

MISSION CRITICAL

Project Artemis, Imaging from the Moon and Deep Space



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Many people consider this image, the Earthrise from Apollo 8, to be the most significant photograph ever taken. Taken at the end of a tumultuous year, 1968, it reminded everyone on Earth that we were all on this rock in space together....



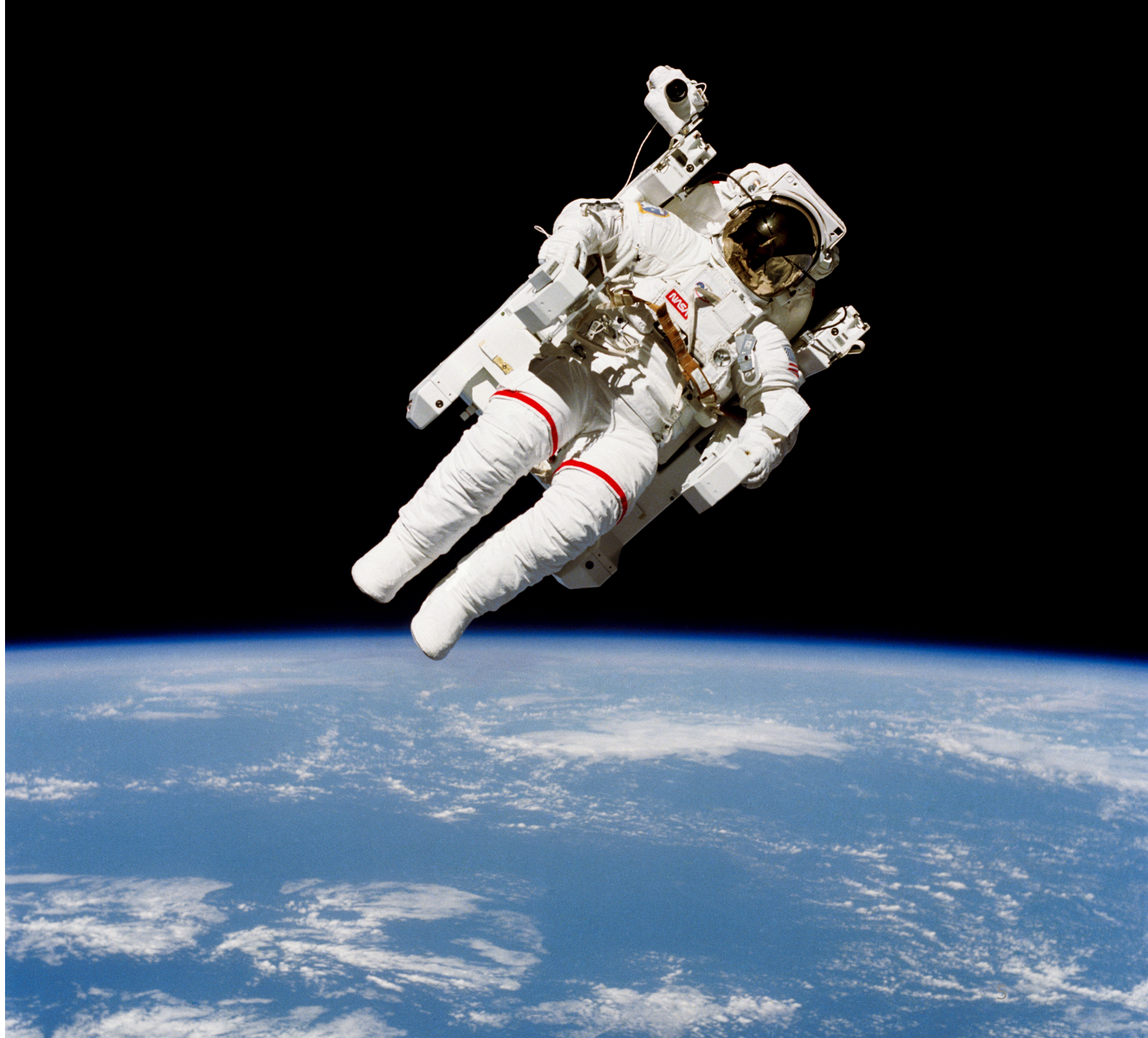
When Michael Collins took this photograph, everyone who currently lived, and had ever lived, were present in the frame, except for Michael Collins. Neil Armstrong and Buzz Aldrin were in the Lunar Lander, the rest of us were on Earth.

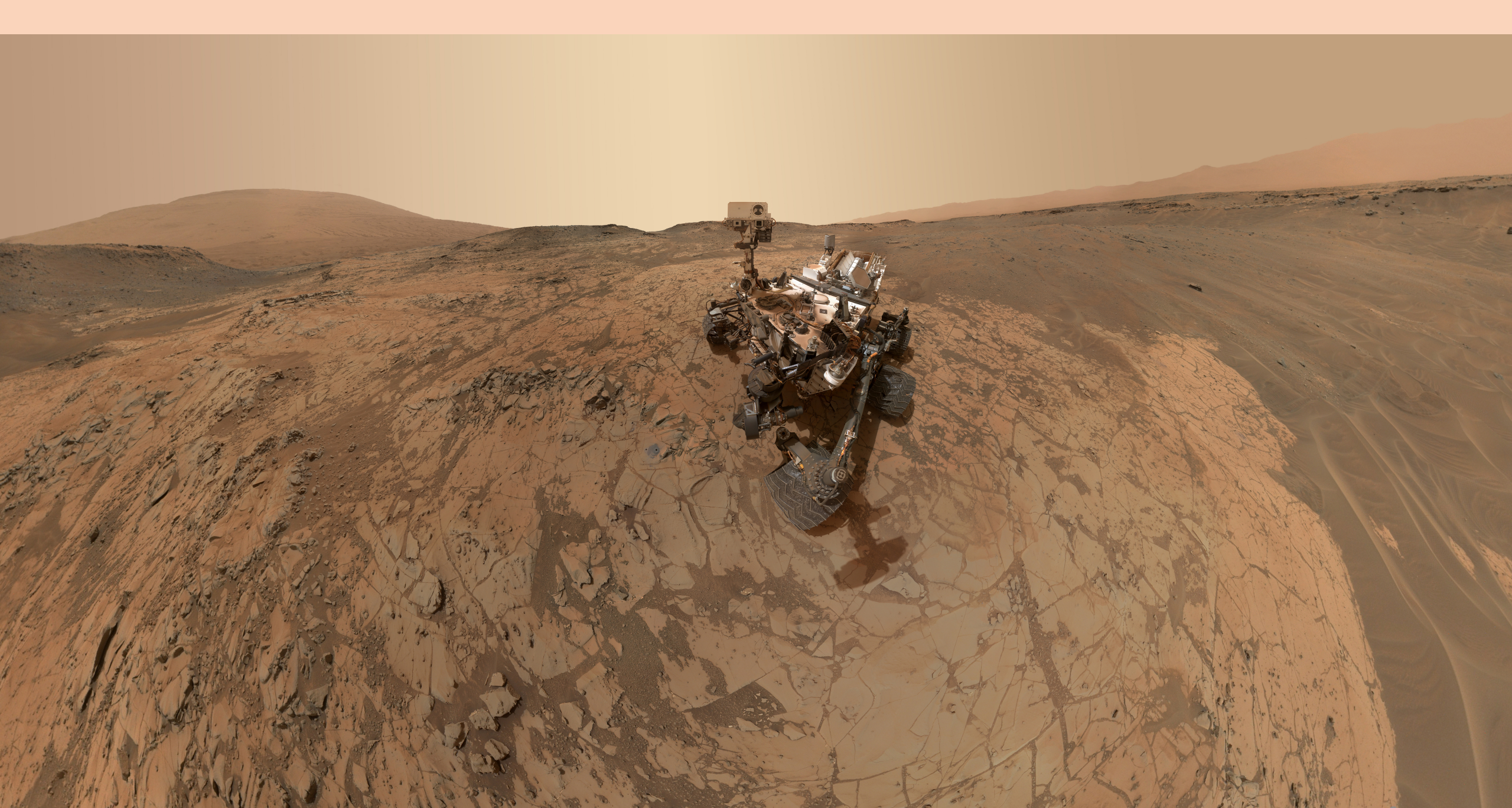


The most significant live television broadcast of all time was an afterthought!



Bruce McCandless, who was CapCom for the moonwalk on Apollo 11, later would become his own spacecraft and fly untethered in space on Shuttle Mission 41-B in 1984

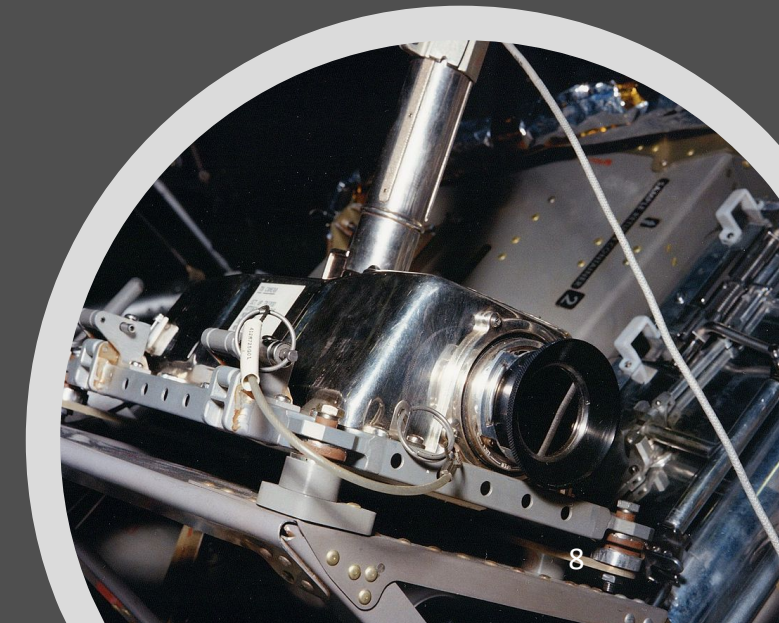






During the early days of human space flight, NASA had to invent everything, including cameras. This is the television camera used for the Apollo 11 mission.

Today, we can fly commercial off-the-shelf cameras and components, using industry standards for compression and transmission.



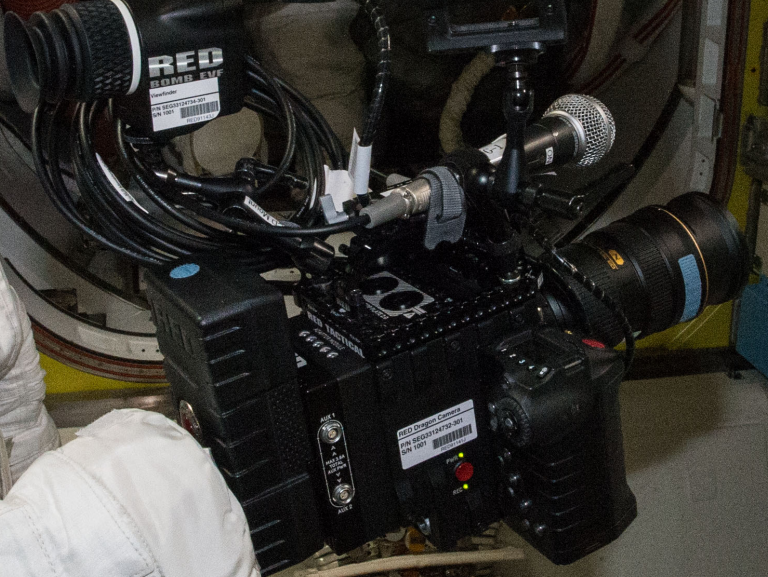


OUT TO CUP

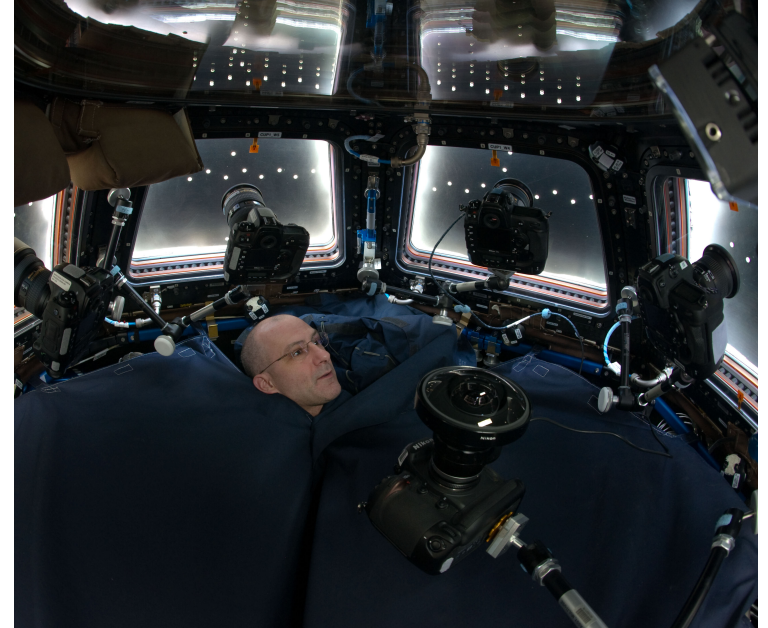
To CUP



INTERNATIONAL SPACE STATION
ISS DATA SYSTEMS CHECKLIST



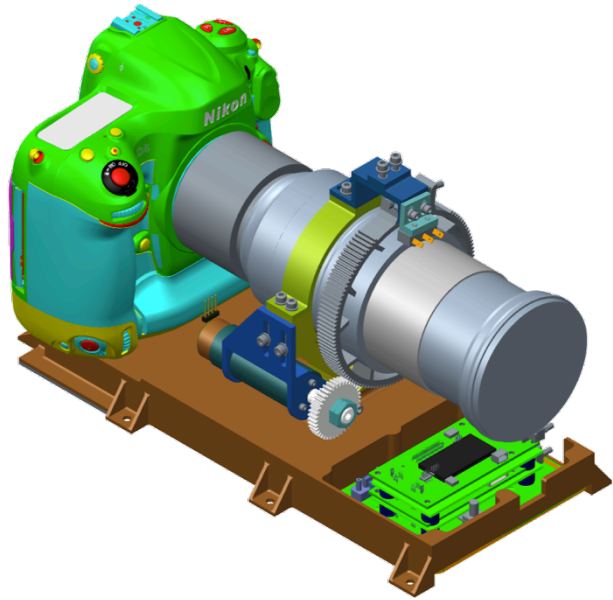


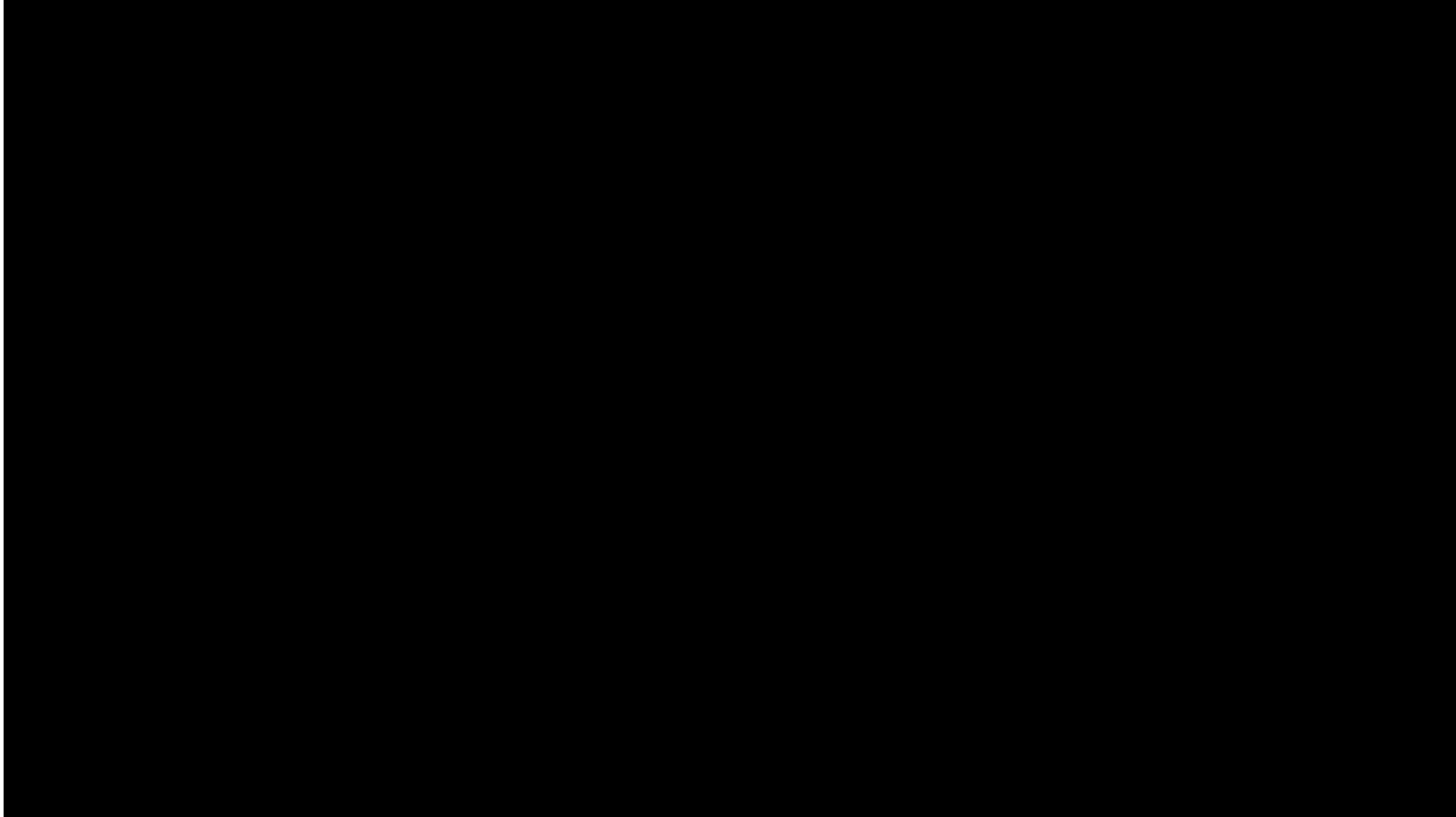


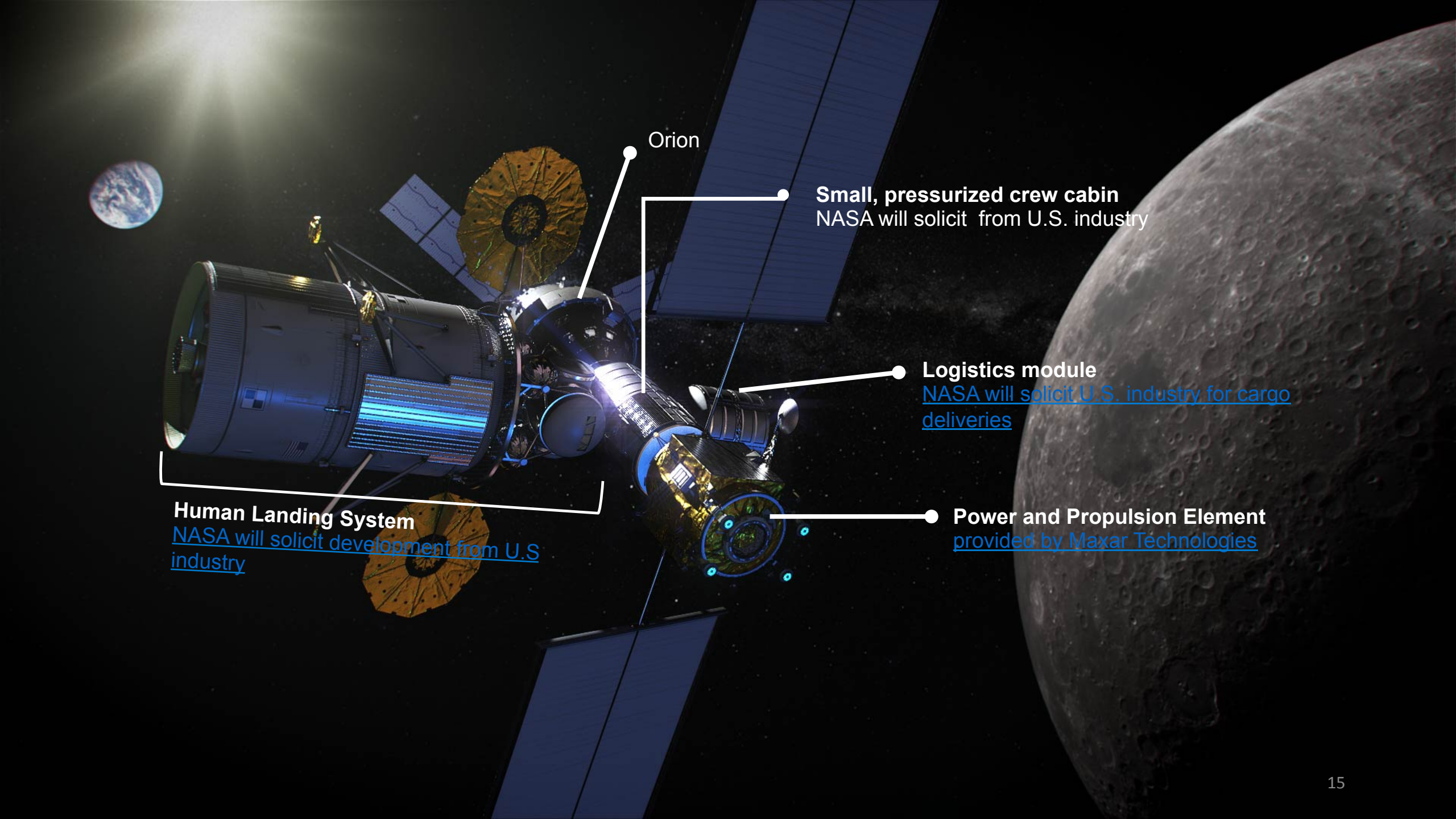
The ISS is a great Lab for testing and flying different types of cameras.

- An IMAX Canon camera rig used for their last space-themed film
- A 3D Virtual Reality Camera
- A new internal vehicle robot free floater called ASTROBEE

We've even modified a Nikon camera to put an HD camera on the outside of the ISS







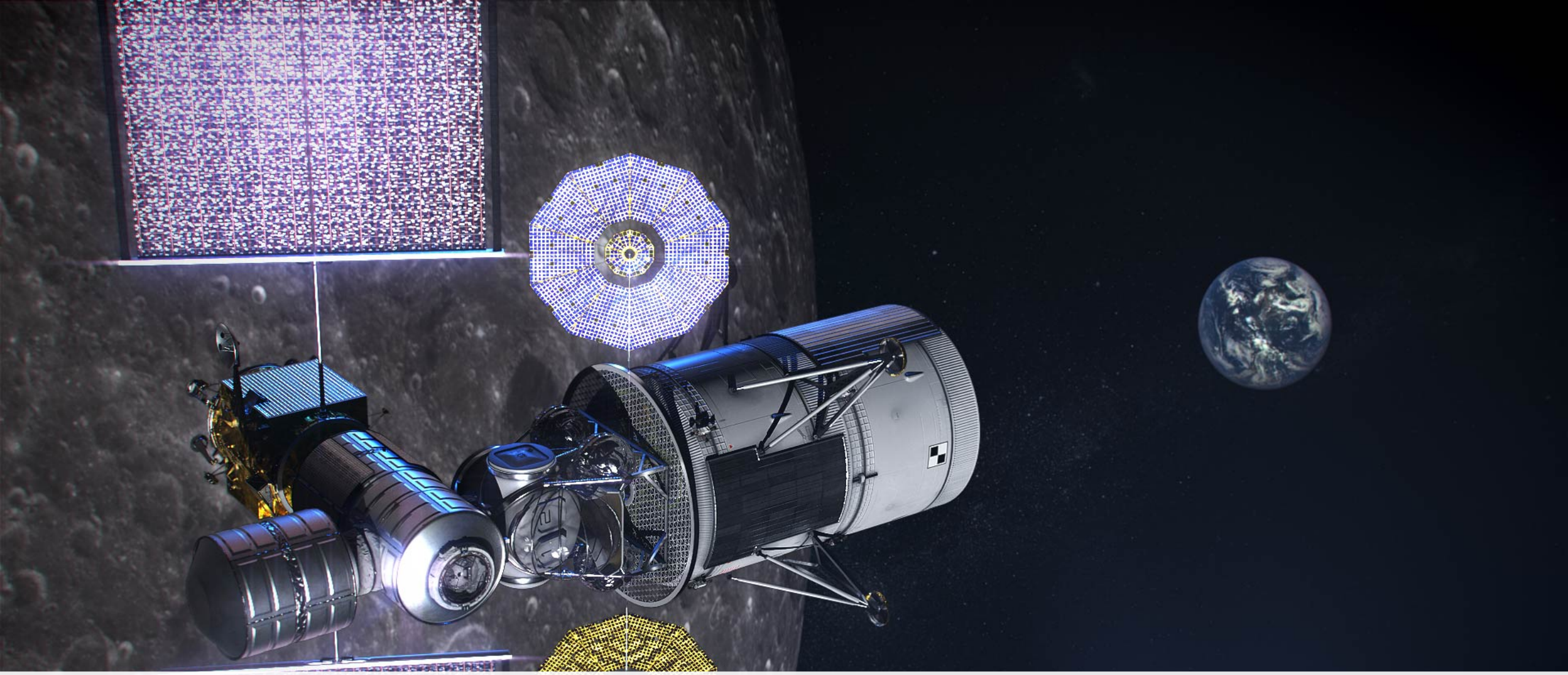
Orion

Small, pressurized crew cabin
NASA will solicit from U.S. industry


Logistics module
NASA will solicit U.S. industry for cargo deliveries

Power and Propulsion Element
provided by Maxar Technologies

Human Landing System
NASA will solicit development from U.S. industry



The environment around and on the Moon is very challenging: Extremes in heat and cold; vacuum; radiation; lunar dust.



Imaging in the space around the Moon, on the lunar surface, and on Mars presents all kinds of challenges. Radiation is one of the most challenging. This is a shot from a Red Digital Cinema camera with the lens cap on after being on ISS for over two years. Those aren't stars....

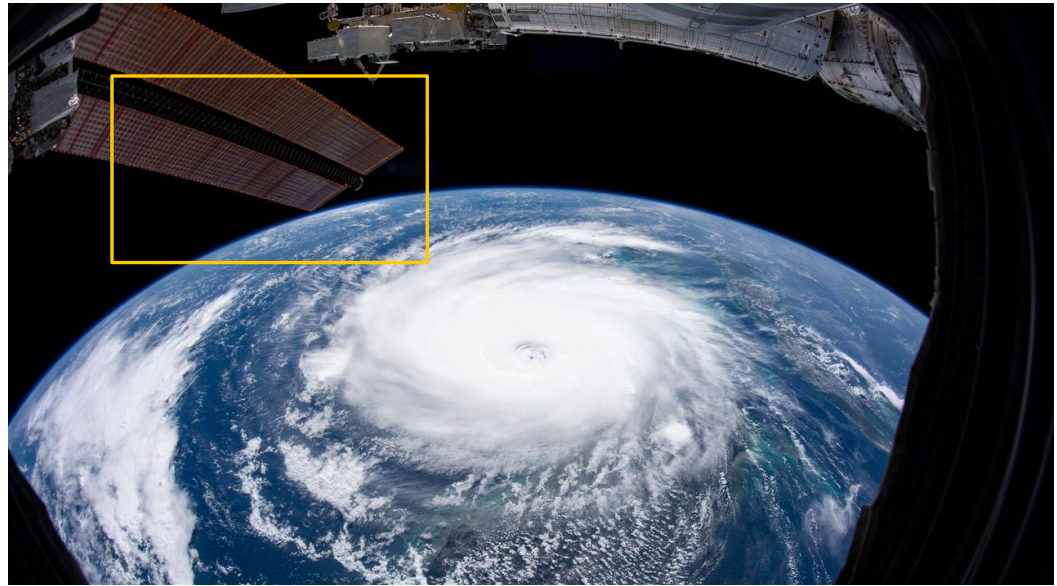
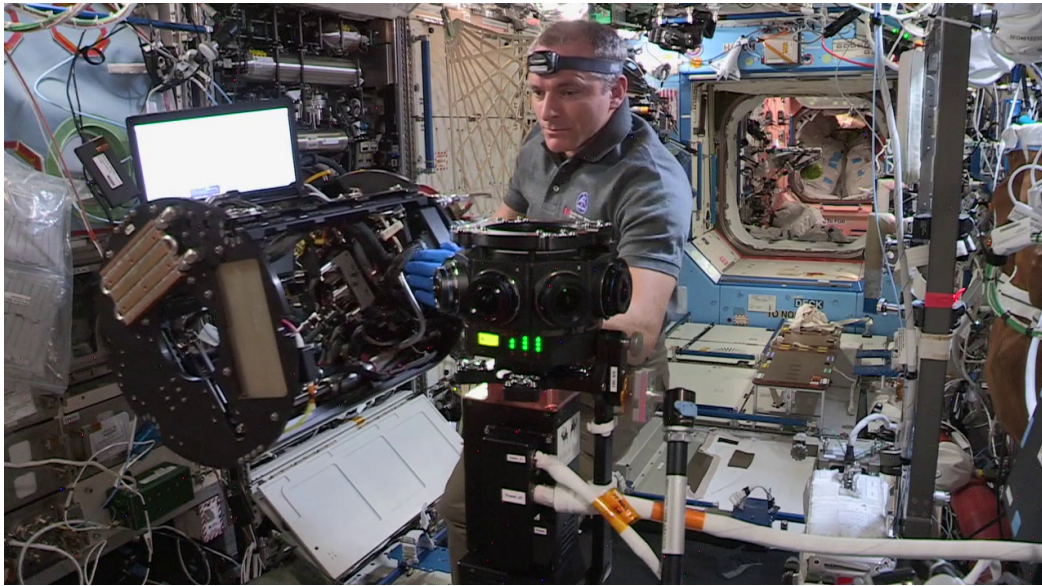


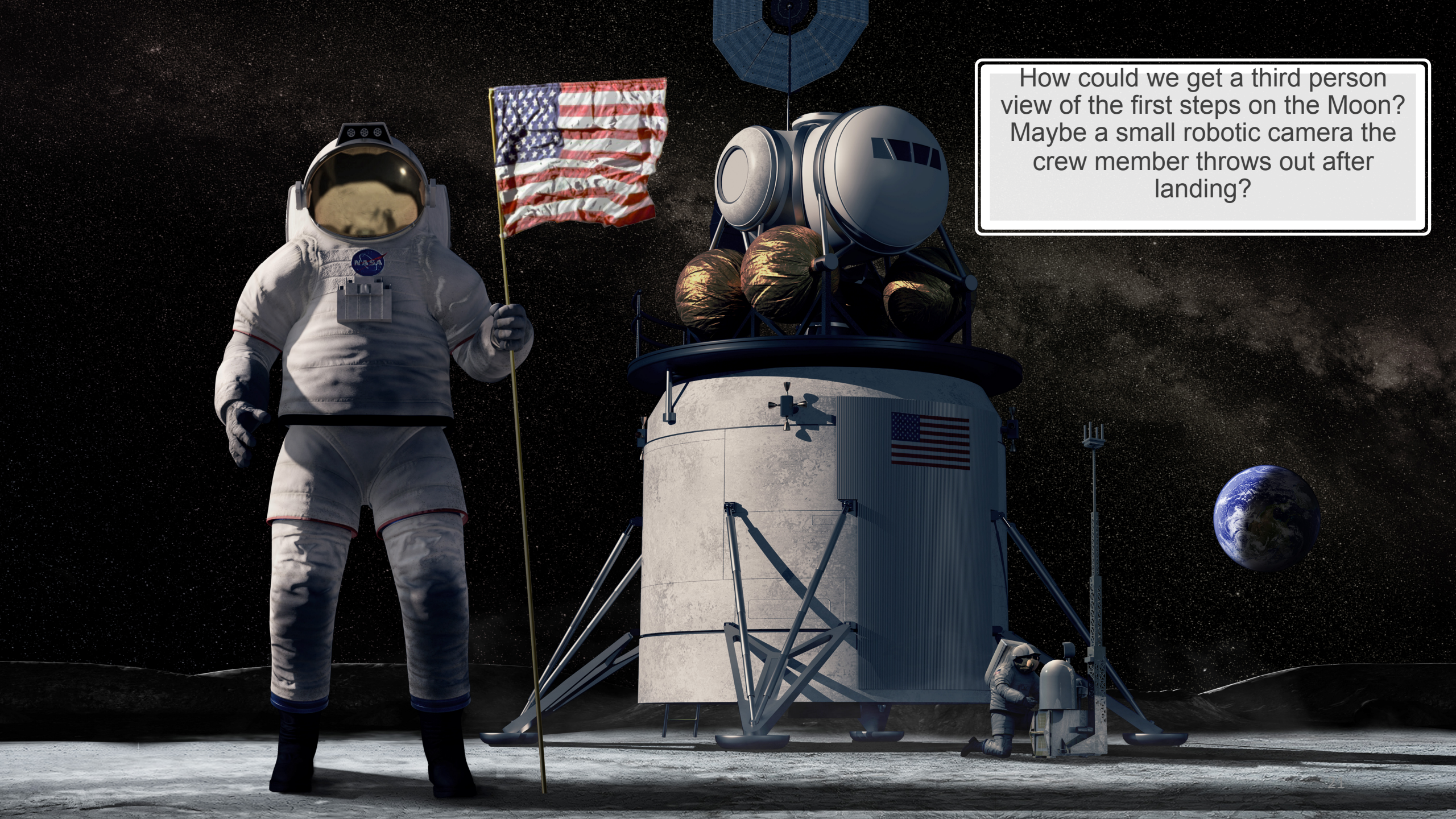
In a well lit scene like this
damaged pixels may not
be so apparent, but they
are there



Each one of these dead pixels is caused by ionizing radiation that has penetrated the vehicle and damaged the camera's sensors. This means the cameras we fly to the Moon will need to be easily replaced. Trying to radiation harden a HD or UHD video camera would be cost prohibitive

NASA will need some help! NASA and its partners could use help with a Pan/Tilt system with no moving parts. Maybe a VR camera or extract HD out of 8K?





How could we get a third person view of the first steps on the Moon? Maybe a small robotic camera the crew member throws out after landing?

A “follow in real-time” site for the public using real imagery, audio and telemetry like “apolloinrealtime.org” web site would be incredible

The screenshot displays the Apollo 11 Real-Time Mission Experience website. At the top left, it features the Apollo 11 logo and the text "The First Landing on the Moon Apollo 11 Real-Time Mission Experience". Below this, the date and time "Wed Jul 16 1969 08:31:05 AM" and "Mission Elapsed Time: -00:00:55" are shown. A progress bar at the top tracks mission stages: Countdown, On the Way to the Moon, In Lunar Orbit, On the Surface, Luna Docked w/ Returning to Earth, and Re-entry. A secondary bar shows specific events: Countdown, Good luck and godspeed, Launch (Lift-off), Stage 2, and On the Way to the Moon (Trans-lunar Injection, Transposition and Docking). The main content area is divided into three tabs: PHOTOGRAPHY, MISSION CONTROL AUDIO, and ASTROMATERIAL SAMPLES. The PHOTOGRAPHY tab is active, showing a large central image of the Apollo 11 rocket on the launch pad. To the left of the main image is a "Mission Control Channels" list with options like FOD, MSN DIR, FLIGHT, CAPCOM, BOOSTER, RETRO, FIDO, GUIDO, SURGEON, EECOM, GNC, TELCOM, CONTROL, INCO, OPS & PRO, FAO, ASST FD, NETWORK, COMM TECH, COMM CTRL, TRACK, TRACK-R, RECOVERY, RCVY ASST, RCVY STUS, CONF LOOP, and GOSS 2. To the right of the main image is a vertical strip of smaller thumbnail images. Below the main image is a transcript section with a search bar and playback controls. The transcript shows the following text:

-00:01:01 Public T-minus 60 seconds and counting. We have passed T-minus Affairs 60, 55 seconds and counting. Neil Armstrong just reported back, "It's been a real smooth countdown." We have passed the 50-second mark. Our transfer is complete. We're on internal power with the launch vehicle at this time.

-00:00:42 Public 40 seconds away from the Apollo 11 liftoff. All the Affairs second stage tanks now pressurized. 35 seconds and counting. We are still go with Apollo 11.

-00:00:31 Public 30 seconds and counting. Astronauts report, "It feels Affairs good." T-minus 25 seconds. 20 seconds and counting. T-minus 15 seconds, guidance is internal, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, GO!

Dropping in on Mars in High-Res



Technologies NASA and its Industry partners will likely need help with:

Minimizing affects of radiation

Lunar Dust resilience

Autonomous operations/Artificial Intelligence

Pan/Tilt/Zoom capability without moving parts

Robotic cameras for lunar surface

Anything else you can imagine!



Links and more information

- <https://www.nasa.gov/topics/moon-to-mars>
- <https://images.nasa.gov/>
- <https://www.nasa.gov/nextstep/humanlander2>
- <https://www.nasa.gov/multimedia/nasatv/index.html#public>
- <https://archive.org/details/NASA-Ultra-High-Definition>
 - Downloadable 4K videos
- <https://youtu.be/rgBKFEeXfww>
 - Music video featuring ISS 4K imagery & updated rendition of “Sounds of Silence”
- https://youtu.be/lil_I_-7aOM
 - VR 360° video shot inside Neutral Buoyancy Lab
- <https://youtu.be/7k2uKb9vCOI>
 - First 8K from space
 - Downloadable here, <https://images-assets.nasa.gov/video/First-8K-Video-from-Space/First-8K-Video-from-Space~orig.mp4>

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