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BELLCOMM, INC.

SUBJECT: AAP Experiment Assignments - Case 600-1

DATE: June 27, 1967

FROM: M. S. Feldman

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ABSTRACT

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This memorandum reports the results of an effort to organize and update experiment assignments for inclusion in the AAP Flight Mission Assignments Document.

Experiment assignment lists are included which indicate the following:

1. Original experiment assignments to the Orbital Workshop and ATM missions - AAP-1 through AAP-4.

2. Mission AAP-1A experiment assignments and the resulting unloading of experiments from AAP-1 through AAP-4.

3. Proposed assignments for inclusion in the draft FMAD.

4. Current status of AAP experiment assignments.

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MEMORANDUM FOR FILE

This memorandum reports the results of an effort to organize and update experiment assignments for inclusion in the AAP Flight Mission Assignments Document.

Status Review

Prior to the advent of the AAP-1A mission and the two refurbished CM missions, the AAP Flight Mission Assignments consisted of the Orbital Workshop missions and the ATM missions which reused the Orbital Workshop. These missions were identified as AAP-1 through AAP-4. Experiments assigned to these missions are shown on Figure 1.

Prior to the scheduled May meeting of the MSFEB, the AAP Program Office requested MSC to conduct a compatibility analysis of sixteen experiments on a new mission designated AAP-1A. This mission was identified as a CSM earth orbital mission independent of the Orbital Workshop. The experiments selected for the compatibility analysis consisted of anticipated transfers from the Apollo Program and experiments that could be transferred from the overloaded Orbital Workshop missions. Figure 2 indicates the experiments considered by MSC for the AAP-1A mission and also indicates their previous assignment. Figure 2 also represents the experiment assignments that existed at the beginning of the effort to provide experiment assignments for the draft FMAD.

Ground Rules for Proposed Experiment Assignments

The following ground rules were used in arriving at a proposed assignment of experiments for the draft FMAD:

1. There are to be the following seven missions:

   A. AAP-1A will be a CSM high inclination earth orbital mission.

   B. AAP-1/AAP-2 will be a dual launch Orbital Workshop mission.

   C. AAP-3A will be a refurbished CSM mission that utilizes the Orbital Workshop.

SATURN APOLLO APPLICATIONS EXPERIMENTS
(PROPOSED FIRST USE)

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS AAP-1	/AAP-2	AAP-3	/AAP-4
SCIENTIFIC					
S006	SYNOPTIC WEATHER PHOTOGRAPHY	X			
S009	NUCLEAR EMULSION		X		
S015	ZERO "G" SINGLE HUMAN CELL			X	
S017	X-RAY ASTRONOMY		X		
S018	MICROMETEOROID COLLECTION		X		
S019	UV STELLAR ASTRONOMY		X		
S020	UV/X-RAY SOLAR PHOTOGRAPHY		X		
S027	GALACTIC X-RAY MAPPING			X	
S052	WHITE LIGHT CORONAGRAPH				X
S053	UV CORONAL SPECTROGRAPHS				X
S054	X-RAY SPECTROGRAPHIC TELESCOPE				X
S055	UV SPECTROMETERS				X
S056	X-RAY TELESCOPE				X
S061	POTATO RESPIRATION			X	
S063	UV AIRGLOW HORIZON PHOTOGRAPHY		X		
S065	MULTI-BAND TERRAIN PHOTOGRAPHY(HAND HELD)	X			
TECHNOLOGICAL					
T002	MANUAL NAVIGATION SIGHTINGS		X		
T004	FROG OTOLITH FUNCTION		X		
T017	METEOROID IMPACT & EROSION		X		
T020	JET SHOES		X		
T021	METEOROID VELOCITY		X		
T022	HEAT PIPE	X			

FIGURE 1

SATURN APOLLO APPLICATIONS EXPERIMENTS
(PROPOSED FIRST USE)

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS AAP-1	AAP-2	AAP-3	AAP-4
DOD					
D017	CARBON DIOXIDE REMOVAL		X		
D018	INTEGRATED MAINTENANCE		X		
D019	SUIT DONNING & SLEEP STATION EVALUATION		X		
D020	ALTERNATE RESTRAINTS EVALUATION		X		
D021	EXPANDABLE AIRLOCK TECHNOLOGY		X		
D022	EXPANDABLE STRUCTURE FOR RECOVERY		X		
MEDICAL					
M018	VECTORCARDIOGRAM		X		
M050	METABOLIC ACTIVITIES		X		
M051	CARDIOVASCULAR FUNCTION ASSESSMENT		X		
M052	BONE AND MUSCLE CHANGES	X			
M053	HUMAN VESTIBULAR FUNCTION		X		
M055	TIME AND MOTION STUDIES		X		
ENGINEERING					
M401	MAPPING AND SURVEY SYSTEM	X			
M439	STAR/HORIZON AUTOMATIC TRACKING			X	
M466	SPACE SUITS EVALUATION		X		
M469	ST-124 REMOVAL		X		
M479	ZERO "G" FLAMMABILITY		X		
M486	ASTRONAUT EVA EQUIPMENT		X		
M487	HABITABILITY/CREW QUARTERS		X		
M488	HIGH PRESSURE GAS EXPULSION		X		
M489	HEAT EXCHANGER SERVICE		X		
M492	TUBE JOINING ASSEMBLIES		X		
M493	ELECTRON BEAM WELDING		X		

FIGURE 1 (CONT.)

SATURN APOLLO APPLICATIONS EXPERIMENTS

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS				
		AAP-1A	AAP-1	AAP-2	AAP-3	AAP-4
SCIENTIFIC						
S005	SYNOPTIC TERRAIN PHOTOGRAPHY	X				
S006	SYNOPTIC WEATHER PHOTOGRAPHY	X ←	⊗			
S009	NUCLEAR EMULSION	X ←		⊗		
S015	ZERO "G" SINGLE HUMAN CELL	X ←			⊗	
S016	TRAPPED PARTICLES ASYMMETRY	X				
S017	X-RAY ASTRONOMY	X ←		⊗		
S018	MICROMETEOROID COLLECTION	X ←		⊗		
S019	UV STELLAR ASTRONOMY	X ←		⊗		
S020	UV/X-RAY SOLAR PHOTOGRAPHY	X ←		⊗		
S027	GALACTIC X-RAY MAPPING				X	
S052	WHITE LIGHT CORONAGRAPH					X
S053	UV CORONAL SPECTROGRAPHS					X
S054	X-RAY SPECTROGRAPHIC TELESCOPE					X
S055	UV SPECTROMETERS					X
S056	X-RAY TELESCOPE					X
S061	POTATO RESPIRATION				X	
S063	UV AIRGLOW HORIZON PHOTOGRAPHY	X ←		⊗		
S065	MULTI-BAND TERRAIN PHOTOGRAPHY(HAND HELD)	X	X		X	
TECHNOLOGICAL						
T002	MANUAL NAVIGATION SIGHTINGS	X ←		⊗		
T003	IN-FLIGHT NEPHELOMETER	X				
T004	FROG OTOLITH FUNCTION	X ←		⊗		
T017	METEOROID IMPACT & EROSION			X		
T020	JET SHOES			X		
T021	METEOROID VELOCITY			X		
T022	HEAT PIPE		X			
T023	SURFACE ADSORBED MATERIALS			X		

FIGURE 2

SATURN APOLLO APPLICATIONS EXPERIMENTS

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS				
		AAP-1A	AAP-1	AAP-2	AAP-3	AAP-4
DOD						
D017	CARBON DIOXIDE REMOVAL	X ←	⊗			
D018	INTEGRATED MAINTENANCE			X		
D019	SUIT DONNING & SLEEP STATION EVALUATION			X		
D020	ALTERNATE RESTRAINTS EVALUATION			X		
D021	EXPANDABLE AIRLOCK TECHNOLOGY			X		
D022	EXPANDABLE STRUCTURE FOR RECOVERY			X		
MEDICAL						
M018	VECTORCARDIOGRAM			X		X
M050	METABOLIC ACTIVITIES			X		X
M051	CARDIOVASCULAR FUNCTION ASSESSMENT			X		X
M052	BONE AND MUSCLE CHANGES		X	X	X	X
M053	HUMAN VESTIBULAR FUNCTION			X		X
M055	TIME AND MOTION STUDIES			X		X
ENGINEERING						
M401	MAPPING AND SURVEY SYSTEM	X ←	⊗			
M439	STAR/HORIZON AUTOMATIC TRACKING				X	
M466	SPACE SUITS EVALUATION			X		
M469	ST-124 REMOVAL			X		
M479	ZERO "G" FLAMMABILITY			X		
M486	ASTRONAUT EVA EQUIPMENT			X		
M487	HABITABILITY/CREW QUARTERS			X		
M488	HIGH PRESSURE GAS EXPULSION			X		
M489	HEAT EXCHANGER SERVICE			X		
M492	TUBE JOINING ASSEMBLIES			X		
M493	ELECTRON BEAM WELDING			X		

FIGURE 2 (CONT.)

D. AAP-3/AAP-4 will be a dual launch ATM mission that utilizes the Orbital Workshop.

E. AAP-5 will be a refurbished CSM mission that utilizes the Orbital Workshop.

2. The CM Scientific Airlock will be utilized on AAP-1A.

3. No experiments requiring EVA or the use of SM Sector 1 will be assigned to AAP-1A.

4. Experiment M401, Lunar Mapping and Survey System, will be assigned to AAP-1A.

5. Experiments will be removed from AAP-3 to conserve weight and no new experiments will be assigned to AAP-3.

Applying these ground rules resulted in the proposed experiment assignments shown in Figure 3. The previous history of experiment assignments is also shown in Figure 3.

Specific Comments

A number of clarifying comments are presented below and noted on Figure 3 to explain certain proposed experiment assignments.

1. Experiments S005 Synoptic Terrain Photography and S006 Synoptic Weather Photography were not proposed as experiments assigned to any specific mission. It was anticipated that an operational camera would be carried on all flights for taking photographs at the astronauts discretion which should accomplish the intent of these two experiments without making a specific assignment. It should also be recognized that S065 Multi-band Terrain Photography, which was proposed for assignment to AAP-1A, AAP-2, AAP-3A and AAP-3, is aimed at providing more complete information of terrain characteristics than S005.

2. Experiment S017 X-Ray Astronomy was not proposed for a mission assignment because S069, an improved version of S017, was proposed for assignment to AAP-2.

3. The Coronagraph Experiment proposed for AAP-1A does not yet have a number as it still requires a Headquarters Sponsoring Office.

PROPOSED EXPERIMENT ASSIGNMENTS

EXP. NO.	TITLE	MISSIONS: APOLLO	1A	1	2	3A	3	4	5
SCIENTIFIC									
S005	SYNOPTIC TERRAIN PHOTOGRAPHY	⊗	⊗ 1						
S006	SYNOPTIC WEATHER PHOTOGRAPHY	⊗	⊗ 1						
S009	NUCLEAR EMULSION		⊗	⊗	X				
S015	ZERO "G" SINGLE HUMAN CELL	⊗	X				⊗		
S016	TRAPPED PARTICLES ASYMMETRY	⊗	X						
S017	X-RAY ASTRONOMY	⊗	⊗ 2						
S018	MICROMETEOROID COLLECTION	⊗	X		⊗		TO 1A	⊗	
S019	UV STELLAR ASTRONOMY	⊗	X		⊗		TO 1A	⊗	
S020	UV/X-RAY SOLAR PHOTOGRAPHY	⊗	X						
S027	GALACTIC X-RAY MAPPING			X			⊗		
S028	DIM LIGHT PHOTOGRAPHY	⊗	X						
S051	DAY TIME SODIUM CLOUD	⊗	X						
	CORONAGRAPH		X 3						
S052	WHITE LIGHT CORONAGRAPH							X	R
S053	UV CORONAL SPECTROGRAPHS							X	R
S054	X-RAY SPECTROGRAPHIC TELESCOPE							X	R
S055	UV SPECTROMETERS							X	R
S056	X-RAY TELESCOPE							X	R
S061	POTATO RESPIRATION					X	⊗		
S063	UV AIRGLOW HORIZON PHOTOGRAPHY		X					⊗	
S065	MULTI-BAND TERRAIN PHOTOGRAPHY(HAND HELD)		X	⊗	X	R	R		
S067	GAMMA RAY AND X-RAY SPECTROSCOPY								X 4
S069	X-RAY ASTRONOMY				X 2		R		
S070	UV/X-RAY ASTRONOMY				⊗				X
S071	CIRCADIAN RHYTHM - POCKET MICE					X 4			
S072	CIRCADIAN RHYTHM - VINEGAR FLY					X 4			
S073	GEGENSCHEN/ZODIACAL LIGHT					X 5			
S074	COSMIC RAY/ELECTRON								X 4

FIGURE 3

PROPOSED EXPERIMENT ASSIGNMENTS

EXP. NO.	TITLE	MISSIONS							
		APOLLO	1A	1	2	3A	3	4	5
MEDICAL									
M018	VECTORCARDIOGRAM				X	R	R		
M050	METABOLIC ACTIVITIES				X	R	R		
M051	CARDIOVASCULAR FUNCTION ASSESSMENT				X	R	R		
M052	BONE AND MUSCLE CHANGES			X	X	R	R		
M053	HUMAN VESTIBULAR FUNCTION				X	R	R		
M055	TIME AND MOTION STUDIES				X	R	R		
M056	SPECIMEN MASS MEASUREMENT DEVICE				X 4	R	R		
M057	TOTAL BODY EXERCISE SYSTEM				X 4	R	R		
M058	BODY MASS MEASUREMENT DEVICE				X 4	R	R		
ENGINEERING									
M401	MAPPING AND SURVEY SYSTEM		X ←	⊗					
M402	ORBITAL WORKSHOP				X	R	R		R
M439	STAR/HORIZON AUTOMATIC TRACKING		X ←				⊗		
M466	SPACE SUITS EVALUATION				X 6				
M469	ST-124 REMOVAL				X				
M479	ZERO GRAVITY FLAMMABILITY				X				
M486	ASTRONAUT EVA EQUIPMENT				X 7				
M487	HABITABILITY/CREW QUARTERS				X	R	R		R
M488	HIGH PRESSURE GAS EXPULSION				X				
M489	HEAT EXCHANGER SERVICE				X				
M492	TUBE JOINING ASSEMBLIES				X				
M493	ELECTRON BEAM WELDING				X				
M508	EVA HARDWARE EVALUATION				X 4				
M509	ASTRONAUT MANEUVERING EQUIPMENT				X 4				

FIGURE 3 (CONT.)

PROPOSED EXPERIMENT ASSIGNMENTS

EXP. NO.	TITLE	MISSIONS							
		APOLLO	1A	1	2	3A	3	4	5
TECHNOLOGICAL									
T002	MANUAL NAVIGATION SIGHTINGS	⊗ →	X	← ⊗					
T003	IN-FLIGHT NEPHELOMETER	⊗ →	X		X 8				
T004	FROG OTOLITH FUNCTION	⊗ → 9							
T017	METEOROID IMPACT & EROSION				X	R			
T020	JET SHOES				X				
T021	METEOROID VELOCITY				X	R			
T022	HEAT PIPE			X					
T023	SURFACE ADSORBED MATERIALS				X				
DOD									
D008	RADIATION IN SPACECRAFT	⊗ →	X		X 10				
D009	SIMPLE NAVIGATION	⊗ → 11							
D017	CARBON DIOXIDE REMOVAL	⊗ →	X	← ⊗					
D018	INTEGRATED MAINTENANCE				X				
D019	SUIT DONNING & SLEEP STATION EVALUATION				X				
D020	ALTERNATE RESTRAINTS EVALUATION				X				
D021	EXPANDABLE AIRLOCK TECHNOLOGY				X	R			
D022	EXPANDABLE STRUCTURE FOR RECOVERY				X	R			

FIGURE 3 (CONT.)

4. The following experiments, for which assignments were proposed, have not yet been presented to the MSFEB for approval:

S067	Gamma Ray and X-Ray Spectroscopy
S071	Circadian Rhythm - Pocket Mice
S072	Circadian Rhythm - Vinegar Fly
S074	Cosmic Ray/Electron
M056	Specimen Mass Measurement Device
M057	Total Body Exercise System
M058	Body Mass Measurement Device
M508	EVA Hardware Evaluation
M509	Astronaut Maneuvering Equipment

5. Experiment S073 Gegenschein Zodiacal Gun, which was proposed for assignment to AAP-3A, has not yet been presented to the Experiment Coordinating Panel (ECP) for processing.

6. Experiment M466 Space Suit Evaluation is to be incorporated into M508 EVA Hardware Evaluation.

7. Experiment M486 Astronaut EVA Equipment is to be replaced by M508 EVA Hardware Evaluation and M509 Astronaut Maneuvering Equipment.

8. Experiment T003 In-flight Nephelometer was proposed for AAP-1A to be used in the CM atmosphere and for AAP-2 to be used in the Orbital Workshop atmosphere.

9. Experiment T004 Frog Otolith Function was not proposed for assignment to AAP missions as it was understood that the sponsoring Headquarters Office was taking action to fly this experiment on an unmanned flight.

10. Experiment D008 Radiation in Spacecraft was proposed for AAP-1A to be used in the CM location and for AAP-2 to be used in the Orbital Workshop location.

11. Experiment D009 Simple Navigation was not proposed for assignment as it is very similar to T002 Manual Navigation Sightings which was proposed for AAP-1A.

Current Status

At the June 16, 1967 Apollo Applications Program Review Meeting, the Program Director enumerated the following recommendations on experiment assignments to AAP missions:

1. Due to the program uncertainties in Missions AAP-3A and AAP-5, no new experiment, i.e. other than repetitions of Orbital Workshop experiments, should be assigned to AAP-3A and AAP-5.

2. S017 X-Ray Astronomy should be assigned to AAP-1A and its updated version S069 should be assigned to AAP-2.

3. The current listing of experiment assignments to AAP-1A should not be modified in any official documentation until after certain program decisions regarding the AAP-1A mission are finalized.

4. Experiments which have not been processed by the MSFEB and assigned to the AAP Program for implementation should not be included in an assignments list.

These recommendations result in the proposed experiment assignments shown in Figure 4.

1021-MSF-bap

M. S. Feldman

SATURN APOLLO APPLICATIONS EXPERIMENTS

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS				
		AAP-1A	AAP-1	AAP-2	AAP-3	AAP-4
SCIENTIFIC						
S005	SYNOPTIC TERRAIN PHOTOGRAPHY	X				
S006	SYNOPTIC WEATHER PHOTOGRAPHY	X				
S009	NUCLEAR EMULSION	X				
S015	ZERO "G" SINGLE HUMAN CELL	X				
S016	TRAPPED PARTICLES ASYMMETRY	X				
S017	X-RAY ASTRONOMY	X				
S018	MICROMETEOROID COLLECTION	X				
S019	UV STELLAR ASTRONOMY	X				
S020	UV/X-RAY SOLAR PHOTOGRAPHY	X				
S027	GALACTIC X-RAY MAPPING		X			
S052	WHITE LIGHT CORONAGRAPH					X
S053	UV CORONAL SPECTROGRAPHS					X
S054	X-RAY SPECTROGRAPHIC TELESCOPE					X
S055	UV SPECTROMETERS					X
S056	X-RAY TELESCOPE					X
S061	POTATO RESPIRATION				X	
S063	UV AIRGLOW HORIZON PHOTOGRAPHY	X				
S065	MULTI-BAND TERRAIN PHOTOGRAPHY(HAND HELD)	X		X	X	
S069	X-RAY ASTRONOMY			X		
TECHNOLOGICAL						
T002	MANUAL NAVIGATION SIGHTINGS	X				
T003	IN-FLIGHT NEPHELOMETER	X				
T004	FROG OTOLITH FUNCTION	X				
T017	METEOROID IMPACT & EROSION			X		
T020	JET SHOES			X		
T021	METEOROID VELOCITY			X		
T022	HEAT PIPE		X			
T023	SURFACE ADSORBED MATERIALS			X		

FIGURE 4

SATURN APOLLO APPLICATIONS EXPERIMENTS

EXP. NO.	TITLE	PROPOSED FLIGHT ASSIGNMENTS				
		AAP-1A	AAP-1	AAP-2	AAP-3	AAP-4
DOD						
D017	CARBON DIOXIDE REMOVAL	X				
D018	INTEGRATED MAINTENANCE			X		
D019	SUIT DONNING & SLEEP STATION EVALUATION			X		
D020	ALTERNATE RESTRAINTS EVALUATION			X		
D021	EXPANDABLE AIRLOCK TECHNOLOGY			X		
D022	EXPANDABLE STRUCTURE FOR RECOVERY			X		
MEDICAL						
M018	VECTORCARDIOGRAM			X		X
M050	METABOLIC ACTIVITIES			X		X
M051	CARDIOVASCULAR FUNCTION ASSESSMENT			X		X
M052	BONE AND MUSCLE CHANGES		X	X	X	X
M053	HUMAN VESTIBULAR FUNCTION			X		X
M055	TIME AND MOTION STUDIES			X		X
ENGINEERING						
M401	MAPPING AND SURVEY SYSTEM	X				
M402	ORBITAL WORKSHOP			X		
M439	STAR/HORIZON AUTOMATIC TRACKING				X	
M466	SPACE SUITS EVALUATION			X		
M469	ST-124 REMOVAL			X		
M479	ZERO "G" FLAMMABILITY			X		
M486	ASTRONAUT EVA EQUIPMENT			X		
M487	HABITABILITY/CREW QUARTERS			X		
M488	HIGH PRESSURE GAS EXPULSION			X		
M489	HEAT EXCHANGER SERVICE			X		
M492	TUBE JOINING ASSEMBLIES			X		
M493	ELECTRON BEAM WELDING			X		

FIGURE 4 (CONT.)

BELLCOMM, INC.

Subject: AAP Experiment Assignments From: M. S. Feldman

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