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Final

LIFE SCIENCES SPACELAB MISSION DEVELOPMENT TEST III

Development Plan
for
Inflight Procedures

National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

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SPACELAB MISSION DEVELOPMENT TEST III

DEVELOPMENT PLAN FOR INFLIGHT PROCEDURES

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INTRODUCTION

Spacelab Mission Development Test III (SMD-III) represents the third in a series of tests designed to prepare the Life Sciences Directorates of the Johnson Space Center (JSC) and the Ames Research Center (ARC) for conducting research in the Life Sciences on the upcoming Space Shuttle missions. Experience gained from SMD-III will be primarily derived from 26 scientific experiments and 12 Operational Test Requirements (OTR's) to be performed during the test. The experiments and OTR's are intended to accomplish specific scientific, medical, and engineering objectives which may be applicable to future Shuttle flights.

Unlike previous JSC tests, SMD-III will require intercenter coordination between JSC and ARC to test the "host center" concept for participation in conducting research during the Shuttle program. Consequently, 20 of the 26 Life Science experiments and 4 OTR's included in the SMD-III complement are under the direction of ARC scientists and engineers.

The 26 scientific experiments (see Table 1) have been divided into two distinct categories: those studies classified as "animal" experiments (designated as Group A), and those classified as "human" experiments (Groups B, C). Likewise, the 12 OTR's (see Table 2) may be conveniently classified by originator; i.e., 4 of the OTR's originate from the Life Sciences Directorate (LSD) of ARC, while 8 are products of the Life Sciences Directorate of JSC.

A comprehensive set of procedures is necessary to the efficient and effective conduct of the experiments and OTR's. These procedures describe how each experiment and OTR should be performed. Development of the flight procedures for SMD-III will be a dual effort of JSC and ARC (see Table 3). Initial development of procedures for the 15 animal experiments will be the responsibility of the Life Sciences Directorate at ARC, while all human experiment procedures will be developed by the Life Sciences Directorate of JSC. In a similar fashion, procedure development for 9 of the 12 OTR's will be the

Table 1

Experiments of SMD-III

	Expt. No.	Experiment Title	Originator
Group A	3	Rat Collagen	ARC
	10	Somatomedin	ARC
	11	3-Methyl Histidine	ARC
	12	Proteolytic Enzymes	ARC
	13	Muscle Degradation	ARC
	15	Otolith Activity	ARC
	21	Hypothalamic Structure	ARC
	23	Angiotensin	ARC
	27	Lymphoid Tissue	ARC
	39	Bone Resorption	ARC
	42	Drosophila Aging	ARC
	57	Nucleate Boil	ARC
	59	Metabolism	ARC
	60	Pyrogens	ARC
	76	CV Dynamics	ARC
Group B	5	Biofeedback	ARC
	8	Insulin	ARC
	49	CV Alteration	ARC
	51	Motion Sickness	ARC
	58	CP Function	ARC
Group C	66	Otolith Output	JSC
	68	Erythrokinetics	JSC
	74	Immune Response	JSC
	75	Basal Metabolism	JSC
	77	Inflight Electrolytes	JSC
	78	Earth Observations	JSC

Table 2

Operational Test Requirements for SMD-III

OTR No.	Operational Test Requirement Title	Originator
1	Inflight Exercise	LSD-JSC
2	Shuttle Medical Kit Definition/Review	LSD-JSC
3	Medical Monitoring	LSD-JSC
5	Potable Water System, Urine Monitor System, and Waste Management System Engineering Evaluation	LSD-JSC
8	Volatile Metabolites	LSD-JSC
9	Contamination Control	LSD-JSC
11	Surgical Bench	LSD-ARC
13	Crew Health Stabilization	LSD-JSC
14	Biological Specimen Holding Facility (LMSC)	LSD-ARC
16	Biological Specimen Holding Facility (MDAC)	LSD-ARC
18	Primate and Small Vertebrate Transporter (GE)	LSD-ARC
20	Hygiene/Personal Cleansing/Housekeeping	LSD-JSC

Table 3

SMD-III Procedures Development Responsibilities

	Basic Development	Initial Format	Update and Final Format	Flight Data File Publication
Group A Expts.	LSD-ARC	LSD-ARC	Boeing	Boeing
Group B Expts.	LSD-JSC	LSD-JSC	Boeing	Boeing
Group C Expts.	LSD-JSC	LSD-JSC	Boeing	Boeing
OTR's 1, 2, 3, 8, 9	LSD-JSC	LSD-JSC	Boeing	Boeing
OTR's 11, 14, 16, 18	LSD-ARC	LSD-ARC	Boeing	Boeing
OTR's 5, 20	FOD-JSC	FOD-JSC	FOD-JSC	FOD-JSC

responsibility of the originator of the requirement (as mentioned above). Because OTR's 5 and 20 are representative of flight independent systems, procedures development for these two OTR's will be the responsibility of the Flight Operations Directorate (FOD) of JSC. Operational Test Requirement 13 will not require inflight procedures.

The Boeing Aerospace Company will provide technical support in the development of experiment procedures and procedures for those OTR's not under the jurisdiction of the Flight Operations Directorate (see Table 3). Specifically, Boeing will edit, revise, and format these procedures as they evolve during crew training prior to the test and will publish the procedures as part of the Flight Data File for the actual conduct of the test.

SCOPE

The plan outlined in this report is intended to cover development of inflight procedures for all 26 experiments and 9 of the 12 OTR's to be performed as a part of SMD-III. Of the 3 OTR's not covered, 2 will be the responsibility of the Flight Operations Directorate of JSC while the third will not require inflight procedures (refer to Table 3). Initial development and formatting of the procedures for the 26 experiments and 9 OTR's will be the responsibility of the Life Sciences Directorates of JSC and ARC. Boeing's effort will follow from this initial development and will continue through the completion of final experiment procedures.

APPROACH TO DEVELOPMENT OF INFLIGHT PROCEDURES

Initial development of inflight experiment or OTR procedures will be the responsibility of the Principal Investigator (PI). The PI will be assisted in the initial and all other phases of development by the Project Engineer (PE). At the time of their initial release, the procedures will be approved by the PI, PE (if appropriate), System Engineer, and the respective Center Science Manager. Once released, all changes to the procedures must be approved by the MMB Executive Committee. Review and coordination of changes

will be the primary responsibility of the Procedures Coordinator (see Figures 1 and 2). Close coordination with the crew during training will allow for efficient updating of the procedures. It is important to note that all changes must receive the ultimate approval of both the PI and the Procedures Coordinator.

For those experiments and OTR's originating from ARC, the Documentation Control Center at ARC will have the responsibility for initial formatting, coordination of approvals, and initial release of procedures. In the case of JSC-originated procedures, the original will be submitted to the PE who will format the document with the assistance of Boeing. Reference document for the formatting will be the ALT/OFT Flight Data File Preparation Standards (JSC 09958) prepared by the Flight Operations Directorate of JSC. The accuracy and clarity of the formatted version will be verified by allowing the crew to use the procedure during training. Attendance by the PI, his designated representative, and/or Boeing personnel at the training sessions will be necessary to obtain crew comments for improvement of the procedures and verification of their completeness. Procedure updates will be incorporated as they arise. Once the procedure has been finalized and approved by the PI, the crew, and the Procedures Coordinator, Boeing will perform the final editing and will publish the procedure as part of the Flight Data File (see Milestone 6 of the Schedule for Completion of Inflight Procedures).

Procedures will be stored in a system similar to the Generalized Documentation Processor during the time of their development. Storage in such a system will allow for documenting and controlling all procedures and will provide a method for standardizing the procedures in form and content.

CHANGE CONTROL

Initial control of changes to experiment and OTR procedures will be vested in the Principal Investigator and the Procedures Coordinator. No changes to a procedure will be instituted without the approval of these two personnel. Upon submission by the crew (or other personnel) of a proposed change, the

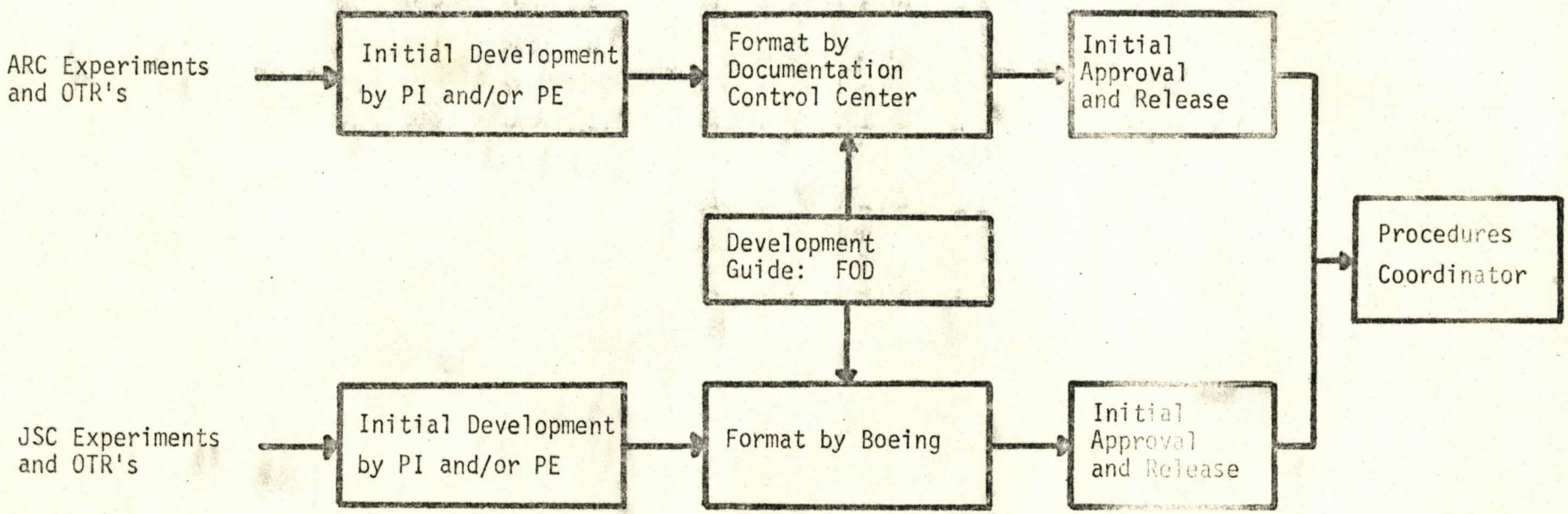

Figure 1. Flow Chart for Initial Release of Inflight Procedures

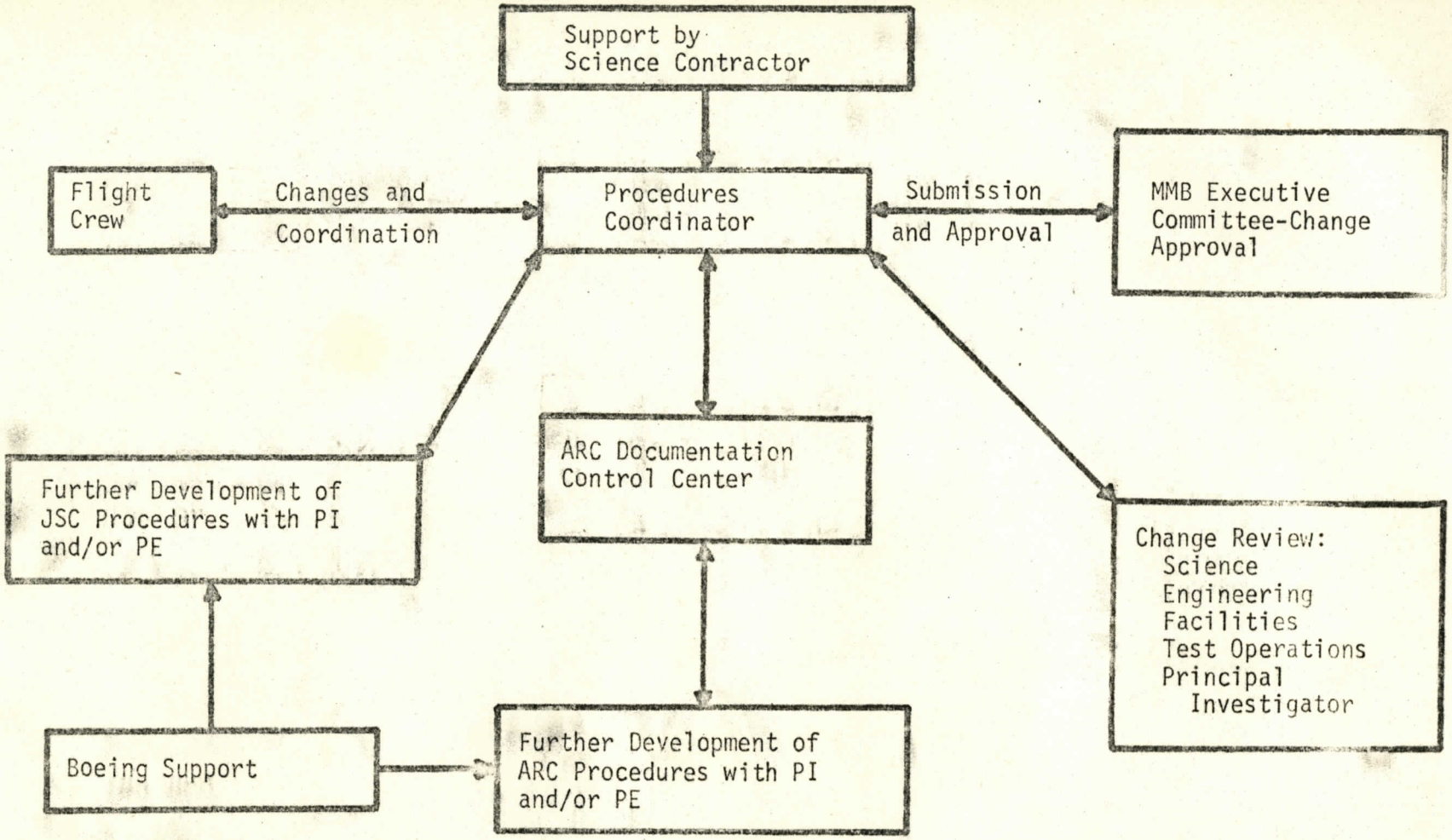

Figure 2. Flow Chart for Final Development and Change Control of Inflight Procedures

PI and Procedures Coordinator will review the proposal and recommend acceptance or rejection of the change. If accepted, the change will immediately be incorporated into the proper procedure.

Following the completion of phase training (April 15), a more rigid form of change control will be implemented. Authority for change control will then lie with the Mission Management Board (MMB). Similar to the previous form of control, all changes to inflight procedures will be initiated only by the PI and the Procedures Coordinator. The changes will require the approval of the MMB Executive Committee and should be sent to the Procedures Coordinator, Chuck Sawin, Ph.D., DB6, JSC, Houston, Texas 77058.

Upon receipt of the proposed changes, the Procedures Coordinator will distribute them to the following groups as appropriate for impact statements and recommendations:

1. Science (Experiments Working Group, John A. Rummel, Ph.D., Paul X. Callahan, Ph.D.)

2. Engineering (R. W. Nolte, R. Mah)

3. Facilities (F. R. Spross, B. Dalton)

4. Test Operations (G. H. Cress)

5. Appropriate Principal Investigator

6. Flight Crew

These groups will provide written statements within three days to the Procedures Coordinator who will present the statements to the MMB Executive Committee for disposition. Disapproved Change Requests will be returned to the originator. Approved changes will be sent to those on the original distribution list.

The information to be included in a Change Request is given below:

1. Inflight Procedure No.
2. Title
3. Originator
4. Change Requested
5. Justification
6. Impact

SCHEDULE FOR COMPLETION OF INFLIGHT PROCEDURES

	MILESTONES
1	JSC EXPER. READINESS REVIEW
2	OPERATIONAL READINESS REVIEW
3	TEST READINESS REVIEW
4	CREW TRAINING
5	SMD-III MISSION TEST
6	FLIGHT DATA FILE ASSEMBLY
7	DEVELOP. OF ROUGH DRAFT PROC.
8	PRELIM. VERSION OF PROCEDURES
9	CREW TRAINING (MOCKUP)
10	TEST-READY PROCEDURES
11	POST-TEST, UPDATED PROCEDURES
12	POST-TEST REPORT
13	
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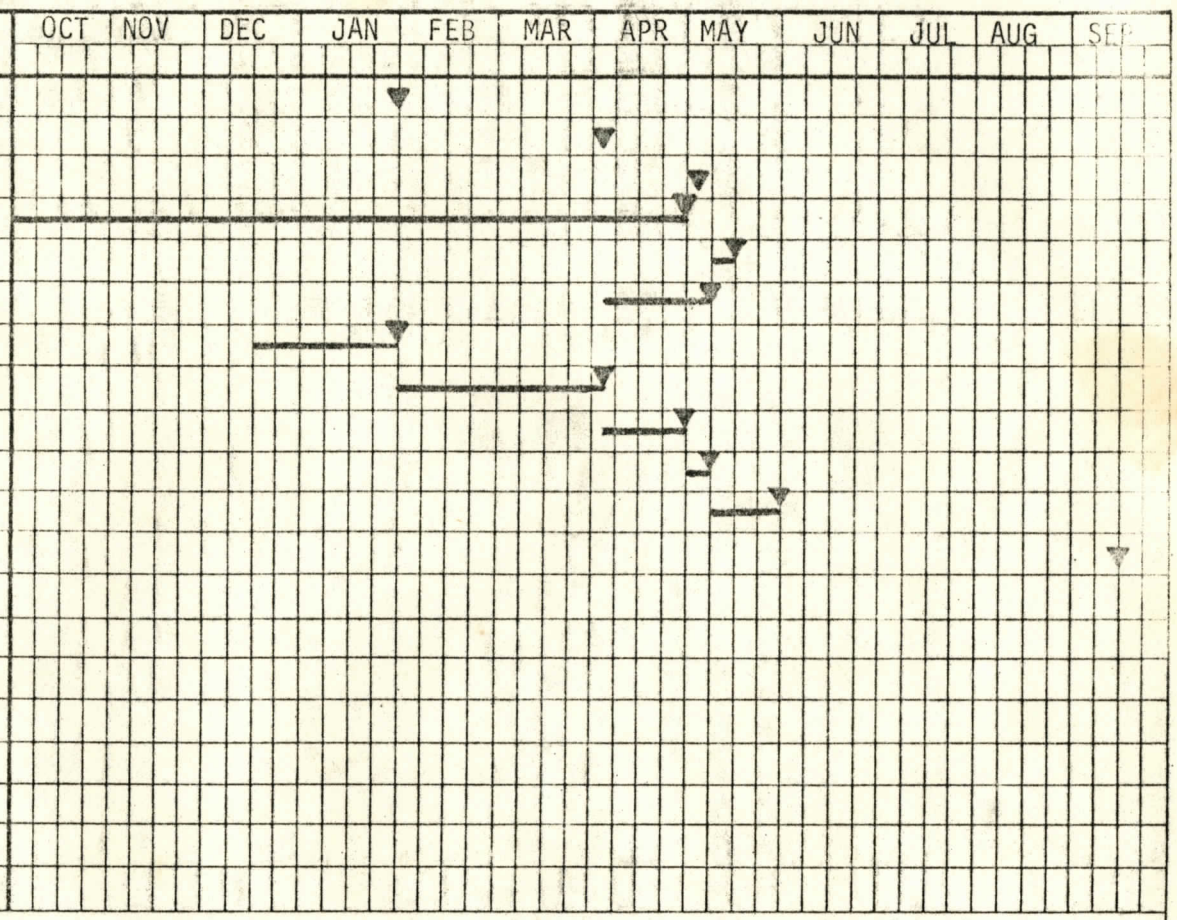

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