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INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE III

FINAL REPORT, VOLUME I

Integrated Payload and Mission Planning Process Evaluation

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

MCDONNELL DOUGLAS
CORPORATION

MCDONNELL DOUGLAS

INTEGRATED PAYLOAD AND MISSION PLANNING, PHASE III

FINAL REPORT, VOLUME I
Integrated Payload and Mission Planning Process Evaluation

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PREFACE

This report documents the results of a study conducted by the McDonnell Douglas Astronautics Company (MDAC) from 1 June 1976 to 31 March 1977 for the NASA George C. Marshall Space Flight Center (MSFC) related to integrated payload and mission planning for Space Transportation System (STS) payloads. This Phase III effort is a continuation of the Shuttle payload planning studies initiated by NASA/MSFC in October 1974.

An executive summary of this phase is reported in MDC-6740. Final detailed technical results of this study phase are reported in the following volumes of MDC G6741.

Volume I	-	Integrated Payload and Mission Planning Process Evaluation
Volume II	-	Logic/Methodology for Preliminary Grouping of Spacelab and Mixed Cargo Payloads
Volume III	-	Ground Data Management Analysis and Onboard versus Ground Real-Time Mission Operations
Volume IV	-	Optimum Utilization of Spacelab Racks and Pallets

This Volume I presents the results of Task 1.0 which provide the definition of the payload planning process, an analysis of payload planning tasks and schedules, and the definition of payload planning major products, including mockups of two new products: the Planning Baseline and the Mission Approval Document.

Included in the appendixes of this volume are the following Task 2.1 results.

- Appendix E - Early Spacelab Mission Assignments (Task 2.1A)
- Appendix F - Operations Planning Methodology for Determining the Tracking Requirements for Flight and Ground Items (Task 2.1B)
- Appendix G - STS Payload Carrier Data Files (Task 2.1B)

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H. B. Sorkin	-	Simulation and GO Program Modeling
J. W. Kerry	-	Data Systems and Analysis
P. R. Atkinson	-	Operations Analysis
R. R. Hassel	-	Operations Data Files
R. E. Holmen	-	Overall Planning Process
J. A. Navarra	-	Schedule Critical Items Analysis

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ACRONYMS AND ABBREVIATIONS

AA	NASA Associate Administrator
CBO	Congressional Budget Office
CDMS	Command and Data Management System
COR	Contracting Offices Representative
CORE	common operational research equipment
CPSE	common payload support equipment
DDT&E	design, development, test, and evaluation
DOD	Department of Defense
GO	Generalized Operations (Computer Program)
IMAP	Integrated Mission Analysis and Planning
IP&MP	Integrated Payload and Mission Planning
IUS	Intermediate Upper Stage
JURG	joint users requirements group
LRF	launch recovery facilities
MDAC	McDonnell Douglas Astronautics Company
MIRADS	Marshall Information, Retrieval and Display System
MPS	Mission Planning System
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NOAA	National Oceanographic and Atmospheric Administration
OA	Office of Applications
OAST	Office of Aeronautics and Space Technology
OFT	Orbiter Flight Test
OMB	Office of Management and Budget
OMS	Orbital Maneuvering System
OPPI	Office of Planning and Program Integration
OSF	Office of Space Flight
OSS	Office of Space Sciences
PAD	Project Approval Document

POP	Program Operating Plan
PPDB	Payload Planning Data Bank
PSRD	Payload Support Requirement Document
R&I	Receiving and Inspection
SFOP	Space Flight Operations Plan
SSPD	Shuttle System Payload Data
SSPPSG	STS payload planning steering group
SPRAG	STS Payload Requirements and Analysis Group
SR&T	supporting research and technology
STS	Space Transportation System
SSUS	Spinning Solid Upper Stage
WBS	work breakdown structure

SUMMARY

The principal objectives of this study were to continue definition of the integrated payload and mission planning process for STS payloads and to conduct discrete tasks which will evaluate performance and support initial implementation of this process. The scope of activity was limited to NASA and NASA-related payload missions only.

The integrated payload and mission planning process has been defined in detail, including all related interfaces and scheduling requirements. The process begins its annual cycle with the formulation of a NASA Payload Model and Payload Descriptions covering the STS operational span. Using NASA-headquarters-supplied program planning guidelines, a NASA Mission Model and a NASA Planning Baseline (more detailed 5-year plan of payload complements and mission descriptions are prepared). At the request and direction of the cognizant payload Program Office, specific missions are analyzed in sufficient detail to assess the compatibility of the payload complement and provide preliminary definition of the mission, cargo, operations, and development requirements. A mockup of the major new planning document (Planning Baseline) has been prepared and submitted to NASA for review.

Related to the payload mission planning process, a methodology for assessing early Spacelab mission manager assignment schedules was defined. Application of the methodology indicates that the first six Spacelab missions should be approved and mission managers assigned by March 1977. By the last quarter of 1979, all of the first 19 Spacelab missions should be approved and mission managers assigned to meet the projected flight dates. This assessment may be updated or extended as missions are defined.

Sets of parameters necessary to define STS payload carriers (Orbiter, Spacelab, IUS, and SSUS) were developed to support the creation of data files for the NASA Payload Planning Data Bank (PPDB). These data parameters

were structured for single point update and by vehicle configuration. A set of operations planning parameters was also identified and formatted for the purpose of inclusion into an operations planning data bank. These files will be used by NASA to support the planning activities for the Planning Baseline and Mission Model.

Section 1
INTRODUCTION

The NASA STS will introduce a new era of space activity involving a significant increase in the number and types of space payloads and missions. The payload users will include NASA, DOD, commercial, and foreign interests. To satisfy the varied needs of these payload users, and in order to utilize the STS in the most effective way, additional emphasis is being given by NASA to the unique planning and program integration activities necessary to fully exploit STS capabilities. This planning and integration process becomes extremely important when considering the high rate of projected STS traffic, the frequent requirement for payload sharing of STS flights, the varied states of payload development, and the different operational aspects of each payload.

In 1974, NASA contracted with MDAC for assistance in the preliminary definition of an agency-wide planning and integration flow process which would translate payload-user requirements for flight into definitive plans for the utilization of the STS. This study effort (Phases I and II) was completed in April 1975. However, major organization changes have since been made within NASA to accommodate STS operations; namely, the establishment of the Office of Planning and Program Integration (OPPI) for NASA payloads and the adoption of new mission management approaches. The principal objectives of the Phase III study effort were to update the planning process for these changes, continue the definition of the processes, and conduct discrete tasks that will evaluate effectiveness and support initial implementation of the processes.

To accomplish the study objectives, two main tasks were established:

- Task 1.0 - In Task 1.0, the planning process defined in Phases I and II was updated; the revised planning process was evaluated and simulated; and the associated procedures, documents, and discrete products were defined in sufficient detail for implementation by NASA.

- Task 2.0 - In Task 2.0, discrete tasks were performed to evaluate the process effectiveness and support its final implementation, specifically: (1) payload/cargo planning and grouping and compatibility analyses, and (2) payload flow and mission operations assessments.

Integrated payload and mission planning refers to a generic, NASA-wide STS-payload mission planning process performed prior to mission approval and assignment. As such, planning activities of NASA Headquarters, payload centers, and STS centers and operators are included in the planning process.

The major ground rules and assumptions for Task 1 of Integrated Payload and Mission Planning are summarized in Table 1-1. The planning process includes all the various NASA agencies that are involved with the planning and integration of payloads into the STS. However, the process addressed here is limited to NASA and NASA-related payloads only. Other payloads, such as DOD, commercial, or foreign payloads, are integrated outside of this process. Payloads to be considered are those identified in the NASA Payload Model as approved by the COR. Emphasis is placed on defining the planning process and products for early Spacelab missions. In developing the

Table 1-1 22707

MAJOR GROUND RULES AND ASSUMPTIONS FOR INTEGRATED PAYLOAD MISSION PLANNING PROCESS EVALUATION (TASK 1)

- AGENCY-WIDE PLANNING AND INTEGRATION PROCESS
- PROCESS FOR NASA AND NASA-RELATED PAYLOADS ONLY
- USE COR-APPROVED PAYLOAD DATA ONLY
- EMPHASIS ON EARLY SPACELAB MISSIONS
- MAXIMUM USE OF EXISTING NASA PROCEDURES AND TOOLS
- STUDY EFFORT IS TO BE PRODUCT ORIENTED
- PROCESS IMPLEMENTATION IN 1976-77 PERIOD

definition of the planning process, maximum use was made of existing NASA procedures and tools. The study efforts were product oriented; that is, as soon as discrete tasks were completed, they were documented and submitted to NASA for review and approval. The planning process is to be developed in the 1976-77 period and go into a normal operational mode in the 1977-78 period.

Section 2 of this volume updates the definition of the planning process. In earlier contract phases, the planning process was referred to as STS/Payload Utilization Planning. Since this work was completed, the changes made within NASA, relative to the planning and integration processes, required an update of the objectives and guidelines for the planning process, its interfaces, and its products. This led to an update of the planning process and master flow.

Section 3 presents the results of the planning process analysis wherein a time-phased simulation of the master flow was performed to determine adequacy of the process to meet critical planning cycle time lines and produce the required products.

Section 4 defines the planning products (reports and other documents) and their production tasks and schedules. A mockup of the Planning Baseline is included in the Appendix.

Section 5 defines the data systems (computing programs, data banks, and structure) used or planned for the planning process and production of its products.

Section 2
INTEGRATED PAYLOAD AND MISSION PLANNING PROCESS DEFINITION

2.1 INTEGRATED PAYLOAD AND MISSION PLANNING OBJECTIVES

Any definition of the integrated payload and mission planning process must satisfy the planning process basic objective and the key functions it must provide or support. Experience has shown that any planning process must have well defined goals and products keyed to user needs if it is to escape the realm of academia and influence the activity involved in implementing a program. It cannot be all encompassing, at least at the detailed level, nor can it provide the guidance it should if it is fragmented. It must integrate the various elements involved in long-range planning, at least in a preliminary fashion, to assess problems and incompatibilities before they occur, preclude these where it can, and bring them to the attention of management in time for resolution when necessary. This is the primary function of long-range planning. The planning process supports this function through providing visibility into future programs and by integrating and assessing these programs with a planning baseline. The role of the planning process and its products in supporting the planning functions is indicated in Table 2-1. The planning functions noted are those explicitly identified in the roles and responsibilities of the Office of Planning and Program Integration (OPPI) which the payload planning process must support. Each product provides the output of a given function, and, in some cases, provides the basic input data needed for other functions. Not indicated here, but certaintly inherent in assessment of the long-range plan validity, is the comparison and assessment of the fiscal and technical resources needed to implement the projected missions.

2.2 NASA PLANNING PROCESS

The integrated payload and mission planning process is a part of NASA's overall planning for the implementation and accommodation of payload missions for the Shuttle era. NASA's overall planning process is still evolving, but was defined for the purpose of this study as shown in Figure 2-1. NASA and NASA-related payloads — such as National Oceanographic and

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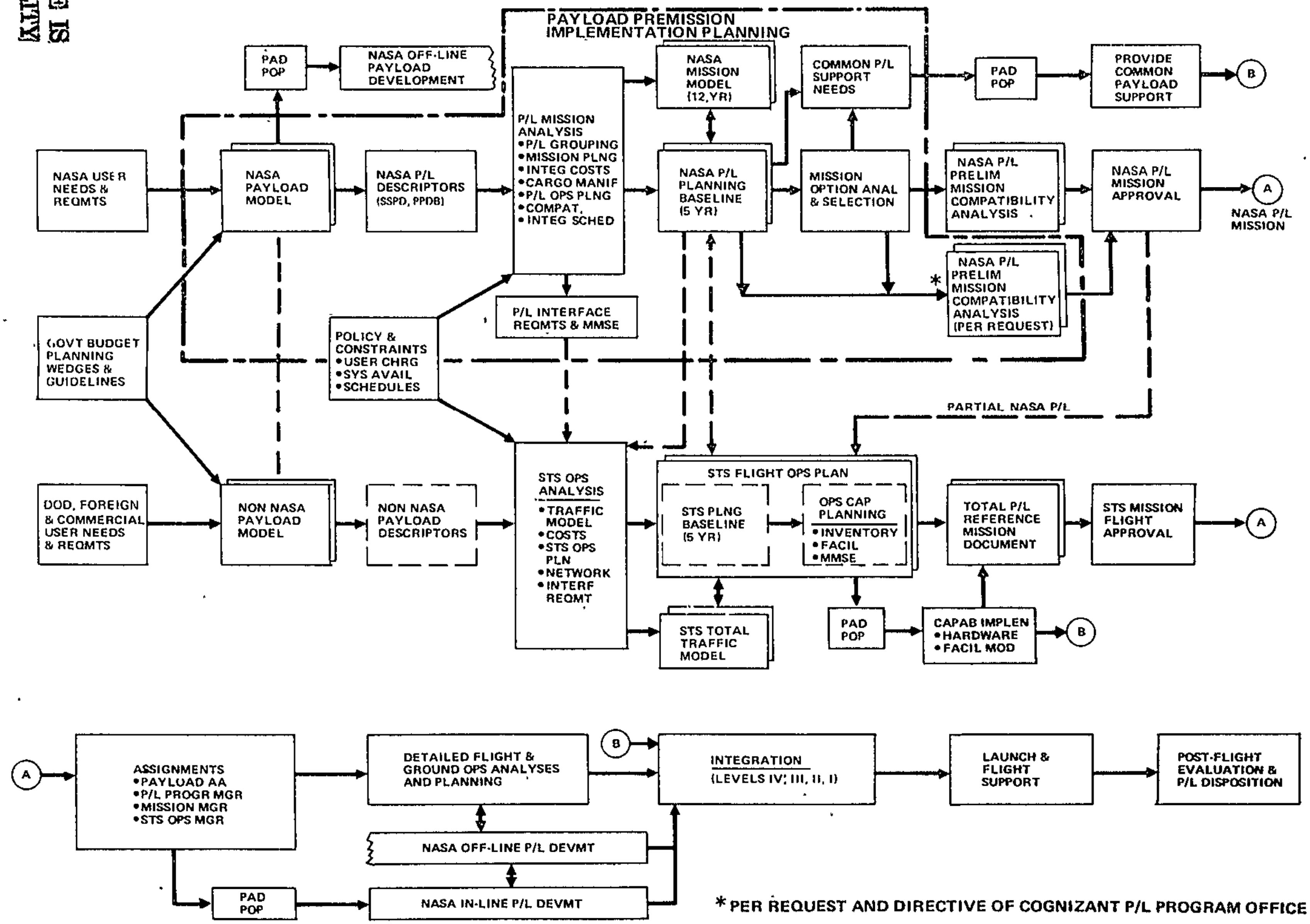
Figure 2-1

AGENCY PLANNING



* PER REQUEST AND DIRECTIVE OF COGNIZANT P/L PROGRAM OFFICE

Table 2-1

IP&MP BASIC FUNCTIONS

IP&MP OBJECTIVE: PROVIDE SOUND, INTEGRATED LONG-RANGE PLANS FOR NASA AND NASA-RELATED PAYLOADS, PAYLOAD GROUPINGS, AND MISSIONS

IP&MP PROCESS: PRODUCTS
⊙ INPUT
● OUTPUT

FUNCTIONS	PAYLOAD MODEL	SSPD/PPDB	MISSION MODEL	PLANNING BASELINE	MISSION ANALYSES
1. DEVELOP/MAINTAIN NASA PAYLOAD MODEL	●	●			
2. DEVELOP/MAINTAIN MISSION MODEL AND SUPPORTING ANALYSES		⊙	●		
3. IDENTIFY/INTEGRATE/ANALYZE USER REQUIREMENTS		⊙	⊙	●	
4. IDENTIFY/RECOMMEND COMMON PAYLOAD SUPPORT NEEDS		⊙	○	●	
5. INTEGRATE NASA PAYLOAD FLIGHT ASSIGNMENTS INTO OSF's STS FLIGHT SCHEDULE		○	⊙	●	
6. ANALYZE/RECOMMEND PAYLOAD FLIGHT ASSIGNMENTS		⊙		⊙	●

Atmospheric Administration (NOAA) weather satellites — are compiled and defined on a regular basis in the NASA Payload Model by the planning process. Working with NASA Headquarters-supplied guidelines and STS accommodations data, these payloads are grouped into feasible and compatible payload groupings of STS missions over a 12-year span in the NASA Mission Model. A five-year projection, performed in more detail and including consideration of the project schedules and funding guidelines, is provided in the NASA Planning Baseline. Specific missions compatibility analyses are performed at the request and direction of the cognizant payload Program Office. These analyses support selection of a confirmed payload complement and assess the mission, cargo, operations, and development requirements.

For NASA (and NASA-related) payload missions, mission development is initiated upon approval by NASA Headquarters, leading to assignment to a Payload Program Associate Administrator (AA). Partial NASA payloads, upon NASA payload approval, are passed on to the Office of Space Flight (OSF) for incorporation in mixed (NASA and non-NASA) missions for approval.

Somewhat in parallel, five-year projections of non-NASA payloads are accommodated by the OSF traffic model and Space Flight Operations Plan (SFOP) which integrate the total STS traffic and help identify and plan future STS capability requirements. A Mission Manager and an STS Operation Manager are assigned by their respective AA to coordinate and manage the development of their respective portions of the total mission. Project Approval Documents (PADs) and Project Plans are prepared to obtain and manage the funding for mission implementation. Individual NASA payloads which may fly on this mission, or others, may be previously approved and implemented or may be dependent on online approval and development with the mission.

An example of the relationships between the upstream processes and the downstream analyses, is integration and operations activities for a typical Spacelab payload as shown in Figure 2-2. The activities are initiated at NASA Headquarters and are supported by appropriate NASA centers and contractors. These processes, which include preliminary mission and integration activities, may be interpreted as advanced planning activities. After the planning process is completed and missions are approved, a mission manager is selected and detailed mission and payload operations planning is initiated. This activity, conducted at the appropriate NASA center, leads to integration of the payloads. When this work is completed,

Figure 2-2

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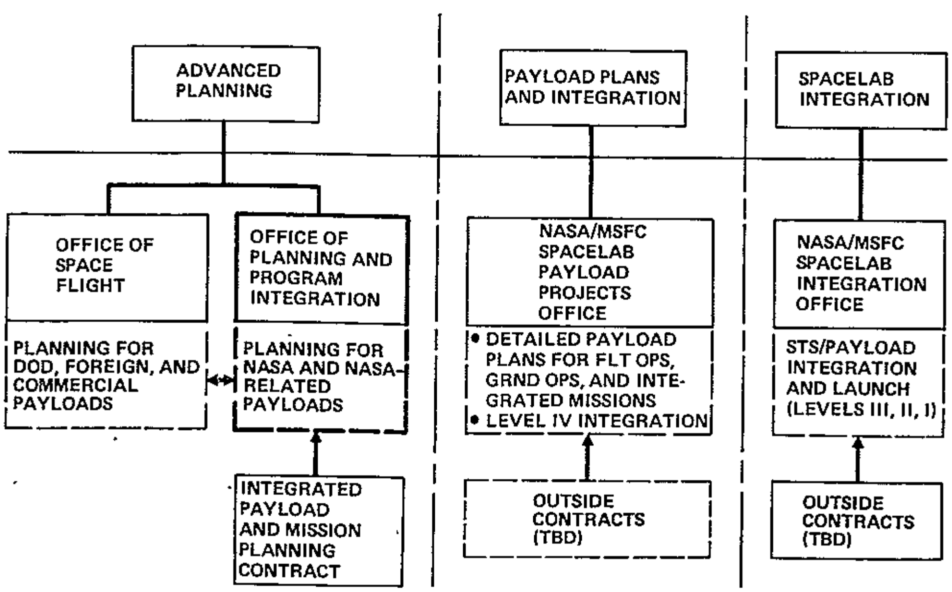
SPACELAB PROGRAM RELATIONSHIPS (EXAMPLE)



the installed payloads are shipped to the launch site, integrated into the Spacelab STS, and launched. From this example, it may be interpreted that this process is the leading edge of all planning processes for a specific mission.

2.3 NASA PREMISSION IMPLEMENTATION PLANNING PROCESS

2.3.1 Master Flow Chart

The process and products were analyzed to identify and schedule the necessary functions and tasks required to develop the products in a timely manner and to interface with the key external milestones and guidelines associated with the established NASA management decision and budget formulation processes. A detailed master flow chart (Figure 2-3) covering one annual cycle of the process and interfacing activities was prepared to assist in defining and assessing the process (task flows, sequences, inputs, interfaces, and schedules). Some 80 different tasks were identified, most of which are preformed twice or more per cycle. For clarity, only one full task flow is shown for some items, such as interface requirements or mission approval. Basically, the Payload Model and Planning Baseline are updated twice each year; Mission Compatibility Analyses are essentially performed continually as required to meet requested reviews and initiate developments. NASA Headquarter interfaces (guidance, data, reviews, and approvals) are keyed to the budget formulation process. Payload centers interface with supporting payload project data and utilization of the Planning Baseline. STS centers interface with total traffic data, preliminary flight schedule assessments, and utilization of the Planning Baseline and validated payload interface requirements.

On Figure 2-3, the master flow is presented in a one-year cycle time line that is organized horizontally by the following functional elements or products.

- 1.0 NASA Headquarters (approvals, payload planning wedges, program operating plan POP calls, budget, etc.)
- 2.0 NASA Premission Implementation Planning
  - 2.1 Payload Model (includes formal updates of PPDB)
  - 2.2 Mission Model (updated as required)
  - 2.3 Planning Baseline

2.4 Integrated Payload Interface and Common Payload Support Requirements Analysis

2.5 Mission Compatibility Analyses (performed as requested by the cognizant payload Program Office)

3.0 Payload Centers (SPRAG reviews, payload data, etc.)

4.0 STS centers and operations

Basically, the planning process is fed by the NASA payload lists developed by each Program Office and by NASA-related payloads[1] from the compilation of non-NASA payloads. Previously, the NASA AAs released payload lists in January and June. In order to accommodate these into approved Payload Model and Shuttle System Payload Data (SSPD) formats by January and July, the payload list releases are assumed to occur in November and May. Descriptive and programmatic data on these payloads is compiled into a NASA Payload Model and approved by the OPPI. This is updated semi-annualy (January and June) and represents the official list of NASA payloads approved for planning purposes.

Descriptive data on these payloads and NASA-related payloads is compiled on STS SSPD sheets and filed into the PPDB. The payload centers support this activity by providing the necessary data. This data is used in the development and assessment of payload groupings by flight and year, which feed the update of the NASA Mission Model and the Planning Baseline, and the continuing analysis and assessment of integrated payload interface requirments. The interface requirements are compiled and assessed in coordination with the SPRAG and the joint users requirements group (JURG). The assessed requirements are reviewed by the STS payload planning steering group (SSPPSG) for validation and imposed on the STS as appropriate. In some cases this will lead to identification of requirements for new common payload support needs; this leads to generation of the necessary PAD and Project Plans by the appropriate Program Office.

The Mission Model, which presents a brief description of NASA and NASA-related payload groupings over a 12-year horizon, is updated as required to

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[1] NASA-related payloads are assumed to be non-NASA payloads which are developed or integrated by NASA into NASA-managed payload groupings.

represent a reasonable projection of NASA long-range plans. It is reviewed by the AAs and approved for planning purposes by OPPI. When Mission Model updates are required they should be scheduled during low-activity periods in the annual cycle.

The Planning Baseline is a five-year projection of NASA payload projects and missions (payload grouping, desired flight dates, orbits, accommodations, etc.). It is updated twice a year following update of the Payload Model. The Planning Baseline presents a 5-year NASA Missions Plan, mission synopses, and assessments of the STS utilization and payload support requirements. The Planning Baseline is reviewed by the AAs and approved by OPPI.

The March Planning Baseline groups the (new) November payloads into updated and new mission definitions and provides a common programmatic planning reference to the centers to support their concurrent and July POP responses. This March issue incorporates the January POP guidelines and budget plan. It is approved for planning purposes by OPPI, by April, and supports the formulation of the five-year budget preview to the Office of Management and Budget (OMB) in April and the project and operations planning by the centers.

Reviews of the POP guidelines and budget plan and the May payload list (including new start guidelines) lead to the September update of the Planning Baseline, which focuses on the programmatics (integrated schedules and funding compatibility), for input to NASA Headquarters in support of the formulation and submittal of the NASA budget to OMB in October. This effort will incorporate the new-starts review data approved by the AAs. Headquarters lead time requires an early September submittal.

Those missions requiring approval in this cycle are analyzed in depth sufficient to establish mission compatibility, feasibility, and requirements necessary to initiate mission planning. These analyses are performed at the request and direction of the cognizant payload Program Office. These are reviewed by NASA Headquarters and, upon approval, initiate planning for mission implementation. This is initiated by assignment to a payload program AA and mission manager. This leads to a mission project plan and PAD (if required) and, on approval and funding release, to development of the integrated mission.

2.3.2 March Submittal Example

A simplified product task block schedule is presented in Figure 2-4 as an example of the planning process for a March submittal, and covers the Payload Model January update, the Planning Baseline March submittal, and an April Mission Compatibility Analysis. Compiling and preparation of SSPD is initiated in October, based on prospective payloads submitted by the various discipline offices and on NASA-related payloads submitted by other users. Effort is concentrated on updating of approved or high probability of approval payloads. Following NASA and OMB budget negotiations in mid-November, the Payload Model is updated, based on the AA-approved Payload List in early December. The Payload Model is submitted in late December or early January for Headquarters review and approval. Beginning with the approved Payload List, SSPD effort is accelerated and PPDB update initiated to complete Level A payloads descriptions by early January and Level B by late January.

The Planning Baseline update is initiated in December with long-lead analyses, accelerated by final guidelines and payloads data in January, and submitted for Headquarters review in mid-March. Development of the Planning Baseline proceeds along two lines, a programmatic overview and a compilation of the individual mission descriptions over the five-year projection.

Mission Compatibility Analysis will have a more flexible schedule dependent on mission complexity and analysis requirements and available lead time from request to review. The example shown in Figure 2-4 is for an April review initiated in January with identification and selection (in February) of a mission payload complement, followed by a technical analysis of the mission requirements and a programmatic definition of its development requirements.

2.4 NASA PLANNING PROCESS CYCLE

The annual fiscal-year cycle of NASA planning is summarized in Figure 2-5 with emphasis on the process and the key products. The cycle begins with the initiation of the President's budget planning for the next fiscal year. Based on projections of this budget plan and NASA and OMB negotiations, a NASA planning wedge is established which is used to initiate the process. The NASA Payload Model, payload descriptions, and Planning Baseline documents are prepared in steps and the results are used by NASA to respond to the

Figure 2-4
PLANNING PROCESS - MARCH SUBMITTAL

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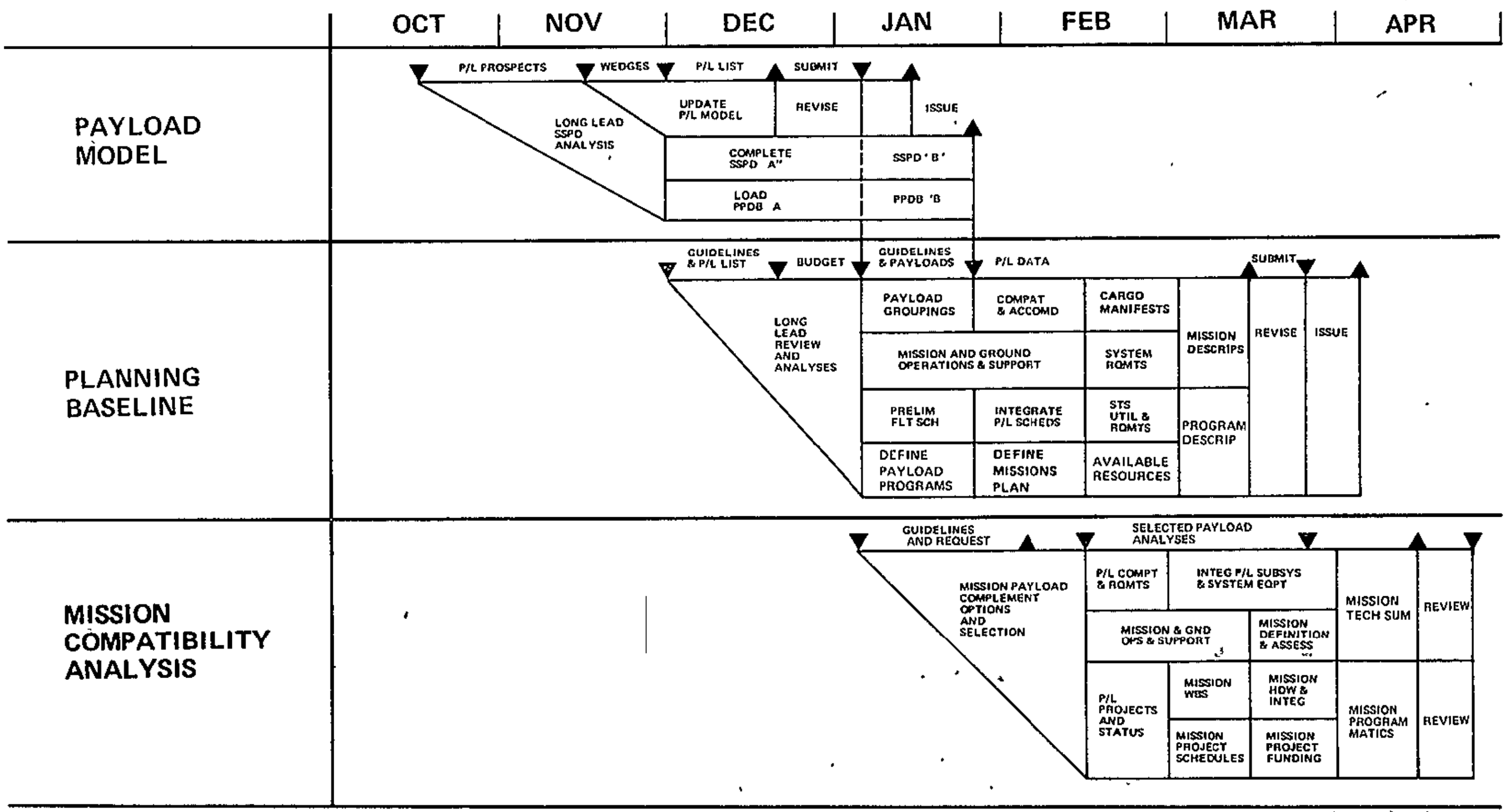

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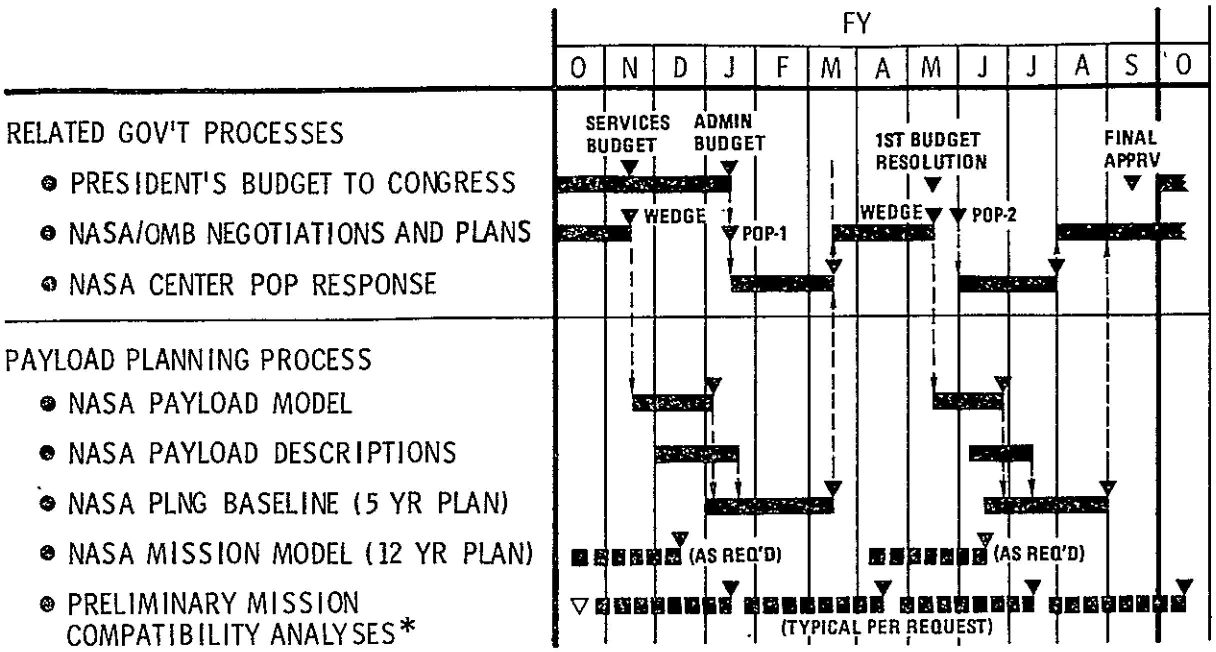
Figure 2-5

AGENCY PLANNING PROCESS CYCLE



*CONDUCTED AT DIRECTIVE OF COGNIZANT PAYLOAD PROGRAM OFFICE

first Program Operating Plan (POP-1) call in January. This POP-1 response is used to formulate a revised planning wedge in May, and the process is repeated. After response to POP-2, final NASA and OMB plans are established that will be the basis for planning approval for the subsequent fiscal year.

The semiannual update of the Payload Model and Planning Baseline are indicated in relation to the budget reviews at NASA Headquarters and the POP responses by the NASA centers. The initial, or Spring cycle, sets the basic response to the Administration directives and budget. The March Planning Baseline accompanies but does not incorporate the March POP response which goes into the submitted-budget first resolution by Congress and the OMB and Congressional Budget Office (CBO) Spring preview of projected (five-year) budgets. The July POP response by the centers can utilize the approved March Planning Baseline. The September Planning Baseline incorporates the July POP response and proposed new starts through the NASA Headquarters Program Offices budget submittals in August. The September Planning Baseline supports the budget formulation and major program decisions.

Requested mission compatibility analyses are prepared and submitted to meet review schedules. The Mission Model is updated only as required, with the effort scheduled between major regular activities, i.e., Planning Baseline updates.

2.5 PLANNING, FUNDING, AND MISSION IMPLEMENTATION

The planning process, government funding activities, and payload development are shown in a simplified manner in Figure 2-6 to illustrate their phasing relationships. This example shows the activities for FY'80 only. For this fiscal year, NASA planning processes begin in FY'78. After a one-year cycle, the plans for FY'80 are formulated, and the total government budget is submitted to Congress for review and approval. This government-approval cycle requires a one-year lead time before FY'80 funds can be actually released. For representative NASA payloads, preliminary design activities can be proceeding in parallel with these planning activities, but, the substantial funding for development and implementation cannot be released until the fiscal year funds are released. A typical in-line payload development cycle is shown to be three years before actual flight.

Thus, as indicated by this phasing relationship, the planning process provides planning for a five-year fiscal period with a six-year horizon from completion of the activities. This process is repeated for each subsequent fiscal year.

Figure 2-6
PLANNING, FUNDING AND MISSION IMPLEMENTATION

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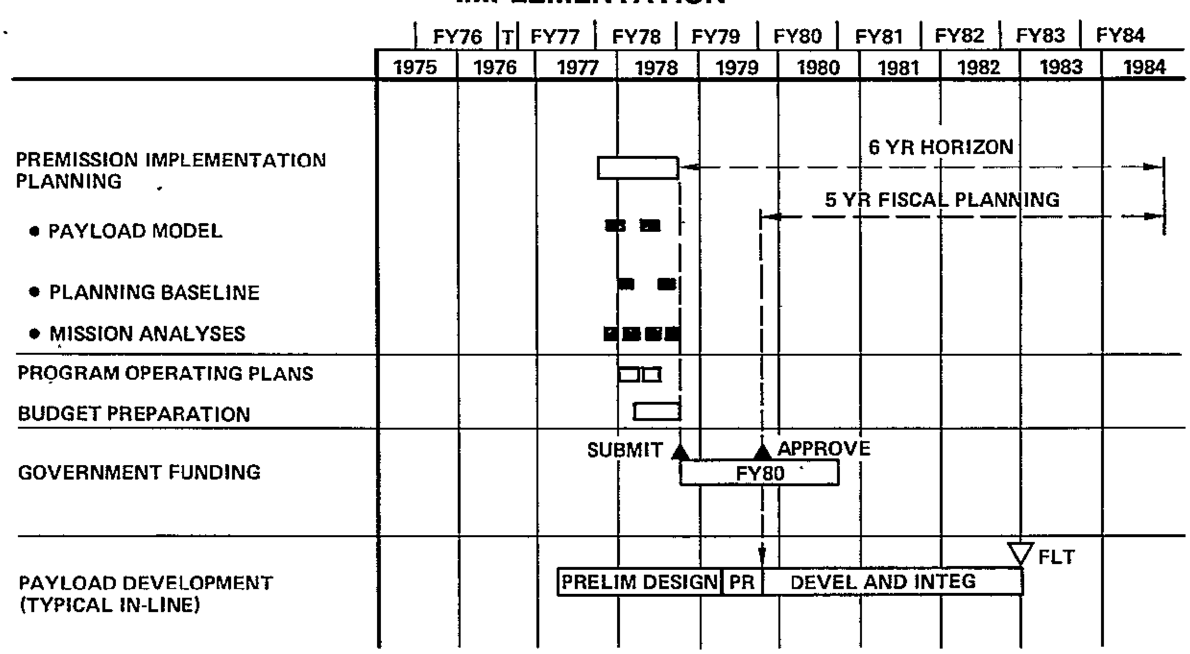


Section 3
INTEGRATED PAYLOAD AND MISSION PLANNING PROCESS ANALYSIS

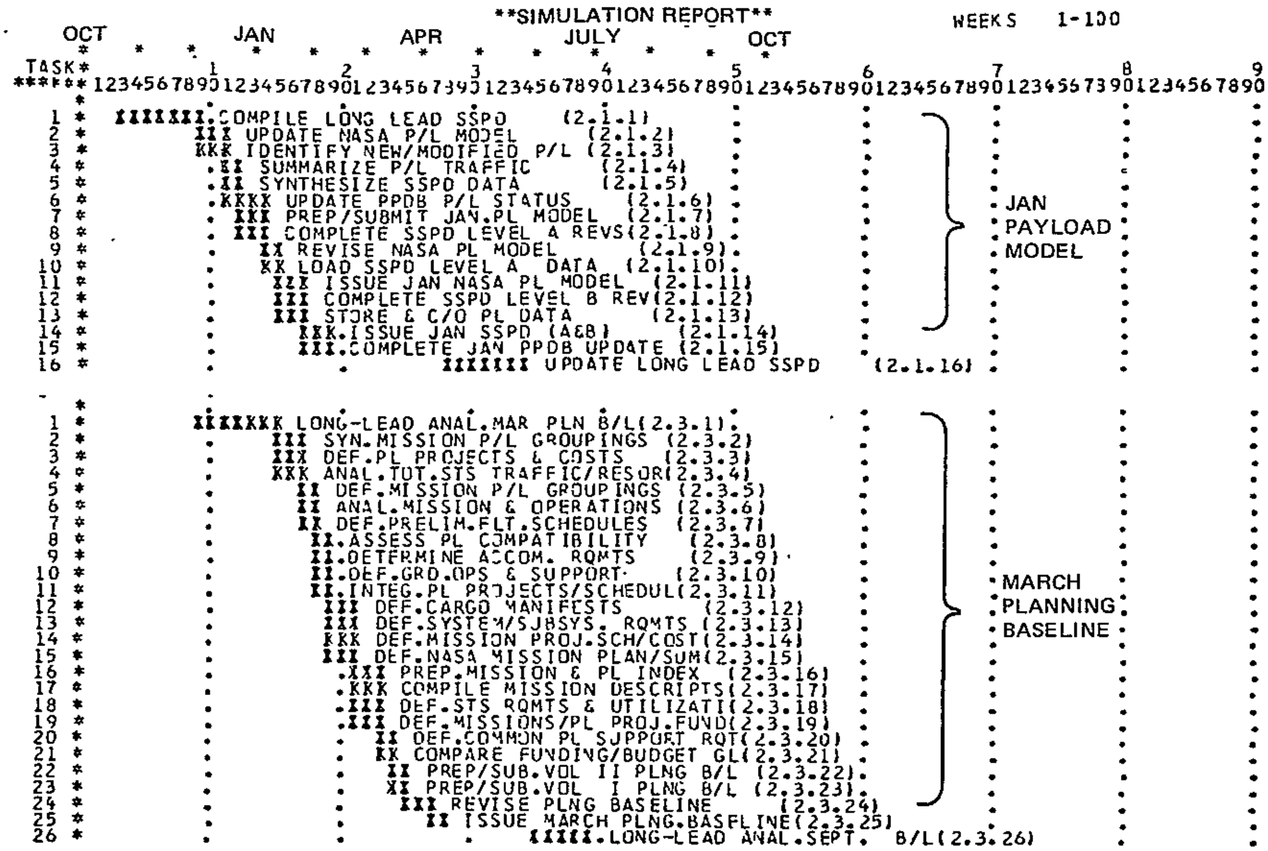
The updated process was analyzed in terms of the production schedules and input, output, approvals, and negotiations milestones. Task titles which indicate the type of effort required at each step in the process were defined using the previous (Phase II) task master flow as a guide. The task description sheets and task durations, previously developed, provided similarity information, and where no correlation existed, the task durations were estimated and iterated.

When the tasks defining the process were laid out, the input milestones, the product or assessment, output milestones, and the task durations themselves were investigated for adjustment if the task schedule was too compact. Simulation reports such as shown in Figure 3-1 were used to take either integrated or snapshot views of the task production schedules. The simulation unit of time (input) is work days, and the simulation report (output) unit of time, represented by each of the symbols appearing before a task title, was selected to be either in months (in the quarterly report) or in weeks. The task production schedules for the two products shown in Figure 3-1 provided an overview of the task duration and predecessor (dependency) conditions that were postulated. Assessments of the task activity definition and duration were made by inspection, and any changes that resulted were made to the master flow chart.

The planning process cycle, although fairly constrained by the NASA Headquarters activity milestones (budget negotiations, approvals, POP calls, program plan and funding preparations, etc.), was adjusted, where possible, to obtain a task schedule that was balanced with regard to corresponding tasks and activities being performed at the various NASA payload centers and by the STS centers and operators.

FIGURE 3-1

PLANNING PROCESS SIMULATION REPORTS



Simulation results of the planning process are presented in Appendix A. It should be noted that the simulation results were used to develop the master flow (Figure 2-3) which is the final process definition. The simulation reports themselves were not updated to reflect revisions and last minute changes. As such, the master flow incorporates a preliminary schedule analysis and is scaled to a rough time line sufficient to identify the tasks and interfaces. With changes to some of the product contents, some tasks were added or revised and these were not resimulated.

Section 4
PRODUCT DEVELOPMENT

4.1 MAJOR INTEGRATED PAYLOAD AND MISSION PLANNING PRODUCTS

The planning process assembles the data needed for planning and processes it for publication in appropriate documents. Several of these documents, i.e., Payload Model, Mission Model, Interface Requirements, and Integrated Mission Analysis and Planning (IMAP), have been published in the past. In the future, this process will synchronize the development and publication of these documents so that they support coordinated agency planning.

An important tenet of the study was that development of new documentation should be minimized, and that where documentation was necessary, current or planned documentation should be used, if possible. In this sense, the existing Payload Model and Mission Model are incorporated into the process. The existing IMAP reports are representative of preliminary mission compatibility analyses. The Planning Baseline, which contains the requirements for NASA-wide planning, is the only major new document specifically generated for the process.

The three major types of documents that are developed in the planning process are listed together with some of their key characteristics in Table 4-1. The NASA Payload Model and the Planning Baseline are references for deciding on general program content and pacing and in formulating the budget. The Mission Model provides long-range program projections and options. Another planning product is the Mission Compatibility Analyses performed and reported on request for review.

The NASA Payload Model covers all NASA and NASA-related payloads over a 12-year horizon and presents them in an ordered and condensed catalog of approximately 20 to 30 pages. The NASA Mission Model covers the projected 12 years of STS operations and presents the preliminary NASA and

Table 4-1

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MAJOR PAYLOAD PLANNING PROCESS DOCUMENTS

DOCUMENT	PURPOSE	FLIGHT COVERAGE	ISSUE FREQUENCY	REPORT SIZE
NASA PAYLOAD MODEL (12 YR)	CATALOG OF ALL FIRM AND PROJECTED NASA AND NASA-RELATED PAYLOADS WITH DESIRED LAUNCH YEAR, AND CURRENT STATUS	NOT RELATED TO FLIGHTS EXCEPT BY TYPE	UPDATED EVERY 6 MO (JAN, JUN)	20-30 PAGES
NASA MISSION MODEL (12 YR)	SUMMARY OF CARGO MANIFESTS AND PRELIMINARY MISSION SCHEDULES FOR ALL NASA/NASA RELATED PAYLOAD TRAFFIC DURING TOTAL STS LIFETIME (12 YR)	ALL NASA AND NASA/ RELATED MISSIONS (e.g. 295 STS MISSIONS FOR 1980-1992)	UPDATED AS REQ'D	60 PAGES
NASA PLANNING BASELINE (5 YR)	PRELIMINARY DESCRIPTIONS, SCHEDULES AND RESOURCES OF FIRM AND PROJECTED MISSIONS WITHIN A 5 YR FISCAL PLANNING CYCLE FOR NASA AND NASA-RELATED PAYLOADS	~e.g. 96 FLIGHTS (FY 1980-85)	UPDATED EVERY 6 MO (MAR, SEPT)	50 PAGE PROGRAM OVERVIEW 200 PAGES MISSION DESCRIPTIONS

NASA-related groupings of payloads into NASA missions (e.g., 267 NASA and 28 NASA-related flights) plus NASA traffic summaries.

The Planning Baseline covers the NASA and NASA-related missions and NASA payload projects over the next five years, e.g., approximately 96 missions over the FYs '80-'85 period). It includes a program overview, estimated at 50 pages, and a mission descriptions catalog, typically 200 to 300 pages based on two-page descriptions per mission.

4.2 NASA PAYLOAD MODEL

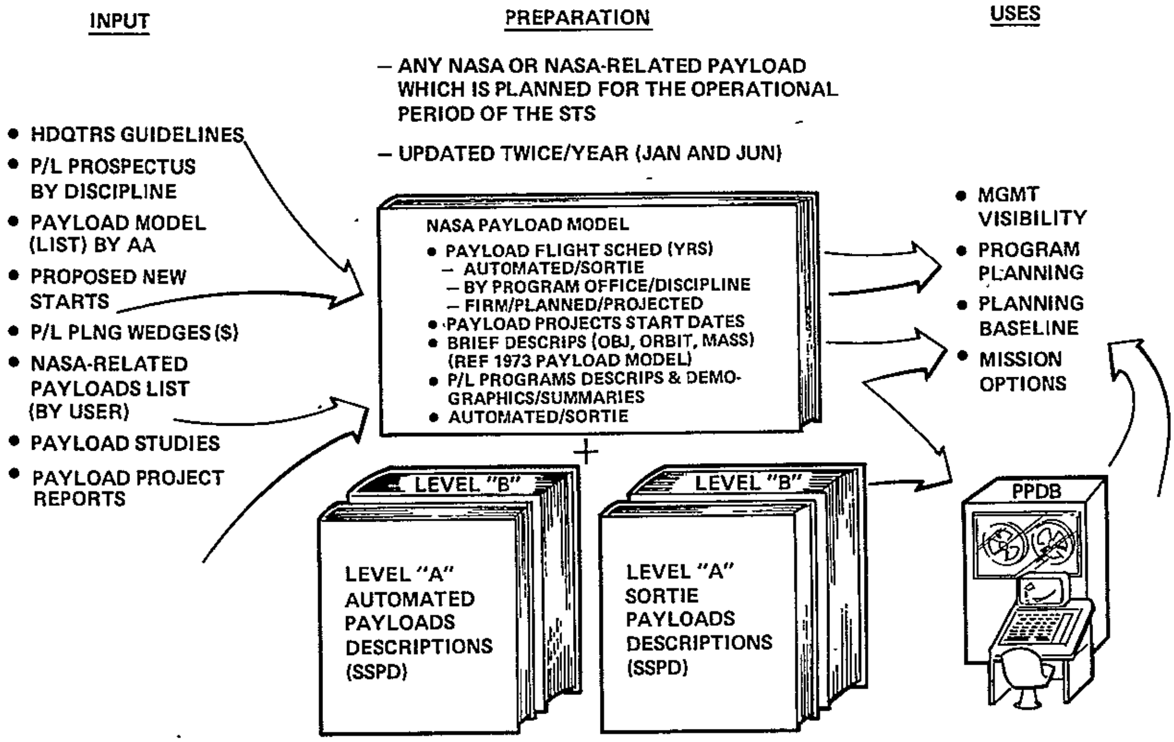
The NASA Payload Model (Figure 4-1) is based on NASA payload lists provided by the AAs for the Office of Space Sciences (OSS), the Office of Applications (OA), and the Office of Aeronautics and Space Technology (OAST), and by NASA-related payload data supplied by users to OPPI. In addition, payload projects status reports, new starts proposals, and various payload studies provide additional data for preparing the Payload Model.

The Payload Model and associated SSPD are used throughout NASA as references in performing studies. They are also used in the planning process for capture and cost analyses, interface requirement analysis mission options and definition, and for the Planning Baseline. Data from the SSPD are used to load and update the PPDB which is a centrally controlled source of payload data.

22868

Figure 4-1

NASA PAYLOAD MODEL



The Payload Model contains:

A. A brief description and status (firm, planned, and projected) of each payload anticipated during the next 12 years – grouped into automated and sortie payloads by sponsor (office and discipline).

B. Assigned payload codes and physical parameters (e.g., mass and dimensions)

C. Brief mission descriptions, including desired launch schedules and orbital parameters.

D. Identification of data source and responsible organization for each payload. These sources provide payload descriptors (SSPD Level A and B sheets). The descriptor sheets are grouped into Level A and Level B Payload Description Books that are separate but supportive documents to the Payload Model.

Payload listing within a discipline should be sequenced by planned or desired first flight date. The listing should also include the estimated or planned payload development lead time and thus indicate its required new start date (fiscal year). The payload code should designate the discipline and whether it is a sortie or automated payload.

The Payload Model updating is initiated in November and May each year, and is issued in January and June following approval by the OPPI. Figure 4-2 presents the tasks and schedule associated with the June Payload Model update.

Figure 4-2

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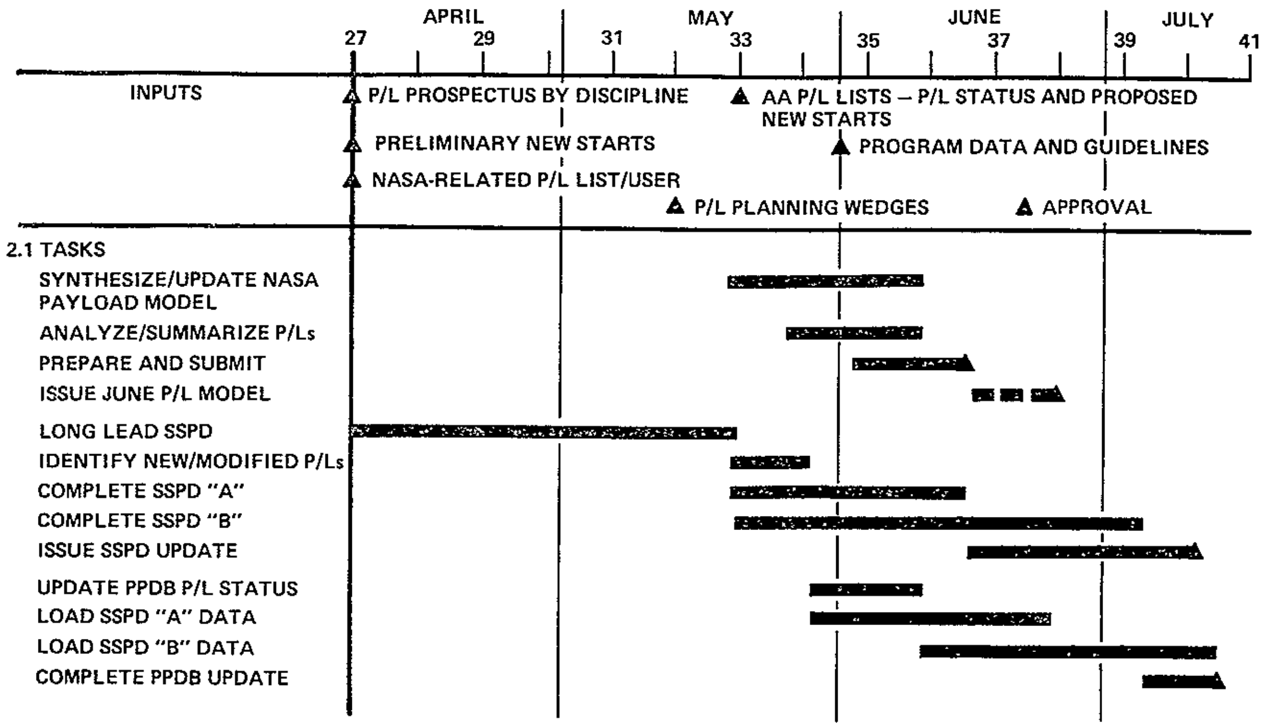
JUNE PAYLOAD MODEL



Updating the June Payload Model is initiated by receipt from NASA Headquarters of the individual payload offices' (OSS, OA, and OAST) payload lists around mid-May. These should review and update the schedule and status of any payload currently in development or scheduled for flight, or retrieval and servicing, as well as identify proposed new starts (and their flight year) and projected or planned future payloads over the new decade. Deletions, deferrals, or other changes to previously planned payloads should be noted. These payload lists and data are integrated along with NASA program planning guidelines, and NASA-related payload lists to synthesize an updated NASA Payload Model consistant with program goals and resources. Payload program characteristics (% by office, flight mode, etc.) will be summarized for a demographic overview of the payload program and an annual payload flight schedule summary (all NASA/NASA-related payloads) as well as descriptive listing (sequence table by office and discipline) are prepared. A draft document is prepared and submitted in mid-June to OPPI. Following approval, an approved June Payload Model is issued and distributed.

Payloads requiring new or formal updates to their SSPD sheets and PPDB entries will be identified.

Updates may be made at any time through the proper OPPI channels. Formal update reviews are preformed in association with the semiannual updates of the Payload Model. For the June Payload Model, the associated updating of payload descriptions (SSPDs) is initiated in April on approved or high probability of approval payloads. The SSPD sheets are the initial formatted descriptions prepared at two levels of detail — Level A, the first level is a 2 to 4 page format, Level B is a 10 to 20 page format. Appendix B presents a suggested Level A SSPD format for sortie payloads. These are filled in or completed as required by the appropriate payload sponsors or other cognizant organization and are compiled into two documents: Level A Payload Descriptions, and Level B Payload Descriptions. As these description sheets are completed and approved, the updated data are entered into the PPDB for cataloging and access to subsequent PPDB users.

4.3 NASA MISSION MODEL

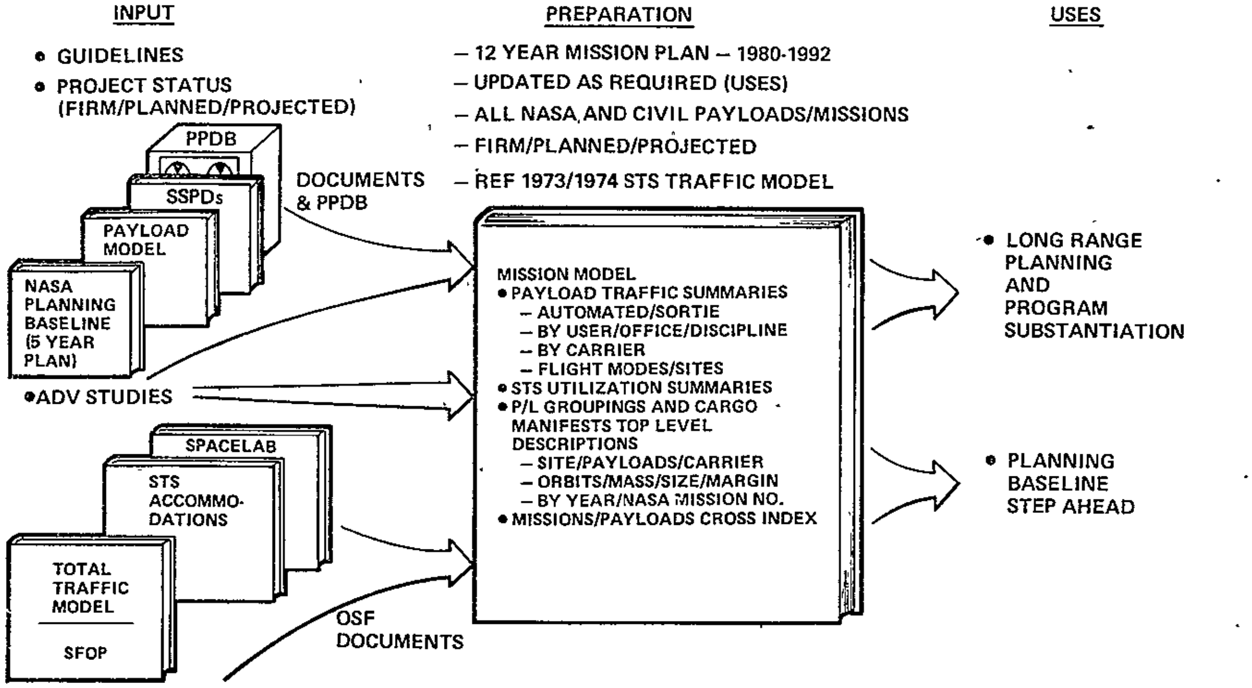
The NASA Mission Model (Figure 4-3) presents summary cargo manifests and preliminary schedules (one-year granularity) for NASA and NASA-related missions during the operational lifetime of the STS. The cargo manifests are made up from the payloads in the NASA Payload Model using data available from the SSPDs and PPDB. The PPDB can be used to extract mission-compatible payloads — e.g., same orbits, viewing, year, etc. — through automatic search and retrieval of requested key characteristics. This provides a preliminary screening of payload candidates for a given mission grouping. STS and Spacelab handbooks and accommodations data are used to match payload groupings to STS and Spacelab capabilities.

The NASA Mission Model is used throughout NASA as a reference for performing studies and as a basis for facility planning, charting future directions for the centers, and long-range planning — particularly in the supporting research and technology (SR&T) development area. It also provides users with preliminary flight-assignment information, year(s) flown, other payloads involved in multiple cargoes, etc.

Figure 4-3

22870

NASA MISSION MODEL



The NASA Mission Model contains:

A. Summary cargo manifests for each flight, including:

1. NASA mission number and year. (For approved flights, launch dates are included. For payload-launch-constrained flights, launch windows are included.)
2. Launch site.
3. Compatible payload grouping for each flight.
4. Sortie payloads carried and automated payloads delivered, retrieved, and/or serviced (also indicates user or office for each payload).
5. Payload name, code, type, weight, and dimensions.
6. Identification of which payloads have shrouds (e.g., for cleanliness) or other accommodation-driven flight configurations.
7. Payload orbit parameters (the orbits that the payloads are delivered to, and/or retrieved from).
8. Total cargo weight and dimensions.
9. Load factor (based on weight).
10. STS flight configuration and STS elements involved for each launch (IUS, Spacelab modules and pallets, TUG, Upper Stages, OMS kits, and major flight support equipment).

B. Payload and mission cross index by payload name, discipline, and office.

C. STS element utilization summaries (launch rates, schedule, IUS expenditure rate, TUG utilization rate, and Spacelab module and pallet Payload traffic summaries which indicate the traffic by user and/or

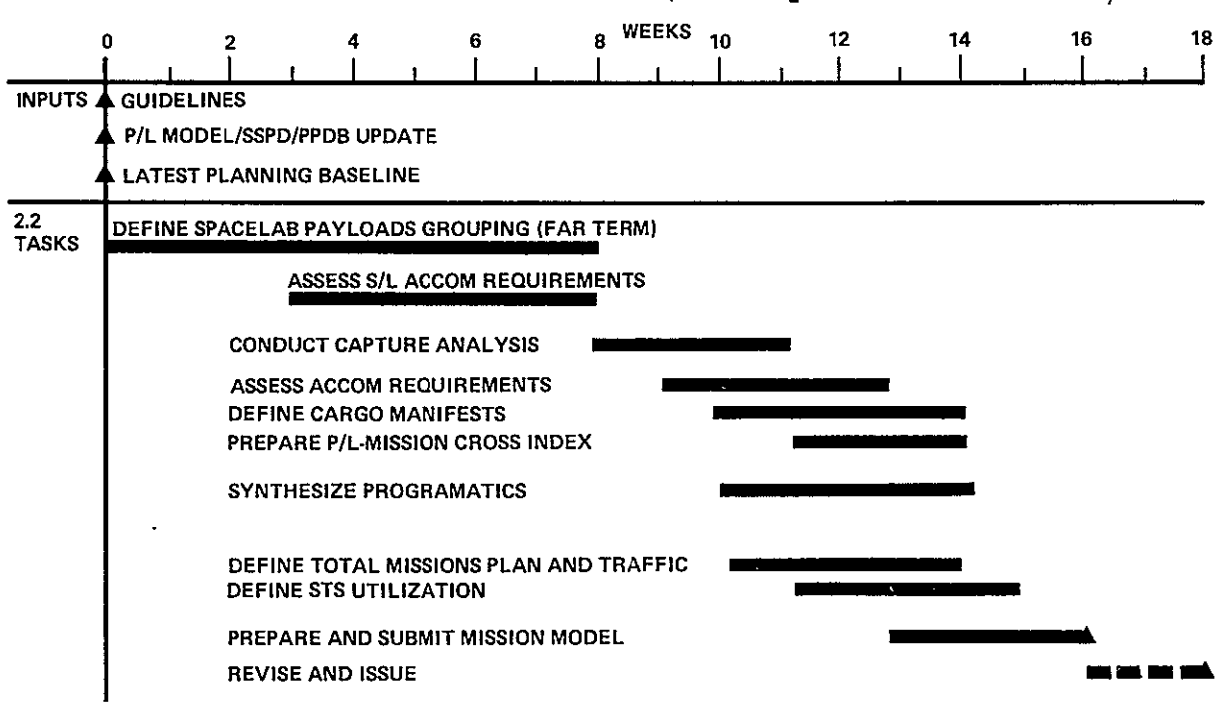
D. Payload traffic summaries which indicate the traffic by user and/or office and flight modes and/or carriers. Summary charts indicate percentage of flights with payloads by each user, operating mode, payload reflights, etc.

The NASA Mission Model is published (updated) as appropriate to reflect major changes in the long-range program trends, characteristics, and/or objectives. Updating of the NASA Mission Model (Figure 4-4) will be done when directed by NASA Headquarters, OPPI. Mission Model payload capture analyses is preceded by Spacelab payload grouping analysis for far-term

Spacelab payloads. This allows insertion of Spacelab payloads as compatible, integrated, single payloads into the mission-payload capture program for rapid assessment. The payload grouping and capture programs match the payloads basic physical characteristics (mass, dimensions) and mission requirements (orbit) to the STS capability. Detailed time line or functional

Figure 4-4 22871

NASA MISSION MODEL UPDATE (AS REQUIRED/DIRECTED)



interfaces are not considered except in average load context (average power, etc). NASA cargo manifests are delineated in desired flight sequence (Mission Plan). Near-term (five years) payloads and missions are extracted from the latest Planning Baseline. For new (far-term) missions, payload accommodation requirements are briefly assessed to identify major cargo manifest content support items (e.g., OMS, modules, pallets, etc.). A mission and payload cross reference index is prepared identifying all missions on which each payload flys. Program (far-term) mission rates and resources requirements are identified for NASA/NASA-related payload groupings. These are summarized (with the near-term data from the latest Planning Baseline) into programmatic overview charts indicating user participation (% OSS, % OA, etc.), carrier distribution (% Spacelab, % IUS, etc.), and modes (% delivery, etc.). Major STS utilization (modules, pallets, IUS, Orbiter, OMS, etc.) is defined. The NASA Mission Model is documented and submitted to OPPI, NASA Headquarters, for approval.

4.4 NASA PLANNING BASELINE (FIVE-YEAR PLAN)

The Planning Baseline (Figure 4-5) describes the firm-plus-projected NASA and NASA-related traffic within the six-year planning horizon with preliminary schedules and resource utilization profiles. It serves as a common point of departure and provides planning data for the organizations that must do the procurement for, and the planning and implementation of, the missions included in the plan. Payload projects, mission plans and schedules, STS utilization and requirements, and two-page mission descriptions are presented. Appendix C presents a mockup version of the 1977-1982 Planning Baseline document.

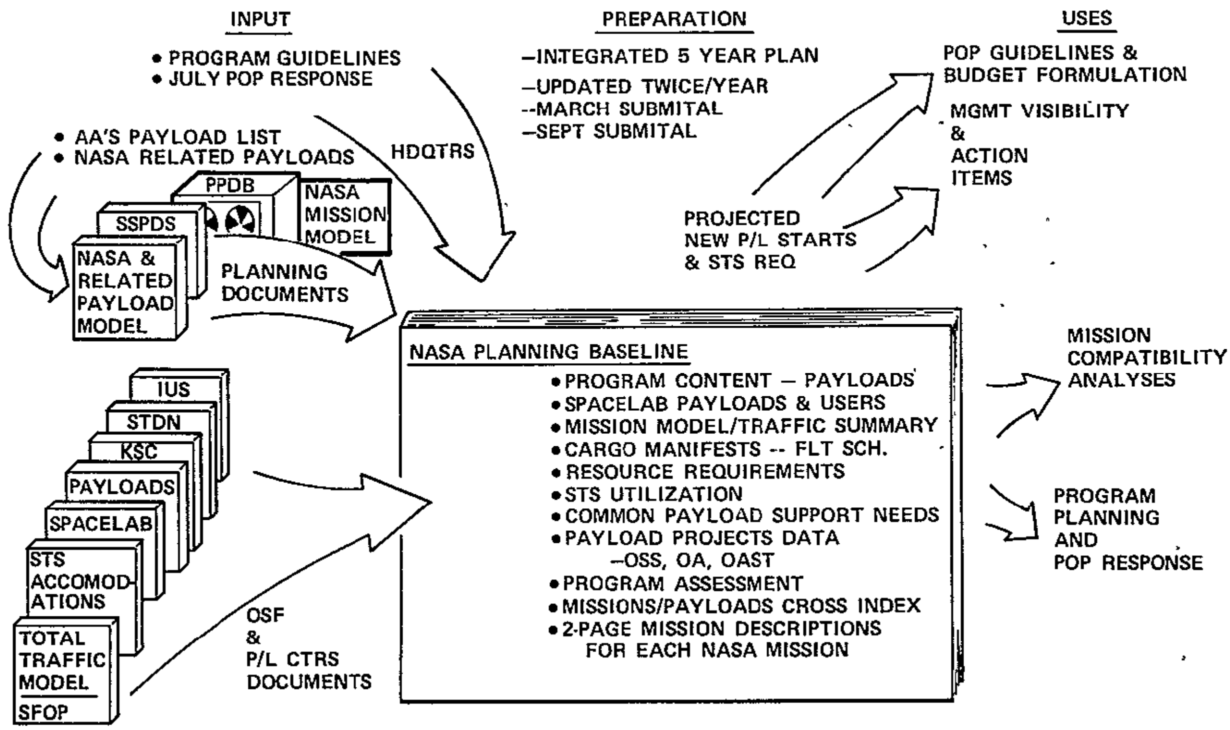
The Planning Baseline is used throughout NASA as a common reference that summarizes NASA and NASA-related payloads, missions, and STS element utilization. The prime users of the March issue are the NASA centers who employ it to support their project planning and July POP response. The September issue prime user is NASA Headquarters for conducting NASA program planning, preparation, and support of the Budget Plan submittal to OMB in October.

Other users include working and steering groups, study groups, etc., in relating their specific project or function to the total NASA program overview.

Figure 4-5

22795

NASA PLANNING BASELINE



In order to preclude overlaying a new management planning system on the various centers, the development of the Planning Baseline is predicted on using current data which are developed by the various centers in their normal course of business. Table 4-2 summarizes the input sources identified for integration into the Planning Baseline. As can be seen, the majority of the input sources are already in existence or are normally produced for new payloads. However, some new sources of data, or expansions to existing data sources, appear to be necessary.

While data on new starts and program schedules exist for each payload office, it would be convenient to pull these together each January and June as official OPPI program planning guidelines. The mission models, although in existence, needs to be updated and oriented to the planning process and functions, including a long-range guideline to the Planning Baseline semiannual updates. Spacelab payload integration plans would provide guidelines and specific data for Spacelab payload grouping analyses and Spacelab mission description and utilization. The remaining documents in Table 4-2, the lower half of the matrix, would provide reference to STS accommodations and planning needed for preparing mission descriptions and assessing STS utilization requirements.

19812

Table 4-2

DATA SOURCES - PLANNING BASELINE

DATA SOURCES \ INPUTS	PAYLOAD LISTS/PROJECT STATUS & SCHEDULE SUMMARY	MISSION REQUIREMENTS	STS ACCOMMODATIONS	TRAFFIC MODEL/ CARGOES SUMMARY	FLIGHT SCHEDULES	RESOURCE BASE UTILIZATION/INVENTORY	MAJOR NEW STARTS/ PROJECTS	PROGRAM MILESTONES & SCHEDULE
HEADQUARTERS GUIDELINES								
– PLANNING GUIDELINES							O	O
– AA'S PAYLOAD LISTS	*						*	
INTEGRATED PAYLOAD & MISSION PLANNING								
– PAYLOAD MODEL, SSPD/PPDS	●	●						
– MISSION MODEL		●		●				
– PAYLOAD INTERFACE RQMTS		O				O		
PAYLOAD PROJECT DOCUMENTS								
– PHASE A/B STUDIES	●	●					●	
– PAYLOAD PROJECT PLANS AND PADS	●	●			●		●	●
– SPACELAB PAYLOAD INTEGRATION PLANS	O		O			O		O
SHUTTLE SYSTEMS DOCUMENTS (0700)								
– PAYLOAD ACCOMMODATIONS (VOL XIV)			●					
– PROGRAM PLAN/STATUS REPORTS						●	●	●
IUS PAYLOAD ACCOMMODATIONS AND USERS HANDBOOK			O					
SPACELAB SYSTEMS DOCUMENTATION								
– PAYLOAD ACCOMMODATIONS (SLP/2104)			●					
– PROGRAM PLAN/STATUS REPORTS						●	●	●
SUPPORT OPERATIONS DOCUMENTS								
– STDN (101.1) AND TDRS (101.2) USERS GUIDES			●			●		
– KSC STS USERS HANDBOOK			●			●		
– KSC SHUTTLE PROJECT SUMMARY (K-SM-03, 1,02,3)								●
– JSC FLIGHT SYSTEMS SUPPORT CAPABILITY			O			O		
– POC OPERATIONS CAPABILITY			O			O		
ACCOMMODATION RESERVATIONS								
– STDN MISSION MODEL (STDN 816)						●		●
– TRAFFIC MODEL/SPACE FLIGHT OPERATIONS PLAN (1)				O	O	O		O
– SPACELAB ELEMENTS AND LOGISTICS PLAN				O		O		O
– POC OPERATION PLANS						O		O
– KSC SHUTTLE PROJECT SUMMARY						*		●

NOTE: ADDITIONAL DOCUMENTATION REQUIRED TO COVER WTR AND REMOTE RECOVERY SITES

● EXISTING DATA
* RECOMMENDED EXPANSION TO EXISTING DOCUMENTS
O REQUIRES NEW DOCUMENTS

(1) PREPARATION IN PLANNING BY OSF

A definitive mockup (Appendix C) of the Planning Baseline was prepared showing the format and typical content of the document. The mockup was based on previously developed descriptions and outlines, recent coordination on program needs, data and material in the Early STS Mission Plan (June 22, 1976), and specific mission studies. A horizontal format (Figure 4-6), similar to a briefing document with a minimum of text, was selected to accommodate tabular program data in the most efficient manner.

Briefly, a program assessment and overview section follows the introduction. This is followed by a more detailed overview of the five-year plans of each Payload Program Office, a section summarizing resource requirements and STS utilization, and a Missions Plan (preliminary flight schedule and payloads). This is followed by a mission and payload cross index and flight-sequenced two-page descriptions of each NASA and NASA-related payload mission. These summarize each mission objective and description, configuration, weights, support requirements and equipment, payload descriptions, development milestones, and program management information.

The Planning Baseline is submitted each March and September. The September Planning Baseline (Figure 4-7) preparation is initiated in June following the first budget resolution and Payload Model update. Preparation proceeds along two lines: mission descriptions and program overview. Mission descriptions are initiated by updating and synthesizing new payload groupings based on the new program guidelines and payload and STS traffic updates. Mission operations are defined and payload compatibility and STS accommodations assessed. Flight system requirements and cargo manifest are defined and ground operations and support requirements defined. Program overview is initiated by compiling payload project data (firm or projected) for each program office and defining preliminary development schedules for the updated missions (integrated payloads and missions schedules and mission project key milestones start, integration, and launch). STS requirements and utilization is compiled across the missions by year and (new) common payload support needs identified and defined. General program summary and assessments are made to complete the overview.

The Planning Baseline is coordinated throughout NASA Headquarters by OPPI. Upon completion of this coordination, the document is reviewed by the OPPI for final approval.

Figure 4-6

22794

NASA PLANNING BASELINE FORMAT

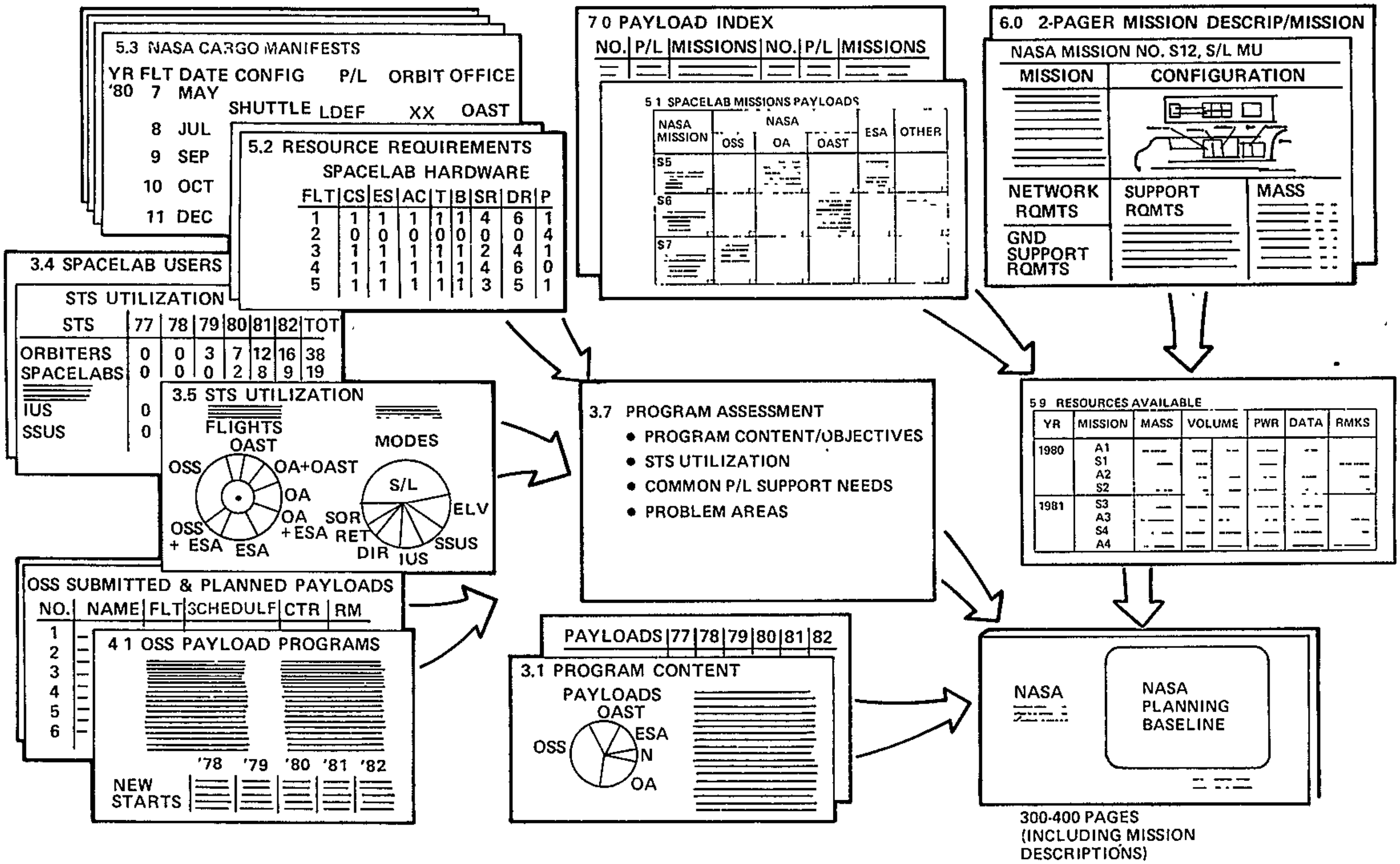
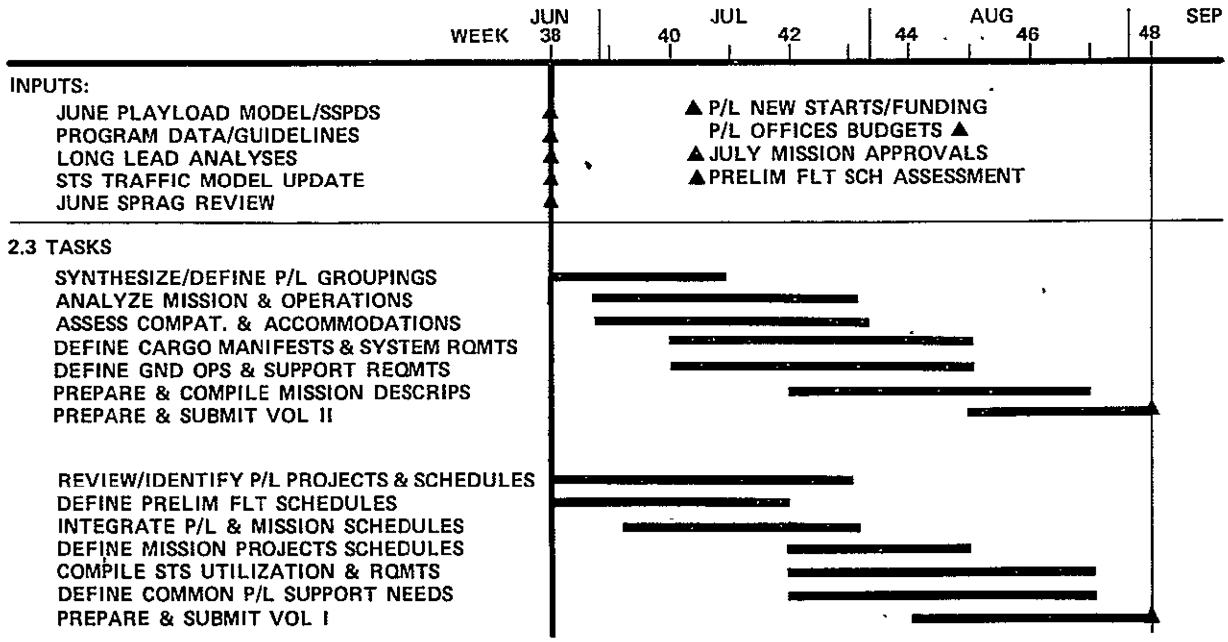


Figure 4-7 22797

SEPTEMBER PLANNING BASELINE



4.5 PRELIMINARY MISSION COMPATIBILITY ANALYSES

In the course of premission approval planning, preliminary mission analyses may be performed to assess the compatibility of the integrated payload with the STS, the mission profile and operations, and the individual payloads and experiment operations.

Depending upon the specific request, data input, and direction by the cognizant payload Program Office, these analyses may cover areas such as:

A. Payload definition data, including:

1. Objectives and requirements of each of the experiments in the payload complement.
2. Experiment equipment. Specific equipment unique to a single experiment, as well as that which is shared by two or more experiments, e.g., Common Operational Research Equipment (CORE).
3. Mission equipment, both Common Payload Support Equipment (CPSE) and Mission-Dependent Support Equipment, required.
4. Configuration definition, layouts, and mass properties (space, weight, and center-of-gravity).

B. Mission definition data including mission profile, orbit selection, launch time, attitude and g-level requirements, tracking and communications, maneuvers, and environment.

C. Integrated payload interface requirements, including:

1. STS subsystems analysis and capability assessments, comparing:
    a. Electrical power system(s) against power and energy timeline demands.
    b. Command and data management system (CDMS) against requirements for displays, controls, payload checkout, onboard experiment analysis, storage, etc.
    c. Guidance, navigation, stabilization, and control systems against requirements for upper stage operations, experiment pointing accuracy, deadband, g-levels, contamination, etc.
    d. Communications (onboard and network) systems against data stream and control requirements.
    e. Crew systems against crew, skills, and payload specialist requirements.
    f. Environmental control life support systems against environmental, cooling, etc., payload and mission requirements.
2. STS and payload interface analysis and compatibility assessments, comparing:
    a. Structural and mechanical interfaces and constraints against structural and mechanical loads, etc.
    b. Fluid systems interfaces against coolant, etc., requirements.
    c. Safety, reliability, payload bay environment, etc., interfaces against potential safety hazards, and operational and environmental requirements.

D. Mission operations, including mission sequence of events, payload operations, experiment resources, attitude maneuvering time line from lift off through landing, and experiment and crew operations.

E. Ground operations, including payload integration and STS element ground operations flows, activities, and time line required to process payload elements through the various levels of integration and launch operations; mission support operations; interface requirements; and impact assessments.

F. STS resource utilization summary, including:

1. The identification of the STS elements required, the resources required for each task in the mission and ground operation activities, and time lines for the utilization of these resources. Standard STS time lines are used as appropriate.
2. Compatibility problems encountered and possible solutions evaluated.
3. Unallocated resources such as weight capability, space, power, and heat rejection capability which can be made available to complementary additional payloads will be specified with a description of any problems related to their utilization.

G. Preliminary cost estimates of the mission and a funding profile relating it to schedule estimates.

H. Launch and mission schedules, including the phasing of payload experiment availability dates with respect to the desired launch date.

I. Assessment of the mission's safety with respect to the STS and its interface verification.

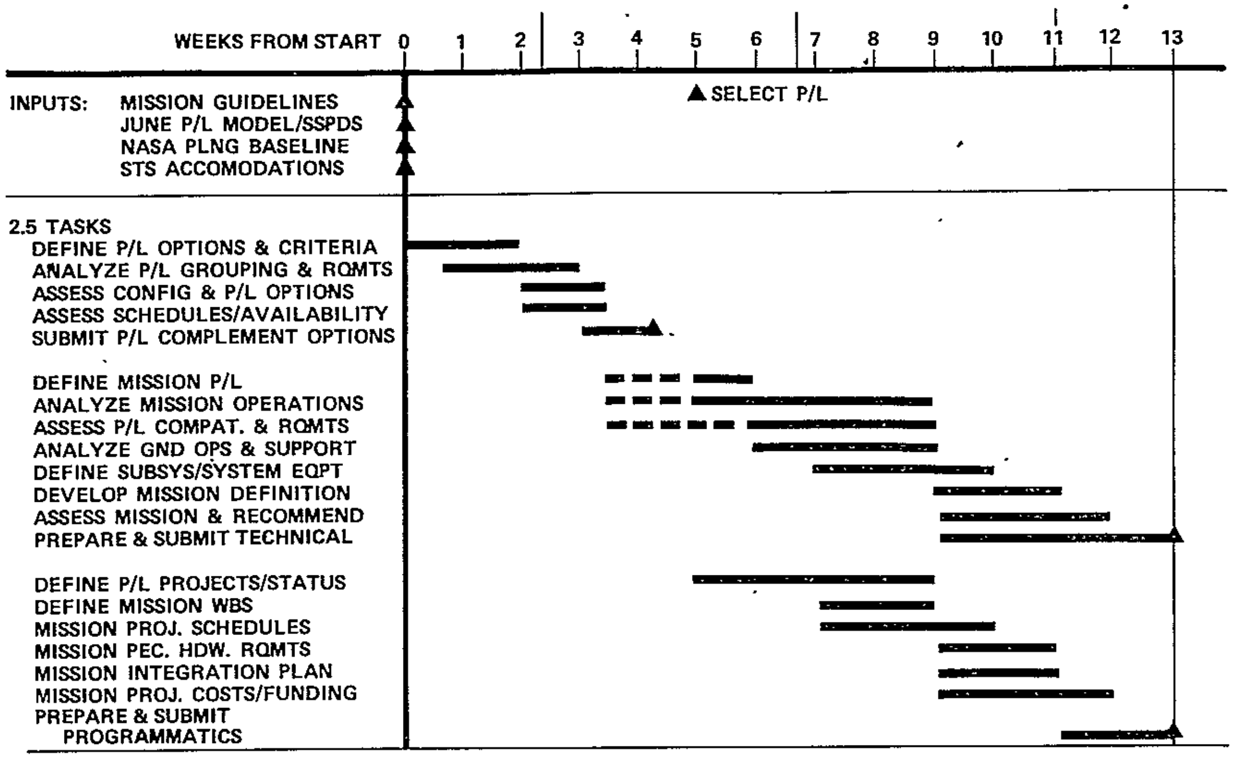
J. Alternate payloads and groupings as candidate options to the proposed payload complement for possible use as contingency payloads.

Not all of the areas may be analyzed to the depth indicated in each case. The degree of analysis and depth of reporting will be dependent upon the specific request, effort level, and time available.

Figure 4-8 indicates the tasks and schedules required to perform a comprehensive mission compatibility analysis. Completion time is estimated at eight weeks following payload selection. The preceding payload selection analysis, which may not be required in some cases, is estimated as a five-week process, including the definition of mission payload options, evaluation, and selection.

Figure 4-8 22790

COMPREHENSIVE MISSION COMPATIBILITY ANALYSIS SCHEDULE



Following payload selection, the mission payload configuration, stowage, support equipment, and mass properties are defined, and missions operations are analyzed to define orbits, launch time, and flight attitude and maneuvers. Integrated payload compatibility and accommodation requirements, including resources time lines, are assessed. A summary mission description (preliminary) is developed and problem areas assessed. A technical summary is prepared for review.

Mission payload projects availability is assessed against preliminary mission development schedules and major milestones are defined. Mission-peculiar hardware development requirements are identified and a mission project work breakdown structure (WBS) may be defined. Integration plans (approach, levels, sites, and dates) are identified. Mission project costs and funding requirements are estimated and a programmatic supplement prepared for review.

Section 5
INTEGRATED PAYLOAD PLANNING DATA SYSTEMS

The analytical efforts require to produce the payload planning products require efficient data systems. A problem exists in data exchange, update, and utilization, particularly in nondedicated flights with multidiscipline payloads that are developed by several different NASA centers. The start of the entire planning process therefore occurs with the efforts to develop and specify the payload data required.

The NASA PPDB is an excellent tool, but, in order for this system to be effective, it requires that each center prepare, insert, and maintain the payload data for which they are responsible.

The data system use for product production is outlined in Figure 5-1. The data systems are:

1. SSPD — Levels A and B data files.
2. PPDB — Containing files: SSPD, Payload Model, Mission Model and Cargo Manifests, Common Payload Support Equipment, and STS Payload Carrier Data files (see Appendix G) such as IUS, SSUS, Spacelab, and Orbiter.
3. Spacelab Payload Grouping Program — Spacelab rack and pallet payload capture program for input to the STS payload utilization program.
4. STS Payload Utilization Program — Payload capture program for evaluating and planning the 12-year Mission Model.
5. Mission/System/Compatibility Analysis — Mission analysis and system analysis programs used to perform a further compatibility review of the payloads missions planned over the next five years.
6. Mission Planning System (MPS) — An integrated set of planning and analysis programs capable of performing mission feasibility investigations leading to mission implementation decisions.

Figure 5-1

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PAYLOAD PLANNING DATA SYSTEM USE

PAYLOAD PRODUCT	DATA SYSTEM: SSPD	PPDB	SPACELAB PAYLOAD GROUPING PROGRAM	STS PAYLOAD UTILIZATION PROGRAM	MISSION/ SYSTEM/ COMPATIBILITY ANALYSIS	MPS (OR EQUIV)	COMMENT
1. PAYLOAD MODEL	√	√					THE BASIS FOR ALL LONG-RANGE PLANNING EVALUATIONS
2. MISSION MODEL	√	√	√	√			THE 12-YEAR FLIGHT SPECTRUM FOR ALL NASA AND NASA-RELATED PAYLOADS
3. PLANNING BASELINE	√	√	√	√	√		THE REFINED LOOK AT MISSION FEASIBILITIES FOR THE 5-YEAR PLAN
4. MISSION COMPATIBILITY ANALYSES	√	√			√	√	THE MISSION/SYSTEM ANALYSIS RESULTS IN EVALUATING FLIGHT/PAYLOAD COMPATIBILITY WHICH SUMMARIZES THE CASE FOR A MISSION'S IMPLEMENTATION

As shown, the cornerstone for all the products is the payload data which should be present in its latest form in the SSPD. Access to the latest SSPD data requires that the responsible center input and maintain these data in the PPDB for NASA-wide access and planning use.

The NASA and NASA-related Payload Model consists of a catalog and description of firm and projected payloads approved for use in planning for up to 12 years in the future. It provides the basis for both near-term and long-range planning. Detailed payload data are added to the SSPD files, published, and placed in the PPDB as they are developed. The distinction is that the Payload Model is only the catalog of brief descriptions of these payloads whereas the detail data for planning analysis are separate entities updated in the SSPD.

The Spacelab Payload Grouping Program fits Spacelab-designed sortie payloads together in racks and/or on pallets to form Spacelab flight configurations and grossly evaluates their total demands on the STS system to assure that the configurations are feasible (preliminary groupings). The logic for the Spacelab Payload Grouping Program, developed under Task 2.1c of this contract, is reported in Volume II. This program is currently in development at MSFC. The Spacelab-configured payloads resulting from this program are fed into the existing MSFC STS Payload Utilization (Capture) Program which synthesizes a 12-year-long flight plan (Mission Model) of automated and sortie payload flights. The STS capture program fits automated payloads to flights and adds them to Spacelab flights where possible. These candidate payload groupings are each fed through a set of system performance screens to reduce the combination sets to those basically feasible. An iteration with mission operations and scheduling of STS components is performed until an acceptable Mission Model is achieved.

The Planning Baseline (which covers the missions in the next five years) is a more detailed look at the feasibility of these missions, and requires an assortment of technical analyses. These analyses could be grouped into a data system to rapidly appraise the payload mission compatibility at a lower level of detail than that in the Mission Model.

The mission compatibility analyses investigate payload STS system compatibility to the level required to support mission implementation decisions. An integrated set of routines resident on an interactive data system, such as the MPS at MSFC, is required to effectively evaluate these missions. The responsible center, using its particular data system, will make use of the predecessor payload planning products and the latest payload data definition to establish the case for mission feasibility.

Appendix A

INTEGRATED PAYLOAD PLANNING PROCESS SIMULATION

A simulation of the payload planning process was performed using the MDAC-developed Generalized Operations (GO) program. GO is an event simulation model which handles task flow sequences, durations, priorities, starting dates, the resources required and available for event accomplishment, and queuing and conflict reports when run in the resources-constrained mode. The activities, durations, and schedules were simulated using GO to obtain that program's output formats.

The activities shown on the planning process master flow are presented in Table A-1 as input data to the GO program. These data include key task-event descriptions (task titles and corresponding master flow task numbers), durations (in work days required), start dates (if task starts independently after a delay of n days from the start of the simulations, which was set at Oct 1), predecessor task lists (if task starts dependent upon the completion of required predecessor tasks), and task location relative to the eight master flow organizational elements.

The related activities for a single one-year cycle are shown in the event time line of Figure A-1 on a quarterly basis. This figure portrays an integrated time line of all of the 277 tasks or activities simulated, presented in the order of when each of the activities is completed.

A breakout of the tasks contained in each of the organizational elements of the master flow is shown in Figure A-2 on a weekly basis. Key submittal or issue dates for the major products are indicated on the figure, as are the durations for all the activities. It is recognized that some actual development, analysis, and update durations will be longer than shown (some being nearly continuous) as only the critical (minimum) durations were simulated (these being activated by releases, approvals, etc.).

The process cycle requires 12 months, matching the government fiscal year from October to October. As indicated by the time lines, the production of the major products requries nearly continuous effort all year long in each of these product areas.

Table A-1. Key Task Event Descriptions (Page 1 of 3)

VER 8.0 09/09/76 19.55.21 PAGE 3

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*            DATA SET DAVIN        AT LEVEL 005 AS OF 09/09/76
***GO RUN CONTROL*** TS  MASTER FLOW (AUG 1976)
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MASTER FLOW (ORGANIZATIONAL ELEMENTS)

Org	Task	Type	Description	Work Days	Start Day	Predecessor Tasks		Seq.
*			DATA SET DAVIN AT LEVEL 005 AS OF 09/09/76				00	00001
***GO			RUN CONTROL*** TS MASTER FLOW (AUG 1976)				11	00002
01							18	00003
01	1							
01	01		NASA HDQTRS				31	00004
01	02		- PAYLOAD MODEL				31	00005
01	03		- MISSION MODEL				31	00006
01	04		- PLANNING BASELINE				31	00007
01	05		- INTEG. P/L INTERFACE RQTS.& MMSE				31	00008
01	06		- MISSION APPROVAL DOCUMENT				31	00009
01	07		PAYLOAD CENTERS				31	00010
01	08		STS CENTERS/OPERATORS				31	00011
01	09		- MAD (CONTINUED TASKS)				31	00012
01	1	2	COMPLETE OMB HEARINGS (1.1)	5	5		61	00013
01	2	2	DEVELOP P/L.PROSPECTUS-DISCP (1.2)	5	5		61	00014
01	3	2	PROVIDE NASA REL.P/L BY USER (1.3)	5	5		61	00015
01	4	2	COMPLETE OMB MARKUP (1.4)	5	25	1 2 3	61	00016
01	5	2	PROVIDE P/L PLNG.WEDGES-NOV. (1.5)	5	25	1 2 3	61	00017
01	6	2	DEVELOP P/L MODEL BY P/L AA (1.6)	5	35	5	61	00018
01	7	2	FINALIZE NASA/OMB BUDGET (1.7)	5	50	4	61	00019
01	8	2	PROGR'' DATA AND GUIDELINES (1.8)	5	67	7	61	00020
01	9	2	REVIEW & APR.JAN.NASA PL MOD (1.9)	5	67		61	00021
01	10	2	POP-1 CALL & GUIDELINES (1.10)	5	75	8	61	00022
01	11	2	AA CALLS FOR NEW STARTS (1.11)	5	78	9	61	00023
01	12	2	REV/ANALYSE POP-1 RESPONSE (1.12)	5	115		61	00024
01	13	2	REV/APPROVE MAR. PLNG. B/L (1.13)	5	120		61	00025
01	14	2	SPECIFIC MISSION OBJ.& GUID (1.14)	5	120		61	00026
01	15	2	PREPARE BUDGET REVIEW (1.15)	10		12 13	61	00027
01	16	2	UPDATE P/L PROSPECTUS-DISCP (1.16)	5	130	13	61	00028
01	17	2	PROVIDE NASA REL.PL BY USER (1.17)	5	130		61	00029
01	18	2	OMB BUDGET REVIEW (1.18)	5		15	61	00030
01	19	2	PROVIDE P/L PLNG.WEDGES-MAY (1.19)	5	150	18	61	00031
01	20	2	BUDGET FIRST RESOLUTION (1.20)	5	157	18	61	00032
01	21	2	UPDATE PL MODEL BY PL AA (1.21)	5	160	19 16	61	00033
01	22	2	REV/SELECT MISSION PL OPTIO (1.22)	5	155		61	00034
01	23	2	PROGRAM DATA & POP-2/GUIDEL (1.23)	5	168	20 19	61	00035
01	24	2	REV/APPROVE MISSION MODEL (1.24)	5	168		61	00036
01	25	2	REV/APPR.JUNE NASA PL MODEL (1.25)	5	185		61	00037
01	26	2	REV/APPROVE MISSION (1.26)	5	[illegible]		61	00038
01	27	2	ASSIGN P/L AA & PGM. MGR. (1.27)			26	61	00039
01	28	2	P/L PROJECTS & FUNDING (1.28)	5	213		61	00040
01	29	2	OSF PROJECTS & FUNDING (1.29)	10	215		61	00041
01	30	2	REV/APPR. SPLIT P/L MISSION (1.30)	10	220	27	61	00042
01	31	2	P/L OFFICES BUDGET TO COMPT (1.31)	10	225	28	61	00043
01	32	2	OSF BUDGET TO COMPTROLLER (1.32)	10	225	29	61	00044
01	33	2	BUDGET FORMULATION & ISSUES (1.33)	15	235		61	00045
01	34	2	REV.SEPT.PLNG.B/L -APPROVAL (1.34)	15	235		61	00046
01	35	2	NASA MGT. PROGRAM DECISIONS (1.35)	5	250	33 34	61	00047
01	36	2	FINALIZE BUDGET SUBMITTAL (1.36)	5	255	33 35	61	00048
02	1	1	COMPILE LONG LEAD SSPD (2.1.1)	30	10		61	00049
02	2	1	UPDATE NASA P/L MODEL (2.1.2)	10	40		61	00050
02	3	1	IDENTIFY NEW/MODIFIED P/L (2.1.3)	10	40	1	61	00051
02	4	1	SUMMARIZE P/L TRAFFIC (2.1.4)	5		2	61	00052
02	5	1	SYNTHESIZE SSPD DATA (2.1.5)	5		3	61	00053
02	6	1	UPDATE PPDB P/L STATUS (2.1.6)	15		3	61	00054
02	7	1	PREP/SUBMIT JAN.PL MODEL (2.1.7)	10		4	61	00055
02	8	1	COMPLETE SSPD LEVEL A REVS (2.1.8)	10		5	61	00056
02	9	1	REVISE NASA PL MODEL (2.1.9)	5		7 8	61	00057
02	10	1	LOAD SSPD LEVEL A DATA (2.1.10)	5		5 6	61	00058
02	11	1	ISSUE JAN NASA PL MODEL (2.1.11)	10		9	61	00059
02	12	1	COMPLETE SSPD LEVEL B REV (2.1.12)	10		9 8	61	00060
02	13	1	STORE & C/O PL DATA (2.1.13)	10		8 9 10	61	00061
02	14	1	ISSUE JAN SSPD (A&B) (2.1.14)	10		12	61	00062
02	15	1	COMPLETE JAN PPDB UPDATE (2.1.15)	10		12 13	61	00063
02	16	1	UPDATE LONG LEAD SSPD (2.1.16)	30	135		61	00064
02	17	1	UPDATE NASA P/L MODEL (2.1.17)	5	165		61	00065
02	18	1	IDENTIFY NEW/MODIFIED P/L (2.1.18)	5	165	16	61	00066
02	19	1	SUMMARIZE P/L TRAFFIC (2.1.19)	10		17	61	00067
02	20	1	UPDATE SSPD DATA (2.1.20)	10		18	61	00068
02	21	1	UPDATE PPDB P/L STATUS (2.1.21)	15		18	61	00069
02	22	1	PREP/SUBMIT JUNE PL MODEL (2.1.22)	5		19	61	00070
02	23	1	COMPLETE SSPD LV.A UPDATE (2.1.23)	5		20	61	00071
02	24	1	REVISE NASA PL MODEL (2.1.24)	5		22 23	61	00072
02	25	1	LOAD SSPD LEVEL A DATA (2.1.25)	5		21	61	00073
02	26	1	ISSUE JUNE NASA PL MODEL (2.1.26)	10		24	61	00074
02	27	1	COMPLETE SSPD-B UPDATE (2.1.27)	10	190	23	61	00075
02	28	1	STORE & C/O P/L DATA (2.1.28)	10		25	61	00076
02	29	1	ISSUE JUNE SSPD A&B UPDAT (2.1.29)	10		27	61	00077
02	30	1	COMPLETE JUNE PPDB UPDATE (2.1.30)	10		28	61	00078
03	1	1	FAR TERM S/L P/L GROUPINGS (2.2.1)	20	90		61	00079
03	2	1	ASSESS SPACELAB ACCOM.RQMT (2.2.2)	20		1	61	00080
03	3	1	CAPTURE ANALYSIS-NASA/REL. (2.2.3)	5		2	61	00081
03	4	1	SYN. MISSION MODEL PROGRAM (2.2.4)	15	130		61	00082
03	5	1	ASSESS CAPTURE ACCOM.REQTS (2.2.5)	10		3	61	00083
03	6	1	DEFINE CARGO MANIFESTS (2.2.6)	5		5	61	00084
03	7	1	ASSESS NASA MISSIONS COSTS (2.2.7)	5		5 4	61	00085
03	8	1	PREP.MISSION & PL INDEX (2.2.8)	5		5	61	00086
03	9	1	DEFINE MISSIONS PLAN/SUMRY (2.2.9)	5		6 4	61	00087
03	10	1	DEF.MISSION MODEL FUNDING (2.2.10)	5	155	7	61	00088
03	11	1	DEF.STS UTILIZATION (2.2.11)	5		9	61	00089
03	12	1	PREP/SUBMIT MISSION MODEL (2.2.12)	10		10 11 8	61	00090
03	13	1	REVISE MISSION MODEL (2.2.13)	5		12	61	00091
03	14	1	ISSUE MISSION MODEL (2.2.14)	10	180		61	00092
04	1	1	LONG-LEAD ANAL.MAR PLN B/L (2.3.1)	30	40		61	00093
04	2	1	SYN.MISSION P/L GROUPINGS (2.3.2)	10		1	61	00094
04	3	1	DEF.PL PROJECTS & COSTS (2.3.3)	10		1	61	00095
04	4	1	ANAL.TOT.STS TRAFFIC/RESOP (2.3.4)	10		1	61	00096
04	5	1	DEF.MISSION P/L GROUPINGS (2.3.5)	5		2	61	00097
04	6	1	ANAL.MISSION & OPERATIONS (2.3.6)	5		2	61	00098
04	7	1	DEF.PRELIM.FLT.SCHEDULES (2.3.7)	5		2 4	61	00099
04	8	1	ASSESS PL COMPATIBILITY (2.3.8)	5		5 6	61	00100
04	9	1	DETERMINE ACCOM. RQMTS (2.3.9)	5		5 6	61	00101
04	10	1	DEF.GRD.OPS & SUPPORT (2.3.10)	5		5 6	61	00102
04	11	1	INTEG.PL PROJECTS/SCHEDUL (2.3.11)	5		5 3 7	61	00103
04	12	1	DEF.CARGO MANIFESTS (2.3.12)	10		8 9	61	00104

Annotations: START DAY; MASTER FLOW NUMBER (IN BRACKETS); 01 = NASA HDQ; 02 = PAYLOAD MODEL

TASK TYPE (1 = PLNG, 2 = NASA HDQTRS, 3 = PL CENTERS, 4 = STS OPS)
TASK NUMBER IN ORGANIZATIONAL ELEMENT
ORGANIZATION ELEMENT NUMBER

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Table A-1. Key Task Event Descriptions (Page 2 of 3)

MCDONNELL-DOUGLAS AUTOMATION COMPANY VER 8.0 09/09/76 PAGE 5
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				ΔT	START	PREDECESSOR TASKS		
04	13	1	DEF.SYSTEM/SUBSYS. RQMTS (2.3.13)	10		9	61	00105
04	14	1	DEF.MISSION PROJ.SCH/COST(2.3.14)	10		9 10 11	61	00106
04	15	1	DEF.NASA MISSION PLAN/SUM(2.3.15)	10		11	61	00107
04	16	1	PREP.MISSION & PL INDEX (2.3.16)	10		12 15	61	00108
04	17	1	COMPILE MISSION DESCRIPTS(2.3.17)	10		12 13 14 15	61	00109
04	18	1	DEF.STS RQMTS & UTILIZATI(2.3.18)	10		13 14 15	61	00110
04	19	1	DEF.MISSIONS/PL PROJ.FUND(2.3.19)	10		14 15	61	00111
04	20	1	DEF.COMMON PL SUPPORT RQT(2.3.20)	5		17 18	61	00112
04	21	1	COMPARE FUNDING/BUDGET GL(2.3.21)	5		19	61	00113
04	22	1	PREP/SUB.VOL II PLNG B/L (2.3.22)	5	115	16 17	61	00114
04	23	1	PREP/SUB.VOL I PLNG B/L (2.3.23)	5		20 21	61	00115
04	24	1	REVISE PLNG BASELINE (2.3.24)	10		22 23	61	00116
04	25	1	ISSUE MARCH PLNG.BASELINE(2.3.25)	5		24	61	00117
04	26	1	LONG-LEAD ANAL.SEPT. B/L(2.3.26)	20	170	25	61	00118
04	27	1	SYN.MISSION PL GROUPINGS (2.3.27)	10		26	61	00119
04	28	1	DEF.PL PROJECTS & COSTS (2.3.28)	10		26	61	00120
04	29	1	ANAL.TOT.STS TRAFFIC/RESR(2.3.29)	10		26	61	00121
04	30	1	DEF.MISSION P/L GROUPINGS(2.3.30)	5		27	61	00122
04	31	1	ANAL.MISSION & OPERATIONS(2.3.31)	5		27	61	00123
04	32	1	DEF.PRELIM.FLT.SCHEDULES (2.3.32)	5		27 29	61	00124
04	33	1	ASSESS PL COMPATIBILITY (2.3.33)	5		30 31	61	00125
04	34	1	DETERMINE ACCOM. RQMTS (2.3.34)	5		30 31	61	00126
04	35	1	DEF.GRD.OPS & SUPPORT (2.3.35)	5		30 31	61	00127
04	36	1	INTEG.PL PROJECTS/SCHED. (2.3.36)	5		30 28 32	61	00128
04	37	1	DEF.CARGO MANIFESTS (2.3.37)	10		33 34	61	00129
04	38	1	DEF.SYSTEM/SUBSYS. RQMTS (2.3.38)	10		34	61	00130
04	39	1	DEF.MISSION PROJ.SCH/COST(2.3.39)	10		34 35 36	61	00131
04	40	1	DEF.NASA MISSION PLAN/SUM(2.3.40)	10		36	61	00132
04	41	1	PREP.MISSION & PL INDEX (2.3.41)	10		37 40	61	00133
04	42	1	COMPILE MISSION DESCRIPTS(2.3.42)	10		37 38 39 40	61	00134
04	43	1	DEF.STS RQMTS & UTILIZATI(2.3.43)	10		38 39 40	61	00135
04	44	1	DEF.MISSIONS/PL PROJ.FUND(2.3.44)	10		39 40	61	00136
04	45	1	DEF.COMMON PL SUPPORT RQT(2.3.45)	5		42 43	61	00137
04	46	1	COMPARE FUNDING/BUDGET GL(2.3.46)	5		44	61	00138
04	47	1	PREP/SUB.VOL II PLNG B/L (2.3.47)	5	235	41 42	61	00139
04	48	1	PREP/SUB.VOL I PLNG B/L (2.3.48)	5		45 46	61	00140
04	49	1	REVISE PLNG BASELINE (2.3.49)	10		47 48	61	00141
04	50	1	REVISE PLNG B/L (FINAL) (2.3.50)	10		49	61	00142
04	51	1	ISSUE SEPT.PLNG BASELINE (2.3.51)	5		50	61	00143
05	1	1	COMPILE P/L INTERFACE RQTS(2.4.1)	20			61	00144
05	2	1	INTEG.PL I/F RQTS/ACCOM (2.4.2)	20		1	61	00145
05	3	1	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	15		2	61	00146
05	4	1	COORD. REV. INTEG.PL I/F (2.4.4)	5	65	3	61	00147
05	5	1	ISSUE VALIDATED PL I/F RQT(2.4.5)	5		4	61	00148
05	6	1	COMPILE P/L INTERFACE RQTS(2.4.1)	20	65		61	00149
05	7	1	INTEG.PL I/F RQTS/ACCOM (2.4.2)	20		6	61	00150
05	8	1	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	15		7	61	00151
05	9	1	COORD. REV. INTEG.PL I/F (2.4.4)	5	130	8	61	00152
05	10	1	ISSUE VALIDATED PL I/F RQT(2.4.5)	5		9	61	00153
05	11	1	COMPILE P/L INTERFACE RQTS(2.4.1)	20	130		61	00154
05	12	1	INTEG.PL I/F RQTS/ACCOM (2.4.2)	20		11	61	00155
05	13	1	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	15		12	61	00156
05	14	1	COORD. REV. INTEG.PL I/F (2.4.4)	5	195	13	61	00157
05	15	1	ISSUE VALIDATED PL I/F RQT(2.4.5)	5		14	61	00158
05	16	1	COMPILE P/L INTERFACE RQTS(2.4.1)	20	195		61	00159
05	17	1	INTEG.PL I/F RQTS/ACCOM (2.4.2)	20		16	61	00160
05	18	1	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	15		17	61	00161
05	19	1	COORD. REV. INTEG.PL I/F (2.4.4)	5	260	18	61	00162
05	20	1	ISSUE VALIDATED PL I/F RQT(2.4.5)	5		19	61	00163
05	21	1	ASSESS PL I/F RQTS TO MMSE(2.4.6)	10	65		61	00164
05	22	1	DEFINE NEW MMSE RQT/CONCEP(2.4.7)	15		21	61	00165
05	23	1	ASSESS MMSE SCHED/FUNDING (2.4.8)	15		22	61	00166
05	24	1	IDENTIFY/ASS.MMSE OPTIONS (2.4.9)	15		22	61	00167
05	25	1	DEV/SUB MMSE RQMTS (2.4.10)	15		23 24	61	00168
05	26	1	ASSESS PL I/F RQTS TO MMSE(2.4.6)	10	195		61	00169
05	27	1	DEFINE NEW MMSE RQT/CONCEP(2.4.7)	15		26	61	00170
05	28	1	ASSESS MMSE SCHED/FUNDING (2.4.8)	15		27	61	00171
05	29	1	IDENTIFY/ASS.MMSE OPTIONS (2.4.9)	15		27	61	00172
05	30	1	DEV/SUB MMSE RQMTS (2.4.10)	15		28 29	61	00173
06	1	1	DEF.MISSION PL OPTIONS (2.5.1)	5			61	00174
06	2	1	ANAL.PL GROUP.MISSION RQTS(2.5.2)	5		1	61	00175
06	3	1	SCHED/AVAIL ASSESS. (2.5.3)	5		1	61	00176
06	4	1	CONFIG/PL GROUP.OPTIONS (2.5.4)	5		2	61	00177
06	5	1	DEF.PGM.SCHEDULE & ISSUES (2.5.5)	5		3	61	00178
06	6	1	PREP/SUB MISSION PL COMPLE(2.5.6)	5		4 5	61	00179
06	7	1	DEFINE MISSION PAYLOAD (2.5.7)	5		6	61	00180
06	8	1	ANALYZE MISSION OPERATIONS(2.5.8)	5		6	61	00181
06	9	1	DEF.PL PROJECTS COSTS/STAT(2.5.9)	5		6	61	00182
06	10	1	ASSESS PL COMPATIBILITY (2.5.10)	5		7	61	00183
06	11	1	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	5		7 8	61	00184
06	12	1	DEFINE MISSION W.B.S. (2.5.12)	5		9	61	00185
06	13	1	ANAL.GROUND OPS & SUPPORT(2.5.13)	5		10 11	61	00186
06	14	1	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)	5		11	61	00187
06	15	1	MISSIONS PROJ SCHED/OVERU(2.5.15)	5		11 12	61	00188
06	16	1	DEFINE GRD.OPS & SUPPORT (2.5.16)	5		13	61	00189
06	17	1	DEV. MISSION DEFINITION (2.5.17)	5		14	61	00190
06	18	1	DEF.MISSION UNIQUE HDW RQ(2.5.18)	5		13 14 15	61	00191
06	19	1	ASS.MISSION & RECOMMENDAT(2.5.19)	10		16 17	61	00192
06	20	1	DEF.INTEGRATION PLAN (2.5.20)	10		16 17 18	61	00193
06	21	1	DET.MISSION PROJ COST/FND(2.5.21)	10		18	61	00194
06	22	1	PREP/SUB MAD-VOL I (TECH)(2.5.22)	10		19	61	00195
06	23	1	PREP/SUB MAD-VOL II(PROJ)(2.5.23)	10		19 20 21	61	00196
06	24	1	DEF.MISSION PL OPTIONS (2.5.1)	5	65		61	00197
06	25	1	ANAL.PL GROUP.MISSION RQTS(2.5.2)	5		24	61	00198
06	26	1	SCHED/AVAIL ASSESS. (2.5.3)	5		24	61	00199
06	27	1	CONFIG/PL GROUP.OPTIONS (2.5.4)	5		25	61	00200
06	28	1	DEF.PGM.SCHEDULE & ISSUES (2.5.5)	5		26	61	00201
06	29	1	PREP/SUB MISSION PL COMPLE(2.5.6)	5		27 28	61	00202
06	30	1	DEFINE MISSION PAYLOAD (2.5.7)	5		29	61	00203
06	31	1	ANALYZE MISSION OPERATIONS(2.5.8)	5		29	61	00204
06	32	1	DEF.PL PROJECTS COSTS/STAT(2.5.9)	5		29	61	00205
06	33	1	ASSESS PL COMPATIBILITY (2.5.10)	5		30	61	00206
06	34	1	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	5		30 31	61	00207
06	35	1	DEFINE MISSION W.B.S. (2.5.12)	5		32	61	00208
06	36	1	ANAL.GROUND OPS & SUPPORT(2.5.13)	5		33 34	61	00209
06	37	1	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)	5		34	61	00210

Table A-1. Key Task Event Descriptions (Page 3 of 3)

MCDONNELL-DOUGLAS AUTOMATION COMPANY VER 8.0 09/09/76 19.55.21 PAGE 7
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				ΔT	START	PREDECESSOR TASKS		
06	38	1	MISSION PROJ SCHED/OVERVU(2.5.15)	5		34 35	61	00211
06	39	1	DEFINE GRD.OPS & SUPPORT (2.5.16)	5		36	61	00212
06	40	1	DEV. MISSION DEFINITIONS 2.5.17)	5		37	61	00213
06	41	1	DEF.MISSION UNIQUE HDW RQ 2.5.18)	5		36 37 38	61	00214
06	42	1	ASS.MISSION & RECOMMENDAT(2.5.19)	10		39 40	61	00215
06	43	1	DEF.INTEGRATION PLAN (2.5.20)	10		39 40 41	61	00216
06	44	1	DET.MISSION PROJ COST/FND(2.5.21)	10		41	61	00217
06	45	1	PREP/SUB MAD-VOL I (TECH)(2.5.22)	10		42	61	00218
06	46	1	PREP/SUB MAD-VOL II(PROJ)(2.5.23)	10		42 43 44	61	00219
07	1	3	SPRAG REVIEW INTG.PL I/F(REF.DEC)	10	55		61	00220
07	2	3	PROPOSE NEW PL STARTS (FEB) (3.1)	50	80		61	00221
07	3	3	POP-1 RESPONSE (PAYLOADS) (3.2)	35	80		61	00222
07	4	3	SPRAG REVIEW INTG.PL I/F(REF.MAR)	10	120		61	00223
07	5	3	SPRAG REVIEW MMSE RQMTS.(REF.MAR)	10	120		61	00224
07	6	3	PAYLOAD PROJECTS PLANNING (3.3)	70	135	2	61	00225
07	7	3	SPRAG REVIEW INT.PL.I/F(REF.JUNE)	10	185		61	00226
07	8	3	NEW STARTS COSTS/SCHEDULES (3.4)	10		5	61	00227
07	9	3	POP-2 RESPONSE (PAYLOADS) (3.5)	10		6	61	00228
07	10	3	ASSIGN MISSION MANAGER (3.6)	5	215		61	00229
07	11	3	PREPARE/SUBMIT PROJECT PLAN (3.7)	40		10	61	00230
07	12	3	SPRAG REVIEW INT.PL.I/F(REF.SEPT)	10	250		61	00231
07	13	3	SPRAG REVIEW MMSE RQMTS(REF.SEPT)	10	250		61	00232
08	1	4	PROVIDE TOTAL TRAF.MODEL-JAN(4.1)	20	50		61	00233
08	2	4	ASSESS PRELIM. FLT. SCHEDULE(4.2)	5	85		61	00234
08	3	4	PROPOSE NEW STS STARTS (4.3)	30	85		61	00235
08	4	4	POP-1 RESPONSE (STD) (4.4)	35	80	1	61	00236
08	5	4	NON-NASA PAYLOADS (4.5)	15	120		61	00237
08	6	4	STS OPERATIONS CAPABIL.PLNG.(4.6)	70	135	3	61	00238
08	7	4	UPDATE TOTAL TRAFFIC MODEL (4.7)	15		5	61	00239
08	8	4	PROVIDE TOTAL TRAF.MODEL-JUN(4.8)	20	175	7	61	00240
08	9	4	ASSESS PRELIM. FLT.SCHEDULE (4.9)	10		6	61	00241
08	10	4	POP-2 RESPONSE (STD) (4.10)	10		6 8	61	00242
08	11	4	UPDATE TOTAL TRAFFIC MODEL (4.11)	15	260		61	00243
09	1	1	DEF.MISSION PL OPTIONS (2.5.1)	5			61	00244
09	2	1	ANAL.PL GROUP.MISSION RQTS(2.5.2)	5		1	61	00245
09	3	1	SCHED/AVAIL ASSESS. (2.5.3)	5		1	61	00246
09	4	1	CONFIG/PL GROUP.OPTIONS (2.5.4)	5		2	61	00247
09	5	1	DEF.PGM.SCHEDULE & ISSUES (2.5.5)	5		3	61	00248
09	6	1	PREP/SUB MISSION PL COMPLE(2.5.6)	5		4 5	61	00249
09	7	1	DEFINE MISSION PAYLOAD (2.5.7)	5		6	61	00250
09	8	1	ANALYZE MISSION OPERATIONS(2.5.8)	5		6	61	00251
09	9	1	DEF.PL PROJECTS COSTS/STAT(2.5.9)	5		6	61	00252
09	10	1	ASSESS PL COMPATIBILITY (2.5.10)	5		7	61	00253
09	11	1	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	5		7 8	61	00254
09	12	1	DEFINE MISSION W.B.S. (2.5.12)	5		9	61	00255
09	13	1	ANAL.GROUND OPS & SUPPORT(2.5.13)	5		10 11	61	00256
09	14	1	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)	5		11	61	00257
09	15	1	MISSION PROJ SCHED/OVERVU(2.5.15)	5		11 12	61	00258
09	15	1	DEFINE GRD.OPS & SUPPORT (2.5.16)	5		13	61	00259
09	17	1	DEV. MISSION DEFINITION (2.5.17)	5		14	61	00260
09	18	1	DEF.MISSION UNIQUE HDW RQ(2.5.18)	5		13 14 15	61	00261
09	19	1	ASS.MISSION & RECOMMENDAT(2.5.19)	10		16 17	61	00262
09	20	1	DEF.INTEGRATION PLAN (2.5.20)	10		16 17 18	61	00263
09	21	1	DET.MISSION PROJ COST/FND(2.5.21)	10		18	61	00264
09	22	1	PREP/SUB MAD-VOL I (TECH)(2.5.22)	10		19	61	00265
09	23	1	PREP/SUB MAD-VOL II(PROJ)(2.5.23)	10		19 20 21	61	00266
09	24	1	DEF.MISSION PL OPTIONS (2.5.1)	5	65		61	00267
09	25	1	ANAL.PL GROUP.MISSION RQTS(2.5.2)	5		24	61	00268
09	26	1	SCHED/AVAIL ASSESS. (2.5.3)	5		24	61	00269
09	27	1	CONFIG/PL GROUP.OPTIONS (2.5.4)	5		25	61	00270
09	28	1	DEF.PGM.SCHEDULE & ISSUES (2-5.5)	5		26	61	00271
09	29	1	PREP/SUB MISSION PL COMPLE(2-5.6)	5		27 28	61	00272
09	30	1	DEFINE MISSION PAYLOAD (2.5.7)	5		29	61	00273
09	31	1	ANALYZE MISSION OPERATIONS(2.5.8)	5		29	61	00274
09	32	1	DEF.PL PROJECTS COSTS/STAT(2.5.9)	5		29	61	00275
09	33	1	ASSESS PL COMPATIBILITY (2.5.10)	5		30	61	00276
09	34	1	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	5		30 31	61	00277
09	35	1	DEFINE MISSION W.B.S. (2.5.12)	5		32	61	00278
09	36	1	ANNAL.GROUND OPS & SUPPORT2.5.13)	5		33 34	61	00279
09	37	1	DEF.SUBSYSTEM/SUPPORT EQPT2.5.14)	5		34	61	00280
09	38	1	MISSION PROJ SCHED/OVERVU(2.5.15)	5		34 35	61	00281
09	39	1	DEFINE GRD.OPS & SUPPORT (2.5.16)	5		36	61	00282
09	40	1	DEV. MISSION DEFINITION (2.5.17)	5		37	61	00283
09	41	1	DEF.MISSION UNIQUE HDW RQ(2.5.18)	5		36 37 38	61	00284
09	42	1	ASS.MISSION & RECOMMENDAT(2.5.19)	10		39 40	61	00285
09	43	1	DEF.INTEGRATION PLAN (2.5.20)	10		39 40 41	61	00286
09	44	1	DET.MISSION PROJ COST/FND(2.5.21)	10		41	61	00287
09	45	1	PREP/SUB MAD-VOL I (TECH)(2.5.22)	10		42	61	00288
09	46	1	PREP/SUB MAD-VOL II(PROJ)(2.5.23)	10		42 43 44	61	00289

***** ABOVE ACTION SATISFACTORILY COMPLETED *****

* GO * QUARTERLY REPORT

1977 · 1978 · 1979 · 1980 · 1981 — JAN APR JUL OCT (quarters)

TASK CODE		TASK
6	1	DEF.MISSION PL OPTIONS (2.5.1)
1	2	DEVELOP P/L PROSPECTUS-DISCP(1.2)
1	3	PROVIDE NASA REL.P/L BY USER(1.3)
6	2	ANAL.PL GROUP.MISSION RQTS(2.5.2)
6	3	SCHED/AVAIL ASSESS. (2.5.3)
1	1	COMPLETE OMB HEARINGS (1.1)
6	5	DEF.PGM.SCHEDULE & ISSUES (2.5.5)
6	4	CONFIG/PL GROUP.OPTIONS (2.5.4)
6	6	PREP/SUB MISSION PL CCMPLE(2.5.6)
5	1	COMPILE P/L INTERFACE RQTS(2.4.1)
6	9	DEF.PL PROJECTS COSTS/STAT(2.5.9)
6	7	DEFINE MISSION PAYLOAD (2.5.7)
6	8	ANALYZE MISSICN OPERATIONS(2.5.8)
1	4	COMPLETE OMB MARKUP (1.4)
1	5	PROVIDE P/L PLNG.WEDGES-NOV.(1.5)
6	10	ASSESS PL COMPATIBILITY (2.5.10)
6	11	ASS.RESOURCE RQMTS/ACCCMS(2.5.11)
6	12	DEFINE MISSION W.B.S. (2.5.12)
6	15	MISSION5 PROJ SCHED/OVERU(2.5.15)
6	13	ANAL.GROUND OPS & SUPPORT(2.5.13)
6	14	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)
5	2	INTEG.PL I/F RQTS/ACCOM (2.4.2)
2	1	COMPILE LONG LEAD SSPC (2.1.1)
6	16	DEFINE GRD.OPS & SUPPCRT (2.5.16)
6	17	DEV. MISSION DEFINITION (2.5.17)
6	18	DEF.MISSION UNIQUE HDW RQ(2.5.18)
1	6	DEVELOP P/L MODEL BY P/L AA (1.6)
6	20	DEF.INTEGRATICN PLAN (2.5.20)
6	21	DET.MISSION PROJ COST/FND(2.5.21)
2	3	IDENTIFY NEW/MODIFIED P/L (2.1.3)
2	2	UPDATE NASA P/L MODEL (2.1.2)
6	19	ASS.MISSION & RECOMMENDAT(2.5.19)
2	5	SYNTHESIZE SSPD DATA (2.1.5)
1	7	FINALIZE NASA/OMB BUDGET (1.7)
5	3	PREP/SUB INTEG.PL I/F RQTS(2.4.3)
2	4	SUMMARIZE P/L TRAFFIC (2.1.4)
6	22	PREP/SUB MAD-VOL I (TECH)(2.5.22)
6	23	PREP/SUB MAD-VOL II(PRCJ)(2.5.23)
2	6	UPDATE PPDB P/L STATUS (2.1.6)
2	7	PREP/SUBMIT JAN.PL MODEL (2.1.7)
2	8	COMPLETE SSPD LEVEL A REVS(2.1.8)
7	1	SPRAG REVIEW INTG.PL I/F(REF.DEC)
4	1	LONG-LEAD ANAL.MAR PLN B/L(2.3.1)
2	10	LOAD SSPD LEVEL A DATA (2.1.10)
5	4	COORD. REV. INTFG.PL I/F (2.4.4)
6	24	DEF.MISSION PL OPTIONS (2.5.1)
8	1	PROVIDE TOTAL TRAF.MODEL-JAN(4.1)
1	8	PROGRAM DATA AND GUIDELINES (1.8)
1	9	REVIEW & APR.JAN.NASA PL MOD(1.9)
2	9	REVISE NASA PL MODEL (2.1.9)
5	21	ASSESS PL I/F RQTS TO MMSE(2.4.6)

TASK TYPE	SYMBOL	DESCRIPTION
1	X	PAYLOAD PLANNING
2	⊗	NASA HDQTRS
3	+	PL CENTERS
4	Δ	STS OPS

TASK NUMBER IN ORGANIZATIONAL ELEMENT

ORGANIZATIONAL ELEMENT NUMBER (6 = MISSION APPROVAL DOCUMENT, ETC.)

Figure A-1. GO Quarterly Report (Sheet 1 of 6)

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* GO * QUARTERLY REPORT

TASK CODE		TASK	1977 JAN	1978 JAN	1979 JAN	1980 JAN	1981 JAN
5	5	ISSUE VALIDATED PL I/F RQT(2.4.5)	.	.X	.	.	.
6	25	ANAL.PL GROUP.MISSION RQTS(2.5.2)	.	.X	.	.	.
6	26	SCHED/AVAIL ASSESS. (2.5.3)	.	.X	.	.	.
4	4	ANAL.TOT.STS TRAFFIC/RESOR(2.3.4)	.	.X	.	.	.
6	27	CONFIG/PL GROUP.OPTIONS (2.5.4)	.	.X	.	.	.
6	28	DEF.PGM.SCHEDULE & ISSUES (2.5.5)	.	.X	.	.	.
1	10	POP-1 CALL & GUIDELINES (1.10)	.	.@	.	.	.
2	11	ISSUE JAN NASA PL MODEL (2.1.11)	.	.X	.	.	.
2	12	COMPLETE SSPD LEVEL B REV(2.1.12)	.	.X	.	.	.
2	13	STORE & C/O PL DATA (2.1.13)	.	.X	.	.	.
4	2	SYN.MISSION P/L GROUPINGS (2.3.2)	.	.X	.	.	.
4	3	DEF.PL PROJECTS & COSTS (2.3.3)	.	.X	.	.	.
1	11	AA CALLS FOR NEW STARTS (1.11)	.	.@	.	.	.
4	6	ANAL.MISSION & OPERATIONS (2.3.6)	.	.X	.	.	.
4	7	DEF.PRELIM.FLT.SCHEDULES (2.3.7)	.	.X	.	.	.
5	6	COMPILE P/L INTERFACE RQTS(2.4.1)	.	.X	.	.	.
6	29	PREP/SUB MISSION PL COMPLE(2.5.6)	.	.X	.	.	.
4	5	DEF.MISSION P/L GROUPINGS (2.3.5)	.	.X	.	.	.
2	15	COMPLETE JAN PPDB UPDATE (2.1.15)	.	.XX	.	.	.
5	22	DEFINE NEW MMSF RQT/CONCEP(2.4.7)	.	.XX	.	.	.
6	31	ANALYZE MISSION OPERATIONS(2.5.8)	.	.XX	.	.	.
6	32	DEF.PL PROJECTS COSTS/STAT(2.5.9)	.	.XX	.	.	.
4	8	ASSESS PL COMPATIBILITY (2.3.8)	.	.XX	.	.	.
4	9	DETERMINE ACCOM. RQMTS (2.3.9)	.	.XX	.	.	.
4	10	DEF.GRD.OPS & SUPPORT (2.3.10)	.	.XX	.	.	.
4	11	INTEG.PL PROJECTS/SCHEDUL(2.3.11)	.	.XX	.	.	.
8	2	ASSESS PRELIM. FLT. SCHEDULE(4.2)	.	.AA	.	.	.
2	14	ISSUE JAN SSPD (A&B) (2.1.14)	.	.XX	.	.	.
6	30	DEFINE MISSION PAYLOAD (2.5.7)	.	.XX	.	.	.
6	33	ASSESS PL COMPATIBILITY (2.5.10)	.	. X	.	.	.
6	34	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	.	. X	.	.	.
6	35	DEFINE MISSION W.B.S. (2.5.12)	.	. X	.	.	.
6	36	ANAL.GROUND OPS & SUPPORT(2.5.13)	.	. X	.	.	.
6	37	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)	.	. X	.	.	.
6	38	MISSION PROJ SCHED/OVERVU(2.5.15)	.	. X	.	.	.
4	12	DEF.CARGO MANIFESTS (2.3.12)	.	. X	.	.	.
4	13	DEF.SYSTEM/SUBSYS. RQMTS (2.3.13)	.	. X	.	.	.
4	14	DEF.MISSION PROJ.SCH/COST(2.3.14)	.	. X	.	.	.
4	15	DEF.NASA MISSION PLAN/SUM(2.3.15)	.	. X	.	.	.
5	7	INTEG.PL I/F RQTS/ACCOM (2.4.2)	.	.XX	.	.	.
6	40	DEV. MISSION DEFINITIONS 2.5.17)	.	. X	.	.	.
6	41	DEF.MISSION UNIQUE HDW RQ 2.5.18)	.	. X	.	.	.
5	23	ASSESS MMSE SCHED/FUNDING (2.4.8)	.	. X	.	.	.
5	24	IDENTIFY/ASS.MMSE OPTIONS (2.4.9)	.	. X	.	.	.
6	39	DEFINE GRD.OPS & SUPPORT (2.5.16)	.	. X	.	.	.
4	18	DEF.STS RQMTS & UTILIZATI(2.3.18)	.	. XX	.	.	.
4	19	DEF.MISSIONS/PL PROJ.FUND(2.3.19)	.	. XX	.	.	.
3	1	FAR TERM S/L P/L GROUPINGS(2.2.1)	.	. XX	.	.	.
4	16	PREP.MISSION & PL INDEX (2.3.16)	.	. XX	.	.	.
4	17	COMPILE MISSION DESCRIPTS(2.3.17)	.	. XX	.	.	.
7	3	POP-1 RESPONSE (PAYLOADS) (3.2)	.	.+++	.	.	.

Figure A-1. GO Quarterly Report (Sheet 2 of 6)

* GO * QUARTERLY REPORT

TASK CODE	
8 4	POP-1 RESPONSE (STD) (4.4)
4 20	DEF.COMMON PL SUPPORT RQT(2.3.20)
4 21	COMPARE FUNDING/BUDGET GL(2.3.21)
6 42	ASS.MISSION & RECOMMENDAT(2.5.19)
6 43	DEF.INTEGRATION PLAN (2.5.20)
6 44	DET.MISSION PROJ COST/FND(2.5.21)
8 3	PROPOSE NEW STS STARTS (4.3)
5 8	PREP/SUB INTEG.PL I/F RQTS(2.4.3)
5 25	DEV/SUB MMSE RQMTS (2.4.10)
4 23	PREP/SUB.VOL I PLNG B/L (2.3.23)
1 12	REV/ANALYSE POP-1 RESPONSE (1.12)
4 22	PREP/SUB.VOL II PLNG B/L (2.3.22)
6 46	PREP/SUB MAD-VOL II(PRCJ)(2.5.23)
1 13	REV/APPROVE MAR.-PLNG. B/L (1.13)
1 14	SPECIFIC MISSION OBJ.& GUID(1.14)
6 45	PREP/SUB MAD-VOL I (TECH)(2.5.22)
9 1	DEF.MISSION PL OPTIONS (2.5.1)
4 24	REVISE PLNG BASELINE (2.3.24)
7 4	SPRAG REVIEW INTG.PL I/F(REF.MAR)
7 5	SPRAG REVIEW MMSE RQMTS.(REF.MAR)
3 2	ASSESS SPACELAB ACCOM.RQMT(2.2.2)
7 2	PROPOSE NEW PL STARTS (FEB) (3.1)
1 15	PREPARE BUDGET REVIEW (1.15)
8 5	NON-NASA PAYLCADS (4.5)
9 2	ANAL.PL GROUP.MISSION RQTS(2.5.2)
9 3	SCHED/AVAIL ASSESS. (2.5.3)
4 25	ISSUE MARCH PLNG.BASELINE(2.3.25)
3 3	CAPTURE ANALYSIS-NASA/REL.(2.2.3)
1 16	UPDATE P/L PRCSPECTUS-DISCP(1.16)
1 17	PROVIDE NASA REL.PL BY USER(1.17)
5 9	COORD. REV. INTEG.PL I/F (2.4.4)
1 18	OMB BUDGET REVIEW (1.18)
9 4	CONFIG/PL GROUP.OPTIONS (2.5.4)
9 5	DEF.PGM.SCHEDULE & ISSUES (2.5.5)
5 10	ISSUE VALIDATED PL I/F RQT(2.4.5)
3 4	SYN. MISSION MODEL PROGRAM(2.2.4)
9 6	PREP/SUB MISSION PL COMPLE(2.5.6)
3 5	ASSESS CAPTURE ACCOM.REQTS(2.2.5)
8 7	UPDATE TOTAL TRAFFIC MODEL (4.7)
5 11	COMPILE P/L INTERFACE RQTS(2.4.1)
9 7	DEFINE MISSION PAYLOAD (2.5.7)
9 8	ANALYZE MISSICN OPERATIONS(2.5.8)
9 9	DEF.PL PROJECTS COSTS/STAT(2.5.9)
3 6	DEFINE CARGO MANIFESTS (2.2.6)
3 7	ASSESS NASA MISSIONS COSTS(2.2.7)
3 8	PREP.MISSION & PL INDEX (2.2.8)
3 9	DEFINE MISSIONS PLAN/SUMRY(2.2.9)
1 19	PROVIDE P/L PLNG.WEDGES-MAY(1.19)
9 10	ASSESS PL COMPATIBILITY (2.5.10)
9 11	ASS.RESOURCE RQMTS/ACCCMS(2.5.11)
9 12	DEFINE MISSION W.B.S. (2.5.12)

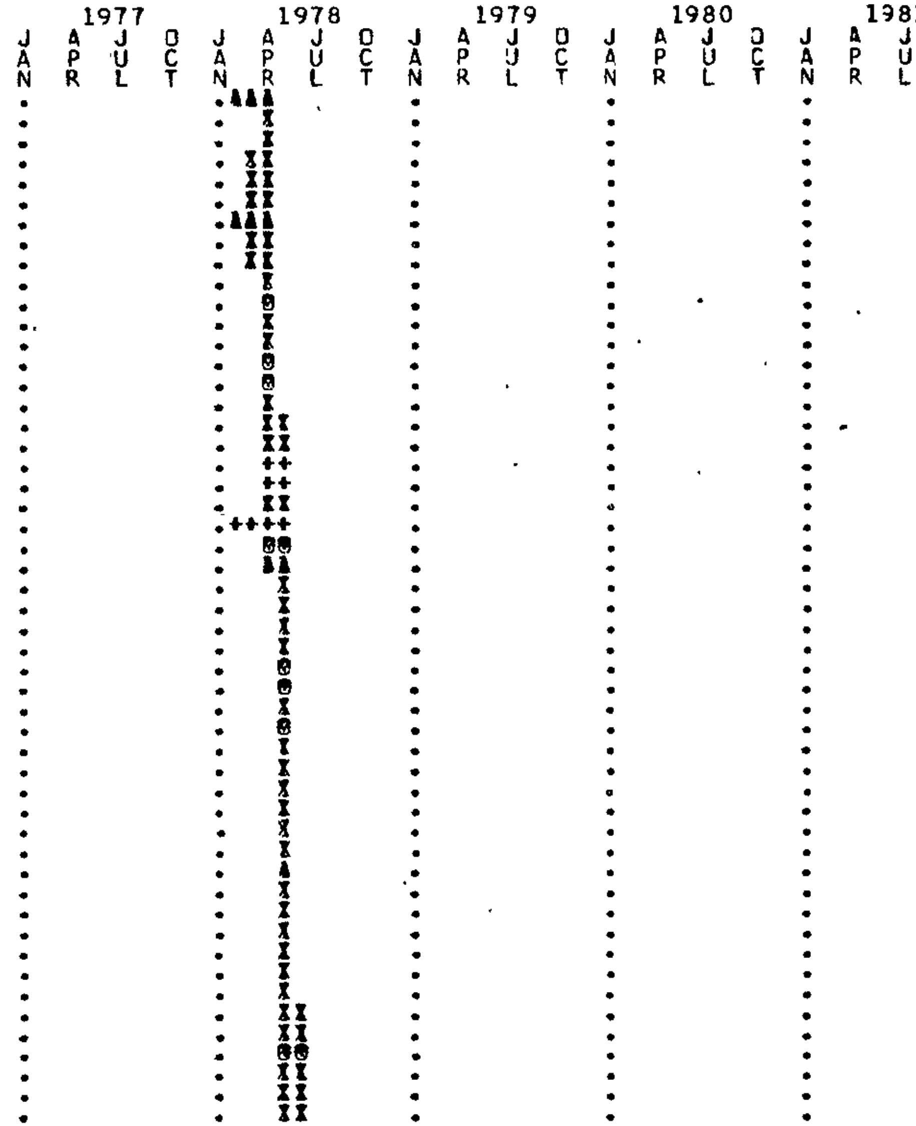

Figure A-1. GO Quarterly Report (Sheet 3 of 6)

* GO * QUARTERLY REPORT

1977 — 1978 — 1979 — 1980 — 1981 (quarters: JAN, APR, JUL, OCT)

TASK CODE		SCHEDULE (1978 APR–JUL)
3 10	DEF.MISSION MODEL FUNDING(2.2.10)	X
9 14	DEF.SUBSYSTEM/SUPPORT EQP(2.5.14)	X
9 15	MISSION PROJ SCHED/OVERVU(2.5.15)	X
3 11	DEF.STS UTILIZATION (2.2.11)	X
1 22	REV/SELECT MISSION PL CPTIO(1.22)	@
1 20	BUDGET FIRST RESOLUTICN (1.20)	@
9 13	ANAL.GROUND OPS & SUPPORT(2.5.13)	X
1 21	UPDATE PL MODEL BY PL AA (1.21)	@
2 16	UPDATE LONG LEAD SSPD (2.1.16)	XX
9 16	DEFINE GRD.OPS & SUPPORT (2.5.16)	X
9 17	DEV. MISSION DEFINITICN (2.5.17)	X
9 18	DEF.MISSION UNIQUE HDW RQ(2.5.18)	X
5 12	INTEG.PL I/F RQTS/ACCCM (2.4.2)	XX
1 23	PROGRAM CATA & POP-2/GUIDEL(1.23)	@
1 24	REV/APPROVE MISSION MOCEL (1.24)	@
2 18	IDENTIFY NEW/MODIFIED P/L(2.1.18)	X
2 17	UPDATE NASA P/L MODEL (2.1.17)	X
3 12	PREP/SUBMIT MISSION MODEL(2.2.12)	X
9 19	ASS.MISSION & RECOMMENDAT(2.5.19)	XX
9 20	DEF.INTEGRATICN PLAN (2.5.20)	XX
9 21	DET.MISSION PROJ COST/FND(2.5.21)	XX
3 13	REVISE MISSICN MODEL (2.2.13)	XX
2 19	SUMMARIZE P/L TRAFFIC (2.1.19)	XX
2 20	UPDATE SSPD DATA (2.1.20)	XX
5 13	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	XX
2 22	PREP/SUBMIT JUNE PL MCDEL(2.1.22)	X
2 23	COMPLETE SSPD LV.A UPCATE(2.1.23)	X
9 22	PREP/SUB MAD-VCL I (TECH)(2.5.22)	X
9 23	PREP/SUB MAD-VOL II(PROJ)(2.5.23)	X
2 21	UPDATE PPDB P/L STATUS (2.1.21)	XX
3 14	ISSUE MISSION MODEL (2.2.14)	X
4 26	LONG-LEAD ANAL.SEPT. B/L(2.3.26)	XX
2 24	REVISE NASA PL MODEL (2.1.24)	X
2 25	LOAD SSPD LEVEL A DATA (2.1.25)	X
1 25	REV/APPR.JUNE NASA PL MODEL(1.25)	@
8 8	PROVIDE TOTAL TRAF.MOCEL-JUN(4.8)	AA
9 24	DEF.MISSION PL OPTIONS (2.5.1)	XX
7 7	SPRAG REVIEW INT.PL.I/F(REF.JUNE)	++
4 29	ANAL.TOT.STS TRAFFIC/RESR(2.3.29)	XX
2 27	COMPLETE SSPD-B UPDATE (2.1.27)	XX
9 25	ANAL.PL GROUP.MISSION RQTS(2.5.2)	X
9 26	SCHED/AVAIL ASSESS. (2.5.3)	X
5 14	COORD. REV. INTEG.PL I/F (2.4.4)	X
2 26	ISSUE JUNE NASA PL MODEL (2.1.26)	XX
2 28	STORE & C/O P/L DATA (2.1.28)	XX
4 27	SYN.MISSION PL GROUPINGS (2.3.27)	XX
4 28	DEF.PL PROJECTS & COSTS (2.3.28)	XX
8 6	STS OPERATIONS CAPABIL.PLNG.(4.6)	AAAA
4 31	ANAL.MISSION & OPERATIONS(2.3.31)	X
4 32	DEF.PRELIM.FLT.SCHEDULES (2.3.32)	X
5 26	ASSESS PL I/F RQTS TO MMSF(2.4.6)	X

Figure A-1. GO Quarterly Report (Sheet 4 of 6)

* GO * QUARTERLY REPORT

Schedule columns: 1977 (JAN, APR, JUL, OCT), 1978 (JAN, APR, JUL, OCT), 1979 (JAN, APR, JUL, OCT), 1980 (JAN, APR, JUL, OCT), 1981 (JAN, APR, JUL)

TASK CODE		Task	Schedule (1978, APR–JUL)
7	6	PAYLOAD PROJECTS PLANNING (3.3)	++++
1	26	REV/APPROVE MISSION (1.26)	@
9	27	CONFIG/PL GROUP.OPTIONS (2.5.4)	X
9	28	DEF.PGM.SCHEDULE & ISSUES (2-5.5)	X
5	15	ISSUE VALIDATED PL I/F RQT(2.4.5)	X
4	30	DEF.MISSION P/L GROUPINGS(2.3.30)	X
2	29	ISSUE JUNE SSPD A&B UPDAT(2.1.29)	X
2	30	COMPLETE JUNE PPDB UPDATE(2.1.30)	X
1	27	ASSIGN P/L AA & PGM. MGR. (1.27)	@
9	29	PREP/SUB MISSION PL COMPLE(2-5.6)	X
4	33	ASSESS PL COMPATIBILITY (2.3.33)	X
4	34	DETERMINE ACCOM. RQMTS (2.3.34)	X
4	35	DEF.GRD.OPS & SUPPORT (2.3.35)	X
4	36	INTEG.PL PROJECTS/SCHED. (2.3.36)	X
8	10	POP-2 RESPONSE (STD) (4.10)	AA
5	16	COMPILE P/L INTERFACE RQTS(2.4.1)	XX
1	28	P/L PROJECTS & FUNDING (1.28)	@@
9	30	DEFINE MISSION PAYLOAD (2.5.7)	XX
9	31	ANALYZE MISSION OPERATIONS(2.5.8)	XX
9	32	DEF.PL PROJECTS COSTS/STAT(2.5.9)	XX
7	8	NEW STARTS COSTS/SCHEDULES (3.4)	++
7	9	POP-2 RESPONSE (PAYLOADS) (3.5)	++
8	9	ASSESS PRELIM. FLT.SCHEDULE (4.9)	AA
5	27	DEFINE NEW MMSE RQT/CONCEP(2.4.7)	XX
9	33	ASSESS PL COMPATIBILITY (2.5.10)	X
9	34	ASS.RESOURCE RQMTS/ACCOMS(2.5.11)	X
9	35	DEFINE MISSION W.B.S. (2.5.12)	X
7	10	ASSIGN MISSION MANAGER (3.6)	+
4	37	DEF.CARGO MANIFESTS (2.3.37)	XX
4	38	DEF.SYSTEM/SUBSYS. RQMTS (2.3.38)	XX
4	39	DEF.MISSION PROJ.SCH/COST(2.3.39)	XX
4	40	DEF.NASA MISSION PLAN/SUM(2.3.40)	XX
9	36	ANNAL.GROUND OPS & SUPPORT2.5.13)	X
9	37	DEF.SUBSYSTEM/SUPPORT EQPT2.5.14)	X
9	38	MISSION PROJ SCHED/OVERVU(2.5.15)	X
1	29	OSF PROJECTS & FUNDING (1.29)	@
9	39	DEFINE GRD.OPS & SUPPORT (2.5.16)	X
9	40	DEV. MISSION DEFINITION (2.5.17)	X
9	41	DEF.MISSION UNIQUE HDW RQ(2.5.18)	X
4	41	PREP.MISSION & PL INDEX (2.3.41)	X
4	42	COMPILE MISSION DESCRIPTS(2.3.42)	X
4	43	DEF.STS RQMTS & UTILIZATI(2.3.43)	X
4	44	DEF.MISSIONS/PL PROJ.FUND(2.3.44)	X
1	30	REV/APPR. SPLIT P/L MISSION(1.30)	@
1	31	P/L OFFICES BUDGET TO COMPT(1.31)	@
5	28	ASSESS MMSE SCHED/FUNDING (2.4.8)	X
5	29	IDENTIFY/ASS.MMSE OPTIONS (2.4.9)	X
5	17	INTEG.PL I/F RQTS/ACCOM (2.4.2)	X
4	45	DEF.COMMON PL SUPPORT RQT(2.3.45)	X
4	46	COMPARE FUNDING/BUDGET GL(2.3.46)	X
1	32	OSF BUDGET TO COMPTROLLER (1.32)	@

Figure A-1. GO Quarterly Report (Sheet 5 of 6)

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* GO * QUARTERLY REPORT

TASK CODE		1977 JAN	APR	JUL	OCT	1978 JAN	APR	JUL	OCT	1979 JAN	APR	JUL	OCT	1980 JAN	APR	JUL	OCT	1981 JAN	APR	JUL
9 44	DET.MISSION PROJ COST/FND(2.5.21)	.				.			XX	.				.				.		
4 48	PREP/SUB.VOL I PLNG B/L (2.3.48)	.				.			XX	.				.				.		
4 47	PREP/SUB.VOL II PLNG B/L (2.3.47)	.				.			XX	.				.				.		
9 42	ASS.MISSION & RECOMMENDAT(2.5.19)	.				.			XX	.				.				.		
9 43	DEF.INTEGRATICN PLAN (2.5.20)	.				.			XX	.				.				.		
4 49	REVISE PLNG BASELINE (2.3.49)	.				.			X	.				.				.		
9 45	PREP/SUB MAD-VOL I (TECH)(2.5.22)	.				.			X	.				.				.		
9 46	PREP/SUB MAD-VOL II(PRCJ)(2.5.23)	.				.			X	.				.				.		
5 18	PREP/SUB INTEG.PL I/F RQTS(2.4.3)	.				.			XX	.				.				.		
5 30	DEV/SUB MMSE RQMTS (2.4.10)	.				.			XX	.				.				.		
1 33	BUDGET FORMULATION & ISSUES(1.33)	.				.			00	.				.				.		
1 34	REV.SEPT.PLNG.B/L -APPROVAL(1.34)	.				.			00	.				.				.		
1 35	NASA MGT. PROGRAM DECISIONS(1.35)	.				.			0	.				.				.		
7 12	SPRAG REVIEW INT.PL.I/F(REF.SEPT)	.				.			++	.				.				.		
7 13	SPRAG REVIEW MMSF RQMTS(REF.SEPT)	.				.			++	.				.				.		
7 11	PREPARE/SUBMIT PROJECT PLAN (3.7)	.				.			+++	.				.				.		
1 36	FINALIZE BUDGET SUBMITTAL (1.36)	.				.			00	.				.				.		
4 50	REVISE PLNG B/L (FINAL) (2.3.50)	.				.			XX	.				.				.		
4 51	ISSUE SEPT.PLNG BASELINE (2.3.51)	.				.			X	.				.				.		
5 19	COORD. REV. INTEG.PL I/F (2.4.4)	.				.			X	.				.				.		
5 20	ISSUE VALIDATED PL I/F RQT(2.4.5)	.				.			X	.				.				.		
8 11	UPDATE TOTAL TRAFFIC MODEL (4.11)	.				.			A	.				.				.		

re A-1. GO Quarterly Report (Sheet 6 of 6)

FIGURE A-2

PLANNING PROCESS WEEKLY REPORT (SHEET 1 OF 4)

SIMULATION REPORT

OCT JAN APR JULY OCT | WEEKS 1-100 | PAGE 1

FACILITY	TASK	ACTIVITY	GROUP
1	1	COMPLETE OMB HEARINGS (1.1)	NASA HDQ
	2	DEVELOP P/L PROSPECTUS-DISCP(1.2)	
	3	PROVIDE NASA REL.P/L BY USER(1.3)	
	4	COMPLETE OMB MARKUP (1.4)	
	5	PROVIDE P/L PLNG.WEDGES-NOV.(1.5)	
	6	DEVELOP P/L MODEL BY P/L AA (1.6)	
	7	FINALIZE NASA/OMB BUDGET (1.7)	
	8	PROGRAM DATA AND GUIDELINES (1.8)	
	9	REVIEW & APR.JAN.NASA PL MOD(1.9)	
	10	POP-1 CALL & GUIDELINES (1.10)	
	11	AA CALLS FOR NEW STARTS (1.11)	
	12	REV/ANALYSE POP-1 RESPONSE (1.12)	
	13	REV/APPROVE MAR. PLNG. B/L (1.13)	
	14	SPECIFIC MISSION OBJ.& GUID(1.14)	
	15	PREPARE BUDGET REVIEW (1.15)	
	16	UPDATE P/L PROSPECTUS-DISCP(1.16)	
	17	PROVIDE NASA REL.PL BY USER(1.17)	
	18	OMB BUDGET REVIEW (1.18)	
	19	PROVIDE P/L PLNG.WEDGES-MAY(1.19)	
	20	BUDGET FIRST RESOLUTION (1.20)	
	21	UPDATE PL MODEL BY PL AA (1.21)	
	22	REV/SELECT MISSION PL OPTIO(1.22)	
	23	PROGRAM DATA & POP-2/GUIDEL(1.23)	
	24	REV/APPROVE MISSION MODEL (1.24)	
	25	REV/APPR.JUNE NASA PL MODEL(1.25)	
	26	REV/APPROVE MISSION (1.26)	
	27	ASSIGN P/L AA & PGM. MGR. (1.27)	
	28	P/L PROJECTS & FUNDING (1.28)	
	29	OSF PROJECTS & FUNDING (1.29)	
	30	REV/APPR. SPLIT P/L MISSION(1.30)	
	31	P/L OFFICES BUDGET TO COMPT(1.31)	
	32	OSF BUDGET TO COMPTROLLER (1.32)	
	33	BUDGET FORMULATION & ISSUES(1.33)	
	34	REV.SEPT.PLNG.B/L -APPROVAL(1.34)	
	35	NASA MGT. PROGRAM DECISIONS(1.35)	
	36	FINALIZE BUDGET SUBMITTAL (1.36)	
…	…	…	…
2	1	COMPILE LONG LEAD SSPD (2.1.1)	PAYLOAD MODEL
	2	UPDATE NASA P/L MODEL (2.1.2)	
	3	IDENTIFY NEW/MODIFIED P/L (2.1.3)	
	4	SUMMARIZE P/L TRAFFIC (2.1.4)	
	5	SYNTHESIZE SSPD DATA (2.1.5)	
	6	UPDATE PPDB P/L STATUS (2.1.6)	
	7	PREP/SUBMIT JAN.PL MODEL (2.1.7)	
	8	COMPLETE SSPD LEVEL A REVS(2.1.8)	
	9	REVISE NASA PL MODEL (2.1.9)	
	10	LOAD SSPD LEVEL A DATA (2.1.10)	
	11	ISSUE JAN NASA PL MODEL (2.1.11)	
	12	COMPLETE SSPD LEVEL B REV(2.1.12)	
	13	STORE & C/O PL DATA (2.1.13)	
	14	ISSUE JAN SSPD (A&B) (2.1.14) ← JAN PL MODEL	
	15	COMPLETE JAN PPDB UPDATE (2.1.15)	
	16	UPDATE LONG LEAD SSPD (2.1.16)	
	17	UPDATE NASA P/L MODEL (2.1.17)	
	18	IDENTIFY NEW/MODIFIED P/L(2.1.18)	
	19	SUMMARIZE P/L TRAFFIC (2.1.19)	
	20	UPDATE SSPD DATA (2.1.20)	
	21	UPDATE PPDB P/L STATUS (2.1.21)	
	22	PREP/SUBMIT JUNE PL MODEL(2.1.22)	
	23	COMPLETE SSPD LV.A UPDATE(2.1.23)	
	24	REVISE NASA PL MODEL (2.1.24)	
	25	LOAD SSPD LEVEL A DATA (2.1.25)	
	26	ISSUE JUNE NASA PL MODEL (2.1.26)	
	27	COMPLETE SSPD-B UPDATE (2.1.27)	
	28	STORE & C/O P/L DATA (2.1.28)	
	29	ISSUE JUNE SSPD A&B UPDAT(2.1.29) ← JUNE PL MODEL	
	30	COMPLETE JUNE PPDB UPDATE(2.1.30)	

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FIGURE A-2

PLANNING PROCESS WEEKLY REPORT (SHEET 2 OF 4)

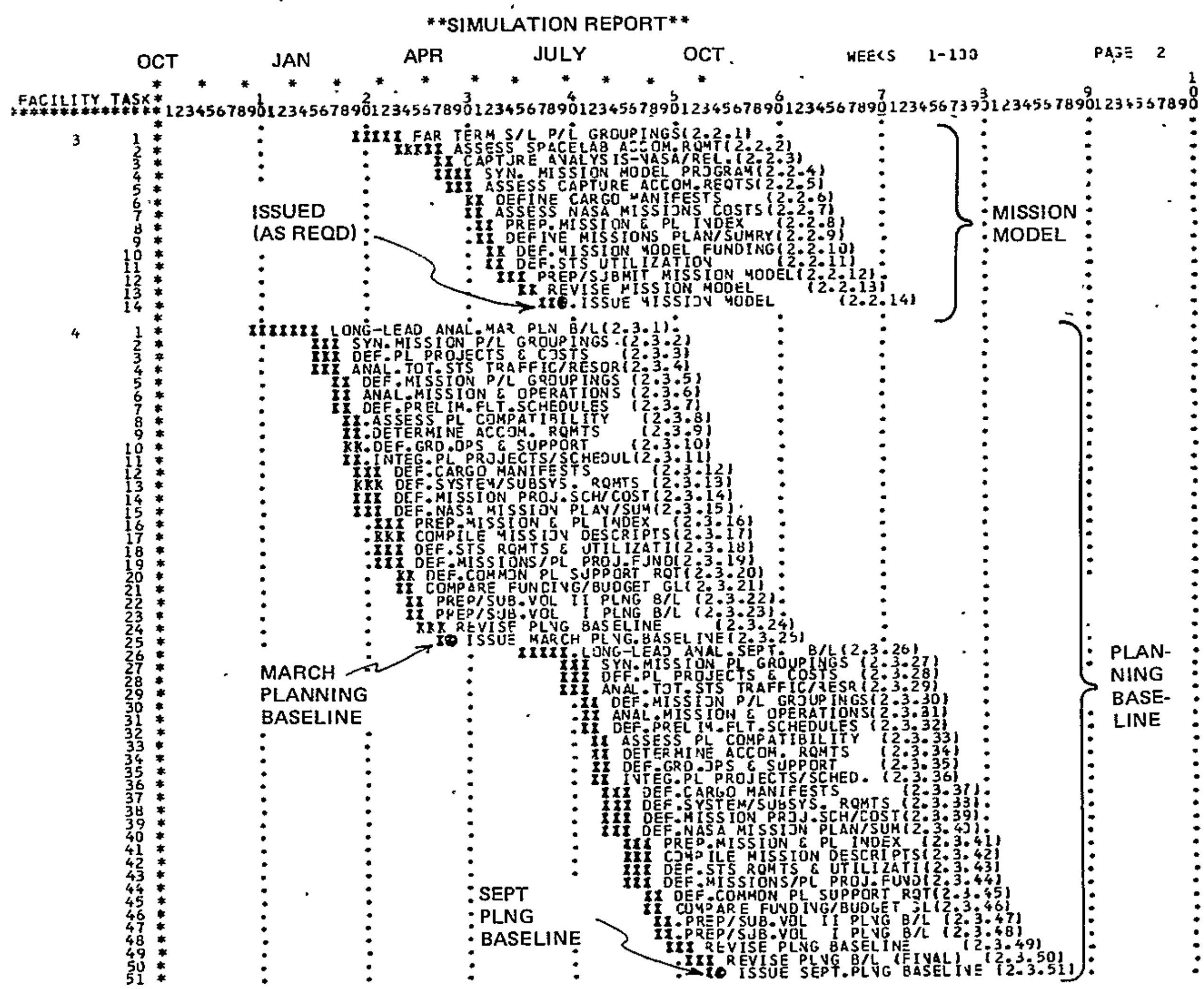


FIGURE A-2

PLANNING PROCESS WEEKLY REPORT (SHEET 3 OF 4)

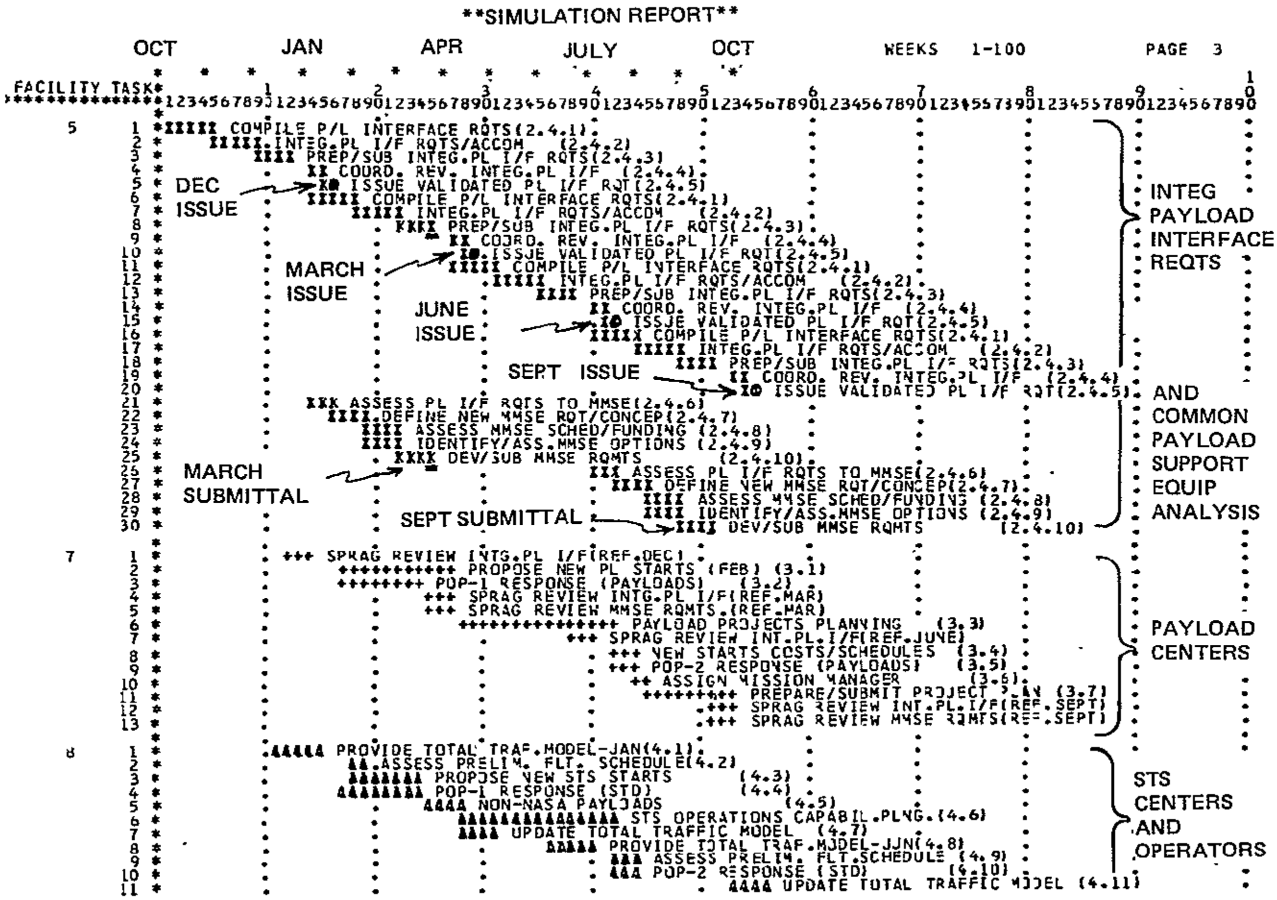
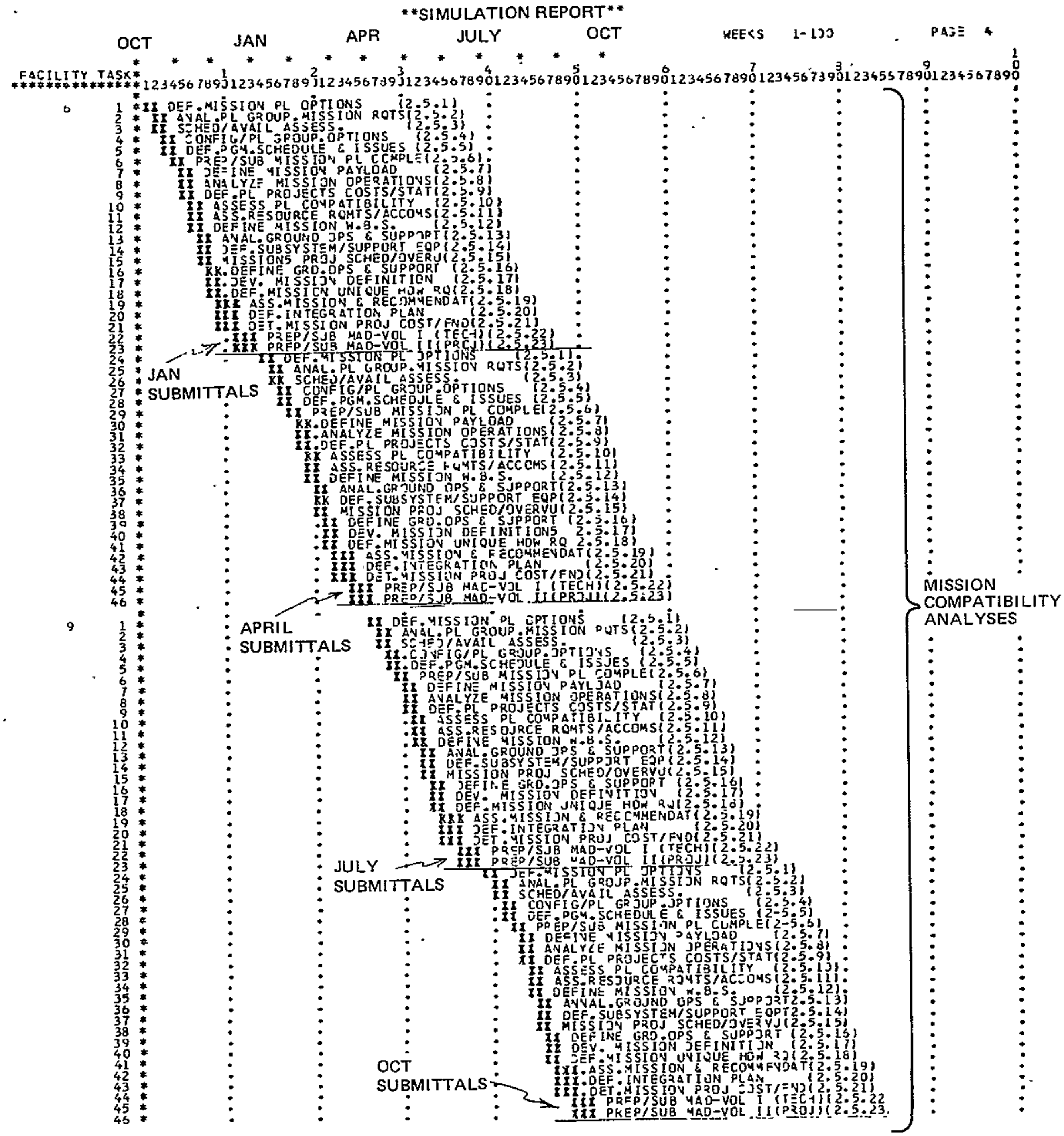


FIGURE A-2

PLANNING PROCESS WEEKLY REPORT (SHEET 4 OF 4)



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Appendix B

STS PAYLOAD DATA SUGGESTED LOAD SHEETS

The mission descriptions in the Planning Baseline mockup were reviewed in the context of the payload data input required to produce them and to arrive at a preliminary assessment of mission and payload compatibility. This payload data level assessment was compared to the level indicated in the prior issues of SSPD Level "A" sheets (sortie). A revised SSPD Level "A" load sheet (sortie) was developed which would be adequate for development of the mission descriptions in the Planning Baseline. Despite efforts to reduce the data level required, the new data sheets (presented here) are as extensive, and in some areas, request additional information. Specifically, this includes provision for multiple (series) mission at differing orbital parameters/ targets, payload status and principal contact, increased major instrument descriptions (envelope, mounting area/location), and identification of mission (payload) support equipment required. Some of this data may not be available at initial payload formulation, however, any attempt to integrate the payload into a mission description will tend to identify or require the synthesis of this information. Such data should be so noted ("assumed" or "analysis derived," etc.) and/or approved by the relevant payload principal investigator/sponsor/ discipline working group prior to documenting (SSPD book) and insertion into the PPDB. In many cases it may be easier to have such data approved for planning purposes post facto rather than require its initial generation by the payload sponsor (i.e., have him approve or modify the completed SSPD rather than "fill in the blanks").

An additional useful input would be conceptual sketches of the payload installation as envisioned by the payload sponsor/investigator. Although these may initially conflict with installation constraints and multipayload requirements, they would nevertheless be useful in understanding the payload installation requirements.

SUGGESTED LEVEL A SSPD INPUT SHEETS

SORTIE PAYLOAD PLANNING INPUT DATA
SHEET 1

PAYLOAD NO.__________
PREP. DATE __________
REVISION DATE__________

1.0 PAYLOAD NAME__________

2.0 DEVELOPMENT AGENCY/OFFICE__________

3.0 PRINCIPAL CONTACT (ADDRESS/PHONE)__________

4.0 PAYLOAD/EXPERIMENT PURPOSE: __________

5.0 PAYLOAD STATUS__________
- .1._____PLAN ONLY
- .2._____PROPOSED/SUBMITTED TO__________
- .3.____APPROVED BY__________
- .4.____FUNDED BY__________

6.0 DISCIPLINE
- .1._____ ASTRONOMY
- 2._____HIGH ENERGY PHYSICS
- .3._____SOLAR PHYSICS
- .4._____ ATMOSPHERICS & SPACE PHYSICS
- .5._____EARTH OBSERVATIONS
- .6._____EARTH/OCEAN PHYSICS
- .7.____SPACE PROCESSING
- .8.____LIFE SCIENCES
- .9.____SPACE TECHNOLOGY
- .10.___COMM/NAV
- .11.___OTHER (SPECIFY)__________

7.0 PAYLOAD TYPE/MODE (CHECK EACH AS APPROPRIATE)

7.1 CARRIER
- .1._____ MODULE (PRESSURIZED)
- .2. _____ PALLET
- .3. _____ CARRY-ON
- .4. _____ OTHER (SPECIFY)__________

7 2 OPERATIONS MODE
- .1.____ONBOARD CONTROL
- .2.____GROUND CONTROL
- .3.____MAN-IN-LOOP
- .4.____ AUTOMATED
- .5.____OTHER (SPECIFY) __________

8.0 MISSIONS DATA

	MISSION: ①	②	③
.1. DESIRED FLIGHT DATES			
.2. DESIRED TIME ON ORBIT			
.3. DESIRED INCLINATION (DEG)			
.4. DESIRED APOGEE ALTITUDE (KM)			
.5. DESIRED PERIGEE ALTITUDE (KM)			
.6. VIEWING (SPECIFY TARGETS)			
.1.___EARTH			
.2.___SOLAR			
.3.___STELLAR			
.4.___OTHER (INCLUDES NONE)			
.7. VIEWING FREQUENCY (SPECIFY) (E.G., MINUTES/ORBIT, HRS/DAY, ETC)			
.8. VIEWING CONSTRAINTS (SPECIFY) (E.G , SUNLIGHT, DOWN SUN, ETC)			
.9. SPECIAL REQUIREMENTS (SPECIFY)			
.1. MANEUVERS (SPECIFY)			
.2. POINTING ACCURACY			
.1 ARC SEC			
.2 HR/OPN			
.3. POINTING STABILITY			
.1 ARC SEC			
.2 HR/OPN			
.3 ARC SEC/SEC			

SORTIE PAYLOAD PLANNING INPUT DATA
SHEET 2

PAYLOAD NO.________
PREP. DATE ________
REVISION DATE________

9.0 MAJOR INSTRUMENTS/EQUIPMENT DESCRIPTIONS

EQUIPMENT NAME	DIMENSION ENVELOPE (CM)	MASS (kg) (DRY/WET)	EQUIPMENT LOCATION (MODULE, PALLET, ETC)	DESCRIPTION OF PHYSICAL/FUNCTIONAL REQUIREMENTS
.1	(Hx WxD, WHERE HxW = OPERATING FACE OF INSTRUMENT)			I.E., VENTING, COLD PLATE, ETC. MOUNTING AREA (M^2)
.2				
.3 (ETC)				
ITEMS 1 – 3 4 – – – – – – –	VOL (M^3)	TOTAL MASS	LOCATION MODULE PALLET OTHER	SPECIAL REMARKS MOUNTING AREA (M^2)

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SORTIE PAYLOAD PLANNING INPUT DATA
SHEET 3

PAYLOAD NO. ____________
PREP. DATE ____________
REVISION DATE ____________

10. POWER REQUIREMENTS (WATTS) (FLIGHT)

	DC	AC/FREQ
.1 STANDBY		
.2 OPERATING		

11. EXPERIMENT OPERATIONS

	HR/OPERATION	FREQ	CREW-NO.	HRS/OPN	
.1 ___ CONTINUOUS	______	______	______	______	______
.2 ___ INTERMITANT	______	(I.E., 1 ORBIT OVER TARGET, ETC.)	______	______	______
.3 ___ (SPECIFY)	______	______	______	______	______

(E.G., EVA, RMS, ____

____

12. DATA/COMMUNICATIONS – ON-ORBIT

	STORED	DOWN		UP
		RT	DUMP	
.1 DIGITAL				
MAX RATE (KBPS)				
MB/OPERATION				
MB/MISSION				
.2 ANALOG				
BW				
HR/OPERATION				
.3 TV HRS/DAY				

13. COMPUTER SUPPORT (YES OR NO) BULK MEMORY (SIZE) ______ RAPID ACCESS MEMORY (SIZE) ______

14. ENVIRONMENTAL REQ – IN FLIGHT – OPERATING/STANDBY

	MODULE LOCATED	PALLET LOCATED
.1 TEMPERATURE °K		
.2 HUMIDITY %		
.3 CLEANLINESS, CLASS		
.4 ACOUSTIC LIMIT, dB OVERALL		
.5 ACCELERATION LIMIT, g		
.6 RADIATION RATE LIMIT, J/Kg-S		
.7 OTHER (SPECIFY)		

SORTIE PAYLOAD PLANNING INPUT DATA
SHEET 4

PAYLOAD NO. ____________
PREP. DATE ____________
REVISION DATE ____________

15. SPECIAL HEAT REJECTION REQUIREMENTS (WATTS) (STANDBY/OPERATING)
- .1 MODULE ITEMS ____________________
- .2 PALLET ITEMS ____________________

16. FLIGHT SUPPORT & INTEGRATION EQUIPMENT REQUIREMENTS (QUANTITY)
- .1 (MISSION DEPENDENT SPACELAB SUBSYSTEM EQUIPMENT – MDSE)

.1____1 METER RACKS
.2____0.5 METER RACKS
.3____CEILING STORAGE CONTAINERS
.4____MODULAR FILM VAULT
.5____TOP AIRLOCK
.6____AFT AIRLOCK
.7____HIGH QUANTITY WINDOW/VIEWPORT
.8____HIGH VACUUM VENT FACILITY
.9____PALLET COLD PLATES
.10____PALLET THERMAL COVER
.11____EXP. HEAT EXCHANGER
.12____EXP. PWR SWITCHING PANELS
.13____EXP. INVERTER (400 HZ)
.14____EXP. RAU
.15____EXP. I/O UNIT
.16____EXP. COMPUTER
.17____DATA DISPLAY/SYMBOL GENERATOR
.18____HI DATA RATE RECORDER
.19____MULTIPLE PAYLOAD MOUNT (MPM)
.20____INSTRUMENT POINTING SYSTEM (IPS)
.21____OTHER (SPECIFY)

17. GROUND SUPPORT REQUIREMENTS
- .1 SPECIAL HDLG ____________________
- .2 CLEANLINESS ____________________
- .3 POWER ____________________
- .4 ACCESS ____________________
  ____
- .5 FLUIDS/GASES ____________________
- .6 CRYOGENICS ____________________
- .7 TEST & CHECKOUT ____________________
  ____
- .8 SPECIMEN HOLDING/TRANSFER ____________________
- .9 RADIOACTIVE MATERIALS ____________________
- .10 INTEGRATION ____________________

Appendix C
PLANNING BASELINE MOCKUP

The mockup of the NASA Planning Baseline document was devised as a means of definition of the contents and format. The mockup presented here is the third revision, and reflects the evolution of the document from a broader concept incorporating STS/OSF/OTDA assessments and significant budget/ funding assessments to a more restrictive concept dedicated to NASA payload programs (including NASA related) and missions only with no fiscal analyses. However, a general constraint to payload planning wedges (fiscal) is assumed through the input of the Headquarters Payload AA's to the Payload Model/new starts lists.

The mockup, as presented here, provides sample charts/data for each section along with text suggesting the content of each section. Mission descriptions for three of the 31 NASA/NASA-related STS missions (excluding OFT) during 1977-1982 is presented in the two-page mission description format. The mockup presents missions in terms of NASA mission numbers (automated and sortie) in nominal sequence of desired flight date and makes no attempt to structure or schedule non-NASA missions or STS flight numbers which will accommodate the NASA missions. The Planning Baseline is built upon elements of the Payload Model and Mission Model with increased depth and assessment of the five-year projection. The major new elements are 1) greater definition of Spacelab payloads and 2) the two-page mission descriptions for each NASA/NASA-related mission. In addition, the Planning Baseline is updated twice a year (March and September) whereas the Mission Model is updated only as necessary to reasonably reflect nominal long range program planning. Thus, at any given time, the Planning Baseline is the more current document for the next five years planning and updates of the Mission Model extrapolate from it.

NASA PLANNING BASELINE

1977 – 1982

INTEGRATED PAYLOAD
AND
MISSION PLANNING

October 1976

NASA
National Aeronautics and
Space Administration

NASA

NASA

NASA PLANNING BASELINE

1977 – 1982

October 1976

Approved
P E Culbertson
Assistant Administrator
Planning and Program Integration

NASA
National Aeronautics and
Space Administration

George C Marshall Space Flight Center
Marshall Space Flight Center Alabama 35812
AC 205 453-0034

PREFACE

A brief summary of:

- Document Objective
- Submittal Authority
- Contents

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

DOD	Department of Defense
FY	Fiscal Year
HQS	NASA Headquarters
IMS	Institutional Management Support
IP&MP	Integrated Payload and Mission Planning (Project Office at MSFC)
IUS	Interim Upper Stage
JURG	Spacelab Joint Users Requirements Group
K	Thousand
KSC	Kennedy Space Center
LRF	Launch and Recovery Facilities
MSFC	Marshall Space Flight Center
MMSE	Multi-discipline Mission Support Equipment
NASA	National Aeronautics and Space Administration
NMI	NASA Management Instruction
OA	Office of Applications
OPPI	Office of Planning and Program Integration
OSF	Office of Space Flight
OSS	Office of Space Science
OTDA	Office of Tracking and Data Acquisition
PDR	Preliminary Design Review
POP	Program Operating Plan
REDSTAR	Resource Data Storage and Retrieval
SPPO	Shuttle Payload Planning Office
SPRAG	STS Payload Requirements and Analysis Group
SSPPSG	Space Shuttle Payload Planning Steering Group
STS	Space Transportation System
TBD	To Be Determined
TP	Transition Period

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FY	OSS	OA	OAST	OTDA
1977 (APPROVED)	EXPLORERS (2) SOLAR MAX LS MINILAB SPACELABS 1 & 2	MAGSAT THEMATIC MAPPER SPACE PROCESSING CLOUD PHYSICS SPACELAB 3	LDEF 77 DROP DYNAMICS SPACELAB 6	
1978 (SUBMITTAL)	EXPLORERS (2) SPACE TELESCOPE JUPITER PROBE LUNAR ORBITER SPACELABS 4 & 8	EXPLORERS (1) SPACELABS 5 & 7 TIROS O ENVIROSAT A	FLUID PHYSICS LAB SPACELAB 15 LDEF-78	
1979 (PROJECTED)	EXPLORERS (2) GRAVITY PROBE EXOECLIPTIC OBS SPACELAB 9 SPACELAB 13 BESS	STORMSAT SPACELAB 10 SPACELAB SPACELAB		
1980 (PROJECTED)	EXPLORERS SPACE			
1981 (PROJECTED)				
1982 (PROJECTED)				

TABLE LISTING BY YEAR AND OFFICE, SIGNIFICANT NEW STARTS – INDICATES CONTENTS OF PLANNED NASA PROGRAM

viii

Section 1: INTRODUCTION

Describes the purpose and authority of the Planning Baseline, its intended use, the time period covered and the program and project areas covered (in general).

Summarizes program assessment (Section 3) results and general characteristics (NASA program activity and forecast, non-NASA participation, program schedule and funding compatibility (with guidelines), resource base utilization, and critical problem areas.

SAMPLE TEXT

SAMPLE TEXT

i

Section 2: GUIDELINES

General Programmatic guidelines and priorities, by major program office area (all supplied by Headquarters), will be presented. Delineates the major guidelines and directives provided by Headquarters. In addition, major assumptions made in preparing the Baseline shall be presented.

SAMPLE TEXT

2

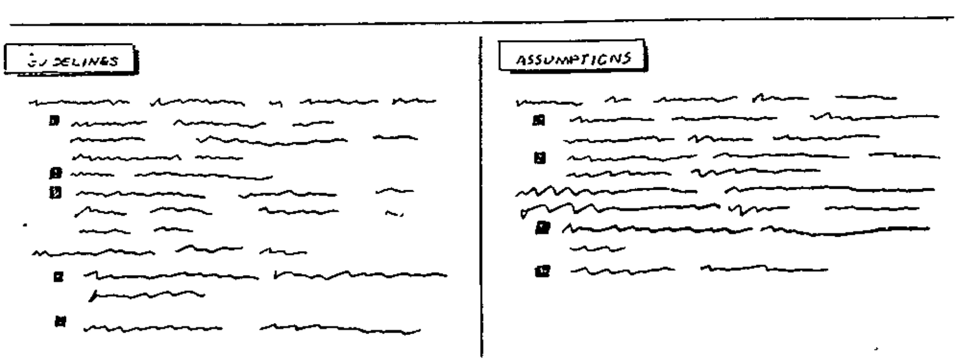


Figure 2-1. Guidelines and Assumptions

3

Section 3: PROGRAM ASSESSMENT

3.1 PROGRAM CONTENT

A short discussion on the current status, objectives, and thrust of the NASA program over the 5-year projection. Provide a short discussion (approximately 6 to 12 lines) of each program office (OSS, OA, OAST, OTDA) and its primary on-going programs and major new starts over 5-year projection. Brief note on NASA-related participation, brief note on other civil (non-NASA) payloads and DOD activity (unclassified).

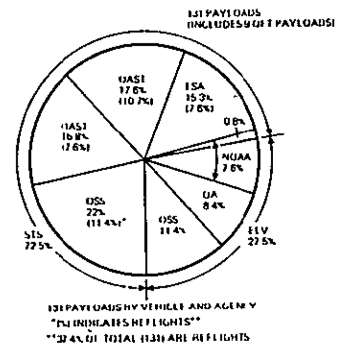


Figure 3-1. NASA/NASA Related Payloads — 1977 to 1982

4

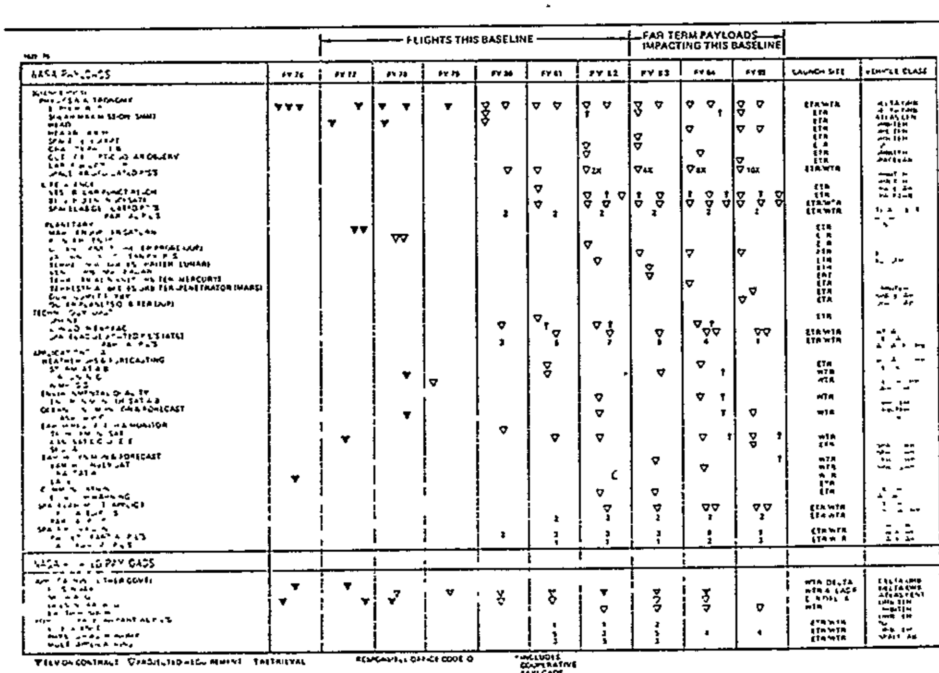


Figure 3-2. June 1976 NASA Payload Model for Planning Purposes

5

3.2 SPACELAB PAYLOADS

Provides a more detailed discussion and listing (Figure 3-3) of Spacelab payloads and programs by program office, users, etc., - focusing on Spacelab payload model similar to Figure 3-2. Group small payloads by discipline and office and by flight year to preclude excessively detailed listing. Discuss Spacelab payload grouping criteria.

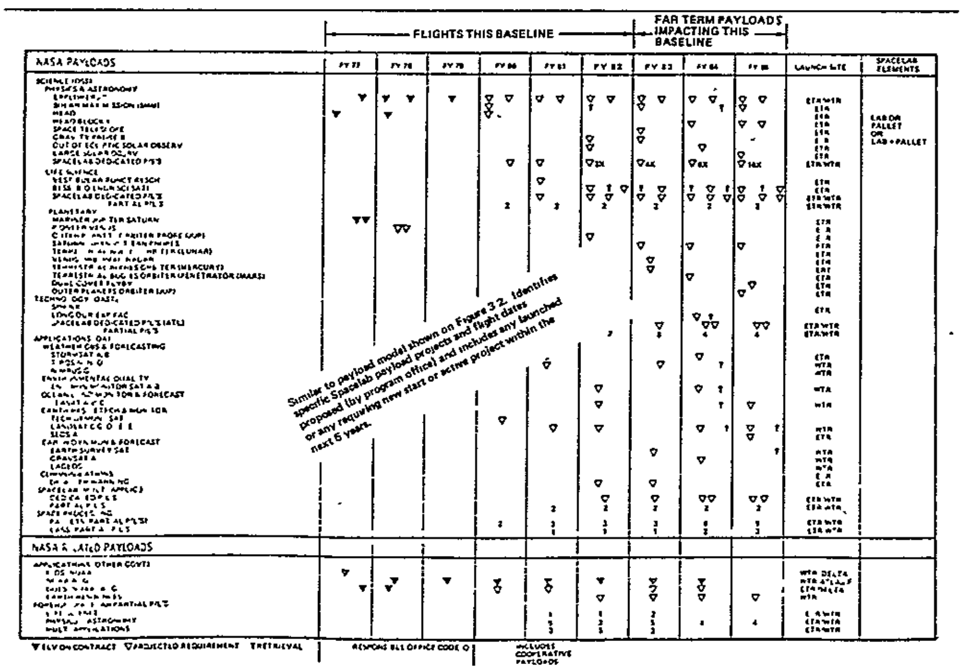
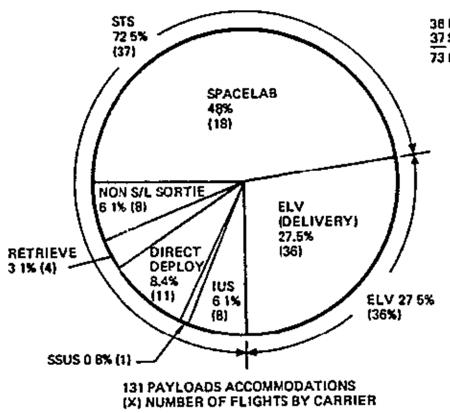


Figure 3-3 June 1976 NASA Spacelab Payload Model for Planning Purposes

7

3.3 MISSION MODEL

Provide brief text describing the NASA/NASA related mission model (Figure 3-4) - text on grouping of payloads into flights - types of flights by each user, STS flights versus ELV, Spacelab traffic, retrievel, IUS, etc.



NUMBER OF PAYLOADS

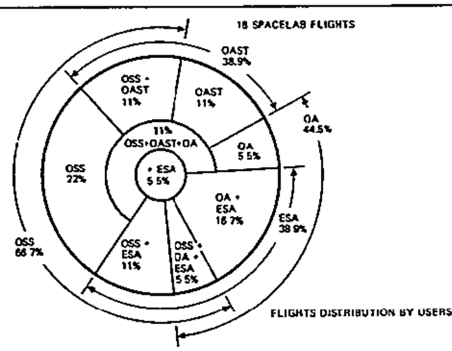
Payload Office	S/L	Sortie (Non S/L)	Direct Retrieve	Direct Deploy	SSUS	IUS	ELV
OSS	13	4	2	5	0	5	15
OA	15	3	0	2	0	2	11
OAST	17	0	2	3	0	1	0
ESA*	18	1	0	1	*	0	*
NOAA	0	0	0	0	1	0	10
TOTAL	63	8	4	11	1	8	36

*Only OFT or Partial Spacelab ESA Payloads are NASA Related

Figure 3-4 NASA/NASA Related Mission Model – 1977 to 1982

3.4 SPACELAB USERS - 1977 TO 1982

Discusses how these Spacelab payloads are grouped on the planned Spacelab flights (Figure 3-5), and the percentage of Spacelab flights contributed by each user - including shared flights and percentage of individual payloads reflown by each user.



SPACELAB FLIGHT NUMBER

User	1	2	3	4	5	6	[4 / 7]	8	[3 / 9]	10	11	12	13	[6 / 14]	15	16	[11 / 17]	18	Total	% Flights
OSS	X	X	X	(X)			(X)	X	X		(X)	X	X				X	(X)	12	66 7
OA	X		X		X				X	X			X		(X)	X			8	44 5
OAST	X	X	X			(X)			X					(X)			X		7	38 9
ESA	X				X			X		X		X	X			X			7	38.9

34 Payloads Grouped by Office and Flight

(X) = Dedicated Mission   [ ] = Cargo Reflight

Figure 3 5. Spacelab Users – 1977 to 1982

3.5 STS UTILIZATION

Discusses STS utilization by user and by element - required mission rates by key elements, etc. Spacelab rack and pallets units indicate the number of racks or pallets that must be flown each year to accommodate the Spacelab payloads, i.e. A given single flight may fly 8 single racks and 8 double racks in one long module or four pallets and no module, etc. The total flown each year is indicated for each element and launch site. In addition Figure 3-6 shows the distribution of STS users by flights (dedicated and shared) and total payload mass distribution, including percent of payloads reflown, during the six year time period.

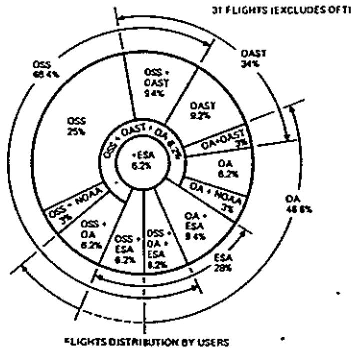


Figure 3-6 NASA/NASA Related STS Utilization — 1977 to 1982

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Table 3-1
NASA/NASA-RELATED STS UTILIZATION

STS Hardware and Facilities	Planned NASA/NASA-Related STS Flights						
	CY 77	CY 78	CY 79	CY 80	CY 81	CY 82	Total Flights
Orbiters							
ETR	0	0	3 (OFT)	3 OFT/4	12	15	6 OFT/31
WTR	0	0	0	0	0	1	1
Spacelab							
ETR	0	0	0	(2)	(8)	(9)	(18)
Short Module				0	2	4	6
Long Module				1	4	4	9
Pallet Units				5	14	18	35
Rack Units (Single)				6	29	31	67
Rack Units (Double)				4	17	23	47
WTR	0	0	0	(0)	(0)	(0)	(0)
Short Module							
Long Module							
Pallet Units							
Rack Units (Single)							
Rack Units (Double)							
IUS							
ETR			0	0	3 (6 stgs)	5 (16 stgs)	8 (22 stgs)
WTR			0	0	0	0	
SSUS							
ETR			0	1	0	0	1
WTR			0	0	0	0	

11

Table 3-2

COMMON PAYLOAD SUPPORT NEEDS - NEW OR ADDITIONAL

Item	Description	Mission and Payloads	Need Date	Est. Start	Est. Funding
Flight Equipment					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ground Equipment					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Facilities					
WTR					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FTC					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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3.6 COMMON PAYLOAD SUPPORT NEEDS

Assesses and identifies payload program new or additional support requirements above those already planned or authorized. These are items required by several payload programs (not unique to a single project) which lend themselves to common usage and in the category of general capability which should be separately funded projects or amortized across several payload programs. This would include additions to the STS (e.g., Spacelab racks), new payload flight support equipment (MMSE, APPS, etc.), or additions to the data network or ground facilities (POCC, PCR, etc.) which are payload program driven. Discussion and Table 3-2 should (1) identify major items, (2) identify payloads and missions requiring item, (3) give general requirements as appropriate (e.g., supply 5-kw continuous power, etc.), and (4) define need date, start date and estimated funding. Minor items may be lumped together into a generic category identified by project start date (e.g., MMSE-78).

[illegible]

SAMPLE TEXT

[illegible]

[illegible]

12

3.7 PROGRAM ASSESSMENT AND RECOMMENDATIONS

This text will assess the program content against the general objectives in the different program areas - as to sufficiency, overall program balance, sequence, etc. It will summarize the results of the STS utilization and common payload support needs assessments to identify/support specific recommendation (additional procurements, deferrals, etc.). In addition, it will identify program level program milestones, etc.) and suggest alternatives, options, or other remedial action as warrented. It will highlight action items calling for management decision and implementation, including new starts and mission approvals required this cycle.

- PROGRAM THRUST/CONTENT VERSUS OBJECTIVES
- PROGRAM BALANCE I.E., SCIENCE APPLICATION, TECHNOLOGY, OSF . . . CURRENT AND FORCASTED
- STS UTILIZATION – (OVER/UNDER, ETC.)
- CPS-SCOPE-NEED – CAUSES
- PROBLEM AREAS
- NEW STATUS IMPACTS

Figure 3-7. Program Assessment

Continuation of text for Paragraph 3.7 provides program recommendations.

SAMPLE TEXT

16

PROBLEM AREAS

OPTIONS

- MISSION APPROVAL SUBMITTALS
- MAJOR NEW START DECISIONS

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Figure 3-8. Program Recommendations

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Section 4: PROGRAM OVERVIEW

4.1 OFFICE OF SPACE SCIENCE PROGRAMS

Summarizes the Office of Space Science (OSS) program activities. The various OSS missions and programs (current, submitted, proposed new starts, and planned) will be assessed against the NASA program objectives and guidelines to establish their program basis and priorities (this assessment may/should be done by the OSS/Headquarters). Program assessment should address OSS disciplines (i.e., Physics and Astronomy, Planetary, Life Sciences, other). The basic point of this section is to establish an integrated overview of the Space Scie^ce Program, and its supporting elements/projects, which is also integrated with the basic purpose, objectives, and guidelines of the total NASA program (i.e., to place each OSS project in its proper context of the total NASA program objectives and goals).

4.1.1 OSS Currently Authorized Projects

Briefly describes status and schedule of currently active and authorized OSS payload and mission projects. Table 4-1 identifies flight date, mission number (and or vehicle), schedule profile (5-year projection), lead center, mission manager, integration site and date, and payload type.

[illegible]

SAMPLE TEXT

[illegible]

SAMPLE TEXT

[illegible]

Table 4-1

OSS CURRENTLY AUTHORIZED PAYLOADS

Ref No	SSPD No.	Name	First Flt Date	NASA Mission No.	CY Schedule 77	78	79	80	81	82	Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
		Physics & Astronomy													
			● — List by flight sequence in each discipline.												
		Planetary													
		Life Sciences													

Notes: * Spacelab Payload; † Deployed Payload; Retained Payload; + [illegible] Payload; Ÿ SSUS Payload; ATP △ Design, Mfg, Integrate, Launch

4.1.2 OSS Submitted and Planned New Projects

Identifies OSS payloads/mission concepts currently planned as potential projects starts by estimated start year on a project-by-project basis as shown in Table 4.2. Text will discuss table and specific projects with emphasis on near-term submitted or proposed projects or on significant program impact projects (unique STS requirements, etc.). In-process or planned studies or submitted MADS for selected payloads/missions will be cited and major problem areas or pacing items noted, especially impacts on the resource base.

Estimates of start dates, key milestones based on the tentative flight date(s), and STS utilization will be identified. Major project elements and interfaces to other projects and the resource base may be identified. Only payload/mission concepts which are sponsored (for planning pruposes) by the appropriate Program Office (via Payload Model/Traffic Model approval) are included.

Table 4-2

OSS SUBMITTED AND PLANNED NEW PAYLOADS

Fei c.	SSPD No.	Name	First Flt Date	NASA Mission No.	CY Schedule 77	78	79	80	81	82	Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
		1978 New Starts (Submitted)													
•	LS-10-5	ML-2A Minilab	1/81	53							JSC	MFSC	7/80	---	---
			● List by flight sequence in each discipline.												
		1979 New Starts (Planned)													
		1980 New Starts (Planned)													
		1981 New Starts													
		1982 New Starts													

Notes. * Spacelab Payload † Deployed Payload
Retained Payload + IUS Payload
SSUS Payload
ATP Design Dev Integrate Launch

4.2 OFFICE OF APPLICATIONS PROGRAMS

Similar to Paragraph 4.1 for OSS, but addressed to OA Program objectives and disciplines, missions and programs, new starts, and guidelines.

4.2.1 OA Currently Authorized Projects

Coverage is the same as that described in Paragraph 4.1.1 for OSS.

Table 4-3

OA CURRENTLY AUTHORIZED PAYLOADS

Pr No.	SSPD No.	Name	First Flt Date	NASA Mission No.	CY Schedule						Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
					77	78	79	80	81	82					
		Physics & Astronomy													
			←List b_ 'light sequence in each discipline.												
		Planetary													
		Life Sciences													

Notes * Spacelab Payload
† Deployed Payload
O Retained Payload
+ IUS Payload
K SSUS Payload
ATP Design Dev Integrate Launch

4.2.2 OA Submitted and Planned New Projects

Coverage is the same as that described in Paragraph 4.1.2 for OSS.

Table 4-4

OA SUBMITTED AND PLANNED NEW PAYLOADS

Ref No.	CSPD No.	Name	First Flt Date	NASA Mission No.	CY Schedule 77	78	79	80	81	82	Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
		1978 New Starts (Submitted)													
			● List by flight sequence in each discipline.												
		1979 New Starts (Planned)													
		1980 New Starts (Planned)													
		1981 New Starts													
		1982 New Starts													

Notes: * Spacelab Payload
† Deployed Payload
0 Retained Payload
+ IUS Payload
K SSUS Payload
ATP △ Design / Dev / Integrate / Launch

4.3 OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY PROGRAMS

Coverage is similar to that provided in Paragraph 4.1 for OSS, but addressed to OAST Program objectives and disciplines, missions and programs, new starts, and guidelines.

4.3.1 OAST Currently Authorized Payload Projects

Coverage is similar to that provided in Paragraph 4.1.1 for OSS. However, because of the detail of OAST projects, they should be grouped by program areas or major projects with visibility emphasis those projects resulting in STS payloads and missions. Only space payload projects are covered.

Table 4-5

OAST CURRENTLY AUTHORIZED PAYLOADS

[illegible] No.	SSPD No.	[illegible]	First Flt Date	NASA Mission No.	CY Schedule 77	78	79	80	81	82	Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
		Physics & Astronomy													
			● List by flight sequence in each discipline.												
		Planetary													
		Life Sciences													

Notes: * Spacelab Payload; † Deployed Payload; Retained Payload; + I'C Payload; K SSUS Payload; ATP △ Design / [illegible] / Integrate / Launch

4.3.2 OAST Submitted and Planned New Payload Projects

Coverage is similar to that provided in Paragraph 4.1.2 for OSS and as amended by Paragraph 4.3.1. Coverage is provided for OAST space payload projects only.

Table 4-6

OAST SUBMITTED AND PLANNED NEW PAYLOADS

Re. No	SSPD No	Name	First Flt Date	NASA Mission No.	CY Schedule 77	78	79	80	81	82	Lead Center	Integ Site	Integ Date	Mission Manager	Remarks
		1978 New Starts (Submitted)													
			●— List by flight sequence in each discipline.												
		1979 New Starts (Planned)													
		1980 New Starts (Planned)													
		1981 New Starts													
		1982 New Starts													

Notes: * Spacelab Payload O Retained Payload K SSUS Payload ATP △ Design / Dev / Launch / Integrate
† Deployed Payload + IUS Payload

Section 5: NASA MISSIONS PLAN

5.1 SUMMARY

This section summarizes the total NASA missions, i.e., the flights authorized, planned, and proposed over the 5-year period. The NASA/NASA related traffic will be analyzed and defined by mission type, activity trends - by site, users, etc.

Table 5-1
SPACELAB MISSION SUMMARY

NASA Mission No.	Preferred Launch Date	Mission	Agency	Primary Objectives
S1	Jul 1980	First Spacelab Mission	NASA/ESA	Spacelab VFI
S2	Oct 1980	Second Spacelab Mission	NASA	Spacelab VFI
S3	Jan 1981	Third Spacelab Mission	NASA	Space Processing
S4	Mar 1981	Life Science (Mod I)	NASA	Life Science
S5	Jun 1981	Multiuser 81-3	NASA/ESA	Earth Viewing
S6	Aug 1981	Atl Emphasis No. 1	NASA	Advanced Technology
S7	Sep 1981	Life Science (Mod I)	NASA	Life Science
S8	Oct 1981	Combined Astronomy	NASA	Space Viewing
S9	Nov 1981	Multiuser 82-1	NASA	Space Processing
S10	Feb 1982	Multiuser 82-2	NASA/ESA	Earth Viewing
S11	Apr 1982	Life Science (Mod II)	NASA	Life Science
S12	May 1982	AMPS	NASA/ESA	Space Physics
S13	Jun 1982	Multiuser 82-4	NASA/ESA	Earth Viewing
S14	Jul 1982	Atl Emphasis No. 2	NASA	Advanced Technology
S15	Aug 1982	Evaul	NASA	Earth Viewing
S16	Sep 1982	Multiuser 82-3	NASA/ESA	Earth Viewing
S17	Oct 1982	Life Science (Mod II)	NASA	Life Science
S18	Nov 1982	Astronomy/High Energy	NASA	Space Viewing

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Table 5-2

SPACELAB MISSIONS PAYLOADS

MASS (KG)/PRESSURE VOL (M^3) X PALLET AREA (M^2)/OPERATING POWER (KW)

NASA Mission	NASA			ESA	Other (Designated)
	OSS	OA	OAST		
S1 First Spacelab July 1980 57°/250 km LM+1 Pallet Number of P/L's 18	1. AP-09-S Electron Accelerator 2. Gamma Ray Spectrometer 3. FUV Imaging and Spectrometer 4 AP-13-S LLL TV 5. LS-13-S Minilab 6. Active Cavity Radiometer 6	1. EO-01-S Atmospheric Cloud Physics 1	1. ST-46-S Non-metallic Material Sampler 2. ST-08-S Induced Environment Contamination Monitor 3. ST-64-S Fluid Flow 4 ST-86-S Horizon Sensor 5 ST-81-S Lubricants 5	1. Passive Atmospheric Sounding 2. APE-01 Lidar 3. EOE-01 Metric Camera 4. LSE-03 Sled Vestifunction 5. SPE-80-85 Space Processing 5	1. Ion States (India). 1
S2 Second Spacelab October 1980 35°/450 km 4 Pallets Number of P/L's 14	1. AS-42-S Schmidt Camera 2. Gamma Ray Spectrometer 3. AS-73-S EUV Telescope 4 AP-13-S LLL TV 5. HE-31-S Cosmic X-Ray 6. HE-25-S Trans Radiation Spectrometer 7. SO-29 TD 33 IPS Solar P/L 11	0	1. ST-46-S Non-metallic Material Sampler 2. ST-60-S Column Density Monitor 3. Star Tracker 3	0	0
S3 Third Spacelab January 1981 28 5°/400 km LM + 1 Pallet Number of P/L's 5	1. LS-13-S Minilab ML-2A 1	1. EO-01-S Atmospheric Cloud Physics 2. SP-31-S Space Processing 3. Pallet Space Processing (TBD) 3	1. ST-31-S Drop Dynamics 1	0	0
S4 Life Science (Mod I) March 1981 28 5°/370 km LM + 1 Pallet Number of P/L's 12	1. LS-09-S Life Science Dedicated Lab (Mod I) (II Lab Groupings) 2. HE-17-S High Energy Cosmic Ray Detector 12	0	0	0	0

Table 5-2

SPACELAB MISSIONS PAYLOADS

MASS (KG)/PRESSURE VOL (M^3) X PALLET AREA (M^2)/OPERATING POWER (KW) (Continued)

NASA Mission	NASA			ESA	Other (Designated)
	OSS	OA	OAST		
S5 Multiuser 81-3 June 1981 55°/450 km SM + 3 Pallets Number of P/L's 11	0	1 EO-20-S Synthetic Aperture Radar Antenna 2. EO-19-S MK II Interferometer 3. CN-04-S RFI Survey 4. CN-08-S Open TWT 5 CN-16-S Multibeam Antenna 6 CN-21-S BW Compression Modulation 7. Stero Camera 7	0	1 Passive Atmospheric Sounder 2. APE-01 Lidar 3. SPE-80-85 Space Processing 4 SPE-01 Free Flow Electrophoresis 5 STE-10 Heat Pipe 4	0
S6 Atl No 1 August 1981 50°/450 km SM + 2 Pallets Number of P/L's 12	0	0	1 ST-31-S Drop Dynamic 2. ST-67-S Large Structure 3 ST-61-S Laser Hftfrodyne 4. ST-44-S MW Radiometer 5. ST-08-S Contamination Monitor 6 ST-85-S Silicon Solar Cells 7. ST-60-S Column Density Monitor 8. STS-35-S Combustion Facility 9 ST-34-S Two-Phase Heat Transfer 10. ST-64-S Fluid Flow 10	0	1. Laser Gruo (NASA-OSF) 2 Short Manipulator (NASA-OSF) 0
S7 Life Science (Mod I) September 1981 28 5°/370 km LM + 1 Pallet Number of P/L's 12	1 LS-09-S Life Sciences Dedicated Lab (Mod I) 2. (Pallet TBD) 12	0	0	0	0

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Table 5-2

SPACELAB MISSIONS PAYLOADS

MASS (KG)/PRESSURE VOL (M^3) X PALLET AREA (M^2)/OPERATING POWER (KW) (Continued)

NASA Mission	NASA OSS	NASA OA	NASA OAST	ESA	Other (Designated)
S8 Combined Astronomy October 1981 TBD 5 Pallets Number of P/L's 8	1. AS-42-S Schmidt Camera 2. AS-73-S EUV Telescope 3 SO-12-S XUV Sepctrograph 4. SO-33-S X-Ray Burst Detector 5. Neutron and Gamma-Ray Telescope 6. HE-17-S HE Cosmic Ray Detector 6	0	0	1. ASE-01 W7 Galactic Camera 2. ASE-12 Lyman Alpha Telescope 0	0
S9 Multiuser 82-1 November 1981 28.5°/400 km LM + 1 Pallet Number of P/L's 5	1. LS-13-S Minilab 1	1. EO-01-S Atmospheric Cloud Physics 2. SP-31-S Space Processing 3 Pallet Space Processing 3	1 ST-31-S Drop Dynamics 1	0	0
S10 Multiuser 82-2 February 1982 57°/400 km SM + 3 Pallets Number of P/L's 4	0	1. CN-04-S RFI Survey 2 EO-20-S Applications Imaging Radar 3. CN-07-S Large Deploy Antenna 3	0	1. EOE-07 MW Radiometer/ Scatterometer/ Altimeter 1	0
S11 Life Science (Mod II) April 1982 28.5°/370 km LM + 1 Pallet Number of P/L's 12	1. LS-09-S Life Science Dedicated Lab (Mod II) 2. (Pallet TBD) 12	0	0	0	0

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Table 5-2

SPACELAB MISSIONS PAYLOADS

MASS (KG)/PRESSURE VOL (M^3) X PALLET AREA (M^2)/OPERATING POWER (KW) (Continued)

NASA Mission	NASA OSS	NASA OA	NASA OAST	ESA	Other (Designated)
S12 AMPS May 1982 57°/260 x 425 km SM + 3 Pallets Number of P/L's 9	1 AP-06-S AMPS (Atmospheric, Magnetospheric and Plasmas in Space) - Electron Accelerators - Lidar - RF Power Transmitters - Optical and Plasma Insts 7	0	0	1. Plasma and magnetospheric experiments with Subsatellite 2	0
S13 Multiuser 82-4 June 1982 55°/250 km LM + 1 Pallet Number of P/L's 7	1. LS-13-S Minilab 1	1 EO-21-S Shuttle Imaging MW System 1	0	1. STE-10 Heat Pipe 2. EOE-01 Metric Camera 3. SPE-01 Electrophoresis 4. SPE-80-85 Space Processing 5 LSE-03 Sled-Vest Function 5	0
S14 Atl No. 2 July 1982 55°/370 km SM + 2 Pallets Number of P/L's 10	0	0	1 Atl No. 2 (Ref 5 6) (Assume 50% New) 10	0	0
S15 Evaul August 1982 TBD (SM + 2 Pallets) Number of P/L's 8	0	1. Earth Viewing Lab (TBD) (Assumed) 8	0	0	0

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Table 5-2

SPACELAB MISSIONS PAYLOADS

MASS (KG)/PRESSURE VOL (M^3) X PALLET AREA (M^2)/OPERATING POWER (KW) (Concluded)

NASA Mission	NASA			ESA	Other (Designated)
	OSS	OA	OAST		
SL16 Multiuser 82-3 September 1982 55°/350 km LM + 1 Pallet Number of P/L's 8	0	1. EO-19-S MK II Interferometer 2. CM-16-S Adaptive Multibeam Antenna 2	0	1. SPE-01 Electrophorfsis 2. SPE-80-85 Space Processing 3. APE-07 IR Radiometer 4. CNE-01 One-Way Nav 5. EOE-01 Metric Camera 6. EOE-07 MW Radiometer/ Scatterometer/ Altimeter 6	0
SL17 Life Sciences (Mod II) October 1982 28.5°/370 km LM + 1 Pallet Number of P/L's 13	1. LS-09-S Life Sciences Dedicated Lab (Mod II) 2. (Pallet TBD) 12	0	1. Advanced Life Support Technology 1	0	0
S18 Solar Ast./High Energy November 1982 (TBD) 5 Pallets Number of P/L's 7	1. SO-12-S XUV Spectroheliograph, X-Ray and Spectrograph 2. Small IR Cryo Telescope 3. IUE Spectrograph 4. Narrow Field Objective Spectrograph 5. Low Energy Gamma Ray Telescope 6. Ionization Spectrometer 7. Negatron-Position 7	0	0	0	0
Total through 1982 Number of P/L's 175	88	28	31	25	3
New P/L's 100	42	20	20	15	3
Repeats P/L's 75	46	8	11	10	0

Table 5-3

STS AVAILABILITY DATA USED IN THIS BASELINE

Hardware	ESA Free Hardware On Line Dates (CY) (Firm)	Initial Buy On-Line Dates (CY) (Planned)
Core Segment	(1) 7/15/79	(2) 5/9/81
Experimeng Segment	(1) 7/15/79	(2) 9/21/82
Aft End Cone	(1) 7/15/79	(2) 5/12/81
Tunnel	(1) 7/15/79	(2) 1/1/83
Aft Utility Bridge	(1) 7/15/79	(2) 5/9/82
Racks	(16) 7/15/79	(22) 3/19/81 (32) 9/9/81
Pallets	(1) 7/15/79 (5) 9/15/79	(7) 9/27/80 (10) 11/14/81
Igloo	(1) 9/15/79	(2) 12/20/81

( ) Indicates the number of hardware items on-line.

SHUTTLE ORBITER AVAILABILITY

Orb. 102	1979	Firm
Orb. 101	Nov. 1980	Firm
Orb. 103	Aug. 1981	Planned

5.2 RESOURCE REQUIREMENTS

Requirements for transportation, data handling, and mission payload support resources (STS, LRF, NET, POCC, etc.) will be presented for the NASA/NASA-related missions plan (cargo manifests). Requirements include a preliminary flight schedule (the cargo manifest) missions plan, network data links, and rates, and estimates of total mission hours/day requiring payload ground support operations. Requirements shall be identified as to status; i.e., firm (underlined) or planned. Requirements may be "best estimates" and need not be exacting analyses. Requirements will be presented by flight year and by system element (Shuttle, Spacelab modules, racks, pallets, KSC-ETR, WTR, Network, and POCC). These requirements may be compared against the available or planned resources as warrented to indicate support adequacy or need.

Table 5-4

ORBITER MISSION KIT MANIFEST/UTILIZATION (Revision III)

NASA MISSION NO	MISSION KIT NO.* 1	2		3	4	5		6	7	8		9	10		11	12		13	14		15
	OMS KITS - 500, 1000 & 1500 FT/SEC DELTA-V	BRIDGE FITTINGS (QTY)	KEEL FITTINGS (QTY)	RADIATOR PANELS Δ KIT	RTG COOLING KIT	AIRLOCK-INSIDE (STD)	AIRLOCK-OUTSIDE	TUNNEL ADAPTER KIT	DOCKING MODULE	INERT FLUID LINE	VOLATILE FLUID LINE	PROPELLANT DUMP FLUID LINE KITS	MISSION EXTENSION-N_2	MISSION EXTENSION - DELTA WASTE	MISSION EXTENSION-EPS CRYO KIT TANSK O_2, H_2	ELECT POWER HARNESS	AVIONICS HARNESS	HI-GAIN ANTENNA (2ND L.H SIDE ANT)	REMOTE MANIPULATOR SYS - L.H. (BASELINE)	REMOTE MANIPULATOR SYS - R H. (PAYLOAD)	GSE COOLING (WATER)
A1		4	1	1		1								•		8E	8A		1		
S1		7	2	1			2	1		8I 9I 10I					1	5E	5A		1		1
A2		6	2	1		1										8E	8A		1		
S2		8	2	1		1				1I 2I 3I					1	1E	1A		1		
S3		7	2	1			2	1		11I 12I 14I					1	5E 11E	5A 11A		1		1
A3		4	1	1		1										8E	8A		1		
S4		7	2	1			2	1		8I 9I 10I	•				1	5E	5A		1		1
A4		4	1	1		1										8E	8A		1		
S5		7	2	1			2	1		8I 9I 10I					1	5E	5A		1		1

*NUMBERS IN THE COLUMNS REFER TO MISSION KIT DESIGNATION NUMBERS IDENTIFIED IN ATTACHED KIT DESIGNATION CHARTS EXCEPT BRIDGE FITTINGS SHOWN BY QUANTITY

Table 5-4

ORBITER MISSION KIT MANIFEST/UTILIZAITON (Revision III) (Continued)

NASA MISSION NO.	MISSION KIT NO.* 1	2		3	4	5		6	7	8		9	10		11	12		13	14		15
	OMS KITS – 500, 1000 & 1500 FT/SEC DELTA-V	BRIDGE FITTINGS (QTY)	KEEL FITTINGS (QTY)	RADIATOR PANELS & KIT	RTG COOLING KIT	AIRLOCK-INSIDE (STD)	AIRLOCK-OUTSIDE	TUNNEL ADAPTER KIT	DOCKING MODULE	INERT FLUID LINE	VOLATILE FLUID LINE	PROPELLANT DUMP FLUID LINE KITS	MISSION EXTENSION-N_2	MISSION EXTENSION – DELTA WASTE	MISSION EXTENSION-EPS CRYO KIT TANKS O_2, H_2	ELEC POWER HARNESS	AVIONICS HARNESS	HI-GAIN ANTENNA (2ND L.H. SIDE ANT)	REMOTE MANIPULATOR – L.H. (BASELINE)	REMOTE MANIPULATOR SYS – R.H. (PAYLOAD)	GSE COOLING (WATER)
S6		7	2	1			2	1		8I 9I 10I 12I					1	3E	3A	1	1		1
A5		4	1	1		1										8E	8A		1		
S7		7	2	1			2	1		8I 9I 10I					1	5E	5A		1		1
A6	-	4	1	1		1										8E	8A		1		
S8		8	3	1		1				1I 2I 3I		1			1	1E	1A		1		
S9		7	2	1			2	1		11I 12I 14I					1	5E 11E	5A 11A		1		1

*NUMBERS IN THE COLUMNS REFER TO MISSION KIT DESIGNATION NUMBERS IDENTIFIED IN ATTACHED KIT DESIGNATION CHARTS EXCEPT BRIDGE FITTINGS SHOWN BY QUANTITY

Table 5-5

SPACELAB HARDWARE REQUIREMENTS BY FLIGHT

S/L Flt No.	Core Seg	Exp Seg	Aft Cone	Tunnel	Aft Utility Bridge	Single Racks	Double Racks	Pallets	Igloo
1	1	1	1	1	1	4	6	1	0
2	0	0	0	0	0	0	0	4	1
3	1	1	1	1	1	2	4	1	0
4	1	1	1	1	1	4	6	1	0
5	1	0	1	1	1	2	2	3	0
6	1	0	1	1	1	2	2	2	0
7	1	1	1	1	1	4	6	1	0
8	0	0	0	0	0	0	0	5	1
9	1	1	1	1	1	3	5	1	0
10	1	0	1	1	1	2	2	3	0
11	1	1	1	1	1	4	6	1	0
12	1	0	1	1	1	2	2	3	0
13	1	1	1	1	1	3	5	1	0
14	1	0	1	1	1	2	2	2	0
15	1	0	1	1	1	2	2	2	0
16	1	1	1	1	1	4	6	1	0
17	1	1	1	1	1	4	6	0	0
18	0	0	0	0	0	0	0	5	1

Table 5-6

(ISSUE DATE) SPACELAB HARDWARE REQUIREMENTS SUMMARY

Hardware Inventory Requirements				Inventory Buildup Requirements			
Year (CY)	1980	1981	1982				
Core Segment	1	2	2	(1) 7/15/79	(2) 6/27/81		
Exp. Segment	1	1	2	(1) 7/15/79	(2) 9/12/82		
Aft End Cone	1	2	2	(1) 7/15/79	(2) 8/5/81		
Tunnel	1	1	1	(1) 7/15/79			
[3] Aft Util Bridge	1	2	2	(1) 7/15/79	(2) 8/7/81		
[1] Racks	16	32	38	(16) 7/15/79	(32) 12/ 7/80	(38) 5/3/82	
[2] Pallets	5	10	8	(1) 7/15/79	(5) 5/31/80	(6) 6/13/81	(10) 8/13/81
Igloo	1	1	1	(1) 7/15/79			

[1] Rack requirement exceeds Spacelab Planned Procurement by 6 racks.

[1] Spacelab 3 requires 1 double rack 6 months earlier than presently projected.

[2] Pallet requirement projects 3-month accelerated procurement of 3 pallets.

[3] Aft Utility Bridge requirements in 1981, (2) exceeds available (1)

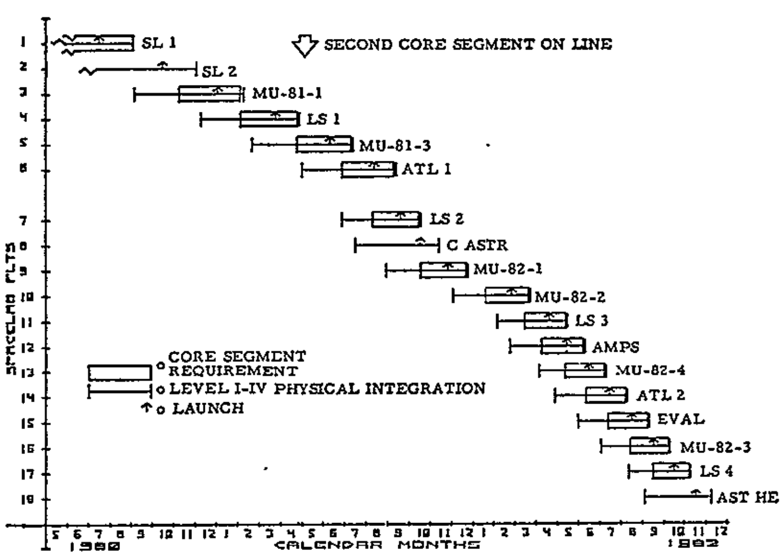

Figure 5-1. (Issue Date) Spacelab Core Segment Utilization Timeline (Revision III)

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5.3 NASA CARGO MANIFESTS - DESIRED FLIGHT SCHEDULE

Cargo Manifests composed from the Payload List will be defined by NASA mission number, duration, launch site, orbits, and flight date (tentative or approved). Cargo manifests will designate the payloads and major STS elements required for a specific flight (a cargo manifest with a MAD authorized prime payload will become a flight manifest under mission manager control). Once approved and assigned the mission program office will be indicated.

Table 5-7

(ISSUE DATE) NASA MISSIONS PLAN - FY 1980 TO 1982. CARGO MANIFEST

†Year	†NASA Mission	Date	Configuration	Mission Description Page No.	†Payloads and Agency	Altitude (km)	Inc. (Deg)	Duration (Days)	Mission Program Office	Remarks
1980	A1	May	Shuttle		LDEF Retrieval/OAST)	250	32			Coupled Missions, Etc.
	S1	Jul	Spacelab - L+P		First Spacelab/OSS	250	57*			
	A2	Sep	SSUS-D		GOES/NOAA	Syn.	0			
	S2	Oct	Spacelab - P		Second Spacelab/OSS	450	35*			
1981	S3	Jan	Spacelab - L+P		Multi-User 81-1/OA	400	28 5			
	A3	Feb	IUS (2-Stage)		STORMSAT/OA	Syn.	0			
			Shuttle		Soft X-Ray - Deploy/OSS	400	28.5			
	S4	Mar	Spacelab - L+P		Life Science (Mod 1)/OSS	370	28.5			
	A4	May	Shuttle		Space Processing/OA	300	28.5			
					Vestibular Function - Deploy/OSS	300	28.5			
			IUS (2-Stage)		SPHINX B/C/OAST	36,000/ 1,000	20			
	S5	Jun	Spacelab - L+P		Multi-User 81-3	450	55			
	S6	Aug	Spacelab - L+P		ATL Emphasis	450	50			
	A5	Sep	Shuttle		LDEF - Deploy	500	28 8			
					BESS - Deploy	500	28.8			
	S7	Sep	Spacelab - L+P		Life Science	370	28.5			
	A6	Oct	IUS (2-Stage)		Very Long Baseline Inter.	1 AU	—			
			Shuttle		Gravity Probe B - Deploy	460	33			
					SMM - Retrieval	460	33			
	S8	Oct	Spacelab - P		Combined Astronomy	—	--			
	S9	Nov	Spacelab - L+P		Multi-User 82-1	400	28.5			

†Underlining designates headquarters approved flight or payload; underlined year indicates approval of all flights for that year
*Dependent on Experiment Selected from Announcement of Opportunity.

Table 5-7

(ISSUE DATE) NASA MISSIONS PLAN – FY 1980 TO 1982: CARGO MANIFEST (Continued)

†Year	†NASA Mission	Date	Configuration	Mission Description Page No.	†Payloads and Agency	Altitude (km)	Inc. (Deg)	Duration (Days)	Mission Program Office	Remarks
1982	A7	Jan	IUS (4-Stage)		Out-of-Eliptic Solar Observatory	Escape	--			
	A8	Jan	IUS (4-Stage)		Outer Planet Orbiter/Probe (Jupiter)	Escape	--			
	S10	Feb	Spacelab – L+P		Multi-User 82-2	400	57			
	A9	Apr	Shuttle		BESS – Retrieval	475	28.8			
	S11	Apr	Spacelab – L		Life Science (Mod II)	370	28.5			
	A10	May	IUS (2-Stage)		Disaster Warning	Syn.	0			
			Shuttle		LDEF – Retrieval	470	28 8			
	S12	May	Spacelab – L+P		AMPS	260x425	57			
	S13	Jun	Spacelab – L+P		Multi-User 82-4	250	55			
	S14	Jul	Spacelab – L+P		ATL Emphasis	370	55			
	A11	Aug	IUS (2-Stage)		Very Long Baseline Inter.	5,000	0			
			Shuttle		BESS – Deploy	500	28.8			
	S15	Aug	Spacelab L+P		EVAL					
	S16	Sep	Spacelab – L+P		Multi-User 82-3	350	55			
	S17	Oct	Spacelab – L		Life Science (Mod II)	370	28.5			
	S18	Nov	Spacelab – P		Astr./High Energy	--	--			
	A12	Dec	IUS (4-Stage)		Saturn, Uranus, Titan Probe	Escape	--			
	A13	Dec	Shuttle – WTR		Earth Survey Saturn	907 7	99 1			

†Underlining designates headquarters approved flight or payload, underlined year indicates approval of all flights for that year.

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Table 5-8

NASA EXPENDABLE LAUNCH VEHICLE MANIFEST

ORGANIZATION: PROGRAM DEVELOPMENT	MARSHALL SPACE FLIGHT CENTER NASA/NASA RELATED PAYLOADS EXPANDABLE LAUNCH VEHICLE MANIFEST	NAME: PD33 DATE: MAY 1976

Listed by flight sequence

FY	DATE	NO.*	PAYLOAD NAME & AGENCY	EXPENDABLE LAUNCH VEHICLE	LAUNCH SITE
1977		1	EXPLORER/OSS	DELTA	
		2	HEAO/OSS	ATLAS/CENTAUR	
		3	MARINER JUPITER SATURN/OSS	TITAN/CENTAUR	
		4	MARINER JUPITER SATURN/OSS	TITAN/CENTAUR	
		5	LANDSAT/OA	DELTA	
		6	ITOS (NOAA)	DELTA	
		7	GOES (NOAA)	DELTA	
		8	GOES/NOAA	DELTA	
1978		1	EXPLORER/OSS	DELTA	
		2	EXPLORER/OSS	DELTA	
		3	HEAO/OSS	ATLAS/CENTAUR	
		4	PIONEER VENUS/OSS	ATLAS/CENTAUR	
		5	PIONEER VENUS/OSS	ATLAS/CENTAUR	
		6	TIROS/NOAA	ATLAS F	
		7	SEASAT/OA	ATLAS F	
		8	NOAA/NOAA	ATLAS F	
		9	GOES/NOAA	DELTA	

NOTE Underlines indicate authorized or contracted payloads (vs planned)
* DOES NOT REPRESENT FLIGHT SEQUENCE.

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Table 5-8

NASA EXPANDABLE LAUNCH VEHICLE MANIFEST (Continued)

ORGANIZATION	MARSHALL SPACE FLIGHT CENTER	NAME
PROGRAM DEVELOPMENT	NASA/NASA RELATED PAYLOADS EXPANDABLE LAUNCH VEHICLE MANIFEST	PD33
		DATE MAY 1976

FY	DATE	NO.*	PAYLOAD NAME & AGENCY	EXPANDABLE LAUNCH VEHICLE	LAUNCH SITE
1979		1	EXPLORER/OSS	DELTA	WTR
		2	NIMBUS G/OA	DELTA	WTR
		3	NOAA/NOAA	ATLAS F	WTR
1980		1	EXPLORER/OSS	DELTA	WTR
		2	EXPLORER/OA	DELTA	WTR
		3	SOLAR MAX MISSION/OSS	DELTA	ETR
		4	HEAO/OSS	ATLAS/CENTAUR	ETR
		5	NOAA/NOAA	ATLAS F	WTR
		6	GOES/(NOAA)	DELTA	ETR

* DOES NOT REPRESENT FLIGHT SEQUENCE.

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Table 5-8

NASA EXPENDABLE LAUNCH VEHICLE MANIFEST (Concluded)

ORGANIZATION	MARSHALL SPACE FLIGHT CENTER	NAME
PROGRAM DEVELOPMENT	NASA/NASA RELATED PAYLOADS EXPANDABLE LAUNCH VEHICLE MANIFEST	PD33
		DATE MAY 1976

FY	DATE	NO.*	PAYLOAD NAME & AGENCY	EXPANDABLE LAUNCH VEHICLE	LAUNCH SITE
1981		1	EXPLORER/OSS	DELTA	WTR
		2	TIROS/NOAA	ATLAS F	WTR
		3	LANDSAT/OA	DELTA	WTR
		4	NOAA/NOAA	ATLAS F	WTR
		5	GOES/NOAA	DELTA	ETR
1982		1	LUNAR POLAR ORBITER/OSS	DELTA	ETR
		2	ENVIRO MONITOR/OAA	ATLAS F	WTR
		3	SEASAT/OA	ATLAS F	WTR
		4	LANDSAT/OA	DELTA	WTR
		5	NOAA/NOAA	ATLAS F	WTR
		6	EARTH RESOURCES/OA	DLETA	WTR

* DOES NOT REPRESENT FLIGHT SEQUENCE.

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5.4 NASA MISSIONS AVAILABLE RESOURCES

The excess resources available for additional payloads over and above those NASA and NASA-related payloads planned to be flown are indicated in Table 5-9. For the excess mass available, both the balance of the launch performance capability (up) and the balance of the nominal return landing limit (32,000 lbs down) are shown. These mass data, together with the volumes available, outline the deployment, retrieval, and/or round trip (sortie) payload growth available on each flight. The unpressurized up and down volumes presented are volumes available at the fuel bay diameter of 15 ft (4.72m). No unpressurized volume was assumed to be available above the Spacelab tunnel or the pallet(s). The up and down pressurized volumes available represent rack availability only, as unused spaces in the Orbiter cabin, Spacelab ceiling, subfloor, or center aisle were not considered. Additional mission margin information is presented in a Comments column.

Table 5-9

EXCESS RESOURCES AVAILABLE FOR ADDITIONAL PAYLOADS

YEAR	NASA MISSION NO	ΔMASS (kg) UP	ΔMASS (kg) DOWN	Δ VOLUME (M^3) UNPRESSURIZED UP	Δ VOLUME (M^3) UNPRESSURIZED DOWN	Δ VOLUME (M^3) PRESSURIZED UP	Δ VOLUME (M^3) PRESSURIZED DOWN	Δ POWER	Δ DATA	COMMENTS
1980	A1	29 400	7 700	1,200	600	N/A	N/A	~100%	~100%	---
	S1	14,800	1,800	0	0	1 5	1.5	TBD	TBD	---
	A2	24,800	12,200	775	775	N/A	N/A	~100%	~100%	TBD ADDITIONAL VOLUME (DOWN) AVAILABLE IN SPACE VACATED BY SSUS D/GOES
	S2	TBD	TBD	284	284	N/A	N/A	TBD	TBD	LAUNCH PERFORMANCE = 26,800 kg (S/L MASS TBD) (NOTE THIS IS A PALLET-ONLY S/L CONFIGURATION)
1981	S3	15 000	400	0	0	5.3	5 3	TBD	TBD	TWO DOUBLE RACKS ARE TWO SINGLE RACKS ARE EMPTY
	A3	11,700	12,600	232	1,200	N/A	N/A	~100%	~100%	ORBITER RETURNS EMPTY, EXCEPT FOR SHUTTLE/IUS ATTACH AND STRUCTURE AND PAYLOAD RETENTION FITTINGS, ETC
	S4	15,900	2 200	0	0	0 5	0.5	TBD	TBD	ASSUMES A 2 000 kg TRANSITION RADIATION COSMIC RAY DETECTOR PAYLOAD ON A SINGLE PALLET
	A4	7,800	7,200	497	797	N/A	N/A	TBD	TBD	ASSUMES A SPACE PROCESSING/OA PAYLOAD OF 4,784 kg ON A SINGLE PALLET ASSUMES 300 M^3 VOLUME (DOWN) AVAILABLE WHEN VACATED BY IVS/SPHINX B/C
	S/5									

Section 6: MISSION DESCRIPTIONS

Provides a detailed description of a typical mission description 2-page layout. Each mission description will consist of a standardized 2-page spread as shown on the following pages. At a rate of approximately 40 missions/year, 400 pages would be required for the mission descriptions. It is anticipated this volume would be bound in a loose-leaf binder to facilitate making change pages.

NASA MISSION S3
(NASA SPACELAB MISSION NO. 3 - MU81-1)

PREPARATION DATE: 9-23-76
REVISION DATE 10-17-76

PROGRAM INFORMATION

Planned Launch Date - 1-31-81
Program Office - NASA/OA
Mission Status - approved
Mission Assignments
- Lead Center - MSFC
- Mission Manager -
- Mission Scientists -
- POCC - TBD

STS Assignments
- STS Ops Mgr - TBD
- Orbiter - TBD
- Spacelab - TBD
- MCC - TBD

References
- S/L 3 IMAP - SE-012-019-2H

MISSION OBJECTIVE

Space Processing is primary emphasis.*
- o Science objective is low gravity processing of biological material and metallurgical samples
- o Accommodate large number of samples
- o Engineering objective includes evaluation of carrier & payload equipment

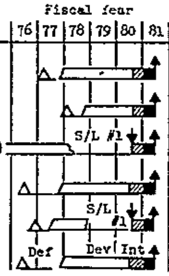
PAYLOAD DESCRIPTIONS

(all NASA payloads)

	Description	Vol (M^3)	Avg Pwr (kw)	Mass (kg)
*1	OA-Space Processing (SP-31-S) - processing and separation of large numbers of biological and metallurgical samples for isolation of certain species of proteins, enzymes or cells and crystal growth and solidification studies - rack mounted, continuous flow and stationary column electrophoresis units, furnance and controls, data system	2.4	0 6	383
*	OA-Space Processing - pallet mounted heating and levitating of materials in low gravity, furnaces, electromagnetic unit, electrophoresis unit	TBD (expmts)	TBD	TBD
3	OA-Atmospheric Cloud Physic (EO-01-S) - study physics of clouds on a microscopic level in chambers where gravity influnces are negligible - rack mounted - cloud chamber, pumps, camera, controls	1.7	1 4	507
4	OLS - Life Science Minilab (ML-2A) - rack mounted - biomed/biology, specimens cages, [illegible]	1 5	0 4	394
5	OAST - Drop Dynamics (ST-31-S) - study the dynamics, shape, formation, and modification of fluid drops in low gravity - rack mounted - drop generator, acoustic chamber, lighting, data system	1 0	0 1	209

DEVELOPMENT SCHEDULE - S/L #3 Flt

√ = Approved
S = Submitted



FACILITIES REQUIREMENTS

SPECIAL EQUIPMENT

FLIGHT EQUIPMENT

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible] film storage
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible] rack [illegible]

GROUND EQUIPMENT

- [illegible]
- [illegible]
- [illegible] freezer

NASA MISSION S3
(NASA SPACELAB MISSION NO. 3 - MU81-1)

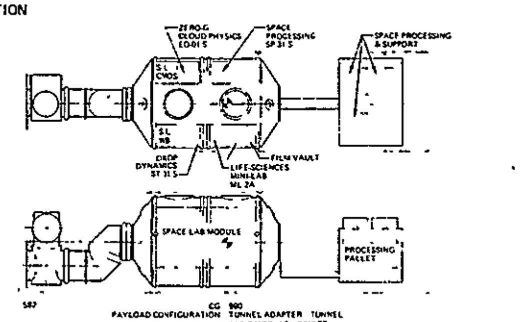
PREPARATION DATE. 9-23-76
REVISION DATE. 10-17-76

MISSION DESCRIPTION

Launch Site - KSC
Recovery Site - KSC
Orbit Inclination (Deg) - 28.5
Orbit Altitude (Km) - 370 x 370
Launch Window - -1422 EST
Flt. Attitude - X/LV (Gravity Grad.)
Mission Duration - 7 days
Expmts. Reqmts. "G" Limit 1.0E-4
Point - None
Orbit Maneuvers - None

Experiments Operations:
SP-31 - 120 hrs continuous at 1.3 kW
SP(Pallet) - TBD
EO-01 - 22 hrs at 3.2 kW
ML-2A - 20 hrs at 2.5 kW
ST-31 - 10 hrs at 0.2 kW

CONFIGURATION



NETWORK REQUIREMENTS - Expmts.

- TDRS - ku-Band, ≤ 250 Kbps
- Voice - Up/Down
- Video Down (ML-2A)
- Command Link (Expmts.) - None
- Total Mb/mission ~ 4000

GROUND SUPPORT REQUIREMENTS

- POCC - R/T Data (Except ST-31-S)
- Prelaunch Power & EC to ML-2A from T-63. Also Post-landing (Specimen Removal ASAP)
- EO-01 Cleanliness Class - 10K
- Specimen Hold. Fac at Lch & Rec Site
- Load Cryogenics (SP-31 Freezer) (ML-2A Freezer)

FLIGHT SUPPORT REQUIREMENTS

- *• Payload Power, Avg. - 5 9 kW
  Payload Power, Peak - 8.1 kW
- *• Total Energy - 972 KWH
- ML-2A require 0.4 kW Cont from Specimen Loading at T-63 to Recovery at TBD
- EO-01-S requires maximum power during operation (exclusive)
- Payload Specialists 2 to 3
- Expmts. Data Rate ≤ 250 Kbps
- Orbiter Payload Recorder
- Film Vault (Rack)
- TV/Video Recorder (ML-2A)
- Maintain Low "G" (≤ 1.0E-4) during Expmt. operations
- Furnace Venting
- Average Heat Load - 6.4 kW
- Peak Heating - 8 4 kW

*Excludes pallet mounted space processing (TBD), includes aft flight deck at 0 3 kW

WEIGHTS

WEIGHT SUMMARY - KG

		Launch	Entry
Mission Independent Orbiter Support		1389	1006
Spacelab Mission Independent (Long Module + Pallet)		5430	5430
Transfer Tunnel		346	346
Spacelab Mission Dependent		1200	1200
Spacelab Module Payload		2079	2075
Experiment equipment	1503/1499		
Crew Plus Equipment	268		
Contingency	308		
Spacelab Pallet Payload & Support		4016	4016
MISSION PAYLOAD TOTAL		14460	14073

MCDONNELL DOUGLAS

NASA MISSION A-8
(IUS (4-STAGE) WITH JUPITER OUTER PLANET ORBITER/PROBE)

PREPARATION DATE 10-15-6
REVISION DATE

PROGRAM INFORMATION

Planned Launch Date: January 1982
(fixed launch window)
Program Office NASA/OSS
Mission Status. Planned
Mission Assignments:
Lead Center. JPL
Mission Manager: TBD
Mission Scientist: TBD
POCC: JPL
STS Assignments:
STS Ops Mgr.. TBD
Orbiter: TBD
IUS: TBD
MCC: TBD

MISSION OBJECTIVE

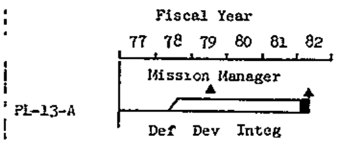
Inject the spacecraft into an Earth escape trajectory to orbit Jupiter and probe the planet's atmosphere.

PAYLOAD DESCRIPTIONS

Outer Planet Orbiter/Probe (Jup.) (PL-13-A):

Will determine Jupiter's atmospheric structure, elemental and isotopic abundances, and cloud characteristics. Will make remote measurements of the characteristics of the atmospheres of some of its satellites. Will refine measurements of the characteristics of interplanetary space. Probe instruments may include mass spectrometer, temperature and pressure gages, and accelerometers; spacecraft bus instruments may include IR radiometer, UV photometer, etc.

DEVELOPMENT SCHEDULE



SPECIAL EQUIPMENT

FLIGHT EQUIPMENT

- o IUS Support Structure/Interface
- o RTG Cooling Jackets
- o Contamination Shroud (jettisoned)

GROUND EQUIPMENT

- o IUS transport and handling (pyro, solid motors, etc.)
- o RTG handling (storage, cooling, etc.)

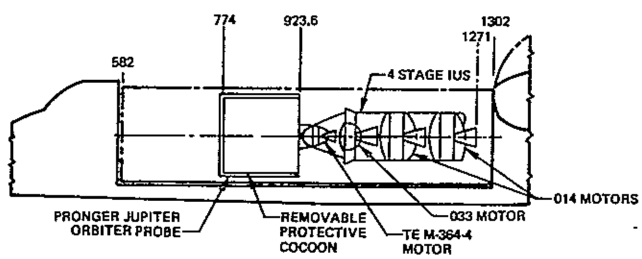
NASA MISSION A-8
(IUS (4-STAGE) WITH JUPITER OUTER PLANET ORBITER/PROBE

PREPARATION DATE 10-15-6
REVISION DATE

MISSION DESCRIPTION

Launch Site. KSC
Recovery Site: KSC
Mission (January 1982)
IUS (4-stage) with PL-13-A
Shuttle Orbit:
Inclination. 28.5
Altitude. 160 km
Payload Orbit:
C_3 = 80 km^2/sec^2
Mission Duration: 1 day
Launch Window Duration: ~ 21 days

CONFIGURATION



NETWORK REQUIREMENTS

- o TDRS - S-band/X-band (16 bps and 1200 bps)
- o DSN - S-band/X-band (16 bps and 4000 bps) (command R/T link 4000 bps)
- o Total Mb/mission (digital only) ~ 60,000

FLIGHT SUPPORT REQUIREMENTS

- o Payload Power (none required from Shuttle--payload supplies own power via RTG)
- o Data interface and checkout: Digital and Serial digital.
- o Crew requirements
  (1) mission specialist
  (checkout/deploy)
- o RTG cooling

WEIGHTS

ITEM (Kg)	LAUNCH	DOWN
FIRST STAGE @ IGN (OFF LOADED)	8235	0
SECOND STAGE @ IGN	10369	0
THIRD STAGE @ IGN	3399	0
FOURTH STAGE @ IGN	1211	0
PAYLOAD ADAPTER	0	0
PIONEER JUPITER ORBITER/PROBE	1400	0
SHROUD	520	0
SHROUD PRESSURIZATION	215	< 215
RTG COOLING	370	370
ATTACH STRUCTURE	59	59
SHUTTLE INTERFACE	1974	1974
RETENTION FITTINGS	25	25
TOTAL	27,767	< 2643

GROUND SUPPORT REQUIREMENTS

- o POCC - R/T Selective Data
- o RTG handling and installation
- o IUS handling, mating, arming/safing

NASA Mission No. A-6
(IUS [2 Stage] with VLB-I, Deploy Gravity Probe-B, and Retrieve SMM)

PREPARATION DATE 10-15-76
REVISION DATE

PROGRAM INFORMATION

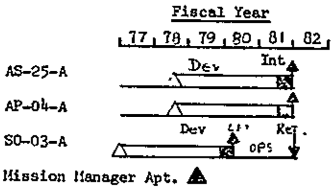
Planned Launch Date = 10-1-81
Program Office = NASA/OSS
Mission Status = Approved
Mission Assignments
- Lead Center : GSFC
- Mission Manager : TBD
- Mission Scientist: TBD
- POCC : TBD

STS Assignments
- STS Ops Mgr : TBD
- Orbiter : TBD
- IUS : TBD
- MCC : TBD

MISSION OBJECTIVE

- o Inject very long baseline interferometer into a solar orbit using a two-stage IUS
- o Deploy Gravity Probe-B Satellite
- o Retrieve Solar Maximum Mission (SMM) Satellite

DEVELOPMENT SCHEDULE



PAYLOAD DESCRIPTIONS

Very long baseline interferometer VLBI-1 (AS-25-A):
Explorers are small automated spacecraft that perform special investigations at varying altitudes of galactic and extra-galactic objects emitting in different regions of the electromagnetic spectrum. This payload will operate in the microwave spectrum from a 1AU solar orbit.

Gravity Probe-B (AP-04-A):
Will experimentally test Einstein's general theory of relativity by measuring the precession of orthogonal gyroscopes in earth orbit..

Solar max mission (SO-03-A):
Will measure brightness of selected solar phenomena visible in the UV, X-ray, and Gamma-ray regions using OSO class spacecraft. Specific study of Corona/Chromosphere interactions and other characteristics.

SPECIAL EQUIPMENT

FLIGHT EQUIPMENT

- o IUS Support Structure
- o Experiment retrieval/attach structure
- o Pallet, platform, and attach structure

GROUND EQUIPMENT

- o IUS - transport and handling
- o GN_2 and LH_e loading, vent, and purge facilities
- o SMM refurbishment facility

NASA Mission A-6
(IUS [2-stage] with VLBI-1, Deploy Gravity Probe-B, and Retrieve SMM

PREPARATION DATE 11/15/76
REVISION DATE.

MISSION DESCRIPTION

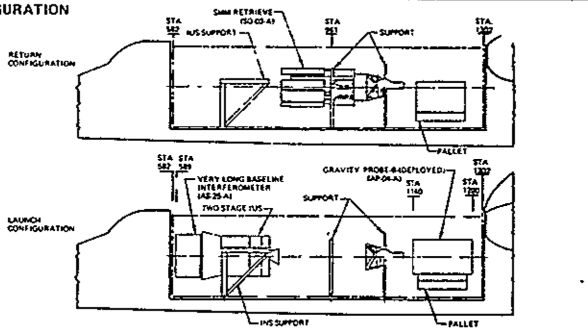
Launch Site = KSC
Recovery Site = KSC
Mission (October, 1981)
- IUS (2-stage) with AS-25-A
- Deploy: AP-04-A
- Retrieve: SO-03-A

Orbit Inclination (Deg)
- AS-25-A: -
- AP-04-A: 33
- SO-03-A: 33

Orbit Altitude (Km)
- AS-25-A: $C_3=26 Km^2/sec^2$
- AP-04-A: 460
- SO-03-A: 460

Mission Duration = 7 days
Orbit Maneuvers:
- Shuttle to point AP-04-A at guide star before release.
- Shuttle retrieval maneuvers (SO-03-A).

CONFIGURATION



NETWORK REQUIREMENTS

- o STDN - S-Band ∿ 3000 bps
- o TDRS - S-Band ∿ 11 Kbps
- o DSN - S-Band = (TBD) Kbps
- o Command Link (Expmts) < 3000 bps
- o Total Mb/mission ∿ 60

FLIGHT SUPPORT REQUIREMENTS

- o Payload Power, Avg = 400W
- o Payload Power, Peak = (TBD)W
- o Total Energy ∿5 KWH
- o Data Interface and On-orbit checkout
- o Crew requirements:
  - (1) Mission specialist (payload deploy/retrieval)

WEIGHTS (Kg)

ITEM	LAUNCH	DOWN
FIRST STAGE IUS @ IGN	10395	0
SECOND STAGE IUS @ IGN	3449	0
SHUTTLE INTERFACE (IUS)	1657	1657
PAYLOAD ADAPTER	64	0
VERY LONG BASELINE INTER	907	0
GRAVITY PROBE B	650	0
PALLET	600	600
PLATFORM	95	95
ATTACH STRUCTURE	80	80
SOLAR MAXIMUM MISSION (SMM)	0	1590
ATTACH STRUCTURE	864	864
THERMAL CONTROL & PWR DIST	95	95
RETENTION FITTINGS	420	420
PSS	45	45
TOTAL	19321	5446

GROUND SUPPORT REQUIREMENTS

- o POCC - R/T Data
- o Load Cryogenics (LH_e, GH_2)
- o Prelaunch pwr and EC
- o Payload ordinance and safing
- o Cleanliness Class = 10,000

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Section 7: PAYLOAD INDEX

Provides a 5-year payload index arranged by flight date within each discipline. The index will be separated into two parts: (1) Spacelab payloads, and (2) non-Spacelab payloads.

Table 7-1

STS MISSIONS: 5-YEAR SPACELAB PAYLOAD INDEX

P/L Ref No.	Payload	Missions	P/L Ref No.	Payload	Missions	P/L Ref No.	Payloads	Missions
	OSS			OA			OAST	
	Physics & Astronomy	12,15, 25,12		Weather				
				Environment				
	Life Science			Resources				
	NOTE: LIST BY FLIGHT DATE IN EACH DISCIPLINE			Communication			OSF	
				Space Proc			Other	

Table 7-2

STS MISSIONS: 5-YEAR NON-SPACELAB PAYLOAD INDEX

P/L Ref No.	Payload	Missions	P/L Ref No.	Payload	Missions	P/L Ref No.	Payloads	Missions
	OSS			OA			OAST	
	Physics & Astronomy			Weather				
		17,28, 35,64						
	NOTE. LIST BY FLIGHT DATE IN EACH DISCIPLINE			Environment			OSF	
	Planetary			Resources			Other	
				Communication				
	Life Science							

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Appendix D

EARLY SPACELAB MISSION ASSIGNMENTS (TASK 2.1A)

This appendix contains the methodology and results of evaluating when Mission Managers should be assigned to the early Spacelab missions. This is presented in Section D-1. This methodology was then exercised upon NASA's request for the determination of Mission Manager scheduling for the early STS automated payloads missions (Non-Spacelab, NASA/NASA-Related Missions). These results are contained in Section D-2.

D.1.1 Early Spacelab Mission Manager Assignment Results

Scheduling assessments for mission approval and mission manager assignment dates are summarized in Figure D-1 for the first 19 Spacelab missions. Mission approval analyses and documents are required prior to these dates. Firm mission start dates and schedules should be based on the results of the mission approval analyses for each mission. Mission approval leads to the definition phase and, as indicated, mission implementation (detailed planning, hardware development, etc.) begins 10 to 18 months later. As indicated in Figures D-1 and D-2, the first six missions should be approved at this time (March 1977), with two more missions (7 and 8) to be approved in 1977. The busiest year is 1978 when seven missions require approval - mostly in the last quarter. By the last quarter of 1979, all of the first 19 missions should be approved. The methodology could be updated-by experience-before that date and then subsequent missions (e.g., 1983 through 1985) assessed.

D-1.2 Early Spacelab Missions Assignment Methodology

The lead times for payload approval, funding, development, and integration activities can be substantial for some of the planned STS payloads. Therefore, as shown in Figure D-3, one of the initial study efforts was to define the tasks, functions, and scheduling with associated rationale for mission manager assignment of early Spacelab missions. This involved

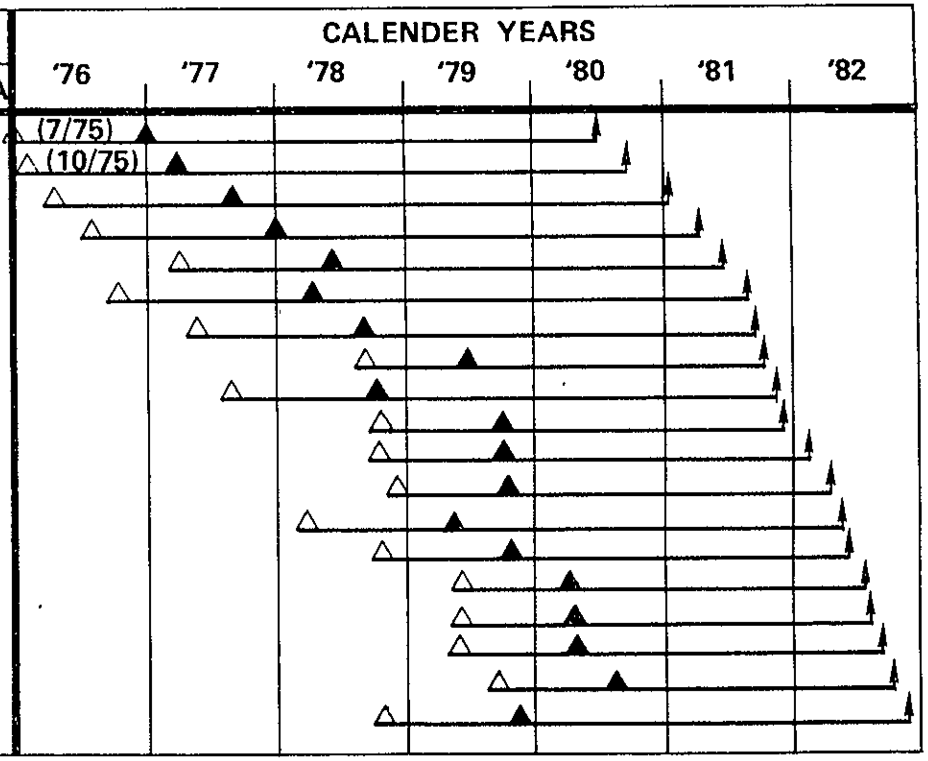
Figure D-1

EARLY SPACELAB MISSIONS SCHEDULING SUMMARY

TASK 2.1A

OBJECTIVE: DEFINE THE SCHEDULING AND RATIONAL FOR THE MISSION MANAGER ASSIGNMENT FOR EARLY SPACELAB MISSIONS

S/L FLT	SPACELAB MISSION	USERS			
		OSS	OA	OAST	ESA
1	FIRST S/L	X	X	X	X
2	SECOND S/L –AST.	X			
3	SPACE PROC. EMPHASIS	X	X	X	
4	LIFE SCIENCE MOD 1	X			
5	MU 81-3	X	X		X
6	ATL–1			X	
7*	MU 81-2		X		X
8	LIFE SCIENCE MOD 1	X			
9	PALLET ASTRO.	X			X
10	MU 82-1 (R NO. 3)	X	X	X	
11	MU 82-2		X		X
12	LIFE SCIENCE MOD 2	X		X	
13	AMPS	X			X
14	MU 82-4	X	X		X
15	ATL-2			X	
16	EVAL		X		
17	MU 82-3		X		X
18	LIFE SCIENCE MOD 2	X			
19	PALLET ASTRO	X		X	



*COMBINED WITH NO. 5 IN OCT 76

△ MISSION APPROVAL AND MANAGER ASSIGNMENT, ATP MISSION DEFINITION

▲ ATP MISSION IMPLEMENTATION, PAYLOAD SELECTION

CONCLUSION – MISSION MANAGERS SHOULD ALREADY BE APPOINTED FOR SPACELAB MISSIONS 1 THROUGH 6 (AS OF MR 1977)

Figure D-2

22697

EARLY SPACELAB MISSION MANAGER ASSIGNMENT RESULTS

SPACELAB NO.	STS FLT NO.	FLT DATE	PAYLOAD	MISSION MGR ASSIGNMENT
1	8	JUL 80	FIRST SPACELAB (L+P)	1975 - 3 QTR
2	10	OCT 80	SECOND SPACELAB (P)	1975 - 4 QTR
3	12	JAN 81	MULTI-USER (NASA)	1976 - 1 QTR
4	14	MAR 81	LIFE SCIENCE (MOD 1)	1976 - 3 QTR
5	17	JUN 81	MULTI-USER (NASA, ESA)	1977 - 1 QTR
6	19	AUG 81	ATL EMPHASIS	1976 - 4 QTR
↓				
19	48	NOV 82	ASTR/HIGH ENERGY	1978 - 4 QTR

CONCLUSION - MISSION MANAGERS (AS OF MARCH 1977) SHOULD ALREADY BE APPOINTED FOR SPACELAB MISSIONS 1 THROUGH 6

Figure D-3

22711

EARLY SPACELAB MISSION ASSIGNMENTS

OBJECTIVES:

TO DEFINE THE SCHEDULING AND RATIONAL FOR MISSION MANAGER ASSIGNMENT FOR EARLY SPACELAB MISSIONS

APPROACH:

1) DEFINE THE ROLES AND FUNCTIONS OF THE MISSION MANAGER

2) DETERMINE SCHEDULES FOR MISSION MANAGER FUNCTIONS FOR THREE BASIC CATEGORIES OF MISSION PAYLOAD MATURITY/COMPLEXITY

3) DEVELOP A METHODOLOGY FOR ASSESSING THE PAYLOAD MATURITY/COMPLEXITY

4) DEVELOP A METHODOLOGY FOR ASSESSING THE IMPACT OF PAYLOAD MATURITY/COMPLEXITY ON SPACELAB MISSION CATEGORIES AND SCHEDULES

5) UTILIZE THE METHODOLOGY TO ASSESS ASSIGNMENT LEAD TIMES FOR THE EARLY SPACELAB MISSIONS

defining the roles and functions of the mission manager, schedules for his activities, a methodology for assessing payload maturity/complexity and assessing the impact on schedules, and an evaluation of assignment lead times for the early (first two years) Spacelab missions using this methodology.

The major assumptions and guidelines used in the analysis of early Spacelab mission assignments are shown on Figure D-4. Most are self-explanatory.

The methodology used to determine the lead times needs further clarification. For each mission, twelve (12) payload related characteristics (such as payload complexity, payload integration, Spacelab configuration impact, mission flight plan, crew/training, ground operations/support, etc.) have been identified and ranked with respect to percent application in each category of payload/mission complexity (I, II, III). The values derived for each characteristic were then summed, averaged, and used to calculate the months of lead time for that payload mission. Using the flight dates defined in the mission model, one can then determine the actual month and year that mission approval and mission manager assignment should be made. This is the approach that was taken, however, it is not the only approach that could be applied, and, as such, it is considered to be only a rough guide to the timing required for mission manager assignment. More specific information and samples of the application of this methodology are given later in this presentation.

The methodology shown in Figure D-5 for assessing lead times for initiation of Spacelab missions development--specifically assignment of a mission manager and initiation of mission definition--is based on the bottom-up lead time analysis for three basic categories of missions and on an assessment methodology for evaluating each mission against a set of characteristics relative to each of the three basic categories. The methodology, while using objective factors, is basically an ordered array of subjective evaluations systematically defined and combined to produce a lead time value for each mission assessed. The methodology obviously cannot, and is not intended to, provide a rigorous schedule or lead time assessment which a specific mission project schedule analysis could provide. Rather, the intent is to provide a simple and easily applied visibility tool for

Figure D-4

MAJOR ASSUMPTIONS AND GUIDELINES FOR EARLY SPACELAB MISSION ASSIGNMENTS

- EARLY SPACELAB MISSIONS COVER THE FIRST TWO YEARS OF SPACELAB OPERATIONS
- A MISSION PROJECT BEGINS WITH THE APPROVAL OF THE MISSION APPROVAL DOCUMENT
- MISSION MANAGER SHOULD BE ASSIGNED PRIOR TO FINAL EXPERIMENT SELECTION
- EVALUATION APPLIES TO MULTI-DISCIPLINE OR MULTI-PAYLOAD MISSIONS
- GENERIC CATEGORIES OF PAYLOAD/MISSION COMPLEXITY:

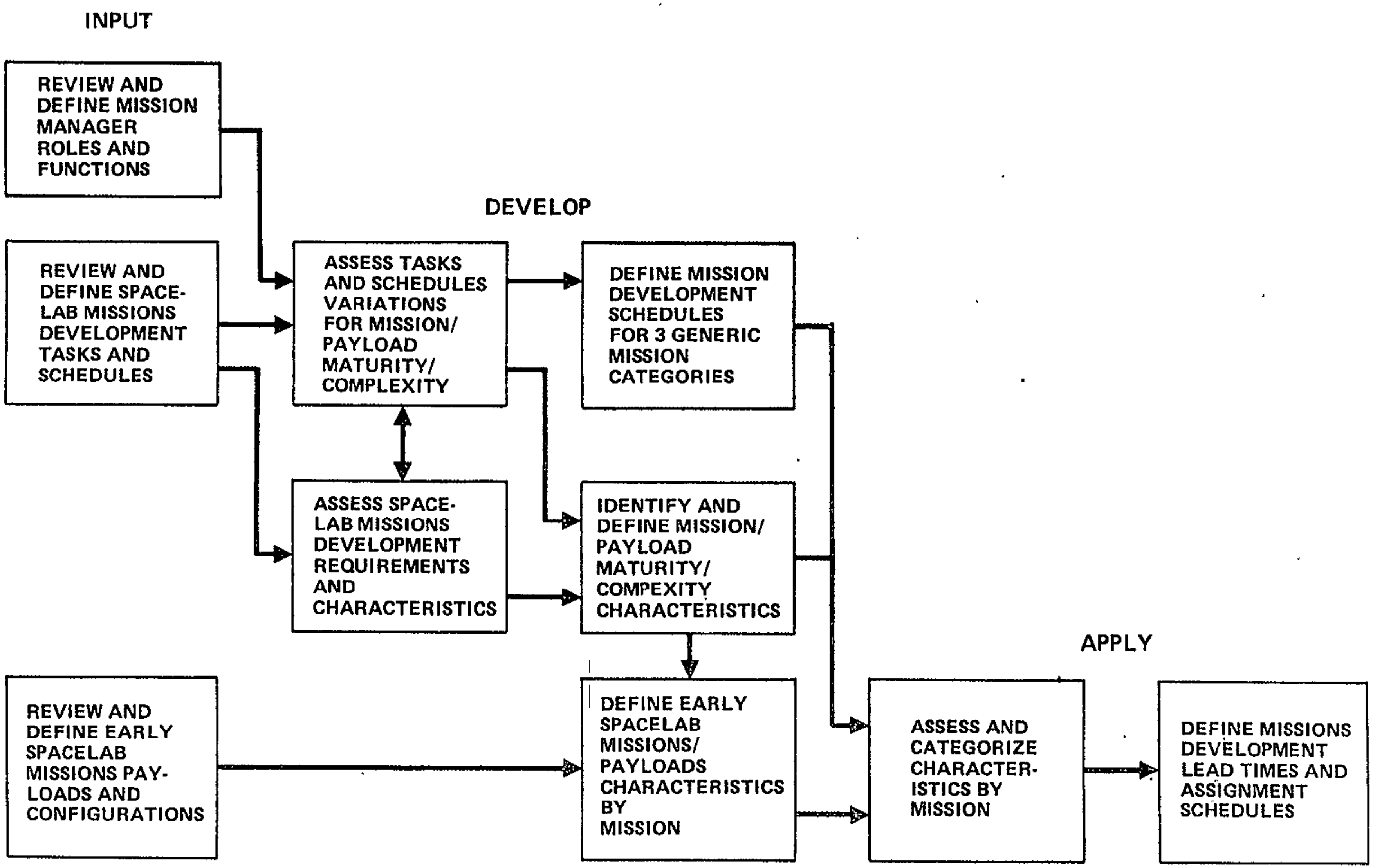
	DURATION (MONTHS)			
	PRELIM. DEFIN. PHASE	DEFINITION PHASE	DEVELOPMENT PHASE	TOTAL
I - NEW COMPLEX MISSION	7	11	42	60
II - OPERATIONAL MISSION WITH NEW PAYLOADS OF MODERATE COMPLEXITY	6	6	30	42
III - OPERATIONAL REFLIGHTS	5	5	24	34

- METHODOLOGY - FOR SPECIFIC PAYLOAD CHARACTERISTICS (12), DETERMINE PERCENT APPLICATION IN EACH CATEGORY (I, II, III); SUM; NORMALIZE; CALCULATE LEAD TIME

Figure D-5

22875

EARLY SPACELAB MISSIONS ASSIGNMENT METHODOLOGY



planning purposes and the initiation of mission approval analyses. The mission approval analyses will include the project schedule analysis to define/justify the necessary mission project lead times and schedule milestones.

The mission manager's functions and the associated products for each phase of mission development are indicated on Figure D-6. The first three tasks represent an updating and detailing of the information contained in the Mission Compatibility Analyses and leads to generation of Payload Interface Documents (ICDs) and Payload Support Requirements Documents (PSRDs). As mission manager, he is responsible for mission project management and reporting and maintains Level II control of the mission. The mission manager is responsible for supporting the carrier operator in the analytical experiment integration and for development of mission (payload) operations plans. He manages development of mission peculiar support hardware, Level IV integration, and provides support to launch site payload integration. He manages mission payload operations during flight and supports post flight payload operations and data distribution.

The Generic Mission Project Phasing shown in Figure D-7 summarizes the mission development milestones and relates these to the mission manager's functions by project phase. Thus, the mission manager, on assignment at mission approval for implementation, prepares the initial project plan for the mission and the Announcement of Opportunity (AO) release during preliminary preparations; following PAD approval, he manages mission definition and updates project plan documentation. During this phase, he develops the Payload Support Requirements Document (PSRD) initial input to the Spacelab Integrator for anlaytical experiment integration (AEI) activity. (This is subsequently updated twice--at the mission CDR, and prior to start of hands-on integration.) A key schedule driver is the need to provide mission definition to the STS operators by two years prior to flight to allow adequate time for development of detailed planning (ground and flight), training, and implementation.

Figure D-6

22876

EARLY SPACELAB MISSIONS ASSIGNMENT

MISSION MANAGER ROLES AND FUNCTIONS

	FUNCTIONS	PRODUCTS
1.	MANAGE PAYLOAD DEFINITION AND INTERFACE	• PAYLOAD MANIFEST • EXPERIMENTS SELECTION
2 AND 3.	MANAGE INTEGRATED PAYLOAD MISSION PLANNING AND INTEGRATION REQUIREMENTS ANALYSIS	• PSRDs (FLIGHT AND GROUND) • PAYLOAD ICDs
4.	MANAGE MISSION PAYLOAD PROJECT PLANNING AND IMPLEMENTATION	• PROJECT PLAN AND REVIEWS • BUDGET AND POP RESPONSE • LEVEL II CONTROL
5.	MANAGE MISSION OPERATIONS PLANNING	• AEI/COMPATIBILITY • CPSE/GSE/EQUIPMENT • PAYLOAD CHECKOUT REQUIREMENTS • PAYLOAD OPERATIONS PLANS • INTEGRATION PLANS • TRAINING PLANS
6.	MANAGE MISSION IMPLEMENTATION	• MISSION GSE/SOFTWARE • PAYLOAD CREW TRAINING • INTEGRATION (IV) • LAUNCH SITE PAYLOAD SUPPORT • FLIGHT (MISSION OPERATIONS) • DATA DISTRIBUTION

MCDONNELL DOUGLAS

Figure D-7

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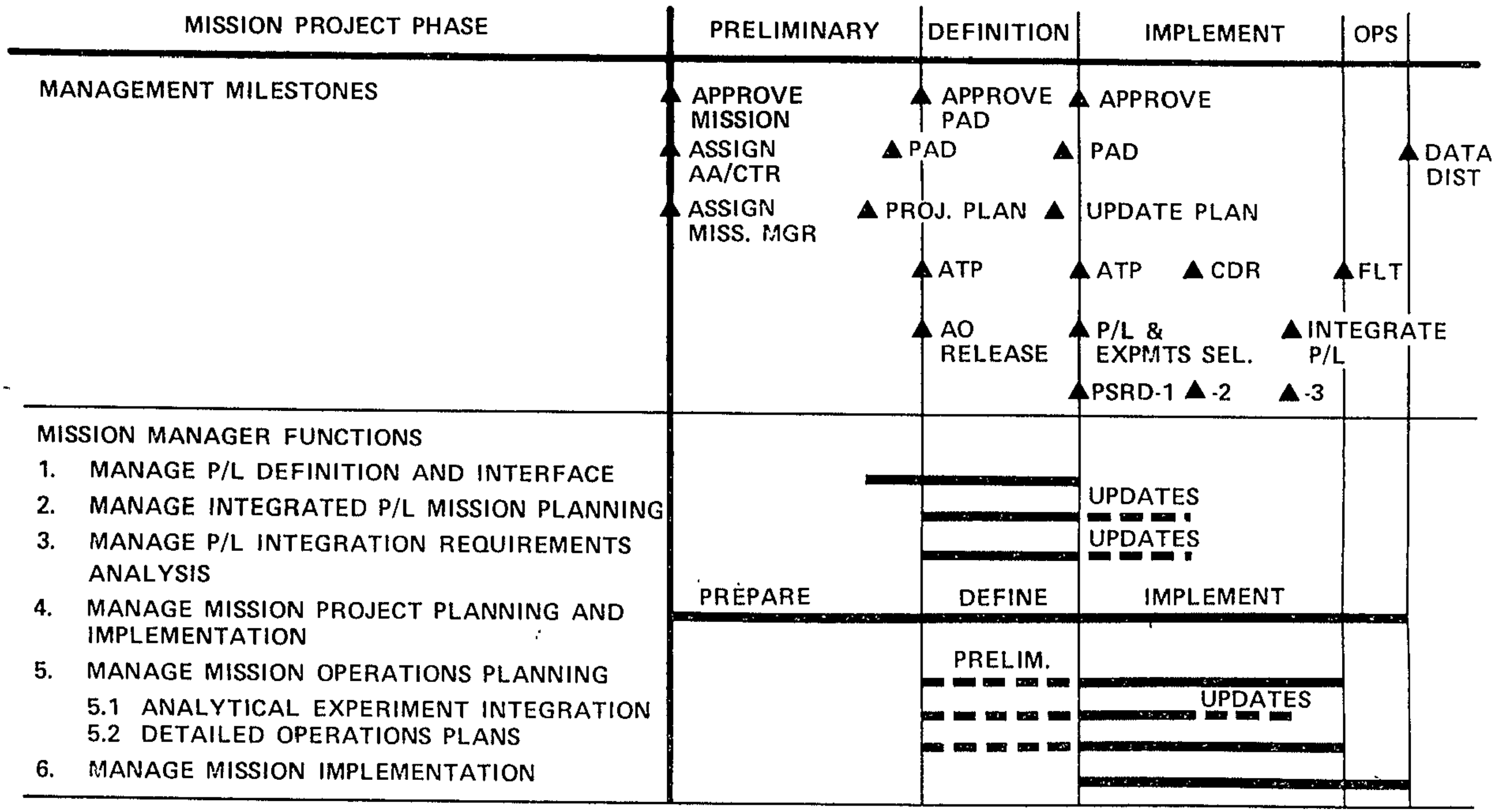
SPACELAB PAYLOADS GENERIC MISSION PROJECT PHASING



There are three different mission categories used in the assignment methodology differing by the maturity/complexity of their configurations, payloads, experiments, operations, crew, and requirements. As indicated in Figure D-8, a Category I mission is essentially a completely new mission in all aspects, while a Category II mission primarily uses standard or previously-tested configurations and operations--although new payloads, experiments, and crew may be involved. Category III is a reflight of the same (or slightly modified) payload to the same or similar flight plan but new experiments, PIs, and even crew may be allowed. Assessment of these criteria is a matter of experienced judgement by personnel familiar with the mission. Seldom would a specific mission fall completely in a single category--assessment of each mission characteristic is proportioned between the categories and the summation of the individual assessments in each category are converted into lead time requirements.

Detailed task scheduling was prepared for the three different mission categories. The scheduling of the Mission Manager's top level functions were performed in each case. The tasks have been correlated with the May, 1976 Spacelab Program schedules as well as various planning schedules.

The various tasks and functions which the Mission Manager must perform/manage or interface with are delineated in Figure D-9 under six top level functions along with schedule estimates (in months to launch) for each task. Scheduling of tasks were constrained to planned or logical predecessor/successor sequence and/or to already fairly firm milestones (e.g., start Level IV integration, start operations planning, etc.). This figure presents schedules for a Category I mission, indicating that up to 60 months-or five years-prior to launch the mission should be assigned to a mission manager to initiate development. Category I schedules are based on Spacelab Missions 1 and 2 master schedules. The 60-month lead time is sufficient to allow on-line (post-approval) payload development.

Figure D-8

22877

EARLY SPACELAB MISSIONS ASSIGNMENT

MISSION CATEGORIES

CATEGORY I - EARLY MISSIONS (E.G. S/L 1-6), OR COMPLEX NEW MISSIONS/PAYLOADS (E.G. AMPS)
- NEW OPERATIONS/INTERFACES/EQUIPMENT

CATEGORY II - OPERATIONAL MISSIONS
- MODERATE COMPLEXITY, NEW PAYLOADS
- PRIMARILY USING STANDARD OR PREVIOUSLY DEVELOPED OPERATIONS/INTERFACES/EQUIPMENT

CATEGORY III - OPERATIONAL REFLIGHT
- SAME MISSION AND PAYLOAD (INTEGRATED)
- SAME/SIMILAR OPERATIONS/INTERFACES/EQUIPMENT; NEW EXPERIMENTS

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Figure D-9

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SPACELAB PAYLOADS MISSION MANAGER

MISSION CATEGORY I

TOP LEVEL ROLES AND FUNCTIONS

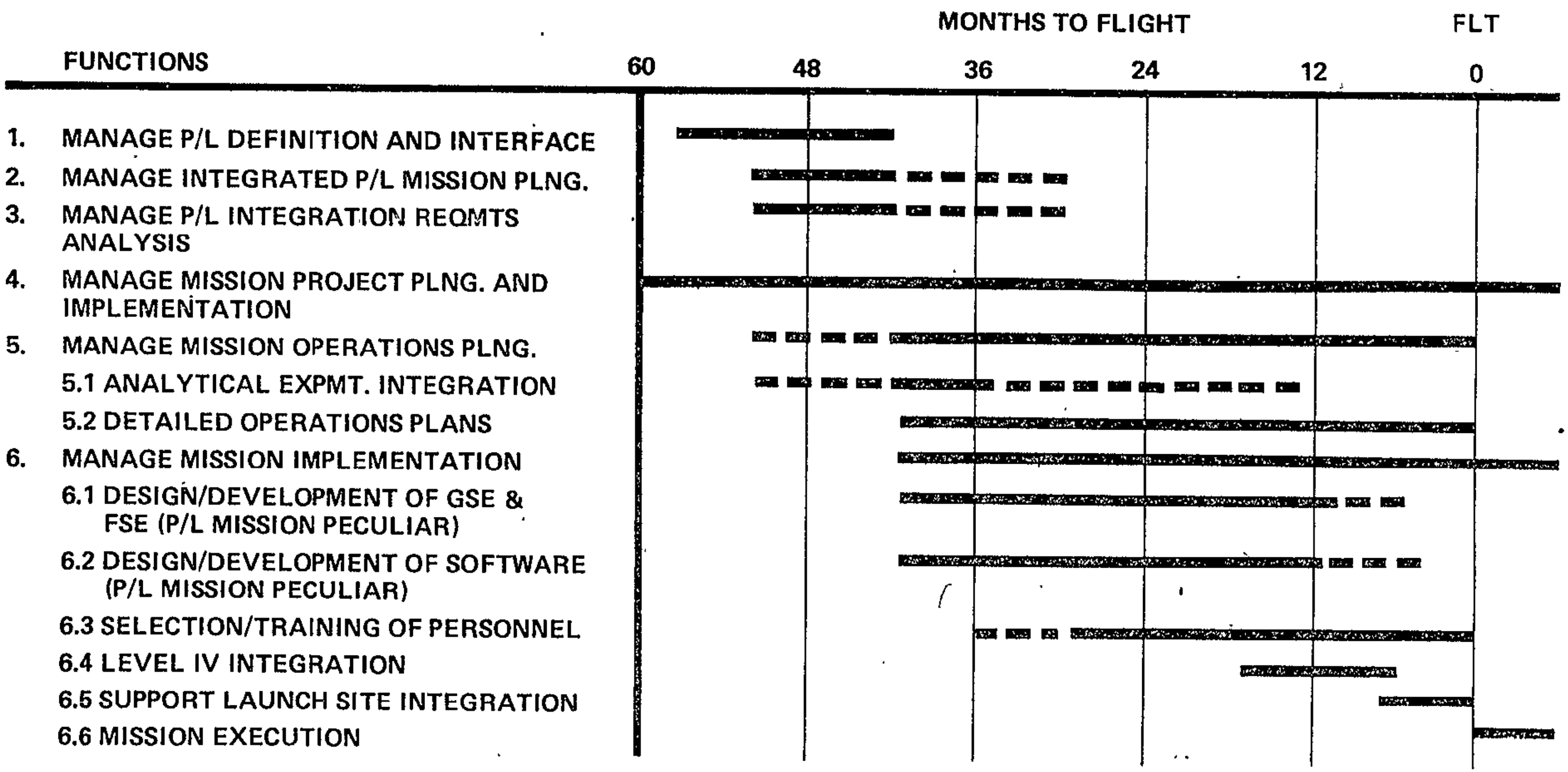

Figure D-10 presents the mission manager assignment lead time for standard operational (Category II) Spacelab missions. Lead time requirements for Category II is 42 months or 3-1/2 years. The major reduction from Category I schedules are in mission operations planning and implementation/integration. This category would not allow time for development of major new items of mission peculiar equipment or major new payloads (on-line).

Figure D-11 details the lead time (34 months) for reflight missions. Category III lead time is based on flying the same integrated payload over essentially the same mission profile and operations timeline; however, some variations within mission margins are acceptable along with new experiments and new crew (training).

A summary of the preceding results for the three basic mission categories is shown in Figure D-12 and relates them to the key mission development milestones. It can be seen that the largest single reduction in lead time occurs in the Level IV integration time.

To assess the space missions against the basic mission categories, a set of twelve mission and project characteristics were defined and assessed against each category. Figure D-13 presents the characteristics representative assessment against each basic category. The Spacelab configuration, for instance, may be new - i.e., never flown before - or a tested (flown) standard. Individual or integrated payloads may be new and complex, new and simpler, or have flown before on a similar mission. Interfaces may be standard with ample margins or new and complex. Key personnel - Mission Manager, P.I.'s, crew - may be new or experienced. A mission with many different payloads, experiments, and P.I.'s will tend to be more complex and difficult to integrate. The assessment of each characteristic in each category is intended as a guide to ordered assessment and not as a rigorous condition to be imposed on the assessment.

Figure D-10

SPACELAB PAYLOADS MISSION MANAGER

MISSION CATEGORY II

TOP LEVEL ROLES AND FUNCTIONS

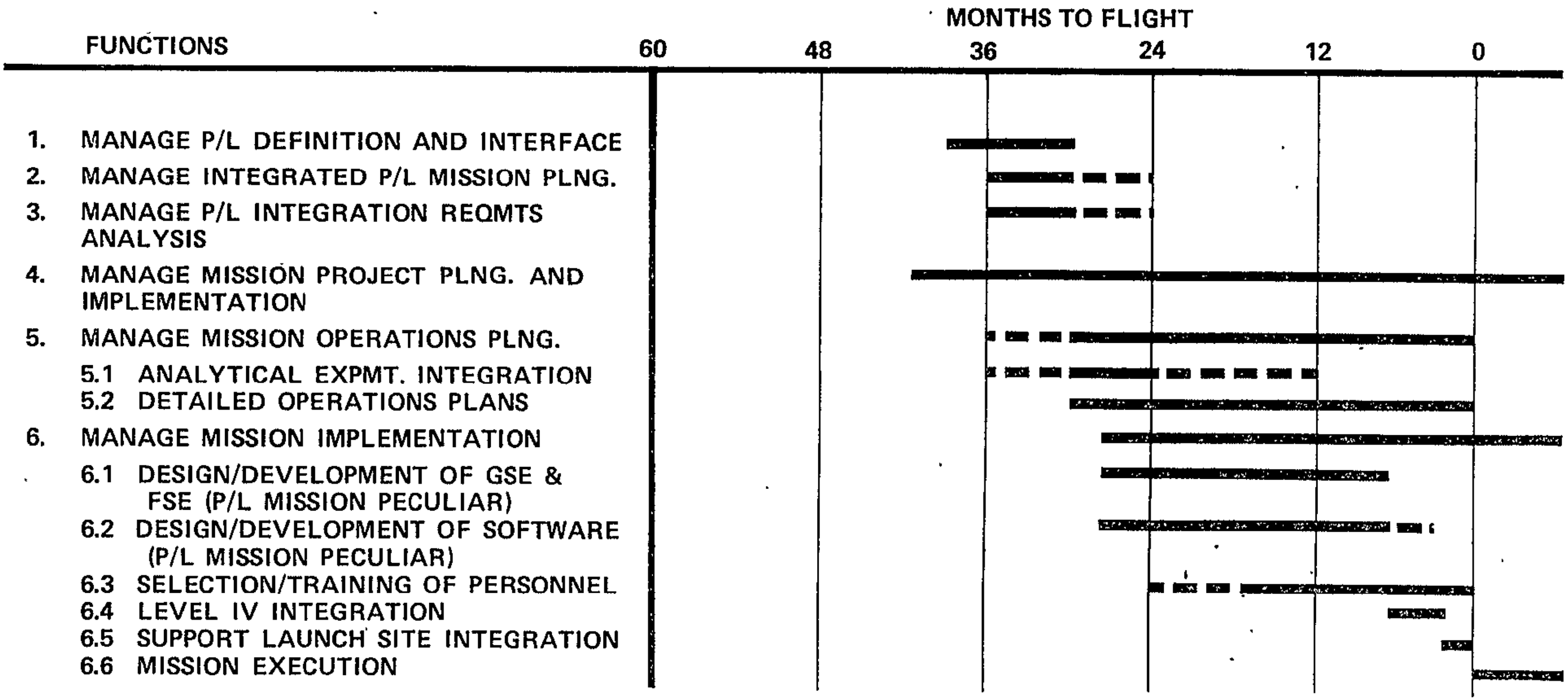

Figure D-11

SPACELAB PAYLOADS MISSION MANAGER

MISSION CATEGORY III

TOP LEVEL ROLES AND FUNCTIONS

FUNCTIONS

1. MANAGE P/L DEFINITION AND INTERFACE
2. MANAGE INTEGRATED P/L MISSION PLNG.
3. MANAGE P/L INTEGRATION REQMTS ANALYSIS
4. MANAGE MISSION PROJECT PLNG. AND IMPLEMENTATION
5. MANAGE MISSION OPERATIONS PLNG.
   - 5.1 ANALYTICAL EXPMT. INTEGRATION
   - 5.2 DETAILED OPERATIONS PLANS
6. MANAGE MISSION IMPLEMENTATION
   - 6.1 DESIGN/DEVELOPMENT OF GSE & FSE (P/L MISSION PECULIAR)
   - 6.2 DESIGN/DEVELOPMENT OF SOFTWARE (P/L MISSION PECULIAR)
   - 6.3 SELECTION/TRAINING OF PERSONNEL
   - 6.4 LEVEL IV INTEGRATION
   - 6.5 SUPPORT LAUNCH SITE INTEGRATION
   - 6.6 MISSION EXECUTION

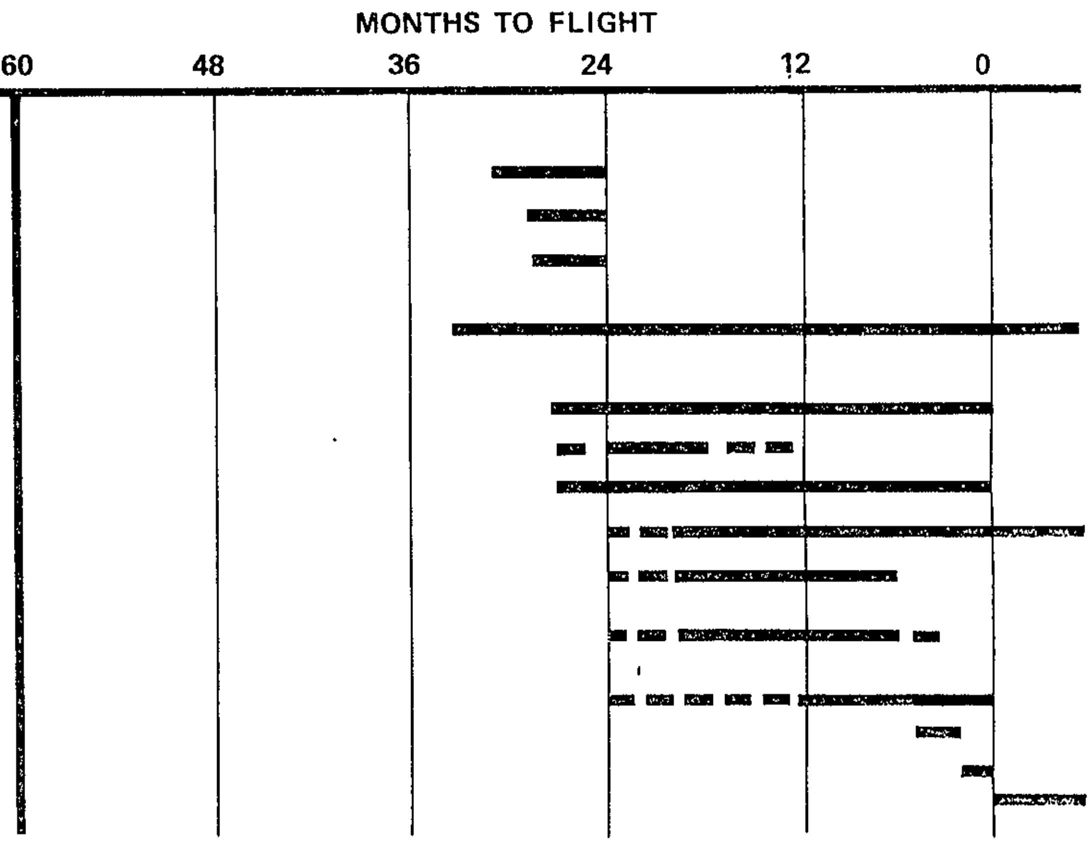

Figure D-12

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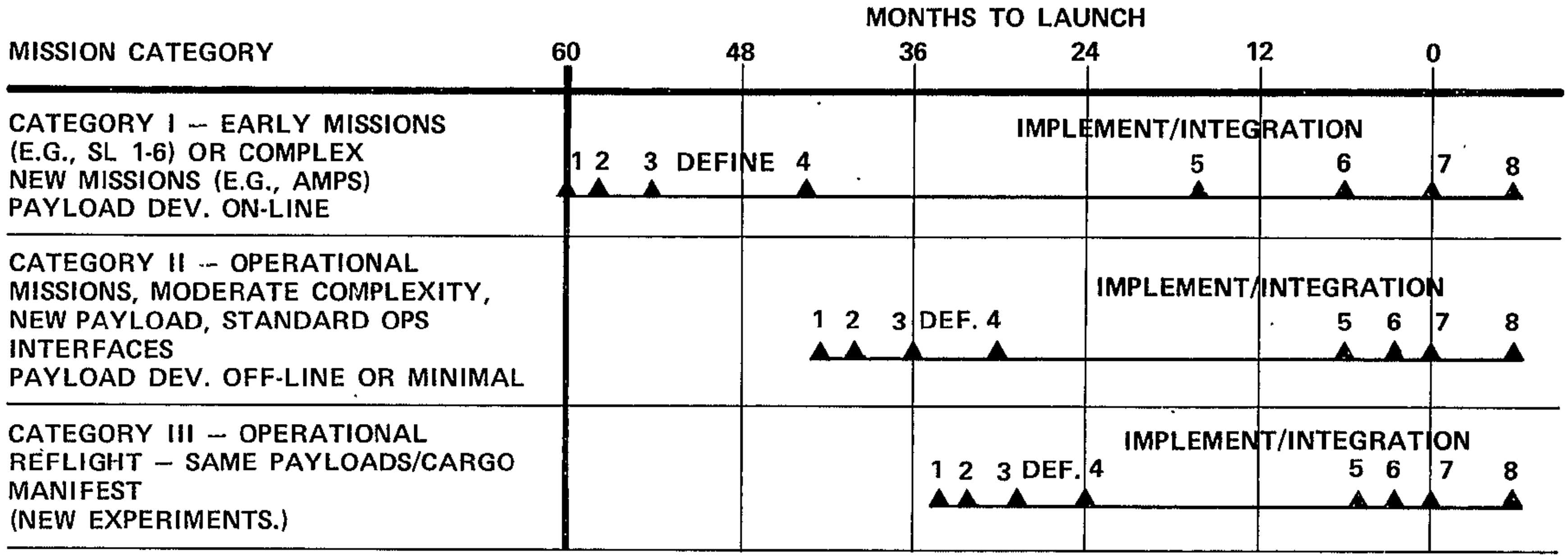
SPACELAB BASIC MISSION CATEGORIES DEVELOPMENT LEAD TIMES



NOTES:
(1) MISSION MANAGER ASSIGNED
(2) PROJECT PLAN SUBMITTAL TO AA
(3) PAD APPROVAL AND FUNDING RELEASE, START DEFINITION
(4) START MISSION IMPLEMENTATION (PAYLOAD SELECTED)
(5) START LEVEL IV INTEGRATION
(6) START LEVEL III/II INTEGRATION
(7) FLIGHT OPERATIONS
(8) POST MISSION REPORTS

Figure D-13

22798

SPACELAB MISSIONS CATEGORIES CHARACTERISTICS

MISSION CATEGORY	I	II	III
	INCLUDES EARLY DEVELOPMENT MISSIONS AND NEW COMPLEX PAYLOADS	OPERATIONAL PHASE AND MODERATELY COMPLEX NEW PAYLOADS	OPERATIONAL REFLIGHT - SAME PAYLOADS
LEAD TIME - VALUE (MONTHS)	60	42	34
PAYLOAD DEVELOPMENT (PRIMARY)	ON-LINE	OFF-LINE	N/A (OFF-LINE)
CHARACTERISTICS			
SPACELAB CONFIGURATION	NEW	STD	SAME
PAYLOADS (INDIVIDUAL INSTRUMENTS ---)	NEW/COMPLEX	NEW	SAME
INTEGRATED PAYLOAD	NEW/COMPLEX	NEW	SAME
EXPERIMENTS	NEW/COMPLEX	NEW	NEW/SIMILAR
MISSION FLIGHT PLAN	NEW/COMPLEX	STD	SIMILAR
PAYLOAD INTERFACES/ACCOMODATIONS	NEW/COMPLEX	STD/MARGINS	SAME/MINIMAL
PAYLOAD RESOURCES TIMELINE	NEW/COMPLEX	STD/MARGINS	SIMILAR
CREW (PERSONNEL)/TRAINING	NEW/COMPLEX	STD	SAME/SIMILAR
GROUND OPERATIONS AND SUPPORT	NEW/COMPLEX	STD	SAME/SIMILAR
MISSION MANAGER	NEW	NEW/EXPERIENCED	SAME/EXPERIENCED
EXPERIMENTERS/PI'S	NEW	NEW/EXPERIENCED	NEW/EXPEREIENCED

Definition of Characteristics

1. Spacelab Configuration — The first time a specific S/L configuration is used it ranks a new (I) - this applies to the major elements, e.g., long module plus one pallet, etc. If one of the "standard" S/L configurations, subsequent uses are assessed a II (operational) or III (if same cargo manifest, kits, etc.).
2. Payloads - Individual payloads are assessed as to whether they are new payloads (never flown) or reflights. The payload assessment is split into the percentage that individual instruments fit into each category. Thus, for a group of 6 moderately complex payloads, 3 of which have flown before the assessment is 0.5 (II) and 0.5 (III). For early missions (up through mission 6) and new complex payloads (e.g., solar fine pointing), on-line development Category I is indicated.
3. Integrated Payload - Integrated payload characteristic is assessed as a single element - i.e., an integrated payload of instruments, each of which have flown before but not together, is primarily a new (II) payload. Only a group of instruments that have all flown together before in essential the same configuration (same cargo manifest) can be completely evaluated as a reflight (III).
4. Experiments - Experiments can be new in any of the three categories - they are essentially associated with the categories of their individual instruments (which may be new or reflights). This characteristics is provided to reinforce and/or modify the payload categorization and allow that reflights (III) can accept new experiments. Experiments assessments should reflect the newness or complexity of payload operations and their potential impact on mission development requirements.
5. Mission Flight Plan - This assesses the degree of difficulty of the mission flight profile and attitude requirements - e.g., extremely low-g flight, complex mutliple maneuvers or attitudes requirements would be assessed in Category I, at least for early missions. More standard or developed profiles would be Category II, a simple standard or repeat profile, Category III. As for the other characteristics, assessments can be split (proportioned) among the categories.
6. Payload Interfaces/Accommodations - This characteristic allows assessment of the complexity and difficulty of accommodating the integrated payload interfaces - between payloads (compatibility) and with the STS/Spacelab.

Volume, mass, and c.g. margins, number of individual payloads and their size/requirements/complexity, etc., are factors to consider in assessing the interface accommodations. This characteristic assesses payload physical and environmental accommodation requirements (e.g., dimensions, mass, cleanliness, acoustics, etc.) Generally a new, complex payload - emphasis is on accommodating the integrated (total) payload - would be Category I, a simple or moderately complex payload which has flown before (on STS) would be Category III. Requirements for on-line development of new mission support equipment - not already initiated - requires Category I unless very simple item or modification of existing equipment (Category II); Category III allows only minor mods/updates. Assessment may be proportioned between categories but longest lead time assessment should dominate.

7. Payload Resources Timelines - This assesses the resource requirements that the integrated payload imposes on the STS/Spacelab. New payloads imposing high power, heat rejection, data stream, etc., requirements on the STS subsystems are assessed in Category I and/or II - depending on the margins and complexity (timeline, multiple demands, etc.). Resource requirements within standard allowance and margins would be Category II. Payloads requiring special or new flight support equipment (APPS, IPS, etc.) would tend toward Category I. Assessment may be proportioned between categories but longest lead time assessment should dominate.
8. Crew/Training - This assessment characterizes the crew size, complexity of crew flight operations, and crew requirements. Multi-discipline missions requiring much crew-payload operations with new payloads, especially EVA operations, would tend toward Category I assessment. Repeats of previous missions with similar operations and the same payload would be Category III. Category II applies to less complex and single discipline type payloads, especially those involving primarily standardized types of crew operations. The assessment should reflect the impact on the lead times for developing a training plan, training aids and equipment programs (if required), and for training a crew for the mission. The assessment may be proportioned between categories.
9. Ground Operations and Support - Assesses newness and complexity of payload integration and support operations - impact on lead times for planning (integration plans, etc.), mission support equipment development (GSE, software), and payload integration (Levels I-IV). This requires consi-

deration of the configuration complexity (racks/pallets, etc.), number of different payloads and users (increased integration coordination), and unique or new support requirements (not previously provided or used for preceding missions). Early missions and complex multi-user new payloads with many racks would be assessed as Category I dominant - also missions requiring on-line development of new major GSE or other support items. Otherwise, Category II (new payloads) or Category III (reflight) would be the dominant assessments.

10. Mission Manager - This assessment modifies or reinforces the basic characteristics of the mission as early mission (Category I), operational new (Category II), or operational reflight (Category III). The assessment reflects that new mission managers should require longer lead times than experienced mission managers - especially in the early mission formulation phase. Early missions of necessity have new (inexperienced) mission managers (Category I) whereas operational missions will have more experienced or better prepared managers (Category II). Reflights, if managed by the same manager as the initial mission are assessed as Category III (otherwise Category II may apply).

11. Experimenters/PI's - This assessment reflects the newness and complexity imposed on the mission project by (1) new or inexperienced PI's, and (2) the number of different PI's involved in a given flight - i.e., the more inexperienced PI's the longer and more difficult will be the experiment planning and integration tasks, the more experiment interface problems will arise, and the more formal coordination required. Factors in assessing this are: (1) as the program becomes operational more (Spacelab) experienced PI's are participating (i.e., early missions rate Category I, later missions Category II or Category III repeats) and (2) more payloads involved on a flight means potentially more PI's involved (not always). The second factor may allow assessment bias toward the higher lead time categories. Assessments may be proportioned between categories with consideration of the payloads and experiments assessments.

12. Remarks - This assessment characterizes the basic overall assessment of the mission - i.e., early, new or repeat, complex, standard, or special (unique). It also should reflect whether mission payloads or support equipment are developed primarily on-line (Category I) or off-line (Category II or III).

As an aid in assessing the characteristics of any given mission, several factors should be considered for each characteristic. Figure D-14 indicates one set of such factors. The higher the demand factor in each case, i.e., early, new, complex, special, multiple, low margins, high performance, equipment development, the more the characteristic assessment is in Category I. If the characteristic is not new (see exceptions), is a repeat or similar, not highly complex and marginal, and requires little or no equipment or payload development, the more it may tend to Category III. Once operational, most Spacelab missions using standard interfaces and operations should center on Category II assessment.

The payloads for the first 19 Spacelab Missions are identified in Figure D-15. A summary of the basic payload characteristics of the 19 early Spacelab missions is shown in Figure D-16 based on the Early STS Missions Plans, June 22, 1976, and specific mission documents on Spacelab Missions 1-4. Gross assumptions are made on some of the less defined missions, especially ATL and EVAL. The number of new payloads and repeat payloads are identified for each flight as well as the users (OSS, OA, OAST, ESA) who have one or more payloads on a flight. Those flights with only monolithic payload designations are assumed to have large complex (multi-instrument) payloads. Those flights which appear to be single user payloads are designated, as well as those flights which appear to be repeats of previous flights.

An Example Spacelab Mission Assessment is shown in Figure D-17 and illustrates the use of the methodology for Spacelab Mission 11, which is a short module + pallet mission with most of the same payloads as Mission 7.

Each characteristic is assessed as to the degree (0 to 1.0) it fits in each of the three mission categories. This assessment should be based on the experienced judgement of personnel familiar with the mission reviewing the characteristics of the mission relative to preceding missions, e.g., whether a new Spacelab configuration is involved, how many of the instruments have been flown before, is the mission flight plan "standard" or unique, are there new or non-standard timelines or interfaces involved, are new experimenters/PI's involved, etc.

Figure D-14

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MISSION CHARACTERISTICS ASSESSMENTS

(FACTORS TO BE CONSIDERED IN ASSESSMENT)

CHARACTERISTIC \ ASSESSMENT FACTOR	EARLY MISSIONS	NEW OR REPEATS	COMPLEX-ITY	STD. OR SPECIAL	MULTI-PLICITY	MARGINS (PHYSICAL)	PERFORM. (FUNCT.)	EQPT DEV.	ON-LINE VS OFF-LINE
1. S/L CONFIGURATION	X	X							
2. PAYLOADS (INDIVIDUAL)		X	X						X
3. INTEGRATED PAYLOAD		X	X		X				X
4. EXPERIMENTS			X		X				
5. MISSION FLIGHT PLAN			X	X			X		
6. P/L INTERFACE/ACCOM-MODATIONS		X	X	X	X	X		X	X
7. P/L RESOURCES TIMELINES		X	X	X	X	X	X	X	X
8. CREW/TRAINING	X	X	X	X	X		X	X	X
9. GROUND OPS & SUPPORT	X	X	X	X	X			X	X
10. MISSION MANAGER	X	X							
11. EXPERIMENTERS/PI'S		X			X				
12. REMARKS	X	X	X	X					X

Figure D-15

SPACELAB MISSIONS (JUNE, 1976 PLAN)

Elements / S/L Flt. #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
S/L Module	L	O	L	L	L	S	S	L	O	L	S	L	S	L	S	S	L	L	O
S/L Pallets	1	4	1	0	1	2	3	0	5	1	3	0	3	1	2	?	1	0	5
OSS																			
COL-2A (carry on)	X		X	X				X											
AP-09-S Elect. Accel.	X																		
AP-13-S LLLTV	X	X																	
SO-11-S 65 cm Photoheliograph		X																	
SO-11-S Solar Monitor Pkg		X																	
SO-11-S Solar X-Ray Telescope		X							X										
SO-11-S Lyman α/WL Coronograph		X																	
SO-11-S X-Ray Burst Det.		X							X										
HEA Cosmic X-Ray Telescope		X																	
AS-42-S EUV Schmidt/Spect.		X							X										
AS UV Imag. Telescope		X							X										
HE-25-S Transition Rad. Spec.		X							X										
ML-1A (LS Minilab)			X		X					X				X					
LS-09-S (Mod-1)				X				X											
UV Spect/Photometer									X										
Dbl. Scat. Neutron & γ Teles.									X										
X-Ray Spectrograph									X										X
XUV Spectroheliograph									X										X
LS-09-S (Mod-2)												X						X	
AP-06-S (AMPS)													X						
Hard X-Ray Imag Telescope																			X
Negatron-Position Expt																			X
Ionization Spectrometer																			X
Low Energy Expt.																			X
IUE Spectrograph																			X
Small IR Cryo Telescope																			X
OA																			
EO-01-S Zero g Cloud Physics	X		X							X									
EO-19-S MK II Interferometer					X												X		
SP-31-S Space Processing			X																
ESP-100 Electrophoresis			X							X									
-200 APPS Multi Furnace			X							X									
-500 EM Levitation			X							X									
CN-21-S BW Compress Mod Expt					X														
CN-16-S Adapt Multibeam Ant.					X												X		
CN-04-S RFI Survey							X				X								
CN-08-S TWT							X												
EO-20-S App Imag Radar							X				X								
CN-07-S Lg Deply Ant											X								
EO-21-S Shuttle Imag. Radar														X					
EVAL																X			
OAST																			
ST-31-S Drop Dynamics	X		X							X									
ATL:																			
Space Enviro effects on Composites						X									X				
Large Space Structures						X									X				
End to End Info System						X									X				
Adv Heat Pipe						X									X				
Enviro Column Density Monitor						X									X				
Modular Inst Point Technology Lab						X									X				
Solar Array Materials						X									X				
Superfluid He Properties						X									X				
Aerospace Sensing						X									X				
LS-Adv Tech. Eqpt Dev.												X						X	
ESA																			
APE-01 Lidar	X						X												
APE-07 IR radiometer	X						X										X		
LSE-03 Sled														X					
ASE-01 WF Galactic Camera	X								X										
EOE-01 Metric Camera	X						X							X			X		
SPE-01 FF Electrophoresis	X				X									X			X		
SPE-80-85 Space Processing	X				X									X			X		
STE-10 Heat Pipe	X				X									X					
Grille Spectrometer	X																		
CNE-01 One Way Nav					X												X		
EOE-07 MW Rad/Scat/Alt							X				X						X		
ASE-12 Lyman α									X										
Plasma/Magnet Subsat													X						

MCDONNELL DOUGLAS

Chart 4

SPACELAB MISSIONS (June, 1976 PLAN)

Elements / S/L Flt. #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
S/L Module	L	O	L	L	L	S	S	L	O	L	S	L	S	L	S	S	L	L	O
S/L Pallets	1	4	1	0	1	2	3	0	5	1	3	0	3	1	2	2	1	0	5
OSS																			
COL-2A (carry on)	X		X	X				X											
AP-09-S Elect. Accel.	X																		
AP-13-S LLLTV	X	X																	
SO-11-S 65 cm Photoheliograph		X																	
SO-11-S Solar Monitor Pkg		X																	
SO-11-S Solar X-Ray Telescope		X							X										
SO-11-S Lyman∝/WL Coronograph		X																	
SO-11-S X-Ray Burst Det.		X							X										
HEA Cosmic X-Ray Telescope		X																	
AS-42-S FUV Schmidt/Spect.		X							X										
AS UV Imag. Telescope		X							X										
HE-25-S Transition Rad. Spec.		X							X										
ML-1A (LS Minilab)			X		X					X				X					
LS-09-S (Mod-1)				X				X											
UV Spect/Photometer									X										
Dbl. Scat. Neutron & γ Teles.									X										
X-Ray Spectrograph									X										X
XUV Spectroheliograph									X										X
LS-09-S (Mod-2)												X						X	
AP-06-S (AMPS)													X						
Hard X-Ray Imag Telescope																			X
Negatron-Position Expt																			X
Ionization Spectrometer																			X
Low Energy Expt.																			X
IUE Spectrograph																			X
Small IR Cryo Telescope																			X
OA																			
EO-01-S Zero g Cloud Physics	X		X							X									
EO-19-S MK II Interferometer					X												X		
SP-31-S Space Processing			X																
ESP-100 Electrophoresis (APPS)			X							X									
-200 APPS Multi Furnace			X							X									
-500 EM Levitation (APPS)			X							X									
CN-21-S BW Compress Mod Expt					X														
CN-16-S Adapt Multibeam Ant.					X												X		
CN-04-S RFI Survey							X				X								
CN-08-S TWT							X												
EO-20-S App Imag Radar							X				X								
CN-07-S Lg Deply Ant											X								
EO-21-S Shuttle Imag. Radar														X					
EVAL																X			
OAST																			
ST-31-S Drop Dynamics	X		X							X									
ATL:																			
Space Enviro effects on Composites						X									X				
Large Space Structures						X									X				
End to End Info System						X									X				
Adv Heat Pipe						X									X				
Enviro Column Density Monitor						X									X				
Modular Inst Point Technology Lab						X									X				
Solar Array Materials						X									X				
Superfluid He Properties						X									X				
Aerospace Sensing						X									X				
LS-Adv Tech. Eqpt Dev.												X						X	
ESA																			
APE-01 Lidar	X						X												
APE-07 IR radiometer	X						X										X		
LSE-03 Sled														X					
ASE-01 WF Galactic Camera	X								X										
EOE-01 Metric Camera	X						X							X			X		
SPE-01 FF Electrophoresis	X				X									X			X		
SPE-80-85 Space Processing	X				X									X			X		
STE-10 Heat Pipe	X				X									X					
Grille Spectrometer	X																		
CNE-01 One Way Nav					X												X		
EOE-07 MW Rad/Scat/Alt							X				X						X		
ASE-12 Lyman ∝									X										
Plasma/Magnet Subsat													X						

Figure D-16

EARLY SPACELAB MISSIONS

S/L FLT NO.	1	2	3	4	5	6	7	4 / 8	9	3 / 10	11	12	13	14	6 / 15	16	17	12 / 18	19
S/L CONFIGURATION*	N	N	R	N	R	N	N	R	N	R	R	R	R	R	R	R	R	R	R
NEW PAYLOADS	13	10	5	1**	4	1**	4	0	5	0	1	1**	2**	2	0	1**	0	0	6
REPEAT PAYLOADS	0	0	3	1	4	0	3	2**	6	6	3	0	0	6	1**	0	8	1**	2
% NEW PAYLOADS	1.0	1.0	.6	.8	.5	1.0	.6	0	.5	0	.3	1.0	1.0	.3	0	1.0	0	0	.8
USERS: OSS	X	(X)	X	(X)	X	—	—	(X)	X	X	—	(X)	X	X	—	—	—	(X)	(X)
OA	X	—	X	—	X	—	X	—	—	X	X	—	—	X	—	(X)	X	—	—
OAST	X	—	X	—	—	(X)	—	—	—	X	—	X	—	—	(X)	—	—	X	—
ESA	X	—	—	—	X	—	X	—	X	—	X	—	X	X	—	—	X	—	—
STS FLT NO.	8	10	12	14	17	19	21	23	25	27	30	34	36	38	40	42	44	46	48

NOTES
*N = NEW, R = REPEAT
** = LARGE COMPLEX (MULTI INSTRUMENT) PAYLOAD
(X) = DEDICATED MISSION (SINGLE USER)
[ ] = REPEAT MISSION (SAME CARGO MANIFEST)

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Figure D-17

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ASSESSMENT METHODOLOGY SPACELAB MISSIONS CLASSIFICATIONS

EXAMPLE SL#11, MU82-2, FLT 2/82 (SIMILAR TO SL#7) SM + PALLET

	CATEGORIES		
LEAD TIMES (MONTHS)	60	42	34
CHARACTERISTICS	I NEW COMPLEX	II OPERATIONAL	III REPEATS
1. S/L CONFIGURATION		1.0	
2. PAYLOADS (INDIVIDUAL)		.3	.7
3. INTEGRATED PAYLOAD		.7	.3
4. EXPERIMENTS		.5	.5
5. MISSION FLIGHT PLAN		.5	.5
6. P/L INTERFACE/ACCOMMODATIONS		.5	.5
7. P/L RESOURCES/TIMELINE		.5	.5
8. CREW/TRAINING		.5	.5
9. GROUND OPERATIONS AND SUPPORT		.3	.7
10. MISSION MANAGER		1.0	
11. EXPERIMENTERS/PI'S		.5	.5
12. REMARKS		1.0	
CATEGORY TOTAL	0	7.3	4.7
NORMALIZED (÷ 12)	0 I	.61 II	.39 III
CAT. LEAD TIME (MONTHS)	0	27	13
MISSION LEAD TIME =	40 MONTHS		
START TIME (MISSION APPROVAL)	OCT '78		

The assessments are summed in each mission category and normalized by dividing by the number of assessment characteristics (12). This provides an assessment of the degree that the total mission is characterized in each of the three categories. The product of the total mission assessment in a category times its respective category lead time is summed across the three categories. The result is a lead time assessment unique to that mission. In this case, mission lead time is calculated as 61% of Category II, or 27 months plus 39% of Category III (13 months) for a total of 40 months. For the given flight date of February 1982, this gives a mission assignment date of October 1978. This implies that prior to October 1978 a mission approval analysis should be performed to assess the mission requirements and schedules. A firmer start date may then be assessed at that time.

Assessments for Spacelab Missions 3-19 start dates based on the described methodology are presented in Figures D-18, 19, and 20. Flight dates correspond to those in the Early STS Mission Plan, June 22, 1976. Figure D-18 presents Missions 3-8. Mission 3 start date (Mission Manager assignment) is assessed as March 1976 and it was assigned a Mission Manager at that time. Mission 5, which has some similarities to Mission 1, need not be initiated until March 1977 although more definition of this mission and its payload (Mission Approval Document) would be timely now. This is particularly true of Mission 6, the ATL, which appears at this time to be a particularly complex mission which should be initiated in the very near future.

Figure D-19 continues the methodology assessment of early Spacelab missions and covers Mission 9 through 14. Except for Missions 9 (Pallet Astronomy) and 10 (AMPS), the assessed start dates are in the last quarter of 1978.

The methodology assessment of early Spacelab missions is continued in Figure D-20 and covers Missions 15 through 19. Except for Mission 19, assessed start dates are in 1979.

The results of the assessments worked in Figures D-18 through D-20 were presented in Section D-1.1 (see Figures D-1 and D-2).

SPACELAB MISSION SCHEDULING - 1

SPACELAB FLIGHT	3 SP/MU			4 LS-MOD-1			5 MU 81-3			6 ATL-1			7 MU 81-2			8 LS MOD-1		
FLIGHT DATE	JAN '81			MAR '81			JUN '81			AUG '81			SEP '81			OCT '81		
MISSION CATEGORY*	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
CHARACTERISTICS	LM + PALLET			LM ONLY			LM + PALLET			SM + PALLETS			SM + PALLETS			NO.4 REFLT		
1. S/L CONFIGURATION	.5	.5			1.0			1.0		1.0			1.0					1.0
2. PAYLOADS (INDIVIDUAL)	.6		.4	.8		.2	.3	.3	.4	.8	.2		.5		.5		.2	.8
3. INTEGRATED P/L	1.0			1.0			1.0			1.0			1.0				.2	.8
4. EXPERIMENTS	1.0			1.0			.6	.3	.1	.6	.4		.8	.2			1.0	
5. MISSION FLT PLAN	.5	.5			1.0			1.0			1.0		.5	.5				1.0
6. P/L INTERFACE/ACCOM	1.0			.8	.2		.6	.2	.2	1.0			.4	.4	.2		.2	.8
7. P/L RESOURCES T/L	1.0			1.0			.6	.4		1.0			.8	.2			.5	.5
8. CREW/TRAINING	1.0			1.0			.6	.4		1.0			.7	.3			.5	.5
9. GROUND OPS & SUPPORT	1.0			.8	.2		.4	.4	.2	1.0			.6	.4			.5	.5
10. MISSION MANAGER	1.0			1.0			1.0			1.0				1.0				1.0
11. EXPERIMENTORS/PIs	1.0			.8	.2		.3	.3	.4	.8	.2		.5	.5			.5	.5
12. REMARK	1.0			1.0			1.0			1.0				1.0				1.0
CATEGORY TOTAL	10.6	1.0	.4	9.2	2.6	.2	6.4	4.3	1.3	10.2	1.8	0	6.8	4.5	.7	0	3.6	8.4
NORMALIZED	.88	.08	.03	.77	.22	.02	.53	.36	.11	.85	.15	0	.57	.38	.06	0	.3	.7
X CAT.LEAD TIME(MOS)	53	3.4	1	46	9.3	.7	32	15	3.7	51	6.3	0	34	16	2	0	13	24
MISSION LEAD TIME(MOS)		57.4			56			50.7			57.3			52			37	
START DATE	MAR '76			JUL '76			MAR '77			OCT '76			MAY '77			SEP '78		

* I= EARLY AND COMPLEX NEW PAYLOADS (60 MOS), II = OPERATIONAL AND NEW MODERATELY COMPLEX PAYLOADS (42 MOS),
III = OPERATIONAL REFLIGHTS, SAME CARGO MANIFESTS (34 MOS)

Figure D-19

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SPACELAB MISSION SCHEDULING - 2

SPACELAB FLIGHT	9 AS			10 MU 82-1			11 MU 82-2			12 LS-MOD 2			13 AMPS			14 MU 82-4		
FLIGHT DATE	NOV '81			DEC '81			FEB '82			APR '82			MAY '82			JUN '82		
MISSION CATEGORY*	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
CHARACTERISTICS	PALLETS ONLY			NO.3 REFLT			SM + PALLET			LM ONLY			SM + PALLETS			LM + PALLET		
1. S/L CONFIGURATION		1.0				1.0		1.0			1.0			1.0			1.0	
2. PAYLOADS (INDIVIDUAL)	.4	.4	.2		.2	.8		.3	.7		.5	.5		1.0		.3		.7
3 INTEGRATED P/L	1.0				.2	.8		.7	.3		1.0			1.0			1.0	
4. EXPERIMENTS	.4	.6			.8	.2		.5	.5		1.0			1.0			1.0	
5. MISSION FLT PLAN	.5	.5				1.0		.5	.5		1.0		1.0				1.0	
6. P/L INTERFACE/ACCOM	.4	.4	.2		.2	.8		.5	.5		.5	.5	1.0			.5	.5	
7. P/L RESOURCES	.7	.3			.6	.4		.5	.5		.5	.5	1.0			.5	.5	
8. CREW/TRAINING	.5	.5			.6	.4		.5	.5		.5	.5	.6	.4			1.0	
9. GROUND OPS & SUPPORT	.7	.3			.2	.8		.3	.7		.4	.6	.4	.6		.3	.7	
10. MISSION MANAGER		1.0				1.0		1.0			1.0			1.0			1.0	
11. EXPERIMENTORS/PTs	.4	.6			.2	.8		.5	.5		.6	.4		1.0			1.0	
12. REMARK	1.0					1.0		1.0			1.0		.6	.4		.5	.5	
CATEGORY TOTAL	6.0	5.6	.4	0	3.0	9.0	0	7.3	4.7	0	9.0	3.0	4.6	7.4	0	2.1	9.2	.7
NORMALIZED	.5	.47	.03	0	.25	.75	0	.61	.39	0	.75	.25	.38	.62	0	.17	.77	.06
*CAT.LEAD TIME(MOS)	30	20	1	0	11	26	0	27	13	0	32	8	23	27	0	10	32	2
MISSION LEAD TIME(MOS)	51			37			40			40			50			44		
START DATE	AUG '77			NOV '78			OCT '78			DEC '78			MAR '78			OCT '78		

*I = EARLY AND COMPLEX NEW PAYLOADS (60 MOS), II = OPERATIONAL AND NEW MODERATELY COMPLEX PAYLOADS (42 MOS),

III = OPERATIONAL REFLGITHS, SAME CARGO MANIFESTS (34 MOS)

Figure D-20

SPACELAB MISSIONS SCHEDULING - 3

SPACELAB FLIGHT	15 ATL-2 **			16 EVAL			17 MU 82-3			18 LS-MOD-2			19 SP/AS/HE					
FLIGHT DATE	JUL '82			AUG '82			SEP '82			OCT '82			NOV '82					
MISSION CATEGORY*	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
CHARACTERISTICS	SM + PALLETS			SM + PALLETS			LM + PALLET			NO.12 REFLT			PALLETS ONLY					
1. S/L CONFIGURATION		1.0			1.0			1.0			1.0			1.0				
2. PAYLOAD (INDIVIDUAL)		.3	.7		.6	.4			1.0		.2	.8	.4	.4	.2			
3. INTEGRATED P/L		.5	.5		1.0			1.0			.2	.8	.6	.4				
4. EXPERIMENTS		.7	.3		1.0			.6	.4		1.0		.4	.6				
5. MISSION FLT PLAN			1.0		1.0			1.0				1.0	.5	.5				
6. P/L INTERFACE/ACCOM		.5	.5		.6	.4		1.0			.2	.8	.6	.2	.2			
7. P/L RESOURCES		.7	.3		.8	.2		1.0			.5	.5	.5	.5				
8. CREW/TRAINING		.7	.3		.6	.4		.6	.4		.5	.5		1.0				
9. GROUND OPS & SUPPORT		.5	.5		.6	.4		.6	.4		.5	.5	.5	.5				
10. MISSION MANAGER			1.0		1.0			1.0				1.0		1.0				
11. EXPERIMENTORS/PIs		.5	.5		.6	.4		.6	.4		.5	.5	.4	.6				
12. REMARK		.3	.7		1.0			1.0				1.0	1.0					
CATEGORY TOTAL	0	5.7	6.3	0	9.8	2.2	0	9.4	2.6	0	3.6	8.4	4.9	6.7	.4			
NORMALIZED	0	.48	.52	0	.82	.18	0	.78	.22	0	.3	.7	.41	.56	.03			
*CAT. LEAD TIME (MOS)	0	20	18	0	34	6	0	33	7	0	13	24	25	23	1			
MISSION LEAD TIME (MOS)	38			40			40			37			49					
START DATE	MAY '79			APR '79			MAY '79			SEP '79			OCT '78					

*I = EARLY AND COMPLEX NEW PAYLOADS (60 MOS), II = OPERATIONAL AND NEW MODERATELY COMPLEX PAYLAODS (42 MOS),

III = OPERATIONAL REFLIGHTS, SAME CARGO MANIFESTS (34 MOS)

**ATL-2 IS CURRENTLY UNDEFINED -- ASSUMED SIMILAR TO ATL-1 (SL NO. 6)

D-2.1 Early STS Mission Manager Scheduling - Automated Payloads

The methodology for assessing lead times for initiation of mission development for automated payloads is based on:

(1) methodology previously developed and presented for Spacelab missions,
(2) Delta mission planning procedures (Figures D-21 and 22),
(3) STS planning requirements (Figure D-23), and
(4) data on the development lead times for typical and representative payloads (Figure D-24).

Mission development is assumed initiated by the approval of the Mission Approval Document and assignment to a Mission Manager responsible for the integration of the various payloads and support elements planned/assigned to a specific STS flight. This includes preparation of the integrated payload operations and interface requirements to be imposed on the STS and coordination with the STS Operations Manager and individual Payload Managers in the implementation of these requirements.

Generic mission development lead times (Figures D-25 through D-28) are estimated based on the required functions and milestones (payload integration, operations planning, GSE/software development/mod, training, launch operations) and time estimates for each for three basic mission categories; (1) early missions and those with new and complex payloads, (2) operational missions with new payloads of moderate complexity using mostly standard (previously developed) interfaces and procedures, and (3) operational reflights of previous STS-flown payloads/similar missions. Each of the automated payload/missions (Figures D-29 and D-30) is assessed relative to these categories against a set of twelve mission payload characteristics (Figure D-31, to arrive at a combined mission development lead time for each specific mission (Figures D-32 and 33).

The results of this effort are summarized in Figure D-34 which indicates estimated start dates for each of the individual payloads as well as the assessed mission development start date (mission approval/manager assigned) for each mission (indicated by left hand bracket). As Figure D-32 through 34 indicate, mission development lead times assessments range from 27 (#49) to 38 (#9, #16) months with 33 months average. This allows

Figure D-21

DELTA MISSION PLANNING

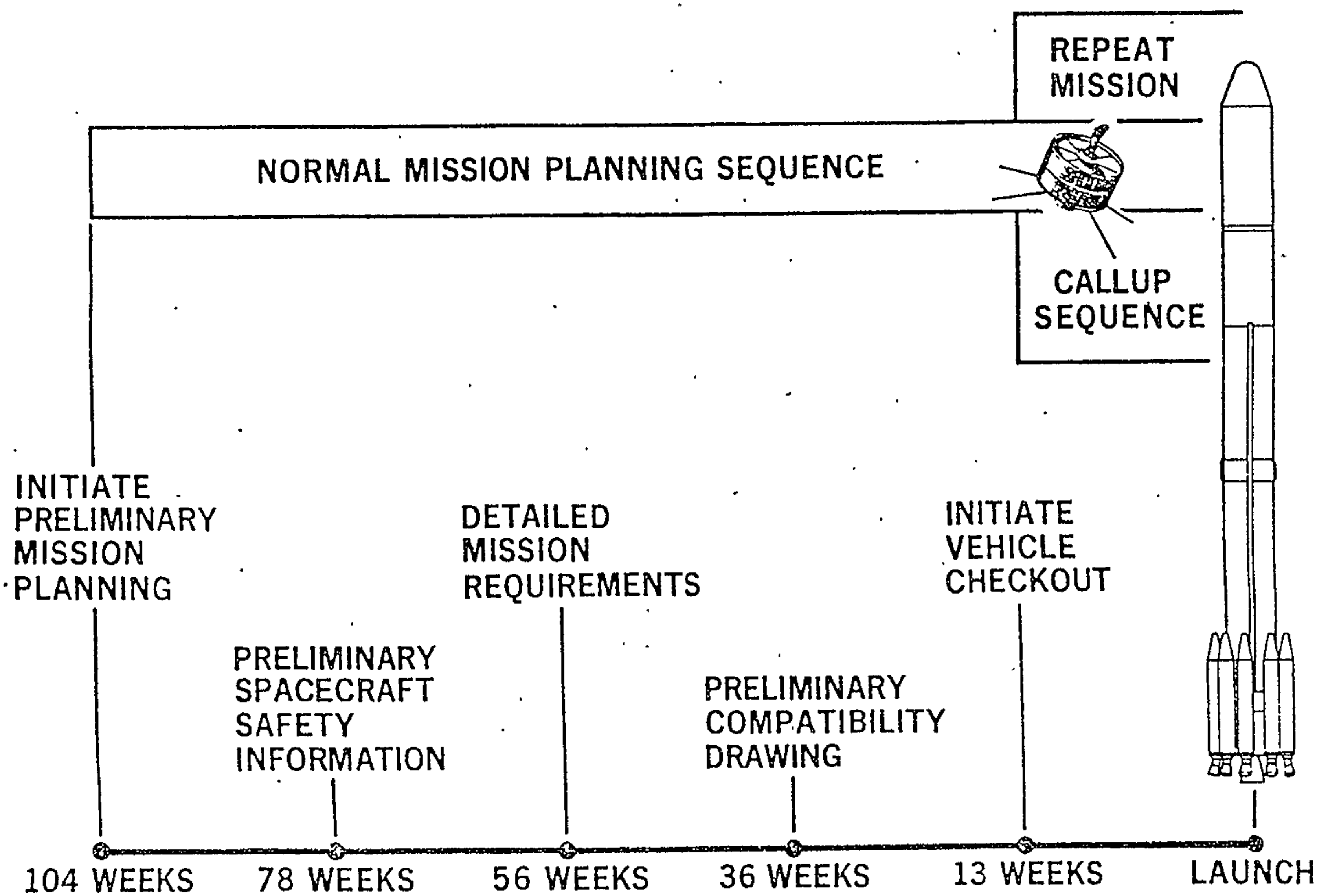
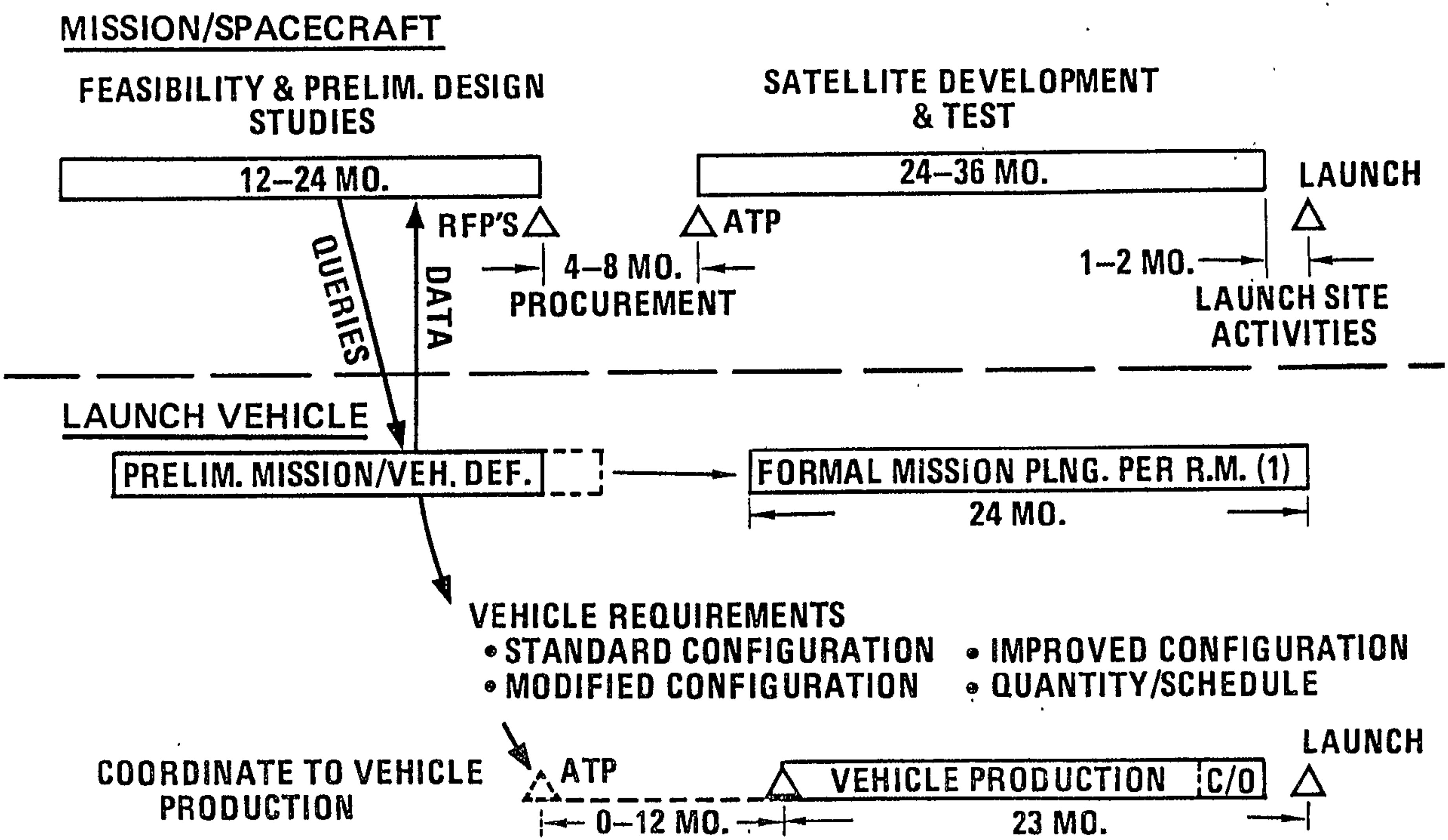


Figure D-22

3J1-85884

EVOLUTION OF DELTA MISSIONS REQUIREMENTS (TYPICAL)



(1) USUALLY COVERED BY LAUNCH CONTRACTS.

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NASA-S-76-4118

Figure D-23

SPACE TRANSPORTATION SYSTEM
GENERAL PLANNING SUMMARY

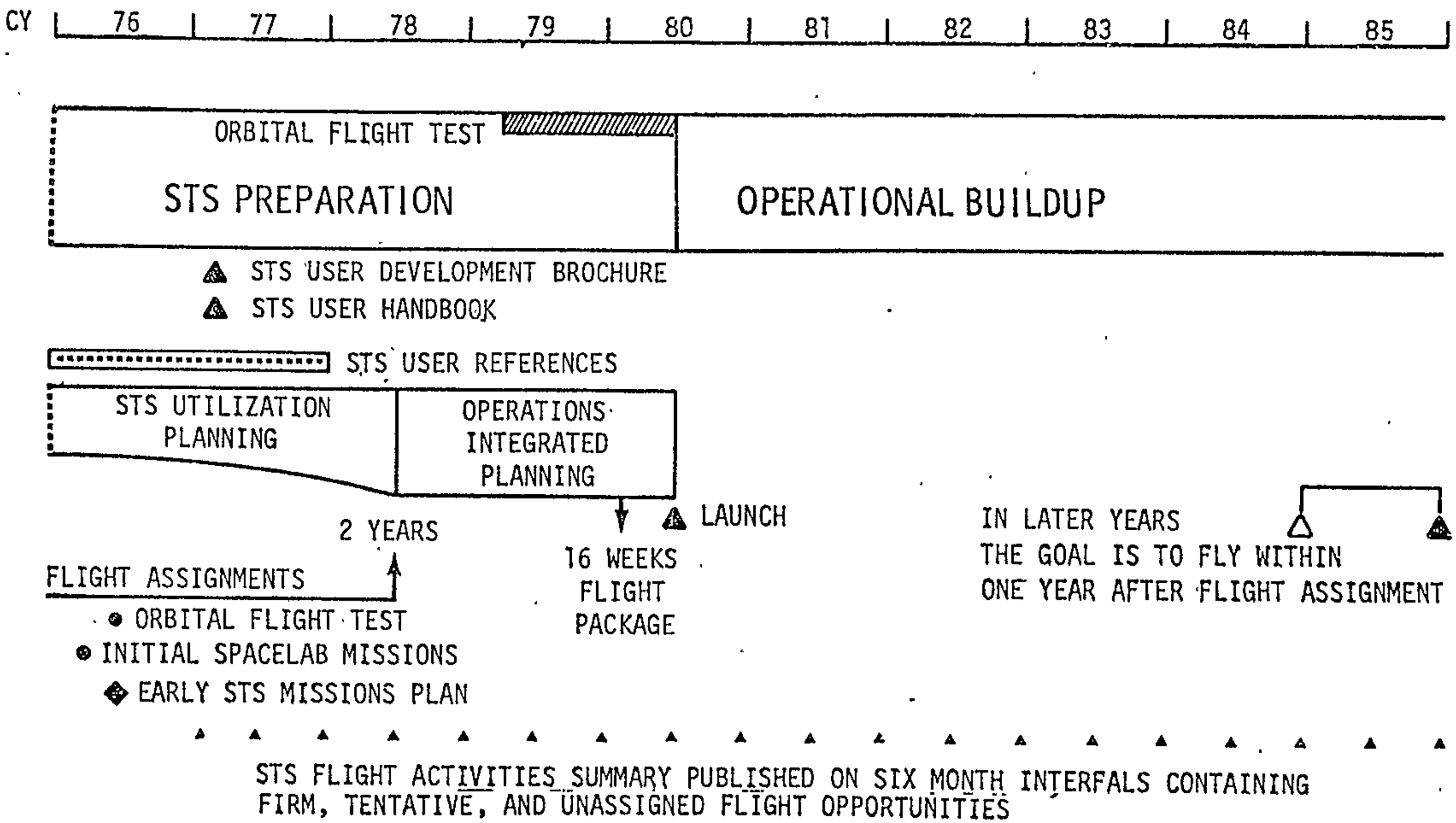

Figure D-24

AUTOMATED SPACECRAFT DEVELOPMENT TIMES

EXAMPLE SPACECRAFT/ EXPERIMENTS	MONTHS: STUDIES AND PROPOSALS	PROCURE	DESIGN AND DEVELOP	INTEGRATION IV*	INTEGRATION III–I	FIRST LAUNCH	REMARKS
NASA							
LAGEOS (EXPLORER CLASS)	24	–	28	2	2	6/76	DELTA
SEASAT–A (SMALL OBSERVER)	24	–	25	4	2	5/78	ATLAS
ATMOSPHERE EXPLORER	12	9	21	4	5	4/73	DELTA
SEASAT B (MED OBSERVER)	24	–	36	6	2	6/82	ATLAS
NIMBUS E (MED OBSERVER)	12	4	38	9	2	6/72	DELTA
RAE–B (EXPLORER)	12	–	25	10	2	10/72	DELTA
GAMMA RAY (EXPLORER)	24	–	36	7	4	10/79	MMS OFT FLTS (GAMMA RAY, SOLAR MAX, AIRSAT)
SOLAR MAX (SMALL OBS)	18	–	29	6	4	2/80	
AIRSAT (SMALL OBS)	24	9	32	6	5	5/80	
LDEF (CARRIER)	12	–	34	12	5	9/79	OFT NO. 3
LDEF (NEW EXPMTS)	12	–	18	6	2	9/81	REFLIGHT
SPACE TELESCOPE (LG OBS)	24	12	48	12	4	5/83	REVISITS
HEAO (MED OBS)	18	12	36	6	2	4/77	AC–ELV
MARINEER-JUPITER/SATURN	24	8	36	6	2	9/77	TC–ELV
PIONEER VENUS	36	12	36	6	2	5/78	AC–ELV
FOREIGN							
ESRO–EXOSAT	42	6	40	6	1	10/80	DELTA
ESRO–COS–B	31	9	37	6	1	10/75	DELTA
COMMERCIAL							
RCA–DOMSAT	39	7	18	6	1	11/75	DELTA
AEROSAT	24	4	29	6	1	11/78	DELTA

*INSTALLATION OF EXPERIMENTS IN SPACECRAFT

Figure D-25

24005

AUTOMATED PAYLOADS MISSION MANAGER

MISSION CATEGORY I - EARLY OR COMPLEX NEW MISSIONS (PAYLOAD DEVELOPMENT NOMINAL OR OFF-LINE)

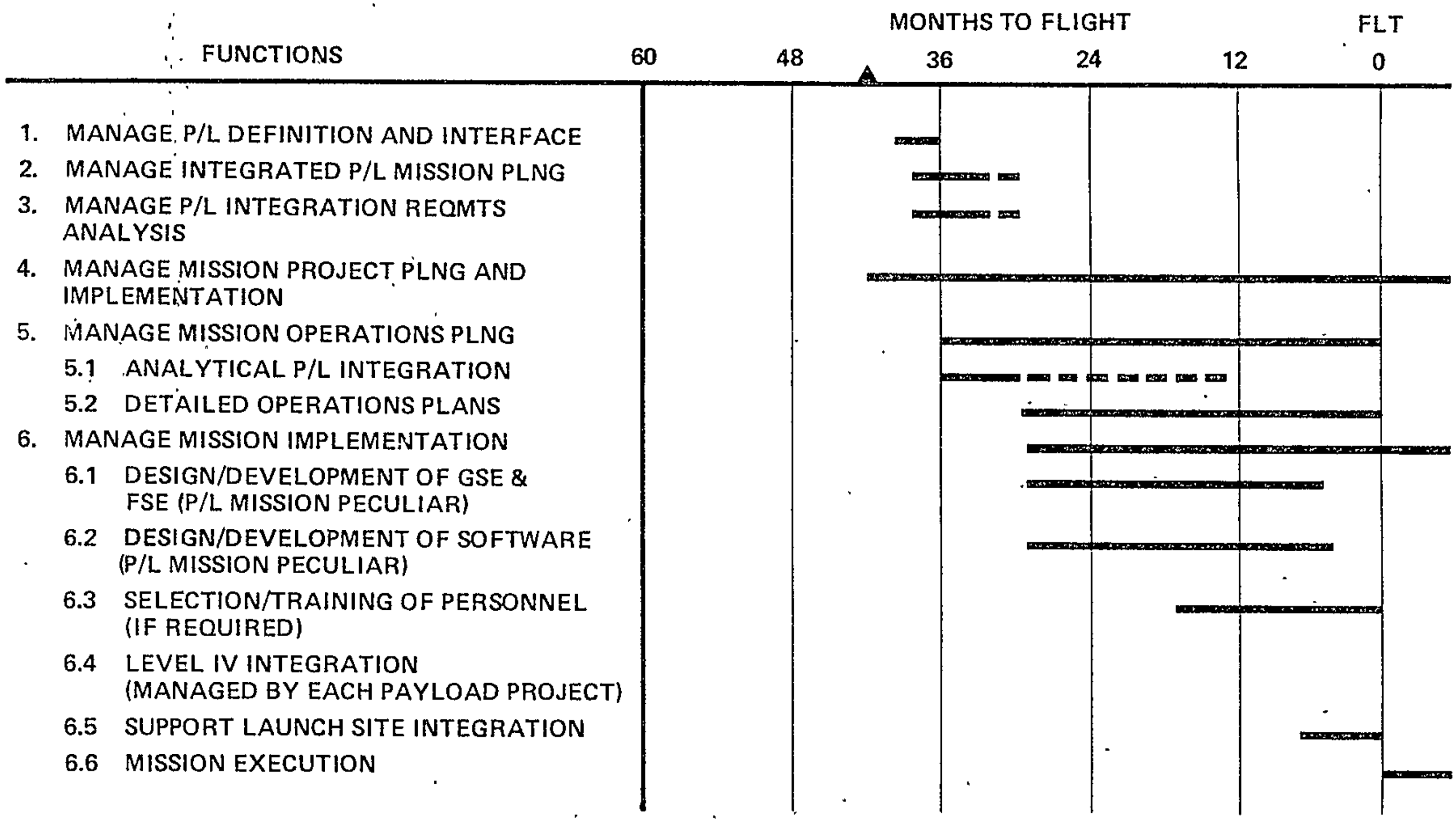

Figure D-26

24006

AUTOMATED PAYLOADS MISSION MANAGER

MISSION CATEGORY II - OPERATIONAL MISSIONS, MODERATE COMPLEXITY, NEW PAYLOADS

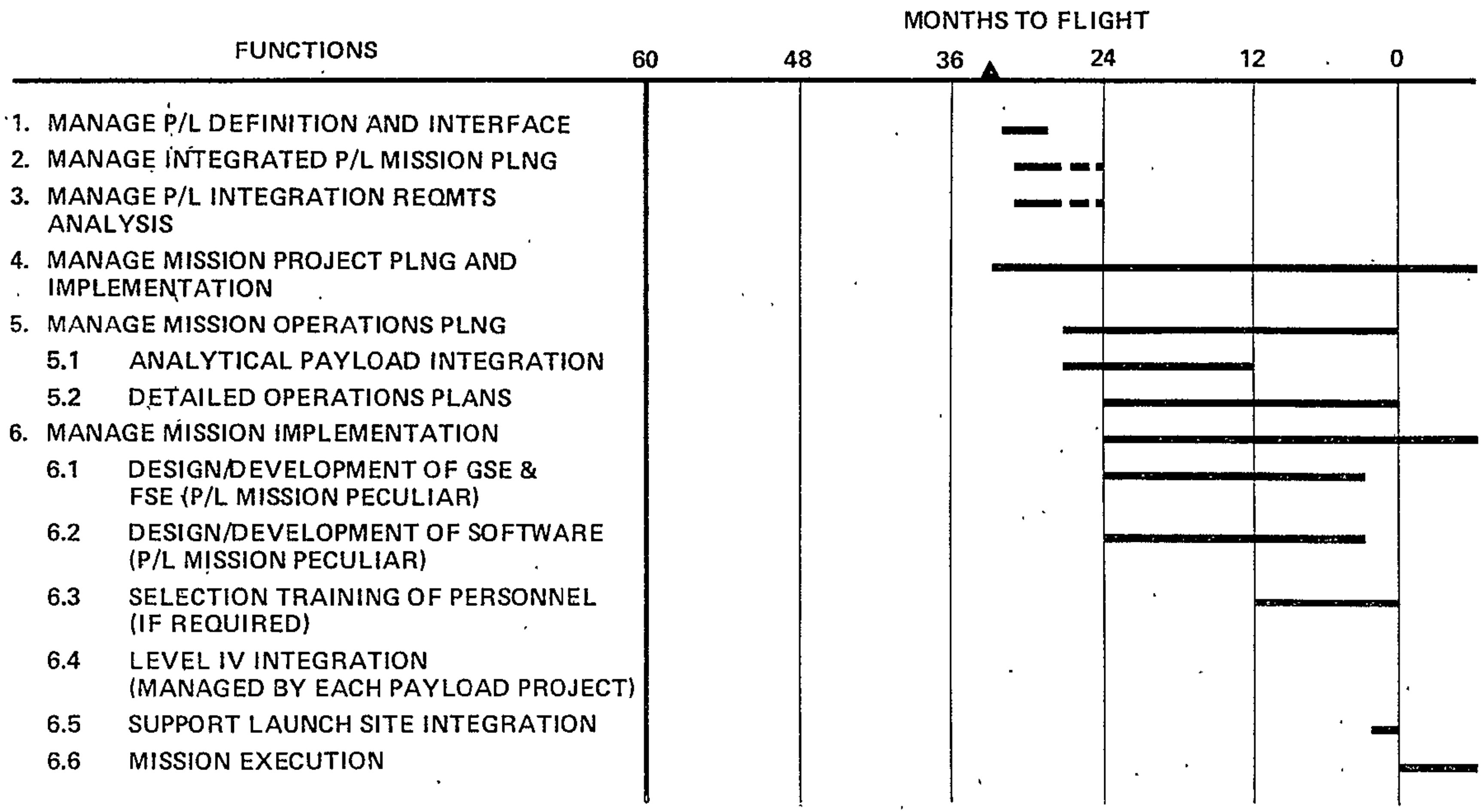

Figure D-27

SPACELAB PAYLOADS MISSION MANAGER

MISSION CATEGORY III - OPERATIONAL REFLIGHT

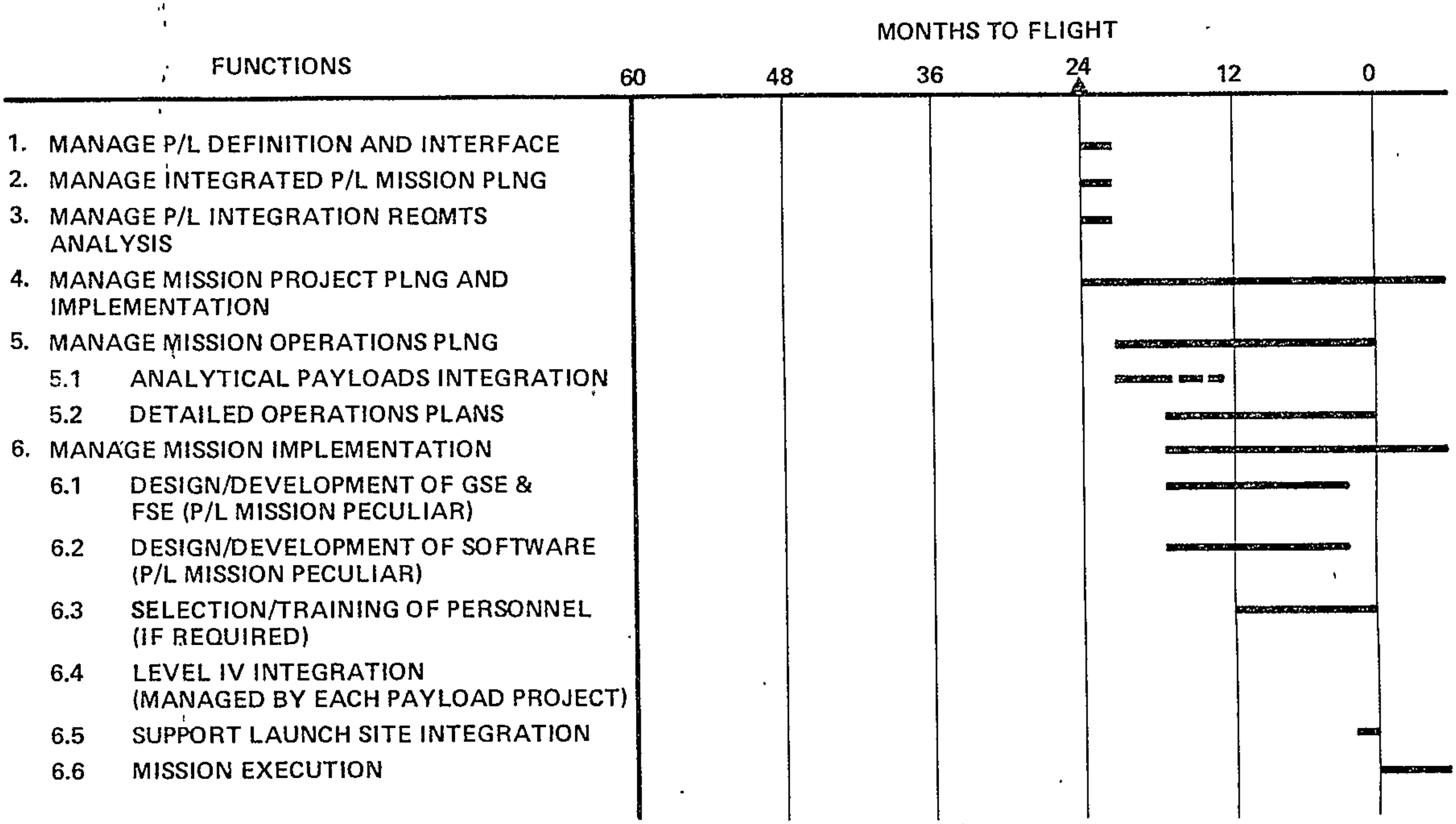

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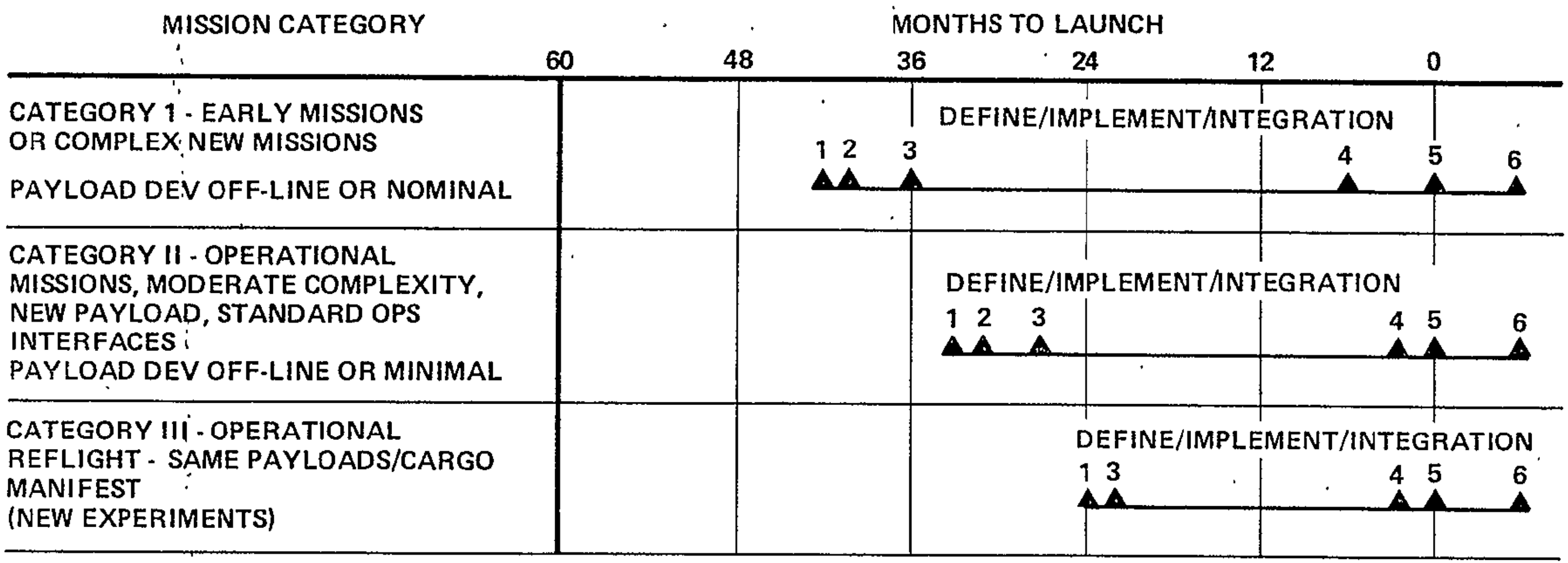
Figure D-28

24008

AUTOMATED PAYLOADS MISSION CATEGORIES DEVELOPMENT LEAD TIMES



NOTES:
(1) MISSION MANAGER ASSIGNED
(2) PROJECT PLAN SUBMITTAL TO AA
(3) START MISSION IMPLEMENTATION (PAYLOAD SELECTED)
(4) START LEVEL III/II INTEGRATION
(5) FLIGHT OPERATIONS
(6) POST MISSION DISTRIBUTION

Figure D-29

NON-S/L NASA/NASA-RELATED MISSIONS

STS Flt # & Flt Date	Payloads/User	Carrier	Mode	% New P/L	Remarks
7 May '80	STP-1/DOD	IUS	Deploy	1.0	DOD mission prime
	(LDEF/OAST)	ORB	Retrieve	0	LDEF deployed by STS #4
9 Sep '80	Aerosat/Comsat	SSUS	Deploy	New on STS	First SSUS Mission
	Aerosat/Comsat	SSUS	Deploy		
	GOES/NOAA	SSUS	Deploy		
13 Feb '81	Stormsat/OA	IUS	Deploy	1.0	First NASA IUS
	Soft X-ray/OSS	ORB	Deploy	1.0	
16 May '81	Foreign Comm/ESA	SSUS	Deploy	1.0	Four users (APPS flown previously on S/L #3)
	APPS/OA	ORB	Sortie	0	
	Vest. Func./OSS	ORB	Deploy	1.0	
	Sphinx/OAST	IUS	Deploy	1.0	
20 Sep '81	LDEF/OAST	ORB	Deploy	0	Reflight
	BESS/OSS	ORB	Deploy	1.0	Retrievable
22 Oct '81	VLB Inter/OSS	IUS	Deploy	1.0	
	Grav Probe/OSS	ORB	Deploy	1.0	
	(SMM/OSS)	ORB	Retrieve	New on STS	Delta deployed
28 Jan '82	Exoecliptic Obs/OSS	IUS	Deploy	1.0	Four-stage IUS and RTG
29 Jan '82	Jupiter ORB/Probe/OSS	IUS	Deploy	1.0	Four-stage IUS and RTG
33 Apr '82	Weststar/Comm	SSUS	Deploy	1.0	Commercial
	Foreign Comm/ESA	SSUS	Deploy	0	Ref. Flt #16
	(BESS/OSS)	ORB/OMS	Retrieve	0	Ref. Flt #20
35 Apr '82	Disaster Warn/OA	IUS	Deploy	1.0	
	APPS/OA	ORB	Sortie	0	Reflight
	(LDEF/OAST)	ORB	Retrieve	0	Ref. Flt #20
41 Aug '82	VLB Inter/OSS	IUS	Deploy	0	Ref. Flt #22
	BESS/OSS	ORB	Deploy	0	Reflight
	APPS/OA	ORB	Sortie	0	Reflight
49 Dec '82	Saturn Probe/OSS	IUS	Deploy	1.0	Similar to #29
50 (WTR) Dec '82	Earth Survey Sat/OA	OMS Kit	Deploy	1.0	First WTR flight

Figure D-30

24013

EARLY STS MISSIONS-
AUTOMATED PAYLOADS NASA/NASA RELATED
ESTIMATED LEAD TIME TO DEVELOP

SPACECRAFT	STUDIES AND PROPOSALS	PROCURE	ATP (EST)	DESIGN AND DEVELOP	INTEGRATION IV* (MONTHS)	INTEGRATION III–I (MONTHS)	FIRST LAUNCH	REMARKS
LDEF (INITIAL)	12	—	7/75	34	12	5	10/79	CARRIER
LDEF (NEW EXPMTS)	12	—	7/79	18	6	2	9/81	REFLIGHT
GOES	—	—	7/77	30	6	2	9/80	OPERATIONAL
STORMSAT	24	6	12/77	30	6	2	2/81	SMALL OBS
SOFT X-RAY	12	6	9/78	20	6	2	2/81	EXPLORER
FOREIGN COMM/ESA	36	6	9/77	36	6	2	5/81	FOREIGN
APPS (NEW EXPMTS)	12	—	7/79	18	2	2	5/81	REFLIGHT
VEST FUNCTION SAT	24	—	3/78	30	6	2	5/81	SMALL SAT.
SPHINX	24	6	9/77	36	6	2	5/81	ADV TECH
BESS	24	9	1/78	36	6	2	9/81	ADV LS
VLB INTERF	12	6	6/78	20	6	2	10/81	EXPLORER
GRAV PROBE	12	6	6/78	20	6	2	10/81	EXPLORER
EXOECLIPTIC OBSER	24	9	5/78	36	6	2	1/82	PIONEER
JUPITER ORB PROBE	24	9	5/78	36	6	2	1/82	PIONEER +
DISASTER WARN	24	6	2/79	30	6	2	4/82	COMSAT
APPS (NEW EXPMTS)	12	—	6/80	18	2	2	4/82	REFLT
VLB INTERF	—	—	4/80	20	6	2	8/82	EXPLORER
BESS (NEW EXPMTS)	12	—	10/80	18	2	2	8/82	REFLT
APPS (NEW EXPMTS)	12	—	10/80	18	2	2	8/80	REFLT
SATURN PROBE	24	9	4/79	36	6	2	12/82	PIONEER +
EARTH SURVEY	24	9	4/79	36	6	2	12/82	MED OBS

*INSTALLATION OF EXPERIMENTS IN SPACECRAFT

Figure D-31

24009

AUTOMATED PAYLOADS MISSION CATEGORIES CHARATERISTICS

MISSION CATEGORY	I (NEW/COMPLEX)	II (STD/OPERATIONAL)	III (REFLIGHT)
LEAD TIME (MONTHS):			
ON-LINE P/L DEV	42 – 60	NA	NA
OFF-LINE P/L DEV	42	33	24
CHARACTERISTICS			
1. VEHICLE CONFIGURATION	NEW	STD	SAME
2. NUMBER DIFFERENT PAYLOADS/USERS	≥3	3≤	2≤
3. PAYLOADS (INDIVIDUAL S/C)	NEW/COMPLEX	NEW	SAME
4. INTEGRATED PAYLOAD*	NEW/COMPLEX	NEW	SAME
5. MISSION FLIGHT PLAN	NEW/COMPLEX	STD	SIMILAR
6. P/L INTERFACES/ACCOM	NEW/COMPLEX	STD/MARGINS	SAME/MINIMAL
7. P/L OPERATIONS	NEW/COMPLEX	STD	SIMILAR
8. RESOURCE/PERF RQMTS	MARGINAL	ADEQUATE	ADEQUATE
9. CREW/TRAINING	NEW/COMPLEX	STD	SAME/SIMILAR
10. GND OPS & SUPPORT	NEW/COMPLEX	STD	SAME/SIMILAR
11. MISSION MGR	NEW	NEW/EXPERIENCED	NEW/EXPERIENCED
12. REMARKS	NEW/COMPLEX MULTI-PAYLOADS OR ON-LINE	STD/MODERATELY COMPLEX/NEW PAYLOADS	OPERATIONAL REFLIGHT

*ASSIGN VALUE = 0 FOR SINGLE PAYLOAD MISSIONS

Figure D-32

24010

AUTOMATED PAYLOADS MISSION SCHEDULING ASSESSMENT

P/L DEV OFF-LINE

STS FLIGHT NUMBER	7			9			13			16			20			22		
FLIGHT DATE	MAY 80			SEP 80			FEB 81			MAY 81			SEP 81			OCT 81		
PAYLOADS/CARRIERS	STP(DOD)/IUS (RETRIEVE LDEF/ORB)			AEROSAT/SSUS AEROSAT/SSUS GOES/SSUS			STORMSAT/IUS SOFT X-RAY/ ORB			FOR COM/SSUS APPS/ORB VEST FUNCT/ ORB SPHINX/IUS			LDEF/ORB BESS/ORB			VLBI/IUS GRAV PROBE/ORB (RETRIEVE SMM/ORB)		
MISSION CATEGORY	I	II	III	I	II	III	I	II	III	I	II	IIII	I	II	III	I	II	III
CHARACTERISTICS																		
1. VEHICLE CONFIGURATION		1.0		1.0				1.0		0.5	0.5			1.0			1.0	
2. NO. PAYLOADS/USERS			1.0	1.0				1.0		1.0				0.5	0.5		1.0	
3. PAYLOADS (INDIVIDUAL)		0.5	0.5		1.0			1.0		0.4	0.3	0.3		0.5	0.5		1.0	
4. INTEGRATED PAYLOAD		0			1.0			1.0		0.5	0.5			0.5	0.5		1.0	
5. MISSION FLIGHT PLAN	0.5	0.5			1.0			1.0			1.0				1.0	0.5	0.5	
6. P/L INTERFACE/ACCOM		0.5	0.5	1.0				1.0		0.5	0.5			0.5	0.5		1.0	
7. P/L OPERATIONS	0.5	0.5		1.0				1.0		0.6	0.4			0.5	0.5	0.5	0.5	
8. RESOURCE/PERF RQMTS		1.0			1.0			1.0		0.6	0.4			0.5	0.5		1.0	
9. CREW/TRAINING	0.5	0.5			1.0			1.0		0.5	0.5				1.0		1.0	
10. GND OPS & SUPPORT		1.0		1.0				1.0		0.5	0.5			0.5	0.5		1.0	
11. MISSION MANAGER		1.0		1.0				1.0		1.0				0.5	0.5		1.0	
12. REMARKS	0.5	0.5		1.0				1.0		1.0				0.5	0.5		1.0	
CATEGORY TOTAL	2.0	7.0	2.0	7.0	5.0	0	0	12.0	0	7.1	4.6	0.3	0	5.5	6.5	1.0	11.0	0
NORMALIZED	0.17	0.58	0.17	0.58	0.42	0	0	1.0	0	0.59	0.38	0.03	0	0.47	0.53	0.08	0.92	0
X CATEGORY LEAD TIME (MOS)	7.1	19.1	4.1	24.4	13.8	0	0	33.0	0	24.8	12.5	0.7	0	15.5	12.7	3.4	30.4	0
MISSION LEAD TIME (MOS)	30.3			38.2			33.0			38.0			28.2			33.8		
START DATE	NOV 77			JUL 77			MAY 78			MAR 78			APR 79			JAN 79		

Figure D-33

24011

AUTOMATED PAYLOADS MISSION SCHEDULING ASSESSMENT

STS FLIGHT NUMBER	28			29			33			35			41			49			50		
FLIGHT DATE	JAN 82			JAN 82			APR 82			APR 82			AUG 82			DEC 82			DEC 82		
PAYLOADS/CARRIERS	EXOECLIPTIC PIONEER (4 STG IUS)			JUPITER PROBE (4 STG IUS)			WESTSTAR/SSUS ESA COMSAT/ SSUS (RET BESS)			DIASTER/IUS APPS/ORB (RET LDEF)			VLBI/IUS BESS/ORB APPS/ORB (OMS)			SATURN PROBE (4 STG IUS)			EARTH SURVEY (OMS) (FIRST WTR)		
MISSION CATEGORY	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
CHARACTERISTICS																					
1. VEHICLE CONFIGURATION	1.0			1.0				1.0			1.0			1.0			1.0			1.0	
2. NO. PAYLOADS/USERS			1.0			1.0		1.0			1.0			1.0				1.0			1.0
3. PAYLOADS (INDIVIDUAL)		1.0			1.0			0.7	0.3		0.5	0.5			1.0			1.0			1.0
4. INTEGRATED PAYLOAD		0			0			1.0			0.5	0.5		1.0			0			0	
5. MISSION FLIGHT PLAN		1.0			1.0			1.0		1.0				1.0			1.0		1.0		
6. P/L INTERFACE/ACCOM	1.0			1.0				0.7	0.3		0.5	0.5		0.5	0.5			1.0		1.0	
7. P/L OPERATIONS		1.0			1.0		0.5	0.5		0.5	0.5			0.5	0.5			1.0		1.0	
8. RESOURCE/PERF RQMTS	1.0			1.0				1.0		0.5	0.5			0.5	0.5	1.0			1.0		
9. CREW/TRAINING		1.0			1.0			1.0		0.5	0.5			0.5	0.5			1.0		1.0	
10. GND OPS & SUPPORT	1.0			1.0				1.0			1.0			0.5	0.5			1.0	1.0		
11. MISSION MANAGER		1.0			1.0			1.0			1.0			1.0				1.0		1.0	
12. REMARKS	1.0			1.0				1.0			1.0			0.5	0.5			1.0	1.0		
CATEGORY TOTAL	5.0	5.0	1.0	5.0	5.0	1.0	0.5	10.9	0.6	2.5	8.0	1.5	0	8.0	4.0	1.0	2.0	8.0	4.0	5.0	2.0
NORMALIZED	0.42	0.42	0.08	0.42	0.42	0.08	0.04	0.91	0.05	0.21	0.67	0.12	0	0.67	0.33	0.08	0.17	0.67	0.33	0.42	0.17
X CATEGORY LEAD TIME (MOS)	17.7	13.9	2.0	17.7	13.9	2.0	1.7	30.0	1.2	8.8	22.0	2.9		22.0	8.0	3.4	5.6	16.1	13.9	13.9	4.1
MISSION LEAD TIME (MOS)		33.6			33.6			32.9			33.7			30.0			27.1			31.9	
START DATE	MAR 79			MAR 79			JUL 79			JUN 79			FEB 80			SEP 80			APR 80		

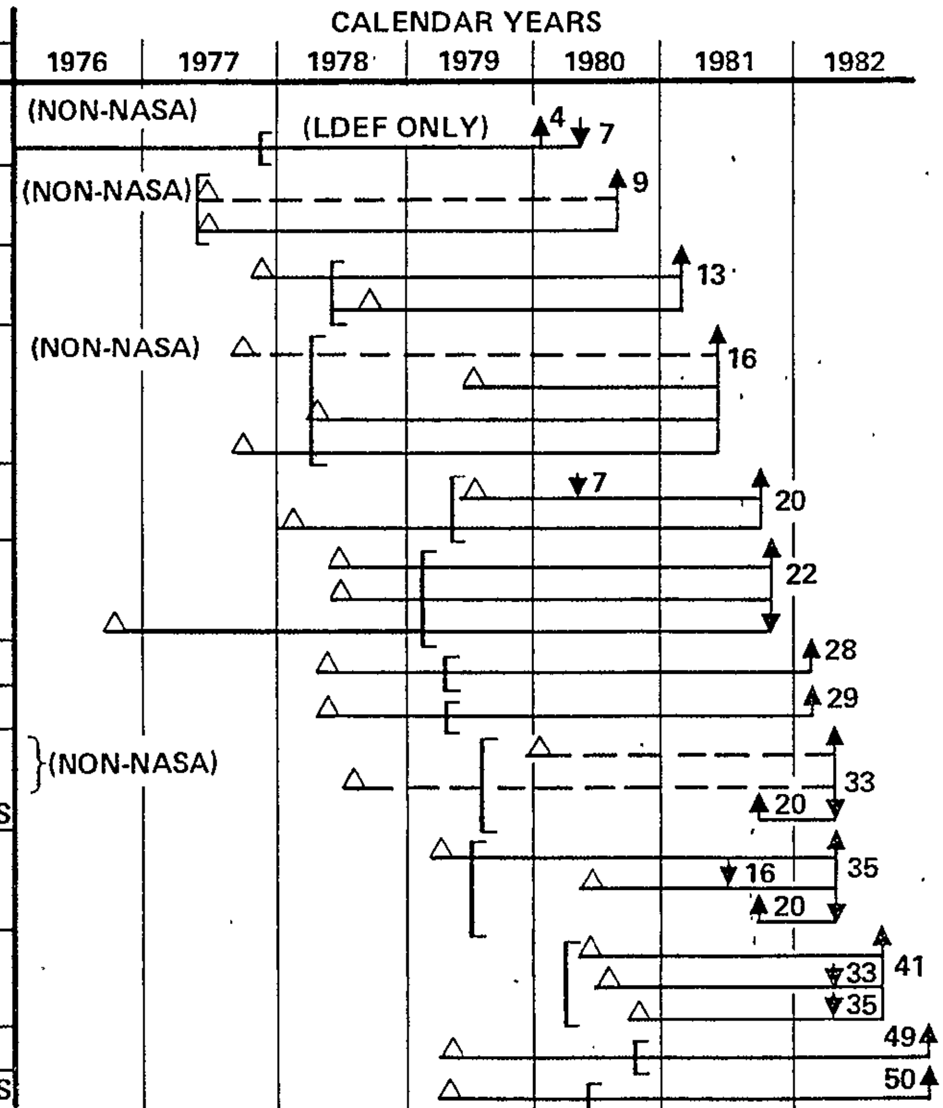
Figure D-34

24012

AUTOMATED PAYLOADS MISSIONS SCHEDULING SUMMARY

(MISSIONS WITH NASA/NASA-RELATED PAYLOADS)

STS FLT	PAYLOAD	CARRIERS IUS	SSUS	
7	STP-1/DOD (LDEF RETRIEVAL/OAST)	X		
9	AEROSATS/COMSATS GOES/NOAA		X X	
13	STORMSAT/OA SOFT X-RAY/OSS	X		
16	FOREIGN COMM/ESA APPS REFLIGHT/OA - NEW EXPMTS VEST. FUNCTIONS SAT/OSS SPHINX/OAST	 X	X	
20	LDEF REFLIGHT/OAST (NEW EXPMTS) BESS/OSS			
22	VLB INTEF/OSS GRAV PROBE/OSS (RETRIEVE SMM/OSS)	X		
28	EXOCLIPTIC OBSERVER	X		
29	JUPITER PROBE	X		
33	WESTSTAR/COMM FOREIGN COMM/ESA (RETRIEVE BESS/OSS)		X X	 OMS
35	DISASTER WARN/OA APPS REFLIGHT/OA (NEW EXPMTS) (RETRIEVE LDEF/OAST)	X		
41	VLB INTER/OSS BESS REFLIGHT/OSS (NEW EXPMTS) APPS REFLIGHT/OA (NEW EXPMTS)	X		
49	SATURN PROBE/OSS	X		
50	EARTH SURVEY/OA (WTR)			OMS



△ INDIVIDUAL PAYLOAD DEVELOPMENT (OC/D) INITIATED

[MISSION APPROVAL/MISSION MANAGER ASSIGNED the Mission Manager nine months to develop integrated payload requirements and plans prior to start of STS detailed operations planning at T-24 months. Later missions (and reflights) may require less lead time as time required for STS detailed operations planning is expected to decrease by the 1984-85 time period. For the early missions assessed here, however, mission approval analyses are indicated for Missions 7 and 9 by mid-1977, for Missions 13 and 16 by early 1978, for Missions 20, 22, 28, 29 by early 1979, etc. Subsequent update and application of this methodology could be used to update this current assessment.

The methodology, while using some objective factors, is basically an ordered array of subjective evaluations systematically defined and combined to produce a lead time value for each mission assessed. The methodology obviously cannot, and is not intended, provide a rigorous schedule or lead time assessment which a specific mission project schedule analysis could provide. Rather, the intent is to provide a simple and easily applied visibility tool for planning purposes and the initiation of mission approval analyses. The mission approval analyses will include the project schedule analysis to define/justify the necessary mission project lead times and schedule milestones.

Appendix E

OPERATIONS PLANNING METHODOLOGY FOR DETERMINING THE TRACKING REQUIREMENTS FOR FLIGHT AND GROUND ITEMS (TASK 2.1B)

Objective

The objective of this task was to build an operations planning data file with sufficient scope and detail to support the following operations planning activities (A-J), identified for both the five-year (Planning Baseline) and 12-year (Mission Model) plans.

A. STS hardware and support equipment inventory requirements analysis for both flight operations and ground processing.

B. Payload flight operations requirements analysis, both on-orbit and ground.

C. Ground processing requirements analysis for individual payloads and integrated missions.

D. Crew and experiment timelines for experiment operations.

E. Manpower and ground processing timeline for mission integration.

F. Resource requirements analysis to support ground processing and experiment operations.

G. Contingency analysis for both ground processing and flight operations.

H. Hazards identification and procedures analysis for both ground processing and experiment operations.

I. Ground transportation requirements analysis.

J. STS accommodations versus payload requirements compatibility analysis.

Approach

Substantial quantities of technical data, pertinent to ground and flight operations analysis in support of the STS utilization planning, are being generated through a wide variety of effort within NASA, DOD, and their industrial contractors. This task consisted of reviewing these sources of information and sorting out and formatting data required to perform the operations analysis. A format was prepared for these data for the purpose of inclusion into an operations planning data bank. These data parameters include, but are not limited to, the definition and capabilities of STS elements such as the tracking and communication network, facilities for STS and payload elements, support equipment, and ground transportation systems.

Preliminary parameter formats for operations planning data files were submitted to NASA for review. The files were structured, as listed in Figure E-1, into levels of integration, flight operations, and post mission operations. It became apparent that many operations functions are similar over several levels of integration and these can enjoy the same file formatting.

Information in the data files is stored in six areas. These operations areas include:

- o Payload and mission assignment:
  1. Payload Name (SSPD name and number)
  2. Mission Assignment (mission objectives, characteristics, profiles)
- o Operations requirements, flows and timelines:
  3. Operations Requirements (schedules, constraints)
  4. Operations Flows and Timelines (flow functions, sequence, durations)
- o Equipment and facilities requirements:
  5. Equipment Requirements (experiment/STS-provided equipment requirements)
  6. Facility Accommodations Requirements (facilities, environment, etc.)

A sample of the Operations Planning Data File parameter descriptions is illustrated in Figure E-2. Data files indicated by the X mark should contain the parameter values. (The five operations files were not all identified for each parameter--pending NASA approval of the level of detail and format.)

The preliminary Operations Planning Data Files are presented in Figure E-3. Following the preparation of these file formats, the level of detail of the operations flow activities provided in the data files appeared to be too low. (File maintenance problems occur with too much detail.) Consideration was then given to possibly two or three levels of detail according to time remaining before launch (more detail closer to launch). For example, the 12-year and five-year plans could use the following detail tasks:

Figure E-1

22880

OPERATIONS PLANNING DATA FILES -CONTENT-

- OPERATIONS PARAMETERS STRUCTURED INTO DATA FILES COVERING
  1. LEVEL IV INTEGRATION
  2. LEVEL III/II INTEGRATION
  3. LEVEL I INTEGRATION
  4. FLIGHT
  5. POST-MISSION
- MANY OPERATIONS FUNCTIONS ARE SIMILAR OVER SEVERAL LEVELS OF INTEGRATION AND CAN ENJOY SAME FORMAT
- MAJOR ELEMENTS OF THE DATA FILE(S) INFORMATION INCLUDE:
  1. PAYLOAD NAME
  2. MISSION ASSIGNMENT
  3. OPERATIONS REQUIREMENTS
  4. OPERATIONS FLOWS AND TIMELINES
  5. EQUIPMENT REQUIREMENTS
  6. FACILITY ACCOMMODATIONS REQUIREMENTS

22881

Figure E-2

OPERATIONS PLANNING DATA FILE
DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
1.0 PAYLOAD NAME	X	X	X	X	X
2.0 MISSION ASSIGNMENT					
2.1 OBJECTIVES	X	X	X	X	X
2.2 SPACECRAFT GENERAL PHYSICAL CHARACTERISTICS DESCRIBE SUBSYSTEMS, DIMENSIONS, WEIGHT (WITH AND WITHOUT SHIPPING CONTAINER)	X	X	X	X	X
2.3 GROUND AND FLIGHT MISSION PROFILE					
2.3.1 INTEGRATION LOCATION (SITE)	X	X	X		
2.3.2 ORBITER FLIGHT PROFILE				X	
2.3.3 UPPERSTAGE FLIGHT PROFILE				X	
2.3.4 SPACECRAFT FLIGHT PROFILE				X	
2.3.5 RETRIEVAL				X	
2.3.6 POST MISSION LOCATION					X
3.0 OPERATIONS REQUIREMENTS					
3.1 SCHEDULES (DATES AND TIMES)					
3.1.1 SPACECRAFT ON-DOCK AT INTEGRATION LOCATION	X	X	X		
3.1.2 LAUNCH WINDOW			X	X	
3.1.3 ESTIMATED LIFE OF SPACECRAFT				X	
3.1.4 RETRIEVAL				X	X
3.2 PREREQUISITES (TBD)					
3.3 CONSTRAINTS					
3.3.1 ORIENTATION (VERTICAL VERSUS HORIZONTAL)					
3.3.2 STRONGBACK (LOAD EQUALIZATION)					
3.3.3 TOW SPEED (MAXIMUM)					
3.4 ABORT REQUIREMENTS					
3.4.1 GROUND					

Figure E-3

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
1.0 PAYLOAD NAME	x	x	x	x	x
2.0 MISSION ASSIGNMENT					
2.1 Objectives	x	x	x	x	x
2.2 Spacecraft General Physical Characteristics	x	x	x	x	x
Describe subsystems, dimensions, weight (with and without shipping container).					
2.3 Ground and Flight Mission Profile					
2.3.1 Integration Location (Site)	x	x	x		
2.3.2 Orbiter Flight Profile				x	
2.3.3 Upperstage Flight Profile				x	
2.3.4 Spacecraft Flight Profile				x	
2.3.5 Retrieval				x	
2.3.6 Post Mission Location					x
3.0 OPERATIONS REQUIREMENTS					
3.1 Schedules (Dates and Times)					
3.1.1 Spacecraft On-Dock at Integration Location	x	x	x		
3.1.2 Launch Window			x	x	
3.1.3 Estimated Life of Spacecraft				x	
3.1.4 Retrieval				x	x
3.2 Prerequisites					
(TBD)					
3.3 Constraints					
3.3.1 Orientation (Vertical vs. Horizontal)					
3.3.2 Strongback (Load Equalization)					
3.3.3 Tow Speed (Maximum)					
3.4 Abort Requirements					
3.4.1 Ground					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
3.4.1.1 Recycling Requirements					
3.4.1.2 Special Procedures					
3.4.1.3 Time/Safety Critical Activities					
3.4.2 Flight					
3.4.2.1 Boost Phase					
4.0 OPERATIONS FLOWS AND TIMELINES (List by Time Durations, Sequence Orders, Priorities, Location)					
4.1 MSFC Integration Site					
(To be supplied)					
4.2 JSC Integration Site					
(Same type of activities as shown under MSFC Integration Site)					
4.3 GSFC Integration Site					
(Same type of activities as shown under MSFC Integration Site)					
4.4 Other Integration Site					
(Same type of activities as shown under MSFC Integration Site)					
4.5 KSC Integration, Launch and Landing Site					
4.5.1 Automated Spacecraft Facilities Activities					
4.5.1.1 Provide DOD Security During P/L Processing (if required)					
4.5.1.2 Transport GSE to S/C C/O Facility					
4.5.1.3 Hoist GSE Shipping Container Off of Transporter					
4.5.1.4 Remove Transporter					
4.5.1.5 Wash Down Container					
4.5.1.6 Remove GSE from Container					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
4.5.1.7 GSE Receiving Inspection					
4.5.1.8 Locate GSE in C/O Facility					
4.5.1.9 Structural Mate GSE to Facility					
4.5.1.10 Connect GSE to Support Facility					
4.5.1.11 GSE Prepower Checks					
4.5.1.12 Power-Up GSE					
4.5.1.13 Verify GSE Capability to Control and Monitor					
4.5.1.14 Transfer S/C in Shipping Container to S/C C/O Facility					
4.5.1.15 Hoist Container Off of Transporter					
4.5.1.16 Remove Transporter					
4.5.1.17 Wash Down Container					
4.5.1.18 Remove S/C from Container					
4.5.1.19 Locate S/C in Test Cell					
4.5.1.20 Perform S/C Receiving Inspection					
4.5.1.21 Connect GSE to S/C					
4.5.1.22 Electronic Subsystem Tests					
4.5.1.23 Propulsion Subsystem Tests					
4.5.1.24 Propulsion Leak Checks					
4.5.1.25 SCF Compatibility Test (DOD Only)					
4.5.1.26 Solar Array Test					
4.5.1.27 Upper Stage/Orbiter Interface Verification					
4.5.1.28 Spacecraft CST					
4.5.1.29 Install S/C in Container					
4.5.1.30 Transfer to Integration Facility					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.2 Spacelab Checkout Facilities (To be supplied)					
4.5.3 Integration Facility (SAEF-1) Activities					
4.5.3.1 Assemble and Checkout Upper Stage					
4.5.3.2 Integrate S/C to Upper Stage					
4.5.3.2.1 Provide DOD Security During P/L Processing (If required)					
4.5.3.2.2 Transport GSE to SAEF-1 Airlock					
4.5.3.2.3 Hoist GSE Shipping Container Off of Transporter					
4.5.3.2.4 Remove Transporter from Airlock					
4.5.3.2.5 Wash Down Container					
4.5.3.2.6 Remove GSE from Container					
4.5.3.2.7 Move GSE into Clean Room					
4.5.3.2.8 GSE Receiving Inspection					
4.5.3.2.9 Locate GSE in Clean Room					
4.5.3.2.10 Structural Mate GSE to SAEF-1					
4.5.3.2.11 Connect GSE to Support Facility					
4.5.3.2.12 GSE Prepower Checks					
4.5.3.2.13 Power-Up GSE					
4.5.3.2.14 Verify GSE Capability to Control and Monitor					
4.5.3.2.15 Transport S/C to SAEF-1 Airlock					
4.5.3.2.16 Hoist Shipping Container Off of Transporter					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.3.2.17 Remove Transporter from Airlock					
4.5.3.2.18 Wash Down Container					
4.5.3.2.19 Remove S/C from Container					
4.5.3.2.20 Move S/C into Clean Room					
4.5.3.2.21 Receiving Inspection					
4.5.3.2.22 Locate S/C in Clean Room					
4.5.3.2.23 Install Secure Equipment on Upper Stage (if required)					
4.5.3.2.24 Attach Hoist to S/C					
4.5.3.2.25 Set-Up Access Equipment					
4.5.3.2.26 Hoist S/C and Lower Onto Upper Stage					
4.5.3.2.27 Structural Mate S/C to Upper Stage					
4.5.3.2.28 Connect Functional Interfaces					
4.5.3.2.29 Remove Hoist from S/C					
4.5.3.2.30 Set-Up GSE					
4.5.3.2.31 Test Preparations					
4.5.3.2.32 P/L IST					
4.5.3.2.33 SCF Compatibility Test (DOD Only)					
4.5.3.2.34 Perform Orbiter Interface Verification					
4.5.3.2.35 Move Canister/Transporter to SAEF-1					
4.5.3.2.36 Perform Canister Clean Room Entry Preparations					
4.5.3.2.37 Move Canister/Transporter into Clean Room					
4.5.3.2.38 Attach Canister Support Services					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.3.2.39 Open Canister Doors					
4.5.3.2.40 Align Canister Trunnion Locks					
4.5.3.2.41 Attach Handling Unit to P/L					
4.5.3.2.42 Demate GSE from P/L					
4.5.3.2.43 Translate P/L into Canister					
4.5.3.2.44 Structural Mate P/L to Canister					
4.5.3.2.45 Close P/L Canister Doors					
4.5.3.2.46 Disconnect Canister Support Services					
4.5.3.2.47 Establish P/L Environment in Canister					
4.5.3.2.48 Tow Canister into Airlock					
4.5.3.2.49 Tow Canister to Pad					
4.5.4 OPF Payload Installation Activities					
(To be supplied)					
4.5.5 Launch Pad Activities					
4.5.5.1 P/L GSE PCR Installation and Removal					
4.5.5.1.1 Transfer GSE to LP					
4.5.5.1.2 Reconfigure PCR Flip-Up Panels					
4.5.5.1.3 Hoist GSE and Position in PCR Airlock					
4.5.5.1.4 Move GSE into PCR					
4.5.5.1.5 Locate GSE in PCR					
4.5.5.1.6 Remove GSE Shipping Protective Covers					
4.5.5.1.7 Structural Mate GSE to PCR					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.5.1.8 GSE Receiving Inspection					
4.5.5.1.9 Connect GSE to Facility Services					
4.5.5.1.10 GSE Pre-Power Checks					
4.5.5.1.11 Power-Up Support Equipment					
4.5.5.1.12 Verify GSE Capability to Control and Monitor					
4.5.5.1.13 Disconnect GSE from Facility Services					
4.5.5.1.14 Structural Demate GSE from PCR					
4.5.5.1.15 Install Protective Covers on GSE					
4.5.5.1.16 Reconfigure PCR Flip-Up Panels					
4.5.5.1.17 Move GSE into PCR Airlock					
4.5.5.1.18 Lower GSE onto Transporter					
4.5.5.1.19 Transport GSE to Storage or Return to Supplier					
4.5.5.2 NASA/Commercial P/L or IUS PCR Installation					
4.5.5.2.1 Position Canister Below PCR					
4.5.5.2.2 Attach Hoist to Canister					
4.5.5.2.3 Demate Canister from Transporter					
4.5.5.2.4 Hoist Canister					
4.5.5.2.5 Mate Canister to PCR					
4.5.5.2.6 Inflate PCR Seals					
4.5.5.2.7 Purge Interstitial Door Area					
4.5.5.2.8 Open PCR Doors					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.5.2.9 Attach Canister Pneumatics					
4.5.5.2.10 Open Canister Doors					
4.5.5.2.11 Align PGHM Manipulators					
4.5.5.2.12 Extend PGHM into Canister					
4.5.5.2.13 Attach PGHM to Payload					
4.5.5.2.14 Release Payload from Canister					
4.5.5.2.15 Translate P/L from Canisters into PCR					
4.5.5.2.16 Close Canister Doors					
4.5.5.2.17 Disconnect Canister Pneumatics					
4.5.5.2.18 Close PCR Doors					
4.5.5.2.19 Deflate PCR Seals					
4.5.5.2.20 Lower Canister and Mate to Transporter					
4.5.5.2.21 Return Canister and Transporter to Storage					
4.5.5.3 DOD P/L PCR Installation					
4.5.5.3.1 Position Mobile Airlock (MA) for Hoisting					
4.5.5.3.2 Attach Hoist to MA					
4.5.5.3.3 Demate MA from Transporter					
4.5.5.3.4 Hoist MA to PCR Main Doors					
4.5.5.3.5 Structurally Mate MA to PCR					
4.5.5.3.6 Mate Support Services to MA					
4.5.5.3.7 Position S/C Container Below MA					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.5.3.8 Open MA P/L Entrance Door					
4.5.5.3.9 Attach Hoist to S/C Container Handling Fixture					
4.5.5.3.10 Secure Guidelines					
4.5.5.3.11 Hoist S/C into MA					
4.5.5.3.12 Close MA P/L Entrance Door					
4.5.5.3.13 Wash Down S/C Container					
4.5.5.3.14 Remove S/C from Container					
4.5.5.3.15 Establish Environment Compatible with PCR					
4.5.5.3.16 Open PCR Main Doors					
4.5.5.3.17 Open MA Main Doors					
4.5.5.3.18 Transfer S/C to PCR on Monorail					
4.5.5.3.19 Attach S/C Cradle to PGHM					
4.5.5.3.20 Attach S/C to Upper Stage					
4.5.5.3.21 Return S/C Handling Fixture to MA					
4.5.5.3.22 Close PCR Main Doors					
4.5.5.3.23 Close MA Main Doors					
4.5.5.3.24 Open MA P/L Entrance Door					
4.5.5.3.25 Lower Handling Fixture to Shipping Container					
4.5.5.3.26 Transfer S/C Container to Storage Facility or Supplier					
4.5.5.3.27 Disconnect Support Services from MA					
4.5.5.3.28 Lower MA onto Transporter					
4.5.5.3.29 Return MA to Storage					
4.5.5.4 DOD Factory-to-Pad PCR Activities					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
4.5.5.4.1 Set Up Payload Access Equipment					
4.5.5.4.2 Configure Each P/L Element for Testing					
4.5.5.4.3 Perform Pre-Power Checks on each P/L Element					
4.5.5.4.4 Connect GSE to each Payload Element					
4.5.5.4.5 Power-Up Support Equipment					
4.5.5.4.6 S/C Performance Verification					
4.5.5.4.7 Upper Stage Performance Verification					
4.5.5.4.8 Connect and Verify Fluid Interfaces Between P/L Elements					
4.5.5.4.9 Install P/L Components (Batteries, Fairings, etc.)					
4.5.5.4.10 Install, Connect and C/O Ordnance					
4.5.5.4.11 Perform System Alignment					
4.5.5.4.12 Connect and Verify Electrical Interfaces between P/L Elements					
4.5.5.4.13 Test Preparations					
4.5.5.4.14 S/C ACS Functional Test					
4.5.5.4.15 SCF Compatibility Test					
4.5.5.4.16 Payload IST					
4.5.5.4.17 Load Pneumatic Systems					
4.5.5.4.18 Load S/C Fluids					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
4.5.5.5 Orbiter/Payload Integrated Activities					
4.5.5.5.1 Swing PCR from Stored Position to Orbiter					
4.5.5.5.2 Inflate PCR Door Seals					
4.5.5.5.3 Purge Interstitial Door Area					
4.5.5.5.4 Open PCR Doors					
4.5.5.5.5 Open P/L Bay Doors					
4.5.5.5.6 Install P/L Access in Orbiter					
4.5.5.5.7 Translate P/L into Bay with PGHM					
4.5.5.5.8 Structural Mate Payload to Orbiter					
4.5.5.5.9 Retract PGHM into PCR					
4.5.5.5.10 Connect Orbiter-to-Payload Interfaces					
4.5.5.5.11 Verify Mechanical Interfaces					
4.5.5.5.12 Verify Electrical Interfaces					
4.5.5.5.13 Verify Fluid Interfaces					
4.5.5.5.14 Final P/L Non-Hazardous Servicing					
4.5.5.5.15 Secure P/L GSE					
4.5.5.5.16 Cabin Closeout					
4.5.5.5.17 Launch Readiness Verification Test					
4.5.5.5.18 Set Up Mid-Body Umbilical for P/L Loading					
4.5.5.5.19 Payload Hazardous Servicing (as required)					
4.5.5.5.20 Secure P/L Servicing Lines					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.5.5.21 PCR Retract Preparations					
4.5.5.5.22 Close P/L Bay and PCR Doors					
4.5.5.5.23 Deflate PCR Seals					
4.5.5.5.24 Rotate PCR to Launch Position					
4.5.5.5.25 Clear Pad					
4.5.5.5.26 T-2 Hour Standby					
4.5.5.5.27 Payload Cryogenic Loading					
4.5.5.5.28 Crews at Ready Area					
4.5.5.5.29 Crew and Passenger Loading					
4.5.5.5.30 Secure and Closeout Cabin					
4.5.5.5.31 Terminal Count					
4.5.6 Returning Payload Activities					
4.5.6.1 Routine Post Landing Activities					
4.5.6.1.1 Establish DOD Payload Security (if required)					
4.5.6.1.2 Connect Ground Services					
4.5.6.1.3 Start Data Dump					
4.5.6.1.4 Ordnance Safing (as required)					
4.5.6.1.5 Crew Exchange					
4.5.6.1.6 Tow Orbiter to OPF					
4.5.6.1.7 Provide DOD Security during P/L Operations (if required)					
4.5.6.1.8 Payload Deservicing					
4.5.6.1.9 Payload Removal					
4.5.6.1.10 Remove Orbiter ASE					
4.5.6.1.11 Connect P/L Ground Servicing Equipment					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.6.1.12 Payload Propellant Systems Deservicing					
4.5.6.1.13 Disconnect P/L Ground Servicing Equipment					
4.5.6.1.14 Payload Data Dump					
4.5.6.1.15 Purge Classified Data from Recorders and Computers (if required)					
4.5.6.1.16 Establish Cleanliness Control					
4.5.6.1.17 Establish Hazardous Operations Control					
4.5.6.1.18 Attach Hoist to P/L Bay Doors					
4.5.6.1.19 Open Payload Bay Doors					
4.5.6.1.20 Attach Strongback to Payload					
4.5.6.1.21 Attach Hoist to Payload					
4.5.6.1.22 Disconnect Orbiter-to-Payload Interfaces					
4.5.6.1.23 Hoist and Position P/L on Transporter					
4.5.6.1.24 Move Payload to Processing Area					
4.5.6.1.25 Demate Functional Interfaces between P/L Elements					
4.5.6.1.26 Attach Hoist and Sling to S/C					
4.5.6.1.27 Demate Structural Interfaces between P/L Elements					
4.5.6.1.28 Hoist Payload and Lower Onto Fixture					
4.5.6.1.29 Disassemble Payload as Required for Shipping					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
4.5.6.1.30 Package P/L and Its Equipment					
4.5.6.1.31 Ship Payload to Supplier					
4.6 VAFB Integration, Launch and Landing Site					
(To be supplied)					
4.7 Secondary Landing Site					
(To be supplied)					
5.0 EQUIPMENT REQUIREMENTS					
5.1 STS-Provided Equipment and Airborne Mission Kits					
5.1.1 SSV					
5.1.2 IUS					
5.1.3 SSUS					
5.1.4 Tug					
5.1.5 IVE					
5.1.6 CITE					
5.1.7 PSS Panel					
5.1.8 MSS Panel					
5.1.9 Spacelab					
5.1.9.1 Support Module					
5.1.9.2 Experiment Module					
5.1.9.3 Pallets					
5.1.9.4 Racks					
5.1.9.5 Tunnel					
5.1.9.6 Utility Bridge					
5.1.10 Tunnel Adapter					
5.1.11 Docking Module					
5.1.12 Airlock					
5.1.12.1 Inside					
5.1.12.2 Outside					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
5.1.13 PBK					
5.1.13.1 500 FPS ΔV					
5.1.13.2 1000 FPS ΔV					
5.1.13.3 1500 FPS ΔV					
5.1.14 Radiator Panel Delta Kit					
5.1.15 RTG Cooling Kit					
5.1.15.1 Three RTG's					
5.1.15.2 Six RTG's					
5.1.16 Fluid Service Lines					
5.1.16.1 Inert					
5.1.16.2 Volatile					
5.1.17 Propellant Dump/Vent Lines					
5.1.17.1 Cryo					
5.1.17.2 RTG Coolant					
5.1.18 Mission Extension					
5.1.18.1 N_2					
5.1.18.2 Waste					
5.1.18.3 Cryo					
5.1.19 Wire Harness Cables					
5.1.20 Second Antenna					
5.1.21 RMS					
5.1.21.1 LH					
5.1.21.2 RH					
5.1.22 Water GSE Coolant Line Kit					
5.2 MMSE-Provided Equipment					
5.2.1 Access Equipment, Payload Canister, Horiz. (KMA-MH-03)					
5.2.2 Canister, Payload (KMA-MH-10)					
5.2.3 Canister, Payload Element (KMA-MH-11)					
5.2.4 Fixture, Payload Handling (KMA-MH-19)					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
5.2.5 Set, Transportation Instrumentation (KMA-MH-26)					
5.2.6 Transporter, Payload Canister (KMA-MH-39)					
5.2.7 Transporter, Payload Element Canister (KMA-MH-41)					
5.2.8 Unit, Environmental Conditioning (KMA-MH-44)					
5.2.9 Access Platform, S/C Assembly Stand, Vertical (KMB-MH-06)					
5.2.10 Unit, Aux. Power (KMB-MH-21)					
5.2.11 Sling Set, Multipurpose (KMB-MH-27)					
5.2.12 Stand, S/C Assy., Vertical (KMB-MH-34)					
5.2.13 Access Equip., P/L Canister, Vertical (KMB-MH-45)					
5.2.14 Work Stand, P/L Assy./Test Horiz. (KMB-AH-30)					
5.2.15 Set, Hydrazine, Service (KMB-MS-01)					
5.2.16 Set, Instrument Gas, Service (KMB-MS-02)					
5.2.17 Set, LHe, Service (KMB-MS-03)					
5.2.18 Cart, P/L Purge (KMB-MS-09)					
5.2.19 Set, LH_2, Service (KMB-SS-02)					
5.2.20 Set, LN_2, Service (KMB-SS-03)					
5.2.21 Set, LO_2, Service (KMB-SS-05)					
5.3 Experiment-Provided Equipment (Description includes dimensions, weight and interface requirements)					
5.3.1 Payload Canister					
5.3.2 Spacecraft Rotation Fixture					
5.3.3 Cover Set					
5.3.4 Storage Cover Set					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
5.3.5 Portable Clean Room					
5.3.6 Alignment Set					
5.3.7 Calibration Set					
5.3.8 Environmental Control Unit					
5.3.9 Animal Support Equipment					
5.3.10 Photography Support Kit					
5.3.11 Optics Support Kit					
5.3.12 Radioactive Material Support Kit					
5.3.13 RTG Cooling Set					
5.3.14 Cable Sets					
5.3.15 Breakout Boxes					
5.3.16 Ordnance Simulator					
5.3.17 P/L Electrical Simulator					
5.3.18 Comm./Instrumentation Test Set					
5.3.19 Engine Alignment Test Set					
5.3.20 G&N Test Set					
5.3.21 Electrical Test Set					
5.3.22 Propulsion Test Set					
5.3.23 Adapters					
5.3.24 Star Tracker Test Set					
5.3.25 Simulators					
5.3.26 Transporter					
5.3.27 Payload Cradle					
6.0 FACILITY ACCOMMODATIONS REQUIREMENTS					
6.1 Facilities					
6.1.1 Operations					
6.1.1.1 Minimum Room Height					
6.1.1.2 Floor Space (Length by Width)					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
6.1.1.3 Door Size (Width by Height)					
6.1.1.4 Crane					
6.1.1.4.1 Hook Height					
6.1.1.4.2 Load					
6.1.1.5 Explosion Proofing Required					
6.1.1.6 Control Room					
6.1.1.6.1 Number of People					
6.1.1.6.2 Number of Consoles/Racks					
6.1.2 Storage and Warehouse Area					
6.1.2.1 Floor Space (Length by Width)					
6.1.2.2 Floor Loading					
6.1.3 Office Requirements (No. of People)					
6.2 Environmental Requirements					
6.2.1 Cleanliness Level					
6.2.1.1 Factory Clean					
6.2.1.2 100,000					
6.2.1.3 10,000					
6.2.1.4 100					
6.2.2 Cleanliness Shroud Requirements					
6.2.3 Temperature					
6.2.3.1 Operating (Max/Min)					
6.2.3.2 Non-Operating (Max/Min)					
6.2.4 Relative Humidity (Max/Min)					
6.2.5 Pressure/Vacuum Requirements					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
6.3 Electrical					
6.3.1 DC Power (List maximum voltage, current, power and backup requirements for each).					
6.3.1.1 5 VDC					
6.3.1.2 28 VDC					
6.3.1.3 Other					
6.3.2 AC Power (List maximum voltage, current, phases, power, frequency, backup requirements for each)					
6.3.2.1 115 VAC					
6.3.2.2 220 VAC					
6.3.2.3 440 VAC					
6.3.2.4 Other					
6.3.3 Sequencer/Power Distribution					
6.3.3.1 Control by Experiment GSE					
6.3.3.2 Control by LPS					
6.3.4 Simulations					
6.3.4.1 Trajectory					
6.3.4.2 Training					
6.3.5 Electromechanical Compatibility (EMC) Requirements					
6.4 Communications/Data					
6.4.1 RF					
6.4.1.1 Channels					
6.4.1.1.1 Frequency (Hz)					
6.4.1.1.2 Bandwidth (Hz)					
6.4.1.1.3 Bit Rate (Bits/Sec)					
6.4.1.1.4 Power (Watts)					
6.4.1.2 Method					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION			FLT	POST MISSION
	IV	III/II	I		
6.4.1.2.1 Open Loop					
6.4.1.2.2 Closed Loop					
6.4.2 Hardline Channels					
6.4.2.1 Frequency					
6.4.2.2 Bandwidth					
6.4.2.3 Bit Rate					
6.4.2.4 Power					
6.5 Caution and Warning Functions					
6.5.1 Quantity					
6.5.2 Type					
6.6 Fluids (Fill, drain, vent, waste removal requirements defined by flow rates, pressures, temperature, moisture content and purity)					
6.6.1 Gases					
6.6.1.1 Shop Air					
6.6.1.2 Gaseous Nitrogen (GN_2)					
6.6.1.3 Gaseous Helium (GHe)					
6.6.1.4 Gaseous Oxygen (GO_2)					
6.6.1.5 Gaseous Hydrogen (GH_2)					
6.6.1.6 Other Gases					
6.6.2 Liquids					
6.6.2.1 Liquid Nitrogen (LN_2)					
6.6.2.2 Liquid Helium (LHe)					
6.6.2.3 Liquid Oxygen (LO_2)					
6.6.2.4 Liquid Hydrogen (LH_2)					
6.6.2.5 Water (Coolant)					
6.6.2.6 Water (Potable)					
6.6.2.7 Water (Demineralized)					
6.6.2.8 Monomethyl Hydrazine (MMH)					
6.6.2.9 Hydrazine (N_2H_4)					
6.6.2.10 Aerozine 50					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
6.6.2.11 Nitrogen Tetraoxide (N_2O_4)					
6.6.2.12 Hydraulic Fluid (List Type)					
6.6.2.13 Ammonia (NH_3)					
6.6.2.14 Freon (List Type)					
6.6.2.15 Solvents					
6.6.2.16 Other Liquids					
6.7 Special Handling and Transportation					
6.7.1 Acceleration Limits					
6.7.1.1 X Axis +, - g's					
6.7.1.2 Y Axis +, - g's					
6.7.1.3 Z Axis +, - g's					
6.7.2 Vibration and Shock					
6.7.2.1 Frequency Ranges					
6.7.2.2 Magnitudes					
6.7.3 Acoustics Limits					
6.7.3.1 Frequency					
6.7.3.2 Magnitude					
6.7.4 Enroute Requirements					
6.7.4.1 Power					
6.7.4.2 Data Monitoring					
6.7.4.3 Environmental					
6.7.4.3.1 Temperature					
6.7.4.3.2 Humidity					
6.7.4.3.3 Cleanliness					
6.7.4.4 Purge					
6.8 Hazards (Description of Potential Hazards and the Necessary Safeguards)					
6.8.1 Radioactive Materials					
6.8.1.1 Type					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
6.8.1.2 Special Handling					
6.8.1.3 Storage Requirements					
6.8.2 Toxic Materials					
6.8.2.1 Type					
6.8.2.2 Levels					
6.8.3 Asphyxiant Materials					
6.8.3.1 Type					
6.8.4 Flammable Materials					
6.8.4.1 Type					
6.8.4.2 Ignition Type and Temperature					
6.8.5 Corrosive Materials					
6.8.5.1 Type					
6.8.5.2 Incompatible Materials					
6.8.5.3 Reaction Description					
6.8.6 Ordnance/Pyrotechnic Devices					
6.8.6.1 Type and Level					
6.8.6.2 Location of Installation and Connection					
6.8.6.3 Purpose					
6.8.6.3.1 Integral Kick Motor					
6.8.6.3.2 Spin Motors					
6.8.6.3.3 Separation Devices					
6.8.6.3.4 Gas Generator					
6.8.6.3.5 Explosive Valves					
6.8.6.3.6 Other					
6.9 Technical Support Areas					
6.9.1 Chemical Lab					
6.9.2 Shop Area					
6.9.2.1 Mechanical (Machine)					
6.9.2.2 Electrical					

Figure E-3 (Continued)

OPERATIONS PLANNING DATA FILE

PRELIMINARY

DATA FILE CONTENT

PARAMETER (DESCRIPTION)	LEVEL OF INTEGRATION IV	III/II	I	FLT	POST MISSION
6.9.3 Battery Lab					
6.9.4 Biomedical Lab					
6.9.5 Dark Room					
6.9.6 Optics Test Room					
6.9.7 Solar Array Test Room					
6.9.8 Spin Test Facility					
6.9.9 Other					
6.10 Technical Support Services					
6.10.1 Clean Rooms/Laminar Flow Benches (Class)					
6.10.2 Data/Communications					
6.10.3 Range Timing					
6.10.4 Meteorological					
6.10.5 Instrument Calibration					
6.10.6 Chemical Sampling					
6.10.7 Chemical Analysis					
6.10.8 Component Cleaning					
6.10.9 Tool Cribs					
6.10.10 Photography					
6.10.11 Other					
6.11 Administrative Services					
6.11.1 Motor Pool					
6.11.2 Fork Lifts					
6.11.3 Reproduction					
6.11.4 Other					

12-Year	Five-Year
Spacecraft Subsystem Checkout	Connect GSE to S/C Electronic Subsystem Test Propulsion Subsystem Test Propulsion Leak Tests STDN/SCF Compatibility Test Solar Array Test

In evaluating how the operations data files should be used, and therefore their preferred format, it was suggested that operations flows and timelines be generated in either of two modes (as shown in Figure E-4):

Option 1 — Generalized functional activities can be input and then the user could structure them into an operational flow by sequencing a group of required functions.

(Comment) The large number of flows that could be developed from a list of activities is a potential problem, Some functional choices include:

1. OPF vs PCR payload installation.
2. Spacecraft/IUS integration in SAEF-1 vs PCR.
3. IUS vs SSUS vs Tug.
4. Spacecraft factory-to-pad vs factory-to-SAEF-1 vs factory-to-spacecraft checkout facility.
5. Spacelab Level III and II integration at KSC vs VAFB for VAFB launches.
6. IUS/SSUS assembly and checkout at KSC vs VAFB for VAFB launches.

Option 2 — Operational flows developed for specific generic payloads can be input.

(Comment) Utilizing existing KSC (PGOR and VGOR) flows appears the most effective way to store operations data considering user complexity, flow options, and inter-center agreement. As an example of multiple flow options, the PGOR effort developed 37 different Shuttle flows as follows:

Figure E-4

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OPERATIONS FLOWS AND TIMELINES FILES

4.5.5.2	NASA/COMMERCIAL PAYLOAD OR IUS PCR INSTALLATION
4.5.5.2.1	POSITION CANISTER BELOW PCR
4.5.5.2.2	ATTACH HOIST TO CANISTER
4.5.5.2.3	DEMATE CANISTER FROM TRANSPORTER
4.5.5.2.4	HOIST CANISTER

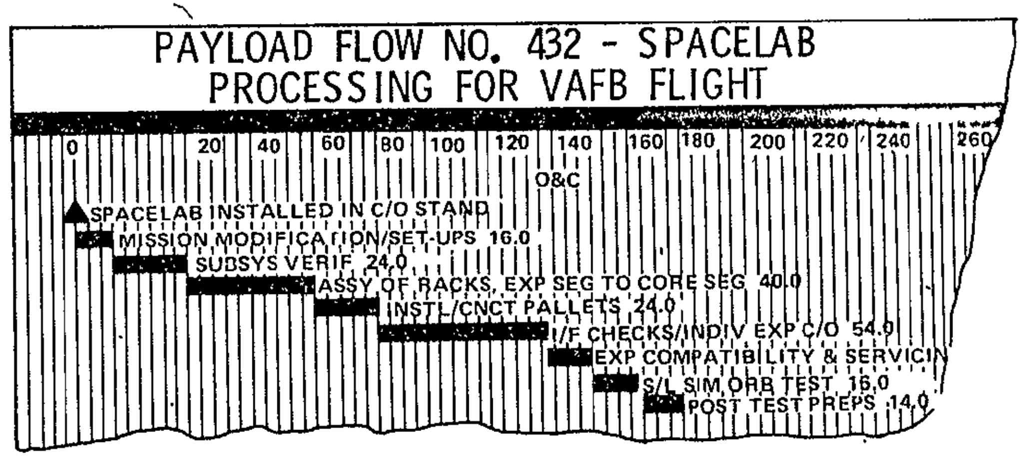
OPTIONS:

1. ELEMENTAL FUNCTIONS ENTRY

   (GENERALIZED OPERATIONAL REQUIREMENTS/FUNCTIONS CAN BE INPUT. DIFFERENT FUNCTIONAL FLOWS CAN THEN BE STRUCTURED BY SEQUENCING A GROUP OF REQUIRED FUNCTIONS)

2. GENERIC FLOW ENTRY

   (SPECIFIC SHUTTLE/PAYLOAD FLOWS CAN BE INPUT)



Spacelab	13
Free-Flyer	5
OFT Only	4
IUS	12
Tug	3
TOTAL	37

The issues raised about the files as to the handling of intended user options pointed to utilizing the existing KSC (PGOR and VGOR) flows that were developed for generic payloads as the most effective way to store operations data. There are two distinct advantages:

1. Agreement with the KSC Launch and Landing Site personnel is virtually guaranteed.
2. Less complication for the operator in real time establishing the proper flow for a payload.

The preliminary Operations Planning Data Files contained a candidate operations planning data file structure, format, and list of parameters to be considered. The level of detail was too low and did not address the problem of how to limit the parameters to only those you really need for IP&MP support.

The attached methodology outline addresses the inherent problem of determining which operational flight and ground elements (facilities and equipment) you have to track in order to analyze both the 12-year and the five-year mission plans adequately. This is aimed at determining how low a level of detail you have to go for operations planning.

Operations Planning Methodology for Determining the Tracking Requirements for Flight and Ground Items

The process of determining which flight and ground items should be tracked will be accomplished in three phases. The initial phase will identify those items which can, for one reason or another, be eliminated from tracking lists. The final two phases will provide tracking guidelines for the 12-year scheduling and the 5-year scheduling activities.

I. Initial Phase

Introduction

This phase will identify and classify the flight and ground items and eliminate those items possible by predetermined processes.

The flight and ground items will be classified by category to determine which ones should be tracked. To accomplish this, the items will be processed through a sequence of tasks to determine the category into which each item should be placed. These categories are defined in Table E-1.

Table E-1. Categories

Category	Definition
A	Items requiring tracking.
B	Items combined into a higher level item.
C	Items eliminated by usage rate.
D	Items where no competition for use exists.
E	Minor hardware items.

This procedure will identify those items that may be eliminated in the initial phase. Only items in Category A will require tracking. Category A items will consist of those items not eliminated as Category B, C, D or E.

Hardware Identification

Prior to categorizing hardware to determine which items require tracking, it will be necessary to identify all flight and ground items. This will be done by first identifying those facilities to be used by integration or operational activities. These facilities will be identified to the highest level possible. In some instances, the facility may be an entire facility and in others it may be a major operational area. This will depend on the self-sufficiency of the area. For example, each of the two cells (major operational areas) located in the SAEF are self-sufficient. Therefore, SAEF-1 Cell 1 and SAEF-1 Cell 2 will each be considered a facility. Elsewhere, if multiple checkout cells exist, but they are serviced by a single control area which can operate only one cell at the time, the entire complex of cells and control area would be considered as an entity.

After each facility or operational area has been identified, the types of functions, or operations, to be performed in that area will be determined. This will be done at the highest level possible (i.e., hoisting, assembly, servicing). Then, for each function or operation to be performed, the candidate hardware items necessary to perform them will be identified. For example, a hoisting operation requires slings, tethers, overhead cranes, spreader bars, etc. In order to accomplish subsequent tasks in this effort, the types and quantities of items available or authorized must be identified.

In developing the list of items, those items supporting orbital operations must be considered to accomplish this. For that reason, the Orbiter will be included as a facility or operational area.

The next step in identification of hardware consists of placing each item into a complexity level. This will assist in the categorizing of the items.

Four complexity levels will be used from minor items (Level 4) to self-sufficient facilities (Level 1). Representative items for each level are provided in Table E-2. These items will then be placed into categories which will determine which should or should not be tracked.

TABLE E-2 - HARDWARE ITEM COMPLEXITY LEVELS

LEVEL	DEFINITION OF LEVEL	REPRESENTATIVE ITEMS	
		GROUND	FLIGHT
1	Self-Sufficient Facility or Operational Area	a. Bldg 4708 Test Area No. 1 b. SAEF-1 Cell 1 c. MOCR at MOCC	Orbiter, ET, SRB
2	Model or Kit of Equipment	a. Power Unit b. Hoisting Kit c. Flight Director's Console	a. OMS b. Module c. Pallet d. Second RMS Kit
3	Major Hardware Item	a. Leak Detector b. Slings c. Display Unit	a. OMS Engine b. Rack c. IPS d. Grappler
4.	Minor Hardware Item	a. Valve b. Turn Buckles c. Switch	a. Valve b. Panel c. Gimbal Ring d. RMS Elbow

Category Identification

Each item will then be placed into a specific category depending on specific usage. Items not placed into lower categories (B, C, D, or E) will be placed into Category A and will be tracked.

Task 1. Category B Items Identification

Combining lower complexity level items into higher level items consists of two tasks. First, all items which are permanently attached to a particular item shall be considered as part of that item and eliminated from the tracking list. For example, the access stand, hydrazine servicing system, overhead crane, etc., are integral parts of the SAEF-1; therefore, they are classified as Category B and eliminated from the tracking list. In essence, they are tracked by tracking SAEF-1, Cell 1, and SAEF-1, Cell 2. The second task is that effort necessary to analyze small important items that have a common function so that they may be combined into a kit. Usage of kits will drastically reduce the number of items that are tracked which will promote cost effectiveness. As an example, a power supply, breakout boxes, patch panels, etc., may be combined into a Power Kit. Likewise gauges, adapters, regulators, valves, etc., may be combined into a Propulsion Kit for tracking purposes.

Task 2. Category C Items Identification

Some items may be eliminated from the tracking list if the planned launch rate was a design requirement in the determination of quantity requirements. These items will be identified and may be eliminated from the tracking list as long as the planned conditions do not exceed the design conditions. For example, the Space Shuttle vehicle, its facilities and support equipment need not be considered unless the launch rate exceeds 40 per year from KSC and 20 per year from VAFB. Other conditions may also warrant tracking due to unusually close launch dates, excessive mission time (e.g., 30 days in orbit), etc. Certain other items, such as the Spacelab support module, may be analyzed to establish maximum Spacelab usage capability.

Task 3. Category D Items Identification

Some items may be eliminated if they are available in a quantity which is greater than the requirements. The items usage areas are summarized to show the maximum quantity that may be required at any one time. Next, the maximum anticipated usage is compared with the availability as shown in the matrix (Table E-3) which may be utilized for Category D test. Those items which have a quantity available that equals or exceeds the maximum required may be classed as Category D and eliminated from the tracking list. Another group of items that fall within Category D are the items which are provided by the payload. By definition, payload project supplied items are not used for other payloads, hence there is no competition for these items and only need to be tracked internally to the payload project.

Low cost items that require tracking should be analyzed for a cost tradeoff between the cost of procuring additional items, as opposed to the cost of tracking the item. Tracking will be an expensive process based on 12 years of the operational STS program.

Table E-3. TRACKING IDENTIFICATION MATRIX - CATEGORY D TEST

SIMILAR CHART REQUIRED FOR FLIGHT SUPPORT EQUIPMENT

		ITEMS OF GSE BY QUANTITY														
FACILITY		a	b	c	d	e	f	g	h	i						
PAD A		1	1													
PAD B		1	1													
OPF	CELL 1	1														
	CELL 2	1														
O&C	CELL 1															
	CELL 2															
	CELL 3															
SAEF-I	CELL 1		1													
	CELL 2		1													
BLDG S			1													
BLDG ...																
BLDG ...																
BLDG ...																
BLDG ...																
BLDG ...																
INTRA-SITE																
INTER-SITE																
IN ORBIT																
Σ MAX. REQMT		4	5													
Σ AVAILABILITY		2	6													
TRACK		YES	NO													

Task 4. Category E Items Identification

A large quantity of items fall into Category E. They are mostly minor hardware items. This category generally includes items such as flexible hoses, oscilloscopes, bench equipment, etc. By definition, unavailability of these items shall not cause a schedule perturbation either because there are workarounds or that suitable substitutes are readily available.

Task 5. Category A Items Identification

After completion of Task 4, a list of equipment is compiled which could not be eliminated. This tracking list will be used in the following analysis phases. This list makes up the Category A items.

II. 12-Year Scheduling Phase

The 12-year operational timelines are developed to a very high level showing the facilities planned for its activities and a gross level of function descriptions. Duration times should be estimated on the basis of weeks in each facility.

Estimates for the starting time at each site as defined by each project's programmatics should also be based on weeks.

The tracking list of equipment which was developed in the initial phase is used as a "shopping list" for defining the equipment that is required to support the particular payload ground and mission operations.

The resultant list of trackable items on a time required basis is stored in the computer as "reserved items." Reservations are made unless the quantity available is exceeded. For that case, the schedule must be shifted to allow the required reservations to be made.

An example of 12-year scheduling is shown on the 12-year master schedule shown in Table E-4.

III. 5-Year Scheduling Phase

The 5-year scheduling phase is performed in the same way as the 12-year scheduling phase with the difference being greater depth at five years.

Timelines and programmatic times are based on days rather than weeks. The operations functions are defined to a lower level so that more definitive scheduling of trackable items may be made. As an example, if the 12-year schedule has a function called subsystem checkout, the 5-year schedule would break that function down to its individual subsystems (i.e., communications, power, attitude control, guidance and control, etc.).

Reservations for trackable items are entered into the computer to assure availability. If the reservation request exceeds the availability, then the schedule must either be shifted or a workaround must be developed.

EXAMPLE

TABLE E-4. 12 YEAR MASTER SCHEDULE

NO. KSC-4

DATE 10-15-76

ISSUE No. 1

PAGE 1 OF 1

TYPE: AUTOMATED/METEORLOGICAL

SITE: KSC

TIME:
- BY DAYS FOR 5YR SCHEDULE
- BY WEEKS FOR 12 YEAR SCHEDULE

	ACTIVITY	WEEKS / CALENDAR TIME	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9															
		ELAPSED TIME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	FACILITIES & FIXED EQUIP:		ON DOCK																																			
2	TRANSPORT TO FACILITY A		▭																																			
3	FACILITY A ACTIVITIES (CELL NO. 1)		▬	▬	▬	▬	▬	▬	▬																													
4	TRANSPORT TO FACILITY B									▭																												
5	FACILITY B ACTIVITIES (CELL NO. 1)										▬	▬	▬																									
6	TRANSPORT TO FACILITY C												▭																									
7	FACILITY C ACTIVITIES (PAD B)													▬	▬	▬	▬	▬	▬	▬	▬	▬	▬															
8	LAUNCH																							△														
9																																						
10																																						
11	PORTABLE GSE REQUIRED:																																					
12	GSE ITEM a		1							1			1																									
13	b		2	2	2	2	2	2	2	2																												
14	c									3	3	3	3																									
15	d		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
16	e													2	2	2	2	2	2	2	2	2	2															
17	f													1	1	1	1	1	1	1	1	1	1															
18	g		2	2	2	2	2	2	2	2	2	2	2																									
19	h													1	1	1	1	1	1	1	1	1	1															
20																																						
21																																						
22	FLIGHT SUPPORT EQUIP. REQUIRED:																																					
23	ITEM 1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
24	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2															
25	3									1	1	1	1	1	1	1	1	1	1	1	1	1	1															
26	4									3	3	3	3	3	3	3	3	3	3	3	3	3	3															
27	5													1	1	1	1	1	1	1	1	1	1															
28	6													1	1	1	1	1	1	1	1	1	1															
29	7													1	1	1	1	1	1	1	1	1	1															
30																																						
31																																						
32																																						
33																																						
34																																						
35																																						
		ELAPSED TIME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
		CALENDAR DATE WEEK	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9															
		YR										1988			1989																							

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Appendix F
STS PAYLOAD CARRIER DATA FILES (TASK 2.1B)

To support the development of the payload planning process and products (Mission Model, Planning Baseline, Mission Compatibility Analyses) and to support other uses of the PPDB, NASA plans to build automated PPDB files containing sets of parameters sufficient to describe specific STS payload carriers (Shuttle, Spacelab, IUS, SSUS). The objective of the MDAC task effort as shown in Figure F-1, was to identify and define all the parameters needed to build such data files. The approach taken was to review all the parameters currently being used in related analyses, add to, sort out, and format these parameters, and indicate the applicability of each parameter and the level of detail required for the planning process and products.

Data file parameter contents were defined for the following STS payload carriers:

- File I - Orbiter
- File II - Spacelab
- File III - IUS (Intermediate Upper Stage)
- File IV - SSUS (Spin Stabilized Upper Stage)

These data sheets attempt to scope the following areas for each payload carrier:

1. Programmatics
2. Configuration
3. Subsystems
4. Operations (relevant to Mission Analysis efforts)
5. Costs

After the description of each parameter is given, a checkmark is presented as shown in Figure F-2 indicating whether these data are needed for:

1. The Mission Model (MM)
2. The Planning Baseline (B/L)
3. Mission Compatibility Analyses (MA)

The data are needed for the documents where the checkmark appears and for the documents which follow--but not for the preceding document(s). These estimations were based on the document definitions of Task 1.0.

FIGURE F-1

STS PAYLOAD CARRIER DATA FILES

OBJECTIVES:

IDENTIFY ALL PARAMETERS NEEDED TO BUILD AUTOMATED DATA FILES ON STS PAYLOAD CARRIERS FOR USE IN THE PLANNING PROCESS

APPROACH:

1) REVIEW PARAMETERS BEING USED IN THE PAYLOAD PLANNING PROCESS AND RELATED EFFORTS RELATIVE TO STS CARRIERS (SHUTTLE, SPACELAB, IUS, SSUS)

2) SORT OUT, IDENTIFY AND FORMAT THESE PARAMETERS

3) INDICATE APPLICABILITY OF THE PARAMETERS FOR THE PREPARATION OF SPECIFIC PRODUCTS (MISSION MODEL, PLANNING BASELINE, AND MISSION ANALYSES)

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Figure F-2

PAYLOAD CARRIER DATA FILES
FILE (II) SPACELAB

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.0	SUBSYSTEMS			
3.1	ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEM (EPDS)			
3.1.1	POWER (AVERAGE NOMINAL AND MAXIMUM) REQUIRED BY BASIC SL EQUIPMENT CONFIGURATIONS,FOR ASCENT, DESCENT AND ON-ORBIT PHASES:			
3.1.1.1	LONG MODULE	X		
3.1.1.2	CORE MODULE	X		
3.1.1.3	LONG MODULE + PALLET(S)	X		
3.1.1.4	CORE MODULE + PALLET(S)	X		
3.1.1.5	PALLET(S) ONLY	X		
3.1.2	POWER (NOMINAL AND MAXIMUM) REQUIRED BY MISSION DEPENDENT SPACELAB EQUIPMENT (MDSE),FOR ASCENT, DESCENT, AND ON-ORBIT PHASES:			
3.1.2.1	EXPERIMENT COMPUTER			X
3.1.2.2	HIGH DATA RATE RECORDER (HDRR)			X
3.1.2.3	DATA DISPLAY UNIT AND SYMBOL GENERATOR			X
3.1.2.4	EXPERIMENT INVERTER – 400 Hz			X
3.1.2.5	EXPERIMENT I/O UNIT			X
3.1.2.6	EXPERIMENT POWER SWITCHING PANELS			X
3.1.2.7	INSTRUMENT POINTING SUBSYSTEM (IPS)			X
3.1.3	POWER (NOMINAL AND MAXIMUM) REQUIRED BY COMMON PAYLOAD SUPPORT EQUIPMENT (CPSE),FOR ASCENT, DESCENT, AND ON-ORBIT PHASES:			
3.1.3.1	TOP AIRLOCK			X
3.1.3.2	AFT AIRLOCK			X
3.1.3.3	HIGH QUALITY WINDOW/VIEWPORT ASSEMBLY			X
3.1.3.4	MODULAR FILM VAULTS			X
3.1.3.5	HIGH VACUUM VENT FACILITY			X
	NOTE: SUPPLIED VOLTAGE (VDC, VAC, NOMINAL AND RANGES), POWER LEVELS (NOMINAL AND PEAK(S) INCLUDING DURATION, FREQUENCY AND TIME BETWEEN PEAKS), AND ENERGY AVAILABLE, ACCESS AND EXTRACT THE DATA FROM THE FOLLOWING FILES:			

During the definition of these data files, considerations as to their usage were prepared. These included:

a. Items/factors that appear to be required but are missing from information sources.
b. Notes, on recommended data/format which could ease solution approaches to various mission analysis tasks.
c. Notes, on which files should be accessed for data (to keep data entry singular, and therefore controlled).

File data input and usage for example, showed that some resource parameters used by one STS element are supplied from another STS element (e.g., Orbiter power, ECS, RCS, etc., supplied to Spacelab, IUS, and SSUS elements) and should only be entered once. These data should be accessed and extracted from the appropriate STS element payload carrier data file. Changes to the parameter values should be via single entry control. This and other considerations are shown in Figure F-3.

The formats for the STS payload carrier data files are presented next. These parameters are ordered by appropriate system/subsystem and by mission analysis areas. Some of the parameters are probably too detailed for the products development, but should reside in such data files for other PPDB uses.

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Figure F-3

PAYLOAD CARRIER DATA FILES (NOTES)

- GRAPHICS OF FUNCTIONAL/SCHEMATIC/CONFIGURATION LAYOUTS SHOULD BE INCLUDED TO ASSIST IN ANALYSIS AND AS AN ILLUSTRATIVE AID.
- USAGE RATES WHICH AFFECT PLANNING SHOULD BE INCLUDED (APPROXIMATIONS SHOULD BE EXPLAINED).
- WHEN A FILE'S PARAMETER VALUE CHANGES EITHER:
  - (A) HAVE THE AFFECTED SYSTEMS (THE USER SYSTEMS) ACCESS THAT FILE FOR THE "CONTROL VALUES," (PREFERRED), OR
  - (B) UPDATE ALL DATA FILES WHICH CONTAIN THAT PARAMETER.
- A REFERENCE TO THE APPLICABLE DOCUMENT AND FILE REVISION DATE SHOULD BE KEPT ON ALL "CONTROL DATA" FOR QUICK REFERENCE CHECKS.
- THE DATA PARAMETERS WHEN RESIDENT ON THE DATA FILES, SHOULD INCLUDE THE DEFINITIONS OF ALL THE ENTITIES TO SUPPORT TECHNICAL USERS AT INTERACTIVE TERMINALS.
- THE PROBLEM OF SUFFICIENTLY DEFINING WHAT THE INTERFACES ARE, SHOULD BE ADDRESSED VIA "THE INPUT/OUTPUT BLOCK" MODE. A SYSTEM'S OUTPUT AT ITS DELIVERY INTERFACE SHOULD BE PRESENTED IN ASCENDING ORDER FROM NOMINAL TO MAXIMUM OUTPUT STARTING WITH THE BASELINE SYSTEM AND ADDING PROGRESSIVE CAPABILITY VIA KITS, TANKS, FUEL CELLS, ETC.

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	B/L	MA
1.	PROGRAMMATICS			
1.1	Initial Operational Capability (IOC)-(year)	X		
1.2	Number of Shuttle flights available per year (and by launch site)	X		
1.3	Orbiter usage constraints	X		
1.3.1	WTR launch site - launch rate/turnaround capability (days)	X		
1.3.2	ETR launch site - launch rate/turnaround capability (days)	X		
1.3.3	Recovery sites (list & constraints)		X	
1.3.4	Maximum launch and landing weight/provisions	X		

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MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	M.M.	B/L	MA
2.	CONFIGURATION			
2.1	Orbiter hardware list, mass properties and volumes			
2.1.1	Basic Orbiter hardware		X	
2.1.2	Payload chargeable hardware items (mass, cg, dimensions, etc of kits etc)		X	
2.2	Orbiter body axis and payload coordinate system/ stations	X		
2.3	Orbiter dimensional and physical data			
2.3.1	Overall Orbiter dimensions and volumes		X	
2.3.2	Orbiter cargo bay doors			X
2.3.3	Orbiter radiator			X
2.3.4	Field of view of the Orbiter cargo bay		X	
2.3.5	Illumination of Orbiter cargo bay		X	
2.4	Mass properties of the Orbiter		X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.	SUBSYSTEMS			
3.1	Structural and mechanical payload interfaces			
3.1.1	Payload attachment concepts and locations			
3.1.1.1	Payload installation criteria		X	
3.1.1.2	Payload attachment locations in the payload bay		X	
3.1.1.3	Payload accommodations in the cabin			
	(1) Forward flight deck		X	
	(2) Mid-deck		X	
	(3) Aft flight deck		X	
	(4) Stowage		X	
3.1.2	Payload-to-Orbiter interface requirements			
3.1.2.1	Structural interface			X
3.1.2.2	Payload alignment			X
3.1.2.3	Orbiter deflections			X
3.1.2.4	Standard payload ground handling attachment interface			X
3.1.3	Cargo center of gravity envelopes	X		
3.1.4	Payload bay envelope			
3.1.4.1	Dynamic payload envelop (length/diameter)	X		
3.1.4.2	Payload volume with kit installations	X		
3.1.5	Payload attachment point load limits		X	
3.1.6	Payload design load factors(linear g and angular -rad/sec2)			
3.1.6.1	Cargo limit design accelerations for 65KLB up/ 32KLB down		X	
3.1.6.2	Cargo limit design accelerations for 65KLB down		X	
3.2	Environmental control and Life Support System (ECLSS).			
3.2.1	Atmospheric revitalization subsystem (ARS)			
3.2.1.1	ARS for habitable payloads (on-orbit, via orbiter air duct kit)			X
	(1) ARS airflow rate (cfm)			
	(2) Conditioned air CO2 partial pressure			
	(3) dewpoint temperature			
	(4) drybulb temperature			
	(5) air supply pressure			
	(6) returning (to Orbiter) air max allowable dewpoint temperature			
	(7) Returning (to Orbiter) air max allowable drybulb temperature			
	(8) Total pressure (to payload) range			
	(9) Gas composition (to payload) range			
3.2.1.2	Oxygen supply to payloads			X
	(1) Gaseous oxygen flow rate (nom/max)			

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	P/L	MA
	(2) Mass (nom/max and per cryo kit)			
	(3) Pressure (nom/max) range			
	(4) Temperature range			
3.2.1.3	Air cooling of payload equipment located in Aft flight deck			X
	(1) Air flow rate			
	(2) Drybulb temperature range			
	(3) Dewpoint temperature range			
3.2.2	Food, water and waste management subsystem (FWM)			X
3.2.2.1	Water dump provisions			
3.2.3	Active thermal control subsystem (ATCS)(cooling only)			X
3.2.3.1	Payload heat exchanger-- Orbiter coolant waterloop total heat load rejection (watts) capacity:			
	(1) On-orbit, payload doors open			
	(2) On-orbit, payload, payload doors open--using payload radiator kit			
	(3) Launch thru landing mission phases with payload doors closed			
	(4) Post landing--after GSE hookup			
3.2.4	Smoke detection and fire suppression system			X
3.2.5	Airlock support subsystem (ALSS)			X
3.3	Electrical Power System (EPS)			
3.3.1	Voltages (VDC, VAC, nominal, and ranges), power levels (nominal and peak(s) including durations, frequency and time between peaks), and energy available per flight phase:			
3.3.1.1	Prelaunch and post landing		X	
3.3.1.2	Launch, ascent and descent	X		
3.3.1.3	On-orbit:			
	(1) Primary power	X		
	(2) Back-up power		X	
	(3) Energy kits (4 max)	X		
	(4) Additional power (for systems located in Orbiter Aft flight deck, AFD)		X	
3.3.2	Electrical interfaces (list,location(s) and nominal usages)		X	
3.3.3	Ripple and operational voltages			X
3.3.4	Fuel cell powerplant (FCP) performance		X	
3.3.5	Payload energy available	X		
3.3.6	Emergency power (operating description, levels, and systems effected)			X
3.4	Remote manipulator system(RMS)			

MM=MISSION MODEL; P/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	E/L	MA
3.4.1	Functional capability			X
3.4.2	RMS performance			X
3.4.2.1	RMS Physical and dynamic characteristics			
3.4.2.2	Payload deployment and retrieval			
3.4.3	RMS lift and reach capabilities			X
3.5	Shuttle payload performance capability			
3.5.1	KSC performance			
3.5.1.1	Circular orbit altitude & inclination payload performance	X		
3.5.1.2	Elliptical orbit altitude & inclination payload performance	X		
3.5.1.3	Launch site inclination limits	X		
3.5.2	WTR performance			
3.5.2.1	Circular orbit altitude & inclination payload performance	X		
3.5.2.2	Elliptical orbit altitude & inclination payload performance	X		
3.5.2.3	Launch site inclination limits	X		
3.6	Orbital maneuvering system (OMS)			
3.6.1	OMS thrust, Isp, chamber pressure, engine mixture ratio(s), gimbal angle limits pitch/yaw, fuel, oxidizer, and pressurization tanks weight/volumes, and delta V characteristics	X		
3.6.2	Orbital maneuvering capability (envelopes)	X		
3.6.3	OMS combustion products and envelopes		X	
3.6.4	Payload return capabilities (altitude & inclination limits)			
3.6.4.1	Direct entry and de-orbit conditions		X	
3.6.4.2	Abort conditions		X	
3.7	Reaction control subsytem (RCS)			
3.7.1	Attitude control performance			
3.7.1.1	Orbiter pointing stability (course and fine deadbands)	X		
3.7.1.2	Orbiter pointing accuracy	X		
3.7.1.3	Attitude disturbance by spin-up and release of payloads		X	
3.7.1.4	Translational and rotational maneuvers (thrust levels, Isp, firing order and logic, duty cycles)		X	
3.7.1.5	Rendezvous capability	X		
3.7.1.6	System description(chamber pressure, engine mixture ratio, number of thrusters, locations(s), thrust directions, fuel, oxidizer and pressurications tanks weight/volumes, and delta V characteristics)	X		
3.7.1.7	Orbiter RCS max. acceleration levels		X	

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PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	E/L	MA
3.7.2	RCS propellant consumption			
3.7.2.1	Propellant available (forward and aft tanks)	X		
3.7.2.2	Vernier thrusters		X	
3.7.2.3	Primary thrusters		X	
3.7.2.4	Translational maneuvers		X	
3.7.2.5	Rendezvous		X	
3.7.2.6	Propellant usage due to attitude constraints (eg thermal control attitude propellant usage)		X	
3.7.2.7	Vernier RCS fuel usage for limit cycle control		X	
3.7.2.8	RCS propellant distribution and recommended usage estimates			X
3.7.2.9	Combustion products and envelopes			X
3.7.3	Passive attitude control mode			X
3.8	Guidance, navigation, and controlsystem (GN&C)			
3.8.1	Inertial measurement unit (IMU)(pointing accuracy)		X	
3.8.2	Orbiter navigation base			X
3.8.3	Navigation accuracy		X	
3.9	Space Shuttle operational contamination control		X	
3.9.1	Prelaunch phase		X	
3.9.2	Ascent phase		X	
3.9.3	On-orbit phase		X	
3.9.4	De-orbit and descent phase		X	
3.9.5	Landing phase		X	
3.10	Crew interface and accommodations			
3.10.1	Crew size and provisions			
3.10.1.1	Nominal orbiter crew size (eg 4 men)		X	
3.10.1.2	Maximum orbiter crew size (seating limit)		X	
3.10.1.3	Nominal orbiter expendables (eg 28 man days)		X	
3.10.1.4	Maximum orbiter stowage provisions for crew expendables (man days) (payload weight chargeable for excess over nominal crew size and duration)		X	
3.10.2	Crew compartments (accommodation provisions and list of on-orbit operations and payload support monitor-ing and control functions performed at each station)			
3.10.2.1	Forward flight deck (commander and pilot station)			X
3.10.2.2	Aft flight deck (list of operational capabilities)			
	(1) Mission station			X
	(2) Payload station			X
	(3) On-orbit station			X
3.10.2.3	Mid-deck			
	(1) Sleep stations			X
	(2) Food service station			X
	(3) Personnel hygiene station			X

MM=MISSION MODEL; E/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	B/L	MA
	(4) Exercise facilities			X
	(5) Stowage			X
	(6) Payload bay airlock			X
	(7) Side access hatch			X
3.10.3	Crew access provisions (equipment dimensions, allow -able payload diameters, EVA timelines, and EVA/ Rescue support equipment)			
3.10.3.1	Orbiter airlock			
	(1) airlock entrance hatch			X
	(2) airlock			X
	(3) payload bay hatch			X
3.10.3.2	Docking module (payload chargeable item in payload bay)			X
	(1) Docking module			X
	(2) EVA/rescue hatch			X
	(3) Docking module hatch			X
	(4) Tunnel adapter			X
3.10.3.3	Tranfer tunnel (spacelab equipment)			
	(1) Transfer tunnel			X
	(2) Tunnel egress hatch			X
	(3) Spacelab hatch			X
3.10.4	Manned manuevering unit (MMU) (weight/volume characteristics and performance)			X
3.10.5	Crew stations and habitability			X
3.10.5.1	Utility work bench			X
3.10.5.2	Stowage container			X
3.10.5.3	Standard equipment			X
	(1) Tool and maintenance assembly			X
	(2) Trash disposal bag			
	(3) On-orbit equipment restraints and stowage provisions			
3.10.5.4	Crew restraints/mobility aids			X
	(1) Foot restraints			
	(2) Locomotion aids and handholds			
	(3) EVA restraint/mobility aids			
3.11	Avionics (functions, hardware payload interfaces and operating characteristics/limits. This describes the payload support services received through the el- ectrical and functional hardline interfaces between the payload umbilical and the directly interfacing avionics electrical equipment for attached payload and via RF link for detached payloads)			
3.11.1	Functions			X
3.11.1.1	Scientific data handling (on-board digital com-			

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
	putation, memory, data storage, data rates, format etc)			
3.11.1.2	Engineering data handling			
3.11.1.3	Uplink/forward link (bands, date rate timing format etc)			
3.11.1.4	Audio (voice communication)			
3.11.1.5	Television			
3.11.1.6	GN&C payload data interfaces			
3.11.1.7	Caution and warning			
3.11.1.8	Timing			
3.11.1.9	Rendezvous tracking			
3.11.2	Hardware interfaces			
3.11.2.1	Payload data interleaver (PDI)			
3.11.2.2	Payload signal processor			
3.11.2.3	Payload interrogator			
3.11.2.4	Multiplex/demultiplexer (MDM)			
3.11.2.5	S-band FM signal processor			
3.11.2.6	Ku-band signal processor			
3.11.2.7	Audio central control unit			
3.11.2.8	Payload bay lighting and closed circuit television (CCTV)			
3.11.2.9	Master timing unit (MTU)			
3.11.2.10	Caution and warning electronics unit			
3.11.2.11	Rendezvous radar			
3.11.2.12	Mission sppecialist station (MSS) pulse code modulation (PCM) recorder			
3.11.2.13	payload wideband recorder			
3.12	Payload service panels (electrical, communication, data,and fluid interface capabilities and locations)			
3.12.1	Forward bulkhead			X
3.12.1.1	Forward payload bay bulkhead interconnect panels			
3.12.1.2	Forward utility bridge			
3.12.2	Aft bulkhead			X
3.12.3	Prelaunch payload service panels			X
3.12.4	Bay sidewall electrical panels			X
3.12.5	Payload bay cabling and fluid lines			X
3.12.6	Payload fluid fill, vent, drain and dump provisions (by flight phase)			X
3.12.7	Payload heat removal kit provisions			X
3.12.8	Payload heat exchanger interface panel			X

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MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

(I) SHUTTLE (ORBITER)

DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	B/L	MA
4.	PAYLOAD ENVIRONMENT			
4.1	Vibration (vibration levels over frequency ranges versus location, mounting configuration, and equipment weight)			
4.1.1	Sinusoidal vibration			X
4.1.2	Random vibration			X
4.2	Acoustics (overall dB per flight phase and stations)			X
4.3	Shock			X
4.4	Accelerations and angular rates (by flight phase and durations)			
4.4.1	Atmospheric drag accelerations		X	
4.4.2	Boost thrust accelerations		X	
4.4.3	On-orbit OMS thrust accelerations		X	
4.4.4	On-orbit RCS accelerations and angular rates		X	
4.4.5	De-orbit and landing accelerations		X	
4.5	Temperature (operating limits)			
4.5.1	Pre-launch			X
4.5.2	Launch and ascent			X
4.5.3	On-orbit (with STS)			X
4.5.4	Descent			X
4.6	Atmosphere			
4.6.1	Pressure			X
4.6.2	Composition			X
4.6.3	Relative humidity			X
4.7	Class cleanliness and contamination (high/low levels)	X		
4.8	Electrical and magnetic environments			
4.8.1	Radiated emissions			X
4.8.2	Conducted emisssions			X
4.8.3	Magnetic sources environments			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; **MA=MISSION ANALYSIS**

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(I) SHUTTLE (ORBITER)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	E/L	MA
5.	COST			
5.1	Recurring cost(s) per flight	X		

MM=MISSION MODEL; E/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA.
1.	PROGRAMMATICS			
1.1	Initial operational capability - (IOC) (year)			
1.1.1	IOC of nominal duration SL	X		
1.1.2	IOC of 30-day duration SL	X		
1.2	Number of available/allowable SL (module) flights per year (Guideline or reference limit if available)	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
2	CONFIGURATION			
2.1	Hardware content list of basic Spacelab	X		
2.2	Major diameter (of module and pallet elements)	X		
2.3	Overall length(s) (of elements)	X		
2.4	Possible flight configurations (list)	X		
2.5	Basic flight configurations (equipment/element list, gross weight, drawings, cg conditions, and available /remaining payload volumes and racks)			
2.5.1	Long Module Configuration	X		
2.5.2	Long Module plus one pallet configuraton	X		
2.5.3	Long module plus two pallet train configuration	X		
2.5.4	Short module plus two pallet train configuration	X		
2.5.5	Short module plus three pallet train configuration	X		
2.5.6	Pallet-only configuration/15 meter pallet	X		
2.5.7	Pallet-only/9 meter independently suspended pallet	X		
2.6	Volume and mounting area available to Spacelab payloads	X		
2.7	Mass available for Spacelab payloads			
2.7.1	Spacelab element mass	X		
2.7.2	Spacelab payload mass (ranges/limits)	X		
2.7.3	Overall mass breakdown/summaries	X		
2.8	Center of gravity constraints	X		
2.9	Module structure			
2.9.1	Overall configuration			
2.9.1.1	Basic structure floor		X	
2.9.1.2	Overhead structure		X	
2.9.2	Accommodation capability		X	
2.10	Mission dependent structure - racks			
2.10.1	Standard Experiment racks description	X		
2.10.2	Standard racks - experiment allowable envelope	X		
2.10.3	Standard racks carrying capability	X		
2.10.4	Payload mounting interface within racks	X		
2.10.5	Payload interface to ECS, EPDS, CDMS within racks		X	
2.11	Pallet Segment			
2.11.1	Basic configuration	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

MCDONNELL DOUGLAS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
2.11.2	Mission dependent structure	X		
2.11.3	Physical accomodation capabilities	X		
2.11.4	Igloo (for pallet-only configurations) equipment		X	
2.11.4	list			
2.12	Transfer tunnel(s)		X	
2.13	Module-to-pallet utility bridge(equipment list)		X	
2.14	End Cone(s) configuration/capabilities		X	
2.15	Subfloor subsystems capabilities		X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PARAMETER (DESCRIPTION)		MM	B/L	MA
3.	SUBSYSTEMS			
3.1	Electrical power and distribution subsystem (EPDS)			
3.1.1	Power (avg nominal and max) required by basic SL Equipment configurations, for ascent, descent, and on-orbit phases:			
3.1.1.1	Long module	X		
3.1.1.2	Core module	X		
3.1.1.3	Long module + pallet(s)	X		
3.1.1.4	Core module + pallet(s)	X		
3.1.1.5	Pallet(s) only	X		
3.1.2	Power (nominal and max)required by mission dependent Spacelab equipment (MDSE),for ascent, descent,and on-orbit phases:			
3.1.2.1	Experiment computer			X
3.1.2.2	High data rate recorder (HDRR)			X
3.1.2.3	Data display unit and symbol generator			X
3.1.2.4	Experiment inverter - 400Hz			X
3.1.2.5	Experiment I/O unit			X
3.1.2.6	Experiment power switching panels			X
3.1.2.7	Instrument pointing subsystem (IPS)			X
3.1.3	Power (nominal and max) required by common payload support equipment (CPSE), for ascent, descent, and on-orbit phases:			
3.1.3.1	Top airlock			X
3.1.3.2	Aft airlock			X
3.1.3.3	High quality window/viewport assembly			X
3.1.3.4	Modular film vaults			X
3.1.3.5	High vacuum vent facility			X
	Note:supplied voltage (VDC,VAC, nominal and ranges), power levels (nominal and peak(s) including duration, frequency and time between peaks), and energy available, access and extract the data from the following files:			
	PHASE — FILE			
	(1) Prelaunch and post landing — --Orbiter (EPS)			X
	— --Orbiter (GSE)			X
	(2) Launch, ascent and descent — --Orbiter (EPS)		X	
	(3) On-orbit:			
	(a) Primary power — --Orbiter (EPS) (dedicated power source)	X		
	(b) back-up — --Orbiter (EPS)		X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)		MM	B/L	MA
		(back-up source shared with Orbiter)			
	(c) Energy kits	--Orbiter (EPS)	X		
	(d) Additional power (for systems located in Orbiter aft flight deck, AFD)	--Orbiter (AFD)			X
	(e) Multi-mission equipment (e.g., Auxiliary payload power system, APPS)	--MMSE	X		
3.2	Environmental control subsystem (ECS)				
3.2.1	Spacelab gaseous nitrogen capability (kg)			X	
3.2.2	Pallet mounted cold plates freon loop capability (watts) (to cool pallet mounted payload electronics, etc.)			X	
3.2.3	Module cabin airloop cooling capability (watts)			X	
3.2.4	Module avionics airloop cooling capability (watts and m/min) (Separate system to cool rack mounted subsystem and experiment equipment)			X	
3.2.5	Spacelab (basic) configuration dependent ECS requirements (watts) for ascent, descent, and on-orbit phases:				
3.2.5.1	Core module		X		
3.2.5.2	Long module		X		
3.2.5.3	Core module + pallet(s)		X		
3.2.5.4	Long module + pallet(s)		X		
3.2.5.5	Pallet(s) only		X		
3.2.6	Spacelab experiment support equipment ECS cooling loop requirements (watts), for ascent, descent, and on-orbit phases specified as to:				
3.2.6.1	Pallet-only (pallet coolant loop requirements)			X	
3.2.6.2	Module-only (heatload distribution between air cooling using the cabin loop and/or the avionics loop, and/or liquid cooling using the experiment heat exchanger -- which is a mission dependent, removable item.)			X	
3.2.6.3	Module + pallets (all the above)			X	
3.2.7	List and description of Spacelab passive thermal control devices (eg insulations, surface coatings, and thermal blankets to protect the module, pallet segments, utility lines, and externally mounted subsystem equipment.) Note:for ECS products and conditions supplied by STS systems other than the Spacelab itself, access and extract the data from the following			X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)		MM	B/L	MA
	files:				
	PARAMETER	FILE			
	(a) Orbiter (total heat rejection) coolant waterloop heatload (watts) capacity	Orbiter		X	
	(b) Gaseous oxygen flow and capacity	Orbiter (ECLSS)		X	
	(c) Airflow airloop capacity (kg/hr)	Orbiter (ECLSS)		X	
	(d) Air cooling capability watts) from Orbiter AFD	Orbiter (ECLSS)		X	
3.3	Command and data management subsystem(CDMS) (Capabilities and characteristics,eg bit rate, storage, number of files, etc for each of the following subsystems)				
3.3.1	CDMS equipment and location				
3.3.1.1	Basic Spacelab CDMS equipment, eg				
	(1) Experiment data bus				X
	(2) Back up computer				X
	(3) Mass memory				X
	(4) Keyboard/CRT				X
	(5) Intercom				X
3.3.1.2	Mission dependent CDMS equipment, eg				
	(1) Experiment computer				X
	(2) Experiment I/O unit				X
	(3) Experiment RAU				X
	(4) Keyboard/CRT				X
	(5) High rate multiplexer				X
	(6) High rate digital recorder				X
3.3.2	Data Acquisition and control				
3.3.2.1	Remote acquisition units (RAU)				X
3.3.2.2	Input/output unit				X
3.3.2.3	High rate multiplexer				X
3.3.2.4	High rate digital recorder				X
3.3.2.5	Closed circuit TV system				X
3.3.2.6	4.2 MHz analog channel				X
3.3.3	Data Transmission				
3.3.3.1	Network system				X
3.3.3.2	Down-link				X
3.3.3.3	Up-link				X
3.3.4	Data Processing				
3.3.4.1	Computer				X
3.3.4.2	Mass memory unit (MMU)				X
3.3.4.3	Data Display Unit and keyboard				X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.3.5	Subsystem control			
3.3.5.1	Control concept			X
3.3.5.2	Activation Sequence			X
3.3.6	Intercom			X
3.3.7	Caution and warning			
3.3.7.1	emergency signals			X
3.3.7.2	Warning and caution signals			X
3.3.7.3	Experiment/caution and warning interface			X
3.4	Instrument pointing subsystem(IPS) (capabilities and characteristics, eg attitude accuracy, attitude hold limits etc.)			
3.4.1	IPS description (equipment list)		X	
3.4.2	Payload accommodation capabilities			
3.4.2.1	Payload mass			X
3.4.2.2	Payload dimensions			X
3.4.2.3	Pointing and stabilization			X
3.4.2.4	Payload supporting services			X
3.4.2.5	Flexibility adnd growth potential			X
3.4.3	IPS interface			
3.4.3.1	Spacelab/orbiter interface			X
3.4.3.2	Spacelab/payload interface			X
3.4.3.3	Spacelab ground support			X
3.4.3.4	Spacelab subsystem interfaces			X
3.4.4	Habitability and cleanliness requirements			X
3.4.5	Environment			X
3.4.6	Software			X
3.4.7	Operations			
3.4.7.1	Operating modes			X
3.4.7.2	Emergency control			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
4.	PAYLOAD ENVIRONMENT			
4.1	Module flight envirnoment			
4.1.1	Vibrations(vibration levels over frequency ranges verses module locations, mounting configuration, and equipment weight)			
4.1.1.1	Sinusoidal vibration			X
4.1.1.2	Random vibration			X
4.1.2	Acoustic noise			X
4.1.3	Shock			X
4.1.4	Linear acceleration			X
4.1.4.1	Nominal mission/emergency sequence		X	
4.1.4.2	On-orbit maneuvers		X	
4.1.4.3	Orbit Atmosphere accelerations		X	
4.1.5	Temperature (operating limits)			
4.1.5.1	Prelaunch			X
4.1.5.2	Ascent			X
4.1.5.3	On-orbit (with STS)			X
4.1.5.4	Descent			X
4.1.6	Atmosphere			
4.1.6.1	Pressure			X
4.1.6.2	Composition			X
4.1.6.3	Relative humidity			X
4.1.7	Cleanliness and contamination		X	
4.1.8	Electrical environment - module			
4.1.8.1	Radiated emissons			X
4.1.8.2	Conducted emmissions			X
4.1.8.3	Bonding and lightning protection			X
4.1.8.4	Electrical surface properties			X
4.1.9	Magnetic environment (Spacelab and STS sources)			X
4.1.10	Radiation environment (inside module)			X
4.2	Pallet flight environment			
4.2.1	Vibration			X
4.2.2	Acoustic noise			X
4.2.3	Shock			X
4.2.4	Linear acceleration			X
4.2.5	Temperature (operating limits)			
4.2.5.1	Prelaunch			X
4.2.5.2	Ascent			X
4.2.5.3	On-orbit (with STS)			X
4.2.5.4	Descent			X
4.2.6	Atmosphere (pressure, humidity)			
4.2.6.1	Launch sequence			X
4.2.6.2	On-orbit			X
4.2.6.3	Re-entry sequence			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
4.2.7	Cleanliness and contamination			X
4.2.8	Electrical environment - pallet			X
4.2.9	Magnetic environment			X
4.2.10	Radiation environment			X
4.2.11	Meteoroids			X
4.3	Airlock and airlock equipment flight environment			
4.3.1	Vibration			X
4.3.2	Acoustic			X
4.3.3	Shock			X
4.3.4	Linear acceleration			X
4.3.5	Temperature			X
4.3.6	Atmosphere			X
4.3.7	Contamination			X
4.3.8	Electrical			X
4.3.9	Magnetic			X
4.3.10	Radiation environment			X
4.3.11	Meteoroid environment			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
5.	COST			
5.1	Recurring cost per flight	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(III) INTERIM UPPER STAGES (IUS)
DATA FILE CONTENT

07-06-76

	PARAMETER (DESCRIPTION)	MM	B/L	MA
1.	PROGRAMMATICS			
1.1	Initial Operational Capability (IOC) - (year)	X		
1.2	Number of IUS available per year	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
2.	CONFIGURATION			
2.1	Hardware content list of basic IUS (total vehicle, stage(s), interstage, attach fittings, fairings)	X		
2.2	Major Diameters per stage and per configuration	X		
2.3	Overall Length, dimensions and volume per stage and per configuration	X		
2.4	cg location (distance aft of attach flange) per stage and per configuration			
2.4.1	Pre-burn (max propellant)	X		
2.4.2	Post-burn	X		
2.5	Roll moment of inertia per stage and configuration			
2.5.1	Pre-burn		X	
2.5.2	Post-burn		X	
2.6	Transverse moment of inertia per stage and configuration			
2.6.1	Pre-burn		X	
2.6.2	Post-burn		X	
2.7	STS mounting provisions			
2.7.1	Cradle or bay attachment requirements		X	
2.7.2	Dynamic envelope (length and diameter)	X		
2.7.3	Safety requirements (through safe/arm devices and/or redundant monitor/control)		X	
2.8	Payload mounting provisions			X
2.9	Payload separation characteristics			X
2.10	Balast weight provisions		X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.	SUBSYSTEMS			
3.1	Propulsion (solid rocket motor(s) systems) (per stage and IUS configuration):			
3.1.1	Weight of nominal propellant	X		
3.1.2	Weight of minimum propellant (max off-loaded design condition)		X	
3.1.4	Weight of dry IUS stage	X		
3.1.5	Nominal gross IUS weight (per stage and IUS configuration)			
3.1.5.1	Pre-burn	X		
3.1.5.2	Post-burn		X	
3.1.6	Total (nominal) impulse (N-s)	X		
3.1.7	Maximum thrust (N)		X	
3.1.8	Average thrust (N)	X		
3.1.9	Specific impulse (Isp) at max thrust (sec)		X	
3.1.10	Specific impulse (Isp) at average thrust (sec)	X		
3.1.11	Propellant type (main propulsion, attitude, and auxiliary systems) and number of motors/thrusters	X		
3.1.12	List of combustion products (for payload screening purposes		X	
3.1.13	Restart capability (number)		X	
3.1.14	Performance specifications of engines/thrusters, firing logic, and control arms.		X	
3.2	Guidance and control subsystem (G&C)			
3.2.1	Three sigma Synchronous Orbit Insertion Accuracy			
3.2.1.1	Perigee (dh,km)		X	
3.2.1.2	Apogee (dh,km)		X	
3.2.1.3	Inclination (di,deg)		X	
3.3	Electrical Power System (including both the power required from the Orbiter, and the IUS on-board power available to IUS and payload systems)			
3.3.1	On-board voltage (VAC,VDC, nominal and ranges)	X		
3.3.2	Power levels (nominal and peak(s) including durations, frequency, and the time between peaks)	X		
3.3.3	Energy consumption (nominal and max)	X		
3.3.4	Umbilical attachment and retraction from Orbiter requirements (for caution and warning, control, monitoring, and power)		X	
3.3.5	Maximum free-flying lifetime hours) (operational lifetime based on battery, etc., limits)	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.3.6	Electrical interface(s) wiring, connectors			X
3.4	Telemetry, tracking, and command subsystem (TT&C)			
3.4.1	Command/control and telemetry capability (bps band(s), center frequencies, max power output, channels)	X		
3.4.2	Payload status, checkout, and/or abort operations command requirements		X	
3.4.3	Orbiter display/control panel requirements (eg, at Payload Specialist's Station)			X
3.4.4	Navigation		X	
3.4.5	Avionics list		X	
3.5	IUS Attitude Control System per stage/configuration			
3.5.1	Attitude pointing accuracy (per axis) and stability		X	
3.5.2	Payload jettison/separation tip-off rates			
3.5.2.1	Pitch/yaw (deg/sec)		X	
3.5.2.2	Roll		X	
3.5.2.3	Velocity (M/s)		X	
3.5.3	IUS-Payload controlability envelope per stage and per configuration			
3.5.3.1	IUS stations Z vs X (cg boundary for IUS+payload-gimbal angle control boundaries)	X		
3.5.3.2	IUS/TUG X station limits for Shuttle Imposed liftoff and landing cg constraints on:			
	(a) delivery missions	X		
	(b) Retrieval missions (Tug only)	X		
3.6	Environmental control system			
3.6.1	Passive insulation options and locations			X
3.6.2	Temperature-time profiles (location dependent, eg guidance compartment, engine section)			X
3.6.3	RF shield/special environments (eg acoustic blankets)			X
3.6.4	Active thermal system (characteristics, capabilities)			X
3.7	Instrumentation systems			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
4	ENVIRONMENT			
4.1	Vibration (vibration levels over frequency ranges versus location, mounting configuration--with/ without shroud, and equipment weight)			
4.1.1	Sinusoidal vibration			X
4.1.2	Random vibration			X
4.2	acoustic noise			X
4.3	Shock			X
4.4	Linear acceleration			
4.4.1	Nominal mission/emergency sequences		X	
4.4.2	On-orbit maneuvers		X	
4.5	Temperature (operating limits)--fairing on/off			
4.5.1	Pre-launch			X
4.5.2	Ascent			X
4.5.3	On-Orbit (with STS)			X
4.5.4	Free Flying			X
4.6	Relative humidity			X
4.7	Pressure limits			X
4.8	Class cleanliness and contamination (high/low levels)	X		
4.9	Electrical and magnetic environments			
4.9.1	radiated emissions			X
4.9.2	Conducted emissions			X
4.9.3	Magnetic sources environments			X

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
5.	COST			
5.1	Recurring cost per flight	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(IV) SPIN STABILIZED UPPER STAGE (SSUS)
DATA FILE CONTENT

07-07-76

	PARAMETER (DESCRIPTION)	MM	B/L	MA
1.	PROGRAMMATICS			
1.1	Initial operational capability (IOC)	X		
1.2	Number of SSUS available per year	X		

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

PAYLOAD CARRIER DATA FILES
PRELIMINARY
(IV) SPIN STABILIZED UPPER STAGE (SSUS)
DATA FILE CONTENT

	PARAMETER (DESCRIPTION)	MM	B/L	MA
2.	CONFIGURATION			
2.1	Hardware content list of basis SSUS (total vehicle, stage(s), interstage, spin table, attach fittings, fairings)	X		
2.2	Major diameter (m)	X		
2.3	Overall length, dimensions, and volume	X		
2.4	CG location (distance aft of attach flange)			
2.4.1	Pre-burn (max propellant)	X		
2.4.2	Post-burn	X		
2.5	Roll moment of inertia (about spin axis) (kg-m2)			
2.5.1	Pre-burn		X	
2.5.2	Post-burn		X	
2.6	Transverse moment of inertia			
2.6.1	Pre-burn		X	
2.6.2	Post-burn		X	
2.7	STS mounting provisions			
2.7.1	Cradle attachment, retention system, tilt and spin table, etc., requirements		X	
2.7.2	Dynamic envelope (length and diameter)	X		
2.7.3	Safety requirements (through safe/arm devices, and/or redundant monitor/control)		X	
2.7.4	Angular accelerations and spin rates (min, nom, max)		X	
2.8	Payload mounting provisions		X	
2.9	Payload separation characteristics		X	
2.10	Balast weight provisions		X	

MM=MISSION MODEL; B/L=PLANNING BASELINE; MA=MISSION ANALYSIS

	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.	SUBSYSTEMS			
3.1	Propulsion			
3.1.1	Weight of nominal solid rocket motor propellant	X		
3.1.2	Weight of minimum propellant (max off-loaded design condition)		X	
3.1.3	Weight of maximum propellant		X	
3.1.4	Weight of dry SSUS stage	X		
3.1.5	Nominal gross SSUS weight			
3.1.5.1	Pre-burn	X		
3.1.5.2	Post-burn	X		
3.1.6	Nominal action (burn) time		X	
3.1.7	Total (nominal) impulse (N-s)	X		
3.1.8	Maximum thrust (N)		X	
3.1.9	Average thrust (N)	X		
3.1.10	Specific impulse (Isp) at max thrust (sec)		X	
3.1.11	Specific impulse (Isp) at average thrust (sec)	X		
3.1.12	Propellant type (main propulsion, attitude, and auxiliary systems) and number of motors/thrusters			
3.1.13	List of Combustion Products		X	
3.1.14	Restart capability (if any)		X	
3.1.15	Performance specifications of engines/thrusters, firing logic, and control arms.		X	
3.2	Guidance and control subsystem (G&C)			
3.2.1	Three sigma synchronous orbit transfer insertion accuracy			
3.2.1.1	Perigee (dh, km)			X
3.2.1.2	Apogee (dh,km)			X
3.2.1.3	Inclination (di,deg)			X
3.3	Electrical power system (including both the power required from the Orbiter and the SSUS on-board power available to SSUS and payload systems)			
3.3.1	On-board voltages (VAC,VDC, nominal and ranges)		X	
3.3.2	Power levels (nominal and peak(s) including durations, frequency, and time between peaks)	X		
3.3.3	Energy consumption (nominal and max)		X	
3.3.4	Umblical attachment and retraction from Orbiter requirements (umblical for caution and warning, control, monitoring, and power)			X
3.3.5	Maximum free-flying life time (hours) (operational lifetime based on battery, etc. limits)	X		

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	PARAMETER (DESCRIPTION)	MM	B/L	MA
3.3.6	Electrical interface(s) wiring, connectors			X
3.4	Telemetry, tracking, and command subsystem (TT&C)			
3.4.1	Command/control requirements (unless autonomous)		X	
3.4.2	Payload status, checkout, and/or abort operations command requirements			X
3.4.3	Orbiter display/control panel requirements (eg at payload specialist's station)		X	
3.4.4	Telemetry (band, center frequency, max power output, channels, bps)			X
3.4.5	Avionics List	X		
3.5	STS attitude control system (requirements)			
3.5.1	Attitude hold accuracy requirements (per axis) (Orbiter supplied initial position and pointing guidance, navigation and stabilization)		X	
3.6	SSUS Attitude Control System			
3.6.1	Nutation control system capability (deg) (maintain the spin coning angle within limits if SSUS required to remain in parking/phasing orbit)			X
3.6.2	SSUS-Payload balance and alignment criteria:			
3.6.2.1	Dynamic Unbalance limit (radians) (principal pitch, yaw, and roll axes of inertia deviations from perpendicular and parallel to spacecraft centerline		X	
3.6.2.2	Payload cg offset from centerline limit (m)		X	
3.6.2.3	Despin System Characteristics		X	
3.7	Environmental Control System			X
3.7.1	Passive insulation options and locations			X
3.7.2	Temperature-time profiles (location dependent, eg guidance compartment,engine section)			X
3.7.3	RF Shield/special environments (eg acooustic blankets)			X
3.8	Instrumentation Systems			X

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	PARAMETER (DESCRIPTION)	MM	B/L	MA
4.	ENVIRONMENT			
4.1	Vibration (vibration levels over frequency ranges versus location, mounting configuration - with/ without shroud, and equipment weight)			
4.1.1	Sinusoidal vibration			X
4.1.2	Random Vibration			X
4.2	Acoustic Noise			X
4.3	Shock			X
4.4	Linear Acceleration			
4.4.1	Nominal Mission/Emergency Sequences		X	
4.4.2	On-Orbit Maneuvers		X	
4.5	Temperature (operating limits)-fairing on/off			
4.5.1	Prelaunch			X
4.5.2	Ascent			X
4.5.3	On-orbit (with STS)			X
4.5.4	Free Flying			X
4.6	Relative Humidity			X
4.7	Pressure limits			X
4.8	Class cleanliness and contamination (high and low levels)	X		
4.9	Electrical and Magnetic Environments			
4.9.1	Radiated emissions			X
4.9.2	Conducted emissions			X
4.9.3	Magnetic sources environments			X

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	PARAMETER (DESCRIPTION)	MM	B/L	MA
5.	COST			
5.1	Recurring cost per flight	X		

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