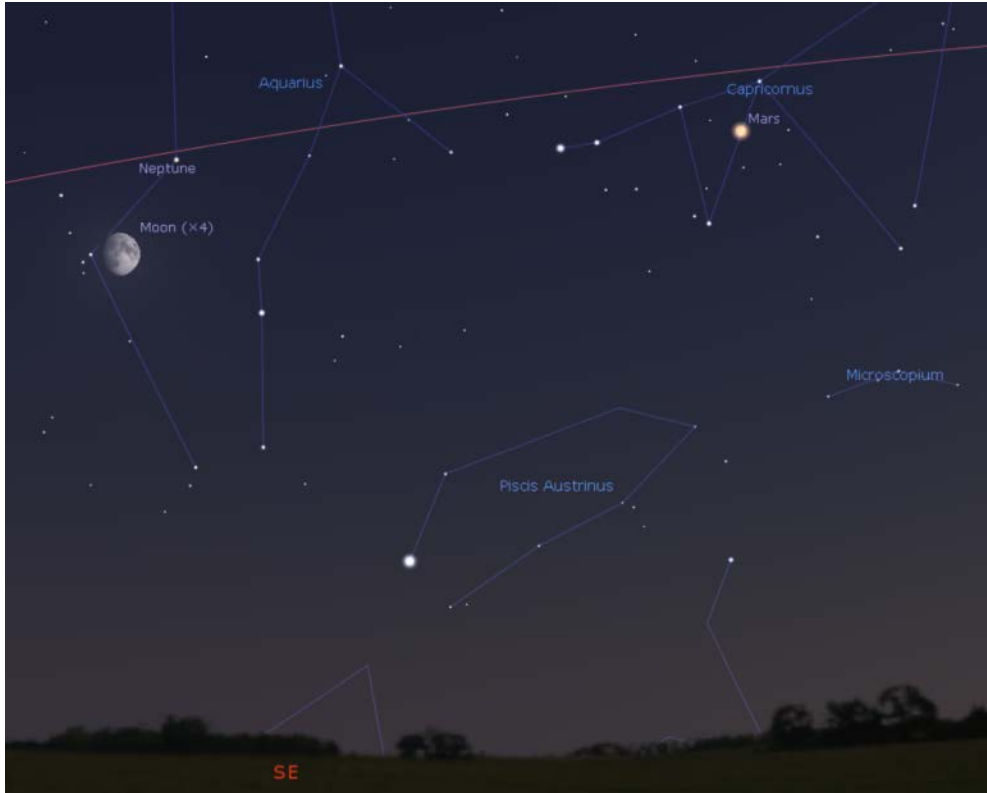
Natural bridge
in King Crater melt pond



Lunar Observing Equipment



The Moon is Your Guide to the Skies

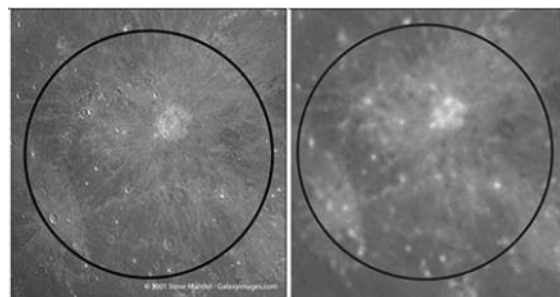
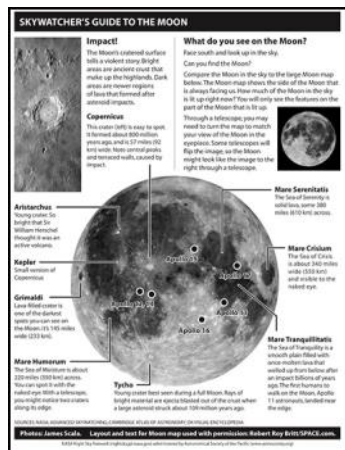


The Moon & Mars on
October 20, 2018 at 7:00 pm



The crescent Moon
“pointing” to Venus

Night Sky Network Resources



International Observe the Moon Night
Resources on the Night Sky Network:

<http://bit.ly/nsnmoonnight>

Observe the Moon with an astronomy
club near you!

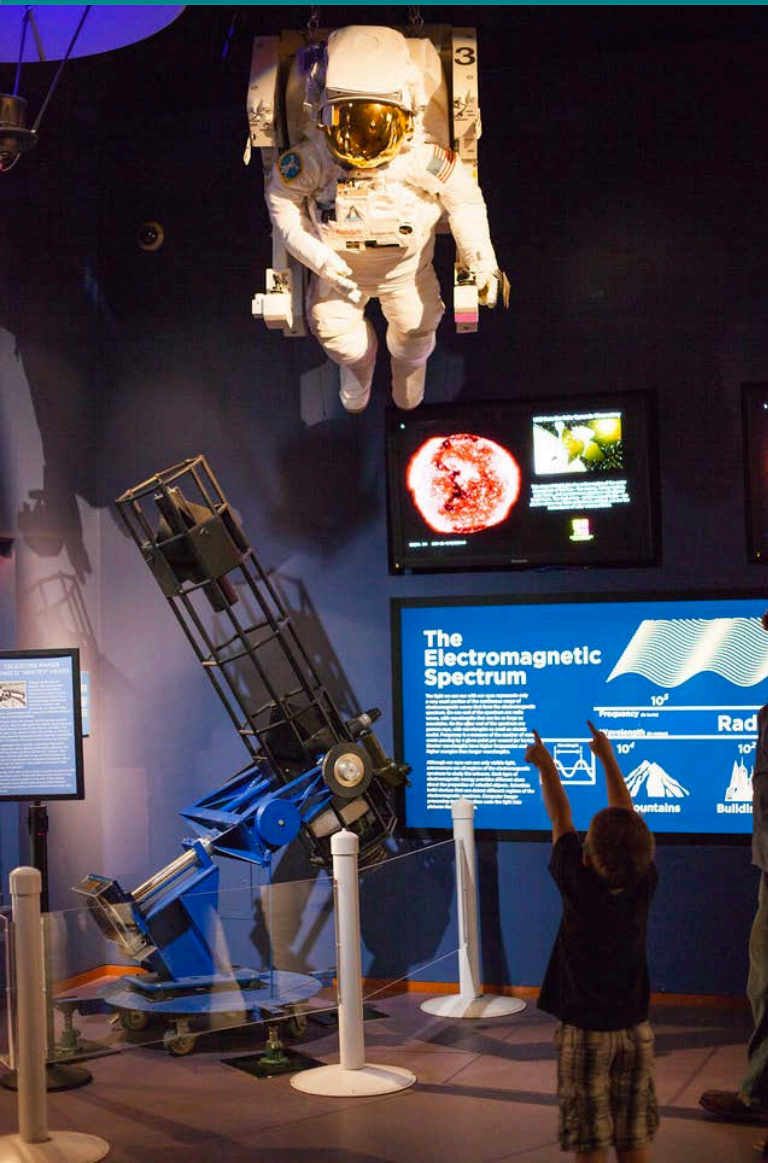
<http://bit.ly/findnsn>

LIFT OFF: APOLLO + BEYOND



- Overview and project partners
- Media Mix + Mingle kickoff event
- Regional and state-wide events
- Museum of Life and Science events

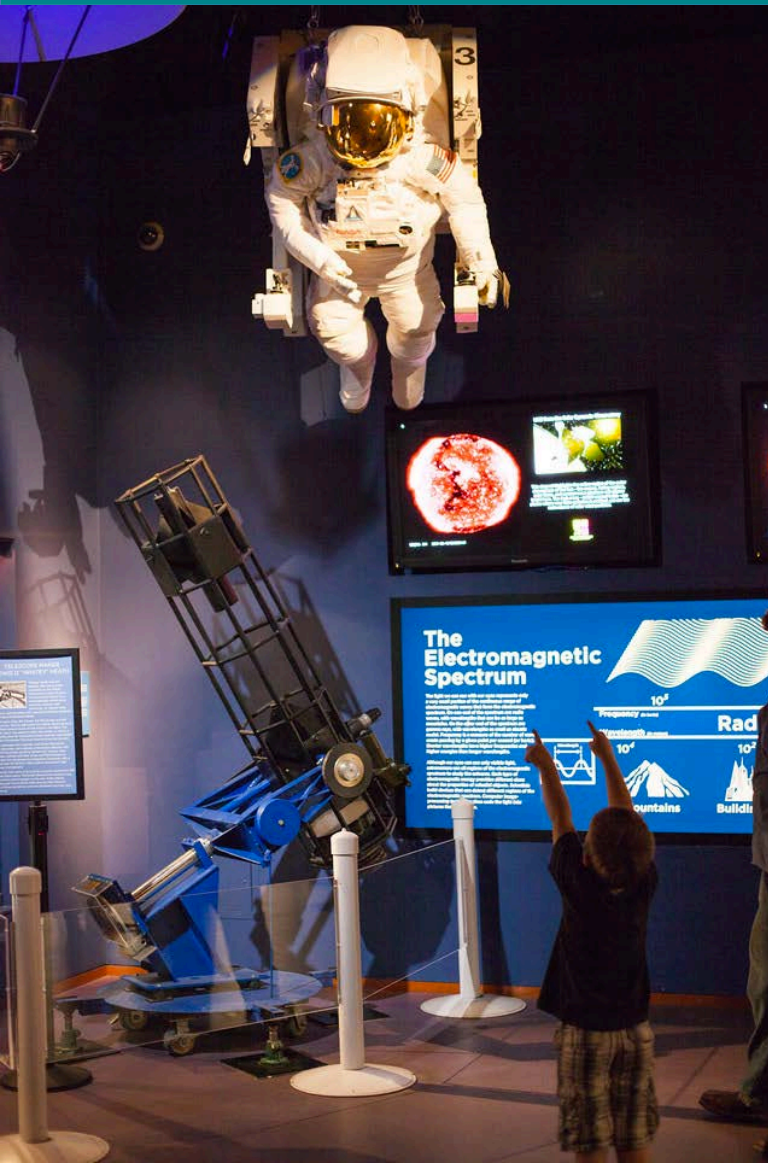
LIFT OFF: APOLLO + BEYOND



A year-long campaign of space that features festivals, exhibits, lunar- and star-gazing parties, feature films and documentaries, model rockets, space camps, astronomy days, musical performances, educational programming, and fun activities.

January through December 2019

LIFT OFF: APOLLO + BEYOND



Partnering Organizations

- Marbles Kids Museum
- Morehead Planetarium and Science Center
- Museum of Life and Science
- North Carolina Museum of History
- North Carolina Museum of Natural Sciences
- North Carolina Space Grant
- North Carolina Symphony

Media Mix + Mingle Kickoff Event

Event Description

- Marbles, 10/13/18 Unveiling of Lift Off: Apollo + Beyond year long campaign with media and all project partners.
- Free screening of First Man showing at the IMAX
- Panel Discussion
 - Rick Houston (Houston (veteran journalist and consultant/extra on First Man)
 - Martha G. Lemasters (author who worked in public relations for NASA during the 60s and 70s)
 - Richard McColman (Full dome Theater Manager at the Morehead Planetarium and Science Center)
 - Michael Neece (novelist writing about astronauts' training in stellar navigation at the Morehead Planetarium in the 60s and 70s)

Regional and Statewide Events

- A Space Spectacular with the NC Symphony
- Standing on the Shoulders of Apollo: The US Space Program— Past, Present, Future - Gerald D. Griffin, Former Flight Director, Project Apollo, Mission Control Center (NC Museum of History, Raleigh)
- Exhibit Opening: One Giant Leap: North Carolina and the Space Race (NC Museum of History)
- One Giant Leap Festival (Everyone at NC Museum of History, June 20th)
- An Evening with Astronaut Mae C. Jemison: Exploring the Frontiers of Science and Human Potential (Carolina Theater)
- 2019 Statewide Star Party: The Moon and Beyond

Museum of Life and Science Events

- Model Rocket Workshop
 - March 16, 2019 Build Day
 - March 23, 2019 Launch Day
- Moon Madness in The Lab
- Adult Space Camp
- Earthrise Screening (Carolina Theater)
- Hardwired Code: Apollo and the Invention of Software – A Tinkering Family Workshop
- Countdown to Launch – Museum-wide celebration



Upcoming Online Workshops



Deepening and Extending Family Engagement and Learning Through Interactive Exhibits and Facilitated Hands-on Activities

Tuesday, October 23, 2018

2pm-3pm Eastern / 11am-12pm Pacific

Extending Your Earth & Space Science Exhibits - Free Multimedia Resources from NASA's Universe of Learning, NASA's Eyes, and the NISE Network

Tuesday, November 27, 2018

2pm-3pm Eastern / 11am-12pm Pacific

Learn more at nisenet.org/events

Annual Partner Survey – Coming Soon

When: Email invitations in November

Why: In order to learn more about your experiences in the NISE Network and with presenting Earth and space science content

- We want to hear from partners across a diversity of roles, institution types, geographical regions, and levels of Network involvement
- Whether or not you completed last year's survey
- Even if others at your organization have participated

Who: Contact Marta Beyer at mbeyer@mos.org with any questions



EXPLORE SCIENCE Earth & Space

Applications Now Open!

**Explore Science: Earth & Space 2019 toolkit applications
are due November 1, 2018**



<http://www.nisenet.org/earthspacekit-apply>

Get Involved

Learn more and access the
NISE Network's online digital resources
nisenet.org

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