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SUBJECT: Apollo 10 Photo Debriefing
Case 340

DATE: June 12, 1969

FROM: F. El-Baz

ABSTRACT

To implement the experience and knowledge gained from the Apollo 10 flight, it should be sought to provide; (1) a sighting device for each onboard camera, (2) stowage sockets for the photographic equipment, (3) an additional camera, or two, to serve as back-up in case of failures, (4) a high speed film to photograph in shadowed areas and in earthshine, and (5) a long focal length (500 mm or Questar) lens to obtain high resolution photography of candidate landing sites for future landing missions where needed.

(NASA-CR-106888) APOLLO 10 PHOTO DEBRIEFING
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N79-72840

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MEMORANDUM FOR FILE

The Apollo 10 photo debriefing was held on June 3 at MSC. Astronauts Thomas P. Stafford, Eugene A. Cernan, and John W. Young briefed about 30 participants on the photographic part of the mission. The recovered films (70 mm and 16 mm) were shown while the astronauts commented and answered inquiries. The astronauts displayed great interest in the scientific aspects of the mission and were well versed in their descriptions of lunar surface characteristics. Following are some of the more pertinent remarks.

LUNAR SURFACE OBSERVATIONS

Color

The lunar maria were described as brown at high sun angles, and greyish brown near the terminator (the color reproduced in frame 5149 of landing site 2 was described to approximate the real color in the latter case). The crew reiterated their commentary which accompanied the TV transmission following TEI where they noted a color mottling of Mare Serenitatis, light brown and tan brown, as compared to the darker "chocolate brown" color of Mare Tranquillitatis.* The astronauts emphasized the lack of any green tints which are apparent in some of the color film.

The color of the lunar highlands was described as tan (frame 5079 approximates the real color). Deviations from the tan color are caused by mare material (brown), fresh impact craters (chalky white) and a number of "jet black" layers and blocks. It was indicated that the contrast between the white and black outcrops as produced on the black and white film is less than the real contrast; white is brighter and black is darker on the lunar surface than on the film.

Relief

The Apollo 10 astronauts indicated that relief on the moon is very impressive, especially at the junction between the maria and the highlands. They also indicated that at low altitude (47000 ft) the horizon looked flat, whereas at high altitude (60 n.mi.) there is a definite curvature to the horizon.

*The color boundaries noted by the Apollo 10 astronauts correspond very well to albedo boundaries within and between the two maria.

One rather striking remark concerns the difference in appearance between the Farside and Nearside highlands. The crew indicated that the Farside is "rolling" and displays a less rugged appearance than the Nearside which is characterized by sharp peaks.*

High Sun

As expected, the Apollo 10 astronauts found it difficult to see at high sun illumination. They stated that it was difficult to pick up details especially near subsolar point. The use of polaroid sun glasses, which was tried, did not help any because the "zero phase just flattens everything out". They also stated that landmark tracking is difficult beyond 40° sun.

Earthshine

Like the Apollo 8 crew, the Apollo 10 astronauts were able to "pick up all kinds of details in earthshine". They also noted shadows in craters from earthshine and described several features of this lighting condition. As expected, they were unable to see much before passing over the sunlight terminator, but as soon as this is done, "the moon glows at us...this moon looks like a Christmas tree here in the dark side...it is highly illuminated from the earth."

Speaking of the amount of detail decipherable in earthshine, it was noted that, "Somboddy ought to carry a high speed film and get all that stuff." The astronauts also noted that it would not be difficult to do landmark tracking in earthshine.

* This impression may be due to the fact that the astronauts performed much landmark sighting in the Nearside and not in the Farside. Since they were familiar with the gross features of the Nearside they may have tried to look for details harder and more often in this more familiar side of the moon. This is a limitation of manned operations which we must realize and account for. However, the remark invokes further study and analysis. There are several factors which may account for such a difference if indeed it is regional. The difference in age and/or composition of lunar formations on both sides, as well as the difference in morphological manifestations of lunar volcanism in the two cases, may account for a difference in appearance. This subject should be pursued further because of its importance to fundamental aspects of the moon and the earth-moon system.

Landing Sites

- a. Landing site 2: As indicated earlier, the color reproduced in frame 5149 was described to approximate the real color of the landing site area. From pre-flight training and in-flight landmark sighting, the astronauts are very familiar with the detailed geology of the landing site. They stated that the first one-third of the ellipse (easternmost part, which was photographed from the LM prior to camera failures) appears to be the smoothest part, whereas the central area is much rougher.
- b. Landing site 3: The Apollo 10 crew agreed that the landing site in Sinus Medii "is a rough site", comparatively. The returned photographic data includes excellent low sun angle views of that site.
- c. The crater Censorinus: Speaking of this candidate landing site for a later Apollo mission, the astronauts stated: "It looks pretty rough." They noted large blocks outside and inside the crater, i.e., on the ejecta rim as well as on the inside wall slopes. Therefore, they believe that in order to land an Apollo mission in that area we need either high resolution photographic coverage prior to the flight or a "lot of hover time".

Volcanics

A good background in geology was apparent from the crew's descriptions of geological features, especially what they called volcanics. They noted "volcanic cones" on the farside, one exhibiting a number of flows on the rim. They also delineated as volcanic an area between crater Schmidt and landing site 3 (from 0° to 20°E near the equator). This region, which includes the Delambre uplands and areas north of Pickering, is known to display features characteristic of upland volcanics.

Slump Features and Blocks

The crew indicated that they were able to decipher slump features which, they explained, are very common, especially within craters on the nearside. Fractures along which slumping occurs were evident.

Resolvable blocks and boulders, from 60 n.mi. altitude, are very common. The astronauts indicated that they appear to be more common on the nearside than on the farside. This observation is related to the aforementioned statement on relief: farside more rolling and nearside more rugged in appearance.

MISCELLANEOUS COMMENTS

Earth Observations

The Apollo 10 astronauts were impressed by the amount of detail they were able to see on the earth: "It was just as looking at a map!" They indicated that the Mediterranean countries, especially Spain and Egypt, were the easiest to locate. Moreover, they stated that one could see features such as the San Joaquin Valley "all the way from the moon".

Solar Corona

The participants in the debriefing were interested in the crew's descriptions of the solar corona. Figure 1 is a schematic drawing based on a sketch drawn by the astronauts to illustrate the progressive stages of what they observed during two minutes.

Some Operational Aspects

- a. Camera: In view of camera failures and persistent jamming of the film, the astronauts were not quite happy with the photographic equipment. They indicated that it was difficult to change film magazines and remove the sighting from one camera to install it on the other. They also noted the difficulty of aiming the 70 mm camera with the 250 mm lens because of space limitations. Another problem was that of stowage where the equipment, particularly the camera lenses, had no place to store with easy access. In a comment about the spot meter, they indicated that its readings were off by 2 f stops from those of the flight plan, and therefore it was not relied upon.
- b. Windows: Unlike the Apollo 8 flight, the windows of the Apollo 10 spacecraft stayed clear throughout the flight: "no fogging and no contamination". The Apollo 10 crew stated that they find it easier to aim through the hatch window when using the 250 mm lens.

- c. Maps: The crew found the photo plan easy to follow and when asked about the accuracy of the maps of the farside they agreed it was adequate; "I was impressed", said astronaut Cernan.
- d. LM: The LM structures appear to have interfered in several instances while photographing with the 16 mm camera. In some photos the astronauts pointed out some dents on the LM outer walls and explained that they may have been made during boost.
- e. Re-entry: Upon re-entry into the earth's atmosphere the Apollo 10 crew felt the rise of temperature. They stated that the color outside the window was purple; "I tell you that is hot!"

IMPLEMENTATION

To implement the results of the experience and knowledge of the Apollo 10 astronauts, the following items should be sought:

1. Adding a sighting device (perhaps a fold-down type) to each and every camera.
2. Providing stowage sockets (perhaps with clip-ons) for the photo equipment for an easy access.
3. Providing an additional camera (or two) to serve as back-up in case of failure.
4. Carrying a high speed film to photograph shadowed areas (in sunlit surfaces) and in earthshine.
5. Carrying a long focal length lens to provide high resolution photography of candidate landing sites for future missions.

2015-FEB-acm

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Attachment
Figure 1

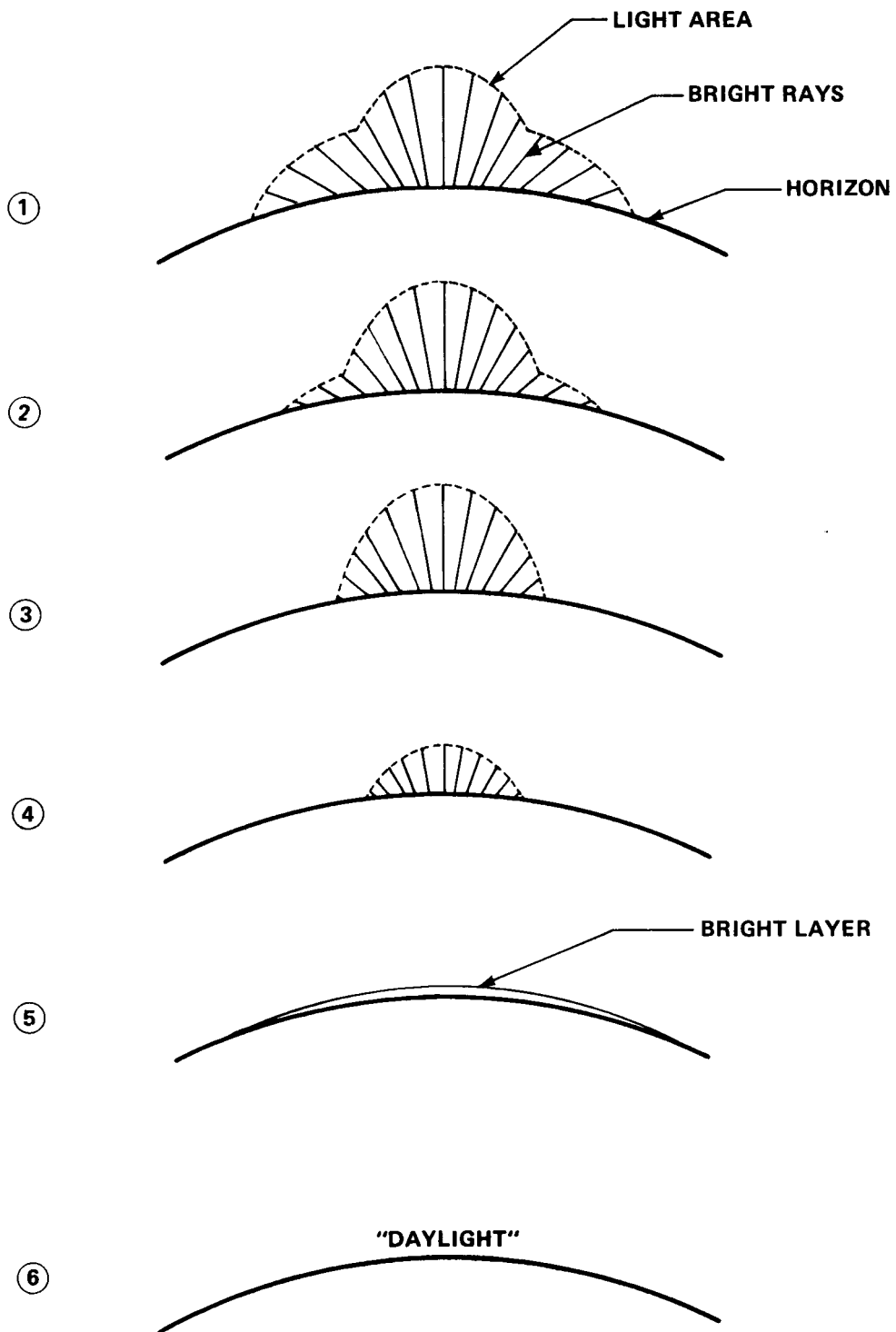


FIGURE 1 STAGES OF OBSERVED SOLAR CORONA (TWO MINUTES DURATION)

BELLCOMM, INC.

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