Capt Juan Vasquez

DMSP BLOCK SIX RISK REDUCTION

PRIME CONTRACTOR SUPPORT BRIEFING TO NPOESS INTEGRATED PROGRAM OFFICE

Prepared for:

NPOESS
INTEGRATED PROGRAM OFFICE

SILVER SPRING , MARYLAND

November 30, 1994

CONTRACT F04701-91-C-0068

Prepared by:

Lockheed
Missiles & Space Company, Inc.
SUNNYVALE, CALIFORNIA
94088-3504

I.11

AGENDA

- OVERVIEW AND LOCKHEED TEAM INTRODUCTION
- LOCKHEED TEAM PHASE 0 PLANS
- TOP-LEVEL NPOESS SYSTEM ARCHITECTURE
- PRELIMINARY RESULTS, ISSUES, AND CONCERNS
- DISCUSSION

NPOESS: DOD AND DOC CONVERGED WEATHER SATELLITE PROGRAM

NPOESS

MISSION

- ADVANCED ENVIRONMENTAL SYSTEM FOR GLOBAL DoD AND DoC MISSIONS
- C3 WITH CDA AND RTS

CONCEPT

- 3S/C CONSTELLATION WITH MULTI-SPECTRAL VISUAL, IR, MICROWAVE, AND SPACE ENVIRONMENT SENSORS
- WB DATA PROCESSED AND DISSEMINATED BY CENTRAL USERS
- NB DATA DIRECT TO TACTICAL TERMINALS

CUSTOMER

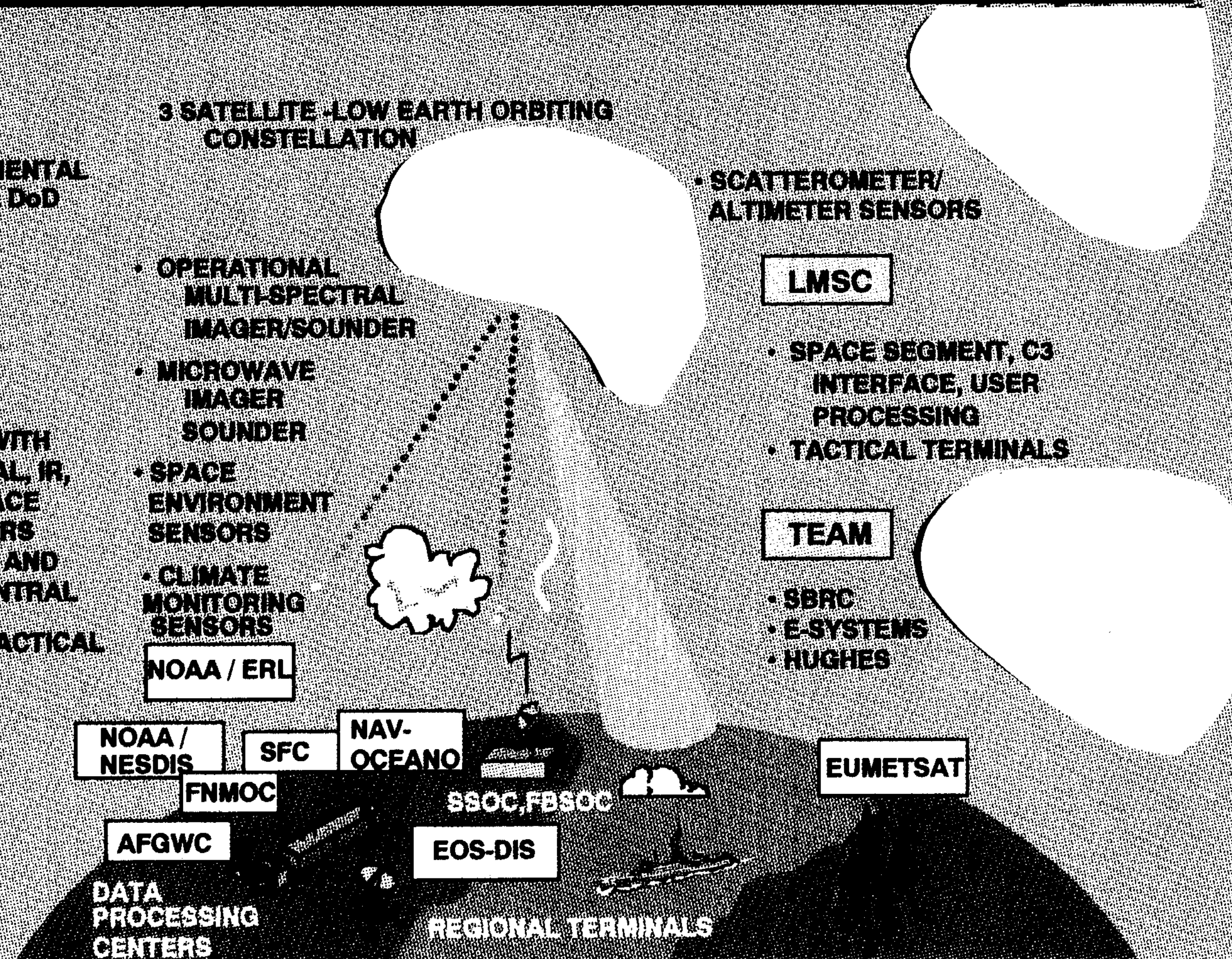
IPO

USERS

AWS
CNOC
NOAA

3 SATELLITE -LOW EARTH ORBITING CONSTELLATION

- OPERATIONAL MULTI-SPECTRAL IMAGER/SOUNDER
- MICROWAVE IMAGER SOUNDER
- SPACE ENVIRONMENT SENSORS
- CLIMATE MONITORING SENSORS
- SCATTEROMETER/ ALTIMETER SENSORS



LMSC

- SPACE SEGMENT, C3 INTERFACE, USER PROCESSING
- TACTICAL TERMINALS

TEAM

- SBRC
- E-SYSTEMS
- HUGHES

M0371K3019

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LMSC MANAGEMENT PHILOSPOPHY

- INVESTING WISELY
- NO OVERRUNS
- SUBMIT DELIVERABLES EARLY
- BE RESPONSIVE AND FLEXIBLE
- IDENTIFY REQUIREMENTS EARLY AND OFTEN
- CLOSE ACTIONS THOROUGHLY
- NO SURPRISES

LOCKHEED TEAM INTRODUCTION

LMSC ORGANIZATION CHART

▪ ***NPOESS***

LOCKHEED MISSILES AND SPACE COMPANY, INC
VANCE COFFMAN
SAM ARAKI
DICK SCANLAN
EXECUTIVE V.P.S

- MISSILE SYSTEMS DIVISION
  L.D. MONTAGUE
  PRESIDENT
  GM
- RESEARCH AND DEVELOPMENT
  J.B. REAGAN
  V.P., GM
- SPACE SYSTEMS DIVISON
  D.F. TANG,
  PRESIDENT
  GM
  - **NASA AND FEDERAL SYSTEMS**
    A. GUASTAFERRO, V.P.
    - **ADV. ENVIR. PGMS**
      M.G. WHITTEN
- LOCKHEED TECHNICAL OPERATIONS CO.
  R.W. DESSLING
  PRESIDENT, GM

11/15/94

PROGRAM ORGANIZATION

NPOESS

DMSP BLOCK 6/NOAA CONVERGENCE NPOESS
M. G. WHITTEN

Bus Mgr
M. Durham

SCIENCE TEAM
Dr. K. Hardy
Dr. K. Hutchison
Dr. Y. Chiu
Dr. T. Wilheit
Dr. P. Rosenkranz
S. Westerman

- EDR ANALYSIS
- PHENOMENOLOGY
- ENVIRONMENTAL MODEL AND RQTS DEFINITION
- COMMUNITY I/F

SYSTEMS ENGINEERING
D.J. Paul

- SYSTEMS ENGR
- C3 INTEGRATION
- RISK ANALYSIS
- OPS CONCEPT
- MISSION ANALYSIS
- REQMTS ANALYSIS/ SPECIFICATION
- TECHNOLOGY DVLPMT
- SPECIALTY ENG'R
- LOGISITICS

SENSOR SYSTEMS
P. Callary

- OASIS DEVELOPMENT
- EDU DEVELOPMENT
- PAYLOAD TRADES
- SENSOR DESIGN
- R&DD SUPPORT
- MISS DEVELOPMENT
- SESS DEVELOPMENT
- SENSOR S/C I/F

SPACECRAFT ENGINEERING
J. Clapp

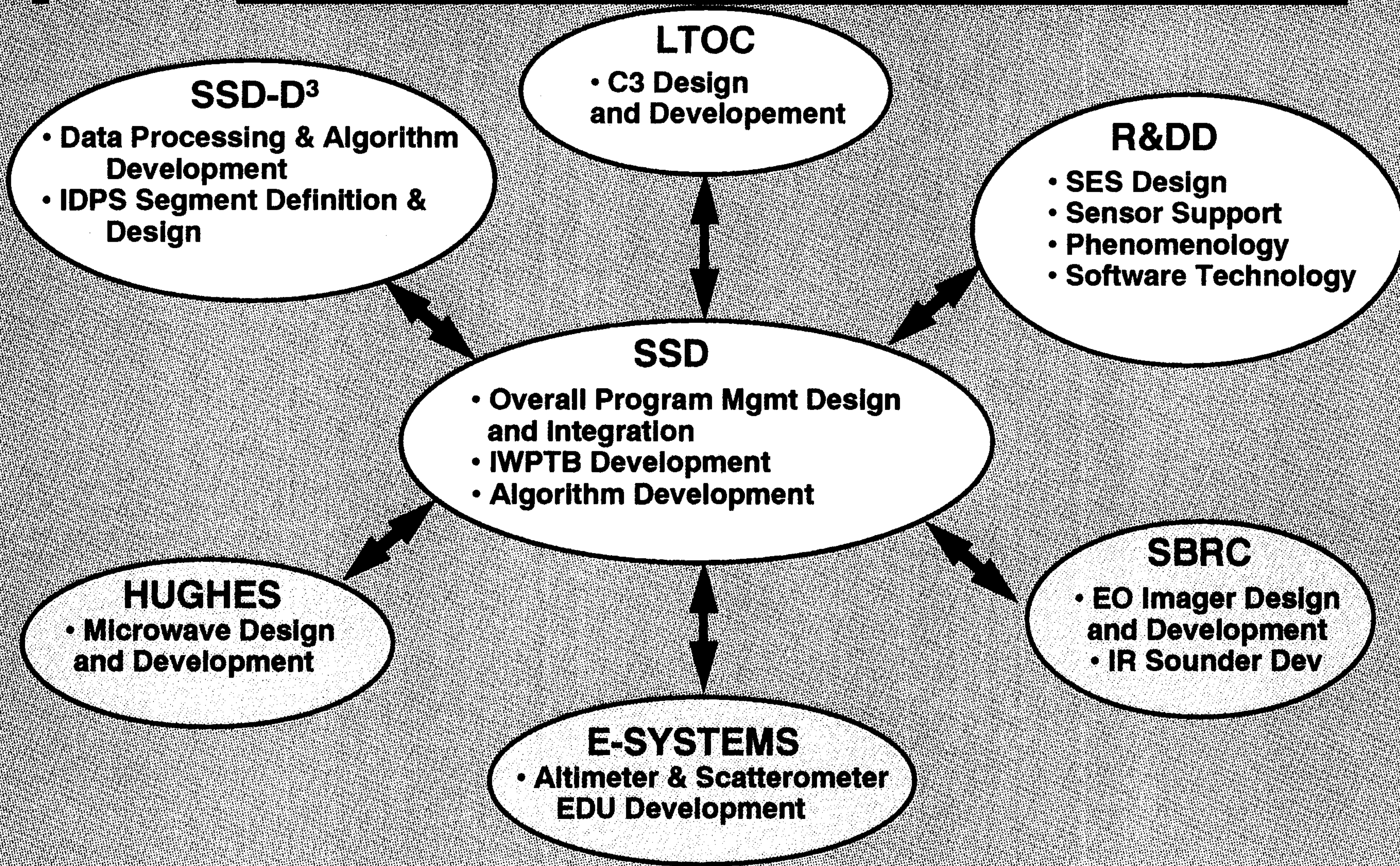
- SPACECRAFT ENGR
- BUS INTEGRATION
- SENSOR INTEGRN
- F-SAT ADAPTATION

DATA AND USER SYSTEMS
P. Topping

- IDPS SEGMENT
- IWPTB DEVELOPMENT
- SSD-D3 SUPPORT
- OBP DEVELOPMENT
- ALGORITHM DEVELOPMENT
- CREST

TEAM RESPONSIBILITIES

■ *NPOESS*



SPACE SYSTEMS DIVISION - D3
- IDPS SYSTEM DEVELOPMENT -

SSD - DATA DEVELOPMENT AND DISSEMINATION (D3) LINE OF BUISNESS OFFERS PROVEN WEATHER AND OCEANOGRAPHIC SYSTEMS DEVELOPMENT

- **DEVELOPED AND DEPLOYED:**
  - **US AIR FORCE MARK IVB TACTICAL WEATHER SATELLITE TERMINAL**
    - » **INGESTS POLAR AND GEOSTATIONARY WEATHER SATELLITE DATA**
  - **US NAVY TACTICAL ENVIRONMENTAL SUPPORT SYSTEM (TESS (3))**
    - » **INGESTS CONVENTIONAL WEATHER AND SATELLITE DATA**

- **DEVELOPED COMMERCIAL WEATHER DATA PROCESSING SYSTEMS**
  - **LOCKHEED ENVIRONMENTAL ANALYSIS AND DISPLAY SYSTEM (LEADS)**
  - **LOCKHEED APT/WEFAX WEATHER SYSTEM (LAWS)**

- **PROVIDED TRADE STUDIES AND DESIGNS FOR PROCESSING DMSP BLOCK 6 DATA AT CENTRAL AND REGIONAL USER SITES**
- **DEVELOPED CLOUD IMAGERY AND AUTOMATED CLOUD DETECTION AND TYPING ALGORITHMS**
- **DEVELOPED TEAM OF WORLD CLASS EXPERTS FROM THE UNIV OF TEXAS, MIT, AND TEXAS A&M FOR THE DEVELOPMENT OF TEMPERATURE AND MOISTURE PROFILE ALGORITHMS**

LOCKHEED TECHNICAL OPERATIONS COMPANY

■ ***NPOESS***

ROLE:

- OPERATIONS CONCEPT
- GROUND SYSTEM DESIGN
- TRADE STUDIES

BACKGROUND:

- TECHNICAL SERVICES COMPANY (SERVICE COMPANY RATES)
- WHOLLY OWNED SUBSIDIARY OF LMSC
  - COLLOCATED FOR EASY ACCESS TO LMSC ENGINEERING STAFF
- OPERATIONS OF DMSP AND PRECURSOR SATELLITES SINCE EARLY 1960's
- PROVIDE LAUNCH & EARLY ORBIT SUPPORT FOR CURRENT DMSP & TIROS VEHICLES
- PARTICIPATED IN BLOCK 6 STUDIES SINCE 1990
- OPERATE HUBBLE SPACE TELESCOPE & "OTHER" LEO S/C
- OPERATE LAUNCH PROCESSING AT VANDENBERG AFB

R&DD EXPERIENCE

■ *NPOESS*

- A RESEARCH DIVISION OF MORE THAN 800 SCIENTISTS AND ENGINEERS

  - DESIGNS & BUILDS SPACE SENSORS
    - - CRYOGENIC LIMB ARRAY ETALON SPECTROMETER (CLAES)
    - - GRAVITY PROBE B
    - - MANY SPACE ENVIRONMENTAL SENSORS FOR NASA/NOAA

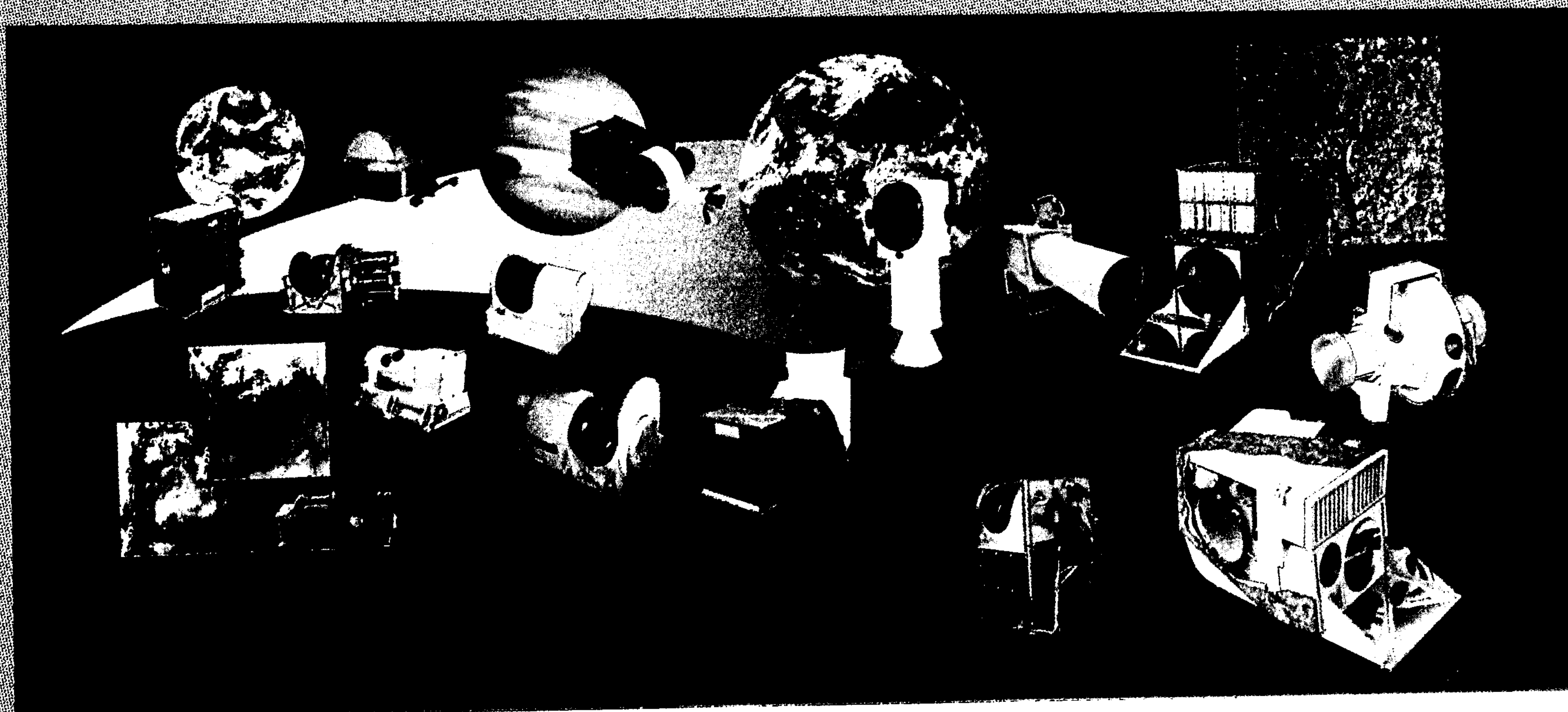
- CARRIES OUT ANALYSIS OF SPACE DATA

  - FOR DOD, NASA, AND NSF
  - PARTICIPATED IN THE FIX OF THE HUBBLE SPACE TELESCOPE

- PERFORMS ADVANCED SIMULATIONS TO RETRIEVE IONOSPHERIC AND ATMOSPHERIC PARAMETERS FROM SATELLITE DATA

  - ELECTRON DENSITY PROFILES
  - NEUTRAL ATMOSPHERIC DENSITY
  - TROPOSPHERIC TEMPERATURE AND MOISTURE PROFILES

THREE DECADES OF SBRC SPACE SENSORS



- 20 Unique Designs: 2.1 to 377 kg
- 67 SBRC Sensors Launched: 260 Instrument Years in Space

HUGHES SPACE & COMMUNICATIONS CO. EXPERIENCE

HSC OFFERS PROVEN MANAGEMENT AND TECHNOLOGY BASED ON:

1. **SUCCESSFUL, ON-ORBIT PROVEN SSM/I FOR DMSP PROGRAM**

   - 5 PRODUCTION SENSORS, 1 REFURBISHED PROTOTYPE
   - FIRST SSM/I LAUNCHED IN JUNE 1987, STILL FUNCTIONING

2. **IN-DEPTH STUDY OF EOS HIGH RESOLUTION MICROWAVE SPECTROMETER/SOUNDER (HIMMS)**

   - EVOLVED INTO EOS MIMR SENSOR BEING BUILT IN EUROPE

3. **TROPICAL RAINFALL MEASURING MISSION (TRMM) MICROWAVE IMAGER (TMI)**

   - SIMILAR TO SSM/I WITH ADDITIONAL 10.65 GHz FEEDHORN
   - ON-SCHEDULE FOR MID-1995 DELIVERY

E-SYSTEMS EXPERIENCE

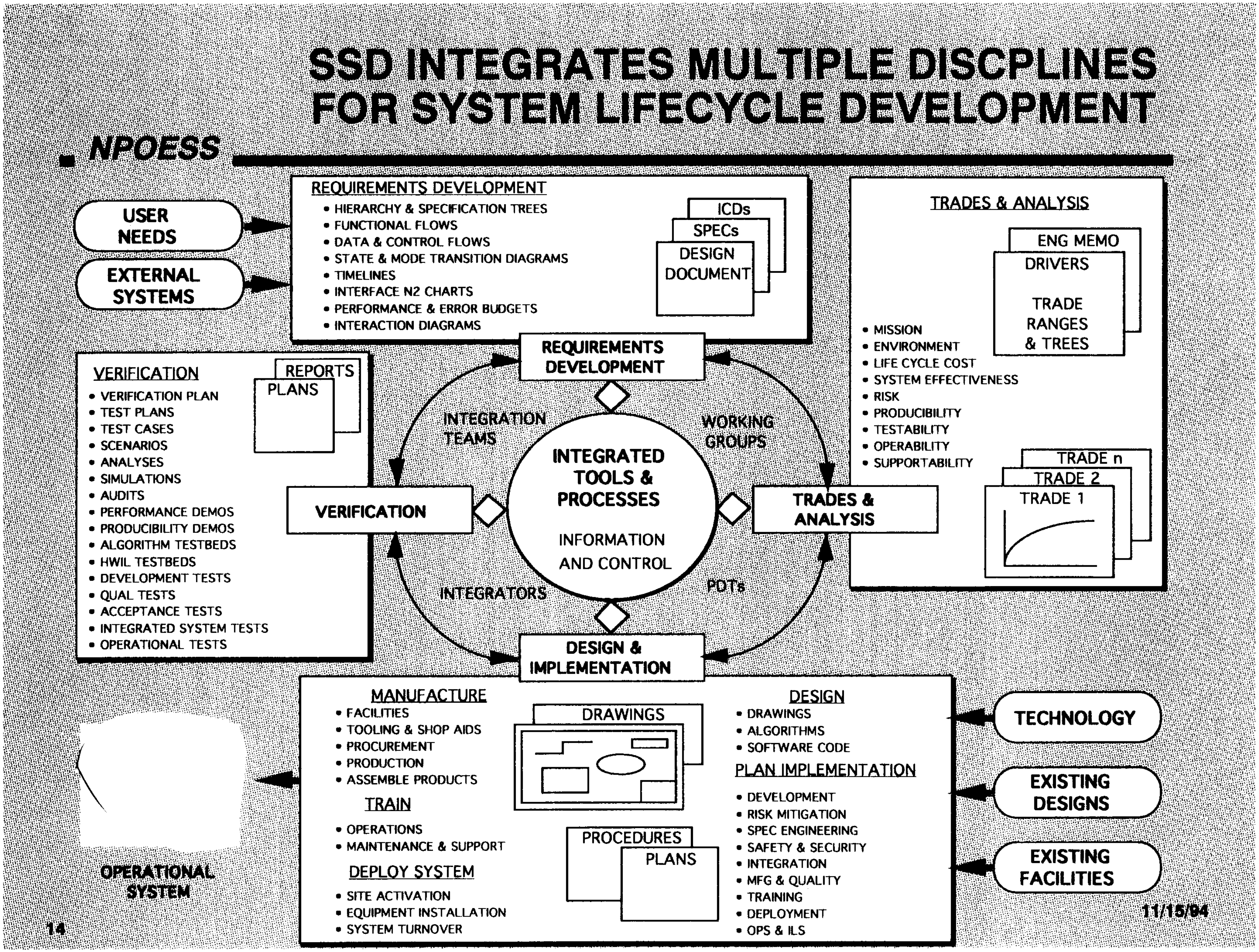
■ *NPOESS*

- EXPERIENCE IN DESIGNING AND BUILDING STATE-OF-THE-ART MILITARY SPACE PAYLOADS CAN BE APPLIED TO IMPLEMENTING NPOESS REQUIREMENTS .

  - DEVELOPMENT AND PRODUCTION OF RELIABLE SPACE PAYLOADS:
  - SUPPLIER OF GEOSAT FOLLOW-ON ALTIMETER
  - EHF / UHF SPACEBORNE PAYLOAD EXPERIENCE RELEVANT TO STORE AND FORWARD AND SURFACE DATA COLLECTION CAPABILITIES

- COORDINATION OF MULTI-SERVICE USER REQUIREMENTS ENHANCES UNDERSTANDING OF NPOESS MISSION PAYLOAD REQUIREMENTS .

  - ARCHITECTURE TRADES USED TO OPTIMIZE DESIGN
  - UTILIZATION OF COMMON HARDWARE FOR COST REDUCTION


SSD INTEGRATES MULTIPLE DISCPLINES
FOR SYSTEM LIFECYCLE DEVELOPMENT
NPOESS
USER NEEDS
EXTERNAL SYSTEMS
REQUIREMENTS DEVELOPMENT
• HIERARCHY & SPECIFICATION TREES
• FUNCTIONAL FLOWS
• DATA & CONTROL FLOWS
• STATE & MODE TRANSITION DIAGRAMS
• TIMELINES
• INTERFACE N2 CHARTS
• PERFORMANCE & ERROR BUDGETS
• INTERACTION DIAGRAMS
ICDs
SPECs
DESIGN DOCUMENT
TRADES & ANALYSIS
ENG MEMO
DRIVERS
TRADE RANGES & TREES
• MISSION
• ENVIRONMENT
• LIFE CYCLE COST
• SYSTEM EFFECTIVENESS
• RISK
• PRODUCIBILITY
• TESTABILITY
• OPERABILITY
• SUPPORTABILITY
TRADE n
TRADE 2
TRADE 1
VERIFICATION
• VERIFICATION PLAN
• TEST PLANS
• TEST CASES
• SCENARIOS
• ANALYSES
• SIMULATIONS
• AUDITS
• PERFORMANCE DEMOS
• PRODUCIBILITY DEMOS
• ALGORITHM TESTBEDS
• HWIL TESTBEDS
• DEVELOPMENT TESTS
• QUAL TESTS
• ACCEPTANCE TESTS
• INTEGRATED SYSTEM TESTS
• OPERATIONAL TESTS
REPORTS
PLANS
REQUIREMENTS DEVELOPMENT
INTEGRATION TEAMS
WORKING GROUPS
INTEGRATED TOOLS & PROCESSES
INFORMATION AND CONTROL
VERIFICATION
TRADES & ANALYSIS
INTEGRATORS
PDTs
DESIGN & IMPLEMENTATION
MANUFACTURE
• FACILITIES
• TOOLING & SHOP AIDS
• PROCUREMENT
• PRODUCTION
• ASSEMBLE PRODUCTS
TRAIN
• OPERATIONS
• MAINTENANCE & SUPPORT
DEPLOY SYSTEM
• SITE ACTIVATION
• EQUIPMENT INSTALLATION
• SYSTEM TURNOVER
DRAWINGS
PROCEDURES
PLANS
DESIGN
• DRAWINGS
• ALGORITHMS
• SOFTWARE CODE
PLAN IMPLEMENTATION
• DEVELOPMENT
• RISK MITIGATION
• SPEC ENGINEERING
• SAFETY & SECURITY
• INTEGRATION
• MFG & QUALITY
• TRAINING
• DEPLOYMENT
• OPS & ILS
TECHNOLOGY
EXISTING DESIGNS
EXISTING FACILITIES
OPERATIONAL SYSTEM
14
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LOCKHEED TEAM PHASE 0 PLANS

OBJECTIVE AND GUIDELINES

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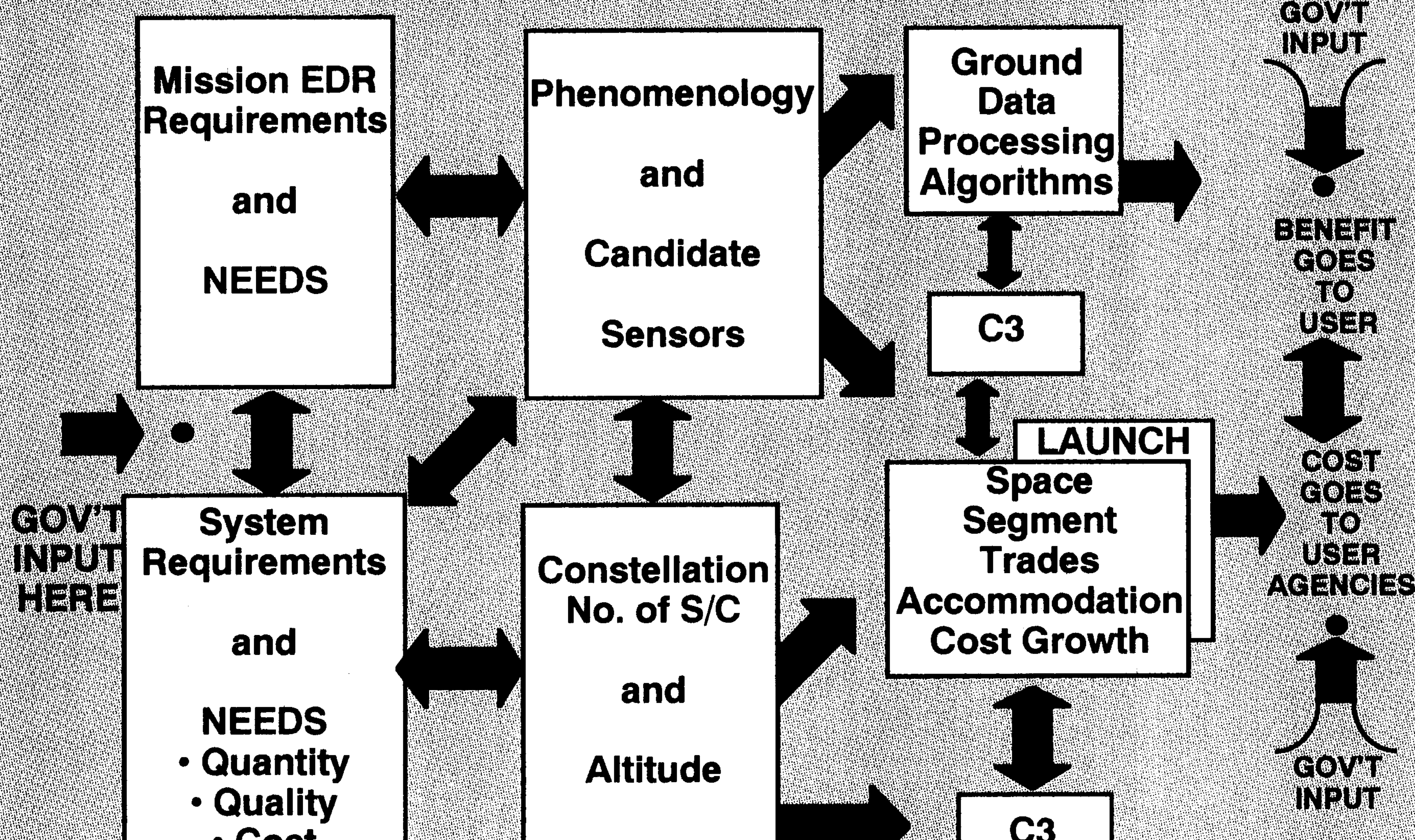
- PHASE 0 OBJECTIVE
  - FIND THE MOST COST-EFFECTIVE ARCHITECTURES THAT CONVERGE EXISTING AND ADVANCED DMSP AND POES FUNCTIONS AND FACILITIES INTO A SINGLE, INTEGRATED SPACE AND GROUND SEGMENT USER SYSTEM
- GUIDELINES
  - LEVERAGE ONGOING EDR STUDIES INTO SUPPORT FOR "GO-AHEAD" DECISION
  - BALANCE COST VS. PERFORMANCE OF OPERATIONAL AND SCIENCE REQUIREMENTS
  - USE END-TO-END SYSTEM TRADES TO MINIMIZE TECHNICAL AND SCHEDULE RISK
  - ITERATE TO IDENTIFY COST-EFFECTIVE SYSTEM ARCHITECTURES

COST VS PERFORMANCE END-TO-END SYSTEM TRADES

■ *NPOESS*



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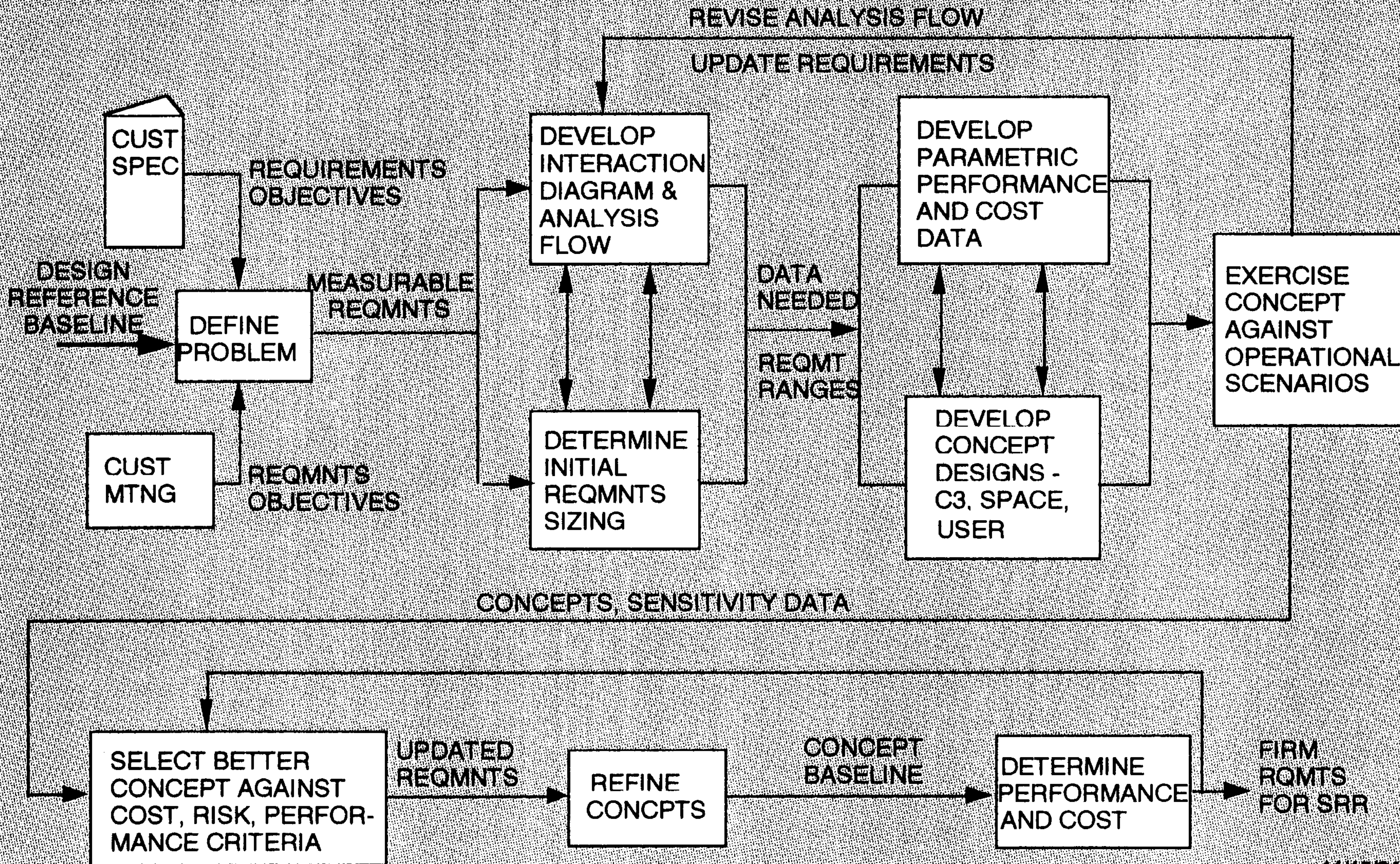
SSD PHASE 0 ANALYSIS AND ITERATIVE TRADES APPROACH

▪ *NPOESS*



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STRAWMAN OPERATIONAL SCENARIO

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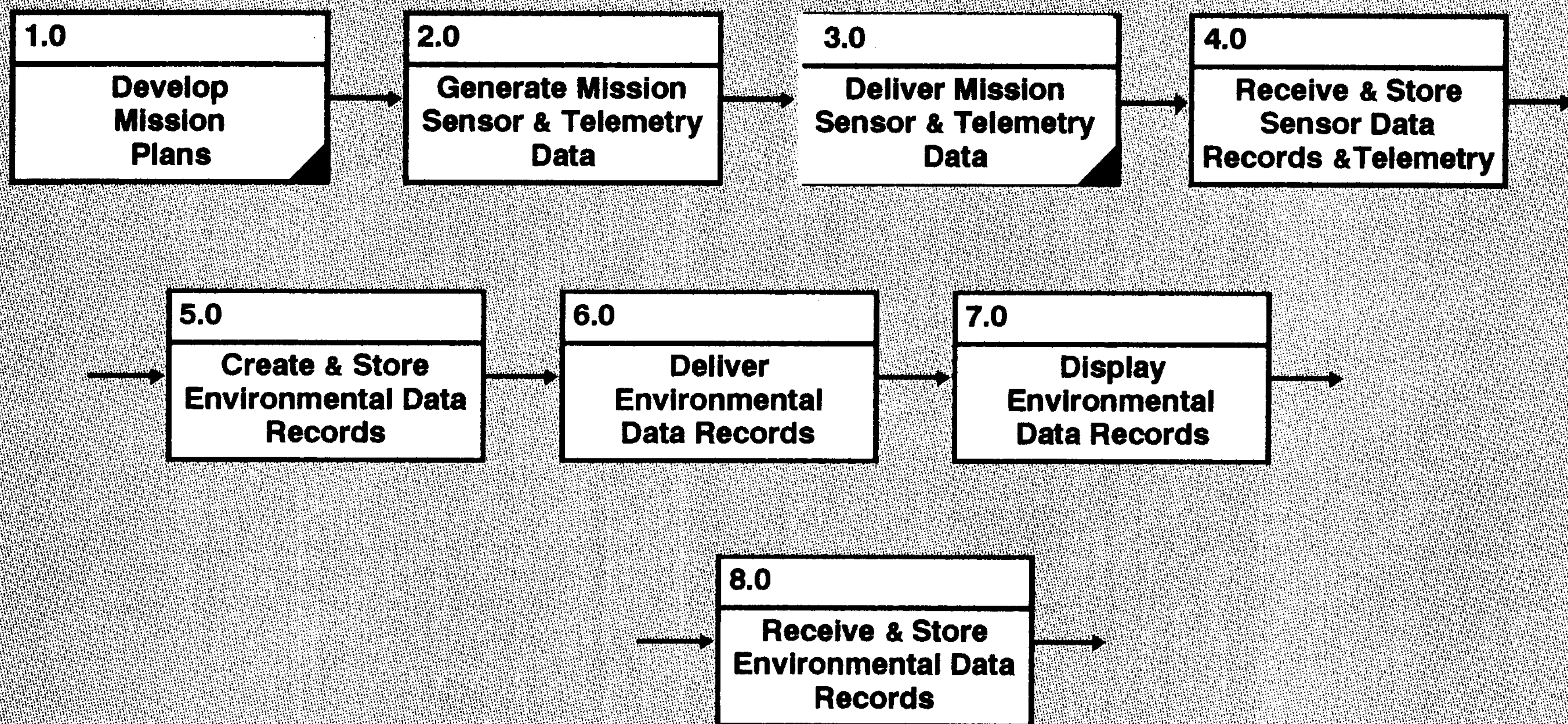
Ops State - Normal Mode*



C3 FUNCTIONS

* EM #1125, EM#1129, EM#1149, EM#1146

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APPROACH FOR CONVERGENCE OF EDR REQUIREMENTS

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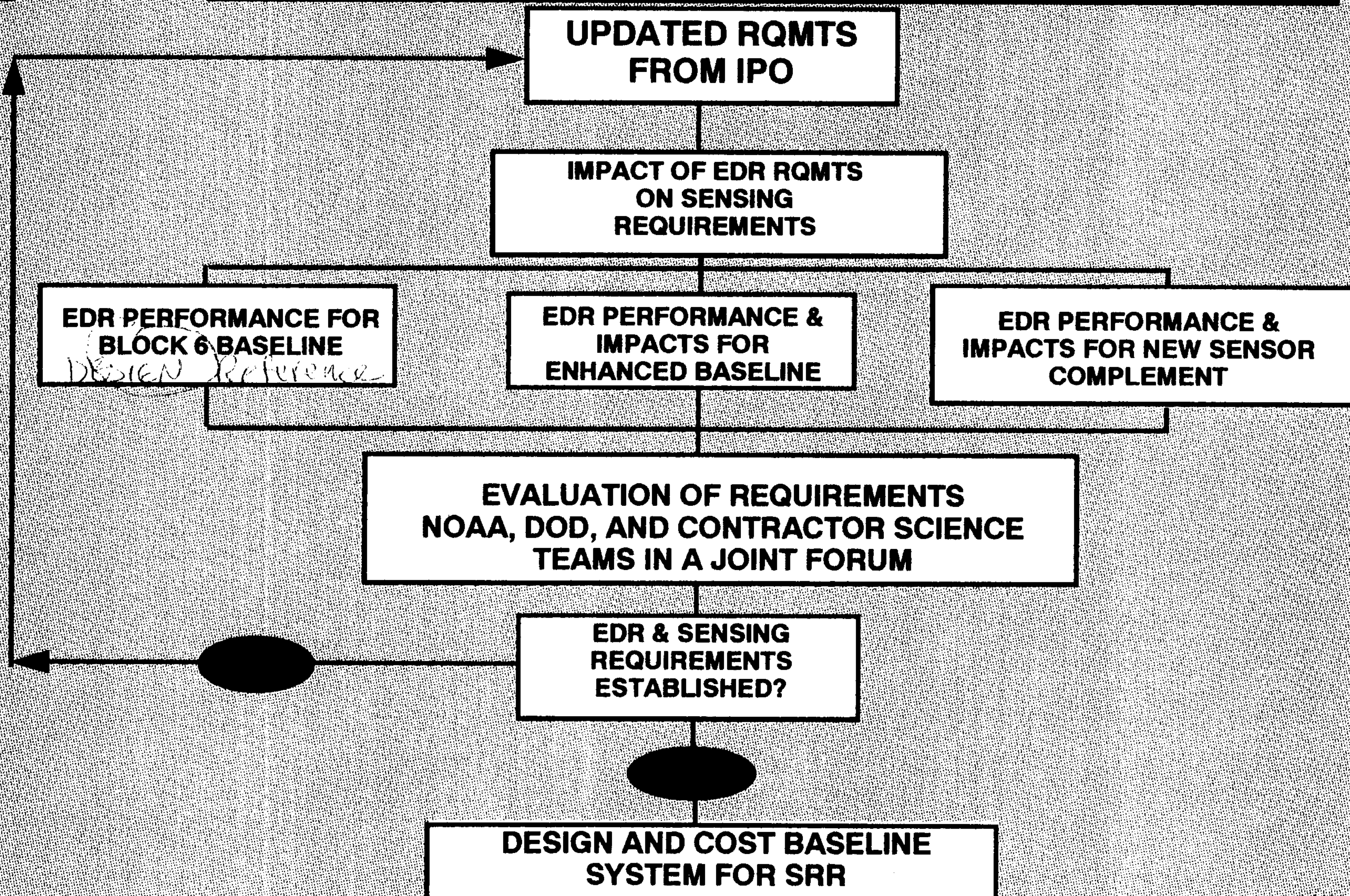

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REQUIREMENTS ANALYSIS PROCESS

Supplier "Hows"

Design Features/
Performance Measures

Customer "Wants"

1. Severe Wx Forecast
2. Cloud Imagery
•
•
•

Utility/Relationship Matrix

Measures how well "Wants" are met.

Prioritization of Customer "Wants"

1. Cost
2. Supportability
3. Mission Effectiveness
•
•

Sensitivity to Design Features

Prioritzation of relative importance of changes in design features

Key Tasks

1. Identify operational and environmental needs
2. Identify customer preferences
3. Prioritize importance of design features

EXAMPLE OF REQUIREMENTS ANALYSIS MATRIX

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* EDR CONTAINS A KEY PARAMETER (see Data Requirements)   B/L: Indicates one of the 8-channels of the OMIS/VIRSR Baseline

10/1/94 A-Spec Number	WAVELENGTH & KEY PHENOMENON (nanometers or / EDR	402-422 chlorophyll	433-453 chlorophyll	545-565 sediments	605-625 clouds B/L	860-880 clouds B/L	1.35-1.4 mm cirrus	1.58-1.64 snow/ice B/L	3.55-3.93 cirrus SST B/L	10.3-11.3 clouds SST B/L	11.5-12.5 clouds SST B/L	0.4-1.0 clouds aurora B/L	8.4-8.7 cirrus SST B/L	PRIORITY	REL WGHT
20.3.1	CLOUD IMAGERY*	0	0	0	19.6	19.6	13	19.6	19.56	19.56	19.6	19.6	13.04	2	6.52
20.3.2	CLOUD COVER/LAYERS	0	0	0	12.6	12.6	8.38	12.6	12.57	12.57	12.6	4.19	8.38	6	4.19
20.4.3	SEA ICE*	0	0	0	11.5	11.5	7.64	11.5	11.46	11.46	11.5	3.82	7.64	7	3.82
20.6	SEA SURFACE TEMPERATURE*	0	0	0	7.44	7.44	7.44	11.2	11.16	11.16	11.2	0	7.44	8	3.72
20.9.17	LAND SURFACE TEMPERATURE	0	0	0	5.58	5.58	5.58	8.37	8.37	8.37	8.37	0	5.58	11	2.79
20.3.9	CLOUD TOP TEMPERATURE	0	0	0	4.48	4.48	4.48	6.72	6.72	6.72	6.72	0	4.48	13	2.24
20.9.2	ALBEDO	2.14	2.14	2.14	6.42	6.42	4.28	4.28	4.28	4.28	4.28	0	4.28	14	2.14
20.9.3.2	AURORAL IMAGERY	0	0	0	0	0	0	0	0	0	0	5.88	0	17	1.96
20.9.3.1	AURORAL BOUNDARY	0	0	0	0	0	0	0	0	0	0	5.58	0	18	1.86
20.9.42	VEGETATION/SURFACE TYPE	0	0	2.98	4.47	4.47	2.98	2.98	0	0	0	0	0	23	1.49
20.3.10	CLOUD TOP HEIGHT	0	0	0	2.24	2.24	2.24	3.36	3.36	3.36	3.36	0	2.24	27	1.12
20.9.4	BATHYMETRY (DEEP OCEAN & NR SHORE)	2.79	2.79	2.79	1.86	1.86	1.86	1.86	0.93	0.93	0.93	0	0.93	30	0.93
20.9.1.2	AEROSOL PARTICLE SIZE	0.75	0.75	0.75	2.25	1.5	0.75	0	0	0	0	0	1.5	34	0.75
20.3.6.2	CLOUD OPTICAL DEPTH/TRANSMITTANCE	0	0	0	2.25	2.25	1.5	1.5	1.5	0	0	0	1.5	36	0.75
20.9.1.4	SUSPENDED MATTER	0.75	0.75	0.75	1.5	1.5	1.5	1.5	0	0	0	0	1.5	38	0.75
20.3.3	CLOUD BASE HEIGHT	0	0	0	0.75	0.75	0.75	0.75	0.75	0	0	0	0.75	39	0.75
20.9.3.3	OPTICAL BACKGROUNDS	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	1.5	40	0.75
20.4.1	FRESH WATER ICE CONCENTRATIONS	0	0	0	1.95	1.95	1.3	1.95	1.95	1.95	1.95	0.65	1.3	41	0.65
20.9.23	OCEAN COLOR (CHLOROPHYLL)	1.68	1.68	1.68	1.12	1.12	1.12	1.12	0	1.12	1.12	0	0.56	43	0.56
20.9.1.3	AEROSOL OPTICAL THICKNESS ***	0	0	0	1.12	1.12	0	0	0	0	0	0	1.12	44	0.56
20.9.20	CURRENTS	1.41	1.41	1.41	0.94	0.94	0.94	0.94	0	0.94	0.94	0	0.47	47	0.47
20.3.7	CLOUD TOP PRESSURE	0	0	0	0.94	0.94	0.94	1.41	1.41	1.41	1.41	0	0.94	50	0.47
20.9.18	LITTORAL SEDIMENT TRANSPORT	0.74	0.74	1.11	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0	0.74	52	0.37
20.3.4	CLOUD ICE, LIQUID EQUIVALENT	0	0	0	1.11	1.11	0.74	1.11	1.11	1.11	1.11	1.11	0.74	58	0.37
20.9.8	BIOLUMINESCENCE	0	0	0	0	0	0	0	0	0	0	0	0	63	0.19
20.3.6.1	DROPLET SIZE DISTRIBUTION INDEX	0	0	0	0.57	0.57	0.38	0.38	0.38	0	0	0	0.38	67	0.19
20.9.41	TURBIDITY	0	0	0	0	0	0	0	0	0	0	0	0	68	0.19
20.3.5.1	CLOUD ICE WATER PATH	0	0	0	0.57	0.57	0.38	0.57	0.38	0	0	0	0.38	71	0.19
	TOTALS	11.76	11.76	15.1	93.4	92.6	70.5	95.8	88.13	87.18	87.2	40.8	67.39		

*** If re-stated as Optical Depth, vice thickness, a passive system could be used, and the priority would be higher.

Value for the wavelength band: 3 for critical, 2 for important, 1 for helpful, and 0 for useless; and weighted by "RELATIVE WEIGHT".

"RELATIVE WEIGHT" IS A VALUE ASSIGNED TO EACH OF THE 72 EDRs THAT INDICATES THE EDR'S RANKING OR WEIGHT NORMALIZED TO 100.

EXAMPLE REQUIREMENTS ISSUE

COMMENT NUMBER: SYS-13

REFERENCE: Attachment 4, Vol. 1, Appendix B Section: 20.

QUESTION/CONCERN:

Part of the Data Availability requirement to the Centrals reads as follows: "95% of time, data shall be provided to Centrals at min. once per orbital period, within TBD period + 30 min. from time of observation". There are several issues associated with this requirement.

DISCUSSION:

One issue refers to the phrase "once per orbital period". We have interpreted this phrase to mean that 95% of the time, you want to be able to downlink the data in question at least once each orbit. During the other 5% of the time, the system will need to accommodate the notion that blind revs may occur between contacts with the system's ground station network.

Another issue refers to how the requirement is trying to specify the age of the oldest data to be delivered to the Centrals. We interpreted the requirement as specifying the timeframe (t) from the data's time of observation (i.e., t = 0) until all of the data is provided to the Centrals by the C3S. It seems to be the intention of the requirement that this timeframe be no greater than the sum of the orbital period which corresponds to a satellite's operational altitude and which currently is TBD minutes in length plus an additional 30 minutes for data routing from the satellite through the C3S to the Centrals.

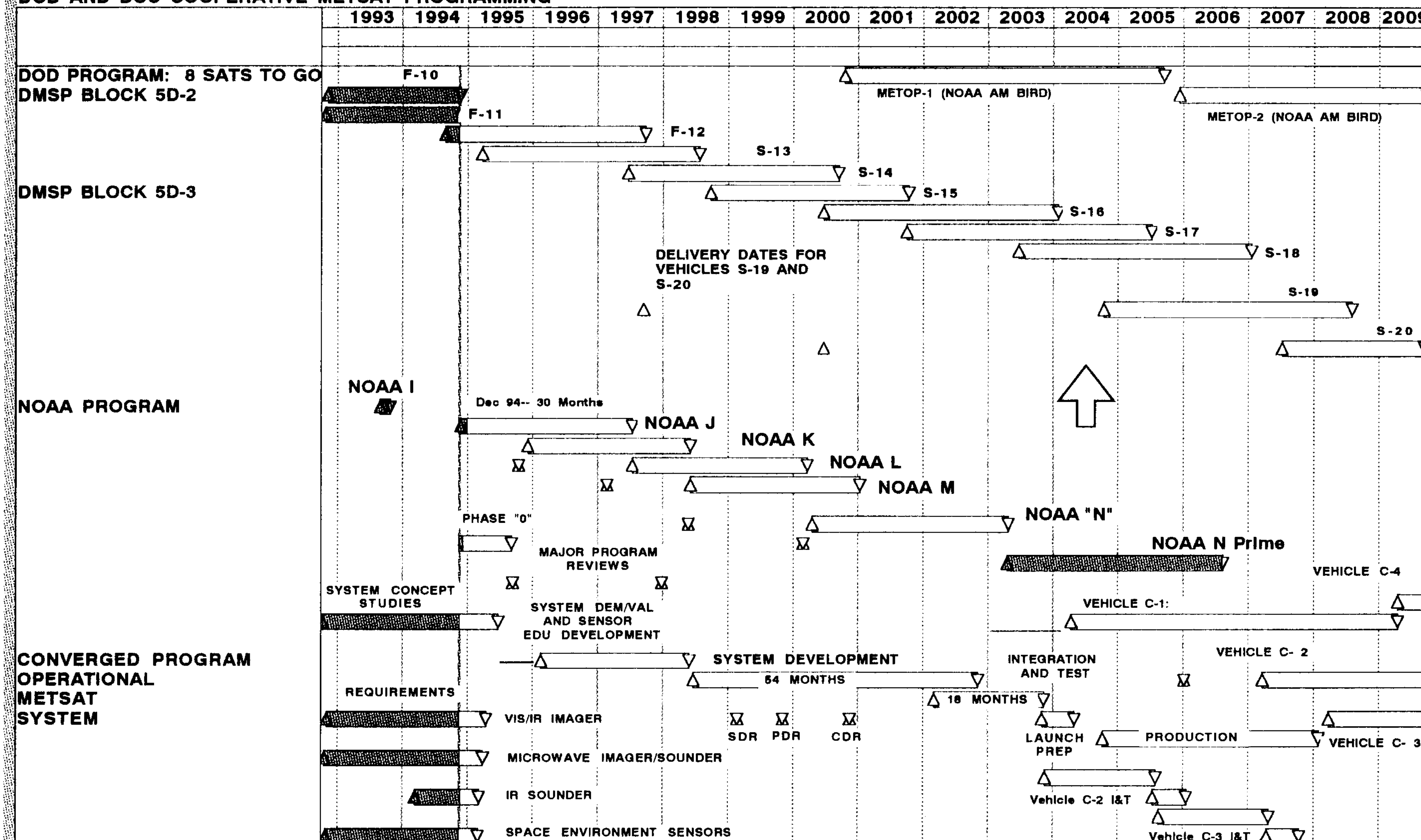
RECOMMENDATION:

In accordance with our interpretation the requirement should read as follows (unless otherwise directed): "95% of time, all data acquired by a satellite since its last contact with a ground station shall be downlinked to the C3S at least once per orbit such that the timeframe from the data's time of observation until it is provided to the Centrals shall be no greater than an orbital period of TBD minutes plus 30 minutes."

N-PRIME AND METOP DRIVES C-1 NEED DATE

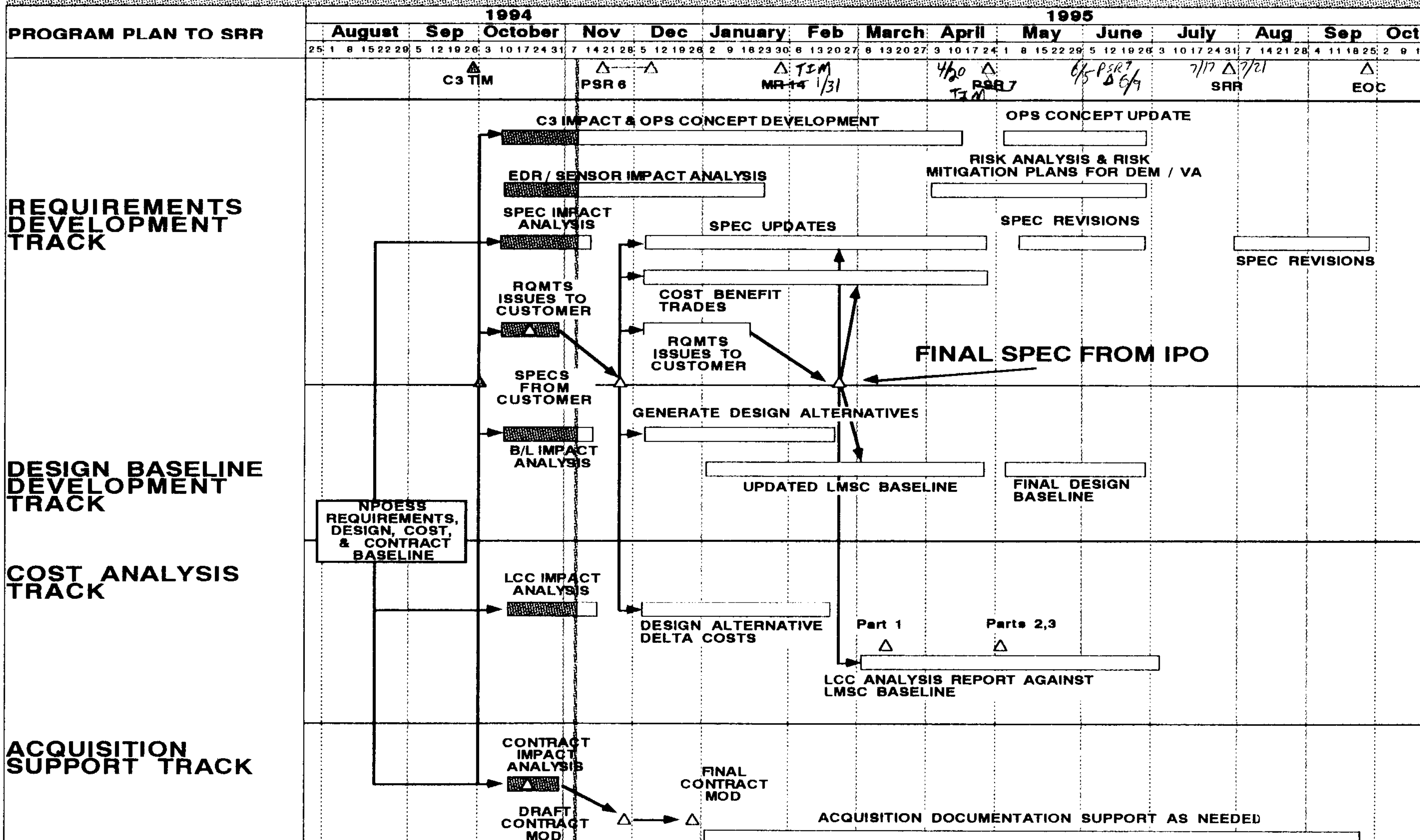
NPOESS

DOD AND DOC COOPERATIVE METSAT PROGRAMMING



SRR PLANNING SCHEDULE

NPOESS

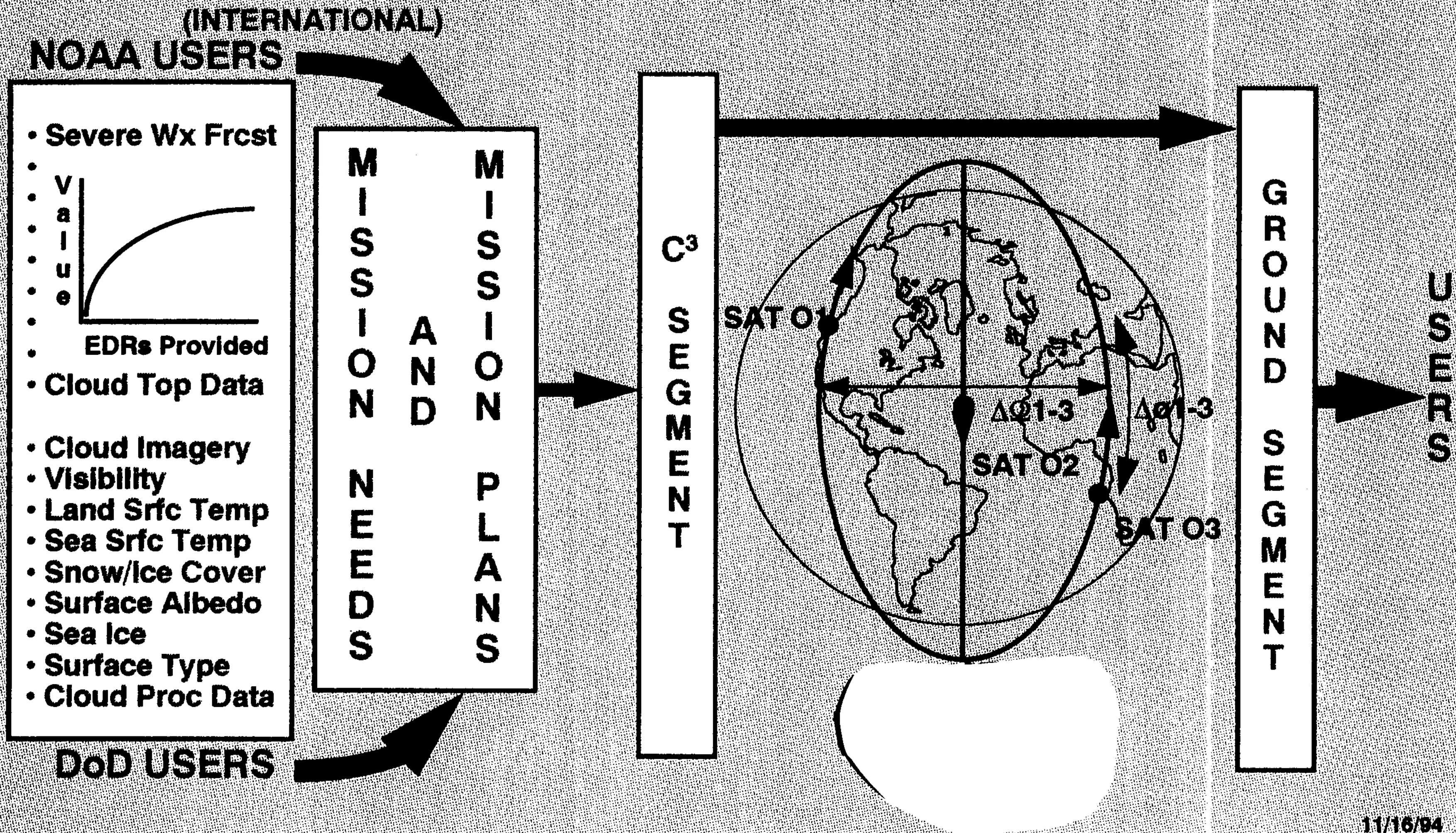


TOP-LEVEL NPOESS SYSTEM ARCHITECTURE

GOOD INITIAL BASELINES PROMOTE CONVERGENCE

- ***NPOESS***

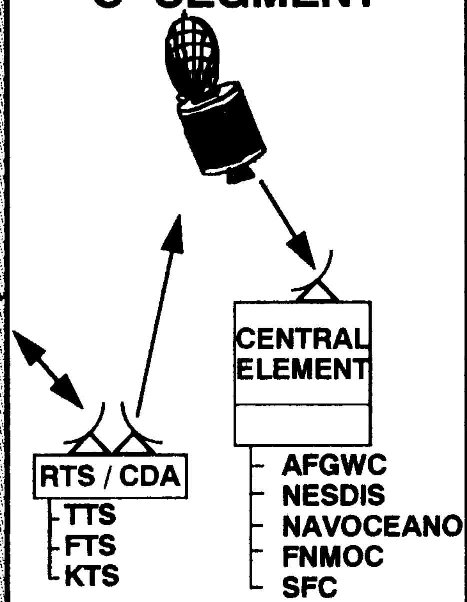
AN INTEGRATED END -TO - END SPACE AND GROUND SEGMENT USER SYSTEM



USER REQUIREMENTS ARE HEAVILY LEVERAGED AGAINST SPACE SEGMENT COST

COST: $8X	$1X	$1X
SPACE SEGMENT	**C^3 SEGMENT**	**USERS**

C^3 SEGMENT

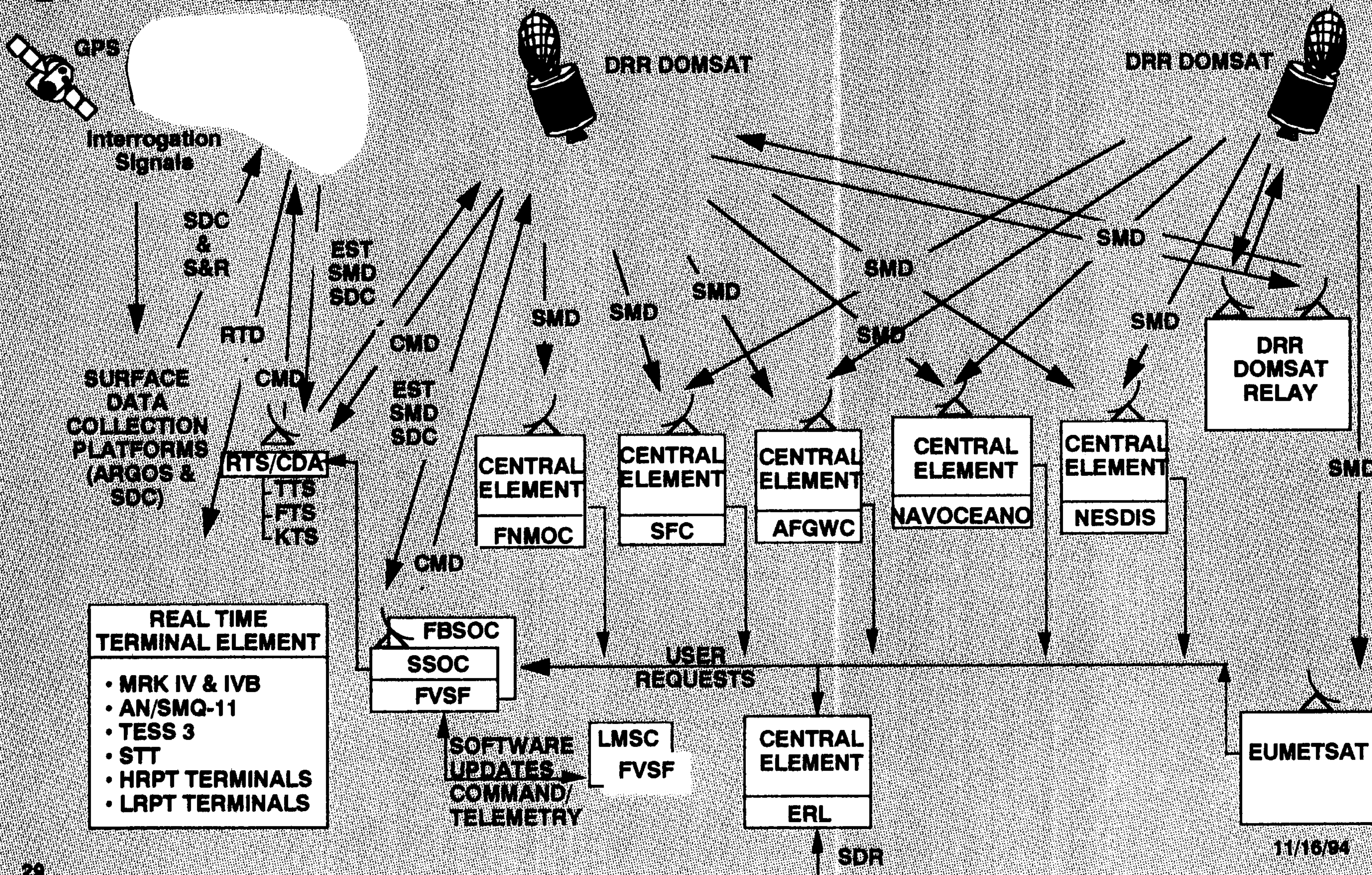


USERS

- CENTRAL SITES
- REGIONAL SITES
- SHARED PROCESSING NETWORK
- INTERFACE DATA PROCESSING

CONVERGED SYSTEM BASELINE ARCHITECTURE

- *NPOESS*



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INTEGRATED C^3-USER DATA FLOW

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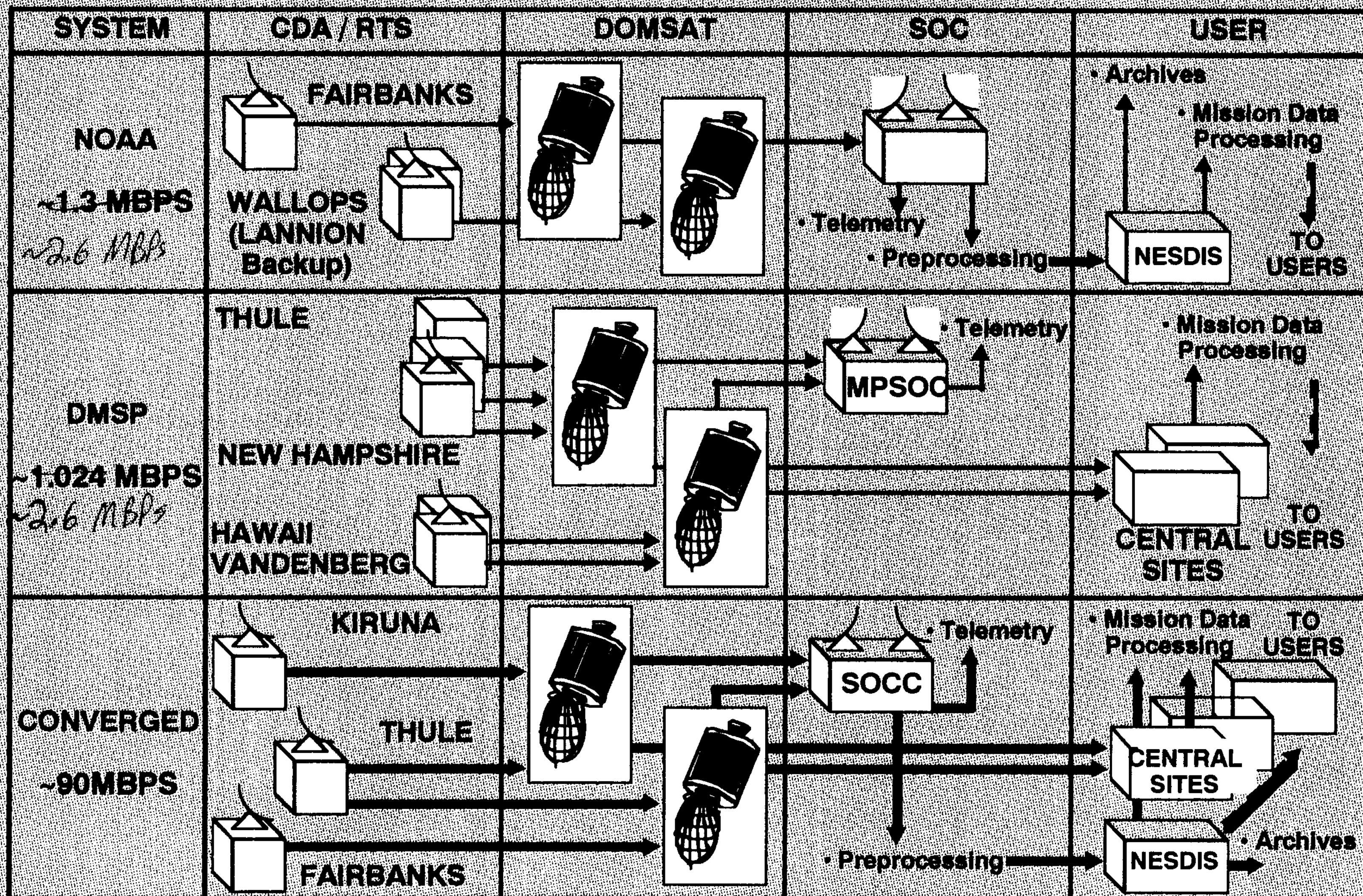
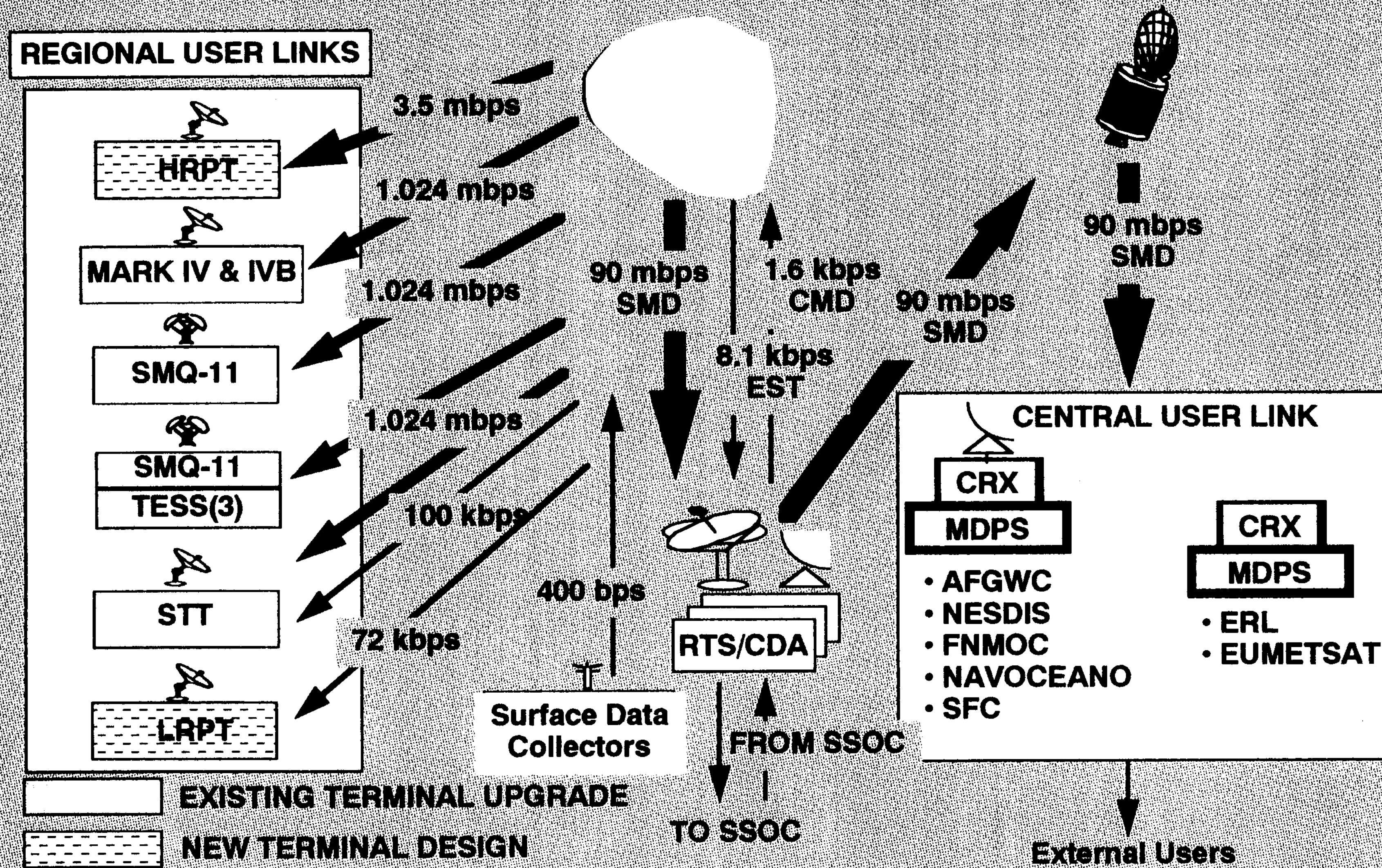
Stored data rates



CONVERGED SYSTEM LINK OVERVIEW

- *NPOESS*



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SATELLITE O3

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CANDIDATE CONVERGED CONSTELLATION PAYLOADS

SAT01
0530A

- OASIS
- MISS
- SESS
- ARGOS
- MSTRS

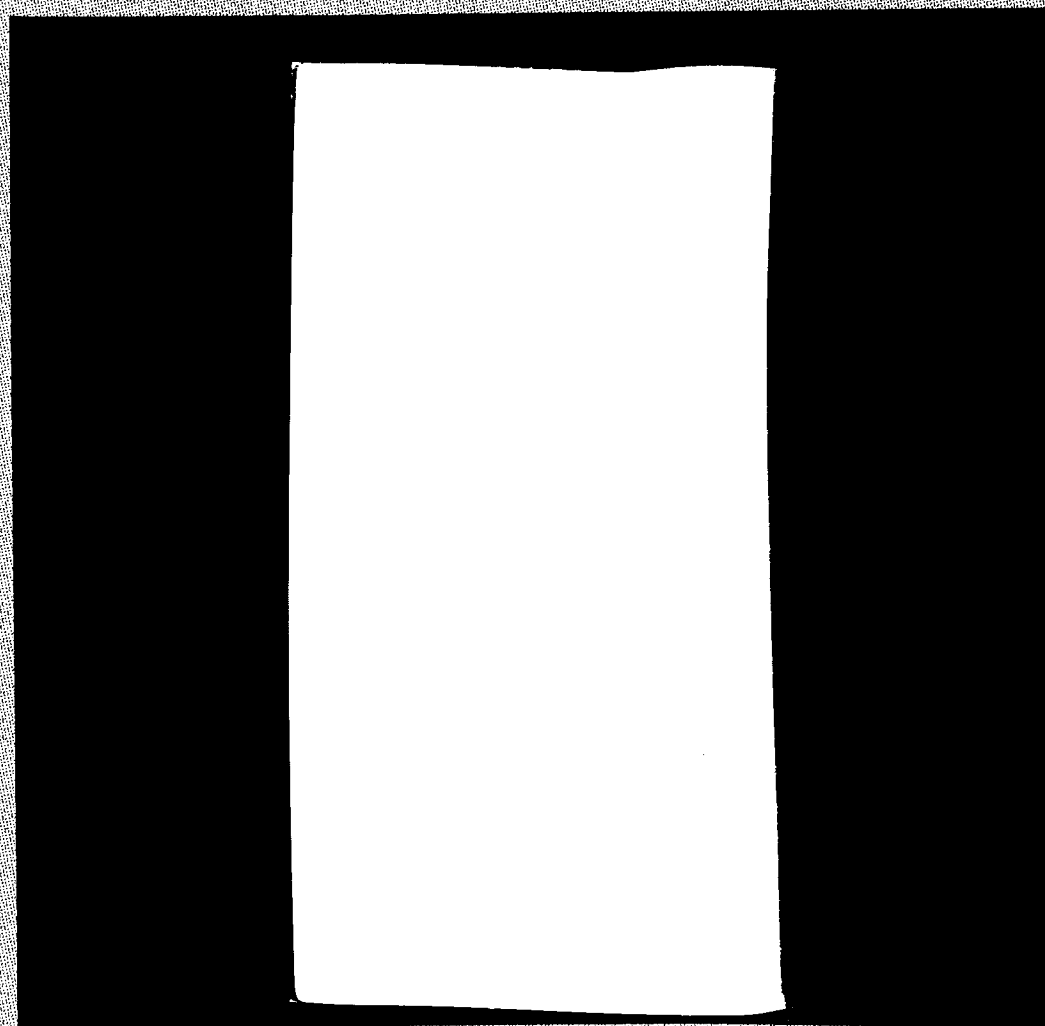
SAT02
0930D

- OASIS
- MIMR
- AMSU-1
- AMSU-2
- MHS
- SESS
- S&R
- ARGOS
- IASI

SAT03
1330A

- OASIS
- MISS
- AMSU-1
- MHS
- AIRS/ITS
- SBUV
- SESS
- S&R
- ARGOS
- MSTRS

SATELLITE NO 3 CONFIGURATION -STOWED



PHASE 0 TRADES

- E/O IMAGER
- MICROWAVE IMAGER
- PROFILERS
- SESS & CLIMATE
- C3 - IDP

E/O IMAGER TRADES

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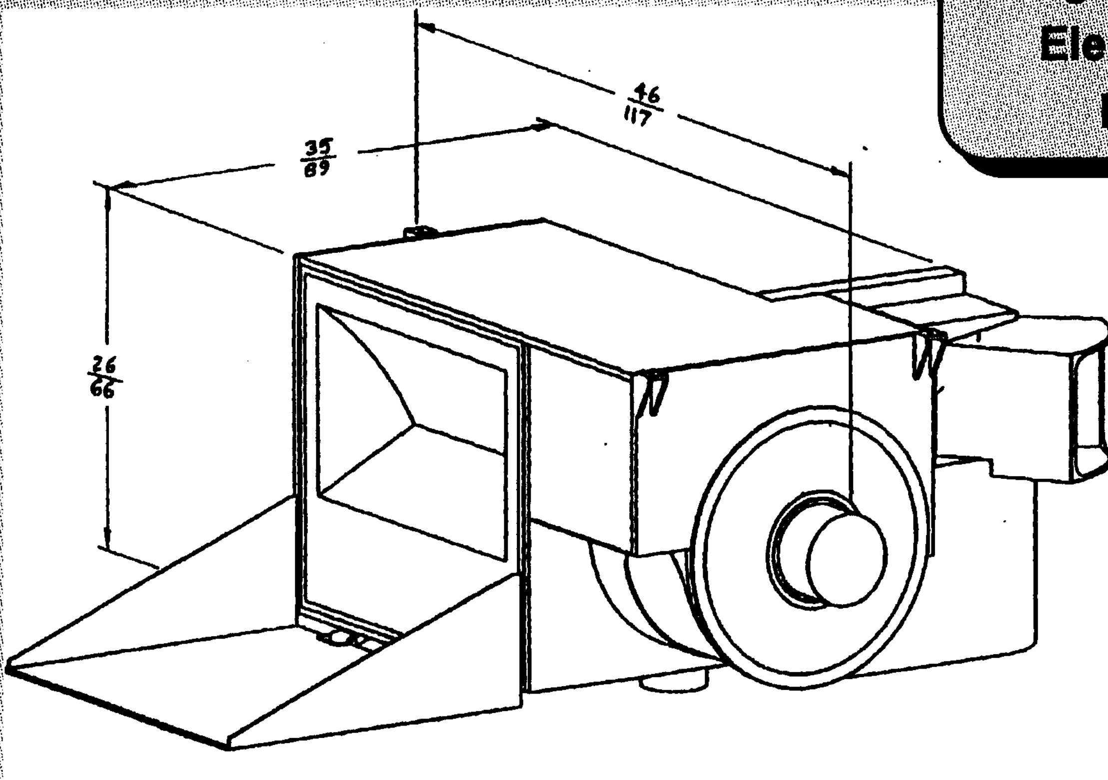
OASIS - OPERATIONAL ADVANCED SPECTRAL IMAGING SENSOR

- NUMBER OF OASIS SPECTRAL CHANNELS
  - 8 CHANNEL BASELINE
  - 9 -11 CHANNEL OPTION (4 IR +4-6 VIS + LLL)
  - 16-18 CHANNEL (ADDS OCEAN COLOR BANDS TO ABOVE UNIT)
  - UTILIZE SEPARATE SEAWIFs TYPE SENSOR FOR OCEAN COLOR
- RESOLVE DOD "CONSTANT" RESOLUTION ISSUES
  - CURRENT PROGRAM REFERS TO "CONSTANT" RESOLUTION
    - » ACTUAL RESOLUTION VARIES BY ~3X FROM NADIR TO EDGE
  - ORIGINAL BLOCK 6 DEFINITION
    - » 0.65 km ± 25% AT ANY POINT IN SCAN
  - CURRENT CONSTANT RESOLUTION 0.65 -1.3 km
  - FUTURE CONSTANT RESOLUTION DEFINITIONS IN CONSIDERATION
    - » ≤ 0.65 km AT EDGE OF SCAN
    - » 0.65 ± 0.0 km OVER THE ENTIRE SCAN

BASELINE OASIS DESIGN CONCEPT

Aperture: 17 cm (6.7")
Focal Length: 122.4 cm (48.2")
Size: 117x89x66 cm (46x35x26")
Weight: Scanner - 78 Kg (172 lb)
Electronics: 27 Kg (59.5 lb)
Power: <200 W (Ave.)



OASIS TECHNICAL CAPABILITY

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PARAMETER	OASIS REQUIREMENT	
• ALTITUDE	833 KM POLAR	
• EQUATORIAL CROSSING	0530; 0930; 1330	
• TOTAL SOLAR ANGLE RANGE	0 - 95 DEG	
• SCAN ANGLE RANGE	+/-55.5 DEG	
• SENSOR	CROSS-TRACK SCANNER	
• ENVELOPE (IN)	52 x 33 x 25	
(CM)	132 x 83.8 x 63.5	
• ELECTRONICS (IN)	16 x 16 x 8	
(CM)	40.6 x 40.6 x 20.3	
• POWER (IN)	12 x 8 x 8	
(CM)	30.5 x 20.3 x 20.3	
• MASS LBS (KG)	304 (137.9)	
• AVG POWER (W)	216.9; PEAK< 250	
• SPATIAL RESOLUTION		LLL
- NADIR	0.65 KM	3.25 KM
- SCAN END: 55.5 DEG	1.3 KM	6.5 KM
• BAND-TO-BAND REG	0.25 PIXEL (1/4)	
• SYSTEM LINEARITY	$\leq$ TBD %	
• POLARIZATION	$\leq$ 5 %	
• RELIABILITY	5 YEARS	

OASIS MEASUREMENT BANDS AND CAPABILITY

- ***NPOESS***
  - ASSUMED DMSP REQUIREMENTS FOR ENVELOPE, MASS, AND POWER
  - RADIOMETRIC SENSITIVITY, CALIBRATION, BAND-TO-BAND REGISTRATION AND RELIABILITY REQUIREMENTS WILL LIKELY BE IMPACTED BY THE CONVERGENCE PROCESS

BANDS (um)		SPECIFIED OMIS (SYSTEM LEVEL REQUIREMENTS) [1]	SPECIFIED VIRSR		OASIS CAPABILITY	
			CAL	SEN.	DERIVED CAL [2]	SENSITIVITY
1	0.605 - 0.625	12% @ 0.5 ALBEDO	1.7%	20	6%	9.6
2	0.86 - 0.88	12% @ 0.5 ALBEDO	1.7%	20	6%	9.6
3	1.51 - 1.75	15% @ 0.5% ALBEDO	1.7%	20	6%	9.6
4	3.60 - 3.9	0.85 K (2.8-5.2% @ 340-260K)	1.73%	0.1K (300K)	3.95%	3.41% (0.56K) (260)
5	10.3 - 11.3	0.3 K (0.55%) @ 270K 0.9 K (3.3%) @ 190 K	0.6%	0.1K (300K)	1.16%	3.12% (0.84K) (190K)
6	11.5 - 12.5	0.3 K (0.5%) @ 270K 0.9 K (3%) @ 190 K	0.53%	0.1K (300K)	1.1%	2.78% (0.84K) (190K)
7	0.4 - 1.0	20%	N/A	N/A	15%	6
8	8.4 - 8.7	ASSUMED 0.85K (1.2-3.2% @ 340 - 190 K)	0.77%	0.1K (300K)	1.3%	3.75% (0.8K) 190K

1 - ALL VALUES ARE 1σ

2 - FEASIBLE CAL VALUES BASED ON MODIS EXPERIENCE

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MICROWAVE SENSOR TRADES

BASELINE:

MICROWAVE IMAGER/SOUNDER SUITE (MISS)

- CONICALLY SCANNED SENSOR THAT DOES MICROWAVE IMAGER AND SOUNDING WITH A 2m DISH

OPTION:

SPLIT MICROWAVE SOUNDER / IMAGER PACKAGE

- CONICALLY SCANNED ADVANCED MICROWAVE IMAGER (AMI) WITH A 2m DISH
- CROSS-TRACK NADIR SOUNDER FOR TEMPERATURE SOUNDING (e.g. AMSU-A)
- CROSS-TRACK NADIR SOUNDER FOR MOISTURE SOUNDING (e.g. MHS)
- CROSS-TRACK NADIR SOUNDER FOR UPPER AIR SOUNDING (e.g. INFRARED PRESSURE MODULATOR RADIOMETER)

BASELINE MISS DESIGN CONCEPT

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MISS HERITAGE

MISS OFFERS EXTENSIVE FLIGHT HERITAGE OF SEVERAL CHANNELS

FUNCTION & CHANNEL #	FREQUENCY (GHz) & POLARIZATION	HERITAGE	DESIGN STATUS
IMAGING			
1 & 2	19.35 V & H	SSM/I, TMI	FLIGHT
3	23.8 H	SSM/I, TMI	FLIGHT*
4 & 5	37.0 V & H	SSM/I, TMI	FLIGHT
6 & 7	91.65 V & H	SSM/I, TMI	FLIGHT
MOISTURE SOUNDING			
8	150		BREADBOARD
9	170		BREADBOARD
10	183 +/- 3		BREADBOARD
11	183 +/- 7		BREADBOARD
TEMPERATURE SOUNDING			
1 - 20	37 V & H many near 60	SSM/I, TMI SSMIS STUDY	FLIGHT ANALYSIS ONLY

** SSM/I, TMI @ 22.235 GHz, MINOR MODIFICATION NECESSARY FOR 23.8 GHz*

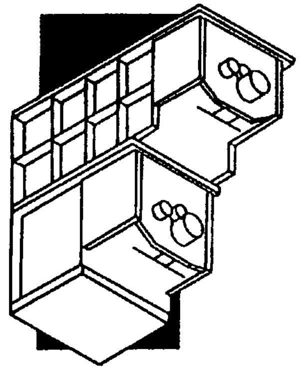
KEY PROFILER TRADES

- MICROWAVE SOUNDER REQUIREMENTS DRIVERS
  - GROUND COVERAGE (NOAA AMSU/MHS ~ 80% COVERAGE
  - SENSOR LIFETIME (AMSU/MHS VS NEW SENSORS)
  - SOUNDING REQUIREMENTS (LEVELS vs #CHANNELS)
  - HORIZONTAL RESOLUTION (NADIR vs EDGE OF SCAN)
- IR SOUNDER REQUIREMENTS DRIVERS
  - AIRS 2378 SPECTRAL CHANNELS vs 1000 - 1500 CHANNELS
  - [redacted]
  - RELIABILITY
    - » LIFETIME (MECHANICAL REFRIGERATOR vs PASSIVE RADIATOR)
    - » DEVELOPMENT RISK (AIRS vs NEW SENSOR ... CONSIDERING LIFETIME ISSUES)
  - SIZE, WEIGHT, POWER
  - COST (NRE + RECURRING)
    - » AIRS vs LOW COST [redacted] (OR ITS)

INITIAL SENSOR CANDIDATES FOR PROFILER SUITE

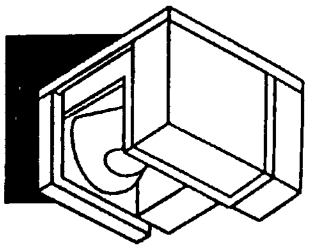
MICROWAVE SOUNDERS

AMSU



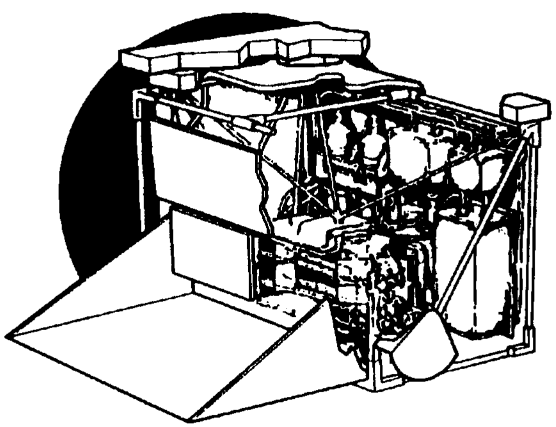
AND

MHS



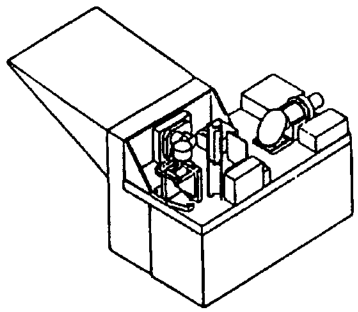
IR SOUNDERS

AIRS



OR

vs ITS



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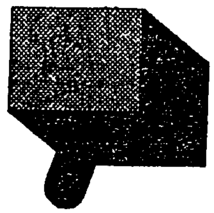
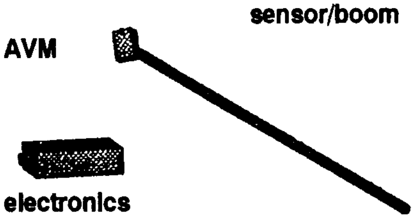
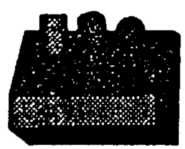
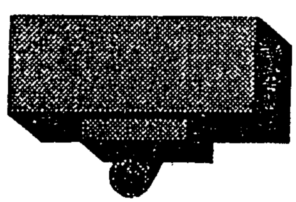
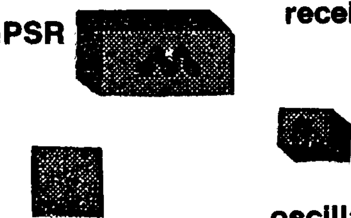
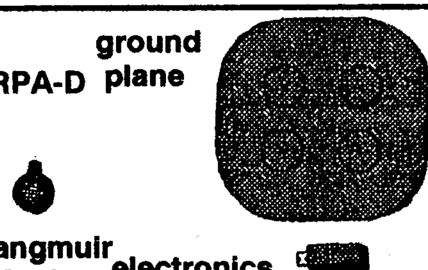
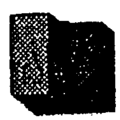
SESS INSTRUMENTS AND EDRs (1 OF 2)

ENVIRONMENT DATA RECORD	SENSOR	COMPONENTS/ HERITAGE	ATTRIBUTES
AURORAL BOUNDARIES	ABIS 	FUV IMAGER / DMSP BLOCK5, HILAT, POLAR BEAR	FUV REMOTE SENSING OF AURORAL EMISSIONS PROVIDES QUANTITATIVE INFORMATION ON SPECTRAL PROPERTIES OF AURORAL PARTICLE FLUXES. DESIGN SIMILAR TO NADIS FOR COST REDUCTION
GEOMAGNETIC FIELDS	AVM 	BOOM-MOUNTED VECTOR MAGNETOMETER/ DMSP BLOCK5, MAGSAT	PROVIDES INFORMATION ABOUT AURORAL CURRENT SYSTEMS TO SUPPORTS ELECTRODYNAMIC MODELING AND AURORAL BOUNDARY IDENTIFICATION
RADIATION DOSE	HEPS 	UARS/PEM/NASA	STATE-OF-ART DESIGN PROVIDES HIGH-ENERGY PARTICLE FLUXES AND SPECTRA
NEUTRAL ATMOSPHERE MEASUREMENTS	NADIS 	FUV LIMB-SCANNING SPECTROMETER/ DMSP BLOCK 5, ABIS	FUV REMOTE SENSING OF DAYTIME NEUTRAL ATMOSPHERE EMISSIONS. DESIGN SIMILAR TO ABIS, BUT SCANS LIMB INSTEAD OF NADIR

SESS INSTRUMENTS AND EDRs (2 OF 2)

NPOESS

ENVIRONMENT DATA RECORD	SENSOR	COMPONENTS/ HERITAGE	ATTRIBUTES
IONOSPHERIC ELECTRON DENSITY	GPSR 	GPS RECEIVER AND ANTENNA / TOPEX	INNOVATIVE TECHNIQUE FOR IONO-SPHERIC REMOTE SENSING USING GPS SIGNALS RECEIVED BY DMSP, DAY & NIGHT GLOBAL IONOSPHERIC SPECIFICATION INDEPENDENT OF MODEL
IONOSPHERIC ELECTRIC FIELDS	RPA-D 	RETARDING POT. ANALYZER AND DRIFTMETER/ DMSP BLOCK 5 AND DYNAMICS EXPLORE	LOCAL ELECTRIC FIELD & ELECTRON DENSITY MEASUREMENTS USED FOR ELECTRODYNAMIC MODELING AND IONOSPHERIC SPECIFICATION
PRECIPITATING CHARGED PARTICLES	MEPS 	HEMISPHERIC ELECTROSTATIC ANALYZER / DMSP BLOCK 5 & CRRES	STATE-OF-THE-ART DESIGN USED SUCCESSFULLY ON THE CRRES SATELLITE; SIMULTANEOUS ENERGY AND PITCH ANGLE DISCRIMINATION

AEROSOL MEASUREMENTS FROM SATELLITES

KEY METHODOLOGY

- EO IMAGERY AND RADIATIVE TRANSFER MODELING FOR COLUMNAR ATMOSPHERIC PROPERTIES
  - CORRECT FOR PATH DEPENDENT ATMOSPHERIC SCATTERING
  - CORRECT FOR STRATOSPHERIC AEROSOL
  - GENERATE TOTAL AEROSOL OPTICAL DEPTH THICKNESS
  - AEROSOL PARTICLE SIZE FOR ATMOSPHERIC COLUMN

- ACTIVE MEASUREMENTS FOR AEROSOL PROFILES
  - HORIZONTAL SPATIAL RESOLUTION REQUIRES SCANNING LIDAR
  - EXISTING MINIMUM BECOMES COST DRIVER FOR SYSTEM

C^3S- IDPS TRADE FLOW

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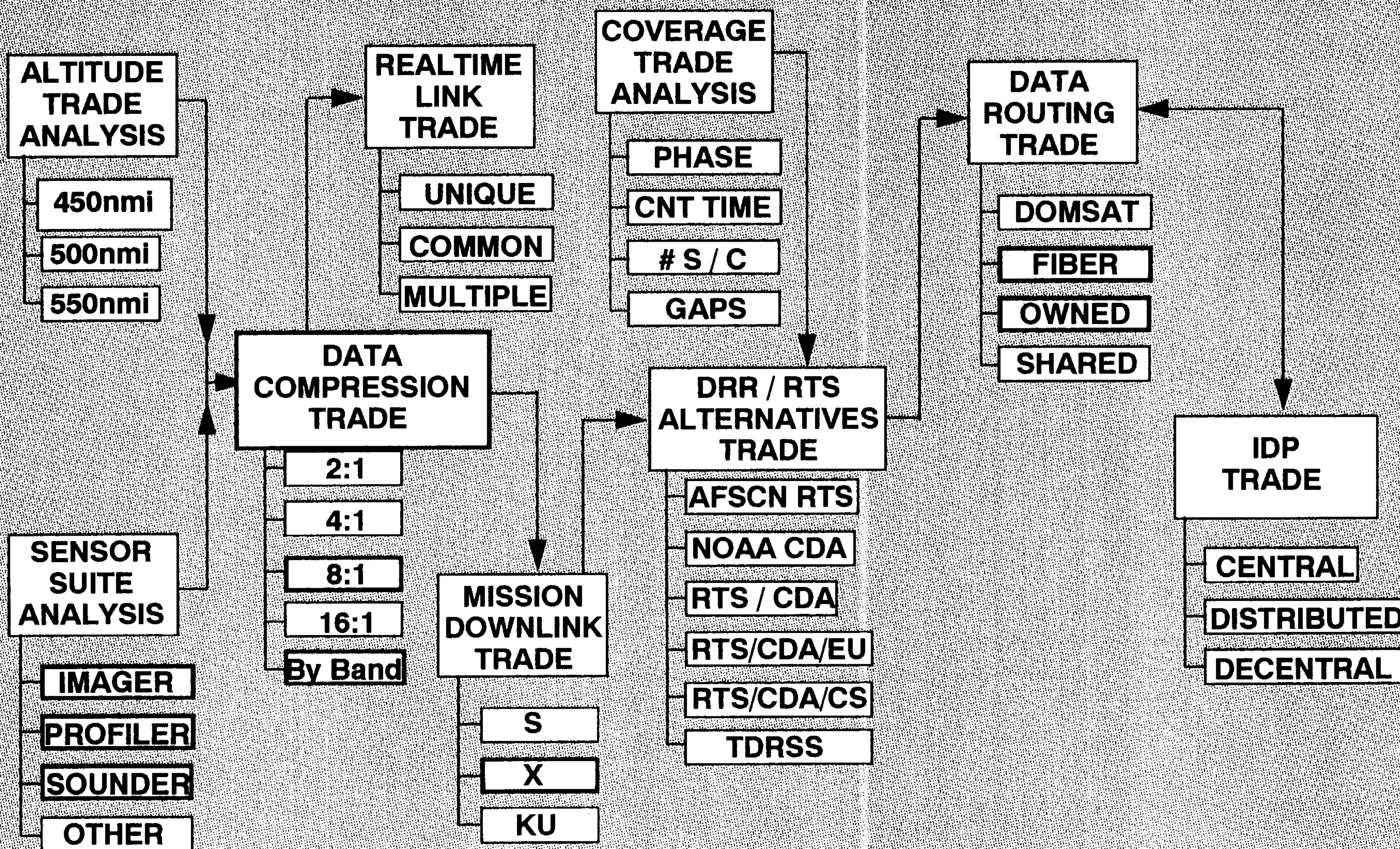

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DRR TRADE TREE

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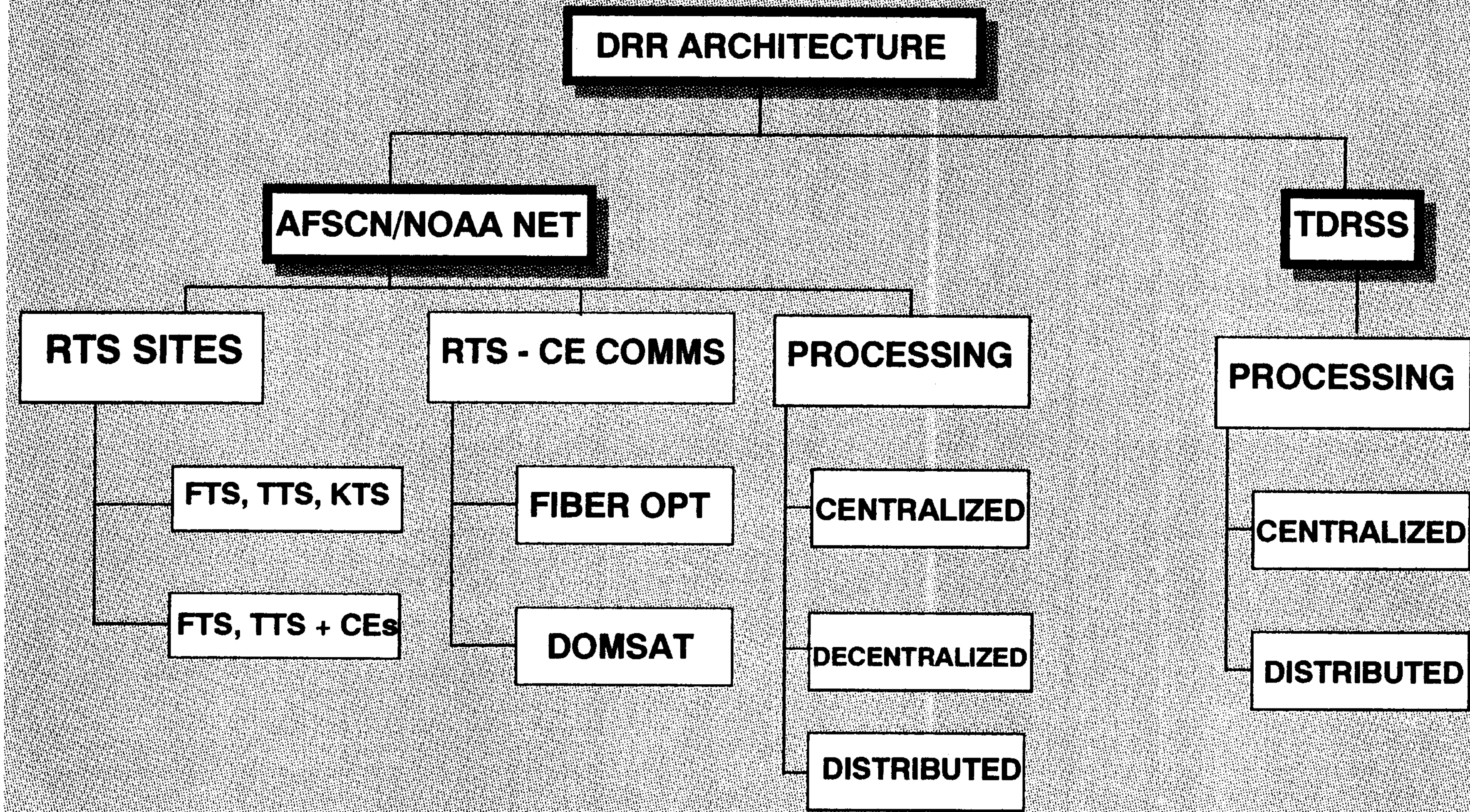

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SRR PROCESS SUPPORTS ACQUISITION PROCESS

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REQUIREMENTS DEVELOPMENT

- **MISSION AND REQUIREMENTS ANALYSIS**
- ***FUNCTIONAL FLOW ANALYSIS***
- ***PRELIMINARY REQUIREMENTS ALLOCATION***
- ***RELIABILITY ANALYSIS***
- ***SYSTEM INTERFACE STUDIES***
- ***GENERATION OF SPECIFICATION***
- **TPM PLANNING**

KEY

- **PRIMARY EMPHASIS FOR ACQ SPT**
- ***LIMITED TO KEY COST-PERFORMANCE DRIVERS***

BASELINE DEVELOPMENT

- **TRADE STUDIES (INCLUDING COST)**
- ***SYNTHESIS***
- ***LOGISTICS SPT ANALYSIS***
- ***EMC***
- ***SURVIVABILITY/VULNERABILITY***
- **ENVIRONMENTAL CONSIDERATIONS**
- ***HUMAN FACTORS ANALYSIS***
- **MANPOWER REQUIREMENTS/ PERSONNEL ANALYSIS**

PROGRAM PLANNING

- ***ENGINEERING INTEGRATION***
- **INTEGRATED TEST PLANNING**
- ***DATA MANAGEMENT PLANS***
- ***CONFIGURATION MANAGEMENT PLANS***
- ***PRELIMINARY MANUFACTURING PLANS***
- **MILESTONE SCHEDULES**

PROGRAM RISK ANALYSIS

LIFE CYCLE COST ANALYSIS

SYSTEM REQUIREMENTS REVIEW "SHALL"s

- **RISK IDENT AND RANKING.**
- **RISK AVOID / REDUCTION & CONTROL**
- **SIGNIFICANT TRADE-OFFS**
- ***IDENTIFYING COMPUTER RESOURCES & PARTITIONING INTO HWCIs AND CSCIs.***
- ***PRODUCIBILITY AND MANUFACTURING CONSIDERATIONS***
- ***SIGNIFICANT HAZARD CONSIDERATION***

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PRELIMINARY RESULTS, ISSUES, AND CONCERNS

- PROGRAMMATIC
- SYSTEM PERFORMANCE
- EDRs / SENSORS
- C^3 - IDPS

PROGRAMMATIC ISSUES

CONGRESSIONAL SUPPORT	• WILLINGNESS TO FUND DEPENDS ON 1) PERCEIVED NEED 2) COST SAVINGS 3) COST CREDIBILITY
COST	• TREAT LCC AS THRESHOLD AND OBJECTIVE
SCHEDULE	• IPO COMMITMENT TO TIMELINE • PHASE ZERO DEVELOPS ALTERNATIVES • STRONG DEM-VAL REDUCES SYSTEM RISK • EUROPEAN COMMITMENT CAN DRIVE N PRIME LAUNCH DATE
REQUIREMENTS	• SPATIAL RESOLUTION PLUS CALIBRATION REQUIREMENTS GROWTH MEANS COST • RQMTS RESOLUTION PROCESS NEEDED TO MEET DEM-VAL AND EMD DATES
COMMUNICATIONS	• IPO-CONTRACTOR TEAM COMMUNICATIONS ESSENTIAL (VTC, PSR, TDY)

DATA GROWTH: A TRANSITION CHALLENGE

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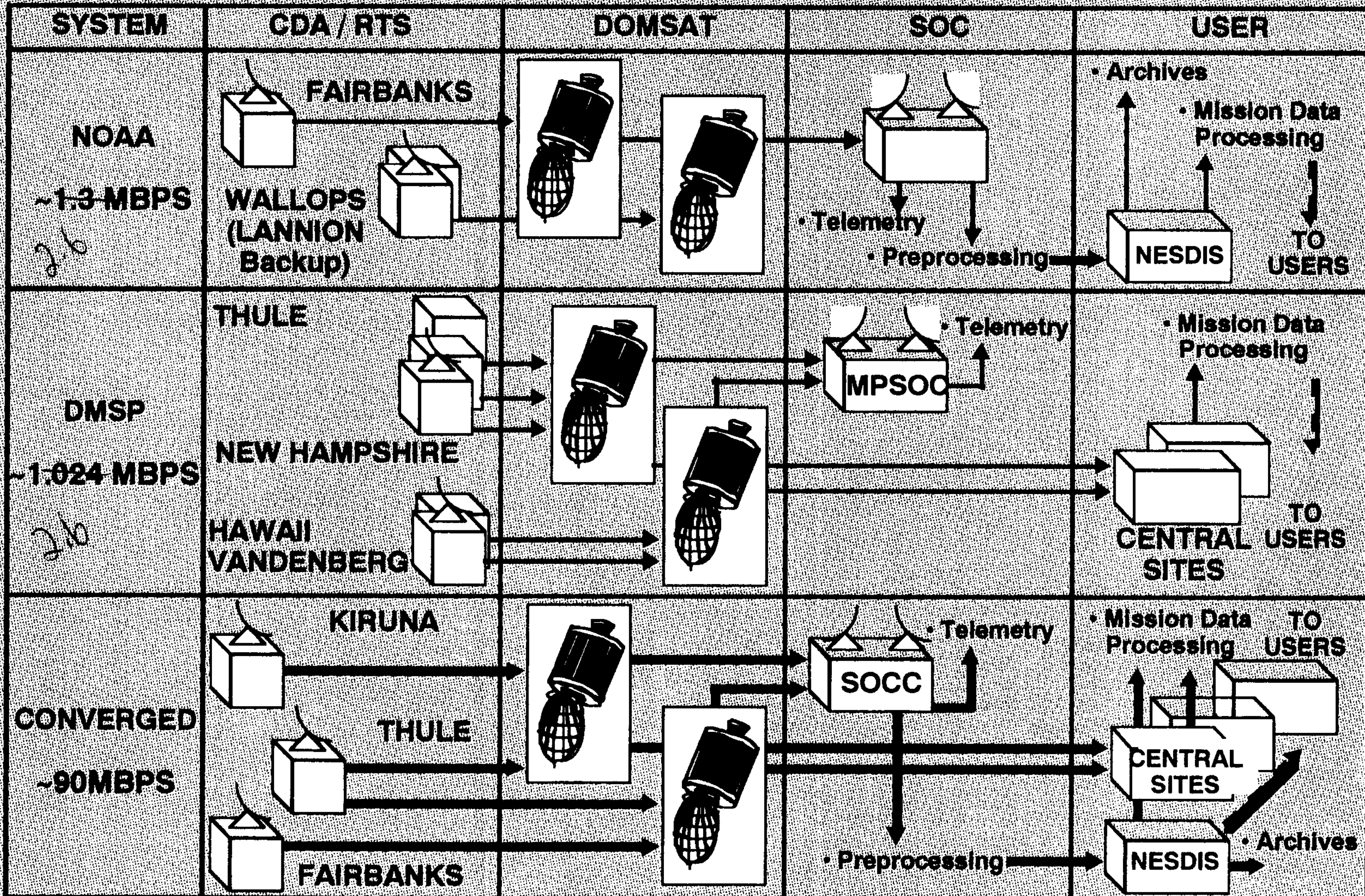

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SYSTEM PERFORMANCE

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REQUIREMENTS BECOME KEY METRICS FOR THE SYSTEM

O QUANTITY:	40 GB PER ORBIT 72 EDRS TO USERS
O QUALITY:	0.65KM RESOLUTION 1-4 KM MAPPING ACCURACY
O COVERAGE:	100% CONTIGUOUS 4 TO 6 HR REFRESH
O AVAILABILITY:	95%
O TIMELINESS:	ONCE PER ORBIT PLUS 30 MINS

--ALL IMPACT END-TO-END SYSTEM DESIGN AND COST--

SUMMARY OF SYSTEM PERFORMANCE ISSUES AND CONCERNS

- DATA VOLUME (40 Gb PER ORBIT) MAY PRECLUDE S-BAND DOWNLINK ALTERNATIVE
- IS TDRSS STILL AN OPTION?
- DATA TO FIELD USERS WILL DRIVE NUMBER AND CONTENT OF REALTIME DOWNLINKS
- MAPPING ACCURACY GOALS NOT FEASIBLE
  - 0.25 / 1 km E/O; 1 km MICROWAVE; 10 m BATHYMETRY
- HOW WE DEFINE GLOBAL AVERAGE REFRESH CAN DRIVE CONSTELLATION SIZE:
  - 3 SATS FOR 4 HRS VS 2 SATS FOR 6 HRS
- CLARIFICATION OF DATA AVAILABILITY REQUIREMENT ESSENTIAL TO DETERMINE SYSTEM-WIDE DATA LOADING
- COMMON ELECTRICAL AND DATA INTERFACES FOR <u>ALL</u> SENSORS
  - MAY NOT BE APPROPRIATE FOR EXISTING / GFE SENSORS
  - PRIME CONTRACTOR CAN TAILOR

PRELIMINARY PROCESSING ESTIMATES

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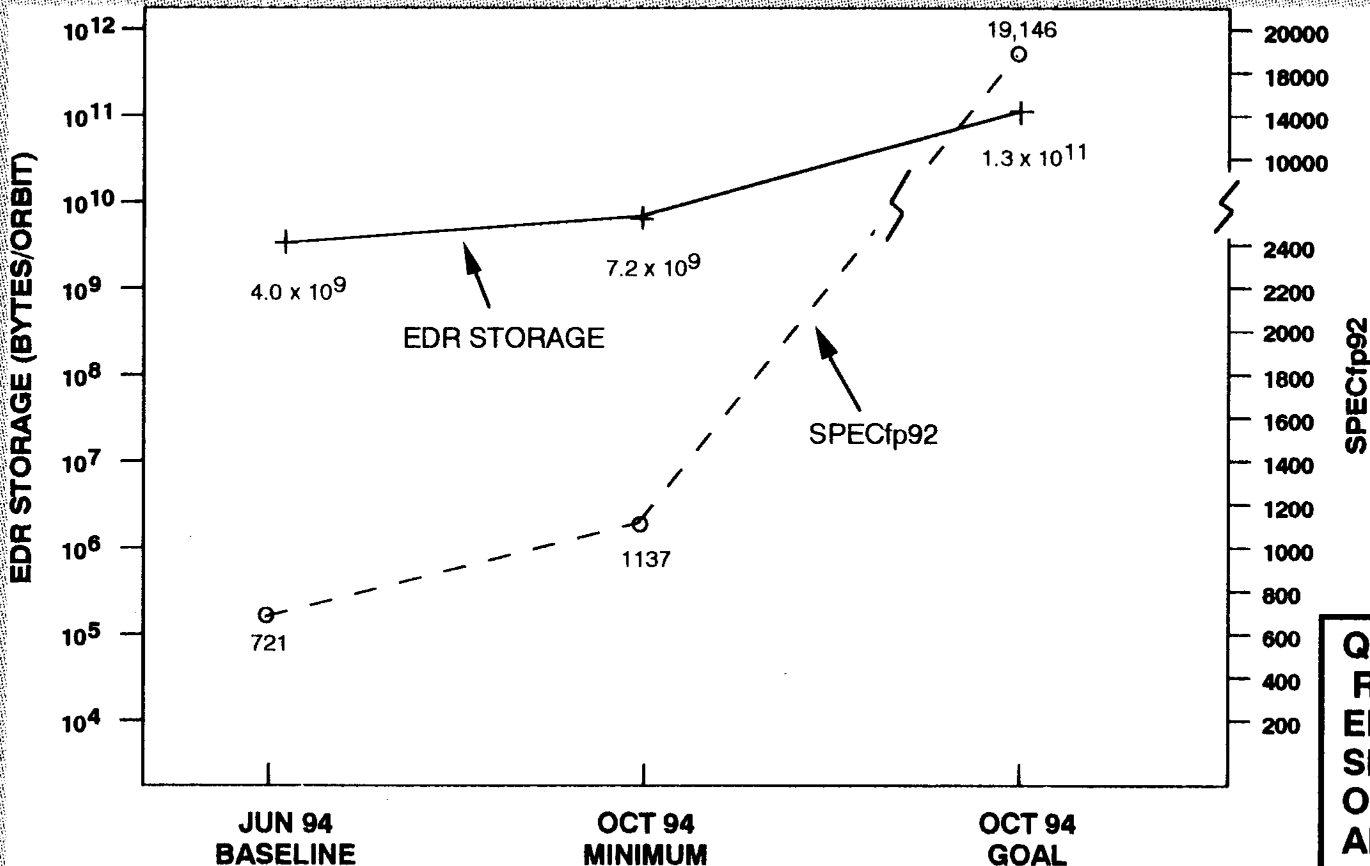

QUANTITY AND RESOLUTION OF EDRS HAVE A SIGNIFICANT IMPACT ON STORAGE AND PROCESSING

Note: 1 200MHz DEC Alpha CPU = 180 SPECfp92

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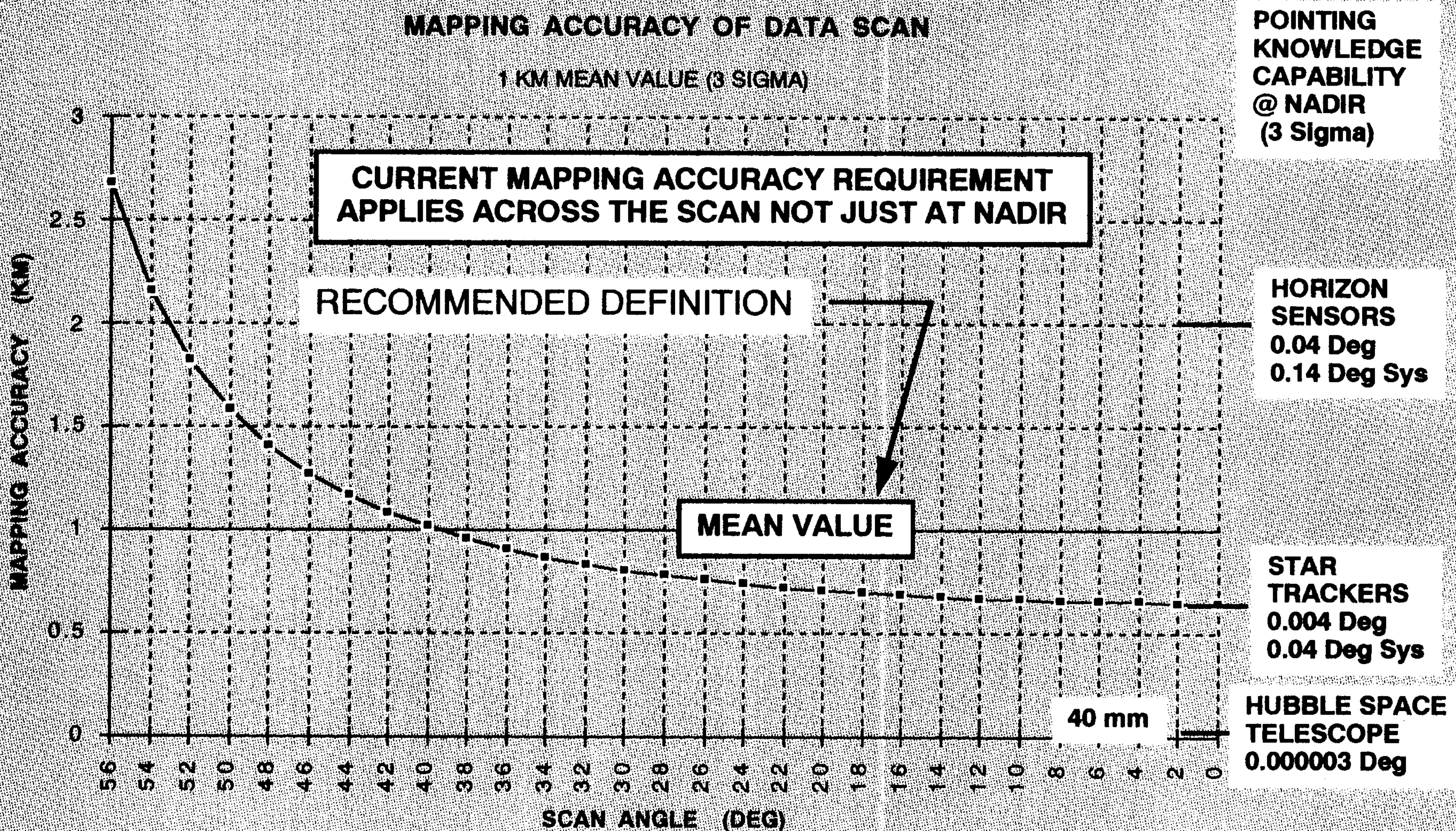
CROSSTRACK MAPPING CAPABILITY AND REQUIREMENTS DEFINITION



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SUMMARY OF EDR / SENSOR ISSUES AND CONCERNS

- RELATIVE WEIGHTS / PRIORITIES OF EDRs REQUIRED TO FOCUS TRADES
- MICROWAVE IMAGERY RESOLUTION REQUIREMENTS (ICE AND SNOW) FOR LESS THAN 50 km AT 19.5 GHz UNACHIEVABLE WITHOUT SIGNIFICANT IMPACT ON ANTENNA SIZE
- LAND AND SEA SURFACE TEMPERATURE GOALS UNACHIEVABLE
- SES EDR AND INSTRUMENT ISSUES IDENTIFIED

EO SENSOR / WAVELENGTH COMPARISON

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B/L: Indicates one of the 8-channels of the OMIS/VIRSR Baseline

NOMINAL WAVELENGTHS (nanometers or micrometers)

WAVE-LE / SENSOR	402-422 chloro-phyll	433-453 chloro-phyll	459-479 cloud	483-493 color	500-520 chloro-phyll	526-536 color	546-556 color	545-565 sedi-ments	605-625 clouds B/L	620-670 cloud	662-672 color	673-683 color	743-753 color	841-876 cloud	860-880 clouds B/L	890-920 water vapor	931-941 water vapor	915-965 water vapor	1.23-1.25 mm cloud	1.35-1.4 cirrus
CZCS		√			√		√				——		700-800							
SeaWifs	√	√		√	√			√			——		√		√					
MODIS	√	√	√	√		√	√	√		√	√	√	√	√	√	√	√	√	√	√
OMIS/VIRSR									√						√					
Advanced VIRSR	√	√						√	√						√					√

WAVE-LE / SENSOR	1.58-1.64 snow/ice B/L	2.105-2.155 cloud	3.55-3.93 cirrus SST B/L	3.93-3.99 cloud	3.93-3.99 cloud	4.02-4.08 cloud	4.43-4.50 atm temp	4.48-4.55 atm temp	6.54-6.90 water vapor	7.18-7.48 water vapor	8.4-8.7 cirrus SST B/L	9.58-9.88 ozone	10.3-11.3 clouds SST B/L	11.5-12.5 clouds SST B/L	13.19-13.49 cloud	13.49-13.79 cloud	13.79-14.09 cloud	14.09-14.39 cloud	0.4-1.0 clouds aurora B/L	
CZCS													——							
SeaWifs																				
MODIS	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		
OMIS/VIRSR	√		√								√		√	√					√	
Advanced VIRSR	√		√								√		√	√					√	

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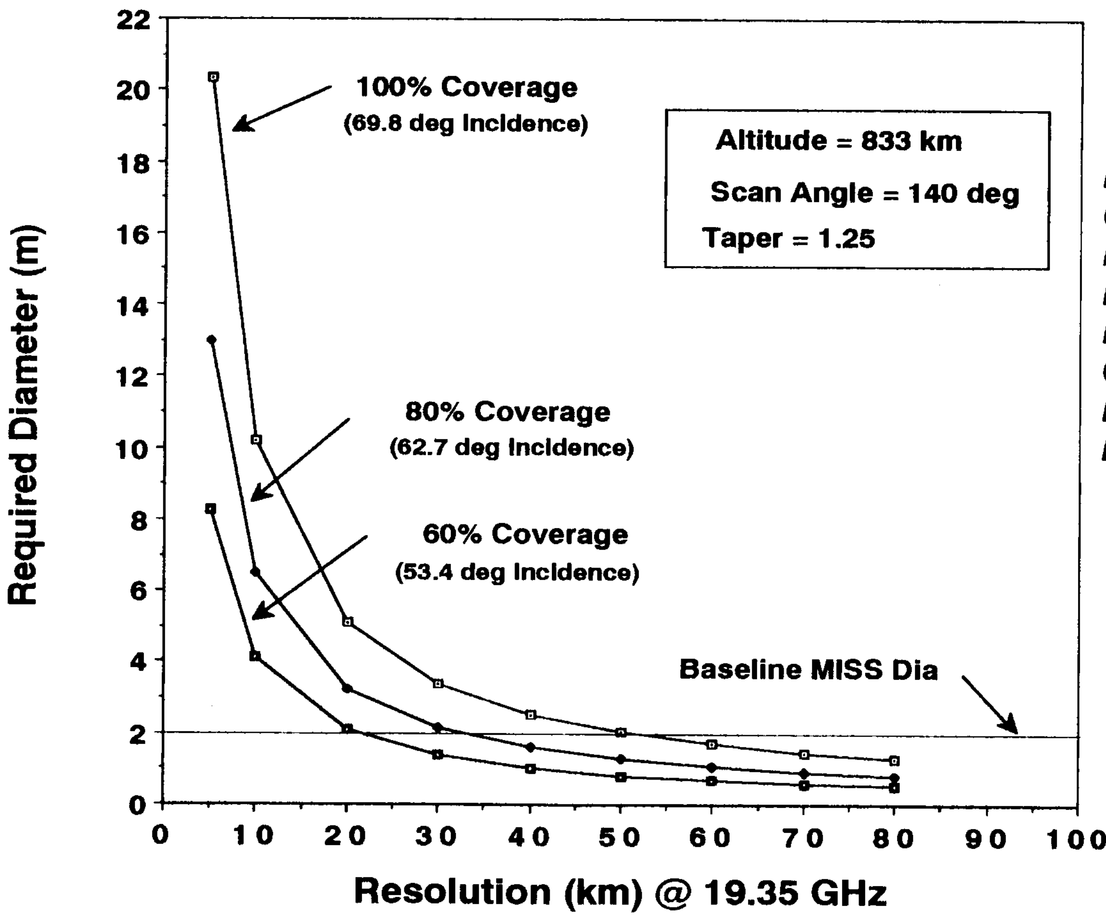
MICROWAVE IMAGERY SENSOR COMPARISON

PHYSICAL OBSERVABLE (maximum score given in parentheses)	SENSOR OPTION					
	AMSR	MIMR	MISS	SSM/I	SSMIS	TMI
Ocean Wind Speed (7)	7	7	4	4	4	7
Sea Ice - Edge (7)	7	7	7	7	7	7
Sea Ice - Concentration (7)	7	7	7	7	7	7
Sea Ice - Age (11)	11	11	8	8	8	8
Sea Ice - Thickness (1)	0	0	0	0	0	0
Sea Ice - Leads/Polynyas (7)	7	7	7	7	7	7
Sea Surface Temperature (10)	10	10	5	5	5	7
Soil Moisture (7)	4	4	2	2	2	3
Precipitation (over ocean) (8)	8	8	6	6	6	8
Precipitation (over land) (10)	8	8	10	8	10	8
Snow Cover / Depth (10)	10	10	8	8	8	9
Surface Type (6)	6	6	6	6	6	6
Cloud Liquid Water (7)	7	7	7	7	7	7
Snow Water Equivalence (9)	7	7	4	4	4	5
Fresh Water Ice Concentration (7)	7	7	7	7	7	7
Ice Surface Temperature (2)	2	2	0	0	0	0
Salinity (2)	0	0	0	0	0	0
MAX POSSIBLE SCORE: 117	108	108	88	86	88	96
Add 10 GHz to MISS: Score = 100	Score derived by: 3 points for critical frequency, 2 for important, 1 for helpful					

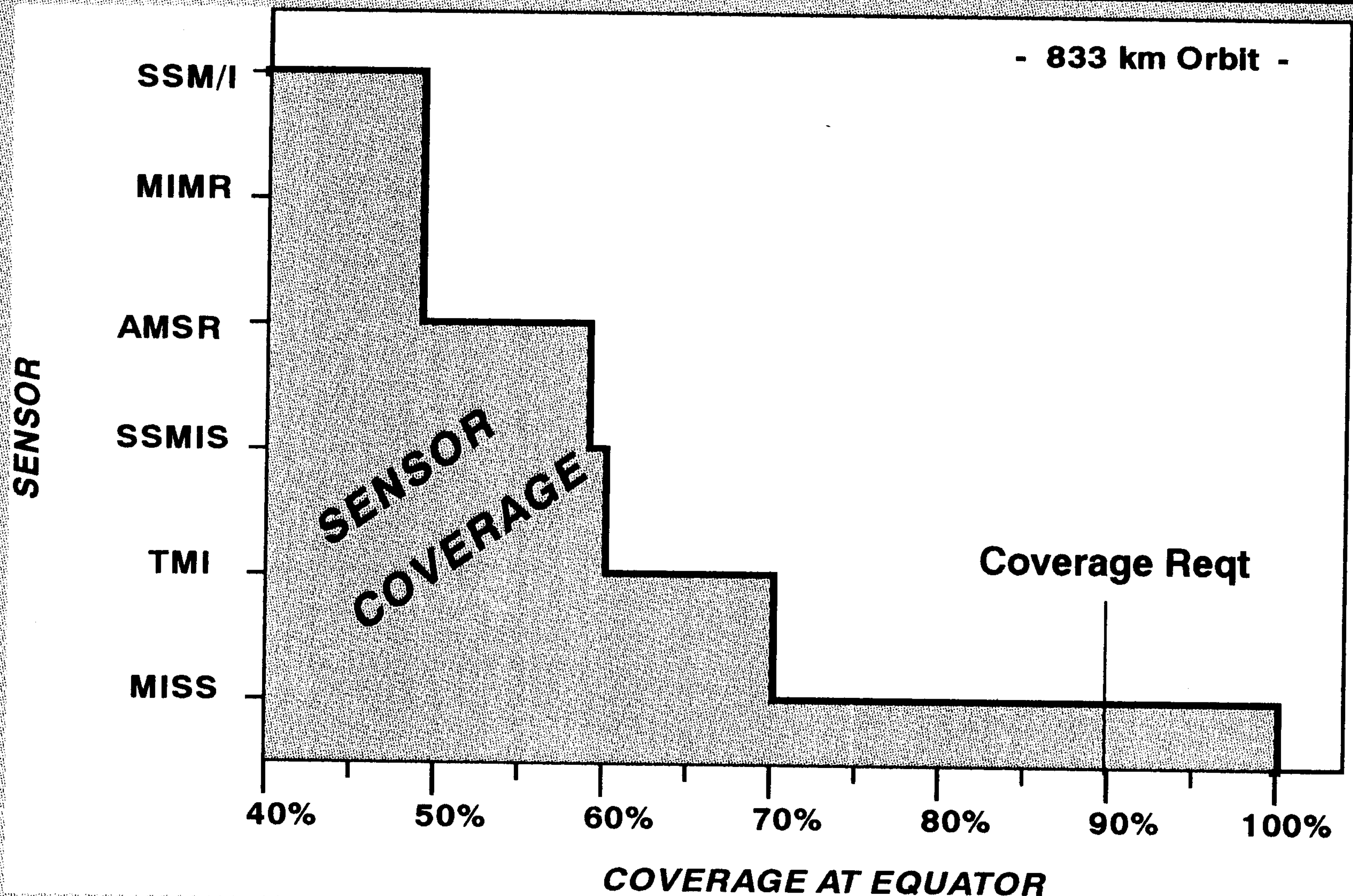
■ *NPOESS*

MICROWAVE CONICAL SCANNER SIZING OPTIONS vs RESOLUTION



HIGHER RESOLUTION CAN BE ACHIEVED FOR THE SAME DIAMETER ANTENNA BY REDUCING THE COVERAGE (AT THE EXPENSE OF AVERAGE REFRESH)

MICROWAVE IMAGERY SENSOR
- COVERAGE COMPARISON -



PRELIMINARY SEA SURFACE TEMPERATURE (SST) PARAMETRICS FOR E/O BANDS

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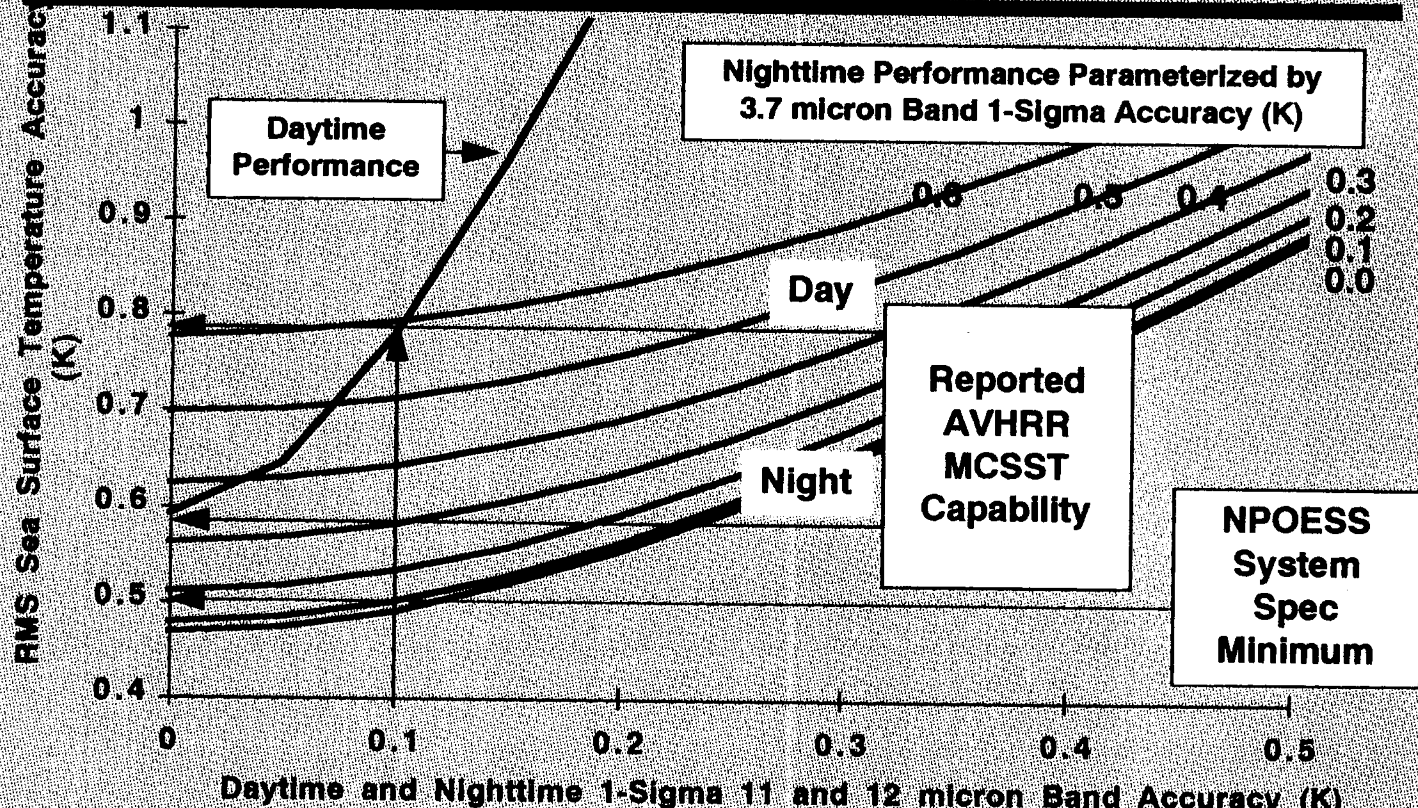

- NPOESS SYSTEM SPEC MINIMUM UNATTAINABLE USING E/O BANDS IN DAYTIME. ACHIEVABLE WITH 1-s ERROR OF 0.1 K AT 3.7 microns AND 0.1 K AT 11/12 microns AT NIGHT.
- GOAL OF 0.25 K IS UNATTAINABLE
- BASED ON RESULTS FROM McCLAIN, ET. AL., 1983

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SES INSTRUMENT ISSUES

EDR#	NAME	INSTRUMENT	COMPLEX	HERITAGE	non-NPOESS RESOURCES	MULTI USE
20.9.3 20.9.3.1 20.9.3.2 20.9.3.4	Auroral Imagery	ABIS	High	Yes	None	Yes
20.9.3.3 (new)	Optical Background	Cooled IR Radiometer	Medium	Yes	None	No
20.9.9	Electric Field	RPAD (upgrade)	Medium	Yes	None	Yes
20.9.10	Electron Density	GPSR + RPAD + ABIS + NADIS	GPSR = Low	Yes	None	Yes
20.9.13	Geomagnetic Field	VECMAG	Low	Yes	None	No
20.9.15 20.9.15.1 20.9.15.2 20.9.15.3 20.9.16.1	In-Situ Measurements	RPAD (upgrade)	Low	Yes	None	Yes
20.9.16	Scintillation	Multifrequency Radio Beacon	Medium	Yes	Ground Recvrs Reqd	No
20.9.22	Neutral Density	NADIS	High	Yes*	None	Yes
20.9.26 20.9.26.1 20.9.26.2 20.9.26.3 20.9.35	Energetic Particles	HEPS	High	Yes	None	No
20.9.33 (new)	Solar EUV	Whole Disk Imager	Medium	Yes	None	No

* not proven

WHITE BOXES HIGHLIGHT CRITICAL ISSUES

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SUMMARY OF C3-IDPS ISSUES AND CONCERNS

- FOUR REALTIME DATA LINKS REPRESENT
  - MULTIPLE USER CONSTITUENCIES
  - A COMPLICATION FOR OBP
  - A COMPELLING NEED FOR DATA COMPRESSION
- C3 / IDPS ARCHITECTURE ALTERNATIVES
  - CAN SAVE 30 - 50 % OF C3 LCC
  - CENTRALIZED PROCESSING AND TDRSS CAN SAVE ~ 80% C3 LCC
- C2 ALTERNATIVES CAN
  - PROVIDE EUMETSAT I / F FOR O2 DRR
  - RE-ALLOCATE FVSF FUNCTIONS WITHIN SOC
- COTS USAGE CAN REDUCE SOC - RELATED COSTS
- NOAA - LIKE SOC MANNING REDUCES COSTS

POLICY DECISIONS IMPACT SYSTEM PERFORMANCE

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POLICY ON GROUND STATIONS	POLICY ON C2 OF EUROPEAN O2	USEABILITY OF EUROPEAN O2 IN NPOESS	DATA AVAILABILITY COMPLIANCE	DATA REFRESH COMPLIANCE
U.S. ONLY (THULE, FAIRBANKS, OTHER RTS/CDAs)	U.S. B/U O2 C2 CAPABILITY	YES	YES	YES FOR 4 HR REQ'T
	NO U.S. B/U O2 C2 CAPABILITY	EUROPEAN O2 CONTROL VIA U.S. SITES	YES	YES FOR 4 HR REQ'T
		NO EUROPEAN O2 CONTROL VIA U.S. SITES	O1 & O3 ONLY	NEEDS U.S. O2 TO MEET 4 HR
U.S. PLUS EUROPEAN (THULE, FAIRBANKS, KIRUNA)	U.S. B/U O2 C2 CAPABILITY	YES	YES *	YES FOR 4 HR REQ'T
	NO U.S. B/U O2 C2 CAPABILITY	EUROPEAN O2 CONTROL VIA U.S. SITES	YES *	YES FOR 4 HR REQ'T
		NO EUROPEAN O2 CONTROL VIA U.S. SITES	O1 & O3 ONLY *	NEEDS U.S. O2 TO MEET 4 HR

* WHEN U.S. SITES ARE NOT AVAILABLE, NEEDS 1) ESOC B/U C2 OF U.S. O1 & O3 OR 2) U.S. C2 OF O1/O3 VIA EUROPEAN SITE

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RECOMMENDATIONS

- SUPPORT CONVERGENCE, IT'S STILL A NATIONAL GOAL
- INSURE PHASE ZERO TRACES LCC AND DOCUMENTS CREDIBLE COST SAVINGS
- PREPARE NOW FOR A CONVERGED DEM-VAL IN EARLY FY 96
- START OPERATIONS CONCEPT DEVELOPMENT EARLY
- SUPPORT IN-DEPTH REQUIREMENTS ANALYSIS AND END-TO-END SOLUTIONS