SATELLITE SERVICES WORKSHOP

JUNE 22-24, 1982

NASA JOHNSON SPACE CENTER

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SATELLITE DESIGN SESSION

SPACE PLATFORM

BY

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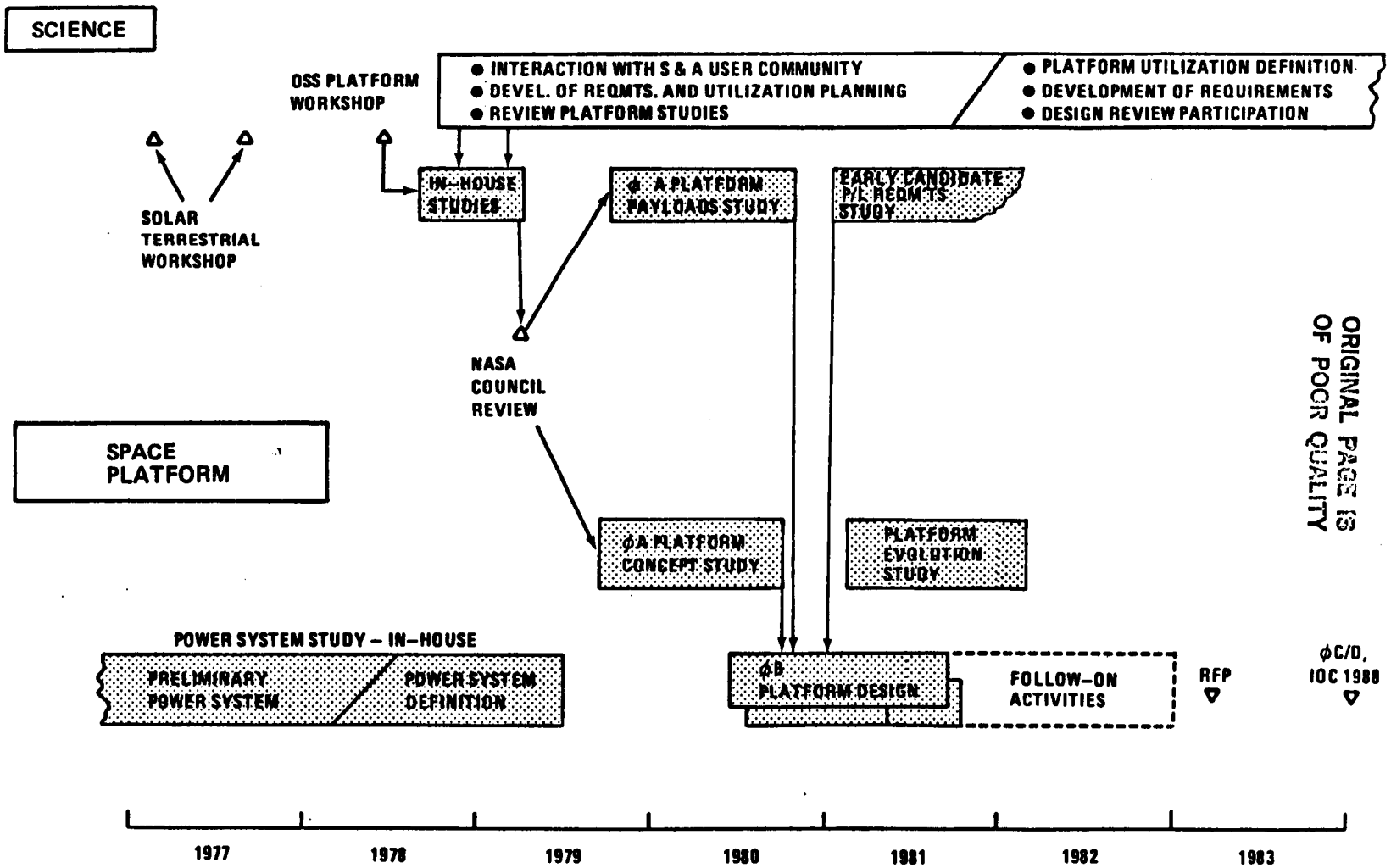
SPACE PLATFORM PROJECT
MARSHALL SPACE FLIGHT CENTER

1990–81

SPACE PLATFORM PROGRAM



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SPACE PLATFORM
DESIGN REQUIREMENTS

ORBIT BASED WITH MINIMUM OF FIVE-YEAR LIFE WITH MAINTENANCE

COMPATIBLE WITH STS FOR DELIVERY, MAINTENANCE AND RETRIEVAL

COMPATIBLE WITH DELIVERY AND OPERATION IN ANY STS ACCESSABLE ORBIT

PROVIDE RESOURCES FOR FREE FLYER MISSIONS

PROVIDE ELECTRICAL POWER CONTINUOUSLY TO THE USER AT 28VDC OR 120 VDC

PROVIDE HEAT REJECTION FOR PAYLOADS

PROVIDE ORBIT ALTITUDE MAINTENANCE WITHOUT ORBITER REVISIT FOR A MINIMUM OF ONE YEAR

PROVIDE HIGH DATA RATE COMMUNICATIONS TO THE GROUND VIA TDRSS

MINIMIZE COST AND RISK THROUGH USE OF EXISTING DESIGNS

SPACE PLATFORM SUBSYSTEM DESIGN CHARACTERISTICS

ELECTRICAL POWER (APPROXIMATELY 12 kW)

- O DUAL WING FLEXIBLE FLATFOLD SOLAR ARRAY (APPROX. 31 kW CAPACITY)
- O MODULAR DESIGN WITH MULTIPLE POWER PROCESSING GROUPS
  - 50 AH NiCd BATTERIES
  - P^3 CHARGERS AND REGULATORS
- O UTILIZATION OF EXISTING HARDWARE/DESIGNS (SEPS, MMS, ETC.)

THERMAL CONTROL (APPROXIMATELY 12 kW)

- O PUMPED FLUID SYSTEM
  - DEPLOYABLE FLUID RADIATOR
  - COLD PLATES FOR SUBSYSTEM COOLING
  - DUAL LOOP SYSTEM
  - HEAT EXCHANGER PAYLOAD COOLING INTERFACE
- O UTILIZATION OF EXISTING HARDWARE/DESIGNS (SHUTTLE, SPACELAB)

SPACE PLATFORM SUBSYSTEM DESIGN CHARACTERISTICS (CONT'D)

ATTITUDE CONTROL (3 AXIS POINTING & STAB. WITH SUB ARC MIN. ACCURACY)

- CONTROL MOMENT GYROS (CMG) AND RATE GYROS FOR POINTING AND STABILIZATION CONTROL
- MAGNETIC TORQUERS FOR MOMENTUM MANAGEMENT
- EARTH, SUN AND STAR SENSORS FOR ATTITUDE DETERMINATION.
- UTILIZATION OF EXISTING HARDWARE/DESIGNS (SKYLAB, SPACE TELESCOPE, ETC.)

COMMUNICATIONS (50 KBPS - 200 + MBPS)

- REDUNDANT LOW DATA RATE S-BAND AND HIGH DATA RATE KU-BAND THRU TDRSS
- UTILIZATION OF EXISTING HARDWARE/DESIGNS (LANDSAT, FLT SAT COM, MMS, ETC.)

DATA HANDLING (RATES COMPATIBLE WITH COMM. SUBSYSTEM)

- REDUNDANT CENTRAL COMPUTER AND DATA BUS
- LOW DATA RATE RECORDERS
- HIGH DATA RATE MULTIPLEXERS AND RECORDERS
- UTILIZATION OF EXISTING HARDWARE/DESIGNS (SHUTTLE, SPACELAB, MMS, ETC.)

SPACE PLATFORM SUBSYSTEM DESIGN CHARACTERISTICS (CONT'D)

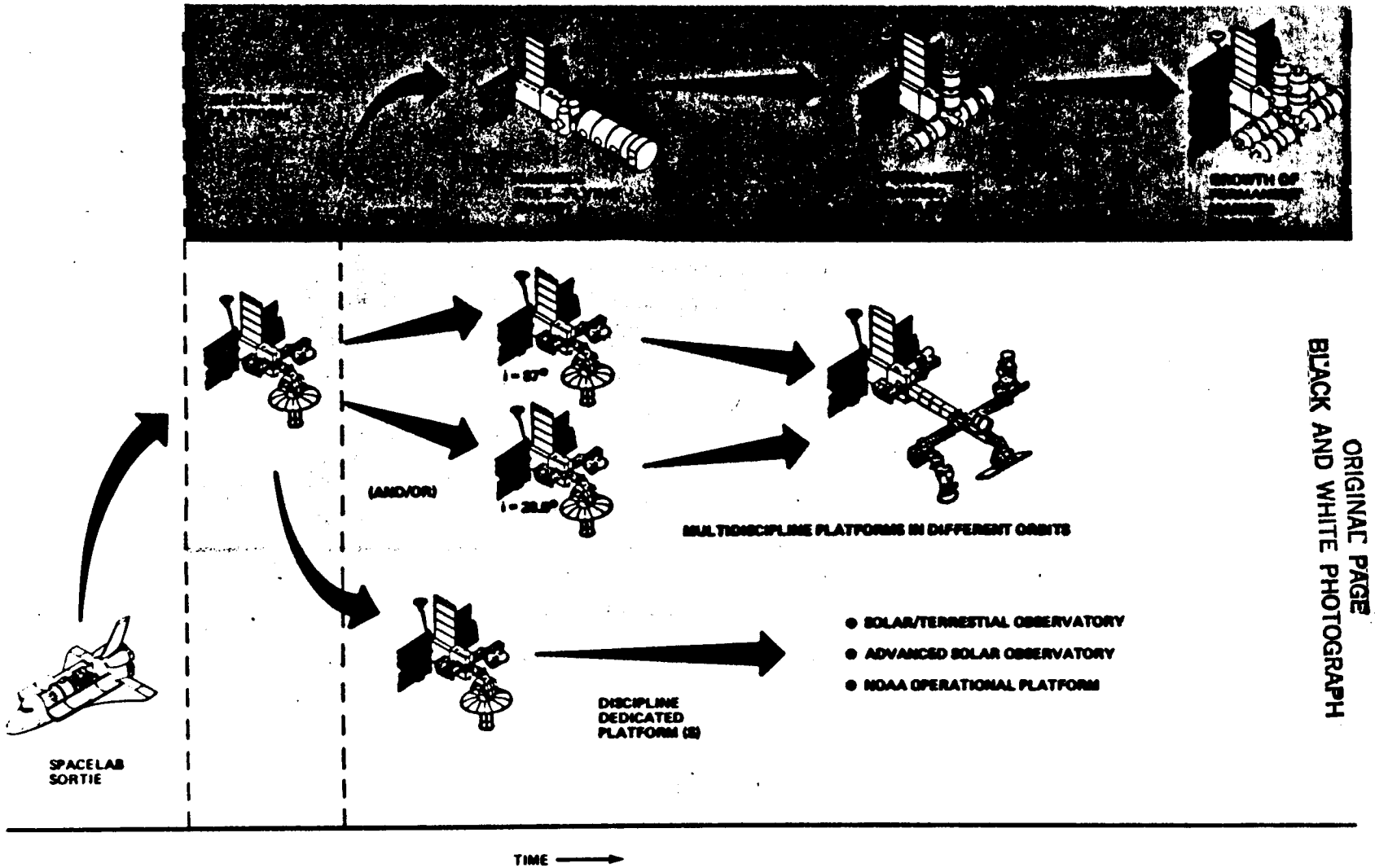
PROPULSION

- BLOWDOWN HYDRAZINE SYSTEM
- REDUNDANT THRUSTERS FOR REBOOST AND ATTITUDE CONTROL BACKUP
- UTILIZATION OF EXISTING HARDWARE/DESIGNS (TDRSS, HEAO, IUS, ETC.)

STRUCTURE

- STANDARD AEROSPACE CONSTRUCTION USING ALUMINUM FRAMES AND SHEAR PANELS

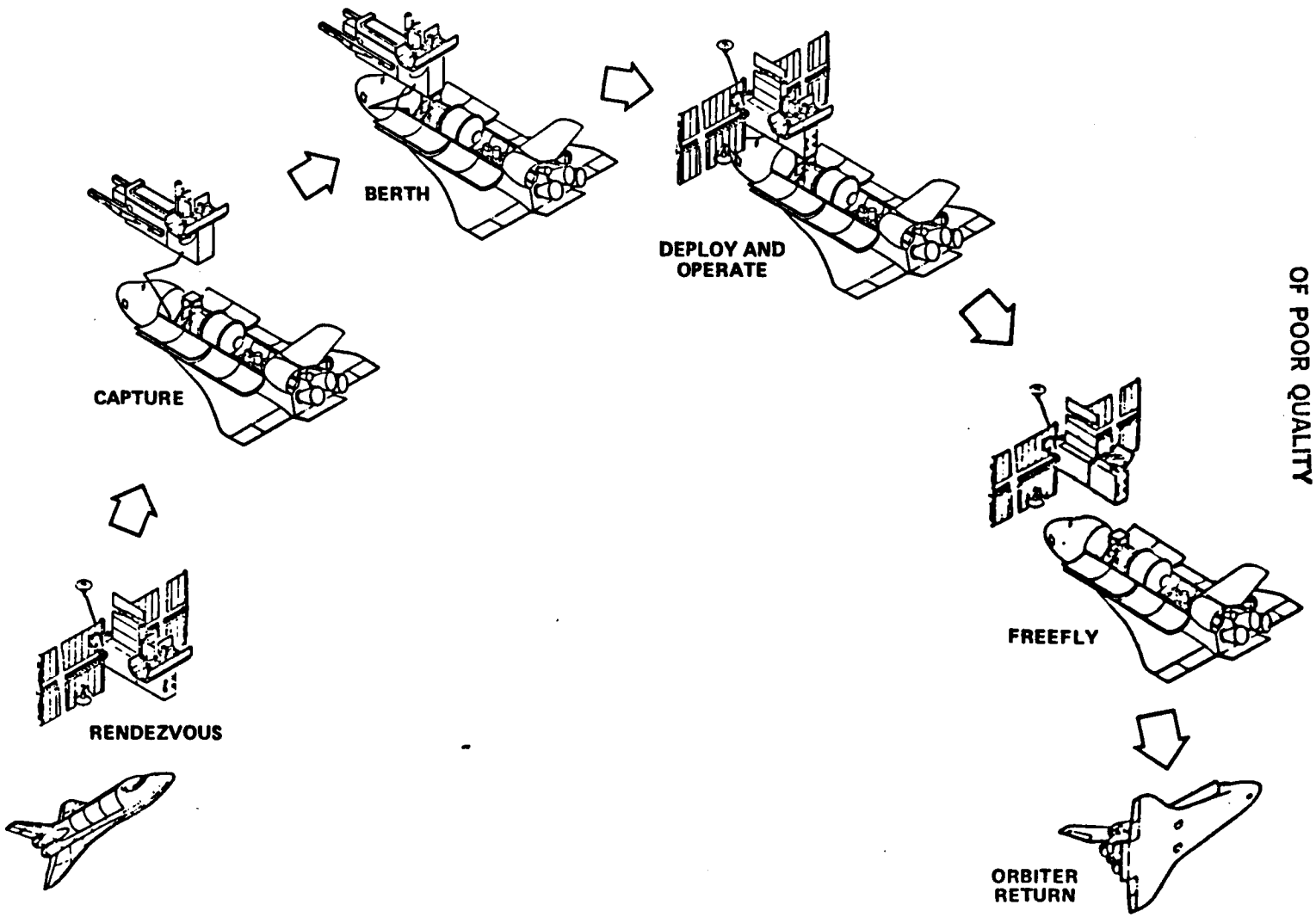
SPACE PLATFORM EVOLUTION SCENARIOS



MSFC–6/81–PM 1629A

PD996-80C

25kW POWER SYSTEM RENDEZVOUS & BERTHING



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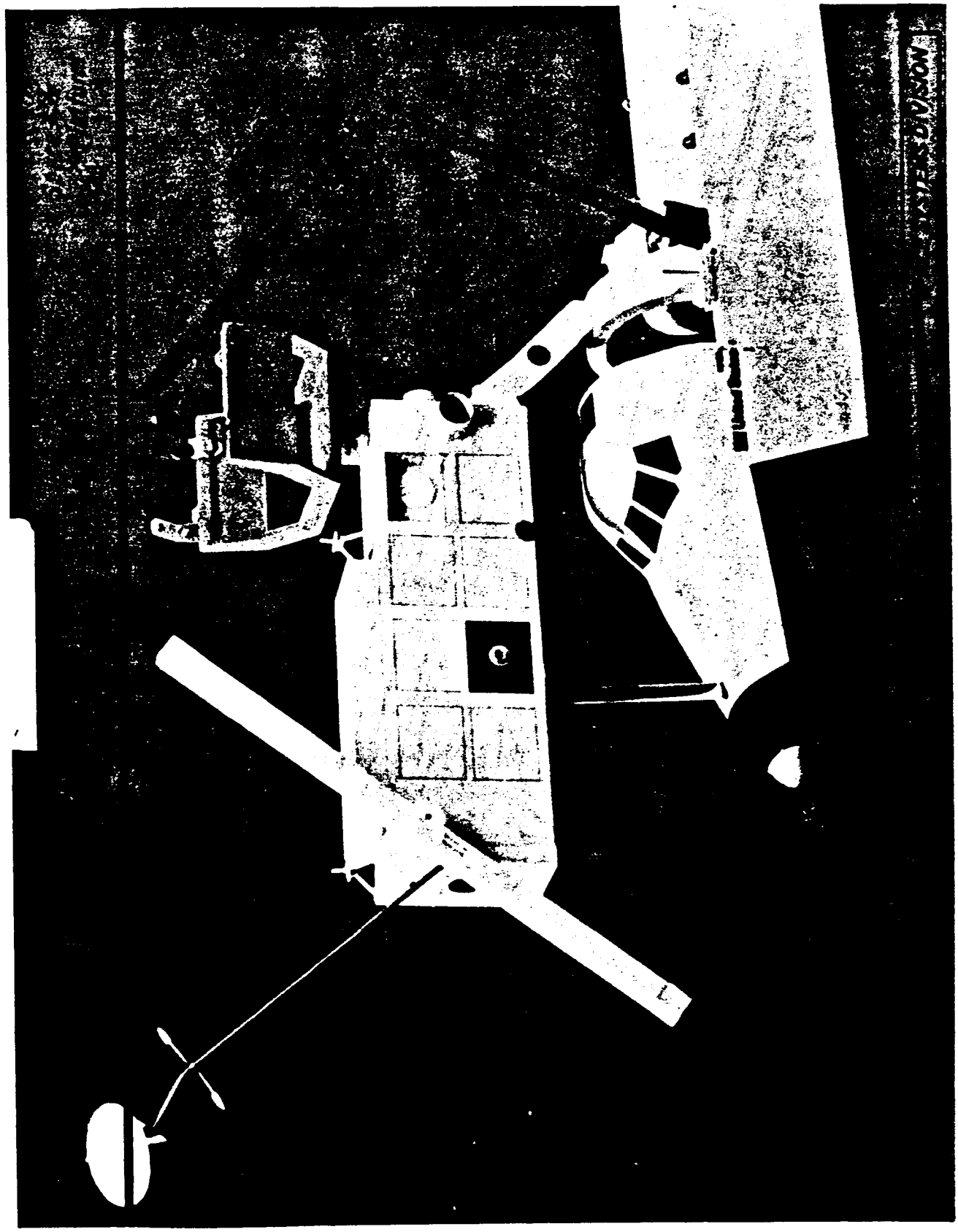
SPACE PLATFORM

ON-ORBIT SERVICING AND MAINTENANCE

- AN ORBITAL REPLACEABLE UNIT (ORU) IS THE HARDWARE TO BE REPLACED AS A UNIT DURING ON-ORBIT MAINTENANCE

- FOR ON-ORBIT SERVICING AND MAINTENANCE THE SPACE PLATFORM MUST:

  - MEET THE STS/ORBITER RETRIEVAL REQUIREMENTS (NHB 1700.,7A)
  - BE COMPATIBLE WITH THE RMS FOR CAPTURE, BERTHING AND MAINTENANCE OPERATIONS
  - BE IN A BERTHED MODE FOR CREW MAINTENANCE OPERATIONS



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SPACE PLATFORM

ON-ORBIT MAINTENANCE

SYSTEMS REQUIREMENTS

- DESIGN ALL ACTIVE SYSTEMS FOR ON-ORBIT MAINTENANCE
- ON-ORBIT MAINTENANCE SHALL NOT COMPROMISE THE INTEGRITY OF THE FLIGHT SYSTEM
- THE DESIGN FOR MAINTENANCE SHALL BE VERIFIED
- ORU'S SHALL BE EASILY ACCESSIBLE TO THE EVA CREWMEN IN THE BERTHED MODE WITHOUT REMOVAL OF OTHER ORU'S

SPACE PLATFORM
ON-ORBIT MAINTENANCE

DESIGN REQUIREMENTS

- SYSTEM DESIGNED FOR EVA ACCESS
  - HAND RAILS - TRANSLATION AIDS
  - HAND HOLDS - FOOT RESTRAINTS
  - TEATHER ATTACHMENTS - CREW AND EQUIPMENT
  - CREW/SUIT SAFETY
    - SHARP EDGES
    - ELECRIC SHOCK
    - FLUIDS/GAS EXPOSURE

- ORU'S DESIGNED FOR EVA REPLACEMENT
  - CREW/SUIT SAFETY
  - CREW HANDLING AIDS
  - EVA SUIT/GLOVE COMPATIBILITY - ACCESS AND TASK
  - ALIGNMENT GUIDES
  - QUICK DISCONNECTS
  - COMPATIBLE WITH STANDARD EVA TOOL KIT
  - MEET MAN/SYSTEMS REQUIREMENTS - MSFC - STD - 512A AND JSC 10615

- SYSTEM DESIGNED FOR ON-ORBIT MAINTENANCE OPERATIONS
  - FAULT DETECTION TO THE ORU LEVEL WITH FLIGHT AND GROUND SYSTEMS
  - SYSTEM CONFIGURATION/STATUS TO A SAFE AND OPERATIONAL CONDITION
    - SYSTEM SAFE FOR REMOVAL/REPLACEMENT
    - MAINTAIN REQUIRED OPERATIONAL LEVEL

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SPACE PLATFORM

ON-ORBIT MAINTENANCE

CONSIDERATIONS FOR SELECTION OF ORU LEVEL

- ORU'S MAY BE AT VARIOUS LEVELS FOR A SINGLE SPACECRAFT
  - COMPONENT
  - EQUIPMENT GROUP
  - ASSEMBLY OR FUNCTIONAL GROUP

- SYSTEM DESIGN IMPACT
  - FAULT DETECTION LEVEL REQUIRED
  - SYSTEM CONTROL TO PROVIDE MAINTENANCE STATUS

- DESIGN COMPLEXITY AND COST TO MEET ORU CAPABILITY

- THE REQUIREMENTS FOR AND COST OF LOGISTICS SUPPORT AND SPARES

SPACE PLATFORM

ON-ORBIT MAINTENANCE

OBSERVATIONS FOR NEW PROJECTS

- ON-ORBIT MAINTENANCE MUST BE PROJECT LEVEL REQUIREMENT
  - PROJECT REQUIREMENT
  - CONTRACT REQUIREMENT
  - PROJECT CONTROLED

- ON-ORBIT MAINTENANCE MUST BE IMPLEMENTED EARLY
  - CONCEPT DEFINITION MUST IMPLEMENT
  - BY ALL DESIGN ORGANIZATIONS STARTING WITH PRELIMINARY DESIGN

- MUST BE A SYSTEMS APPROACH
  - ACCESS
  - FAULT DETECTION
  - SYSTEM CONFIGURATION FOR REPLACEMENT
  - LOGISTICS