

NASA CR
147702

FINAL REPORT
FOR
SPACELAB COST REDUCTION ALTERNATIVES STUDY

CREW TRAINING TASK ANALYSIS
VOLUME III

NAS 9-14484
EXHIBIT B

1 DECEMBER 1975

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Lyndon B. Johnson Space Center
Houston, Texas

Prepared by
TRW SYSTEMS GROUP
One Space Park
Redondo Beach, California

(NASA-CR-147702) SPACELAB COST REDUCTION ALTERNATIVES STUDY. VOLUME 3: CREW TRAINING TASK ANALYSIS Final Report (TRW Systems Group) 100 p HC \$5.00 CSCI 22B N76-24317 Unclas 41805 G3/15



FINAL REPORT
FOR
SPACELAB COST REDUCTION ALTERNATIVES STUDY

CREW TRAINING TASK ANALYSIS
VOLUME III

NAS 9-14484
EXHIBIT B

1 DECEMBER 1975

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Lyndon B. Johnson Space Center
Houston, Texas

Prepared by
TRW SYSTEMS GROUP
One Space Park
Redondo Beach, California

Approved: _____

R. L. Morris

R. L. Morris
Study Manager
TRW Systems
(213) 535-0477

Approved: _____

C. R. Hicks, Jr.

C. R. Hicks, Jr.
Contracting Officer Representative
Flight Control Division
(713) 483-4555

FOREWARD

This document represents one part of the Final Report for the Spacelab Cost Reduction Alternatives Study, prepared by TRW Systems under Contract NAS9-14484/Exhibit B with NASA, Lyndon B. Johnson Space Center. The complete list of documents which make up the Final Report is as follows:

- Volume I - Executive Summary
- Volume II - Final Briefing
- Volume III - Crew Training Task Analysis

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 APPROACH	1
3.0 TRAINING ANALYSIS DOCUMENTATION	9
Top Flow Diagrams	
On Orbit Spacelab Operations (Module or Module-Pallet Missions)	10
On Orbit Spacelab Operations (Pallet Missions)	10
Second Level Flow Diagrams and Training Analysis Worksheets	
<u>Function</u>	
3.1 Activate Spacelab Subsystems From Orbiter	11
3.2 Verify Spacelab Subsystems Status From Orbiter	20
3.3 Operate Spacelab Subsystems From Orbiter	22
3.4 Perform Initial Ingress of Module	39
3.5 Verify Spacelab Subsystems Status From Module	41
3.6 Operate Spacelab Subsystems From Module	44
3.7 Perform In-Flight Maintenance on Spacelab Subsystem Equipment	47
3.8 Prepare Spacelab for Return	50
3.9 Perform Final Egress From Module	55
3.10 Shutdown Spacelab Subsystems From Orbiter	57
3.11 Perform Off-Duty Activities	59
3.12 Verify Experiment Status From Orbiter	63
3.13 Activate Experiment From Orbiter	66
3.14 Conduct Experiment Operations From Orbiter	69
3.15 Perform Follow-On Ingress of Module	72
3.16 Verify Experiment Status From Module	73
3.17 Conduct Experiment Operations From Module	77
3.18 Perform In-Flight Maintenance on Experiment Equipment	81
3.19 Deactivate Experiment	82
3.20 Shutdown Experiment	85

TABLE OF CONTENTS (Continued)

	<u>Page</u>
3.22 Egress Module	88
3.23 Perform Personal Activities for Deboost/ Reentry	90
3.24 Activate Experiment From Module	92
3.25 Activate Spacelab Subsystems From Module	94

1.0 INTRODUCTION

The purpose of this document is to provide the detailed data generated during the flight crew task analysis effort. It also describes the methods used to:

- Identify the Spacelab functions performed by the flight crew during the on-orbit phase of flight
- Analyze the functions to determine the tasks that must be performed to operate the Spacelab subsystems to support payload operations.

The analyses were based upon the May 1975 issue of the Spacelab Accommodation Handbook, Design Reference Mission data provided by the NASA as the Spacelab Baseline Program Plan and Remote Control Concept ECP.

2.0 APPROACH

The on-orbit phase of flight was analyzed to identify the functions that had to be performed to meet flight objectives. The functions identified were combined into a top-level functional flow diagram (3.0 On-Orbit Operations). Each function, in turn, was analyzed to determine the major activities necessary to perform the function. The activities and activity sequences were presented in second level functional flow diagrams. Each major activity was further analyzed to define the operator tasks that are performed to accomplish that activity.

Training Analysis Worksheets were used to document the analysis of each function down to the task level and provide training requirements data for each task.

2.1 Top Level Functional Flow Diagrams

The functional flow diagram, 3.0 On-Orbit Operations, presents the sequence of functions performed by the crew to operate the Spacelab systems during the on-orbit phase of a flight. The flow diagram has been assigned an arbitrary number of 3.0, which is indicative of the fact that it is but one of several flight phases (e.g., launch, ascent, on-orbit, descent, landing). Two flow diagrams are presented to accommodate either module and pallet missions or pallet-only missions. The diagrams can be expanded to include the flight crew functions associated with Shuttle vehicle systems operation.

The flow diagram (Module or Module-Pallet) provides a baseline function numbering system and flow sequence which is employed to describe any Spacelab configuration and experiment payload combination. Each Design Reference Mission (DRM) analyzed for this study and its top-flow diagram will be keyed to this baseline and use the same number for identical functions. In this way, the same functions performed for different missions are readily identified and the analytic data developed from the initial analysis can be referenced in any subsequent analysis. The AMPS mission was used as the baseline for this study.

2.1.1 Function Description

A brief description of each function is provided in Table 1.

2.2 Second Level Functional Flow Diagrams

Preparatory to performing the task analyses, each function was analyzed to determine the major activities and activity sequence essential to performance of that function. A second level flow diagram was prepared for each function to present the major activities, illustrate the activity sequence and identify the input and output functions related to the particular function being presented. The second level flow diagram differentiates between experiment and experiment/Spacelab equipment interface activities. Experiment activities are illustrated by use of dash-outlines which indicate that the analyses of the activities are not performed by TRW but are referenced to MSFC task analyses on the Training Analysis Worksheets.

2.3 Training Analysis Worksheet

Training Analysis Worksheets are prepared for each function to document the analysis performed on each major activity to define the operator tasks required to accomplish the activity. The training requirements data provided for each task includes:

- Equipment used to accomplish task, its location and type
- Allocation of task to crew member(s)
- Time criticality and sequence dependency information
- Type of skill and level of difficulty
- Level of knowledge required
- Criticality to flight objectives and crew and vehicle safety
- Training equipment required.

Table 1. On-Orbit Operations Functions

FUNCTION NUMBER AND TITLE	DESCRIPTION
3.1 ACTIVATE SPACELAB SUBSYSTEMS FROM ORBITER	ACTIVITIES ASSOCIATED WITH EITHER THE INITIAL APPLICATION OF POWER AND EQUIPMENT CHECKOUT AND CALIBRATION OF SPACELAB SUBSYSTEMS FROM THE ORBITER WORKSTATION OR REACTIVATION OF SUBSYSTEMS FOLLOWING A MAINTENANCE ACTION.
3.2 VERIFY SPACELAB SUBSYSTEMS STATUS FROM ORBITER	AFTER ASCENT, INSPECT EQUIPMENT FOR DAMAGE, REMOVE AND STOW LAUNCH RESTRAINTS AND, IF APPLICABLE, VERIFY STATUS OF SUBSYSTEMS ACTIVATED PRIOR TO LAUNCH. DURING ON-ORBIT OPERATIONS AT FLIGHT DECK WORKSTATION, COMPARE SPACELAB SUBSYSTEMS PARAMETERS AND OPERATING CONDITIONS FOR CONFORMANCE WITH REQUIREMENTS FOR CURRENT PHASE OF THE FLIGHT.
3.3 OPERATE SPACELAB SUBSYSTEMS FROM ORBITER	MONITOR AND CONTROL SPACELAB SUBSYSTEMS OPERATION FROM ORBITER WORKSTATION TO MAINTAIN OR CHANGE PERFORMANCE IN RESPONSE TO FLIGHT REQUIREMENTS OR CAUTION AND WARNING DEMANDS.
3.4 PERFORM INITIAL INGRESS OF MODULE	ACTIVITIES REQUIRED FOR INITIAL TRANSITION FROM THE ORBITER MID-DECK TO THE MODULE.
3.5 VERIFY SPACELAB SUBSYSTEMS STATUS FROM MODULE	AFTER INITIAL INGRESS, INSPECT EQUIPMENT FOR DAMAGE, REMOVE AND STOW LAUNCH RESTRAINTS AND, IF APPLICABLE, VERIFY STATUS OF SUBSYSTEMS ACTIVATED PRIOR TO LAUNCH. SUBSEQUENTLY, COMPARE SPACELAB SUBSYSTEM PARAMETERS AND OPERATING CONDITIONS FOR CONFORMANCE WITH REQUIREMENTS FOR THE CURRENT PHASE OF THE FLIGHT.
3.6 OPERATE SPACELAB SUBSYSTEMS FROM MODULE	MONITOR AND CONTROL SPACELAB SUBSYSTEMS FROM MODULE WORKSTATION TO MAINTAIN OR CHANGE PERFORMANCE IN RESPONSE TO FLIGHT REQUIREMENTS OR CAUTION AND WARNING DEMANDS.
3.7 PERFORM IN-FLIGHT MAINTENANCE ON SPACELAB SUBSYSTEM EQUIPMENT	ACTIVITIES ASSOCIATED WITH THE SERVICING OR REPAIR OF SPACELAB SUBSYSTEM EQUIPMENT.
3.8 PREPARE SPACELAB FOR RETURN	ACTIVITIES REQUIRED TO SECURE SPACELAB EQUIPMENT AND ATTAIN THERMAL STABILITY PRIOR TO DEBOOST AND REENTRY.
3.9 PERFORM FINAL EGRESS FROM MODULE	ACTIVITIES REQUIRED FOR FINAL TRANSITION FROM THE SPACELAB TO THE ORBITER MID-DECK.
3.10 SHUTDOWN SPACELAB SUBSYSTEMS FROM ORBITER	ACTIVITIES ASSOCIATED WITH SHUTTING DOWN THE SPACELAB SUBSYSTEMS NOT FUNCTIONALLY REQUIRED DURING DEBOOST/REENTRY.
3.11 PERFORM OFF-DUTY ACTIVITIES	COVERS GENERAL HABITABILITY AND SAFETY ACTIVITIES PERFORMED IN ORBITER WHICH ARE NOT PART OF THE NOMINAL SPACELAB OR EXPERIMENT OPERATIONS.
3.12 VERIFY EXPERIMENT STATUS FROM ORBITER	AFTER ASCENT, INSPECT EXPERIMENT EQUIPMENT FOR DAMAGE AND REMOVE AND STOW LAUNCH RESTRAINTS. DURING ON-ORBIT OPERATIONS AT ORBITER WORKSTATION, COMPARE EXPERIMENT CONDITIONS/PARAMETER VALUES FOR CONFORMANCE WITH REQUIREMENTS FOR THE CURRENT PHASE OF THE FLIGHT.
3.13 ACTIVATE EXPERIMENT FROM ORBITER	ACTIVITIES AT ORBITER WORKSTATION ASSOCIATED WITH EQUIPMENT OPERATIONS REQUIRED TO PERFORM EXPERIMENTS CONFIGURED FOR CDS CONTROL. ACTIVITIES INCLUDE INITIAL EQUIPMENT SET-UP/ORIENTATION, APPLICATION OF POWER, EQUIPMENT CHECKOUT AND CALIBRATION.
3.14 CONDUCT EXPERIMENT OPERATIONS FROM ORBITER	INCLUDES ACTIVITIES AT ORBITER WORKSTATION REQUIRED TO PERFORM EXPERIMENTS FOLLOWING INITIAL ACTIVATION OF EXPERIMENT-RELATED EQUIPMENTS.
3.15 PERFORM FOLLOW-ON INGRESS OF MODULE	ACTIVITIES RELATED TO PERSONNEL MOVEMENT FROM ORBITER TO MODULE AFTER INITIAL INGRESS. ASSUMES AS SOP, THE HATCHES REMAIN OPEN THROUGHOUT ON-ORBIT OPERATIONS.
3.16 VERIFY EXPERIMENT STATUS FROM THE MODULE	AFTER ASCENT, INSPECT EXPERIMENT EQUIPMENT FOR DAMAGE AND REMOVE AND STOW LAUNCH RESTRAINTS. DURING ON-ORBIT OPERATIONS, COMPARE EXPERIMENT CONDITIONS/PARAMETER VALUES AT MODULE WORKSTATION FOR CONFORMANCE WITH REQUIREMENTS FOR THE CURRENT PHASE OF THE FLIGHT.
3.17 CONDUCT EXPERIMENT OPERATIONS FROM MODULE	INCLUDES ACTIVITIES IN MODULE REQUIRED TO PERFORM EXPERIMENTS FOLLOWING INITIAL ACTIVATION OF EXPERIMENT-RELATED EQUIPMENTS.
3.18 PERFORM IN-FLIGHT MAINTENANCE ON EXPERIMENT EQUIPMENT	ACTIVITIES RELATED TO THE SERVICING AND REPAIR OF EXPERIMENT EQUIPMENT.
3.19 DEACTIVATE EXPERIMENT	INCLUDES ACTIVITIES REQUIRED TO DEACTIVATE AN EXPERIMENT UPON COMPLETION OF A CYCLE OF OPERATION OR DEACTIVATION OF EQUIPMENT PRIOR TO UNSCHEDULED MAINTENANCE ACTIVITY.
3.20 SHUTDOWN EXPERIMENT	ACTIVITIES RELATED TO REMOVING POWER FROM EXPERIMENT EQUIPMENT, RETRIEVING DEPLOYED UNITS AND SECURING EQUIPMENT FOR DEBOOST/REENTRY.
3.22 EGRESS MODULE	ACTIVITIES RELATED TO PERSONNEL MOVEMENT FROM MODULE TO ORBITER. ASSUMES, AS SOP, HATCHES REMAIN OPEN THROUGHOUT ON-ORBIT OPERATIONS.
3.23 PERFORM PERSONAL ACTIVITIES FOR DEBOOST/REENTRY	INCLUDES DRESSING BIOMED SENSORS AND PRESSURE GARMENT ASSEMBLY AND ACTIVITIES RELATED TO OCCUPYING SEATS IN PREPARATION FOR DEBOOST/REENTRY.
3.24 ACTIVATE EXPERIMENT FROM MODULE	ACTIVITIES IN MODULE ASSOCIATED WITH EQUIPMENT OPERATIONS REQUIRED TO PERFORM EACH SET OF EXPERIMENTS. ACTIVITIES INCLUDE INITIAL EQUIPMENT SET-UP/ORIENTATION, APPLICATION OF POWER, EQUIPMENT CHECKOUT AND CALIBRATION.
3.25 ACTIVATE SPACELAB SUBSYSTEMS FROM MODULE	ACTIVITIES ASSOCIATED WITH COMPLETING THE SET-UP OF SPACELAB SUBSYSTEMS FROM THE MODULE WORKSTATION, WHICH WERE NOT TOTALLY ACTIVATED OR WERE PARTIALLY SHUTDOWN FOR MAINTENANCE ACTION.

ORIGINAL PAGE IS
OF POOR QUALITY

2.3.1 Data Entry Codes

All entries on the Training Analysis Worksheet are self-explanatory with the exception of the following coded items:

Equipment Type

- SLMI - Spacelab Mission Independent
- SLMD - Spacelab Mission Dependent
- OMI - Orbiter Mission Independent.

Task Allocation

- C - Commander
- P - Pilot
- MS - Mission Specialist
- PS - Payload Specialist.

Criticality

- 1) Of no direct consequence to achieving flight objectives.
- 2) Small consequence to achieving flight objectives.
- 3) Would degrade flight objectives
- 4) Probable serious consequence and may result in aborted flight.
- 5) Results in aborted flight, but not result in loss of crew or vehicle.
- 6) Results in aborted flight with probable loss of crew and vehicle.

Skill/Knowledge Difficulties Level Definitions

Knowledge

low (k) Task performance requires an understanding of basic engineering or scientific principles involved in order to comprehend and interpret the function and operation of the specific equipment in the context of the operational conditions. Minimal experience in the application of these principles to equipment operation is required to gain the requisite operation or maintenance proficiency.

medium (K) Task performance requires applications experience and knowledge of the theory and principles of the engineering or scientific disciplines involved in order to comprehend and interpret the function and operation of the specific equipment in the context of the operational situation. Repetitive experience in task performance is required to gain the required operation or maintenance proficiency.

high (\bar{K}) Task performance requires detailed and highly specialized knowledge and experience in the engineering or scientific disciplines involved in order to comprehend and interpret the function and operation of the specific equipment in the context of the operational situation. Repetitive experience in task performance is required only to familiarize the operator with the specifics of the equipment's operation or maintenance proficiency.

Skills (Perceptual/Motor)

low (p) (m) Task performance requires application of normal motor/perceptual skills which are relatively unaffected by the environment. Skill proficiency is gained as a normal consequence of task performance on the specific equipment.

medium (P) (M) Task performance or the operational environment requires that normal motor/perceptual skills be modified or enhanced. Repetitive training on the specific equipment in the environment is required to develop the desired proficiency.

high (\bar{P}) (\bar{M}) Task performance on the specific equipment requires unfamiliar or unnatural coordination of normal or modified skills, or the environment produces an unnatural or unfamiliar sensory stimulus, or the task requires extreme preciseness in skill performance. Realistic, repetitive application training is required to develop and maintain proficiency.

Time Criticality Definition

low (t) Task performance is neither time nor sequence dependent or time critical.

medium (T) Task performance is time and/or sequence dependent but not time critical.

high (\bar{T}) Task performance is time and/or sequence dependent and time critical.

Sequence
Dependent: Task operation must be performed in a specific sequence.

Time
Dependent: Task operation must be performed within a specified, adequate period of time.

Time
Critical: Task operation must be performed within a limited time period.

2.3.2 Training Equipment Definitions

2.3.2.1 Mockup

General Description

Physical Fidelity: Dimensionally and geometrically accurate representation of equipment and/or facility. Visual fidelity is not required.

May use static or animated overlays to exhibit operational configurations of controls and displays.

Functional Fidelity: Minimal, usually limited to mechanical equipment.

Types

System: Complete physical structure. May be of exterior shell and/or interior configuration.

Partial: A specific area and/or one or more work stations within the total structure.

Hi-Fidelity: Physical and visual fidelity required throughout. May include exterior as well as interior. Simple display and control devices may be functional.

Training Uses

Habitability, layout familiarization, stowage, restraint use, EVA/IVA path familiarization, safety procedures development.

2.3.2.2 Trainer

General Description

Physical Fidelity: Dimensionally and geometrically accurate representation of the equipment and its confines. Specific areas may have visual fidelity dependent upon training requirements.

Functional Fidelity: Mechanically and electronically emulates the operational control, display and response characteristics of the equipment to the extent that non-complex procedural skills and operating sequences can be developed and transferred to the operational situation.

May be electrically or manually controlled to modify visual indications of system, subsystem, assembly or component performance. Microprocessors may be employed for control of some functions. Alphanumeric, graphic and vector display overlays may be used or non-interactive video display presentation capability may be provided.

Types

Whole-Task: Complete physical structure. May be of exterior and/or interior configuration.

Part-Task: A work station or specific group of related work stations. Surrounds may be deleted.

Training Uses

Procedural task practice and malfunction analysis on non-complex, dynamically slow and minimally interactive operating functions.

2.3.2.3 Simulator

General Description

Physical Fidelity: Dimensionally, geometrically and visually accurate representation of the equipment and its confines.

Functional Fidelity: Accurately emulates the operational control, display and response characteristics of the actual equipment and, if required, the perceptual environment.

Equipment performance usually controlled by computer and/or direct manual or electrical intervention by an operator.

Types

Whole-Task: Complete reproduction of all equipment, operations and phenomena likely to occur in actual performance.

Part-Task: Complete reproduction of the phenomena and operations likely to occur in actual operations for a specific and interrelated group of equipments.

Training Uses

Procedural task practice and malfunction analysis of complex, interactive, rapidly dynamic and time critical operations.

2.3.3 Training Equipment Selection Criteria

The following criteria were used to select the types of training equipment necessary for training of Spacelab flight crew. Selection of a specific type of equipment is dependent upon the level, type and complexity of the skills and knowledge required to perform the job operation.

2.3.3.1 Mockups Selection Criteria

Mockups are most applicable for developing:

- familiarization with the general layout and configuration of the equipment and/or facility
- mechanical skills associated with such activities as unit removal/replacement actions, stowage provisions and techniques, ingress/egress and translation paths, habitability and safety, etc.

2.3.3.2 Trainer Selection Criteria

Part task and whole task (system) trainers are most suitable for imparting the skills and knowledge necessary to perform operations which are:

procedural in nature, require the application of perceptual and motor skills and knowledge in combination to accomplish job operations

AND EITHER

involve tasks that follow a logical cause and effect relationship and necessitate analysis, synthesis or interpretation of data in order to perform the next operation

OR

require a series of coordinated, procedural type, interactions with other operators.

2.3.3.3 Simulator Selection Criteria

Simulator type training devices are most applicable for imparting the requisite skills and knowledge necessary to perform operations which are:

complex and require moderate to high perceptual and motor skills and/or knowledge in combination to accomplish the task(s),

AND EITHER

require a series of dynamic coordinated interactions with other operators,

OR

involve a series of dynamic manned interactions between two or more system elements necessitating the analysis, synthesis or interpretation of data derived from multiple sources in order to perform the next operation,

OR

require interaction with equipment whose display, control or response functions cannot be satisfactorily replicated or are too costly to replicate without recourse to computer technology and/or actual equipment.

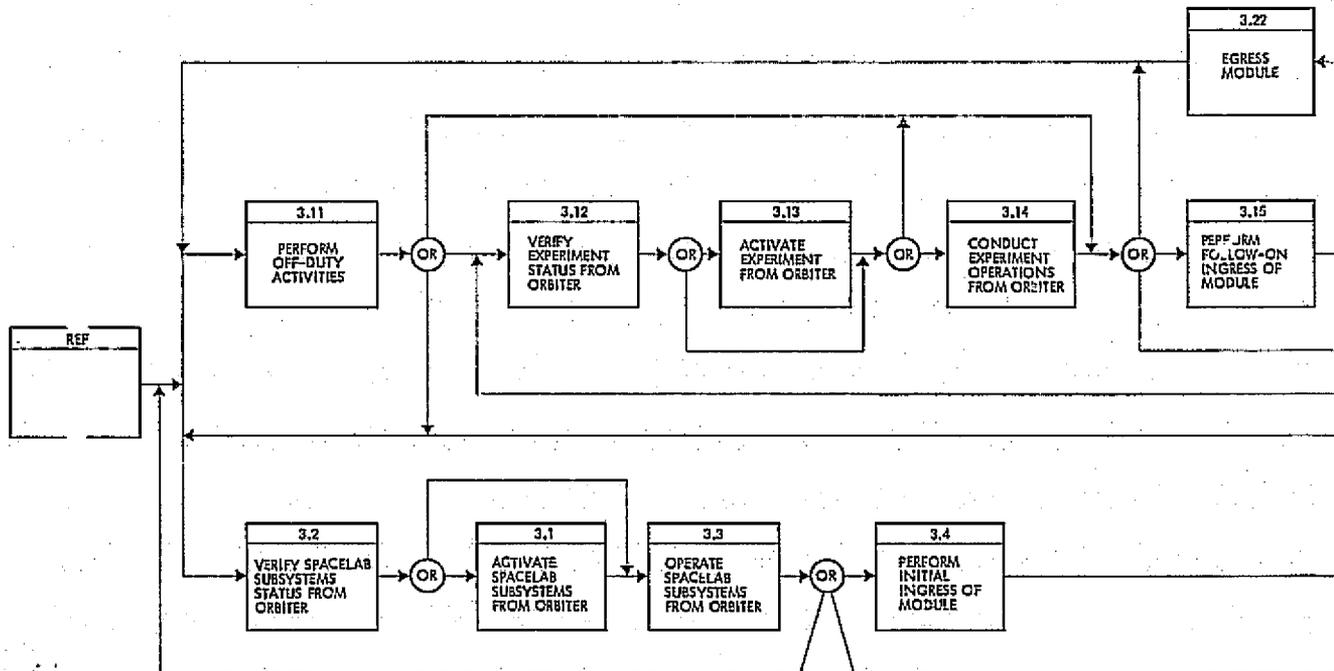
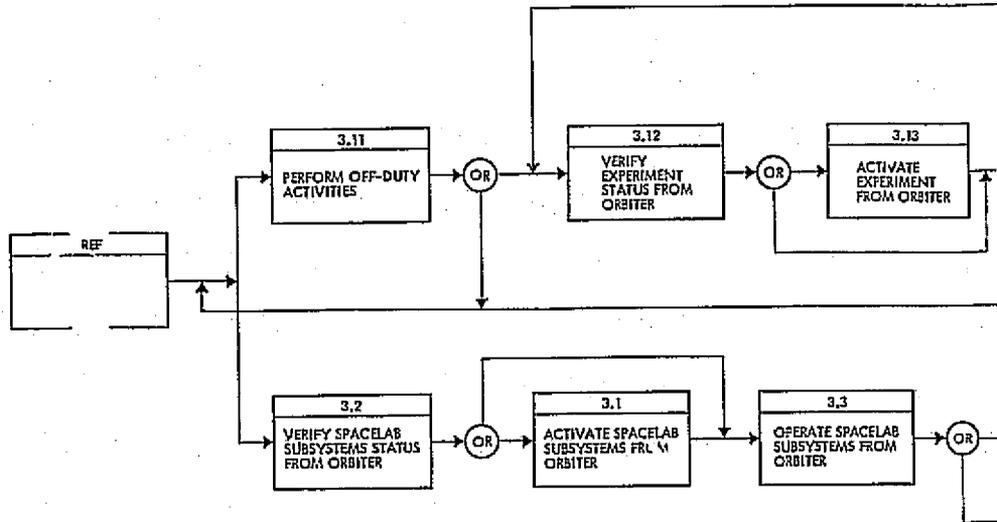
A simulator may be of part task or whole task design, dependent upon the number of job operations and work stations which meet the above criteria.

System training devices may be part simulator, part trainer and part mockup.

3.0 TRAINING ANALYSIS DOCUMENTATION

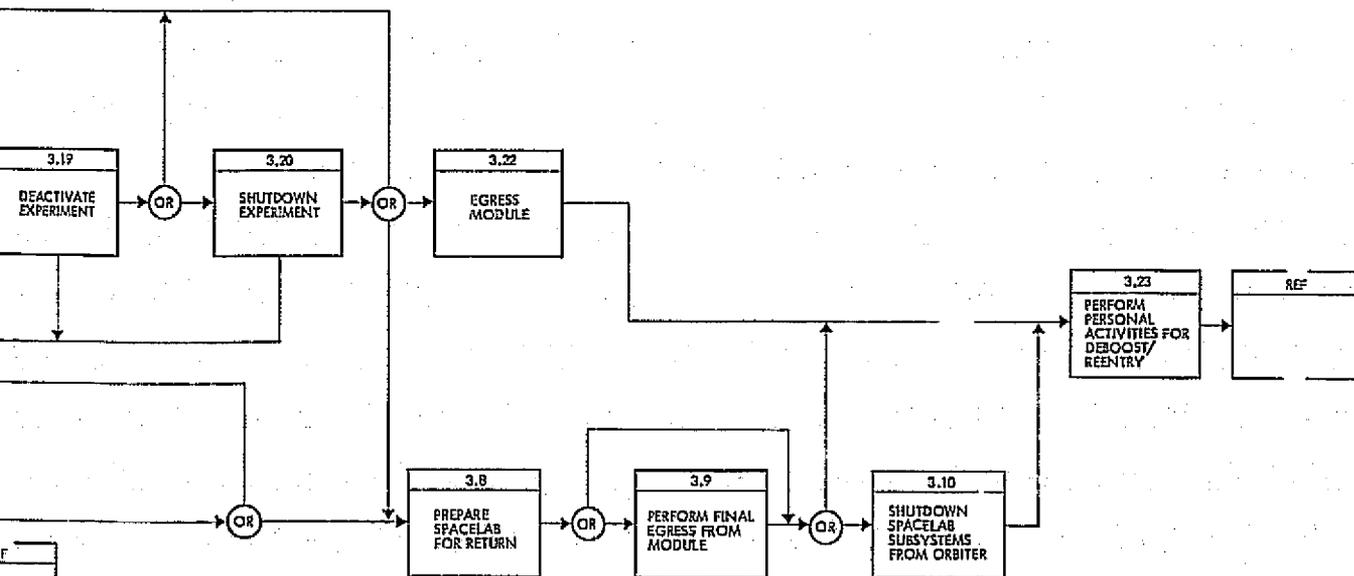
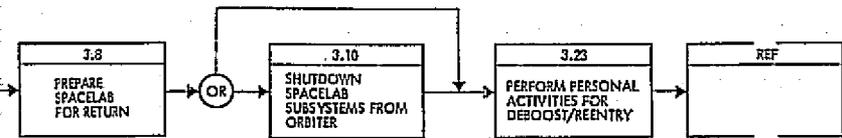
The detailed data is presented in the following sequence:

- 1) Top Level Functional Flow Diagrams for:
 - Module or Module-Pallet Missions
 - Pallet Missions.
- 2) Second Level Flow Diagram and Associated Training Analysis Worksheets for each function in numerical sequence.



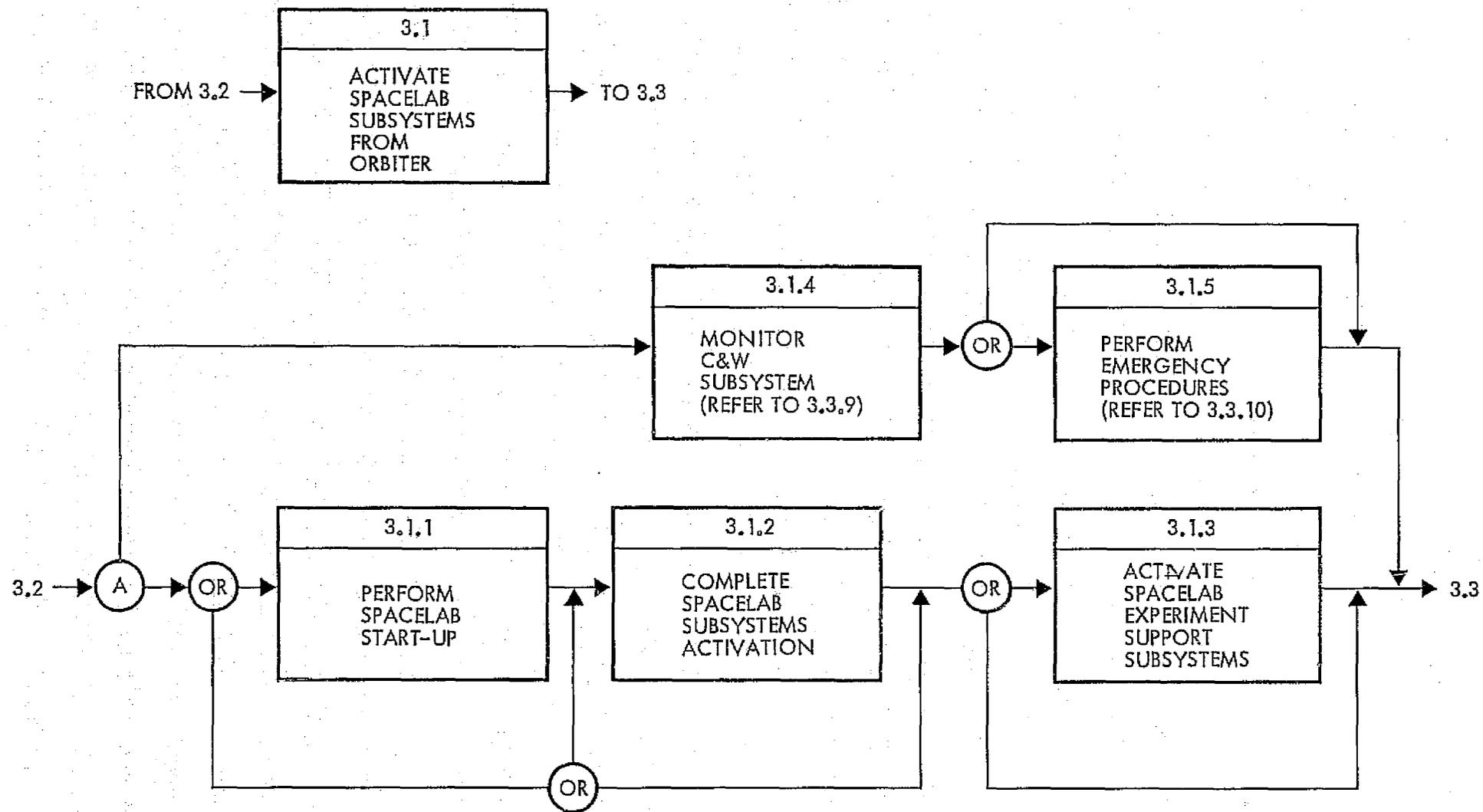
ORIGINAL PAGE IS
OF POOR QUALITY

FOLDOUT FRAME



3.0 On-Orbit Operations

WORLDWIDE FRAME 60



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM — 3.1 ACTIVATE SPACELAB SUBSYSTEMS FROM ORBITER

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING ANALYSIS WORK SHEET	MISSION	AMPS	Function Description: Activities associated with either the initial application of power and equipment checkout and calibration of Spacelab subsystems from the Orbiter work station or reactivation of subsystems following a maintenance action.
	FUNCTION	3.1 Activate Spacelab Subsystems from Orbiter	

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME RECD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1	Activate Spacelab subsystems from Orbiter	<p>Note 1. In order to accommodate pre-launch checkout of the Spacelab and its payload and enable activation and operation of Spacelab subsystems and certain payload elements throughout the prelaunch to on-orbit period, the capability exists for remote control of these subsystems through the Orbiter Data Processing and Software Subsystem.</p> <p>Note 2. This analysis assumes that the AMPS payload (except for ground checkout purposes) does not require the Spacelab or experiment subsystems to be active prior to the on-orbit phase of the mission.</p>								
3.1.1	Perform Spacelab start-up	Operate Orbiter Data Processing and Software subsystem keyboard to initiate start-up routine.	DP&S keyboard and CRT	Flight Deck Work Station	OMI	C,P	t	pmk or (pmk for sequence of step by step backup)	2	Part Task Trainer (PTT) AFD, MDM Sim

TRAINING ANALYSIS WORK SHEET		MISSION FUNCTION	PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS							
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.1	Continued	<p>Note 3. Assume programmed routine of sequenced commands through Orbiter GPU/MDM interface with Spacelab.</p> <p>Note 4. Although the MDM activation command sequence is assumed to be preprogrammed, the sequence can be performed on a step-by-step basis by individual command code input to the keyboard or through back-up switches on the aft flight deck control panel.</p> <p>The sequence of MDM commands will:</p> <p>a. Connect Orbiter source power to Spacelab DC main bus input to the Power Control Box (PCB) for direct distribution to the SS Power Distribution Box (PDB) and Emergency Box (EB).</p> <p>From the EB the power is directly distributed to the:</p> <ul style="list-style-type: none"> - Spacelab control panels - Caution and warning panel - Emergency lights in module - Total pressure cabin sensors 								

TRAINING
ANALYSIS
WORK SHEET

 MISSION AMPS
 FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.1	(Continued)	<ul style="list-style-type: none"> - Fire and smoke detector assembly - CDMS emergency power supply - Depressurization valve RCCB switch contact <p>In the PDB, the DC power is distributed to normally closed circuit breaker contacts for secondary distribution.</p> <p>Within the PCB the power is distributed to normally open circuit breaker contacts to the inverters, experiment DC bus and control panels.</p> <ul style="list-style-type: none"> b. Connect SS inverter to DC power. 115v-3φ 400 Hz power distributed to normally closed RCCB contacts in PDB. c. Close RCCB's in PDB for (reclose following power overload or shut-down or reset if inadvertent open resulting from launch.) secondary distribution of dc power. <ul style="list-style-type: none"> - ECS DC lines 1 and 2 - ASCS instrumentation bus 	MDM (Backup switches	Flight Deck (AFD)	SLMI	C,P	t	pmk	2	PTT-AFD, MDM Sim
			MDM (Backup switch all SS PDB RCCB's)	Flight Deck (AFD)	SLMI	C,P	t	pmk	2	PTT-AFD, MDM Sim

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.1	(Continued)	<ul style="list-style-type: none"> - CDMS DC lines 1, 2, 3 - Signal conditioning circuit - IPS - CPSE <p>Secondary distribution of AC to:</p> <ul style="list-style-type: none"> - CDMS AC line - ECS AC lines 1, 2, 3 - Direct connected CDMS elements - Energize avionics fan <p>d. Activate SS CDMS components as required to prepare computer for operation.</p> <p>e. Activate SS computer</p> <p>f. Activate the SS RAU's</p>	MDM (Backup switch)	Flight Deck (AFD)	OMI (SLMI)	C,P	t	pmk	2	PTT-AFD, MDM Sim
			MDM	Flight Deck	OMI	C,P	t	pmk	2	PTT-AFD, MDM Sim
			MDM (Backup switch)	Flight Deck (AFD)	OMI	C,P	t	pmk	2	PTT-AFD, MDM Sim
3.1.2	Complete Spacelab Subsystem Activation	<p>Operate CDMS keyboard to initiate activation routine.</p> <ul style="list-style-type: none"> - AFD keyboard and CRT to ON - Enter start command 	CDMS Keyboard and CRT	AFD	SLMI	C,P, MS	t	pmk or (pm K for seq of step by step backup)	2	PTT-AFD, PT Sim CDMS

**TRAINING
ANALYSIS
WORK SHEET**
MISSION AMPS
FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.2	(Continued)	<p>Note 5. The following CDMS command functions may be performed through either the AFD CDMS keyboard/CRT or Orbiter Data Processing and Software Subsystem Keyboard/CRT work stations via MDM interface with the Spacelab SS computer I/O.</p> <p>Note 6. Assume preprogrammed routine for sequenced commands to complete activation of Spacelab subsystems.</p> <p>Note 7. Although the CDMS activation command sequence is assumed to be preprogrammed, the sequence can be accomplished on a step-by-step basis by individual command code input to the keyboard or through backup switches in the AFD control panel.</p> <p>The sequence of commands will:</p> <p>a. Energize cabin fan</p> <p>b. Energize water pump and water loop heaters OFF</p> <p>c. Energize Master O₂ solenoid valve</p>	SS CDMS Keyboard and CRT (Backup switches) (Backup switch) (Safing MDM)	AFD (AFD) (AFD) (Orbiter)	SLNI ↓ ↓	C,P MS ↓ ↓	t ↓ ↓	pmk ↓ ↓	2 ↓ ↓	PTT-AFD, PT Sim CDMS, MDM Sim ↓ ↓

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.2	(Continued)	d. Energize Master N ₂ solenoid valve	(Safing MDM)	(Orbiter)	SLMI	C, P MS	t	pmk	2	PTT-AFD, MDM Sim
		e. Activate O ₂ and N ₂ sensors, controllers and solenoid valves.								
		f. Energize ECLS AC powered sensor and controllers	(Backup switch)	(AFD)						
3.1.3	Activate Spacelab Experiment Support Subsystems	a. Operate SS CDMS keyboard to activate experiment CDMS components for experiment computer operation.	SS-CDMS Keyboard and CRT (Backup switch)	AFD (AFD)						PTT-AFD, PT sim CDMS, MDM Sim
		b. Activate experiment computer	SS-CDMS Keyboard and CRT	AFD						
		c. Activate experiment RAU's	SS-CDMS Keyboard and CRT (Backup switch)	AFD (AFD)						
		d. Connect experiment DC bus to main DC power for distribution to Experiment Distribution Boxes (EDB).	SS-CDMS Keyboard and CRT (Backup switch) (MDM)	AFD (AFD) (Flight Deck)						

TRAINING
ANALYSIS
WORK SHEET

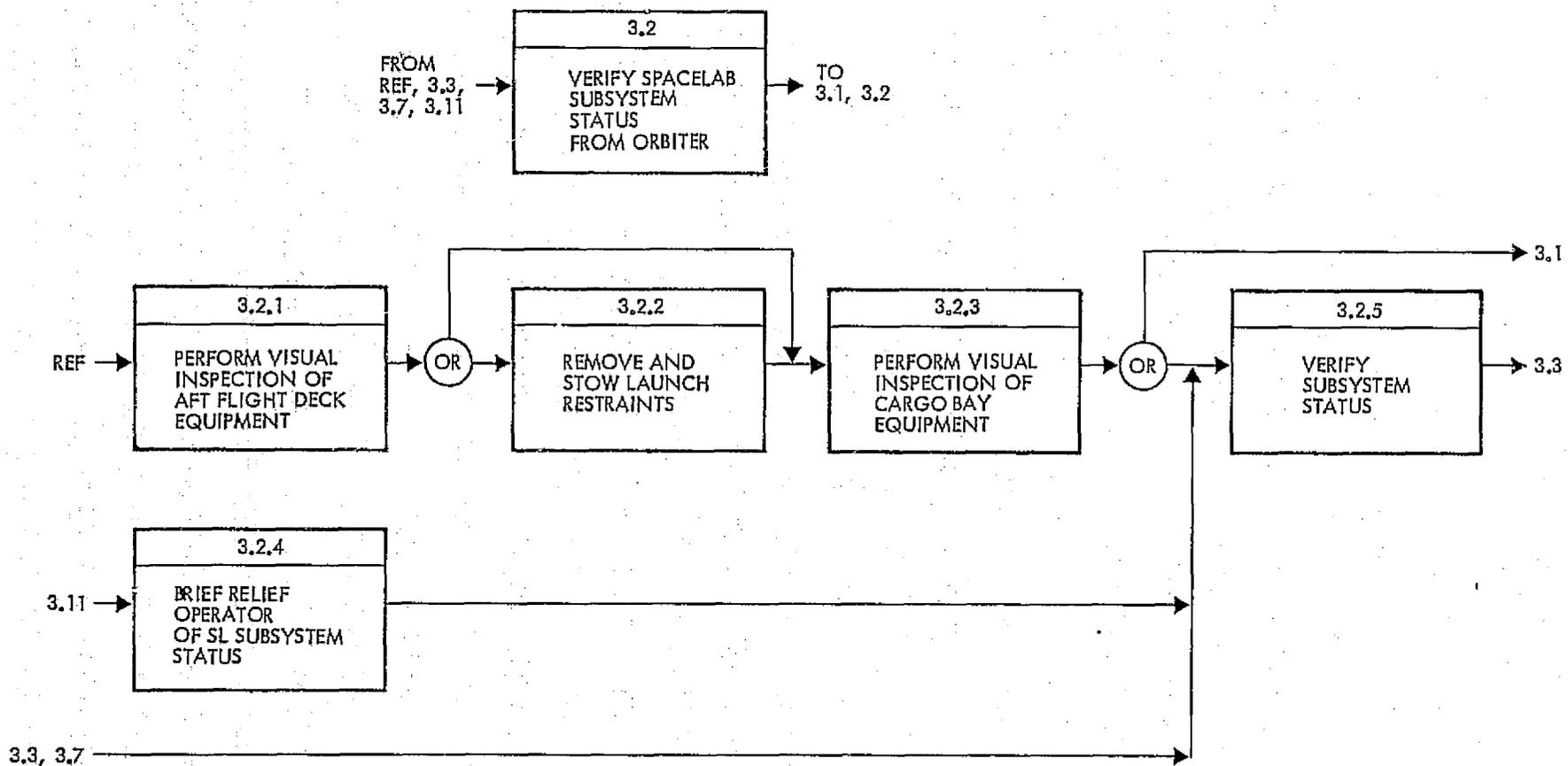
MISSION AMPS
FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOW-LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.3	(Continued)	e. Connect experiment inverter to DC power. 115v 3ø 400 Hz power distributed to EDB's.	SS-CDMS Keyboard and CRT (Backup switch) (MDM)	AFD (AFD) (Flight Deck)	SLMI	C,P MS	t	pmk	2	PTT-AFD, PT Sim CDMS, MDM Sim
		f. Distribute experiment DC and AC power to experiment switching panels.	SS-CDMS (Backup switch)	AFD (AFD)						
		g. Activate video monitor	SS-CDMS	AFD						
		h. Activate IPS by input of commands to IPS through keyboard and monitor video to	SS CDMS Keyboard and CRT, video monitor	AFD						Part Task Simulator CDMS and IPS Visual Field
		- Deployed Mode								
		• deploy platform					T	pmk	2	
		• calibrate IPS against Orbiter IMU using IPS reference star or sun						PmK	3	
		• establish IPS sensor biases and store in SS computer						pmK	3	

TRAINING
ANALYSIS
WORK SHEET

 MISSION AMPS
 FUNCTION 3.1 Activate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.1.3	(Continued)	- Stowed Mode <ul style="list-style-type: none"> • calibrate IPS against Orbiter IMU using strapdown star sensor • establish IPS sensor biases and store in SS computer 	SS CDMS Keyboard and CRT, video monitor ↓ ↓	AFD ↓ ↓	SLMI ↓ ↓	C,P MS ↓ ↓	 T T	 PmK pmK	 3 3	Part Task Simulator CDMS and IPS Visual Field
3.1.4	Monitor C&W Subsystem	Reference 3.3.9								
3.1.5	Perform Emergency Procedures	Reference 3.3.10.								



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM -- 3.2 VERIFY SPACELAB SUBSYSTEM STATUS FROM ORBITER

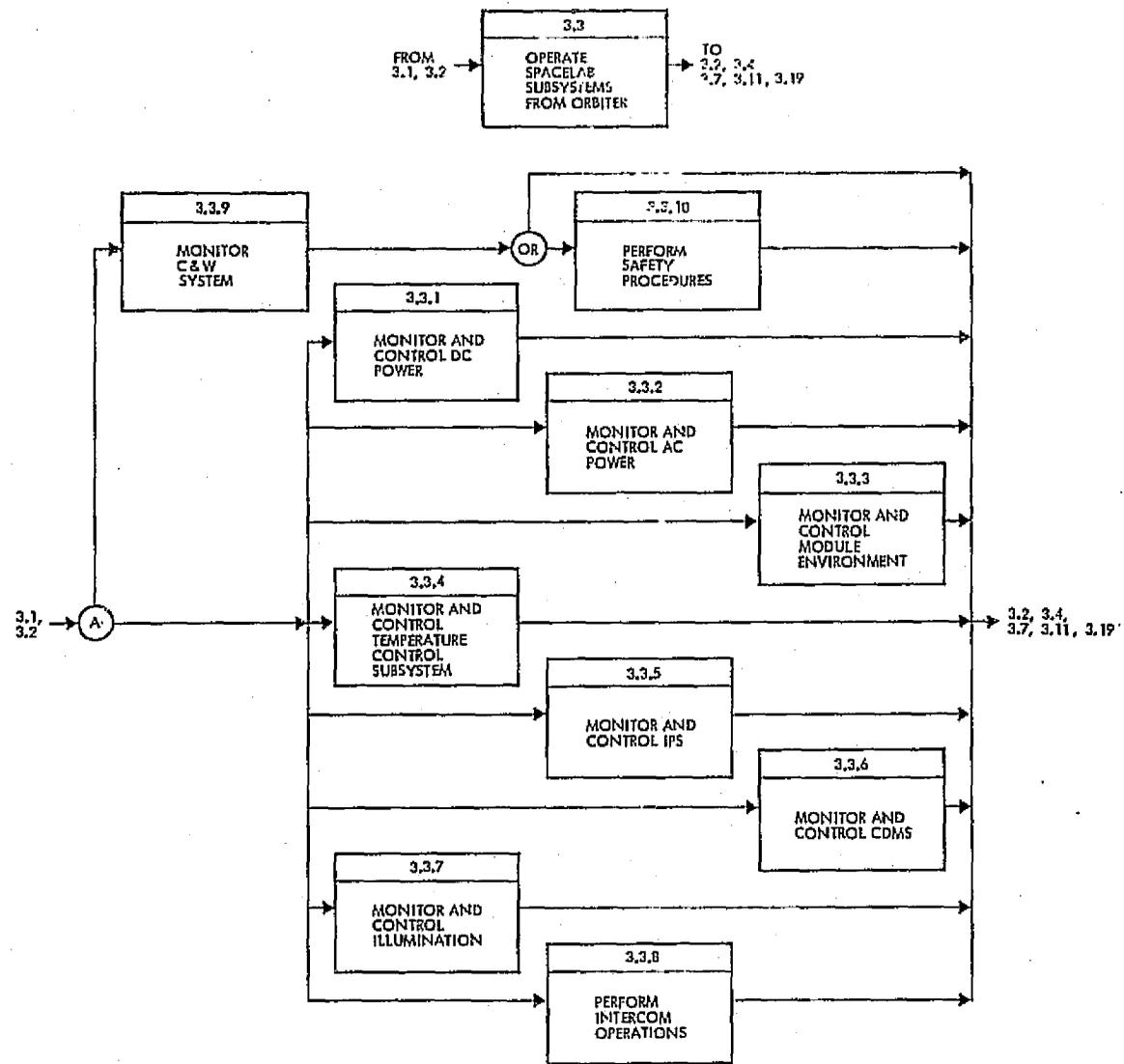
**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.2 Verify Spacelab
 Subsystem Status from Orbiter

Function Description: After ascent, inspect equipment for damage, remove and stow launch restraints and, if applicable, verify status of subsystems activated prior to launch. During on-orbit operations at flight deck workstation, compare Spacelab subsystems parameters and operating conditions for conformance with requirements for current phase of the flight.

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.2	Verify Spacelab sub- systems status from Orbiter	Note 1 - For AMPS mission assume no SL subsystems or experiments operating prior to on-orbit phase.								
3.2.1	Perform visual inspec- tion of AFD equipment	Inspect AFD equipment for damage which may have occurred during launch		AFD	SLMI	C,P, MS,PS	t	pmk	2	Mockup - AFD
3.2.2	Remove and stow launch restraints	If required, remove launch restraints in aft bay and stow		AFD	SLMI		t	pmk	2	Mockup - AFD NIF
3.2.3	Perform visual inspec- tion of cargo bay	Operate orbiter CCTV cargo bay cameras and monitor video to inspect for damage which may have occurred during launch	Orbiter CCTV camera and monitor controls	AFD	OMI	C,P, MS,PS	t	Pmk	3	AFD Mockup Module Mockup Orbiter Cargo Bay Mockup
3.2.4	Brief relief operator	Shift change activity Inform operator on normal/abnormal conditions for each subsystem and schedule status. • EPDS • IPS • ECS • CPSE • CDMS	SS CDMS AFD C&D Panel	AFD	SLMI	C,P	t	pmk	3	PTT-AFD, PT Sim CDMS
3.2.5	Verify Subsystem Status	Verify status of Spacelab subsystems activated prior to launch or verify status of subsystem following a re- configuration of a subsystem or any maintenance action	SS CDMS, AFD C&D panel	AFD	SLMI	C,P, MS	t	pmk	3	PTT-AFD, PT Sim CDMS

RECEIVED AT
 AIR FORCE
 STATION
 11/17/68



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.3 OPERATE SPACELAB SUBSYSTEMS FROM ORBITER

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

Function Description: Monitor and control Spacelab subsystems operation from Orbiter workstation to maintain or change performance in response to flight requirements or C&W demands.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.1	Monitor and Control DC Power	<p>Monitor main bus DC voltage level</p> <ul style="list-style-type: none"> • 28 ±2 vdc nominal • <26 vdc (advisory) C&W • >32 vdc (caution) C&W • <20 vdc auto switch to emergency <p>Monitor DC power level and consumption</p> <ul style="list-style-type: none"> • 7.0 KW average • 12.0 KW peak • >430A (caution) C&W • Emergency power not available (advisory) C&W • Shunt temperature high (caution) C&W <p>Monitor DC power distribution status</p> <ul style="list-style-type: none"> • SS • Experiment <p>Identify DC power malfunctions</p> <p>Identify C&W conditions in other SL subsystems or experiments correctable or alleviated through DC power control</p>	<p>SS-CDMS keyboard and CRT C&D Panel</p> <p>C&W Panel, SS-CDMS CRT and Keyboard, C&D Panel</p>	AFD	SLMI	C, P, MS	t	pmk	2	PTT-AFD, PT Sim CDMS

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.1	(Continued)	Identify DC power (non-malfunction) anomalies	SS-CDMS Keyboard and CRT, C&D Panel, C&W Panel	AFD	SLMI	C,P, MS	T	pmK	3	PTT-AFD, PT sim CDMS, MDM Sim
		Operate controls to:	Orbiter DP&S Keyboard and CRT, SS-CDMS Keyboard and CRT, C&D Panel	FD	OMI/SLMI	C,P	T		3	
		<ul style="list-style-type: none"> Reconfigure DC power distribution as required by flight plan Reconfigure DC power distribution to isolate and/or by-pass a DC power malfunction or reduce load Reconfigure DC power distribution to eliminate a DC power (non-malfunction) anomaly Coordinate with MS/PS as required 	Switches	AFD			T		4	
			Intercom				T		4	
							T		2	
3.3.2	Monitor and Control AC Power	Monitor AC voltage and frequency of inverter output 115/200 vac ±5% 400 Hz ±TBD AC under voltage (advisory) C&W Monitor AC power level and consumption 400 Hz - 2.25 KVA average	SS-CDMS Keyboard and CRT C&D Panel		SLMI	C,P MS	t	pmk	2	

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.2	(Continued)	<p>Monitor AC power distribution status</p> <ul style="list-style-type: none"> • SS inverter and SS distribution • Experiment inverter and experiment distribution • Experiment inverter to SS distribution • SS inverter/exp. inverter to both SS and experiment distribution <p>Identify AC power malfunctions</p> <p>Identify C&W conditions in other Spacelab subsystems or experiments correctable or alleviated through AC power control</p> <p>Identify AC power (non-malfunction) anomalies</p> <p>Operate controls to:</p> <ul style="list-style-type: none"> • Reconfigure AC power distribution as required by flight plan • Reconfigure AC power distribution to isolate and/or by-pass an AC power malfunction or reduce load 	<p>C&D Panel</p> <p>↓</p> <p>C&W panel, SS-CDMS CRT and Keyboard C&D Panel</p> <p>↓</p> <p>Orbiter DP&S Keyboard and CRT, SS-CDMS Keyboard and CRT, C&D Panel</p> <p>↓</p>	<p>AFD</p> <p>↓</p> <p>FD</p> <p>AFD</p>	<p>SLMI</p> <p>↓</p> <p>QMI/SLMI</p>	<p>C,P,MS</p> <p>↓</p> <p>C,P</p>	<p>t</p> <p>↓</p> <p>T</p> <p>↓</p> <p>T</p>	<p>pmk</p> <p>↓</p> <p>pmk</p> <p>↓</p>	<p>2</p> <p>↓</p> <p>4</p> <p>↓</p> <p>3</p> <p>↓</p> <p>4</p>	<p>PTT-AFD, PT Sim CDMS</p> <p>↓</p> <p>PTT-AFD, PT Sim CDMS, MDM Sim</p> <p>↓</p>

**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.3 Operate Spacelab
 Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.2	(Continued)	<ul style="list-style-type: none"> Reconfigure AC power distribution to eliminate an AC power (non-malfunction) anomaly Coordinate with MS/PS as required 	Orbiter DP&S Keyboard and CRT, SS-CDMS Keyboard and CRT, C&D Panel Intercom	AFD	OMI/ SLMI	C,P	T	pmk	4	PT Sim CDMS MDM Sim
3.3.3	Monitor and Control Module Environment	<p>Monitor ECLS displays to verify that cabin environment is within prescribed tolerances</p> <ul style="list-style-type: none"> Temperature 18-27°C Total pressure rate of change 3.33 mm Hg/sec (emergency) C&W 1.00 mm Hg/sec (advisory) C&W Total pressure Nominal 760 mm Hg ±1% High 840 mm Hg (warning) C&W Low 518 mm Hg (warning) C&W Low 749 mm Hg (advisory) C&W Dump valve open (warning) C&W O₂ partial pressure Nominal 160 mm Hg High 188 mm Hg (warning) C&W Low 115 mm Hg (warning) C&W Low 140 mm Hg (advisory) C&W CO₂ partial pressure Nominal 5 mm Hg High 8 mm Hg (caution) C&W 	SS-CDMS Keyboard and CRT		SLMI	C,P MS	t	pmk	2	
			SS-CDMS Keyboard and CRT, C&D Panel							

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.3	(Continued)	<ul style="list-style-type: none"> • Carbon Monoxide 15 Mg/m³ (advisory) C&W • Trace contaminants - TBD • Air flow - TBD • Humidity 6°C dewpoint to 70% RH <p>Monitor ECLS and pressurized component status</p> <p>Identify ECLS malfunctions</p> <p>Identify C&W conditions in other SL subsystems or experiments correctable or alleviated through ECLS control (e.g., fire in avionics loop or cabin loop (warning) C&W, avionics fan failure ΔP = 0 (caution) C&W</p> <p>Identify ECLS (non-malfunction) anomalies</p> <p>Operate controls to:</p> <ul style="list-style-type: none"> o Reconfigure ECLS as required to isolate, by-pass or inactivate a failed component or assembly o Remove/replace LiOH cannisters 	<p>SS-CDMS Keyboard and CRT, C&D Panel</p> <p>↓</p> <p>C&W Panel, SS-CDMS CRT and Keyboard, C&D Panel</p> <p>↓</p>	AFD	SLMI	C,P MS	t	pmk	2	PTT-AFD, PT Sim CDMS
						C,P, MS	T	pmK	4	
							T		3	
						C,P	T		4	
							T		2	

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING ANALYSIS WORK SHEET		MISSION	PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS							
		AMPS	EQUIPMENT							
		FUNCTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
NO.	TITLE	DESCRIPTION								
3.3.3	(Continued)	<ul style="list-style-type: none"> Safe an otherwise automatically activated component (e.g., N₂ O₂ pressure relief valve) in response to C&W condition Coordinate with MS/PS as required 	Orbiter DP&S Keyboard and CRI	AFD	SLMI	C,P	T	pmK	5	PTT-AFD, PT Sim CDMS
			Intercom				T		2	
3.3.4	Monitor and Control Temperature Control Subsystem	<p>Monitor TCS displays to verify that the active cooling system is performing within prescribed tolerances.</p> <ul style="list-style-type: none"> Rack air temperature output 22 to 40°C at 3 KW minimum Heat exchanger inlet H₂O temperature TBD Water pump temperature TBD Freon pump temperature TBD <p>Monitor displays of TCS component/assembly status.</p> <ul style="list-style-type: none"> Water loop heaters Auto or ON Water pump 1 or 2 ON. Water pump failure, ΔP = 0 (caution) C&W Freon pump 1 or 2 ON. Freon pump failure TBD - C&W 	SS-CDMS Keyboard and CRT, C&D Panel			C,P, MS	t	pmk	2	

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.4	(Continued)	Identify TCS malfunctions	C&W Panel, SS-CDMS Keyboard and CRT, C&D Panel	AFD	SLMI	C,P, MS	T	pmK	4	PTT-AFD, PT Sim CDMS
		Identify C&W conditions in other SL subsystems or experiments correctable or alleviated through TCS control					T		4	
		Identify TCS (non-malfunction) anomalies					T		3	
		Operate controls to:					T		3	
		<ul style="list-style-type: none"> Reconfigure TCS to by-pass, isolate or inactivate failed components or assemblies Dump excess water 					T		4	
		Coordinate with MS/PS as required					T		2	
3.3.5	Monitor and Control IPS	Input requisite through SS-CDMS keyboard to:	SS-CDMS Keyboard, and CRT, video monitor				T		2	
		<ul style="list-style-type: none"> Platform deployment Calibration of IPS to Shuttle IMU Reestablish biases and store Point IPS at selected targets in accordance with flight plan and maintain pointing Retract platform (Ref. 3.3.6 and 3.1.3) 					T	pmK	3	PT simulator CDMS/IPS visual field
							T	pmK	3	
						C,P, MS,PS	T	pmK	4	
			and IPS C&D Panel			C,P, MS	t	pmk	2	PTT-AFD

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.6	Monitor and Control CDMS	<p>Note 2: The CDMS operates on a continuous basis during on-orbit operations, providing the capability for data acquisition, monitoring, formatting, processing, displaying, recording and transmission, in addition to providing the command and control of Spacelab subsystems and experiment operation. The CDMS can be considered as being comprised of a Spacelab subsystems CDMS (SS-CDMS) and an experiment CDMS (E-CDMS). The former controls and monitors Spacelab subsystems and configures the E-CDMS for operations. The SS-CDMS is configured for operation by the Orbiter DP&S through the MDM interface.</p> <p>Monitor CDMS CRT display and/or C&D panel to assure that all elements are properly configured for monitoring and controlling SI subsystems and experiments.</p> <ul style="list-style-type: none"> • SS-CDMS SS-I/O SS-I/O couplers SS-DMA SS-Computer power SS-RAUS IPS CPSE 	<p>CDMS Keyboard and CRT, C&D Panel</p> <p>↓</p>	AFD	SLMI	C,P,MS	t	pmk	2	<p>PTT-AFD</p> <p>↓</p> <p>PTT-AFD CDMS Simulator</p> <p>↓</p>

TRAINING
ANALYSIS
WORK SHEET

 MISSION AMPS
 FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP. REQUIRED
3.3.6	(Continued)	<ul style="list-style-type: none"> E-CDMS E-I/O E-I/O couplers E-DMA E-computer power E-RAU's E-applications program(s) loaded Recorder CCTV E-RAU block transfer Other Back-up computer MMU 	CDMS Keyboard and CRT, C&D Panel	AFD	SLMI	C,P,MS	t	pmk	2	PTT-AFD CDMS Simulator, MDM Sim
		Identify CDMS malfunctions	C&W panel, SS-CDMS CRT and Keyboard, C&D Panel, Computer Self Test Control and Indicator	AFD	SLMI	C,P,MS	T	pmK	3	
		Operate controls to								
		<ul style="list-style-type: none"> Deactivate SS computer Deactivate E-computer 	Orbiter DP&S Keyboard-MDM SS-CDMS keyboard	FD AFD	OMI SLMI	C,P C,P,MS	T T	pmk pmk	3 3	

ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.6	(Continued)	<ul style="list-style-type: none"> • Activate back-up computer for S-S use <ul style="list-style-type: none"> - SS I/O and couplers - SS I/O DMA to B/U comp. - B/U comp. auto start <p>Note 3: Assumes S-S program loaded in B/U computer</p> <ul style="list-style-type: none"> • Activate B/U computer for exp use. <ul style="list-style-type: none"> - E I/O and couplers - E I/O DMA to B/U comp. - MMU to B/U comp. - MMU power - B/U comp. -ON - Load B/U comp. Exec - Load E-Operations and application program - B/U auto start • Connect MMU to load E applications program to E-computer • Connect MMU to load SS operations and applications program into Back-up computer. (Assumes prior failure of E computer and load of E program into B/U computer with subsequent failure of S-S computer.) 	MDM (back-up switch) MDM MDM SS CDMS Keyboard ↓ SS-CDMS Keyboard (MDM) MDM ↓ SS-CDMS Keyboard MDM (Back-up switches)	FD (AFD) FD FD AFD FD AFD FD (AFD)	OMI OMI SLMI OMI (SLMI)	C,P C,P,MS C,P C,P,MS C,P	T ↓ ↓ ↓ ↓	pmK ↓ ↓ ↓ ↓	3 ↓ ↓ ↓ 4 ↓	PTT-AFD, CDMS Simulator, MDM Sim ↓ ↓ ↓

TRAINING ANALYSIS WORK SHEET

MISSION AMPS
 FUNCTION 3.3 Operate Spacelab Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.6	(Continued)	<ul style="list-style-type: none"> Operate CCTV cameras and video monitors Operate recorder and communications Obtain requisite data from RAU or storage <ul style="list-style-type: none"> Alphanumeric parameter list Vector display Special graphics for display on CRT or video monitor Perform S-S data computations Command parameter change to SS-CDMS controlled component <p>Note 4: If E-computer fails, the experiment operating and applications programs may be read into the B/U computer from Mass Memory Unit. Two computer failures result in an aborted flight.</p>	AFD C&D Panel ↓ CDMS CRT and Keyboard, CCTV control, AFD C&D panel ↓	AFD	SLMI	C,P,MS,PS ↓ C,P,MS	t	pmk	2	PTT-AFD CDMS Simulator
3.3.7	Monitor and Control Illumination	<p>Note 5: Only emergency illumination in module is controlled via MDM power application to EPDS from Orbiter</p>								

TRAINING ANALYSIS WORK SHEET		MISSION	PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS							
		AMPS	EQUIPMENT							
		FUNCTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
NO.	TITLE	DESCRIPTION								
3.3.8	Perform Intercom Operations	Use intercom for coordinating operations as required by SOP	Communications and Recording Panel	AFD	SLMI	C,P,MS,PS	T	pmk	1	PTT-AFD
3.3.9	Monitor C&W System	Interpret audio-visual emergency warning, caution and advisory displays to identify anomalies in SL and experiment subsystems performance. See 3.3.1 through 3.3.6	C&W Panel	AFD	SLMI	C,P,MS,PS	T	pmK	4	AFD Mock-up
3.3.10	Perform Safety Procedures	<p>Note 6: In addition to subsystem operations required to eliminate, isolate or bypass the malfunction, the following activities may be performed for:</p> <p>Total pressure rate of change (emergency) 3.33 mm Hg/sec - module</p> <p>- Decreasing pressure</p> <ul style="list-style-type: none"> Retreat to Orbiter Isolate SL/Orbiter ECS systems Automatic operation of N₂ and O₂ solenoid valves to minimize pressure loss during evacuation Safe close O₂ + N₂ after evacuation complete 	<p>Tunnel</p> <p>Hatches</p> <p>N/A</p> <p>MDM</p>	<p>--</p> <p>Orbiter Mid Deck and Module</p> <p>--</p> <p>FD</p>	<p>SLMI</p> <p>--</p> <p>OMI</p>	<p>C,P,MS,PS</p> <p>C,P,MS,PS</p> <p>--</p> <p>C,P</p>	<p>T</p> <p>T</p> <p>--</p> <p>T</p>	<p>pmK</p> <p>pmK</p> <p>--</p> <p>pmK</p>	<p>5</p> <p>5</p> <p>-</p> <p>5</p>	<p>PTT-AFD</p> <p>Module Mockup Orbiter MD and FD Mockup</p> <p style="text-align: center;">↓</p>

TRAINING ANALYSIS WORK SHEET

MISSION AMPS
 FUNCTION 3.3 Operate Spacelab Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.10	(Continued)	- Increasing pressure								
		• O ₂ pp high, safe close O ₂ solenoid valve	MDM (RAU)	FD (AFD)	OMI (SLMI)	C,P	̄	pmK	5	PTT-AFD, Module ip Mockup, MDM Sim
		• O ₂ pp low, safe close N ₂ solenoid valve	MDM (RAU)	↓	↓	C,P	̄	pmK	5	
		• Depressurization valve open to reduce pressure	MDM	↓	OMI	C,P	̄	pmK	5	
		• Retreat to Orbiter	Tunnel, hatches	--	SLMI	C,P, MS,PS	̄	pmK	5	
		Total pressure high (warning) and - O ₂ pp high								
		• Safe close O ₂ solenoid valve	MDM (RAU)	FD (AFD)	OMI (SLMI)	C,P	̄	pmK	4	
		• Depressurization valve open to reduce pressure to normal range	MDM	FD	OMI		↓	↓	↓	
		- O ₂ pp low								
		• Safe close N ₂ solenoid valve	MDM (RAU)	FD (AFD)	OMI (SLMI)		↓	↓	↓	
		• Depressurization valve open to reduce pressure to normal range	MDM	↓	OMI		↓	↓	↓	
		• Don personal breathing equipment	PBE	↓	SLMI	C,P, MS,PS	↓	↓	↓	

**TRAINING
ANALYSIS
WORK SHEET**

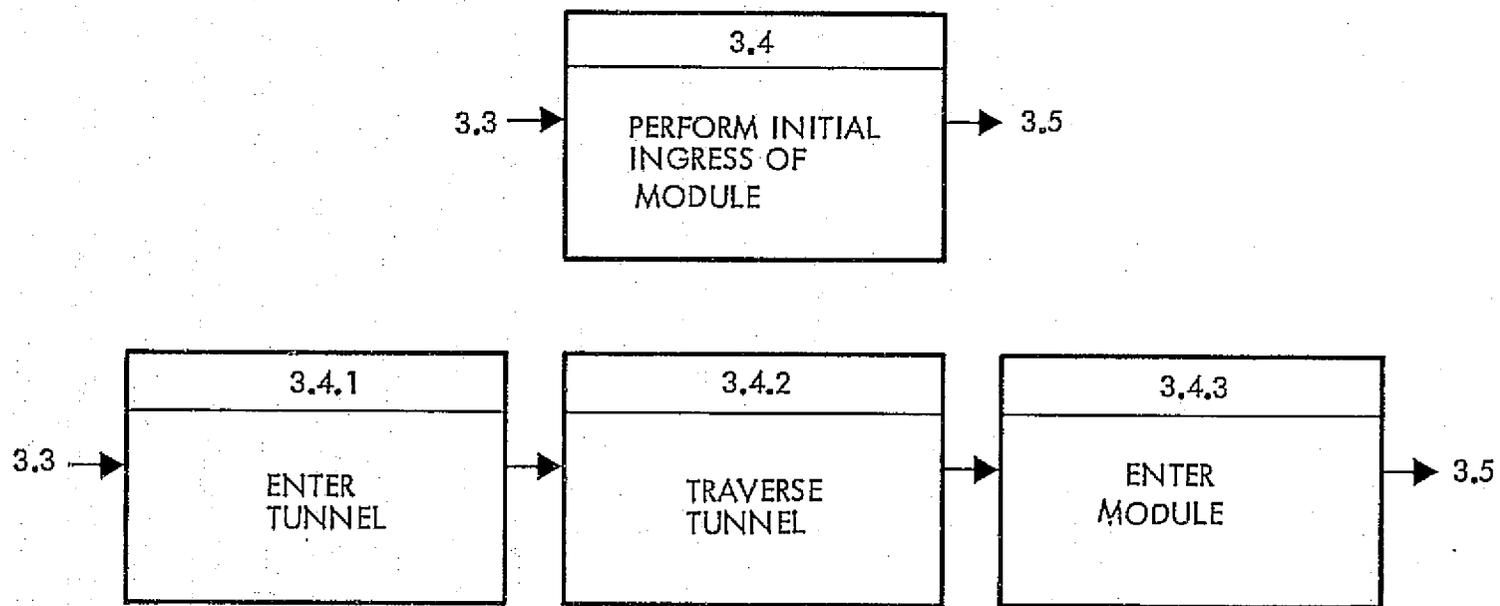
MISSION AMPS
 FUNCTION 3.3 Operate Spacelab
 Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.10	(Continued)	Total pressure low (warning) and - O ₂ pp high								
		• Depressurization (dump) valve close	MDM	FD	OMI	C,P	T	pmK	4	PTT-AFD, Module Mockup, MDM Sim
		• N ₂ solenoid valve open	MDM (RAU)	FD (AFD)	OMI (SLMI)	C,P				
		- O ₂ pp low								
		• Depressurization (dump) valve close	MDM	FD	OMI	C,P				
		• O ₂ solenoid valve open	MDM (RAU)	FD (AFD)	OMI (SLMI)	C,P				
		• N ₂ solenoid valve open as required								
		• Don PBE	PBE	↓	SLMI	C,P, MS,PS				
		Fire in cabin (warning)		FD, AFD, Module	SLMI	C,P, MS,PS				
		• Don PBE	PBE							
		• Cabin fans OFF	MDM	FD	OMI	C,P, MS,PS				
		• Employ hand-held Freon fire extinguisher	Freon 1301 extinguisher	Module	SLMI	C,P, MS,PS				

**TRAINING
ANALYSIS
WORKSHEET**

 MISSION AMPS
 FUNCTION 3.3 Operate Spacelab
Subsystems from Orbiter

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.3.10	(Continued)	or <ul style="list-style-type: none"> • Retreat to Orbiter • Isolate Orbiter/SL ECS • Safe close O₂ solenoid valve • Depressurization (dump) valve open or • Open N₂ solenoid valve Fire in Avionics Loop (warning) Refer to fire in cabin and <ul style="list-style-type: none"> • Avionics fans OFF CO ₂ high (caution) <ul style="list-style-type: none"> • Change LiOH cannister 	Tunnel Hatches MDM (RAU) MDM MDM (RAU) MDM (RAU) ECLS	--- Orbiter Mid Deck and Module FD (AFD) FD FD (AFD) FD (AFD) Module	SLMI ↓ OMI (SLMI) ↓ OMI ↓ OMI SLMI ↓ OMI (SLMI) ↓ SLMI	C,P, MS,PS ↓ C,P ↓ C,P ↓ C,P ↓ C,P MS	T ↓ T ↓ T ↓ T ↓ T	pMK ↓ pMK ↓ pMK ↓ pMK	5 ↓ 4 ↓ 3	PTT-AFD, Module Mockup, MDM Sim, Orbiter MD Mockup PTT-AFD, Module Mockup, MDM Sim



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.4 PERFORM INITIAL INGRESS OF MODULE

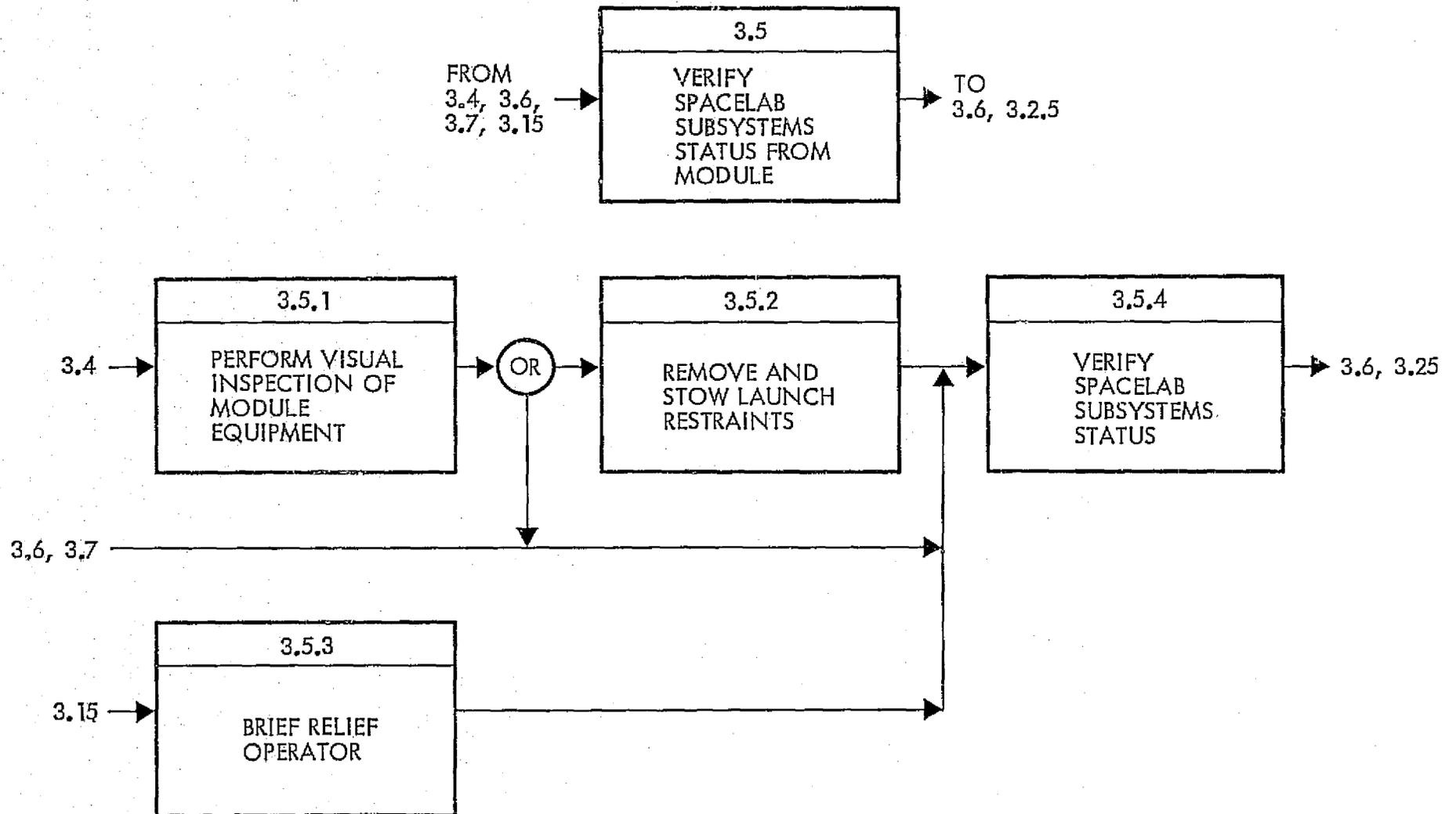
ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.4 Perform Initial
Ingress of Module

Function Description: Activities required for initial transition from the Orbiter mid-deck to the module.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.4.1	Enter Tunnel	Open tunnel ventilation air valve	Tunnel ventilation air valve	Mid Deck	OMI	C,P,MS	t	pmk	2	ORB-Mockup
3.4.1.1	Verify Orbiter/Tunnel Pressure Equalization	Verify: o Pressure differential within limits o Atmospheric habitability within limits	Pressure gauge	Mid Deck Hatch	OMI	C,P,MS	t	pmk	3	PTT-AFD
			AFD C&D panel	Aft Flight Deck	OMI	C,P,MS	t			
3.4.1.2	Operate and Latch Hatch	Unlock, open and secure hatch	Hatch	Mid Deck	OMI	C,P,MS	t	pMk	2	WIF-Mockup
3.4.1.3	Visually Inspect Tunnel	Inspect for obstruction or damage			OMI	C,P,MS	t	Pmk	2	Module Mockup
3.4.2	Traverse Tunnel	Perform IVA of Tunnel			OMI	C,P,MS	t	pMk	2	WIF-Mockup
3.4.3	Enter Module				OMI	C,P,MS	t			
3.4.3.1	Verify Tunnel/Module Pressure Equalization	Verify pressure differential within limits	Pressure gauge	Module Hatch	SLMI	C,P,MS	t	pmk	3	Module Mockup
3.4.3.2	Verify Module Habitability	Verify Habitability of Module	Intercom to Aft Flight Deck		SLMI	C,P,MS	t	pmk	2	-
3.4.3.3	Operate and Latch Hatch	Unlock, open and latch hatch	Hatch	Module	SLMI	C,P,MS	t	pMk	2	WIF-Mockup



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.5 VERIFY SPACELAB SUBSYSTEMS STATUS FROM MODULE

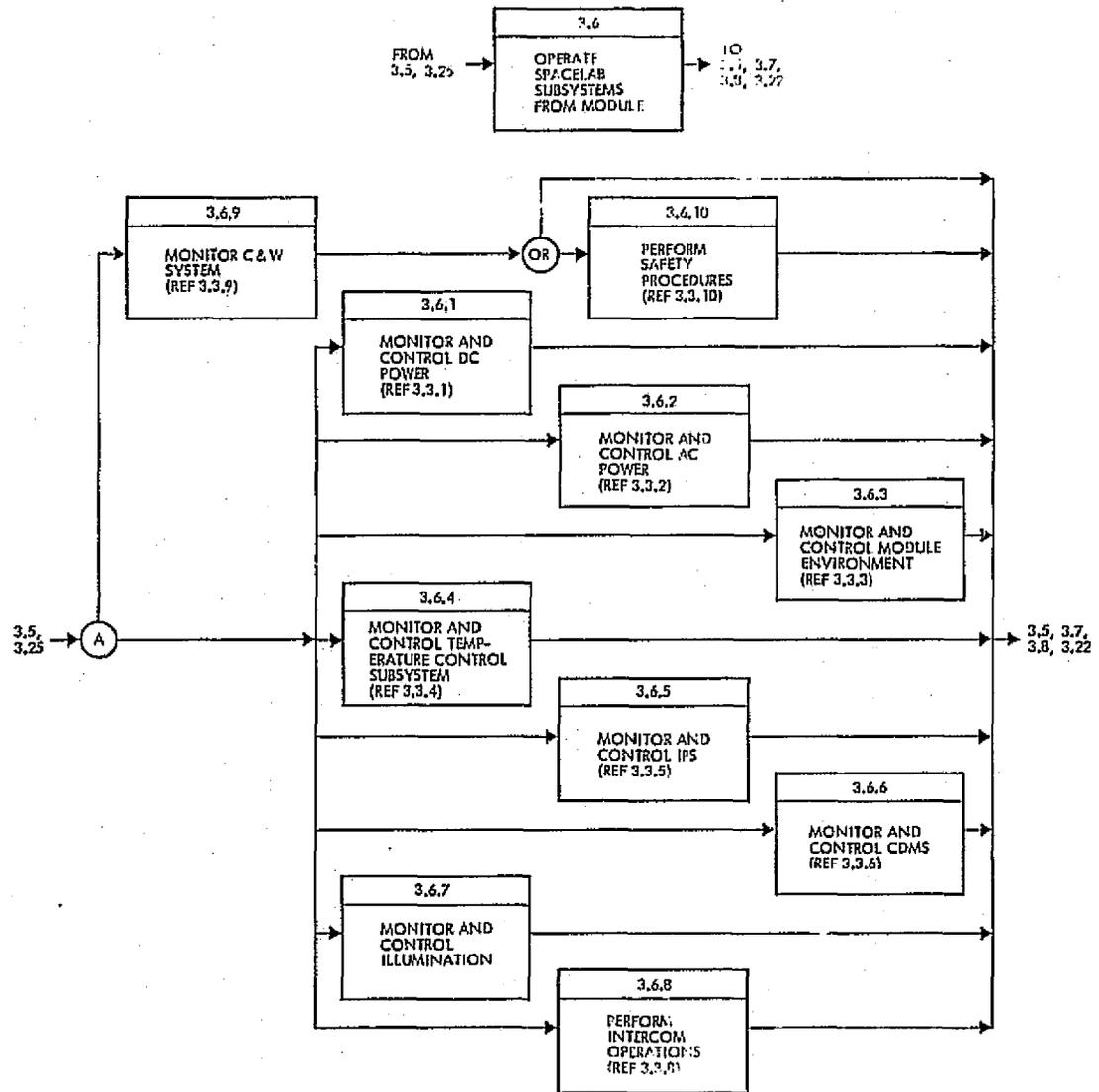
TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u>	Function Description: After initial ingress, inspect equipment for damage, remove and stow launch restraints and, if applicable, verify status of subsystems activated prior to launch. Subsequently, compare Spacelab subsystem parameters and operating conditions for conformance with requirements for the current phase of the flight.							
		FUNCTION <u>3.5 Verify Spacelab Subsystems Status from Module</u>								
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME RECD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.5	Verify Spacelab Subsystems Status from Module	Note 1: For AMPS mission, assume no SL subsystems or experiments operating prior to on-orbit phase.								
3.5.1	Perform Visual Inspection of Module Equipment	Inspect module equipment for damage which may have occurred during launch.		Core Segment	SLMI SLMD	C,P,MS MS,PS	t	pmK	3	Module Mockup
3.5.2	Remove and Stow Launch Restraints	If required, remove launch restraints and stow.		Module	SLMI	C,P,MS	t	pmK	2	Module Mockup
3.5.3	Brief Relief Operator	Shift change activity Inform operator on normal/abnormal conditions for each subsystem and schedule status. <ul style="list-style-type: none">• EPDS• ECS• CDMS• IPS• CPSE	SS CDMS CRT and Keyboard, C&D Panels	Module	SLMI	C,P,MS	t	pmK	3	PTT-Module
3.5.4	Verify Subsystem Status	Verify status of SL subsystems activated prior to launch or verify status of subsystem following a reconfiguration of a subsystem or any maintenance action	S-S CDMS CRT and Keyboard, C&D Panels	Module Central Control Rack	SLMI	C,P,MS	t	pmK	3	PTT-Module

**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.5 Verify Spacelab
 Subsystems Status from Module

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.5.4	(Continued)	Verify status of CPSE <ul style="list-style-type: none"> • Airlock • Hi-Quality Window • Film Vault • Viewport 	Airlock C&D Panel Window C&D Panel Film Vault C&D Panel Viewport Purge Control	Module ↓	SLMI ↓	MS,PS ↓	t ↓	pmk ↓	2 ↓	Module Mockup ↓

ORIGINAL PAGE IS
OF POOR QUALITY



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.6 OPERATE SPACE LAB SUBSYSTEMS FROM MODULE

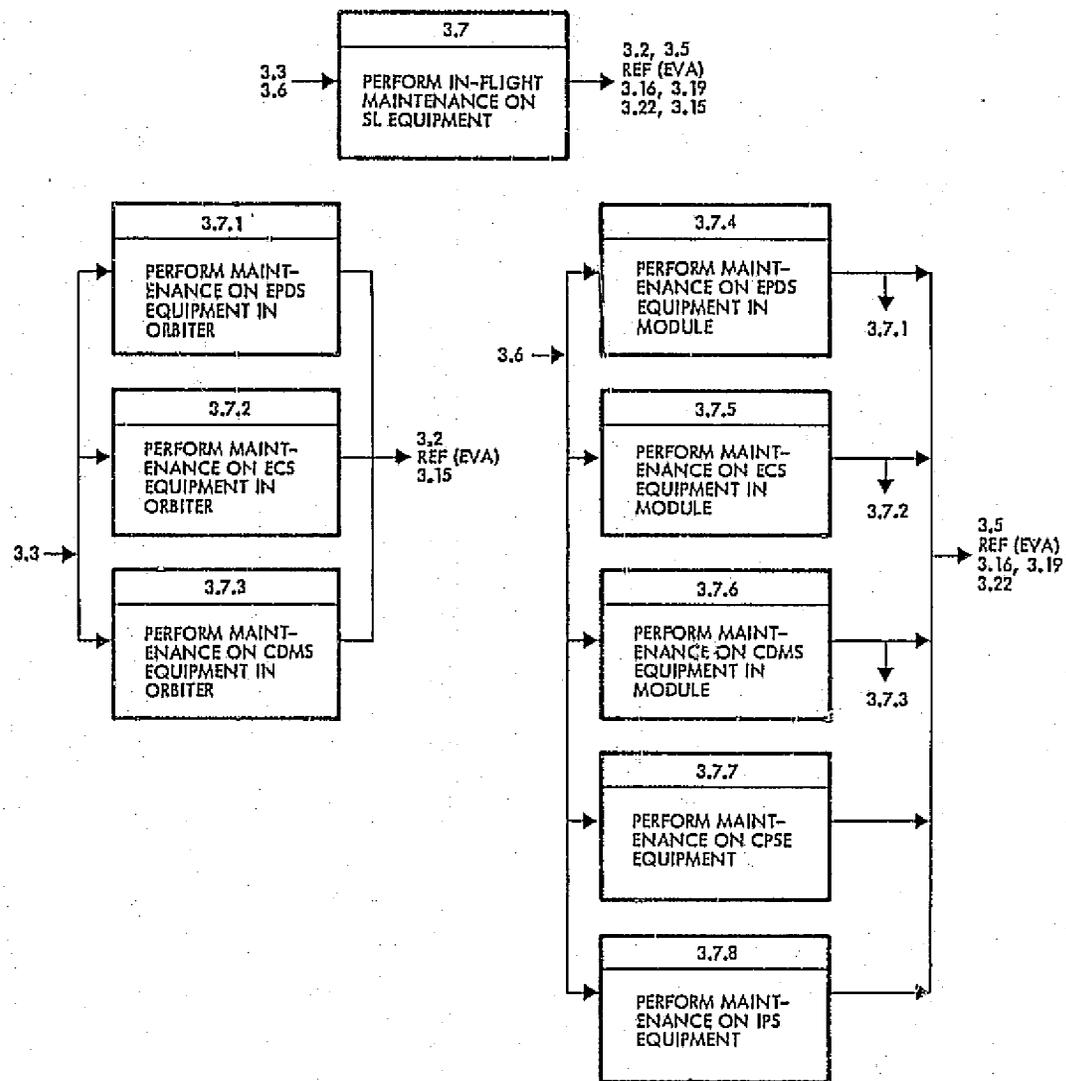
**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.6 Operate Spacelab
 Subsystems from Module

Function Description: Monitor and control Spacelab subsystems from module workstation to maintain or change performance in response to flight requirements or C&W demands.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.6	Operate Spacelab Subsystems from Module	Note 1: Primary control of Spacelab subsystems is accomplished through the Orbiter DP&S MDM's and S-S CDMS in the AFD. Control of the subsystems from within the module is limited to those elements which can be addressed through the S-S CDMS and back-up switches in the SL central control rack or CPSE control panels.								
3.6.1	Monitor and Control DC Power	Ref. 3.3.1								PTT-Module, CDMS-Sim
3.6.2	Monitor and Control AC Power	Ref. 3.3.2								↓
3.6.3	Monitor and Control Module Environment	Ref. 3.3.3								and Module Mock-up
3.6.4	Monitor and Control Temperature Control Subsystem	Ref. 3.3.4								PTT-Module and CDMS-Sim

TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u> FUNCTION <u>3.6 Operate Spacelab Subsystems from Module</u>		PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS						
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.6.5	Monitor and Control IPS	Ref. 3.3.5								PTT-Module, PT Sim, CDMS, IPS, Visual Field
3.6.6	Monitor and Control CDMS	Ref. 3.3.6								PTT-Module and CDMS Sim
3.6.7	Monitor and Control Illumination	Ref. 3.3.7 for emergency illumination in module. Operate controls to activate module lighting	Central Control Rack	Module	SLMI	NS,PS	t	pmk	1	Not req'd
3.6.8	Perform Intercom Operations	Ref. 3.3.8								Not req'd
3.6.9	Monitor C&W System	Ref. 3.3.9								Module Mock-up
3.6.10	Perform Safety Procedures	Ref. 3.3.10								PTT-Module, Module, Mock-up



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.7 PERFORM IN-FLIGHT MAINTENANCE ON SPACELAB SUBSYSTEM EQUIPMENT

**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.7 Perform In-Flight Maintenance on
 Spacelab Subsystem Equipment

Function Description: Activities associated with the servicing or
 repair of Spacelab subsystem equipment.

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
		Note: Spare parts, components or assemblies (other than light bulbs, fuses, etc.) are NOT planned for supporting any remove, repair, replace maintenance actions. Malfunction isolation and correction by reconfiguration of components (redundant/parallel) are considered as operation actions, Ref. 3.3 or 3.6.								
3.7.1	Perform Maintenance on Orbiter Mounted EPDS Equipment	TBD								
3.7.2	Perform Maintenance on Orbiter Mounted ECS Equipment	TBD								
3.7.3	Perform Maintenance on Orbiter Mounted CDMS Equipment	TBD								
3.7.4	Perform Maintenance on Module EPDS Equipment	TBD								
3.7.5	Perform Maintenance on Module ECS Equipment	TBD								
3.7.6	Perform Maintenance on Module CDMS Equipment	TBD								

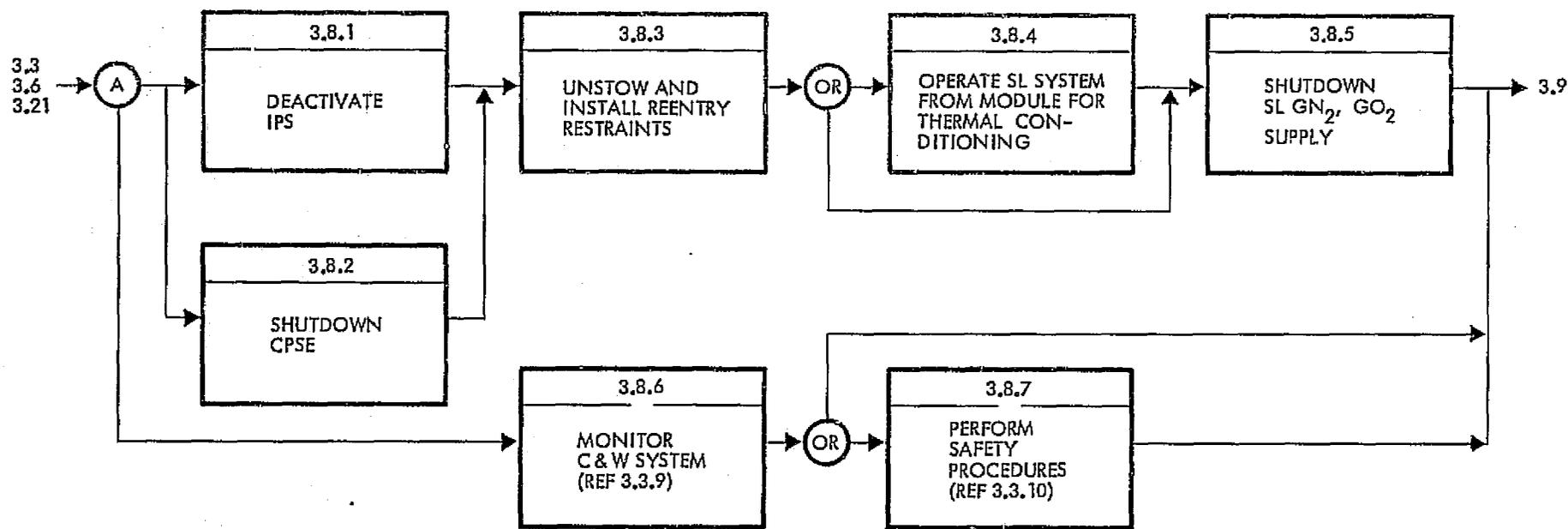
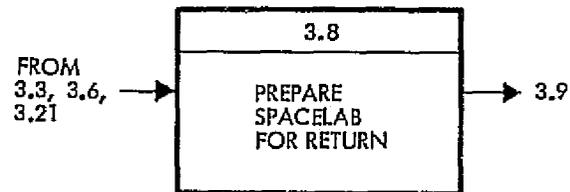
ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
 IN THE POOR QUALITY

TRAINING
 ANALYSIS
 WORK SHEET

MISSION AMPS
 FUNCTION 3.7 Perform In-Flight Maintenance on
 SpaceLab Subsystem Equipment

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.7.7	Perform Maintenance on Module CPSE	TBD								
3.7.8	Perform Maintenance on Module IPS Equipment	TBD								



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.8 PREPARE SPACELAB FOR RETURN

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.8 Prepare Spacelab
for Return

Function Description: Activities required to secure Spacelab equipment and attain thermal stability prior to deboost and reentry

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.8.1	Deactivate IPS	Set gimbals to null position and lock	SS-CDMS CRT and keyboard	Module Central Control Rack or Aft Flight Deck	SLMI	C,P, MS	T	pmk	2	PTT-AFD, SS-CDMS Sim, PTT IPS and/or PTT Mod, SS-CDMS Sim, PTT IPS
		Retract Platform	SS-CDMS CRT and keyboard						2	
		Monitor IPS C&D to verify retracted and locked	IPS C&D						2	
		Identify malfunction condition Ref 3.3.5 • Gimbal disabled	↓						4	
		Coordinate for RMS manual null positioning, retract and lock of IPS and payload. If NO GO, jettison payload • Jettison payload	IPS C&D, Intercom						4	
		Activate release	IPS C&D						4	
		Coordinate for RMS operated jettison	Intercom						2	

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.8 Prepare SpaceLab
for Return

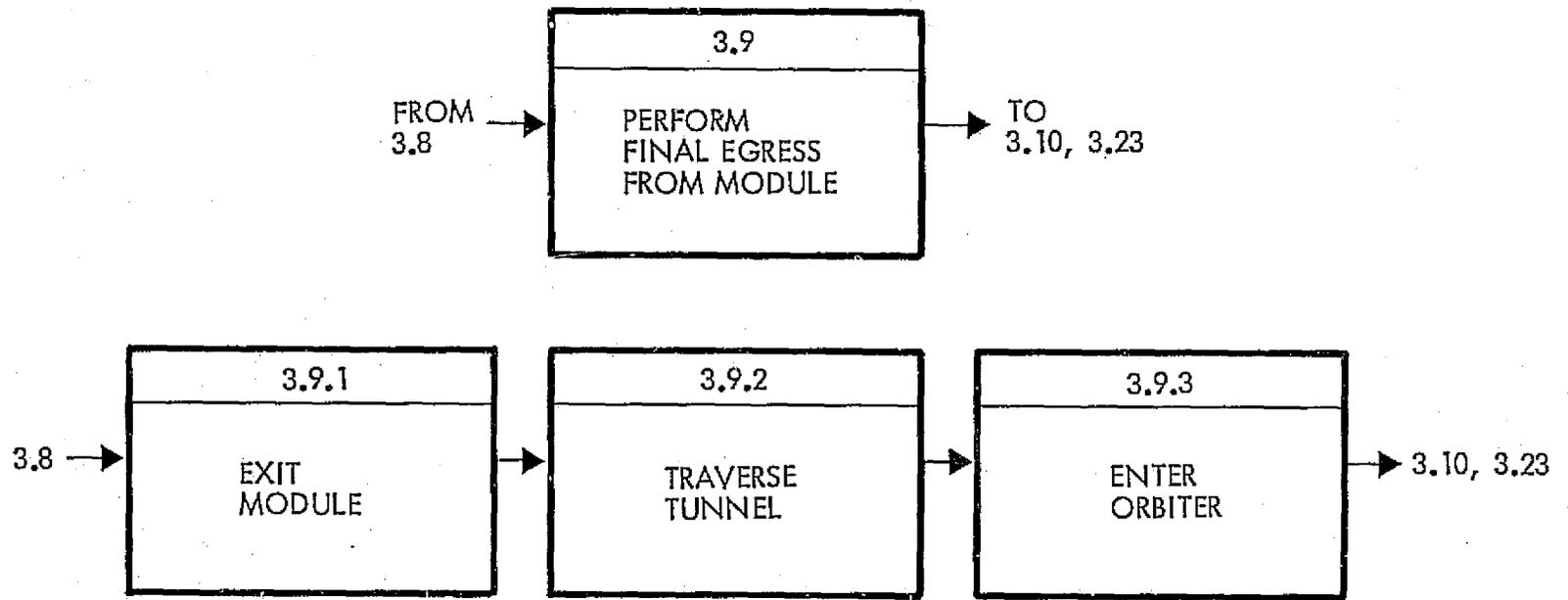
NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.8.2	Shut Down CPSE	Shut down airlock(s)								
		• Verify pressure	Airlock C&D	Airlock Housing	SLMI	C,P, MS	t	pmk	1	PTT-airlock
		• Verify thermal conditioning	Airlock C&D	↓					1	
		• Verify experiment hardware mass within limits for reentry (100 Kg) if to be left in airlock	Flight Plan						4	
		• All switches and light indicators off	Airlock C&D	↓					1	
		Shut down viewport(s)								
3.8.3	Unstow and Install Reentry Restraints	• Close and lock thermal cover	Manual control	Viewport	SLMI	C,P, MS		pmk	2	Viewport Mockup
		• Safety glass pane locked	Manual control						1	
		• Heaters and purge off	Switch control panel						1	
		Film vault door(s) secured	Manual lock	Vault	SLMI	MS,PS		pmk	2	Film Vault Mock-up
		Remove restraints from stowed position	TBD		SLMD SLMI	C,P, MS,PS		pMk	2	Module Mock-up
		Install restraints								4

TRAINING ANALYSIS WORKSHEET		MISSION								
		FUNCTION								
		AMPS								
		3.8 Prepare Spacelab for Return								
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.8.4	Operate SL System from Module for Thermal Conditioning	Note 1: Primary control of Spacelab subsystem is operationally performed at FD and AFD workstations (Ref. 3.1 and 3.3)								
		Monitor ECS for thermal stability under minimum power load <ul style="list-style-type: none"> • Pallet input freon temp. • Input temp. interloop HX • Output temp. interloop HX • Avionix compartment air inlet/outlet temp. differential • Avionix HX inlet/outlet water temp. • Conden. HX air temp. • Conden. HX inlet/outlet water temp. 	ECS C&D, SS-CDMS CRT and keyboard	Module central control rack or Aft Flight Deck	SLMI	C,P, MS	t	pmK	2	PTT Module, SS-CDMS Sim
		Operate EPDS to attain thermal stability <ul style="list-style-type: none"> • Monitor and control DC power and distribution • Monitor and control AC power and distribution 	C&W panel EPDS C&D SS-CDMS CRT and keyboard	Module central control rack	SLMI	C,P, MS		pmK	2	
	Operate CDMS to attain thermal stability <ul style="list-style-type: none"> • Monitor and control ECS components 	SS-CDMS CRT and keyboard, C&W panel								

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.8 Prepare SL
for Return

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.8.4	Continued	<ul style="list-style-type: none"> • Monitor and control EPDS components • Monitor and control CDMS components 	SS-CDMS CRT and keyboard, C&W panel	Module central control rack	SLMI	C,P MS	t ↓	pmK	2	PTT Module SS-CDMS Sim.
3.8.5	Shut Down SL GN ₂ , GO ₂ Supply	Close manual shutoff valves.	GN ₂ -GO ₂ control valves	Fwd end cone bulkhead input lines	SLMI	C,P, MS	↓	pmk	2	Module Mock-up
3.8.6	Monitor C&W System	Refer to 3.3.9								
3.8.7	Perform Safety Procedures	Refer to 3.3.10								



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.9 PERFORM FINAL EGRESS FROM MODULE

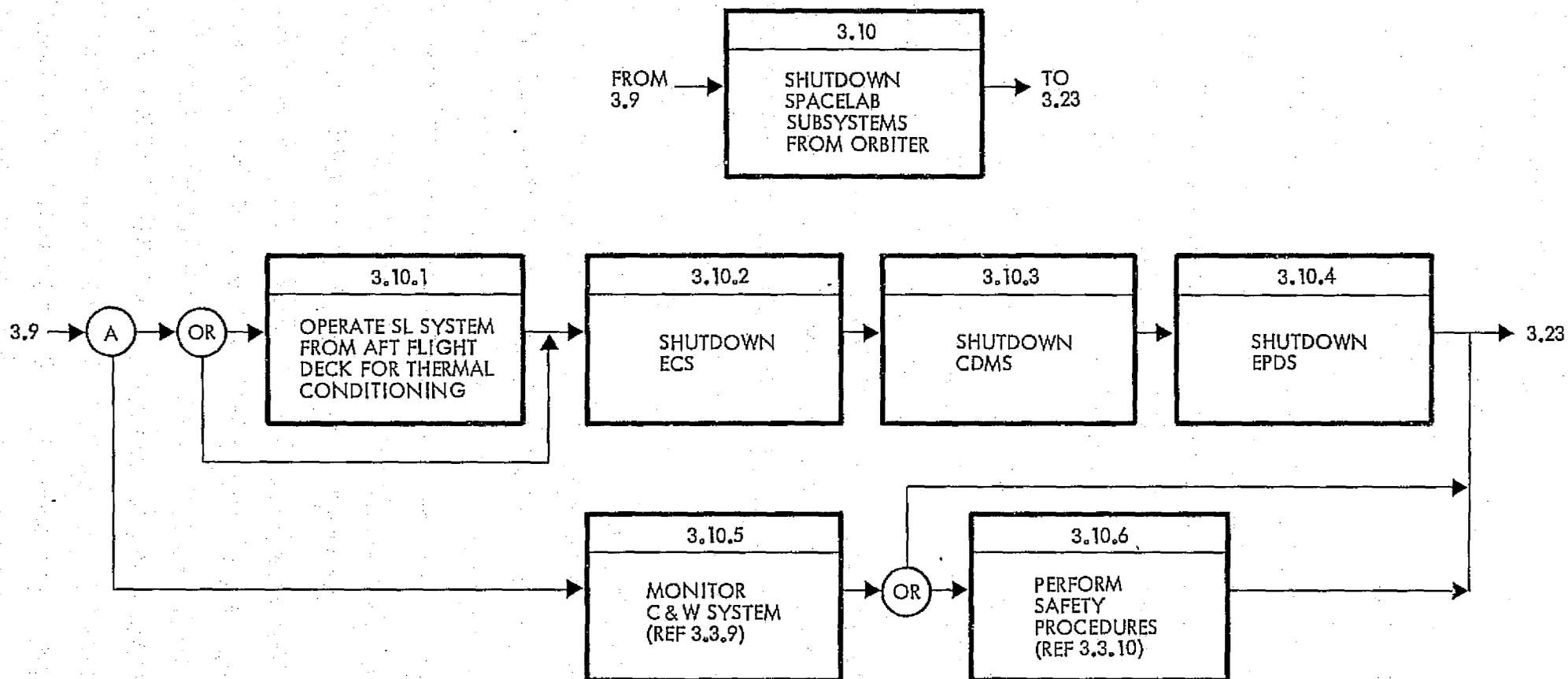
**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.9 Perform Final Egress
from Module

 Function Description: Activities required for final transition from the
 Spacelab to the Orbiter mid-deck.

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.9.1	Exit Module	Release hatch latch	Hatch	Module	SLMI	C,P, MS	t	pmk	1	Module Mock-up WIF Mock-up Orbiter Mockup
		Close and lock hatch	Hatch	Module					2	
3.9.2	Traverse Tunnel	Perform IVA through tunnel		Tunnel					1	
3.9.3	Enter Orbiter			Orbiter Mid Deck						
		Release hatch latch	Hatch						1	
		Close and lock hatch	Hatch						3	
		Shut down tunnel ventilation fan							2	
		Shut off tunnel ventilation air supply valve	ECS Panel	Aft Flight Deck				pmk	2	

 ANALYSIS 8002
 ST 8074 17/01/80



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.10 SHUTDOWN SPACELAB SUBSYSTEMS FROM ORBITER

TRAINING
ANALYSIS
WORK SHEET

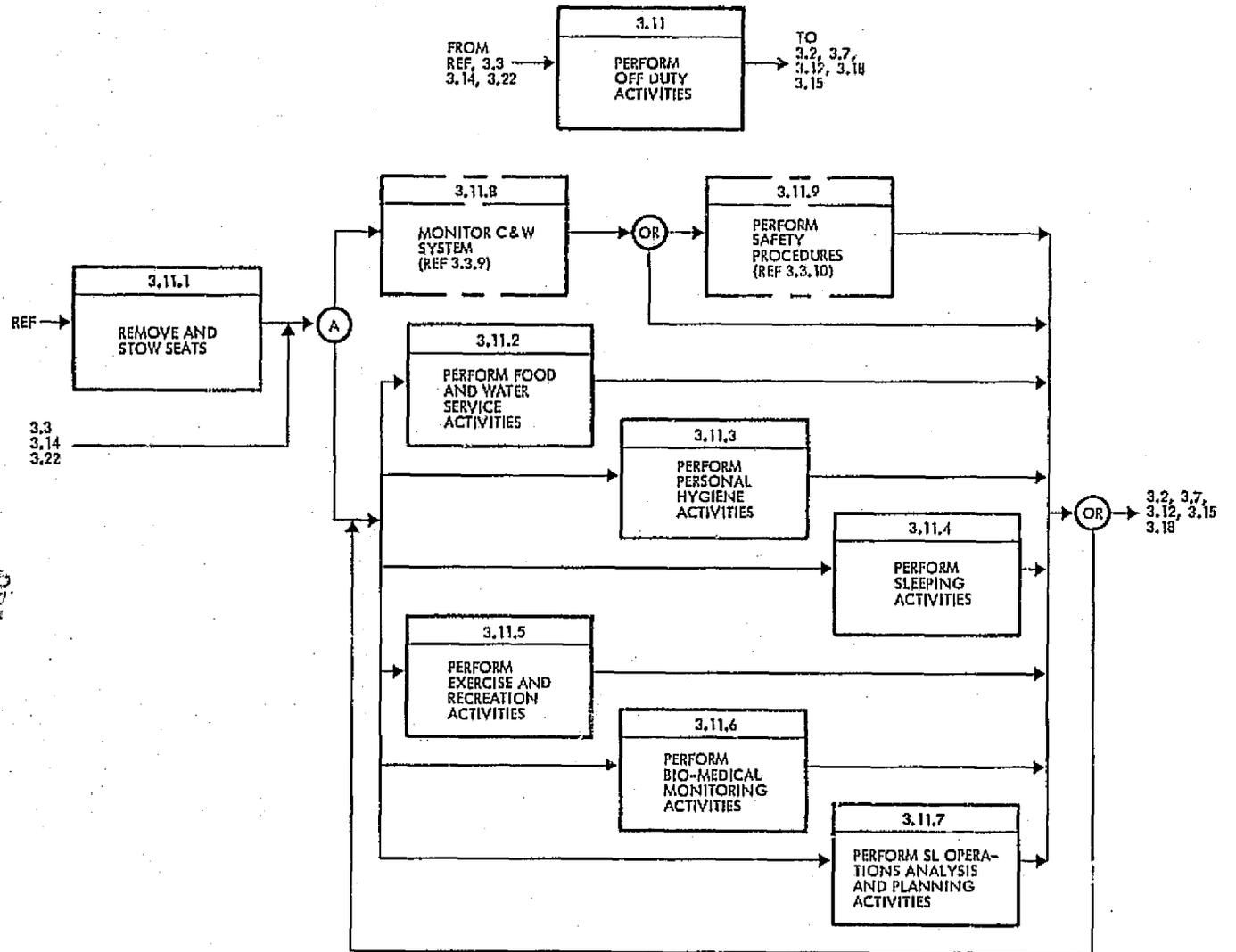
MISSION AMPS
 FUNCTION 3.10 Shutdown Spacelab
 Subsystems from Orbiter

Function Description: Activities associated with shutting down the Spacelab Subsystems not functionally required during deboost/reentry.

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.10.1	Operate SL System from Aft Flight Deck for Thermal Conditioning	Note: Thermal conditioning operations may be accomplished at either the Module central control rack or Aft Flight Deck stations. Ref. 3.8.4 Verify Orbiter HX coolant return from payload within specification <104°F (40°C)	Intercom	AFD Aft Flight Deck	SLMI SLMI OMI	C,P, MS	t	pmK	2	PTT-AFD SS-CDMS Sim.
3.10.2	Shut Down ECS	Operate controls and monitor displays to shut down ECS-TCS, ECLS	ECS C&D, SS-CDMS CRT and keyboard		SLMI					
3.10.3	Shut Down CDMS	Operate controls and monitor displays to shut down CDMS - Computers, I/O, Mass Memory, CCTV, SL Intercom	SS-CDMS CRT and keyboard, CDMS C&D panel, Orbiter DP&S MDM							PTT-AFD, PTT-FD, MDM and SS-CDMS Sim.
3.10.4	Shut Down EPDS	Operate controls and monitor displays to shut down EPDS	EPDS C&D panel							
3.10.5	Monitor C&W System	Refer to 3.3.9								
3.10.6	Perform Safety Procedures	Refer to 3.3.10								

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.11 PERFORM OFF-DUTY ACTIVATES

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.11 Perform Off-Duty
Activities

Function Description: Covers general habitability and safety activities performed in Orbiter which are not part of the nominal SL or experiment operations.

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.11.1	Remove and Stow Seats	Upon achieving operational orbit all seats in the mid deck and aft flight deck are disassembled and stowed	Passenger seats	Aft Flight Deck, Mid Deck	SLMI	PS,MS	t	pMk	1	Orbiter MD and FD Mock-up and Actual Equipment as required
3.11.2	Perform Food and Water Service Activities	Remove food packages from storage facility	Modular storage	Mid Deck						
		Prepare food packages for consumption	Temporary modular storage cabinet	Mid Deck		C,P, PS,MS		pMk		
		Eat meal	Galley	Mid Deck						
		Dispose of food and material waste	Waste Mgmt Sys	Mid Deck						
3.11.3	Perform Personal Hygiene Activities	Replenish food supply in temporary storage	Modular and temporary storage cabinets	Mid Deck						
		Use body cleansing equipment	Premoistened towels, soap and dry towels	Hygiene Station	OMI	C,P, MS,PS		pMk		
		Use solid waste disposal system	Waste Mgmt Sys							

 APPROVED BY: [Signature]
 DATE: 20/11/80
 BY: [Signature]

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.11 Perform Off-Duty
Activities

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REOD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.11.3	Continued	Use teeth cleansing equipment	Potable H ₂ O supply, tooth brush and paste	Hygiene Station	OMI	C,P, MS,PS	t	pmk	1	Orbiter Mock-up and Actual Equipment as Required
		Use liquid waste disposal system	Waste Mgmt Sys	↓	↓					
		Use toilet equipment	Waste Mgmt Sys	↓	↓					
		Use shaving equipment	Shaver	↓	↓					
		Dispose of shaving waste	Waste Mgmt air entrainment or solid waste disposal	↓	↓					
3.11.4	Perform Sleeping Activities	Remove sleeping bag from storage	Modular storage	Mid Deck	OMI	C,P, MS,PS		pmk	1	
		Attach sleeping bag to structural connects	Sleep station	↓	↓					
		Enter and close sleeping bag	↓	↓	↓					
		Exit sleeping bag	↓	↓	↓					
		Stow sleeping bag	Modular storage	↓	↓					
3.11.5	Perform Exercise and Recreation Activities	TBD								

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.11 Perform Off-Duty
Activities

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.11.6	Perform Biomedical Monitoring Activities	Implace/don/use biomed sensor kit equipment Replace biomed sensor equipment	TBD			C,P, MS,PS	t			Actual Equipment as Required
3.11.7	Perform SL Operations Analysis and Planning Activities	Review experiment operations data, POC data and flight plan Modify flight data file as required Replan experiment schedule as required	TV monitor, audio tape recorder playback, FDF, photos FDF FDF	Mid Deck ↓		MS,PS ↓	↓	pmK ↓	2 ↓	↓
3.11.8	Monitor C&W System	Refer to 3.3.9								
3.11.9	Perform Safety Procedures	Refer to 3.3.10								

PRECEDING PAGE BLANK NOT FILMED

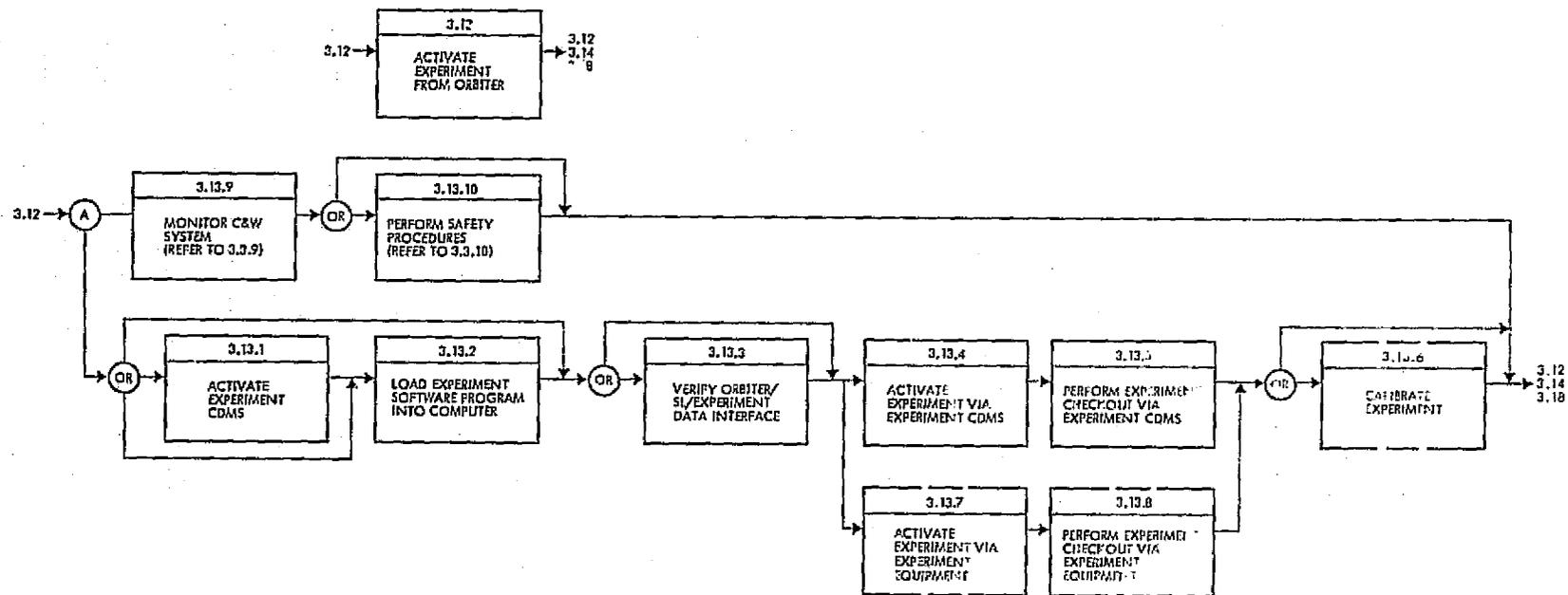
ORIGINAL PAGE IS
OF POOR QUALITY

TRAINING ANALYSIS WORK SHEET		MISSION FUNCTION	AMPS 3.12 Verify Experiment Status from Orbiter	Function Description: After ascent, inspect experiment equipment damage and remove and stow launch restraints. During on-orbit operations at Orbiter work station, compare experiment conditions/parameter values for conformance with requirements for the current phase of the flight.						
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REOD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.12.1	Perform visual inspection of experiment equipment	Inspect experiment equipment located in module and on pallet for damage which may have occurred during launch.	CCTV Video monitor	AFD	SLMI	MS,PS	t	P,m,K	3	Module Mockup
3.12.2	Remove and stow experiment equipment launch restraints		Refer to MSFC task analysis							
3.12.3	Brief relief operator on experiment status	Shift change activity	Refer to MSFC task analysis							
3.12.4	Verify status of experiment CDMS	Compare status/usage of experiment related equipments/components that are parts of CDMS against planned operations. <ul style="list-style-type: none"> • Computers • I/O • RAU • Recorders in use and amount of tape remaining • CCTV, Video monitor • Applications program loaded and operating 	CDMS C&D, CRT and Keyboard, Flight Data File	AFD	SLMI		t	p,m,K	2	PTT-AFD PT Sim CDMS
					C,P,MS					
					MS,PS					
3.12.5	Verify experiment status via experiment CDMS	Display experiment data for evaluation against experiment objectives.	CDMS C&D, CRT and Keyboard Flight Data File	AFD	SLMI	PS	t	p,m,K	3	PTT-AFD Exp Sim CDMS
3.12.6	Verify status of CPSE	Check condition of: <ul style="list-style-type: none"> • Viewport for visual clarity (no condensation or fogging) 	Viewport	AFD	SLMD	MS,PS	t	p,m,k	2	Mock-up, AFD

PRECEDING PAGE BLANK NOT FILMED

TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u> FUNCTION <u>3.12 Verify Experiment Status from Orbiter</u>		PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS						
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.12.7	Verify experiment status via experiment equipment	This task is performed if the necessary experiment equipment and/or controls are located in Orbiter	Refer to MSFC experiment task analysis							
3.12.8	Verify experiment status via communication links	Communicate with POCC Reference MSFC experiment tasks analysis for verification of: <ul style="list-style-type: none"> ■ Experiment checkout OK ■ Experiment calibration OK ■ Experiment flight plan coverage ● Experiment procedure for next run/cycle 	Communication Console	AFD	SLMI	MS,PS	T	p,m,K	3	AFD Mockup
3.12.9	Perform realtime replanning	Reprogram experiment/flight plan procedures (refer to task 3.12.8) Coordinate planned changes with POCC Enter replanned procedures in Flight Data File	Flight replanning aids	AFD	SLMD	MS,PS	T	p,m,K	3	Actual Equipment as required and AFD Mockup
			Communication Console	AFD	SLMI	MS,PS	T	p,m,K	3	
			Flight Data File	AFD	SLMD	MS,PS	T	p,m,K	3	

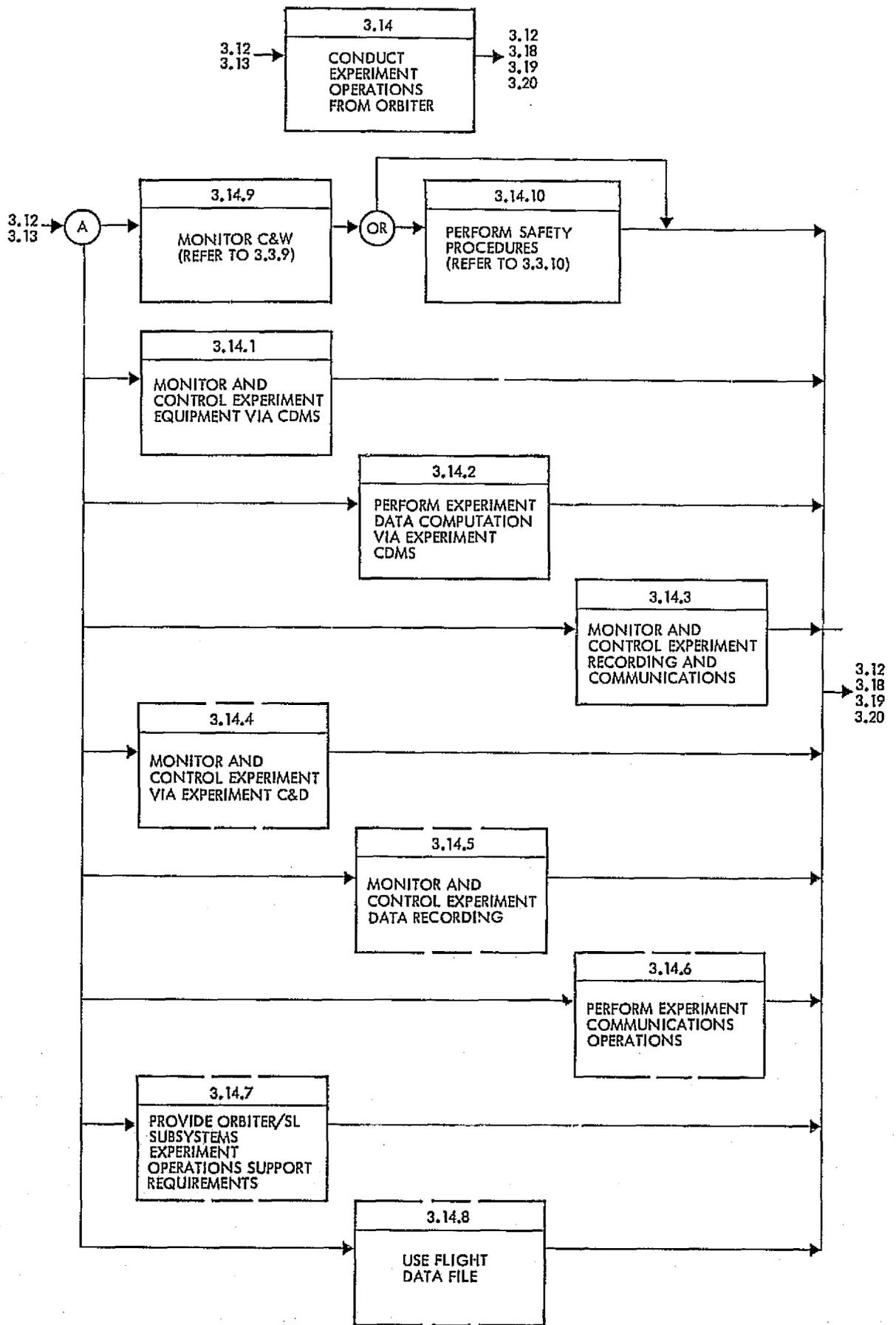
ORIGINAL LABEL IS
OF POOR QUALITY



SECOND LEVEL FUNCTIONAL FLOW - 3.13 ACTIVATE EXPERIMENT FROM ORBITER

TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u>	Function Description: Activities at Orbiter Workstation associated with equipment operations required to perform experiments configured for CDMS control. Activities include initial equipment set-up/orientation, application of power, equipment checkout and calibration.							
		FUNCTION <u>3.13 Activate Experiment from Orbiter</u>								
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.13.1	Activate experiment CDMS	Activate CRT and Keyboard	S/S CDMS	AFD	SLMI	C,P,MS	t	p,m,k	2	PTT-AFD
		Enter commands to power up experiment CDMS components required to start experiment computer operation (Refer to Function 3.1).	S/S CDMS CRT and Keyboard	AFD	SLMI	C,P,MS	t	p,m,k	2	PT Sim CDMS
3.13.2	Load experiment software program into computer	Enter commands to configure CDMS equipment to enable transfer of experiment software program from mass memory into experiment computer.* (It is assumed that the capacity of the computer memory is inadequate to store all of the software programs required to control all of the experiments scheduled for a flight. Therefore a capability to load different software programs according to experiment schedules is required.) Note: The software program to control the first scheduled experiment will probably be loaded prior to launch. *(Refer to Function 3.3)	CRT and Keyboard	AFD	SLMI	C,P,MS	T	p,m,K	3	

TRAINING ANALYSIS WORK SHEET		MISSION								
		AMPS								
		FUNCTION	3.13 Activate Experiment from Orbiter							
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.13.3	Verify Orbiter/SL/ experiment data interface	Verify that controls are configured to: <ul style="list-style-type: none"> • Record experiment data • Display experiment data • Downlink experiment data 	Communication console Experiment CDMS Flight Data File	AFD	SLMI	MS,PS	T	p,m,K	3	PTT-AFD, PT Sim CDMS
3.13.4	Activate experiment via experiment CDMS	Enter command to initiate computer control of experiment	CDMS CRT and Keyboard	AFD	SLMI	MS,PS	t	p,m,k	2	PTT-AFD, Exp Sim CDMS ↓
3.13.5	Perform experiment checkout via experiment CDMS	Configure controls to check out the experiment using software program	CDMS CRT and Keyboard	AFD	SLMI	MS,PS	t	p,m,K	2	
3.13.6	Calibrate experiment	Tasks can be performed from Orbiter if the necessary experiment equipment and/or controls are located in Orbiter	}	Refer to MSFC experiment task analysis						
3.13.7	Activate experiment via experiment equipment									
3.13.8	Perform experiment checkout via experiment equipment									



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.14 CONDUCT EXPERIMENT OPERATIONS FROM ORBITER.

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.14 Conduct Experiment Operations from Orbiter

Function Description: Includes activities at Orbiter workstation required to perform experiments following initial activation of experiment-related equipments.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.14.1	Monitor and control experiment equipment via CDMS	Deploy/calibrate/point/retract IPS (Refer to function 3.3).	SS-CDMS CRT and Keyboard	AFD	SLMI	C,P, MS, PS	T	P,m,K	4	Refer to function 3.3
		Deploy/retract booms, antennas, satellites, target balloons as required by flight plan.	CDMS CRT and Keyboard Flight Data File CCTV and Video Monitor	AFD	SLMI SLMD SLMI	MS,PS	T	p,m,K	3	P.T. simulator (Exp CDMS)
		Monitor response of deployed equipment to commands					T	P,m,K	3	
		Observe position of deployed equipment relative to STS and relative to each other.					T	P,m,K	3	
		Monitor displays and operate controls to change experiment equipment mode of operation. <ul style="list-style-type: none"> • Optical systems • Cameras • Wavelength equipment • Satellites 					T	p,m,K	3	
3.14.2	Perform experiment data computation via experiment CDMS	Input experiment data to experiment computer for processing by computational software program.	Experiment CDMS CRT and Keyboard	AFD	SLMI	MS,PS	T	p,m,K	2	PT simulator (Exp CDMS)

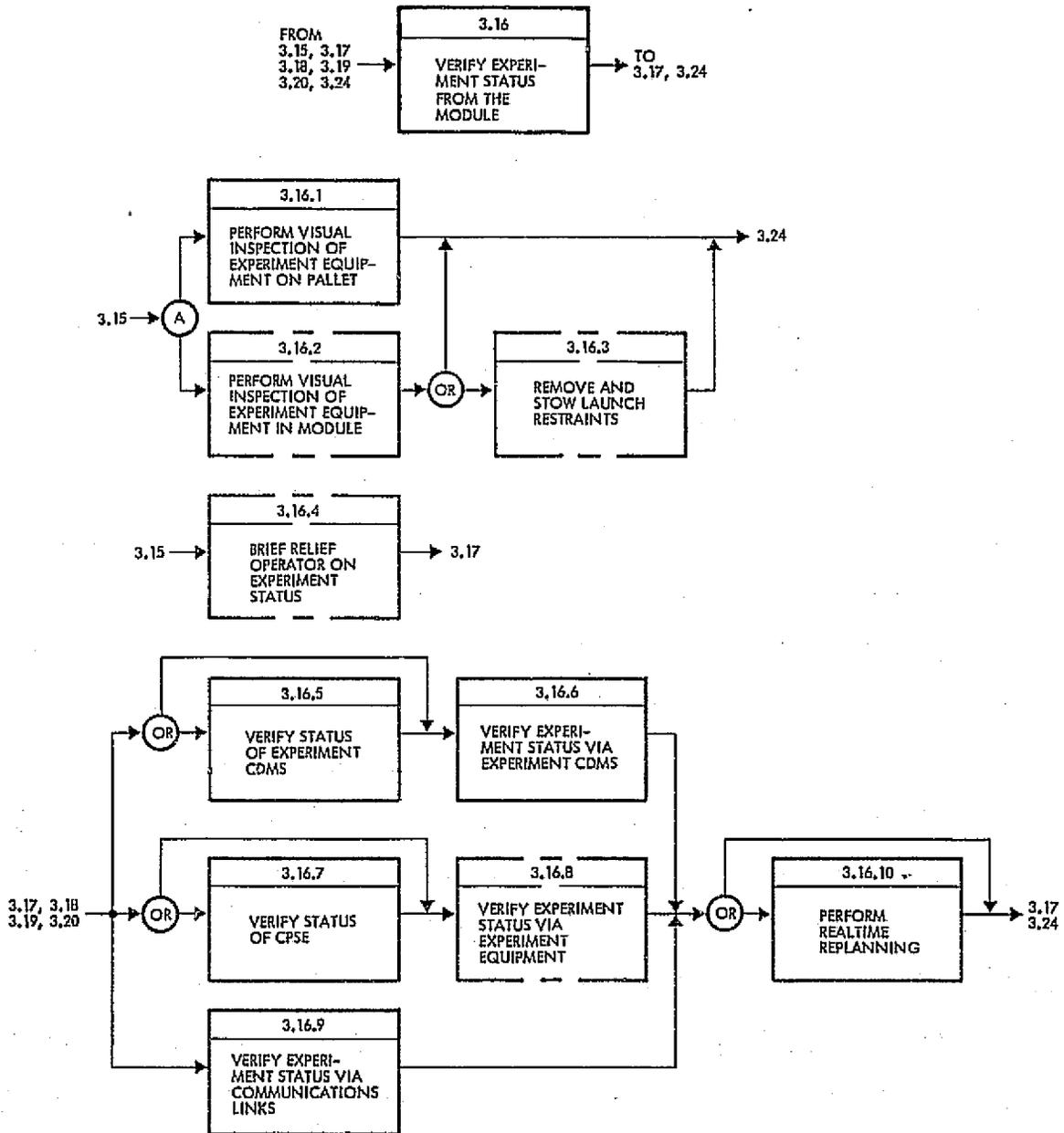
TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u> FUNCTION <u>3.14 Conduct Experiment Operations from Orbiter</u>		PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS						
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.14.3	Monitor and control experiment recording and communications	Monitor and control use of tape recorders to meet flight plan objectives. Monitor performance of communications systems. Operate controls to enable communications: <ul style="list-style-type: none"> • Within the Orbiter • Between Orbiter and PCCC 	Recorder and Communication Control Panel	AFD	SLMI	C,P, MS, PS	t	p,m,k	2	PTT-AFD, Recorder and Comm Panel Mockup
3.14.4	Monitor and control experiment via experiment C&D	Tasks can be performed if controls are located at Orbiter work station	Refer to MSFC experiment task analysis							
3.14.5	Monitor and control experiment data recording	Tasks can be performed if controls are located at Orbiter work station	Refer to MSFC experiment task analysis							
3.14.6	Perform experiment communications operations	Operate user-provided communication equipment (Task can be performed if controls are located at Orbiter work station)	Refer to MSFC experiment task analysis							
3.14.7	Provide Orbiter/SL subsystems experiment operations support requirements		Refer to MSFC experiment task analysis							
3.14.8	Use Flight Data File		Refer to MSFC experiment task analysis							

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.15 Perform Follow-On
Ingress of Module

Function Description: Activities related to personnel movement from Orbiter to module after initial ingress. Assumes as SOP, the hatches remain open throughout on-orbit operations.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
	Reference 3.22	IVA in reverse order from 3.22								



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.16 VERIFY EXPERIMENT STATUS FROM MODULE

UNCLASSIFIED
 OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEETMISSION AMPS
FUNCTION 3.16 Verify Experiment
Status from Module

Function Description: After ascent, inspect experiment equipment for damage and remove and stow launch restraints. During on-orbit operations, compare experiment conditions/parameter values at module workstation for conformance with requirements for the current phase of the flight.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.16.1	Perform visual inspection of experiment equipment on pallet	Inspect experiment equipment located on pallet for damage which may have occurred during launch	CCTV, Video Monitor Viewport	Module Aft end cone	SLMI SLMD	MS,PS	T	PmK	3	Module Mockup Viewport Mockup
3.16.2	Perform visual inspection of experiment equipment in module	Inspect experiment equipment located in module for damage which may have occurred during launch	Refer to MSFC experiment task analysis							
3.16.3	Remove and stow launch restraints	Remove launch restraints from experiment equipment and stow	Refer to MSFC experiment task analysis							
3.16.4	Brief relief operator on experiment status	Shift change	Refer to MSFC experiment task analysis							
3.16.5	Verify status of experiment CDMS	Compare status/usage of experiment related equipments/components that are part of CDMS against planned flight operations <ul style="list-style-type: none"> • Computer • I/O • RAU • Application program loaded and operating 	CDMS CRT and Keyboard Flight Data File	Module Module	SLMI SLMD	MS,PS MS,PS	t t	p,m,K p,m,K	2 2	PTT-Module, PT Sim CDMS
3.16.6	Verify experiment status via experiment CDMS	Perform visual status check of: booms, satellite, antennas, target balloons	CCTV Video monitor CDMS CRT and Keyboard	Module	SLMI SLMI	MS,PS	t	Pmk	2	PTT-Module, Exp Sim CDMS

**TRAINING
ANALYSIS
WORK SHEET**

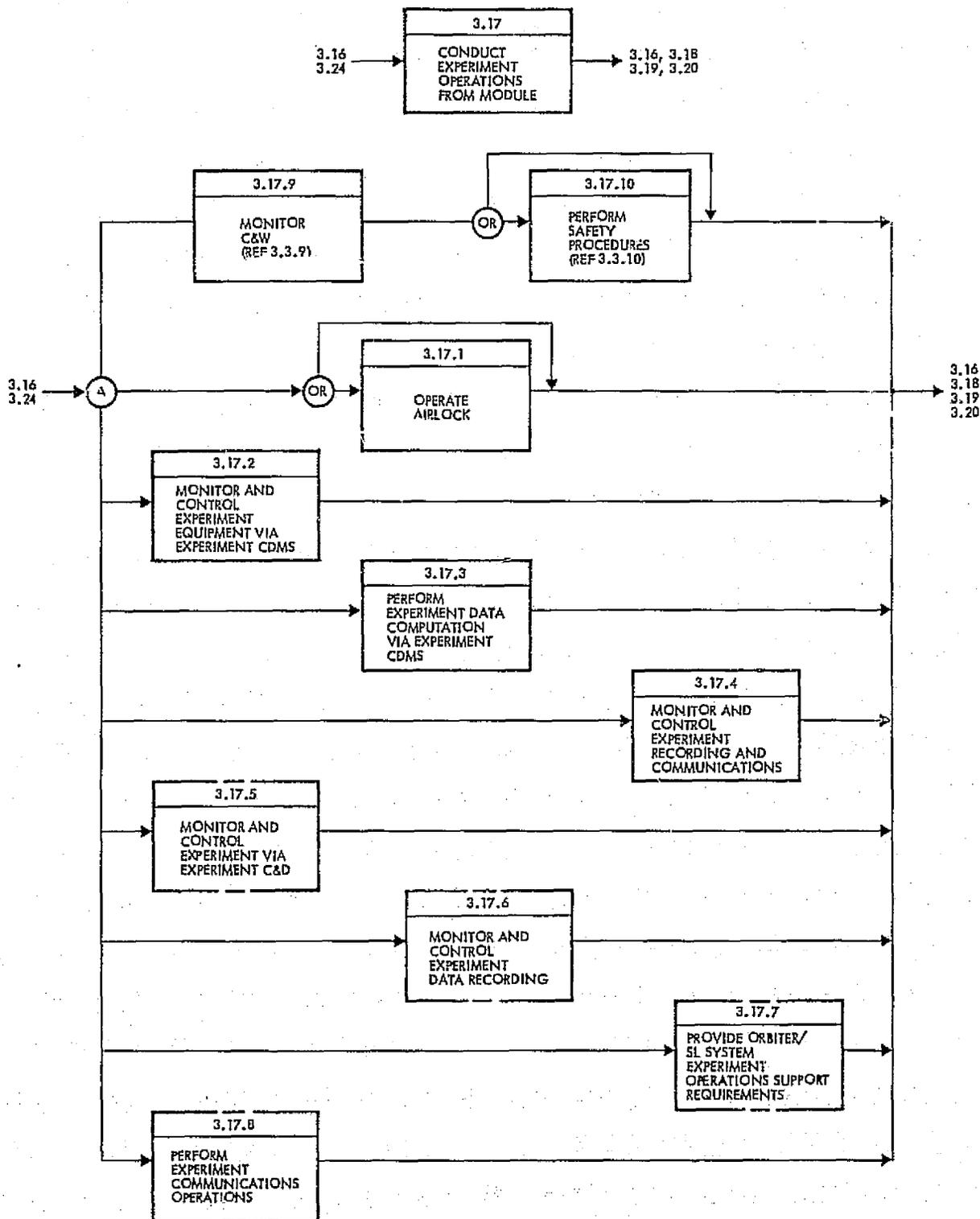
 MISSION AMPS
 FUNCTION 3.16 Verify Experiment
Status from Module

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.16.6	(Continued)	Display experiment data for evaluation against experiment objectives	Flight Data File	Module	SLMD	MS,PS	T	pmK	3	
3.16.7	Verify Status of CPSE	Check condition of: <ul style="list-style-type: none"> • Viewport for visual clarity (no condensation or fogging) • Film vaults • Airlocks, pressure, temperature, inner/outer hatch position, illumination 	Viewport Film Vault Airlock actuator and control panel	Top of module, aft end core Module Top airlock on module Aft airlock in module	SLMD SLMD SLMD	MS,PS MS,PS MS,PS	t t t	pmk pmk pmk	2 2 2	Viewport Mockup Film Vault Mockup Airlock Mockup
3.16.8	Verify experiment status via experiment equipment		Refer to MSFC experiment task analysis							
3.16.9	Verify experiment status via communication links	Communicate with POC Reference experiment task analysis for verification of: <ul style="list-style-type: none"> • Experiment checkout OK • Experiment calibration OK • Experiment flight plan coverage • Experiment procedure for next run/cycle 	Communication Console Refer to MSFC experiment task analysis	Module	SLMI	MS,PS	T	pmK	2	PTT Module

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.16 Verify Experiment
Status from Module

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.16.10	Perform real time replanning.	Reprogram experiment/flight plan procedures (refer to 3.16.9)	Flight replanning aids	Module	SLMD	MS,PS	T	pmK	3	Actual Equip-ment as required, Module Mockup
		Coordinate planned changes with POC	Communication Console	Module	SLMI	MS,PS	T	pmK	3	
		Enter replanned procedures in Flight Data File	FDF	Module	SLMD	MS,PS	T	pmK	3	



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM -
3.17 CONDUCT EXPERIMENT OPERATIONS FROM MODULE

QUALITY
OF PERFORMANCE

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.17 Conduct Experiment
Operations from Module

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.17.3	Perform experiment data computation via experiment CDMS	Input experiment data to computer for processing by computational software program	Experiment CDMS CRT and Keyboard	Module	SLMI	MS,PS	T	pmK	2	PT Simulator (Exp CDMS)
3.17.4	Monitor and Control experiment recording and communications	Monitor and Control use of tape recorder to meet flight plan objectives Monitor performance of communications. Operate controls to enable communications: <ul style="list-style-type: none"> o Within module o Between module and Orbiter o Between module and POC 	Recorder and Communication Control and Monitoring Panel	Module	SLMI	MS,PS	t	pmk	2	Recorder and Communication Panel mockup
3.17.5	Monitor and Control experiment via experiment G&D	--- Refer to MSFC experiment task analysis	---	--	--	--	--	--	-	--
3.17.6	Monitor and Control experiment data recording	Monitor and control recording of experiment data on equipment provided by user	Refer to MSFC experiment task analysis	---	---	--	--	--	-	--
3.17.7	Provide Orbiter/SL System experiment operations support requirements	--- Refer to MSFC experiment task analysis	---	--	--	--	--	--	-	--

**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.17 Conduct Experiment
 Operations from Module

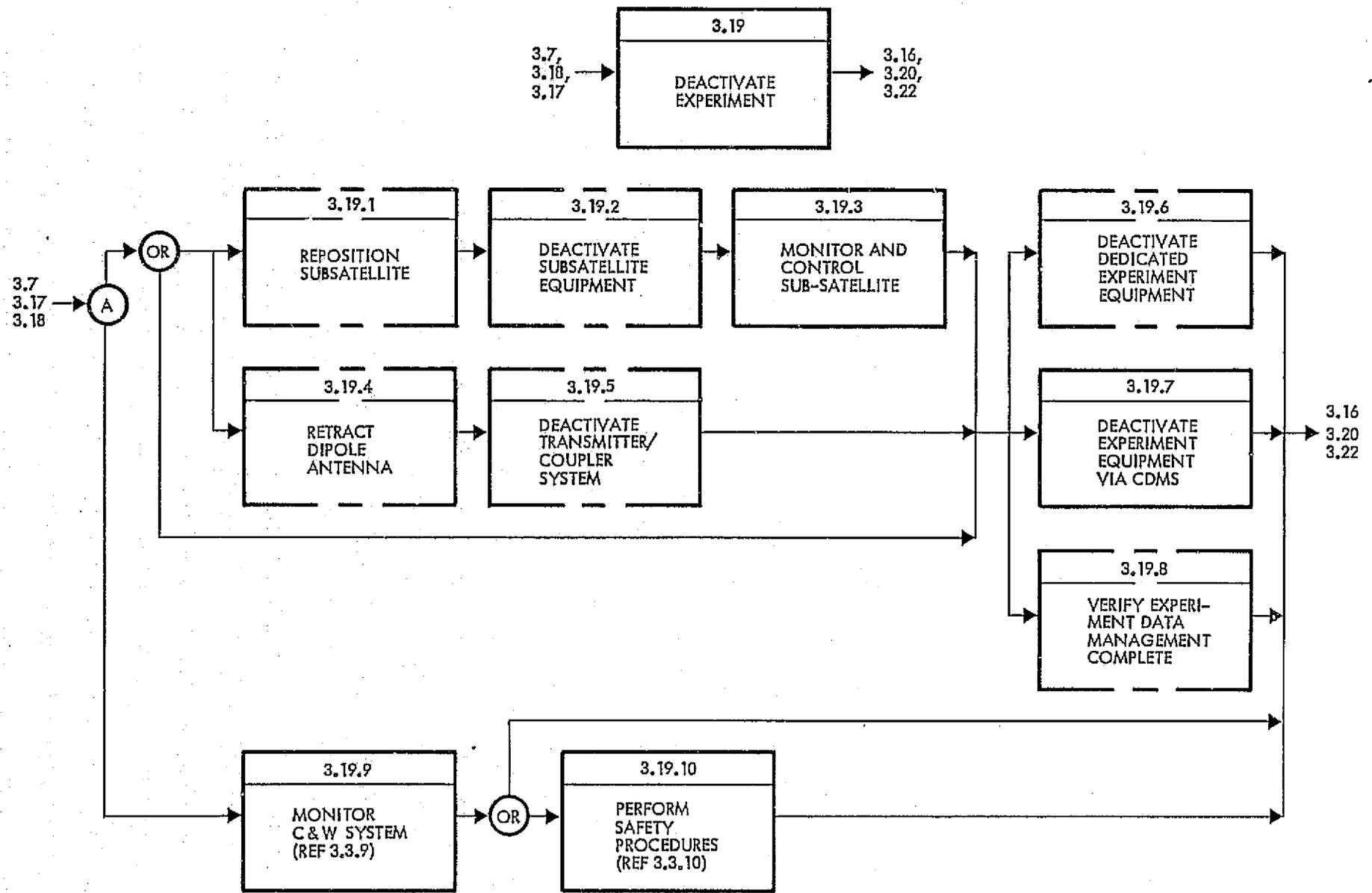
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.17.8	Perform experiment communications operations	Operate user provided communication equipment	Refer to MSFC experiment task analysis			--	--	--	-	--
3.17.9	Monitor C&W System	Refer to 3.3.9								
3.17.10	Perform Safety Procedures	Refer to 3.3.10								

**TRAINING
ANALYSIS
WORK SHEET**

MISSION AMPS
 FUNCTION 3.18 Perform In-Flight Maintenance on Experiment Equipment

Function Description: Activities related to the servicing and repair of experiment equipment.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
	Maintenance tasks TBD	Refer to MSFC Task Analysis								



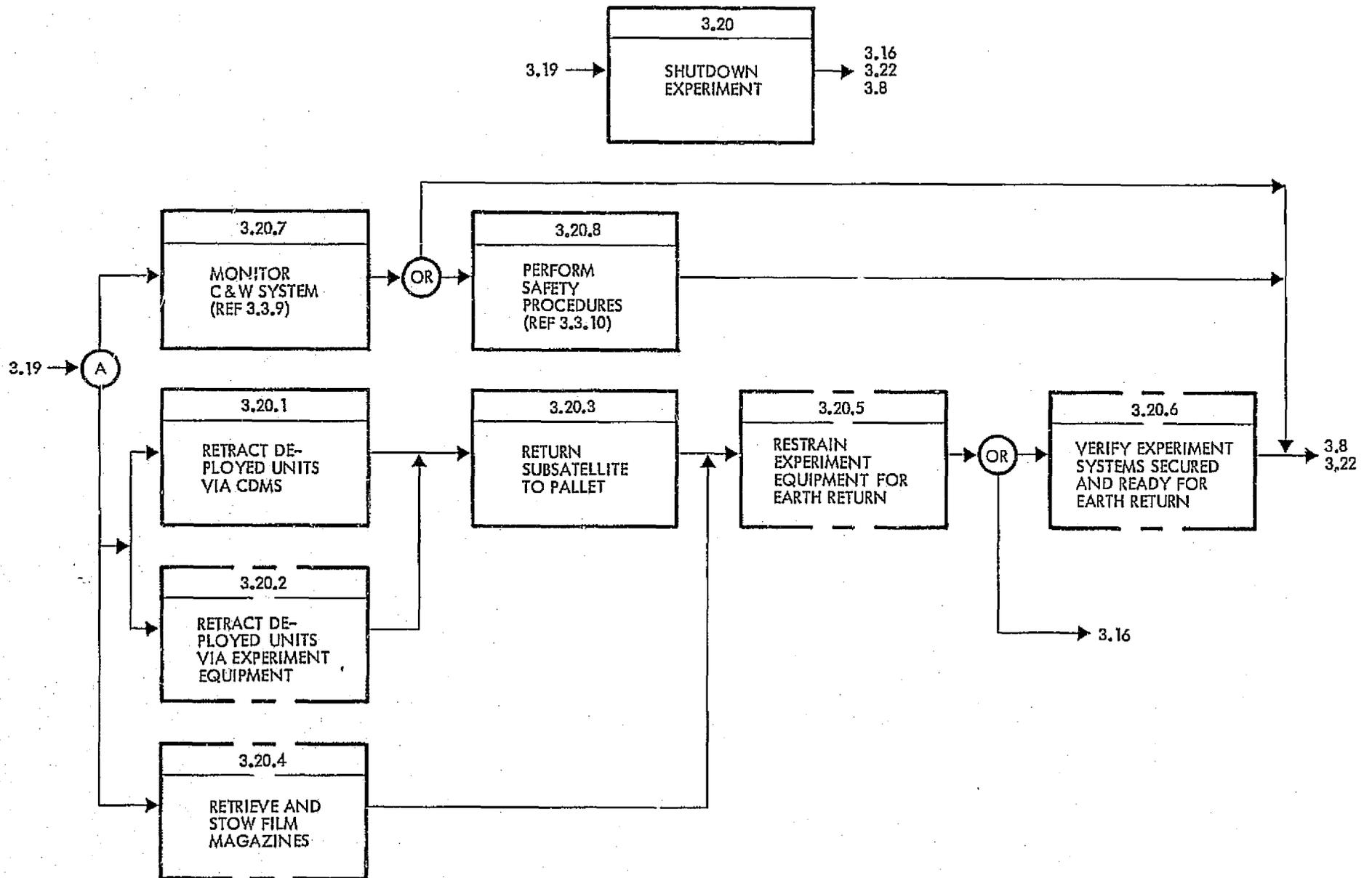
SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.19 DEACTIVATE EXPERIMENT

TRAINING ANALYSIS WORK SHEET		MISSION <u>AMPS</u>	Function Description: Includes activities required to deactivate an experiment upon completion of a cycle of operation or deactivation of equipment prior to unscheduled maintenance activity							
		FUNCTION <u>3.19 Deactivate Experiment</u>								
TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.19.1	Reposition Subsatellite	Position subsatellite to a location/orientation required for use in an upcoming experiment	Refer to MSFC experiment task analysis							
3.19.2	Deactivate subsatellite equipment	Deactivate onboard subsatellite equipment/instrumentation. (House-keeping instrumentation/data remains activated)	Refer to MSFC experiment task analysis							
3.19.3	Monitor and Control subsatellite	Configure subsatellite C&D's and experiment computer for automatic takeover of subsatellite control/monitoring	CDMS CRT and Keyboard	Module	SLMI	MS,PS	t	p,m,k	2	PTT Module, Exp Sim, CDMS
3.19.4	Retract dipole antenna	Monitor retraction	Refer to MSFC experiment task analysis CCTV	Module	SLMI	MS,PS	t	P,m,K	2	PTT Module
3.19.5	Deactivate transmitter/coupler system		Refer to MSFC experiment task analysis							
3.19.6	Deactivate dedicated experiment equipment	Deactivate equipment not required for use in upcoming experiment	Refer to MSFC experiment task analysis							

TRAINING
ANALYSIS
WORKSHEET

MISSION AMPS
FUNCTION 3.19 Deactivate
Experiment

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.19.7	Deactivate experiment equipment via CDMS	Retract booms, deflate target balloons	CCTV	Module	SLMI	MS,PS	T	P,m,k	3	PTT-Module, Exp Sim CDMS ↓
		Deactivate SL recorders	CDMS CRT and Keyboard	Module	SLMI	MS,PS	t	p,m,k	2	
		Deactivate RPS. Return gimbal system to Null, initiate locks to secure system					T	p,m,k	3	
3.19.8	Verify experiment data management complete		Refer to MSFC experiment task analysis							



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.20 SHUTDOWN EXPERIMENT

ORIGINAL PARTS IS
OF POOR QUALITY

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.20 Shutdown
Experiment

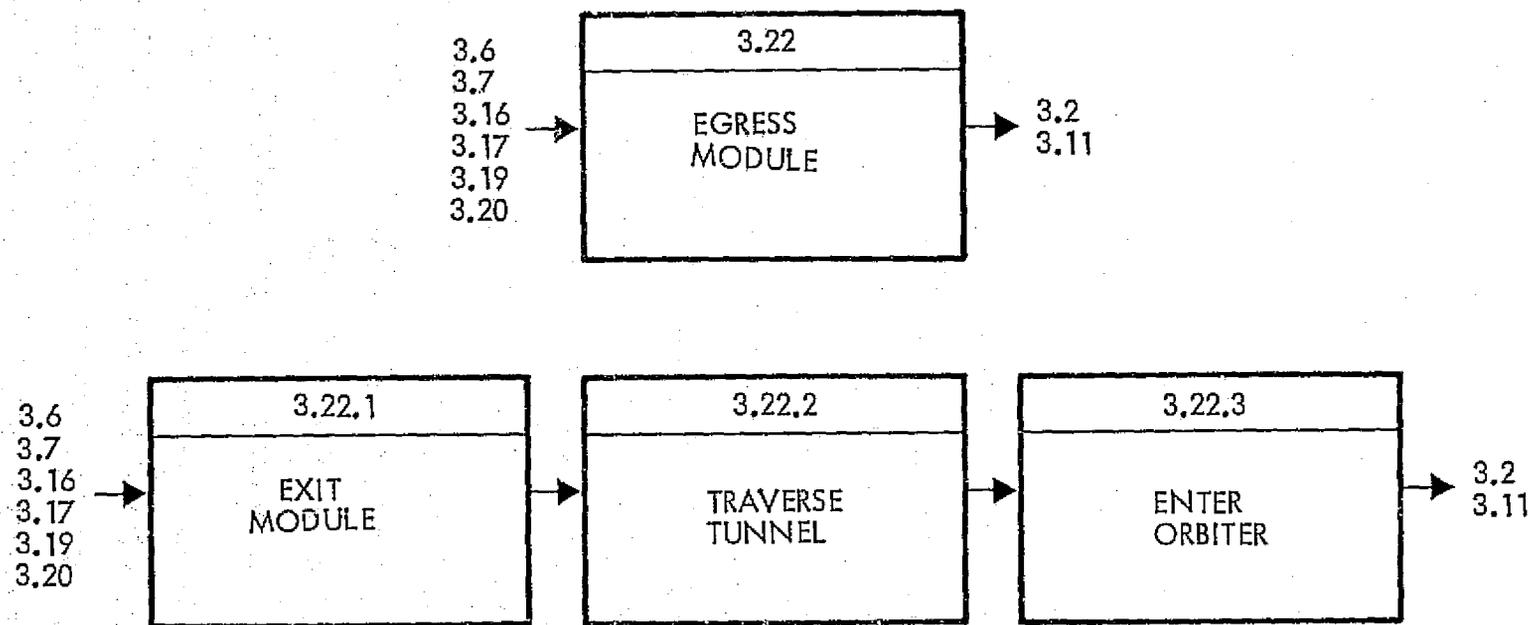
Function Description: Activities related to removing power from experiment equipment, retrieving deployed units and securing equipment for deboost/reentry

NO.	TITLE	TASK DESCRIPTION	EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
			NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/ KNOW- LEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.20.1	Retract deployed units via CDMS	Deflate target balloons on boom Retract 50M boom Retract 300M boom Retract RPS, initiate locks to secure system, replace protective covers	CDMS CRT & Keyboard CCTV	Module	SLMD SLMI	MS,PS MS,PS	T ↓	P,m,k ↓	3 ↓	PTT Module, Exp Sim CDMS
3.20.2	Retract deployed units via experiment equipment	Retract LIDAR, initiate locks to secure system, replace protective covers	Refer to MSFC experiment task analysis							
3.20.3	Return subsatellite to pallet	Position subsatellite over cargo bay opening Capture subsatellite with RMS and restore to pallet Secure for earth return	RMS CCTV Viewport	Aft flight deck	SLMI SLMI SLMD	P,MS	T	P,M,K	4	PTT AFD Orbiter Cargo Bay Mockup AFD W/RMS Mockup
3.20.4	Retrieve and stow film magazines	Refer to MSFC experiment task analysis								
3.20.5	Restrain experiment equipment for earth return	Refer to MSFC experiment task analysis								

TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.20 Shutdown
Experiment

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.20.6	Verify experiment systems secured and ready for earth return	Perform final checklist of experiment equipment status for earth return <ul style="list-style-type: none"> • Power off • Films/tape storage • "Loose" items secured • Thermal conditioning • Data management 	Refer to MSFC experiment	task analysis						



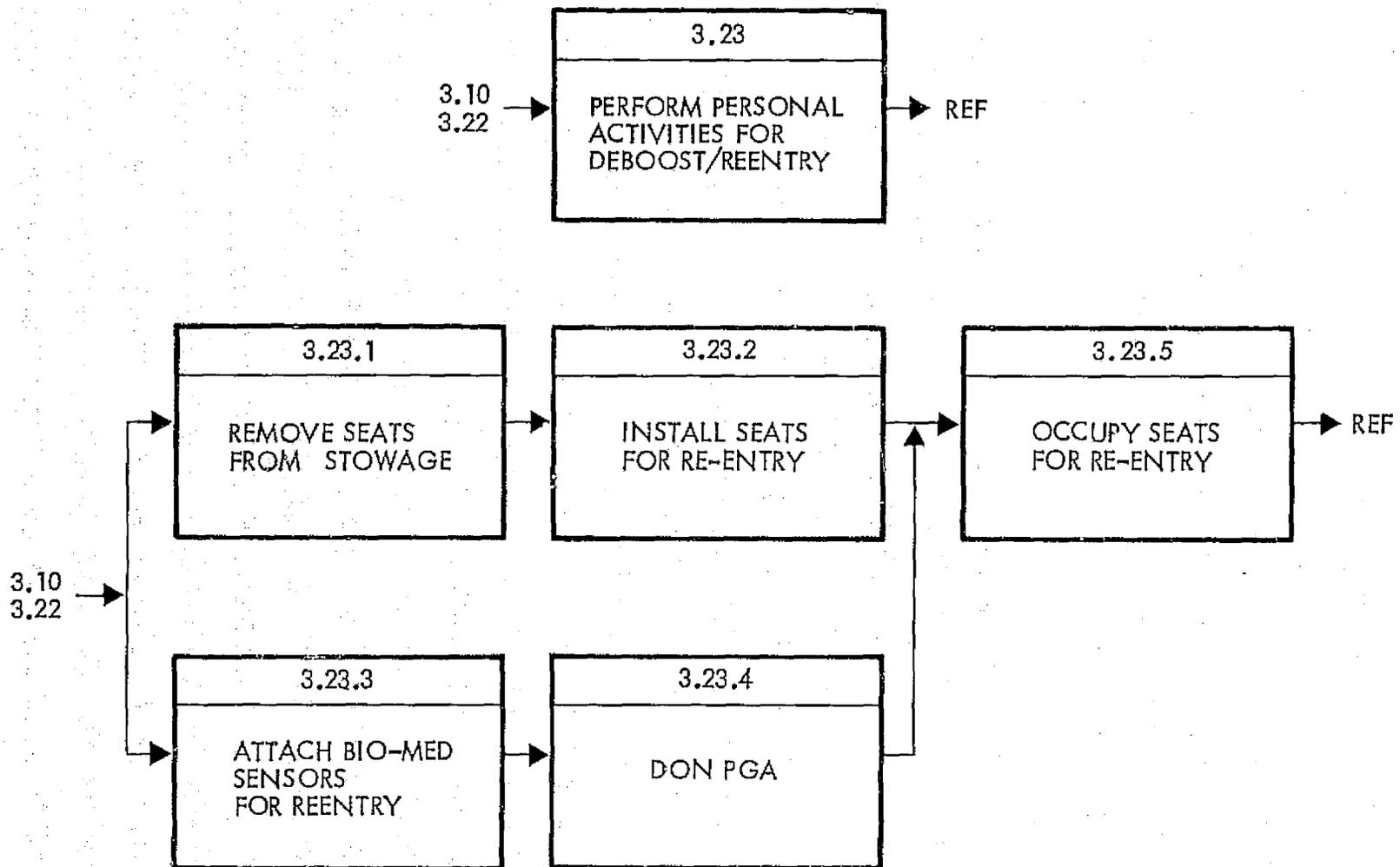
SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.22 EGRESS MODULE

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.22 Egress Module

Function Description: Activities related to personnel movement from module to Orbiter. Assumes, as SOP, hatches remain open throughout on-orbit operations.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.22.1	Exit Module	IVA	None			C,P, MS,PS	t	pMk	2	Module Mockup WIF Mockup Orbiter Mockup
3.22.2	Traverse Tunnel	IVA	None			↓	↓	↓	↓	
3.22.3	Enter Orbiter	IVA	None			↓	↓	↓	↓	



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.23 PERFORM PERSONAL ACTIVITIES FOR DEBOOST/REENTRY

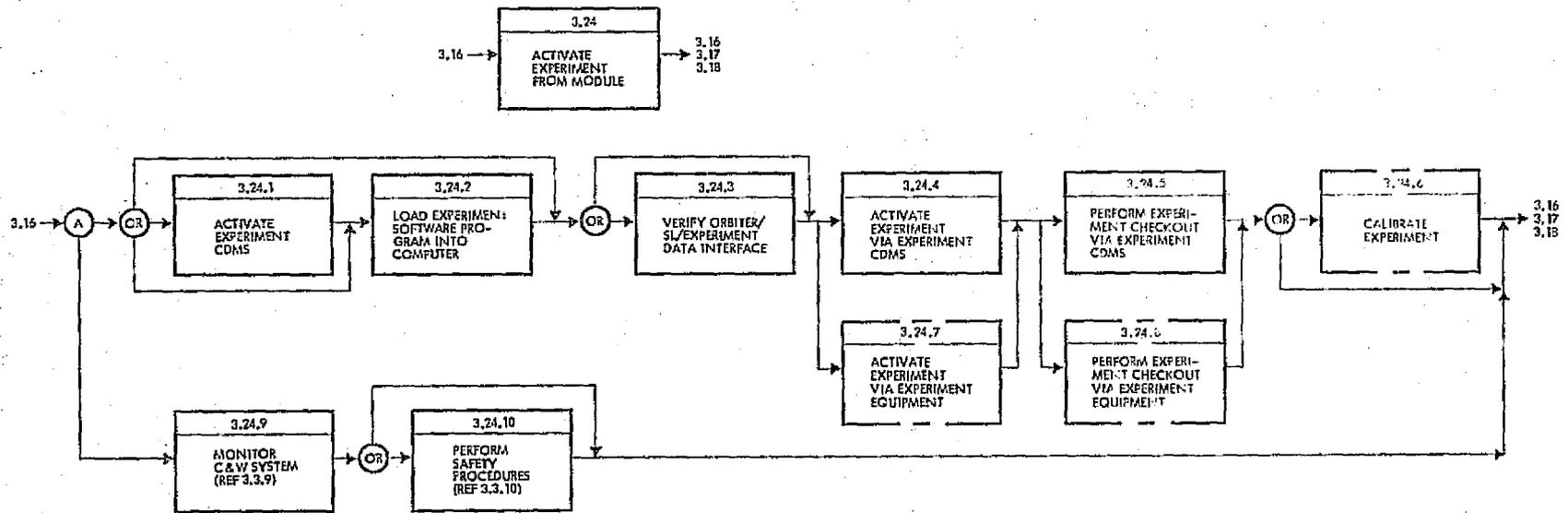
TRAINING
ANALYSIS
WORK SHEET

MISSION AMPS
FUNCTION 3.23 Perform Personal Activities for Deboost/Reentry

Function Description: Includes donning biomed sensors and pressure garment assembly and activities related to occupying seats in preparation for deboost/reentry.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.23.1	Remove seats from stowage	Remove passenger seats for mid deck and aft flight deck from stowage	Passenger seats	Aft flight deck, mid flight deck	SLMI	MS,PS	t	pMk	1	Orbiter Mockup, actual equipment as required and WIF Mockup ↓
3.23.2	Install seats for reentry	Assemble seats, install seats and install restraints required for reentry	Passenger seats, seat restraints	Aft flight deck, mid flight deck	SLMI	MS,PS	t	p,M,k	1	
3.23.3	Attach biomed sensors for reentry	Implace, don, use biomed sensor kit equipment required during reentry	TBD			C,P,MS,PS				
3.23.4	Don PGA	Don PGA and perform checkout of pressure suit	Pressure garment assembly	Aft flight deck and mid deck	SLMI	C,P,MS,PS	t	p,M,k	2	
3.23.5	Occupy seats for reentry	Enter seats, perform final checkout of biomed sensors and PGA hook-up, attach restraints	PGA Biomed sensors Seat restraints	Aft flight deck and mid deck	SLMI	C,P,MS,PS	t	p,M,k	2	

ORIGINAL PAGE IS
OF POOR QUALITY



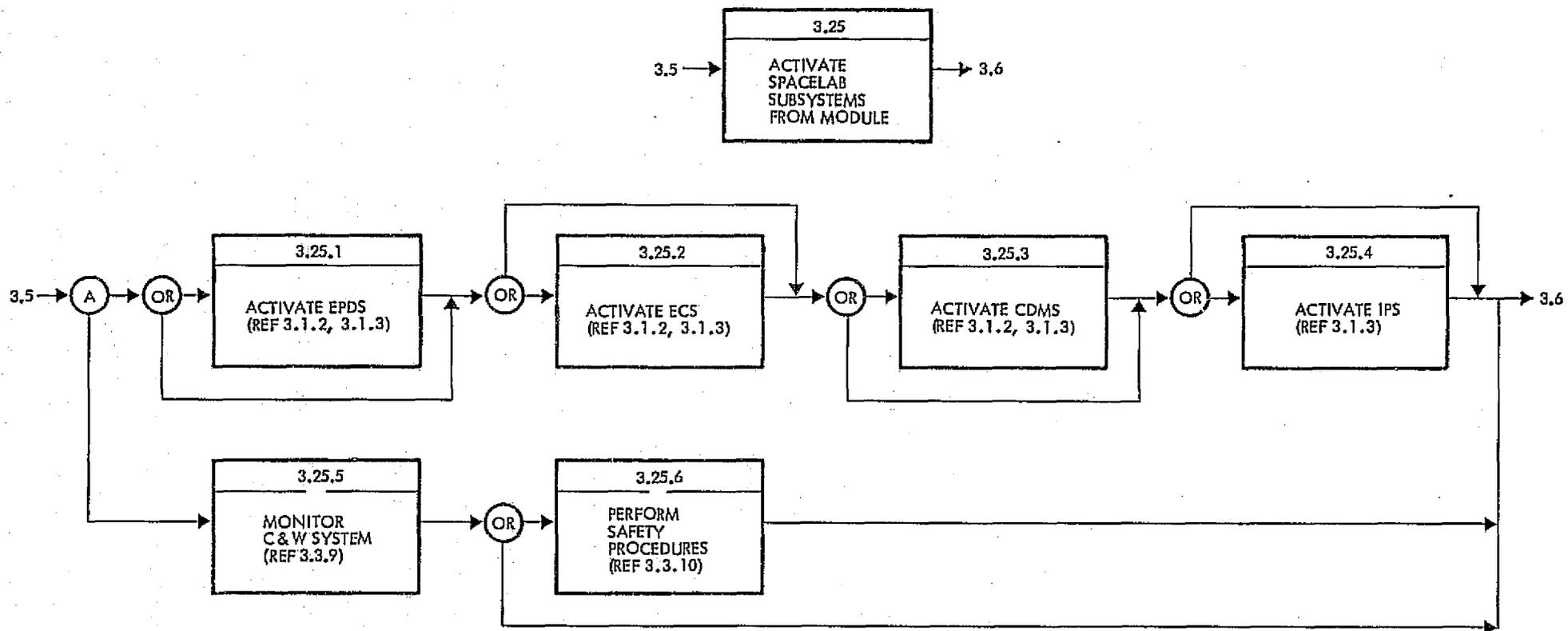
SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.24 ACTIVATE EXPERIMENT FROM MODULE

TRAINING ANALYSIS WORK SHEET

MISSION AMPS
 FUNCTION 3.24 Activate Experiment from Module

Function Description: Activities in module associated with equipment operations required to perform each set of experiments. Activities include initial equipment set-up/orientation, application of power, equipment checkout and calibration.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.24.1	Activate Experiment CDMS	Activate experiment CRT and Keyboard Enter commands to power up experiment CDMS components required to start experiment computer operation	SS-CDMS CRT and Keyboard	Module	SLMI	MS,PS	t	pmk	1	PTT-Module, PT Sim CDMS
3.24.2	Load experiment software program into computer	Ref. 3.13.2	CDMS CRT and Keyboard	↓	↓	↓	t	pmk	2	
3.24.3	Verify Orbiter/SL/experiment data interface	Ref. 3.13.3	Communication Console CDMS CRT and Keyboard Flight Data File	↓	SLMI SLMI SLMD	↓	t	pmk	2	PTT-Module, Exp Sim CDMS
3.24.4	Activate experiment via experiment CDMS	Ref. 3.13.4	Experiment CDMS CRT and Keyboard	↓	SLMI	↓	t	pmk	2	
3.24.5	Perform experiment checkout via experiment CDMS	Ref. 3.13.5	Experiment CDMS CRT and Keyboard	↓	SLMI	↓	t	pmk	2	↓
3.24.6	Calibrate experiment	--- Refer to MSFC experiment	task analysis	---	---	---	-	---	-	---
3.24.7	Activate experiment	--- Refer to MSFC experiment	task analysis	---	---	---	-	---	-	---
3.24.8	Perform experiment checkout via experiment equipment	--- Refer to MSFC experiment	task analysis	---	---	---	-	---	-	---
3.24.9	Monitor C&W System	Ref. 3.3.9								
3.24.10	Perform Safety Procedures	Ref. 3.3.10								



SECOND LEVEL FUNCTIONAL FLOW DIAGRAM - 3.25 ACTIVATE SPACELAB SUBSYSTEMS FROM MODULE

**TRAINING
ANALYSIS
WORK SHEET**

 MISSION AMPS
 FUNCTION 3.25 Activate Spacelab
Subsystems from Module

Function Description: Activities associated with completing the set-up of Spacelab subsystems, from the module workstation, which were not totally activated or were partially shut down for maintenance action.

TASK			EQUIPMENT			PERSONNEL, TRAINING AND TRAINING EQUIPMENT REQUIREMENTS				
NO.	TITLE	DESCRIPTION	NOMENCLATURE	LOCATION	TYPE	TASK ALLO	TIME REQD	SKILL/KNOWLEDGE	CRIT	TRNG & TRNG EQUIP REQUIRED
3.25	Activate Spacelab Subsystems from Module	Note 1: Primary control of Spacelab subsystems is operationally performed at the AFD workstation through MDM, RAU or back-up switches. Control from the module is limited to those elements which can be addressed through the SS-CDMS or through the limited number of switches or manual controls located in the module.								
3.25.1	Activate EPDS	Ref. 3.1.2, 3.1.3 Apply power to experiments at the individual rack experiment switching panel.	Experiment switch panel	Module	SLMI	MS,PS	t	pmk	2	Module Mockup
3.25.2	Activate ECS	Ref 3.1.2, 3.1.3 Adjust module temperature control thermostat	Temperature controller	Module	SLMT	MS,PS	t	pmk	1	Module Mockup
3.25.3	Activate CDMS	Ref. 3.1.2, 3.1.3								
3.25.4	Activate IPS	Ref. 3.1.3								
3.25.5	Monitor C&W system	Ref. 3.3.9								
3.25.6	Perform Safety Procedures	Ref. 3.3.10								