

Lunar Science

HONR 269i

To The Moon and Back: The Apollo Program

Chronology

- June-August 1962: Iowa Space Science Board Summer Study Group
- December 1963: Sonnet Report on Apollo Science
- July 1964 First successful Ranger mission
- October 1964: Scientist Astronaut applications invited
- June-July 1965: Woods Hole Space Science Board Conference
- July 1965: Falmouth Lunar Science Conference
- July 1965: Apollo Site Selection Board established
- February 1966: Office of Space Science decision on experiments
- May 1966: First successful Surveyor mission
- August 1966: First successful Lunar Orbiter mission
- July 1969: First Apollo lunar landing
- September 1977: Termination of ALSEP monitoring

The Sonnet Report (1963)

- Office of Manned Space Flight specifically requested input on:
 - Number of missions
 - Background of crew members
 - Duration of lunar stay
 - Payload (weight and power)
 - Mobility (e.g., surface vehicle)
 - Space suit capabilities
- Additional input was requested on:
 - Landing site selection
 - Need for a soft-landed supply vehicle

Reasons for Scientific Inquiry

- Advancing human knowledge
- Providing a scientific basis for engineering
- Supporting operational activities

Selection Criteria

- Scientific importance
- Feasibility
- Particular to the Moon
- Best carried out with human assistance

Scientific Disciplines

- In-Situ:
 - Geology (mapping, sampling, drilling, ...)
 - Solid body geophysics (heat flow, radioactivity, seismology, gravity, ...)
 - Atmosphere (density, scattering, ...)
 - Plasma physics (electric field, magnetic field, plasma flows, ...)
 - Surface physics (bombardment, dust structure, dust transport, electrostatic, ...)
 - Astronomy (ultraviolet, radio, ...)
- Sample analysis:
 - Geochemistry
 - Biology

Scientific Activities on the Moon

- Observation of natural phenomena
- Collection of material
 - Geological samples
 - Biological samples
- Emplacement of long-term monitoring equipment

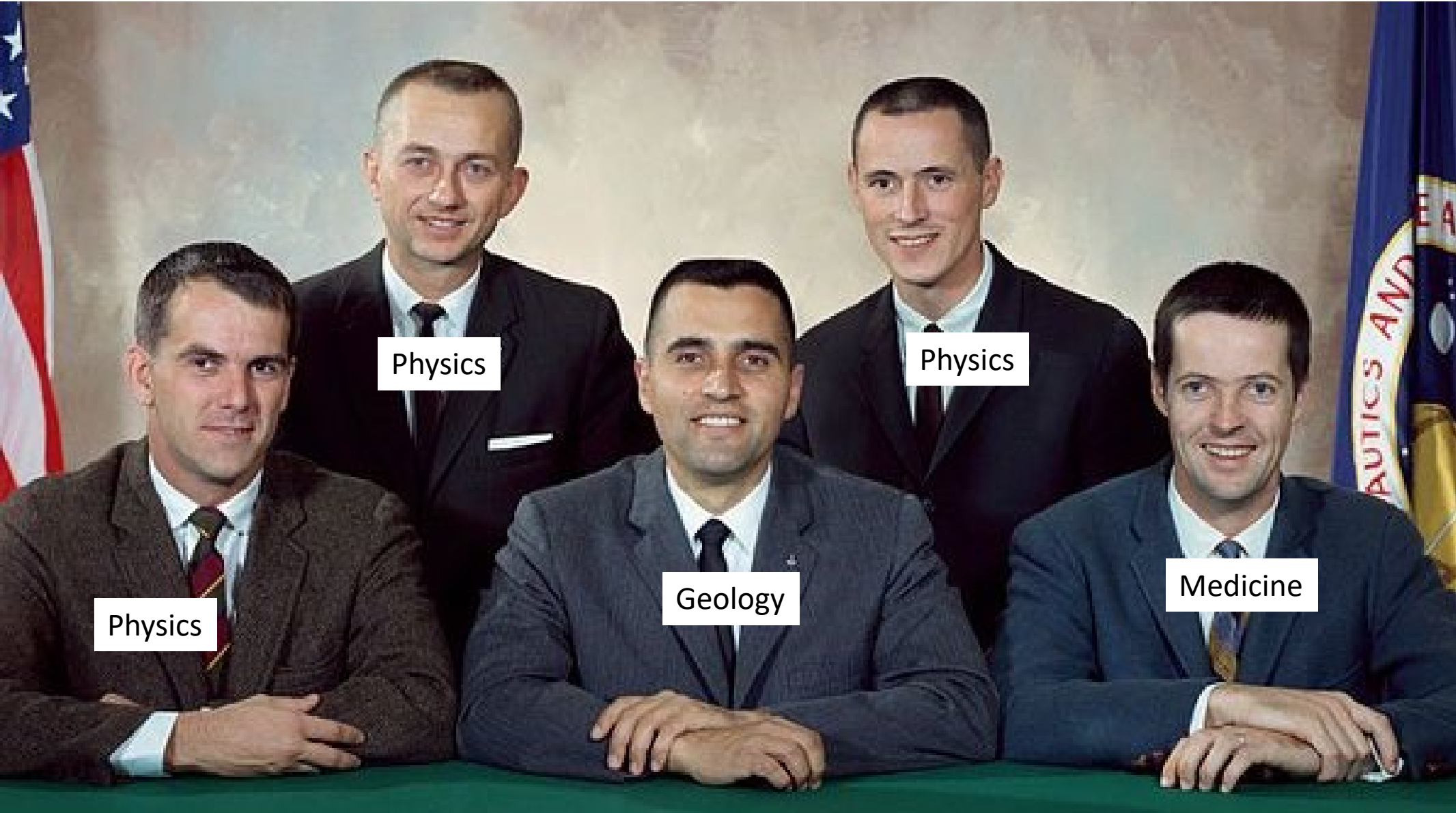
Operational Needs

- Spacesuit mobility
 - Necessary for sampling and emplacement
- High-resolution maps
 - Based on orbital photography with resolution of less than 3 feet
- Precise positioning, helmet-mounted TV, high resolution camera
 - To maximize scientific return given limited time
- Multi-day surface stays with multiple moonwalks
 - Characterizing one square mile on earth takes a week
- Landing site selection
 - Any site for the first landing, then guided by scientific interest
- Lunar rover
 - To reconcile landing risk with scientifically interesting sites

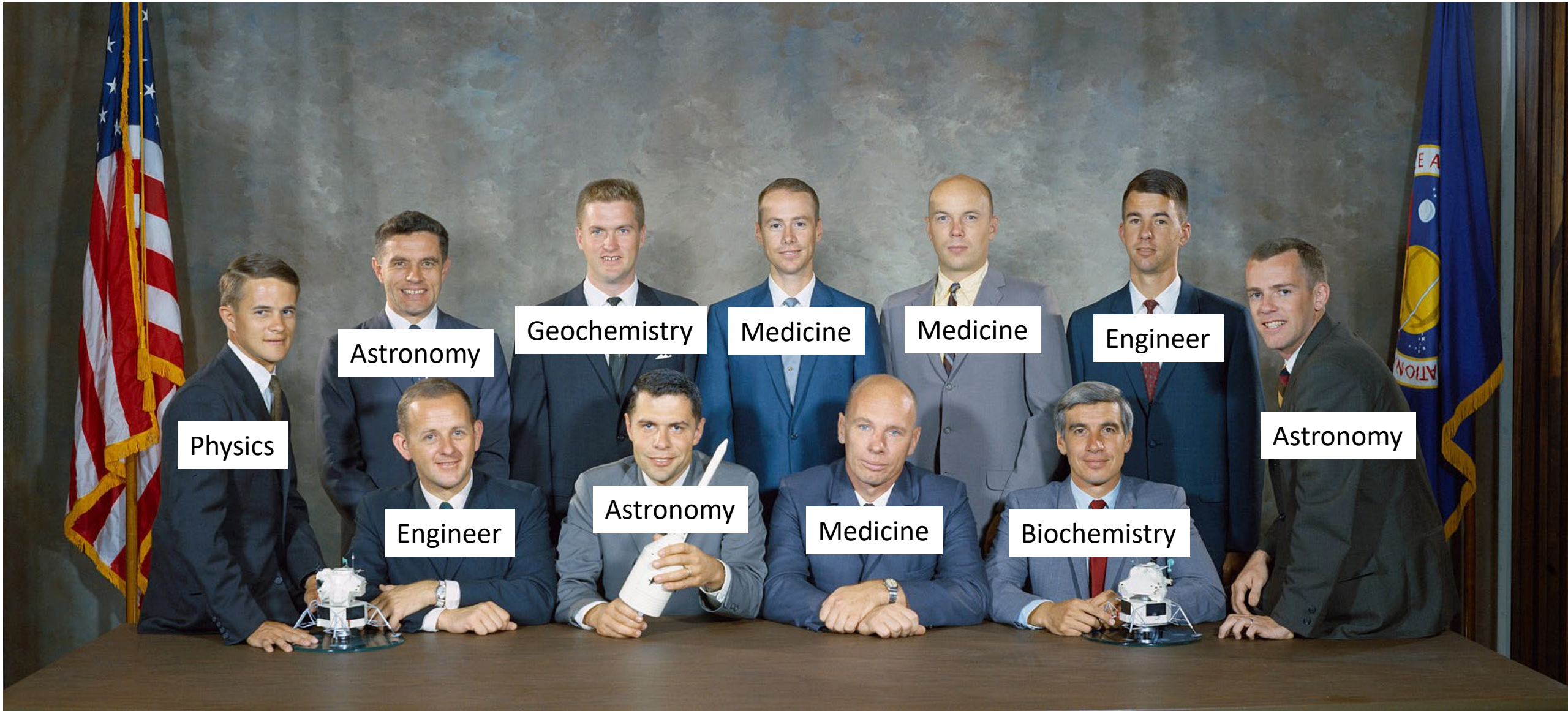
Scientist Astronauts

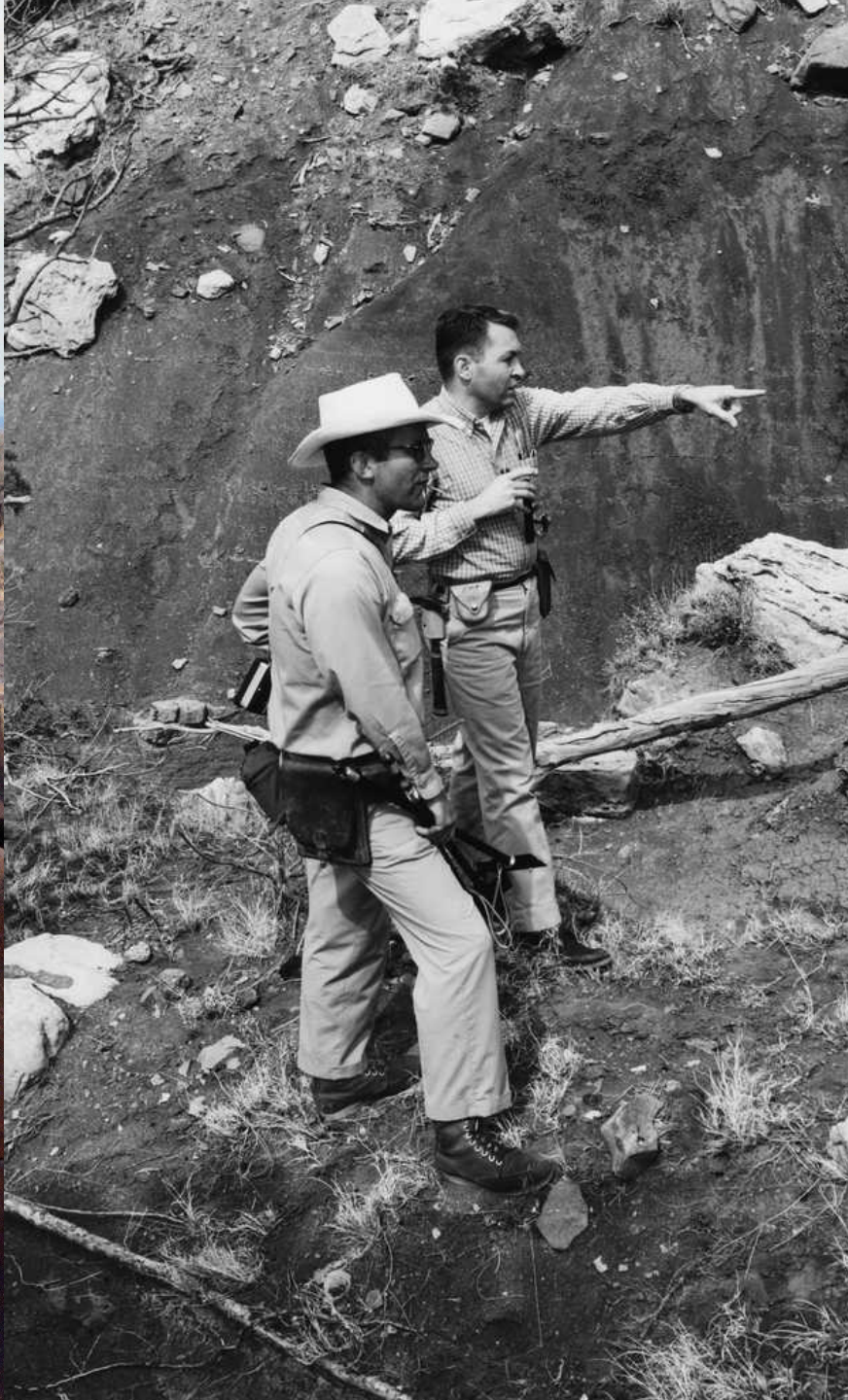
- One on each (initially 3-person) lunar landing crew
- Optimally, a combined background in geology and geophysics
- Continuing involvement in research
- Based at a research institute near Manned Spacecraft Center
 - Hosting visiting scientists
- Contribute to scientific training of pilot astronauts
- Less than 50% of time spent on flight training (except short periods)

Astronaut Group 4 (June 1965)



Astronaut Group 6 (1967)





NASA and the National Reconnaissance Office

- Lunar Orbiter
 - Apollo site certification
 - Based on Air Force Samos program design
- Lunar Mapping and Survey System (“Upward”)
 - Backup plan for Apollo site certification
 - KH-7 Gambit-1 camera (2 ft resolution on Earth)

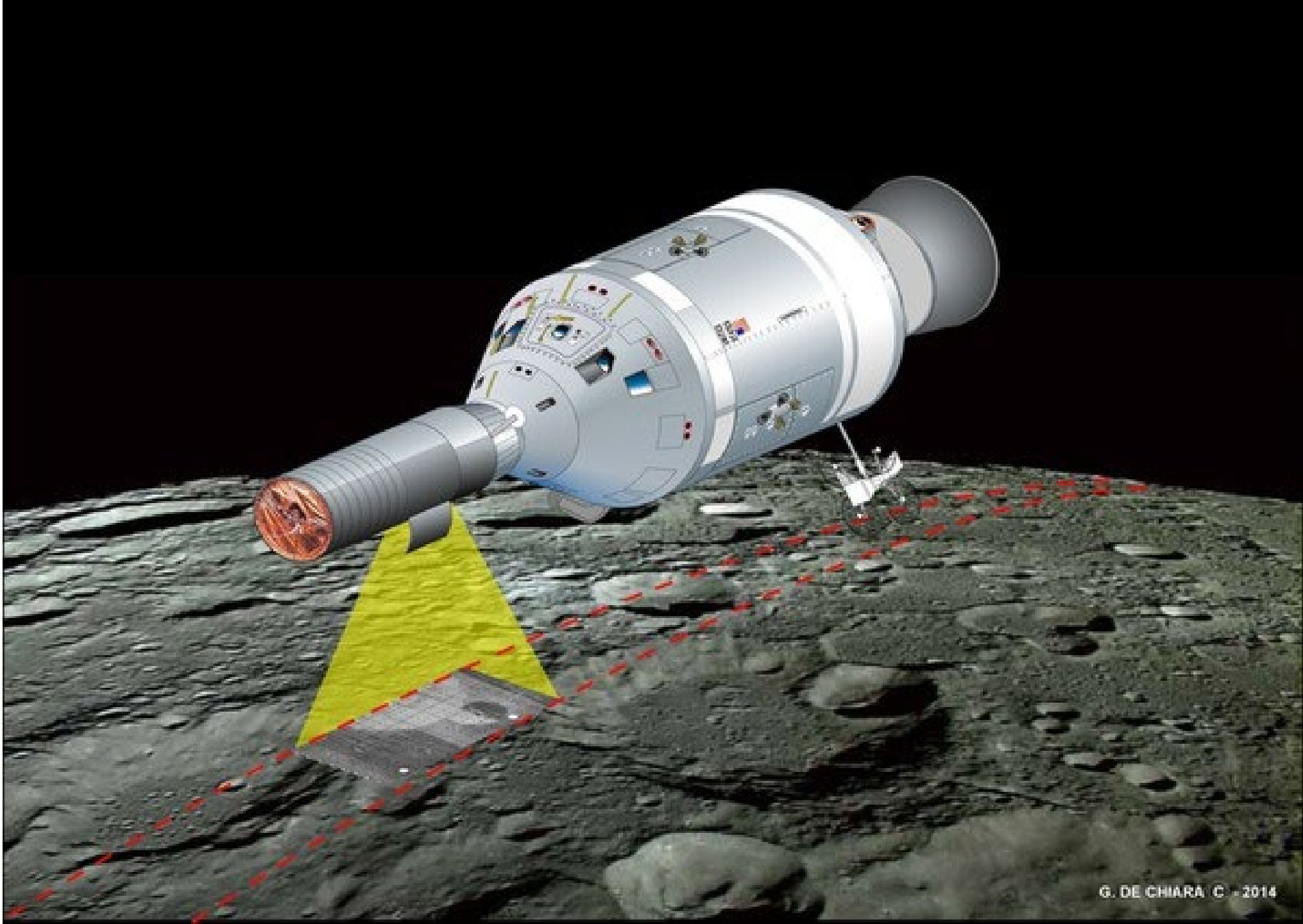


BEFORE



AFTER





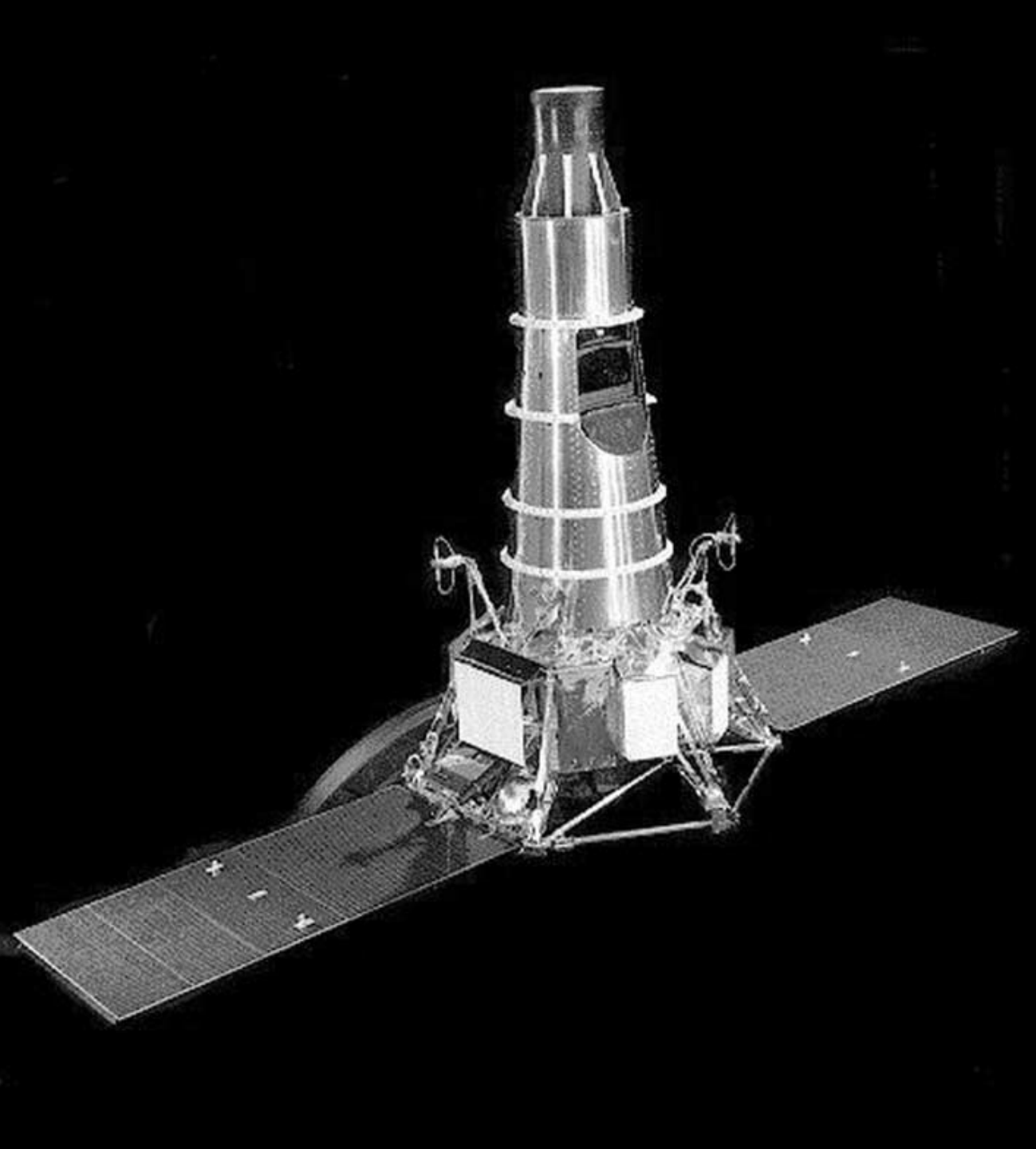
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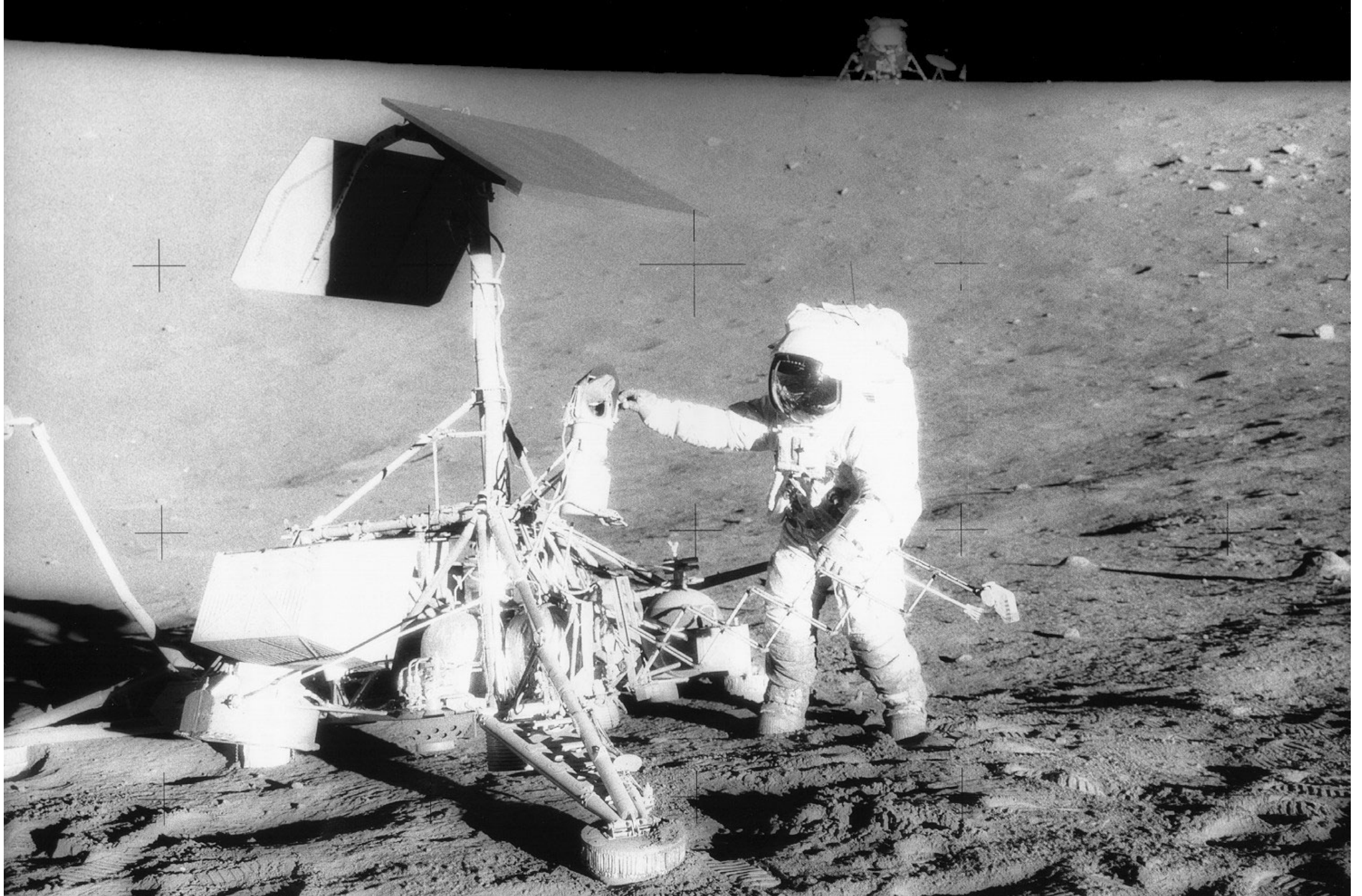
TYURATAM MISSILE TEST CENTER
KAZAKSTAN, SOVIET UNION



SPACE BOOSTER

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Discussion Groups

- Sonnet Report (“Report of the Ad Hoc Working Group on Apollo Experiments and Training on the Scientific Aspects of the Apollo Program”)
 - The first try to nail down what Apollo should do on the Moon
- Compton chapter 3 (“Apollo’s Lunar Exploration Program”)
 - An explanation of what happened after the Sonnet Report
- FETM episode 10 (“Galileo was Right”)
 - A dramatization of scientific training for an Apollo mission
- NRO Draft (“Project Upward: The NRO and NASA”)
 - Reuse of spy satellite technology in the Apollo program