May 15, 1972

Aviation Week & Space Technology

Apollo 16 Color Portfolio

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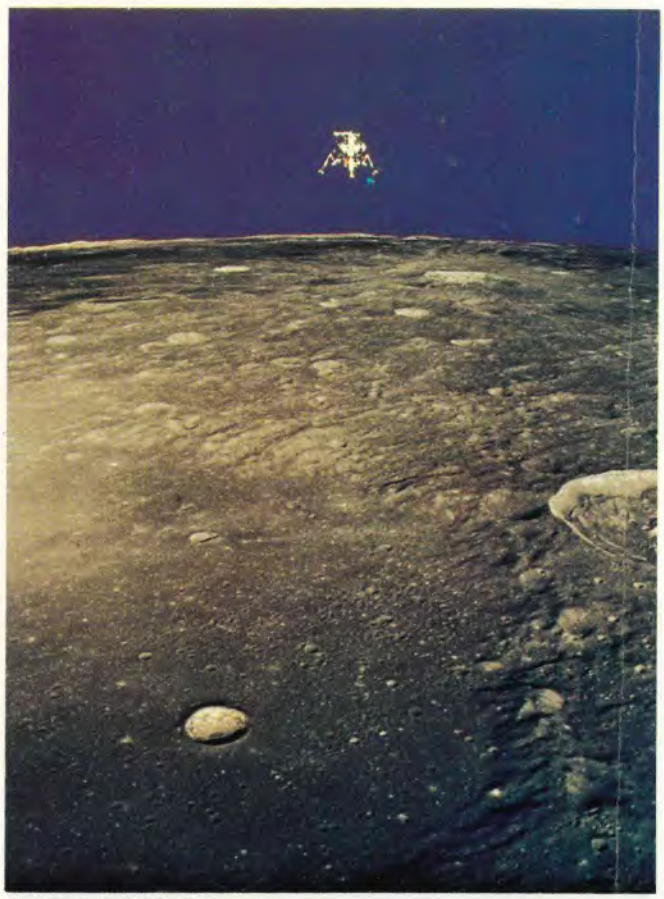

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HUNTINGTON ALLOYS

Luna 20, 16 Samples Differ Greatly

Lunar material brought to earth by the Luna 20 unmanned spacecraft earlier this year (AW&ST Mar. 20, p. 20) differed greatly from Luna 16 samples in color, chemical content and physical texture, Soviet scientists said.

Luna 20 landed approximately 80 mi. north of the Luna 16 site, in a highland region between the Sea of Fertility and the Sea of Crises (AW&ST Feb. 28, p. 12). Luna 16's sample was from the Sea of Fertility (AW&ST Sept. 28, 1970, p. 19).

Scientists said the Luna 20 material was strikingly lighter in color than the nearly-black Luna 16 sample. Luna 20 sample was described as light gray in color.

There was far fewer crystalline and glazed particles in the Luna 20 sample, and the average particle size in the earlier sample was smaller, the scientists said. There were twice as many particles more than 1 mm. in diameter in the later sample than in Luna 16.

Silicon content was almost identical in the two samples, as were the relative amounts of magnesium and potassium. Luna 16 sample contained twice as much iron and six times as much titanium as was found in the Luna 20 material. The Luna 20 sample, on the other hand, contained approximately 40% more aluminum and 25% more calcium than the sample from the mare.

Soviets said Luna 16 samples generally were similar to those of the U. S. Apollo 11 and 12 and hinted they expect to find similarities between Luna 20 and Apollo 15 and 16 samples.

carefully planned flight routes. In this way, when the aircraft discovers a SAM radar illuminating it, the defensive options could include resort to onboard jammers, a call for ECM support jamming, defensive maneuvers or a combination of these actions.

Wild Weasel anti-radar aircraft, now extensively deployed in Southeast Asia, will have the assignment of assisting the CASS aircraft in hunting down and attacking SAM radars. The advanced Wild Weasel McDonnell Douglas F-4D aircraft probably will handle the ECM jamming support as well as the SAM hunt/kill function.

Protection against enemy aircraft is likely to be a more ticklish job. AWACS could detect hostile aircraft threatening CASS and vector interceptors to meet them. Counter action also might be invoked against enemy ground-controlled intercept and airborne intercept radars to reduce their acquisition capability as a means of lessening airborne threats against CASS.

A-10A Prototype Makes First Flight At Edwards AFB

Fairchild Industries prototype A-10A attack aircraft made a 43-min. first flight May 10 from Edwards AFB in California.

The A-10A is to engage in a competitive flyoff next fall with the Northrop A-9A in the Air Force AX program for an advanced ground support aircraft (AW&ST Apr. 17, p. 15).

On the initial flight, Fairchild Republic Div. Test Pilot Howard (Sam) Nelson was at the A-10A's controls.

The A-10A aircraft was taken to a maximum altitude of 17,000 ft., and the speed was kept below 200 kt. indicated air speed.

During the flight, Nelson checked a number of the A-10A's systems, as well as performing a variety of banks and rolls.

Apollo Fuel Explosion Under Study

Explosion of a tank on a unit being used to clear the Apollo 16 command module of residual reaction control fuel possibly was caused either by a chemical reaction that built up pressure in the tank or an equipment malfunction, according to preliminary findings of a seven-member investigative board studying the incident, which occurred in San Diego May 7.

Forty-six persons were hospitalized, 45 of them for 48 hr., for observation to determine if they had inhaled toxic nitrogen tetroxide fumes. An employe of North American Rockwell, Donald Coleman, suffered knee and foot injuries in the accident.

The explosion occurred as two wheeled consoles were removing oxidizer and fuel from the spacecraft. The explosion was set off in a neutralizing tank in one of the reaction control system propellant deactivation units.

A spokesman for the National Aeronautics and Space Administration's Manned Spacecraft Center said the investigation board so far has seen no relation between the accident and procedural change in the Apollo 16 landing in which the reaction control system fuel and oxidizer residuals were kept onboard the spacecraft instead of being jettisoned before splashdown.

New Business

Autocall Div. of Federal Sign & Signal Corp. and Ling-Oliver-O'Dwyer, Inc., have received an $884,973 joint venture contract to furnish a fire alarm system for Dallas-Ft. Worth Regional Airport.

Sikorsky Aircraft Div. of United Aircraft Corp. will procure long-leadtime items for further production of RH-53D helicopters under a $16-million Navy contract.

Bendix Navigation & Control Div. has received Air Force contracts for $9.5 million for two-gyro platforms for Northrop F-5Es and dead reckoning navigation systems for McDonnell Douglas F-4s.

General Telephone & Electronics Corp. has received a $7-million Army contract for command, control and communications subsystem support for the Prototype Demonstration Program for Site Defense. The program is aimed at augmenting the Safeguard anti-ballistic missile defense system.

Talley Industries, Inc., will produce explosive cartridges to remove the lids that protect Minuteman missile silos under a $340,000 contract from the Boeing Co.

Rohr Industries has been selected as apparent low bidder on a contract to build 300 transit cars for the new Washington, D. C., subway system. Rohr's bid was $91.6 million. A contractor will be selected in about 60 days.

Lockheed Missiles & Space Co. has a $705,790 contract from the Coast Guard for a prototype skimmer designed to clean up oil spills in the open sea at a rate of 200-1,200 gal./min., depending on sea state and thickness of the slick. The diesel-powered 12,500-lb. device will be mounted on a catamaran that can be transported by Coast Guard/Lockheed C-130 aircraft or surface craft as small as 95-ft. cutters. Delivery is due next March.

Pioneer 10 Flight

Jupiter-bound Pioneer 10 next week will enter a threshold of space never before visited by a spacecraft from earth.

On May 25, the spacecraft will have crossed the 50 million mi. separating the orbits of Mars and earth in three months, two months shorter than any other previous Mars-bound spacecraft.

Pioneer 10 will enter the asteroid belt to make man's first probe of the region about July 1. The spacecraft will take seven months to cross the 175-million-mi. belt that lies between the orbits of Mars and Jupiter. The spacecraft is scheduled to reach Jupiter on Dec. 3, 1973.

ICAO Aerosat Plan Gets Airline Support

Washington—International Air Transport Assn. has tentatively endorsed a recommendation for a less ambitious initial aerosat program that would be used solely for experimentation and operational evaluation. Approach was developed at the recent International Civil Aviation Organization meeting in Montreal (AW&ST May 1, p. 27).

The Air Transport Assn. also is expected to endorse the austere aerosat program recommended by ICAO's Seventh Air Navigation Conference (AW&ST Apr. 17, p. 17).

The international carriers' group said, "in view of the controversy which has surrounded the subject in the past, IATA believes that real progress has been made at this conference."

The effect of the austere aerosat recommendation is uncertain on the present impasse over the White House Office of Telecommunications Policy insistence that the U. S. portion of an aerosat system be owned and operated by a commercial company (AW&ST Feb. 21, p. 17).

In developing the official ICAO aerosat policy, the group sought to ease airline concern that the carriers might be required to use aerosat for routine air traffic control oceanic operations and that user charges would be imposed to pay for the initial system.

The long-used terminology of "pre-operational" was dropped in the ICAO policy statement. Instead, the initial system is referred to only as "Phase 1" in a three-phase program leading to a fully operational aerosat. ICAO said "Phase 1 is the evaluation and development phase." Its purpose would be to "permit experiments, evaluation and development of technical and operational capability in an operational environment."

ICAO said that "telecommunications channels provided should be limited to those necessary to achieve an adequate evaluation." The policy statement emphasized that the Phase 1 aerosat "should operate in supplement to and in parallel with conventional systems serving air traffic control. It is understood that the carriage of airborne elements of the satellite system will be on a voluntary basis and that all conventional means of terrestrial communications will still need to be available."

The conference also went on record that nations participating in the deployment of the Phase 1 aerosat should meet its costs from research and development funds and avoid, wherever possible, any allocation of system cost in the form of user charges.

IATA said it "will seek assurances directly from the governments [involved] . . . that the cost of such a system will in fact not be recovered directly or indirectly from the users. On the assumption that the governments concerned will accept the [ICAO] recommendation . . . some international carriers on this new basis could be expected to participate in the evaluation and development phase."

IATA recommended that the ICAO Astra Panel make a more detailed study of the scope of the Phase-1 program. It also called for an "assessment of the impact of aerosats on the present organization and deployment of air navigation facilities and services."

The ICAO document avoids any recommendation that the Phase 1 aerosat coverage should include both the Atlantic and Pacific oceans, as originally planned in the memorandum of understanding drawn up by the Federal Aviation Administration and the European Space Research Organization last summer. Instead, ICAO simply says that coverage should be "over various areas." Considerable interest was shown in using aerosat to provide coverage over the African and Australian land masses.

The shift in emphasis to a more modest Phase 1 aerosat probably means that no more than three flight-model satellites would be procured, instead of the six originally planned by the FAA-ESRO agreement. This should permit two satellites to be deployed over the Atlantic for air surveillance experiments. If the first two launches were successful, the third flight model could be deployed over the Pacific.

If only two satellites were successfully deployed, one of the spacecraft could be moved over the Pacific after completion of the air surveillance tests.

Although both IATA and ATA had earlier criticized plans for obtaining air surveillance service from the pre-operational aerosats, arguing that it was not needed, IATA representatives at the ICAO meeting agreed to the inclusion of surveillance experiments in the Phase 1 system.

The shift in emphasis from a pre-operational aerosat to a more limited system designed solely for experimentation recasts the program into a format that closely resembles the one originally proposed two years ago jointly by ESRO and the National Aeronautics and Space Administration.

At that time, the ATA opposed the program on the grounds that there was not sufficient input from the airlines and FAA, which would use the system. The issue was finally resolved in early 1971 when the Office of Telecommunications Policy declared that the FAA should be responsible for development of aerosat. The latest development at Montreal prompts some speculation that NASA might again be brought into the program, under FAA direction, if OTP were to relax its requirement for commercial ownership of the U. S. half of the Phase 1 system.

The ICAO policy statement emphasizes that the Phase 1 aerosat "would not imply a commitment to a following operational proving phase or to continuing the same institutional arrangements" employed for the initial phase.

This statement appears to be directed, at least partially, at OTP decision-makers in the hope that they might approve FAA, or NASA, ownership of the U. S. half of the experimental system with the assurance that the follow-on operational system arrangement could be changed.

ESRO's aerosat program manager, Dr. J. A. Vandenkerckhove, who came to Washington directly from the ICAO meeting to deliver a paper on the aerosat program at the recent Fourth Communications Satellite Systems Conference, was extremely optimistic over developments in Montreal.

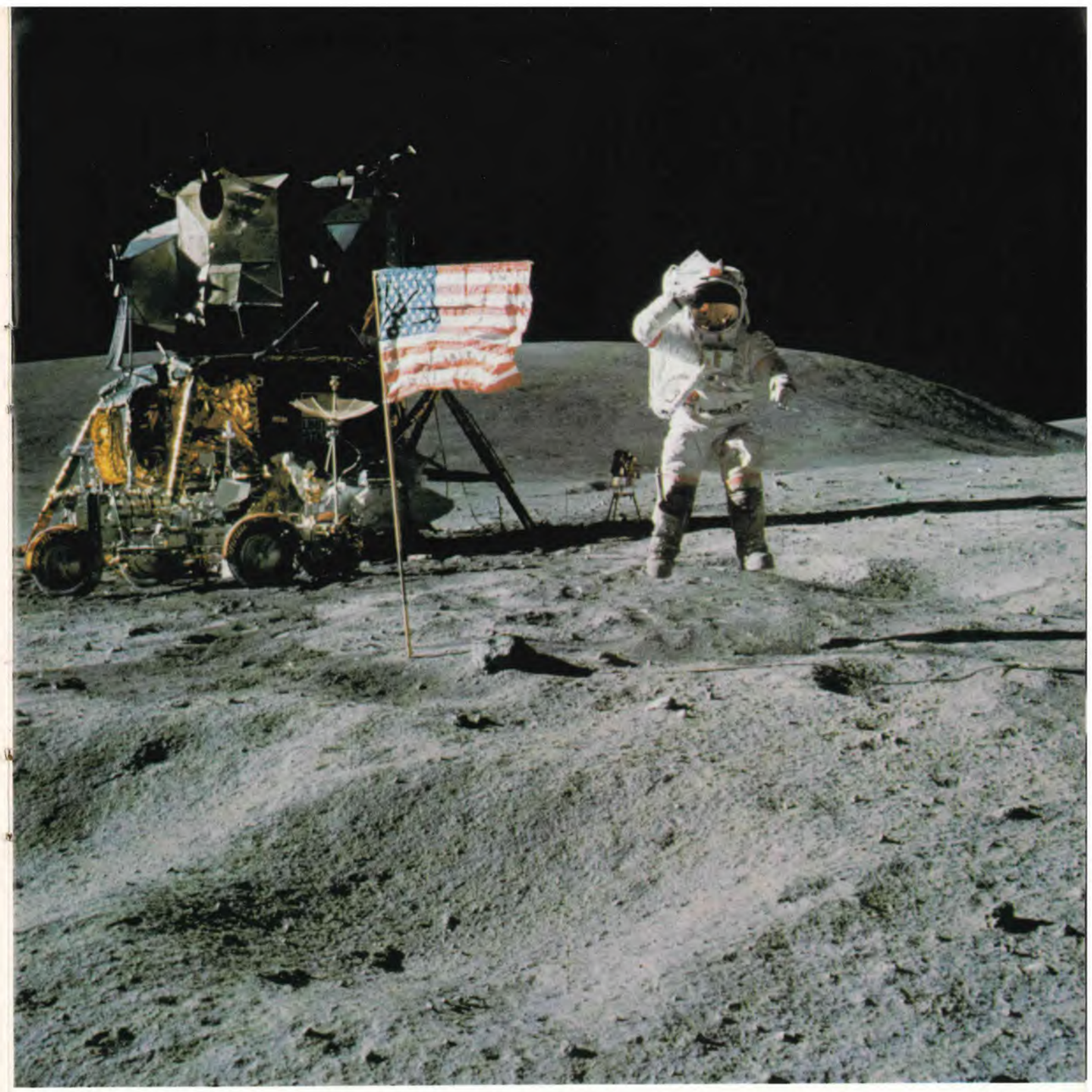
He indicated that ESRO is waiting for a new U. S. proposal for a joint program and added that he hoped "it will be forthcoming soon."

The ESRO official told AVIATION WEEK & SPACE TECHNOLOGY that his agency is, and has been, agreeable to having the U. S. portion of the aerosat system owned either by a commercial company or by the U. S. government.

But Vandenkerckhove indicated that ESRO is standing firm on its requirement that European companies obtain a fair and proportional share of the aerosat development and fabrication.

The current eight-month aerosat projects that ESRO is funding with three European consortiums are emphasizing those spacecraft subsystems for which European companies expect to compete (see p. 59). These include the communications transponder and satellite antennas.

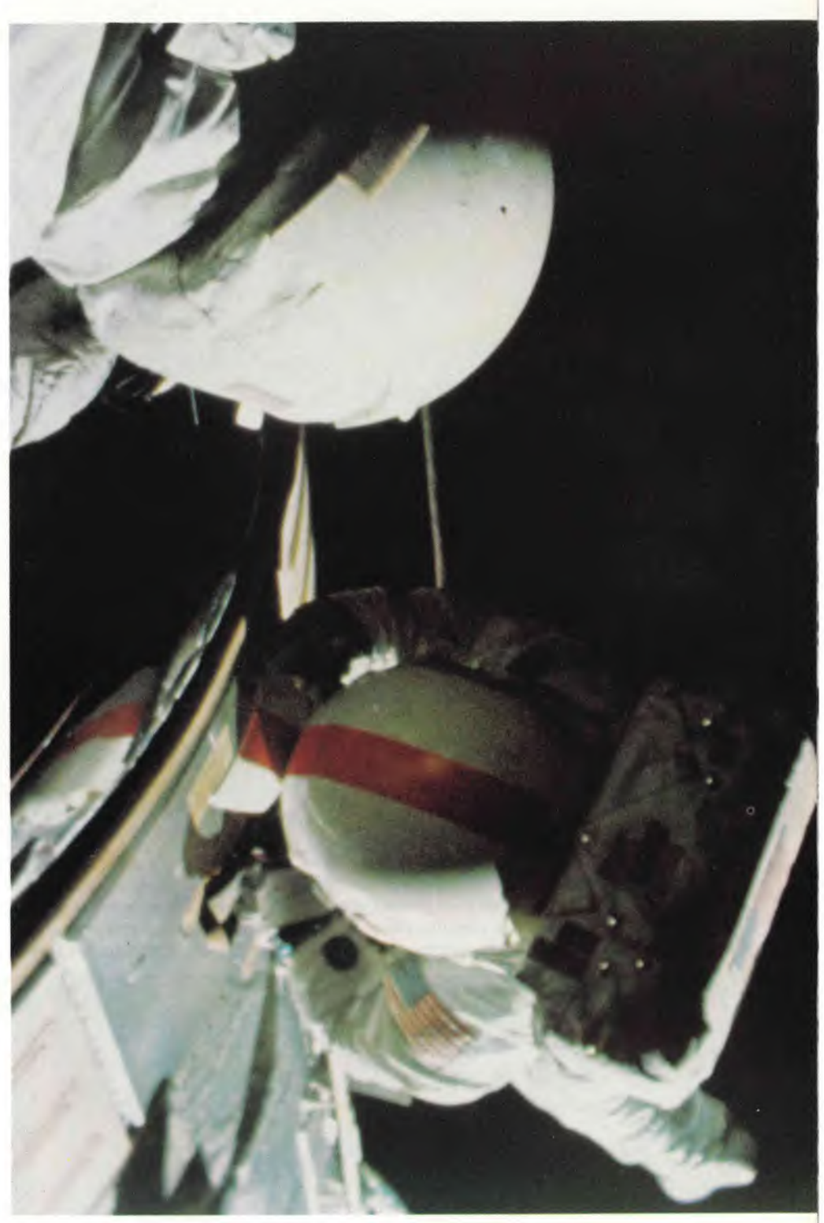
By late November, these ESRO-funded efforts are expected to result in working hardware that can demonstrate feasibility, Vandenkerckhove told the recent conference, sponsored by the American Institute of Aeronautics and Astronautics.



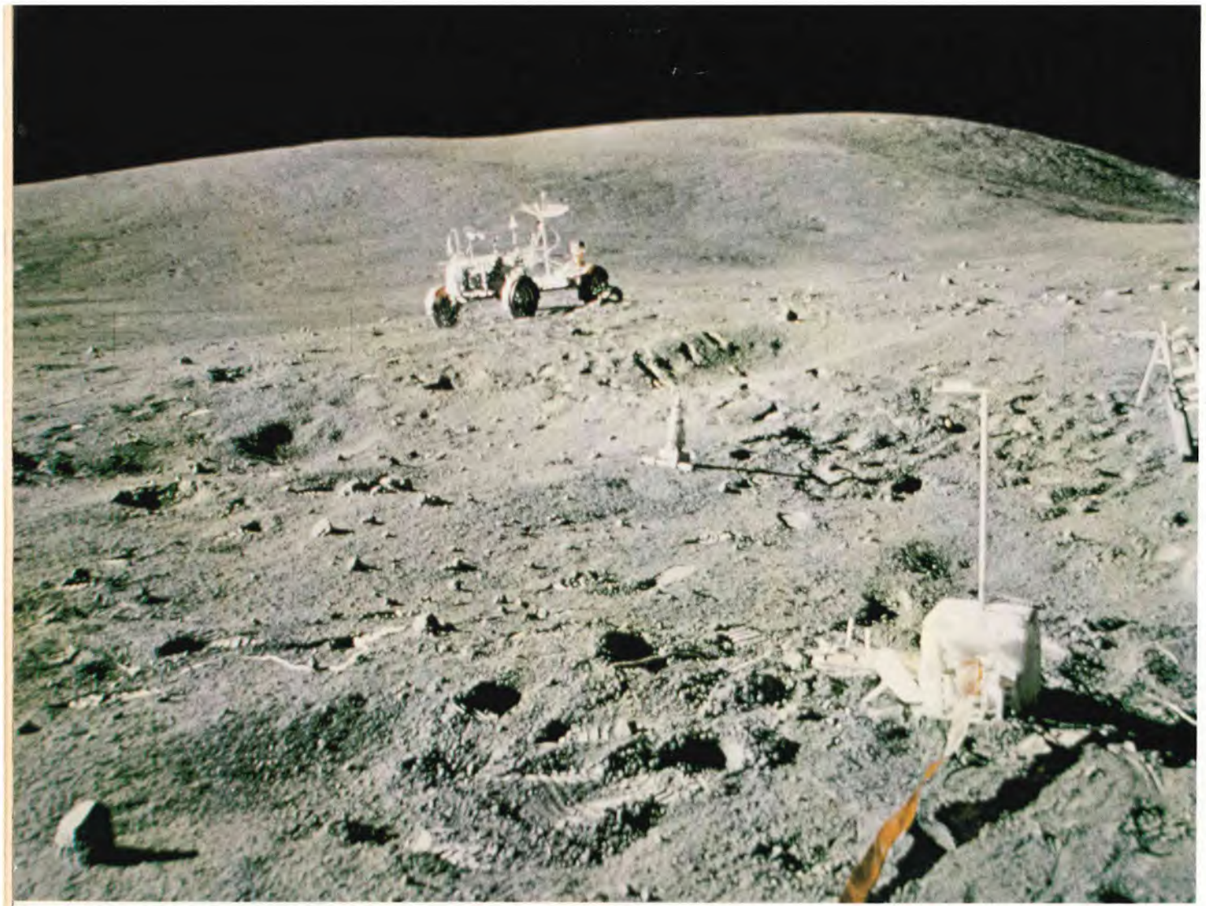
Special Color Portfolio:

Apollo 16 Explores Lunar Highlands

Astronaut John Young is photographed while leaping above the moon's surface to give "a big Navy salute" during the Apollo 16 mission. The picture was made by Astronaut Charles Duke, Young's fellow crew member on the lunar surface, about 2 hr. after the two began their first sortie of the moon. A few minutes after this photograph was taken, it was Duke's turn to have his picture made saluting. Young, a U.S. Navy captain, chided Duke, a USAF lieutenant colonel, about not knowing how to salute in the Air Force. Duke's comeback: "Sure we do. And we fly high and straight and land soft." In the background are the U.S. flag, the lunar roving vehicle, and the lunar module, Orion. Paint is flaked from meteoroid shield panels of lunar module near steerable antenna. This was observed during the outbound trip to the moon, but was not considered critical.

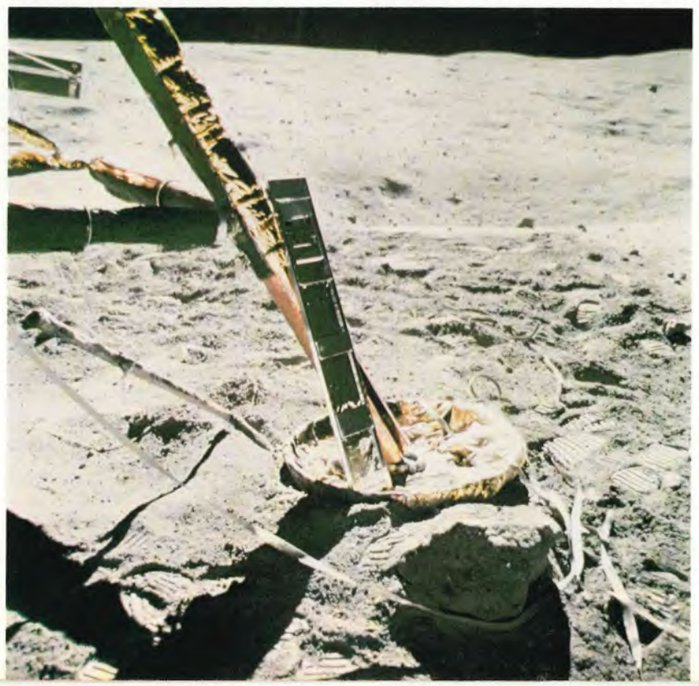


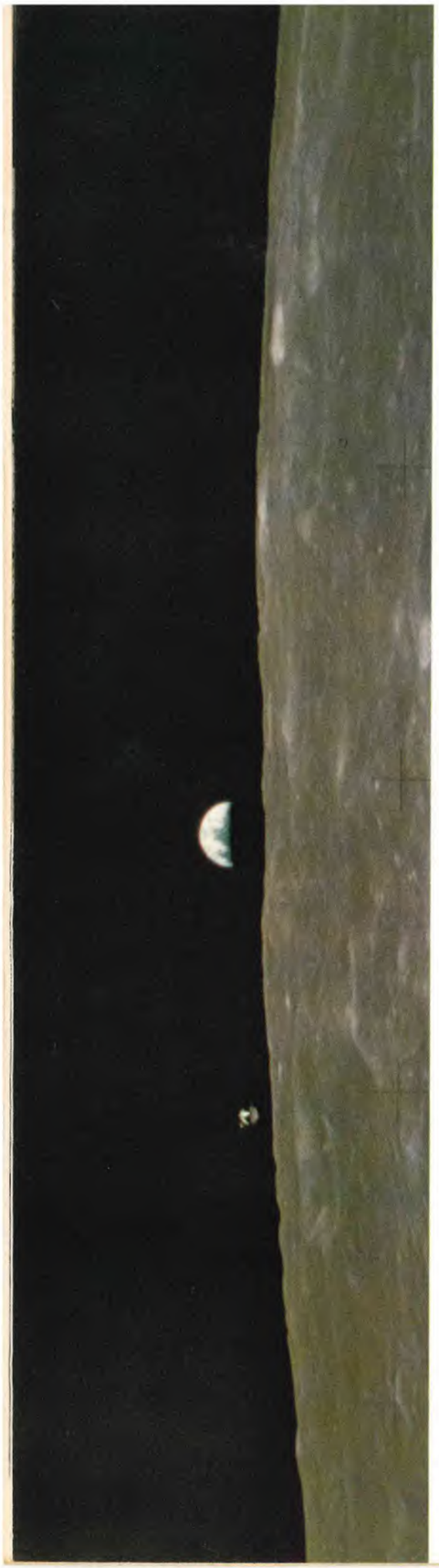
Lunar roving vehicle is put through its paces on the rolling Cayley Plains (left) by Astronaut John Young. The exercise of the sturdy rover was called the grand prix. Several times the vehicle had all four wheels off the ground as it bounced along in one-sixth gravity in a manner reminiscent of a slow motion movie. A "rooster tail" of dust also was kicked up from the surface as the rover twisted and turned. Photograph at right shows Command Module Pilot Thomas K. (Ken) Mattingly as he begins his extravehicular activity to the spacecraft service module to retrieve film cassettes containing the photographs he made of the lunar surface while in orbit about the moon. Holding a tether line and watching his progress is Lunar Module Pilot Charles Duke. Mattingly is wearing the red-striped helmet of Apollo 16 Mission Commander Young because it was equipped with a different kind of sun visor which afforded better protection from the unfiltered solar rays in space.

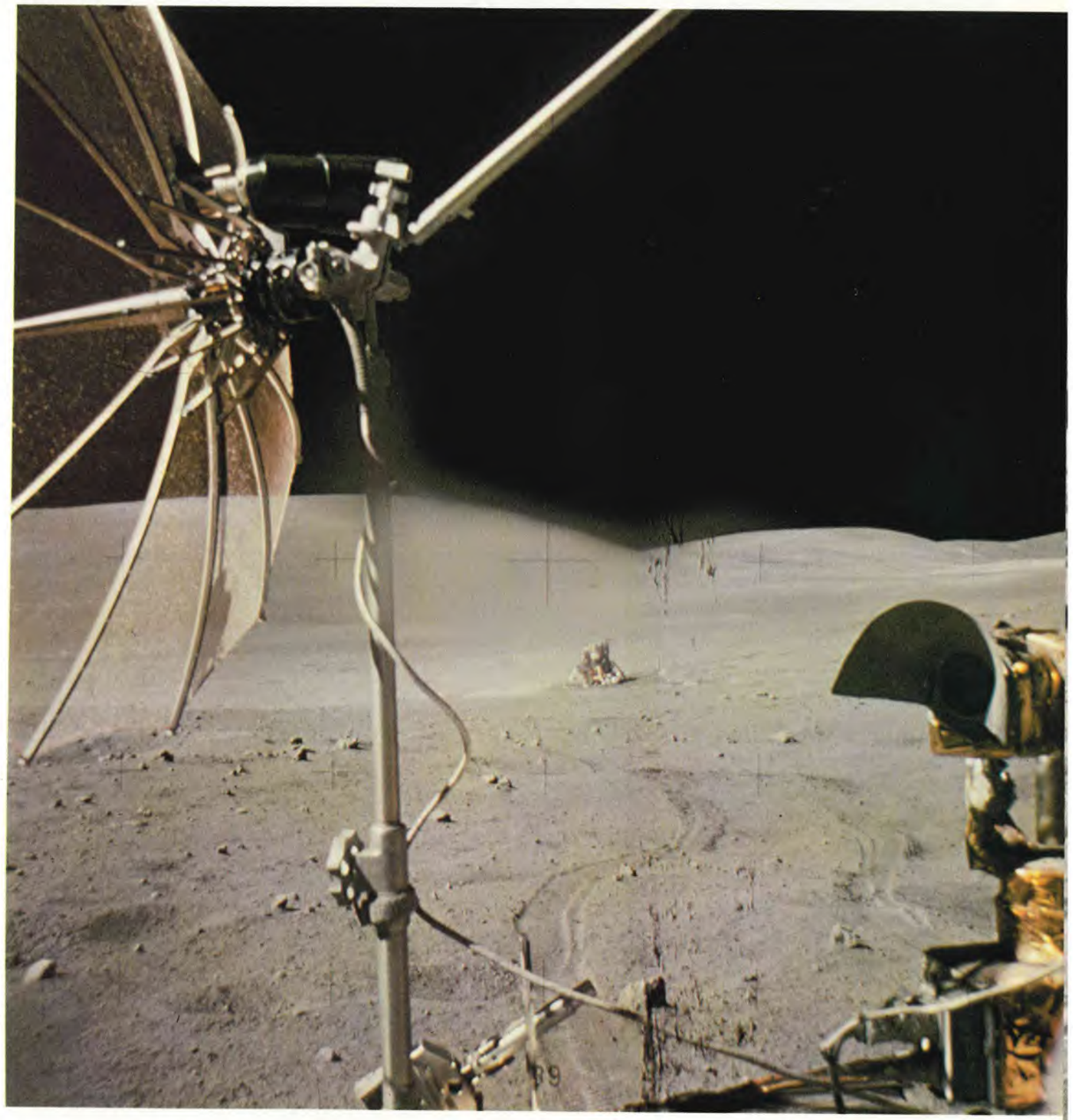


Heat flow experiment to take moon's temperature, which was irreparably damaged, is in foreground (top left) with a Descartes landmark, Stone Mountain, in background. Cosmic ray experiment (lower left) is deployed near lunar module footpad. Footpad just missed boulder there and touchdown point was close to crater at upper right, estimated at 25 ft. in diameter and 10 ft. deep. Rubble prevalent in the Cayley Plains landing area is evident from picture of Buster crater (bottom center). At lower right is photograph of rock rolled over by Astronauts John Young and Charles Duke to show depression left in the lunar soil.

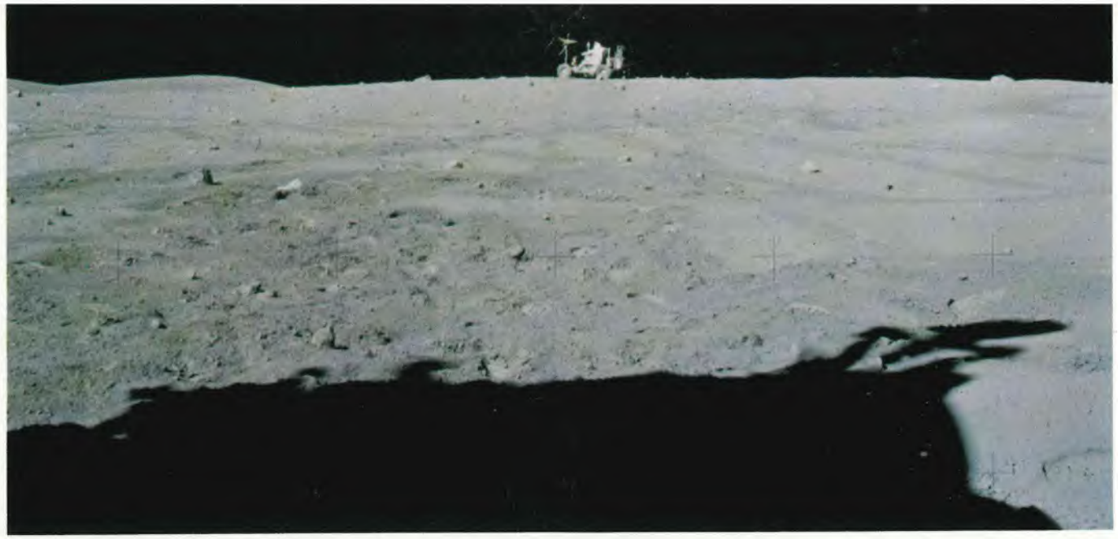
Large boulder split off from House Rock near North Ray crater contains first shatter cone identified on moon (arrow, above). Shatter cones are patterns in rock caused by impact. Black streaks in center of photo are flaws in processing, but small dark spots at upper right are zap pits, small black inclusions with light halos. Diagonal lineations at bottom were noted by geologists.



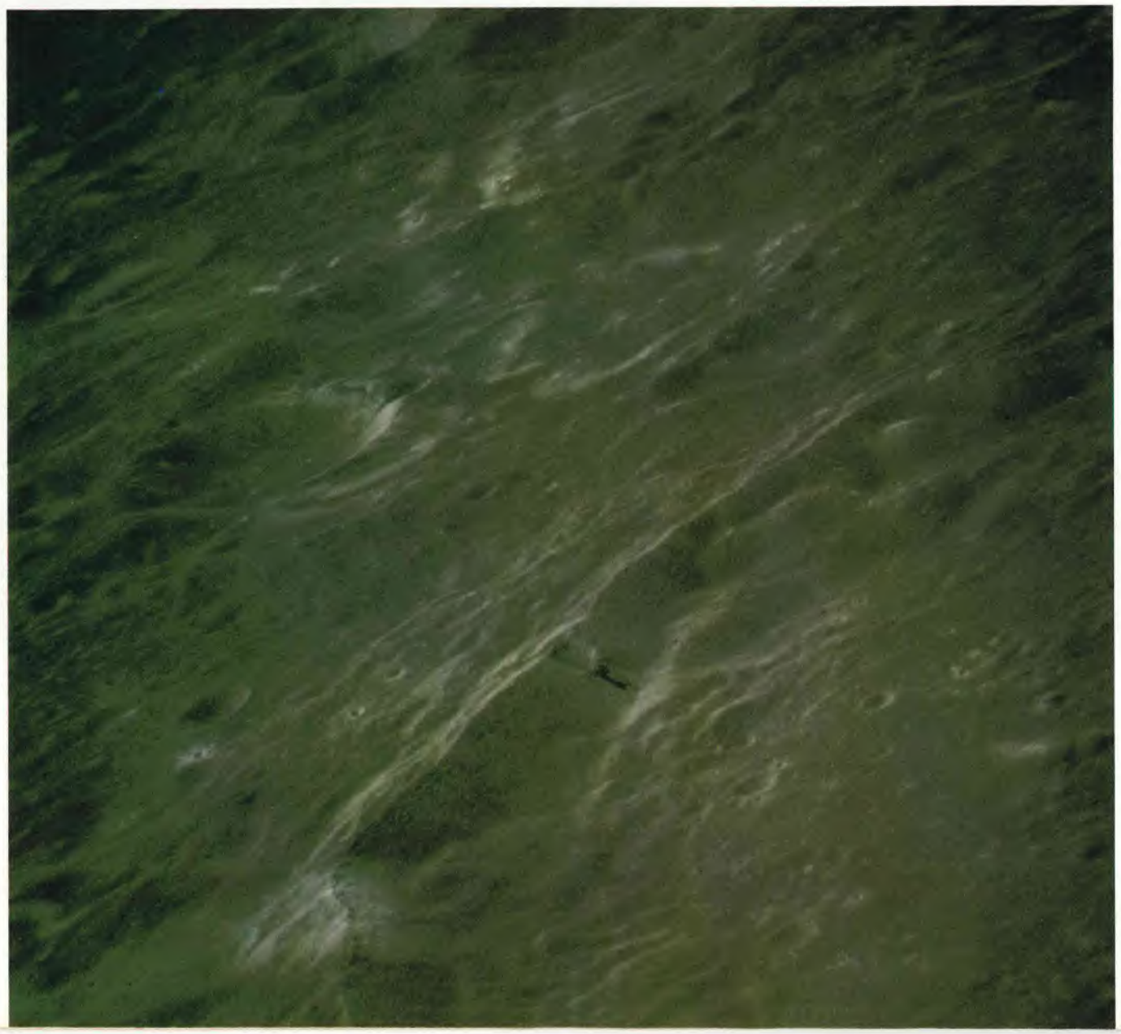


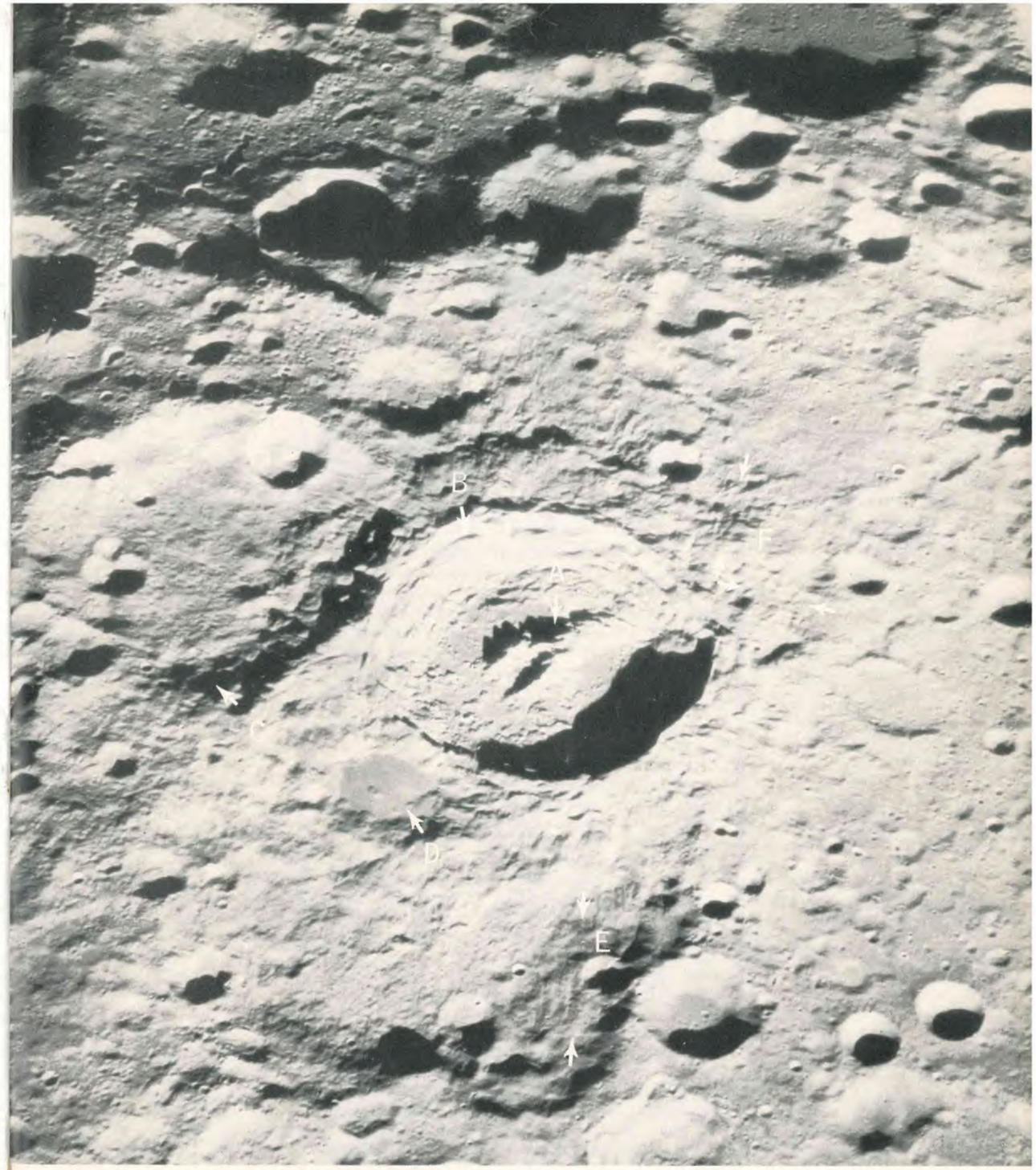


Apollo 16 command module Casper is shown in rare picture (left) coming around the moon with a clearly defined earth in background. Top center photograph shows lunar module nearing rendezvous with lunar orbiting command module after completion of the lunar exploration phase of the mission. Note buckled and damaged panels on the lunar module ascent stage. Protruding above the stage is the rendezvous radar antenna. Twin craters, Messier and Messier A, with long ray pattern are at right of module. Middle of Plum crater (center, below) bears resemblance to a terrestrial sink hole, but neither crew nor geologists are calling it that. Sink holes on earth can be result of water eroding away soft subsurface rock like limestone. Astronaut Charles M. Duke, Jr., is collecting sample with tongs in foreground and rover is parked on opposite side of what is a very subdued rimless crater. Time is during the crew's first extravehicular activity. Lunar module appears small on the moon's surface in photo (above) taken from the lunar roving vehicle. Picture gives good indication of angle at which the spacecraft landed on the undulating Cayley Plains at Descartes. At right in foreground is color television camera, its lens protected by a sunshield, and at left the high gain antenna which beamed television signals to earth 250,000 mi. away.

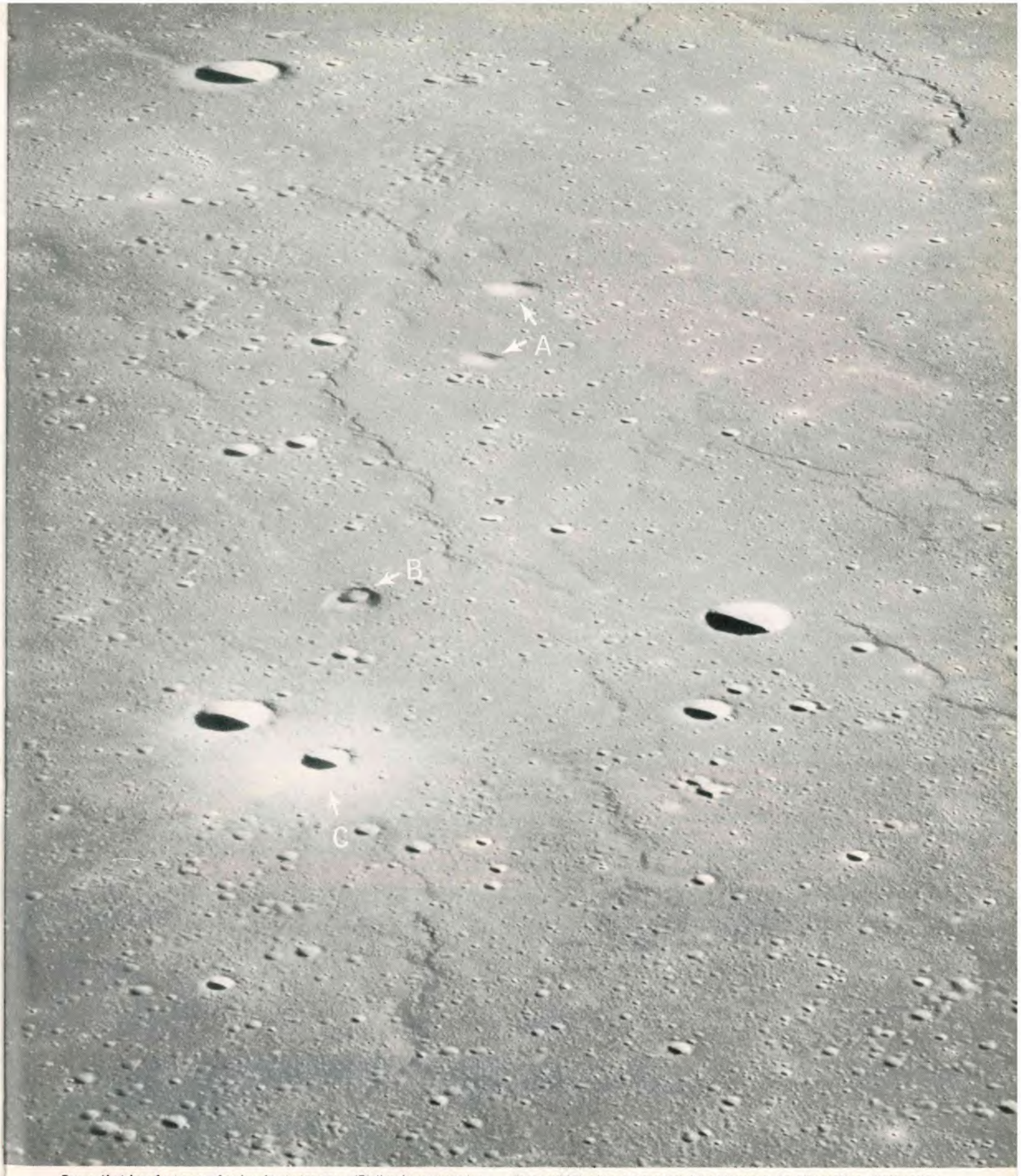


Lunar surface disturbed by astronauts near the lunar module shows subtle contrasts with undisturbed patches in background. Tracks of the lunar rover mark some of the area, and the rover itself is being driven to its final parking place by Astronaut John Young at the end of the last lunar traverse. One of the intriguing observations from orbit by Astronaut Thomas K. Mattingly was the black material that appeared to have flowed from a depression in the wall of Guyot crater (below, center). Mattingly also reported seeing other material unlike the prevailing terrain alongside the black. Guyot is on the lunar farside.



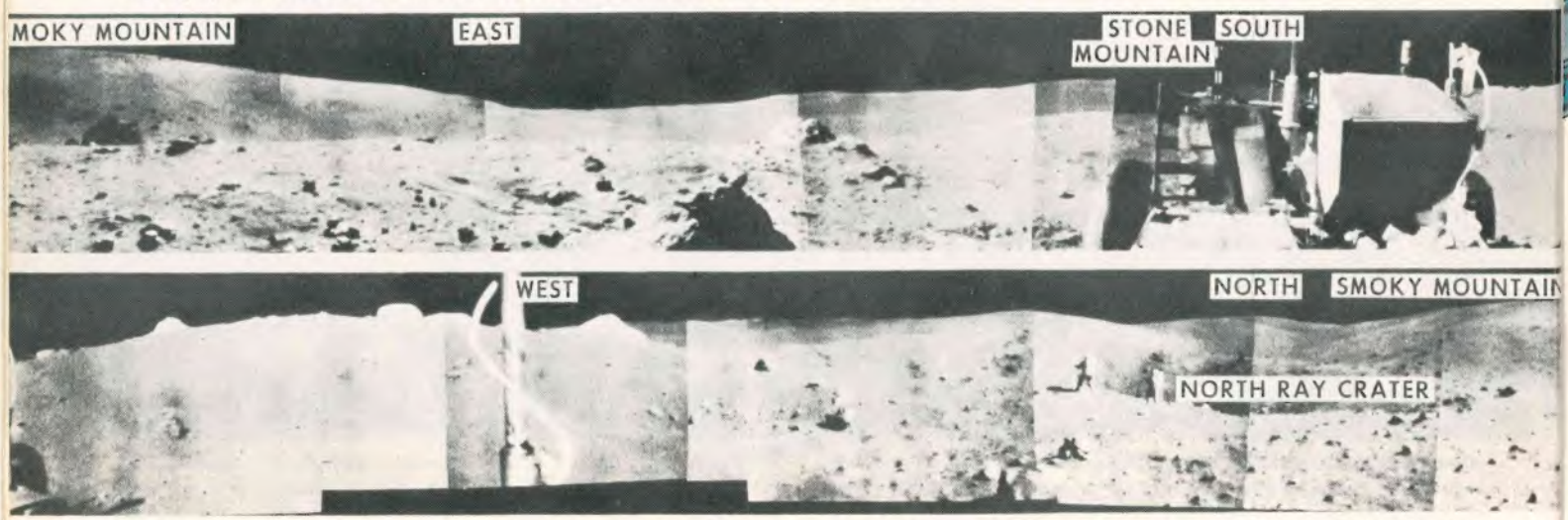


Unusual Y-shaped central peak with what appears to be a connection with terraces in the wall of King Crater (A) was observed visually and photographed by Astronaut Thomas K. Mattingly during the Apollo 16 command and service module orbit of the moon. Geologists will study this feature in detail to attempt to determine whether it was the result of rebound of bedrock following impact or whether the structure may have been formed by collapse. Extension of wall terraces (B) onto a crater floor as far as the central peak is greater than most other lunar craters. King is younger than the neighboring crater (C), judging from the ejecta from King flowing over it. In addition to ejecta, geologists identify sets of parallel lineaments (E), some running perpendicular to each other (F), as a result of fractures. These may be evidence of lunar crustal stresses, which are attracting increased attention from lunar geologists (AW&ST Apr. 17, p. 44). Pool of dark material (D) is fresher and younger than King crater. Arms on Y are oriented toward north.



Dome that has features of volcanic cinder cone (B) lies in a mare between the craters Alphonsus and Fra Mauro 500 mi. west of the Apollo 16 landing site. Astronaut Thomas K. Mattingly described the crater from orbit as matching the mare floor in texture and albedo, which his Hasselblad camera photo confirms, and it lacks the bright ray patterns of neighboring craters, like the fresh one below it (C). Several wrinkle ridges cross the mare, which may be faults from which viscous material has flowed. An alternative explanation is that they are faults reflecting settling of the mare. Dome-shaped features (A) are considered pre-existing structures that were flooded by mare basalt flow, leaving only the old tops exposed. Mattingly checked an area near the landing site where photo interpretation suggested a cinder cone, but his observation was that the structure was much like other craters in the area.

Line resembling a high water mark along mountains abutting a mare was photographed at the western edge of the moon. Astronaut Thomas K. Mattingly reported during the flight seeing at least two such marks, this one and another on the Riphaeus mountains-bordered Mare Cognitum. One interpretation is that this line marked the high point of a lava flow that later cooled and contracted, settling to a lower elevation. Another is that it is a toe of loose material that moved downslope and collected at the base. Mattingly used the term bench in some of his descriptions. Crater density is higher in the mare although the highlands are considered older. Mass wasting of debris downslope may have filled many highland craters, however.



Panoramic view from the lunar rover parked near North Ray crater was pieced together from photos from the TV pictures transmitted from the moon by the RCA television camera on the vehicle. Large blocks studded the lunar surface near the crater, on whose rim Apollo 16 astronauts John W. Young and Charles Duke, Jr., are walking.Directions of view and major surface features are identified on the photo montage. North Ray crater was north of the landing site of the lunar module.