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SIR-C/X-SAR FREE FLYER CONCEPT

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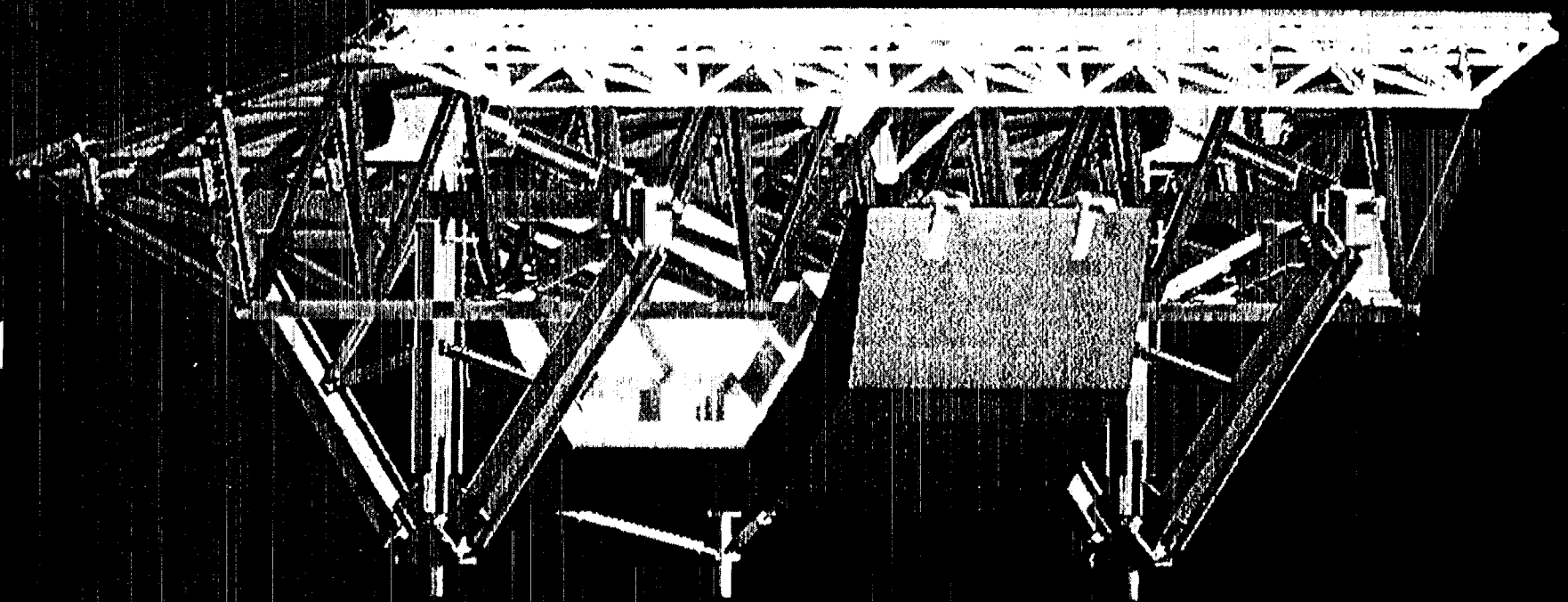
SPACEBORNE IMAGING RADAR - C



- X-SAR PANELS
- L-BAND PANELS
- C-BAND PANELS
- PALLET
- ANTENNA CORE STRUCTURE (ACS)
- ANTENNA TRUNNION STRUCTURE (ATS)
- X-SAR SUPPORT STRUCTURE (XSS) & TRI-DRIVE

SIR-C/X-SAR FREE FLYER CONCEPT - OVERVIEW

- WHAT IS IT?
  - THE ADDITION OF SPACECRAFT SUBSYSTEMS TO EXISTING SIR-C/X-SAR SUBSYSTEMS TO PRODUCE A FREE FLYING, NEAR-TERM MULTIPARAMETER SPACEBORNE SAR
  - INTERIM CAPABILITY LEADING TO EOS SAR/MULTISAR ERA
- WHY?
  - PROVIDES OPPORTUNITY FOR A ONE (PLUS) YEAR DATA SET AT A MODEST COST
  - PROVIDES A SCIENCE DATA SET NOT POSSIBLE WITH AN ATTACHED PAYLOAD
  - PROVIDES SCIENCE COMMUNITY WITH LONGER TERM MULTIPARAMETER SAR DATA SOON.
  - PROVIDES OPPORTUNITY TO DEMONSTRATE A RAPID TURNAROUND ENGINEERING PROJECT IN ADDITION TO PLACING A VERY HIGH PERFORMANCE SET OF INSTRUMENTS IN ORBIT
- WHEN?
  - WHEN SCIENCE RESULTS DEMONSTRATE NEED FOR MULTIPARAMETER SAR

SCIENCE OBJECTIVES

1. EXTEND SIR-C/X-SAR MULTIFREQUENCY, MULTIPOLARIMETRIC, MULTIINCIDENCE ANGLE OBSERVATIONS TO PRODUCE DATA SETS OVER MULTIPLE SEASONS AND OVER MORE SITES

2. EXTEND SIR-C/X-SAR ALGORITHM VALIDATION OVER A MULTISEASONAL PERIOD

3. COLLECT A GLOBAL* MULTIPARAMETER SAR DATA SET AS AN EOS SAR PRECURSOR

4. BEGIN THE GLOBAL SCALE GEOPHYSICAL PRODUCT SET CONSISTENT WITH THOSE PLANNED FOR EOS SAR/MULTISAR
   - CALIBRATED
   - VALIDATED AGAINST GROUND TRUTH

*TO 57° LATITUDE

SCIENCE RATIONALE

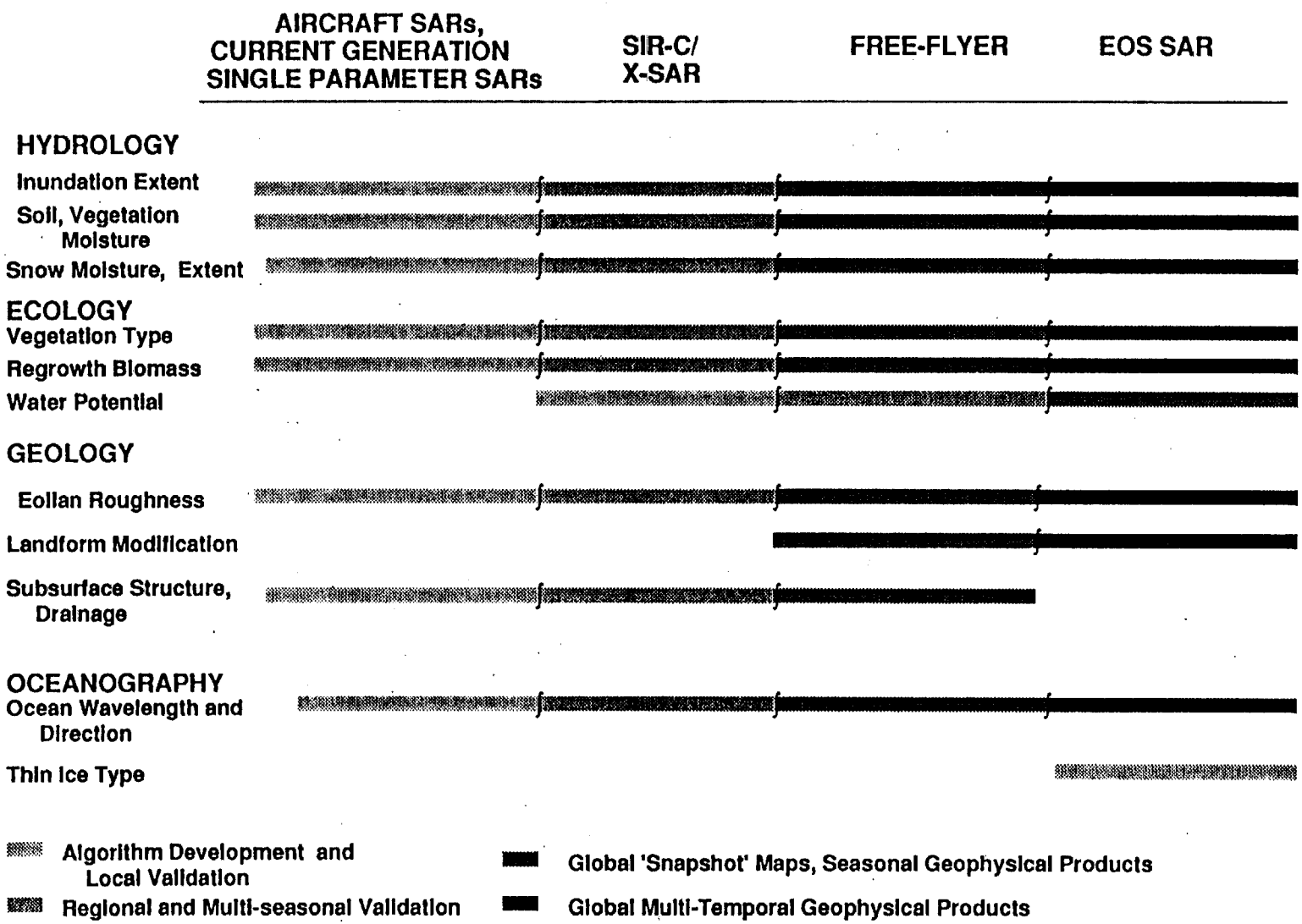
GLOBAL GEOPHYSICAL PRODUCTS:

- ALGORITHMS VALIDATED LOCALLY WITH AIRCRAFT SARs, ERS-1, JERS-1, RADARSAT, AND SHUTTLE-BASED SIR-C/X-SAR
- GLOBAL PRODUCTS ARE HIGH PRIORITY FOR CLIMATE MODELS (E.G., VEGETATION TYPE, AERODYNAMIC SURFACE ROUGHNESS)

REGIONAL ALGORITHM VALIDATION:

- IMPORTANCE OF MULTITEMPORAL OBSERVATIONS SHOWN BY AIRCRAFT SARs AND ERS-1
- SIR-C/X-SAR SHUTTLE MISSIONS PROVIDE MAXIMUM OF THREE SHORT PERIODS IN TIME
- EXTENDED MULTITEMPORAL DATA WILL ALLOW:
  - MONITORING
  - PROVIDE ADDITIONAL DIMENSION TO ENHANCE CLASSIFICATION
  - MUST BE UNDERSTOOD AS IT AFFECTS ANY OPERATIONAL ALGORITHM
- MEANS OF ASSESSING TRADEOFFS BETWEEN SEASONAL MULTITEMPORAL OBSERVATIONS AND FREQUENCY/POLARIZATION DIVERSITY

GEOPHYSICAL PARAMETERS FROM SAR



PROGRAMMATIC GOALS

- PROVIDE A NEAR-TERM, INTERIM, HIGH-PERFORMANCE MULTIPARAMETER FREE FLYER SAR
- DEMONSTRATE LONG-TERM STABILITY OF NEW TECHNOLOGY SARs
- PROVIDE A HIGH-CAPABILITY SYSTEM AT MODEST COST
- MAXIMIZE SCIENCE RETURN FOR INVESTMENT TO DATE
- EARLY START FOR EOS SAR DATA SET INCLUDING PROCESSING DISTRIBUTION AND ARCHIVING
- DEMONSTRATE A FAST TRACK IMPLEMENTATION

CONCEPT DESCRIPTION

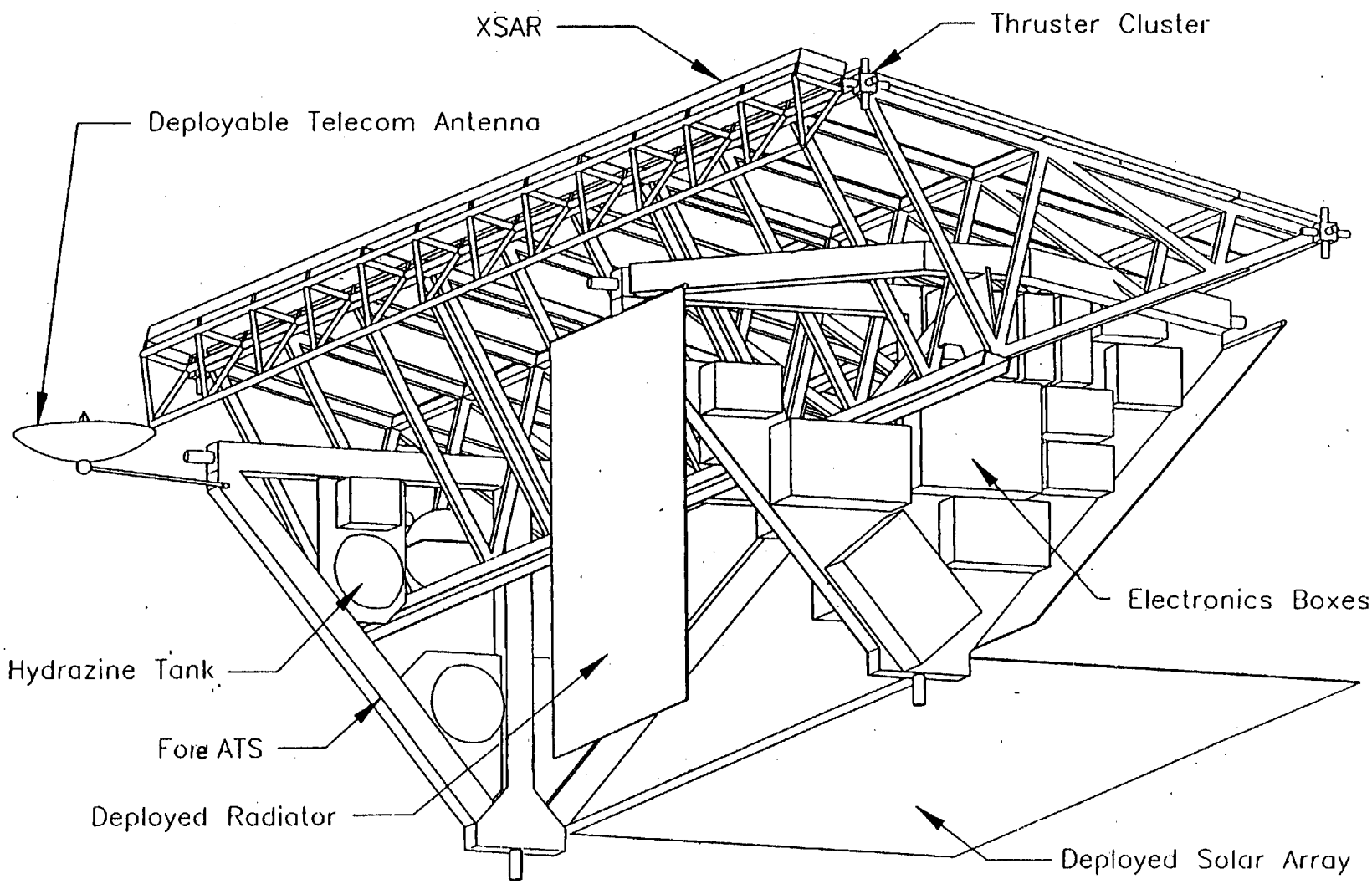
- COMPLETE SIR-C/X-SAR SHUTTLE MISSIONS
- UTILIZE A SHUTTLE FLIGHT OPPORTUNITY TO PLACE AN AUGMENTED SIR-C/X-SAR SYSTEM IN ORBIT
- AUGMENTATION CONSISTS OF ADDING SPACECRAFT SUBSYSTEMS TO EXISTING STRUCTURE
- SUBSYSTEMS ARE LARGELY EXISTING DESIGNS TO PROVIDE ELEMENTS NOW SUPPLIED BY STS
  - POWER
  - THERMAL CONTROL
  - DATA STORAGE/COMMUNICATIONS
  - COMMAND AND CONTROL
  - ATTITUDE CONTROL
  - PROPULSION

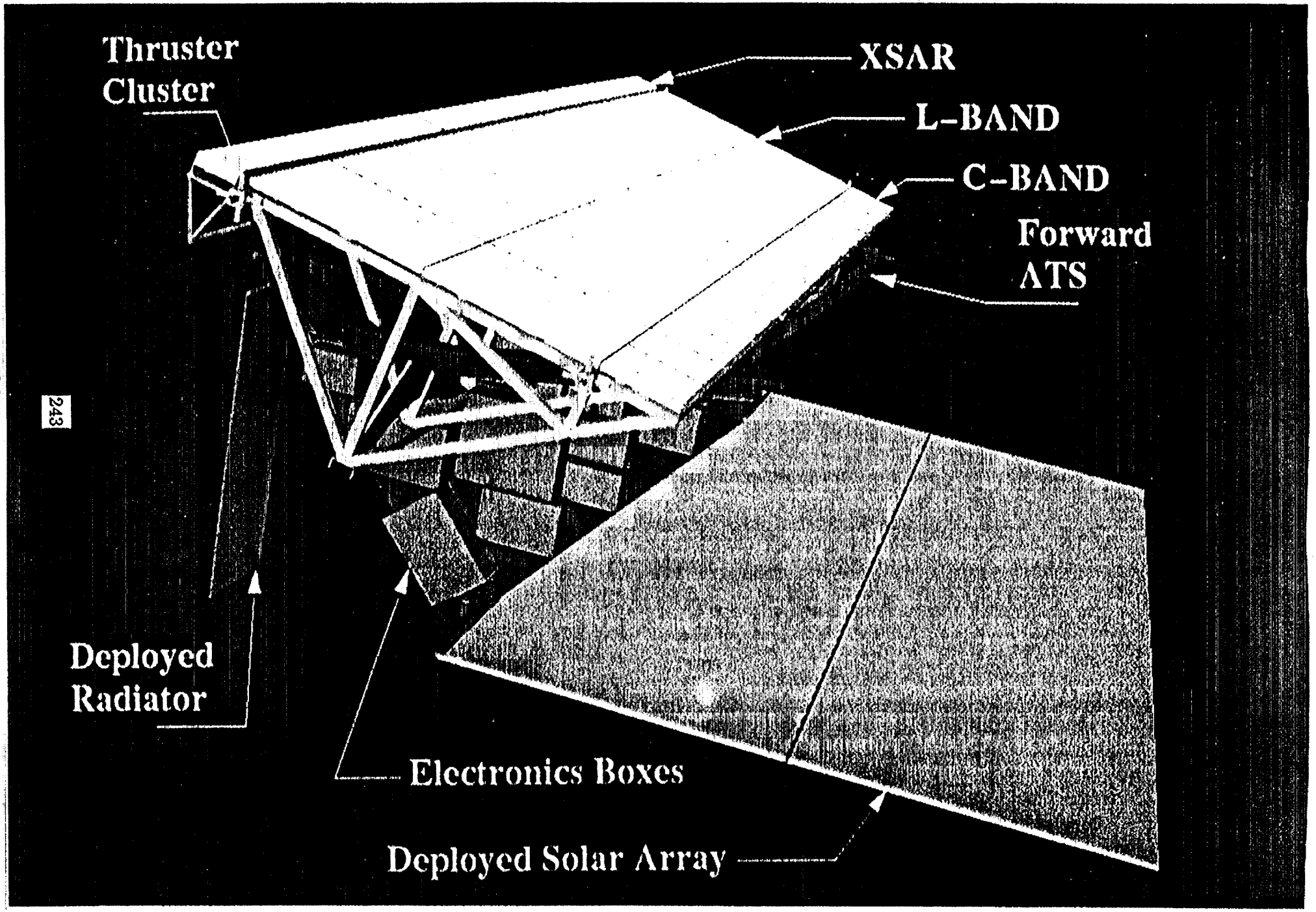
} POSSIBLE USE OF MARS OBSERVER SPARES

SIR-C/X-SAR FREE FLYER CONSTRAINTS AND ASSUMPTIONS

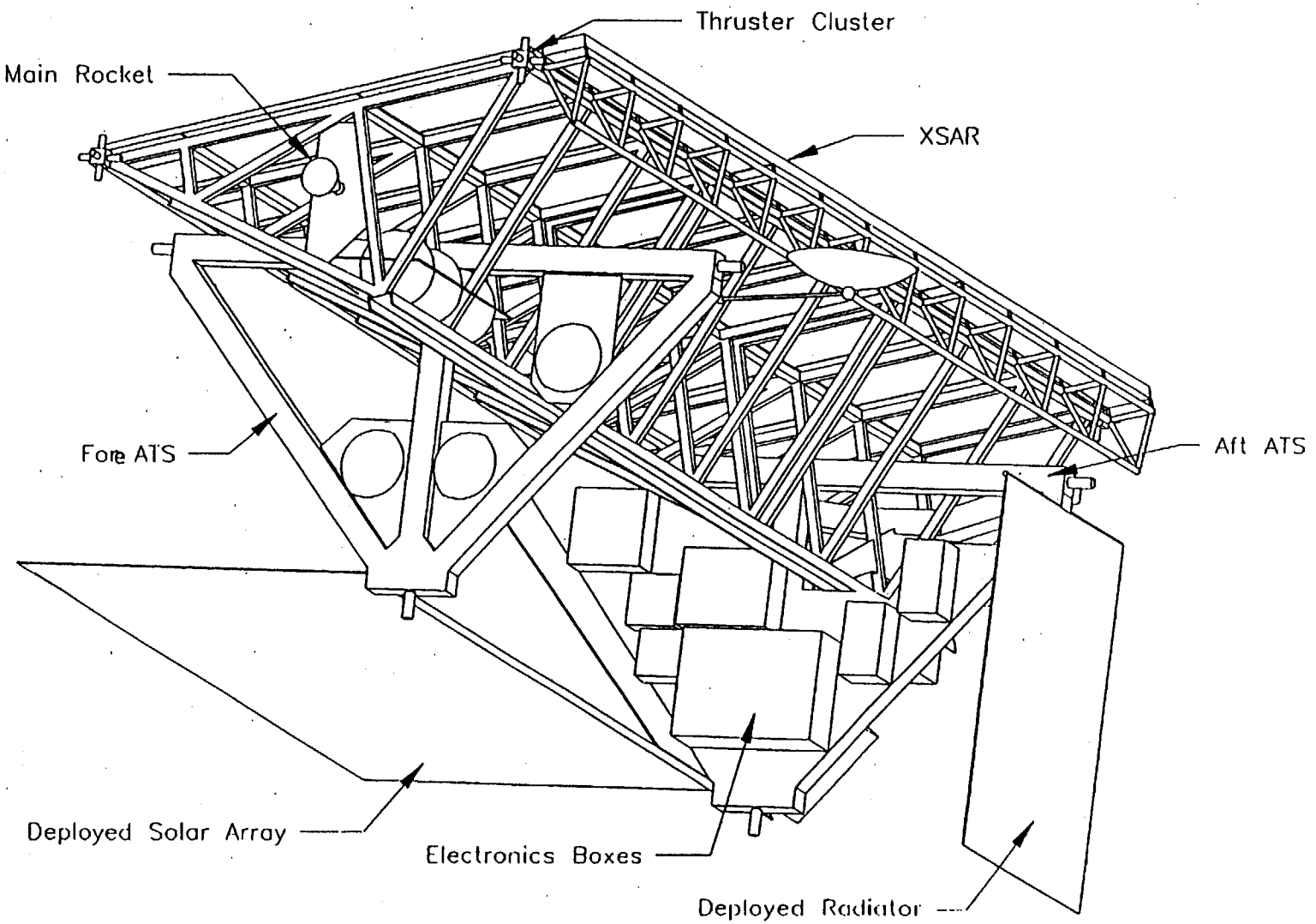
- COOPERATIVE PROGRAM WITH GERMANY AND ITALY (X-SAR)
- NO CHANGES (OTHER THAN REPAIR, IF NEEDED) TO EXPERIMENT HARDWARE
  - SAME BOXES, INTERFACES
- AUGMENT EXISTING STRUCTURE TO PROVIDE STRUCTURAL FUNCTIONS OF SPACELAB PALLET
- LAUNCH FROM STS. USE SPACECRAFT PROPULSION TO RAISE ORBIT
- WILL REQUIRE A CONTROLLED REENTRY
- INITIALLY PROCESS DATA THROUGH SYSTEMS BASED ON EXISTING SIR-C AND X-SAR DATA SYSTEMS AUGMENTED BY ALASKA SAR FACILITY
- EVENTUALLY UTILIZE EOS DIS FOR DATA STORAGE / CATALOGING / DISTRIBUTION
- LAUNCH DATE DRIVEN BY IMPLEMENTATION LEAD TIME, SIR-C/X-SAR RESULTS, AND SPACE STATION UTILIZATION OF STS
- COST IS THE PRINCIPAL DETERMINANT OF FEASIBILITY

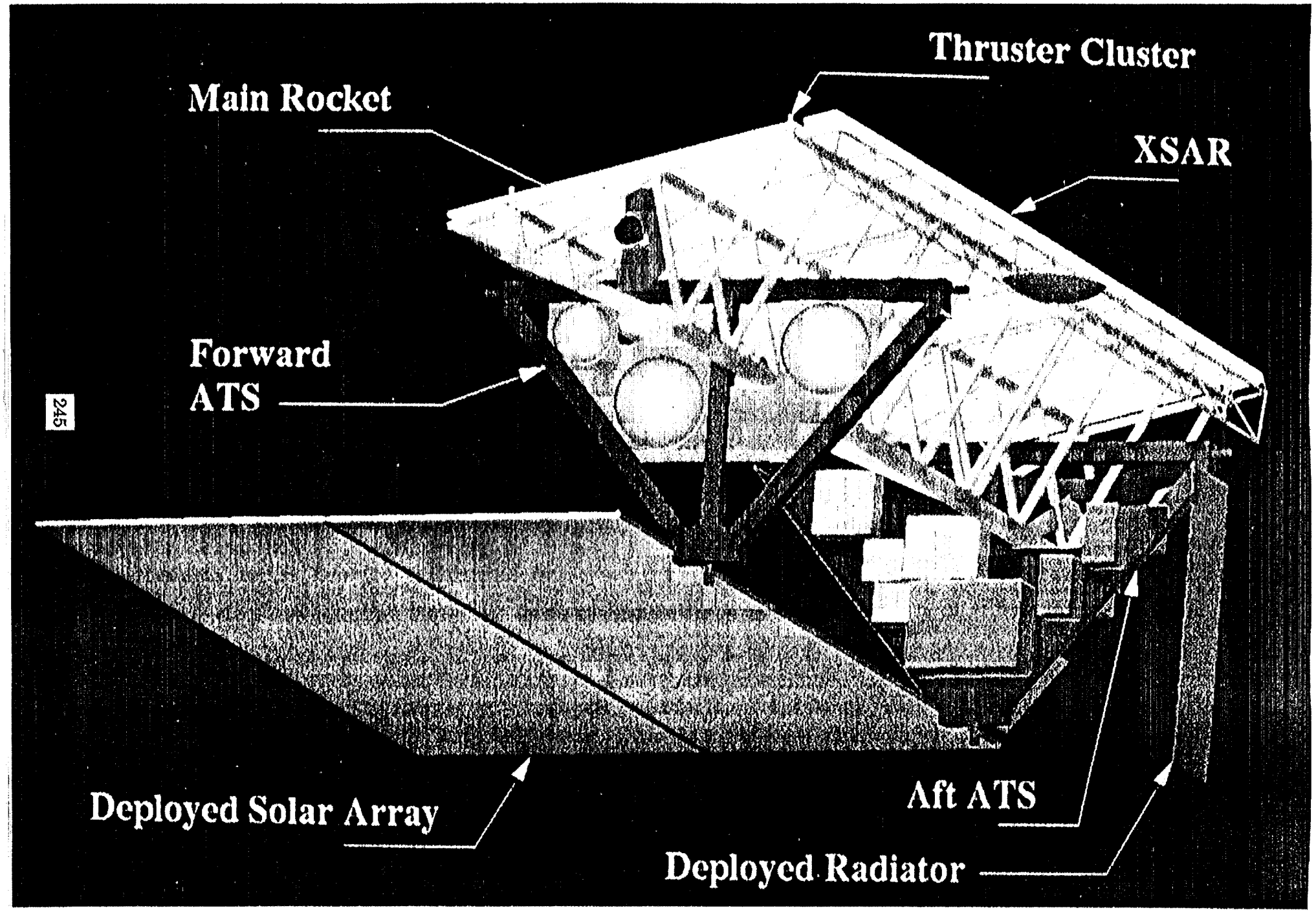
A CONFIGURATION CONCEPT




Thruster Cluster
XSAR
L-BAND
C-BAND
Forward ATS
Deployed Radiator
Electronics Boxes
Deployed Solar Array

A CONFIGURATION CONCEPT



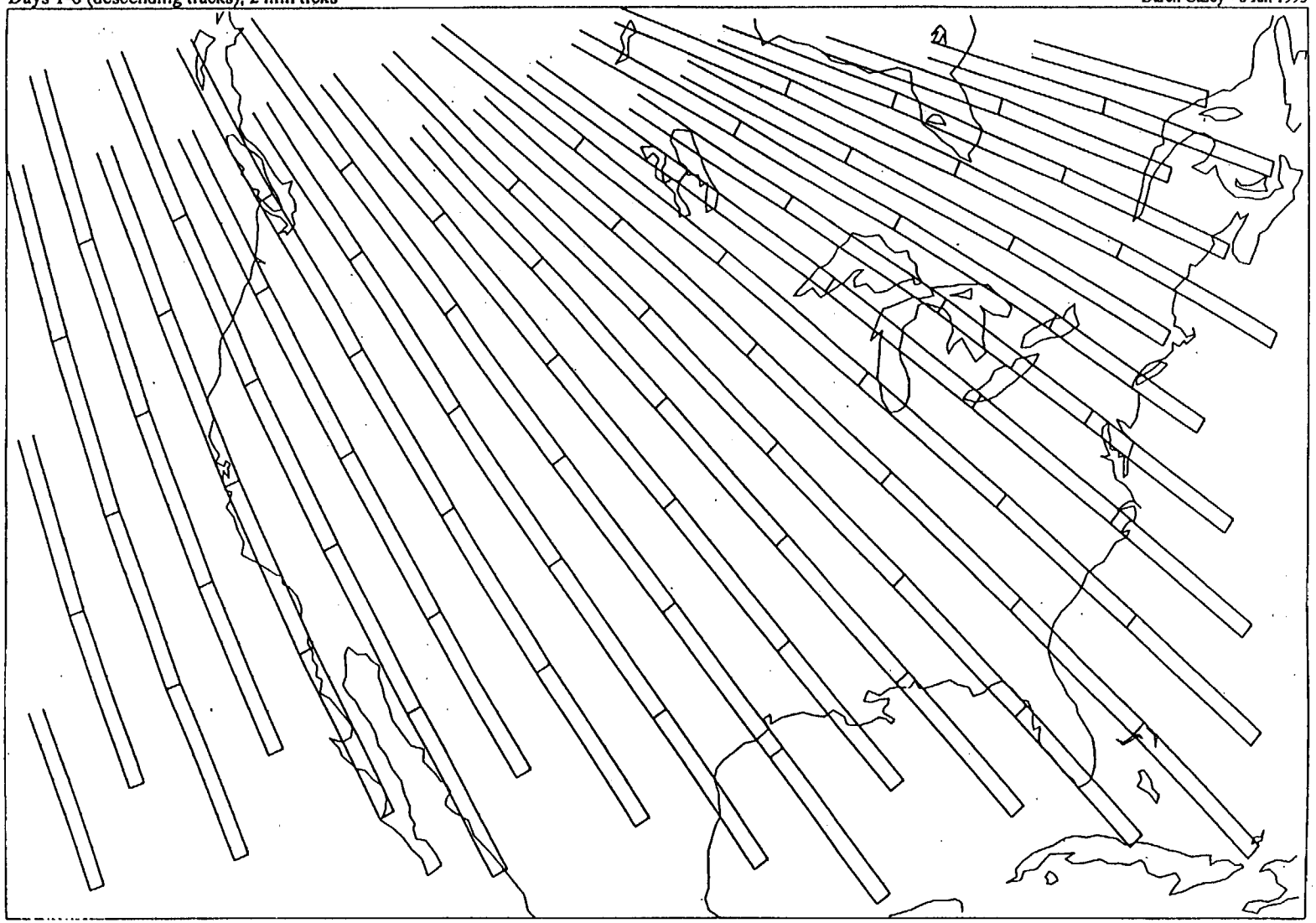

Thruster Cluster
Main Rocket
XSAR
Forward
ATS
Deployed Solar Array
Aft ATS
Deployed Radiator

A CANDIDATE MISSION DESCRIPTION

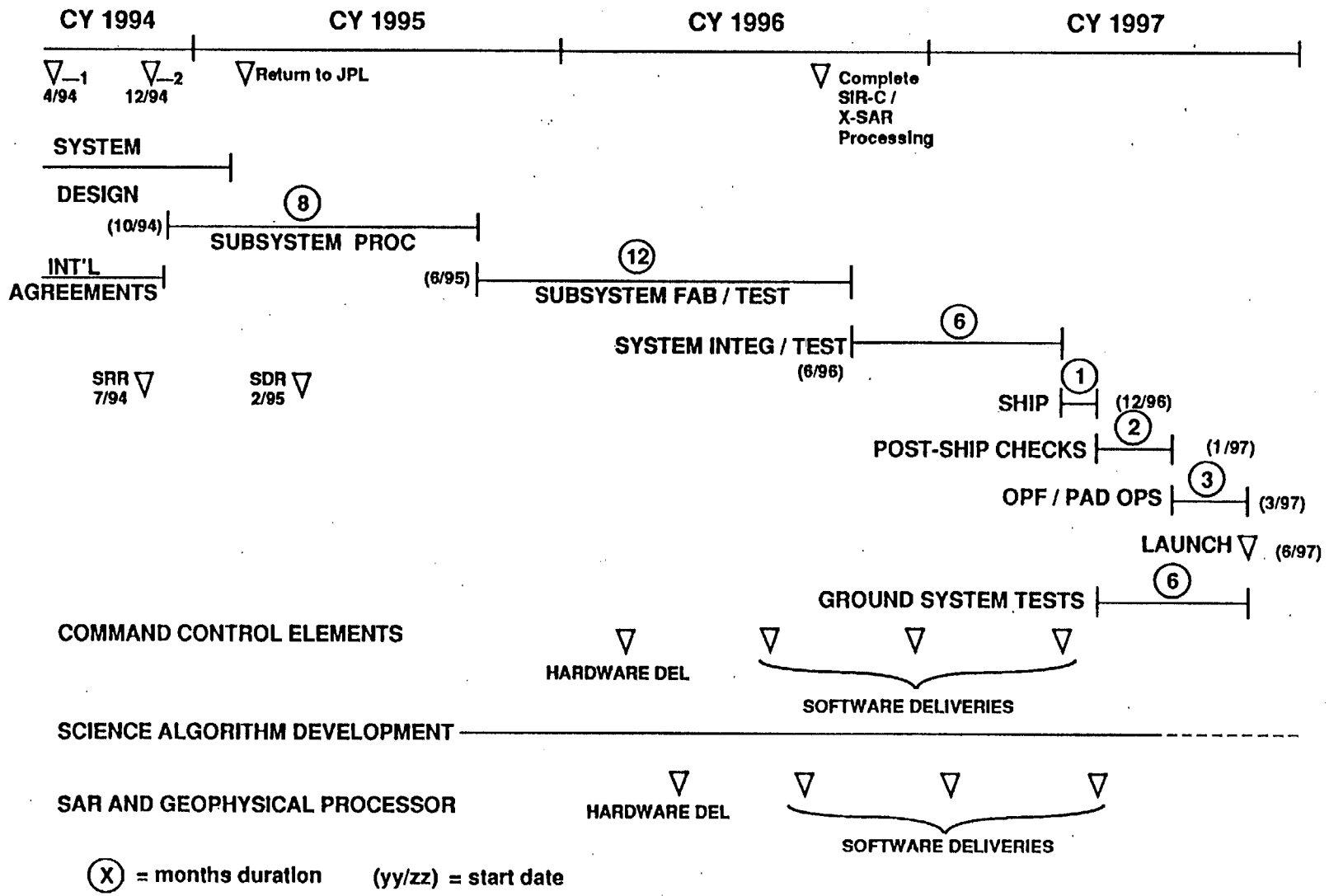
- LAUNCH ON STS AT 57° INCLINATION TO MAXIMUM ATTAINABLE ALTITUDE
- RAISE ORBIT WITH ON-BOARD PROPULSION UP TO HIGHER ALTITUDE
  - GREATER THAN OR EQUAL TO 50 KM WIDE SWATH
  - ALLOWS GLOBAL COVERAGE (±57° LATITUDE)
- ORBIT MANEUVERS ON 7-DAY INTERVALS ALLOWS GROUND TRACK CONTROL ±1 KM
- MISSION LIFE OF ONE YEAR REQUIREMENT, EXTENDED PAST THAT AS A GOAL
- DATA ACQUISITION - 200 MBPS FOR APPROXIMATELY 10 PERCENT DUTY CYCLE
- TARGETED REENTRY WILL BE REQUIRED (APPROXIMATELY 100 M/SEC DELTA V)

SIR-C Freeflyer - 450 km altitude
40° incidence angle, left-looking, 70 km swath
Days 1-6 (descending tracks), 2 min ticks

Orbit: J2
Map: Ortho (40N,100W - 3.5 Zoom)
Daren Casey - 8 Jan 1993



AN IMPLEMENTATION SCENARIO



SUMMARY

- RECENT LOOK AT PLACING THE EXISTING SIR-C/X-SAR INSTRUMENTS IN LOW EARTH ORBIT SUGGESTS NO MAJOR TECHNICAL OBSTACLES EXIST
- CONTINUING INTERNATIONAL COOPERATION
- COST APPEARS TO BE MODEST AND AMOUNT WILL BE CRITICAL TO PROGRAM INITIATION
- SHUTTLE LAUNCH MANIFEST IS A SCHEDULE DRIVER
- MISSION COULD BE LOW COST IF EXECUTED QUICKLY USING EXISTING SUBSYSTEM DESIGNS
- SIGNIFICANT SCIENCE VALUE. BEGINS EOS SAR GLOBAL DATA SET EARLY