

SPACE STATION TASK FORCE PERSPECTIVE

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No text available at time of printing.

PRESENTATION OUTLINE

- PRELIMINARY PROGRAM DESCRIPTION
 - DEFINITIONS
 - FUNCTIONS
 - CAPABILITIES
 - MANAGEMENT APPROACH
 - SCHEDULES
- SPACE STATION SERVICING CAPABILITY
- SPACE STATION - ORBITAL TRANSFER VEHICLE (OTV) PROGRAM INTERFACES

Figure 1

SPACE STATION PLANNING GUIDELINES

MANAGEMENT RELATED

- Three year extensive definition (5-10% of program cost)
- NASA-wide participation
- Development funding in FY 1987
- IOC: early 1990's
- Cost of Initial capability: \$8.0B
- Extensive user involvement
 - Science and applications
 - Technology
 - DoD
 - Commercial
- International participation

ENGINEERING RELATED

- Continuously habitable
- Shuttle dependent
- Manned and unmanned elements
- Evolutionary
- Maintainable/restorable
- Operationally autonomous
- Customer friendly
- Technology transparent

Figure 2

SPACE STATION PROGRAM ARCHITECTURE: WHAT IS A SPACE STATION

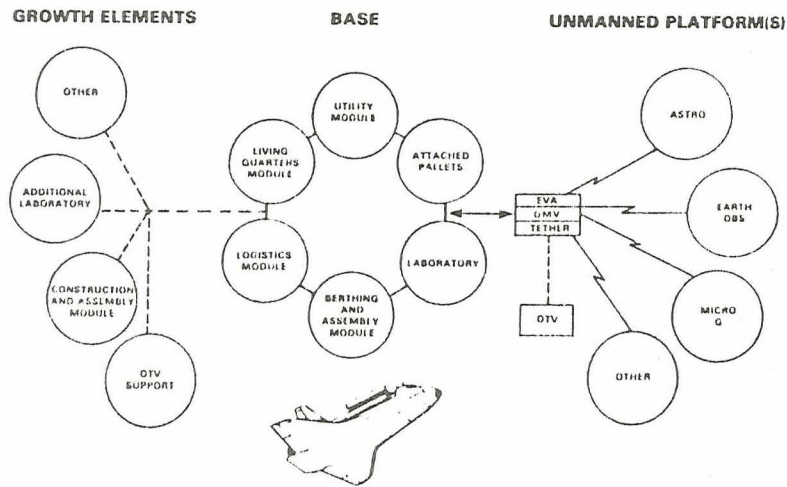


Figure 3

FUNCTIONS OF A SPACE STATION

- On-orbit laboratory
 - Science and applications
 - Technology
- Permanent observatory(s)
- Transportation node
- Servicing facility
 - Free flyers
 - Platforms
- Communications and data processing node
- Manufacturing facility
- Assembly facility
- Storage depot

A space station is a multi-purpose facility

Figure 4

SPACE STATION FUTURE

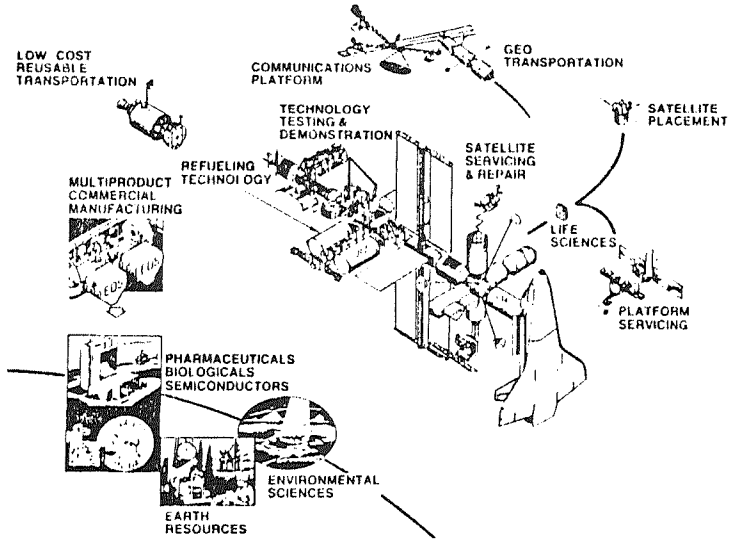


Figure 5

SPACE STATION INITIAL

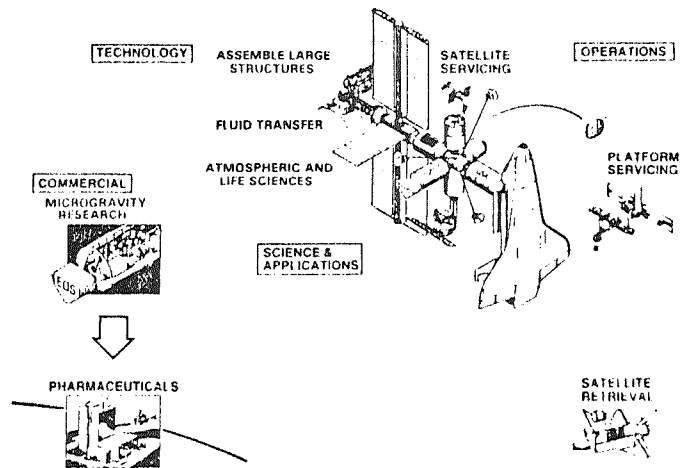


Figure 6

THE RELATIONSHIP BETWEEN THE SPACE STATION PROGRAM AND OTHER PROGRAMS

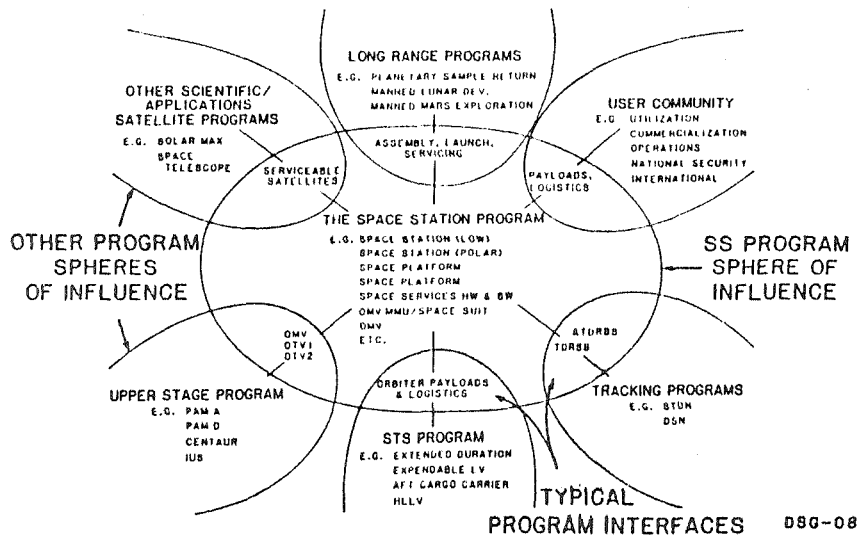


Figure 7

**SPACE STATION DEFINITION
PRELIMINARY MISSION DATA BASE
(1991-2000)**

- Initial Data Base
- Derived from Shuttle and ELV Base
- Will Change as Station Capabilities Become Better Understood and Mission Priorities Shift
- Not the List of Mission/Payloads the Station Will Fly in 1991

SCIENCE AND APPLICATIONS

- Astrophysics
- Earth Science and Applications
- Solar System Exploration
- Life Sciences
- Materials Science
- Communications

COMMERCIAL

- Materials Processing in Space
- Earth and Oceans Observations
- Communications

TECHNOLOGY DEVELOPMENT

- Materials and Structures
- Energy Conversion
- Computer Science and Electronics
- Propulsion
- Controls and Human Factors
- Space Station Systems/Operations
- Fluid and Thermal Physics

Figure 8

SCOPE OF INITIAL SPACE STATION

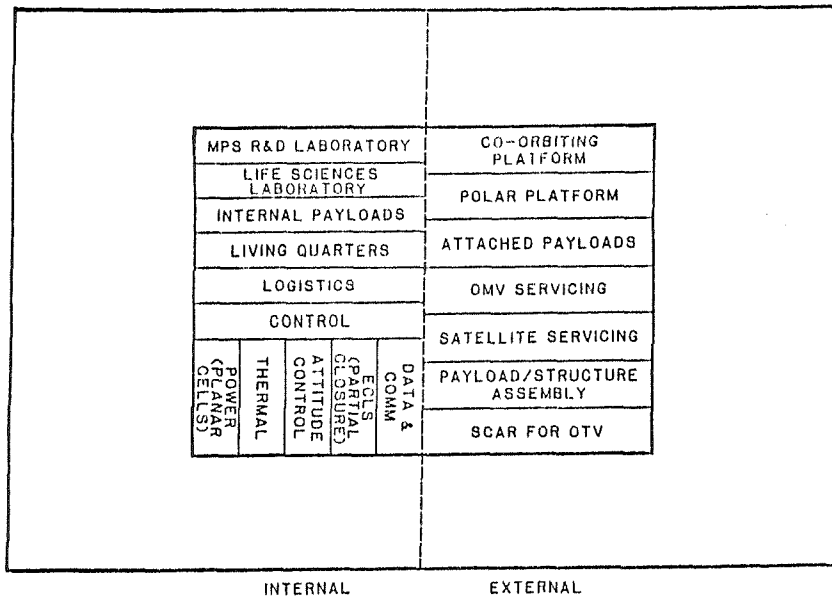


Figure 9

ADDED SCOPE FOR INTERNATIONAL AND COMMERCIAL PARTICIPATION

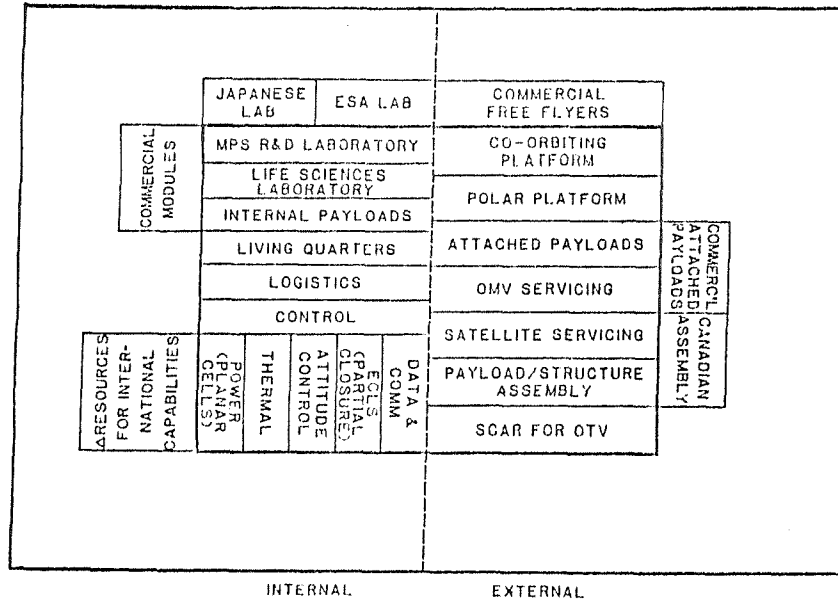


Figure 10

SCOPE OF GROWTH CONFIGURATION

MORE R&D LABORATORIES		MORE INTERNATIONAL LABORATORIES		MORE COMMERCIAL FREE FLYERS		Δ CO-ORBIT PLATFORM CAPABILITY		
MORE LIFE SCIENCES LABS		JAPANESE LAB	ESA LAB	COMMERCIAL FREE FLYERS		Δ POLAR PLATFORM CAPABILITY		
MORE COMMERCIAL MODULES	COMMERCIAL MODULES	MPS R&D LABORATORY		CO-ORBITING PLATFORM		VERY LARGE SPACE STRUCTURES CONSTRUCTION		
		LIFE SCIENCES LABORATORY		POLAR PLATFORM				
Δ LIVING QUARTERS		LIVING QUARTERS		ATTACHED PAYLOADS		MORE COM-MERICAL ATTACHED PAYLOADS	MORE COM-MERICAL ATTACHED PAYLOADS	
Δ LOGISTICS CAPABILITY		LOGISTICS		OMV SERVICING				
Δ CONTROL CAPABILITY		CONTROL		SATELLITE SERVICING		CANADIAN ASSEMBLY	MORE CANADIAN ASSEMBLY & CON-STRUCTION	
Δ RESOURCES INTERNATIONAL	Δ RESOURCES FOR INTER-NATIONAL CAPABILITIES	POWER (PLANAR CELLS)	THERMAL	ATTITUDE CONTROL	ECLS (PARTIAL CLOSED)			DATA & COMM
						Δ THERMAL CAPABILITY	Δ ATTITUDE CONTROL	
INCREASED ON-BOARD AUTONOMY/AUTOMATION		POWER (CONCENTRATOR CELLS)	Δ THERMAL CAPABILITY	Δ ATTITUDE CONTROL	ECLS (CLOSED)	Δ DATA & COMM	OTV DELIVERY OF SATELLITES TO GEO	SATELLITE SERVICING AT GEO
							GEO PLATFORM DELIVERY	OTV PLANETARY MISSIONS
INTERNAL				EXTERNAL				

Figure 11

THE SPACE STATION PROGRAM WILL EVOLVE THROUGH A "BLOCK" SERIES

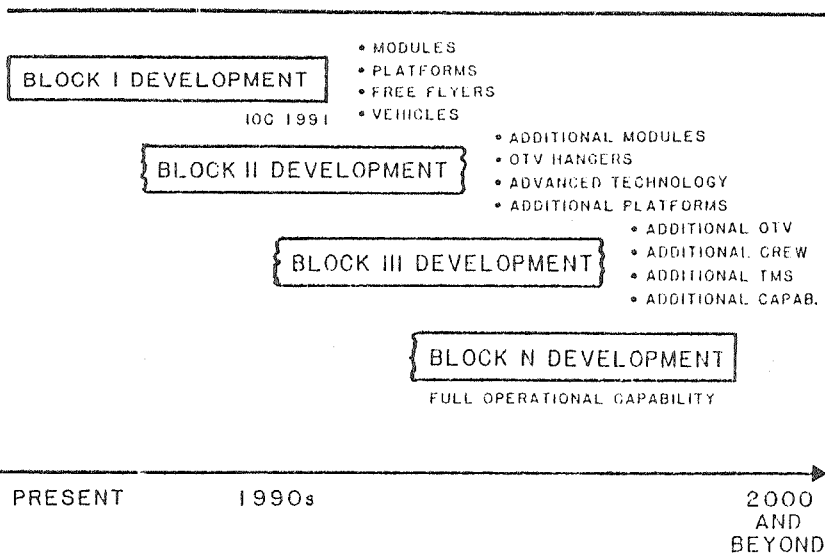


Figure 12

SPACE STATION PROGRAM EXTENDED DEFINITION

- SCOPE AND DURATION BEYOND "PHASE B"
- TWO CONTRACTORS COMPETE FOR EACH WORK PACKAGE
- PRODUCTS ARE A BLEND OF DOCUMENTATION AND HARDWARE DEMONSTRATIONS

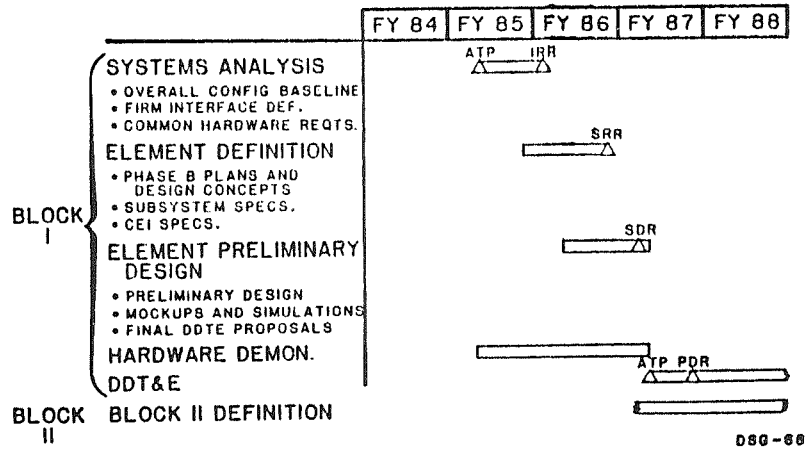


Figure 13

SPACE STATION OVERALL SCHEDULE

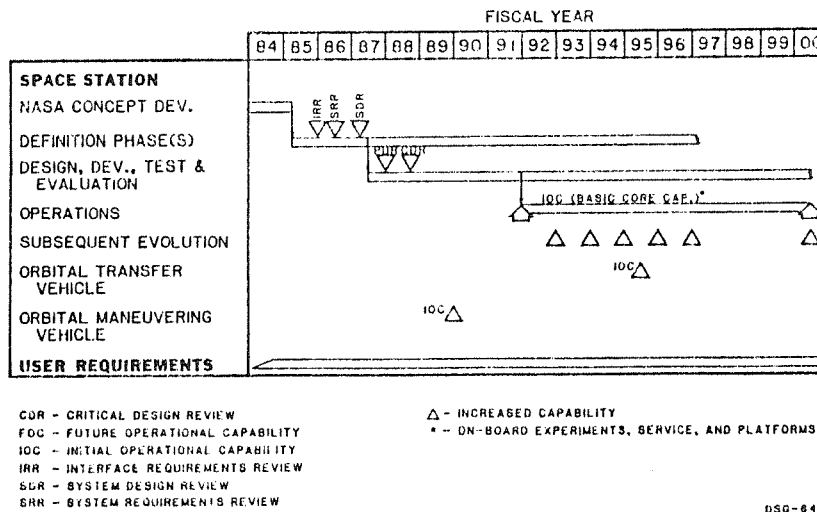
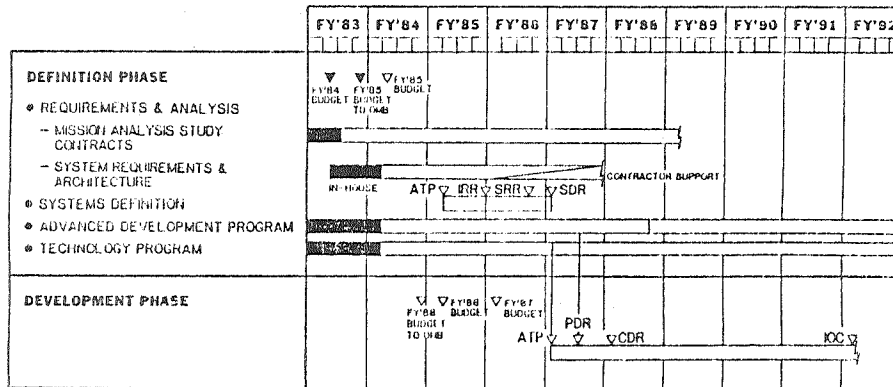


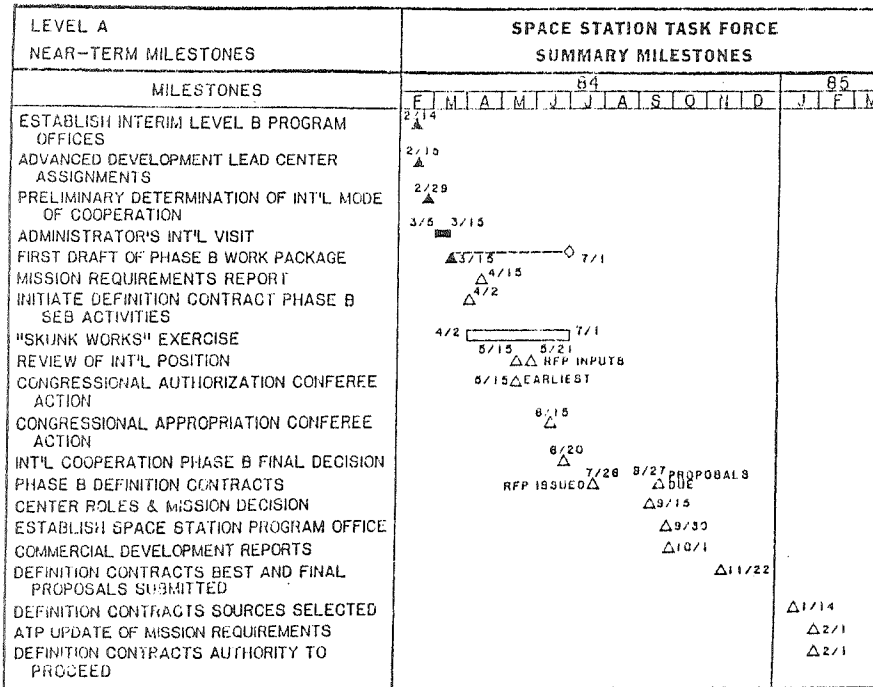
Figure 14

SPACE STATION PLANNING SCHEDULE



02/07/84
056-2073

Figure 15



03/15/84

Figure 16

SPACE STATION PROGRAM DEFINITION ACTIVITY

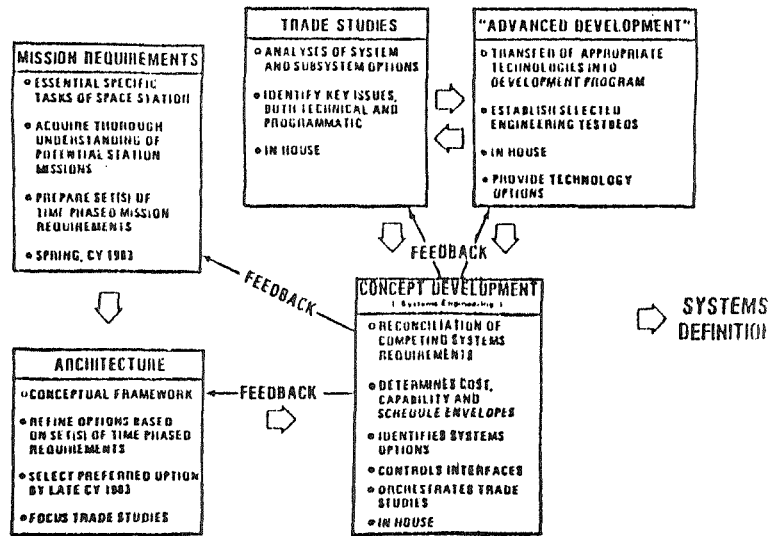


Figure 17

SPACE STATION SERVICING CAPABILITY

THE SPACE STATION BASE WILL HAVE THE CAPABILITY TO SERVICE OR PROVIDE SERVICING SUPPORT FOR:

- PAYLOADS ATTACHED TO THE STATION
- SATELLITES BROUGHT TO THE STATION BY THE TMS OR SERVICED REMOTELY BY THE TMS
- TMS BASED AT THE STATION
- CO-ORBITING PLATFORM AND ITS PAYLOADS
- LARGE SPACE STRUCTURE TDM'S
- PAYLOADS TO BE PLACED IN ORBIT BY THE TMS AND TO BE LAUNCHED TO HIGHER ENERGY ORBITS
- SPACE-BASED REUSEABLE OTV
- SATELLITES IN GEO SERVICED REMOTELY BY THE TMS

SERVICING FUNCTIONS AT THE SPACE STATION WILL INCLUDE:

- REPLENISHMENT OF CONSUMABLES
 - PROPELLANT S
 - PRESSURANTS
 - COOLANT S
- RECHARGING/REPLACEMENT OF BATTERIES
- CONSTRUCTION OF LARGE SPACE STRUCTURES
- ASSEMBLY (POSSIBLE FUELING) AND MATING OF PAYLOADS
- CHECKOUT
 - SATELLITES
 - TMS
 - OTV
 - PAYLOADS
- REPAIR AND UPGRADING, PRIMARILY BY ORU EXCHANGE

Figure 18

SERVICING FACILITIES AT THE SPACE STATION

COMMON FACILITIES

- SUPPORT STRUCTURE
- REMOTE MANIPULATOR SYSTEM (RMS) - RELOCATABLE
- MANIPULATOR FOOT RESTRAINT (MFR)
- MANNED MANEUVERING UNITS (MMU) - TWO
- MODULAR EQUIPMENT STORAGE ASSEMBLY (MESA)
- GENERAL STORAGE AREA - ENCLOSED
MMU'S, MFR, MESA
- WORK AREA (CONSTRUCTION OF LARGE SPACE STRUCTURES)
- EXTERNAL WORK SITE MONITORING AND CONTROL STATION
(IN A PRESSURIZED MODULE)

MULTIPURPOSE PRESSURIZED WORK
VOLUME-NEED TO BE DETERMINED

ORBITAL TRANSFER VEHICLE (OTV) FACILITIES

- BERTHS - TWO
- PROPELLANT AND PRESSURANT TANKS
- ELECTRICAL POWER STATION
- CHECKOUT EQUIPMENT
- HANGARS UNPRESSURIZED - TWO
- PAYLOAD ASSEMBLY/CHECKOUT AREA - ENCLOSED
- STORAGE AREA - ENCLOSED
SPARE ASSEMBLIES, ORU'S, MANNED GEO
MISSION MODULE

Figure 19

THE SERVICING FACILITY AND OPERATIONS

- PLACE SEVERE REQUIREMENTS ON THE SPACE STATION
 - SAFETY
 - CONTAMINATION
 - CONTROL STATION VIEWING OF SERVICING OPERATIONS
 - APPROACH/DEPARTURE CORRIDORS
 - THERMAL CONTROL OF FLUIDS STORED ON THE STATION
 - EVA CORRIDORS
 - ACCESS TO PRESSURIZED WORK VOLUME (IF DEEMED NECESSARY)
 - CONSUMABLES AND CARGO TRANSFER
 - ATTITUDE CONTROL AND PROPULSION
 - RMS REACH CAPABILITY
 - POSSIBLE CRYOGENIC PROPELLANT BOIL-OFF USAGE (ECLS,
PROPULSION, POWER)
 - GROWTH CAPABILITY
- AFFECT OTHER ELEMENTS OF THE SPACE STATION
 - SCIENTIFIC INSTRUMENTS FIELDS OF VIEW
 - G LEVEL OF THE LABORATORIES
 - CONTAMINATION OF ENVIRONMENT

THE SERVICING FACILITY AND OPERATIONS ARE A MAJOR DRIVER
FOR BOTH THE INITIAL AND GROWTH STATIONS

Figure 20

**CRITICAL TECHNOLOGY DEVELOPMENT FOR
OMV/OTV/SATELLITE SERVICING**

- FLUID MANAGEMENT
 - CRYOGENICS
 - STORABLE FLUIDS
- LONG-TERM ORBITAL STORAGE OF CRYOGENICS
- CONTAMINATION CONTROL/REMOVAL
- IMPROVED EXTRAVEHICULAR MANEUVERING UNIT (EMU)
- ROBOTIC SERVICING CAPABILITY
- RENDEZVOUS, APPROACH, AND BERTHING
 - OMV
 - OTV
 - SATELLITES
 - PLATFORM

Figure 21

TOP LEVEL SERVICING FACILITY ISSUES

- OTV PROPELLANT DEPOT LOCATION
 - ATTACHED
 - TETHERED
 - FREE FLYING
- DEGREE OF SERVICING AUTOMATION
 - INITIAL STATION
 - GROWTH STATION
- NEED FOR A PRESSURIZED WORK VOLUME

Figure 22

DESIRABLE FEATURES FOR A SPACE STATION BASED OTV

- SPACE MAINTAINABLE
- MODULAR
- HIGH REUSEABILITY
- SIMPLE PAYLOAD INTEGRATION AND SERVICING CAPABILITY
- SYNERGISTIC WITH SPACE STATION SYSTEMS/ELEMENTS
- COMMONALITY WITH SPACE STATION SYSTEMS/ELEMENTS
- STANDARDIZED INTERFACES - OMV, SATELLITES, SPACE STATION
- GROWTH CAPABILITY
- HIGH EFFICIENCY (LOW WEIGHT, HIGH ISP)
- NON-CONTAMINATING
- WIDE THRUST LEVEL CAPABILITY

Figure 23

**PROPOSED OTV TECHNOLOGY DEVELOPMENT
FLIGHT EXPERIMENTS**

SHUTTLE SORTIE FLIGHTS (1987 - 1990)

- PROPELLANT TRANSFER, STORAGE, AND REFRIGERATION/RELIEFATION
- DOCKING AND BERTHING
- EMU/EVA OPERATIONS
- PAYLOAD MATING/INTERFACE
- OTV SHELTER STRUCTURE
- SERVICING FACILITIES/EQUIPMENT

**TECHNOLOGY DEVELOPMENT MISSIONS ON SPACE STATION
(1991 -)**

- PROPELLANT TRANSFER, STORAGE, AND REFRIGERATION/RELIEFATION
- DOCKING AND BERTHING
- MAINTENANCE
- PAYLOAD INTEGRATION

SPACE-BASED OTV OPERATIONS (1995)

Figure 24

ORBITAL TRANSFER VEHICLE (OTV) - SPACE STATION PROGRAM INTERFACES

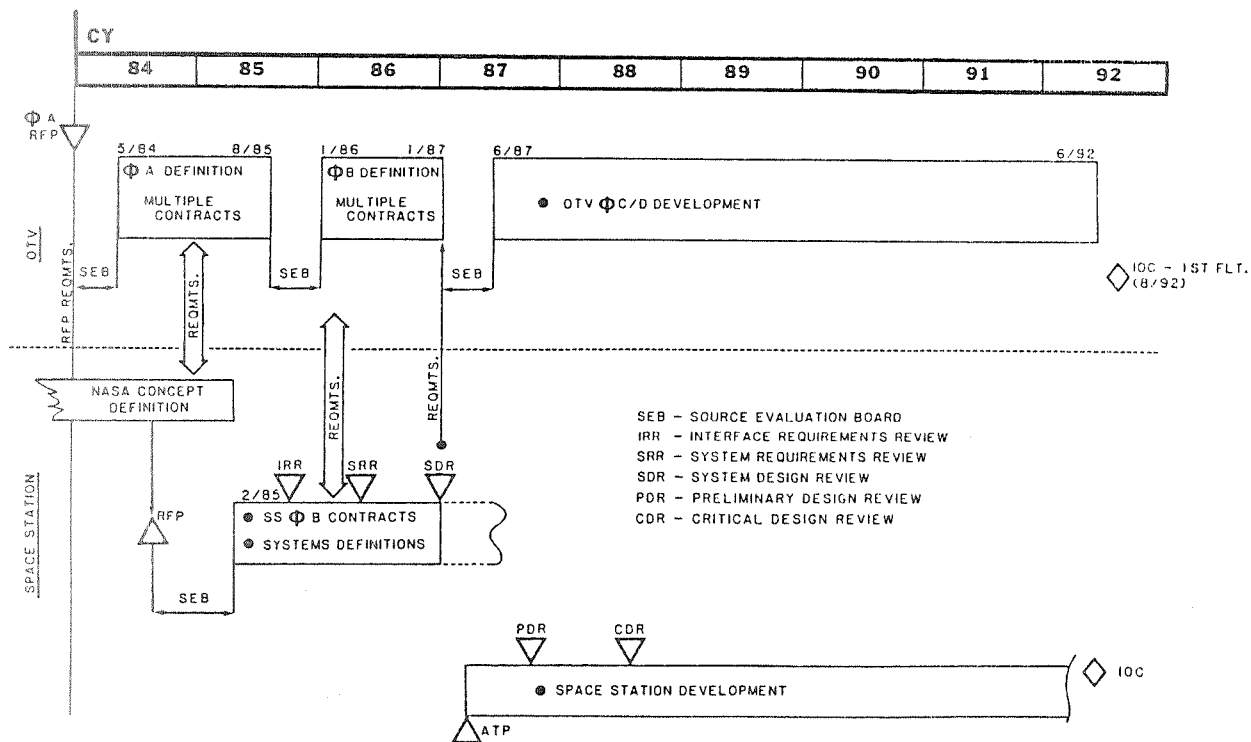


Figure 25