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SCIENCE AND APPLICATION SPACE PLATFORM SASP.
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CONCEPTUAL DESIGN STUDY
SCIENCE AND APPLICATIONS SPACE PLATFORM (SASP)
VOLUME I EXECUTIVE SUMMARY

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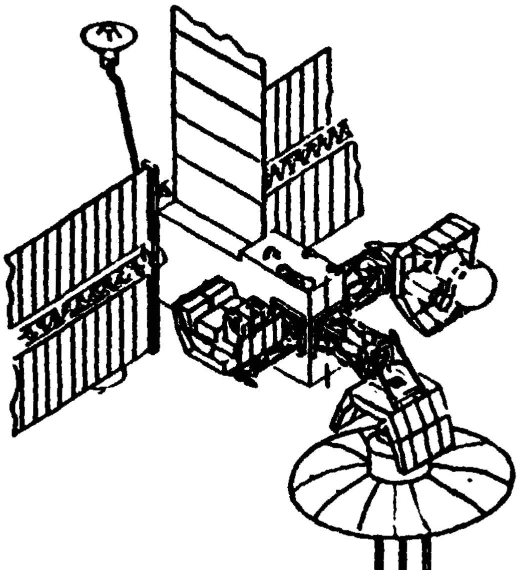
BASIC

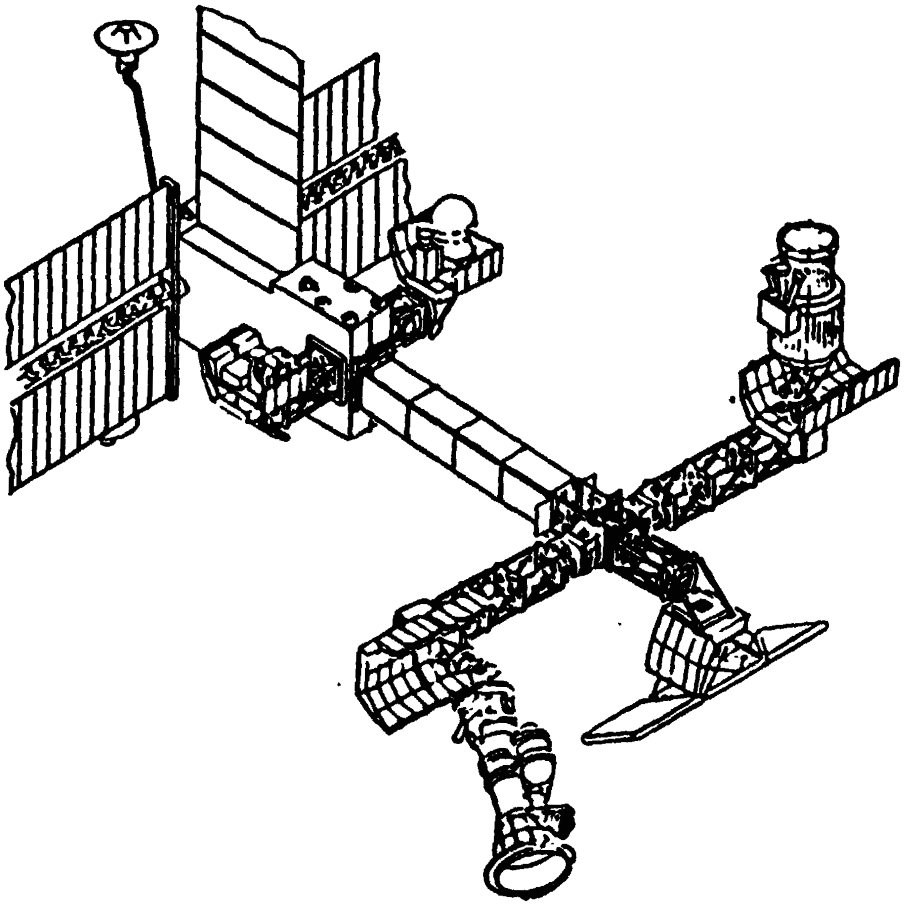
PLATFORM

FAMILY

First Order



Second Order



INTRODUCTION

Starting in the mid-1980's, platforms in low-earth orbit will provide highly beneficial and adaptable accommodations for a great variety of science and applications payloads. The platform configuration conceived in this study consists of a two-part evolution as shown in the facing illustration. The First Order Platform consists of minor appendages to the Power System for improved payload viewing, whereas, the Second Order Platform is designed to better accommodate more and larger payloads.

The system design philosophy applied in the development of this platform concept is as follows:

- Provide a highly-modular system for:
  - simple, low-cost, initial capability to accommodate Spacelab payloads modified for long-duration flight.
  - conservative escalation of mission capability for more and larger payloads.
  - flexible adaptation to a great variety of payload groups.
- Maximize payload integration simplicity and flexibility of use.
- Optimize distribution of functions among Platform, Power System, Payloads, and Ground Support.

The long duration, multipayload, free-flying platform will not only be beneficial to many payloads, but also to heavily overloaded mission support elements such as data relay satellites. Figure A illustrates the modular elements of the Platform System which can be assembled in various fashions to suit differing mission needs. Although the study focused primarily on an unmanned, free-flying platform for viewing/sensing/transmitting payloads, a manned access/berthing module was also designed for the separate flight of manned modules with the Power System.

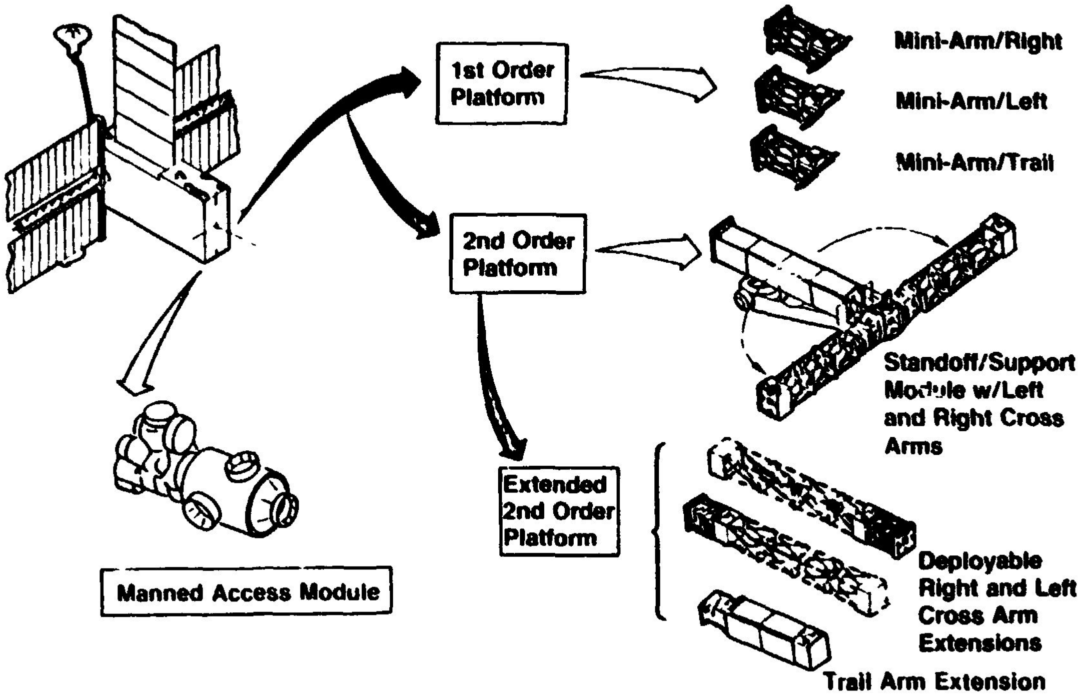


Figure A - Platform Parts Catalog

This Phase A study followed and capitalized on an extensive Pre-Phase A study by NASA in-house at MSFC, and also paralleled the major portion of a TRW study of platform payload prospects. The overall flow of the study is shown in Figure B.

The overall conclusions of the study are as follows:

- The platform configuratiton can effectively fulfill the documented requirements of many of the NASA/OSS and OSTA payloads planned for the mid-to-late eighties (earlier NASA programmatics analyses indicated considerable cost benefits for payloads with the Platform mode versus dedicated free-flyers for each payload).

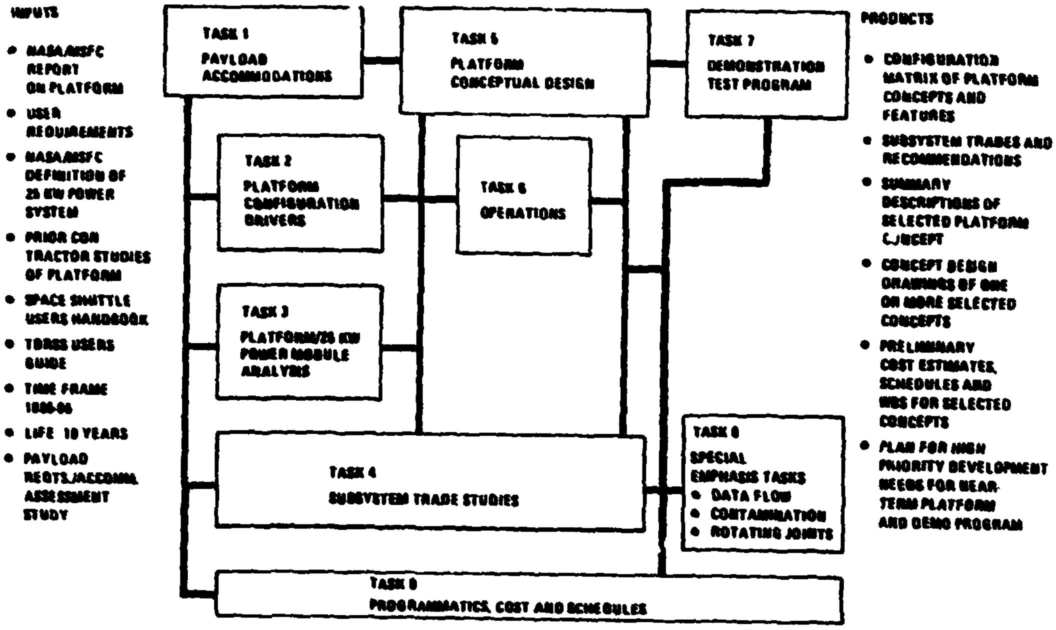


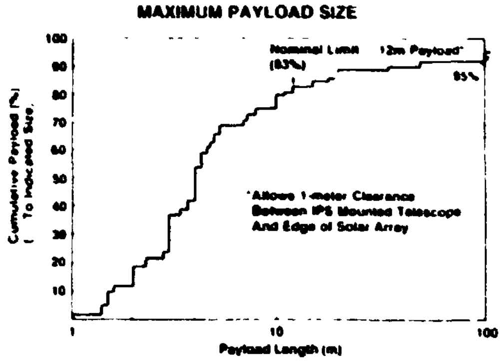
Figure B - Study Task Flow

- The modularity, shape, and size of the recommended platform concept fulfills the utilitarian goals embodied in the philosophy stated earlier. Moreover, it provides particularly good dispersion and viewing freedom for a number of payloads up to 12 meters in length.
- The T-bar and cruciform configurations inherent in the recommended platform, with rotary joints on each arm, provide the highly-flexible viewing and physical separation desired by payloads plus convenient loading access.
- Deployable structures (considered for platform arm extensions) offer cargo bay stowage compaction advantages but structural modeling for rigidity analysis plus development/testing is required to better understand performance.
- Payload stabilization of 1.5 arc seconds can probably be achieved with an instrument pointing system with platform structure selected.

- Shuttle RMS support of platform deployment and loading requires a dual-hub berthing arm (for the extended span reaches involved) or RMS relocation.
- The reference Power System used in the study fulfills most platform/payload requirements but numerous minor changes are suggested.

Section 1 PAYLOAD ACCOMMODATIONS (Task 1)

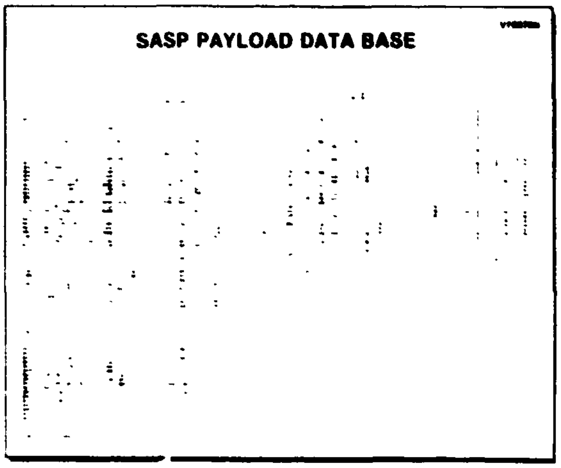
The SASP payload data base was created by developing a computerized (MCAUTO/CONFIRM) compilation of information from documents provided by NASA-OSS and OSTA. Figure 1-1 itemizes the payload parameters which were examined to determine requirement envelopes and percentage of payload capture relative to various levels of system and subsystem capabilities.



PAYLOAD PARAMETERS EVALUATED

- Inclination Ranges
- Desired Inclinations
- Altitude Ranges
- Desired Altitudes
- Pointing Accuracy
- Pointing Stability
- Maximum Payload Dimensions
- Average Power
- Peak Power
- Data Rates
- Mass
- Thermal
- Servicing
- Viewing
- No. of Pallets
- Availability
- Orbit Stay

- **Based on OSS and OA Payload Descriptions and Model (1979)**
- **Developed Computerized Data Base**
- **Relegated Very Large Payloads to Adv Platform (LARC/MSFC Study)**



SASP PAYLOAD DATA BASE

Figure 1-1 Payload Requirement Envelopes

Section 2 CONFIGURATION DRIVERS (Task 2)

The SASP should be a modular system capable of a variety of configuration steps. A low cost First Order Platform Concept should employ small payload berthing arms for the standoff necessary to prevent payload/pallet interferences, and to provide flexible payload viewing. A ±90° rotation and 90° hinge capability should also be provided on each arm.

Next, a Second Order Platform Concept should provide improved payload viewing and isolation for larger payloads via increased physical separation of payloads from each other and the Power System plus three vernier rotation joints. Also, since the considerable resources of the Power System can support more than just a few payloads, extension arms should support increased platform loadings.

Configuration drivers were derived from (1) payload requirements, and (2) the requirements and constraints imposed by platform integration with related external systems such as the Orbiter, TDRSS, and the Power System. Maximum payload dimensions were used to establish Second Order Platform sizing. Cross-arm separation from the Power System solar array was established to avoid possible collision risk for a majority of the payloads and to identify payloads (17%) which represent unwieldy installations and were relegated to the larger advanced platform (separate MDAC study for LaRC). Berthing port separation distances were established to avoid collision risk between adjacent payloads during scanning. Both first and second order platform designs must meet a wide range of viewing directions for the various and simultaneous interests of multiple payloads.

System drivers considered included Orbiter performance, Orbiter RMS reach, TDRSS support potential, integrated viewing (payload, radiators, solar-arrays, etc.)

intersystem dynamics, environmental impacts, orientation, and intersystem configuration impacts.

Section 3 POWER SYSTEM INTERFACES (Task 3)

Overall Power System interfaces with the Platform and its payloads were studied and the resulting comments are summarized on Table 3-1 below.

1st Order Platform	2nd Order Platform
Power	
• Provide 25 kW 30 and 120 VDC at One of the y Ports • Consider Adding Higher Power Capacity at One y Port for Unique Applications • Provide 6 kW 30 and 120 VDC at the ± y Ports • Terminate Equipment Grounding Conductor from Miniarms	• Consider Means to Bypass 120 VDC Regulator • Consider 12.5 and 25 kW Options • Provide a Third Isolatable 120 VDC Bus Interface • Terminate Equipment Grounding Conductor from Platform Support Module
Thermal Control	
• Provide Thermal Services to ± y Ports (Pumps in PS) • Performance Characteristics of PS Payload Heat Exchanger and Temp Control Logic Needed • NASA Alternatives to Freon 21 • NASA-MSFC Work on Disconnects	• Additional Heat Rejection Capability for Payloads • Performance Characteristics of PS Payload Heat Exchanger and Temp Control Logic Needed • Temp Control System Modifications for 40°F Service to Life Science Payloads • NASA Alternatives to Freon 21 • NASA-MSFC Work on Disconnects
Communication Data	
• Increase KSA Link Capability to 300 MBPS • Increase Capacity at SASP Port to 300 MBPS • Increase Continuous Channel Capacity to Approximately 200 KBPS • Increase Data Storage Capability	• Increase KSA Link Capability to 300 MBPS • Increase Capacity at SASP Port to 300 MBPS • Increase Continuous Channel Capacity to Approximately 200 KBPS • Timing and Position Data from GPS Are TBD
Attitude Control	
• Low-G Attitude Control Mode • PS Structural Distortion? • Pointing Reference Coordination • Berthing Alignment Accuracy • Control System Bandwidth?	• Low-G Attitude Control Mode • PS Structural Distortion? • Pointing Reference Coordination • Berthing Alignment Accuracy • Control System Bandwidth? • Supplemental Control Versus Axis Skewing • Cooperative Control Between PS, SASP, and Pointing System Computers
Docking	
• Provide ± y Ports • Mechanical/Functional Interfaces • Orbiter Berthing Adapter to Provide Access to All Necessary Parts	• Mechanical Functional Interfaces • Telescoping Boom or Equivalent for Orbiter Berthing and Servicing

Table 3-1 Platform/Power System Interface Comments

Section 4 SUBSYSTEM TRADES, CONCEPT DESIGN, AND SPECIAL EMPHASES (Tasks 4, 5, and 8)

In order to avoid repetition in subject treatment, these three tasks are integrated here for clarity. Initially, the features and benefits of alternate conceptual approaches in many areas were traded (see Table 4-1). Next, the accommodation modes and selected subsystem approaches were detailed and integrated. During the first six months, the study addressed only what was later to be designated as the Second Order Platform. However, again for clarity here the later incorporated First Order Platform is discussed first.

4.1 FIRST ORDER PLATFORM

Use of the Power System on a minimal basis must accommodate the variety of viewing freedom needs of the payloads. This dictated the addition of small appendages to the reference Power System as shown in Figure 4.1-1.

4.2 SECOND ORDER SYSTEM

The features of the broader capability Second Order Platform are described in Figure 4.2-1. The accommodation evolution in prospect for payloads are shown in Figure 4.2-2. Modular kit additions, namely the deployable side arms (no radiators) and the thermally-autonomous trail arm, are shown in Figure 4.2-2. The deployable side arm truss incorporates telescopic tubes, selected for their advantageously high compaction ratio, lightweight, substantial rigidity, and minimal number of joints.

4.3 STRUCTURES AND MATERIALS

Figure 4.3-1 gives examples of the analyses performed as well as options and selected approach for the material and basic concept of the SASP structure. The material/structure selected must provide high stiffness ($f_n \geq .1\text{Hz}$), minimum complexity, minimal structural distortion considering thermal and dynamic inputs, have adequate life (5-10 years) in the LEO radiation and thermal cycling environment and adequate strength for the critical loads. Shielded aluminum has attractive prospects but needs further study of joint shielding and deployable applications.

1st Order configuration	
2 vs 3 vs 4 payload berthing ports	3 active payload berthing ports (1 park)
Fixed vs moveable berthing ports	4 position clocked berthing ports
Bottom vs side or end pallet mounts	Bottom mounted pallets
Standoff mini-arms vs direct-to-power system pallet mounting	Standoff mini-arms
Fixed vs scheduleable vehicle orientation	Orientation variable
2nd Order configuration	
Basic shape and compaction (many concepts evaluated)	Folding cross-arms with fixed standoff structure (T-bar)
2 vs 3 arms	Payload/program dependent
Degree of arm rotational capability	±180 degree full length arms 360 degree mini-trail arm
Payload berth separation	13.2 m
PS standoff separation	13 4 m
Fixed vs scheduleable vehicle orientation	Variable orientation
Number of primary berthing ports	5 to 9 (program dependent)
Structural elements and materials	
Fixed truss configurations	Square X rectangular box (sing diag truss)
Deployable truss configurations	Telefold (cable drive)
Truss material	Graphite/epoxy (alum. if covered by radiator)
Attitude control	
Concept approach	PS control (more magnetic torquers requested)
Momentum dump considerations	Options identified orientation and payload dependent
Preliminary modal analysis	Designed in structural damping recommended to improve critical system stability
External disturbance analysis	Methods identified to reduce disturbances
Open loop AGS pointing system disturbance response	Pointing performance potentially much better than orbiter closed loop analysis needed to assess ultimate performance
Thermal/structural response	Acceleration levels and line of sight disturbances identified - potentially not significant impact
Example payload group evaluation	CMG desaturation every 4 orbits, less with orientation skewing
Communications and data management	
Centralized versus distributed payload data processing	Distributed
Payload data storage on power system, platform or pallet	Power system for 1st order platform, supplement by platform system for 2nd order
Multiplexing on power system versus platform	Power system for 1st order platform, supplement by platform system for 2nd order
Berthing equipment	
1st order platform berthing system	Reference power system berthing unit with 1st order platform berthing adapter
2nd order platform berthing system	Reference power system orbiter berthing unit with telescoping boom
Alternate payload carrier	
Many evaluated	Ring-type carrier appears advantageous
Thermal control	
Centralized versus pallet radiator	Centralized
Loop arrangements parallel or series	Parallel
Payload interface options	2 loops with direct fluid interface
Centralized radiator-dual loop alternates	Separate panels optimum
Centralized radiator flow options comparison	Panels in series (4 passes per panel is optimum)
Payload cryogenics	
Cryogenic resupply interface trade	Passive cryogenic cooling requires on orbit fluid transfer
"Common" platform mounted tank size	1.5M tank diameter is optimum
Tank replacement versus tank refill	Tank replacement
Tank refill analysis	Refill from supercritical source or large amounts not feasible
Replacement tank location trade	Payload or accessory pallet location optimum
Power distribution	
Platform power circuit protection/switching options trade	Remote control circuit breaker preferred
Cross-arm power distribution option trade	Radial circuits from support module distributors
Peak/pulse power loads options trade	Power system capability used up to 20 kw at cross-arm berthing ports, payload provides above this (25 kw available at ±Y and X ports of power system and at platform trail arm berth)
Mechanisms	
2nd order platform arm design	Fixed truss with deployable extensions
Rotating joint options	Two-stage in-line utility barrels, EVA replaceable
2nd order platform tolerance	All concepts had relatively small error
2nd order expandable structure service routing concepts	Loop service lines and cables
Support module concept options	Isogrid box with elbow hinges for arms
Pallet access	
1st order (dual hub adapter or multiple dock)	Dual hub adapter
2nd order (dual hub, telescopic, multiple dock or relocated arms)	Dual hub/telescopic

Table 4-1 Trade or Analysis and Results

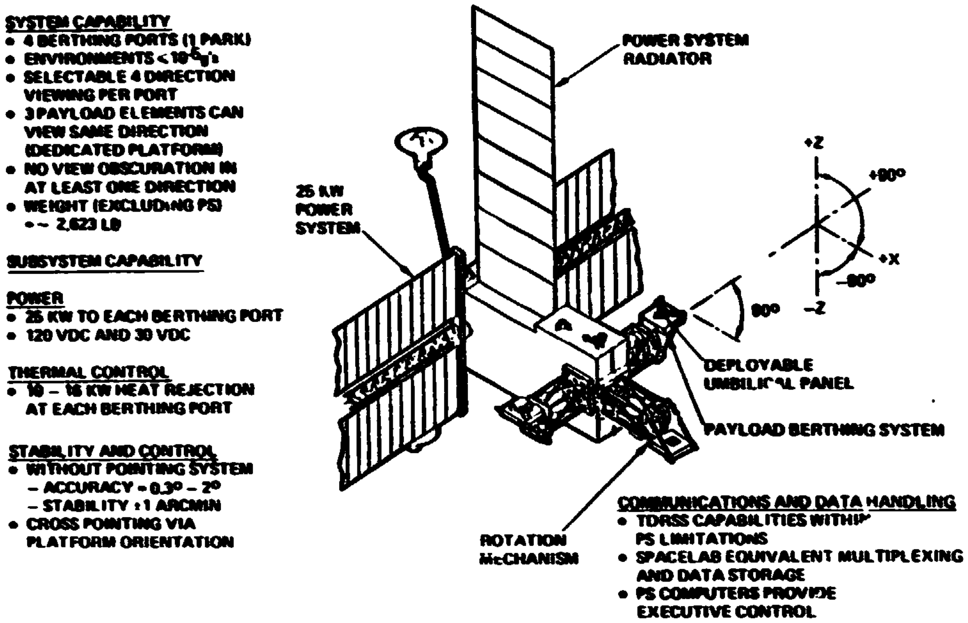


Figure 4.1-1 First-Order Platform

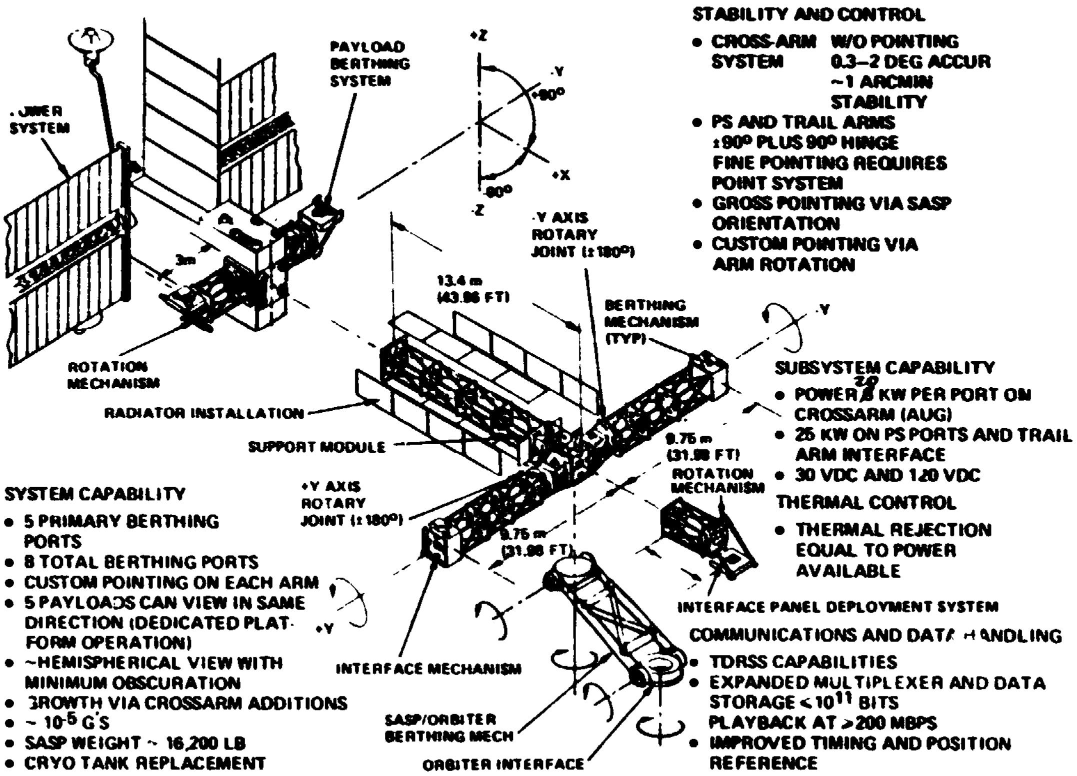


Figure 4.2-1 Second Order Platform

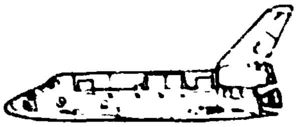
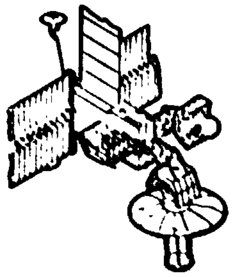
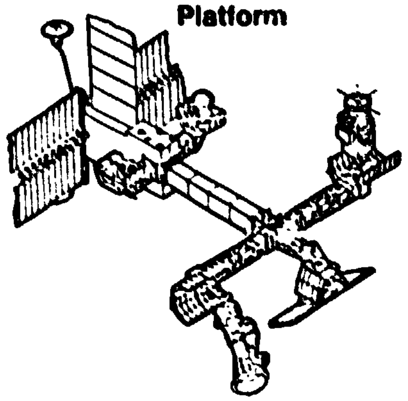
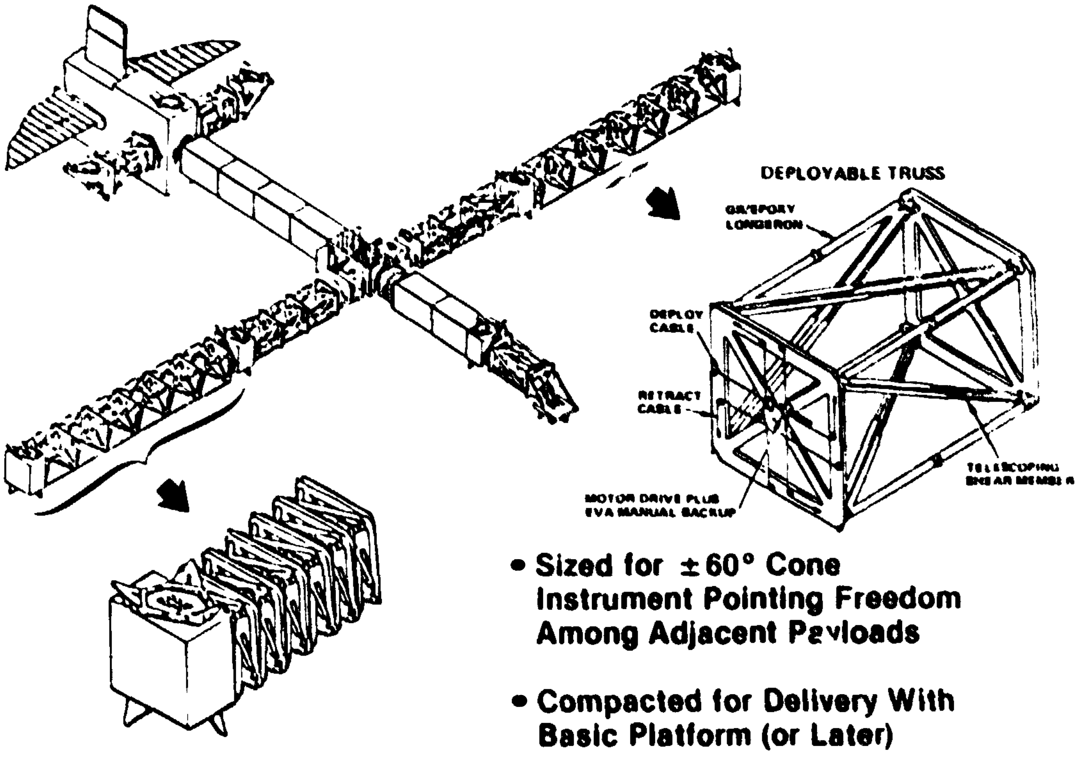
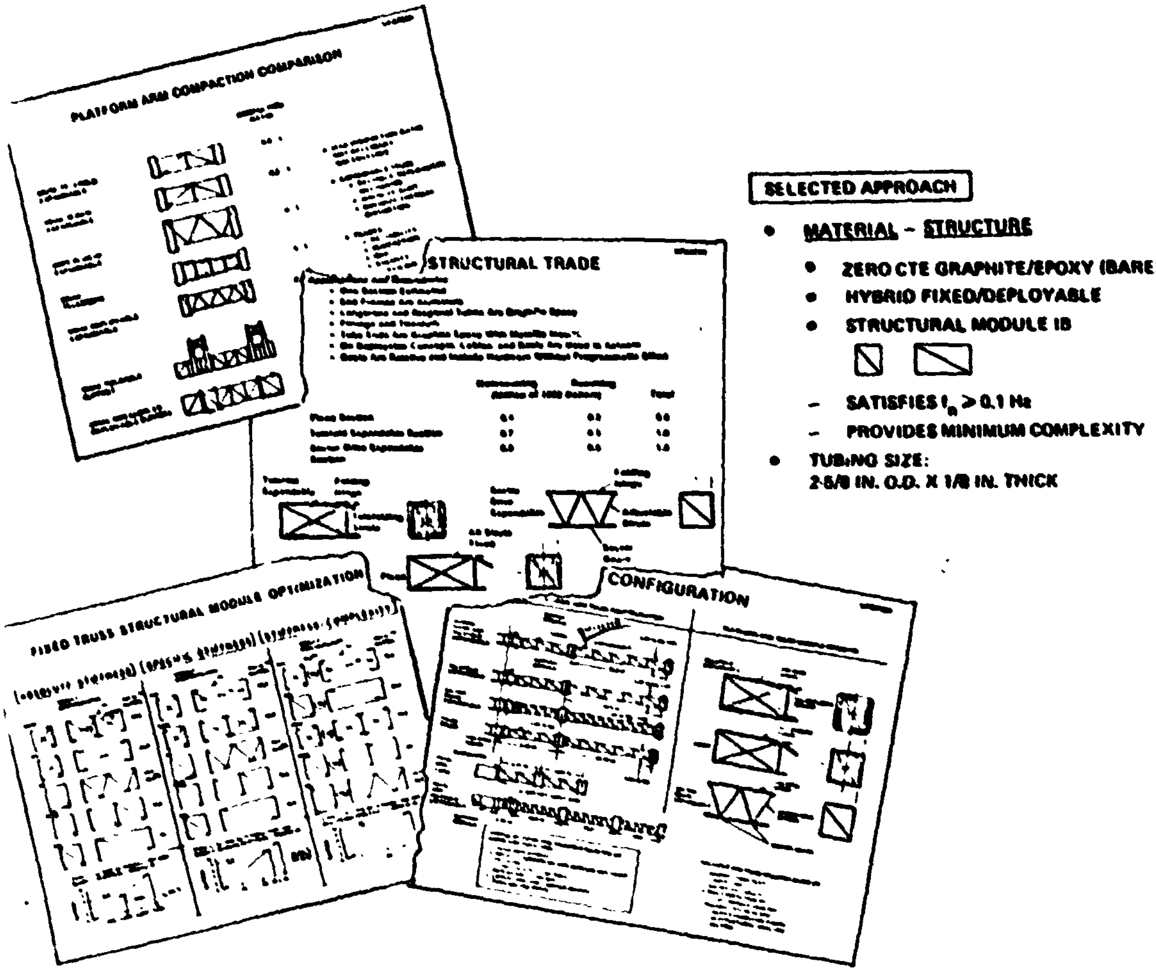
	1981 Shuttle Cargo Bay Spacelab Sortie	1986 First-Order Platform	1987 Second-Order Platform
Flight Modes			
Payloads	Small/Medium Size: 7-14 Day Day Duration	Conversions for 3-6 Month Duration	Small/Medium/Large Sizes: Multi-Month-Year Duration
Pallet Separation	< 1 Meter	~4 Meters	~10-15 Meters
Viewing	• Unidirectional	• Quad-directional via 90° Step Rotation	• Tailored, Multidirectional via 360° Indexed Rotation
Contamination	• 10^{12} mol/cm^2 sec	• Est 10^8	• Est 10^8
Disturbances	• 36×10^{-5}g	• 1×10^{-5}g	• 1×10^{-5}g

Figure 4.2-2 Progression of Payload Accommodations



- Sized for ±60° Cone Instrument Pointing Freedom Among Adjacent Payloads
- Compacted for Delivery With Basic Platform (or Later)

Figure 4.2- Trail Arm and Extension Truss Side Arm



SELECTED APPROACH

- MATERIAL – STRUCTURE
  - ZERO CTE GRAPHITE/EPOXY (BARE)
  - HYBRID FIXED/DEPLOYABLE
  - STRUCTURAL MODULE IB
  - – SATISFIES $f_n > 0.1$ Hz
  - – PROVIDES MINIMUM COMPLEXITY
- TUBING SIZE:
  2-5/8 IN. O.D. X 1/8 IN. THICK

Figure 4.3-1 Material/Structural Analysis

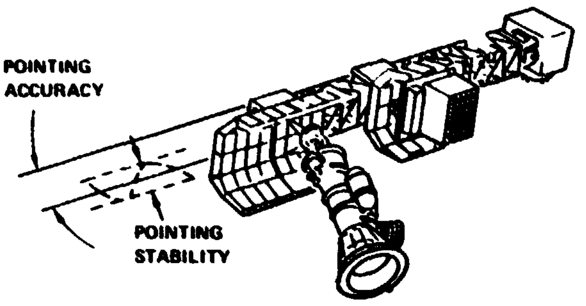
4.4 DYNAMICS AND CONTROL

The issues, analyses, and recommended approaches in this area are highlighted in Figure 4.4-1.

Results of the study showed that the Power System would handily control the SASP/PS configuration. However, additional magnetic torquing may be needed for momentum dump. Rotation of the arms ±180° will provide custom pointing, however, fine pointing must be provided by experiment pointing systems. Very fine pointing requirements will necessitate experiments employing image motion compensation techniques. The addition of relative-alignment sensors and/or SASP mounted attitude sensors looks promising. SASP will make use of the

ISSUES

- EXTERNAL DISTURBANCES
- STRUCTURAL REQUIREMENTS
- AUXILIARY POINTING SYSTEM PERFORMANCE
- IMPACT OF PAYLOAD DISTURBANCES



ANALYSES

- DEFINED DISTURBANCES
- BENDING MODES DEFINED
  - PRELIMINARY
  - NASTRAN
- THERMAL TRANSIENTS
- DEFINED PALLET DYNAMIC ENVIRONMENT
- DEFINED ISOLATION EFFECTIVENESS OF APS
- INVESTIGATED HIGH FREQUENCY STRUCTURES
- DETERMINED MANUFACTURING TOLERANCES
- INVESTIGATED IMPACT OF PASSIVE STRUCTURAL DAMPING
- INVESTIGATED TORQUE SHAPING

CONCLUSIONS/RECOMMENDATIONS

- ARM STRUCTURE $f_n > 0.1$ Hz
- PLATFORM ENVIRONMENT MORE BENIGN THAN SPACELAB
- EXPERIMENT POINTING SYSTEMS EXPECTED TO PERFORM BETTER ON PLATFORM
- EPS PLUS IMC OR MAGNETIC SUSPENSION SHOULD SATISFY MOST POINTING REQT'S
- SASP POINTING W/O EPS
  ACCURACY $< 20 \overset{\frown}{\text{MIN}}$
  STABILITY $< 10 \overset{\frown}{\text{MIN}}$

Figure 4.4-1 Platform Dynamics

ability of the PS computer to improve its attitude knowledge by using attitude data from experiments with very accurate pointing systems.

4.5 COMMUNICATIONS, DATA MANAGEMENT, AND FLOW

The subsystem design is largely driven by the payload requirements, which include very high bit rate data acquisition, near real-time data and command links for payload interactive control, and requirements for video and analog data handling and, in addition, it must furnish command and data handling for the SASP. A second driving requirement is to provide communication with the ground via the Tracking and Data Relay Satellite System (TDRSS). This interface determines the communication channel availability, as a function of TDRS visibility and total loading and also defines the communication system key parameters such as RF power, frequency, signal design, and data rates. Other goals in this area are the accommodation of Spacelab payload data interfaces and assurance that the SASP/payload interface could be readily and reliably integrated on orbit. The results of tradeoffs in design approaches were listed earlier in Table 4-1. Requirements for data acquisition rates of 120 Mbps for individual payloads and approximately 220 Mbps for payload groups have been identified. Real-time data rate requirements in the 50-200 Kbps range (for payload groups) have also been evaluated.

Emphasis was placed on the Platform providing a storage capability for payload data so that it can be dumped to the ground via TDRSS at opportune times and at high rates to minimize TDRSS timeline requirements. Payload data processing has been allocated to the payload to a large degree to provide maximum payload autonomy and to minimize the integration complexity.

The purpose of a special emphasis task on data flow was to analyze the data flow requirements between SASP payloads and the investigators and other users, the mission operations requirements, and the communications and data processing technology and resources available to ensure that the SASP communication and data management system is responsive to payload requirements and that viable approaches are identified to accommodating the overall end-to-end data flow requirements. This analysis will be continued as an add-on/sequel task to the SASP study funded by OSTDS through March, 1981. The study reported herein has identified SASP data management system approaches that are important in relation to end-to-end data flow and has suggested that TDRSS capabilities to support payload real-time interactive control requirements may be marginal, both in respect to real-time downlink data rates and in response time capabilities. It has been shown that a SASP has potential advantages over free-flyers in the efficient use of the TDRSS resource.

4.6 THERMAL CONTROL

The key trades performed in the thermal control area were summarized earlier in Table 4-1. These trades formed the basis for arriving at optimum designs for the two main competing options of centralized platform radiator and pallet located radiators. These two options were compared and the centralized concept was tentatively selected because of higher performance and reduced hardware requirements. The pallet concept can reject only about 3 kW of heat which is a fraction of the sustained electrical power supply capability. Some heat may be lost directly to space from pallet located equipment by passive means. However, it is felt that limiting cooling to 3 kW would place severe design restrictions on the user.

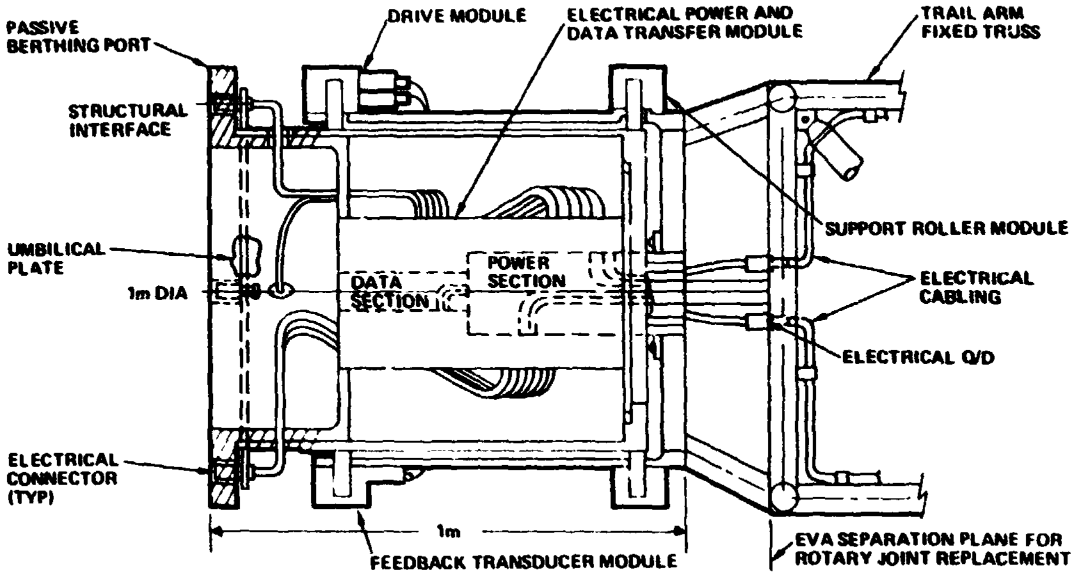
Use of the pallet radiator concept will reduce flexibility on possible new payload carriers such as the MDAC "ring" concept. Another advantage of the centralized concept is the reduced hardware requirements. The centralized concept uses two pump packages whereas a pump package (expensive) is required on each pallet for the palletized radiator concept. One disadvantage of the centralized concept is due to the requirement for cooling fluid connections to be made in space. This requirement is similar to the current Power System design which has three disconnect sets to allow use of the Power System payload heat exchanger. Therefore, it is believed that the same basic disconnect which is developed for Power System will also find application on the Platform.

4.7 POWER DISTRIBUTION

The platform power distribution system has evolved conceptually into options ranging from distributing both dc and ac power, with provisions for utilizing the maximum peak dc power available from the 25 kW Power System (PS), to a more elemental system for distributing and controlling primary dc power only, with peak load demands exceeding nominal distribution capacity being supplied by local peaking batteries. The scope of payload power interfaces ranges from those provided for a First Order Platform where the power is distributed directly from PS berthing ports, to an Extended Second Order Platform which adds distribution from a central support module to payloads on cross arms and trailing arms. Distribution of ac power to payloads has been deleted primarily because of the lack of a hard requirements base for cost-effective system sizing. DC distribution system capability provides 20 kW continuous/30 kW peak at payload interfaces. User provided batteries are required to supply peaking power if experiment (payload element) demand exceeds the 20/30 kW resources. Development of high voltage dc distribution and utilization equipment is encouraged to provide a viable alternative to less efficient lower voltage systems, particularly for high power applications.

4.8 ROTATING JOINTS/BERTHING UNITS

Resulting from Special Emphasis Task 7.b, Figure 4.8-1 shows details of the 360° (no thermal fluid) trail-arm rotating joint. The side-arm joints are ±180° joints to avoid rotating seals for the thermal fluid lines. Figure 4.8-2 shows the two different dual-hub berthing/loading units required between the First and Second Order Platform/Power System combinations and the Shuttle. Note that the larger unit would not be required if a second RMS is installed in the aft right of the cargo bay and used with the First Order Unit.



- No Fluid Transfer Across Rotating Joint
- 360-deg Rotational Feature
- Complete Module EVA Replaceable
- 25-kW Power Transfer Capability
- 100-mbps Data Transfer Capability

Figure 4.8-1 Trail Arm 360-Deg Rotational Joint

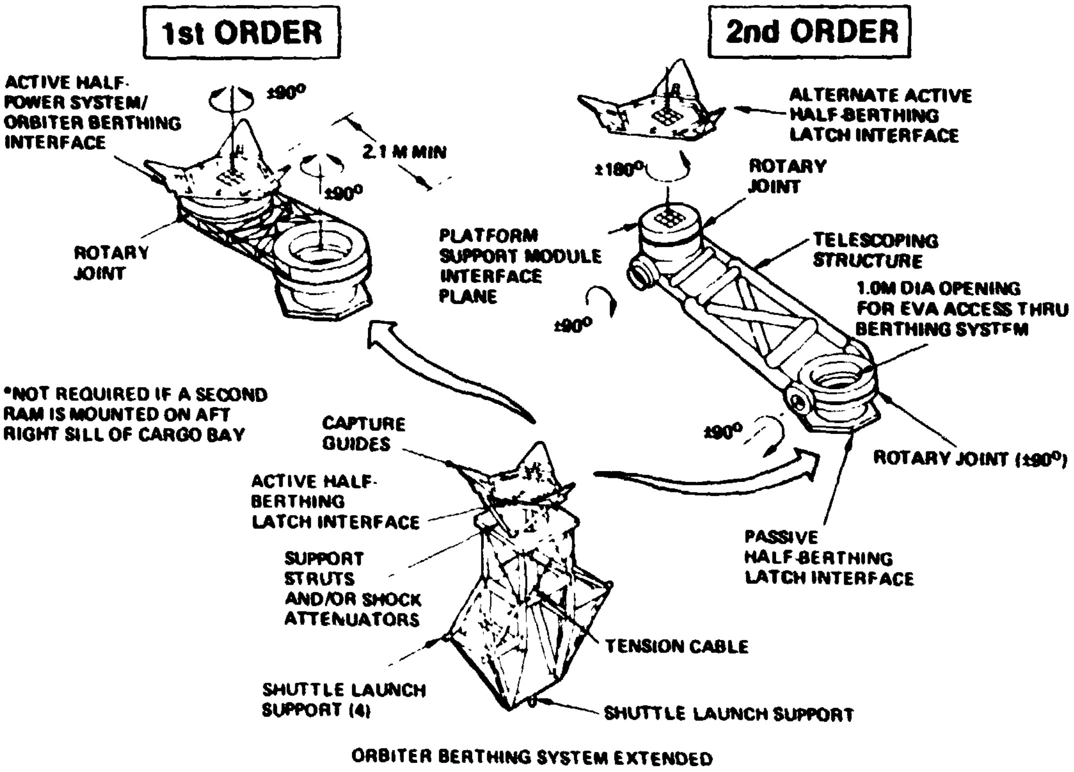
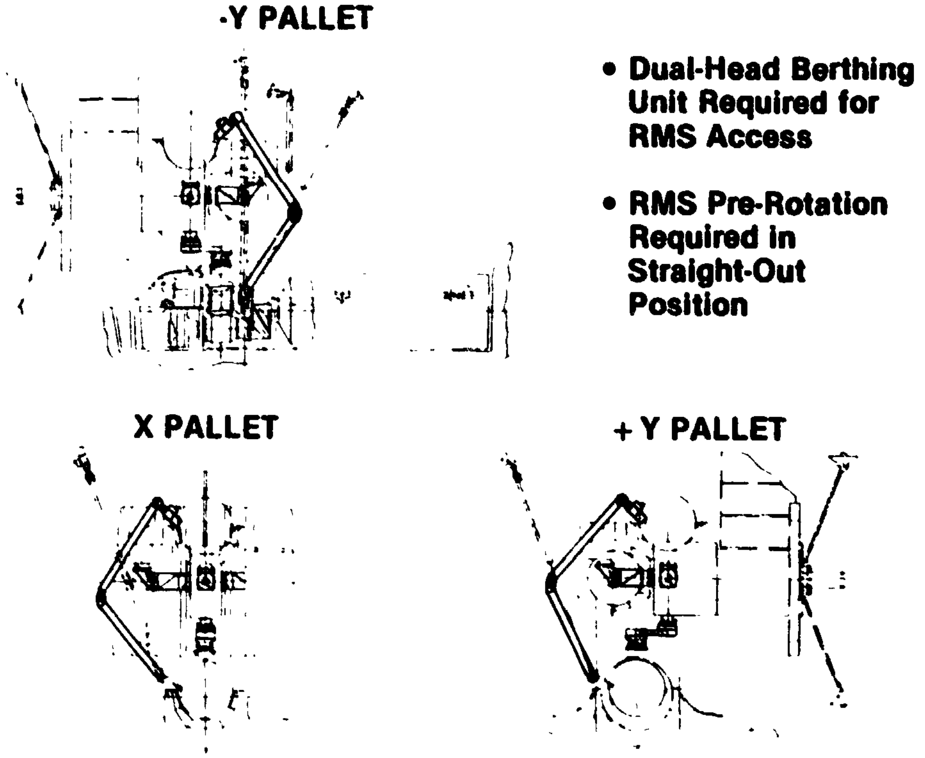


Figure 4.8-2 SASP Dual-Hub Berthing Units

Section 5 OPERATIONS (Task 6)

Figures 5-1 and 5-2 illustrate the platform deployment and loading procedures and geometrics which led to the incorporation of dual-hub Shuttle interface units shown between the Power System or Platform and the Shuttle (and previously on Figure 4.8-2). Figure 5-3 illustrates the process flow envisioned for KSC platform activities.


-Y PALLET

X PALLET

+Y PALLET

- **Dual-Head Berthing Unit Required for RMS Access**
- **RMS Pre-Rotation Required in Straight-Out Position**

Figure 5-1 First Order Platform Pallet Access

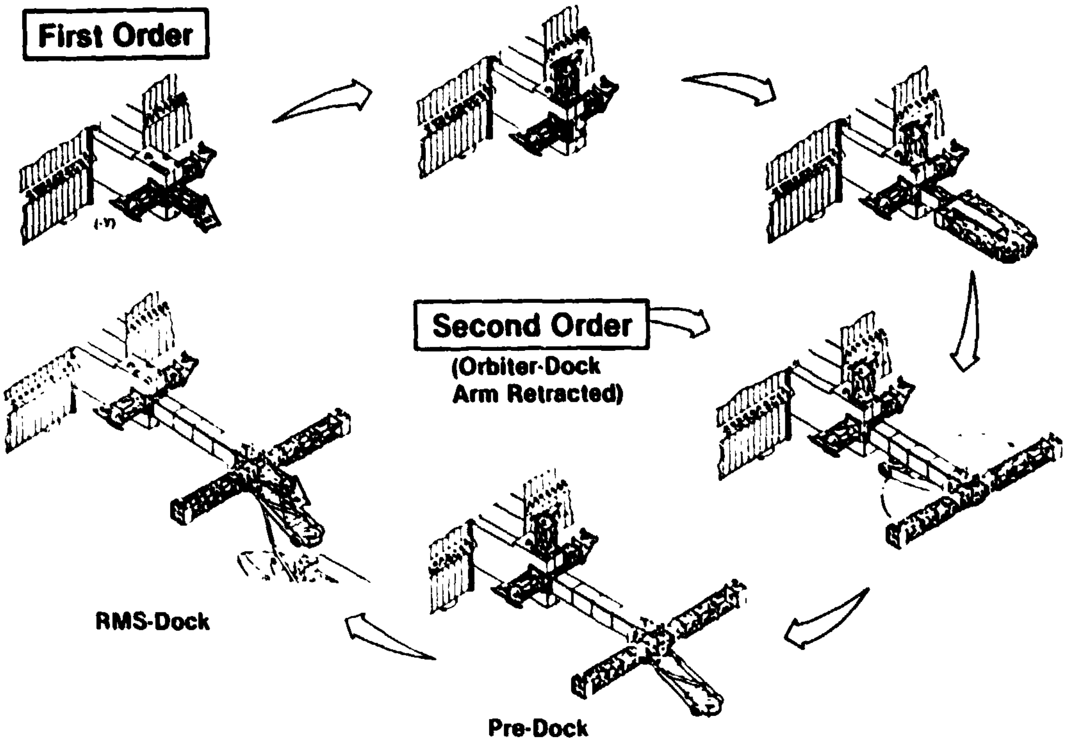


Figure 5-2 First-Second Order Transition

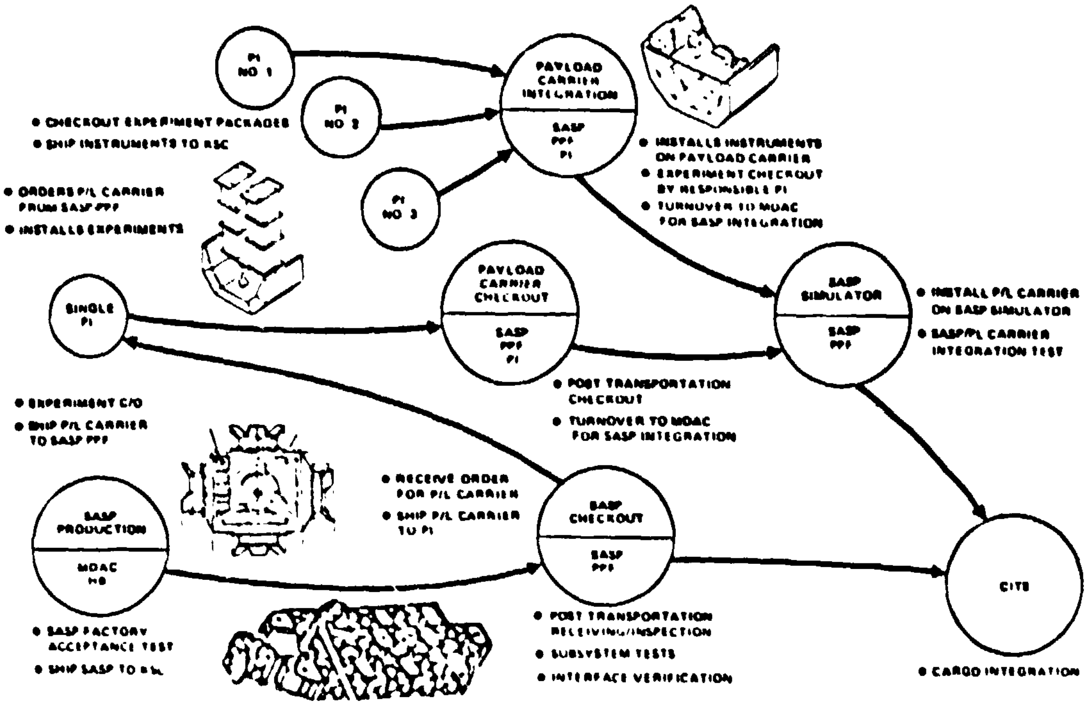


Figure 5-3 KSC Payload/Carrier/Platform Flows

Section 6 DEMONSTRATION TEST (Task 7)

During the development and qualification of the SASP hardware, the required flight performance will be demonstrated via ground test verification wherever practical. Development flight testing will be performed only where ground simulation is inadequate to give the necessary confidence for flight performance. Flight testing could probably best verify the critical parameters of the rotational mechanisms, expandable truss, berthing ports and RMS access, and the structural rigidity in zero-g and other flight environments. A multi-objective, candidate flight demonstration test unit (occupying one pallet) was defined.

Section 7 PROGRAMMATICS, COST AND SCHEDULE (Task 9)

The cost for the Platform portion of the SASP program is shown below in Table 9-1.

	Non-Recur	Recur	Total
FIRST ORDER PLATFORM	18.2	8.0	26.2
SECOND ORDER PLATFORM	52.8	22.2	75.0 (Follows 1st)
TRAIL ARM KIT	12.8	5.3	18.1 (Concurrent with 2nd)

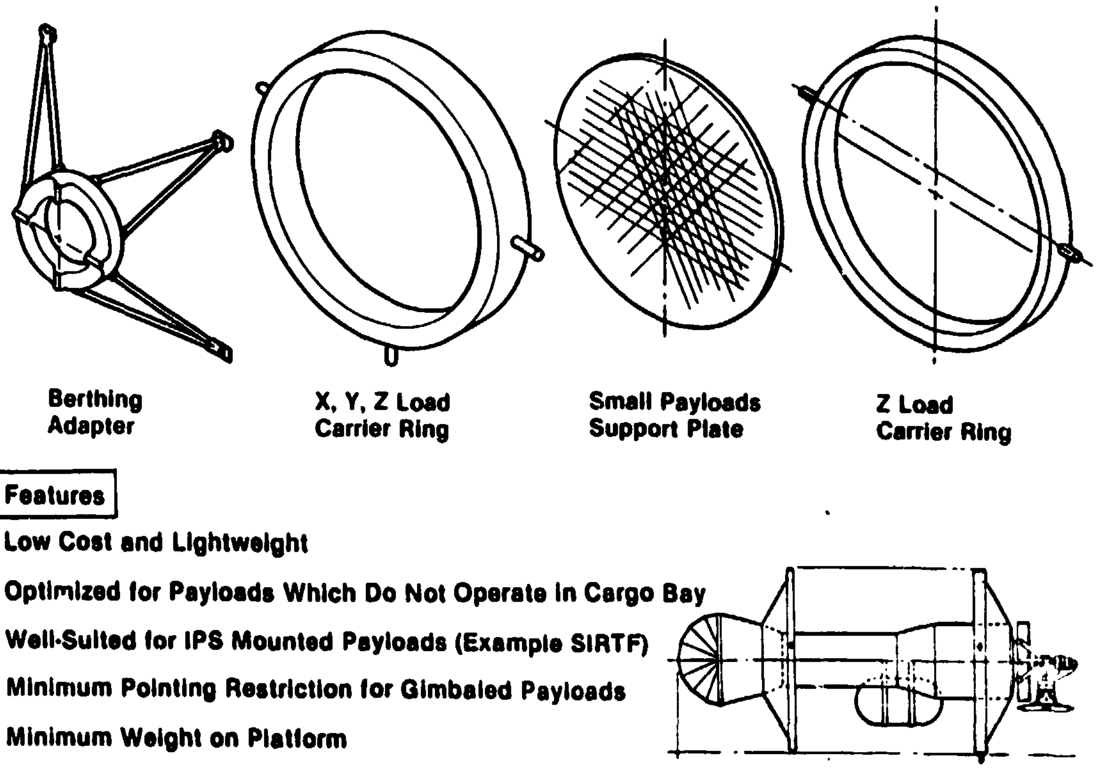
*Does not include project management, SE&I, GSE or Operations.

Table 9-1 Platform Cost (Millions of 1980 $)*

This cost assumes the First Order is begun in July 1983, and delivered at the end of 1985, 30 months later. The first launch is shown as July 1986. The Second Order Platform is a follow-on to the First Order. It shares commonality with the First Order (assumes same contractor and uninterrupted production line). Its peculiar development starts 6 months after the First Order. Its delivery is scheduled for July 1986. It is to be launched and joins the First Order already in orbit sometime in November 1986. The trail arm has not been scheduled but can be available at the same time or any period after the delivery of the Second Order. It can be delivered within 2-1/2 years from its ATP.

Section 8 ADVANCED PAYLOAD CARRIER CONCEPT (Special Subject)

Many considerations suggest that a simpler, lower cost structural interface with the Orbiter may be desirable for SASP payloads. One structural interface concept, configured to provide an alternative to the Spacelab pallet for SASP payloads, is shown in Figure 8-1. Since SASP payloads do not operate while in the cargo bay, a heavy, trough-type design is not required, and a ring concept appears well-suited to the many SASP payloads.



Features

- Low Cost and Lightweight
- Optimized for Payloads Which Do Not Operate in Cargo Bay
- Well-Suited for IPS Mounted Payloads (Example SIRTF)
- Minimum Pointing Restriction for Gimbaled Payloads
- Minimum Weight on Platform

Figure 8-1 Advanced Payload Carrier Concept

A concept for the access module required to berth elements of this system was also developed in the study; details are shown in Figure 9-1.

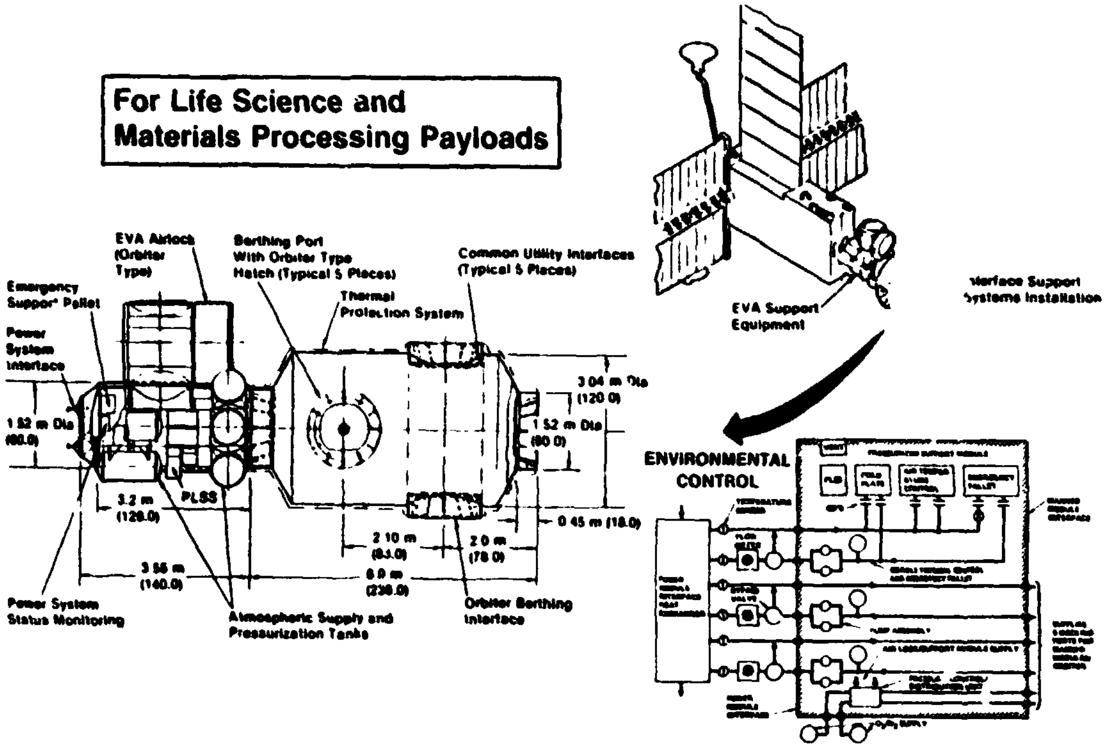


Figure 9-1 Early Manned Platform Access Module

Section 10 SUPPORTING RESEARCH AND TECHNOLOGY

Although no critical items have been identified which require supporting research and technology effort, it is recommended that technical improvement of the following items will minimize program schedule and cost risk:

A. Rigid truss joint.

B. Viscoelastic structural elements.

C. Rotation mechanisms with utility feedthrough.

D. Recorder - high rate, storage capability and reliability.

E. Service routing in deployable structures.

F. Data processing requirements for pointing systems.

G. Freon 21 fluid disconnects.

H. Extension/rotation mechanisms for berthing.