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RAQUEL II SYSTEM CONCEPT REVIEW

(4, 5, 6 December 1974)

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Approved by [redacted] 25X1

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DATE OF REVISION PAGES: 74 Dec 16

BIF: 074771-74 Adden A

SHEETS: 27 (SHEET COUNT OF REVISION/ADDENDUM PAGES ONLY)

REPORT CHANGE RECORD FOR ➨ RAQUEL II System Concept Review

The following additions, revisions, or errata corrections, shall be incorporated into the document identified above. This Report Change Record sheet should be inserted as the first page of the affected document preceding the title page.

ADDENDUM PAGE	REVISION REMOVE PAGE	REVISION INSERT PAGE	ERRATA INSERT PAGE	REVISION OR ERRATA CORRECTION (CORRECT IN INK)	CORRECTIONS MADE INITIALS	CORRECTIONS MADE DATE
Title Page					A.C.L.	12/23/74
A-1 thru A-26					↓	↓

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~~WORKING MATERIAL~~

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~~74 DECEMBER 4~~
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NO OF PAGES____

1) 64 bit word?
2) Power limited?
3) 1 guy for MROs
4) Write up on Band 5

RAQUEL II SYSTEM CONCEPT REVIEW

25X1

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~~WORKING MATERIAL~~

FOREWORD

This document contains reprints of the visual material presented at the RAQUEL II System Concept Review held at LMSC on 4, 5, and 6 December 1974.

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WORKING MATERIAL

RAQUEL II SYSTEM CONCEPT REVIEW

(4, 5, 6 December 1974)

AGENDA

Wednesday, 4 December

Subject	Time
RAQUEL II Study Overview	0900 - 1100
RF Signal Environment	1100 - 1200
(Lunch 1200 - 1300)	
Payload RF Subsystem	1300 - 1400
RF Front Ends	
Measurement/Monitor Tuners	
RF Dynamic Range	
Receiver Tune-Up Scenario	
Signal Recognition/Data Rate Controls	1400 - 1430
Pulse/CW Demodulators	1430 - 1500
Signal Measurements	
Geoposition Study	1500 - 1715
Antenna Hardware	
Payload Hardware	
Data Processing Algorithms/Procedures	

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WORKING MATERIAL

RAQUEL II SYSTEM CONCEPT REVIEW (CONT.)

Thursday, 5 December

Subject	Time
Power Measurement	0830 - 1030
Antenna Hardware	
Payload Hardware	
Data Processing Algorithms/Procedures	
Digital System	1030 - 1400
Payload Digital System and PCM Format	
In-Line/Off-Line Digital Processing	
(Lunch 1200 - 1300)	Data Link at 1300
Analog System	1400 - 1600
Payload Hardware	
TI Receiver Tune-Up Scenario	
BWC/Format	
Pre-D Channel Dynamic Range	
Data Processing Approach and Hardware	
Carrier Coherency	1600 - 1730
Introduction	
Error Sources	
Processing Techniques - Digital/Analog	

Friday, 6 December

System Calibration	0830 - 1130
Internal Test Signal Generator and Power Meter	

RAQUEL II SYSTEM CONCEPT REVIEW (CONT.)

Friday, 6 December

Subject	Time
TSG Scenario	
Ground Test/Calibration Philosophy	
Test Equipment	
On-Orbit Calibration	
(Lunch 1130 - 1230)	
Spacecraft System Engineering	1230 - 1330
Weight	
Host Vehicle Launch Side (+Y or -Y)	
Altitude	
Redundancy	
System Tasking and Mission Planning	1330 - 1500
Power Available	
Command Requirements	
Mission Planning	
Typical Scenario	
Data Link	1500 - 1530
Format	
Pre-emphasis/Filtering	
Readin/Readout Circuits	
Data Recovery	
Meeting Summary/Action Items	1530 - 1600

1300 ?

RAQUEL II STUDY MILESTONES

- SYSTEM COST ANALYSIS STARTED DEC 2, 1974
- SECOND CONCEPT REVIEW SCHEDULED DEC 4-6, 1974
- SPECIFICATION REVIEW SCHEDULED JAN 8, 1975
- FINAL CONCEPT REVIEW SCHEDULED JAN 28, 1975
- SUBMISSION OF COST PROPOSAL SCHEDULED FEB 4, 1975

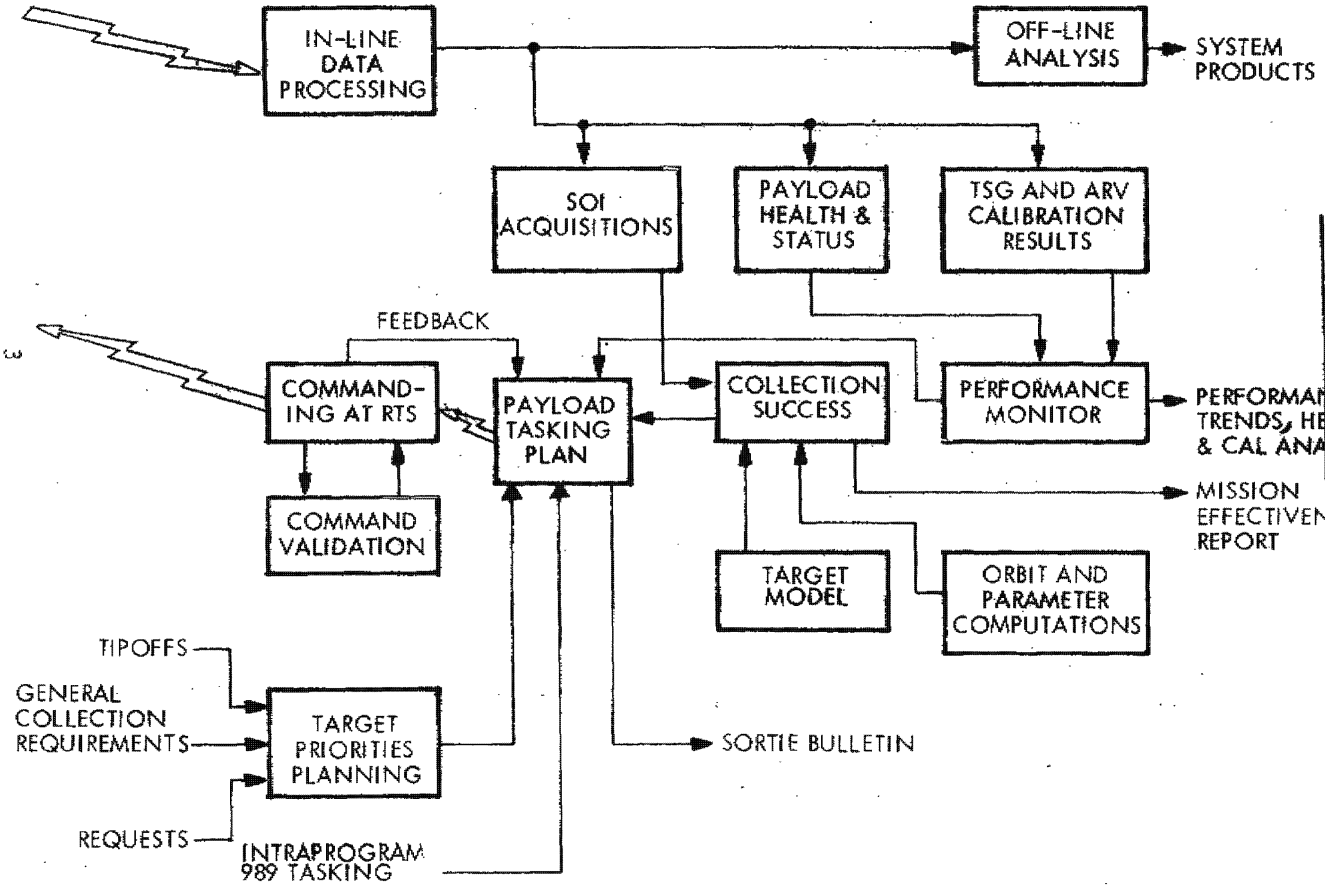
RAQUEL II MISSION REQUIREMENT

- CAPABILITY
  DIRECTED COVERAGE AND EMITTER TECHNICAL INTELLIGENCE, 1.5 TO 10 GHz

- REQUIRED MEASUREMENTS
  - FREQUENCY
  - TIME OF MEASUREMENT
  - PULSEWIDTH (OR CW MOD)
  - PULSE-TO-PULSE PHASE
  - RHCP AMPLITUDE
  - LHCP AMPLITUDE
  - POLARIMETER PHASE
  - INTERFEROMETER PHASE

- DERIVED QUANTITIES
  - FREQUENCY
  - GEOLOCATION
  - EMITTER TRANSMITTED POWER
  - ANTENNA BEAM PATTERNS
  - ANTENNA POLARIZATION CHARACTERISTICS
  - EMITTER SCAN PATTERN
  - INTRAPULSE MODULATION
  - PULSE REPETITION CHARACTERISTICS
  - CW CHARACTERISTICS
  - POTENTIAL FOR COHERENT PROCESSING
  - WEAPON SYSTEM CHARACTERISTICS

MISSION PLANNING CONCEPT



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ARV FUNCTIONAL REQUIREMENTS

PRIME POWER RESOURCES

SPACECRAFT EPHEMERIS ACCURACY

ANTENNA SIZE

TRACKING TECHNIQUES

SIGNAL MODULATION REQUIREMENTS

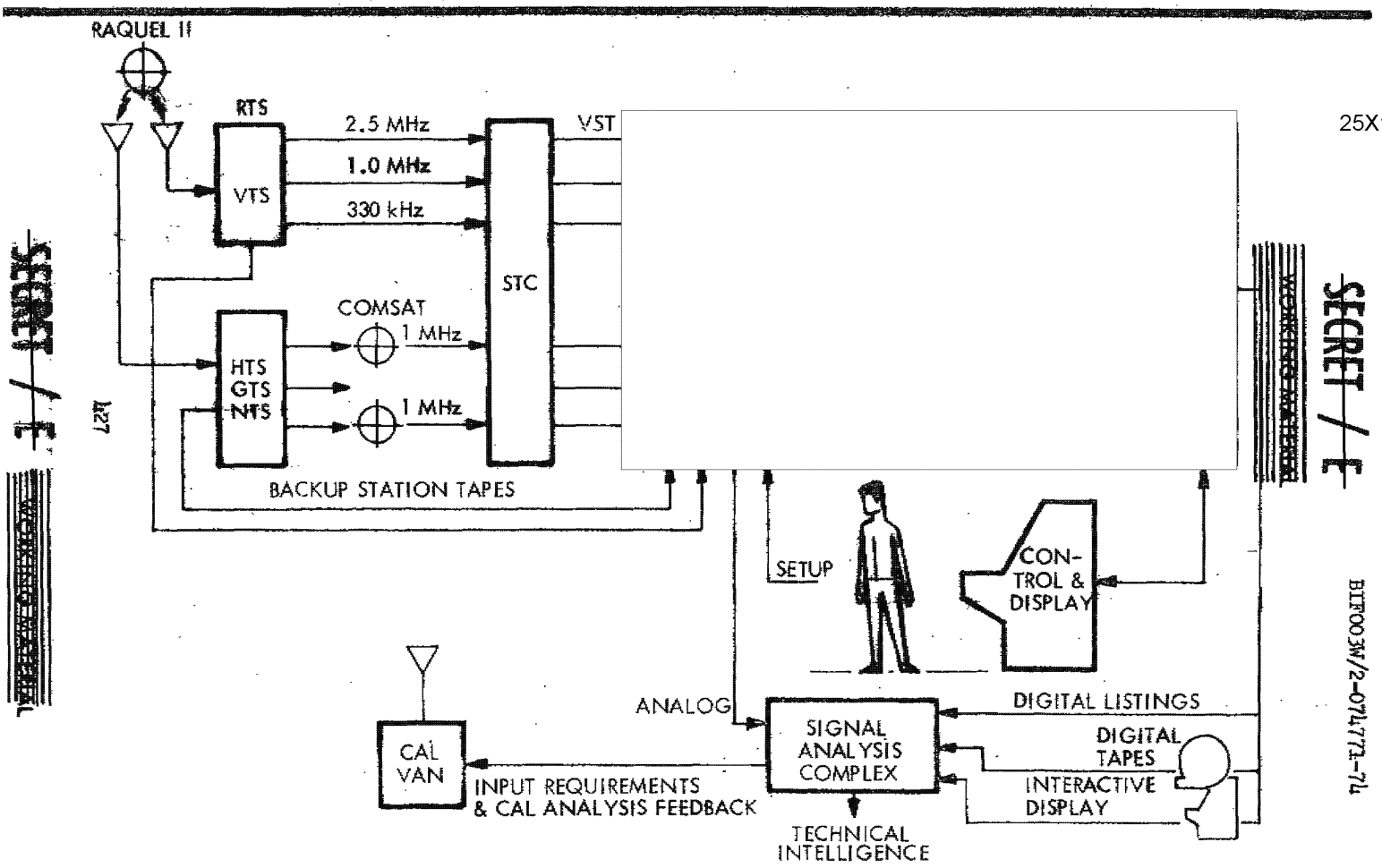
SIGNAL STABILITY

PATTERN SHAPE AND BEAM-POINTING ACCURACY

NOISE ENVIRONMENT

FREQUENCY OF CALIBRATION EXERCISES

GROUND DATA COLLECTION AND CONTROL



POWER ESTIMATE

RF CONVERTERS	18.0 WATTS
TUNE SUBSYSTEMS	14.6
TSG	LOW DUTY CYCLE
PULSE MONITOR DEMOD CW MONITOR DEMOD	} 11.3
PULSE MEASUREMENT DEMOD CW MEASUREMENT DEMOD	} 7.9
TI RECEIVER	5.8
FINE MEASUREMENT	2.2
COHERENT LO	29.1
DATA HANDLER	14.0
RECORD/PLAYBACK	0.2 (R/I)
POWER SUPPLY	25.8 (80%)
TOTAL	128.9 WATTS

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POWER AVAILABLE & TASKING CAPABILITY

- **POWER AVAILABLE**
  - BEST CASE ($\gamma = 100^{\circ}$, 100% SUN) 1053 W-HRS/DAY

		PERCENT INCREASE
– WORST CASE		
280 NM ($\gamma = 140^{\circ}$, 62% SUN)	317 W-HRS/DAY	–
350 NM ($\gamma = 140^{\circ}$, 64.17% SUN)	328 W-HRS/DAY	3.5

- **TASKING CAPABILITY**

	ALTITUDE (NM)	TASKING MODE (MIN/DAY) 4:1	2:1	1:1
– BEST CASE (DUAL R/O)	280	275	227	166
	350	275	227	166
– BEST CASE (SINGLE R/O)	280	255	200	140
	350	255	200	140
– WORST CASE (DUAL R/O)	280	83	68	50
	350	86	70.3	51.7
– WORST CASE (SINGLE R/O)	280	76	60	42
	350	78.6	62.1	43.4

MEMORY ORGANIZATION

- 4 MEMORY BANKS OF 96 BITS EACH
- 15 PARAMETER BLOCKS OF 96 BITS EACH
- 10 RTC'S (WITH SUBCOMMANDS)
  - EACH PE IS ASSIGNED A MEMORY BANK
  - EACH MEMORY BANK CONTAINS 5 POINTERS
  - EACH POINTER SELECTS A PARAMETER BLOCK FOR A GIVEN RECEIVER
  - DATA NOT SPECIFIED IN A PARAMETER BLOCK IS DEFINED IN MEMORY BANK
  - RTC'S (AND THEIR SUBCOMMANDS) DIRECTLY CONTROL LATCHING RELAYS, SO THAT NO PAYLOAD POWER IS REQUIRED TO ACCEPT THESE COMMANDS

RTC'S

RTC	DEVICE	STATES
01XX	STATUS DATA	ON
	TELEMETRY - MODES	ON
02XX	TELEMETRY - MODES	OFF
	STATUS DATA	OFF
	T/R R/O	STOP
03XX	T/R NO. 1	R/O
	T/R NO. 2	R/O
	T/R NO. 3	R/O
06XX	BBU NO. 1 OUTPUT	TRANSMITTER 1/3
	BBU NO. 2 OUTPUT	TRANSMITTER 2/3
	OUTPUTS INTERCHANGED	ENABLE/DISABLE
10XX	T/R NO. 1 RATIO	1:1 / 4:1
11XX	T/R NO. 2 RATIO	1:1 / 4:1
12XX	T/R NO. 3 RATIO	1:1 / 4:1
13XX	T/R BYPASS	ENABLE/DISABLE
	R/O PLUS BYPASS	ENABLE/DISABLE

PRIMARY MISSION PLANNING FUNCTIONS

INPUT	ACTIVITY	OUTPUTS
• PUBLISHED TARGET PRIORITIES • ROLE OF COLLECTION SYSTEM • MODELS (ENVIRON & SC) • TARGET MODEL • USER DIRECTION • EPHEMERIS • SCORING METHODS • INTRA PROGRAM 989 TASKING	SORTIE PLANNING	• TARGETING AND OPERATIONS PLAN • SORTIE BULLETIN
	TASKING GUIDANCE	• DETAIL COMMANDING TO SCF
• INTERCEPT DATA • ANALYTICAL • USER DIRECTION • SCORING METHODS	COLLECTION SUCCESS	• MISSION EFFECTIVENESS REPORT • SORTIE EVALUATION REPORTS
• HEALTH CHECKS • CALIBRATION PASS RESULTS • CALIBRATION HISTORY • CALIBRATION FACILITY ACCURACIES	PERFORMANCE MONITORING	• SYSTEM PERFORMANCE TRENDS REPORT • HEALTH AND CALIBRATION ANALYSIS REPORT • BIAS REPORT

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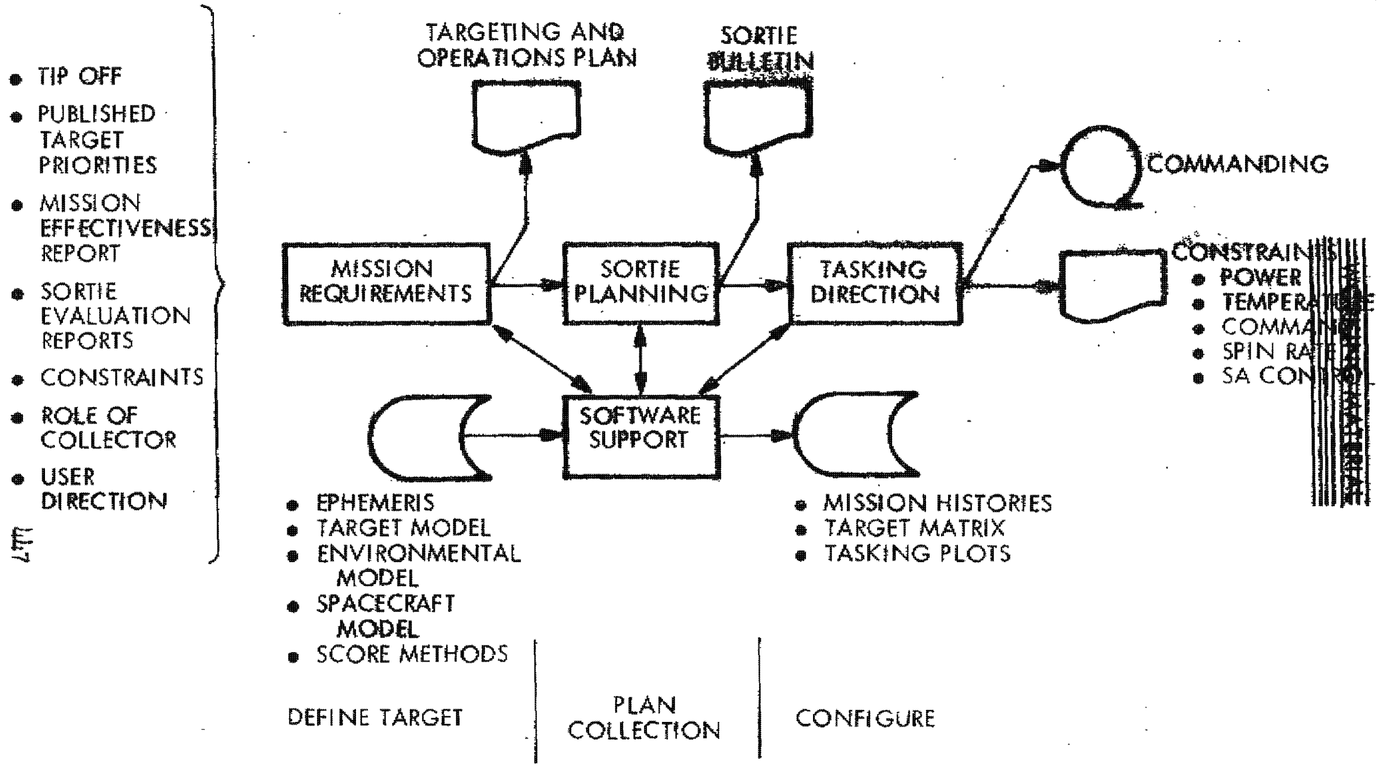
MISSION PLANNING


TIP OFF
PUBLISHED TARGET PRIORITIES
MISSION EFFECTIVENESS REPORT
SORTIE EVALUATION REPORTS
CONSTRAINTS
ROLE OF COLLECTOR
USER DIRECTION
TARGETING AND OPERATIONS PLAN
SORTIE BULLETIN
COMMANDING
MISSION REQUIREMENTS
SORTIE PLANNING
TASKING DIRECTION
POWER
SOFTWARE SUPPORT
EPHEMERIS
TARGET MODEL
ENVIRONMENTAL MODEL
SPACECRAFT MODEL
SCORE METHODS
MISSION HISTORIES
TARGET MATRIX
TASKING PLOTS
DEFINE TARGET
PLAN COLLECTION
CONFIGURE

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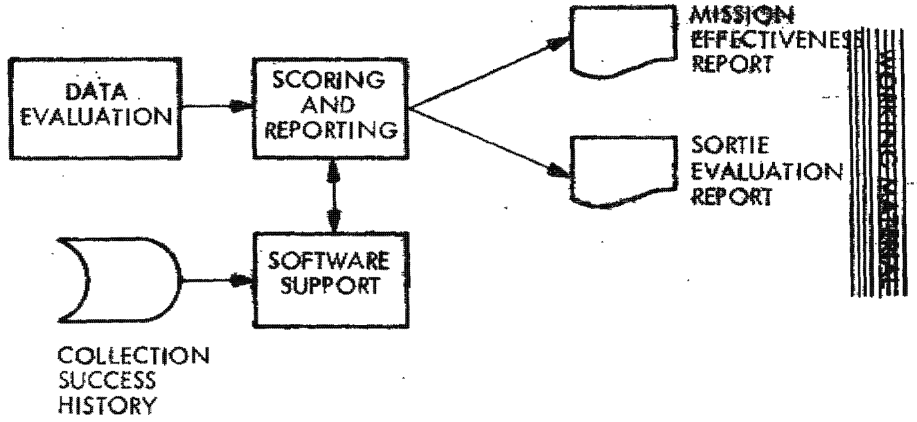
COLLECTION SUCCESS

- TARGETING AND OPERATIONS PLAN
- SORTIE BULLETIN
- COLLECTION RESULTS
  - IN LINE
  - OFF LINE
- USER DIRECTION
- SCORING METHOD



EVALUATE | REPORT

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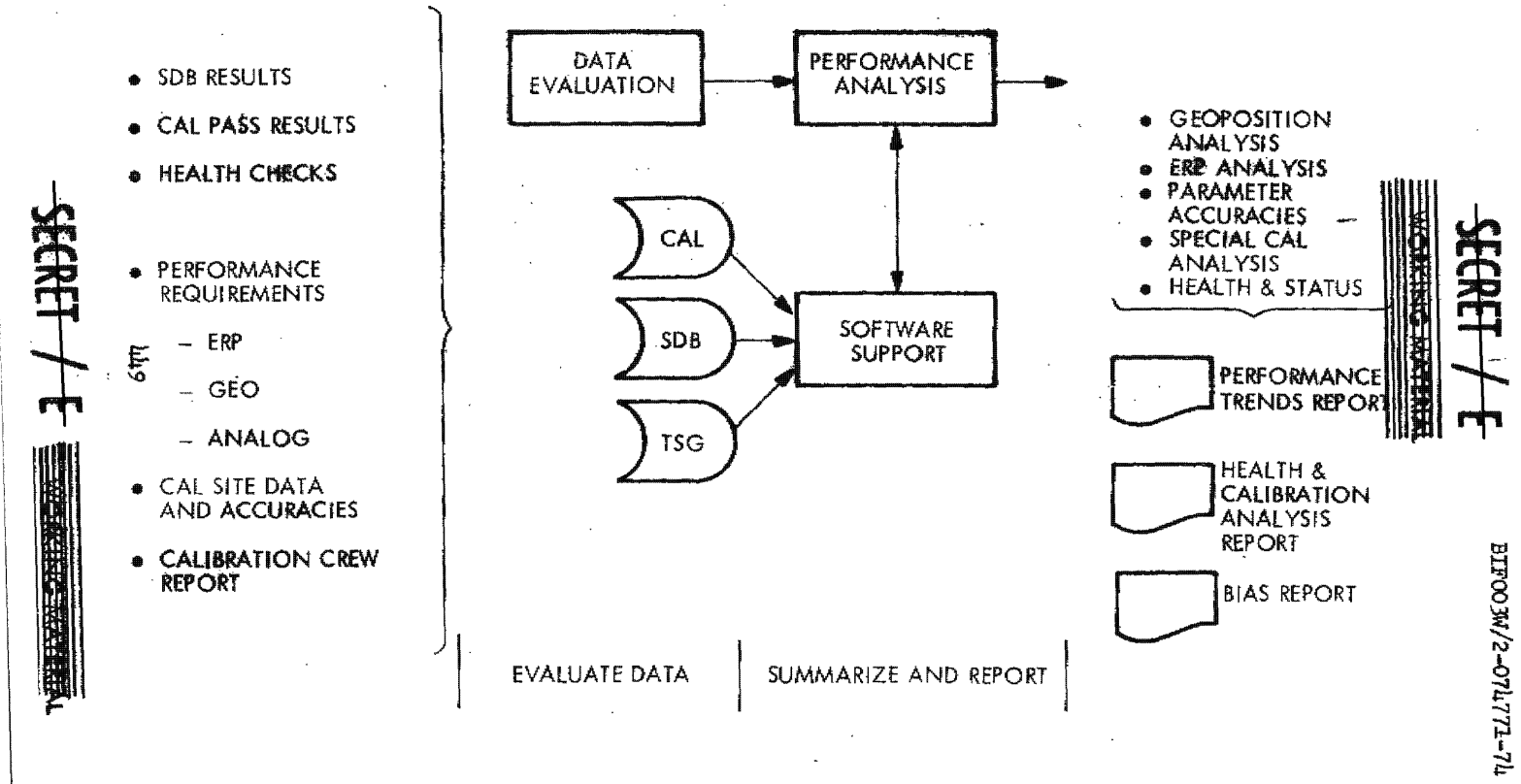
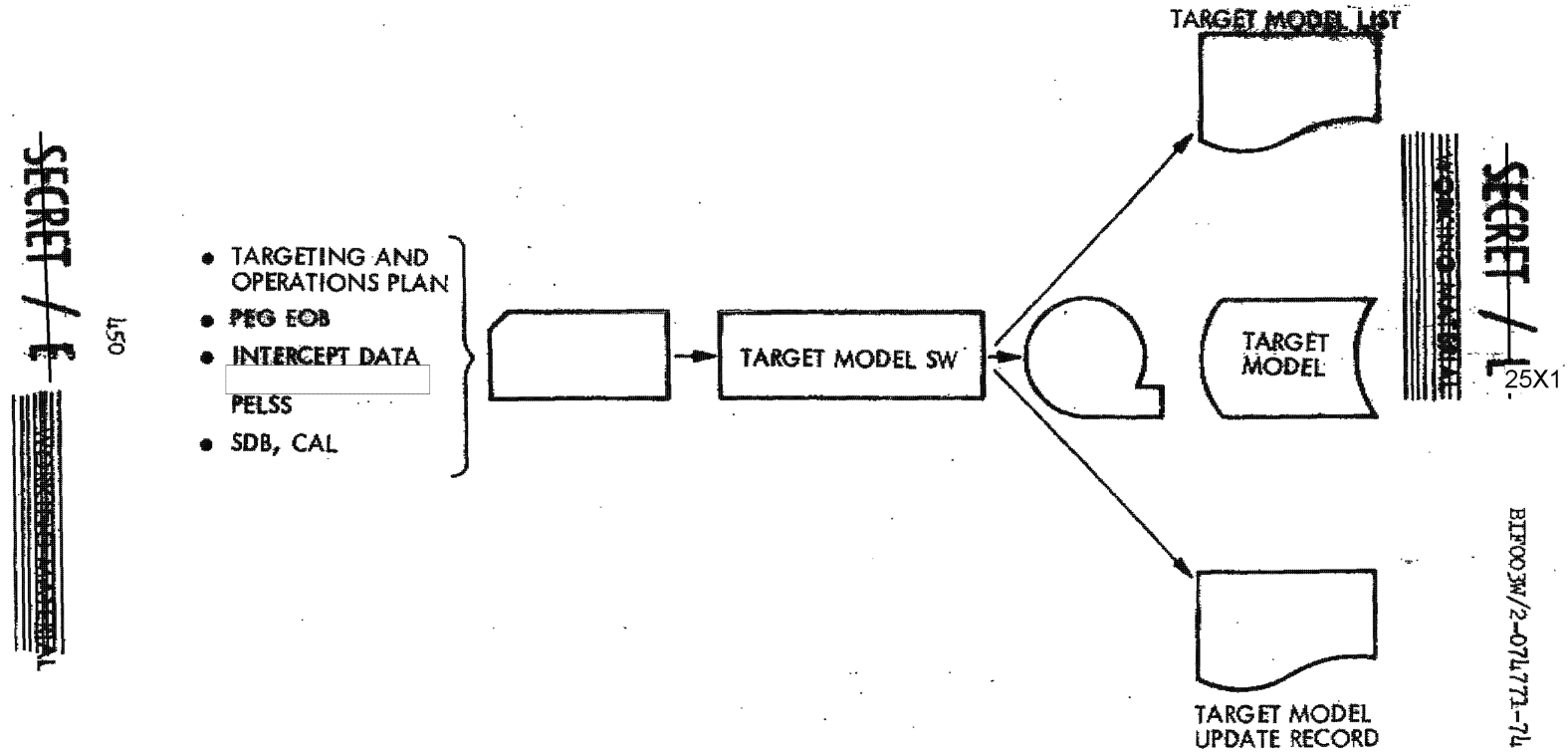
PERFORMANCE MONITORING



CENTRAL FACILITY MISSION PLANNING SOFTWARE SUPPORT



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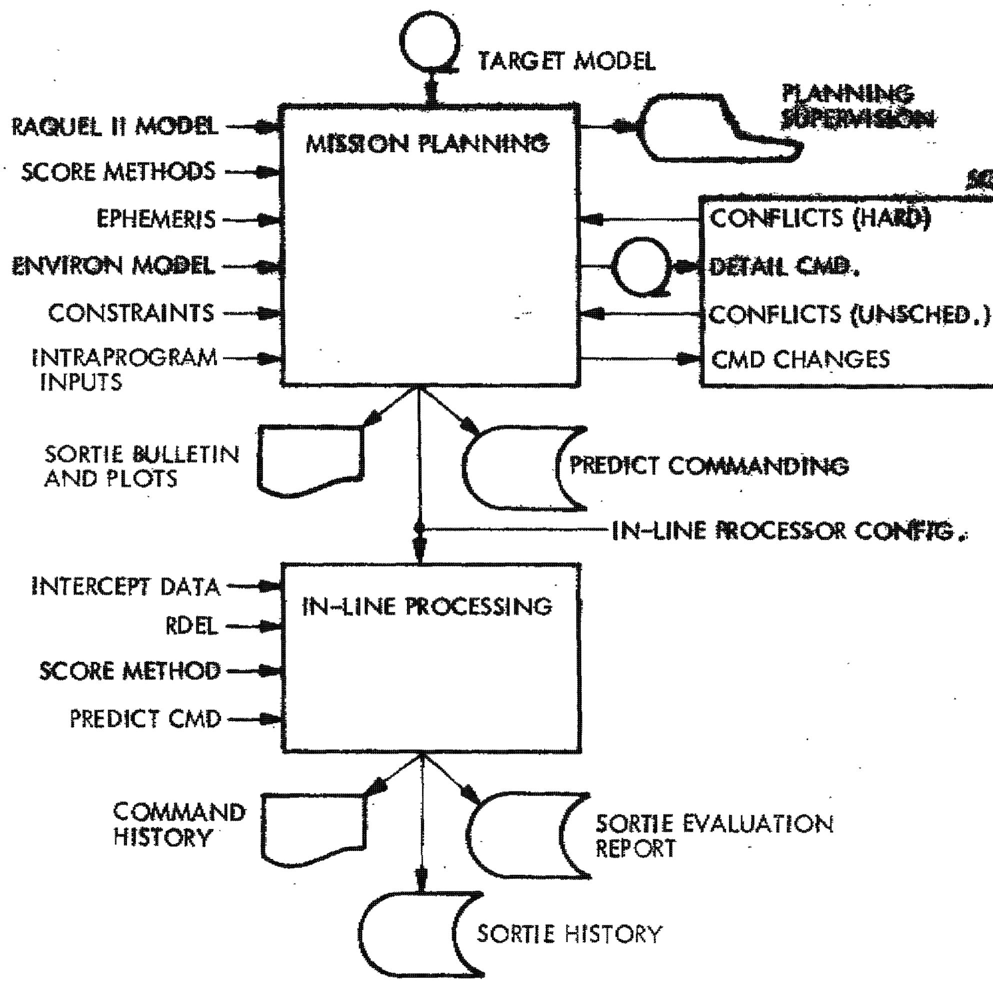

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MISSION PLANNING ITEMS IN WORK

1. SCORING TECHNIQUES
   - SORTIE PLANNING
   - SORTIE EVALUATION
2. RCASP INTERFACE
3. DETAIL REPORT CONTENTS

MAJOR DIFFERENCES BETWEEN RAQUEL I AND RAQUEL II

HARDWARE

- TSSE
  - USE OF SYNTHESIZER AS ONE RF SET
  - MORE SOPHISTICATED POWER MEASUREMENT/CONTROL CALIBRATION SCHEME
  - PROVISION FOR RELATIVE PHASE AND RELATIVE AMPLITUDE
  - DYNAMIC PHASE SIMULATOR
  - TSSE MEASURED PARAMETERS AND STATUS INTO SYSTEM SUBCOM DATA ELIMINATED, EXCEPT FOR SOFTWARE INSERTED TEST SEQUENCE NUMBER
  - GREATER RF POWER DYNAMIC RANGE
  - PHASE CALIBRATION
  - DISCRETE PARAMETER CONTROL

- DPDE
  - DEDICATED EUD IMPLEMENTED USING MICROPROCESSOR
  - INCORPORATION OF SERIAL COMMUNICATOR BETWEEN DPDE/CCMU
  - OFF-LINE COMPUTER
  - PRE-D PROCESSOR

- CCMU
  - MERGE ANECHOIC INFORMATION INTO SYSTEM PCM

MAJOR DIFFERENCES BETWEEN RAQUEL I AND RAQUEL II (Continued)

SOFTWARE

- TSSE
  - STAND-ALONE CAPABILITIES FOR INITIALIZATION AND CALIBRATION
  - 2 RF AMPLITUDE CALIBRATION TABLES AND 1 PHASE CALIBRATION TABLE
- DPDE
  - ALGORITHM TO COMPUTE RMS PHASE ERROR (NOISE)
  - TEST PROGRAM CODING ERRORS TO BE OUTPUT BEFORE RUNNING TESTS
  - LOOPING CAPABILITY FOR COMMANDS TO CHANGE RF FREQUENCY
  - "IF" CAPABILITY TO ALLOW TESTING SYSTEM DATA OR TSSE PARAMETERS FOR SPECIFIC VALUES, THEN CONTINUOUS OR JUMP BASED ON TEST RESULTS
  - ORDER OF MAGNITUDE INCREASE IN PLOTTING SPEED
  - PRINT SGLS DATA
  - SYNCHRONOUS TEST PROGRAM CONTROL OPTION

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ON-ORBIT CALIBRATION FACILITY

- PURPOSE

  PROVIDE A MEANS TO VERIFY AND/OR TEMPER THE DESIGN TRANSFER FUNCTIONS UTILIZED TO DESCRIBE THE SYSTEM'S PARAMETRIC MEASUREMENTS.

- OBJECTIVE

  DEVISE A TESTING SCHEME WHEREBY THE ON-ORBIT CHARACTERISTICS OF THE SYSTEM CAN BE VERIFIED OR RECONCILED WITH THE PRELAUNCH CALIBRATION DATA BASE AND THE ON-BOARD TEST SIGNAL GENERATOR.

- STUDY

  DEFINE EQUIPMENT REQUIREMENTS NECESSARY TO GENERATE, MEASURE, AND RADIATED RF SIGNALS; TO EXERCISE ALL MAJOR PAYLOAD FUNCTIONS; AND PERMIT CALIBRATION OF EACH PARAMETRIC MEASUREMENT.

RAQUEL II CONCEPT REVIEW

25X1

WEDNESDAY, DECEMBER 4

0900-1100 RAQUEL Study Overview

1100-1200 RF Signal Environment

1300-1400 P/L RF Subsystem

1400-1430 Signal Recognition/Data Rate Controls

1430-1500 Pulse/CW Demodulator

1500-1715 Geoposition Study

Antenna Hardware

P/L Hardware

Data Processing Algorithms/Procedures

- Ambiguity Resolution
- Error Analysis Math Model
- Geolocation Method

THURSDAY, DECEMBER 5

0830-1030 Power Measurement

Propagation Effects

Antenna Hardware

P/L Hardware House

Processing Algorithms

ERP and Antenna Beam Pattern

1030-1400	Digital Systems
	P/L Digital System & PCM Format
	In-line/Off-line Digital Processing
	Mission Planning
	Collection Success
	Antenna Calibration Processing
	In-line Processing
	Off-line Processing
	Dedicated Computer
1400-1600	Analog Systems
	P/L Hardware
	BWC
	Predetection Channel Dynamic Range
	Data Processing Approach and Hardware
1600-1730	Carrier Coherency
	Introduction
	Techniques
	Data Description
	Error Sources
	Analysis of Techniques
	Digital Processing
	Analog Processing

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FRIDAY, DECEMBER 6

0830-1130	System Calibration
	Ground Test/Cal Philosophy
	Test Equipment
	Internal TSG and Power Meter
1230-1330	Spacecraft System Engineering
	Weight
	Heat Vehicle Launch Side
	Altitude
	Redundancy
1330-1500	System Tasking and Mission Planning
	Power Available
	Command Requirements
	Mission Planning
	Typical Scenario
1500-1530	Data Link
	Link Calc
	Format
	Preemphasis/Filtering
	R/I - R/O Circuits
	Data Recovery
1530-1600	Meeting Summary/Action Item

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