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STS Users Study (Study 2.2)
Final Report

Volume II: STS Users Plan
(User Data Requirements) Study

Prepared by ADVANCED MISSION ANALYSIS DIRECTORATE
Advanced Orbital Systems Division

1 November 1975

Prepared for
OFFICE OF SPACE FLIGHT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C.

Contract No. NASW-2727

Systems Engineering Operations
THE AEROSPACE CORPORATION

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FOREWORD

The STS Users Study (Study 2.2) Final Report is comprised of three volumes titled as follows:

Volume I	-	Executive Summary
Volume II	-	STS User Plan (User Data Requirements) Study
Volume III	-	Ancillary Equipment Study

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1. INTRODUCTION

1.1 BACKGROUND

Space Transportation System (STS) users need to know throughout the various stages of payload activity the data related to access to, interfacing with, and use of the STS. Many studies have been conducted and others are underway or planned by NASA that provide the STS user with information of the nature required. There exists the need to periodically survey these activities and to relate them in an orderly fashion to the STS user's data requirements.

All STS users are concerned with pre-flight scheduling and STS pre-flight requirements. The user needs to understand the scheduling procedures in the makeup of Shuttle flight manifests. He needs to know payload safety requirements, including checks or tests (if any are required). The user is required to interface with the STS operator on the basis of the user's mission analysis, interface specifications, operational handbooks and manuals, project plans, and support requirements documents. Pre-flight budgeting is an important part of the user's effort, including the transportation charges and related support charges.

All payloads must be integrated with the orbiter, and therefore plans, specifications, drawings, manuals, and other documentation related to all phases of the STS operation are needed. Free-flying payloads also must be integrated for orbital operations in a free-flying mode. Payload operations must be coordinated with STS operations. Radio Frequency (RF) interfaces should be documented and coordinated.

Most users will need to accomplish tradeoff studies for optional or alternative modes of operation with the STS. For example, system tradeoffs are needed to compare alternative payload preparation plans at the launch site; to compare the cost of procuring new satellites with satellite revisit, retrieval, and reuse; and to calculate the value of payload return. The autonomy of the payload in each mode of operation also needs study.

Other STS interface considerations influencing the user's payload project include (1) the integrated test program, (2) subsystem test requirements, (3) project PERT and project schedules, (4) command and communication subsystem specifications, (5) electrical power subsystem specifications and design, (6) data handling and telemetry subsystem specifications and design, (7) spacecraft interface structure, (8) mission operations planning, (9) contamination protection plan, (10) payload environmental criteria, (11) interface control document, and (12) aerospace ground equipment requirements.

The need for data by the STS user is extensive. More data is needed for STS payloads than for expendable launch vehicle payloads since there are more orbiter services and more operational options available to the payload.

1.2 OBJECTIVES AND TASKS

The objectives of this study are to:

1. Prepare an overall estimate of data and information needed by the STS user and organize the data requirements in a matrix format

2. Determine whether, and in which documents, the NASA and USAF studies related to STS users provide the estimated user data requirements listed in the matrix

3. Provide NASA with estimates of additional requirements not currently covered by study activity which, if carried out, would satisfy the matrix of STS user data requirements.

The end product of this effort is the statement of user data requirements covering those areas not currently being provided for. Additional data provided in this report (Sections 6 and 8) relate the data available in the reference documents (see Section 9) to the user data requirements. In addition, outlines are recommended for STS user information documents (Section 11). These outlines are intended for the STS payload projects' use while in the study phase. The outlines are recommended as a basis for a document containing, or in some cases referencing, the data needed for conceptual phase studies for potential STS payloads. Another product of this effort is a list of user data requirements, where the data is evolving as the STS program matures. In many cases the recognition of the need for this information is described in the documentation reviewed; however, the actual data is missing or said "to be determined" (TBD). It is recommended that these areas be monitored in future user studies. The list is reported in Section 5.

The STS User Data Requirements Study was undertaken by approaching the problem from the user's point of view. Payload planning documentation and payload study reports on all phases of payload DDT&E were reviewed to determine the transportation system data required by the payload projects. These documents covered payloads developed for launch on expendable launch vehicles. In addition, STS payload studies were reviewed for the purpose of obtaining user data requirements unique to payloads planned for STS operation. As shown in the STS User Plan Study Data Flow (Figure 1-1), the documents used in this survey came primarily from the NASA studies data bank.

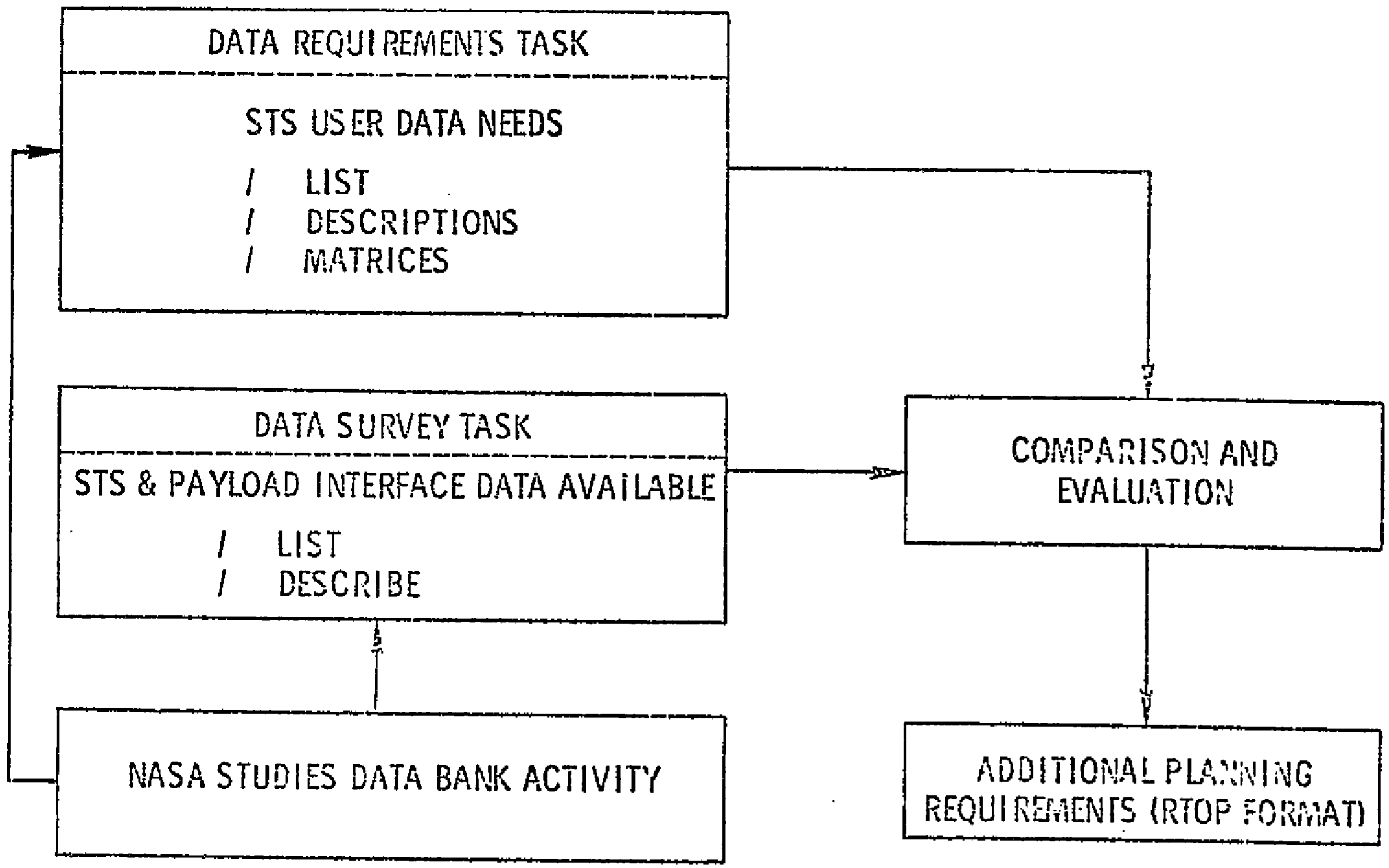


Figure 1-1. STS User Plan Study Data Flow

The documented data survey task was the largest effort in the study. Statements of additional planning requirements were derived by comparing the data required and the data available (see the data flow in Figure 1-1).

The majority of the technical effort was carried out from November 1974 through May 1975. Report writing and the completion of specialists' investigations where data was missing were accomplished after May 1975.

1.3 STUDY ASSUMPTIONS, LIMITATIONS, AND SCOPE

The users whose data needs are described and surveyed in this study include the payload (satellite or escape vehicle) developer, payload integrator, payload operator, experimenters, and experiment developers. Users from government agencies and commercial or other civilian users are covered by the data. Both sortie and free-flyer types of missions (both manned and unmanned) are included as well.

The study uses currently documented information. No new data has been generated for the purpose of satisfying the user data requirements.

The study addresses user data requirements limited to payloads integrating with the STS. Only data required by the user is included. Detailed STS descriptions not directly pertinent to the user's needs and STS payload design philosophy are excluded.

Many of the NASA and contractor documents reviewed contained discussions of data required by the user, but the actual data was missing (frequently TBD or "to be determined"). It was generally assumed in this study that TBDs would be provided in a timely manner.

The statements of user data required but not available in the document surveys describe the data required, and also present the justification and utility of these data. The approach to obtaining the information for the user is expected to be provided by the appropriate NASA organization charged with the responsibility for obtaining the data.

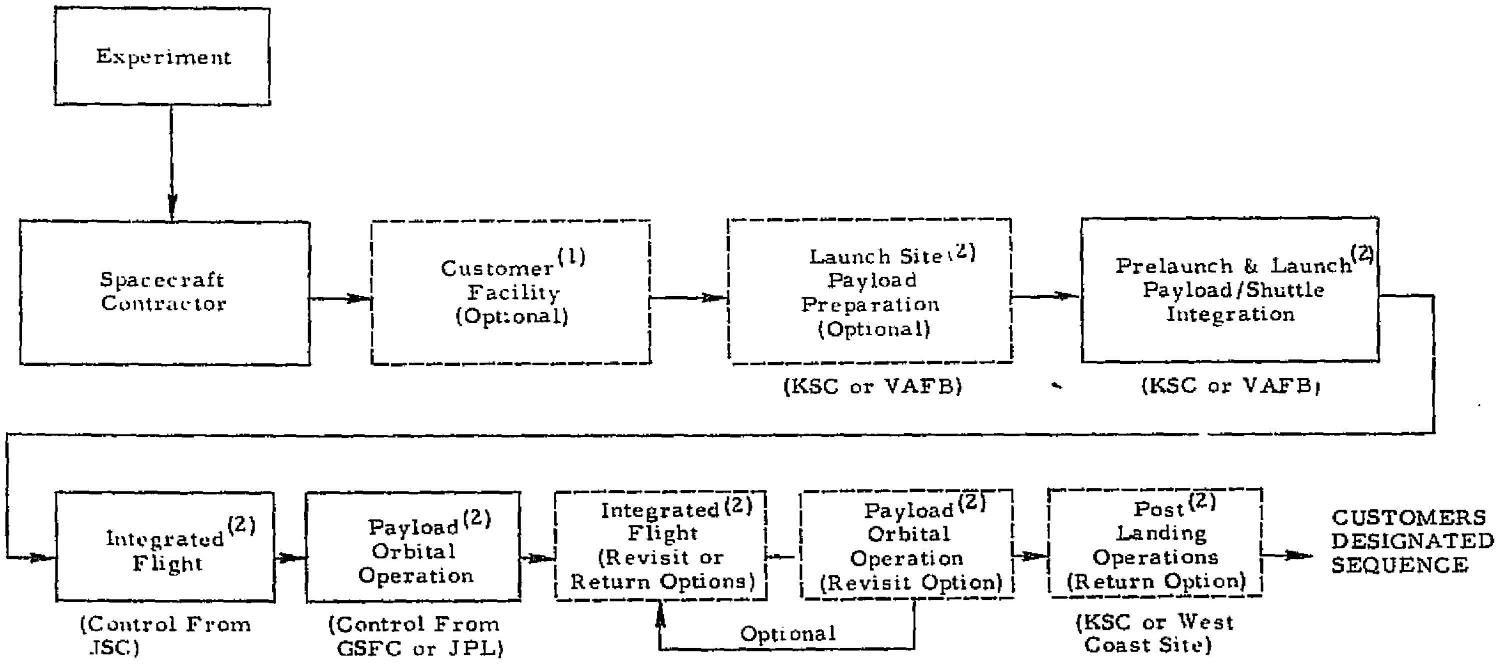
The study scope covers the areas of payload activity with an interface required data exchange (see footnote 2, Figure 1-2). The hardware activities prior to payload arrival at the launch site and subsequent to the landing operations are not included in the study.

1.4 SUMMARY OF RESULTS

In this study it was found that the STS user required information related to flight scheduling and flight manifests was not available. The user will need to understand where in the NASA organization the management and responsibility for these areas reside; the current schedule and projections for available flight accommodations; and the policies and procedures relative to flight scheduling and payload sharing. The user will need to understand and be provided with methods for estimating weights charged to the payloads for the various flight modes.

Another finding in this study resulted from the survey of the data available on dynamic loads on the Shuttle payloads. Recent studies simulating the dynamic payload/orbiter combination have shown that dynamic loads during orbiter landing can range as high as 5 to 9 g's. These loading conditions determined dictated the design of some elements of the payload structure. The uncertainty in these loads, coupled with the weight constraints on some payloads, can result in critical design problems late in the payload development. Load alleviation devices can be utilized, but the user needs data on concepts which could relax this problem.

(Probable Location of Activity Shown In Parentheses)



(1) Center or other user facility, data requirements assumed to be covered elsewhere.

(2) Payload/STS System has operating interface, data exchange required.

Figure 1-2. Typical Payload Sequence, Free Flyer Payload Unit

The STS user has the option to use certain services provided by the orbiter (power, communications, cooling, attachments, the remote manipulator, and attitude and navigation handoff data). Each of the services is supplied through orbiter and orbiter/payload interface equipment. The user needs failure mode and effects data covering each of the equipments.

During the study it was found that the acoustic environment to which the payload would be subjected at liftoff was being predicted on the basis of analytical studies and model testing. The uncertainty in the predicted acoustic environment is relatively large, and it was recommended that a worst-case environment prediction be made for use with payloads following a low risk development program.

In the study it was found that for some payloads, mounting in the payload bay with five attach points should be considered to reduce the attach point loads to acceptable levels. Use of a fifth attach point requires that loads induced by orbiter deflection be added to the payload attachment loads. To accomplish this analysis, the STS user will need orbiter payload bay deflection data to complete attach point designs and load analyses.

It was found during the study that certain data would not be available until they were needed by initial STS users scheduled. For instance, the dynamic loads to which a payload may be subjected are expected to be much better understood after the flight test program. The need for the data on load alleviation devices and the worst-case acoustic environment prediction are the result of this gap in the availability of user required data. These data will enable the payload designer and Shuttle user to work around the temporarily unavailable data.

In several areas the STS capability is currently being defined but is in such a state of change or incomplete definition that the user data requirements cannot be currently quantified. Among these are (1) the expected capability of the remote manipulator system, (2) the procedures and sequence for payload docking, (3) the potential electromagnetic interference between orbiter and payload (due to orbiter radiation), and (4) the orbiter avionics capability. It is recommended that these areas be monitored in the future for STS user data requirements. The avionics system definition is maturing. It is therefore recommended that the user data requirements (and the accompanying potentially costly payload design impacts) be followed closely.

2. USER DATA REQUIRED BUT NOT AVAILABLE IN REFERENCE DOCUMENTS

The following sections describe data needed by the STS user but not found in the reference documents and for which plans to obtain these data in a timely manner could not be identified. The subjects covered are:

1. Data Needed by User on STS Dynamic Load Alleviation Concepts

2. Data Required by STS User on Failure Mode Effects for STS/Payload Interface

3. Data Needed by STS User on Predicted Payload Acoustic Environment for Low Risk Payload

4. Data Required by STS User on Flight Manifests, Multiple Payloads, and Scheduling

5. Data Required by User on Orbiter Payload Bay Deflection

6. Additional Data Requirements for Spacelab Users

Even though the term "STS" covers all elements of the transportation system, including Spacelab, a separate statement of user data required for Spacelab is presented since Spacelab users have some unique requirements for information.

It should be noted that Spacelab is carried as cargo or "payload" in the orbiter payload bay. Thus, the data described as needed by Shuttle payload projects or Shuttle users are also needed by the Spacelab developer, owner, and operator as a Shuttle user.

2.1 DATA NEEDED BY USER ON STS DYNAMIC LOAD ALLEVIATION CONCEPTS

2.1.1 Technical Summary (Objectives)

STS payload studies to date have shown that the acceleration levels experienced during liftoff and landing can be as high as 5 to 9 g's. These loading conditions are determining some elements of the payload structure design. Payloads that are required to be compatible with both an expendable launch vehicle and the Shuttle will be weight constrained by the expendable launch vehicle. Other payloads flown on interim upper stages launched from the orbiter will be weight constrained by the expendable launch vehicle. Other payloads flown on interim upper stages launched from the orbiter will be weight constrained by the performance of the IUS. In addition, the dynamic characteristics of the orbiter are expected to be verified by ground and flight tests during calendar years 1977 and 1978.

In view of the severe loads environment and the existence of weight constraints, the use of load alleviation concepts appears to be attractive. These concepts have the following potential advantages over redesigning the structure: (1) the weight penalty to the payload is minimal, (2) if dynamic loads become a critical design problem late in the payload development program, load alleviation devices can, in concept, be added with modifications to the payload design and testing program.

To enable assessment of the feasibility of load alleviation concepts, the user will require a body of information on the effectiveness of various alleviation approaches (e.g., additional payload supports, shock isolation, modification of the Shuttle operation) and the effects on spacecraft development, test, and operation. This information should be contained within the users' guide.

2.1.2 Justification

There are a variety of situations in which dynamic load alleviation devices could, in concept, be very advantageous to a payload. These situations include the following.

1. A payload program, planning initial launches on an expendable launch vehicle with later transition to the Shuttle, must consider the dynamic lateral loads resulting from the Shuttle events. Since these payloads were not designed for the high lateral loads that can result from events such as the Shuttle landing and liftoff conditions, some type of load alleviation scheme may be required to avoid the modifications and additional weight associated with strengthening of the spacecraft.

2. If the payload weight is limited by an expendable launch vehicle capability and structural beef-up is required for loads encountered during ascent or landing when the payload is in the Space Shuttle, load alleviation devices can be used to minimize the payload weight change so that it can remain compatible with the expendable launch vehicle. This is most likely to occur with payloads transitioning from expendable launch vehicles to the Shuttle.

3. When the payload weight is limited by the upper stage capability, load alleviation devices may be desirable to minimize structural weight. This may happen on new payloads or on payloads transitioning from an expendable launch vehicle to the Shuttle.

4. If the payload is designed for the orbiter using predicted dynamic loads which are later refined or revised so that the loads exceed the design loads, load alleviation devices may be used to avoid requalification at the higher load levels.

There are several general approaches to be investigated when payloads are designed for loads which prove to be non-conservative. For example, a different landing technique, i.e., lower sink rate, may be provided to reduce the landing load on the payload. Second, in order to carry the loads through the payload structure, a beef-up of the payload structure can usually be accomplished. Third, the use of load alleviation devices such as dampers, absorbers, and snubbers can be utilized to reduce the loads due to dynamic amplification. In order to properly consider the latter alternatives and evaluate feasibility and costs, as well as impacts on payload design and operation, data are needed by the user on potential load alleviation devices.

2.1.3 Operating Plan

2.1.3.1 Technical Objective

The technical objective is to furnish information needed by the user on STS dynamic load alleviation concepts. This information would be sufficient to:

1. Show feasible concepts for load alleviation devices applied to reduce payload design loads to acceptable levels during orbiter transient events

2. Provide a list of load alleviation devices, suppliers of currently available devices, concept advantages and disadvantages, and recommendations for use

3. Provide methods of analysis and orbiter characteristics (e.g., orbiter bending under load, see Section 2.5, and dynamic characteristics) for estimating static and dynamic loads in the orbiter/payload combination.

4. Describe the effects of load alleviation devices on typical payload loads test programs

5. Provide trade data comparing solutions for load problems by modifying Shuttle operation, or by payload strengthening, or by load alleviation devices

6. Provide typical effectiveness data for load alleviation approaches applied to a reasonable number of different types of payloads (i.e., high energy; low altitude; multiple payload launch; single payload launch; long, heavy payloads; and long, light payloads).

2.1.3.2 End Product

The end product will be a document containing a matrix of load alleviation device concepts with advantages, disadvantages, and examples of effectiveness for each. Trade data comparing the use of these devices with alternative methods of solving the loads problem should be well documented. Recommendations regarding application of these devices will be needed.

2.1.3.3 Milestone Schedule

Actual application of load alleviation devices could be considered as a part of new start payload programs in FY 77. At that time they would most likely be considered for transitional payloads which were not designed for the Shuttle load environment.

2.2 DATA REQUIRED BY STS USER ON FAILURE MODE EFFECTS FOR STS/PAYLOAD INTERFACE

2.2.1 Technical Summary (Objectives)

The STS user requires failure mode and effects data for equipments interfacing with his payload. Payload projects would normally carry out a failure mode and effects analysis for the spacecraft or experiment itself. The inputs to this failure mode and effects analysis include data required by the project from the interfacing equipment.

The objective, then, is to furnish failure mode and effects data (resulting from failure mode and effects analyses) on: (1) orbiter/payload interface equipment, (2) IUS/payload interface equipment, and (3) Tug/payload interface equipment, to the STS users.

2.2.2 Justification

The STS users need failure mode and effects data on launch vehicle/payload interface equipment, including any protective devices included on the orbiter side of the interface. This need is established for payload projects where it is desired to:

1. Consider possible requirements for payload protection devices on the payload side of the interface
2. Accomplish failure mode and effects analyses (FMEA) on the payload including the integrated launch vehicle/payload phases of operation.

The inclusion of devices to protect the payload from transient and out-of-spec phenomena at the interface normally depends on several factors. In addition to understanding the consequences of possible failures in the interface equipment and the probability that the failure will occur, the payload project would also normally consider the consequences of adding the protective device (e.g., cost, weight, and complexity) and the criticality of the failure effects to payload operation. In addition to identifying the failures, failure modes, and effects for the interface equipment, it is thus also desirable to understand the frequency of occurrence. For instance, rare power interruptions of short duration can many times be tolerated whereas frequent, long-duration power interruptions may be intolerable to a payload.

It is desirable to obtain and present the data once, for all committed STS users, rather than to furnish the data repeatedly to each committed user.

2.2.3 Operating Plan

2.2.3.1 Technical Objectives

The technical objectives of the STS User Data Requirements Plan on failure mode effects for the STS/payload interface are to furnish the following types of failure mode and effects data:

1. Failure mode description
2. Any component redundancy provisions
3. An estimate of the frequency of the occurrence of the failure
4. Failure repairability in orbit
5. The effects of failure on equipment function (e.g., production of errors, cessation, interruption, or other transient behavior)
6. Protective devices on the launch vehicle side of the interface
7. Alternative modes of operation.

For the orbiter these failure mode and effects data are needed for the following interface areas:

1. Orbiter/payload attachments and structural support provision
2. Orbiter power for payload use
3. The remote manipulator
4. Orbiter data handling including data storage, computations, and communications
5. Orbiter-supplied cooling
6. Payload caution and warning system
7. Payload fluid filling
8. Orbiter bay venting and draining
9. Orbiter attitude and navigation handoff data
10. Orbiter service panels (consider human error)
11. Orbiter rendezvous radar capability
12. Orbiter payload lighting.

In the same way, failure mode and effects data on orbiter equipment affecting the payload is needed, including:

1. Orbiter transmitters (effects on electromagnetic compatibility)

2. Orbiter reaction control system.

2.2.3.2 End Product

The end product is a report of the failure mode and effects on the orbiter/payload interface equipment incorporating the areas described above. It is recommended that a similar set of data be made available for the initial upper stage/payload interface equipment and Tug/payload interface equipment as these launch vehicle elements are defined.

2.2.3.3 Milestone Schedule

It is recommended that the orbiter failure mode and effects data be made available by the end of calendar year 1976 since it will probably be needed for satellite new start development in fiscal year 1977. It is recommended that the initial upper stage interface failure mode and effects data be made available at the end of fiscal year 77 since this appears to be the earliest opportunity even though IUS payload new starts could occur as early as fiscal year 1977.

2.3 DATA NEEDED BY STS USER ON PREDICTED PAYLOAD ACOUSTIC ENVIRONMENT FOR LOW PAYLOAD RISK

2.3.1 Technical Summary (Objectives)

The STS user is furnished payload acoustic environment data predicted on the basis of previous launch vehicle experience scaled to apply to the Space Shuttle. These data are soon to be supplemented with the results of 6.4 percent scale Space Shuttle vehicle model testing, again scaled to apply to the full-scale Space Shuttle. Since scaling of the data is approximate, there is a level of uncertainty associated with the results. The actual payload environment is not expected to be known until after several flight tests instrumented for acoustics and made with several different payload configurations in the bay.

The problem, then, is to estimate a worst-case acoustic environment prediction (sound pressure level vs frequency) which, if the payload were designed to withstand it, could lower the risk of having to requalify and perhaps redesign the payload after Shuttle orbital flight test acoustic data becomes available.

The objective, then, is to furnish a 3-sigma, worst-case acoustic environment prediction based on an uncertainty or potential error analysis of the data available and considering the possibility of the effects of orbiter drift (away from the exhaust holes) during liftoff.

2.3.2 Justification

The STS user needs payload acoustic environment data for design and qualification of the payload hardware. The primary design problems are expected to be encountered at low frequency, high amplitude conditions. Protection against payload damage under these conditions is primarily obtained by design of appendages (such as antennas and solar panels) and their supports so as to withstand the environment. Because of the high cost of rework, requalification, and the associated delays, a payload project should consider and may elect to design for a worst-case environment. Thus the satellite design may be more rugged but the project would be certain to avoid program delays and overruns due to the acoustic environment. For the payload project to specify this environment, a worst-case acoustic environment prediction is needed.

It would be desirable to obtain this worst-case environment description all at once so that all potential and committed STS users could have consistent data with which to specify their payloads.

2.3.3 Operating Plan

2.3.3.1 Technical Objectives

The technical objective is to furnish the STS users with worst-case acoustic environment predictions for the STS payload bay, with emphasis on sound pressure levels predicted during liftoff. In estimating the worst-case conditions, potential errors in scaling the available data, potential effects of payload configurations in the bay (e.g., upper stage plus payload and a sun synchronous satellite), and such potential external influences as the relationship of the launch vehicle to the pad during lift-off should be accounted for.

2.3.3.2 End Products

The end product of the STS User Data Requirements Plan for predicted payload acoustic environment for low payload risk is a worst-case acoustic prediction for the STS payload bay (sound pressure level vs frequency) and a report of the analysis and assumptions used to obtain that environment. The report should also discuss the expected utilization of the data to assist the user in the interpretation of the information.

2.3.3.3 Milestone Schedule

These data will probably be needed at the end of calendar year 1976 to support new payload start development in fiscal year 1977 since payloads for Shuttle operation are most likely to be initiated in that year.

2.4 DATA REQUIRED BY STS USER ON FLIGHT MANIFESTS, MULTIPLE PAYLOADS, AND SCHEDULING

2.4.1 Technical Summary (Objective)

The data needed by the STS user for scheduling payloads onto future flights and data needed to be compatible with multiple payload manifests have not been found in the STS User Plan Study. Policy guidelines are needed for potential Shuttle users concerning multiple payloads to be carried in the Shuttle. How and where this information can be obtained by the user needs to be stated. For multiple payload flights, the responsibility (user, user-purchased service, or STS operator?) for performing the various integrated system analyses (i.e., mission analysis, loads analysis) and establishing the data requirements and schedules needs to be established.

2.4.2 Justification

In developing, supporting, and operating a payload to be transported by the STS, the user is concerned with and normally responsible for the payload. The integrity of the user's payload and the success of a user's mission depend on many considerations, among them the flight performance of the vehicles, the loads and environment experienced, and the launch window. For STS flights transporting more than one payload (multiple payloads), these considerations can be significantly affected by the transportation of the additional payload(s). Relative to flight with the user's payload only, the additional payloads:

1. Add to the STS payload launch weight
2. Require additional on-orbit ΔV
3. Require additional STS flight duration
4. Change the mass distribution and stiffness of the integrated orbiter/payload
5. May add to the contaminants

6. May change other aspects of the environment (e.g., acoustic and thermal)

7. May affect the launch schedule or launch window

8. May use orbiter power, cooling, telemetry, or other orbiter services

9. Limit the options for payload location or position in the payload bay.

The user will need data on these interface characteristics for comparison payloads as well as information on the effects on the user's payload.

2.4.3 Operating Plan

2.4.3.1 Technical Objectives

The technical objective is to furnish data to the STS user covering the following:

1. Policy guidelines, procedures, and rules for scheduling flights and for multiple payloads in the Shuttle

2. Data on the effects of companion payloads on a user's payload (see items 1 through 9 under 2.4.2, Justification)

3. Schedules, procedures, responsibilities, and data requirements for multiple payload mission analysis and other integrated system analyses.

2.4.3.2 End Product

The end product of this study will be a document containing the above types of information.

2.4.3.3 Milestone Schedule

Since multiple payloads will be flown on Shuttle flights early in the 1980s, these data will be needed as soon as possible.

2.5 DATA REQUIRED BY STS USER ON ORBITER PAYLOAD BAY DEFLECTION

2.5.1 Technical Summary (Objective)

Studies have shown that adding a fifth attach point for certain payloads mounted in the orbiter within the c.g. constraints reduces the attach point loads to acceptable levels. This fifth attach point, however, complicates the load analyses for the payload. Any loads induced by orbiter deflection must be added to the static and dynamic loads.

The purpose of the orbiter payload bay deflection data is for use in determining payload loads induced by orbiter deflection.

2.5.2 Justification

When orbiter attach point load analyses are performed for certain large, heavy payloads mounted in the orbiter within the c.g. constraints, the results show that allowable loads at one or more of the attach points are exceeded. A solution proposed for this problem is to add a fifth point for attachment of the payload. When this is done, the load analyses for the payload and cradle or adapter become more complex in that loads due to orbiter deflection now add to the static and dynamically induced loads. Orbiter payload bay deflection is due to air loads and propulsive forces at maximum dynamic pressure, thermal distortion and air loads at reentry, air loads and landing impact loads at touchdown, and residual thermal distortion during post-landing soak back. It is desirable to obtain and present the data once, for all STS users, rather than to furnish the data repeatedly to each user.

2.5.3 Operating Plan

2.5.3.1 Technical Objective

The technical objective of the STS user data requirements plan on orbiter payload bay deflection is to furnish relative deflection data for the orbiter in three coordinates for the payload attach points. Data should cover the following conditions (the critical condition is expected to be touchdown):

1. Orbiter payload bay deflection as a result of aerodynamic and touchdown impact forces
2. Orbiter payload bay[(1)] deflection as a result of aerodynamic and propulsion forces at maximum dynamic pressure
3. Orbiter payload bay[(1)] deflection resulting from thermal distortion and air loads at reentry of the orbiter
4. Orbiter payload bay[(1)] deflection resulting from residual soak back heating after landing
5. A sample load analysis demonstrating the use of this deflection data for calculating payload loads.

2.5.3.2 End Product

The end product will be a document containing the deflection data to be used for payload load analyses and examples demonstrating the use of the data.

2.5.3.3 Milestone Schedule

Heavy payloads are scheduled for launch in 1980 and 1981. With normal lead times, these data will be needed as soon as possible.

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(1) With no payload in the bay. Data regarding the influence of the payload on deflections is also needed.

2.6 ADDITIONAL DATA REQUIREMENTS FOR SPACELAB USERS

2.6.1 Technical Summary (Objectives)

Extensive and detailed data are required by Spacelab users. Data in addition to that already available are needed for the definition phase (Phase B) as well as for the development and operations phases of an experiment project. Spacelab users who require this information for program success include the experimenters, experiment suppliers, experiment support equipment supplier, and experiment and experiment support equipment integrator.

Since the Spacelab system will consist of two parts, the pressurized module and the unpressurized pallet, two separate sets of data will be necessary. Data common to both parts can be cross referenced as supplied in other sections of a Payload/Shuttle User Data Requirements Matrix. The sections of this matrix will consist of: (1) pressurized Spacelab/experiment plus support equipment interface data, and (2) pallet/experiment plus support equipment interface data.

2.6.2 Justification

An extensive list of potential scientific and technology payloads has been recommended for inclusion on the Spacelab system. These include both pressurized and unpressurized experiments with widely varying objectives and diverse interface requirements with the STS. Several of these will be in Phase B shortly and must begin specifications and design based on accurate and detailed data regarding Spacelab characteristics. At present these required data are not available for use by Spacelab payload design groups.

2.6.3 Operating Plan

2.6.3.1 Technical Objective

The technical objective of this study is a Payload/Shuttle User Data Requirements Matrix which will provide potential users of the Spacelab with sufficient information to complete the definition, development, and operation phases for flight payloads. This objective should provide detailed data for both (1) the pressurized module, and (2) the unpressurized pallet of Spacelab and interfaces to the Shuttle.

2.6.3.2 End Product

The end product will be a matrix of two separate sections of interface data (the pressurized module and the unpressurized pallet) for users including the following categories:

1. Administrative (data related to scheduling, flight manifests, proprietary rights, user costs, and experiment/Spacelab interface control)
2. Equipment environments (contamination data)
3. Ground support facilities and services (ETR and WTR)
    a. Integration
    b. Pre-flight
    c. Post-flight and retrieval
4. Spacelab services, instruments, and standard support equipments (including data management power supplies; pointing and navigation data; and crew support data, including EVA data)
5. Provisions for experimenters onboard the STS
6. Spacelab experimenter training and qualification

7. Physical constraints and mechanical interfaces

    a. Experiment/Spacelab interface drawings
    b. Payload configuration and dynamics
    c. Thermal

8. Physical characteristics of payloads permitted (e.g., weight and dimensions)

9. Integration procedures, requirements, and instructions for:

    a. Level III integration (integration of experiment plus support equipment with Spacelab or pallet)

    b. Level II integration (integration of pallets and Spacelab elements into a sortie payload unit)

    c. Level I integration (integration of sortie payload unit into the Space Shuttle).

10. Operations (ground operations and flight operations)

    a. Flows and sequence of events
    b. Timelines
    c. Responsibilities
    d. Management

2.6.3.3 Milestone Schedule

These results are needed before the beginning of FY 1977 to prepare for the anticipated start of Phase B definitions of probable Spacelab payloads. It is recommended that a preliminary edition of the data be made available as early as possible, even though it is incomplete. Subsequent editions should also be provided as new data are developed or significant changes are incorporated.

3. SUMMARY OF STUDY ACTIVITIES

The activity record for the study is presented in Figure 3-1. The early task of obtaining additional documents for the NASA data bank stretched out longer than originally anticipated, with the bulk of the documents being received by the end of calendar year 1974. The elapsed time was largely used in developing the data requirements, organizing them in matrix form, and reviewing these both in-house and with NASA. The resulting data requirements matrix is presented in Section 7 of this volume. The data requirements were pulled from the reference material on payload programs which had flown on expendable launch vehicles. The user data needs being studied, however, are for the Space Transportation System users, therefore STS payload studies were used to derive the data requirements peculiar to the STS and its operations. In addition, meetings were held to discuss STS user data requirements with the objective of finding any additional data requirements which would not be obvious from the documentation. The list of user data requirements was not only reviewed by Aerospace specialists, but also by the in-house NASA study directors, Aerospace management, and NASA Headquarters personnel, and were sent to KSC, MSFC, and JSC for comment.

Reference document reviews were initiated in January of 1975. By the end of February, 42 documents had been reviewed by the study team; by the end of March, 77 documents; and by the end of April, over 100. The summaries of the reference reviews are contained in Section 9 of this volume of the report.

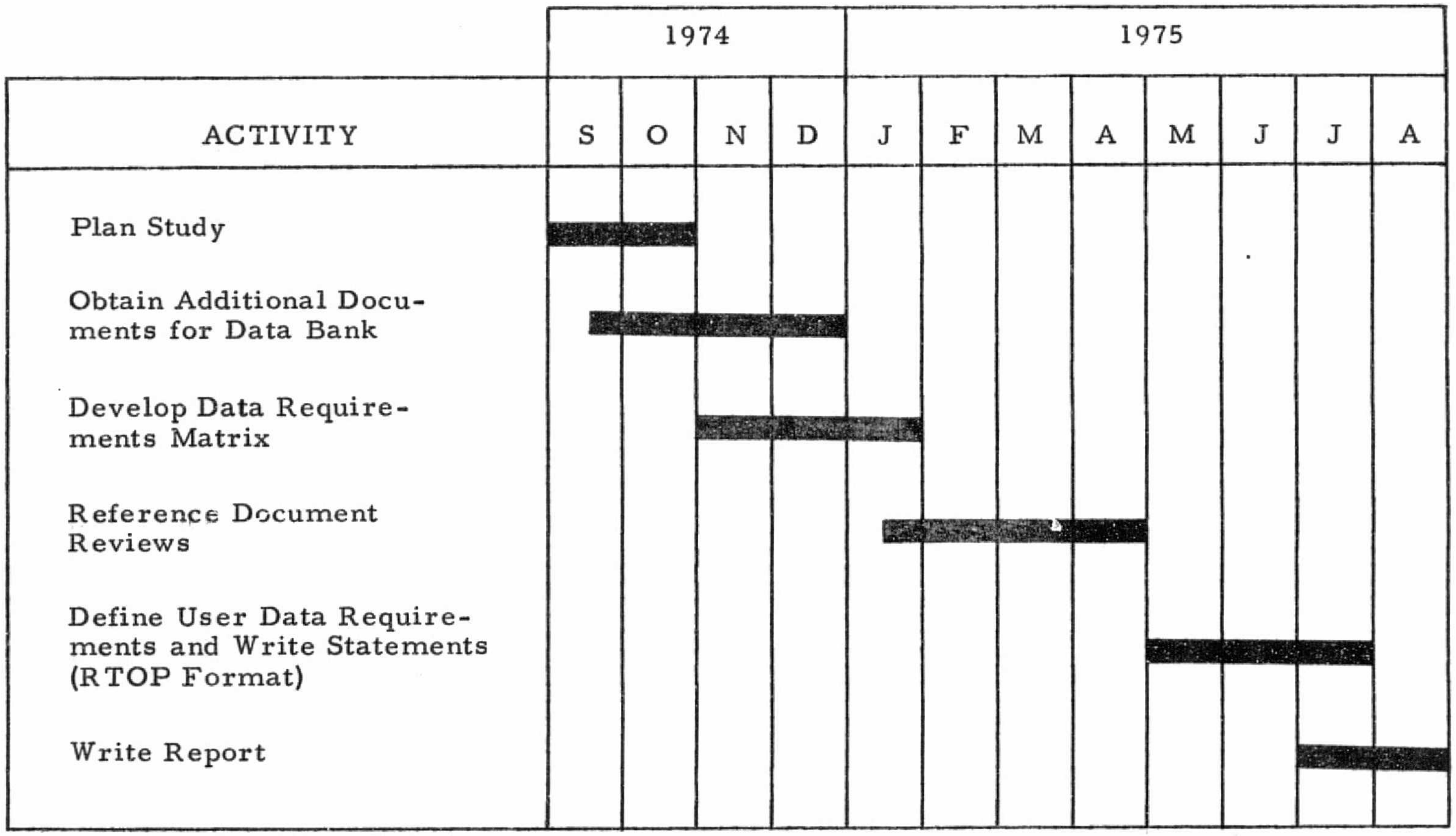

Figure 3-1. Activity Record, STS User Plan (User Data Requirements) Study

The documents that were found to contain data required by the STS user in accordance with the User Data Requirements Matrix were entered into the Matrix by reference key numbers. The Matrix linking the data requirements with the reference key numbers is presented in Section 8 of this volume. A table was also prepared to show the data in the references for each user data requirement for potential STS users making payload project studies in the concept and definition phases. This table is presented in Section 6.

The user data requirements listed in the Matrix which were inadequately covered by the reference material were noted, and studies were initiated for the purpose of defining user data requirements in detail and writing statements describing the user data needed (in RTOP format). These statements are presented in Section 2 of this volume of the report. User data requirement definition studies which were accomplished resulted in information in addition to that reported in Section 2.

4. UTILITY OF STUDY RESULTS

The statements of user data needed in addition to that available in the documents reported in Section 2 of this volume were written for consideration by NASA. The statements are recommendations resulting from the study which are expected to lead to making the data described available to the STS user when these recommendations are implemented. The statements are written in a NASA Research and Technology Operating Plan (RTOP) format since the activities related to implementing these recommendations are expected to be considered by NASA along with other activities described in this same format.

The STS User Data Requirements Matrix describing the data available to the user (see Section 8) is an organized method of presentation enabling the user to rapidly discern which references contain information applicable to his payload project. Thus the Matrix can function as a specialized catalog. By making use of this catalog, a STS user can avoid duplicating the work already accomplished by other organizations. Those interested in planning for payload projects or carrying out planning functions for future space programs can see what data is currently available and what data may be available in the future.

The references of data available have been organized into a table particularly useful to payload projects carrying out conceptual payload studies or payload definition studies. This table is presented in Section 6 and relates the documented information to the user data requirements for the potential STS user requiring conceptual and definition studies.

5. RECOMMENDED ADDITIONAL EFFORT

Pursuing the STS User Plan Study it was noticed that NASA is planning to obtain and document data relative to several critical areas for the STS user. It is recommended that in future studies these areas be reviewed again since it was assumed in this study that the plans would be carried out in order to obtain the information for the user. The list is shown below.

1. Remote Manipulator System, Detailed Capability Data and Corresponding Payload Deployment Sequence

2. Payload Requirements and Sequencing for Rendezvous and Docking to the Orbiter

3. Electromagnetic Compatibility and Electromagnetic Interference for Users in Phase B and the Following Phases

4. Payload Design Loads, Primarily Integrated Payload/Orbiter Dynamic Loads

5. Identification, Capability, and Utility of STS Simulators for the Orbiter/Payload Interface

6. JSC Shuttle Operational Data Book - Contents needed by the user for mission analysis currently has much of the information missing

7. Reentry and Terminal Flight Phase Constraints Affecting the Mission (e.g., return opportunities)

Several areas of user data requirements were related to hardware and STS capability, which are in a state of development; a detailed User Plan study at this time is therefore inappropriate. The orbiter avionics system information appeared to be in a state of flux, reflecting changes in the system, and it is recommended that additional effort be expended

6. POTENTIAL USERS DATA REFERENCES (MATRIX SHEETS)

A Matrix is presented in this section displaying the data requirements and data available for potential users. The complete matrices include committed user data requirements and separate the data requirements information (see Section 7) from the data available information (see Section 8) because of space limitations in the Matrix boxes. For the convenience of the potential user, these two matrices have been combined. The User Data Requirements Matrix is broken up into eight sections:

1.0 Payload/Launch Site Ground Support, ETR

2.0 Integrated Payload/STS Vehicle Ground Operations, ETR

3.0 Payload/Launch Site Ground Support, WTR

4.0 Integrated Payload/STS Vehicle Ground Operations, WTR

5.0 Payload/Shuttle Integrated Flight

6.0 Payload/Upper Stage Integrated Flights

7.0 Users Guide and Payload/Ground Terminal Interface Descriptions for Data Transfer, Communication and Tracking Networks, and Ranges

8.0 Information for STS System Integration and Support for a Space Project.

The item for which the data is required is listed in the left-hand column of the Matrix. The data needed by a user varies with the maturity of a payload project. Thus, the potential user's activities are broken down into three typical phases: Pre-Phase A, Phase A, and Phase B.

Pre-Phase A activities represent the very early work, and usually concentrate on such unique features of a new payload program as the experiments. These early considerations are normally low budget studies.

Phase A is the concept phase, where the primary objective is to prove feasibility of the system to convince the management that Phase B effort is worthwhile. Design work is usually top-level conceptual effort. Analyses performed usually do not go into detail.

Phase B corresponds to the definition phase of a new system. System tradeoffs and design tradeoffs are considered in some detail for the purpose of optimizing the system, minimizing the costs, and assuring competitiveness. From the Phase B activity, a baseline design usually emerges with its associated project cost and schedule estimates and operational plans.

The Matrix is arranged in this way to show typical phases of a satellite project; not all space projects go through each phase.

Entered into the Matrix are several kinds of notations. Whenever an "f" appears, it indicates that the column in which it appears is the first phase in which the data would normally be needed. When a 1 appears, it indicates that the data is normally required for that phase of the project. When a 2 appears, it means that it is normally desirable to have the data for that phase of the project but that the studies can normally proceed using consistent assumptions or by treating the area parametrically.

The third type of notation appearing in the Matrix consists of letters combined with numbers and is a key to the reference document list indicating which document contains data pertinent to the data requirement and is applicable to the phase in which the notation appears. The list of keys and references are in Section 9.

A fourth type of notation appearing in the Matrix is notes which indicate that the data required are either missing or available but need to be documented. The notation "U.S." stands for "User Supplied" and denotes that the reference documentation states that the user supplies the service or equipment and therefore the data.

For example, the user normally would not be concerned with the payload preparation facilities before Phase B since payload preparation is not normally a feasibility problem or a cost driver (see Matrix 1.1, Data Requirements for Payload Preparation). However, in Phase B, where the user is concerned that his cost include all applicable items, he would normally consider payload preparation to assure himself that no costly modifications were needed to the launch site facilities in this area. Thus the data is first needed and required in Phase B, and the source found for this information is reference GS-15.

The documents used in this study are listed in Section 9.1.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Payload Preparation			f, 1 GS-15
2. Laboratories and Calibration Service			f, 2 GS-15
~~3. Anechoic Chamber~~			
~~4. Antenna Range~~			
~~5. Hot Firing~~			
6. Payload/STS Mating			
a. Orbiter			f, 2 GS-3
b. Upper Stage			f, 2
7. Post-Landing Removal			f, 1 GS-3
8. Payload and Payload Support Equipment Storage, and Storage Environment			
9. Payload Support Equipment Maintenance			
10. Office Space			f, 2 GS-15
11. Solid Rocket Motor and Electro-Explosive Storage			

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Enviroment, and Cost Data)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
12. Radioactive Materials Processing		f, 2 GS-15	1 GS-15
13. Work Space On Pad (PCR)			f, 1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
1. Payload Checkout			
a. Electrical		f, 2 EBM-6, 11; GS-3, 4, 5, 6, 15	1 GS-3, 14, 15; RT-8
b. Mechanical		f, 2 EBM-6, 11; GS-3	1 GS-15; RT-8
c. Software		f, 2 EBM-6, 11; GS-3, 4, 6, 14, 15	1 GS-3, 14, 15; RT-8
2. Payload Servicing			
a. Propellants			f, 1 GS-3, 14, 15
b. Gas Storage and Supply			f, 1 GS-3, 14, 15
c. Calibration			
d. Power Supplies			
(1) Portable			f, 1 U.S.*
(2) Installed			f, 1 GS-3; U.S.*
e. Portable Connectors and Adapters			
f. Standard Portable Test Equipment			f, 2 U.S.*

* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
Payload Servicing (Cont'd)			
g. Simulators			
(1) Sail(1)			f, 1 (3)
(2) Integration Verification Equipm't (IVE)			f, 1 GS-15; RT-8
(3) Mission Simulation			f, 1 GS-15
h. Data Processing(2)			f, 1 GS-3, 14, 15
i. Contamination Control		f, 2 EBM-6; GS-3, 14; U.S.*	1 GS-3, 14; U.S.*
j. Cleaning			
k. Repair			f, 2 GS-15
l. Weight and Mass Properties Measurement Equip't.			f, 2 GS-15
m. Thermal Conditioning			f, 2 GS-3; U.S.

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).
(2) Data acquisition, transmission, recording, reduction, and processing equipments (location, routing, capacity, software).
(3) Data applicable to committed user is available.
* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
3. Payload Handling			
a. Physical Constraint			f, 1 GS-3; U.S.*
b. Loads			f, 1 U.S.*
4. Payload Transport			
a. Physical Constraint			f, 1 GS-3
b. Loads and Environment			f, 1 GS-3, 15(1)
5. Environmental Protection (e.g., Bag)			
6. Security and Guards			
7. Communications			

(1) Partial.
* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Cargo Bay Mating			
a. Pre-Pad			f, 1 GS-3, 14, 15
b. On-Pad			f, 1 GS-3, 14, 15
2. Payload Checkout Periods Available			f, 2 GS-3, 14, 15
3. Duration of Payload Dormant Periods as Imposed by STS			
4. Payload/Shuttle Integrated Test(s)			
a. Pre-Pad			
b. On-Pad			
5. Countdown			
a. Scheduled			
b. Unscheduled Holds			
6. Recycle from Launch Scrub			
~~7. Arrival On Site~~			
8. Facility Occupancy Normal Duration and Constraints			

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
9. Servicing Time Available to Payloads			f, 1 GS-3, 14, 15
10. Upper Stage Mating			f, 1 GS-15
11. Post-Landing Access to Payload		f, 2 GS-3, 14, 15; EBM-11	2 GS-3, 14, 15
12. Payload Removal, Post-Landing			

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A		PHASE A		PHASE B	
1. Shuttle Picture and General Flow			f, 1	EBM-6; F-1; JP-13; GS-3(1), 14, 15	1	GS-3(1), 14, 15
2. Upper Stage(s) Picture and General Flow	f, 2	EBM-6; GS-15	1	EBM-6; GS-15	1	GS-15(1)
3. Cargo Bay Ground Environment (Thermal, Dynamic, Contamination)						
a. OPF					f, 2	F-6; GS-3(1), 14, 15(1)
b. VAB					f, 2	GS-3(1), 14, 15
c. Transport to Pad					f, 2	F-6; GS-3, 14, 15(1)
d. PCR					f, 2	F-6; GS-3, 14, 15(1)
e. Post-Landing(2)					f, 2	F-6; GS-3, 14, 15(1)
4. Launch Constraints						
a. Environmental			f, 1(3)	(4)	1(3)	(4)
b. Calendar Limitations			f, 1(3)	(4)	1(3)	(4)
c. Range Safety (Incl. Launch Azimuth)	f, 2	EBM-6; GS-3(1), 15; F-1	f, 1	EBM-6; GS-3(1), 15; F-1	1(3)	GS-3(1), 15; F-1

(1) Partial.
(2) Thermal environment important.
(3) If launch window critical.
(4) Data applicable to committed user are available, see Section 8.0.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
5. Shuttle Payload Attachments and Structural Support Provisions			
a. Design		f, 2 EBM-6;EP-4, 14, 15(A'75)	1 EP-15(A'75)
b. Locations		f, 2 JP-1;EP-4;GS-3; EBM-6	1 JP-1;GS-3
c. Ground Loads Accepted		f, 2 EP-4;EBM-6; GS-3	1 GS-3
d. Latches, Fittings, Attachments		f, 2 EP-4: EBM-6; GS-3	1 GS-3
e. Indexing		f, 2 EP-4; EBM-6; GS-3	1 GS-3
6. Nominal Operational Constraints			
a. Payload Requested Countdown Mods.			f, 1 GS-3, 14, 15 (1)
b. Safety During Ground Operations			f, 1 GS-3,15; EP-17
c. EMC			f, 1 GS-14, 15 (1)
d. Payload Ground Crew			f, 1 (2)

(1) Partial.
(2) Data applicable to committed user is available, see Section 8.0.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
Nominal Operational Constraints (Cont'd)			
e. Installed Payload Access (Pre-Launch and Post-Landing)			f, 1 GS-3[1], 14, 15
f. On-Pad Maintenance, Assembly, Checkout			f, 1 GS-3, 14, 15
g. Contamination			f, 1 GS-3, 15
h. Umbilicals			f, 1 GS-3
i. Ground Access Panels			f, 1 GS-3
j. Natural Environm't.			f, 2 GS-3, 11
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)			
a. Payload Monitoring			
b. Data Handling			
c. Venting & Draining			
d. Electrical Power			
e. Payload Cooling			

(1) Partial.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground) (Cont'd)			
f. Payload Changeout			f, 2 GS-3, 14, 15
8. Launch Management Procedures			
9. Alternate Landing Sites			

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Payload Preparation			f, 1 GS-2, 15
2. Laboratories and Calibration Service			f, 2 GS-12, 15
~~3. Anechoic Chamber~~			
~~4. Antenna Range~~			
~~5. Hot Firing~~			
6. Payload/STS Mating			
a. Orbiter			f, 2 GS-1, 16(1)
b. Upper Stage			f, 2 GS-1, 16
7. Post-Landing Removal			f, 1 GS-1, 16
8. Payload and Payload Support Equipment Storage and Storage Environment			
9. Payload Support Equipment Maintenance			
10. Office Space			f, 2 GS-2, 15
11. Solid Rocket Motor and Electro-Explosive Storage			

(1) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
12. Radioactive Materials Processing		f, 2 GS-15	1 GS-15
13. Work Space On Pad			f, 1 GS-1, 16 (1)

(1) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
Payload Servicing (Cont'd)			
g. Simulators			
(1) Sail[1]			f, ① (3)
(2) Integration Verification Equip't (IVE)			f, ① GS-15; RT-8
(3) Mission Simulation			f, ① GS-15
h. Data Processing[2]			f, ① GS-2, 3, 4, 6, 7[3], 12, 14, 15
i. Contamination Control		f, ② GS-1, 3, 14; U.S.*	① GS-3, 14; U.S.*
j. Cleaning			
k. Repair			f, ② GS-15
l. Weight & Mass Properties Measurement Equipment			f, ② U.S.*
m. Thermal Conditioning			f, ② GS-3; U.S.*

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).
(2) Data acquisition, transmission, recording, reduction, and processing equipments (location, routing, capacity, software).
(3) Data applicable to committed user is available, see Section 8.0.
* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A		PHASE B	
1. Payload Checkout					
a. Electrical		f, 2	GS-1, 3, 4, 6, 7, 15; EP-1	1	GS-3, 15; RT-8
b. Mechanical		f, 2	GS-15	1	GS-15; RT-8
c. Software		f, 2	GS-3, 4, 6, 7, 14, 15	1	GS-3, 14, 15;RT-8
2. Payload Servicing					
a. Propellants				f, 1	GS-3, U.S.*
b. Gas Storage & Supply				f, 1	GS-3, 15
c. Calibration					
d. Power Supplies					
(1) Portable				f, 1	U.S.*
(2) Installed				f, 1	GS-3; U.S.*
e. Portable Connectors and Adapters					
f. Standard Portable Test Equipment				f, 2	GS-2; U.S.*

* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
3. Payload Handling			
a. Physical Constraint			f, 1 U.S.*
b. Loads			f, 1 U.S.*
4. Payload Transport			
a. Physical Constraint			f, 1 U.S.*
b. Loads and Environment			f, 1 GS-3; U.S.*
5. Environmental Protection (e.g., Bag)			
6. Security and Guards			
7. Communications			

* From GS-15, U.S. = User Supplied.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines, and Constraints

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Cargo Bay Mating			
a. Pre-Pad			f, 1 GS-15
b. On-Pad			f, 1 GS-15, 16(1)
2. Payload Checkout Periods Available			f, 2 GS-15, 16
3. Duration of Payload Dormant Periods as Imposed by STS			
4. Payload/Shuttle Integrated Test(s)			
a. Pre-Pad			
b. On-Pad			
5. Countdown			
a. Scheduled			
b. Unscheduled Holds			
6. Recycle from Launch Scrub			
~~7. Arrival On-Site Time Constraint~~			

(1) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
8. Facility Occupancy Normal Duration and Constraints			
9. Servicing Time Available to Payloads			f, 1 GS-1, 3
10. Upper Stage Mating			f, 1
11. Post-Landing Access to Payload		f, 2 GS-1, 15	2 GS-1, 15
12. Payload Removal, Post-Landing			

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Shuttle Picture and General Flow		f, 1 F-1; GS-3[1], 15	1 GS-3[1], 15, 16[2]
2. Upper Stage(s) Picture and General Flow	f, 2	1	1
3. Cargo Bay Ground Environment (Thermal, Dynamic, Acoustic, Contamination)			
a. Orbiter Processing Facility			f, 2 F-6; GS-15[1], 16
b. Vertical Assembly Building			f, 2
c. Transport to Pad			f, 2 F-6; GS-3, 15[1], 16
d. Payload Changeout Facility			f, 2 F-6; GS-3, 15[1], 16
e. Post-Landing[3]			f, 2 F-6; GS-3, 15[1], 16
4. Launch Constraints			
a. Environmental		f, 1[1] CP-3, 14	1[1] CP-3, 14
b. Calendar Limitations		f, 1	1
c. Range Safety (Incl. Launch Azimuth)	f, 2 F-7[1]; GS-3[1], 10[1], 12	f, 1 F-7[1]; GS-3[1], 10[1], 12	1 F-7[1]; GS-3[1] 10[1], 12

(1) Partial Coverage
(2) GS-16 data available approximately July 1976
(3) Thermal environment important

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A		PHASE B	
5. Shuttle Payload Attachments and Structural Support Provisions					
a. Design		f, 2	EP-4	1	
b. Locations		f, 2	EP-4;JP-1;GS-3	1	JP-1; GS-3
c. Ground Loads Accepted		f, 2	EP-4; GS-3	1	GS-3
d. Latches, Fittings, Attachments		f, 2	EP-4; GS-3	1	GS-3
e. Indexing		f, 2	EP-4;GS-3;JP-1	1	GS-3; JP-1
f. Natural Environ.					
6. Nominal Operational Constraints					
a. Payload Requested Countdown Mods.				f, 1	GS-15(1), 16(2)
b. Safety During Ground Operations				f, 1	GS-10(1), 12; EP-17
c. EMC				f, 1	GS-12, 15
d. Payload Ground Crew				f, 1	

(1) Partial Coverage.
(2) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
Nominal Operational Constraints (Cont'd)			
e. Installed Payload Access (Pre-launch and Post-landing)			f, 1 GS-14, 16[1]
f. On-Pad Maintenance, Assembly, Checkout			f, 1 GS-14, 16
g. Contamination			f, 1 GS-15, 16
h. Umbilicals			f, 1 GS-3
i. Ground Access Panels			f, 1 GS-3
j. Natural Environ.			f, 2 GS-3, 11
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)			
a. Payload Monitoring			
b. Data Handling			
c. Venting & Draining			
d. Electrical Power			
e. Payload Cooling			

(1) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground) (Cont'd)			
f. Payload Changeout			f, 2 GS-15, 16 (1)
8. Launch Management Procedures			
9. Alternate Landing Sites			

(1) GS-16 data available approximately July 1976.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Flight Scheduling			
a. Responsibility and Management			
(1) ETR		f, 1 JP-12, 13	1
(2) WTR		f, 1	1
b. Current Schedule Projection and Available Space		f, 1	1
c. Rules and Reqm'ts		f, 1 EP-13; EBM-6	1
d. Flight Application & Scheduling Procedure		f, 1 JP-12, 13	1
2. Manifests			
a. Multiple Payload Policy	f, 2 JP-12, 13	1	1
b. Weights Charged to Payload	f, 2 JP-1, 5, 10	1 JP-1, 5, 10	1 JP-1, 5
c. Manifest Management	f, 2	1	1
3. Shuttle Performance Maps (Payload Weight, Spacecraft and Payload Chargeables)	f, 1 EBM-6, 11; JP-1; F-1, 7	1 EBM-6, 11; JP-1; F-1, 7	

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
4. Flight Plans and Mission Analysis Data			
a. Generalized Mission Analysis Data	f, 1 EP-6, 8; JP-2, 6; F-1, 7; WF-1, 2, 3, 4; EBM-11		
b. Specific Mission Analysis(1) Data		f, 1 EP-2(2), 7, 9, 10, 11 WF-5, 6	1 EP-2(2); WF-5, 6, 7, 8, 9, 10
c. Flight Parameters			
5. User-Furnished Propulsion			
a. NASA Policy and Constraints		f, 1 DATA EXISTS, NEEDS TO	1 BE DOCUMENTED
b. Special Requirements for Motors		f, 2	1
6. Multi-Use Payload Adapter(s)		f, 2 EP-15(A'75)	1 EP-15(A'75)

(1) Inputs for performance and trajectory analyses.
(2) U.S. Government agencies only.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A		PHASE B	
7. Shuttle Payload Attachments and Structural Support Provisions					
a. Changes from Ground Configuration		f, 2	EP-4;EBM-6, 11; F-7	1	(1)
b. Flight Loads Accepted		f, 2	EP-4;EBM-6, 11; F-1, 7; JP-1	1	JP-1; EBM-11
8. Shuttle Power					
a. Locations		f, 1	EBM-11;F-1, 2, 7, 8; JP-12;EP-4, 14, 15(A'75)	1	EP-15(A'75); JP-1; EBM-11
b. Quality and Schedule		f, 1	EP-4, 14; F-1, 2, 7, 8; EBM-6, 11;JP-1	1	JP-1, 12; EBM-11
c. Kitting Provisions		f, 1	EP-4, 14;EBM-6; F-1, 2, 7, 8;JP-1, 5	1	(1)
9. Remote Manipulator					
a. Functions		f, 1	EBM-6, 11;F-1, 7; JP-16	1	JP-12, 16;EBM-11
b. Limitations		f, 1	EBM-6, 11;F-1, 7; JP-1, 16	1	JP-1, 16;EBM-11
c. End Effectors		f, 2	EBM-6, 11; F-1; JP-12[1], 16[2]	1	EBM-11

(1) Partial.
(2) Some data applicable to committed user is available.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A		PHASE B	
10. Shuttle Data Handling, Transmission and Recording (Diagnostic, Monitoring, Checkout)					
a. Equipment and Stations		f, 2	EBM-6; EP-14; F-1, 2, 7; JP-12(1), 13	1	(2)
b. Software		f, 2	EBM-6, 11; JP-12(1)	1	EBM-11
c. Codes		f, 2	EBM-6, 11	1	JP-12(1), 13; EBM-11
d. Rates		f, 2	EBM-6, 11; EP-4; F-1, 2, 7	1	JP-12(1), 13; ELM-11
e. Capacity				1	JP-13; EBM-11
11. Orbiter-Supplied		f, 1	EP-14; JP-1; F-1, 2, 7, 8; EBM-11	1	JP-1, 12(1); EBM-11
12. Additional Payload Services Furnished by Orbiter					
a. Payload Monitoring		f, 2	EBM-11; F-1; JP-12(1)	1	EBM-11
b. Venting and Draining				f, 1	F-8; EBM-11
c. Fluid Filling				f, 1	EBM-11

(1) Specification data TBD.
(2) Some data applicable to committed user is available, see Section 8.0.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
13. Shuttle Attitude and Navigation			
a. Normal Navigation Accuracy		f, 1 EBM-6; JP-1	1 JP-1
b. Normal Pointing Accuracy		f, 1 EBM-6, 11; JP-1; F-7	1 JP-1, 12; EBM-11
c. Tip-Off Rates at Deployment			f, 1 JP-12, 16
d. Provisions for Accuracies Exceeding Normal			f, 1 F-7
e. Payload Initialization (Handoff) Data			f, 1 JP-12[1], 16
14. Shuttle Service Panels			
a. Electrical			f, 2 F-7, 8
b. Fluid			f, 2 F-7, 8
c. Data Bus			f, 2
15. Shuttle Environments			
a. Acoustic			f, 2 EBM-11; JP-1, 12[1] F-7, 8

(1) Specification Data TBD.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A		PHASE A		PHASE B	
Shuttle Environments (Cont'd)						
b. Thermal					f, 2	EBM-11; JP-1, 12; F-7, 8
c. Vibration					f, 2	EBM-11; JP-1, 12; F-7, 8
d. Shock					f, 2	EBM-11; JP-1, 12; F-7, 8
e. Pressure					f, 2	EBM-11; JP-1, 12; F-7, 8
f. Ambient Gas					f, 2	JP-1, 12; F-6, 7, 8
16. Shuttle Contamination and Sources						
a. Location	f, 1	EP-4, 14; EBM-6; F-6, 7, 8	1	EP-4, 14; EBM-6; F-6, 7, 8	1	JP-15(1)
b. Contaminants	f, 1	EP-4, 14; EBM-6; F-2, 6, 7, 8	1	EP-4, 14; EBM-6; F-2, 6, 7, 8	1	JP-15(1)
c. Contamination Level	f, 1	EP-4, 14; EBM-6; F-6, 7, 8; JP-1	1	EP-4, 14; EBM-6; F-6, 7, 8; JP-1	1	JP-1
d. Contamination Control	f, 1	EP-4, 5, 14; JP-17; EBM-6;F-6, 7, 8	1	EP-4, 5, 14; JP-17 EBM-6;F-6, 7, 8	1	JP-15(1), 17

(1) Also reviewed for Sections 1, 2, 3, and 4 as GP-14.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

ıterface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
17. EMC/EMI			
a. Ground Shielding, etc			f, 1 (1)
b. Radiation Environ't			f, 1 (1)
18. Loads			
a. Nominal Limit Load Factors		f, 2 EBM-6, 11; JP-1, 14; F-7	1 JP-1; EBM-11
b. Load Transformation Matrix Inputs			f, 1 (2)
c. Dynamic Model			f, 2 EP-20(3); EBM-11
d. Final Design Loads			
19. Safety			
a. Responsibility		f, 1 EP-2; JP-1	1 EP-2, 17; JP-1
b. Test Points			f, 1 EP-2
c. Criteria and Factors		f, 2 EP-2, 14; F-1, 2	1 EP-2, 17
d. Range Safety(4)		f, 2 EP-2	2 EP-2
20. Orbit Maneuvers		f, 1 EP-2; JP-1; WF 1-4	1 EP-2; JP-1; WF 1-10
21. Rendezvous Capability		f, 1	1 JP-12

(1) Specifications available, see committed user columns, Section 8.0.
(2) Some data applicable to committed user is available, see Section 8.0.
(3) Information relevant but incomplete.
(4) Including launch azimuth constraints.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
22. Payload Docking		f, 1	1 JP-12
23. Module Exchange Mechanism	f, 2	1	1 JP-18, 19
24. RCS Accelerations		f, 1 JP-1	1 JP-1, 12
25. Payload Lighting			
26. Spacelab Capability			
a. Data Range	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
b. Data Storage	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
c. Data Reduction Equipment and Software	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
d. Power for Experiments	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
e. Physical Constraints & Environment	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
f. Standard Instrumentation	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11
g. Provisions for Experimentor	f, 2 EBM-6, 11	1 EBM-6, 11	1 EBM-11

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A		PHASE A		PHASE B	
Spacelab Capability (Cont'd)						
h. Qualifications and Training Required for Experimentor	f, 2	EBM-6, 11	1	EBM-6, 11	1	EBM-11
i. Interface for User Requirements Exceeding Orbiter Spacelab Capabilities	f, 2	EBM-6, 11	1	EBM-6, 11	1	EBM-11
27. Sequence of Events Orbiter Attitude and Timelines						
a. Powered Flight					f, 1	JP-12 (1)
b. On-Orbit Stay	f, 2	F-1; EBM-6	1	F-1; EBM-6	1	JP-12 (1)
c. Deployment					f, 1	JP-12 (1)
28. Orbiter Physical Constraints						
a. Payload Envelopes			f, 1	EBM-6, 11; EP-4; F-1, 7; JP-1, 10	1	JP-1, 12; EBM-11
b. c.g. Envelopes			f, 1	EBM-6, 11; EP-4; F-1, 7; JP-1, 10	1	JP-12; EBM-11

(1) Specification data TBD.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A		PHASE A		PHASE B	
29. User Costs						
a. Transportation			f, 2	F-4(A'76)	1	F-4(A'76)
b. Extra Orbiter Charges			f, 2	F-4(A'76)	1	F-4(A'76)
c. Spacelab Charges			f, 2	F-4(A'76)	1	F-4(A'76)
d. STS Guarantees and Penalties			f, 2	F-4(A'76)	1	F-4(A'76)
30. Abort Sequences and Probability of Abort, Provision for Reflight	Combined with Data Required on 5.0.2					
31. Payload Specialist Function						
a. General Description	f, 2	EBM-6, 11; JP-1, 12, 13; F-1, 7	1	EBM-6, 11; JP-1, 12, 13; F-1, 7	1	JP-1, 13, 15(1); EBM-11
b. Specific Task Description	f, 2	EBM-6, 11; F-7	1	EBM-6, 11; F-7	1	EBM-11
32. Mission Specialist Function						
a. General Description	f, 2	EBM-6, 11; EP-2; JP-1, 12, 13; F-1, 7	1	EBM-6, 11; EP-2; JP-1, 12, 13; F-1, 7	1	EBM-11; EP-2; JP-1, 13
b. Specific Task Descriptions	f, 2	EBM-6, 11; F-7	1	EBM-6, 11; F-7	1	EBM-11

(1) Also reviewed for Sections 1, 2, 3, and 4 as CP-14.

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
33. Return Capability			
a. Deorbit	f, 2 EBM-6; JP-1; WF 1-9	1 EBM-6; JP-1;	1 JP-1; WF 1-10
b. Reentry	f, 2 EBM-6; JP-1; WF 1-4	1 EBM-6; JP-1; WF 1-4	1 JP-1; WF 1-10
c. Landing	f, 2 EBM-6, 11; JP-1; WF 1-4	1 EBM-6, 11; JP-1;	1 JP-1; WF 1-10
d. Safety Constraints		f, 1	1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Upper Stage Generalized Performance (Payload Weight, etc.)	f, 1	1	
2. Upper Stage Performance Characteristics for Mission Analysis			
a. Sequential Weight Statement		f, 1	1
b. Propulsion System Characteristics		f, 1	1
3. Payload Adapter(s)		f, 2 EP-5	1
4. Upper Stage Payload Structural Support			
a. Design		f, 2 EP-5	1
b. Loads Accepted		f, 2	1
5. Upper Stage Power			f, 1 EP-15(A'75)
6. Module Exchange Mechanism	f, 2	1	1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
7. Upper Stage Data Handling & Transmission			
a. Codes		f, 2	1
b. Rates		f, 2	1
8. Upper Stage Attitude and Navigation			
a. Accuracy		f, 1 EP-5	1
b. Tip-Off Rates			f, 1
c. Handoff Data			f, 1
9. Upper Stage Service Panels			
a. Electrical			f, 2
b. Data Bus			f, 2
10. Loads			
a. Nominal Limit Load Factors		f, 2 EP-5	1
b. Dynamic Model			f, 2
c. Shock and Design Loads			f, 1

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STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
11. EMC/EMI			
a. Grounding, Shielding, etc.			f, 1
b. Radiation Environ.			f, 1
12. Safety			
a. Criteria & Factors		f, 2	1 EP-17
13. Stage Contamination Sources	f, 1	1	1
14. Stage Maneuvers and Orientation		f, 1 EP-5	1
15. Rendezvous Capability		f, 1	1
16. Payload Retrieval		f, 1 EP-5	1
17. Sequence of Events, Stage Attitudes, and Timelines			
a. Powered Flight		f, 2	1
b. On-Orbit Stay	f, 2	1	1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
18. Physical Constraints			
a. Envelope		f, 1	1
b. c.g. Envelopes		f, 1	1
19. User Costs (Transportation, Extras)		f, 2	1
20. Procurement Requirements and Production Schedules, Responsibilities		f, 2	1
21. Flight Scheduling Constraints		f, 1	1
22. Manifests			
a. Multiple Payload Policy	f, 2	1	1
b. Weights Charged to Payload	f, 2	1	1
c. Manifest Management	f, 2	1	1
23. Abort Information			
24. Payload Separation Sequence and Signals			f, 1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO THE STS SYSTEM

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
25. Payload Docking			
a. Sequence		f, 1 EP-5	1
b. Equipment		f, 1 EP-5	1
c. Interface		f, 1 EP-5	1
d. Stability Rqmts.		f, 1 EP-5	1
e. Control		f, 1 EP-5	1
f. Loads		f, 1 EP-5	1
26. Computer Programs Available to User		f, 2	1

STS POTENTIAL USER DATA REQUIRED RELATIVE TO GROUND TERMINALS TRACKING NETWORK, AND THE TRACKING AND DATA RELAY SYSTEM BY PAYLOAD PROJECTS

7.0 USERS GUIDE AND PAYLOAD/GROUND TERMINAL INTERFACE DESCRIPTIONS FOR DATA TRANSFER, COMMUNICATION AND TRACKING NETWORKS, AND RANGES

(Locations, Descriptions, Availability, Ground Links, Frequencies, Capacities, Codes, Data Storage, Data Processing, User Charges, NASA Contact)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A		PHASE A		PHASE B	
1. ETR Range					f, 1	
2. WTR Range					f, 1	
3. STS Ground Terminals	f, 2		1		1	
4. STDN Ground Terminals and Data Reduction	f, 2	JP-13;EP-21,22*	1	JP-13;EP-21,22*	1	EP-21,22*
5. DSN Ground Terminals	f, 2		1		1	
6. TDRS System	f, 2	JP-13; EP-21	1	JP-13; EP-21*	1	EP-21*

* Partial Coverage.

LIST OF STS SYSTEM REQUIREMENTS FOR
PREFLIGHT INFORMATION FROM PAYLOAD PROJECTS

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	PRE-PHASE A	PHASE A	PHASE B
1. Project Plan			
a. Project Support Requirements			f, 2 JP-13;GS-8, 14, 15
b. Procurement & Services Requirem'ts			f, 2 GS-8, 14; JP-13; RT-8
2. Mission Analysis	f, 2 JP-13	1 JP-13	1
3. Payload Design/Analysis Documents			
a. Payload Drawing, General Description, & Interface Reqm'ts.		f, 2 EP-3; EBM-11	1 EP-3; GS-8
b. Hazard Analysis and Safety Plan			
c. Payload Tie-Down Loads, Stresses and Deflection Analysis			
d. Analysis of Payload Deployment and Retrieval			
e. Payload Heat Rejection Rates			

LIST OF STS SYSTEM REQUIREMENTS FOR
PREFLIGHT INFORMATION FROM PAYLOAD PROJECTS

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project) - Cont'd

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	PRE-PHASE A	PHASE A	PHASE B
3. Payload Design/Analysis Documents (Cont'd)			
f. Payload Contamination (e.g., Out-Gassing)			
g. Payload Countdown (Sequence, Holds, etc.)			
4. Payload Test Requirements			
a. Payload/STS Integration Simulation			
5. Payload Demonstration to be Carried Out			
6. Payload Inspections Required			

7. DATA REQUIREMENTS MATRIX (MATRIX SHEETS)

The User Data Requirements Matrix presented in Section 7 shows the complete picture of requirements for the life cycle of a project. The data requirements information for the potential user duplicates that displayed in Section 6. The data requirements for the committed user, covering the development and operational phases of a payload project, are also displayed. The symbols for data required remain the same, with the "f" indicating the phase in which the data is first needed; the (1) indicating that the data is required for the successful completion of that phase; and the (2) indicating that the data is desired but that the phase can be completed by making reasonable assumptions.

It was found that the transition payloads being modified for compatibility with the STS transitioning from expendable launch vehicles do not always have the same data requirements as new payloads in the development phase. Therefore, a separate column is used to indicate the data required for transitioning payloads.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data, NASA Contact)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
1. Payload Preparation			f, 1	1		1			
2. Laboratories and Calibration Service			f, 2	1		1			
~~3. Anechoic Chamber~~				~~f, 1~~		~~1~~			
~~4. Antenna Range~~			~~f, 2~~	~~1~~		~~1~~			
~~5. Hot Firing~~			~~f, 2~~	~~1~~		~~1~~			
6. Payload/STS Mating				1					
a. Orbiter			f, 2	1		1			1
b. Upper Stage			f, 2	1		1			1
7. Post-Landing Removal			f, 1	1		1			1
8. Payload and Payload Support Equipment Storage and Storage Environment				f, 1		1			
9. Payload Support Equipm't Maintenance				f, 1		1			
10. Office Space			f, 2	1		1			
11. Solid Rocket Motor and Electro-Explosive Storage				f, 2		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data, NASA Contact) (Cont'd)

DATA REQUIREMENTS ON FACILITIES FOR: \ PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
12. Radioactive Materials Processing		f, 2	1	1		1			
13. Work Space On Pad (PCR)			f, 1	1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase[1]
1. Payload Checkout									
a. Electrical		f, 2	1	1		1			
b. Mechanical		f, 2	1	1		1			
c. Software		f, 2	1	1		1			
2. Payload Servicing									
a. Propellants			f, 1	1		1			
b. Gas Storage and Supply			f, 1	1		1			
c. Calibration				f, 1		1			
d. Power Supplies									
(1) Portable			f, 1	1		1			
(2) Installed			f, 1	1		1			
e. Portable Connectors and Adapters						f, 1			
f. Standard Portable Test Equipment			f, 2	f, 1		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(3)
2. Payload Servicing (Continued)									
g. Simulators									
(1) Sail(1)			f, 1	1		1			
(2) Integration Verification Equipm't (IVE)			f, 1	1		1			1
(3) Mission Simulation			f, 1	1		1			1
h. Data Processing(2)			f, 1	1		1			1
i. Contamination Control		f, 2	1	1		1			1
j. Cleaning				f, 1		1			1
k. Repair			f, 2	1		1			
l. Weight and Mass Properties Measurement Equip't.			f, 2	1		1			
m. Thermal Conditioning			f, 2	1		1			1

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).
(2) Data acquisition, transmission, recording, reduction and processing equipments (location, routing, capacity, software).
(3) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
3. Payload Handling									
a. Physical Constraint			f, ①	①		①			
b. Loads			f, ①	①		①			
4. Payload Transport									
a. Physical Constraint			f, ①	①		①			
b. Loads and Environment			f, ①	①		①			
5. Environmental Protection (e.g., Bag)				f, ①		①			①
6. Security and Guards						f, ①			
7. Communications						f, ①			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase (1)
1. Cargo Bay Mating									
a. Pre-Pad			f, 1	1	1	1			1
b. On-Pad			f, 1	1	1	1			1
2. Payload Checkout Periods Available			f, 2	1	1	1			1
3. Duration of Payload Dormant Periods As Imposed by STS				f, 1	1	1			1
4. Payload/Shuttle Integrated Test(s)									
a. Pre-Pad				f, 1		1			1
b. On-Pad				f, 1		1			1
5. Countdown									
a. Scheduled				f, 1		1			1
b. Unscheduled Holds				f, 1		1			1
6. Recycle from Launch Scrub				f, 1		1			1
7. ~~Arrival On-Site~~				~~f, 1~~		~~1~~			
8. Facility Occupancy Normal Duration and Constraints				f, 1		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines and Constraints (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
9. Servicing Time Available to Payloads			f, 1	1		1			
10. Upper Stage Mating			f, 1	1		1			1
11. Post-Landing Access to Payload		f, 2	2	1		1			1
12. Payload Removal, Post Landing				f, 1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contract

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase[2]
1. Shuttle Picture and General Flow		f, 1	1	1	1	1	1		1
2. Upper Stage(s) Picture and General Flow	f, 2	1	1	1	1	1	1		1
3. Cargo Bay Ground Environment (Thermal, Dynamic, Contamination)									
a. OPF b. VAB			f, 2	1					1
c. Transport to Pad			f, 2	1					1
d. PCR			f, 2	1					1
e. Post-Landing[3]			f, 2	1					1
4. Launch Constraints									
a. Environmental		f, 1[1]	1[1]	1	1	1			1
b. Calendar Limitations		f, 1[1]	1[1]	1	1	1			1
c. Range Safety (Incl. Launch Azimuth)	f, 2	f, 1	1[1]	1	1	1			1

(1) If launch window critical.

(2) For minimum modification transition.

(3) Thermal environment important.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
5. Shuttle Payload Attachments and Structural Support Provisions									
a. Design		f, 2	1	1		1			1
b. Locations		f, 2	1	1		1			1
c. Ground Loads Accepted		f, 2	1	1		1			1
d. Latches, Fittings, Attachments		f, 2	1	1		1	1		1
e. Indexing		f, 2	1	1		1	1		1
6. Nominal Operational Constraints									
a. Payload Requested Countdown Mods.			f, 1	1		1			1
b. Safety During Ground Operations			f, 1	1		1			1
c. EMC			f, 1	1		1			1
d. Payload Ground Crew			f, 1	1		1			1
e. Installed Payload Access (Pre-launch and Post-Landing)			f, 1	1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
6. Nominal Operational Constraints (Cont'd)									
f. On-Pad Maintenance, Assembly, Checkout			f, 1	1		1			1
g. Contamination			f, 1	1		1			1
h. Umbilicals			f, 1	1		1			1
i. Ground Access Panels			f, 1	1		1			1
j. Natural Environ.			f, 2	1		1			1
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)									
a. Payload Monitoring				f, 1		1			
b. Data Handling				f, 1		1			
c. Venting and Draining				f, 1		1			1
d. Electrical Power				f, 1		1			
e. Payload Cooling				f, 1		1			
f. Payload Change-out			f, 2	1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
8. Launch Management Procedures				f, 1		1			1
9. Alternate Landing Sites				f, 1	1	1	1		1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data; NASA Contact)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
1. Payload Preparation			f, 1	1		1			
2. Laboratories and Calibration Service			f, 2	1		1			
3. ~~Anechoic Chamber~~				~~f, 1~~		~~1~~			
4. ~~Antenna Range~~			~~f, 2~~	~~1~~		~~1~~			
5. ~~Hot Firing~~			~~f, 2~~	~~1~~		~~1~~			
6. Payload/STS Mating									
a. Orbiter			f, 2	1		1			1
b. Upper Stage			f, 2	1		1			1
7. Post-Landing Removal			f, 1	1		1			1
8. Payload and Payload Support Equipment Storage and Storage Environment				f, 1		1			
9. Payload Support Equipm't Maintenance				f, 1		1			
10. Office Space			f, 2	1		1			
11. Solid Rocket Motor and Electro-Explosive Storage				f, 2		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data, NASA Contact) (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
12. Radioactive Materials Processing		f, 2	1	1		1			
13. Work Space On Pad			f, 1	1		1			1

(1) For minimum modification transition.

C-2

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
1. Payload Checkout									
a. Electrical		f, 2	1	1		1			
b. Mechanical		f, 2	1	1		1			
c. Software		f, 2	1	1		1			
2. Payload Servicing									
a. Propellants			f, 1	1		1			
b. Gas Storage and Supply			f, 1	1		1			
c. Calibration				f, 1		1			
d. Power Supplies									
(1) Portable			f, 1	1		1			
(2) Installed			f, 1	1		1			
e. Portable Connectors and Adapters						f, 1			
f. Standard Portable Test Equipment			f, 2	f, 1		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions Services Offered, Contact, Cost) - (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(3)
2. Payload Servicing (Continued)									
g. Simulators									
(1) Sail(1)			f, 1	1		1			
(2) Integration Verification Equipm't (IVE)			f, 1	1		1			1
(3) Mission Simulation			f, 1	1		1			1
h. Data Processing(2)			f, 1	1		1			1
i. Contamination Control		f, 2	1	1		1			1
j. Cleaning				f, 1		1			1
k. Repair			f, 2	1		1			
l. Weight and Mass Properties Measurement Equip't.			f, 2	1		1			
m. Thermal Conditioning			f, 2	1		1			1

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).
(2) Data acquisition, transmission, recording, reduction and processing equipments (location, routing, capacity, software).
(3) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions Services Offered, Contact, Cost) - (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
3. Payload Handling									
a. Physical Constraint			f, 1	1		1			
b. Loads			f, 1	1		1			
4. Payload Transport									
a. Physical Constraint			f, 1	1		1			
b. Loads and Environment			f, 1	1		1			
5. Environmental Protection (e.g., Bag)				f, 1		1			1
6. Security and Guards						f, 1			
7. Communications						f, 1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
1. Cargo Bay Mating									
a. Pre-Pad			f, 1	1	1	1			1
b. On-Pad			f, 1	1	1	1			1
2. Payload Checkout Periods Available			f, 2	1	1	1			1
3. Duration of Payload Dormant Periods As Imposed by STS				f, 1	1	1			1
4. Payload/Shuttle Integrated Test(s)									
a. Pre-Pad				f, 1		1			1
b. On-Pad				f, 1		1			1
5. Countdown									
a. Scheduled				f, 1		1			1
b. Unscheduled Holds				f, 1		1			1
6. Recycle from Launch Scrub				f, 1		1			1
7. ~~Arrival On-Site Time Constraint~~				~~f, 1~~		~~1~~			
8. Facility Occupancy Normal Duration and Constraints				f, 1		1			

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines and Constraints (Cont'd)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
9. Servicing Time Available to Payloads			f, 1	1		1			
10. Upper Stage Mating			f, 1	1		1			1
11. Post-Landing Access to Payload		f, 2	2	1		1			1
12. Payload Removal, Post Landing				f, 1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase[2]
1. Shuttle Picture and General Flow		f, 1	1	1	1	1	1		1
2. Upper Stage(s) Picture and General Flow	f, 2	1	1	1	1	1	1		1
3. Cargo Bay Ground Environment (Thermal, Dynamic, Acoustic, Contamination)									
a. Orb. Processing Fac. b. Vert. Assy. Bldg.			f, 2	1					1
c. Transport to Pad			f, 2	1					1
d. P/L Changeout Fac.			f, 2	1					1
e. Post-Landing(3)			f, 2	1					1
4. Launch Constraints									
a. Environmental		f, 1[1]	1[1]	1	1	1			1
b. Calendar Limitations		f, 1[1]	1[1]	1	1	1			1
c. Range Safety (Incl. Launch Azimuth)	f, 2	f, 1	1	1	1	1			1

(1) If launch window critical.

(2) For minimum modification transition.

(3) Thermal environment important

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
5. Shuttle Payload Attachments and Structural Support Provisions									
a. Design		f, 2	1	1		1			1
b. Locations		f, 2	1	1		1			1
c. Ground Loads Accepted		f, 2	1	1		1			1
d. Latches, Fittings, Attachments		f, 2	1	1		1	1		1
e. Indexing		f, 2	1	1		1	1		1
f. Natural Environ.									
6. Nominal Operational Constraints									
a. Payload Requested Countdown Mods.			f, 1	1		1			1
b. Safety During Ground Operations			f, 1	1		1			1
c. EMC			f, 1	1		1			1
d. Payload Ground Crew			f, 1	1		1			1
e. Installed Payload Access (Pre-launch and Post-Landing)			f, 1	1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
6. Nominal Operational Constraints (Cont'd)									
f. On-Pad Maintenance, Assembly, Checkout			f, 1	1		1			1
g. Contamination			f, 1	1		1			1
h. Umbilicals			f, 1	1		1			1
i. Ground Access Panels			f, 1	1		1			1
j. Natural Environ.			f, 2	1		1			1
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)									
a. Payload Monitoring				f, 1		1			
b. Data Handling				f, 1		1			
c. Venting and Draining				f, 1		1			1
d. Electrical Power				f, 1		1			
e. Payload Cooling				f, 1		1			
f. Payload Change-out			f, 2	1		1			1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications and Constraints, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase[(1)]
8. Launch Management Procedures				f, 1		1	- -		1
9. Alternate Landing Sites				f, 1	1	1	1		1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase (1)
1. Flight Scheduling									
a. Responsibility and Management									
(1) ETR		f, 1	1	1	1				1
(2) WTR		f, 1	1	1	1				1
b. Current Schedule Projection and Available Space		f, 1	1	1	1				1
c. Rules and Requirements		f, 1	1	1	1				1
d. Flight Application and Scheduling Procedures		f, 1	1	1	1				1
2. Manifests									
a. Multiple Payload Policy	f, 2	1	1	1	1				1
b. Weights Charged to Payload	f, 2	1	1	1	1				1
c. Manifest Manage-ment	f, 2	1	1	1	1				1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(2)
3. Shuttle Performance Maps (Payload Weight, Spacecraft and Payload Chargeables)	f, ①	①							
4. Flight Plans and Mission Analysis Data									
a. Generalized Mission Analysis Data	f, ①								
b. Specific Mission Analysis(1) Data		f, ①	①	①	①		①	①	①
c. Flight Parameters					f, ①		①	①	①
5. User-Furnished Propulsion									
a. NASA Policy and Constraints		f, ①	①	①					①
b. Special Requirements for Motors		f, ②	①	①					①
6. Multi-Use Payload Adapter(s)		f, ②	①	①	①	①	①		①

(1) Inputs for performance and trajectory analyses.

(2) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
7. Shuttle Payload Attachments and Structural Support Provisions									
a. Changes from Ground Configuration		f, 2	1	1					1
b. Flight Loads Accepted		f, 2	1	1					1
8. Shuttle Power									
a. Locations		f, 1	1	1			1		1
b. Quality and Schedule		f, 1	1	1			1		1
c. Kitting Provisions		f, 1	1	1			1		1
9. Remote Manipulator									
a. Functions		f, 1	1	1			1		1
b. Limitations		f, 1	1	1			1		1
c. End Effectors		f, 2	1	1			1		1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
10. Shuttle Data Handling, Transmission and Recording (diagnostic, monitoring, checkout)									
a. Equipment and Stations		f, 2	1	1				1	1
b. Software		f, 2	1	1				1	1
c. Codes		f, 2	1	1				1	1
d. Rates		f, 2	1	1				1	1
e. Capacity			1	1				1	1
11. Orbiter-Supplied Cooling		f, 1	1	1			1		1
12. Additional Payload Services Furnished By Orbiter									
a. Payload Monitoring		f, 2	1	1			1		1
b. Venting and Draining			f, 1	1			1		1
c. Fluid Filling			f, 1	1			1		1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
13. Shuttle Attitude and Navigation									
a. Normal Navigation Accuracy		f, 1	1	1	1		1		1
b. Normal Pointing Accuracy		f, 1	1	1	1				1
c. Tip-Off Rates at Deployment			f, 1	1			1		1
d. Provisions for Accuracies Exceeding Normal			f, 1	1	1		1		1
e. Payload Initialization (Handoff) Data			f, 1	1	1		1		1
14. Shuttle Service Panels									
a. Electrical			f, 2	1					1
b. Fluid			f, 2	1				1	1
c. Data Bus			f, 2	1					1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
15. Shuttle Environments									
a. Acoustic			f, 2	1					1
b. Thermal			f, 2	1					1
c. Vibration			f, 2	1					1
d. Shock			f, 2	1					1
e. Pressure			f, 2	1					1
f. Ambient Gas			f, 2	1					1
16. Shuttle Contamination and Sources									
a. Location	f, 1	1	1	1					1
b. Contaminants	f, 1	1	1	1					1
c. Contamination Level	f, 1	1	1	1					1
d. Contam. Control	f, 1	1	1	1			1		1
17. EMC/EMI									
a. Grounding, Shielding, etc.			f, 1	1					1
b. Radiation Environment			f, 1	1					1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
18. Loads									
a. Nominal Limit Load Factors		f, 2	1	1					1
b. Load Transformation Matrix Inputs			f, 1	1					1
c. Dynamic Model			f, 2	1					1
d. Final Design Loads				f, 1					1
19. Safety									
a. Responsibility		f, 1	1	1					1
b. Test Points			f, 1	1	1		1		1
c. Criteria and Factors		f, 2	1	1	1		1		1
d. Range Safety(2)		f, 2	2	1	1				1
20. Orbiter Maneuvers		f, 1	1	1	1		1		1
21. Rendezvous Capability		f, 1	1	1	1		1		1
22. Payload Docking		f, 1	1	1			1		1
23. Module Exchange Mechanism	f, 2	1	1	1	1		1		2

(1) For minimum modification transition.
(2) Including launch azimuth constraints.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
24. RCS Accelerations		f, 1	1	1					1
25. Payload Lighting				f, 1					1
26. Spacelab Capability									
a. Data Range	f, 2	1	1	1				1	
b. Data Storage	f, 2	1	1	1				1	
c. Data Reduction Equipment and Software	f, 2	1	1	1				1	
d. Power for Experiments	f, 2	1	1	1		1	1		
e. Phy. Constraints & Environment	f, 2	1	1	1					
f. Standard Instrumentation	f, 2	1	1	1		1	1		
g. Provisions for Experimenter	f, 2	1	1	1		1	1		
h. Qualifications & Training Required for Experimenter	f, 2	1	1	1					
i. Interface for User Requirements Exceeding Orbiter Spacelab Capabilities	f, 2	1	1	1					

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase (1)
27. Sequence of Events, Orbiter Attitude and Timelines									
a. Powered Flight			f, 1	1	1		1		1
b. On Orbit Stay	f, 2	1	1	1	1		1		1
c. Deployment			f, 1	1					1
28. Orbiter Physical Constraints									
a. Payload Envelopes		f, 1	1	1					1
b. c.g. Envelopes		f, 1	1	1					1
29. User Costs									
a. Transportation		f, 2	1	1	1				1
b. Extra Orbiter Charges		f, 2	1	1	1		1	1	1
c. Spacelab Charges		f, 2	1	1	1		1	1	1
d. STS Guarantees and Penalties		f, 2	1	1	1				1
30. Abort Sequences and Probability of Abort, Provision for Reflight				f, 1	1				1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
31. Payload Specialist Function									
a. General Description	f, 2	1	1	1	1		1		1
b. Specific Task Descriptions	f, 2	1	1	1	1		1		1
32. Mission Specialist Function									
a. General Description	f, 2	1	1	1	1		1		1
b. Specific Task Description	f, 2	1	1	1	1		1		1
33. Return Capability									
a. Deorbit	f, 2	1	1	1	1				1
b. Reentry	f, 2	1	1	1	1				1
c. Landing	f, 2	1	1	1	1				1
d. Safety Constraints		f, 1	1	1	1				1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
1. Upper Stage Generalized Performance (Payload Weight, etc.)	f, 1	1							
2. Upper Stage Performance Characteristics for Mission Analysis									
a. Sequential Weight Statement		f, 1	1	1	1				1
b. Propulsion System Characteristics		f, 1	1	1	1				1
3. Payload Adapter(s)		f, 2	1	1	1	1	1		1
4. Upper Stage Payload Structural Support									
a. Design		f, 2	1	1					1
b. Loads Accepted		f, 2	1	1					1
5. Upper Stage Power			f, 1	1			1		1
6. Module Exchange Mechanism	f, 2	1	1	1	1		1		
7. Upper Stage Data Handling and Transmission									
a. Codes		f, 2	1	1				1	1
b. Rates		f, 2	1	1				1	1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
8. Upper Stage Attitude and Navigation									
a. Accuracy		f, 1	1	1	1		1		1
b. Tip-Off Rates			f, 1	1					1
c. Handoff Data			f, 1	1	1		1		1
9. Upper Stage Service Panels									
a. Electrical			f, 2	1					1
b. Data Bus			f, 2	1				1	1
10. Loads									
a. Nominal Limit Load Factors		f, 2	1	1					1
b. Dynamic Model			f, 2	1					1
c. Shock & Design Loads			f, 1	1					1
11. EMC/EMI									
a. Grounding, Shielding, etc.)			f, 1	1					1
b. Radiation Environment			f, 1	1					1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
12. Safety									
a. Criteria and Factors		f, 2	1	1	1				1
13. Stage Contamination Sources	f, 1	1	1	1			1		1
14. Stage Maneuvers and Orientation		f, 1	1	1	1		1		1
15. Rendezvous Capability		f, 1	1	1			1		1
16. Payload Retrieval		f, 1	1	1			1		1
17. Sequence of Events, Stage Attitudes, and Timelines									
a. Powered Flight		f, 2	1	1	1		1		1
b. On-Orbit Stay	f, 2	1	1	1	1		1		1
18. Physical Constraints									
a. Envelope		f, 1	1	1					1
b. c.g. Envelopes		f, 1	1	1					1
19. User Costs (Transportation, Extras)		f, 2	1	1	1		1	1	1
20. Procurement Requirements and Production Schedules, Responsibilities		f, 2	1	1					1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures, NASA Contact

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission & Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
21. Flight Scheduling Constraints		f, 1	1	1	1				1
22. Manifests									
a. Multiple Payload Policy	f, 2	1	1	1	1				1
b. Weights Charged to Payload	f, 2	1	1	1	1				1
c. Manifest Management	f, 2	1	1	1	1				1
23. Abort Information				f, 1	1				1
24. Payload Separation Sequence and Signals			f, 1	1			1		1
25. Payload Docking									
a. Sequence		f, 1	1	1			1		1
b. Equipment		f, 1	1	1			1		1
c. Interface		f, 1	1	1			1		1
d. Stability Rqmts.		f, 1	1	1			1		1
e. Control		f, 1	1	1			1		1
f. Loads		f, 1	1	1			1		1
26. Computer Programs Available to User		f, 2	1	1	1		1	1	1

(1) For minimum modification transition.

DATA REQUIRED RELATIVE TO GROUND TERMINALS, TRACKING NETWORK, AND THE TRACKING AND DATA RELAY SYSTEM BY STS PAYLOAD PROJECTS

7 0 USERS GUIDE AND PAYLOAD/GROUND TERMINAL INTERFACES DESCRIPTIONS FOR DATA TRANSFER, COMMUNICATION AND TRACKING NETWORKS, AND RANGES

(Locations, Descriptions, Availability, Ground Links, Frequencies, Capacities, Codes, Data Storage, Data Processing, User Charges, NASA Contact)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission and Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
1. ETR Range			f, 1	1	1				
2. WTR Range			f, 1	1	1				
3. STS Ground Terminals	f, 2	1	1	1			1	1	1
4. STDN Ground Terminals and Data Reduction	f, 2	1	1	1			1	1	
5. DSN Ground Terminals	f, 2	1	1	1			1	1	
6. TDRS System	f, 2	1	1	1			1	1	1

(1) For minimum modification transition.

LIST OF STS SYSTEM REQUIREMENTS FOR
PREFLIGHT INFORMATION FROM PAYLOAD PROJECTS

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission and Flight Planning	Ground Operation	Orbital Operation	Data Management	Launch Vehicle Transition Phase(1)
1. Project Plan									
a. Project Support Requirements			f, 2	1	1	1	1	1	1
b. Procurement and Services Requirements			f, 2	1	1	1	1	1	1
2. Mission Analysis	f, 2	1	1	1	1		1		1
3. Payload Design/ Analysis Documents									
a. Payload Drawing, Gen. Descript., & Interface Rqmts.		f, 2	1	1	1	1	1		1
b. Hazzard Analysis and Safety Plan				f, 1	1	1	1		1
c. Payload Tie-Down Loads, Stress and Deflection Anal.				f, 1	1				1
d. Analysis of Payload Deployment and Retrieval				f, 1			1		1

(1) For minimum modification transition.

LIST OF STS SYSTEM REQUIREMENTS FOR
PREFLIGHT INFORMATION FROM PAYLOAD PROJECTS (CONT'D)

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT (Cont'd)

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	POTENTIAL USER			COMMITTED USER					
	Pre-Phase A	Phase A	Phase B	Develop. (Phase C/D)	Mission and Flight Planning	Ground Operation	Orbital Operation	Data Manage-ment	Launch Vehicle Transition Phase(1)
3. Payload Design/ Analysis Documents (Continued)									
e. Payload Heat Rejection Rates				f, (1)	(1)	(1)	(1)		(1)
f. Payload Con-tamination (e.g., Out-Gassing)				f, (1)		(1)	(1)		(1)
g. Payload Count down (Sequence, Holds, etc.)					f, (1)	(1)			(1)
4. Payload Test Requirements									
a. Payload/STS Integration Simulation				f, (1)		(1)			(1)
5. Payload Demonstra-tion to be Carried Out				f, (1)	(1)	(1)			(1)
6. Payload Inspections Required					f, (1)	(1)			(1)

(1) For minimum modification transition.

8. DATA AVAILABLE MATRIX (MATRIX SHEETS)

The Matrix in Section 8 presents the keys indicating which reference documents are applicable to each of the data requirements described in Section 7. This Matrix presents the complete picture on data available for a complete project life cycle. The data available for the potential users duplicates the information displayed in the Matrix presented in Section 6 with one general exception. In this Matrix the data is shown in the project phase for which it is expected to be most applicable. It is left to the reader to decide whether it would be suitable to use data intended for a more mature phase of the project. For instance, data intended for the development phase could be applied to Phase A or Phase B, however, using data that may be too detailed for his needs could also prove confusing and expensive to the user. The Matrix in Section 6 contains footnotes in the appropriate areas where the data is available in the more mature phases of the project. These notes have not been duplicated here.

The criteria applied in selecting reference documents for this study was that the source be credible. For example, NASA, DOD, their contractors, and NASA-related agencies who are associated with the Space Transportation System effort are considered credible. If data are presented in a credible source and are applicable to a specific data requirement, they are then listed in the matrix. A majority of the references used were either NASA or Rockwell International documents. The data currently being reported are the best available. It is the responsibility of the user to recognize early data which is subject to change and to protect his project against reasonable changes in the information as the STS matures and better data evolves.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Payload Preparation		GS-15	GS-15 (1)	
2. Laboratories and Calibration Service		GS-15	GS-15	
3. ~~Anechoic Chamber~~				
4. ~~Antenna Range~~				
5. ~~Hot Firing~~		~~GS-15~~		
6. Payload/STS Mating				
a. Orbiter		GS-3	GS-15 (1)	GS-15 (1)
b. Upper Stage			GS-15 (1)	GS-15 (1)
7. Post-Landing Removal		GS-3	GS-15 (1)	GS-15 (1)
8. Payload and Payload Support Equipment Storage and Storage Environment			GS-15 (1)	
9. Payload Support Equipment Maintenance			GS-15	
10. Office Space		GS-15	GS-15	

(1) Partial, details in manuals or TBD.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
11. Solid Rocket Motor and Electro-Explosive Storage			GS-15	
12. Radioactive Materials Processing	GS-15	GS-15	GS-15	
13. Work Space On Pad (PCR)				

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Payload Checkout				
a. Electrical	EBM-6, 11; GS-3, 4, 5, 6, 15	GS-3, 14, 15; RT-8	RT-6; CP-2, 12, 14, 15, 17, 18, 19, 20; GS-14	
b. Mechanical	EBM-6, 11; GS-15	GS-15; RT-8	CP-2, 12, 14, 15, 17, 18, 19; RT-6	
c. Software	EBM-6, 11; GS-3, 4, 6, 14, 15	GS-3, 14, 15; RT-8	CP-12, 14, 15, 18, 19 RT-6; GS-14	
2. Payload Servicing				
a. Propellants		GS-3, 14, 15	CP-3, 4, 12, 14, 15, 18, 19, 20, 21; GS-14	
b. Gas Storage and Supply		GS-3, 14, 15	CP-2, 3, 4, 14, 15, 18, 19, 20, 21; GS-14	
c. Calibration			CP-1, 14, 15, 19	
d. Power Supplies				
(1) Portable		U.S.*		
(2) Installed		GS-3; U.S.*		
e. Portable Connectors and Adapters			CP-14, 19	

* From GS-15.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Payload Servicing (Cont'd)				
f. Standard Portable Test Equipment		U.S.*	CP-14, 15, 17, 19, 21	
g. Simulators				
(1) Sail(1)			F-11(2); CP-1, 14, 19	
(2) Integration Verification Equipment (IVE)		GS-15; RT-8	CP-14, 19	
(3) Mission Simulation		GS-15	CP-1, 14, 19	CP-1, 14, 19
h. Data Processing(2)		GS-3, 14, 15	GS-14; CP-1, 2, 3, 14, 15, 18, 19	GS-3, 14; CP-1, 2, 3, 14, 15, 18, 19
i. Contamination Control	EBM-6; GS-3, 14; U.S.*	GS-3, 14; U.S.*	RT-3; GS-14; CP-1, 2, 3, 4, 14, 19	RT-3; GS-14; CP-1, 2, 3, 4, 14, 19
j. Cleaning			CP-1, 2, 4, 14, 19	CP-1, 2, 4, 14, 19
k. Repair		GS-15	CP-2, 14, 15, 18, 19	CP-2, 14, 15, 18, 19
l. Wt & Mass Properties Mea. Equip.		GS-15	CP-14, 19	CP-14, 19
m. Thermal Conditioning		GS-3; U.S.*	CP-1, 4, 14, 19; GS-3	CP-1, 4, 14, 19; GS-3

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).

(2) Data acquisition, transmission, recording, reduction, and processing equipments (location, routing, capacity, software).

* From GS-15.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
3. Payload Handling				
a. Physical Constraint		GS-3;U.S.*	CP-14, 15, 20, 21	
b. Loads		U.S.*	CP-14, 15, 20, 21	
4. Payload Transport				
a. Physical Constraint		GS-3	CP-14, 20, 21	
b. Loads and Environment		GS-3, 15(1)	CP-14, 20, 21; GS-3	
5. Environmental Protection (e.g., Bag)			CP-1, 14, 18	CP-1, 14, 18
6. Security and Guards			CP-3, 9, 18	
7. Communications			CP-3, 14, 18	

(1) Partial.

* From GS-15.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Cargo Bay Mating				
a. Pre-Pad		GS-3, 14, 15	RT-1; GS-14	RT-1; GS-14
b. On-Pad		GS-3, 14, 15	RT-1; GS-14	RT-1; GS-14
2. Payload Checkout Periods Available		GS-3, 14, 15	RT-1; GS-14	RT-1; GS-14
3. Duration of Payload Dormant Periods as Imposed by STS			RT-1	RT-1
4. Payload/Shuttle Integrated Test(s)				
a. Pre-Pad			RT-1, 6	RT-1, 6
b. On-Pad			RT-1, 6	RT-1, 6
5. Countdown				
a. Scheduled			RT-1; GS-14	RT-1; GS-14
b. Unscheduled Holds			RT-1	RT-1
6. Recycle from Launch Scrub			RT-1	RT-1
7. ~~Arrival On Site~~			~~RT-1~~	~~RT-1~~

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

1.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, ETR

1.3 STS System Schedules, Event Timing, Time Lines, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
8. Facility Occupancy Normal Duration and Constraints			RT-1	
9. Servicing Time Available to Payloads		GS-3, 14, 15	RT-1; GS-3, 14	
10. Upper Stage Mating		GS-15	RT-1; GS-15	RT-1; GS-15
11. Post-Landing Access to Payload	GS-3, 14, 15; EBM-11	GS-3, 14, 15	RT-1; GS-3, 14	RT-1; GS-3, 14
12. Payload Removal, Post-Landing			RT-1; GS-3, 14	RT-1; GS-3, 14

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Shuttle Picture and General Flow	EBM-6;F-1;JP-13; GS-3(1), 14, 15	GS-3(1), 14, 15	CP-2, 4, 12, 14, 15, 19 GS-14	CP-2, 4, 12, 14, 15, 19 GS-3(1), 14
2. Upper Stage(s) Picture and General Flow	EBM-6;GS-15	GS-15(1)	CP-12, 14, 15, 17, 19	CP-12, 14, 15, 17, 19
3. Cargo Bay Ground Environment (Thermal, Dynamic, Contamination)				
a. OPF		F-6;GS-3(1), 14, 15(1)	RT-3(2);CP-3, 14, 15 GS-3(1), 14	RT-3(2);CP-3, 14, 15
b. VAB		GS-3(1), 14, 15	CP-3, 14;GS-14	CP-3, 14; GS-3, 14
c. Transport to Pad		F-6;GS-3, 14, 15(1)	RT-3(2);CP-2, 3, 14; GS-14, 15	RT-3(2);CP-2, 3, 14 GS-14
d. PCR		F-6;GS-3, 14, 15(1)	RT-3(2);CP-3, 14; GS-14	RT-3(2); CP-3, 14; GS-14
e. Post-Landing(3)		F-6;GS-3, 14, 15(1)	RT-3(2);CP-3, 14, 15 GS-14	RT-3(2); GS-14; CP-3, 14, 15
4. Launch Constraints				
a. Environmental			CP-3, 14	CP-3, 14
b. Calendar Limitations			CP-3, 14	CP-3, 14

(1) Partial.
(2) Contamination only.
(3) Thermal environment important.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Launch Constraints (Cont'd)				
c. Range Safety (Incl. Launch Azimuth)	EBM-6;GS-3[1],15; F-1	GS-3[1], 15; F-1	CP-3, 14, 18; F-1; GS-3[1]	CP-3, 14, 18; F-1; GS-3[1]
5. Shuttle Payload Attachments and Structural Support Provisions				
a. Design	EBM-6;EP-4, 14, 15(A'75)	EP-15(A'75)	GS-3; CP-2, 3, 7, 8, 12, 14, 17;F-16	GS-3; CP-2, 3, 7, 8, 12, 14, 17;F-16
b. Locations	JP-1; EP-4; GS-3; EBM-6	JP-1; GS-3	GS-3; CP-2, 3, 7, 8, 12, 14, 20;F-16	GS-3; CP-2, 3, 7, 8, 12, 14; F-16
c. Ground Loads Accepted	EP-4;EBM-6; GS-3	GS-3	GS-3; CP-7, 8, 10, 12, 14, 20;F-16	GS-3; CP-7, 8, 10, 12, 14; F-16
d. Latches, Fittings, Attachments	EP-4; EBM-6; GS-3	GS-3	GS-3; CP-2, 3, 7, 8, 12, 14, 20; F-16	GS-3; CP-3, 7, 8, 9, 12, 14; F-16
e. Indexing	EP-4; EBM-6; GS-3	GS-3	CP-7, 8, 12, 14, 20; GS-3; F-16	CP-7, 8, 12, 14; F-16
6. Nominal Operational Constraints				
a. Payload Requested Countdown Modifications		GS-3, 14, 15[1]	CP-14, 19; GS-3, 14	CP-14, 19;GS-3, 14

(1) Partial.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Nominal Operational Constraints (Cont'd)				
b. Safety During Ground Operations		GS-3; EP-17; GS-15	CP-2, 3, 7, 8, 14, 15, 18, 19; EP-17(1)	CP-2, 3, 7, 8, 14, 15, 18, 19; EP-17(1)
c. EMC		GS-14, 15(2)	GS-14; F-13(3), 14; CP-3, 14, 15, 19	GS-14; F-13(3), 14; CP-3, 14, 15, 19
d. Payload Ground Crew			CP-2, 14, 18, 19	CP-2, 14, 18, 19
e. Installed Payload Access (Pre-Launch and Post-Landing)		GS-3(2), 14, 15	CP-2, 7, 8, 10, 14, 18, 19; GS-14	CP-2, 7, 8, 10, 14, 18, 19; GS-14
f. On-Pad Maintenance, Assembly, Checkout		GS-3, 14, 15	CP-3, 4, 14, 18, 19; GS-3, 14	CP-3, 4, 14, 18, 19; GS-3, 14
g. Contamination		GS-3, 15	CP-1, 4, 14, 19	CP-1, 4, 14, 19
h. Umbilicals		GS-3	CP-14, 19; GS-3	CP-14, 19; GS-3
i. Ground Access Panels		GS-3	CP-14, 19; GS-3	CP-14, 19; GS-3
j. Natural Environ.		GS-3, 11	GS-3	GS-3

(1) Applicable when coupled with references.
(2) Partial.
(3) Specifications for Shuttle equipment and payloads.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

2.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, ETR

2.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)				
a. Payload Monitoring			RT-6; GS-14; CP-2, 3, 7, 8, 14	
b. Data Handling			RT-6; GS-14; CP-2, 3, 7, 8, 14	
c. Venting and Draining			RT-6; GS-3, 14; CP-2, 3, 7, 8, 14	RT-6; GS-3, 14; CP-2, 3, 7, 8
d. Electrical Power			RT-6; GS-3, 14; CP-2, 3, 7, 8, 14, 21	
e. Payload Cooling			GS-3, 14; RT-6; CP-2, 3, 14, 21	
f. Payload Changeout		GS-3, 14, 15	RT-6; GS-14; CP-2, 3, 7, 8, 14	RT-6; GS-14; CP-2, 3, 7, 8, 14
8. Launch Management Procedures			CP-19	CP-19
9. Alternate Landing Sites			CP-3, 19	CP-3, 19

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Payload Preparation		GS-2, 15	GS-15	
2. Laboratories and Calibration Service		GS-12, 15	GS-15	
3. ~~Anechoic Chamber~~				
4. ~~Antenna Range~~		~~GS-2~~		
5. ~~Hot Firing~~				
6. Payload/STS Mating				
a. Orbiter		GS-1, 16 (1)	GS-1, 16	GS-1, 16
b. Upper Stage		GS-1, 16	GS-1, 16	GS-1, 16
7. Post-Landing Removal		GS-1, 16	GS-1, 16	GS-1, 16
8. Payload and Payload Support Equipment Storage and Storage Environment			GS-15	
9. Payload Support Equipment Maintenance			GS-15	
10. Office Space		GS-2, 15	GS-15	
11. Solid Rocket Motor & Electro-Explosive Storage			GS-15	

(1) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.1 Facilities for Payloads (Facility Function, Operation, Description, Environment, and Cost Data)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS ON FACILITIES FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
12. Radioactive Materials Processing	GS-15	GS-15	GS-15	
13. Work Space On Pad		GS-1, 16(1)	GS-1, 16	GS-1, 16

(1) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Payload Checkout				
a. Electrical	GS-1, 3, 4, 6, 7, 15; EP-1	GS-3, 15; RT-8	RT-6	
b. Mechanical	GS-15	GS-15; RT-8	RT-6	
c. Software	GS-3, 4, 6, 7, 14, 15	GS-3, 14, 15; RT-8	RT-6; GS-14	
2. Payload Servicing				
a. Propellants		GS-3, U.S.*	U.S.*	
b. Gas Storage & Supply		GS-3, 15		
c. Calibration			GS-15	
d. Power Supplies				
(1) Portable		U.S.*	U.S.*	
(2) Installed		GS-3; U.S.*	U.S.*	
e. Portable Connectors and Adapters				
f. Standard Portable Test Equipment		GS-2; U.S.*	U.S.*	

* From GS-15.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Payload Servicing (Cont'd)				
g. Simulators				
(1) Sail[(1)]			F-11**	
(2) Integration Verification Equip't (IVE)		GS-15; RT-8	F-11**;GS-15	F-11**; GS-15
(3) Mission Simulation		GS-15	F-11**; GS-15	F-11**; GS-15
h. Data Processing[(2)]		GS-2, 3, 4, 6, 7[(3)], 12, 14, 15	GS-3[(3)], 14, 15	GS-3[(3)], 14, 15
i. Contamination Control	GS-1, 3, 14; U.S.*	GS-3, 14; U.S.*	RT-3; U.S.*; GS-14	RT-3; U.S.*; GS-14
j. Cleaning			U.S.*	U.S.*
k. Repair		GS-15	GS-15	
l. Wt & Mass Properties Mea. Equip't.		U.S.*	U.S.*	
m. Thermal Conditioning		GS-3; U.S.*	GS-3[(3)]; U.S.*	GS-3; U.S.*

* From GS-15. ** Management aspects only.

(1) Lab (at JSC) may be used for some large payload elements (Spacelab, upper stages, LST).

(2) Data acquisition, transmission, recording, reduction, and processing equipments (location, routing, capacity, software).

(3) Limited data.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.2 STS System Support Equipment (Equipment, Lists, Equipment and Interface Descriptions, Services Offered, Contact, Cost)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
3. Payload Handling				
a. Physical Constraint		U.S.*	U.S.*	
b. Loads		U.S.*	U.S.*	
4. Payload Transport				
a. Physical Constraint		U.S.*	U.S.*	
b. Loads and Environment		GS-3; U.S.*	GS-3; U.S.*	
5. Environmental Protection (e.g., Bag)			U.S.*	U.S.*
6. Security and Guards			GS-15	
7. Communications			GS-12, 15	

* From GS-15.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Cargo Bay Mating				
a. Pre-Pad		GS-15	GS-15	GS-15
b. On-Pad		GS-15, 16(2)	GS-15(1), 16	GS-15(1), 16
2. Payload Checkout Periods Available		GS-15, 16	GS-15(1), 16	GS-15(1), 16
3. Duration of Payload Dormant Periods as Imposed by STS			GS-15(1), 16;RT-1	GS-15(1), 16; RT-1
4. Payload/Shuttle Integrated Test(s)				
a. Pre-Pad			RT-6	RT-6
b. On-Pad			RT-6	RT-6
5. Countdown				
a. Scheduled			GS-15, 16	GS-15, 16
b Unscheduled Holds			GS-15, 16	GS-15, 16
6. Recycle from Launch Scrub			GS-16	GS-16
~~7. Arrival On-Site Time Constraint~~				

(1) Partial.
(2) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

3.0 PAYLOAD/LAUNCH SITE GROUND SUPPORT, WTR

3.3 STS System Schedules, Event Timing, Time Lines, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
8. Facility Occupancy Normal Duration and Constraints				
9. Servicing Time Available to Payloads		GS-1, 3	GS-15, 16 (2)	
10. Upper Stage Mating			GS-15 (1), 16	GS-15 (1), 16
11. Post-Landing Access to Payload	GS-1, 15	GS-1, 15	GS-15, 16	GS-15, 16
12. Payload Removal, Post Landing			GS-15, 16	GS-15, 16

(1) Partial.

(2) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Shuttle Picture and General Flow	F-1; GS-3[1], 15	GS-3[1], 15, 16[4]	GS-15, 16	GS-15, 16
2. Upper Stage(s) Picture and General Flow		GS-15[1], 16	GS-15[1], 16	GS-15[1], 16
3. Cargo Bay Ground Environment (Thermal, Dynamic, Acoustic, Contamination)				
a. Orbiter Processing Facility		F-6;GS-15[1], 16	RT-3[2]; GS-15[1], 16	RT-3[2]; GS-15[1], 16
b. Vertical Assembly Building				
c. Transport to Pad		F-6;GS-3, 15[1], 16	RT-3[2];GS-15[1], 16	RT-3[2];GS-15[1], 16
d. Payload Changeout Facility		F-6;GS-3, 15[1], 16	RT-3[2];GS-3, 15[1], 16	RT-3[2];GS-3, 15[1], 16
e. Post-Landing[3]		F-6;GS-3, 15[1], 16	RT-3[2];GS-3, 15[1], 16	RT-3[2];GS-3, 15[1], 16
4. Launch Constraints				
a. Environmental	CP-3, 14	CP-3, 14	CP-3, 14	CP-3, 14
b. Calendar Limitations				

(1) Partial Coverage.
(2) Contamination only.
(3) Thermal environment important.
(4) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Launch Constraints (Cont'd)				
c. Range Safety (Incl. Launch Azimuth)	F-7[1]; GS-3[1], 10[1], 12	F-7[1]; GS-3[1], 10[1], 12	GS-3[1], 10[1], 12	GS-3[1], 10[1], 12
5. Shuttle Payload Attachments and Structural Support Provisions				
a. Design	EP-4		F-16	F-16
b. Locations	EP-4; JP-1; GS-3	JP-1; GS-3	GS-3; F-16	GS-3; F-16
c. Ground Loads Accepted	EP-4; GS-3	GS-3	GS-3; F-16	GS-3; F-16
d. Latches, Fittings, Attachments	EP-4; GS-3	GS-3	GS-3; F-16	GS-3; F-16
e. Indexing	EP-4; GS-3; JP-1	GS-3; JP-1	GS-3; F-16	GS-3; F-16
f. Natural Environ.	EP-4			
6. Nominal Operational Constraints				
a. Payload Requested Countdown Modifications		GS-15[1], 16[2]	GS-15[1], 16	GS-15[1], 16

(1) Partial Coverage.

(2) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
Nominal Operational Constraints (Cont'd)				
b. Safety During Ground Operations		GS-10(1), 12;EP-17	GS-10(1), 12;EP-17*	GS-10(1), 12;EP-17*
c. EMC		GS-12, 15	GS-12;F-13(2), 14(2)	GS-12; F-13(2), 14(2)
d. Payload Ground Crew				
e. Installed Payload Access (Pre-Launch and Post-Landing)		GS-14, 16(3)	CS-14, 15(1), 16	GS-14, 15(1), 16
f. On-Pad Maintenance, Assembly, Checkout		GS-14, 16	GS-14, 15(1), 16	GS-14, 15, 16
g. Contamination		GS-15, 16	GS-15, 16	GS-15, 16
h. Umbilicals		GS-3	GS-3(1)	
i. Ground Access Panels		GS-3	GS-3(1)	GS-3(1)
j. Natural Environ.		GS-3, 11	GS-3, 11	GS-3, 11

(1) Partial Coverage.
(2) Specifications.
(3) GS-16 data available approximately July 1976.

* Applicable when coupled with references.

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

4.0 INTEGRATED PAYLOAD/STS VEHICLE GROUND OPERATIONS, WTR

4.1 Equipment (Pre-Launch, Launch) and Operational Capabilities, Specifications, and Constraints

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
7. Payload Services Furnished by Orbiter or Orbiter Facilities (While on the Ground)				
a. Payload Monitoring			RT-6;GS-14	
b. Data Handling			RT-6 ; GS-14	
c. Venting & Draining			RT-6; GS-3	RT-6; GS-3
d. Electrical Power			RT-6; GS-3	
e. Payload Cooling			RT-6; GS-3	
f. Payload Changeout		GS-15, 16[1]	GS-15, 16	GS-15, 16
8. Launch Management Procedures			GS-12	GS-12
9. Alternate Landing Sites			GS-15	GS-15

(1) GS-16 data available approximately July 1976.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Flight Scheduling				
a. Responsibility and Management			EP-19	
(1) ETR	JP-12, 13		USER DATA REQUIRED	
(2) WTR			↓	
b. Current Schedule Projection and Available Space			↓	
c. Rules and Requirements	EP-13, EBM-6		↓	
d. Flight Application and Scheduling Procedures	JP-12, 13		↓	
2. Manifests			↓	
a. Multiple Payload Policy	JP-12(1), 13(1)		↓	
b. Weights Charged to Payload	JP-1, 5, 10	JP-1 5	↓	
c. Manifest Management			↓	

(1) Pre-Phase A.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
3. Shuttle Performance Maps (Payload Weight, Spacecraft and Payload Chargeables)	EBM-6, 11; JP-1; F-1, 7			
4. Flight Plans and Mission Analysis Data				
a. Generalized Mission Analysis Data	EP-6, 8; JP-2, 6; F-1, 7; WF-1, 2, 3, 4 EBM-11			
b. Specific Mission Analysis(1) Data	EP-2(2), 7, 9, 10, 11 WF-5, 6	EP-2(2); WF-5, 6, 7, 8, 9, 10	WF-5, 6, 7, 8, 9, 10 WF——7, 8, 9, 10	WF-5, 6, 7, 8, 9, 10 WF——7, 8, 9, 10
c. Flight Parameters				
5. User-Furnished Propulsion				
a. NASA Policy and Constraints		DATA EXISTS, NEEDS TO BE DOCUMENTED		
b. Special Requirements for Motors				
6. Multi-Use Payload Adapter(s)	EP-15(A'75)	EP-15(A'75)	COMBINED WITH DATA REQUIRED ON 5.0.2	

(1) Inputs for performance and trajectory analyses.
(2) U. S. Government agencies only.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
7. Shuttle Payload Attachments & Structural Support Provisions				
a. Changes from Ground Configuration	EP-4; EBM-6,11; F-7		RT-5(A'80); F-16	RT-5(A'80); F-16
b. Flight Loads Accepted	EP-4; EBM-6,11; F-1,7; JP-1	JP-1; EBM-11	RT-5(A'80); F-16	RT-5(A'80); F-16
8. Shuttle Power				
a. Locations	EBM-11; EP-4,14,15(A'75); F-1,2,7,8; JP-12;	EP-15(A'75); JP-1; EBM-11	RT-5(A'80)	RT-5(A'80)
b. Quality and Schedule	EP-4,14; F-1,2,7,8; EBM-6,11; JP-1	JP-1,12; EBM-11	RT-5(A'80)	RT-5(A'80)
c. Kitting Provisions	EP-4,14; EBM-6; F-1,2,7,8; JP-1,5		RT-5(A'80)	RT-5(A'80)
9. Remote Manipulator				
a. Functions	EBM-6,11; F-1,7; JP-16	JP-12,16;EBM-11	F-17(1)	F-17(1)
b. Limitations	EBM-6,11; F-1,7; JP-1,16	JP-1,16;EBM-11	F-17(1)	F-17(1)

(1) Same as JP-16.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies, and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
9. Remote Manipulator (Cont)				
c. End Effectors	EBM-6, 11; F-1 JP-12[2], 16[2]	EBM-11	F-17[1]	F-17[1]
10. Shuttle Data Handling, Transmission and Recording (Diagnostic, Monitoring, Checkout)				
a. Equipment and Stations	EBM-6; EP-14; F-1, 2, 7; JP-12[3], 13		RT-5(A'80), 6; F-12	RT-5(A'80), 6; F-12
b. Software	EMB-6,11;JP-12[3]	EBM-11	RT-5(A'80), 6	RT-5(A'80), 6
c. Codes	EBM-6, 11	JP-12[3], 13;EBM-11	RT-5(A'80), 6; F-12	RT-5(A'80), 6; F-12
d. Rates	EMB-6,11; EP-4; F-1, 2, 7	JP-12[3], 13;EBM-11	RT-5(A'80), 6;F-12 EP-19	RT-5(A'80), 6;F-12
e. Capacity		JP-13;EBM-11	RT-5(A'80), 6;F-12	RT-5(A'80), 6;F-12
11. Orbiter-Supplied Cooling	EP-14; JP-1; F-1, 2, 7, 8;EBM-11	JP-1, 12[3];EBM-11	RT-5(A'80)	RT-5(A'80)

(1) Same as JP-16.
(2) Partial.
(3) Specification data TBD.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (Cont'd)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
12. Additional Payload Services Furnished by Orbiter				
a. Payload Monitoring	EBM-11;F-1;JP-12(1)	EBM-11	RT-5(A'80), 6	RT-5(A'80), 6
b. Venting & Draining		F-8;EBM-11	RT-5(A'80)	
c. Fluid Filling		EBM-11	RT-5(A'80)	
13. Shuttle Attitude & Nav.				
a. Normal Navigation Accuracy	EBM-6; JP-1	JP-1		
b. Normal Pointing Accuracy	EBM-6,11;JP-1 F-7	JP-1, 12;EBM-11		
c. Tip-Off Rates at Deployment		JP-12, 16		
d. Provisions for Accuracies Exceeding Normal		F-7		
e. Payload Initialization (Handoff) Data		JP-12(2), 16		
14. Shuttle Service Panels				
a. Electrical		F-7, 8		

(1) Specification data.
(2) Specification data TBD.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
b. Fluid		F-7, 8		
c. Data Bus				
15. Shuttle Environments				
a. Acoustic		EBM-11; JP-1, 12[1] F-7, 8 REQ[3]	RT-5(A'80); F-9 (A'80) REQ[3]	RT-5(A'80); F-9 (A'80) REQ[3]
b. Thermal		EBM-11; JP-1, 12; F-7, 8	RT-5(A'80)	RT-5(A'80)
c. Vibration		EBM-11; JP-1, 12; F-7, 8	RT-5(A'80); F-9 (A'80)	RT-5(A'80); F-9 (A'80)
d. Shock		EBM-11; JP-1, 12; F-7, 8	RT-5(A'80)	RT-5(A'80)
e. Pressure		EBM-11; JP-1, 12; F-7, 8	RT-5(A'80)	RT-5(A'80)
f. Ambient Gas		JP-1, 12; F-6, 7, 8	RT-5(A'80)	RT-5(A'80)
16. Shuttle Contamination and Sources				
a. Location	EP-4, 14; EBM-6; F-6, 7, 8	JP-15[2]	RT-3, 5(A'80), 7	RT-3, 5(A'80), 7
b. Contaminants	EP-4, 14; EBM-6; F-2, 6, 7, 8	JP-15[2]	RT-5(A'80), 7	RT-3, 5(A'80), 7

(1) Specification data TBD.
(2) Also reviewed for Sections 1, 2, 3, and 4 as CP-14.
(3) User Data Required.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: \ PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
c. Contamination Level	EP-4, 14; EBM-6; F-6, 7, 8; JP-1	JP-1	RT-5(A'80), 7	RT-3, 5(A'80), 7
d. Contamination Control	EP-4, 5, 14; EBM-6; F-6, 7, 8; JP-17	JP-15[1], 17	RT-5(A'80), 7; JP-17	RT-3, 5(A'80), 7
17. EMC/EMI				
a. Grounding, Shielding, etc.			F-13[3], 14[3]	F-13[3], 14[3]
b. Radiation Environ.			F-13[3], 14[3]	F-13[3], 14[3]
18. Loads				
a. Nominal Limit Load Factors	EBM-6, 11; JP-1, 14; F-7	JP-1; EBM-11	GF-1; RT-5(A'80)	GF-1; RT-5(A'80)
b. Load Transformation Matrix Inputs			GF-1; RT-5(A'80)	GF-1; RT-5(A'80)
c. Dynamic Model		EP-20[6]; EBM-11	EP-20[6] GF-1; RT-5(A'80)	EP-20[6] GF-1; RT-5(A'80)
d. Final Design Loads			GF-1; RT-5(A'80) REQ[5]	GF-1; RT-5(A'80) REQ[5]
19. Safety				
a. Responsibility	EP-2; JP-1	EP-2, 17; JP-1	RT-4; EP-17[4]	RT-4; EP-17[4]
b. Test Points		EP-2	RT-4	RT-4
c. Criteria & Factors	EP-2, 14; F-1, 2	EP-2, 17	RT-4, EP-17[4]	RT-4; EP-17[4]

(1) Also reviewed for Sections 1, 2, 3, and 4 as CP-14.
(2) Specification data TBD.
(3) Specifications.
(4) Applicable when coupled with references.
(5) User Data Required.
(6) Information relevant but incomplete.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
19. Safety (Cont'd)				
d. Range Safety[1]	EP-2	EP-2	RT-4	RT-4
20. Orbit Maneuvers	EP-2; JP-1;WF-1-4	EP-2; JP-1;WF-1-10	RT-5(A'80);WF-5-10	RT-5(A'80);WF-5-10
21. Rendezvous Capability		JP-12		
22. Payload Docking		JP-12		
23. Module Exchange Mech.		JP-18, 19		
24. RCS Accelerations	JP-1	JP-1, 12	RT-5(A'80)	RT-5(A'80)
25. Payload Lighting			RT-5(A'80);JP-12[2]	RT-5(A'80)
26. Spacelab Capability				
a. Data Range	EBM-6, 11	EBM-11		
b. Data Storage	EBM-6, 11	EBM-11		
c. Data Reduction Equipment & Software	EBM-6, 11	EBM-11		
d. Power for Experiments	EBM-6, 11	EBM-11		
e. Physical Constraints & Environment	EBM-6, 11	EBM-11	RT-7[3]	
f. Std. Instrumentation	EBM-6, 11	EBM-11		

(1) Including launch azimuth constraints.

(2) Specification,data TBD.
(3) Contamination only covered.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
26. Spacelab Capability(Cont)				
g. Provisions for Experimentor	EBM-6 11	EBM-11		
h. Qualifications and Training Required for Experimentor	EBM-6, 11	EBM-11		
i. Interface for User Requirements Exceeding Orbiter Spacelab Capabilities	EBM-6, 11	EBM-11		
27. Sequence of Events, Orbiter Attitude and Timelines				
a. Powered Flight		JP-12(1)		
b. On-Orbit Stay	F-1; EBM-6	JP-12(1)		
c. Deployment		JP-12(1)		
28. Orbiter Physical Constraints				
a. Payload Envelopes	EBM-6,11;EP-4; F-1, 7; JP-1, 10	JP-1, 12;EBM-11		
b. c.g. Envelopes	EBM-6, 11;EP-4; F-1, 7; JP-1, 10	JP-12;EBM-11		

(1) Specification data TBD.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
29. User Costs				
a. Transportation	F-4(A'76)	F-4(A'76)	F-4(A'76)	F-4(A'76)
b. Extra Orbiter Charges	F-4(A'76)	F-4(A'76)	F-4(A'76)	F-4(A'76)
c. Spacelab Charges	F-4(A'76)	F-4(A'76)	F-4(A'76)	F-4(A'76)
d. STS Guarantees and Penalties	F-4(A'76)	F-4(A'76)	F-4(A'76)	F-4(A'76)
30. Abort Sequences and Probability of Abort, Provision for Reflight		COMBINED WITH DATA REQUIRED ON 5.0.2		
31. Payload Specialist Function				
a. General Description	EBM-6,11;JP-1.12, 13; F-1,7	JP-1,13,15(1);EBM-11	RT-6	RT-6
b. Specific Task Description	EBM-6,11;F-7	EBM-11	RT-6	RT-6
32. Mission Specialist Function				
a. General Description	EBM-6,11;EP-2; JP-1,12,13;F-1,7	EBM-11;EP-2; JP-1,13	RT-6	RT-6
b. Specific Task Descp't	EBM-6,11; F-7	EBM-11	RT-6	RT-6

(1) Also reviewed for Sections 1, 2, 3, and 4 as CP-14.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

5.0 PAYLOAD/SHUTTLE INTEGRATED FLIGHT (CONT'D)

Interface Specifications, V hicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
33. Return Capability				
a. Deorbit	EBM-6; JP-1; WF 1 to 9	JP-1; WF 1 to 10	WF 5 to 10	WF 5 to 10
b. Reentry	EBM-6; JP-1; WF 1 to 4	JP-1; WF 1 to 10	WF 5 to 10	WF 5 to 10
c. Landing	EBM-6,11; JP-1; WF 1 to 4	JP-1; WF 1 to 10	WF 5 to 10	WF 5 to 10
d. Safety Constraints				

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Upper Stage Generalized Performance (Payload Weight, etc.)				
2. Upper Stage Performance Characteristics for Mission Analysis				
a. Sequential Weight Statement			GF-2	GF-2
b. Propulsion System Characteristics			GF-2	GF-2
3. Payload Adapter(s)	EP-5		GF-2	GF-2
4. Upper Stage Payload Structural Support				
a. Design	EP-5		GF-2	GF-2
b. Loads Accepted			GF-2	GF-2
5. Upper Stage Power		EP-15 (A'75)	GF-2	GF-2
6. Module Exchange Mechanism				

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
7. Upper Stage Data Handling & Transmission			GF-2	GF-2
a. Codes				
b. Rates				
8. Upper Stage Attitude and Navigation				
a. Accuracy	EP-5			
b. Tip-Off Rates				
c. Handoff Data				
9. Upper Stage Service Panels				
a. Electrical				
b. Data Bus				
10. Loads				
a. Nominal Limit Load Factors	EP-5			
b. Dynamic Model				
c. Shock and Design Loads				

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
11. EMC/EMI				
a. Grounding, Shielding, etc			F-13[1], 14[1]; GF-2	F-13[1], 14[1]; GF-2
b. Radiation Environ.			F-13[1], 14[1]; GF-2	F-13[1], 14[1]; GF-2
12. Safety				
a. Criteria & Factors		EP-17	GF-1, 2; EP-17[2]	GF-1, 2; EP-17[2]
13. Stage Contamination Sources			GF-2	GF-2
14. Stage Maneuvers and Orientation	EP-5		GF-2	GF-2
15. Rendezvous Capability				
16. Payload Retrieval	EP-5			
17. Sequence of Events, Stage Attitudes, & Timelines				
a. Powered Flight			GF-2	GF-2
b. On-Orbit Stay			GF-2	GF-2

(1) Specifications.
(2) Applicable when coupled with references.

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
18. Physical Constraints				
a. Envelope			GF-2	GF-2
b. c.g. Envelopes			GF-2	GF-2
19. User Costs (Transportation, Extras)				
20. Procurement Requirements and Production Schedules, Responsibilities				
21. Flight Scheduling Constraints				
22. Manifests				
a. Multiple Payload Policy				
b. Weights Charged to Payload				
c. Manifest Managem't				
23. Abort Information				
24. Payload Separation Sequence and Signals			GF-2	GF-2

STS USER PLAN STUDY

DATA REQUIRED RELATIVE TO THE STS SYSTEM BY STS PAYLOAD PROJECTS

6.0 PAYLOAD/UPPER STAGE INTEGRATED FLIGHTS (CONT'D)

Interface Specifications, Vehicle Data, System Capabilities, Software, Policies and Procedures

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
25. Payload Docking	EP-5			
a. Sequence				
b. Equipment				
c. Interface				
d. Stability Rqmts.				
e. Control				
f. Loads				
26. Computer Programs Available to User				

DATA REQUIRED RELATIVE TO GROUND TERMINALS, TRACKING NETWORK, AND THE TRACKING AND DATA RELAY SYSTEM BY STS PAYLOAD PROJECTS

7.0 USERS GUIDE AND PAYLOAD/GROUND TERMINAL INTERFACE DESCRIPTIONS FOR DATA TRANSFER, COMMUNICATION AND TRACKING NETWORKS, AND RANGES

(Locations, Descriptions, Availability, Ground Links, Frequencies, Capacities, Codes, Data Storage, Data Processing, User Charges)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. ETR Range				
2. WTR Range				
3. STS Ground Terminals				
4. STDN Ground Terminals and Data Reduction	JP-13; EP-21, 22*, 23	EP-21*, 22*, 23	EP-21*, 22*, 23	EP-21*, 22*
5. DSN Ground Terminals				
6. TDRS System	JP-13; EP-21	EP-21*	EP-21*	EP-21*

* Partial coverage.

STS USER PLAN STUDY

LIST OF STS SYSTEM REQUIREMENTS FOR
PRE-FLIGHT INFORMATION FROM PAYLOAD PROJECTS

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project)

PAYLOAD PROGRAM PHASES / DATA REQUIREMENTS FOR:	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
1. Project Plan				
a. Project Support Requirements		JP-13; GS-8, 14, 15	GS-9	GS-9, 14
b. Procurement and Services Requirem'ts		GS-8, 14; JP-13; RT-8	GS-9	GS-9, 14
2. Mission Analysis	JP-13			
3. Payload Design/Analysis Documents				
a. Payload Drawing, General Description, & Interface Req'mts.	EP-3; EBM-11	EP-3; GS-8	RT-2; GS-9	RT-2; GS-9
b. Hazard Analysis and Safety Plan			RT-2,4; GF-1; GS-10; EP-17(1)	RT-2, 4; GF-1; GS-10; EP-17(1)
c. Payload Tie-Down Loads, Stress and Deflection Analysis			RT-2	RT-2
d. Analysis of Payload Deployment and Retrieval			RT-2	RT-2

(1) Applicable when coupled with references.

STS USER PLAN STUDY

LIST OF STS SYSTEM REQUIREMENTS FOR
PRE-FLIGHT INFORMATION FROM PAYLOAD PROJECTS

8.0 INFORMATION FOR STS SYSTEM INTEGRATION AND SUPPORT FOR A SPACE PROJECT (CONT'D)

(Documents and Reports Itemizing the Normal Information Needed for Launch Vehicle Integration and Support for a Space Project)

DATA REQUIREMENTS FOR: / PAYLOAD PROGRAM PHASES	Pre-Phase A And Phase A (PA + A)	Phase B (B)	Development And Operating Phase (D, M, G, O, DM)	Launch Vehicle Transition Phase (T)
3. Payload Design/Analysis Documents (Cont'd)				
e. Payload Heat Rejection Rates			RT-2	RT-2
f. Payload Contamination (e.g., Out-Gassing)			RT-2, 3, 7	RT-2, 3, 7
g. Payload Countdown (Sequence, Holds, etc.)			RT-2; GS-9	RT-2; GS-9
4. Payload Test Rqmts.				
a. Payload/STS Integration Simulation			RT-2; GS-9	RT-2; GS-9
5. Payload Demonstration to be Carried Out			RT-2; EP-17(1)	RT-2; EP-17(1)
6. Payload Inspections Required			RT-2; GS-9	RT-2; GS-9

9. DOCUMENT REVIEWS

Over 100 documents were reviewed by the members of the Study Team. Many of these reviews were accomplished by personnel also working on the DOD STS Users Guide. When a document was reviewed for applicability to the Guide, it was also reviewed for applicability to the Space Transportation System data required for the STS User Plan. This procedure avoided duplication of effort and made the best use of the members available for the Study.

Section 9.1 lists the key identifying the documents reviewed along with the document reference. This furnishes a quick access listing for the user and an index to the document summaries contained in Section 9.2. The summaries themselves describe not only the general subject covered by the document, but also several other items which are important to a user in rapidly assessing the utility of the document and its information for his particular needs. It is important to understand the basis for the data and information contained in the document since simulation and test data are normally more reliable than parametric analyses or early specifications and full-scale test data is normally more valid than small-scale data. Under "Status of Information," notes were made relative to the intent of the authors of the reference document relative to applicability of the data and possible extensions or updating in the future. The content of the document is summarized along with comments of the reviewer and explanatory notes. Each document reviewer also noted the applicability of the data to the Data Requirements Matrix presented in Section 7. The results of these reviews were then incorporated in the data available Matrix presented in Section 8.

Most of the documents surveyed in this study came from two major data banks. SAMSO maintains a document listing and data retrieval system for STS-related documents. Extensive use was made of this Space Transportation System data bank. In addition, Aerospace Corporation has requested and accumulated a large NASA studies data bank incorporating payload data from both NASA and DOD payloads for use in NASA studies. Study 2.2 contributed some resources to the request and accumulation effort and made extensive use of the data bank.

9.1 Document List and Keys

CP Listings:

CP-1 Payload Processing Facilities, JFKSC Shuttle Projects Office, 1 April 1974.

CP-2 Space Shuttle System Payload Accommodations, JSC-07700, Vol. XIV, Revision C, 3 July 1974.

CP-3 Space Shuttle Flight and Ground System Specification, JSC-07700, Vol. X, Revision A, 2 January 1974.

CP-4 Launch Pad Station Set Requirements Document, Volume 23, K-SM-10.1.7, Basic, 12 July 1974.

CP-5 Launch Processing System - Checkout Control and Monitor Subsystem Design Requirements, KSC-LPS-RD-026, 9 August 1974.

CP-6 Schedules and Status Summary - Shuttle Projects Office, K-SM-03.1, 5 November 1974.

CP-7 Preliminary Interface Concept Briefing - SOSS DOD/STS Payload Interface Study - FY 75, McDonnell Douglas Astronautics Company, 28 January 1975.

CP-8 Preliminary Interface Concept Briefing - DMSP, DOD/STS Payload Interface Study - FY 75, McDonnell Douglas Astronautics Company, 27 January 1975.

CP-9 DOD Shuttle Systems Requirements, SAMSO-LRV, 18 November 1974.

CP Listings (Cont'd)

CP-10 Orbiter Vehicle End Item Specification for the Space Shuttle System, Part 1, Specification No. MJO 70-0001-1A, 20 December 1973.

CP-11 DOD Payload Interface Assessment Briefing, Part 1, Rockwell International, SD 74-SH-0332, 20 December 1974.

CP-12 Orbiter Payload Accommodations Briefing Manual/Charts, Rockwell International, SD 74-SH-0298, 16 October 1974.

CP-13 DOD Space Transportation System (STS) Payload Interface Study, Technical and Management Summary, SAMSO-TR-73-280-Vol. 1, McDonnell Douglas Astronautics Company/TRW Systems Group, October 1973.

CP-14 DOD Space Transportation System (STS) Payload Interface Study, FY 74 Extension Final Report, SAMSO-TR-74-198, October 1974.

CP-15 Launch Site Accommodations Handbook for Shuttle Payload, JFKSC, 1 February 1974.

CP-16 Payload Interface Team Documentation - Avionics Baseline, Orbiter 102, PDR - JSC-09320, February 1975.

CP-17 Payload Integration - Schedules and Status Summary, Volume 2, JFKSC K-SM-03.2, 15 October 1974.

CP-18 DOD Space Transportation System Operations Concept (Preliminary), Reusable Launch Vehicle System Program Office, Operation and Evaluation Division, 30 October 1974.

CP-19 Shuttle System - Ground Operations Plan, NASA/KSC, K-SM-09, 20 February 1975.

CP-20 Multi-User Mission Support Equipment, Third Progress Review, Martin-Marietta Corporation, Denver Division, February 1975.

CP-21 Multi-Use Mission Support Equipment (MMSE) (Launch Site) - MMSE Catalog, Revision A, Martin-Marietta Corporation, Denver Division, February 1975.

EBM Listings

EBM-1 Scientific Uses of the Space Shuttle, Space Science Board, National Academy of Sciences, Washington, D. C., 1974.

EBM-2 A Long-Range Program in Space Astronomy, Position Paper of the Astronomy Missions Board, NASA SP-213, Washington, D. C., 1969.

EBM-3 Priorities for Space Research 1971-1980, Space Science Board, National Academy of Sciences, Washington, D. C., 1971.

EBM-4 Announcement of Opportunity for Scientific Definition of Space Shuttle Missions for Solar Physics Spacelab Payloads, NASA AO #5, NASA, Washington, D. C., 15 July 1974.

EBM-5 Scientific Objectives and Instrument Performance Criteria for a Large Solar Observatory, E. B. Mayfield, et al., The Aerospace Corporation, ATR 72(7268)-1, 30 August 1972.

EBM-6 Proceedings of the Space Shuttle Sortie Workshop, Volume I, Policy and System Characteristics, R. W. Johnson, General Chairman, 31 July - 4 August 1972, NASA, Washington, D. C.

EBM-7 Proceedings of the Space Shuttle Sortie Workshop, Volume II, Working Group Reports, R. W. Johnson, General Chairman, 31 July - 4 August 1972, NASA, Washington, D. C.

EBM-8 Summarized NASA Payload Descriptions, Automated Payloads, NASA/MSFC, July 1974.

EBM-9 Summarized NASA Payload Descriptions, Sortie Payloads, NASA/MSFC, July 1974.

EBM-10 Summarized NASA Payload Descriptions, Volume II, Sortie Payloads, NASA/MSFC, July 1974.

EBM-11 Spacelab Payload Accommodation Handbook (Preliminary), T. J. Lee (NASA/MSFC) and H. Stoewer (ESRO), May 1975.

EP Listings:

EP-1 Vandenberg Launch Processing System, Station Set V84 Requirements Document, Book III, Part 1, Updated.

EP-2 Space Shuttle System DOD Reference Missions, Mission 2, The Aerospace Corporation, TOR-0075 (5421-04)-2, 8 July 1974.

EP-3 Payload Questionnaire.

EP-4 Current Space Shuttle Payload Accommodations and Interfaces, Rockwell International, Space Division, SSV74-30, 17 July 1974.

EP-5 DOD Space Transportation System (STS) Payload Interface Study, Volumes I and II, SAMSO-TR-73-280, McDonnell Douglas/TRW Systems, October 1973.

EP-6 The Mission Type/Phase Concept for Shuttle Mission Planning and Standardization, JSC/TRW, JSC-08420, JSC Internal Note No. 73-FM-126, 20 August 1973.

EP-7 Space Shuttle System Baseline Reference Missions, Volume II, Mission 2, Revision 1, JSC-07896, JSC Internal Note 73-FM-47, 29 May 1974.

EP-8 Initial Configuration Control OMS and RCS Propellant Budgets for Orbiter Missions.

EP-9 Nominal Return-to-Launch Site (RTLS) Abort Trajectories for Mission 3A (Configuration 5-MCR R2), Rockwell International, Internal Letter No. 393-100-74-037, 20 May 1974.

EP-10 Mission 3A Trajectory, AOA Abort to EAFB, NAH Division T, Ferrnell, 41086029-73, 30 July 1974 (Also see TN 15303.9, 3A AOA to Edwards).

EP-11 Navy Payload/Shuttle Integration Study, Rockwell International Internal Letter #SS-74/016, 31 January 1974.

EP-12 Vehicle Management and Mission Planning System (Phase 1B) Users Document, Volume I, Batch Loader Program (BLP), JSC-08567, 14 December 1973.

EP Listings (Cont'd)

EP-13 Earth Orbit Shuttle Scheduling Constraints, NASA MSC Internal Note No. 73-FM-9, 31 January 1973.

EP-14 DOD Payload Interface Assessment Briefing, Part 1, Rockwell International, Space Division, SD 74-SH-0332, 20 December 1974.

EP-15 Second Progress Review, Multi-Mission Support Equipment (MMSE), William Pratt, et al, Martin-Marietta Corporation, December 1974.

EP-16 Payload Descriptions, Volume 1, Automated Payloads; Volume II, Shuttle Sortie Payloads, Level B Data, MSFC Preliminary Data, July 1974.

EP-17 Safety Policy and Requirements for Payloads Using the National Space Transportation System, Payload Safety Steering Group (Ad Hoc), NASA Headquarters, Washington, D. C., July 1974 (Revised February 1975).

EP-18 Deep Space Network (DSN) Standard Practice, Deep Space Network/Flight Project Interface Design Handbook, JPL 810-5, Revision C, 15 April 1972.

EP-19 Space Shuttle Program, Flight Operations, Level II Program Definition and Requirements, Volume VIII, NASA JSC-0700, Vol. VIII, 14 March 1975.

EP-20 Narrative Technical Description of Current Dynamic Test and Isolation Practices, McDonnell Douglas, Western Division, Huntington Beach, California, P. F. Spas (Task Monitor), October 1974 (Revised January 1975).

EP-21 Tracking and Data Relay Satellite System (TDRSS) Users Guide, NASA/GSFC, X-805-74-176, Revision 1, September 1974.

EP-22 Network Integration Study, Parts A, B, NASA/GSFC, Report No. STDN No. 809, June 1972.

EP-23 STDN Users Guide, Revision 2, NASA/GSFC, GSFC Report STDN No. 101.1, J. N. Scott, Requirements and Plans Office, May 1974.

F Listings:

F-1 DOD Space Shuttle System Summary, Headquarters, SAMSO, Reusable Launch Vehicle System Program Office, 1 August 1974.

F-2 DOD Payload Interface Assessment Briefing, Part 1, Rockwell International, Space Division, SD 74-SH-0332, 20 December 1974.

F-3 Shuttle Operational Data Book, Volume I, Shuttle Systems Performance and Constraints Data, JSC-08934, June 1974 (and updated through 1 January 1975).

F-4 NASA Memorandum, User Price Policy Steering Group, from MK, Chairman, User Pricing Policy Steering Group, 3 September 1974.

F-5 Requirement/Definition Document, Crew Station and Equipment, Book 7, Rockwell International, Space Division, PDR Conference, IRD SE-493T, WBS 1.2.1.4.1, 31 January 1974.

F-6 Orbiter Contamination Sources Review, Presented at the 6th Meeting of the Particles and Gases Working Group, 6 November 1974, Joint Meeting with Payload Contamination Requirements Definition Group, Rockwell International, Space Division.

F-7 Space Shuttle System Summary, Rockwell International, Space Division, 4 August 1974.

F-8 Orbiter 102 PDR, Payload Accommodations and Interfaces, Team 15, Payload Integration, Rockwell International, Space Division, SSV75-1-1, 17 February 1975.

F-9 Space Shuttle System Acoustics, Shock and Vibration Data Book, Rockwell International, SD 74-SH-0082, 1 June 1974.

F-10 Shuttle System Integrated Mission Events and Sequences, Rockwell International, Space Division, SD 75-SH-0050, 28 February 1975.

F Listings (Cont'd)

F-11 Space Shuttle Program Shuttle Avionics Integration Laboratory, NASA/JSC, JSC-08663, Volume I, Sail Project Plan, 20 September 1974.

F-12 Specification, Interleaver, Payload Data, Rockwell International, Space Division, MC476-0136, 10 May 1974.

F-13 Specification, Electromagnetic Compatibility Requirement, Systems for the Space Shuttle Program, NASA/JSC, JSC Document SL-E-0001, 4 June 1973.

F-14 Space Shuttle Program Specification, Electromagnetic Interference Characteristics, Requirements for Equipment, NASA/JSC, JSC Document SL-E-0002, Revision A, 16 September 1974.

F-15 Space Shuttle Electromagnetic Effects Compatibility Control Plan, Revision B, Rockwell International, Space Division, SD 72-SH-0216B.

F-16 Requirements/Definition Document, Payload Retention Mechanisms, Volume 2-5, Rockwell International, Space Division, SD 72-SH-0102-5, 15 November 1974.

F-17 Requirements/Definition Document, Payload Deployment and Retrieval Mechanisms, Volume 2-8, Rockwell International, Space Division, SD 72-SH-0102-8, 15 November 1974.

F-18 Requirements/Definition Document, Data Process and Software, Volume 5-5, Rockwell International, Space Division, SD 72-SH-0105-5, 5 December 1974.

GF Listings:

GF-1 Safety Policy and Requirements for Payloads Using the National Space Transportation System, Payload Safety Steering Group, NASA Headquarters, July 1974 (Revised February 1975).

GF-2 STS Users Guide, Section 10, Detailed Upper Stage Description - IUS, The Aerospace Corporation, TOR-0075(5421-03)-1, 28 February 1975.

GS Listings:

GS-1 DOD STS Ground Operations Study - Recommended Concept, Siting Arrangement and Acquisition Plan, Martin Marietta Corporation, MCR-74-309, AF-SAMSO-TR-74-234, October 1974.

GS-2 Planning Factors Guide, 290-75, Hq., 1st Strategic Aerospace Division, 1 July 1974.

GS-3 Level II Program Definition and Requirements, Volume XIV, Payload Accommodations (Revision C), Change No. 3, NASA/JSC, JSC-07700, Vol. XIV, 3 July 1974.

GS-4 LPS Concept Description Document, NASA/KSC, KSC-DD-LPS-007, Digital Electronics System Office, Directorate of Design Engineering, 11 January 1974 (Revised).

GS-5 Launch Processing System, Station Set 84 Requirements Document, Book I, NASA/JSC, K-SM-10.1.23, Owen Sizemore, Shuttle Project Office, 22 February 1974 (Second Draft).

GS-6 Launch Processing System, Station Set 84 Requirements Document, Book II, NASA/JSC, K-SM-10.1.23, Owen Sizemore, Shuttle Project Office, 22 February 1974 (Second Draft).

GS-7 Launch Processing System Station Set 84, Requirements Document, Book III, No Number, Prepared by 6595th STG (ST) STS Project Office, VAFB, 9 October 1974.

GS-8 System Description, Program Introduction and Statement of Capability, Volume I, Universal Documentation System, Document 501-72, The Secretariat, Range Commanders Council, July 1972.

GS-9 Program, Mission and Test Requirements, and Support Plans Document Preparation, Document 501-70, The Secretariat, Range Commanders Council, October 1970.

GS Listings (Cont'd)

GS-10 Space and Missile Test Center Manual, Volume I, Range Safety Requirements, SAMTECM 127-1, 16 July 1973.

GS-11 Natural Environments for KSC, VAFB, and EAFB To Be Used for Design, NASA/Rockwell Report No. SD 73-SH-0025B, 10 January 1975.

GS-12 Range User Handbook, Space and Missile Test Center Manual, SAMTECM 80-1, 6 January 1975.

GS-13 Baseline Operations Plan (Review Draft), NASA/JSC, JSC-09331, Flight Operations Directorate, 15 January 1975.

GS-14 Space Shuttle System Payload Interface Verification Plan (Preliminary Draft), Volume I, NASA/JSC, JSC-07700-14-P/L VP-01, 1 February 1975.

GS-15 KSC Launch Site Accommodations Handbook for STS Payloads, Revision 1, Coordination Draft, NASA/KSC, KSC-K-SM-14, February 1975.

GS-16 DOD Ground Support Systems Definition Study, McDonnell Douglas/Sterns Rogers, June 1975.

JP Listings:

JP-1 Space Shuttle System Payload Accommodation, Volume XIV, Revision C, JSC-07700, 3 July 1974.

JP-2 PDR Team 15 Document - Mission Operations Approach, NASA-S-75-622; JSC-09323, H. Ray.

JP-3 PDR Team 15 Document - DOD Satellites, NASA-S-75-634; JSC-09317, H. Lambert, 20 December 1974.

JP-4 PDR Team 15 Document - Common Attachment/Handling Study, NASA-S-75-330; JSC-09318, L. Jenkins, 27 December 1974.

JP-5 PDR Team 15 Document - Weights Chargeable to Payload, NASA-S-75-360; JSC-09324, B. Sevier, 20 December 1974.

JP Listings (Cont'd)

JP-6 PDR Team 15 Document, Volume XIV, Revision C, NASA/JSC, JSC-09310, NASA-S-75-489, E. Armstrong, 20 December 1974.

JP-7 PDR Team 15 Document - Interim Upper Stage, NASA-S-75-627; JSC-09312, H. Lambert, 20 December 1974.

JP-8 PDR Team 15 Document - Large Space Telescope, NASA-S-75-318; JSC-09315, G. Meester, 20 December 1974.

JP-9 PDR Team 15 Document - Spacelab, NASA-S-75-514; JSC-09311, J. O'Laughlin, 24 December 1974.

JP-10 PDR Team 15 Document - Earth Observations Satellite, NASA-S-75-369; JSC-09313, R. Frost, 20 December 1974.

JP-11 PDR Team 15 Document - Long Duration Exposure Facility (LDEF), NASA-S-75-307; JSC-09314, G. Meester, 20 December 1974.

JP-12 Orbiter Vehicle End Item Specification for the Space Shuttle System, Part 1, Performance and Design Requirements, IRD No. TM-258T, W.B.S. 1.2.1.4.1, Specification No. MJO70-0001-1A, Updated to Change No. 3, Rockwell International, Space Division, 22 August 1974.

JP-13 Baseline Operations Plan, Review Draft, JSC-09333, JSC Flight Operations Directorate, 15 January 1975.

JP-14 Payload Structural Attach Loads Definition, Rockwell International, Space Division, MCR 277, Revised Date: 3 December 1974.

JP-15 DOD Space Transportation System (STS) Payload Interface Study, FY 74 Extension, SAMSO-TR-74-198, October 1974.

JP-16 Remote Manipulator System Design Requirements, Performance and Interface Specification, NASA/JSC, JSC-08997, 22 August 1974.

JP Listings (Cont'd)

JP-17 Specification Contamination Control Requirements for the Space Shuttle Program, SN-C-0005, March 1974.

JP-18 Design Definition Studies of Special Purpose Manipulator System for EOS, SPAR/DSMA Team, SPAR-R-592, January 1974.

JP-19 Final Report - Servicing the DSCS-II with the STS, Volume I, Final Briefing, SAMSO-TR-75-135, March 1975.

RT Listings:

RT-1 Shuttle Turnaround Analysis Report, STAR 005, R. E. Reedy, Rockwell Launch Operations Integration, H. K. Widick, Chairman, STAR SP-OPN, January 1975 (Prepared Monthly).

RT-2 Space Shuttle System Payload Interface Verification Plan, JSC-07700-14-P/L VP-01, R. Everline (JSC), February 1975.

RT-3 Orbiter Contamination Control Plan, Rockwell International, SD 75-SH-0289, February 1975.

RT-4 Shuttle System PDR, Safety Analysis Report, Rockwell International, SD-75-SH-0064, 28 February 1975.

RT-5 Space Shuttle Orbital Flight Test Requirements, NASA/JSC, JSC-08576, R. Morton/O. G. Morris, 15 January 1975.

RT-6 Space Shuttle Payload Accommodations on the Aft Flight Deck, NASA/JSC, Spacecraft Design Division, JSC-09343, S. H. Nassiff, 20 January 1975.

RT-7 Payload/Orbiter Contamination Control Requirement Study, MCR 74-474, NASA 8-30755, 27 December 1974.

RT-8 Interface Verification Equipment Study (IVE), Progress Briefing, R. Everline (NASA/JSC); E. R. Richardson (Rockwell International), 14 February 1975.

WF Listings:

WF-1 Space Shuttle System Payload Accommodations, NASA/JSC, JSC-07700, Volume XIV.

WF-2 Space Shuttle Flight Systems Performance Data Book, Volume I, Ascent, SD73-SH-0178-1B, December 1974.

WF-3 Space Shuttle Flight Performance Data Book, Volume II, Orbiter Entry, SD73-SH-0178-2, January 1974.

WF-4 Flight Performance Data Book, Volume IV, Operational, SD73-SH-0178-4, April 1974.

WF-5 MDASP-Mission Design and Analysis Subsystem Prototype, Volume I, Users Guide, The Aerospace Corporation, TOR-0075(5421-07)-1, Vol. I, J. L. Starr, 25 April 1975.

WF-6 MDASP-Mission Design and Analysis Subsystem Prototype, Volume II, Advanced Engineering/Programmers Guide, The Aerospace Corporation, TOR-0075 (5421-07)-1, Vol. II, J. L. Starr, 25 April 1975.

WF-7 Shuttle Operational Data Book, Volume I, Shuttle Systems Performance and Constraints Data, NASA/JSC-08934 (Vol. I), June 1974.

WF-8 Shuttle Operational Data Book, Volume II, Shuttle Mission Mass Properties Data, NASA/JSC-08934 (Vol. II).

WF-9 Aerodynamic Design Data Book, Volume I, Orbiter Vehicle, Rockwell International, SD72-SH-00620 1G, June 1974.

WF-10 Aerodynamic Design Data Book, Volume II, Mated Vehicle, Rockwell International, SD72-SH-00620 2G, June 1974.

WF-11 Review of Shuttle Operational Data Book, The Aerospace Corporation Letter 75-2610.3.1-032, S. T. Chu to SAMSO (LVRO/Capt. J. Jannarone), 3 March 1975.

9.2 DOCUMENT SUMMARY SHEETS

This section presents the individual document summary sheets prepared by the reviewer. They correspond to the key identifying the document (Section 9.1) as follows:

CP-1 through CP-21	Pages 9-15 through 9-35
EBM-1 through EBM-11	Pages 9-36 through 9-46
EP-1 through EP-23	Pages 9-47 through 9-69
F-1 through F-18	Pages 9-70 through 9-99
GF-1 and GF-2	Pages 9-100 and 9-101
GS-1 through GS-16	Pages 9-102 through 9-119
JP-1 through JP-19	Pages 9-120 through 9-138
RT-1 through RT-8	Pages 9-139 through 9-149
WF-1 through WF-11	See Section 10.2 of this report

REFERENCE CP-1

TITLE: Payload Processing Facilities

REPORT NO:

DATE: 1 April 1974

AUTHOR(S): Shuttle Project Office (JFKSC)

SUBJECT: Payload Processing Facilities

BASIS FOR INFORMATION: Dissemination of payload facility capabilities information to payload owners to support their program planning.

STATUS OF INFORMATION:

COVERAGE OR CONTENT: The document provides a pictorial reference to existing facilities that are considered adaptable for Shuttle payload processing. Inside and outside photographs plus a data sheet are furnished for each facility.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 2.i, j, c, h, m, g; also Section 2.1, Item 6.g.

REFERENCE CP-2

TITLE: Space Shuttle System Payload Accommodations

REPORT NO: JSC-07700, Vol. XIV, Revision C

DATE: 3 July 1974

AUTHOR(S):

SUBJECT: Document provides information on the Space Shuttle system required by payloads in the design definition phase.

BASIS FOR INFORMATION: Baseline

STATUS OF INFORMATION: Evolutionary

COVERAGE OR CONTENT: Provides potential users of the Space Shuttle with an official source of information on the Space Shuttle capabilities. It also defines a set of standard interface provisions between the orbiter and payloads. It includes performance data and information on subsystems, environments, and support equipment.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1.a and b, Items 2.b, d, h, i, j, and k. Also for Section 2.1 Items 1; 3.c; 5.a, b, d; 6.b, d, e; and 7.a, b, c, d, e, f.

REFERENCE CP-3

TITLE: Space Shuttle Flight and Ground System Specification - Level II

REPORT NO: JSC 07700, Vol. X, Revision A, Change No. 20

DATE: 2 January 1975

AUTHOR(S):

SUBJECT: System Specification - Level II

BASIS FOR INFORMATION: Evolutionary

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Contains the program level technical requirements for the operational STS and forms the base for control by NASA.

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 3.a, b, c, d; 5.a, b, d; 6.b, c, f; and 9; 4.c. Also Section 1.2, Items 2.a, b, h, i; 6 and 7.

REFERENCE CP-4

TITLE: Launch Pad - Station Set Requirements Document Volume 23

REPORT NO: K-SM-10.1.7 Basic

DATE: 12 July 1974

AUTHOR(S): J. J. Talone, Jr.

SUBJECT: This document is limited to those facilities and GSE at the launch pad required to support checkout and launch of the Space Shuttle vehicle.

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Describes launch pad integration, which includes the facilities, services, and GSE required to meet the functional flow from the start of mobile launch platform jacking in the VAB for rollout to the pad through delivery of the MLP post-launch to the VAB high bay support columns.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 1; 6 f and g; and Section 2.1, Items 2.a, b, i, j, and m.

REFERENCE CP-5

TITLE: Launch Processing System -- Checkout, Control, and Monitor Subsystem -- Design Requirements

REPORT NO: KSC-LPS-RD-026

DATE: 9 August 1974

AUTHOR(S):

SUBJECT: Document describes the preliminary performance objectives and requirements necessary for design, development, and manufacture of the Checkout, Control and Monitor Subsystem (CCMS).

BASIS FOR INFORMATION: Preliminary design requirements for CCMS and interfaces with the Central Data Subsystem (CDS).

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Presents the LPS integrated checkout and launch facility capable of controlling the GSE and orbiter through consoles. It is representative of either Firing Room 1 or Firing Room 3 consoles and interfaces interconnected with Pad A or Pad B.

COMMENTS: No discussion is contained pertaining to payload(s). It is recommended that an interfacing with payload capability write-up be included in the next revision.

APPLICABLE TO DATA REQUIREMENT:

REFERENCE CP-6

TITLE: Schedules and Status Summary

REPORT NO: K-SM-03.1

DATE: 5 November 1974

AUTHOR(S): Shuttle Projects Office

(Upon review, it was determined that this document was not applicable)

REFERENCE CP-7

TITLE: Preliminary Interface Concept Briefing - SOSS DOD/STS Payload Interface Study - FY 75

REPORT NO:

DATE: 28 January 1975

AUTHOR(S): McDonnell Douglas Astronautics Company

SUBJECT: DOD Payload Interface

BASIS FOR INFORMATION: Dissemination of payload interface data

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Briefing charts on pre-launch, ascent, and pre-deployment. Also, subsystem block diagrams.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 5; 6.b and e; 7.a, b, c, d, and f.

REFERENCE CP-8

TITLE: Preliminary Interface Concept Briefing -- DMSP DOD/STS Payload Interface Study - FY 75

REPORT NO:

DATE: 27 January 1975

AUTHOR(S): McDonnell Douglas Astronautics Company

SUBJECT: DOD Payload Interface

BASIS FOR INFORMATION: Dissemination of payload interface data

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Briefing charts on pre-launch, ascent, and pre-deployment; also, subsystem block diagrams.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 5; 6.b and e; 7.a, b, c, d, and f.

REFERENCE CP-9

TITLE: DOD Shuttle System Requirements

REPORT NO:

DATE: 18 November 1974

AUTHOR(S): SAMSO/LRV

SUBJECT:

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Baseline - subject to revision as detailed system information becomes available.

COVERAGE OR CONTENT: Delineates only the DOD STS requirements which directly pertain to the Shuttle system. The document is not intended to provide all DOD STS requirements; e.g., those related to the upper stage or the ground network.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Item 6.

REFERENCE CP-10

TITLE: Orbiter Vehicle End Item Specification for Space Shuttle System, Part I - Performance and Design Requirements

REPORT NO: MJO70-0001-1A

DATE: 20 December 1973

AUTHOR(S):

SUBJECT: The Part I specification establishes the requirements of performance, design, and verification of the orbiter vehicle element of the operational Space Shuttle system.

BASIS FOR INFORMATION: Evolutionary

STATUS OF INFORMATION: Baseline

COVERAGE OR CONTENT: Specifies unique requirements and characteristics to which the orbiter vehicle's subsystems will conform to achieve the required orbiter performance and operational capabilities.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 5.c and 6.e.

REFERENCE CP-11

TITLE:	DOD Payload Interface Assessment Briefing, Part 1
REPORT NO:	SD 74-SH-0332
DATE:	20 December 1974
AUTHOR(S):	Rockwell International

(Please see EP-14)

Page 9-60 of this report

REFERENCE CP-12

TITLE: Orbiter Payload Accommodations Briefing Manual/Charts

REPORT NO: SD 74-SH-0298

DATE: 16 October 1974

AUTHOR(S): Payload Integration Space Shuttle Program

SUBJECT: Orbiter Payload

BASIS FOR INFORMATION: Presents baseline description of the current Shuttle system.

STATUS OF INFORMATION: Baseline

COVERAGE OR CONTENT: Presents general requirements for accommodation, installation, and operation of DOD payloads and Interim Upper Stages (IUS). Provides preliminary design information describing Shuttle system and subsystem capabilities and constraints imposed upon payloads.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1.a, b, c; 2.a and Section 2.1, Items 1; 2; and 5.a, b, c, d, e.

REFERENCE CP-13

TITLE:	DOD Space Transportation System (STS) Payload Interface Study, Technical and Management Summary
REPORT NO:	SAMSO-TR-73-280-Vol. 1
DATE:	October 1973
AUTHOR(S):	McDonnell Douglas Astronautics Company/TRW Systems Group

(Please see EP-5)
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REFERENCE CP-14

TITLE: DOD Space Transportation System (STS) Payload Interface Study FY 74 Extension, Final Report

REPORT NO: SAMSO TR-74-198

DATE: October 1974

AUTHOR(S): Bruce E. Garlich, R. D. Heitchue, D. H. Mitchell

SUBJECT: Study to determine baseline and potentially required interfaces and concepts necessary to integrate DSP, DSCS-II, and FLTSATCOM with the Shuttle orbiter and interirr upper stage concepts.

BASIS FOR INFORMATION: Baseline

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Study was made to update earlier results of the FY 73 study in defining interface requirements, concepts, and costs for launching DOD spacecraft using the Space Shuttle and Interim Upper Stage (IUS)

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1, 2, 3, 4, 5, and 7 and Section 2.1, Items 1, 2, 3, 4, 5, 6, and 7.

REFERENCE CP-15

TITLE: Launch Site Accommodations Handbook for Shuttle Payload

REPORT NO: K-SM-14, Revision 1

DATE: February 1975

AUTHOR(S): W. B. Shapbell, Jr.

SUBJECT: Launch Site Facilities and GSE

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Coordination Draft

COVERAGE OR CONTENT: Contains information on NASA KSC management and organization, operations, facilities and GSE, support, safety, documentation, payload design considerations, schedules, and WTR unique operations.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1, 2, and 3; Section 2.1, Items 1, 2, 3.c, 6.b and c.

C-3

REFERENCE CP-16

TITLE: Avionics Baseline -- Payload Interfaces Team Documentation

REPORT NO: JSC-09320

DATE: February 1975

AUTHOR(S):

SUBJECT: Orbiter 102 PDR

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Proposed Baseline

COVERAGE OR CONTENT: Provides avionics block diagrams, identification of equipment location, payload interfaces, RF links, and data management.

COMMENTS: General avionics information

APPLICABLE TO DATA REQUIREMENT:

REFERENCE CP-17

TITLE: Schedules and Status Summary, Volume 2, Payload Integration

REPORT NO: K-SM-03.2

DATE: 15 October 1974

AUTHOR(S): Shuttle Projects Office (JFKSC)

SUBJECT: Payload and Facilities and Schedules at JFKSC

BASIS FOR INFORMATION: Status summary

STATUS OF INFORMATION: Progressive report

COVERAGE OR CONTENT: Payloads, schedules, facility modification status, interim upper stage/Space Tug/kick stages.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1.a, b; 2.f; also Section 2.1, Items 2 and 5.a.

REFERENCE CP-18

TITLE: DOD Space Transportation System Operations Concept (Preliminary)

REPORT NO:

DATE: 30 October 1974

AUTHOR(S): Reusable Launch Vehicle System Program Office Operation and Evaluation Division

SUBJECT: Provides the preliminary operations concept for the DOD utilization of the Space Transportation System as envisioned by SAMSO.

BASIS FOR INFORMATION: To provide DOD STS users and supporting agencies with an insight into what the STS is and how the DOD might best operate the mature system.

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Missions, STS operations management, VAFB and KSC DOD ground operations, mission operations, and communications concept.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 2.1, Items 6.b, d, e and f; and Section 1.2, Items 1.c; 2.a, b, h, k; 6 and 7.

REFERENCE CP-19

TITLE: Shuttle System - Ground Operations Plan

REPORT NO: K-SM-09

DATE: 20 February 1975

AUTHOR(S): JFKSC: G. W. Knight

SUBJECT: Defines basic mode of operation that is being developed by KSC for ground operations management of the Shuttle system.

BASIS FOR INFORMATION: Evolutionary

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: The plan is the top-level ground operations document that establishes and controls the approved philosophies, concepts, facilities, and methods for conduct of Shuttle system ground operations.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1 and 2; also Section 2.1, Items 1, 2, 6, 8 and 9.

REFERENCE CP-20

TITLE: Multi-User Mission Support Equipment, Third Progress Review

REPORT NO:

DATE: February 1975

AUTHOR(S): W. P. Pratt, Martin Marietta Corporation, Denver Division

SUBJECT: Summarizes the different types of payload mission support equipment.

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Study results

COVERAGE OR CONTENT: Based on the review of the traffic model, requirements for carrier unique, payload unique, and multi-use support equipment are evolving from this study.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 1.a; 2.a, b, d; 3 and 4. Also Section 2.1, Item 5.

REFERENCE CP-21

TITLE: Multi-Use Mission Support Equipment (MMSE) (Launch Site) - MMSE Catalogue, Revision A

REPORT NO:

DATE: February 1975

AUTHOR(S): J. W. Gurr, Martin Marietta Corporation, Denver Division

SUBJECT: Presents an MMSE Catalogue for use at the launch site.

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Study results

COVERAGE OR CONTENT: Based on various payload classes, a launch site flow chart was developed for each class. The flow was assessed to determine activities and support equipment to accomplish these activities. Listing of support equipment was prepared and potential MMSE candidates were selected.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Contains documentation for Matrix Data Requirement Section 1.2, Items 2.a, b, d, f; 3 and 4. Also Section 2.1, Item 7.d and e.

REFERENCE EBM-1

TITLE: "Scientific Uses of the Space Shuttle"

REPORT NO: Space Science Board, National Research Council

DATE: 1974

AUTHOR(S): Richard M. Goody (Chairman)

SUBJECT: Use of the Shuttle for space-based research during the 1980s and beyond.

BASIS FOR INFORMATION: Results of a committee study by the National Academy of Sciences in the fields of: (1) atmospheric and space physics, (2) high energy astrophysics, (3) infrared astronomy, (4) optical and ultraviolet astronomy, (5) solar physics, (6) life sciences, (7) planetary exploration.

STATUS OF INFORMATION: Conceptual study by Space Science Board for NASA and other agency planning.

COVERAGE OR CONTENT: Describes in detail the scientific objectives, instruments, operating modes and manned operation for an exhaustive range of research compatible with the Shuttle, particularly the 27-day Sortie. Identifies requirements which will affect Shuttle development and operations.

COMMENTS: This document details a wide range of potential user requirements which should be a basis for action in design and fabrication of the Shuttle. It is probable that most of the scientific payloads to be flown on the Shuttle are described in this document which has been incorporated by NASA for planning.

APPLICABLE TO DATA REQUIREMENT: All. Pre-Phase A.

REFERENCE EBM-2

TITLE: "A Long Range Program in Space Astronomy" - Position Paper of the Astronomy Missions Board

REPORT NO: NASA SP-213

DATE: July 1969

AUTHOR(S): R. O. Doyle, Editor

SUBJECT: Recommended programs for space-based astronomy into the mid 1980s using automated and manned satellites.

BASIS FOR INFORMATION: Study by committee convened by NASA to identify astronomy program in areas of: (1) high energy astronomy, (2) X-ray and gamma rays, (3) optical, (4) infrared, (5) low-frequency radio, (6) solar physics.

STATUS OF INFORMATION: Position paper adopted by NASA for long-range planning in space astronomy.

COVERAGE OR CONTENT: Detailed study of six areas of space astronomy considering planned, funded, and recommended programs. Includes proposed experiments and instruments and expected time period and funding. Few technical details which impact Shuttle performance.

COMMENTS: This document, with the study by the National Academy of Sciences (EBM-1), provides a detailed program recommended by a consensus of the user community for space-based research. The recommendations will certainly be incorporated into any program funded by NASA for inclusion in the Shuttle payloads.

APPLICABLE TO DATA REQUIREMENT: All. Pre-Phase A

REFERENCE EBM-3

TITLE: "Priorities for Space Research 1971 - 1980"

REPORT NO: Space Science Board, National Research Council

DATE: 1971

AUTHOR(S): Charles H. Townes, Chairman

SUBJECT: Evaluation of NASA proposed programs through 1985 and recommendations for space-based research programs through 1980

BASIS FOR INFORMATION: Committee convened by the National Academy of Sciences to examine and propose scientific research in the areas of: (1) planetary exploration, (2) lunar exploration, (3) astronomy, (4) gravitational physics, (5) solar-terrestrial physics, (6) earth environmental sciences, (7) life sciences.

STATUS OF INFORMATION: Historical information referenced in current studies of space-based research and regarded as valid data.

COVERAGE OR CONTENT: Study of scientific objectives and programs needed to achieve them in seven areas of science. Includes current and planned programs through 1985 and recommends supplemental effort. Discusses instruments and capabilities needed to accomplish programs.

COMMENTS: This document is primarily of historical significance since it is widely references and is regarded as a guideline for several subsequent publications and continuing studies such as the NASA Blue Book (NASA NHB 7150.1, 1971) and the committee convened by NASA by Announcement of Opportunities #5 (EBM-4). It is useful in identifying pre-Phase A planning.

APPLICABLE TO DATA REQUIREMENT: All. Pre-Phase A

REFERENCE EBM-4

TITLE:	Announcement of Opportunity for Scientific Definition of Space Shuttle Missions for Solar Physics Spacelab Payloads
REPORT NO:	NASA Announcement of Opportunity No. 5
DATE:	15 July 1974
AUTHOR(S):	NASA

SUBJECT: Preliminary study to define scientific instruments and programs for a complete solar observatory using the Spacelab capabilities.

BASIS FOR INFORMATION: Pre-Phase A study for definition and preliminary design studies of general purpose, facility-type solar telescope and a quick reaction time system.

STATUS OF INFORMATION: Definition teams are being selected at present.

COVERAGE OR CONTENT: Defines candidate instruments for a large solar observatory and establishes guidelines for the definition groups to use in developing recommended instruments and programs.

COMMENTS: These proposed instruments may be one of the first scientific payloads for the Shuttle. It is based on the NASA "Blue Book" concepts and the follow-on Aerospace study (EBM-5) and represents a strong consensus among potential users.

APPLICABLE TO DATA REQUIREMENT: Section 5.0, Items 2 a, b, c, ; 3; 4; 16 a, b, c, d; 26 a, b, c, d, e, f, g, h, i; 27; 31 a, b; 32 a, b).

REFERENCE EBM-5

TITLE: Scientific Objectives and Instrument Performance Criteria for a Large Solar Observatory

REPORT NO: Aerospace Report No. ATR 72(7268)-1

DATE: 30 August 1972

AUTHOR(S): E. B. Mayfield, A. B. C. Walker, F. A. Morse, T. J. Janssens, D. Vrabec

SUBJECT: Detailed study of the design, construction, and operation of a space-based solar observatory operated as a national facility.

BASIS FOR INFORMATION: Discussions with various solar research groups using the NASA Blue Book as a baseline system (NASA NHB 7150.0)

STATUS OF INFORMATION: Incorporated by NASA as an amendment to the Blue Book

COVERAGE OR CONTENT: Describes complete set of instruments required for solar research during 1980 time period. Identifies operations, data processing, and management modes.

COMMENTS: The instruments described in this report are typical of those selected by NASA in the Announcement No. 5 (EBM-4) for possible inclusion on the Spacelab and Shuttle.

APPLICABLE TO DATA REQUIREMENT: Section 5.0, Items 2, 3, 4, 16, 26, 27, 31, 32.

REFERENCE EBM-6

TITLE: "Proceedings of the Space Shuttle Sortie Workshop. Volume I Policy and System Characteristics"

REPORT NO: NASA, Goddard Space Flight Center

DATE: 31 July - 4 August 1972

AUTHOR(S): R. W. Johnson, L. Meredith

SUBJECT: Policy papers regarding payloads for and operation of the Shuttle for space science applications during the 1980 time period.

BASIS FOR INFORMATION: Policy statements by Office of Space Science, Office of Applications, and Office of Manned Space Flight. Baseline accommodations for payloads by Space Shuttle Program, Johnson Space Center.

STATUS OF INFORMATION: Active planning document prepared by NASA for potential users of the Shuttle and for committees recommending future space science programs.

COVERAGE OR CONTENT: Provides detailed capability and proposed operations data for the Shuttle for space science utilization. Discusses related support for intended users and possible configurations for payloads.

COMMENTS:

Valuable document for Pre-Phase A, Phase A and Phase B planning by potential users of the Shuttle for both integrated flight and deployed payloads.

APPLICABLE TO DATA REQUIREMENT: 1.0: [illegible],7; 1.2: 1,2; 1.3, 1, 12; 2.1: 1,2,4,5; 5.0: 1,3,7,8,9, 10,12,13,[illegible],16,18,26,27,28,31,32,34.

REFERENCE EBM-7

TITLE: "Proceedings of the Space Shuttle Sortie Workshop. Volume II Working Group Reports"

REPORT NO: NASA Goddard Space Flight Center

DATE: 31 July - 4 August 1972

AUTHOR(S): R. W. Johnson and L. Meredith

SUBJECT: Proposed space science programs for the 1980 time period using the Space Shuttle for both integrated and deployed payloads.

BASIS FOR INFORMATION: Committee of representatives from various NASA centers to evaluate space-based research programs and recommend instruments to accomplish these.

STATUS OF INFORMATION: Current, document represents active planning program for space research in wide range of scientific disciplines.

COVERAGE OR CONTENT: Recommends comprehensive research programs in 15 areas of science and technology covering most areas of space science. Based on prior studies and funded programs as well as new programs.

COMMENTS:
One of the most comprehensive studies undertaken by NASA in terms of disciplines covered, however only NASA personnel involved in study.

APPLICABLE TO DATA REQUIREMENT: All Pre-Phase A.

REFERENCE EBM-8

TITLE: Summarized NASA Payload Descriptions, Automated Payloads

REPORT NO: NASA/MSFC - Preliminary

DATE: July 1974

AUTHOR(S): R. Bradford

SUBJECT: Automated payloads for Shuttle sortie operations through 1991. Includes physics, astronomy, earth observations, life sciences and technology.

BASIS FOR INFORMATION: Summary of payload data developed by several committees convened by NASA during recent years for space-based scientific and technology programs using the Shuttle.

STATUS OF INFORMATION: Preliminary. Further refinements are being made by Program Development Office at MSFC.

COVERAGE OR CONTENT: Detailed information on payloads in 12 areas of science and technology which identifies physical, operational, data management, stability, etc. requirements of payloads. Constraints and operations of Shuttle also specified.

COMMENTS: Most current payload planning document for automated scientific and technical programs and operation from Shuttle.

APPLICABLE TO DATA REQUIREMENT: All Pre-Phase A requirements

REFERENCE EBM-9

TITLE: Summarized NASA Payload Descriptions, Sortie Payloads
REPORT NO: NASA/MSFC - Preliminary
DATE: July 1974
AUTHOR(S): H. Craft

SUBJECT: Spacelab payloads for Shuttle sortie operations through 1991. Includes scientific and technology payloads.

BASIS FOR INFORMATION: Summary of payload data developed by several committees convened by NASA during recent years for space-based scientific and technology programs using the Shuttle.

STATUS OF INFORMATION: Preliminary. Further refinements are being made by Program Development Office at MSFC.

COVERAGE OR CONTENT: Detailed information on payloads in 12 areas of science and technology which identifies physical, operational, data management, stability, etc. requirements of payloads. Constraints and operations of Shuttle also specified.

COMMENTS: Most current payload planning document for sortie payloads using Spacelab for scientific and technical programs on Shuttle.

APPLICABLE TO DATA REQUIREMENT: All Pre-Phase A requirements

REFERENCE EBM-10

TITLE: Payload Descriptions, Volume II, Sortie Payloads

REPORT NO: NASA/MSFC - Preliminary

DATE: July 1974

AUTHOR(S): H. Craft

SUBJECT: Engineering descriptions of Spacelab payloads described in EBM-9

BASIS FOR INFORMATION: Summary of data developed by several committees convened by NASA during recent years to recommend scientific and technical payloads for Spacelab. Includes conferences with individual committees.

STATUS OF INFORMATION: Preliminary. Further refinements are being made by Program Development Office at MSFC.

COVERAGE OR CONTENT: Engineering details of scientific and technical payloads recommended in EBM-9. Gives extensive data on payloads but does not identify areas of required technology development before certain payloads can be specified and manufactured.

COMMENTS: Most current planning document attempting to give engineering details of proposed payloads for Spacelab operations.

APPLICABLE TO DATA REQUIREMENT: Pre-Phase A requirements.

REFERENCE EBM-11

TITLE: Spacelab Payload Accommodation Handbook (Preliminary)

REPORT NO:

DATE: May 1975

AUTHOR(S): T. J. Lee, NASA/MSFC and H. Stoewer, ESRO

SUBJECT: Characteristics and capabilities of the Spacelab system for payload planning

BASIS FOR INFORMATION: Baseline information for payload planning provided by NASA/ESRO for Spacelab

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: General and detailed information on capabilities and characteristics of the Shuttle/Spacelab for payload planning. Most of required information for planning is included but about 10% of data in category to be decided.

COMMENTS: Valuable for Phase A and Phase B payload planning.

APPLICABLE TO DATA REQUIREMENT: Phase A 1.1: 2, 6 (a), (b), 7; 1.2: 1 (a), (b), (c), 2 (c), (h); 3 (a), (b); 1.3: 4 (a), (b), 11, 12; 5.0: 3, 4(a), (c), 7 (a), (b), 8 (a), (b), 9 (a), (b), (c), 10 (b), (c), (d), (e), 11, 12 (a), (b), 13 (b), 15 (a), (b) (c), (d), (e), (f), 17 (b), 18 (a), (c), (d), 26 (a), (b), (c), (d), (e), (f), (g), (h), (i), 28 (a), (b), 31 (a), (b), 32 (a), (b), 33 (c); 8.0: 3 (a), (c), (e), (f). Phase B 5.0: 3, 7 (b), 8 (a), (b), 9 (a), (b), (c), 10 (b), (c), (d), (e), 11, 12 (a), (b), (c), 13 (b), 15 (a), (b), (c), (d), (e), 18 (a), (c), (d), 26 (a), (b), (c), (d), (e), (f), (g), (h), (i), 28 (a), (b), 31 (a), (b), 32 (a), (b).

REFERENCE EP-1

TITLE: Vandenberg Launch Processing System, Station Set V84 Requirements Document, Book III, Part I,

REPORT NO:

DATE: Undated

AUTHOR(S):

SUBJECT: Vandenberg launch processing system (VLPS) requirements (in candidate form) and commonality of requirements with KSC.

BASIS FOR INFORMATION: NASA/KSC, DOD/VAFB LPS Subpanel agreements.

STATUS OF INFORMATION: Draft of candidate specifications

COVERAGE OR CONTENT: Level III VLPS requirements for data processing and data management system.

COMMENTS: Applicability to payloads not discussed in report, e.g., payload checkout software, payload servicing hardware. Need payload user's manual for LPS; need cost to user of LPS.

APPLICABLE TO DATA REQUIREMENT: None, not currently usable for payloads.

REFERENCE EP-2

TITLE: Space Shuttle System DOD Reference Missions, Mission 2

REPORT NO: TOR-0075(5421-04)-2

DATE: 8 July 1974

AUTHOR(S): J. D. Lucero, The Aerospace Corporation

SUBJECT:

BASIS FOR INFORMATION: 150,000-lb orbiter, 142.3-inch SRM boosters.

STATUS OF INFORMATION: Revisions to include abort and reentry.

COVERAGE OR CONTENT: Trajectory simulation, vehicle definition and data package, mission design (ascent, orbital maneuvers, rendezvous and docking, deorbit through reentry).

COMMENTS: Deploy payload into 140 x 600 nmi orbit, retrieve from 136 x 600 nmi another payload, 96° inclination.

APPLICABLE TO DATA REQUIREMENT: U. S. Government agencies only, unclassified.

Section of reference applicable to Matrix items 4.b, 19, 20, 32. (Similar to EOS operational missions.)

REFERENCE EP-3

TITLE: Payload Questionnaire

REPORT NO:

DATE:

AUTHOR(S):

SUBJECT: Launch vehicle (Titan III) questionnaire to be completed by payload contractor to initiate definition period.

BASIS FOR INFORMATION: Titan III launch vehicle program

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Mission requirements, payload characteristics, AVE requirements (mechanical, electrical), AGE/facility requirements (mechanical, electrical), test operations.

COMMENTS:

APPLICABLE TO DATA REQUIREMENTS: (8.0/3a) pre-flight information from payload projects, payload design/analysis documents, payload drawing, general description and interface requirements applicable to Phase B.

REFERENCE EP-4

TITLE: Current Space Shuttle System Payload Accommodations and Interfaces

REPORT NO: SSV74-30

DATE: 17 July 1974

AUTHOR(S): Rockwell International, Space Division, System Integration Space Shuttle Program

SUBJECT: Current payload accommodations and interface descriptions and plans.

SCOPE: Delta passengers, delta equipment, delta ECLS, software, delta RCS, structure (payload bay), power distribution and control panels, docking module, delta EPS, disconnect panel and lines, delta OMS, vent lines, candidate payloads.

BASIS FOR INFORMATION: Rockwell International work under Contract NAS9-14000

STATUS OF INFORMATION: Current, July 1974

COVERAGE OR CONTENT: Shuttle system overview and capabilities, payload accommodations and interface descriptions (structures, mechanical, OMS ΔV kits, avionics, environments, service panels, ground operations), integration of specific payloads (pallet, Spacelab plus pallet EOS, LST, Tug ATS, EOS, Navy payload, cryo Tug, Mariner Jupiter).

COMMENTS: Should be helpful in conceptual payload activities (Phase A, Pre-Phase A). Briefing is broken down into sections by subtitle. Subtitles generally correspond to user data requirements items.

APPLICABLE TO DATA REQUIREMENT: (2.1/5) (4.1/5) (5.0/7) Shuttle payload attachments and structural support provisions; (5.0/8) Shuttle power; (5.0/10 d, e) Shuttle data handling, etc., rates, capacity, (5.0/15) Shuttle environments, (5.0/16) Shuttle contaminants, (5.0/25) payload lighting, (5.0/28) orbiter physical constraints.

REFERENCE EP-5

TITLE: DOD Space Transportation System (STS) Payload Interface Study.

REPORT NO.: SAMSO-TR-73-280-Vol. I, Vol. II.

DATE: October 1973.

AUTHOR(S): Bruce Garlich (MDAC), R. D. Heitchue (MDAC), P. E. Romo (TRW).

SUBJECT: Interface Requirements and Concepts (DSCS-II, DSP, Fltsatcom) Delivery and Retrieval Considered.

BASIS FOR INFORMATION: MDAC Study Funded by SAMSO on Transitioning Payloads from Expendable Launch Vehicles to STS. (Shuttle and Fully Reusable Tug).

STATUS OF INFORMATION: Initial Study Complete, Follow-On Study Report Not Issued.

COVERAGE OR CONTENT: Payload/STS Interface Concepts, Integration Eqt., Shuttle Opr., Commonality, Transition Costs, Integrated Operations, Interface Analysis (Thermal, Dynamic, Structural/Mechanical, Safety, Aironics/Electrical, Contamination, Acoustics).

COMMENTS: Compatibility with STS can be achieved with Minimum Mod. Therefore Costs are Low ($2M to $5M).
Used Low Capability Tug, Retrieval of Flt. Sat. Com. Questionable,
Dual Payload Launch Recommended for Study. Common Interface Equipment Recommended for Study.

APPLICABLE TO DATA REQUIREMENT: Matrix 6.0 Item 3 (6.0/3) Payload Adapters, (6.0/4) Payload Structural Support, (6.0/8) Upper Stage Attitude and Navigation, (6.0/10) Loads, (6.0/14) Stage Maneuvers and Orientation, (6.0/16) Payload Retrieval, (6.0/25) Payload Docking, (5.0/16d) Contamination Control, (8.0/3b) Hazard Analysis. Data and information in this reference is judged to be useful for Pre-Phase A and Phase A studies, if updated. The data is scattered throughout Volume I but generally organized into sections corresponding to "data requirements" in Volume II.

REFERENCE EP-6

TITLE: The Mission Type/Phase Concept for Shuttle Mission Planning and Standardization

REPORT NO: JSC-08420, JSC Internal Note No. 73-FM-126

DATE: 26 August 1973

AUTHOR(S): Allan L. DuPont, Jerome A. Bell of JSC; William Lee of TRW Systems

SUBJECT: Definition of a standardization scheme for generating mission planning information and disseminating it among users.

BASIS FOR INFORMATION: Apollo experience

STATUS OF INFORMATION: Data and information labeled "possible," refer to updating and future documents.

COVERAGE OR CONTENT: Four standard mission types (attached, deployment, service, retrieval), eight standard mission phases (Pre-launch, launch abort, on-orbit procedures, maneuvers, rendezvous, orbiter/payload procedures, deorbit/entry/landing phase).

COMMENTS: Conceptual scheme standardizes terminology and mission sequencing.

APPLICABLE TO DATA REQUIREMENT: Mission Analysis.

REFERENCE EP-7

TITLE:	Space Shuttle System Baseline Reference Missions, Volume II, Mission 2, Revision 1
REPORT NO:	JSC-07896, Vol. II, Rev. 1; JSC Internal Note 73-FM-47
DATE:	29 May 1974
AUTHOR(S):	MPAD Staff
SUBJECT:	Satellite service and sortie mission
BASIS FOR INFORMATION:	150,000 orbiter (dry)
STATUS OF INFORMATION:	Final
COVERAGE OR CONTENT:	Ascent, rendezvous, servicing, undocking, sortie experiments, deorbit, entry landing, crew schedule, STDN locations, coverage, physical and thrust characteristics, trajectory parameters, plots, life.
COMMENTS:	Seven day mission, five day sortie activities, 55° orbit, 36,800 lb payload.
APPLICABLE TO DATE REQUIREMENT:	Performance inputs, dispersion, errors, trajectory data, trajectory input data.

REFERENCE EP-8

TITLE: Initial Configuration Control OMS and RCS Propellant Budgets for Orbiter Missions

REPORT NO:

DATE:

AUTHOR(S):

SUBJECT:

BASIS FOR INFORMATION: Preliminary

STATUS OF INFORMATION:

COVERAGE OR CONTENT: Propellant requirements for baseline reference missions (OMS and RCS), dispersions contingencies.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Mission Analysis.

REFERENCE EP-9

TITLE: Nominal Return-to-Launch Site (RTLS) Abort Trajectories for Mission 3A (Configuration 5-MCR R2)

REPORT NO: Internal Letter No. 393-100-74-037

DATE: 20 May 1974

AUTHOR(S): B. C. Johnson/J. D. Moote, Rockwell International, Space Division

SUBJECT:

BASIS FOR INFORMATION: References

STATUS OF INFORMATION:

COVERAGE OR CONTENT: Mission 3A nominal RTLS abort trajectory data (WTR) data, plots.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Abort

REFERENCE EP-10

TITLE: Mission 3A Trajectory, AOA Abort to EAFB, 7-30-74, NAH Division T, Ferrnell, 41086029-73 (also see TN 15303.9, 3A AOA to Edwards)

REPORT NO:

DATE:

AUTHOR(S):

SUBJECT: Trajectory No. 15303.9, Mission 3A AOA

BASIS FOR INFORMATION:

STATUS OF INFORMATION:

COVERAGE OR CONTENT: Reentry trajectory plots to 2100 sec., 6100 nmi.

COMMENTS: Weight 191,460 lbs, attitude 400,000 ft, WTR, inclination 104.06^{o} azimuth (I) = 342.07.

APPLICABLE TO DATA REQUIREMENT: Abort

REFERENCE EP-11

TITLE: Navy Payload/Shuttle Integration Study

REPORT NO: N.R.S.D. Internal Letter No. SS-74/016

DATE: 31 January 1974

AUTHOR(S): W. G. Lanstrom

SUBJECT: Preliminary study of the compatibility of a planned Navy payload/mission for the Shuttle (for NSSA/SAMSO).

BASIS FOR INFORMATION: Conceptual payload data (SOSS payload) references, payload/ Shuttle interface established by discussion, Mission 3A abort case, MECO, throw weight performance + OMS capability, no references for OMS delta V (required) analyses, budget analysis, 150,000 lb orbiter.

STATUS OF INFORMATION: Preliminary integration

COVERAGE OR CONTENT: Payload installation in orbiter, pre-launch ground operations, payload support during ascent, deployment (and checkout) sequence, retrieval sequence, post-landing ground operations, payload relation, preliminary mission analysis, OMS kit weights, direct ascent/direct descent.

COMMENTS: Shuttle mass properties derived from December 1973 "Space Shuttle Mass Properties Status Report," SD 72-SH-0120-15 or orbiter PDR data. Mission peculiar requirements discussed, factors constraining performance. Replacement mission, 84^{o} or 96^{o} inclinations, 150 x 600 nmi orbit, 10,400 lb payload launch, 8,000 lb payload retrieval.

APPLICABLE TO DATA REQUIREMENT: Abort data, mission analysis data, orbiter throw weight performance.

REFERENCE EP-12

TITLE: Vehicle Management and Mission Planning System (Phase IB) Users Document, Volume I, Batch Loader Program (BLP)

REPORT NO: JSC-08567

DATE: 14 December 1973

AUTHOR(S): Jack Williams, Lockheed Electronics

SUBJECT: Description (for BLP user) of data preparation for input to VMMPS

BASIS FOR INFORMATION:

STATUS OF INFORMATION:

COVERAGE OR CONTENT: VMMPS data base (eight files) + mission model files

COMMENTS:

APPLICABLE TO DATA REQUIREMENT:

REFERENCE EP-13

TITLE:	Earth Orbit Shuttle Scheduling Constraints
REPORT NO:	MSC-07692, MSC Internal Note No. 73-FM-9
DATE:	31 January 1973
AUTHOR(S):	Michael E. Ponaker

SUBJECT: Constraints to be used in developing the flight scheduling subsystem of the VMMPS bench program.

BASIS FOR INFORMATION: 1972 reports

STATUS OF INFORMATION: Out of date

COVERAGE OR CONTENT: Lists of constraints including payload constraints and brief discussions of some. List of references.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Constraints (if updated).

REFERENCE EP-14

TITLE: DOD Payload Interface Assessment Briefing, Part 1

REPORT NO: SD 74-SH-0332

DATE: 20 December 1974

AUTHOR(S): H. Kaysen, et al, Rockwell International, Space Division

SUBJECT: R.I. Initial Assessment of DOD Payload Interface Compatibilities with Shuttle System

BASIS FOR INFORMATION: Current R.I. data, Vol. XIV, Rev. C, MDAC Study of DOD Payloads, DSCS-II/Transtage, DSP/Transtage, Fleetsatcom/Centaur Payloads. Study based on Shuttle Payload Requirements Currently Accepted (not those under study).

COVERAGE OR CONTENT: Payload Installation, Environment Compatibility, Safety, Avionics Requirements/Compatibility, Recommendations. Structural/Mechanical Interfaces, Electrical Wire Runs and Disconnects, RTG Cooling Kit and Payload Shrouds, Satellite Deployment, Acoustic Environment, Orbiter Contamination Sources, On-Orbit Thermal Control (Shuttle Compatibility), Safety Assessment, Caution and Warning, Orbital Readiness Test, Software and Electrical Requirements.

COMMENTS: Useful "current" information. Multiple Payloads Between Programs not Considered a la DOD Ground Rule.

APPLICABLE TO DATA REQUIREMENT: Through Phase A

(2.1.5a, 2.1.7c, 5.0.8, 5.0.10a, e, 5.0.11, 5.0.12b, 5.0.14, 5.0.16, 5.0.17a, 5.0.19 b, c.

REFERENCE EP-15

TITLE: Second Progress Review, Multi-Use Mission Support Equipment (MMSE)

REPORT NO:

DATE: December 1974

AUTHOR(S): William Pratt et al, Martin Marietta

SUBJECT: MMSE Study Review

BASIS FOR INFORMATION: SSPD payload data, JSC 07700, Vol. XIV, Revision C data, 5 September 1974 Early Shuttle Mission Plan, reference information on IUS/Satellite interfaces, July 1974. Spacelab Payload Accommodations Handbook, October 1974

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Avionics (Power, Pointing, Communications, Data Management, Monitor and Control, Electrical Cabling); Structural and Mechanical (Adapters, pallets, tilt tables, booms, deployment mechanisms, fluids); Environmental, (RTG coding, unit, shrouds, purge system, contamination monitor and control); Logistics and Operations

COMMENTS: Emphasizing first two years of STS operation in which only Spacelab, LDEF, and EOS are designed for the STS (and possibly 20 then). The applicability of the data to the STS User Plan is minimin and no cost data yet. The adapter, pallet, and tilt table data may eventually be useful in 2.1.5 a and 5.0.6. Avionics may eventually be useful in 5.0.8 a, 6.0.5. Shroud data may eventually be useful in 5.0.16 d. Data in briefing is sketchy, concepts preliminary and subject to improvement.

APPLICABLE TO DATA REQUIREMENT: Need final report to determine

REFERENCE EP-16

TITLE: Payload Descriptions, Vol. I, Automated Payloads, Vol. II, Shuttle Sortie Payloads, Level B Data

REPORT NO: MSFC Preliminary Data

DATE: July 1974

REFERENCE FOR QUESTIONS: Attention Rodney Bradford, PS02, MSFC

SUBJECT: Space Shuttle Payload Descriptions Data (SSPD)

BASIS FOR INFORMATION: Payloads identified by Space Shuttle Payload Planning Working Groups (Reported, May 1973) and National Academy of Sciences Summer Studies of July 1973.

STATUS OF INFORMATION:

COVERAGE OR CONTENT: Payload Data Sheets(21) on 49 NASA and non-NASA, non-DOD Payloads. Also Instructions and Explanations for Data Sheets.

COMMENTS: Some data classified "official use only". Data supercedes October 1973 data. There are only a few new payloads for the STS in the list (Large Telescope, Extended X-Ray Survey, Small High Energy Satellite, LDEF, Sortie) and a few more payloads transitioning but designed for STS (EOS, Tiros-O, Environmental Monitoring Satellite).

APPLICABLE TO DATA REQUIREMENT: Not applicable. These are individual payload data intended for use in setting up interface information from the payload side, requirements and capture analyses.

REFERENCE EP-17

TITLE: Safety Policy and Requirements for Payloads Using the National Space Transportation System

REPORT NO:

DATE: July 1974 (Revised February 1975)

AUTHOR(S): Payload Safety Steering Group (Ad Hoc), NASA Headquarters, Code MQ

SUBJECT: Programmatic and technical safety requirements applicable to all STS payloads during ground operations and during flight operations.

BASIS FOR INFORMATION: Ad Hoc NASA Study Group, now being reviewed for concurrence.

STATUS OF INFORMATION: Concurrence draft (resulting from coordination).

COVERAGE OR CONTENT: Hazard analysis, hazard classification levels, hazard reduction and hazard control, safety assessment reviews, safety compliance data packages, accident/incident/mission failure investigation and reports, radioactive systems, design and operational requirements.

COMMENTS: Cover memo states that "mission success" requirements (i.e., reliability and quality) are not part of the document. These are being left to the discretion of the payload developer.

APPLICABLE TO DATA REQUIREMENT: 2.1.6.b; 4.1.6.b; 5.0.19.a, c; 6.0.12.a; 8.0.3.b; 8.0.5 (Phase B)

REFERENCE EP-18

TITLE: Deep Space Network (DSN) Standard Practice, Deep Space Network/ Flight Project Interface Design Handbook

REPORT NO: JPL 810-5, Revision C

DATE: 15 April 1972

AUTHOR(S):

SUBJECT: DSN Interfaces

BASIS FOR INFORMATION:

STATUS OF INFORMATION:

COVERAGE OR CONTENT: Telecommunications interfaces, simulation interfaces, ground communications interfaces, network control interfaces.

COMMENTS: Supports deep space projects

APPLICABLE TO DATA REQUIREMENT: None known for Shuttle users other than escape payloads.

REFERENCE EP-19

TITLE: Space Shuttle Program, Flight Operations, Level II Program Definition and Requirements Volume VIII

REPORT NO: JSC 0700 Vol. VIII

DATE: 14 March 1975

AUTHOR(S): None Listed

SUBJECT:

1. Shuttle development flight operations, approach and landing flight test, orbital flight test
2. Concepts, assumptions, and requirements during the DDT&E phase

BASIS FOR INFORMATION: Level II requirements and plans

STATUS OF INFORMATION: Baseline issue of document

COVERAGE OR CONTENT: Responsibility, management, mission operations, orbital flight test operations, STS flight operations (to be added at a later date)

COMMENTS:

1. Shuttle training aircraft and crew training simulators are listed and described, as well as the training itself
2. Flight design planning (trajectory analysis), flight planning, flight procedures and flight operations are described for the orbital flight test
3. Boards and panels for flight operations are described
4. Discussion of spacecraft and payloads in areas of data transmission (4.2.6.2.2); MCC coordination of payload operations (4.2.4.3).

APPLICABLE TO DATA REQUIREMENT: 5.0 1.a[1]; 5.0.10 d (transmission only)[1]

(1) Development period only.

REFERENCE EP-20

TITLE: Narrative Technical Description of Current Dynamic Test and Isolation Practices

REPORT NO:

DATE: October 1974 (Revised January 1975)

AUTHOR(S): P. F. Spas (Task Monitor) and Meeting Attendees and Contributors (MDAC, Western Division, Huntington Beach, California)

SUBJECT: Synopsis of dynamic test practices and isolation techniques currently employed on commercial, NASA, and military space systems.

BASIS FOR INFORMATION: MDAC, Task 508 of NASA Contract NAS-1-12436, Survey of 10 different spacecraft manufacturers, designers, and system engineers. Current practices relating to both new and mature spacecraft designs.

STATUS OF INFORMATION: Unknown, however report appears to be a comprehensive compilation.

CONTENTS: Different approaches in the areas of dynamic loads and criteria, dynamic test philosophies, dynamic simulation techniques, Shuttle payload dynamic test meeting information and results.

COMMENTS:

APPLICABLE TO DATA REQUIREMENTS: Section 5.0, Phase B, Dev. & Ops., Transition

REFERENCE EP-21

TITLE: Tracking and Data Relay Satellite System (TDRSS) Users Guide

REPORT NO: Goddard Space Flight Center (GSFC), X-805-74-176, Revision 1

DATE: September 1974

AUTHOR(S): Not Listed on Document

SUBJECT: Potential TDRSS users introduction to TDRSS

BASIS FOR INFORMATION: Definition phase TDRSS study, minimum level of service to be offered.

STATUS OF INFORMATION: The document describes planned TDRSS

COVERAGE OR CONTENT: Contact (TDRSS Project Office, Code 805, GSFC), changes from 10 June 1974 guide, concept, characteristics, post 1979 STDN, TDRSS support capabilities, orbital coverage, user acquisition procedures, user spacecraft capabilities. Appendicies cover: link calculation, combined TDRSS and STDN coverage, user benefits, user support modes, user terminals, frequency plan, signal acquisition.

COMMENTS: Describes multiple access service(telemetry to 50 kbs), single access service (S-band to 6 mbps) (and Ku-band to 300 mbps). TDRSS plan: fully operational by date 1979. TDRSS for low altitude spacecraft, STDN for synchronous spacecraft (1976). No discussion of proprietary data or secure links, user charges, data processing, data storage.

APPLICABLE TO DATA REQUIREMENT: Matrix 7.0, Data Requirements for Items 4 (STDN) and 6 (TDRSS) partially covered for Phases B, Dev., Ops. and Transition, covered for Pre-Phase A, Phase A.

REFERENCE EP-22

TITLE: Network Integration Study

REPORT NO. GSFC Report STDN No. 809, Parts A, B

DATE: June 1972

AUTHOR(S): Not Listed

SUBJFCT: Study of Combinations of MSFN - STADAN Networks

BASIS FOR INFORMATION: Network Study

STATUS OF INFORMATION: Study Complete

COVERAGE OR CONTENT: Study results, mission models, NASCOM facilities, network capability definitions (equipments), cost analysis

COMMENTS: Some data useful to user if coupled with updated information on sites currently available (or planned for future) use; e.g., equipment capabilities and facilities. No apparent consideration given to impact of TDRSS.

APPLICABLE TO DATA REQUIREMENT: 7.0.4 STDN Ground Terminals (partial coverage for all payload project phases)

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REFERENCE EP-23

TITLE: STDN Users Guide, Revision 2

REPORT NO.: GSFC Report STDN No. 101.1

DATE: May 1974

AUTHOR(S): J. N. Scott, Requirements and Plans Office

SUBJECT: Summary description of network resources and capabilities of STDN

BASIS FOR INFORMATION: Installed equipment and facilities + GSFC future plans

STATUS OF INFORMATION: Periodically updated.

COVERAGE OR CONTENT: STDN, network system description, procedures for obtaining use of STDN. Unified S-Band, Goddard Range and Range Rate System C-Band Radar, Tracking, Telemetry, Command Capability, Remote Site Computers, NASA Communications Network, Timing Systems, TDRSS/User Link Calculations.

COMMENTS: Describes planned reduction in ground stations.

APPLICABLE TO DATA REQUIREMENT: 7.0.4., Phase A, B, C/D (Development)

REFERENCE F-1

TITLE: DOD Space Shuttle System Summary

REPORT NO: None

DATE: 1 August 1974, updated 4 December 1974

AUTHOR(S): Report is compiled and maintained by Reusable Launch Vehicles System Program Office (SAMSC/LVRE), with Capt. Paul H. Kruppenbacher editing the 1 August issue and the update.

SUBJECT: Report summarizes the characteristics of the Space Transportation System with emphasis on DOD aspects.

BASIS FOR INFORMATION: Report is a compilation of annotated briefing charts prepared with the assistance of Rockwell International/Space Division and the Aerospace Corporation.

STATUS OF INFORMATION: Current as of 4 December 1974 but made partly obsolete by subsequent STS development; planned to be updated to include Orbiter 102 Preliminary Design Review data in Spring, '75; not an official Air Force publication.

COVERAGE OR CONTENT: General description of Space Transportation System, its capabilities, development milestones, and elements of operations and support systems.

COMMENTS: Good document for an overall view of the Space Transportation System; doesn't provide a great deal of depth; the same material, including identical figures, can be found in other documents.

APPLICABLE TO DATA REQUIREMENT: See attached sheet.

F-1
Continued

APPLICABLE TO DATA REQUIREMENT:

2.1.1	Shuttle Picture and General Flow
2.1.6.j	Nominal Operational Constraints, Launch Azimuth
4.1.1	Shuttle Picture and General Flow
4.1.6.j	Nominal Operational Constraints, Launch Azimuth
5.3	Shuttle Performance Maps
5.4.a, c	Flight Plans and Mission Analysis Data; Generalized Mission Analysis Data, Flight Parameters
5.7.b	Shuttle Payload Attachments and Structural Support Provisions. Flight Loads Accepted
5.8	Shuttle Power
5.9	Remote Manipulator
5.10.a, d, e	Shuttle Data Handling, Transmission and Recording; Equipment and Stations, Rates, Capacity
5.11	Orbiter - Supplied Cooling
5.12.b	Additional Payload Services Furnished by Orbiter, Venting and Draining
5.14.a, b	Shuttle Service Panels; Electrical, Fluid
5.15	Shuttle Environment
5.16.d	Shuttle Contamination and Sources, Contamination Control
5.19.d	Safety, Range Safety
5.27	Sequence of Events, Orbiter Attitude and Timelines
5.28	Orbiter Physical Constraints
5.30	Abort Sequences
5.32.a	Mission Specialist Function, General Description

All of these are given top-level treatment only.

REFERENCE F-2

TITLE: DOD Payload Interface Assessment Briefing, Part 1

REPORT NO: Rockwell International, Space Division, SD 74-SH-0332

DATE: 20 December 1974

AUTHOR(S): None named

SUBJECT: Rockwell International's initial assessment of DOD payload interface compatibilities with the Shuttle system. Three DOD payloads involved: DSCS II, DSP, and FLTSATCOM.

BASIS FOR INFORMATION: Rockwell International's review of SAMSO TR-74-198 final report, "DOD Space Transportation System (STS) Payload Interface Study FY 74 Extension," prepared for SAMSO by MDAC and TRW during October 1974.

STATUS OF INFORMATION: Briefing to assist SAMSO in preparation for Orbiter 102 Preliminary Design Review; no plans to update.

COVERAGE OR CONTENT: Payload installation, environment compatibility, safety, avionics requirements/ compatibility.

COMMENTS: Reference is source for limited Shuttle design information as it regards payload interfaces and accommodations circa December 1974. Care must be exercised to separate out current design data from Rockwell International recommendations.

APPLICABLE TO DATA REQUIREMENT: See attached sheet.

APPLICABLE TO DATA REQUIREMENT:

2.1.3	Cargo Bay Ground Environment
2.1.7.e	Payload Services Furnished by Orbiter or Orbiter Facilities, Payload Cooling
4.1.3	Cargo Bay Ground Environment
4.1.7.e	Payload Services Furnished by Orbiter or Orbiter Facilities, Payload Cooling
5.8	Shuttle Power
5.10.a, d, e	Shuttle Data Handling, Transmission and Recording, Equipment and Stations, Rates, Capacity
5.1.	Orbiter - Supplied Cooling
5.12.a	Additional Payload Services Furnished by Orbiter, Payload Monitoring
5.15.b, e, f	Shuttle Environments; Thermal, Pressure, Ambient Gas
5.16.b, d	Shuttle Contamination and Sources; Contaminants, Contamination Control
5.17.a	EMC/EMI; Grounding, Shielding, etc.
5.19.c	Safety, Criteria and Factors

All of these are given top-level treatment only.

REFERENCE F-3

TITLE: Shuttle Operational Data Book, Volume 1, Shuttle Systems Performance and Constraints Data

REPORT NO. JSC-08934 (Vol. 1)

DATE: June 1974 (and updated through 1-1-75)

AUTHOR(S): None named

SUBJECT: Shuttle operational performance capabilities and limitations.

BASIS FOR INFORMATION: Highest level of data available at time of each update; i.e., specification, estimation, studies, analyses, simulations, ground tests, flight tests, and flight operations.

STATUS OF INFORMATION: Highest level available in each respective area.

COVERAGE OR CONTENT: Shuttle operational performance capabilities and limitations - a complete vehicle description is apparently intended, plus appendixes covering individual Orbiters and whatever unique characteristics they might have; presently incomplete.

COMMENTS: It is stated on page 1-1 of this report that ". . . the SODB shall be used as the standard operational data base for all mission design and planning, simulations, studies, and analyses." This report appears to have an important place in NASA's Shuttle documentation. However, the document as updated through 1-1-75 appears to have little depth in any area. It is vehicle-oriented rather than payload-oriented and of minimal use to payloads.

APPLICABLE TO DATA REQUIREMENT: None

REFERENCE F-4

TITLE: User Pricing Policy Steering Group

REPORT NO: None, is unnumbered NASA memorandum

DATE: 3 September 1974

AUTHOR(S): Philip E. Culbertson

SUBJECT: Allocating charges among users who share an STS flight, determination of basic STS user charging policy.

BASIS FOR INFORMATION: Historical cost data for Delta and Atlas Centaur expendable launch vehicles, assumed Shuttle mission bases and estimated costs (360, 439, and 725 KSC launches)

STATUS OF INFORMATION: Obsolete. Memo says that it is an objective to produce a preliminary user pricing policy by the end of 1974. The latter, or a possible update, should be a better source of data.

COVERAGE OR CONTENT: Review of "which costs must be recovered by Shuttle charges," potential influence of Shuttle charges on the growth of commercial use of space, basic elements of an STS user charging policy, organization and tasks for generating a preliminary STS user charge policy.

COMMENTS: This memorandum is an interesting view of early NASA efforts to decide upon STS user charges. Its information is preliminary and obsolete, but it suggests that follow-on documentation, possibly already available, may be useful.

APPLICABLE TO DATA REQUIREMENT: 5.29, User Costs (This particular document contains no useful material, but follow-on documents may.)

REFERENCE F-5

TITLE: Requirements/Definition Document, Crew Station and Equipment, Book 7

REPORT NO: Rockwell International, Space Division, SD 72-SH-0107

DATE: 31 January 1974

AUTHOR(S): None identified; document approved by E. P. Smith, Chief Program Engineer, Space Shuttle Program

SUBJECT: Definition of requirements for the Shuttle crew station and equipment (crew compartment, interior cabin, and all other areas with which a crewman interfaces or may potentially interface); crew includes Commander, Pilot, Mission Specialist, and Payload Specialist.

BASIS FOR INFORMATION: Planning information valid at publication date

STATUS OF INFORMATION: This is an internally controlled Rockwell International document that is more than one year old. It is now obsolete. An update should be used.

COVERAGE OR CONTENT: See attached copy of contents page.

COMMENTS: This document is obsolete and deals primarily with the layout and operation of crew station components and equipment rather than functions during payload-related operations. Nevertheless, an up-to-date version can be of interest in the later stages of payload mission planning.

APPLICABLE TO DATA REQUIREMENT: None (but see comments above)

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Attachment

BOOK 7

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REFERENCE F-6

TITLE: Orbiter Contamination Sources Review

REPORT NO: None, is a briefing by Rockwell International, Space Division

DATE: 6 November 1974

AUTHOR(S): None given

SUBJECT: Contamination produced by Shuttle subsystems

BASIS FOR INFORMATION: Current Shuttle subsystem designs, design (leakage) criteria

STATUS OF INFORMATION: Briefing presented at 6th meeting of Particles and Gases Working Group, 6 November 1974, joint meeting with Payload Contamination Requirements Definition Group

COVERAGE OR CONTENT: Orbiter water dump nozzle locations and dump effects, fuel cell purges, payload bay liner study, vent system, payload bay purge system, vertical drain lines, RCS plumes, fluid subsystems external leakages.

COMMENTS: Document is adequate as primer on Shuttle contamination sources, design criteria, and, to limited extent, contamination control. Does not cover contamination by payload. Purge system description obsolete.

APPLICABLE TO DATA REQUIREMENT: 2.1.3, Cargo Bay Ground Environment (Contamination)
4.1.3, Cargo Bay Ground Environment (Contamination)
5.15.f, Shuttle Environments, Ambient Gas
5.16, Shuttle Contamination and Sources

REFERENCE F-7

TITLE: Space Shuttle System Summary

REPORT NO: None, is a briefing by Rockwell International, Space Division

DATE: August 1974

AUTHOR(S): None given

SUBJECT: Major aspects of the Space Shuttle system

BASIS FOR INFORMATION: State of system design at time of document preparation.

STATUS OF INFORMATION: Current as of August 1974, now partly obsolete and becoming more so as time passes; RI may prepare a sequel, but no formal schedule for such exists.

COVERAGE OR CONTENT: Shuttle missions and capability, Shuttle vehicle (including typical flight profiles, ground turnaround, and vehicle description), details of Orbiter and its subsystems, payload accommodations.

COMMENTS: Document gives top-level view of Space Shuttle system as of August 1974. Is almost same as "DOD Shuttle System Summary," dated 1 August 1974, having been prepared using many of the same viewgraphs and viewgraph annotations.

APPLICABLE TO DATA REQUIREMENT: See attached sheet

APPLICABLE TO DATA REQUIREMENT:

4.1.4	Launch Constraints, Range Safety
5.3	Shuttle Performance Map
5.4.a	Generalized Mission Analysis Data
5.7	Shuttle Payload Attachments and Structural Support Provisions
5.8	Shuttle Power
5.9.a, b	Remote Manipulator Functions, Limitations
5.10.a, d, e	Shuttle Data Handling, Transmission, and Recording; Equipment and Stations, Rates, Capacity
5.11	Orbiter - Supplied Cooling
5.13.b, d	Shuttle Attitude and Navigation, Normal Pointing Accuracy; Provisions for Accuracies Exceeding Normal
5.14.a, b	Shuttle Service Panels; Electrical and Fluid
5.15	Shuttle Environments
5.16	Shuttle Contamination and Sources
5.18.a	Loads, Nominal Limit Load Factors
5.28	Orbiter Physical Constraints
5.31	Payload Specialist Function
5.32	Mission Specialist Function

All of these are given top-level treatment only.

REFERENCE F-8

TITLE: Orbiter 102 PDR, Payload Accommodations and Interfaces, Team 15, Payload Integration

REPORT NO: Rockwell International, Space Division, SSV75-1-1, briefing

DATE: 17 February 1975

AUTHOR(S): None given

SUBJECT: Orbiter payload accommodations and interfaces at time of Orbiter 102 PDR, February 1975

BASIS FOR INFORMATION: Designs/plans current at time of Orbiter 102 PDR

STATUS OF INFORMATION: Current as of publication date; payload accommodations and interfaces briefings are continually updated by Rockwell International.

COVERAGE OR CONTENT: Orbiter payload accommodations and inte faces

COMMENTS: This is the most up-to-date payload accommodations and interfaces briefing available as of 3-7-75. As is usual with such briefings, the coverage of any area is top-level only.

APPLICABLE TO DATA REQUIREMENT:
- 5.8, Shuttle Power
- 5.11, Orbiter-Supplied Cooling
- 5.12.b, Additional Payload Services Furnished by Orbiter, Venting and Draining
- 5.14.a,b, Shuttle Service Panels, Electrical and Fluid
- 5.15, Shuttle Environments
- 5.16, Shuttle Contamination and Sources

REFERENCE F-9

TITLE: Space Shuttle System Acoustics, Shock and Vibration Data Book

REPORT NO: Rockwell International, Space Division, SD 74-SH-0082

DATE: 1 June 1974

AUTHOR(S): None named.

SUBJECT: Shock, vibration and aeroacoustics environmental criteria for all operational phases of the Shuttle.

BASIS FOR INFORMATION: Data from Saturn V launches, engine static firings, wind tunnel tests of Shuttle scale models; concurrent vehicle configuration and nominal missions.

STATUS OF INFORMATION: All data is predicted; will be updated to reflect changes in the baseline vehicle configuration and mission trajectories, and to include ground and flight test data; no update available as of 3-18-75.

COVERAGE OR CONTENT: Report presently incomplete; covers aeroacoustic noise, rocket engine noise, aerodynamic noise, and Orbiter internal noise levels.

COMMENTS: Report provides detailed data regarding inputs to payload bay; updates should be useful for payload design.

APPLICABLE TO DATA REQUIREMENT: 5.15.a, c Shuttle Environments; Acoustic, Vibration (Shock presumably to be included in an update.)

REFERENCE F-10

TITLE: Shuttle System Integrated Mission Events and Sequences

REPORT NO: Rockwell International, Space Division, SD 75-SH-0050

DATE: 28 February 1975

AUTHOR(S): None given; report prepared by Mission Requirements and Integration.

SUBJECT: Significant mission events and operations for the ascent phase of Shuttle reference missions and intact aborts.

BASIS FOR INFORMATION: Analytical approach to defining significant events and sequences; nominal mission sequences assumed (except for abort cases)

STATUS OF INFORMATION: Incomplete; on-orbit and descent mission phases expected to be included in a future issue of document, date not given.

COVERAGE OR CONTENT: Logic diagrams and mission subphase descriptions for mission phases given on attached sheet.

COMMENTS: Detailed analysis of mission events and operations; nothing of interest to payloads in this issue - a later issue, dealing with on-orbit operations, may include data of interest.

APPLICABLE TO DATA REQUIREMENT: None

F-10
Attachment

TABLE OF CONTENTS

REFERENCE F-11

TITLE: Space Shuttle Program, Shuttle Avionics Integration Laboratory, SAIL Project Plan

REPORT NO: NASA Johnson Space Center report JSC-08663, Volume 1

DATE: September 20, 1974

AUTHOR(S): None given.

SUBJECT: Objectives and approach for the SAIL; presents management methods, roles, and responsibilities applicable to SAIL.

BASIS FOR INFORMATION: SAIL management plans as of September 1974.

STATUS OF INFORMATION: The volumes of JSC-0866 are maintained current by change pages and revisions.

COVERAGE OR CONTENT: See attached table of contents.

COMMENTS: SAIL is intended to "provide a test bed for the verification of all avionics interfaces" of Shuttle program elements, including payloads. This document can provide a payload program office with an overview of SAIL management, should such an overview be desired.

APPLICABLE TO DATA REQUIREMENTS:

1.2.2.g	Payload Servicing, Simulators	management aspects only
3.2.2.g	Payload Servicing, Simulators	

CONTENTS

CONTENTS (Continued)

Page

REFERENCE F-12

TITLE: Interleaver, Payload Data

REPORT NO: Rockwell International, Space Division, procurement specification MC476-0136

DATE: 10 May 1974

AUTHOR(S): W. O. Farr

SUBJECT: Specification for Shuttle Orbiter payload data interleaver

BASIS FOR INFORMATION: Required interleaver characteristics.

STATUS OF INFORMATION: This is initial, unrevised, specification; it is incomplete and being revised.

COVERAGE OR CONTENT: Includes major sections on applicable documents, requirements, quality assurance provisions, preparation for delivery.

COMMENTS: Sections dealing with payload interfaces can be of interest to a payload program; specification is highly detailed; revised version expected to include more data.

APPLICABLE TO DATA REQUIREMENT: 5.10.a, c, d, e Shuttle Data Handling, Transmission and Recording; Equipment and Stations, Codes, Rates, Capability.

REFERENCE F-13

TITLE: Specification, Electromagnetic Compatibility Requirement, Systems for the Space Shuttle Program

REPORT NO: Lyndon B. Johnson Space Center document SL-E-0001

DATE: 4 June 1973

AUTHOR(S): none given

SUBJECT: Specification, by NASA, of electromagnetic compatibility requirements for all Shuttle systems procurements at the element level or higher.

BASIS FOR INFORMATION: Document is a modification of MIL-E-6051D, 7 September 1967, "Military Specification, Electromagnetic Compatibility Requirements, Systems," and contains that specification.

STATUS OF INFORMATION: This is latest version of document.

COVERAGE OR CONTENT: Applicable documents, system EMC plan, EMC board, subsystem/equipment criticality, EMI safety margins, personnel hazards, EMC test program, etc.

COMMENTS: Is very general, does not mention payloads specifically but does apply to payloads, as specified by "Space Shuttle Flight and Ground System Specification," JSC 07700, Volume X, Revision A, through Change 23 dated February 7, 1975.

APPLICABLE TO DATA REQUIREMENT:

2.1.6.c	Nominal Operational Constraints, EMC
4.1.6.c	Nominal Operational Constraints, EMC
5.17	EMC/EMI
6.11	EMC/EMI

REFERENCE F-14

TITLE: Specification, Electromagnetic Interference Characteristics, Requirements for Equipment for the Space Shuttle Program

REPORT NO: Lyndon B. Johnson Space Center document SL-E-0002, Revision A

DATE: 16 September 1974

AUTHOR(S): none given

SUBJECT: Specification, by NASA, of electromagnetic interference characteristics required of equipment for NASA Shuttle System procurements.

BASIS FOR INFORMATION: Document is a modification of MIL-STD-461A; August 1, 1968

STATUS OF INFORMATION: This is latest version of document.

COVERAGE OR CONTENT: Is complete NASA specification for required EMI characteristics when combined with MIL-STD-461A.

COMMENTS: Is very general, does not mention payloads specifically but does apply to payloads, as specified by "Space Shuttle Flight and Ground System Specification," JSC 07700, Volume X, Revision A, through Change 23 dated 7 February 1975.

APPLICABLE TO DATA REQUIREMENT:

2.1.6.c	Nominal Operational Constraints, EMC
4.1.6.c	Nominal Operational Constraints, EMC
5.17	EMC/EMI
6.11	EMC/EMI

REFERENCE F-15

TITLE: Space Shuttle Electromagnetic Effects Compatibility Control Plan, Revision B

REPORT NO: Rockwell International, Space Division, SD73-SH-0216B

DATE: July 23, 1973; revised March 1975

AUTHOR(S): None identified

SUBJECT: Program for management and control of electromagnetic effects so as to prevent adverse effects on any portion of Space Shuttle System, payloads, and associated ground support equipment; program for providing a secure communications system in orbit.

BASIS FOR INFORMATION: Partly based upon Apollo CSM electromagnetic effects control program

STATUS OF INFORMATION: This is latest version of document as of March 1975.

COVERAGE OR CONTENT: See attached pages.

COMMENTS: Should be used by payload program offices; is an important, basic document.

APPLICABLE TO DATA REQUIREMENT:

2.1.6.c	Nominal Operational Constraints, EMC
4.1.6.c	Nominal Operational Constraints, EMC
5.17	EMC/EMI
6.11	EMC/EMI

CONTENTS

CONTENTS

REFERENCE F-16

TITLE: Requirements/Definition Document, Payload Retention Mechanisms, Volume 2-5

REPORT NO: Rockwell International Space Division, SD72-SH-0102-5

DATE: November 15, 1974

AUTHOR(S): None identified

SUBJECT: Shuttle Orbiter payload retention mechanisms requirements/definition

BASIS FOR INFORMATION: Required payload retention mechanism characteristics

STATUS OF INFORMATION: Latest available; although dated November 15, 1974, this document was not sent to SAMSO until March 13, 1975; the document includes many TBD's and TBS's.

COVERAGE OR CONTENT: See attached sheet.

COMMENTS: Better documents than this exist for describing those aspects of the payload retention mechanism of interest to payloads. "Better documents" include recent Rockwell International payload accommodations briefing manuals. This is, however, a basic document that a payload program office might wish to have for reference purposes.

APPLICABLE TO DATA REQUIREMENT:
2.1.5 Shuttle Payload Attachments and Structural Support Provisions
4.1.5 Shuttle Payload Attachments and Structural Support Provisions
5.7 Shuttle Payload Attachments and Structural Support Provisions

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SDM BASELINE
NOV 15 1974

REFERENCE F-17

TITLE: Requirements/Definition Document, Payload Deployment and Retrieval Mechanisms, Volume 2-8

REPORT NO: Rockwell International, Space Division, SD72-SH-0102-8

DATE: November 15, 1974

AUTHOR(S): None identified.

SUBJECT: Shuttle Orbiter payload deployment and retrieval mechanisms requirements/definition

BASIS FOR INFORMATION: Required payload deployment and retrieval mechanism characteristics

STATUS OF INFORMATION: Latest available; although dated November 15, 1974, this document was not sent to SAMSO until March 13, 1975; the document includes many TBS's.

COVERAGE OR CONTENT: See attached sheet.

COMMENTS: There is some data of interest to payloads in this document; it could become part of a payload program office's reference library.

APPLICABLE TO DATA REQUIREMENT: 5.9 Remote Manipulator

TABLE OF CONTENTS

SDM BASELINE
NOV 15 1974

REFERENCE F-18

TITLE: Requirements/Definition Document, Data Process and Software, Volume 5-5

REPORT NO: Rockwell International, Space Division, SD72-SH-0105-5

DATE: December 5, 1974

AUTHOR(S): None identified.

SUBJECT: Technical and verification requirements of Shuttle Orbiter data processing and software subsystem

BASIS FOR INFORMATION: Required characteristics of data processing and software subsystem

STATUS OF INFORMATION: Latest version of this document available; sent to SAMSO March 13, 1975.

COVERAGE OR CONTENT: See attached sheet.

COMMENTS: Very little of interest to payloads. Very little information of interest to anyone (entire document consists of 11 pages, with approximately 5 1/2 pages worth of blank paper). Little hard information; other documents referred to in this document may have hard information.

APPLICABLE TO DATA REQUIREMENT: None

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SDM BASELINE
DEC 5 1974

REFERENCE GF-1

TITLE: Safety Policy and Requirements for Payloads Using the National Space Transportation System

REPORT NO: None

DATE: July 1974 (Revised February 1975)

AUTHOR(S): Payload Safety Steering Group, NASA Headquarters (Code MQ)

SUBJECT: Top level safety requirements to be imposed on NASA/DOD payloads planned for Shuttle application.

BASIS FOR INFORMATION: Payload Safety Steering Group Review and Analysis

STATUS OF INFORMATION: (Concurrence Draft) Document has undergone many revisions and reviews; should be in fair shape.

COVERAGE OR CONTENT: Top level programmatic and specific safety requirements.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: 6.0, item 12 a (Safety Criteria and Factors); 5.0, items 19 a, b, c, d; 8.0, item 3 b.

REFERENCE GF-2

TITLE: STS User's Guide, Section 10, Detailed Upper Stage Description - IUS

REPORT NO: TOR-0075(5421-03)-1

DATE: 28 February 1975

AUTHOR(S): Shuttle and Integration Office, The Aerospace Corporation

SUBJECT: Description of a generic IUS, including interfaces with both the orbiter/ground and payload.

BASIS FOR INFORMATION: Stage characteristics formulated from the SR-IUS-100 baseline requirement minimum DOD required performance (DOD mission model) and information derived from ongoing IUS and payload studies.

STATUS OF INFORMATION: Preliminary and generic - not intended to identify any specific IUS, rather to identify general characteristics which will be definitized at a later date.

COVERAGE OR CONTENT: Section 10 covers all characteristics and capabilities of the baseline IUS including its interface with orbiter/payloads.

COMMENTS: Because the DOD has not selected the IUS contractor, this description is generic only and preliminary. It will be updated periodically and final definition will be made in accordance with IUS selection/validation/deployment.

APPLICABLE TO DATA REQUIREMENT: Section 6.0 Payload/Upper Stage Integration Flights.

REFERENCE GS-1

TITLE: DOD STS Ground Operations Study - Recommended Concept, Siting Arrangement and Acquisition Plan - Technical Data

REPORT NO: AF-SAMSO-TR-74-234, MCR-74-309

DATE: October 1974

AUTHOR(S): Martin Marietta Corporation, Denver Division

SUBJECT: Recommended concept for STS ground support system operations, system configuration and siting arrangement at Vandenberg AFB

941022

BASIS FOR INFORMATION: Results of major study conducted by Martin Marietta with primary support by Ralph M. Parsons Company

STATUS OF INFORMATION: Under consideration by SAMSO for approval and/or modifications and implementation

COVERAGE OR CONTENT: Detailed ground processing flows, timelines, facility and equipment requirements and descriptions and siting arrangement to support Shuttle operations at VAFB

COMMENTS: Emphasis is on Shuttle provisions with only incidental recognition of payload requirements

APPLICABLE TO DATA REQUIREMENT: 3.2.1 a Phase A (Par. 3.1-11, Par. 3.15-9); 3.2.2 i Phase A (Par. 3.4-27); 3.3.9 Phase B (Par. 2.3-11 and 12, Par. 2.3-13 and 14); 3.3.11 Phase A and B (Par. 2.3-5 and 6).

REFERENCE GS-2

TITLE: Planning Factors Guide

REPORT NO: 290-75

DATE: 1 July 1974

AUTHOR(S): HQ, 1st Strategic Aerospace Division

SUBJECT: Facilities and resources of VAFB, California

BASIS FOR INFORMATION: Inputs from 1st Strategic Aerospace Division staff and other units assigned to VAFB

STATUS OF INFORMATION: Approved for official use only. Normal changes to document semi-annually. Major program changes at that time.

COVERAGE OR CONTENT: A single planning document which provides the necessary data to effectively plan for manpower, facilities, and base support capabilities for current and future programs.

COMMENTS: Provides concise summary of resources at VAFB. Verify availability since they may be assigned to specified users.

APPLICABLE TO DATA REQUIREMENT: 3.1.2 Phase B (Annex E, App. II, p E-2-2); 3.1.4 Phase B (Annex E, App. II, p. E-2-1); 3.1.10 Phase B (Annex K, p. K-1); 3.2.2 f Phase B (Annex G, App. II, p. E-2-2); 3.2.2 h Phase A (Annex Q, p. Q-1).

REFERENCE GS-3

TITLE:	Level II Program Definition and Requirements, Volume XIV, Payload Accommodations (Revision C)
REPORT NO:	JSC-07700, Volume XIV, Change Number 6, Revision C
DATE:	January 6, 1975
AUTHOR(S):	Space Shuttle Program, Johnson Spacecraft Center, Houston, Texas
SUBJECT:	Provides information on the Space Shuttle system required by payloads in the design
BASIS FOR INFORMATION:	Baseline Space Shuttle system as it is presently configured and contains the official controlled set of Shuttle capabilities and interface provisions.
STATUS OF INFORMATION:	This is Revision C, dated 3 July 1974, to JSC-07700, Volume XIV, which supersedes Revision B, dated 21 December 1973 plus changes through change 6 dated 6 January 1975.
COVERAGE OR CONTENT:	Official source of information on the Space Shuttle capabilities to deliver payloads into orbit, and return them to earth, on the services that the Shuttle provides to payloads, and the means by which payloads can avail themselves of these services. Includes performance data and information on subsystems, environment, and support equipment.
COMMENTS:	Emphasis on Shuttle provisions with only incidental recognition of payload requirements.

APPLICABLE TO DATA REQUIREMENT: 1.1.6 a, Phase B (par. 5.1.1, Fig. 5-3); 1.1.7 Phase B (5.1.3); 1.2.1 a and c and 3.2.1 a and c, Phase A and B (14.2); 1.2.2 a and 3.2.2 a, Phase B (5.2.2.1 and 5.2.2.3, Figs. 5-6, 7, 9. 10, 11, Tables 5-4 and 12-2); 1.2.2 b and 3.2.3 b, Phase B (Table 12-2); 1.2.2 d (2) and 3.2.2.2 d (2), Phase B (9.1.1, 9.1.2); 1.2.2 h and 3.2.3 h, Phase B and partial Phase C/D and Transition (14.3); 1.2.2 i and 3.2.2 i, Phase A and B (5.1.1, 5.1.2); 1.2.2 m and 3.2.2 m, Phase B and Transition and partial Phase C/D and Gr. Ops. (4.2, 5.2.2.1 and Table 10.2); 1.2.4 b and 3.2.2.4 b, partial Phase B, C/D and Gr. Ops. (4.2.1, 5.1.2); 1.3.9 and 3.3.9, Phase B (5.2.2); 2.1.1 and 4.1.1 partial Phase A, B, and Transition (5.1.1, 5.1.2, Fig. 5-1, Fig. 5-2); 2.1.3 b, c, d and 4.1.3 b, c, d, Phase B, C/D, and Transition (4.2.1, 4.2.2, 4.3.4, 5.1.1, 5.1.2, 5.1.3); 2.1.4 c and 4.1.4 c, partial Phase A, B, C/D, Miss. Ops., Gr. Ops., Transition (Fig. 3-2); 2.1.5 b, c, d, e and 4.1.5 b, c, d, e, Phase A, B, C/D, Gr. Ops., and Transition (2.0 a, 7.0, and App. C); 2.1.6 e and 4.1.6 h and i, Phase B and partial Phase C/D and Transition (12.2 and Figs., App. C); 2.1.6 j and 4.1.6 j, Pre-Phase A and Phase A and partial Phase B and Transition (Fig. 3.2); 2.1.6 k and 4.1.6 k, Phase A, B, C/D, Gr. Ops., and Transition (4.1); 2.1.7 c and 4.1.7 c, Phase C/D and Gr. Ops. (5.2.2); 2.1.7 d and 4.1.7 d, Phase C/D and Gr. Ops. (5.2.2, 9.1.2, 9.1.3); 2.1.7 e and 4.1.7 e, Phase C/D and Gr. Ops. (5.2.2).

REFERENCE GS-4

TITLE: LPS Concept Description Document

REPORT NO: KSC-DD-LPS-007

DATE: Revised 11 January 1974

AUTHOR(S): Digital Electronics System Office, Directorate of Design Engineering, NASA

SUBJECT: Delineates the Launch Processing System (LPS) for integrated test, checkout, and launch control system for the Space Shuttle.

BASIS FOR INFORMATION: Detailed study and analysis of integrated test, checkout, and launch control systems from past programs.

STATUS OF INFORMATION: Approved by Chief, LPS Development Office. Checkout system block diagrams in Appendix A marked "Preliminary."

COVERAGE OR CONTENT: Identifies all necessary equipment and support software to effect timely performance of test, checkout, and launch control of the Space Shuttle. Designed to meet the Space Shuttle launch, maintenance, and refurbishing requirements. A modular or building block concept permits LPS components to be specified at an early date for differing requirements and levels of complexities at various sites.

COMMENTS: Emphasis is on Shuttle provisions with only incidental recognition of payload requirements.

APPLICABLE TO DATA REQUIREMENT: 1.2.1 a Phase A, 1.2.1 c Phase A, 3.2.1 a Phase A, 3.2.1 c Phase A, 3.2.2 h Phase B (Fig. A-19/20 for all).

REFERENCE GS-5

TITLE: Launch Processing System, Station Set 84 Requirements Document, Book I

REPORT NO: K-SM-10.1.23

DATE: 22 February 1974 (Second Draft)

AUTHOR(S): Owen Sizemore, Shuttle Project Office, JFK Space Center, NASA

SUBJECT: Delineates the Launch Processing System (LPS) for integrated test, checkout, and launch control system for the Space Shuttle.

BASIS FOR INFORMATION: Detailed study and analysis of integrated test, checkout, and launch control systems from past programs.

STATUS OF INFORMATION: Copy for System Requirement Review (SRR), held in March 1974 at KSC.

COVERAGE OR CONTENT: Identifies and summarizes all LPS related requirements which have been established at Level II and other general functional requirements levied upon the LPS. Designed to meet the Space Shuttle launch, maintenance, and refurbishing requirements. A modular or building block concept permits LPS components to be specified at an early date for differing requirements and levels of complexities at various sites. Provides details as to how they relate to KSC and VAFB on LPS Requirements Book II (KSC) and Book III (VAFB).

COMMENTS: Emphasis on Shuttle requirements with incidental recognition on payload requirements.

APPLICABLE TO DATA REQUIREMENT: 1.2.1 a Phase A (Par. 11.0).

REFERENCE GS-6

TITLE: Launch Processing System Station Set 84 Requirements Document, Book II

REPORT NO: K-SM-10.1.23

DATE: 22 February 1974 (Second Draft)

AUTHOR(S): Owen Sizemore, Alternate Chairman, LPS Station Set 84 Requirements Team

SUBJECT: Delineates the Launch Processing System (LPS) for integrated test, checkout, and launch control system for the Space Shuttle.

BASIS FOR INFORMATION: Detailed study and analysis of integrated test, checkout, and launch control systems from past programs.

STATUS OF INFORMATION: Draft of candidate specification.

COVERAGE OR CONTENT: Lists and describes all of the requirements for operational equipment and facilities at KSC to conduct Shuttle operations, including early development testing. Contains all known KSC Level III requirements placed upon the LPS. Specifies the facility services (air, power, etc.) that LPS requires in order to operate. Designed to meet the Space Shuttle launch, maintenance, and refurbishing requirements. A modular or building block concept permits LPS components to be specified at an early date for differing requirements and levels of complexities at various sites.

COMMENTS: Emphasis on Shuttle requirements with incidental recognition of payload requirements.

APPLICABLE TO DATA REQUIREMENT: 1.2.1 a Phase A, 1.2.1 c Phase A, 3.2.1 a Phase A, 3.2.1 c Phase A, 3.2.2 h (Limited Data) Phase B (Par. 7.20 for all).

B-1408

REFERENCE GS-7

TITLE: Launch Processing System Station Set 84, Requirements Document, Book III

REPORT NO: No Number

DATE: 9 October 1974

AUTHOR(S): 6595th STG(ST) STS Project Office, VAFB (Col. William C. Chambers)

SUBJECT: Delineates the Launch Processing System (LPS) for integrated test, checkout, and launch control system for the Space Shuttle.

BASIS FOR INFORMATION: Detailed study and analysis of integrated test, checkout, and launch control systems from past programs.

97-1109

STATUS OF INFORMATION: Preliminary draft incorporates only those items agreed to by NASA/KSC and DOD/VAFB LPS requirements development personnel at meetings on 17-18 July 1974 and 12-13 September 1974. NASA/KSC, DOD/VAFB LPS Subpanel agreements.

COVERAGE OR CONTENT: Describes the VAFB functional requirements to support LPS development by KSC. Book III lists all requirements necessary to support LPS development not previously identified in LPS Books I and II. Designed to meet the Space Shuttle launch, maintenance, and refurbishing requirements. A modular or building block concept permits LPS components to be specified at an early date for differing requirements and levels of complexities at various sites.

COMMENTS: No payload data.

APPLICABLE TO DATA REQUIREMENT: 3.2.1 a (Phase A); 3.2.1 c (Phase A); 3.2.2 h (Limited Data - Phase B). (Source: Requirement No. 84-02-01.231 for all)

REFERENCE GS-8

TITLE:	System Description, Program Introduction, and Statement of Capability
REPORT NO:	Document 501-72, Universal Documentation System, Volume I
DATE:	July 1972
AUTHOR(S):	The Secretariat, Range Commanders Council

SUBJECT: Universal Documentation System (UDS), program introduction procedures

BASIS FOR INFORMATION: Procedures approved by Range Commanders Council

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Describes UDS, documents involved, administrative procedures, submittal schedules and instructions, and examples for preparing the first level program introduction document. Also includes compendium of Range policies and directives of concern to users, classification of nuclear materials, and an extensive list of RCC documents applicable to user operations.

COMMENTS: The document defines the officially approved methods by which potential users of a National Range request support by the Range, and in turn specifies the method by which the Range commits support.

APPLICABLE TO DATA REQUIREMENT: 8.1 a, b (Phase B); 8.3 a, g (Phase B); 8.4 a (Phase B).

REFERENCE GS-9

TITLE: Program, Mission and Test Requirements, and Support Plans Document Preparation

REPORT NO: Document 501-70

DATE: October 1970

AUTHOR(S): Secretariat, Range Commanders Council

SUBJECT: Universal documentation system (UDS), program requirements document (PRD), operations requirements document (OR), and range commitment documents.

BASIS FOR INFORMATION: Procedures approved by Range Commanders Council

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Describes PRD, OR, program support plan (PSP), and operations directive (OD) document preparation and processing procedures and content.

COMMENTS: Specifies the second and third level documentation by which detailed formal requirements are levied on ranges and the method by which the ranges formally commit support.

APPLICABLE TO DATA REQUIREMENT: 8.1 a, b (all committed users); 8.3 a, g (Phase C/D, Ground Ops., Transition); 8.4 a (Phase, C/D, Ground Ops., Transition); 8.6 (Phase C/D, Ground Ops., Transition).

REFERENCE GS-10

TITLE:	Range Safety Requirements
REPORT NO:	SAMTECM 127-1, Volume I
DATE:	16 July 1973
AUTHOR(S):	Space and Missile Test Center (SAMTEC)

SUBJECT: Range Requirements for safety in launch operations at VAFB and WTR.

BASIS FOR INFORMATION: Official Policy

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Safety policies, flight analysis/plan procedures and requirements, ground safety requirements, flight termination, missile (launch) operations.

COMMENTS: Applicable to all operations out of VAFB.

APPLICABLE TO DATA REQUIREMENT: 4.1.4 c, partial Phases A, B, C/D, Mission and Flight Planning, Ground Ops., Transition; 4.1.6 b, partial Phases B, C/D, Ground Ops., Transition; 8.3 b, Phases C/D, Mission Planning, Ground Ops., Transition.

REFERENCE GS-11

TITLE: Space Shuttle Natural Environments Data Book

REPORT NO: SD 73-SH-0025B

DATE: 10 January 1975

AUTHOR(S): Rockwell International

SUBJECT: Natural environments for KSC, VAFB, and EAFB to be used for design.

BASIS FOR INFORMATION: Existing statistical data.

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Gives data on winds (pre- and post-launch, landing), lightning, atmospheres, radiation, thermal environment, water recovery environment, etc.

COMMENTS: Gives basic reference data for design and performance analyses and operations planning. Also lists further more detailed documentation.

APPLICABLE TO DATA REQUIREMENT: General

REFERENCE GS-12

TITLE: Range Users Handbook

REPORT NO: SAMTEC Manual 80-1

DATE: 6 January 1972

AUTHOR(S): Headquarters, SAMTEC

SUBJECT: Broad coverage of requirements, policies capabilities, and characteristics of VAFB of direct concern to prospective users of the Range.

BASIS FOR INFORMATION: Existing data.

STATUS OF INFORMATION: Current

COVERAGE OR CONTENT: Planning, scheduling, range safety, communications, data collection and processing, meteorological services, instrumentation, and base support.

COMMENTS: Essential introductory document which should be given first priority by all prospective users. Identifies all subsidiary documentation. Provides initial contact identification.

APPLICABLE TO DATA REQUIREMENT: 3.1.2, Phase B; 3.2.2 h, Phase B; 3.2.7, Ground Ops. (Indirect); 4.1.4 c, all phases; 4.1.6 b, all phases; 4.1.6 c, all phases (Indirect); 4.1.8, all phases.

9-1114

REFERENCE GS-13

TITLE: Baseline Operations Plan

REPORT NO: JSC-09333

DATE: 15 January 1975

AUTHOR(S): JSC

SUBJECT: Baseline plan of operations for MCC to support Shuttle and payload flights.

BASIS FOR INFORMATION: Planning analyses

STATUS OF INFORMATION: Review draft

COVERAGE OR CONTENT: Covers all phases of Shuttle operations from pre-launch through landing rollout.

COMMENTS: Document subject to considerable change, particularly as KSC and DOD (VAFB and KSC) are involved.

APPLICABLE TO DATA REQUIREMENT: Not specifically applicable to any ground system data requirement.

REFERENCE GS-14

TITLE: Space Shuttle System Payload Interface Verification Plan, Volume I (Preliminary Draft)

REPORT NO: JSC 07700-14-P/L VP-01

DATE: February 1975

AUTHOR(S): JSC

SUBJECT: Details plans/requirements for performance of payload interface verification.

BASIS FOR INFORMATION: Planning analyses

STATUS OF INFORMATION: Preliminary draft undergoing NASA reviews.

COVERAGE OR CONTENT: Covers all aspects of interfaces between payloads and the Orbiter/Shuttle system and verification procedures

COMMENTS: Subject to changes per draft reviews. Assessment assumed mature document with specific data by late 1970s.

APPLICABLE TO DATA REQUIREMENT: 1.2.1 c (Phase A, B, C/D); 1.2.2 a and b (Phases B, C/D); 1.2.2 h (Phase B, C/D, Transition); 1.2.2 i (Phase A, B, C/D, Transition); 1.3.1 a and b (Phase B, C/D, Transition); 1.3.2 (Phase B, C/D, Transition); 1.3.5 a (Phase C/D, Transition); 1.3.9 (Phase B, C/D); 1.3.11 (Phase A, B, C/D, Transition); 1.3.12 (Phase C/D, Transition); 2.1.1 (Phase A, B, C/D, Transition); 2.1.3 a, b, c, d (Phase B, C/D, Transition); 2.1.6 a, c, e, f (Phase B, C/D, Transition); 2.1.7 a, b (Phase C/D); 2.1.7 c (Phase C/D, Transition); 2.1.7 d, e (Phase C/D); 2.1.7 f (Phase B, C/D, Transition); 3.2.1 c (Phase A, B, C/D); 3.2.2 h (Phase B, C/D, Transition); 3.2.2.i (Phase A, B, C/D, Transition).

REFERENCE GS-15

TITLE: KSC Launch Site Accommodations Handbook for STS Payloads (Coordination Draft)

REPORT NO: K-SM-14, Revision 1

DATE: February 1975

AUTHOR(S):

SUBJECT: General discussion of KSC and VAFB payload provisions supplied by launch site and of baseline STS operations.

BASIS FOR INFORMATION: In-House Study

STATUS OF INFORMATION: Coordination draft to be approved.

COVERAGE OR CONTENT: Essentially all payload interface and operations concerns.

COMMENTS: Document is a broad, basic source of user data although TBDs are somewhat prevalent. It is expected those will be filled in well before 1980. The VAFB section is not as detailed but is generally adequate except for areas relating to STS timelines.

GS-15
Continued

APPLICABLE TO DATA REQUIREMENT: 1.1.1, 1.1.2, 1.1.5, 1.1.10 (Phase B); 1.1.12 (Phase A, B); 1.2.1 a, b, c (Phase A, B); 1.2.2 a, b, d (1), d (2), f, g (2), h, k, l (Phase B); 1.2.4 b (Partial Phase B); 1.3.1 a, b (Phase B); 1.3.2, 1.3.9, 1.3.10 (Phase B); 1.3.11 (Phase A, B); 2.1.1, 2.1.2 (Phase A, B); 2.1.3 a, b, c, d (Phase B); 2.1.4 c (Phase A, B); 2.1.6 a, b, c, e, f, g (Phase B); 2.1.7 f (Phase B); 3.1.1, 3.1.2 (Phase B, Dev.); 3.1.9 (Dev.); 3.1.10 (Phase B, Dev.); 3.1.11 (Dev.); 3.1.12 (Phase A, B); 3.2.1 a, b, c (Phase A, B); 3.2.2 b (Phase B); 3.2.2 c (Dev.); 3.2.2 g (2) (3) (Phase B); 3.2.2 h (Phase B, Dev., Trans.,); 3.2.2 k (Phase B, Dev.); 3.2.6, 3.2.7 (Dev.); 3.3.1 b (Phase B); 3.2.2 (Phase B); 3.3.11 (Phase A, B); 3.3.12 (Dev., Trans.); 4.1.1 (Phase A, B, Dev., Trans.); 4.1.3 a, b, c, d (Phase B, Dev., Trans.); 4.1.6 a (Phase B - partial); 4.1.6 b, c, e, f (Phase B): 4.1.6 g (Phase B, Dev., Trans.); 4.1.7 f (Phase B); 4.1.9 (Dev., Trans.).

9-118

REFERENCE GS-16

TITLE:	DOD Ground Support Systems Definition Study
REPORT NO:	TBD
DATE:	June 1975
AUTHOR(S):	McDonnell Douglas/Sterns Rogers

SUBJECT: Definition of facility criteria for siting STS at VAFB.

BASIS FOR INFORMATION: Funded Study

STATUS OF INFORMATION: Baseline

COVERAGE OR CONTENT: Facility design requirements for STS facilities supported by operational concept definition.

COMMENTS: Basis for facility construction phase.

APPLICABLE TO DATA REQUIREMENT: 3.1.6 a, b; 3.1.7, 3.1.13 (Phase B, Dev., Trans.); 3.3.1 a, b (Phase B, Dev., Trans.); 3.3.3, 3.3.5 a, b, 3.3.6 (Dev., Trans.); 3.3.9 (Dev.); 3.3.10, 3.3.11, 3.3.12 (Dev., Trans.); 4.1.1.4, 4.1.2, 4.1.3 a, c, d, e; 4.1.6 a, e, f, g; 4.1.7 f (Phase B, Dev., Trans.).

REFERENCE JP-1

TITLE: Space Shuttle System Payload Accommodations

REPORT NO: JSC-07700, Vol. XIV, Revision C

DATE: 3 July 1974

AUTHOR(S): Robert F. Thompson, Manager, Space Shuttle Program

SUBJECT: Level II Program Definition and Requirements Volume XIV

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Revised periodically, Revision C updated by change pages.

COVERAGE OR CONTENT: Describes the capabilities of the Space Shuttle system to accommodate payloads and defines the interfaces between the Space Shuttle system and the Shuttle payloads. Payloads in the design definition phase.

COMMENTS: Much data is presented or is TBD which is needed by paylcad. Explanations and how to use the data is missing. Written from booster side of the interface, user must interpret or request additional data. "How to use" data should be added for the user.

APPLICABLE TO DATA REQUIREMENT: Section 5, items 2.b, 3, 7.b, 8.b, 8.c, 9.b, 11, 13.a, 13.b, 15, 16.c, 18.a, 19.a, 20, 24, 28, 31.a, 32.a, 34.a, b, c. Section 2, items 5.b, e; Section 4, items 5.b, e.

REFERENCE JP-2

TITLE: PDR Team 15 Document - Mission Operations Approach

REPORT NO: NASA-S-75-622; JSC-09323

DATE:

AUTHOR(S): H. Ray

SUBJECT: Mission operations approach

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Proposed approach, PDR document.

COVERAGE OR CONTENT: The approach is to develop a set of standard mission phases and mission types that encompass the Shuttle functions and yet remain constant in certain areas such as mission rules, consummables analysis, constraints, etc. The result is to minimize new planning work. Baseline mission profiles are included.

COMMENTS: Provides a list of standard JSC mission planning references used in Space Shuttle/payload interface activity (mostly internal notes).

APPLICABLE TO DATA REQUIREMENT: Section 5.0, item 4 a.

REFERENCE JP-3

TITLE: PDR Team 15 Document - DOD Satellites

REPORT NO.: NASA-S-75-634; JSC-09317

DATE: 20 December 1974

AUTHOR(S): H. Lambert

SUBJECT: DOD Satellites

BASIS FOR INFORMATION:

STATUS OF INFORMATION: PDR Document

COVERAGE OR CONTENT: An accumulation of accommodation and interface items for DOD satellites

COMMENTS: Not useful

APPLICABLE TO DATA REQUIREMENT: None

REFERENCE JP-4

TITLE: PDR Team 15 Document - Common Attachment/Handling Study

REPORT NO: NASA-S-75-330; JSC-09318

DATE: 27 December 1974

AUTHOR(S): L. Jenkins

SUBJECT: Common attachment/handling study

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Study PDR document

COVERAGE OR CONTENT: Brief study description, includes requirements and criteria, critical issues, and conceptual sketches.

COMMENTS: Study Objective: Integration of handling requirements in a concept which will provide a standard handling interface for all payloads at KSC with a minimum impact on payloads and the orbiter.

APPLICABLE TO DATA REQUIREMENT: None - Conceptual at this time

REFERENCE JP-5

TITLE: PDR Team 15 Document - Weights Chargeable to Payload

REPORT NO.: NASA-S-75-360; JSC-09324

DATE: 20 December 1974

AUTHOR(S): B. Sevier

SUBJECT: Weights Chargeable to Payload

BASIS FOR INFORMATION:

STATUS OF INFORMATION: PDR Document

COVERAGE OR CONTENT:

(1) List of orbiter provided support to payload and payload chargeable items

(2) Description and weights of payload chargeable items (some TBD weights)

COMMENTS: This data should be incorporated into Vol. XIV.

APPLICABLE TO DATA REQUIREMENT: Section 5.0, Item 2.b, 8.c

REFERENCE JP-6

TITLE: PDR Team 15 Document - JSC-07700, Vol. XIV, Revision C

REPORT NO: NASA-S-75-489, JSC-09310

DATE: 20 December 1974

AUTHOR(S): E. Armstrong

SUBJECT: Space Shuttle

BASIS FOR INFORMATION: JSC 07700, Vol. XIV, Rev. C

STATUS OF INFORMATION: PDR Document

COVERAGE OR CONTENT: (1) Payload PRCB Implementation Status
(2) Reference Mission Profiles
(3) List of Standard Interface Drawings

COMMENTS: Indicates changes being made to Vol. XIV by subject but not the actual change. Mission profiles given as sequence of events and includes times, altitudes, velocities.

APPLICABLE TO DATA REQUIREMENT: Section 5.0, Item 4.a

REFERENCE JP-7

TITLE: PDR Team 15 Document - Interim Upper Stage

REPORT NO: NASA-S-75-627; JSC-09312

DATE: 20 December 1974

AUTHOR(S): H. Lambert

SUBJECT: Interim Upper Stage

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT:

1. Lists status of NASA FY 1974 IUS/Tug definition studies and SAMSO Space Shuttle system related studies.
2. Payload with upper stage accommodation drawings
3. Generic IUS bridge utilization and c. g. envelope
4. Sketches of bulkhead interface provisions

COMMENTS: PDR Documentation Support for Payload Interfaces Team

APPLICABLE TO DATA REQUIREMENT: None

C-4

REFERENCE JP-8

TITLE: PDR Team 15 Document - Large Space Telescope

REPORT NO: NASA-S-75-318; JSC-09315

DATE: 20 December 1974

AUTHOR(S): G. Meester

SUBJECT: Large Space Telescope

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT:
1. LST Planning Schedule
2. LST/Shuttle Dimensional Interface (Accessibility)
3. LST/Shuttle c.g. Limits (Envelope)
4. Bridge Utilization

COMMENTS: PDR Documentation Support for Payload Interfaces Team

APPLICABLE TO DATA REQUIREMENT: None

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REFERENCE JP-9

TITLE: PDR Team 15 Document - Spacelab

REPORT NO: NASA-S-75-514; JSC-09311

DATE: 24 December 1974

AUTHOR(S): J. O'Laughlin

SUBJECT: Spacelab

BASIS FOR INFORMATION:

STATUS OF INFORMATION: PDR document, mostly conceptual.

COVERAGE OR CONTENT:

1. System integration engineering master schedule (P 1 of 5)
2. Sketch and table of support locations
3. Conceptual fluid and electrical interfaces
4. Sketches showing bulkhead interface provisions and ECS
5. Longitudinal c.g. plot for representative configurations
6. Drawings - payload accommodation - pallet and experiment module

COMMENTS: Not detailed enough to provide data for Section 5, item 26.

APPLICABLE TO DATA REQUIREMENT: None

REFERENCE JP-10

TITLE: PDR Team 15 Document - Earth Observations Satellite

REPORT NO: NASA-S-75-369; JSC-09313

DATE: 20 December 1974

AUTHOR(S): R. Frost

SUBJECT: Earth Observations Satellite

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT:

1. JSC mission planning references used with GSFC
2. Sketches of EOS operations, flight support system (including module exchange mechanism)
3. Bridge utilization and retention locations
4. Expected EOS X axis c. g. locations
5. Sketches showing bulkhead interface provisions, and plume envelopes
6. Electric power available to payloads
7. OMS kits envelopes and Shuttle performance plots

COMMENTS: PDR documentation support for payload interfaces team.

APPLICABLE TO DATA REQUIREMENT: OMS kits envelopes as part of Section 5.0, item 28.a, payload envelopes, and Item 2.b, weights chargeable to payload.

REFERENCE JP-11

TITLE: PDR Team 15 Document - Long Duration Exposure Facility (LDEF)

REPORT NO: NASA-S-75-307, JSC-09314

DATE: 20 December 1974

AUTHOR(S): G. Meester

SUBJECT: Space Shuttle Payload Accommodations Interface Activities with the Langley Center Long-Duration Exposure Facility

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: Contains a very brief description, size and weight of the LDEF, along with c.g. limitations, bridge utilization, proposed destination and Shuttle performance capability at the proposed destination.

COMMENTS: PDR Documentation Support for Payload Interfaces Team

APPLICABLE TO DATA REQUIREMENT: None

REFERENCE JP-12

TITLE: Orbiter Vehicle End Item Specification for the Space Shuttle System, Part I

REPORT NO: MJ070-0001-1A

DATE: Updated to Change #3, 22 August 1974

AUTHOR(S): D. L. Fernandez and others

SUBJECT: Performance and Design Requirements

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Review includes Change #4 dated 8 October 1974; Change #5 dated 2 Dec 74

COVERAGE OR CONTENT:

COMMENTS: Basic data applies to orbiter. Payload data scattered throughout document. Document contains TBD entries. The data in the specification is evolving as the program matures.

APPLICABLE TO DATA REQUIREMENT: Section 5, Item 28 a**, b**; 2.a (Pre-Phase A); 13 b**, c**, e(TBD); 11**; 8.a*, b**; 15(TBD); 9.a**, c(TBD); 24**; 21**; 25(TBD); 22**; 27.a (TBD), b (TBD), c(TBD); 10.a*, b*, c**, d**; 12.a*, b*

* Pre-Phase A/Phase A

** Phase B

REFERENCE JP-13

TITLE: Shuttle Operations Baseline Operations Plan

REPORT NO: JSC-09333

DATE: 15 January 1975

AUTHOR(S): Edward Pavelka, BOP Team Chairman and Others

SUBJECT: Baseline Operations Plan

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Review Draft

COVERAGE OR CONTENT: Section 2 contains a brief summary of program objectives, vehicle and payload configurations, descriptions of the planned flights, and pertinent assumptions utilized in preparing this document. Section 3 discusses the flight planning and control functions which must be accomplished to fly the operational Shuttle program. Section 4 discusses the Mission Control Center Support Plan and facilities to accomplish JSC's role as the STS Operator. Section 5 discusses the communications and data mangement aspects of STS operations, including a description of the flight and network systems. Section 6 discusses science/payloads operations; Section 7, STS facilities requirements; and Section 8, training.

COMMENTS: Document presents a JSC Operations Plan as of January 1975; it is conceptual in nature. It is anticipated that when the draft review is complete it will become a control document.

APPLICABLE TO DATA REQUIREMENT: Section 5, items 31.a*; 32.a*; 1.a(1)*, d*; 10.a*, c**, d**, e**; 2.a (Pre Phase A)

Section 2, item 1*; Section 8, items 1.a**, b**; 2*;

Section 7, items 6, 4 (both Pre-Phase A)

* Pre-Phase A, Phase A

** Phase B

REFERENCE JP-14

TITLE: Payload Structural Attach Loads Definition

REPORT NO: MCR 277

DATE: 3 December 1974

AUTHOR(S):

SUBJECT: Payload Attachment and Allowable Loads at Attach Points

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Final briefing of a study by Rockwell International. Also proposes additional effort for an integrated loads analysis to be worked on MCR 1612.

COVERAGE OR CONTENT:

- Proposes change to vernier bridge trunnion fitting design to provide smaller attach increments
- Proposes changing from 4 to 5 points of support for payloads to save payload structure weight and reduce constraint on payload location. This is based on results from Rockwell International loads computer program (program is not described or referenced)
- Possible alternative to payload weight reduction is orbiter mid-body weight reduction
- Suggests Rockwell International provide 5 point computer support/ analysis to payload community.

COMMENTS: Document is useful to a payload user to see baseline attach method (4 point support) and an example of a loads calculation (results)

APPLICABLE TO DATA REQUIREMENT: Loads data extracted from JSC 07700, Vol. XIV.

Section 8, item 3 c (partial) (Phase A, B)

Section 5, item 18 a (Phase A, B)

REFERENCE JP-15
(also CP-14)

TITLE: DOD Space Transportation System (STS) Payload Interface Study - FY 74 Extension

REPORT NO: SAMSO-TR-74-198

DATE: October 1974

AUTHOR(S): B. E. Garlich, R. D. Heitchue, D. H. Mitchell

SUBJECT:

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Study results

COVERAGE OR CONTENT: Study to determine interface requirements to integrate 3 DOD payloads with STS and interim upper stage concepts. Only delivery missions are analyzed. An update of a 1973 study.

COMMENTS: Uses December 1973 version of JSC 07700, Vol. XIV (Rev. B). Presents general descriptions of potential IUSs (Centaur, Transtage). Provides examples as applied to the 3 DOD payloads of:

- Payload installation, i.e., c.g. location check
- Shroud concepts for contamination control
- RTG thermal analyses (cooling concepts)
- Safety analysis update of 1973 study
- Avionics subsystem analyses
- Acoustic analyses (comparison of qual levels to STS predictions)
- Spacecraft requalification for existing payload designs
- Contamination analyses

APPLICABLE TO DATA REQUIREMENT: Section 5, items 16 a, b, d (Phase B); 31 a (Phase B)

REFERENCE JP-16

TITLE: Remote Manipulator System Design Requirements, Performance, and Interface Specification

REPORT NO: JSC-08997

DATE: 22 August 1974

AUTHOR(S):

SUBJECT: Remote Manipulator Specification Data

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Specification to be used for proposal

COVERAGE OR CONTENT:

a. Section I contains the design requirements

b. Section II contains the configuration and performance capability defined to meet the design requirements

c. Section III contains the interface requirements

COMMENTS: Contains some TBDs. Payload docking or storage loads (TBD).

APPLICABLE TO DATA REQUIREMENT: Section 5, items 13 c, e (Phase B); 9 a, b (Phase A, B); 9 c (partial) (Phase A).

REFERENCE JP-17

TITLE: Specification Contamination Control Requirements for the Space Shuttle Program

REPORT NO: SN-C-0005

DATE: March 1974

AUTHOR(S): No author, approved by R. F. Thompson

SUBJECT: Contamination control requirements specification

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Approved by NASA JSC for Space Shuttle Program

COVERAGE OR CONTENT: Contains definitions, requirements, and references to applicable documents

COMMENTS: General information for a user. Does not provide expected levels and sources

APPLICABLE TO DATA REQUIREMENT: Section 5.0, item 16 d (Phases A, B, C/D)

REFERENCE JP-18

TITLE: Design Definition Studies of Special Purpose Manipulator System for EOS

REPORT NO: SPAR-R.592

DATE: January 1974

AUTHOR(S):

SUBJECT: Module Exchange Mechanism

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Study performed for GSFC

COVERAGE OR CONTENT: Preliminary design of a module exchange mechanism for use with EOS. Consists of module storage magazine, module manipulator system, and control console.

COMMENTS: Document contains drawings and descriptive material useful for a potential user. Design is for use with the orbiter.

APPLICABLE TO DATA REQUIREMENT: Section 5, item 23, Phase A and Phase B.

REFERENCE JP-19

TITLE: Final Report - Servicing the DSCS-II with the STS, Volume I, Final Briefing

REPORT NO: SAMSO-TR-75-135

DATE: March 1975

AUTHOR(S): Abraham Fiul

SUBJECT: On-orbit servicing of DSCS-II and economic analysis.

BASIS FOR INFORMATION:

STATUS OF INFORMATION: Feasibility study performed for SAMSO.

COVERAGE OR CONTENT: Examines the design feasibility and analyzes the cost benefits of servicing DSCS-II on orbit using a full capability Tug and the Space Shuttle. Designs were made of three-axis stabilized expendable, ground refurbishable, and on-orbit serviceable versions.

COMMENTS: Service unit design for use with an upper stage is presented.

APPLICABLE TO DATA REQUIREMENT: Section 5, item 23, Phases A and B.

REFERENCE RT-1

TITLE: Shuttle Turnaround Analysis Report

REPORT NO: STAR 005

DATE: January 1975 (Prepared Monthly)

AUTHOR(S): R. E. Reedy, Rockwell Launch Operations Integration
H. K. Widick, Chairman, STAR SP-OPN

SUBJECT: Current assessment of allocated and assessed timelines for KSC STS ground operations.

BASIS FOR INFORMATION: Continuing Rockwell International and KSC analysis of Shuttle turnaround operations at KSC and assessment of timelines required for the ground operations versus the allocated 160 hour turnaround cycle.

STATUS OF INFORMATION: Current, based upon real time studies/analysis. Information updated on a monthly basis.

COVERAGE OR CONTENT:
1.0 Level II KSC Ground Operations Timeline Allocation;
2.0 Level II KSC Ground Operations Timeline Assessment;
3.0 Ground Rules - Approved and Recommended;
4.0 Functional Specifications - Approved and Recommended.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: All data items included in Section 1.3 (1 through 12); STS System Schedules, Event Timing, Timelines, and Constraints.

REFERENCE RT-2

TITLE: Space Shuttle System Payload Interface Verification Plan

REPORT NO: JSC-07700-14 -- P/L VP-01

DATE: February 1975

AUTHOR(S): R. Everline (JSC)

SUBJECT: General approach, requirements, guidelines, and implementation plans for verifying that the payload interfaces with the Shuttle are ready for flight.

BASIS FOR INFORMATION: JSC-07700, Volume XIV Space Shuttle System Payload Accommodations - identifiable interfaces which require verification.

STATUS OF INFORMATION: Preliminary draft document; document to be finalized as program documentation approximately 1 June 1975.

COVERAGE OR CONTENT: 1.0 Introduction; 2.0 Verification Program (2.1 Verification Summary, 2.2 Methods for Achieving Interface Verification, 2.3 Responsibility/Documentation/Control); 3.0 Space Shuttle System/Payload Turnaround Activity; 4.0 Interface Verification Requirements.

COMMENTS:

APPLICABLE TO DATA REQUIREMENTS: Section 8.0 Information for STS System Integration and Support for a Space Project - Data Requirements. 3.0 (a through g) Payload Design/Analysis: 4.0 Payload Test Requirements. 5.0 Payload Demonstration. 6.0 Payload Inspections.

REFERENCE RT-3

SUBJECT: Orbiter Contamination Control Plan

REPORT NO: SD 74-SH-0289

DATE: February 1975

AUTHOR(S): Rockwell International Internal Document

SUBJECT: Approach to orbiter contamination control within the requirements of the Space Shuttle Program.

BASIS FOR INFORMATION: Shuttle system requirements - JSC-07700, Volume X, and orbiter contract end item specification/Rockwell International contamination control experience.

STATUS OF INFORMATION: Preliminary draft (review draft to be released in April 1975)

COVERAGE OR CONTENT: This plan defines Space Division's orbiter operations to achieve and maintain cleanliness goals from design of the orbiter through delivery of the last vehicle. It includes sections for all functional groups such as Engineering, Manufacturing and Quality Assurance. Contamination as addressed herein covers particulate, non-volatile residue, fluid borne impurities, soils as could be contained in the orbiter, its subsystems and supporting equipment. Other contamination such as volatile condensible material (VCM) and orbiter effluent control are covered in the Space Shuttle Operational Contamination Control Plan produced by Space Division under separate cover.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Sections 1.2.2 (i) and 3.2.2 (1) STS System Support Equipment - Contamination Control; 2.1.3 and 4.1.3 Ground Operations - Contamination Environment; 5.16 Shuttle Contamination and Sources; and 8.3 (f) Payload Contamination.

REFERENCE RT-4

TITLE: Shuttle System PDR, Safety Analysis Report

REPORT NO: Rockwell International SD 75-SH-0064

DATE: 28 February 1975

AUTHOR(S): C. O. Baker, Rockwell International

SUBJECT: Compilation of Shuttle system level safety concerns and hazards analyses

BASIS FOR INFORMATION: In-house Rockwell International planning and analysis

STATUS OF INFORMATION: Preliminary document for Shuttle system PDR. Document will be updated periodically.

COVERAGE OR CONTENT: See attached page.

COMMENTS: The document describes Shuttle system hazards analysis and can be used as a status report on the Shuttle vehicle as well as a guide for payload hazards and safety analysis.

APPLICABLE TO DATA REQUIREMENT: Sections 5.19 (Safety) and 8.3 (b) Hazard Analysis and Safety Plan.

1.0 INTRODUCTION

This report describes the safety analysis effort performed to date as part of the Shuttle Integration contract, and is submitted in support of the Shuttle Preliminary Design Review (PDR).

Shuttle Integration consists of the integration of the various elements of the Space Shuttle. These are the Orbiter, the Space Shuttle Main Engine (SSME), the External Tank (ET), the Solid Rocket Booster (SRB), and the Ground Facilities. The safety effort in support of this work covers any safety issue which involve two or more of these elements, or, in some cases, the overall Shuttle System The work and results described in this report have been carried out as an integral part of the Space Shuttle Program, and as such they are intended to represent a summarization of the integrated work of the NASA, the Space Division of Rockwell International in its role of System Contractor, and the Element Contractors. Section 2, of this report describes the process currently used for performing safety analysis on the Shuttle Program. This activity consists of identifying and systematically analyzing safety concerns which arise, determining which of these concerns represent hazards to the Shuttle, and resolving these hazards through the appropriate Level II actions (SIR, PRCB, etc.). Section 3 lists and describes significant safety concerns which have been analyzed to date, and Section 4 presents hazard analyses on those hazards which have been processed. This report has been prepared by the Safety group of the Reliability and Safety Department, Space Shuttle Program, at the Space Division of Rockwell International. This group has the responsibility for implementing specific safety tasks, planning, administering and reporting the Shuttle System safety and hazard analysis activities as defined in the Work Breakdown Structure 2.1.3 (Safety).

The integrated vehicle will inherently contain potential hazards. This document summarizes issues and actions that are being worked at the appropriate program level and are a part of the normal on-going development process.

REFERENCE RT-5

TITLE: Space Shuttle Orbital Flight Test Requirements

REPORT NO: JSC-08576

DATE: 15 January 1975

AUTHOR(S): R. Morton, O. G. Morris (NASA JSC)

SUBJECT: Basic flight test requirements for the Shuttle orbital flight test program

BASIS FOR INFORMATION: Test requirements submitted from orbiter system, subsystem, operations, test and integration group personnel, as well as requirements to verify Shuttle payload interface characteristics.

STATUS OF INFORMATION: Draft of flight test requirements. Document will be updated until the start of the flight test program.

COVERAGE OR CONTENT: Flight test requirement work sheets are organized into the following functional catagories: Thermo/Aerodynamics, Structural, Propulsion, Power, Solid Rocket Booster, External Tank, Mechanical, ECLSS, Crew, Avionics, Mission Capability.

COMMENTS: Flight test measurements provide final verification of Shuttle-induced environmental levels experienced by payloads as well as verification of Shuttle payload accommodation capability.

APPLICABLE TO DATA REQUIREMENT: Sections 5.7, 5.8, 5.10, 5.11, 5.12, 5.15, 5.16, 5.18, 5.20, 5.24, and 5.25 (Payload/Shuttle Integrated Flight Interface Capabilities).

REFERENCE RT-6

TITLE: Space Shuttle Payload Accommodations on the Aft Flight Deck

REPORT NO: JSC-09343

DATE: 20 January 1975

AUTHOR(S): S. H. Nassiff, NASA JSC Spacecraft Design Division

SUBJECT: Design concept of the orbiter aft crew stations as a totally integrated on-orbit modular work station

BASIS FOR INFORMATION: Design studies and mockups performed by various NASA Centers, principally JSC and MSFC.

STATUS OF INFORMATION: Space Shuttle Working Paper - Document should be referenced only in other working correspondence and documents by organizations participating in Shuttle program-related activities.

COVERAGE OR CONTENT: See attached page.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Sections 1.2.1 and 3.2.1 (Payload Checkout) 1.3.4 and 3.3.4 (Payload/Shuttle Integrated Tests), 2.1.7 and 4.1.7 (Payload Services Furnished by Orbiter), 5.10 (a) (Shuttle Data Handling), 5.12 (a) (Payload Services), 5.31 (Payload Specialist Function), 5.3.2 (Mission Specialist Function).

9-145

SPACE SHUTTLE PAYLOAD ACCOMMODATIONS ON THE AFT FLIGHT DECK

By Samuel H. Nassiff

SUMMARY

The Orbiter aft flight deck crew stations are being designed as integrated on-orbit modular work stations for payload support operations. Additionally, fixed facilities that are common to all missions will be provided, such as communications panels, lighting controls, TV monitor and controls, cooling ducts, and standard electrical interfaces.

The concept of standardized modular rack panels will accommodate payload user requirements, allow interchangeability of display and control equipment between a habitable module (which also contains standard racks) and the Orbiter aft flight deck, permit standardization and commonality of equipment, and simplify onboard operations. It will also permit installation of displays and controls (D&C) equipment in a standard rack for ground use by the hardware developer. With regard to this concept, an evaluation was performed to determine if adequate panel space was available at the aft crew stations to accommodate a number of payload configurations.

Six representative two-dimensional payload display and control panel configurations were evaluated, utilizing a soft foam core mockup of the Orbiter aft flight deck, with respect to area available for arrangement and location of payload-unique equipment, general crew interfaces, packaging concepts, and mechanization of functions. The Orbiter aft flight deck crew stations mockup was configured to accommodate standup operation by a crewman in a zero-G erect position using only foot restraints.

Adequate area is available at the Orbiter aft flight deck crew stations to accommodate the six sets of payload display and control panels supplied in references 2 and 3 based on the following assumptions:

(1) The display and control panels and information provided in references 2 and 3 reflect the equipment required to effectively checkout and operate the six payloads.

(2) The payloads are representative of the range of payloads to be flown.

(3) No appreciable growth of dedicated Orbiter displays and controls will be required at the aft crew stations.

On missions not requiring rendezvous and docking and/or manipulator operations, additional panel space will be available for accommodating payload supplied equipment. Handholds, crewmen restraints, work surface areas, stowage provisions, payload panel wiring, equipment cooling duct sizing and layout at the aft flight deck are being developed in accordance with the Orbiter subsystem schedules.

REFERENCE RT-7

TITLE: Payload/Orbiter Contamination Control Requirement Study

REPORT NO: MCR74-474, NASA 8-30755

DATE: 27 December 1974

AUTHOR(S): L. E. Bareiss, V. W. Hooper, R. O. Rantauen, E. B. Ress

SUBJECT: Modeling of orbiter and Spacelab contamination sources/payload effects based upon the modeling.

BASIS FOR INFORMATION: Detailed studies.

STATUS OF INFORMATION: Preliminary analysis - results will continue to be refined.

COVERAGE OR CONTENT: See attached page.

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: 5.16 Shuttle Contamination and Sources; 5.26 Spacelab Capability; and 8.3 (f) Payload Contamination.

1.1 Purpose

The purpose of this study is to identify and quantify the expected molecular and particulate on-orbit contaminant environment for selected Shuttle payloads as a result of major Spacelab and Shuttle orbiter contaminant sources. This study reviews individual payload susceptibilities to contamination, identifies the combined induced environment, identifies the risk of Spacelab/payload critical surface(s) degradation, and provides preliminary contamination recommendations. This study also establishes limiting factors which may depend upon operational activities associated with the payloads, Spacelab, and the Shuttle orbiter interface or upon independent payload functional activities. This study will begin to support Spacelab integrated mission planning and furnish a basis for Spacelab/payload and orbiter interface definition in the area of contamination control.

1.2 Scope

This report presents the development of a basic Spacelab contamination computer model which predicts the contaminant environment for three representative Spacelab configurations. The three configurations considered were:

1. a long module and short pallet;
2. a short module and long pallet; and
3. a long pallet.

In combination with an existing Shuttle orbiter contamination model, the total induced environment for these configurations was predicted for the major contaminant sources considered.

REFERENCE RT-8

TITLE: Interface Verification Equipment Study (IVE)

REPORT NO: Progress Briefing

DATE: 14 February 1975

AUTHOR(S): R. Everline (NASA/JSC); E. R. Richardson (Rockwell International)

SUBJECT: Orbiter/Payload (Spacelab) Interface Simulator - Used for interface verification in off-line operations.

BASIS FOR INFORMATION: Requirements and preliminary design study.

STATUS OF INFORMATION: Preliminary design/procurement package for Spacelab to be developed within CY 75.

COVERAGE OR CONTENT: IVE studies include the following:

1. Establishment of Spacelab functional interfaces and requirements
2. Development of generalized payload interface verification requirements
3. IVE subsystem trade studies
4. Development of draft Payload Verification Plan
5. Preliminary design concept for Spacelab functional IVE
6. Preliminary design concepts for standard payload IVE
7. Preliminary procurement package (Spacelab first article).

COMMENTS:

APPLICABLE TO DATA REQUIREMENT: Sections 1.2 (1) Payload Checkout, 1.2 (2 g-2) Simulators (Interface Verification Equipment), 3.2 (1) Payload Checkout (WTR), 3.2 (2g-2) Simulators (Interface Verification Equipment - WTR), 8.0 (1 b) Project Plan, 8.0 (4) Payload Test Requirements, and 8.0 (5) Payload Demonstrations.

10. USER DATA REQUIREMENT DEFINITION STUDIES

Several of the areas identified as a result of the Matrix exercises as missing data required by the STS user needed further study before the missing information could be adequately described. In this section the studies that went into additional depth are reported. These are:

1. Data needed by the user on STS dynamic load alleviation concepts
2. Data required for user mission analysis
3. Data required on Shuttle return constraints
4. Additional data required for Spacelab users

The latter two studies consisted largely of a search for any additional specialized documents covering the areas and consideration of the detailed data requirements for each of these areas.

The first two studies were accomplished by teams of specialists accomplishing tasks related to the user data needs in areas where little historical information exists relative to the user data requirements. The results of these studies are useful as technical backup to the user data requirements statements in Section 2.

10.1 DATA REQUIRED ON LOAD ALLEVIATION DEVICES

10.1.1 Introduction

An investigation into potential STS payload dynamic load alleviation concepts was carried out considering the conditions during orbiter touchdown. The purpose of the investigation was to identify the user data needed on payload dynamic load alleviation and to identify any feasibility problems for use of load alleviation devices. This section of the report describes the investigation. The statement of data needed by the user on STS dynamic load alleviation concepts is presented in Section 2. The reader is referred to Section 2 for the description of the justification of the concern for data in this area.

The results of the study have indicated that the isolation of a payload in the cargo bay from the large accelerations imposed at orbiter landing could probably be accomplished through any one of several means. Presented in this section are some potential shock isolation techniques, all of which would require further study to make a final determination of their validity and their relative merits.

10.1.2 Background

Although the identification of shock isolation techniques applicable to any payload in the orbiter bay is the eventual goal, it was decided for this study to select the Transtage IUS with a DSP mounted to it as a candidate for investigation. This combination is illustrated in Figure 10-1. Any concept which appeared to have merit for the Transtage/DSP would also probably be appropriate for other payloads.

The Transtage/DSP combination has been analyzed by Martin Marietta under a current Air Force contract to determine acceleration responses and structural member loads generated in the DSP/Transtage during landing. Preliminary review of this analysis by the Spacecraft Structures Section of The Aerospace Corporation has indicated that there are loads generated in the DSP which would cause failure of some of the structural members. Since the DSP appears to be typical of spacecraft in the transition period from expendable boosters to the orbiter, it was selected as the candidate for this study.

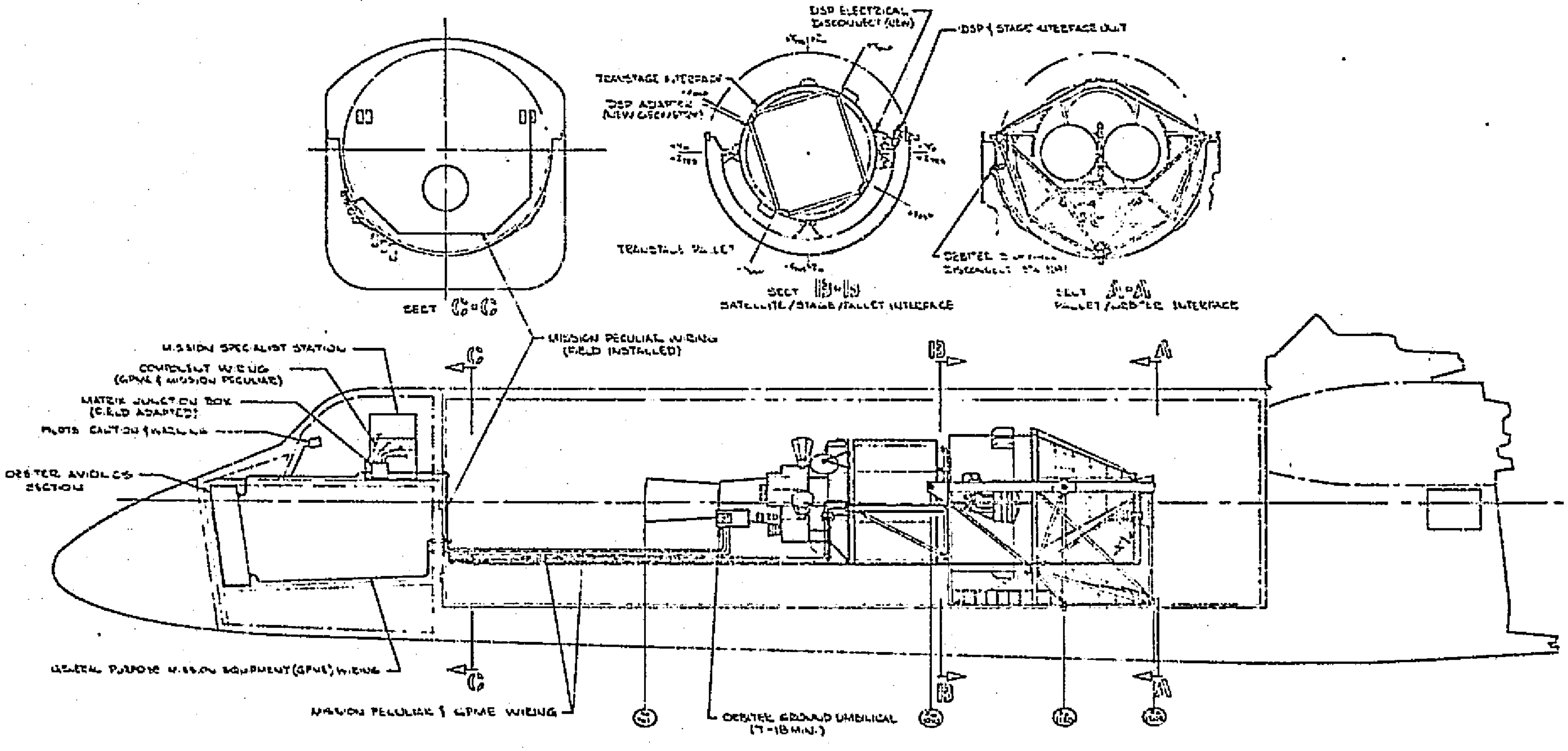


Figure 10-1. DSP/Transtage Installation

10.1.3 Definition of Environment

Actual design of shock isolators for a typical IUS/payload combination such as the DSP/Transtage would require a definition of the design requirements. An example of what would be required is presented in Figures 10-2 and 10-3. This information was developed by the Ground Systems and Environment Department at The Aerospace Corporation for cargo carried in the C-5A aircraft. Figure 10-2 represents the vertical acceleration payload response shock spectrum for the C-5A cargo deck. Responses for varying degrees of damping are plotted. Of interest is the landing peak which occurs at about 10 Hz. Presented in Figure 10-3 is the displacement of the cargo relative to the bay. Note that the rattlespace requirements drastically increase in the lower frequency range.

From these two figures, design requirements for a shock isolation system can be obtained. If, for example, the DSP is transported on its side, then a steady state acceleration of 1 g is applied. If the maximum allowable acceleration is 2 g's, then the frequency range of the isolator system must be such that the shock induced acceleration never exceeds 1 g. Figure 10-2 shows that in the frequency ranges of below 0.8 Hz, 1-3 Hz and 4-6 Hz, the maximum acceleration will stay below 1 g. However, referring to Figure 10-3, it can be seen that the 4-6 Hz range is most desirable since the rattlespace required is lowest.

Information of this type is required before actual design and analysis of shock isolation systems for the orbiter can be performed.

10.1.4 Basic Concepts for Shock Isolation in the Orbiter

Several different methods of reducing the accelerations imposed on payload/IUS combinations in the orbiter bay, and perhaps on the orbiter bay itself, during landing were investigated and are shown schematically in Figures 10-4 through 10-8.

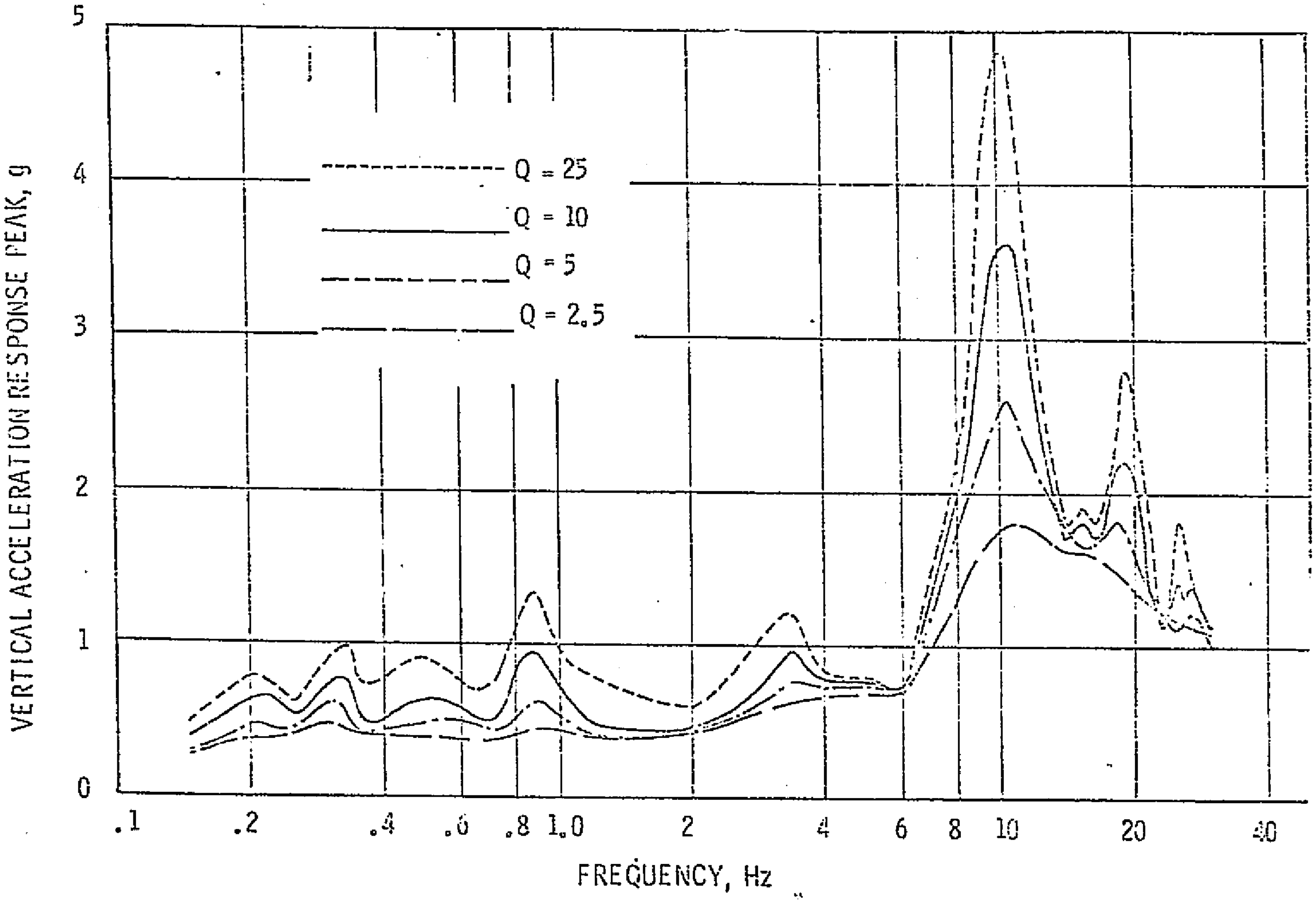


Figure 10-2. Vertical Acceleration Response Spectrum For C-5A Cargo Deck

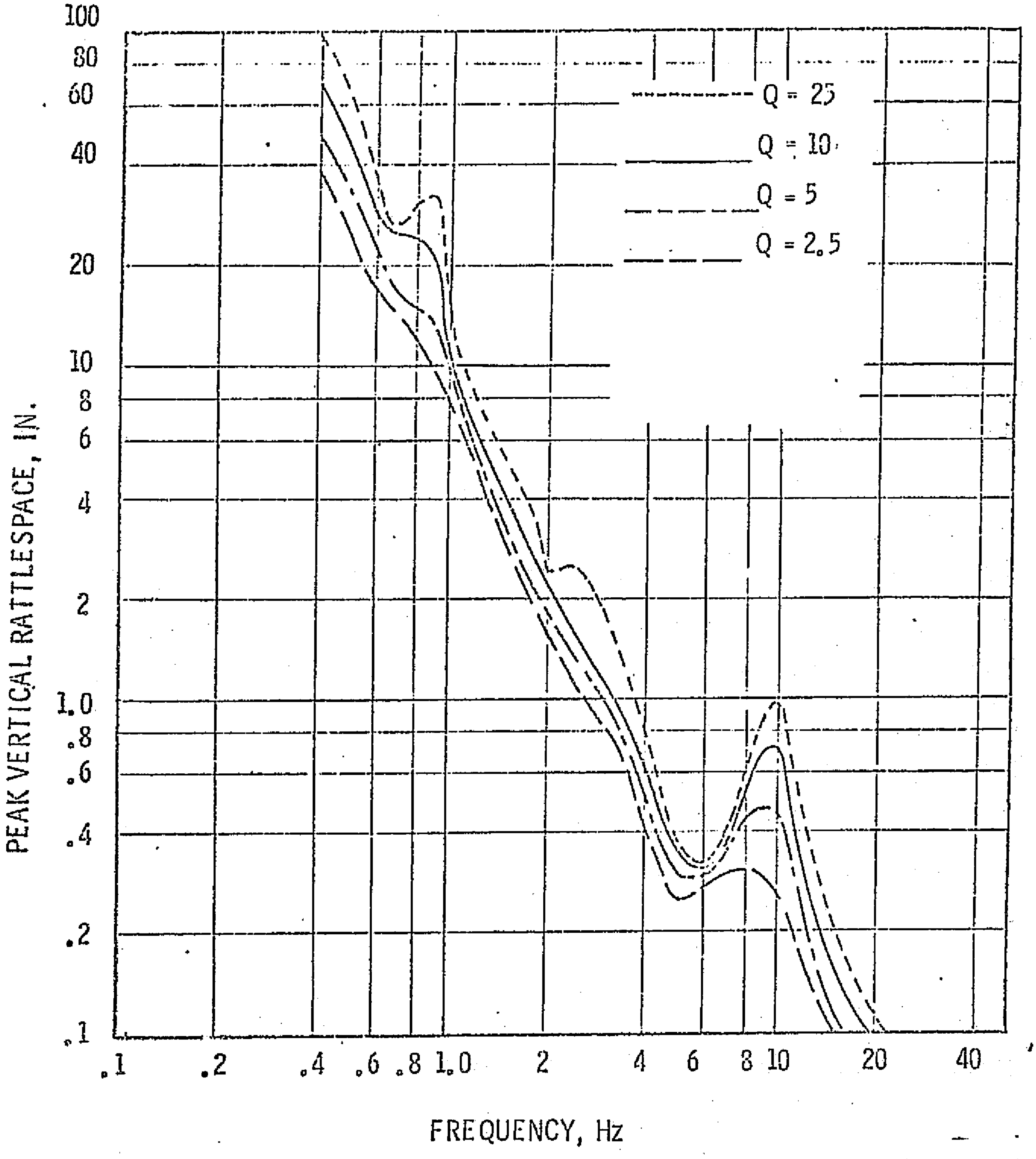


Figure 10-3. Vertical Rattlespace Spectrum fpr C-5A Cargo Deck

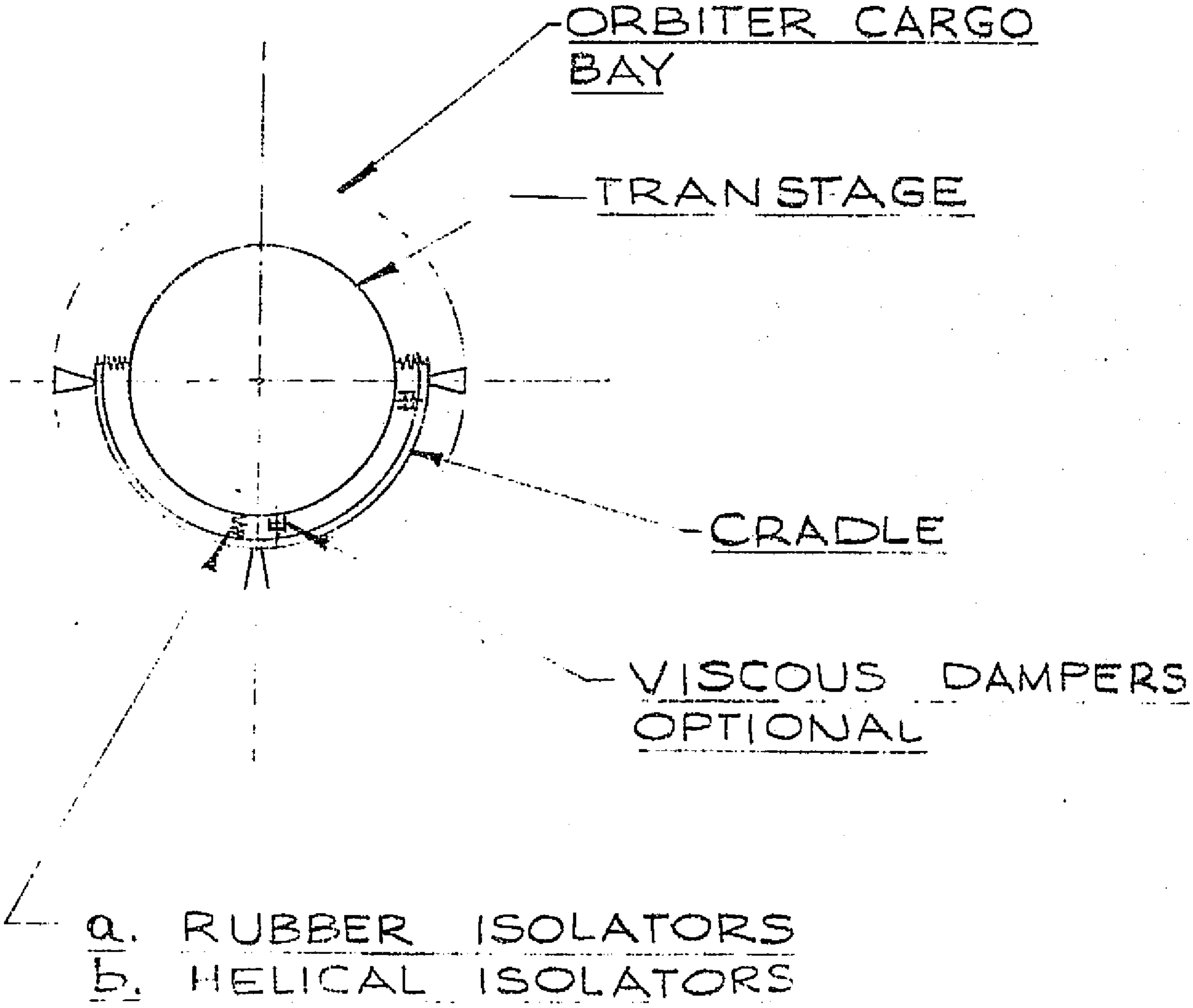


Figure 10-4. Shock Isolators - Transtage/Cradle

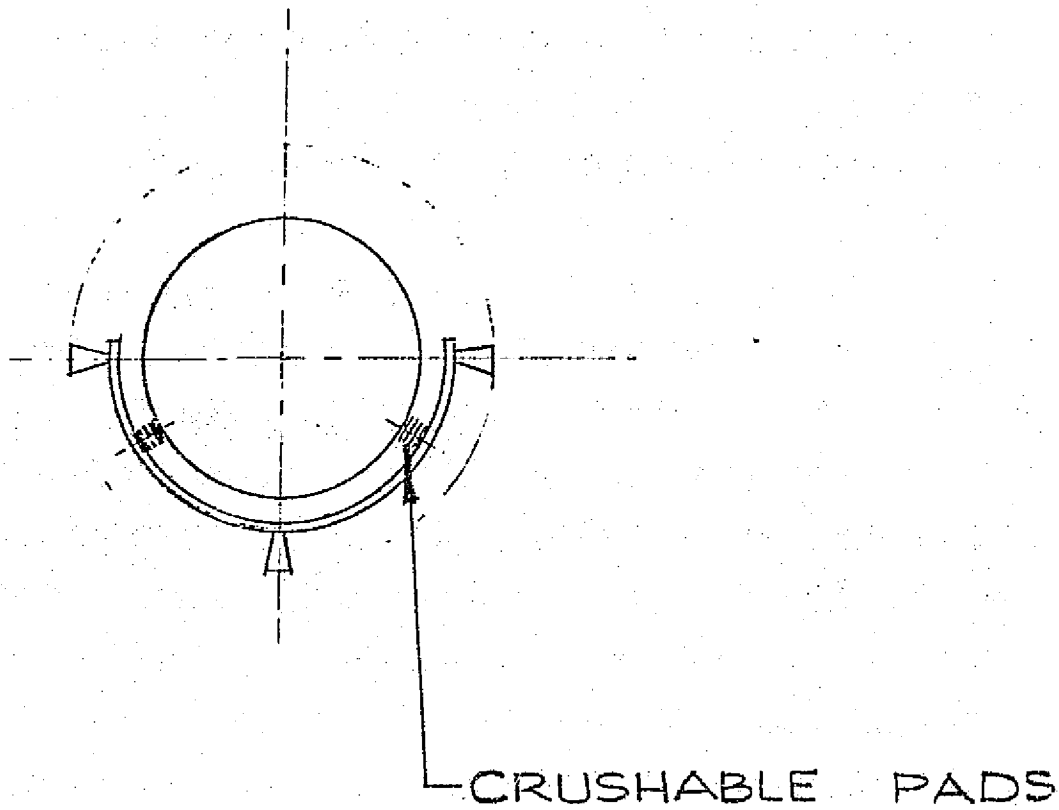


Figure 10-5. Crushable Pads

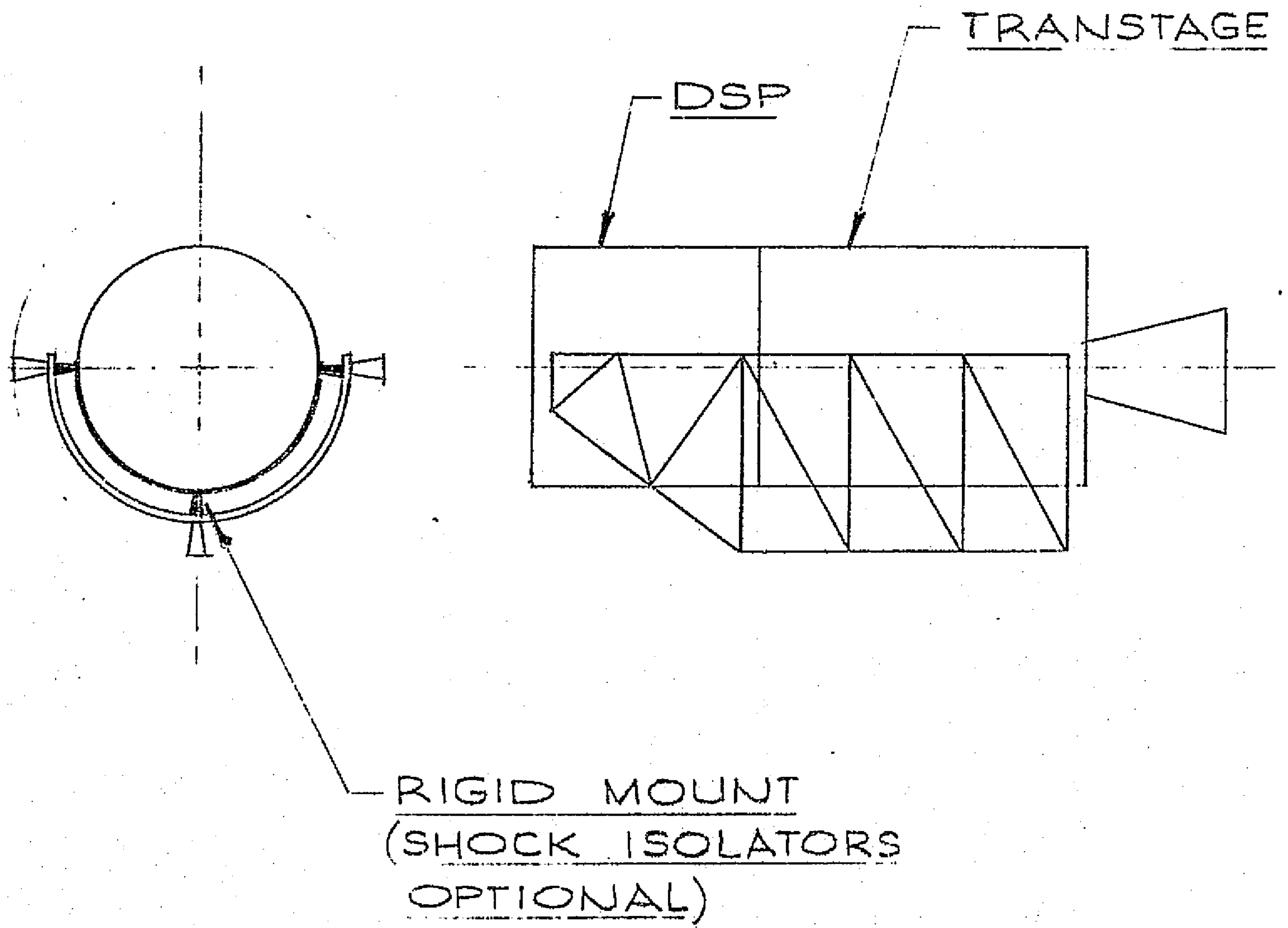


Figure 10-6. Extended Cradle

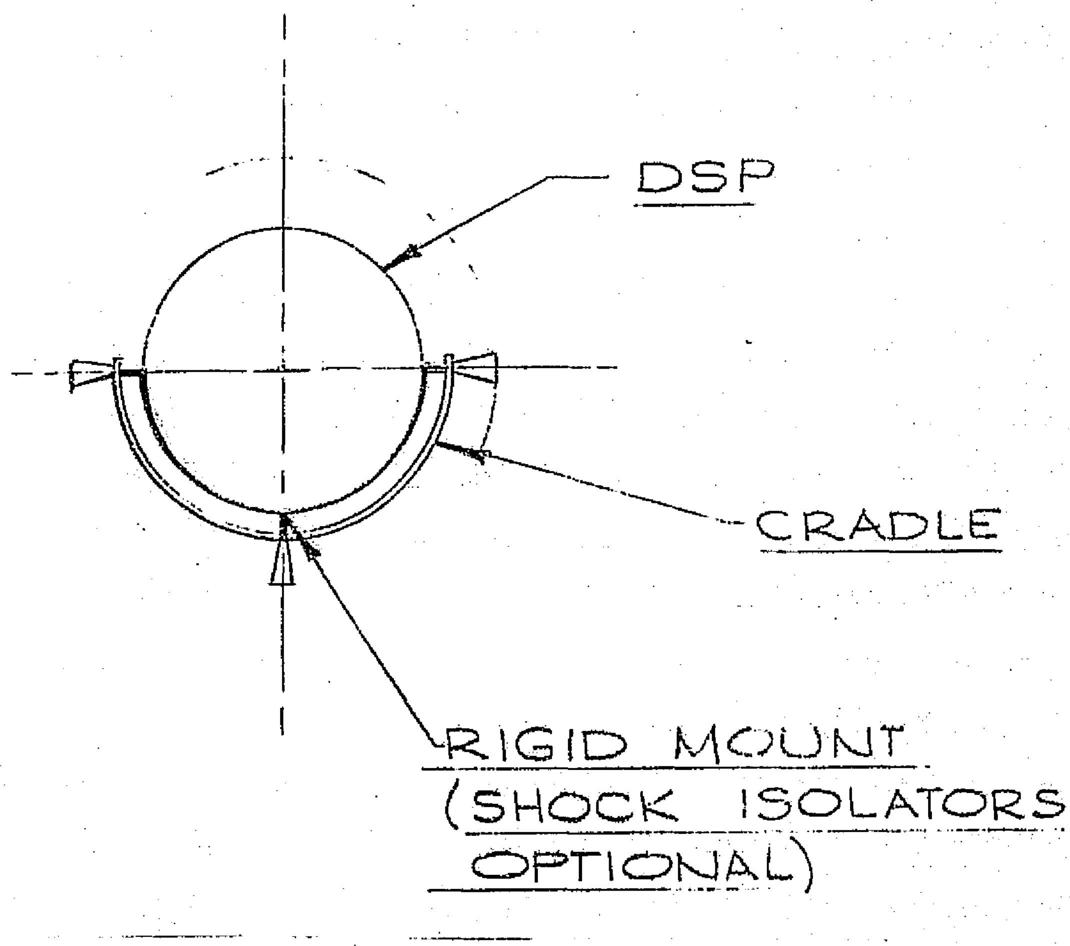


Figure 10-7. Decoupled DSP

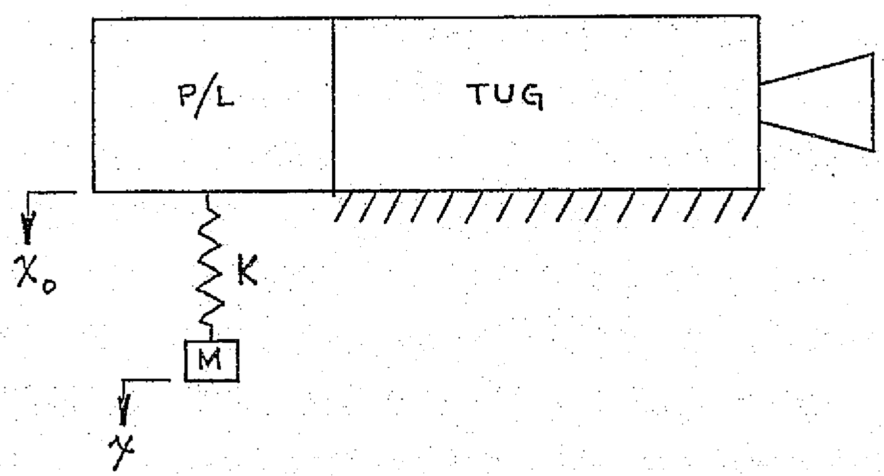


Figure 10-8. Tuned Spring/Mass System Schematic

The basic concepts considered, using the Transtage/DSP as an example, are presented below in outline form and then discussed in subsequent sections of this report. For quick reference, Table 10-1, summarizing some of the advantages and disadvantages of each concept, is also included.

I. SHOCK ISOLATORS EMPLOYED BETWEEN TRANSTAGE AND ITS CRADLE

   A. Rubber Isolators (Figure 10-4)

   B. Helical Isolators (Figure 10-4)

   C. Crushable Pads (Figure 10-5)

   D. Viscous Damper Used in Parallel with A or B (Figure 10-4)

II. EXTENDED TRANSTAGE CRADLE TO SUPPORT DSP

   A. Add Shock Isolators if Required (Figure 10-6)

III. DECOUPLE DSP FROM TRANSTAGE AND SUPPORT IN ITS OWN CRADLE

   A. Rigid Attachment of DSP to Cradle (Figure 10-7)

   B. Add Shock Isolators if Required (Figure 10-7)

IV. TUNED SPRING/MASS SYSTEM ADDED TO THE DSP (Figure 10-8)

10.1.4.1 Shock Isolators Between Transtage and Its Cradle

A minimum modification, the feasibility of which can only be determined through a design and analysis effort, would be the addition of shock isolators between the Transtage and its cradle. The DSP would remain cantilevered from the Transtage.

Some preliminary thoughts on this scheme are presented as follows.

1. Shock isolators, as shown schematically in Figure 10-4, would serve to cushion the suddenness of the forces and motions generated by the landing and thereby reduce the response of the DSP/Transtage, particularly in the higher frequency modes of vibration. Basically, the shock isolators would be required to store the quantity of energy generated by the landing spike and release it later at a slower rate.

   A synthetic rubber isolator or a helical isolator could be used. A typical example of a helical isolator is shown in Figure 10-9. These types of isolators also provide inherent damping which is desirable to prevent excessive excursion of the DSP/Transtage relative to its cradle. Helical isolators, as illustrated in Figure 10-9, are inherently damped through internal wire flexure hysteresis and can provide damping coefficients as high as 0.15.

   The installation of isolators is foreseen to present few technical problems. The main concern is whether they effectively isolate the DSP/Transtage from accelerations which would overload the structure and whether the rattle-space availability is adequate. These concerns can only be resolved through obtaining data on the acceleration environment and an analysis of an isolator system. This scheme also merits further study.

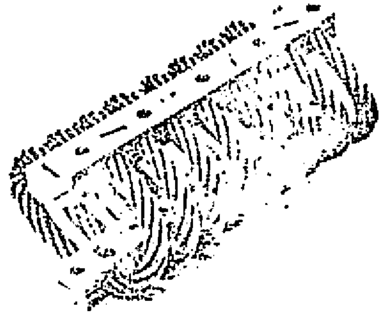
2. Crushable pads between the Transtage and its cradle (see Figure 10-5) could serve to absorb the initial large landing acceleration spike. Whether this approach would be sufficient to reduce the accelerations to an acceptable level can be shown only through analysis.

   The pads could be designed so that they would not change the dynamic characteristics of the cradle/Transtage mounting scheme under any phase of the flight except landing when the large landing spike would crush the pads. The pads would be replaced, of course, prior to the next flight.

   Due to the simplicity of this scheme and its minimal impact on the present designs, it should be investigated further.

Table 10-1. Shock Isolation Concepts

CONCEPT	ADVANTAGES	DISADVANTAGES
I. Shock Isolators	1. Reduce response of payload to landing spike.	1. Probably require some modification to Transtage and cradle.
A. Rubber Isolators	1. Provide inherent damping. 2. Probably no modification of DSP required. 3. They are reusable.	1. May require increased "rattlespace" between IUS/cradle and/or DSP/cargo bay.
B. Helical Isolators	1. Provide high inherent damping (15%). 2. Probably no modification of DSP required. 3. They are reusable.	1. Same as above.
C. Crushable Pads	1. Probably no modification of DSP required. 2. Would not change dynamic characteristics of DSP/Transtage/cradle under any flight phase except landing.	1. Will reduce amplitude of first acceleration cycle. Successive cycles, if any, would not be damped. 2. May require increased "rattlespace". 3. Must be replaced after use.
D. Viscous Dampers	1. Would provide increased damping if required.	1. Cannot be used without a parallel spring connector.
II. Extended Transtage Cradle to Support DSP	1. Would require no modification of Transtage. 2. By stiffening system, could possibly raise natural frequency above landing spike frequency. 3. Would reduce "rattlespace" requirements.	1. Would require structural modification of DSP. 2. Would require structural modification of Transtage cradle. 3. Could possibly be a high weight approach.
III. Decoupled DSP/Transtage	1. Would probably result in the stiffest support system of all concepts listed. 2. Could offer some flexibility to c.g. location control in Orbiter.	1. Mechanically is the most complex concept. 2. Could be a high weight approach. 3. Would require structural modification of spacecraft. 4. Would require some mechanical modification at Transtage interface.
IV. Tuned Spring/Mass	1. No mechanical or structural coupling from DSP to any other surfaces required.	1. Would probably not reduce amplitude of first response cycle. 2. Mass required could be high. 3. Mass is "dead weight" for all flight phases except landing. 4. Structural modification to DSP probably required.



ISOLATION EFFICIENCY

The mounts have been selected to produce the following isolation characteristics at the specified loads:

■ Natural Frequency	10 Hz (600 rpm)
=50% Isolation	20 Hz (1200 rpm)
=75% Isolation	30 Hz (1800 rpm)
=90% Isolation	40 Hz (2400 rpm)
=95% + Isolation	50 Hz (3000 rpm)

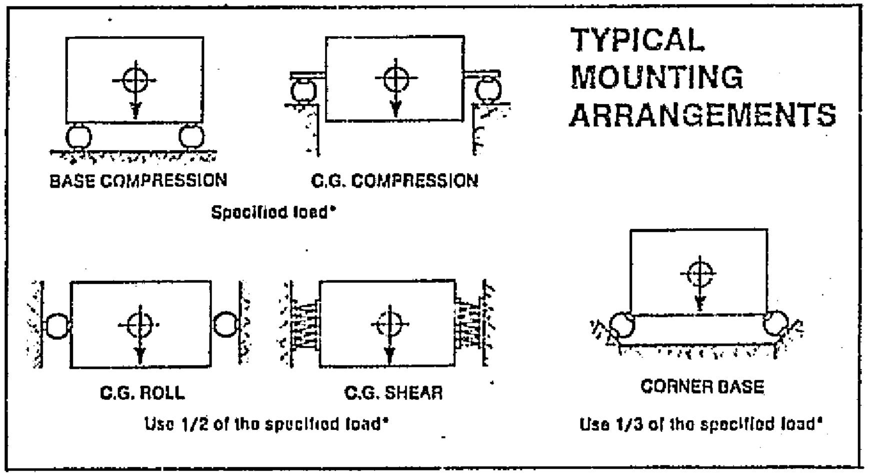


Figure 10-9. Helical Isolator

3. Viscous dampers, such as those shown in Figure 10-10, could be installed between the Transtage and the cradle. The dampers alone will not, of course, support the DSP/Transtage, and a helical or rubber spring isolator system would still be required. In the event that sufficient damping could not be obtained from isolators of the type discussed previously, then the addition of viscous dampers may be required. This approach should be investigated along with the general shock isolation problem.

10.1.4.2 Strongback Cradle Extension

An alternative to actually isolating the Transtage/DSP from the frequency range in which the landing shock occurs is to stiffen the DSP supports. This stiffening can be achieved by extending the Transtage cradle under the DSP to form a stiffer DSP/Transtage combination (Figure 10-11).

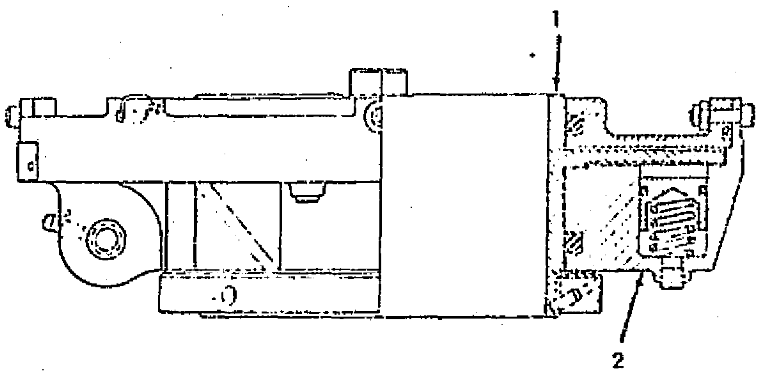
Some of the considerations involved with this concept are as follows.

1. The extension of the cradle necessitates a structural attachment from the cradle to the DSP. The best area for this attachment would be near the sensor/main body interface. Since the DSP is not designed to be supported in this area, modification of the DSP structure would be required.

2. The weight impact associated with this scheme is a function of the spacecraft being supported. Each spacecraft would probably require a unique cradle extension. A representative cradle design for the DSP would provide an indication of the weight penalties associated with this concept.

3. The attachment between the cradle and the DSP could either be rigid or could incorporate shock isolators (with or without viscous dampers), see Figure 10-6. The requirement for isolators could only be determined through a definition of, and an analysis of, the environment. The mechanical installation of the isolators in the system is feasible and should present no major problems.

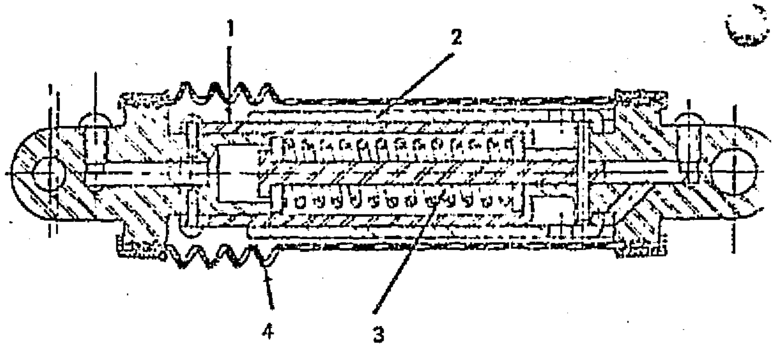
HOUDAILLE
ROTARY VISCOUS DAMPERS



DESCRIPTION AND OPERATION

The Houdaille Rotary Viscous Damper consists of two members spaced by a predetermined gap filled with highly viscous silicone fluid. Relative motion between Stator (1) and Rotor (2) induced by wheel shimmy or other vibratory input causes shearing of the fluid under conditions of high resistance, thus developing a damping force which is proportionate to velocity.

HOUDAILLE
LINEAR VISCOUS DAMPERS



DESCRIPTION AND OPERATION

The Houdaille Linear Viscous Damper produces damping force by means of the shearing of high viscosity fluid between a piston (1) and cylinder (2) moving relatively to each other. This design also includes a centering spring (3) to make it double-acting, and a protective rubber boot (4) to enclose the working components.

Figure 10-10. Viscous Dampers

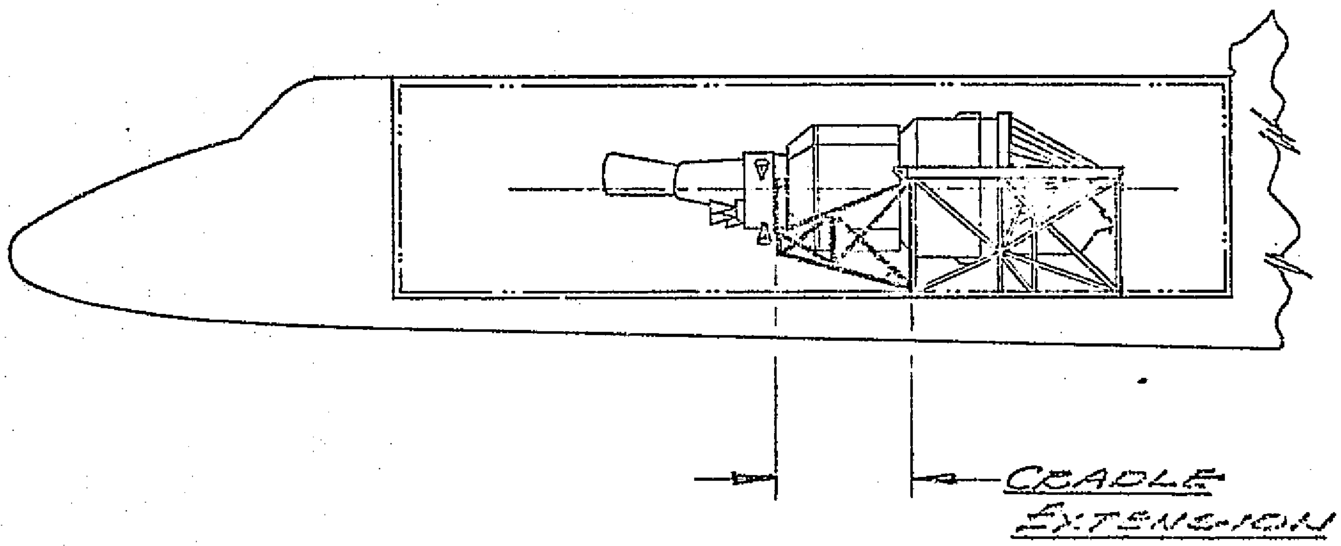


Figure 10-11. Extended Transtage Cradle

4. The concept should be investigated further to allow comparison with the other concepts discussed.

10.1.4.3 Decoupled DSP/Transtage

One method of reducing the accelerations resulting from a cantilevered spacecraft is to support the spacecraft in some other manner, instead of cantilevering it from the front of the IUS. Figure 10-12 illustrates a concept whereby the DSP is supported in its own cradle and is mechanically decoupled from the Transtage during launch and landing. Some of the requirements and considerations for such a design are as follows.

1. The DSP should be decoupled mechanically from the Transtage during launch and landing so that, in the event of an abort, it is not required to move the payload relative to the Transtage (Figure 10-7).

2. A mechanism is required which would hold the DSP to its cradle during launch, flight, and landing, yet would allow movement of the DSP relative to its cradle for coupling or decoupling. This is shown conceptually in Figure 10-12. Some preliminary thought has indicated that it would probably be most desirable to require the DSP to translate longitudinally relative to its cradle. The DSP cradle would remain fixed to the orbiter bay, thus simplifying this interface. Also, the Transtage/cradle system would remain fixed. The translation distance required would be small (6-12 in.).

   Some concepts have been considered for the mechanism required to accomplish this action (Figure 10-12). The initial indications are that it is feasible to design such a mechanism. The complexity and weight penalties associated with such a design could only be determined through a preliminary design effort.

3. Electrical and fluid interfaces, if any, across the DSP/Transtage could incorporate flexible lines and need not be separable during the mating/demating process.

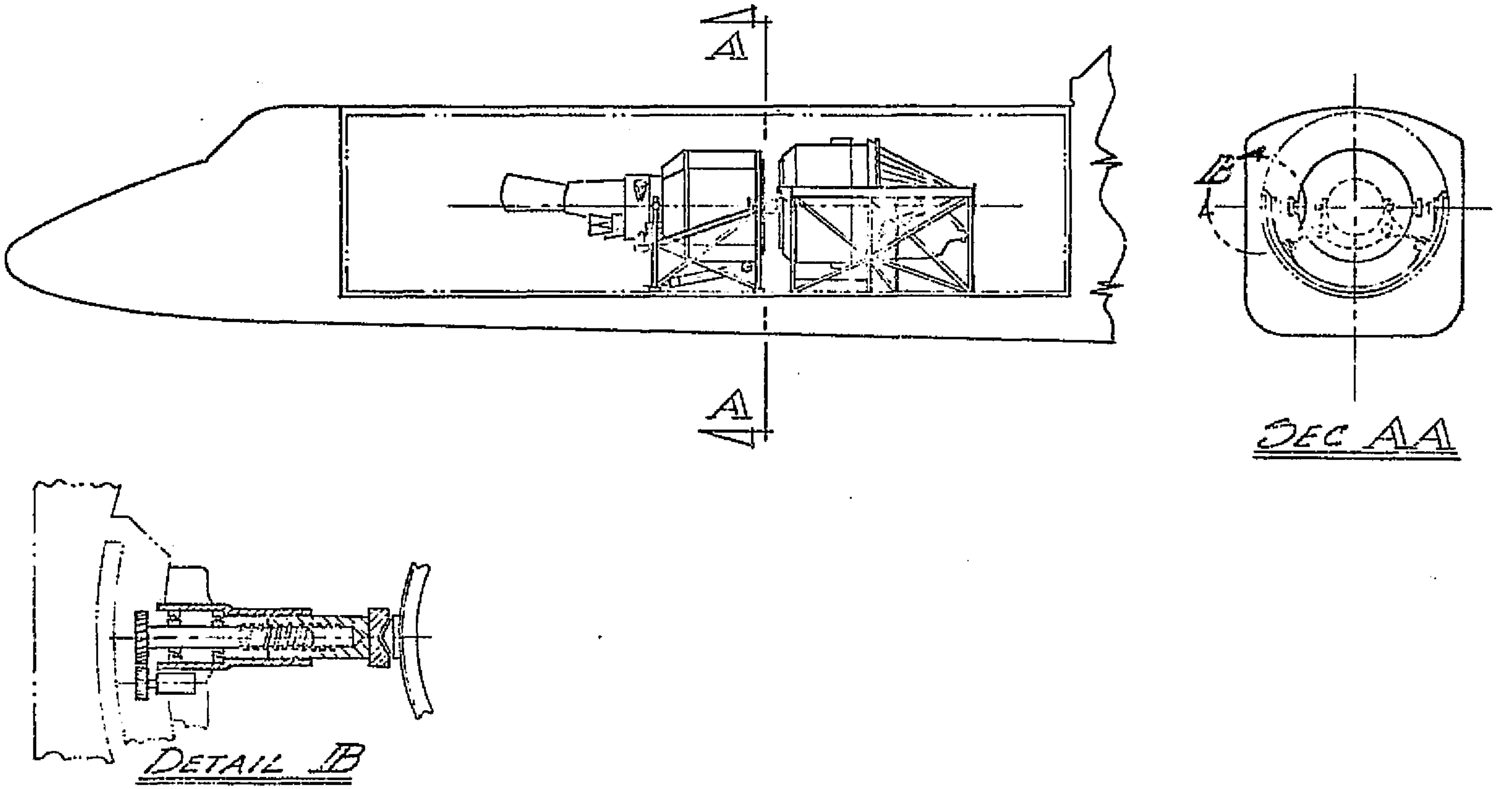


Figure 10-12. Decoupled DSP/Transtage

4. The DSP, as well as most other spacecraft designed for launch on an expendable launch vehicle, is not designed to carry loads through any interface except the aft one. Supporting the DSP in its own cradle will require not only support at the aft end but also at some forward point such as the main body/sensor interface. This will undoubtedly require modification of the DSP internal structure.

5. Shock isolators may or may not be required between the DSP and its cradle. This requirement can only be determined when the landing environment is defined.

6. While no firm design has been generated or any analysis performed for this concept, it is felt that it could result in reduced accelerations both at the payload and at the orbiter attach points. The concept merits further study.

10.1.4.4 Baseline Transtage - Tuned Spring-Mass System on DSP

One concept under consideration which initially seemed attractive was the tuned spring-mass system. In this concept, a mass (or masses) would be mounted directly to the payload via a spring(s). The mass would then be free to vibrate relative to the payload whenever the payload itself acted as the forcing function (see Figure 10-8).

This type of system is normally employed under conditions of steady state vibration when it is desirable to reduce the amplitude of the vibrating object or, as in the case of a transient input such as that induced by a landing shock, it is desired to limit the number of cycles the payload would undergo. However, this system probably would not reduce the initial acceleration the payload would experience on landing. In addition, the mass required could possibly be a large percentage (10 to 20 percent) of the payload. In the case of the DSP, which weighs 2600 lb, the added weight could be appreciable. Structural modifications to the spacecraft may also be required. For these reasons, this concept does not appear to be as attractive as others for further study.

10.1.5 Conclusions

Based on the investigation described in this section, there appear to be three different concepts which could be investigated as possible candidates for reducing the accelerations experienced by the payload in the orbiter bay during landing. These three concepts are:

1. Shock isolators employed between the baseline Transtage and its supporting cradle
2. A strongback extension added to the Transtage cradle to support the DSP
3. Decoupled DSP/Transtage.

Concept 2 could be implemented with or without shock isolation. All three concepts merit further study, including a preliminary design definition analysis of the effectiveness of each in reducing maximum design loads and the applicability of each concept to STS payloads.

Data needed by the STS user regarding these concepts are weight increment, range of reduction in maximum loads (for varying frequencies), method of attachment and release, requirements for reattachment, dimensions, typical installations, loads induced at attach point, and stiffness and damping characteristics of the device(s).

10.2 DATA REQUIRED FOR USER MISSION ANALYSIS

10.2.1 Study of Sources for Mission Analysis Data

10.2.1.1 Reference Documents

The basic reference document for Pre-Phase A analysis of Shuttle capabilities from the user point of view is JSC 07700, Volume XIV, Space Shuttle System Payload Accommodations (WF-1). Launch azimuth limitations at VAFB and KSC are presented with the corresponding range of resulting orbit inclinations. Charts are presented of payload capability to circular orbits as a function of orbit altitude and orbit inclination. Delivery only situations are presented separately from those for delivery and rendezvous. Elliptic orbit capabilities for 100-nmi perigees are also presented. For these, landing opportunities are influenced by the relative positions of the landing sites and orbit apsides; payloads corresponding to the extreme cases are presented. Payloads to sun synchronous orbits as a function of altitude are given. The capabilities presented take into account TPS constraints on reentry. Stability and propellant consumption rates for limit cycle control and propellant consumption for inertial attitude hold for various deadbands are shown. Navigational accuracies and payload pointing errors are also given. Maximum payload limits for ascent and for landing are given. This document is revised periodically; there is to be a revision dated May 1975 which includes revised charts of the payload capabilities. No data are presented for flights employing yaw steering or in which an upper stage is used for final payload delivery.

Detailed data on the reference missions which can serve as a guide for preliminary mission analysis are presented in the following documents from Rockwell International.

(WF-2) 1. Space Shuttle Flight Systems Performance Data Book, Volume I, Ascent, SD73-SH-0178-1B, dated December 1974

(WF-3) 2. Space Shuttle Flight Performance Data Book, Volume II, Orbiter Entry, SD73-SH-0178-2, dated January 1974

(WF-4) 3. Flight Performance Data Book, Volume IV, Operational, SD73-SH-0178-4, dated April 1974

These volumes are updated periodically to reflect revisions in the results.

10.2.1.2 Independent Trajectory Analyses Supported by User

10.2.1.2.1 Mission Design and Analysis Subsystem (MDAS)

The Mission Design and Analysis Subsystem (MDAS) simulation is currently in the initial stage of operational use and is designed to allow analysis of an entire mission from liftoff to landing. It is an on-line computational facility in which simulation detail is restricted to provide fast response while maintaining adequate precision in the results. The system is described in the following documents:

(WF-5) 1. MDASP-Mission Design and Analysis Subsystem Prototype, Volume I, Users Guide, The Aerospace Corporation, TOR-0075(5421-07)-1, Vol. I, J. L. Starr, 25 April 1975

(WF-6) 2. MDASP-Mission Design and Analysis Subsystem Prototype, Volume II, Advanced Engineering/Programmers Guide, The Aerospace Corporation, TOR-0075(5421-07)-1, Vol. II, J. L. Starr, 25 April 1975

There are routines available in MDAS to simulate the ascent portion of flight, impact of the ET, coasting flight, orbital maneuvers, optimum transfer between orbits, rendezvous, sunrise and sunset, deorbit, and reentry. Routines to simulate the operation of an upper stage carried in the Shuttle payload bay are also available. Currently, the ascent portion of MDAS is a two-dimensional simulation; a three-dimensional version is under development at JSC and will be phased in when complete. At that time, yaw steering during ascent can be simulated, a capability which is not available at present.

A unique feature of MDAS is that the program resides on the Computer Sciences Corporation Information Network (INFONET) System. This is a time- sharing network which may be accessed by any compatible acoustic link remote terminal. The Shuttle vehicle characteristics are coded into the simulation and, hence, a user of the system does not have to develop his own simulation or input vehicle data. His results should therefore be comparable with any other user results.

10.2.1.2.2 Maximum Precision Simulations

In the advanced phases of planning, trajectory simulations yielding the maximum precision and detail may be required. The following references are designed to be a data source for such purposes:

(WF-7) 1. Shuttle Operational Data Book, Volume I, Shuttle Systems Performance and Constraints Data, NASA/JSC-08934 (Vol. I), June 1974

(WF-8) 2. Shuttle Operational Data Book, Volume II, Shuttle Mission Mass Properties Data, NASA/JSC-08934 (Vol. II).

To quote from the document, "The purpose of the Shuttle Operational Data Book (SODB) is to provide a single authoritative source of properly validated data which most accurately and completely describes the Shuttle operational performance capabilities and limitations. These data will be kept current and will be based on the highest level of data qualification available at that time, i.e., specification, estimation, studies, analyses, simulations, ground tests, flight tests, and flight operations. Due to the need for the standardization of Shuttle Source Data, the SODB shall be used as the standard operational data base for all mission design and planning, simulations, studies and analyses." It appears that this document will solve the data source problem in the more distant time frame. However, at the present time it is so incomplete as to be of little use for ascent and reentry simulations although some on-orbit data is of value. Comments on the document are contained in Reference 1. Volume II is not published as yet; the user is referred to Rockwell International document SD72-SH-0120, Space Shuttle Mass Properties Status Report, for weight data. This is issued monthly by Rockwell International. In the section on aerodynamics, reference is made to two Rockwell International documents:

(WF-9) 1. Aerodynamic Design Data Book, Volume I, Orbiter Vehicle, SD72-SH-0060 1G, June 1974

(WF-10) 2. Aerodynamic Design Data Book, Volume II, Mated Vehicle, SD72-SH-00620 2G, June 1974

These data are available on tape from NASA JSC, Code EX33.

The aerodynamic data have been revised substantially last December and the revisions are not yet reflected in the above documents.

The Performance Analysis Department at The Aerospace Corporation is in the process of updating its Shuttle simulation to the most current form possible. Data for this purpose are being obtained from Rockwell International document SAS/MR&I-75-039, Mission 3A Ascent Trajectories for the February 1975 Performance Assessment, March 10, 1975. Personal contact with Rockwell International performance personnel has been necessary to resolve various questions in converting the data presented into an operational simulation.

10.2.2 Study of Sequential Weight Statements and Payload Chargeable Weight Data Required

TBS

10.2.3 Reference

(WF-11) Review of Shuttle Operational Data Book, The Aerospace Corporation Letter 75-2610.3.1-032, S. T. Chu to SAMSO (LVRO/Capt. J. Jannarone), 3 March 1975.

10.3 DATA REQUIRED ON SHUTTLE RETURN CONSTRAINTS

10.3.1 Introduction

Operations at our national ranges are generally designed to have minimum impact on the general public. In addition, the Air Force in the operation of its aircraft takes many precautions to limit the hazard and annoyance of the general public. For instance, Air Force Regulation 60-5, Conduct of Air Missions Involving Hazardous Cargo, directs that aircraft commanders will plan flight routing to minimize flights over heavily populated or otherwise critical areas. Hazardous cargoes specifically defined in this regulation are nuclear weapons and high explosives. However, the obvious intent could be applied to the return of the orbiter. Also, AFR 55-34, Reducing Flight Disturbances That Cause Adverse Public Reactions, provides practices that should be used in air operations involving supersonic flight because of the sonic boom problem. These practices, if applied to the orbiter, could be restrictive in terms of orbit inclination because of limited crossrange and maneuvering capability for Abort Once Around (AOA) and End of Mission (EOM).

The return flight of the orbiter involves a relatively fixed flight plan because of the need for precise energy management during the entry and terminal flight phases. It also involves a severe reentry environment including high levels of heating, high dynamic pressures, and a variety of atmospheric effects such as aero-electrical phenomena. In view of the position taken relative to hazardous operations and public reactions for aircraft operations, it is likely that constraints on orbiter operations during the entry and landing phases may be established. Such constraints, because of the limited flexibility of the return flight plan for the orbiter, could have a significant impact on a Shuttle user in terms of the launch azimuths and inclination angles that can be used. Therefore, the Shuttle user should know during the planning stage of a program whether there are such constraints or not and if there are, the limitations imposed on Shuttle missions should be defined.

10.3.2 Reference Document

The Space Shuttle Launch and Recovery Site Review Board report (see Summary, page 10-30) was reviewed. It was reported that the capability to place the sonic boom footprint by changing reentry trajectory and glide paths would minimize the potential restrictions during normal return or during abort. However, this conclusion needs to be clarified and defined so that users can understand any entry and terminal flight phase constraints on the mission.

10.3.3 Study Result

No solid evidence was found at this time showing that there will be restrictions on return flight corridors which will limit the orbiter ephemeris (inclination or altitude). The number of normal return opportunities per day may possibly be limited by the desire to normally restrict the sonic boom nuisance to as small an area as possible. However, even this is speculative and could be ignored in case of emergency. In addition, there do not appear to be solid criteria for determining these limitations or restrictions.

As more data become available from simulations of orbiter reentry trajectories, glide path, and landing (including sonic boom footprints and instantaneous impact traces) for various orbiter inclinations, it is expected that any limitations would be identified for the user. Follow-up effort is needed in behalf of the user.

SUMMARY SHEET FOR REFERENCE OR-1

TITLE: Space Shuttle Launch and Recovery Site Review Board Report

REPORT NO.: None

DATE: 10 April 1972

AUTHOR(S): Dr. Floyd L. Thompson, Major Gen. Edmund F. O'Connor, Mr. Vincent L. Johnson, Mr. Robert H. Curtin, Mr. LeRoy E. Day

SUBJECT: Launch and Recovery Site Selection

BASIS FOR INFORMATION: Previous and Concurrent (1972) Studies by elements within NASA

STATUS OF INFORMATION: Cost information may be outmoded; sonic boom problem is under review at present time.

COVERAGE OR CONTENT:

- Jettisoned body impact locations, sonic boom problem, facilities, logistics, environmental factors, costs, manpower loading, scheduling
- Possible interference with existing traffic patterns was not reviewed in depth

COMMENTS[1]: Abort and end of mission planning considerations reported are very minimal when considering user data requirements:

- Ground safety (i.e., crash and/or debris impact) considerations not addressed.
- Nominal maximum overpressure for any orbiter entry will not exceed 2.0 psf, and, therefore, is in the questionable nuisance or annoyance (gray) area.
- Concluded that the capability to place the sonic boom footprint by changing reentry trajectory and glide path would minimize the potential restrictions during normal return or during abort. This needs to be defined and verified (e.g., orbiter cross-range capability for each inclination, ETR, WTR).
- Information lacking on plan and schedule to accept reentry and glide path for STS operation.

APPLICABLE TO DATA REQUIREMENT:

(1) Considering user data requirements for orbiter return.

10.3.4 Future Effort

10.3.4.1 Technical Objective

The technical objective is to provide operational constraints data for the entry and terminal phases for use in mission design by the Shuttle user during the planning phases of a program. These constraints would be based on safety and annoyance considerations and should consider the possible effect of changes in acceptability of certain situations as more flight experience with the orbiter is obtained and as the orbiter operations approach those of current aircraft.

10.3.4.2 End Product

The end product could be in the form of information defining the acceptable flight corridors over populated areas near proposed landing sites as a function of orbit inclination angle (for AOA and EOM) considering the system's characteristics and capabilities. Factors considered should include sonic booms and possible crash/debris impact hazards and other factors that might operationally constrain the use of the orbiter for a mission. All practical launch azimuths and orbit inclination angles should be considered. Data for return to KSC, VAFB, and [illegible] AFB should be included.

10.4 ADDITIONAL DATA REQUIRED FOR SPACELAB USERS

A special effort was made to obtain documentation related to the Spacelab users' need for information and to develop more detailed lists of the Spacelab user data requirements. The May 1975 issue of the Spacelab Payload Accommodation Handbook was reviewed. The summary sheet for the reference is included in this section (see page 10-33). The contents of the reference were compared to the user data requirements. Those Spacelab user data requirements on which information was not found are described in the statement of data requirements for Spacelab presented in Section 2 of this report.

The Spacelab user is defined as the experiment, experiment supplier, experiment support equipment supplier, and Level IV integrator. Level IV indicates the integration of the experiment and the experiment support equipment.

The user data which is missing includes administrative information, information related to the experimenter in space, physical interface information, integration procedures, operations, and ground support.

SUMMARY SHEET FOR REFERENCE EBM-11

TITLE: Spacelab Payload Accommodation Handbook (Preliminary)

REPORT NO: None

DATE: May 1975

AUTHOR(S): T. J. Lee, NASA/MSFC and H. Stoewer, ESRO

SUBJECT: Characteristics and capabilities of the Spacelab system for payload planning

BASIS FOR INFORMATION: Baseline information for payload planning provided by NASA/ESRO for Spacelab.

STATUS OF INFORMATION: Preliminary

COVERAGE OR CONTENT: General and detailed information on capabilities and characteristics of the Shuttle/Spacelab for payload planning. Some of the required information for planning is included but about 10 percent of the data discussed is to be decided.

COMMENTS: Valuable for Phase A and Phase B payload planning.

APPLICABLE TO DATA REQUIREMENT: Phase A 1.1: 6 a, b; 7; 1.2: 1 a, b, c; 2 c, h; 3 a, b; 1.3: 4 a, b; 11; 12; 5.0: 3; 4 a, c; 7 a, b; 8 a, b; 9 a, b, c; 10 b, c, d, e; 11; 12 a, b; 13 b; 15 a, b, c, d, e, f; 17 b; 18 a, c, d; 26 a, b, c, d, e, f, g, h, i; 28 a, b; 31 a, b; 32 a, b; 33 c; 8.0: 3 a, c, e, f. Phase B 5.0: 3; 7 b; 8 a, b; 9 a, b, c; 10 b, c, d, e; 11; 12 a, b, c; 13 b; 15 a, b, c, d, e; 18 a, c, d; 26 a, b, c, d, e, f, g, h, i; 28 a, b; 31 a, b; 32 a, b.

11. STS USER DOCUMENT OUTLINES

At the request of William F. Moore, STS user document outlines have been prepared as a part of the STS User Plan Study. This section contains the outlines proposed for reference documents for the STS payload projects' use while in the payload study phases (equivalent to Pre-Phase A, Phase A, and Phase B). The outlines are recommended for documents containing, or in some cases referencing, the data and information needed for studies for potential STS payloads. Veteran satellite project personnel prefer the alternate proposed outline. The alternate outline would present the data in a conventional manner like launch vehicle users' guides which have been issued in the past. For instance, satellite offices and contractors working to transition payloads from expendable launch vehicles to the STS would find this document easier to use and appropriate for their project.

New STS users and STS users developing new payloads to be supported by the STS are expected to prefer the document outlined for "New Potential Users." In addition to the data presented in the alternate outline, this document features information on standard interface specifications, standard NASA satellite components, space-qualified equipments, standard STS interface specifications, and basic information on current and projected uses of space. It is also organized so that when the subsystem specialists come on board a payload project and need detailed interface data (usually Phase B or the equivalent), each subsystem will have a section of the report presenting or referencing data needed.

It is recommended that both documents be prepared. Aerospace has special capabilities that relate to certain sections of the documents related to STS/payload interface analysis techniques, interface equipment, and standard components and desires to the documents in these areas.

The outlines presented on the following pages are:

1. Proposed Outline (Condensed Version), STS User Data Document for New Potential Users, Advanced Payload Studies

2. Proposed Outline, STS User Data Document for New Potential Users, Advanced Payload Studies

3. Alternate Proposed Outline, STS User Data Document for Potential Users, Advanced Payload Studies.

Proposed Outline (Condensed Version)

STS User Data Document for New Potential Users
Advanced Payload Studies(1)

(This outline reflects a potential user document approach structured for the purpose of easy and efficient use by the user even though it is more difficult for the STS-oriented personnel to write. This user or payload oriented approach would normally be preferred by a new potential user of space. The outline is also designed to be useful to the subsystem engineers and specialists working on payload studies by providing subsystem sections for data of most interest to each.)

1.0 INTRODUCTION

1.1 Use of Handbook in STS Payload Planning Studies

[Discuss the intended applicability of the data, the basis for the information, the relationship of this document to related documents (KSC Launch Site Accommodation Handbook for STS Payloads, Spacelab Payload Accommodation Handbook, Space Shuttle System Payload Accommodations, IUS Users' Guide, STDN Users' Guide, Orbiter/Payload Interface Control Document (ICD), IUS Interface Control Document). For instance, it should be noted that the KSC Launch Site Accommodation Handbook answers most of the users' questions and supplies most of the launch site data and information required. The information would not be repeated in this document.]

1.2 Uses of Space

1.3 STS System Nomenclature

2.0 HANDBOOK

2.1 Normal User Procedures (With Reference to User Data Available)

2.2 Normal STS Requirements of User (With Reference to User Data Available)

2.3 Launch Opportunities

---

(1) Including Pre-Phase A, Phase A (Concept), and Phase B (Definition) studies. Studies are assumed to include those directed to use any viable STS interface, operational approach, and STS payload design factor or tradeoff studies.

Proposed Outline (Condensed Version) (Cont'd)

2.4 General Information

2.5 Normal Study Tasks

2.6 Defining Shuttle Payloads

2.7 Defining Payload Mode of Operation

(Describe STS-supported modes of operation and payload alternatives)

2.8 Mission Analysis

(Performance, propellant requirements, timelines)

2.9 Supporting Information Available to Support Early (Through Phase A) Payload Studies

(This section is organized into subsections so that the data applicable to the integrated payload is together in a subsection, as are the data applicable to the experiments or mission equipment, the spacecraft portion of the payload, and the payload/STS interface equipments. This breakout is convenient to the user at the concept study phase when the spacecraft can be considered as a unit without considering a lot of subsystem detail.)

2.10 Additional Information Available to Support Payload Definition Study (Phase B)

[The spacecraft subsection broken out in Section 2.9 is replaced by eight subsections in Section 2.10, each presenting data and data sources applicable to subsystem engineers' data requirements in a particular area. Each of these areas could be combined with appropriate additional information to help form the basic source documents for a specific satellite subsystem. The subsections are: (1) Structure (Spaceframe, Adapters, and Cradles); (2) Electrical Power Subsystem; (3) Stability and Control; (4) Guidance and Navigation; (5) Communications, Data Processing, and Instrumentation; (6) Reaction Control System; (7) Propulsion; and (8) Thermal Control. This approach could save considerable document preparation time and resources for a user initiating a new satellite definition study.]

Proposed Outline (Condensed Version) (Cont'd)

2.11 Computer Programs Available for User

2.12 Areas of Risk

2.13 Primary STS User References

3.0 ON-LINE AND FLIGHT PLANS OR HISTORY FOR PAYLOAD PROGRAMS

(References would be made to published records, logs, reports, which describe what STS users have historically done or plan to do so that conceptual and definition studies of payloads can take advantage of this information, enhancing the ability of the user to plan by "similarity".)

4.0 QUESTIONS AND ANSWERS

Proposed Outline

STS User Data Document for New Potential Users

Advanced Payload Studies[1]

(This outline reflects a potential user document approach structured for the purpose of easy and efficient use by the user even though it is more difficult for the STS-oriented personnel to write. This user or payload oriented approach would normally be preferred by a new potential user of space. The outline is also designed to be useful to the subsystem engineers and specialists working on payload studies by providing subsystem sections for data of most interest to each.)

1.0 INTRODUCTION

1.1 Use of Handbook in STS Payload Planning Services

[Discuss the intended applicability of the data, the basis for the information, the relationship of this document to related documents (KSC Launch Site Accommodation Handbook for STS Payloads, Spacelab Payload Accommodation Handbook, Space Shuttle System Payload Accommodations, IUS Users' Guide, STDN Users' Guide, Orbiter/Payload Interface Control Document (ICD), IUS Interface Control Document). For instance, it should be noted that the KSC Launch Site Accommodation Handbook answers most of the users' questions and supplies most of the launch site data and information required. The information would not be repeated in this document.]

1.2 Uses of Space

1.2.1 Conventional

1.2.2 Proposed

1.2.3 New Uses

1.2.4 Low Budget Considerations

1.3 STS System Nomenclature

1.3.1 Shuttle

1.3.2 Initial Upper Stage

---

(1) Including Pre-Phase A, Phase A (Concept), and Phase B (Definition) studies. Studies are assumed to include those directed to use any viable STS interface, operational approach, and STS payload design factor or tradeoff studies.

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

- 1.3.3 Spacelab
- 1.3.4 General Purpose GSE

2.0 HANDBOOK

- 2.1 Normal User Procedures (With Reference to User Data Available)
  - 2.1.1 Planning Activities
  - 2.1.2 Hardware Activities
- 2.2 Normal STS Requirements of User (With Reference to User Data Available)
- 2.3 Launch Opportunities
  - 2.3.1 Automated Spacecraft
    - 2.3.1.1 Availability of STS Elements and Current Flight Schedules
    - 2.3.1.2 Maximum Flight Rates Planned
    - 2.3.1.3 Typical Lead Times
  - 2.3.2 Sortie/Spacelab
    - 2.3.2.1 Availability of STS Elements and Current Flight Schedules
    - 2.3.2.2 Maximum Flight Rates Planned
    - 2.3.2.3 Typical Lead Times
- 2.4 General Information
  - 2.4.1 Administrative Procedures
    - 2.4.1.1 STS/Payload Interface Management
      - 2.4.1.1.1 DOD/NASA Responsibilities
      - 2.4.1.1.2 NASA/User Interface
      - 2.4.1.1.3 NASA STS Organization
      - 2.4.1.1.4 DOD/User Interface
      - 2.4.1.1.5 AFSC/SAMSO STS Organization

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

- 2.4.1.2 Flight Manifest and Policies
  - 2.4.1.2.1 Policies and Procedures for Multiple Payloads
    - 2.4.1.2.1.1 Orbiter
    - 2.4.1.2.1.2 IUS
    - 2.4.1.2.1.3 Spacelab
  - 2.4.1.2.2 STS Operations/Payload Operations Interface
  - 2.4.1.2.3 Integration, Levels I, II, III, IV
    - 2.4.1.2.3.1 Automated
    - 2.4.1.2.3.2 Spacelab
  - 2.4.1.2.4 Automated Payload/Payload Interface
  - 2.4.1.2.5 Spacelab Payload/Payload Interface
- 2.4.2 User Charges (Cover all elements of the STS)
  - 2.4.2.1 Charge Policies
  - 2.4.2.2 Charge Formulas
  - 2.4.2.3 Charge Rates
  - 2.4.2.4 Estimating Charges
- 2.4.3 Legal
- 2.4.4 Advanced Technology

2.5 Normal Study Tasks

- 2.5.1 Similar Payload Studies
- 2.5.2 New Conceptual Payload Studies
- 2.5.3 New Payload Definition Studies

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.6 Definint Shuttle Payloads

- 2.6.1 Automated Payloads
  - 2.6.1.1 Use of Standard Components
  - 2.6.1.2 Use of Standard Modules
  - 2.6.1.3 Spacecraft Sharing
  - 2.6.1.4 Custombuilt Spacecraft
  - 2.6.1.5 STS Payload Services
- 2.6.2 Spacelab
  - 2.6.2.1 Pressurized Experiments
  - 2.6.2.2 Pallet Experiments
  - 2.6.2.3 Spacelab Experiment Services
  - 2.6.2.4 Crew Functions

2.7 Defining Payload Mode of Operation (Describe STS-Supported Modes of Operation and Payload Alternatives)

- 2.7.1 Ground Operations and Launch
  - 2.7.1.1 Automated Spacecraft
    - 2.7.1.1.1 Off-Line
    - 2.7.1.1.2 On-Line
  - 2.7.1.2 Spacelab
    - 2.7.1.2.1 Off-Line
    - 2.7.1.2.2 On-Line
  - 2.7.1.3 Initial Upper Stage
    - 2.7.1.3.1 Off-Line
    - 2.7.1.3.2 On-Line
- 2.7.2 Ascent Operations

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.7.3 On-Orbit Operations (Alternatives for Automated Payloads and Tradeoffs Available)

2.7.3.1 Expendable (Deploy Only)

2.7.3.2 Return (Deploy plus Retrieval)

2.7.3.3 Resupply (Deploy, Retrieval, Service, Redeploy)

2.7.4 Airborne Operations with Spacelab

2.7.4.1 Pressurized

2.7.4.2 Pallet

2.7.5 Return Operations Deorbit

2.7.6 Abort Operations

2.8 Mission Analysis (Performance, Propellant Requirements, Timelines)

2.8.1 Ascent

2.8.2 On-Orbit Maintenance

2.8.3 Deorbit and Return

2.8.4 All-Flight-Phase Analysis

2.9 Supporting Information Available to Support Early (Through Phase A) Payload Studies

2.9.1 Integrated Satellite or Escape Payload

2.9.1.1 Standard Payload/STS Interface Specifications (Top Levels)

2.9.1.1.1 Shuttle/Payload

2.9.1.1.2 IUS/Payload

2.9.1.1.3 Spacelab/Payload

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.9.1.2 Shuttle System Performance (Cover Weight, c.g. Constraints, Launch Azimuth Constraints, Destinations, Timelines, Orbital ΔV, Contingencies, Abort Constraints, Return Constraints)

- 2.9.1.2.1 Ascent Performance
- 2.9.1.2.2 On-Orbit Performance
- 2.9.1.2.3 Return Performance
- 2.9.1.2.4 Mission Planning Techniques (Description and Examples)

2.9.1.3 IUS Performance (Cover Weight, Destinations, Timelines, Orbital ΔV, Contingencies, and Constraints)

- 2.9.1.3.1 Transfer Performance
- 2.9.1.3.2 Performance at Destination
- 2.9.1.3.3 Return Performance
- 2.9.1.3.4 Mission Planning Techniques (Descriptions and Examples)

2.9.1.4 Shuttle Abort

2.9.1.5 Mission Analysis by User (All Flight Phases)

- 2.9.1.5.1 Reference Data
- 2.9.1.5.2 Computer Programs Available
- 2.9.1.5.3 Techniques and Example Analyses

2.9.1.6 Shuttle and IUS Navigation and Pointing Accuracy

2.9.1.7 Safety

2.9.1.8 Mission and Payload Specialists Station Descriptions, Functions

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.9.1.9 Additional Crew

2.9.1.10 Orbiter Payload Bay Environment Calculation Technique and Analysis (Cover uncontrolled and controlled environments, all phases of on-line operation, thermal, acoustic, contamination)

2.9.1.11 Orbiter Loads

2.9.1.11.1 Load Factors

2.9.1.11.2 Acceleration Loads

2.9.2 Experiments and Mission Equipment

2.9.2.1 Spacelab Capability (See Spacelab Payload Accommodation Handbook)

2.9.3 Spacecraft

2.9.3.1 EMC/EMI

2.9.3.2 Weights Chargeable to Payload

2.9.3.3 Orbiter Payload Bay Environment Calculation Technique and Analysis (Cover uncontrolled and controlled environments, all phases of on-line operation, thermal, acoustic, contamination)

2.9.3.4 Upper Stage Transmitted and Induced Loads

2.9.3.4.1 Load Factors

2.9.3.4.2 Acceleration Loads

2.9.3.5 Structural Attachment

2.9.3.5.1 Orbiter

2.9.3.5.2 IUS

2.9.3.5.3 Spacelab

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.9.3.6 Remote Manipulator System (RMS) Payload Services

2.9.3.6.1 General Description of Each of the Services

2.9.3.6.2 Orbiter and IUS Rendezvous Capability

2.9.3.7 User-Furnished Propulsion Requirements

2.9.4 Payload/STS Interface Equipment

2.9.4.1 Airborne Multi-Mission Support Equipment (MMSE)

2.9.4.1.1 IUS/Payload Adapters

2.9.4.1.2 Orbiter/Payload Cradles and Pallets

2.9.4.1.3 Cabling and Umbilicals

2.9.4.1.4 Power Supply and Controls

2.9.4.1.5 Electronic Control and Distribution

2.9.4.1.6 Fluid Service Lines and Controls

2.9.4.1.7 PSS and MSS Equipments

2.9.4.1.8 RTG Cooling

2.9.4.1.9 Shrouds

2.9.4.1.10 End Effectors

2.9.4.1.11 Module Exchange Mechanism

2.9.4.2 STS Kits

2.9.4.2.1 Shuttle

2.9.4.2.2 Spacelab

2.9.4.2.3 IUS

Proposed Outline
STS User Data Document for New Potential Users
(Continued)

2.9.4.3 Miscellaneous Support Equipment

2.9.4.3.1 Special Purpose Flight Support System

2.10 Additional Information Available to Support Payload Definition Study (Phase B)

2.10.1 Integrated Satellite System

(Cover STS Interface Control Document(s); Standard Payload/STS Interface Specifications[1] Applicable to the Integrated Satellite or Common to Subsystems; EVA Capabilities; Equipment Services; Extended Flight Duration)

(In Addition, Cover the Following)

2.10.1.1 Safety

2.10.1.1.1 Requirements

2.10.1.1.2 Equipment

2.10.1.1.3 Software

2.10.1.1.4 Failure Mode Effects Data for STS/Payload Interface

2.10.1.2 Mission Specialist

2.10.1.2.1 Station Description

2.10.1.2.2 Life Support

2.10.1.2.3 Duties and Services Performed

2.10.1.3 Payload Specialist

2.10.1.3.1 Duties and Services Performed

2.10.1.3.2 Station Description

2.10.1.3.3 Training

2.10.1.3.4 Qualification of Personnel

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(1) Covering environments, contamination, orbiter/payload interface equipments (panels, trays), c.g. limits.

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.10.1.4 Additional Crew (Experimenters)

- 2.10.1.4.1 Life Support
- 2.10.1.4.2 Training
- 2.10.1.4.3 Qualification

2.10.1.5 Interface Verification and Flight Certification

- 2.10.1.5.1 Requirements
- 2.10.1.5.2 Techniques and Examples
- 2.10.1.5.3 Verification Equipment

2.10.2 Mission Equipment and Experiments

- 2.10.2.1 Spacelab Loads

2.10.3 Spaceframe, Adapters, and Cradles

- 2.10.3.1 Orbiter Loads
  - 2.10.3.1.1 Dynamic Loads
  - 2.10.3.1.2 Payload Bay Deflections
  - 2.10.3.1.3 Load Estimating Techniques and Examples
  - 2.10.3.1.4 Dynamic Load Alleviation Concepts
- 2.10.3.2 IUS Loads Induced
  - 2.10.3.2.1 Dynamic Loads
- 2.10.3.3 Spacelab Loads Induced
  - 2.10.3.3.1 Dynamic Loads, Pressurized Module
  - 2.10.3.3.2 Dynamic Loads, Pallet
- 2.10.3.4 Techniques and Examples for Payload Load Analysis

Proposed Outline

STS User Data Document for New Potential Users

(Continued)

2.10.3.5 Structural Attachment

2.10.3.5.1 Orbiter

2.10.3.5.1.1 Payload Bay (Attachments)[1]

2.10.3.5.1.2 Airlock

2.10.3.5.1.3 Docking Module

2.10.3.5.2 IUS

2.10.3.5.3 Spacelab

2.10.3.5.4 GSE

2.10.3.6 Remote Manipulator System/Payload Interface

2.10.3.7 Spaceframe (Payload) Chargeable Weights

2.10.4 Electrical Power Subsystem

2.10.4.1 Orbiter Power for Payload

2.10.4.1.1 General Description and Specifications

2.10.4.1.2 Interface Panels, Kits, etc.

2.10.4.1.3 Controls and Commands

2.10.4.1.4 EMC/EMI

2.10.4.1.5 Failure Mode Effects

2.10.4.1.6 Interface with Companion Payloads

2.10.4.2 Spacelab Power for Payloads

2.10.4.2.1 General Description and Specifications

2.10.4.2.2 Interface Panels, Kits, etc.

2.10.4.2.3 Controls and Commands

2.10.4.2.4 EMC/EMI

(1) e.g., latches, bridges, attach point locations, panels, trays, etc. and their load-carrying capability.

Proposed Outline
STS User Data Document for New Potential User
(Continued)

- 2.10.4.2.5 Failure Mode Effects
- 2.10.4.2.6 Interface with Companion Payloads
- 2.10.4.3 Space Qualified Equipments (Catalogs, etc.)
- 2.10.4.4 Electrical Power (Payload) Chargeable Weights
- 2.10.5 Stability and Control
  - 2.10.5.1 Orbiter Handoff Data for Update or Initialization
    - 2.10.5.1.1 General Description and Specifications
    - 2.10.5.1.2 Interface Panels, Kits, etc.
    - 2.10.5.1.3 Controls and Commands
    - 2.10.5.1.4 EMC/EMI
    - 2.10.5.1.5 Failure Mode Effects
    - 2.10.5.1.6 Interface with Companion Payloads
  - 2.10.5.2 Orbiter Pointing and Stability
  - 2.10.5.3 IUS Pointing and Stability
  - 2.10.5.4 Spacelab Pointing and Stability
  - 2.10.5.5 Space Qualified Equipments (Catalogs, etc.)
  - 2.10.5.6 S&C (Payload) Chargeable Weights
- 2.10.6 Guidance and Navigation
  - 2.10.6.1 Orbiter Handoff Data for Updates or Initialization
    - 2.10.6.1.1 General Description and Specifications
    - 2.10.6.1.2 Interface Panels, Kits, etc.
    - 2.10.6.1.3 Controls and Commands
    - 2.10.6.1.4 EMC/EMI
    - 2.10.6.1.5 Failure Mode Effects
    - 2.10.6.1.6 Interface with Companion Payloads

Proposed Outline

STS User Data Document for New Potential User

(Continued)

Proposed Outline

STS User Data Document for New Potential User

(Continued)

2.10.7.5 Detached Payload/Orbiter Telemetry

- 2.10.7.5.1 General Description and Specifications
- 2.10.7.5.2 Interface Panels, Kits, etc.
- 2.10.7.5.3 Controls and Commands
- 2.10.7.5.4 EMC/EMI
- 2.10.7.5.5 Failure Mode Effects
- 2.10.7.5.6 Interface with Companion Payloads

2.10.7.6 Orbiter/Payload Audio-Video System

- 2.10.7.6.1 General Description and Specifications
- 2.10.7.6.2 Interface Panels, Kits, etc.
- 2.10.7.6.3 Controls and Commands
- 2.10.7.6.4 EMC/EMI
- 2.10.7.6.5 Failure Mode Effects
- 2.10.7.6.6 Interface with Companion Payloads

2.10.7.7 IUS Telemetry

- 2.10.7.7.1 General Description and Specifications
- 2.10.7.7.2 Interface Panels, Kits, etc.
- 2.10.7.7.3 Controls and Commands
- 2.10.7.7.4 EMC/EMI
- 2.10.7.7.5 Failure Mode Effects
- 2.10.7.7.6 Interface with Companion Payloads

Proposed Outline

STS User Data Document for New Potential User

(Continued)

2.10.7.8 Spacelab Data Processing (Computing, Recording, Timing)

- 2.10.7.8.1 General Description and Specifications
- 2.10.7.8.2 Interface Panels, Kits, etc.
- 2.10.7.8.3 Controls and Commands
- 2.10.7.8.4 EMC/EMI
- 2.10.7.8.5 Failure Mode Effects
- 2.10.7.8.6 Interface with Companion Payloads

2.10.7.9 Space Qualified Equipments (Catalogs, etc.)

2.10.7.10 CDPI (Payload) Chargeable Weights

2.10.8 Reaction Control System

2.10.8.1 Orbiter Fill, Vent, Drain, Purge for Payload

- 2.10.8.1.1 General Description and Specifications
- 2.10.8.1.2 Interface Panels, Kits, etc.
- 2.10.8.1.3 Controls and Commands
- 2.10.8.1.4 Failure Mode Effects
- 2.10.8.1.5 Interface with Companion Payloads

2.10.8.2 Space Qualified Equipments (Catalogs, etc.)

2.10.8.3 RCS (Payload) Chargeable Weights

2.10.9 Propulsion

2.10.9.1 Orbiter Fill, Vent, Drain, Dump, Purge for Payload

- 2.10.9.1.1 General Description and Specifications
- 2.10.9.1.2 Interface Panels, Kits, etc.

Proposed Outline

STS User Data Document for New Potential User

(Continued)

- 2.10.9.1.3 Controls and Commands
- 2.10.9.1.4 Failure Mode Effects
- 2.10.9.1.5 Interface with Companion Payloads
- 2.10.9.2 Space Qualified Equipments (Catalogs, etc.)
- 2.10.10 Thermal Control
  - 2.10.10.1 Orbiter Payload Heat Rejection
    - 2.10.10.1.1 General Description and Specifications
    - 2.10.10.1.2 Interface Panels, Kits, etc.
    - 2.10.10.1.3 Controls and Commands
    - 2.10.10.1.4 Failure Mode Effects
    - 2.10.10.1.5 Interface with Companion Payloads
  - 2.10.10.2 Orbiter Payload Cooling (Air)
    - 2.10.10.2.1 General Description and Specifications
    - 2.10.10.2.2 Interface Panels, Kits, etc.
    - 2.10.10.2.3 Controls and Commands
    - 2.10.10.2.4 Failure Mode Effects
    - 2.10.10.2.5 Interface with Companion Payloads
  - 2.10.10.3 Space Qualified Equipments (Catalogs, etc.)

2.11 Computer Programs Available for User

- 2.11.1 List Computer Programs, References, Describe Capability, Contact, and Costs (e.g., Mission Analysis and Trajectory Programs, Payload Bay Thermal Models, Orbital Structural Dynamics Model)

2.12 Areas of Risk

2.13 Primary STS User References

Proposed Outline

STS User Data Document for New Potential User

(Concluded)

3.0 ON-LINE AND FLIGHT PLANS OR HISTORY FOR PAYLOAD PROGRAMS

(References would be made to published records, logs, reports which describe what STS users have historically done or plan to do so that conceptual and definition studies of payloads can take advantage of this information, enhancing the ability of the user to plan by "similarity".)

4.0 QUESTIONS AND ANSWERS

Alternate Proposed Outline

STS User Data Document for Potential Users

Advanced Payload Studies

(This outline reflects a conventional approach to a launch vehicle user document. The data is organized so that it is easy to construct the document from the STS personnel point of view and may be easier to find a specific piece of data; however, it may be more difficult for a user to adapt to his specific purposes. Veteran payload managers and engineers tend to prefer this approach for a source document.)

1.0 MANAGEMENT AND PROCEDURES

- 1.1 STS/Payload Interface Management
  - 1.1.1 DOD/NASA Responsibilities
  - 1.1.2 DOD/NASA Organization
  - 1.1.3 NASA STS Organization
  - 1.1.4 NASA/User Interface
  - 1.1.5 AFSC/SAMSO STS Organization
  - 1.1.6 DOD/User Interface
  - 1.1.7 STS Contractors and Subcontractors
    - 1.1.7.1 Shuttle
    - 1.1.7.2 IUS
    - 1.1.7.3 Spacelab
    - 1.1.7.4 Launch Sites
- 1.2 Flight Schedules and Lead Time
  - 1.2.1 Development Schedules for STS Elements
  - 1.2.2 Maximum Flight Rates Planned
  - 1.2.3 Availability of Current Flight Schedules
  - 1.2.4 Typical Lead Times

Alternate Proposed Outline
STS User Data Document for Potential Users
(Continued)

1.3 Flight Manifest and Policies
- 1.3.1 Policies and Procedures for Multiple Payloads
  - 1.3.1.1 Orbiter
  - 1.3.1.2 IUS
  - 1.3.1.3 Spacelab
- 1.3.2 STS Operations/Payload Operations Interface
- 1.3.3 Integration, Levels I, II, III, IV
  - 1.3.3.1 Automated
  - 1.3.3.2 Spacelab
- 1.3.4 Multiple Payload Mission Analysis
- 1.3.5 Automated Payload/Payload Interface
- 1.3.6 Spacelab Payload/Payload Interface

2.0 STS SYSTEM DESCRIPTION

(Brief, general, illustrated system descriptions)

- 2.1 Shuttle
- 2.2 Initial Upper Stage
- 2.3 Spacelab
- 2.4 General Purpose GSE

3.0 STS OPERATIONS

(Sequence of operations, timelines, illustrations)

- 3.1 Off-Line Shuttle Ground Operations
- 3.2 On-Line Shuttle Ground Operations
- 3.3 Launch and Ascent Operations

Alternate Proposed Outline

STS User Data Document for Potential Users

(Continued)

3.4 Shuttle On-Orbit Operations

- 3.4.1 Baseline Orbiter Sequences (Independent of Payload)
- 3.4.2 Orbiter Payload Deployment
- 3.4.3 Orbiter Payload Retrieval
- 3.4.4 Orbiter Payload Servicing
- 3.4.5 Abort Operations

3.5 Shuttle Reentry, Landing, and Post-Landing Operations

3.6 Spacelab Off-Line Operations

3.7 Spacelab On-Orbit Operations

3.8 Spacelab Post-Landing Operations

3.9 Initial Upper Stage Off-Line Operations

3.10 Initial Upper Stage On-Orbit Operations

4.0 STS MISSION SUPPORT EQUIPMENT

(Description, capabilities, interfaces)

4.1 STS Kits

- 4.1.1 Shuttle
- 4.1.2 Spacelab
- 4.1.3 IUS

4.2 Airborne Multi-Mission Support Equipment (MMSE)

- 4.2.1 IUS/Payload Adapters
- 4.2.2 Orbiter/Payload Cradles and Pallets
- 4.2.3 Cabling and Umbilicals
- 4.2.4 Power Supply and Controls
- 4.2.5 Electronic Control and Distribution
- 4.2.6 Fluid Service Lines and Controls

Alternate Proposed Outline

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(Continued)

4.2.7 PSS and MSS Equipments

4.2.8 RTG Cooling

4.2.9 Shrouds

4.2.10 End Effectors

4.3 Launch Site MMSE

4.3.1 Interface Verification Equipment

4.3.2 Payload Stands, Containers, Transporters, and Fixtures

4.3.3 Payload Service Units

4.4 Miscellaneous Support Equipment

4.4.1 Flight Support and Module Exchange Mechanism

5.0 STS USER CHARGES

(Cover all elements of the STS)

5.1 Charge Policies

5.2 Charge Formulas

5.3 Charge Rates

5.4 Estimating Charges

6.0 LAUNCH SITE REQUIREMENTS AND PLANNING FOR KSC, VAFB

(Information on facilities, equipments, procedures, etc. is covered in the KSC Launch Site Accommodations Handbook. This section would relate to the Handbook and add data and information related to the plans or history of other payload programs at the launch site.)

7.0 ON-LINE INTEGRATED STS PAYLOAD HANDBOOK

7.1 Shuttle System Performance

(Cover weight, c.g. and launch azimuth constraints, destinations, timelines, orbital ΔV, contingencies, abort and return constraints)

Alternate Proposed Outline

STS User Data Document for Potential Users

(Continued)

7.1.1 Ascent Performance

7.1.2 On-Orbit Performance

7.1.3 Return Performance

7.1.4 Mission Planning Techniques (description and examples)

7.2 IUS Performance

(Cover weight, destinations, c.g. constraints, destinations, timelines, orbital ΔV, contingencies, and constraints)

7.2.1 Transfer Performance

7.2.2 Performance at Destination

7.2.3 Return Performance

7.2.4 Mission Planning Techniques (Descriptions and Examples)

7.3 Spacelab Capability

(See Spacelab Payload Accommodation Handbook)

7.4 Shuttle Abort

7.5 Mission Analysis by User

7.5.1 Reference Data

7.5.2 Computer Programs Available

7.5.3 Techniques and Example Analyses

7.6 Orbiter Payload Bay Environment Calculation Technique and Analyses

(Cover uncontrolled and controlled environments, all phases of on-line operation, thermal, acoustic, contamination)

Alternate Proposed Outline

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(Continued)

7.7 Orbiter Loads

- 7.7.1 Load Factors
- 7.7.2 Acceleration Loads
- 7.7.3 Dynamic Loads
- 7.7.4 Payload Bay Deflections
- 7.7.5 Dynamic Load Alleviation Concepts

7.8 IUS Loads Induced

7.9 Spacelab Loads Induced

7.10 Techniques and Examples for Payload Load Analysis

7.11 Structural Attachment

- 7.11.1 Orbiter
  - 7.11.1.1 Payload Bay (Attachments, e.g., Latches, Bridges, Attach Point Locations, Panels, Trays, etc., and their Load-Carrying Capability)
  - 7.11.1.2 Airlock
  - 7.11.1.3 Docking Module
  - 7.11.1.4 EVA Hardware
- 7.11.2 IUS
- 7.11.3 Spacelab
- 7.11.4 GSE

7.12 Payload Services

- 7.12.1 General Description of Services
- 7.12.2 Interface and Control for Payload Services

  (Cover avionics, power, fluid supply, and cooling)

Alternate Proposed Outline

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(Continued)

7.12.2.1 STS Hardware (Interface Panels, Kits, etc.)

7.12.2.2 STS Software

7.12.2.3 Interface Specifications

7.13 Safety

7.13.1 Requirements

7.13.2 Equipment

7.13.3 Software

7.13.4 Failure Mode Effects Data for STS/Payload Interface

7.14 Mission Specialist

7.14.1 Station Description

7.14.2 Life Support

7.14.3 Duties and Services Performed

7.15 Payload Specialist

7.15.1 Duties and Services Performed

7.15.2 Station Description

7.15.3 Training

7.15.4 Qualification of Personnel

7.16 Additional Crew (Experimenters)

7.16.1 Life Support

7.16.2 Training

7.16.3 Qualification

7.17 EMC/EMI

7.17.1 Orbiter

7.17.2 IUS

7.17.3 Spacelab

7.17.4 Payload

Alternate Proposed Outline

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(Concluded)

7.18 STS RF Interfaces with Ground Terminals and Mission Control

7.19 Orbiter RF Interfaces with IUS and Payloads

7.20 Sequential Mass Properties Statements and Weights Chargeable to Payload

7.21 Interface Verification and Flight Certification

- 7.21.1 Requirements
- 7.21.2 Techniques and Examples
- 7.21.3 Verification Equipment

8.0 REFERENCES