NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

REPLY TO
ATTN OF: MAL

December 1, 1969

TO : Distribution

FROM : MA/Apollo Program Director

SUBJECT : Minutes of Apollo Site Selection Board

Attached are minutes of the October 30, 1969 Apollo Site Selection Board meeting.

The next meeting of the Board will be held as soon as data from the Apollo 12 mission are available to permit discussion of the Apollo 13 landing site.

Rocco A. Petrone

Attachment
ASSB Minutes (10-30-69)

Distribution:
See Attached

INDEXING DATA

DATE	OPR	#	T	PGM	SUBJECT	SIGNATOR	LOC
10-30-69	HQS		M	LMP	(Above)	PETRONE	0722-11

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Dr. Lawrence Frederick, University of Virginia
Dr. Paul Gast, Lamont/Doherty Geological Observatory
Dr. Richard Jahns, Stanford University
Dr. Charles Lundquist, Smithsonian Astrophysical Obs., Cambridge
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KSC-LO-PLN-3/C. B. Netherton
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MSFC-PM-SAT-E/C. B. Malmede
MSC-TJ/J. H. Sasser

Minutes of the Apollo Site Selection Board Meeting
held at
Apollo Action Center
955 L'Enfant Plaza N., S.W.
Washington, D.C. 20024

October 30, 1969

On October 30, 1969, the Apollo Site Selection Board met at NASA Headquarters. The meeting agenda is attached as Attachment A and attendees are listed in Attachment B.

Introduction

Capt. Scherer reminded the Board that the July 10 meeting resulted in acceptance of a site mission assignments to be used for planning purposes and that MSC was to investigate the operational aspects of conducting a lunar exploration program to those sites. The site assignments at the July 10 meeting were:

G-1 Site 2

H-1 Site 5 (or 4)

H-2 Fra Mauro Fm.

H-3 Rima Bode II

H-4 N to W of Censorinus

J-1 Copernicus Peaks

J-2 Marius Hills

J-3 Tycho

J-4 Rima Prinz I

J-5 Descartes

Capt. Scherer pointed out that in early August Gen. Phillips and Col. McDivitt asked for a set of detailed science mission plans. In response to that request an ad hoc working group meeting of many of the GLEP, GLEP Site Selection Subgroup,

U.S. Geological Survey and operations personnel was held August 12-14.[1] At that meeting it was determined that the Rima Prinz I rille terminus does not appear to be the best site at which to decipher the origin of sinuous rilles. Better, in the minds of the group, would be the head of the Hadley Rille where it appears that a roving vehicle can traverse into the rille. The Hadley/Apennine site, which has always been a prime candidate, thus replaced Rima Prinz I. At the same time, it was realized that more photography of the Hadley/Apennine region is needed. Since such photography could be obtained on a mission to Littrow, it seemed desirable to replace Rima Bode II by Littrow in the mission assignments. These two sites have long been considered as alternates to each other. These actions were formalized by the GLEP on August 23, 1969.[2]

Capt. Scherer noted that the next perturbation occurred at a combined STAC/Lunar Panel (of LPMB) meeting at Flagstaff, Arizona, on September 29 and 30 where several participants complained that their voices were not being heard in regard to site selection. In direct response to that, a meeting was scheduled for MSC on October 16-18, 1969 to review the lunar science rationale and site selection.

Report of October 16-17 GLEP + Meeting

A. J. Calio/MSC reviewed the October 16-17 meeting on site selection at MSC (October 18 was not needed) to which the GLEP, GLEP Site Selection Subgroup, ALSEP PI's, Lunar Panel and other interested scientists were invited. An attendance list is shown in Attachment C (note that the GLEP Site Selection Subgroup has been inadvertantly omitted). The attendees were thoroughly briefed on the science rationale, operational considerations, and potential sites for Apollos 12-20. After those briefings the site assignments list was discussed in detail and resulted in the site assignments and alternates shown in Table I. Notable is the fact that after the intense review, the prime list is the same as existed when the meeting started. These sites and alternates were acceptable to the majority of the meeting

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(1) El-Baz, F. and James, D. B., Minutes of the August 12-14 Meeting of an Ad Hoc Working Group on the Science Objectives of Apollo Missions 12-20, Memorandum for File, Bellcomm, Inc., August 18, 1969.

(2) El-Baz, F., Some GLEP Recommendations on Lunar Exploration Sites, Memorandum for File, Bellcomm, Inc., September 11, 1969.

GLEP SITES AND ALTERNATES
APOLLO MISSIONS 13-20

Apollo Mission	Prime Site	Alternate 1	Alternate 2	Alternate 3
H-2 (13)	Fra Mauro	Alphonsus *	Alphonsus *	Fra Mauro *
H-3 (14)	Littrow	Littrow	Littrow	Littrow
H-4 (15)	Censorinus	Fra Mauro	Fra Mauro	Censorinus
J-1 (16)	Descartes	Censorinus	Censorinus	Descartes
J-2 (17)	Marius Hills	Marius Hills	Marius Hills	Marius Hills
J-3 (18)	Copernicus	Copernicus	Davy Rille	Davy Rille
J-4 (19)	Hadley	Hadley	Hadley Rille	Hadley Rille
J-5 (20)	Tycho	Tycho	Copernicus	Copernicus

* HYGINUS RILLE ALTERNATE SITE FOR H-2 MISSION IF OPERATIONAL CONSTRAINTS PREVENT LANDING AT FRA MAURO OR ALPHONSUS.

TABLE I

participants. Alternate #1 presupposes that Fra Mauro will be unacceptable for H-2 (but O.K. for H-4) while Alternate 2 presupposes the unacceptability of Tycho. Alphonsus is a common desirable scientific substitution but since the operational problems at Alphonsus are apt to be as bad as those at Fra Mauro, Hyginus Rille was given as a second alternative (subsequent MSC study indeed indicated that Alphonsus is unacceptable). Note that Davey Rille is an alternate for Tycho - not a substitute. Davey Rille does not allow the good seismic dispersion that Tycho does nor will it yield a highlands sample. Further, Davey should not be considered prime if Hyginus is reached early. Alternate 3 is simply a combination of Alternates 1 and 2. Mr. Calio stated that the detailed minutes of the meeting would be sent to all participants in about a month but that a shortened version will be sent immediately to the attendees, the STAC and the LPMB for their information and comments.

Dr. Petrone inquired as to whether or not Dr. Urey (a prime critic of the site selection process) who did not show up until the end of the October meeting, is being sufficiently briefed on the site selection status. Capt. Scherer was given an action item to so determine.

Discussion of site selection resulted in a consensus that it is prudent to keep all interested people informed but that, once having gone through the rationale, it is not practical to rearrange sites for an individual's particular preference.

There was a lengthy discussion of Tycho and the difficulties associated with it. It was pointed out that there may well be ways to get around the operational constraints and that placing Tycho in the J-5 slot allows ample time to work the problem.

Assessment of Proposed Mission Sequence

Mr. F. Bennett/MSC discussed the current descent strategy and noted areas where changes will be necessary to obtain pin-point and area landings. He noted that it is an MSC desire to be able to assign a ΔV budget to each mission which is site dependent. The present 99% ellipse is $\sim$12000 ft. (minor axis) by $\sim$48000 ft. (major axis) and assumes errors due to spacecraft venting and no updating prior to visibility. It is obvious that a 1 km radius landing circle is out of the question without improvements. Improvement is envisioned to come primarily from an orbit update two minutes after PDI. That update will be based on four minutes of MSFN data processing. An estimate of the smallest 99% ellipse size, with ΔR_{LS} updating, is about 3300 ft. semi-minor by 4400 ft.

semi-major (oriented with minor axis parallel to flight path). The largest estimated is about 6300 ft. by 4400 ft. semi-axes. The minimum error ellipse approaches the desired 1 km radius landing circle.

For determining manual maneuvering time (thus ΔV) budgets below 500 ft., MSC assumes a nominal 80 sec. to which is added: an allocation of $\frac{\Delta X \text{ ft}}{50 \text{ fps}}$ for overflying the maximum reject area in a 1 km circle and discretionary time of 30 sec. for mare-like sites and 45 sec. for non-mare sites. Note that the overfly time is shorter than on G-1 on account of a faster translational velocity (30 fps on G-1). To this total time, or ΔV, is added the LPD ΔV of 60 fps for all prime sites except Copernicus, Tycho and Censorinus which are allocated 100 fps. Table II summarizes the ΔV budgets.

Cal Perrine/MSC summarized LM weight status for H-missions assuming SPS DOI and 0.99999 probability of non-depletion of propellant. For LM 7, 8, and 9 the maximum useful load margin (science payload) for the descent stage is $\sim$800 lbs. This, considered with the ΔV estimates of Table II, and the fact that the envisioned payloads are <400 lbs, is sufficient for all H missions. For J-missions the LM descent useful load margin is $\sim$1000 lbs for the baseline mission (60 fps ΔV for redesignation, 120 sec. of manual maneuvering below 500 ft.). When all deltas are considered as a function of the site one can derive an available LM payload as shown in Table III. Note that, in the basis of the MSC calculations, one could not carry an LRV ($\sim$400#) and MALSEP ($\sim$400#) to Censorinus, Copernicus Peaks, or Tycho. This point raised some discussion. It was pointed out, for example, that site roughness has been accounted for twice at these sites, once in the LPD budget and again in the manual maneuvering budget. The consensus was that, in view of the continual changes in estimated payload, it is not now reasonable to pre-empt carrying an ALSEP and LRV on the J-missions.

Mr. Perrine continued with a summary of CSM design modifications and estimated weights for J-1 through J-5 (Apollo 16-20). Of particular significance is the fact that both the useful load margin and inert weight limit are site dependent. The current assigned CSM science payloads, shown in Table IV, total about 500 lbs on J-1 and about 700 on J-2 to J-5. Considering the combined LM and CSM capabilities (and assuming a 106,500 lb injected payload and three days in orbit after rendezvous) there appears to be little problem in carrying desired payloads to the Marius Hills, Descartes, and Hadley. Copernicus (J-3) remains a potential problem with both LM and CSM payload, being limited to

REDESIGNATION (LPD) AND MANUAL MANEUVERING REQUIREMENTS

MISSION	SITE	CLASS	LPD ΔV fps	MANUAL MANEUVERING (BELOW 500 FT.)				TOTAL ΔV, fps
				TIME SEC			ΔV, fps	
				NOMINAL PLUS DESCRETE	OVER FLY	TOTAL		
G (APOLLO 11)*	2	MARE	60	110	10	120	636	696
H-1**	7	MARE	60	110	10	120	636	696
H-2	FRA MAURO	MARE	60	110	10	120	636	696
H-3	LITTROW	MARE	60	110	10	120	636	696
H-4	CENSORINUS	NON-MARE	100	125	25	150	795	895
J-1	DESCARTE	MARE	60	110	15	125	663	723
J-2	MARIUS HILLS | IN / OUT	NON-MARE / MARE	60 / 60	125 / 110	25 / 10	150 / 120	795 / 636	855 / 696
J-3	COPERNICUS	NON-MARE	100	125	25	150	795	895
J-4	HADLEY	MARE	60	110	10	120	636	696
J-5	TYCHO	NON-MARE	100	125	25	150	795	895

* POINT LANDING NOT REQUIRED

** POINT LANDING DESIRABLE

TABLE II

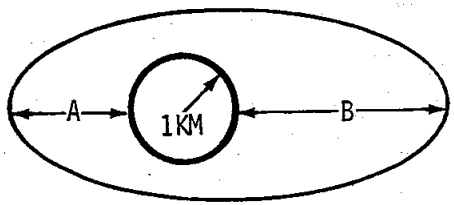
TIME REQUIRED BELOW 500 FT

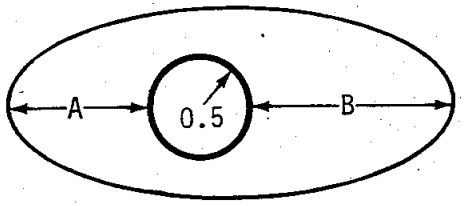
APOLLO 11	ALLOCATION	J MISSIONS
80 SEC	● NOMINAL	80 SEC
$\frac{1,500 \text{ FT}}{30 \text{ FPS}}$ = 50 SEC	● OVER-FLY MAXIMUM REJECT AREA IN 1 KM LANDING CIRCLE	$\frac{\Delta X \text{ FT}}{50 \text{ FPS}}$ = SEC
30 SEC	● DISCRETIONARY TIME	30 SEC MARE 45 SEC NON-MARE
160 SEC (150 SEC ACTUAL APOLLO 11)	TOTAL TIME	110 SEC 125 SEC } + $\frac{\Delta X}{50}$ = SEC

H

ESTIMATED LM PAYLOAD CAPABILITY FOR J-MISSIONS

SITE		REDESIGNATION			MANUAL MANEUVERING				TOTAL Δ LM PAYLOAD	AVAILABLE LM PAYLOAD
		RADIUS AVAILABLE	REDES. ΔV REQUIRED	Δ LM PAYLOAD	LARGEST REJECT	ΔT∠500 REQUIRED	ΔT OVER G BUDGET	Δ LM PAYLOAD		
CENSORINUS		0.5	100	125	1250	150	30	510	635	390*
MARIUS HILLS	IN	1.0	60	0	1250	150	30	510	510	515
	OUT	1.0	60	0	500	120	0	0	0	1025
DESCARTES		1.0	60	0	750	125	5	85	85	940
HADLEY		1.0	60	0	500	120	0	0	0	1025
COPERNICUS		0.5	100	125	1250	150	30	510	635	390
TYCHO		0.5	100	125	1250	150	30	510	635	390





A = UP RANGE REDESIGNATION ≈ 4000 FEET, LIMITED BY VISIBILITY

B = DOWN RANGE REDESIGNATION ≈ ΔV FOR REDESIGNATION

* IF CENSORINUS IS FLOWN ON AN H MISSION, ESTIMATED LM PAYLOAD IS REDUCED TO 804 - 635 = 169 LB. HOWEVER, ACTUAL PERFORMANCE WILL PROBABLY BE GREATER.

TABLE III

MANUAL MANEUVER TIME REQUIRED BELOW 500 FEET

APOLLO 11		J - MISSIONS
80	AUTO GUIDANCE	80
$\frac{1500\ FT}{30\ FPS} = 50$	OVER FLIGHT OF LARGEST REJECT AREA IN LANDING CIRCLE	$\frac{\Delta X}{50\ FPS}$
30	DISCRETIONARY TIME	30 - MARE-LIKE 45 - UNLIKE MARE
160	ESTIMATED REQUIREMENT	$\left\{\begin{matrix}110\\125\end{matrix}\right\} + \frac{\Delta X}{50}$
160	ACTUAL USAGE	TBD

WEIGHT SUMMARY

PROPOSED SM SCIENCE PAYLOADS

EXPERIMENT	CSM				
	112	113	114	115	115A
X-RAY AND ALPHA PARTICLE SPECTROMETER	145	145	145		
GAMMA RAY SPECTROMETER	25	25	25		
24 IN. PAN CAMERA	323	323	323		
S-BAND TRANSPONDER (EXISTING HARDWARE)	-	-	-	-	-
MASS SPECTROMETER		18	18		
3 IN. MAPPING CAMERA		125	125	125	125
LASER ALTIMETER		75	75	75	75
SOUNDING RADAR				165	165
EM SOUNDER "A"				140	140
FAR UV SPECTROMETER				40	40
BISTATIC RADAR (EXISTING HARDWARE)				-	-
IR SCANNING RADAR				50	50
SUBSATELLITE				80	80
TOTAL (LB)	493	711	711	675	675

TABLE IV

ADVANCED LUNAR EXPLORATION DESIGN MODIFICATION AND ESTIMATED WEIGHTS
OCTOBER 13, 1969

		112	113
● SERVICE MODULE			
• NR STATUS (SEPTEMBER 1, 1969)		10706.4	10686.7
- MCR CHANGES		-5.7	-5.7
- CRYOGENICS USED PRIOR TO LAUNCH		-30.4	-30.4
- EXPECTED ADJUSTMENT FOR ACTUAL WEIGHT		-100.0	-100.0
• ALEM MODIFICATIONS		1342.6	1342.6
- SIM AND DOOR	488.0		
- EVA HANDLES AND RESTRAINTS	40.0		
- CRYOGENIC SYSTEM	251.2		
- CRYOGENICS	359.4		
- WIRE HARNESS	170.0		
- INSTRUMENTATION	34.0		
• ALEM EQUIPMENT MOUNTS		108.0	189.0
• SUPPLEMENTAL DATA SYSTEM			25.0
• ALEM STATUS - LESS PAYLOAD (ESTIMATED)		12020.9	12107.2
• USEFUL LOAD MARGIN		SITE	DEPENDENT
• PROJECTED GROWTH		200.0	248.7
• PRELAUNCH CONTINGENCY		50.0	50.0
• INERT WEIGHT LIMIT		SITE	DEPENDENT

a maximum LM payload of 400 lbs (with 450 for CSM) or a maximum CSM payload of ~625 lbs with no LM payload. The situation at Tycho (J-5) is not much better although it was pointed out that one could obtain the 400 lb surface payload and the 700 lb CSM payload if the scientists would be willing to reduce the time in orbit after rendezvous to 2 1/4 days from the baseline three days.

During discussion of the above and of the launch schedule it became apparent that the J-2 site, Marius Hills, presents a potential problem. The site is accessible only during two summer months, using present constraints. It is a prime rover site but there is doubt as to rover availability for a July '71 launch. Dr. Petrone therefore assigned J. Mayer/MSC an action item to determine what constraints must be relieved to extend the Marius Hills launch window.

On the subject of launch-turnaround provisions, Mr. Perrine reminded the Board that it is CSM and LM hypergolics exposure limits that restrict us to two monthly launch opportunities. The scrub/turnaround time is now estimated at a maximum of 32 hrs. if it occurs before LV cryogenic loading and 48 hrs. after cryo loading. In view of those times it appears possible to use a common recycle site, 6R, for all sites except Marius Hills and possibly Hadley for a scrub during the nominal count-down. Many sites would also have a 6R recycle capability if a scrub occurred during a count-down for a T + 24 hrs. attempt at the prime site.

In view of the high desirability of getting to the prime site on each mission, MSC investigated the feasibility of launching to the prime site at T + 24 hours. They concluded that the sun elevation angle of 18°-27° reduces landing visibility but is acceptable if the site has large distinguishable features as do Censorinus, Marius Hills, Copernicus, Hadley, and 6R.

Mr. Perrine next presented the proposed turnaround scheme for Apollo 13-20. The first month one targets for the prime site at the nominal T and, if needed, at T + 24 hours. The second month repeats the T and T + 24 hrs. opportunities and adds an opportunity for the backup site 6R at the nominal sun angle of 5°-14° (note that 6R is not a sufficient backup for Marius Hills and Hadley).

Concerning the photo coverage assessment, Mr. Perrine concluded that additional photography is required at Descartes, Hadley/Apennine, Davey Rille and Censorinus. MSC is prepared to live with available coverage on Fra Mauro, Littrow, Marius Hills, Copernicus, and Hyginus but this will require:

1. accepting present photometric slope inaccuracies;

2. delaying use of radar signal in computer and/or develop software products;

3. accepting LO-IV photography for approach training and descent monitoring;

4. reducing LMS L/R simulation fidelity; and

5. building relief models for these and all other point landing sites.

Prime and Alternate Sites for Apollo 13 (H-2)

MSC (C. Perrine) proposed accepting the GLEP recommended prime site of Fra Mauro for H-2, using a single opportunity in March, 1970. If that opportunity is missed, they would use it and the T + 24 hour opportunity in April with 6R as an April recycle site. In the event Fra Mauro is unacceptable as a prime site on H-2 (subject to decision after H-1), MSC proposed using Hyginus, the Hyginus T + 24 hour, and the recycle 6R for April and May opportunities. The rationale for the delay to April is based primarily on crew training and photo products requirements. Dr. Petrone indicated that he was not happy with the one month delay but will defer a decision.

C. Perrine presented the details of the landing considerations at Fra Mauro. These can easily be summed up by saying that pin-point landing capability is required and that photography from H-1 must be studied before making a final evaluation of site roughness and before deciding on the acceptability of low sun angle landings (the apprehension being that at the low end of the present allowable lighting there may be excessive shadow caused by site roughness).

Regarding alternates to Fra Mauro, Perrine pointed out that Alphonsus is preferred by the GLEP if the landing can be made near a dark halo crater. Study shows that the only accessible dark halo crater is in a region of topography similar to that at the Fra Mauro site. For that reason, and since Hyginus has large smooth areas, Hyginus is the MSC preferred alternate.

In summary, Perrine proposed the following prime site list and an alternate sequence (delayed Fra Mauro, no Tycho):

Prime (and First Opportunity)			Alternate
H-2	Fra Mauro	(3-12-70)	Hyginus
H-3	Littrow	(7-8-70)	Littrow
H-4	Censorinus	(10-30-70)	Fra Mauro
J-1	Descartes	(3-29-71)	Censorinus
J-2	Marius Hills	(7-30-71)	Marius Hills
J-3	Copernicus	(2-19-72)	Davey Rille
J-4	Hadley	(7-14-72)	Hadley
J-5	Tycho	(2-7-73)	Copernicus

ASSB Discussion and Recommendations on Sites

Capt. Scherer noted that at the last ASSB meeting (July 10), Gen. Phillips was left with the action to make a final decision on the H-1 (Apollo 12) prime site (Site 5 or 7). The decision by Gen. Phillips, in conjunction with MSC during the G-1 mission, was to select Site 7. The ASSB formalized that decision.

Discussion of the proposed site assignments focused on the H-2 site. Dr. Petrone accepted Hyginus as the preferred alternate for Fra Mauro. Whether or not Fra Mauro will remain prime will be decided after the H-1 mission. Failure to achieve a pin-point landing on H-1 will lead to a Hyginus preference. A successful point landing on H-1 must be followed (by ~10 days) by an evaluation of the photography of Fra Mauro. If Hyginus should become prime on H-2, the Davey Rille site will be reevaluated.

The ASSB accepted the proposed prime and alternate site lists with the understanding that MSC will make a recommendation on Fra Mauro after H-1. Col. McDivitt posed the problem of having Censorinus in the H-4 slot -- before the extended LM tanks are available. The ASSB agreed that it would need to relook at that sequencing. Further potential problems, to be aired at future meetings, include having Descartes, envisioned as a rover site, in the J-1 slot and the problem of not having a pan camera on the Tycho mission. Note that on the original proposed alternate site list, MSC included Lalande as an alternate for Censorinus. The ASSB consensus was that such a substitution was trading an unknown (and probably as bad) problem for a known problem.

Capt. Scherer/MAL was given the action item to be certain that the LPMB are briefed first hand on this ASSB meeting and that they receive the minutes of the meeting. Mr. Nicks/SL wanted the record to show that the site list is tentative and subject to review as the program progresses.

Plans for H-Mission Camera Systems

Col. McDivitt/MSC briefly summarized the H-mission camera systems. The basic system is the 70 mm Hasselblad with lenses to 500 mm. Using spacecraft roll for IMC, a maximum of 3 m resolution might be attained. The use of a Questar is dubious on account of the small (∿1 mile x 1 mile) field-of-view and only moderate resolution. A new note was the MSC study on the possible use of the (existing) Hycon 18" system in the CM. This camera has a 4 1/2" x 4 1/2" format, IMC, and weighs ∿58 lbs (plus 40-60 lbs for a box). It has the potential for 4-5 m resolution and can photograph a 15 x 1500 mile swath at 60 nm altitude. McDivitt estimated that three flight models and one training unit would cost ∿$800,000. If work were to start immediately, the Hycon could possibly make Apollo 13. Getting it for Apollo 14 and 15 presents no problem.

The possible interference of the Hycon with the multi-spectral experiment, S-158 (approved by the MSFEB for 12 and 13), was discussed. The initial MSC opinion (expressed by McDivitt) was that there would not be room in the CM for both the Hycon and S-158. In summary, Dr. Petrone indicated that he would make a decision on the Hycon for Apollo 13 in the near future, after considering the effects on S-158.

Site Leadtime Reduction

The desire to react rapidly to new scientific findings in the Lunar Exploration Program, including the possibility of changing exploration sites, led to the creation of a Task Group to study site selection leadtime reduction.

A. P. Boysen, Jr./Bellcomm reported on the first phases of the work of the Task Group. He reported that the issue is to understand the controlling factors and to then determine possible actions to reduce the leadtime.

The initial findings indicate that the space vehicle flow at KSC is sensitive to payload changes. In particular, addition or deletion of the roving vehicle is the longest leadtime item. It appears that LV trajectory and software targeting can be adjusted to accommodate other mission planning (up to three months before

launch) but that the leadtime needed for training aids, onboard photo maps, complete mission planning and site specific training is significant. The critical paths and associated leadtimes are shown in Figure 1.

The Task Group has tentatively concluded that in normal situations at least six months leadtime is needed. That the system could respond to a new site on a shorter cycle was admitted (e.g., as for Site 7 on H-1) but that such is done at the expense of the nominal mission success confidence level.

Surface Comm/Nav/TV for J-Missions

Mr. Stoney/MA discussed the scientific, operational, and PIO requirements for lunar surface television. These requirements were then used for evaluation of possible TV systems as shown in Table V. The basic differences in requirements occur because the science requirement is essentially one for high resolution of a still scene while that of the PIO and operations is one for motion. Additionally, there is no scientific desire for a color system.

Also proposed as a potential part of a TV system was an up-link capability. Discussion resulted in a decision by Dr. Petrone to delete up-link TV from further consideration.

No conclusions were reached on which TV system would be best but a consensus was developing that it might be necessary to have two cameras to satisfy both the scientific and PIO/operational requirements. MSC will continue to study the various proposed systems including: costs; ground equipment requirements; and color vs. black and white with regard to weight, power, and scientific utility. MAL will consider the LSS and Tracker in the context of the whole lunar surface science program for Apollo 16-20.

Status of J-Missions Surface Science Definition

Capt. O'Bryant/MAL first reported on the response to the surface science AFO, noting that ~170 letters of intent had been received and that proposal evaluation would occur in early December. It was emphasized that this does not allow work to start now, as is necessary, on an ALSEP for Apollo 16. O'Bryant's schedule indicated that a decision is needed by the end of November to go ahead with the Central Station but that experiment selection can wait until late February or early March. Capt. Scherer/MAL was given the action item to determine the requirements for an ALSEP on 16 and to derive an experiments payload.

CRITICAL MISSION PREPARATION CYCLES

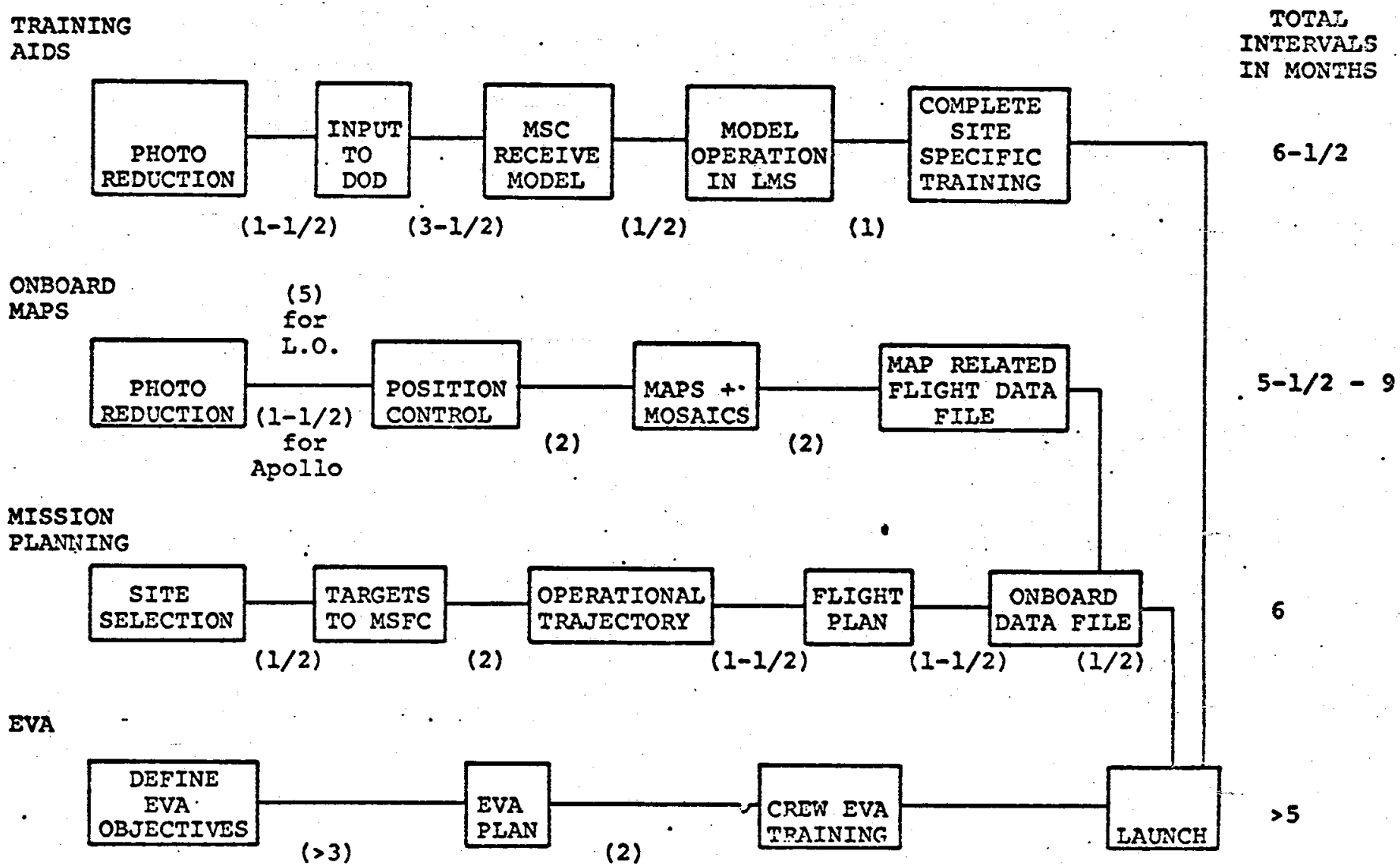


FIGURE I

LUNAR SURFACE TV OPTIONS

SYSTEM	PIO	OPERATION	SCIENCE SUPPORT					COST	AVAIL
			SCENE IDENT	SAMPLE DOC	SAMPLE IDENT	TOPO MARS	PHOTO-METRY		
A-1 COLOR TV	BEST	GOOD	SATIS-FACTORY	FAIR	POOR	NO	NO	800K	APOLLO 16
A-2 APOLLO 11 TV	FAIR	FAIR	SATIS-FACTORY	FAIR	FAIR	NO	NO	1½ → 2M	16
A-3 LSS TV	POOR	POOR TO GOOD	GOOD	VERY GOOD	VERY GOOD	NO	NO	1½ → 2M	16 ? 17
Δ A UPLINK	IMPROVES - SURVELLANCE - FREES ASTRONAUT TIME	IMPROVES FLEXIBILITY	IMPROVES	IMPROVES	NO EFFECT	N/A	N/A	1M	16 ?
B STAFF AND TRACKER	POOR	POOR TO GOOD	VERY GOOD	VERY GOOD	VERY GOOD	YES	YES	10M + 1½ → 2M	17 ?
			PRECISION LOCATION MAY BE REQUIRED FOR OTHER EXPERIMENTS						

TABLE V

Capt. O'Bryant briefed the Board on a Phase C study by Bendix on an Improved ALSEP (IMSEP) for Apollo 17-20. The concept involves modular design for experiments and power (one to three SNAP 19s) allowing three package configurations:

1-2 experiments, 140-165 lbs.

5-6 experiments, 225-325 lbs.

8-9 experiments, 350-400 lbs.

O'Bryant indicated that the proposed development schedule is tight even with the proposed addition of a SLA door (∿$500K) which allows late KSC loading. When discussing an experiments program for 16-20, O'Bryant presented options vs. costs. It was evident that, if one is constrained by the $68M limit, it will not be possible to fly ALSEP or IMSEP on every flight and develop the Lunar Survey System/Tracker. Even without the Survey System/Tracker it may not be possible to have ALSEP/IMSEP on each flight.

AAP Schedule Interface Implications

Mr. J. B. Skaggs/MAP reported on the effect of AAP on the Apollo schedule. That potential conflicts exist in the 1972 time period cannot be denied. However, Skaggs emphasized that since we don't know which S-V the AAP will use from the Apollo buy, since the AAP launch schedule is still not firm, and since the Apollo 16-20 launch schedule is not firm, it is premature to attempt to work out details on interface problems. Nevertheless, the general problem is being worked and MSC will make a report on the subject in late November.

ASSB Charter

Capt. Scherer reviewed the immediate past and the present ASSB membership (the members for this meeting already reflect the changing nature of the Board). Discussion revealed that Dr. Petrone wants the Board to meet more frequently.

There was comment that the constitution of the ASSB is notably devoid of scientific representation. Dr. Petrone pointed out that there is ample scientific input to the ASSB via the existing mechanisms (e.g., GLEP advising S&AD at MSC).

He agreed, however, that it would be a good idea to have an LPMB representative on the ASSB. Capt. Scherer was thus given an action item to determine who should represent the LPMB on the ASSB.

Capt. Scherer was given the action item to iterate the proposed ASSB charter and membership for the next ASSB meeting.

Summary of Action Items

1. Determine whether or not Dr. Urey has been sufficiently informed of the site selection process and results - L. R. Scherer/MAL;

2. Determine what operational constraints must be relieved to extend the Marius Hills launch opportunities - J. Mayer/MSC;

3. Report the results of and send minutes of the ASSB meeting to the LPMB - L. R. Scherer/MAL;

4. Determine who might represent the LPMB on/at the ASSB - L. R. Scherer/MAL;

5. Make a decision on whether or not to fly the Hycon camera on Apollo 13, considering that it may mean deletion of S-158 - R. A. Petrone;

6. Report on the requirements for an ALSEP on Apollo 16 and determine a preliminary experiment array - L. R. Scherer/MAL;

7. Iterate the proposed ASSB charter and membership - L. R. Scherer/MAL.

ATTACHMENT A

AGENDA

Apollo Site Selection Board
October 30, 1969

Members: Dr. Petrone, Capt. Lee, Mr. Stoney, Capt, Scherer, Col. McDivitt, Dr. Kraft, Col. Stafford, Maj. Gen. Stevenson, Mr. Nicks, Dr. Stuhlinger, Mr. Mathews, Mr. Calio

5 min	Introduction	Scherer/MAL
20 min.	Report of October 16-17 GLEP + Meeting	Calio/MSC
60 min.	Assessment of Proposed Mission Sequence - Space Vehicle Performance - Photo Coverage Assessment - Launch Turnaround Provision	Perrine/Bennett/MSC
20 min.	Prime and Alternate Sites for Apollo 13 (H-2)	Perrine/MSC
10 min.	MSC Summary	Perrine/MSC
12:30 - 1:30	- Lunch	
30 min.	ASSB Discussion and Recommendations on Sites	
30 min.	Plans for H-Missions Camera Systems	McDivitt/MSC
10 min.	Report of Site Leadtime Reduction Task Group	Boysen/Bellcomm
20 min.	Surface Comm/Nav/TV for J-Missions	Stoney/MA
15 min.	Status of J-Missions Surface Science Definition	O'Bryant/MAL
10 min.	AAP Schedule Interface Implications	Skaggs/MAP
15 min.	ASSB Charter	Scherer/MAL

ATTACHMENT B

ASSB Members Present

Dr. R. A. Petrone, MA, Chairman
Capt. L. R. Scherer, MAL, Secretary
Maj. Gen. J. D. Stevenson, MO
Mr. C. M. Lee, MA
Mr. W. E. Stoney, MA
Mr. O. W. Nicks, SD
Mr. A. J. Calio, MSC
Col. J. A. McDivitt, MSC
Mr. E. R. Mathews, KSC

ASSB Members Absent

Col. T. B. Stafford, MSC
Dr. C. C. Kraft, MSC
Dr. E. Stuhlinger, MSFC

Other Attendees

R. L. Campbell-NASA Hq./MAB
J. G. Cady-NASA Hq./MAB
R. J. Allenby-NASA Hq./MAL
D. A. Beattie-NASA Hq./MAL
G. Esenwein-NASA Hq./MAL
M. Gruber-NASA Hq./MAL
M. W. Molloy-NASA Hq./MAL
W. T. O'Bryant-NASA Hq./MAL
R. Aller-NASA Hq./MAO
J. K. Holcomb-NASA Hq./MAO
C. Liebermann-NASA Hq./MAP
N. Miller-NASA Hq./MAP
G. Roth-NASA Hq./MAP
J. B. Skaggs-NASA Hq./MAP
D. Bozung-NASA Hq./MAP-1

D. R. Anselmo-Bellcomm/MAS
R. A. Bass-Bellcomm/MAS
P. Benjamin-Bellcomm/MAS
A. P. Boysen, Jr.-Bellcomm/MAS
F. El-Baz-Bellcomm/MAS
W. W. Ennis-Bellcomm/MAS
J. W. Head-Bellcomm/MAS
N. W. Hinners-Bellcomm/MAS
D. B. James-Bellcomm/MAS
M. R. Kerr-Bellcomm/MAS
J. L. Marshall-Bellcomm/MAS
K. E. Martersteck-Bellcomm/MAS
J. Z. Menard-Bellcomm/MAS
R. D. Raymond-Bellcomm/MAS
P. E. Reynolds-Bellcomm/MAS
P. F. Sennewald-Bellcomm/MAS
R. J. Stern-Bellcomm/MAS

Other Attendees (Cont'd.)

C. R. Huss-MSC/FM
J. P. Mayer-MSC/FM
F. V. Bennett-MSC/FM2
C. H. Perrine-MSC/PD
J. R. Sevier-MSC/PD
G. Simmons-MSC/TA
J. H. Sasser-MSC/TJ

F. Kurtz-MSFC/PM-MO
L. B. Bell-MSFC/PM-SAT

J. A. Herbaugh-TRW

H. Masursky-USGS/Menlo Park

APPENDIX C

ATTENDANCE LIST

at GLEP + Meeting
October 16, 17

GLEP MEMBERS

MR. A. J. CALIO, CHAIRMAN	
DR. A. B. BURLINGAME	UNIV OF CALIFORNIA, BERKELEY
DR. L. FREDRICK	UNIV OF VIRGINIA
DR. P. GAST	LAMONT GEOLOGICAL OBS
DR. D. JAMES	BELLCOMM, INC.
DR. F. JOHNSON	SOUTHWEST CENTER FOR ADV RESEARCH
DR. C. LUNDQUIST	SMITHSONIAN ASTROPHYSICAL OBS
DR. H. MASURSKY	U. S. GEOLOGICAL SURVEY
CAPT. L. SCHERER	NASA HEADQUARTERS, CODE MAL
DR. E. SIMMONS	M.I.T.
DR. R. KOVACH	STANFORD UNIV
DR. H. SCHMITT	NASA/MSC

INVITED GUESTS

DR. C. ALLEY	UNIV OF MARYLAND
DR. G. LATHAM	LAMONT GEOLOGICAL OBS.
DR. M. LANGSETH	LAMONT GEOLOGICAL OBS.
DR. W. RUBEY	LUNAR SCIENCE INSTITUTE
DR. T. McCORD	M.I.T.
DR. R. SHORTHILL	BOEING SCIENCE RESEARCH LAB
DR. S. ZISK	LINCOLN LAB
DR. P. DYALL	NASA/AMES

INVITEES NOT ATTENDING

DR. C. SNYDER	JET PROPULSION LAB
DR. C. SONNETT (SENT ALTERNATE)	NASA/AMES
DR. J. FREEMAN, JR.	RICE UNIV
DR. E. SHOEMAKER	C.I.T.
DR. F. PRESS	M.I.T.
DR. H. UREY (ARRIVED AFTER MEETING COMPLETED)	UNIV OF CALIF, LA JOLLA
DR. T. GOLD	CORNELL UNIV
DR. A. TURKEVITCH	ENRICO FERMI INST
DR. D. GAULT	NASA/AMES