



Flight Data File 2102 Workbook

FDF 2102A

Mission Operations Directorate
Space Flight Training Division

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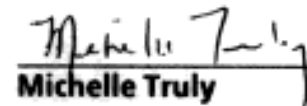
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Foreword

The content of this document was provided by the Systems Section, Operations Training Branch, Mission Operations Directorate (MOD), Lyndon B. Johnson Space Center (JSC), National Aeronautics and Space Administration (NASA). Technical support was provided by the Rockwell Space Operations Company (RSOC) for the Space Operations Contract (SOC). This document was produced through the MOD Training Resource Center, Space Flight Training Division, MOD, JSC, with the assistance of the Integrated Documentation Support Department, Hernandez Engineering, Inc. For additions, deletions, or revisions to the technical content of this document, fill out a JSC form 318 and mail to the document coordinator, Craig Hall/DT49, at 244-7025 or contact the subject matter expert, Michelle Truly, at 244-7307/DT48.

This training manual is designed to give the reader an understanding of what Flight Data File (FDF) is and how it is used. After completing this book, the reader should be able to explain what a particular FDF article is used for and be able to understand and read all types of FDF

This material is for training purposes only. It is intended as an instructor guide and should not be used as a source of operational data. All numerical data, displays, and checklist references are intended only as examples. Consult the applicable Certification Plan outlined in your Flight Operations Support Personnel Training Guide (Blue Book) to determine any prerequisites before using this document. This training package should be studied before attending any classroom session or lesson for which this is a prerequisite.

A training materials Evaluation is included at the end of this document. inputs on this sheet will be used to evaluate the lesson material. You do not need to sign the sheet.

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Objectives

This book is designed to give the reader an understanding of what Flight Data File FDF is and what the different components of it are. The reader will learn what pieces of FDF are used for each flight phase, ascent, orbit, and entry. Lastly, the reader will learn how to "read" the different FDF formats as they follow a very specific design.

Section 1: What is FDF

Flight Data File FDF is the total onboard complement of documentation and related aids available to the crew for flight execution. This includes procedural checklists (C/Ls), integrated timelines, malfunction and reference data books, and flight activity plans, as well as decals, photos, pencils, clamps, and other specialized articles (i.e., Earth

This training manual deals exclusively with the FDF documentation that is associated with procedures; i.e., C/Ls, timelines, and malfunction procedures.

Onboard stowage of the FDF is in one of several fixed and portable containers and/or cloth bags that are strategically placed so that they are readily available to the crew on the flight deck, middeck, or airlock/cargo bay.

All FDF documentation is developed, validated, and fabricated for flight by different sections, branches, and divisions within the Mission Operations Directorate (MOD).

The Space Shuttle Crew Procedures Management Plan (JSC-08969) provides direction for procedures change control and validation.

Section 2: Article Description

There are four types of articles in the FDF that are used throughout a flight for mission execution:

- Control Articles - Timelines that contain the flow of events for the mission
- Support Articles - Nominal task procedures
- Off-Nominal Articles - Procedures used to respond to a system malfunction
- Reference Articles - Handy and good-to-know information

These articles contain essentially all the information that a crew needs to accomplish a mission.

Table 2-1 lists the documents that are contained in each of these four FDF groups. This table lists only those articles that are non-mission dependent; i.e., always flown regardless of the purpose of the mission.

Table 2- 1.- FDF articles that are not mission dependent.

Control articles	Support articles	Off-nominal articles	Reference articles
C/Ls- Ascent Entry Post Insertion C/L Flight Activity Plan Deorbit Preparation CIL Cue Cards	Orbit Operations C/L Cue Cards Extravehicular CIL Extravehicular Cuff C/L Photo/Television C/L	Pocket C/Ls - Ascent Orbit Entry Malfunction Procedures Cue Cards Flip Books Ascent/Entry Systems Procedures Systems AOA CIL Contingency Deorbit Preparation Contingency Extravehicular Operations In-Flight Maintenance C/L Medical C/L	Data Processing System Dictionary Reference Data Book Systems Data Book Charts and Maps Book

Many times, additional FDF articles are flown to help accomplish the mission goal. These documents are usually payload (PL) related and are referred to as mission dependent articles. Table 2-2 contains a sampling of mission -dependent documents.

Table 2-2.- FDF articles that are mission dependent.

Control articles	Support articles	Off-nominal articles	Reference articles
Spacelab Activation/Deactivation CIL	Payload Deployment CIL Payload Operations C/L Payload Deployment and Retrieval System Operations CIL Rendezvous CIL Proximity Operations Book Spacelab Operations C/L Spacelab IPS Operations_C/L	PL Systems Data and Malfunction Procedures Spacelab Malfunction Procedures Spacelab In-Flight Maintenance C/L	Spacelab Reference Data Book Spacelab DPS/CDMS Dictionary

The FDF usage system is set up such that the number of articles needed at any one time is kept to a minimum. Therefore, each FDF article is designed to be used only during a specific mission phase. This helps to keep the cabin organized and also free of loose material during dynamic phases of flight. Table 2-3 is a handy chart that illustrates when each piece of FDF is used throughout the mission. Use this chart as a reference as you read through the rest of this workbook.

Now that you have a basic understanding of the FDF system, it is time to take a closer look at the articles contained in the four FDF groups. The following pages contain brief explanations of those non-mission FDF articles listed in table 2-1.

In addition, appendix A contains a short description of all those FDF articles that are mission dependent. The fact that these articles were placed in an appendix does not mean that they are less important than those described in this section; they are just as important. They were put in an appendix for readability purposes only.

Table 2-3.- FDF usage by mission phase.

<u>Mission phase</u>	<u>Control article</u>	<u>Off-nominal article</u>
2 hr 25 min to Launch	Ascent CIL	Cape Voice
Launch to ETSEP	Ascent 01. Ascent Cue Cards	Cue Cards Flip Books Ascent/Entry Systems Procedures Ascent Pocket C/L
ETSEP to MET 0/00: 50	Ascent C/L	
OMS-2 burn MET 0/00: 50 to 0102:30	Cue Cards for burn Post Insertion C/L	Cue Cards Orbit Pocket C/L Malfunction Procedures Orbit Pocket CIL
MET 0/02:30 to TIG -4 hr	Flight Activities Plan On-Orbit Cue Cards Deorbit Prep CIL	Malfunction Procedures
TIG -4 hr to TIG -50 min		Orbit Pocket C/L Entry Pocket C/L Malfunction Procedures Entry Pocket C/L
TIG -50 min to Deorbit Burn	Entry CIL	
Deorbit Burn	Cue Cards for burn	Cue Cards Entry Pocket C/L
Postburn to EI -5 min	Entry CIL min	
EI -5 min to Rollout	Entry Cue Cards	Cue Cards Flip Books Ascent/Entry Systems Procedures
Postlanding	Entry C/L	<u>Entry Pocket Checklist</u>

Control Articles

Control articles are the primary timelined documents used by the crew from prelaunch through postlanding. These documents contain the schedule of events for the entire mission. The procedures contained in these books include all necessary actions to accomplish mission objectives and ensure crew safety. Each article is designed to be used during a specific mission phase (see table 2-3). Below is a brief description of each n on-mission -dependent control article defined in table 2-3.

Ascent Checklist

The Ascent C/L is the primary timelined control document used from crew ingress (T-2 hr 30 min) through the orbital maneuvering subsystem (OMS) insertion burns. This article contains both the timeline and associated nominal procedures for all crew events that occur prelaunch during ascent and through the OMS-2 burn.

Post Insertion

The Post Insertion contains the schedule of events used to transition the orbiter f ROM the ascent phase to on-orbit operations. This article contains a timeline, procedures, switch verification schematics, and also references procedures in other FDF articles.

Flight Activity Plan

The Flight Activity Plan (FAP) is the control document for on-orbit operations. It contains a timeline that schedules the on-orbit activities and also references support documents for detailed procedures. In addition to a timeline of crew activities, the FAP contains timelines for attitudes, day/night cycles, and communication coverage.

Section 4 covers this document in more detail.

Deorbit Preparation Checklist

The Deorbit Preparation (Deorbit Prep) is used to terminate the on-orbit operations and prepare the orbiter for the deorbit burn. Like the Post Insertion, this article contains a timeline, an entry switch list, procedures, and references procedures in other FDF articles. This document also contains a timeline to back out of ad entry configuration if the deorbit burn is not executed (Deorbit Prep Backout).

Entry Checklist

The Entry C/L is the document used for all nominal crew activities from TIG -50 min through postlanding and crew egress. This checklist is similar to the Ascent C/L insofar as it contains both a timeline and associated procedures.

Cue Cards

Cue cards are short form procedures that are made of sturdy cardboard material and are mounted with Velcro to related displays and controls. Throughout the orbiter there are specific sets of cue cards for each flight phase. During dynamic flight phases (i.e., ascent/entry), the commander (CDR) and pilot (PLT) do not have time to reference procedures in a C/L. Cue cards permit the CDR and PLT to perform procedures during these phases without the encumbrance of a hand-held C/L. In addition, procedures that are used often on orbit are also placed on cue cards for crew convenience. (See appendix C for cue card locations in the cockpit.)

Support Articles

Support articles contain procedures required to support nominal on-orbit activities (not used during ascent or entry). The following descriptions give a brief explanation of those support articles that are always flown. Remember, many other support articles are flown that relate to PL operations.

Orbit Operations Checklist

The Orbit Operations Checklist (Orbit Ops C/L) contains the procedures used to accomplish FAP-scheduled activities on-orbit.

Cue Cards

The on-orbit set of cue cards contains those procedures that are used often while on-orbit. These procedural decals are mounted to associated panels in the crew cabin for easy access and reference. (See appendix C for cue card locations in the cockpit.)

Extravehicular Activity Checklist

The Extravehicular Activity Checklist (EVA C/L) consists of procedures to be used during a planned nominal EVA situation.

Extravehicular Activity Cuff Checklist

The extravehicular activity cuff C/L (EVA cuff C/L) is a short form procedure for use by the EVA crewmember in the airlock and the PL bay.

Photo/Television Checklist

The Photo/Television C/L (Photo/TV C/L) is the set of procedures used to accomplish photo and TV operations scheduled in the FAP.

Off-Nominal Articles

The off-nominal articles contain preplanned procedures that should be performed in the event of a malfunction condition. Each phase of the mission has a separate set of malfunction procedures. Below is a brief description of all of the non-mission-dependent off-nominal articles, defined in table 2-1. Also reference table 2-3 to see when each piece of FDF is used during the mission.

Pocket Checklists - Ascent, Orbit, and Entry

Pocket C/Ls contain those procedures that are considered time-critical for their execution (meaning that these procedures should be executed in 5 minutes or less). Each mission phase has its own dedicated pocket C/L. These books are commonly referred to as the "yellow pages," as they are printed on yellow paper.

Cue Cards

The malfunction cue cards contain short form procedures used by the CDR and PLT to respond to an off-nominal situation quickly. As noted earlier, the cue cards are mounted to various displays and controls for easy reference. There are different sets of cue cards for the different mission phases; i.e., ascent and entry have their own cue cards while all of the OMS burns have their own sets.

Flip Books

Flip books are used by the CDR and PLT during the critical phases of ascent and entry for failures that occur during

these time periods. (See table 2-3 for specific times of ascent and entry.)

The pages of the book, like the cue cards, are made of a sturdy cardboard material, with Velcro tabs on the top that allow the book to remain open unattended. The CDR has one flip book that is located between his/her two far left windows and held in place with a Velcro strap. The PLT has two flip books; one located between the two far right windows and one mounted above the PLT's forward windows. Each flip book is divided into the different orbiter disciplines; i.e., DPS, MPS, OMS, EPS, etc.

It is important to note that the flip books are particular to their designated locations; i.e., the procedure and procedural steps in each book contain only those actions that can be performed on their designated side of the cockpit. For example, the CDR flip book contains procedures or procedural steps that have switch throws on the left side of the cockpit. Similarly, the PLT flip books reference only switch throws for the right side of the cockpit. In the cases where the actions required can be accomplished by either crewmember, both the CDR and PLT flip books contain these steps.

Lastly, the CDR and PLT flip books are divided into two general sections, Powered Flight and Glided Flight. The Powered Flight section is used from launch to ET SEP; the Glided Flight section is used from EI -5 to landing. This document uses certain icons that are particular to this book and the Ascent C/L. The definitions and explanations of their uses are on the first page of the Ascent/Entry Systems Procedures (AESP) book.

Ascent/Entry Systems Procedures

The AESP book is a compilation of the procedures contained in the ascent/entry cue cards and each of the CDR's and PLT's flip books. Like the CDR and PLT flip books, this book is also divided into two general sections, Powered Flight and Glided Flight. Within these two general sections, the procedures are categorized by discipline (i.e., DPS, MPS, etc.). This book is used by mission specialist (MS)2 during ascent and entry. Since MS2 has all the malfunction procedures (CDR and PLT steps combined in one book), MS2 usually coordinates and keeps track of all of the actions being performed.

One very important thing to point out is that this particular piece of FDF is flown in the same binder as the Ascent Pocket C/L and the Entry Pocket C/L. The binder is labeled ASCENT POCKET C/L or ENTRY POCKET C/L and has the AESP in front, followed by the pocket checklists. The Ascent Pocket C/L contains the Powered Flight and Glided Flight sections of the AESP (in case of an abort), whereas the Entry Pocket C/L only contains the Glided Flight section of the AESP. The following sections on FDF usage on aborts may help clarify this. For training purposes, the AESP book is published and maintained separately from the Ascent and Entry Pocket C/Ls. The training AESP books also contain several sections that are not flown in the Ascent and Entry Procedures book (i.e., cue cards, CDR flip book, PLT overhead flip book and PLT window flip book).

Systems Abort -Once -Around

The Systems Abort-Once-Around (AOA) is designed to be used to perform an AOA abort for the cases of the loss of two Freon loops or the loss of two H2O loops. These cases, are extremely critical failures and require elaborate procedures. This book contains "stand-alone" procedures to perform the AOA from post-M ECO through orbiter rollout; no other FDF is required.

Malfunction Procedures

The Malfunction Procedures are used during on-orbit operations and consist of flow charts used to troubleshoot, identify, and respond to a system malfunction. Unlike the Orbit Pocket C/L these procedures are not time-critical; however, they should be performed as soon as possible. In some cases, the malfunction procedures are an extension of the pocket C/L while others can act as stand-alone procedures.

Contingency Deorbit Preparation

As the title implies, the Contingency Deorbit Preparation book is used when a contingency deorbit is required. This may be due to on-orbit failures or failures that have occurred during ascent that require a deorbit after two or three orbits. In most cases, these procedures are stand alone procedures; i.e., no other pieces of FDF are required.

Contingency Extravehicular Activity Operations

The Contingency Extravehicular Activity operations book covers procedures used in the event of an unplanned EVA, such as having to manually close the payload bay doors. This book also contains the procedures used for depressing the cabin prior to any EVA.

In-Flight Maintenance Checklist

The In-Flight Maintenance Checklist (IFM C/L) is the off-nominal document used to repair or replace orbiter equipment. These activities range from removing dirt from an air duct to replacing a general purpose computer (GPQ).

Medical Checklist

The Medical Checklist (MED C/L) provides procedures for medical emergencies and planned in-flight tests.

Reference Articles

Reference articles consist of helpful data and schematics that can be used for additional reference material. The following is a brief description of a few different reference articles.

Data Processing System Dictionary

The Data Processing System Dictionary (DPS DICT) contains reference data about the DPS major modes, cathode ray tube (CRT) displays, and program notes.

Reference Data Book

The Reference Data Book (REF DATA) is an extremely informative and helpful book. It contains dc and ac bus loss critical equipment loss tables, multiplexer/demultiplexer (MDM) equipment loss tables, dedicated signal conditioner failure analysis, and orbiter hardware and software caution and warning (C&W) parameters and messages. Because of its usefulness, MS1 usually carries this book during ascent and entry.

Systems Data Book

The Systems Data Book (SYS Data B K) contains selected orbiter systems performance data, schematics, external figures, and equipment bay and payload photos. Each crew provides input as to what should be contained in this book for their particular mission.

Flight Maps and Charts Book

The maps and charts are used to locate geographical features and star targets. In addition, available runways and landing sites are specified in this book.

FDF During Aborts

The use of FDF during aborts is slightly different but follows the general guidelines of FDF usage. Table 2-4 shows the *FDF* flow for an RTLS, TAL, and AOA.

Table 2-4.- FDF flow for an RTLS, TAL, and AOA.

Time	Control document	Off-nominal
RTLS		
Launch to ET SEP	Ascent C/L RT LS procedures	Cue Cards AESP and-Flip Books;_Powered Flight
ET SEP to landing	Ascent C/L RTLS procedures	Cue Cards AESP and Flip Books; Glided Flight
Landing	Entry C/L Postlanding procedures	Entry Pocket C/L
TAL		
Launch to ET SEP	Ascent C/L TAL procedures	Cue Cards AESP and Flip Books; Powered Flight
ET SEP to landing	Ascent C/L TAL procedures Entry Maneuvers Cue Card	Cue Cards AESP and flip books; Glided Flight
Landing	Entry C/L Postlanding Procedures	Entry Pocket C/L
AOA		
Launch to ET SEP	Ascent C/L	Cue Cards AESP and flip books; Powered Flight
ET SEP to MM 105	Ascent C/L AOA procedures	Ascent Pocket C/L
MM 105 to EI-5	Ascent C/L AOA and AOA Post Burn procedures*	Entry Pocket C/L
EI-5 to landing	Entry Maneuvers Cue Card	Cue Cards AESP and flip books; Glided Flight
Landing	Entry C/L Postlanding Procedures	Entry Pocket C/L

*AOA deorbit burn cue cards are used for the AOA deorbit burn.

Questions

Section 2: Article Description

1. True or False. The nominal procedures for ascent are contained in the Ascent Pocket Checklist
2. True or False. Transition from the Entry Pocket Checklist to the cue cards and Ascent/Entry Systems Procedures occurs at TAEM.
3. True or False. The checklists commonly referred to as the "yellow pages" are the Ascent, Orbit, and Entry Checklists.
4. True or False. The Ascent/Entry Systems Procedures contains all of the procedures printed on ascent/entry cue cards and in the CDR's and PLT's flip books.
5. True or False. The procedures contained in the Malfunction Procedures are considered time-critical and must be performed within 5 minutes of the failure.

Answers

1. False. The nominal ascent procedures are contained in the Ascent Checklist.
2. False. Transition should occur at entry interface (EI) -5.
3. False. The pocket checklists are often called the "yellow pages" since they are printed on yellow paper to help the crew differentiate the malfunction procedures from the nominal procedures.
4. True. This book is used by MS2 during ascent and entry to help keep track of the actions being performed by the CDR and PLT.
5. False. The procedures in the Malfunction Procedures are not time-critical and should be performed as time permits. The malfunction procedures in the pocket checklists are considered time-critical and must be performed within 5 minutes.

Section 3: Display and Control Device Line Structures

Before learning **how to read each** of the FDF articles just described, it is best to stop here and learn some of the basic rules of FDF formatting. One rule in particular is that all FDF articles must reference display and control (D&Q) devices in a specific manner.

The D&C devices consist of various types of switches, circuit breakers, valves, meters, and discrete event indicators. For each of these control devices, there is a specific format that all FDF articles use to reference the device, regardless of the type of FDF it is. This helps to maintain an assured standardization among FDF articles. In this section, we will review all of these formats in order to become familiar with the different line structures for the various control devices.

Basic Line Structure

Panel No.	Control Device Title	(Quantity)	-	Action	(Clarifying Comments)
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Panel Number. Defines the panel that control device is located on. (See location code 2102.) if a row is specified, it will be preceded by a colon; i.e., 0 1 6:A refers to panel 0 16, row A.

Control Device Title. Defines type of control device (i.e., switch, meter, circuit breaker, etc.).

Quantity. Defines number of control devices to be operated whenever a group is defined together in one statement.

Action. Defines the action to be taken.

Clarifying Comments. Clarifies the statement. Usually a catchall for almost any additional information. These comments can also include any tones (C&W, systems management (Bill), etc.) that may be annunciated as a result of the action.

Line Structures for Different Control Devices

Switches

Panel No.	Switch Title	(Quantity)	-	Action	(Clarifying Comments)
-----------	--------------	------------	---	--------	-----------------------

Example: O16:A Brakes MNC-ON

Panel No. = O16, row A
Control device = switch
Switch Title = Brakes MNC
(Quantity) = 1 (default)
Action = place in ON position
(Clarifying Comments) = none

Circuit Breakers

All orbiter circuit breakers are the push/pull type.

Panel No.	cb	Bus	Circuit Breaker Title	(Quantity)	-	Action	(Clarifying Comments)
-----------	----	-----	-----------------------	------------	---	--------	-----------------------

Example: O1:E cb MN C ADTA (two) - open

Panel No. = 01, row E
Control device = cb
Bus = main C (defines power source to cb)
Circuit Breaker Title = ADTA
(Quantity) = 2
Action = open
(Clarifying Comments) = none

Valves

Valves come in two basic forms, lever valves and rotary valves.

Panel No.	Valve Title	vlv	(Quantity)	-	Action	(Clarifying Comments)
------------------	--------------------	------------	-------------------	----------	---------------	------------------------------

Example: AW82B AIRLK DEPRESS vlv - CL

Panel No. AW82B
Valve Title AIRLK DEPRESS
Control device = vlv
(Quantity) = 1 (default)
Action = place in CLOSE position
(Clarifying Comments) = none

Meters

There are three basic types of meters: bar, digital, and gas gauge.

Panel No.	Meter Title ind	(Quantity)	-	Value or Range or Operating Limits	(Clarifying Comments)
------------------	------------------------	-------------------	----------	---	------------------------------

Example: O1 CABIN PRESS ind - 16.7

Panel No. = O1
Meter Title = CABIN PRESS
Control device = ind
(Quantity) = 1 (default)
Action = read value
(Clarifying Comments) = none

Discrete Event Indicators

The main discrete event indicators are pushbutton indicators, annunciator lights, talkbacks, and OFF flags. They are positive confirmation of an event taking place.

Types of indicators:

- pushbutton = pb
- pushbutton light = pb lt
- annunciator lights - lt
- talkbacks tb
- OFF flags flag

Panel No.	Indicator Title	Type of Indicator	(Quantity)	-	Indicator State	(Clarifying Comments)
-----------	-----------------	-------------------	------------	---	-----------------	-----------------------

Example: F6 LDG GEAR ARM pb - ARM

Panel No. = F6

Indicator Title = LDG GEAR ARM

Control device = pb

(Quantity) = 1 (default)

Action = ARM

(Clarifying Comments) = none

Questions

Section 3: Display and Control Device Line Structures

Describe the actions required, as called out, in the following FDF:

L1	FLASH EVAP CNTLR PRI A - ON
L2	FDLN HTR (two) - 1
F4	✓BDY FLAP pb It - off
R4	HYD MPS/TVC ISOL VLV (three) - CL (hold 5 SEC) ✓tb - CL
F8	✓HYD PRESS ind (three) - LO green
O13:A	CRYO O2 CNTLR TK 1 cb - cl

Answers

1. L1 FLASH EVAP CNTLR PRI A - ON
L2 FDLN HTR (two) - 1

On panel L1, place the FLASH EVAP PRI switch in the GPC position and place the two FLASH EVAP FDLN HTR switches in the " 1 " position.

2. F4 ✓BDY FLAP pb lt - off

Check that the BDY FLAP pushbutton light is off on panel K

3. R4 HYD MPS)TVC ISOL VLV (three) - CL
(hold 5 SEC) Ab - CL

Take the three MPS/TVC ISOL VLV switches to the close position, hold them there for 5 seconds, and then check that the M PS/TVC ISCIL talkbacks show "CL."

4. F8 ✓HYD PRESS ind (three) - LO green

On panel F8, check that the three hydraulic pressure indicators are in the 'low green' portion of the three PRESS meters. -

5. 013: A CRYO 02 CNTLR TK 1 cb - cl

The CRYO 02 CNTLR TK 1 circuit breaker should be pushed in. This circuit breaker is located on panel 0 13 row A.

Section 4: Procedural Structures

Now that you have an understanding of how display and control devices are referenced in all FDF articles, we can continue on with reviewing the different FDF articles.

All FDF articles are written in a specific standard format. Of course, not all articles of the FDF are structured exactly the same; some are timed, some are not; some contain procedures, some do not. Unfortunately, the type of FDF article does not necessarily define how it is written. For example, although the Ascent C/L and the FAP are both control articles, they do not abide by the same formatting rules.

This section is divided into three subsections: timed and nontimed C/Ls, timeline procedure documents, and malfunction procedures.

Note that these three subsections do not coincide with the four types of FDF articles described in section 2.

Each subsection defines the format for those FDF articles that have the same procedural structure. FDF examples are used to illustrate how the different documents are formatted. The idea here is that once you understand how a particular FDF article is written, you can read all those FDF articles that are structured similarly. Table 4-1 contains a brief listing of which FDF articles belong to each of the three subsections.

Reference documents are not discussed in this section since each document has its own style and format. It is best to look at the individual documents to see how each one is set up.

Table 4- 1.- Procedure structures.

Checklists		Timelined procedures documents	Malfunction procedures
Timelined	Nontimed		
Ascent C/L Entry C/L Payload Deploy C/L Payload Ops C/L	Orbit Ops C/L Cue Cards Photo/TV C/L EVA C/L	FAP Post Insertion C/L Deorbit Prep Contingency Deorbit Prep Contingency EVA Ops	Cue Cards Ascent Pocket C/L Orbit Pocket C/L Entry Pocket C/L Ascent/Entry Systems procedures Malfunction Procedures

Checklists

All C/Ls, timelined (Ascent and Entry) and nontimelined (Orbit), follow the same structural format.

The following page from the Ascent C/L, shown in figure 4-1, will serve as an example to illustrate how C/Ls are structured. These procedures define the actions that the crew performs from T-1:01:00 to T-32:00:00. On the following pages, sections of this figure will be reviewed in figure 4-2 to show how each procedure is written

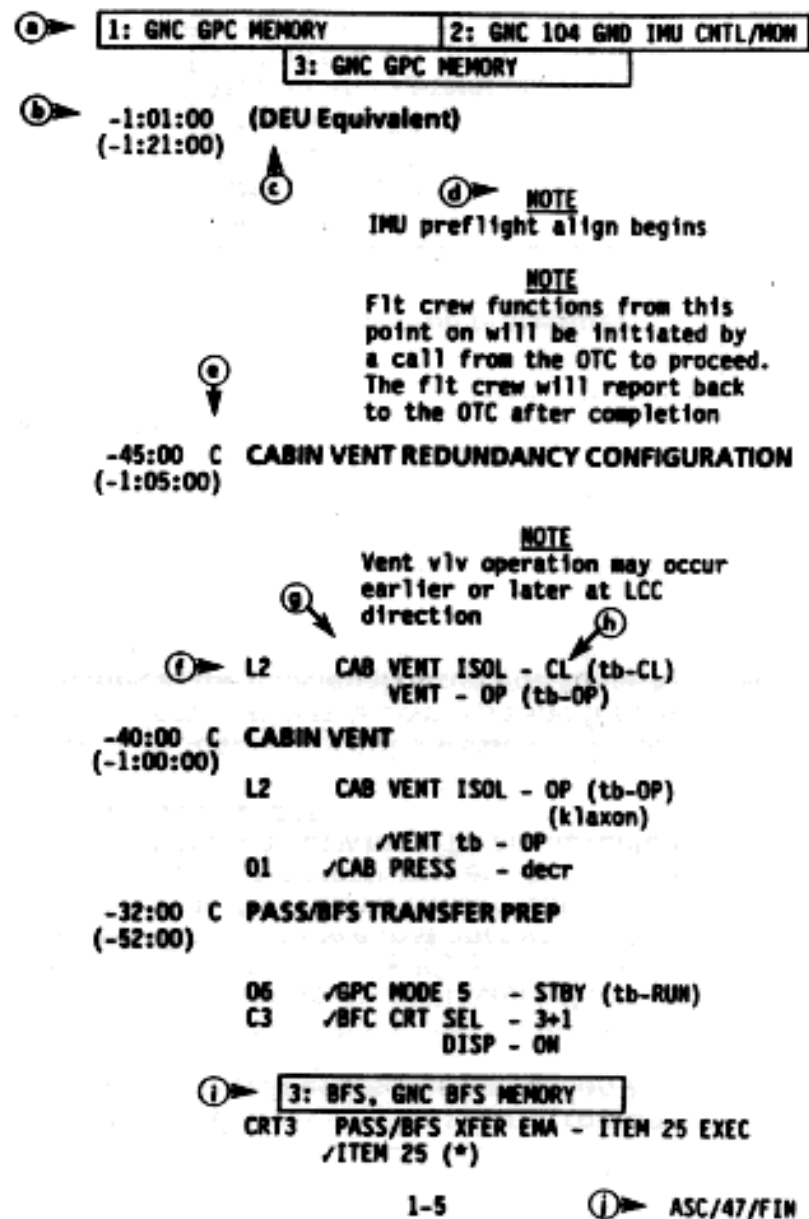


Figure 4- 1.- FDF ascent checklist (references a through j).

Ascent Checklist Procedures

- a. **Header boxes:** When it is desired to manage the use of the CRTs, header boxes will appear at the top of each page to define the box content.

CRT No. BFS, MAJOR FUNCTION SPEC No.

CRT No. = identifies the CRT to be used BFS = only used if display comes from BFS MAJOR FUNCTION = can be either guidance and navigation computer (GNC), SM, or PL SPEC No. = identifies display number TITLE = identical to title on display

- b. **Time:** In the Ascent and Entry C/Ls, the times at which the procedures should be performed are identified on the left. Before T-9 minutes, the ascent C/L lists two times; the time in the parentheses is the time that incorporates the planned launch holds (L-time).

Procedural title: Specifies name of procedure that is to be performed. Procedural titles are always in boldface. Subtitles are written in caps and underlined.

- d. **Procedural notes:** Operations often require clarification or identification of special conditions. Three different forms of information may appear in a procedure: general notes, cautions, and warnings in order of increasing severity.

General Notes: Provide general information or clarify a certain point of operation. See figure 4-2.

Cautions: Cautions are associated with hardware and are used to alert the crewmember of peculiarities that could result in hardware damage or malfunction.

Warnings: Warnings are related to crew safety and are identified by the word WARNING and a double outlined box.

- e. **Crew designation:** Identifies which crewmember will perform the task.

C = Commander

P = Pilot

MS Mission specialist

PS Payload specialist

- f. **Panel location:** Identifies panel number where control device (i.e., switch, circuit breaker, etc.) is located. When panels also have a placarded row identification, the row is identified after a colon (i.e., 0114:13 indicates panel 014. row D).

- g. **Switch title:** The procedural language before the dash (-) identifies the name of the control device (switch, valve, meter, circuit breaker, etc.) to be manipulated. The number following in the parentheses designates the number of control devices to be operated. (See section 3 for further details.)

- h. **Required action:** The procedure following the dash H identifies the action to be taken or the position in which to place a switch, meter, valve, circuit breaker, etc.

- i. **Display change callout:** If a display is changed to support a procedure, it is called out in the body of the procedure.

- j. **Article identification:** The code at the bottom of each page is used to identify the FDF article. It states

- The name of FDF article that page belongs to
- The vehicle this FDF article is applicable.
- The version number of FDF article

In this particular case, this page belongs to the Ascent C/L, it can support all vehicles, and it is the basic version with revision A.

Special Symbols

There are special symbols that are used in all C/Ls that have a particular meaning associated with them. The following page from the Entry C/L serves as a good illustration to show what the symbols signify.

- k. "*" **symbol:** This symbol is used to set off backup or malfunction procedures that are integrated into the nominal procedures. See figure 4-2.
- l. "." **symbol:** The dot or period is used to box in alternate procedures.
- m. "✓" **symbol:** This symbol stands for the instruction check or verify. It implies that the crewmember **will** verify the switch position and if not as expected, place in proper position.

1: GNC DEORB MNVR COAST	2: GNC 50 HORIZ SIT
3: BFS, GNC 50 HORIZ SIT	

* If BFS engaged: *
* Set HSD BFS Items to PASS Config *

k. * If IMU has failed: *
* * * * *
* 2: GNC 51 OVERRIDE *
* 3: BFS, GNC 51 OVERRIDE *
* DES any failed IMUs in BFS *
* * * * *

2: GNC DEORB MNVR COAST	
3: BFS, GNC DEORB MNVR COAST	

P OMS BURN PREP

CRT2 OMS ENG TRIMS
2 ENG BURN:
TRIM LOAD L,R - ITEM 6 +0.0 -5.2
+5.2 EXEC

.....1 ENG BURN.....
TRIM LOAD P - ITEM 6 +0.0 EXEC .
Good eng Y,
LY - ITEM 7 +5.2 EXEC .
RY - ITEM 8 -5.2 EXEC .
.....

l. i. O8 L,R OMS
m. ✓/He PRESS/VAP ISOL (four) - CL
✓TK ISOL (four) - OP (tb-OP)
✓XFEED (four) - CL (tb-CL)
FWD RCS
He PRESS (two) - OP (tb-OP)

FS 3-6 ENT/61-H/FIM

Figure 4-2.- Entry checklist (references k through m).

Timeline Procedure Documents

The Post Insertion, Deorbit Prep, and FAP are timed documents that conform to similar structural formats. Each of these documents contains one or more of the following timelines: an overview timeline, a summary timeline, a detailed timeline, and possibly, a contingency timeline. The following examples illustrate timeline conventions for each of these three control articles. For additional information about reading timelines, see FDF Timeline Format Definitions and Standard Notes 2101 (JSC-19933). This workbook contains very detailed explanations of the different timeline formats.

The Overview Timeline Format - FAP, Post Insertion, and Deorbit Prep

Refer to figure 4-3 for an overview timeline.

- a. **Mission elapsed** time (MET): The time referenced is the cumulative MET expressed in days and hours. MET is referenced to lift-off, which occurs at 0/00: 00: 00 (days/hours: minutes: seconds).
- b. **Activity band**: This row presents an overview of activities scheduled during the flight. For clarity, only major activities are presented.
- c. **Day/night, orbit, notes**:
 - **Day/night**: The orbital day/night intervals are delineated with black bars indicating when the orbiter is in darkness.
 - **Orbit**: The orbital number indicates which orbit the spacecraft is in by numerical sequence. The beginning of an orbit occurs when the orbiter crosses the Earth's equator going from the southern to the northern hemisphere (ascending node). The succession of orbits is numbered in this column with orbit 1 for launch
 - **Notes**: This area is used for supplemental information if required.
- d. **Flight day**: Indicates flight day by numerical sequence. Flight day 1 (FD 1) begins at launch, with subsequent flight days beginning at crew wakeup.

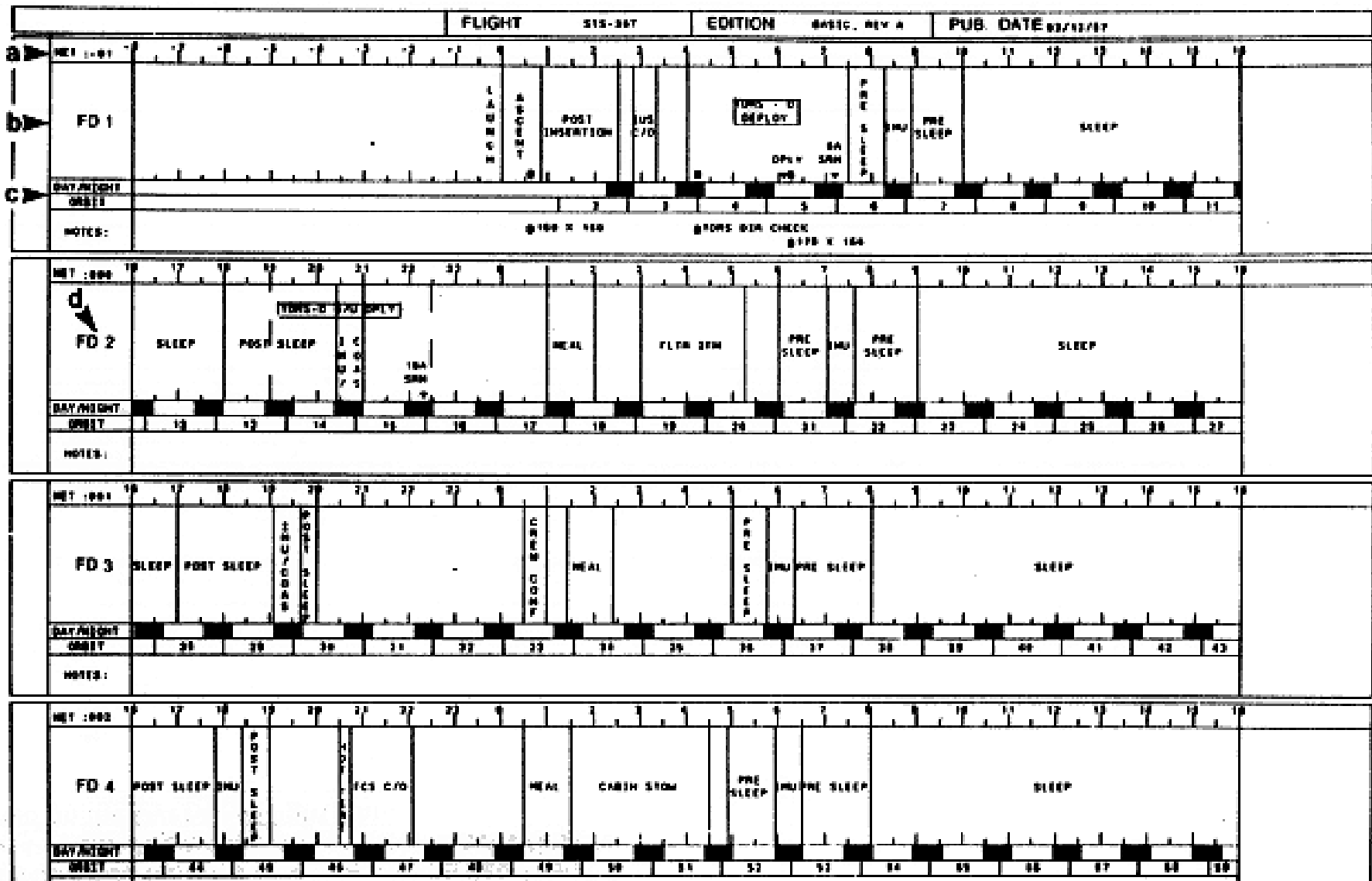


Figure 4-3.- Overview timeline.

Dual-Shift Overview Timeline

For missions that have 24-hour operations, the crew is divided into two teams, a Blue Team and a Red Team. Figure 4-4 shows how the different teams' activities are denoted on the Overview Flight Plan.

OVERVIEW

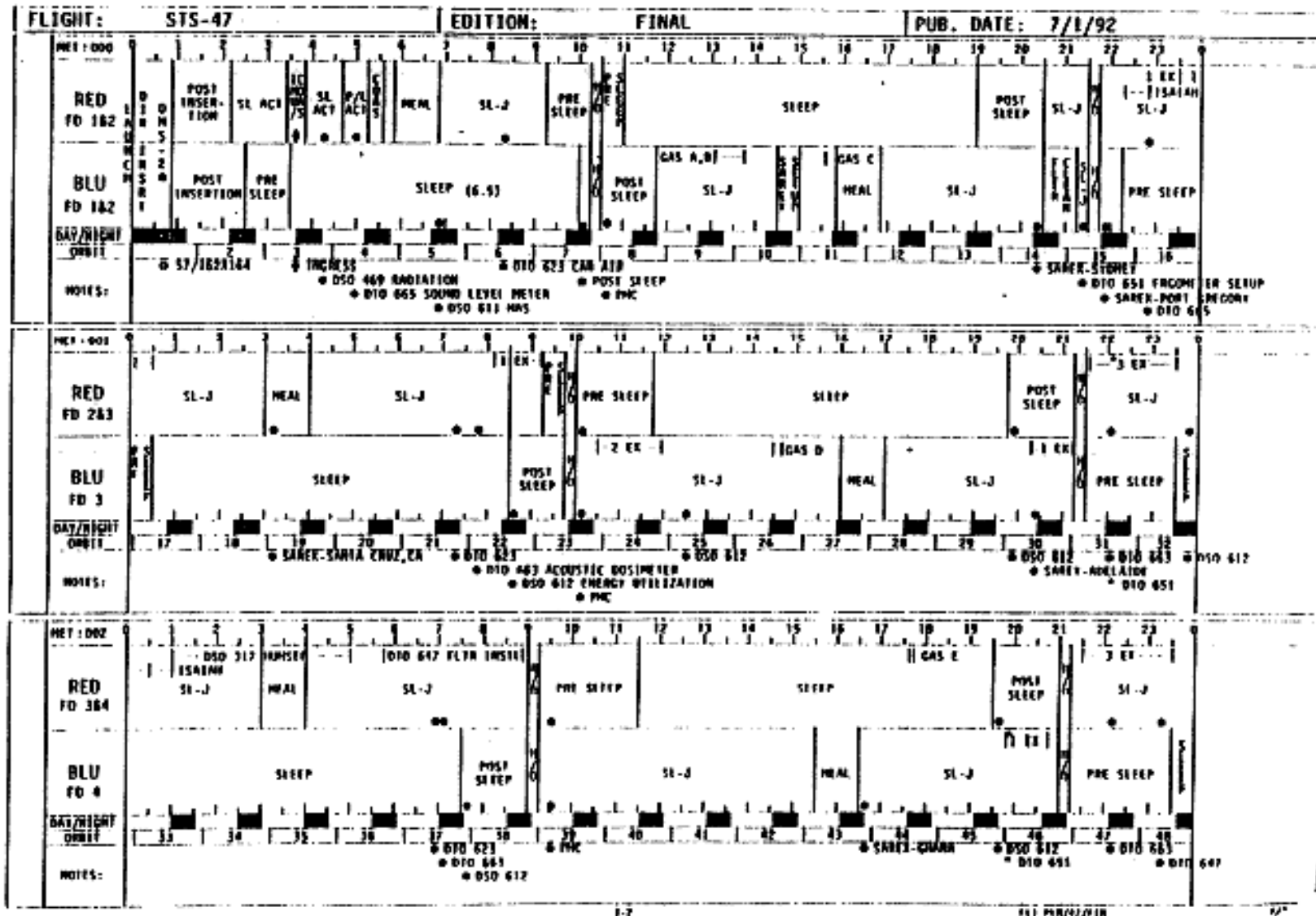


Figure 4-4.- Dual-shift overview timeline.

Summary Timeline Format - FAP, Post Insertion, and Deorbit Prep

Refer to figure 4-5 for a summary timeline.

- a. **Timescales:** Two time references are presented in this section of the summary timeline: MET and central standard time (CST).

MET is referenced to lift-off beginning at 00/00:00:00 (days/h ours: minutes: seconds). The upper left GMT/MET/CST is the time starting point for this page.

Flight day: Indicates flight day (FD) by numerical sequence.

- b. **STS band:** Orbiter related activities are scheduled in this area.

Payload band: PL activities are scheduled in this area.

- d. These two bands are used when there are additional (parallel) STS or PL activities.

- e. **Day/night and orbit**

- **Day/night:** The orbital day/night intervals are delineated with black bars indicating when the orbiter is in darkness.
- **Orbit:** Indicates which orbit the spacecraft is in by numerical sequence. The beginning of an orbit occurs when the orbiter crosses the Earth's equator going from the southern to the northern hemisphere (ascending node). The succession of orbits is numbered in this column starting with Orbit 1 for launch

- f. **Contingency GSTDN coverage:** The ground space flight tracking and data network (GSTDN) communication coverage periods are identified in this area with a horizontal line indicating when communication is available. Since the Tracking and Data Relay, Satellite System (TDRSS) is the nominal communication link, these sites are used for contingency purposes only as the title implies.

- g. **TDRS coverage:** Tracking and Data Relay Satellite (TDRS) coverage is indicated by a line. The thick part shows actual coverage; thin part indicates blockage of Ku-band radar by the orbiter body.

- h. **Attitude and**

Attitude: The current attitude of the vehicle is identified in this area; i.e., IMU, -ZLV.

Maneuvers: An " T " is placed at the time an attitude maneuver is scheduled.

- i. **User field:** User fields are mission-specific. If present, the user field will identify times when a specific activity can occur. An example is experiment opportunity times.

- j. **Notes:** This area will be used for supplemental information if required.

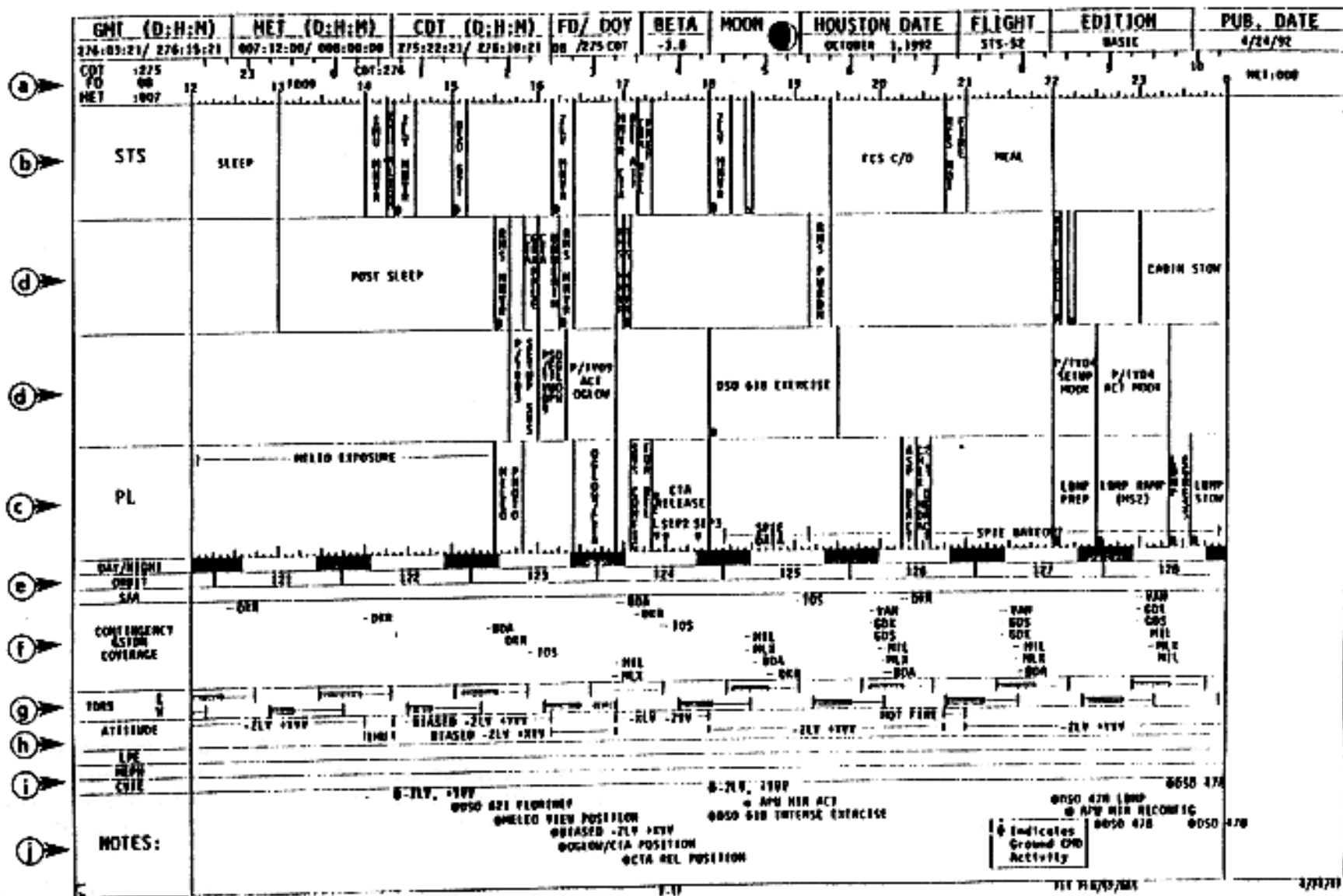


Figure 4-5.- Summary timeline.

Dual-Shift Summary Timeline

As mentioned earlier, when a mission requires 24-hour operations, the crew is divided into a Blue Team and a Red Team. The activities for the two teams on the Summary Timeline are shown in figure 4-6.

SUMMARY
TIMELINE

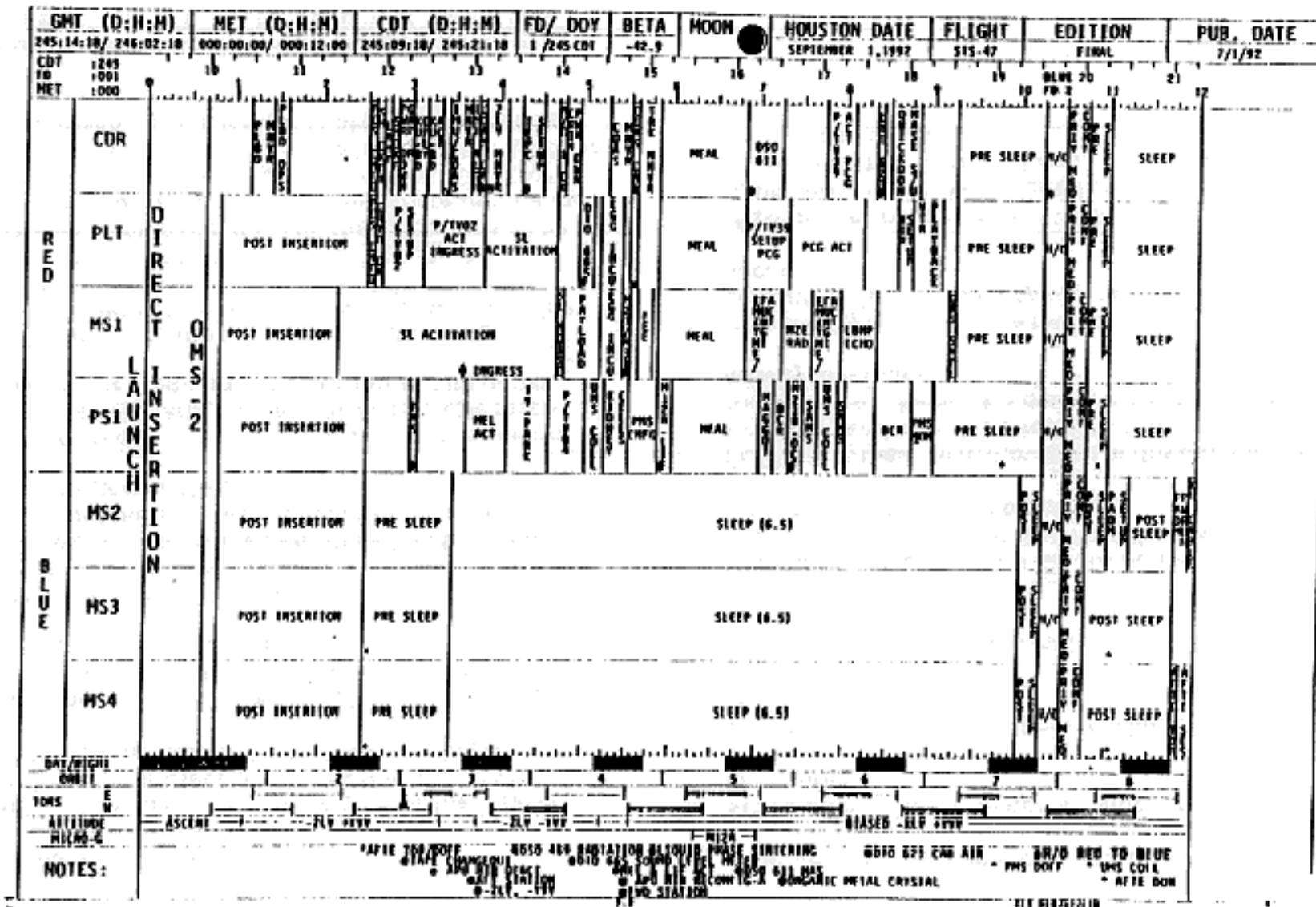


Figure 4-6.- Dual-shift summary timeline.

Detailed Timeline - FAP

Refer to figure 4-8 for a detailed FAP timeline.

- a. **TDRS:** TDRS coverage is indicated by a line. The line on the left indicates coverage by the East satellite, and the line on the right indicates West satellite coverage.
- b. **Contingency RTSIGSTDN coverage:** Contingency remote tracking sites (RTSs) and GSTDN sites and their acquisition periods are identified.
- c. **Day/night cycle:** In this column, a solid bar indicates the period when the orbiter and the Earth are in darkness. A slashed line indicates when the orbiter is in daylight but the Earth beneath the orbiter is still in darkness (terminator).
- d. **MET timescale:** This format is a 5-hour format with 5-minute tick marks on the vertical timescale referenced to MET with lift-off occurring at 0/00:00:00.
- e. **DAP callouts:** In the timescale a digital autopilot (DAP) configuration reference will be included. The DAP configuration that is inactive is in the parentheses. When the active DAP configuration is changed in midpage, the new configuration will be documented adjacent to the point where the change was made. The following are identified: DAP (A#, B#, or transition (TRANS)), mode (automatic (AUTO) or manual (MAN)), and jets (normal (NORM) or vernier (VERN)).
- f. **Orbit:** Indicates the orbit that the spacecraft is in by numerical sequence. orbit 1 begins at lift-off, with subsequent orbits starting when the equator of the Earth is crossed (ascending node).
- g. **Attitude:** Indicates the orbiter attitude.
- h. **STS column:** orbiter-related activities are scheduled in this area.
- i. **Payload column:** PL activities are scheduled in this area.
- j. “ “: This symbol is used to indicate a time-critical event.
- k. **Flight day:** indicates flight day, by numerical sequence. FD 1 begins at lift-off, with subsequent flight days beginning at crew wakeup.
- l. **EZ FAP activities:** Activities listed in this block are not scheduled and may be performed at the crew's convenience. The block is placed in the postsleep activity timeframe.
- m. If an activity requires more than one person to perform it, then the activity will show the number needed.
- n. **Mission Control Center (MCC) column:** Any uplinks, commands, or updates required are scheduled at the appropriate time in this column. TV coverage is also identified in this column.

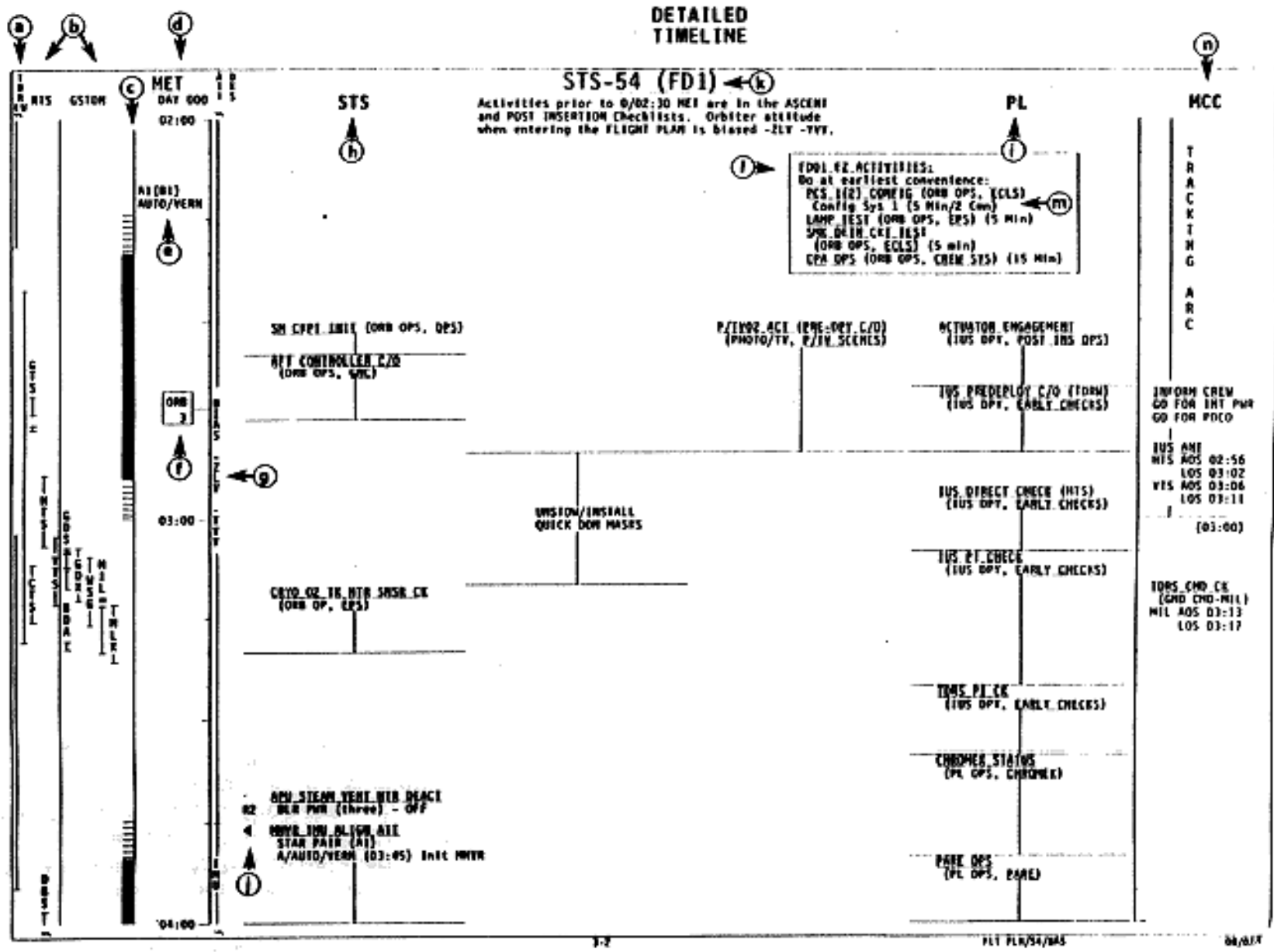


Figure 4-7.- Flight Plan detailed timeline.

Dual-Shift Detailed Timeline

When the mission is a dual-shift operation mission, each team (Blue and Red) gets its own detailed timeline to follow. As you can see in figure 4-8, the team and flight day are noted on the top of the page and, since dual-shift flights are normally very busy, each crewmember's activities are listed individually.

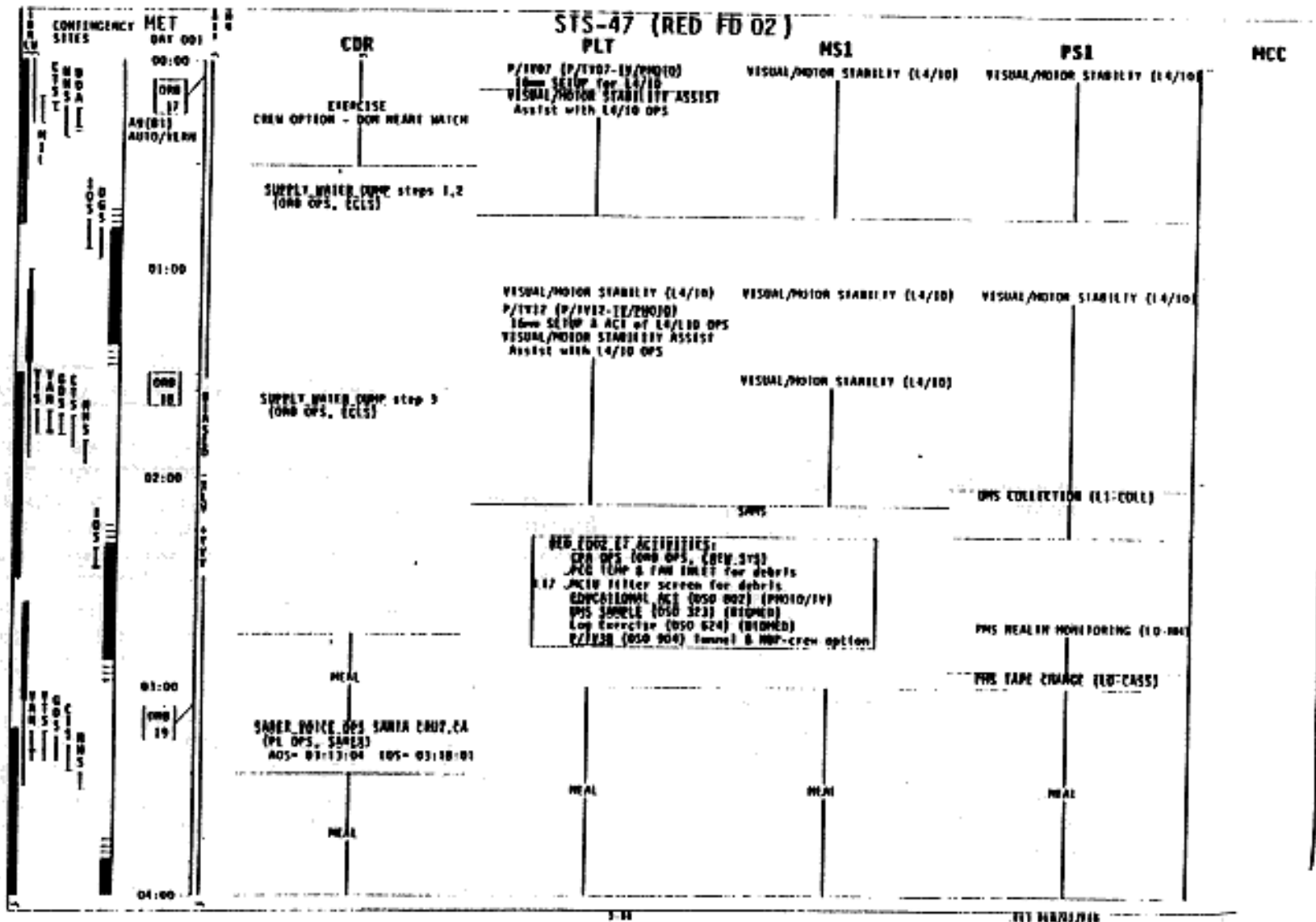


Figure 4-8.- Dual-shift detailed timeline.

Detailed Timeline Format - Post Insertion

Refer to figure 4-9 for a Post Insertion detailed timeline.

- a. **Timescales:** The timescale used in the Post Insertion is MET. The MET is referenced from lift-off beginning at 0/00:00:00 (days/hours: minutes: seconds). The day designation immediately beneath the MET label is for MET DAY counting.
- b. **DAP configuration:** In the timescale, a DAP A and DAP B configuration are included. The DAP configuration that is inactive is in parentheses. When the DAP configuration is changed in midpage, the new configuration will be documented adjacent to the point where the change was made. The following are identified: DAP and configuration number (A# ' B#, or TRANS), mode (AUTO or MAN), jets (NORM or VERN), real-time (RT), and deadband (DO).
- c. **X: XX YY TITLE:** This box is used to call out CRT configuration changes.
- d. "◀": This symbol is used to indicate a time-critical event.
- e. **C, P. or MS:** The letter C (commander), P (pilot), or MS (mission specialist) indicates the specific crewmember designated to perform a task.
- f. **6:** Box-enclosed numerals are used to reference a detailed description.
9. **Uplink column:** Any uplinks, commands, or updates required are scheduled at the appropriate time in this column.
- h. **Procedures:** Detailed procedure blocks and pads, referenced by the box-enclosed numerals in the activity text, are displayed in this area or blank (nontimed) pages.

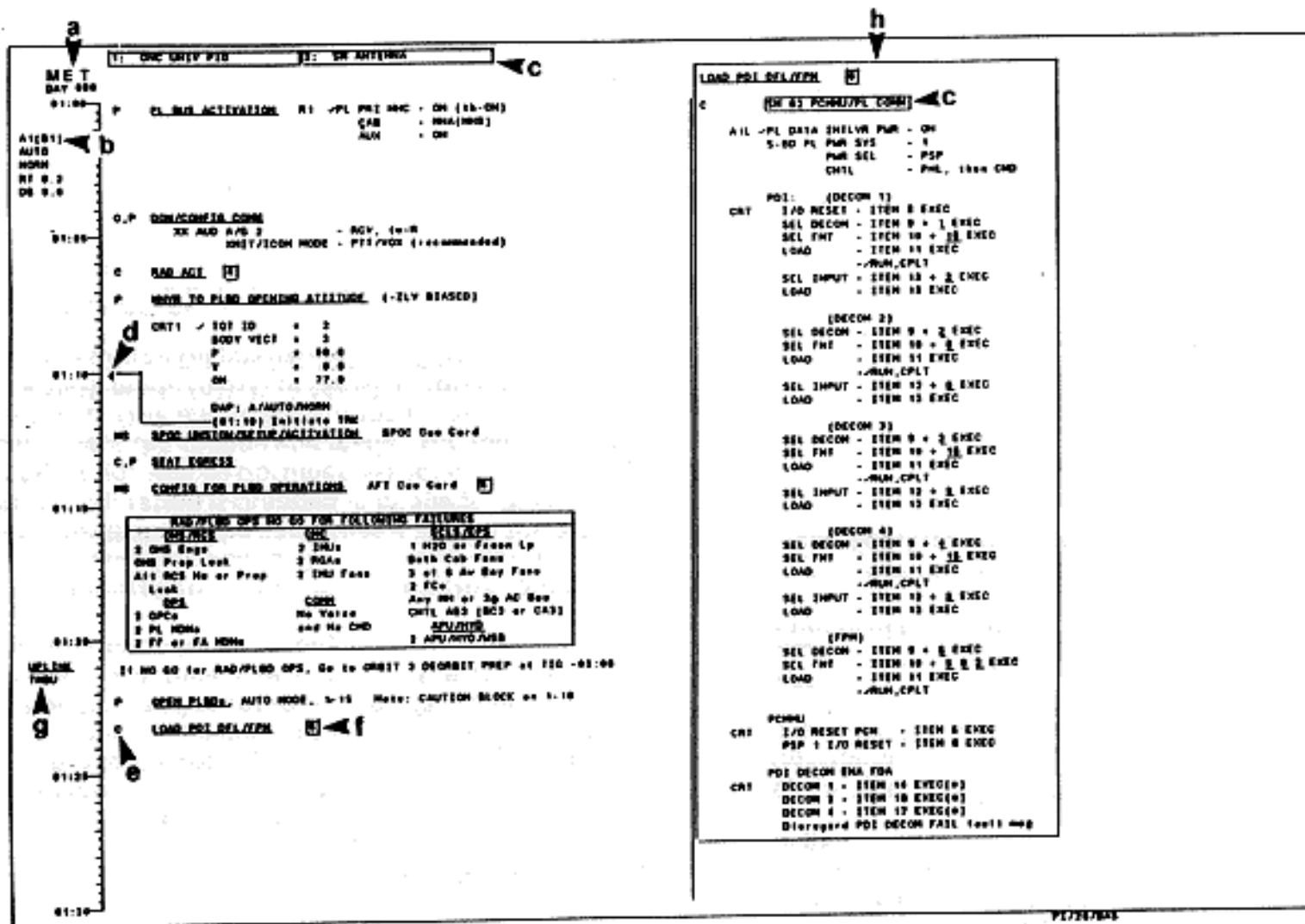


Figure 4-9.- Post Insertion detailed timeline.

Detailed Timeline - Deorbit Prep

Refer to figure 4-10 for a Deorbit Prep detailed timeline.

- a. **Timescales:** The timescale used in the Deorbit Prep is time of ignition (TIG) minus time (TIG-) with cross-reference to the corresponding MET shown at the top of the summary timeline. The TIG is referenced to the ignition time and counts down to 0/00:00:00 on the CRT clock. This time base is used for the deorbit preparations on the entry day.
- b. **DAP configuration:** In the timescale a DAP configuration reference is included. The DAP configuration that is inactive is in the parentheses. When the active DAP configuration is changed in midpage, the new configuration will be documented adjacent to the point where the change was made. The following are identified: DAP and configuration number (A#, B#, or TRANS), mode (AUTO or MAN), in rotation discrete RT, and attitude DB jets (NORM or VERN).
- c. **X: XX YY TITLE** : This box is used to call out CRT configuration changes.
- d. **Procedures:** Detailed procedure blocks and pads, referenced by the box-enclosed numerals, are displayed in this area or on blank (nontimelined) pages.
- e. **C, P, or MS:** The letter C (commander), P (pilot), or MS (mission specialist) indicates the specific crewmember designated to perform a task.
- f. **14** Box-enclosed numerals are used to reference a detailed description.
- g. **Major activity:** This band indicates the duration of major deorbit prep activities.

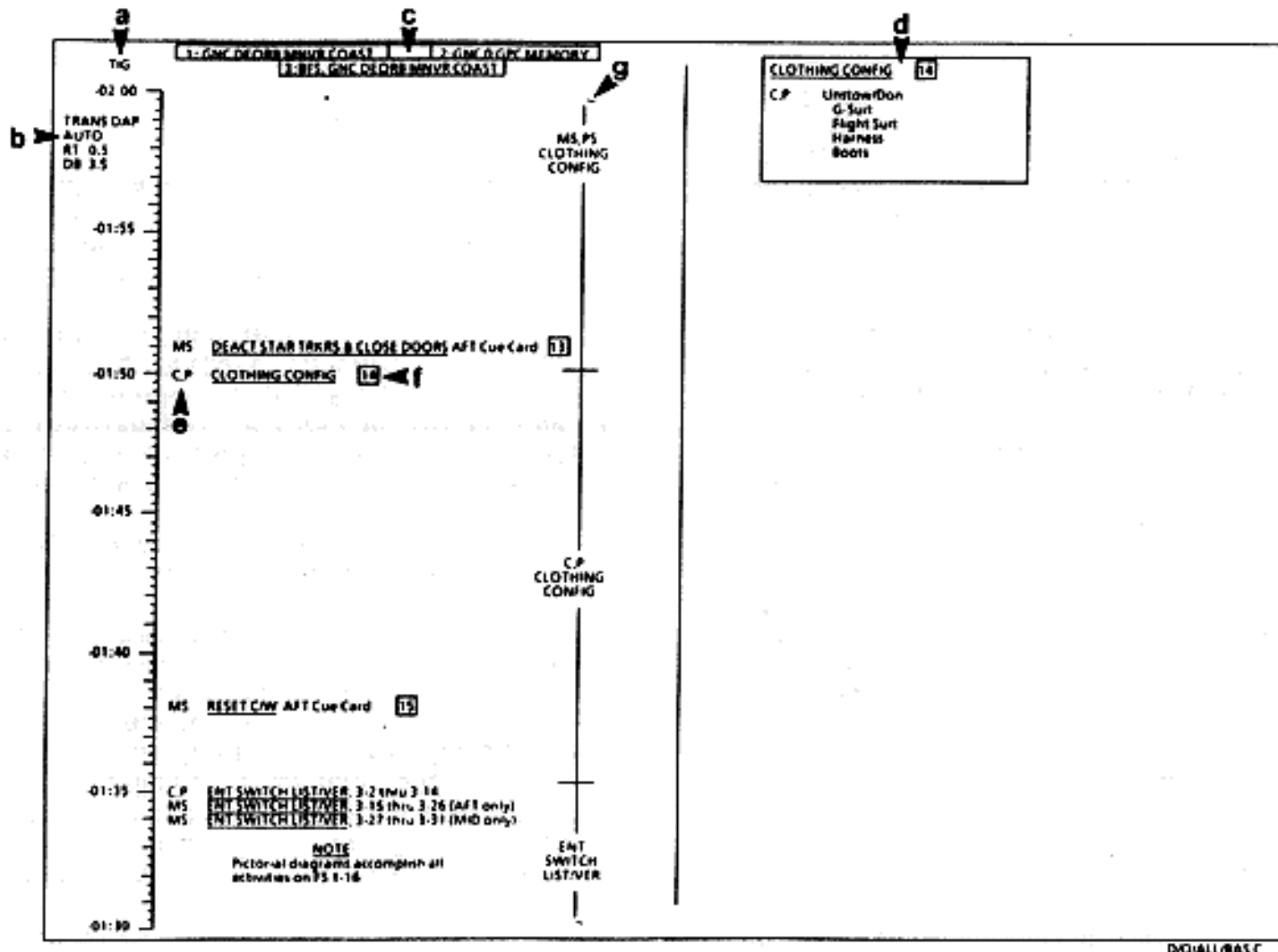


Figure 4- 10, Deorbit Prep detailed timeline.

Malfunction Procedures

There are essentially two types of malfunction procedure formats that are used in all off-nominal FDF articles. One particular format can be found in all of the pocket C/Ls, the CDR's and PLTs **flip books**, cue cards, and the Malfunction Procedures **book**. These procedures are usually quick-reference procedures-and are designed to safe the system rather than troubleshoot the problem. The second format is used exclusively in the Malfunction Procedures book (often called long form MALF procedures). This particular type of malfunction format consists of flowcharts used to troubleshoot, identify, and respond to any system malfunction.

The first format to be discussed is the one that can be found in pocket C/Ls, cue cards, and the long form MALF procedures. the example used is from the Orbit Pocket C/L and deals with ac volts low or high. Since this procedure is contained in the Orbit Pocket C/L, it is time-critical and should be executed in 5 minutes or less

Lastly, the malfunction procedure format that is used only in the malfunctions book will be discussed. An example from the auxiliary power unit/hydraulic (APU/HYD) section will be used to illustrate how to read these types of procedures.

Orbit Pocket Checklist Example

Refer to figure 4-11 for an example from the Orbit Pocket C/L.

- a. **Procedures titles:** Specify the name of the malfunction procedure.
- b. **Header boxes:** These boxes contain the names of the CRT displays that the crewmember should reference while performing the malfunction procedure. These displays are usually those the crew has been directed to by a C&W message.
- c. **">>"symbol:** This symbol informs the crew that they have completed the required actions and should now exit the procedure.
- d. **"IF ... THEN" statements:** Malfunction procedures are designed in a flowchart structure. An "IF" question is asked and the crewmember is directed to a specific part of the procedure depending on the answer. For example, look at the question asked in this particular AC VOLTS procedure. The question asks if the AC VOLTS > 123 or between 108 and 10: If the answer is yes, the crewmember is directed to continue on with the next step. However, if the answer is no, then the crewmember should follow the straight line down to the ELSE portion of the procedure and continue on.

a> AC VOLTS (LOW or HIGH)

b>

SM 67 ELECTRIC
SM SYS SUMM 1

If AC OVERLOAD alarm, go to AC OVERLOAD, 5-3 >>
If single Φ AC VOLTS > 123 or between 108 and 10:

(Confirm with F9 meter)

If INV/AC BUS tb - ON (Inverter lost):

- 1. Affected cb AC CONTR - c1
 INV/AC BUS - OFF (tb-OFF)
 INV PWR - OFF (tb-OFF)
 cb AC CONTR - op

or or

- 2. Perform affected BUS LOSS ACTION, 5-19,
 then go to MAL, EPS, 7.5 11.11 >><c

If INV/AC BUS tb - OFF (O/V or SNSR prob):

- 3. Perform affected BUS LOSS ACTION, 5-19,
 then go to MAL, EPS, 7.5 11.11 >>

d> If multi Φ AC VOLTS < 108:

If INV/AC BUS tb - OFF (SNSR prob or Unannun OVLD):

- 4. Affected cb AC CONTR (three) - c1
 AC BUS SNSR - OFF
 INV/AC BUS - ON (tb-ON)

If any AC AMPS > 14 (Unannun OVLD):

- 5. Affected INV/AC BUS - OFF (tb-OFF)
 cb AC CONTR (three) - op

or or

- 6. Perform affected BUS LOSS ACTION,
 5-19, then go to MAL, EPS, 7.5 11.11 >>

5-4

OPCL/ALL/GEN

Figure 4-11.- Orbit Pocket Checklist procedure.

Malfunctions Book APU/HYD Section Example

Refer to figure 4-12 for an example of the malfunctions book APU/HYD section.

- a. This column contains information concerning what types of fault messages and aural cues the crew should receive, as well as stating what the nominal configuration should have been at the time of the alarm. The fault messages and aural cues are outlined in black boxes.
- b. Circled numbers refer to notes that are contained on the far right side of the page. These notes can be clarifying notes, helpful hints, or concluding statements.
- c. The single black outlined boxes contain the action that the reader should accomplish to determine a final solution. They follow the basic style of asking a question and directing the reader from there, depending on the answer to the question; the arrows direct the reader to the appropriate next step.
- d. The heavy outlined black boxes contain a final statement or solution and usually define the malfunction.

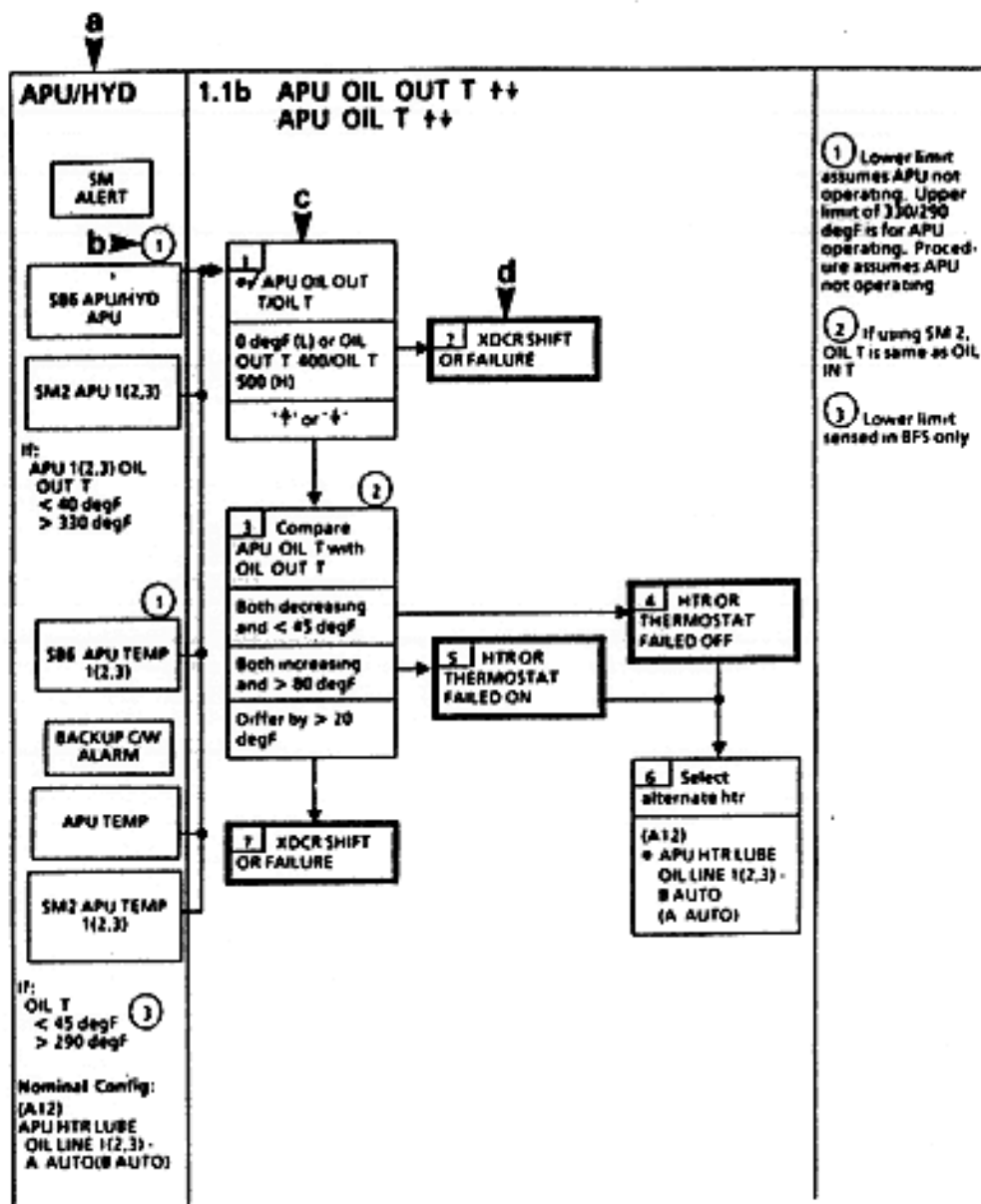


Figure 4-12.- Long form MALF procedures.

Questions

Section 4: Procedural Structures

- A. Using the figure at the right, answer the following questions:
1. What display should be called upon CRT 3? Does it ever change?
 2. Which crewmember is responsible for performing the APU PRESTART?
 3. True or False. In the APU PRESTART procedure, the procedures boxed in by the asterisks should be performed nominally.

1: GNC DEORB MNVR COAST	2: GNC DEORB MNVR COAST
3: BFS, GNC DEORB MNVR COAST	

C OMS TVC GMBL CHECK
 (Perform during S-band AOS)
 CRT1 **SECONDARY CHECK**
 Perform SEC L,R then PRI L,R GMBL CK

* If down arrow(s) or Ms: *
 * Select good GMBL *

MS LES Pressure Integrity Check

P APU PRE-START
 (Perform during S-band AOS)

R4 /HYD BRAKE ISOL VLV (three) tb - CL
 /LG EXTEND ISOL VLV tb - CL

* If tb not CL: *

* R2 (Aff) HYD CIRC PUMP - ON *

* R4 (Aff) ISOL VLV - CL *

* Hold 5 sec, /tb - CL *

* R2 HYD CIRC PUMP - OFF *

R2 BLR N2 SPLY (three) - ON
 /PMR (three) - ON
 /CNTLR/HTR (three) - B
 /APU AUTO SHUTDN (three) - ENA
 CNTLR PWR (three) - ON
 HYD MN PUMP PRESS (three) - LD
 /APU SPEED SEL (three) - NORM
 /OPER (three) - OFF
 /FUEL TK VLV (three) - CL
 /cb FUEL TK VLV ENABLE (six) - CL

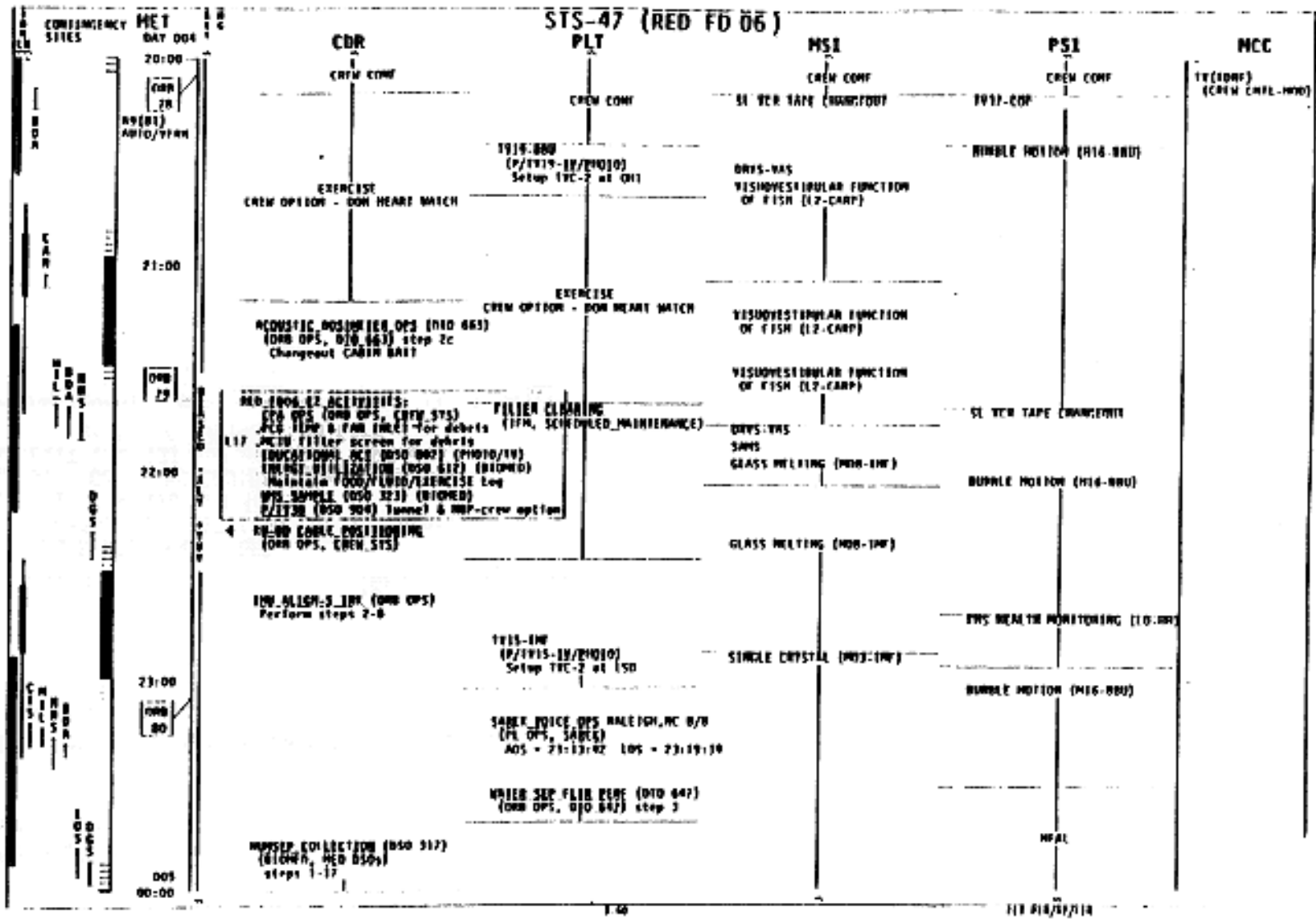
3: BFS, SM SYS SUMM 2

P R2 APU FUEL TK VLV (three) - OP
 /APU/HYD ROY tb (three) - gray
 APU FUEL TK VLV (three) - CL

2: GNC 50 HORIZ SIT

3: BFS, GNC 50 HORIZ SIT

- B. Using the figure shown on page 4-29, answer the following questions:
1. Is the STS-47 flight a single or dual-shift mission?
 2. What time (in MET) does Orbit 80 start?
 3. Is the orbiter in a day or night cycle at MET 4/22:00?
 4. What activity should the CDR perform at MET 4/22:15?
 5. What TDRSS satellite will be available for communications coverage at MET 4/20:00? What contingency communications site will be available if communications using TDRSS were unsuccessful?



- C. Using the figure shown below, answer the following questions:
1. What CRT display should be used to help work this procedure?
 2. If the EXIT T is greater than 170 and increasing, what actions should be performed?

FC EXIT T

BFS, SM SYS SUMM 1

1. MSTR MADS PWR - OFF
2. Perform BUS TIE (Cue Card), then:
If EXIT T > 170 and incr:
| 3. Go to FC SHUTDN (Cue Card) >>
If EXIT T < 131 and decr and no comm:
4. Go to FC SHUTDN (Cue Card)

TROUBLESHOOT: MAL, EPS, FC EXIT T ++, 7.3d **1**

Answers

- A. 1. PASS GNC DEORB MNVR COAST should be on CRT 3 until after the APU PRESTART procedure is performed. At this time, the crew should call up the BFS GNC SPEC 50 display on CRT 3.
2. The "P" to the left of the procedure designates that the pilot should perform this procedure.
3. False. These procedures are a type of malfunction procedure and should not be performed nominally. In this example, these actions should be performed only if either the HYD BRAKE ISOL VLV or LDG EXT ISOL VLV talkbacks do not show "CL."
- B. 1. You can tell by the title on the top of the page that this must be a dual-shift flight, as this page of the Flight Plan specifies that the following timeline is for the Red Team.
2. Orbit 80 starts at MET 4/23:05.
3. The absence of a thick black bar on the day/night cycle bar denotes that the orbiter will be in a day cycle at this time.
4. The CDR should perform the KU-BAND CABLE POSITIONING procedure in the Orbit Ops C/L at this time. The " " to the left of the activity callout denotes that this activity is time-critical and should be performed at its designated time.
5. TDRSS East should be available for communications coverage at this time. If TDRSS communications were unsuccessful, BDA (Bermuda Tracking Site) would be available for S-band communication for approximately 10 minutes.
- C. 1. The box to the right of the procedural title denotes that the BFSD SMS SYS SUMM 1 display should be used while working this procedure.
2. The Fuel Cell Shutdown Procedure (on a cue card) should be performed and then this procedure should be exited, as denoted by the > > symbols.

Appendix A: FDF Articles That Are Mission Dependent

Control Articles

Spacelab Activation/Deactivation Checklist

The Spacelab (SQ Act/Deact C/L contains the timed procedures associated with the activation and deactivation of SL. Since SL operations are active only on orbit, this book is used only during the on-orbit phase of the flight.

Support Articles

Payload Operations Checklist

The PL **Ops** C/L contains all procedures associated with a nondeployable payload. Each PL has its own dedicated C/L that is written in cooperation with the private company that owns the PL and National Aeronautics and Space Administration (NASA).

Payload Deployment Checklist

The PL Deployment C/L contains all procedures needed for a deployable PL (i.e., PL assist module (PAM), inertial upper stage (ILIS)). The following procedures are often included in this document: a flight rules summary, predeploy checkout procedures, on-orbit procedures, deploy procedures, contingency procedures, and alert responses.

Payload Deployment and Retrieval System Operations Checklist

The Payload Deployment and Retrieval System (PDRS) C/L contains those procedures associated with payloads that are designed to be deployed and later retrieved. The deployment and retrieval of the PL are not necessarily accomplished during the same mission; i.e., the Long Duration Exposure Facility (LDEF) was deployed during 41C and was retrieved during STS-32. The following procedures are included in this C/L: nominal operations, off-nominal operations, reference data, and cue cards.

Rendezvous Checklist

The Rendezvous Checklist contains the procedures used during rendezvous operations (maneuvering to a certain attitude to intercept a particular object). This C/L also includes proximity operations procedures that begin when the orbiter is approximately 1000 feet from its target. Some other items contained in this document are: a detailed timeline, contingency operations, reference data, charts, and cue cards.

Proximity Operations Book

The Proximity Operations book is flown only when a rendezvous is planned for that mission. This document contains the procedures used when interfacing with an object that is within 1000 feet of the orbiter. This book contains an operations timeline, contingency operations, reference data, and ranging charts.

Spacelab Operations Checklist

The SL Ops C/L contains all SL nominal operating procedures. This book is referenced by the SL Act/Deact C/L and other SL FDF.

Spacelab IPS Operations Checklist

The SL Inertial Pointing System (IPS) Ops C/L contains the procedures used to operate the IPS. This includes the activation and deactivation procedures as well as the nominal operating 'Procedures.

Off-Nominal Articles

Payload Systems Data and Malfunctions Book

The Payload Systems Data and Malfunctions book is a collection of payload malfunction procedures and reference data. Some of the items contained in this book include IFM procedures, critical equipment lost table, payload schematics, and payload malfunction procedures.

Spacelab Malfunction Procedures

The SL malfunction procedures are very similar to the orbiter malfunction procedures. They contain flowcharts to identify and respond to any SL problem.

Spacelab In-Flight Maintenance Checklist

The SL In-Flight Maintenance Checklist (IFM C/Q) contains procedures used to repair equipment in SL. This may include removing dirt from a filter or replacing a fan.

Reference Data

Spacelab Reference Data

Like the Orbiter Reference Data book, the Spacelab Reference Data book contains a lot of handy and quick-reference information. Some of the information included in this book are a telemetry lost list, a fault messages list, and a fault detection and annunciation (FDA) list.

Spacelab DPS/CDMS Dictionary

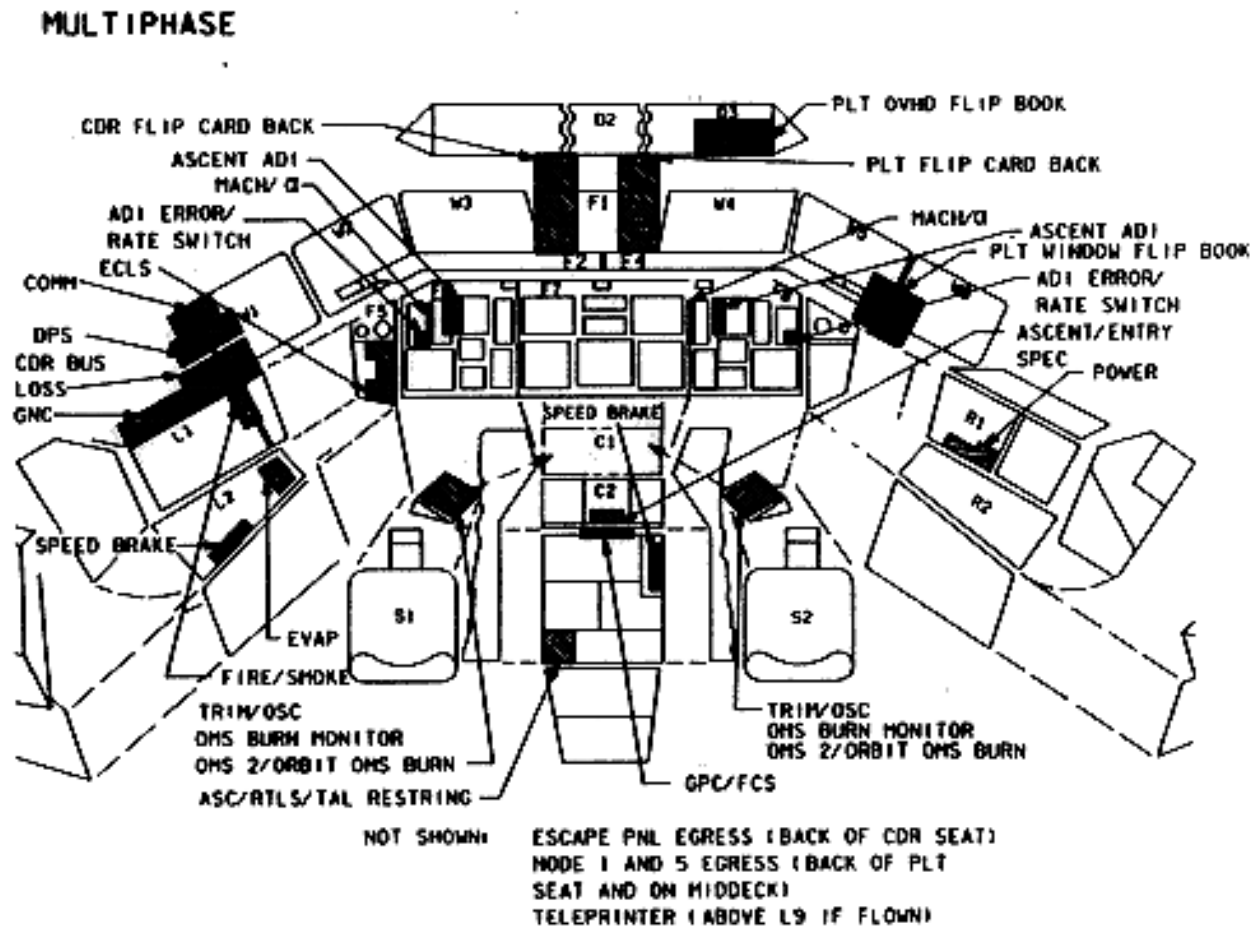
The Spacelab DPS/CDMS Dictionary contains copies and descriptions of the GPC, the subsystem computer operating system (SCOS), and experiment computer operating system (ECOS) computer displays.

Appendix B: Acronyms and Abbreviations

AESP	Ascent/Entry Systems Procedures	IFM	in-flight maintenance
AOA	abort once around	IPS	inertial pointing system
APU	auxiliary power unit	ILIS	inertial upper stage
AUTO	automatic	JSC	Johnson Space Center
		LDEF	long duration exposure facility
C&W	caution and warning	LOS	loss of signal
C/L	checklist	It	light
CDMS	command and data management system		
CDR	commander	MALF	malfunction
CRT	cathode ray tube	MAN	manual
CST	central standard time	MCC	Mission Control Center
		MDM	multiplexer/demultiplexer
D&C	display and control	MECO	main engine cutoff
DAP	digital autopilot	MET	mission elapsed time
DB	deadband	MOD	Mission Operations Directorate
DPS	data processing system	MPS	main propulsion system
		MS	mission specialist
ECOS	experiment computer operating system	NASA	National Aeronautics and Space Administration
EI	entry interface	NORM	normal
EVA	extravehicular activity		
		OMS	orbital maneuvering system
FAP	Flight Activity Plan	ops	operations
FD	flight day		
FDA	fault detection and annunciation	PAM	payload assist module
FDF	Flight Data File	pb	pushbutton
GMT	Greenwich mean time	PDRS	payload deployment and retrieval system
GNC	guidance and navigation computer	PL	payload
GPC	general purpose computer	PLT	pilot
GSTDN	ground space flight tracking and data network	PS	payload specialist
HYD	hydraulic		

RMS	remote manipulator system
RSOC	Rockwell Space Operations Company
RT	real-time
RTS	remote tracking site
SCOS	subsystem computer operating system
SL	Spacelab
SM	systems management
STS	Space Transportation System
STSOC	Space Transportation System Operations Contract
tb	talkback
MRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TIG	time of ignition
TRANS	transition
TV	television
VERN	vernier
vLv	valve

Appendix C: Cue Card Locations in the Cockpit



0112. ART 38

Figure C- 1.- Locations of cue cards for multiphases of flight.

ASCENT

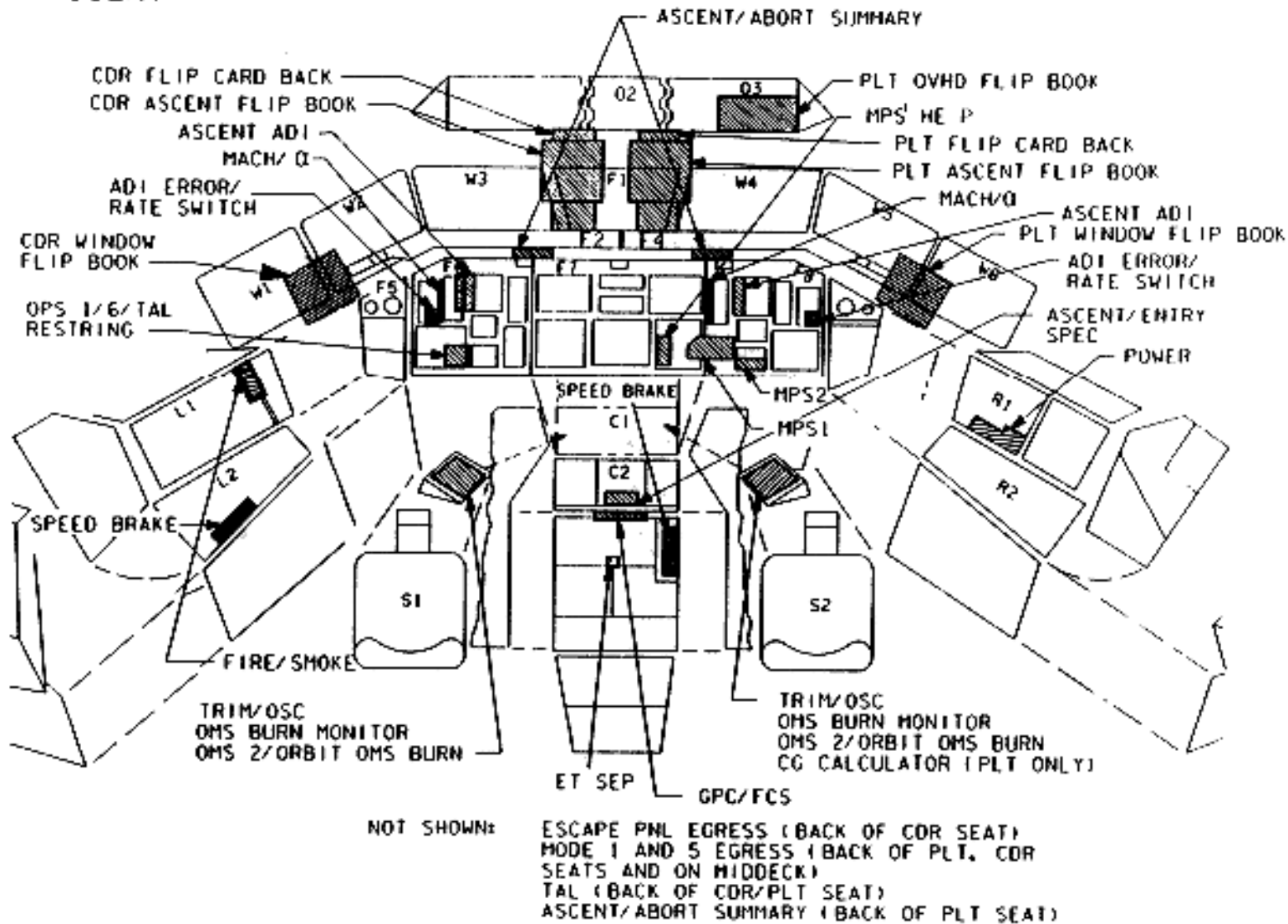
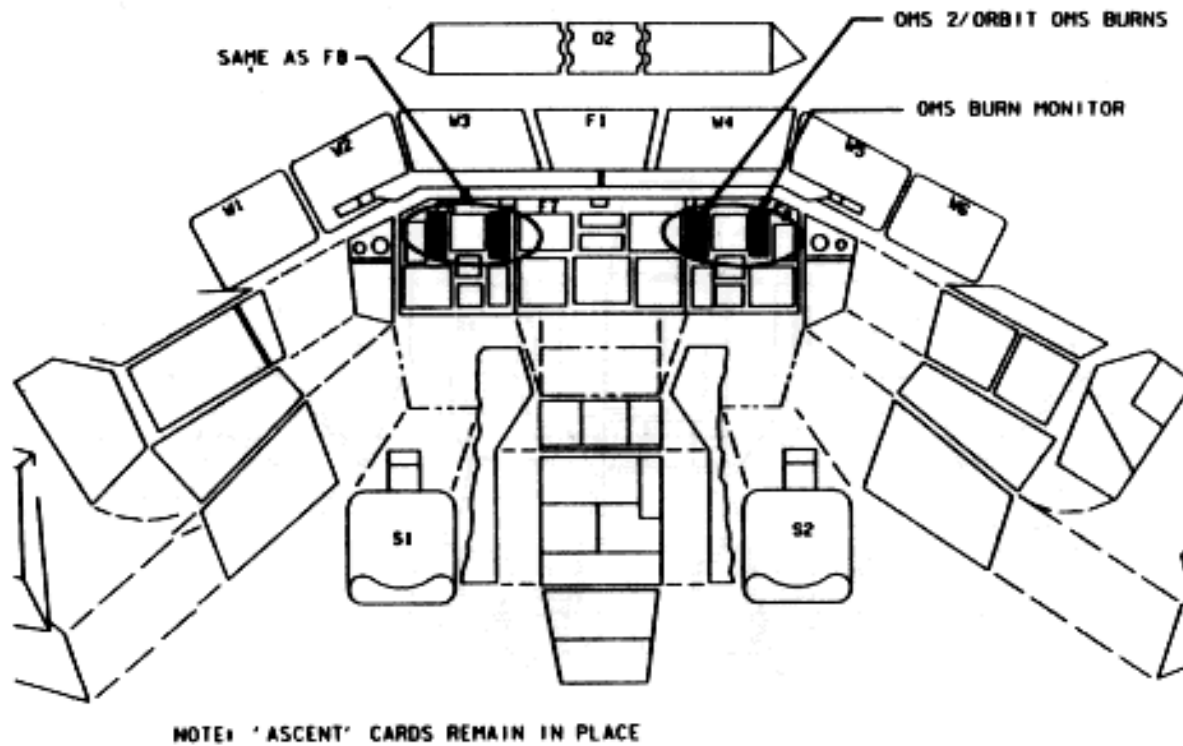


Figure C-2.- Locations of cue cards for ascent.

0112, ART, 44

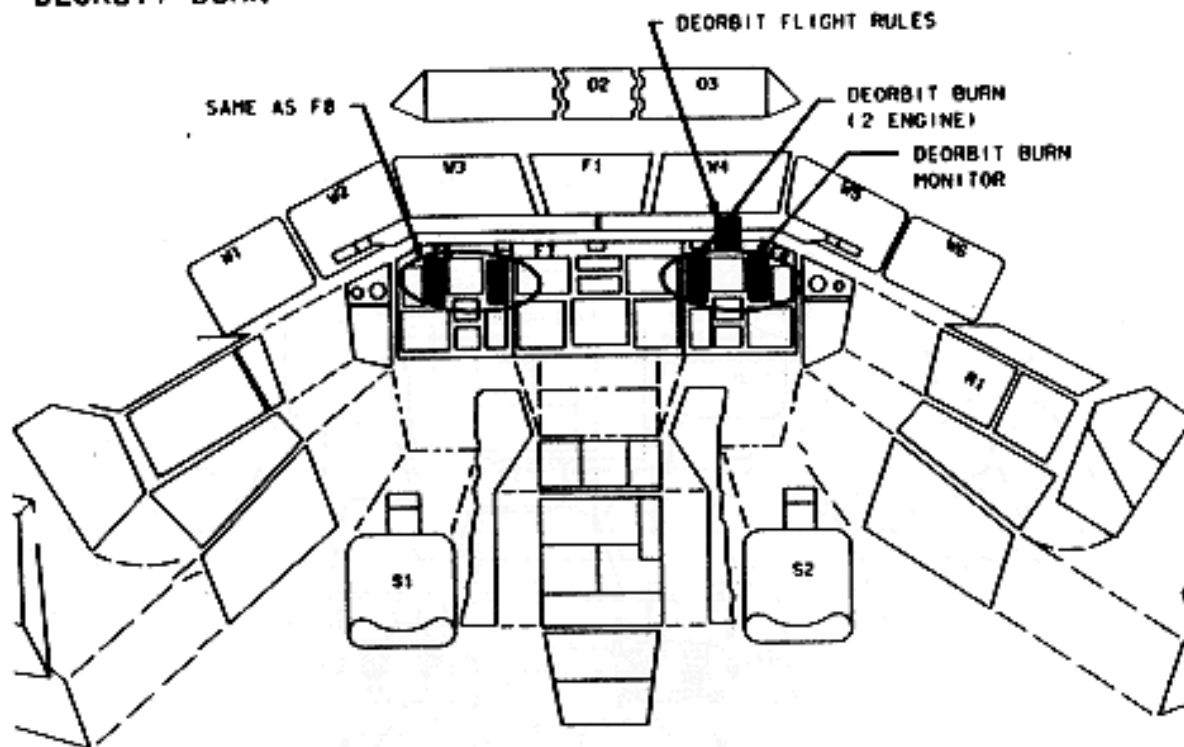
OMS 2 BURN



0112. ART. 35

Figure C-3.- Locations of cue cards for OMS-2 bum.

DEORBIT BURN

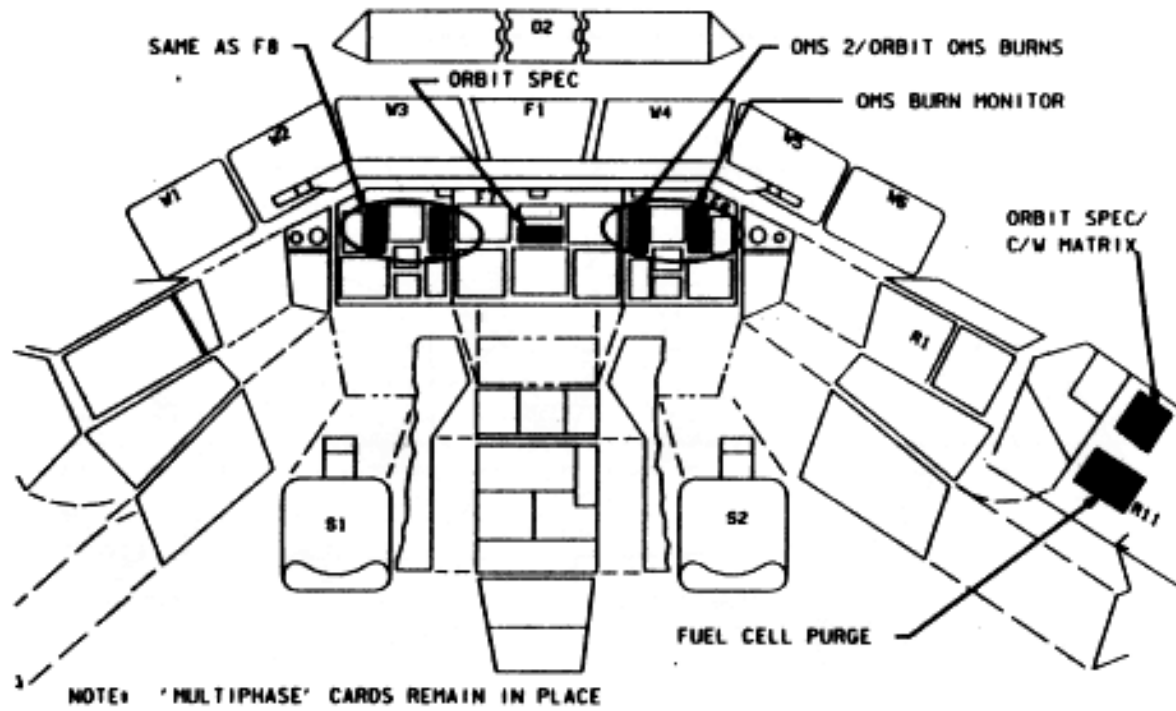


NOTE: 'MULTIPHASE' CARDS REMAIN IN PLACE

0112, ART, 35

Figure C-4.- Locations of cue cards for deorbit bum.

ORBIT



0112. ART, 35

Figure C-S.-Locations of on-orbit cue cards.

ENTRY

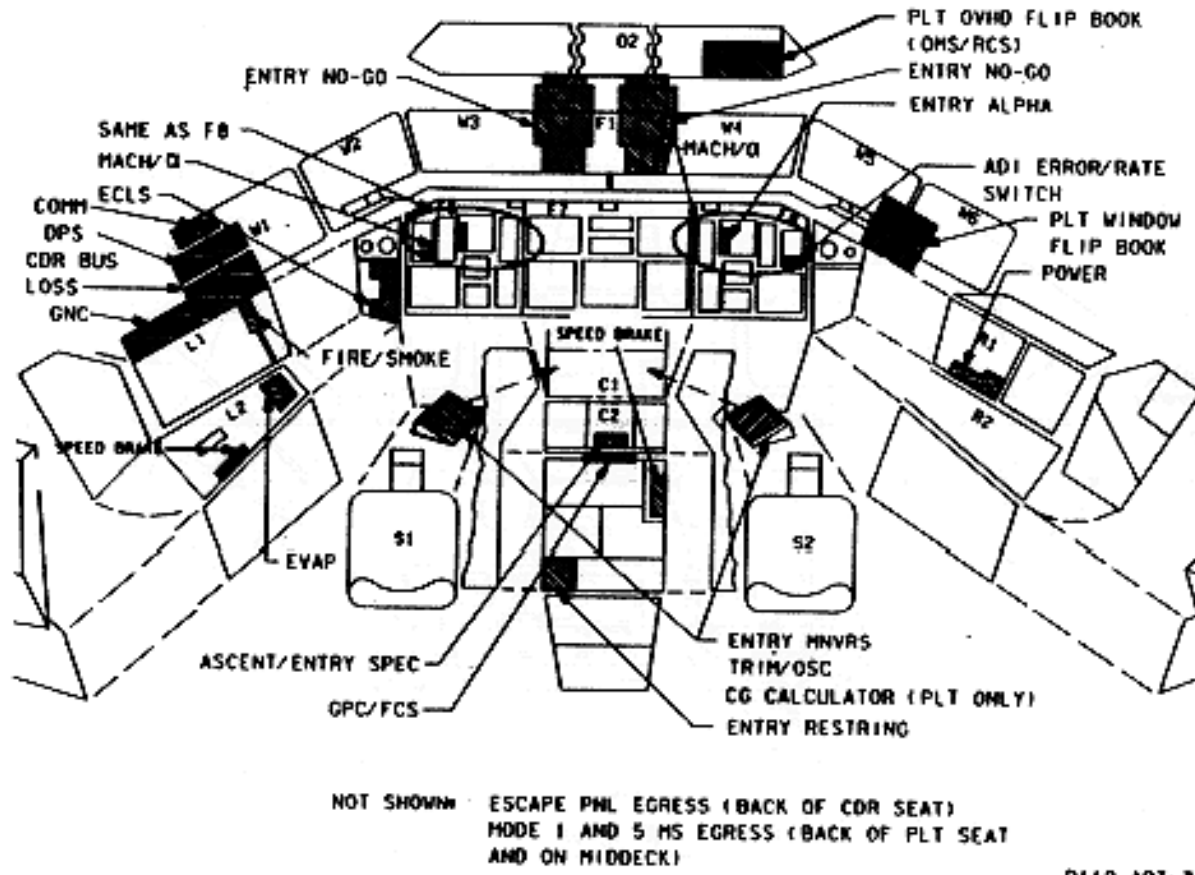


Figure C-6.- Locations of cue cards for entry.

Training Materials Evaluation

Please answer the following questions regarding the lesson you just completed. Your feedback will allow us to produce more effective training materials. When complete, mail to: **MOD Training Resource Center, DT49.**

TITLE/CODE OF LESSON: _____

SIZE OF AUDIENCE/CLASS: _____

1. How well did this lesson meet its purpose?

For each statement below, mark one box on the scale:

- a. *The lesson objectives are clearly stated.*
- b. *The lesson objectives are clearly defined.*
- c. *The lesson effectively teaches skills and information.*
- d. *The lesson meets its purpose and objectives.*

Strongly Disagree				Strongly Agree	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. How satisfying is the content of this lesson?

For each statement below, mark one box on the scale:

- a. *The information is structured in a logical flow.*
- b. *The content is clear.*
- c. *The content is complete.*
- d. *The level of detail is correct for this information.*
- e. *The amount of information is effective.*
- f. *The graphics contribute to my understanding.*

Strongly Disagree				Strongly Agree	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. How appealing was the presentation of this lesson?

For each statement below, mark one box on the scale:

- a. *The overall presentation is appealing.*
- b. *The visuals chosen are appropriate for the lesson.*
- c. *The visuals make the information more interesting.*
- d. *The graphics are legibly reproduced.*
- e. *The audio/visual or print quality is good.*

Strongly Disagree				Strongly Agree	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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4. How valuable is this information?

For each statement below, mark one box on the scale:

- a. *The lesson teaches skills and information I need.*
- b. *The lesson meets my expectations.*
- c. *This information is useful for later reference.*
- d. *I would recommend this lesson to others.*

Strongly Disagree				Strongly Agree	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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**PLEASE WRITE YOUR COMMENTS/QUESTIONS ON THE BACK OF THIS FORM.
EXPLAIN ANY NEGATIVE ANSWERS IN SPECIFIC TERMS
THANK YOU IN ADVANCE FOR YOUR ASSISTANCE!**

Training Materials Evaluation

Please answer the following questions regarding the lesson you just completed. Your feedback will allow us to produce more effective training materials. When complete, mail to: **Communications Section, DT33.**

TITLE/CODE OF LESSON: Audio/UHF Training Manual, AUD/UHF 2102

SIZE OF AUDIENCES/CLASS: _____

1. How well did this lesson meet its purpose?

For each statement below, mark one box on the scale:

- a. *The lesson objectives are clearly stated.*
- b. *The lesson objectives are clearly defined.*
- c. *The lesson effectively teaches skills and information.*
- d. *The lesson meets its purpose and objectives.*

Strongly
Disagree

<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>

Strongly
Agree

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

2. How satisfying is the content of this lesson?

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- d. *The level of detail is correct for this information.*
- e. *The amount of information is effective.*
- f. *The graphics contribute to my understanding.*

Strongly
Disagree

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Strongly
Agree

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

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For each statement below, mark one box on the scale:

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Strongly
Disagree

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Strongly
Agree

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Strongly
Agree

<input type="checkbox"/>	<input type="checkbox"/>
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