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Memorandum

TO : CB/All Astronauts **DATE:**

FROM : CB/Jack Schmitt

SUBJECT: Operational implications of our "present" lunar exploration objectives

As I am supposed to represent our office in general areas related to lunar surface activities and experiments, I would like to have each of your comments on my views of the operational implications of NASA's lunar exploration objectives as they have developed in recent weeks. I hope they roughly coincide with your views; if they do not, one of us will have to change.

Jack S

Jack Schmitt

CB:HHSchmitt:mc 09-16-69

It now appears that the basic spaceflight systems of the Apollo program will be used for a limited period of lunar surface exploration. This period may include as many as ten lunar landings using the LM-5 and slightly augmented LM-5 classes of landing vehicles. The aggregate goals of the exploration can probably be summarized as follows:

a. Obtain sufficient information to determine the desirability of and requirements for an extended, post-Apollo lunar exploration program that might include the need for major new hardware development efforts.

b. Examine, sample, and measure enough of the materials and properties of the Moon to determine its compositional, historical, and evolutionary relationships to the Earth as required for the understanding of the origins and resources of this planet.

c. Establish semi-permanent monitoring stations for scientific and operational studies of lunar and near-lunar environments.

d. Obtain the foundations in operational and scientific techniques required for the successful future exploration of the planets.

Our detailed exploration objectives within the context of these goals are constrained by the capabilities of the LM-5 class of vehicles in the following ways:

a. Landed descent stage payload less than 600 pounds (including life support consumables and assuming stretched descent propellant tanks).

b. Ascent stage payload less than 200 pounds (exluding life support consumables).

c. Probable landing point accuracies no better than ± 1 KM (assuming adequate fuel margins).

d. Lunar surface staytimes of no more than 60 hours (assumes augmentation of the LM-5 consumables capability).

Given the above goals and constraints it appears that we can anticipate the exploration objectives of the follow-on Apollo period. An operational classification of these objectives as a function of three types of probable mission objectives is summarized below.

I. Accurate landing mission

A. Maximizes accuracy of landing at pre-selected target at the probable expense of hardware payload and staytime.

B. Hardware payload limited to those items that maximize the efficiency of data collection during EVA.

C. Maximize length and effectiveness of each EVA possible within any reduced staytime period.

D. To be effective, traverse lengths should be no more than about 1500 feet per usable EVA hour given the nature of geological investigations now indicated to be useful by lunar surface observations, samples and photography.

E. EVA operations should generally be within sight of the LM or a communications relay so as to maximize the effectiveness of the communications link for real-time data collection and analysis and for ground assistance in the planning of successive EVA's.

F. Ascent stage capability for the return of one sample container per EVA appears highly desirable.

II. Hardware delivery mission

A. Maximize landed payload in a new geological and geophysical province at the probable expense of landing accuracy and staytime payload.

B. EVA's limited to those required to activate a scientific station; collect representative samples, observations and photographs of materials at the site; and perform any active experiments required for geophysical examination of the province.

C. Maximize EVA mobility for hardware manipulation and sampling within a given EVA period.

D. Sampling and geological investigations will generally be of the Apollo 12 type with the exception of any new local or special requirements.

III. Rover delivery mission

A. Delivery of a rover as accurately as possible at a pre-selected point at the probable expense of science hardware, staytime and some landing accuracy.

B. Science hardware payload limited to those items that maximize the effectiveness of data collection associated with the use of a rover.

C. Maximize the length and effectiveness of each EVA possible within any reduced staytime period.

D. Rover traverse lengths should be defined on the basis of the science that the use of a rover can uniquely provide.

E. EVA operation should generally be within sight of a communication link with Earth so as to maximize the effectiveness of real-time data analyses, systems monitoring and ground assistance in the planning of successive EVA's.

F. EVA operations should be within walkback distance of a backup life support system; either the LM system or a rover system with capability to support a crewman during the return to the LM.

G. Ascent stage capability for the return of at least one sample container per EVA appears highly desirable.