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Control Systems Jointly

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RUFF/DORIAN

COMOR-D-13/70.1

16 December 1966


MEMORANDUM FOR: Committee on Overhead Reconnaissance
SUBJECT: Satellite Photo Reconnaissance Systems --
Briefings on DORIAN and ZAMAN

Attached for your information are reproductions of the boards used in the DORIAN and ZAMAN briefings presented to COMOR on 6 October (COMOR-M-384, paras 2-6).



Executive Secretary
Committee on Overhead Reconnaissance

Attachments:
Subject briefings

Copies 2, 3	State TCO
4	DIA 
5, 6, 7, 8	DIA TCO
9, 10	OACSI TCO
11, 12	ONI TCO
13, 14, 15, 16	AFNIN TCO
17, 18	NSA TCO
19, 20, 21	NRO TCO

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GROUP 1
Excluded from automatic
downgrading and declassification

RUFF/DORIAN

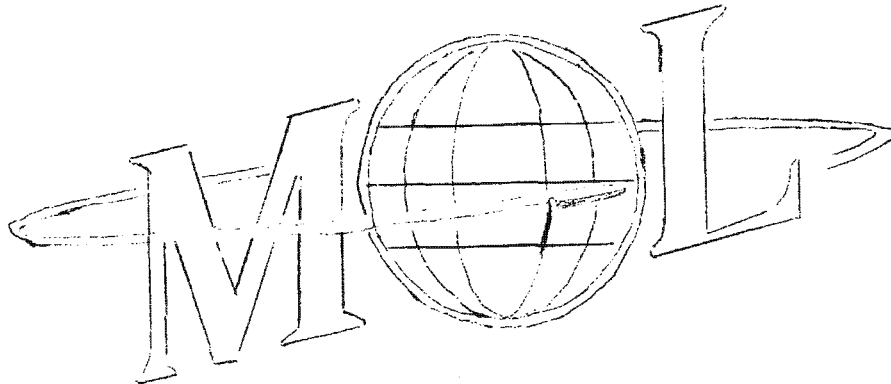
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M A N N E D O R B I T I N G L A B O R A T O R Y

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MOL PROGRAM OBJECTIVES

- o VERY HIGH RESOLUTION ([REDACTED] MANNED OR UNMANNED) OPTICAL RECONNAISSANCE PHOTOGRAPHY TO SATISFY VITAL NATIONAL REQUIREMENTS FOR:
 - TECHNICAL INTELLIGENCE
- PLUS
- TACTICAL PHOTOGRAPHY DURING CRISIS.
- POLICING ARMS CONTROL AGREEMENTS
- CREDIBLE AND DETAILED PHOTOGRAPHY OF SUSPECT ACTIVITY WITHOUT PROVOCATION OF VISIBLE OVERFLIGHT.
- o KNOWLEDGE OF THE NATURE AND VALUE OF CRITICAL CONTRIBUTIONS OF MAN TO PHOTOGRAPHIC RECONNAISSANCE AND TO OTHER MILITARY RELATED SPACE MISSIONS
- o OPTICAL TECHNOLOGY AND DESIGNS FOR SYSTEMS WHICH CAN GIVE RESOLUTION APPROACHING THE ATMOSPHERIC LIMIT.

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COMINT Control

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MOL PROGRAM SECURITY POLICY

- EXISTENCE OF MOL - UNCLASSIFIED
- RECONNAISSANCE PAYLOADS OTHER THAN COMINT - BYEMAN/DORIAN
- COMINT PAYLOADS - BYEMAN/COMINT/DORIAN
- NON RECONNAISSANCE PAYLOADS - SPECIAL ACCESS REQUIRED
- SCIENTIFIC PAYLOADS, BOOSTER, SPACE VEHICLE, GEMINI B - NORMAL SECURITY
- LAUNCH AND RECOVERY - NORMAL SECURITY
- SECURITY IS CONTROLLED BY DNRO

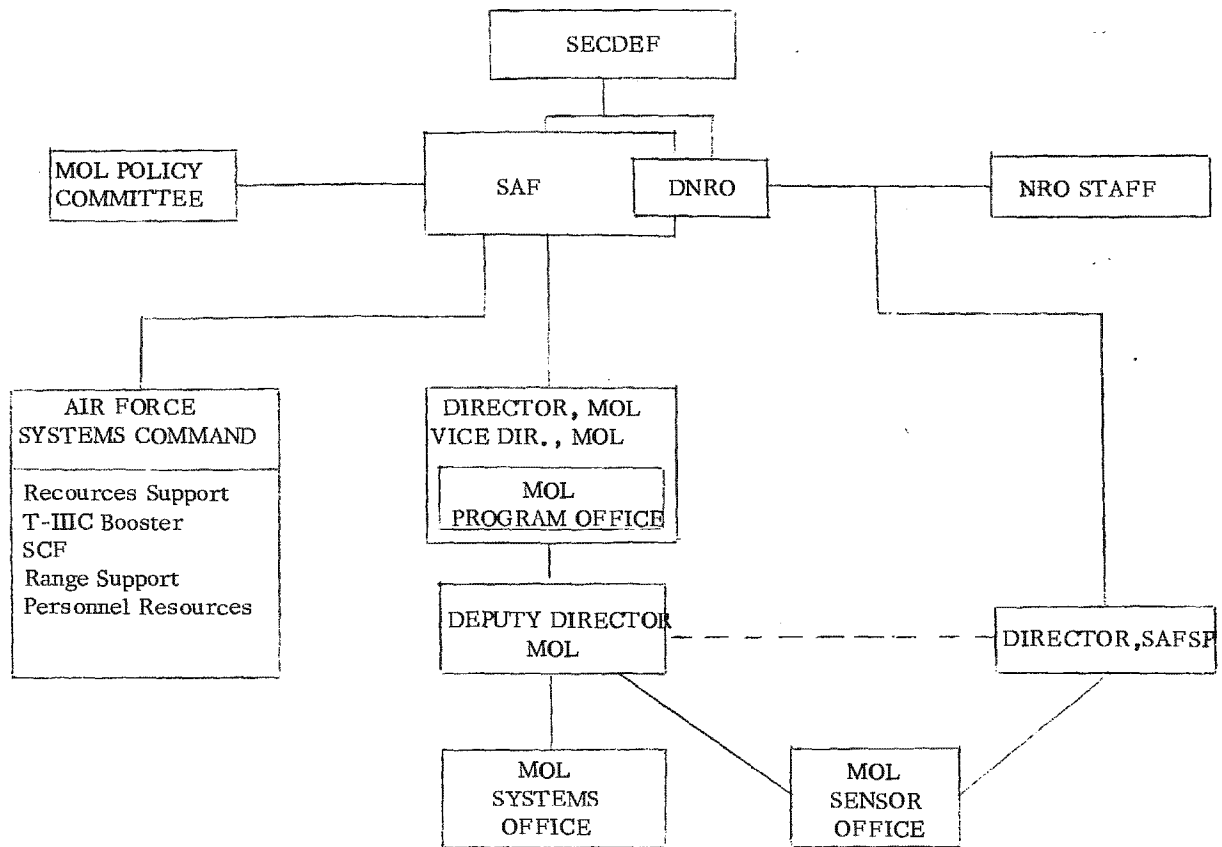
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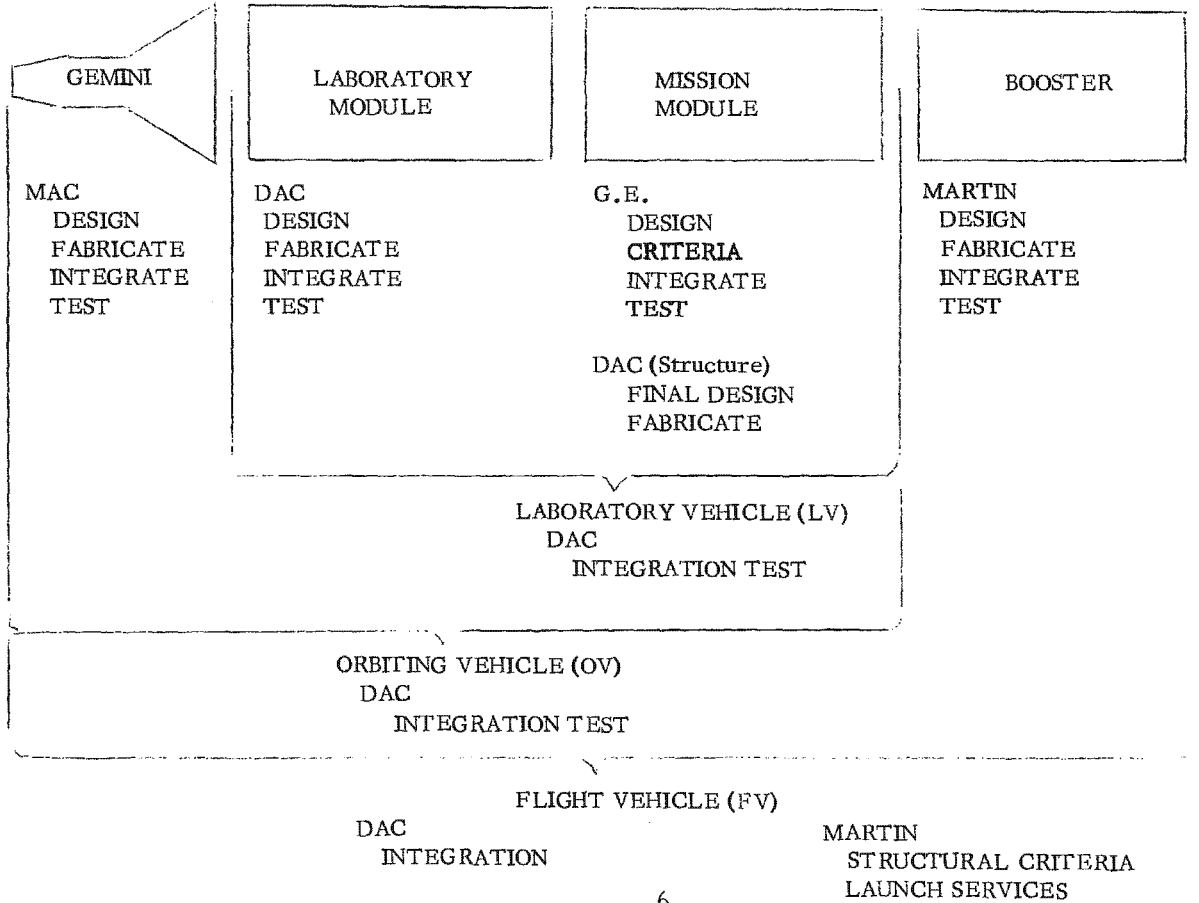
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MOL MANAGEMENT ORGANIZATION



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M O L C O N T R A C T O R R E S P O N S I B I L I T I E S

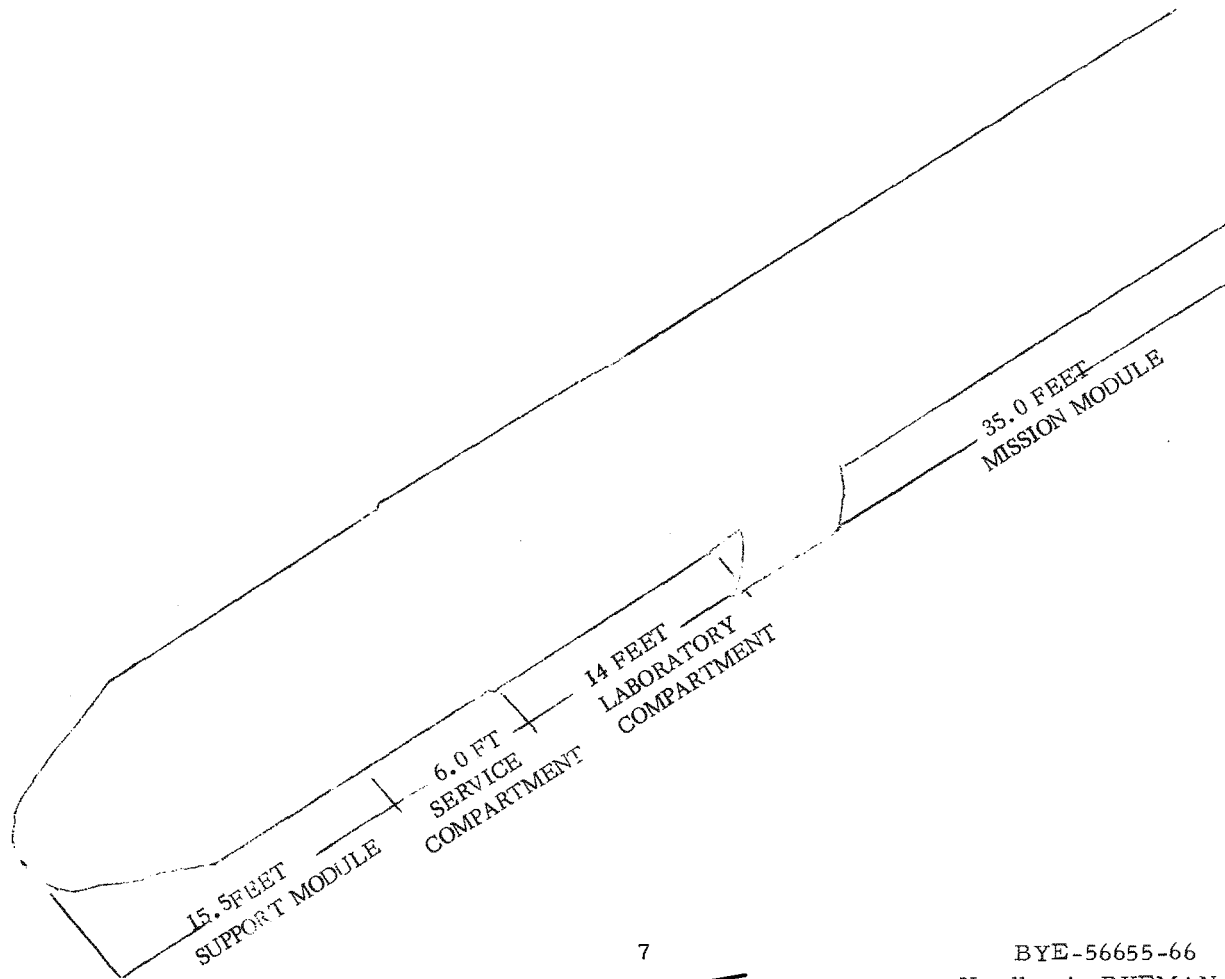


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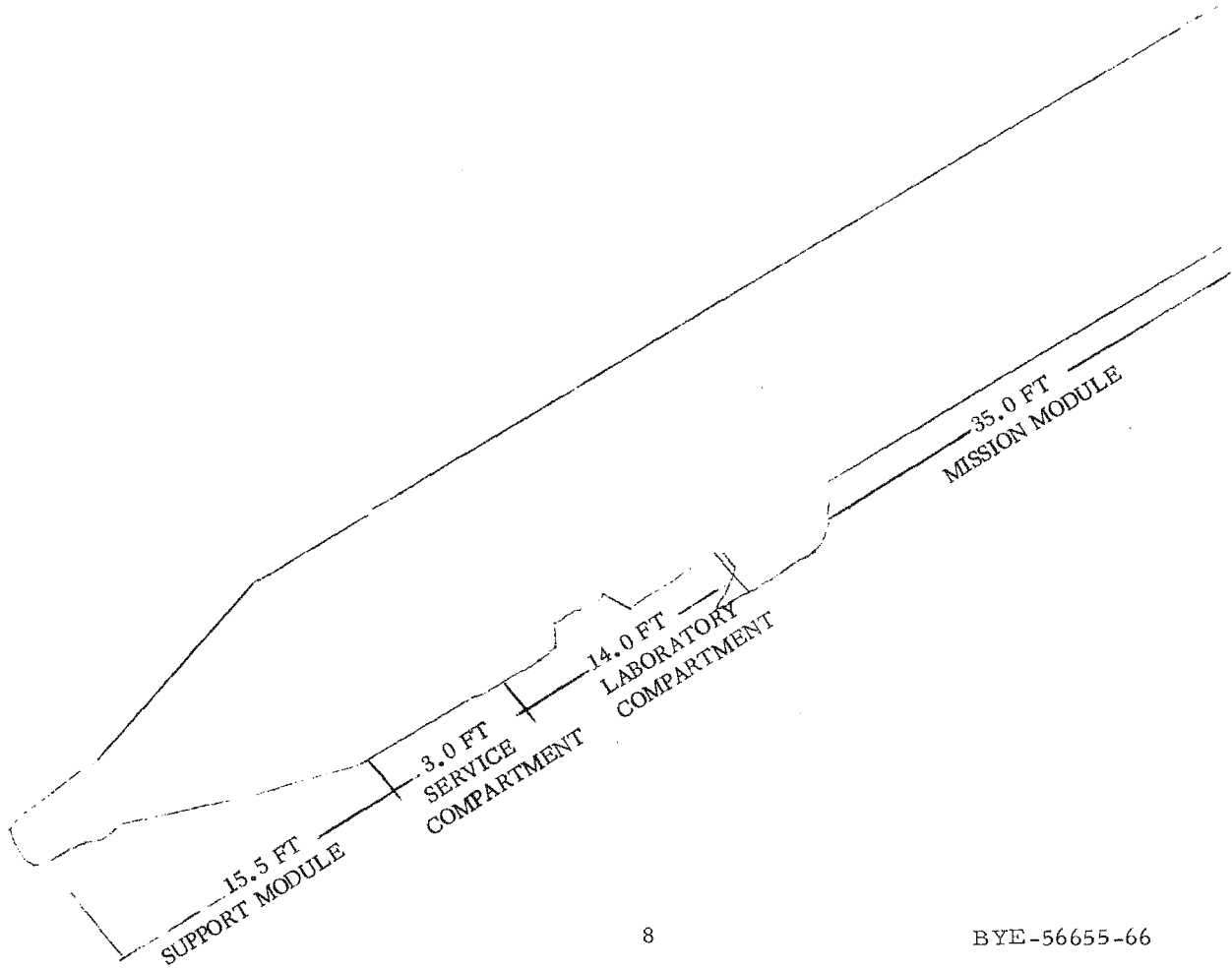
BASELINE MOL AUTOMATIC MODE



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BASELINE MOL MANNED MODE



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UTILIZATION OF MAN IN DEVELOPMENT PHASE

- INSURE ATTAINMENT OF USEFUL RECONNAISSANCE CAPABILITY
EARLY IN DEVELOPMENT PROGRAM

- AVOID EARLY MISSION ABORTS BY REPLACEMENT, REPAIR,
OR MANUALLY WORKING AROUND MALFUNCTIONS

- EXPERIMENTAL INVESTIGATIONS INTO THE NATURE AND VALUE
OF CRITICAL CONTRIBUTIONS OF MAN TO PHOTOGRAPHIC
RECONNAISSANCE AND ENHANCEMENT OF INFORMATION CONTENT

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OTHER MANNED FUNCTIONS

- o FINDING MOBILE AND TACTICAL TARGETS
- o SELECTING PARTS OF PHOTOS FOR QUICK-RESPONSE READOUT
- o LOADING COLOR FILM AND OTHER SPECIALIZED FILM
- o SURVEILLANCE IN CRISIS CONDITIONS
- o VERIFYING TARGETS HAVE BEEN PHOTOGRAPHED
- o SELECTING CLOUD-FREE TARGETS
- o PHOTOGRAPHING
- o CHOOSING VIEW ANGLE REVEALING MOST INTELLIGENCE
- o INSPECTING, INCIDENTAL TO OTHER FUNCTIONS, MANY MORE TARGETS THAN CAN BE PHOTOGRAPHED.

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CHRONOLOGY

CY 65

CY 66

	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
PRESIDENTIAL APPROVAL AND AUTHORITY TO PROCEED		△																	
SIGINT STUDIES AUTHORIZED							△												
REQUEST TO PROCEED WITH PHASE II														△					
LIMITED AUTHORITY TO PROCEED															△				
PHASE II CONTRACT EVALUATION & NEGOTIATION																			
EASTMAN													△	△					
MARTIN													△						
McDONNELL													△						
DOUGLAS													△						
GENERAL ELECTRIC													△						
END OF PHASE I																			
AUTHORITY TO PROCEED PHASE II																			△
																			△

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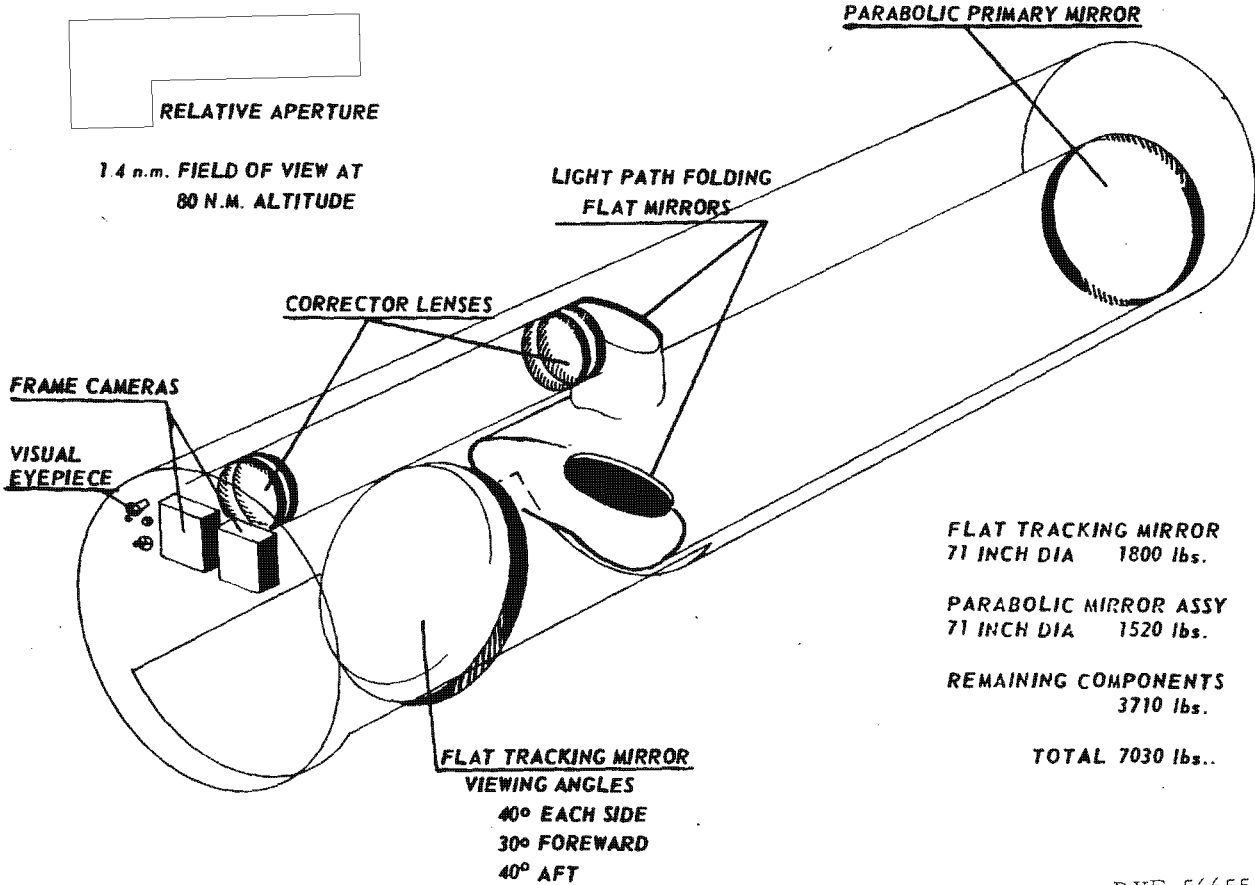
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MOL PAYLOAD



FLAT TRACKING MIRROR
71 INCH DIA 1800 lbs.

PARABOLIC MIRROR ASSY
71 INCH DIA 1520 lbs.

REMAINING COMPONENTS
3710 lbs.

TOTAL 7030 lbs..

FLAT TRACKING MIRROR
VIEWING ANGLES
40° EACH SIDE
30° FOREWARD
40° AFT

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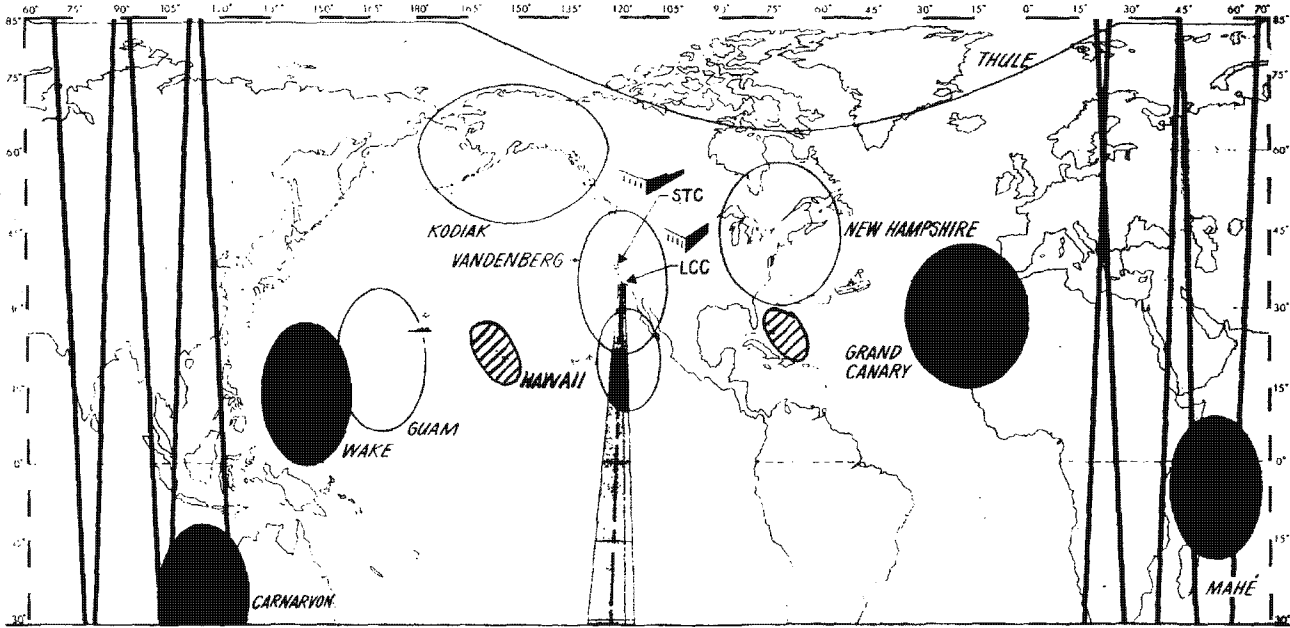
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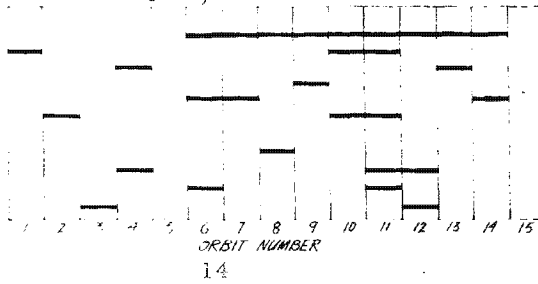
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CONTROL NETWORK FOR MOL



NETWORK COVERAGE $\phi = 80^\circ$, 80-130 NM

- PRIMARY STATIONS
 THULE (SCF)
 KODIAK (SCF)
 GUAM (SCF)
 VANDENBERG (SCF) (WB)
 NEW HAMPSHIRE (SCF) (WB)
 HAWAII (SCF)
- SPECIAL STATIONS
 MAHE (SCF) (DAY 1)
 GRAND CANARY (NASA) (VOICE DAY 1)
 CARNARVON (NASA) (VOICE DAY 1)
 WAKE (WTR) (VOICE DAY 1)



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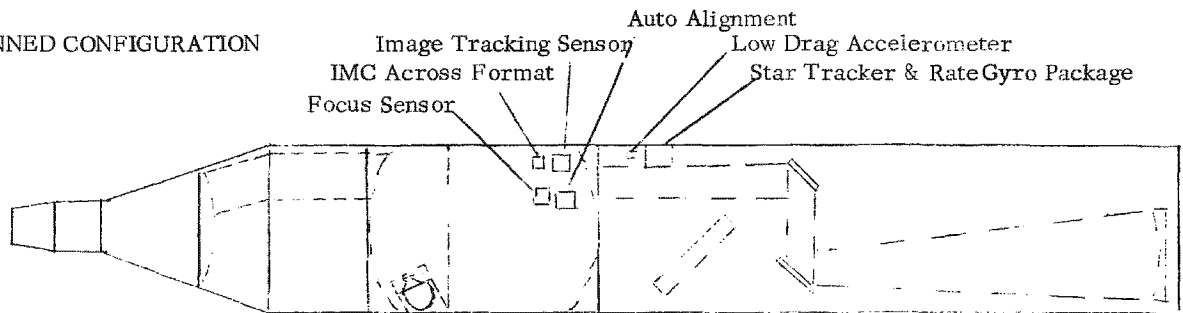
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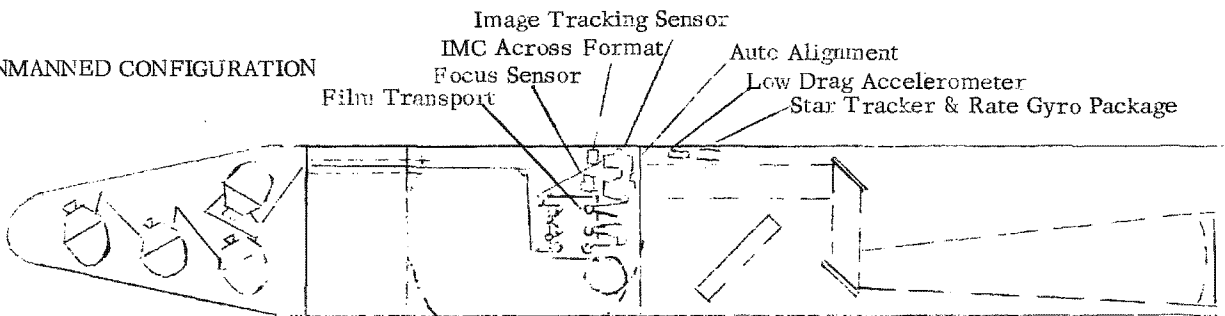
MANNED/UNMANNED SYSTEM

MANNED CONFIGURATION



/ Add Automated Capability to Laboratory and Payload

UNMANNED CONFIGURATION



- / Remove Gemini B
- / Remove Crew Segment and Portable Crew Segment Equipment
- / Add Nose Cone and Data Recovery Capsules
- / Add Auto Film Transport

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PAYLOAD STATUS

- COMPLETED:

DESIGN DEFINITION OF MAJOR COMPONENTS

FIRST - ISSUE SPECIFICATIONS

OPTIMIZATION STUDIES

PHASE II PROGRAM PLAN

CONTRACT NEGOTIATIONS

FACILITIES APPROVED AND UNDER CONSTRUCTION

GRINDING AND POLISHING EQUIPMENT ON ORDER

FINAL CAMERA SPECIFICATION SENT TO ITEK

PRIMARY AND TRACKING MIRROR BLANK

DELIVERIES BEGINNING. 10 OF EACH

SCHEDULED THROUGH OCTOBER, 1968

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NEW DEVICES

IMAGE MOTION SENSING (THREE CONTRACTORS)

MOTION COMPENSATION ACROSS FORMAT (IN ITEK CAMERA CONTRACT)

FOCUS SENSING (EASTMAN)

REMOTE ALIGNMENT (EASTMAN)

TELESCOPES (GENERAL ELECTRIC)

PHOTO READOUT

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EKC/MOL - DORIAN PROGRAM SCHEDULE

Models and Special Construction

Fiscal Year	FY 67				FY 68				FY 69				FY 70															
Calendar Year	1967				1968				1969				1970															
Months	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Months from EDP ATP	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Building Occupancy - Large Grinder					*				+																			
Full Size Mock-Up (Scheduled Completion August 1, 1966)																												
Structural Development Model					P/F			A				T																
Static Load Structure					P/F			A																				
Formula Sample								P/F				A				T												
Thermal Model								P/F				A				T												
Engineering Model									P/F			A				T												
Compatibility Model								P/F				A				T												
Reliability Components								P/F				A				T												
Qualification Model								P/F				A				T												
Flight Model #1									P/F			A				T												

* Building Occupancy P/F Procure & Fabricate
 + Large Grinder Available to Project T Test
 A Assembly

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PHOTOGRAPHIC SYSTEM CAPABILITIES

- o GROUND RESOLUTION AT NADIR -
- o PRIMARY OPTICS
 - SIMULTANEOUS PHOTO AND VISUAL OBSERVATION
 - AUXILIARY PLATEN - COLOR, INFRARED, HIGH SPEED FILM
- o TWO ACQUISITION AND TRACKING SCOPES (ATS)
 - ACCESSIBLE TO BOTH CREWMEN
 - ZOOM CAPABILITY
- o PROGRAMMING
 - ALL OPTICS INDIVIDUALLY PROGRAMMED
 - PRIME OPTICS CAN BE SLAVED TO ATS
- o TARGET COVERAGE
 - 50-100 CLOUD FREE TARGETS PER DAY
 - UP TO 20 FRAMES PER TARGET
 - MULTIPLE STEREO PAIRS
 - 5-6 ACCESSES PER TARGET
- o DATA RETURN
 - DATA RECOVERY VEHICLE PLUS GEMINI
- o MISSION DURATION - 30 DAYS
- o RE-LAUNCH INTERVAL - 60 DAYS

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PRIMARY MOL OPERATIONS

CAMERA PROGRAMMED ON PRIMARY TARGET

TWO TELESCOPES PROGRAMMED ON ALTERNATES

CAMERA CHANGED TO ALTERNATE BASED ON INDICATOR OR WEATHER

SECONDARY PLATEN INSERTED (3 SEC PER OPERATION)

MAIN PHOTOS GO TO RECOVERY CASSETTES

SECONDARY PHOTOS PROCESSED ON BOARD

(BIMAT SYSTEM)

OPERATOR SELECTS TARGET (1" X 2 1/4")

TARGET IS READ OUT OVER STATION

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DETECTING HIGH VALUE INTELLIGENCE

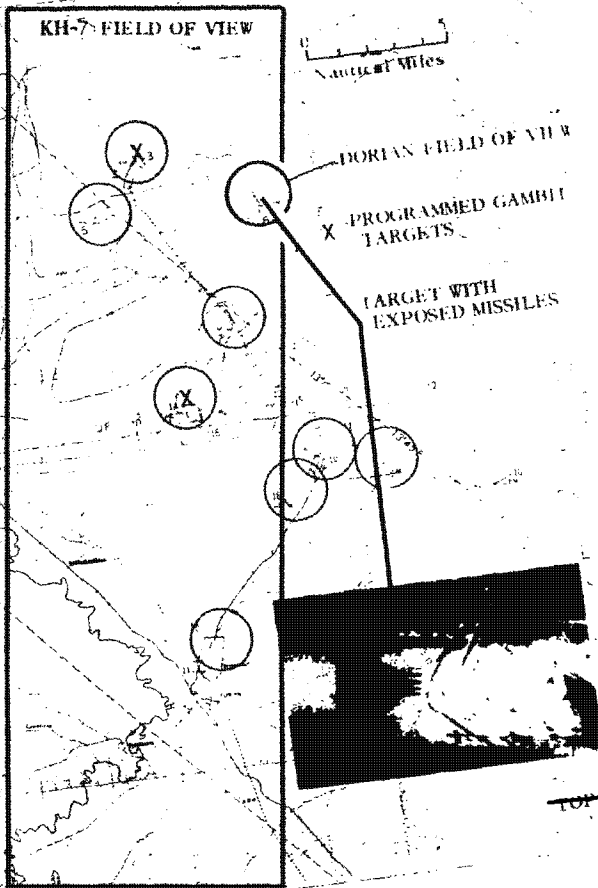
TARGETS PROLIFERATE AT DORIAN
FIELD OF VIEW

OPERATORS INSPECT ALTERNATE
TARGETS

SIMULATIONS SHOW THE INSPECTIONS
CAN BE DONE

70% OF ALL TARGETS INCUR TRANSIENT
CONDITIONS WHICH EXPOSE HIGH VALUE
INTELLIGENCE

MANNED MODE CAN PRODUCE 200% TO
300% OF THE OUTPUT OF SUCH PHOTOS
BY RANDOM ENCOUNTER IN THE
AUTOMATIC MODE



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READOUT PERFORMANCE

CAPACITY OF ANALOG SYSTEM, 1 STATION, 200 N. MI.:

3750 SQ. IN. PER DAY

AT MOL ALTITUDE: 1800 SQ. IN. PER DAY

MOL AVERAGE: 140 TARGET OPERATIONS PER DAY

WEATHER LOSS: 40%

READOUT CAPACITY REQ'D: $0.6 \times 140 \times 2 \times 1 \times 2 \frac{1}{4} = 380$ SQ. IN. PER DAY

ROUTINE RAPID RETURN OF STEREO PHOTOGRAPHY



AT 200 N. MI., TWICE DAILY RETURN OF PHOTOS IN 1-FOOT RESOLUTION CLASS

SUPPLEMENTED BY DIRECT VIEW THROUGH TELESCOPES

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C R I S I S S U R V E I L L A N C E

ORBIT ALTERED TO:

- REPEAT COVERAGE OF AREAS OF INTEREST AT SHORT INTERVALS
(TWO TO THREE DAYS)
- BROADEN SENSOR FIELD OF VIEW, ENLARGE AREA ACCESSIBLE
ON EACH PASS.

AREAS AND TARGETS TO BE OBSERVED:

- REAL TIME CONFIRMATION OF PHOTO SUCCESS
- RAPID DATA RETURN BY WIDEBAND RADOUT
- REPROGRAMMING FLEXIBLE AND IMMEDIATE
- VISUAL REPORTS SUPPLEMENT PHOTO COVERAGE
- GROSS COUNT OF LARGE OBJECTS SUCH AS AIRCRAFT, SHIPS, AND TANKS

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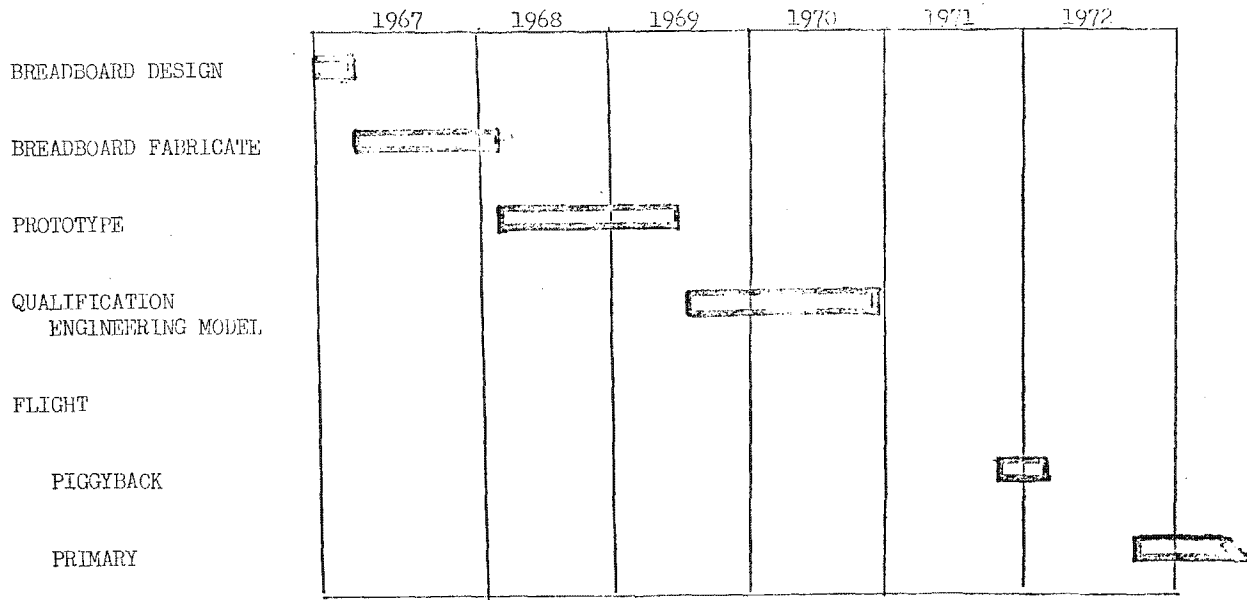
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SCHEDULE



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SYSTEM CONSIDERATIONS

- O CAPABLE OF LONG LIFE
 - NO EXPENDABLES
 - FEWER MOVING PARTS

- O RETROFIT TO REPLACE FILM/READOUT IN GAMBIT-CUBED, DORIAN
 - INITIALLY AS PIGGYBACK

- O NO CHANGE
 - DATA LINK
 - GROUND REPRODUCERS
 - OPTICS
 - OPERATIONS

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C O S T

F I L M R E A D O U T

ENGINEERING DEVELOPMENT

\$45 - 50M

READOUT EQUIPMENT

DATA LINK

GROUND STATION - WHIPPANY

MODIFICATIONS TO GAMBIT-CUBED

THREE FLIGHT MODELS

COST PER LAUNCH EQUAL GAMBIT-CUBED PLUS 2-3 MB. ≈ \$20M

COST PER FRAME, 30-DAY LIFE < GAMBIT-CUBED

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BEAMLINE SECTION

OPERATIONAL

50 MCS PER CHANNEL \longrightarrow > 100 n AMPS BEAM CURRENT

SPOT SIZE $< 5 \mu$ FOR 100 LP/AM

> 200 HOURS ACTIVE LIFE

GEOMETRIC LINEARITY $\sim .5\%$

DEMONSTRATED

BEAM CURRENT ≈ 100 n AMPS IN LABORATORY

SPOT SIZE $< 5 \mu$

LIFE - NOT TESTED

LINEARITY - NOT TESTED: 0.5% DIFFICULT

OTHER POSSIBILITY

DIGISCAN - NEW, UNPROVEN CONCEPT

IF WORKS SHOULD SOLVE BANDWIDTH, LINEARITY PROBLEMS

WILL KNOW IN 18 MONTHS

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STORAGE SECTION

REQUIRE

STORE: 100 FRAMES 12 HOURS

RESPONSE: 80% AT 100 LP/MM

DEMONSTRATED

STORE: > ONE HOUR, SEVERAL DAYS - EASY

RESPONSE: > 80% AT 100 LP/MM

NEED

FABRICATION TECHNIQUE FOR THIN DIELECTRIC FILMS

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IMAGING SECTION

REQUIRED

TO OBTAIN

QUANTUM EFFICIENCY > 5%

EI \geq 6

GAIN \approx 10:1

MTF @ 100 LP/MM 0.8

\geq 100 LP/MM LIMITING
(WITH f/3.5)

FORMAT \geq 4.5 INCHES

DEMONSTRATED

QUANTUM EFFICIENCY 5% AVAILABLE

GAIN > 10:1 AVAILABLE

MTF 0.5 @ 225 LP/MM

30

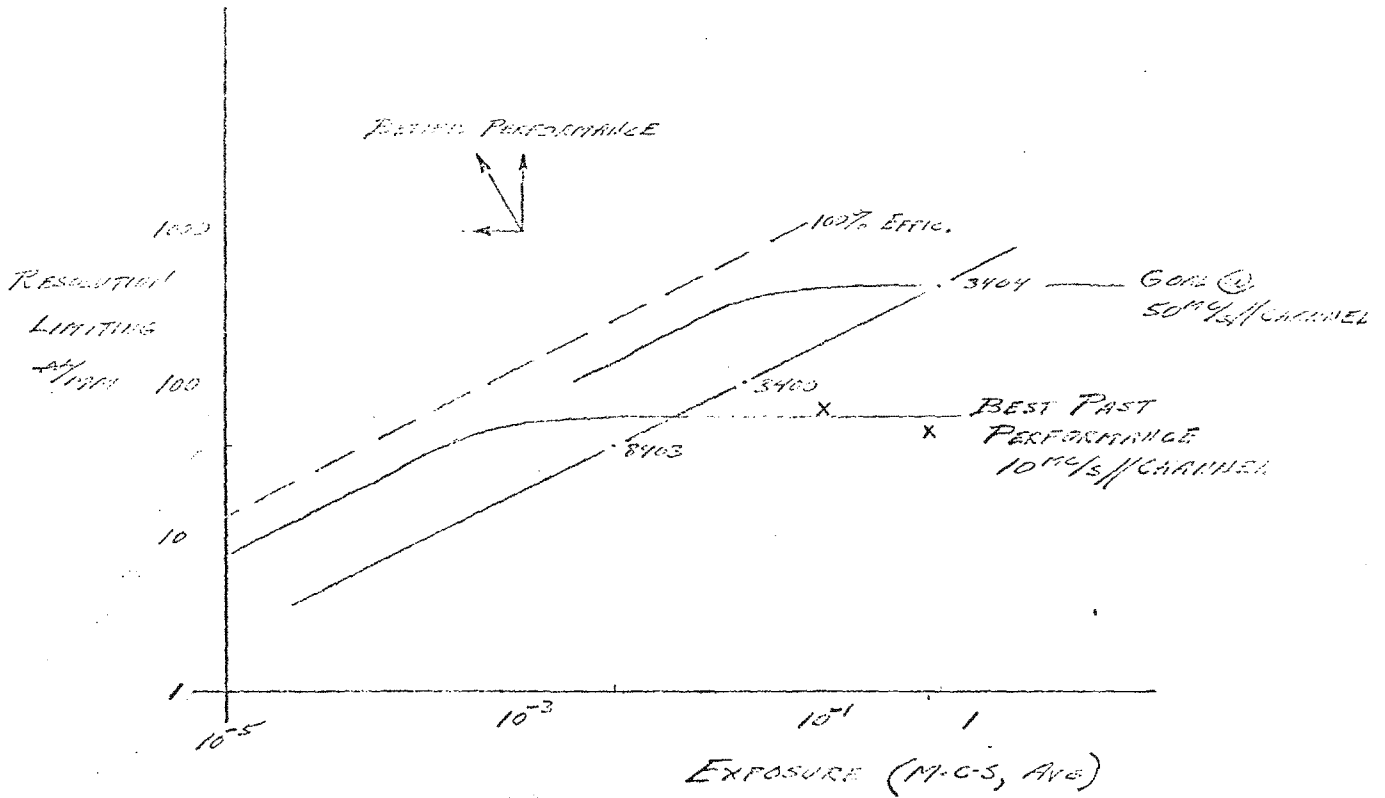
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ALL ELECTRONIC CAMERA

GOALS

CAMERA

SIMPLER - FEWER PARTS

IMPROVED SYSTEM

OUTPERFORM FILM

IMAGING STORAGE

RESOLUTION ~~TREES~~ SENSITIVITY

NON-EXPENDABLE DATA RECORDING

STORAGE SECTION

ADEQUATE BANDWIDTH

READOUT SECTION

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TOTAL SYSTEM

OPERATIONAL PARAMETERS

ALTITUDE > 200 N.MI. (FOR ACCESS)

RESOLUTION ~ 3 FEET

SWATH > 5 N.MI.

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PROJECT ZAMAN

Exploratory Development Program in Support of Electronic
Image Recovery from a Photographic Reconnaissance Satellite

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ZAMAN REQUIREMENTS OBJECTIVES

Cost Effectiveness Improvement for High Resolution Surveillance

Reduced Launch Rate

Demand Targeting

Support Indication (Early Warning) Mission

Insure Immediate Availability of Satellite Photography in Cold War

"Crisis" Situations

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ZAMAN DESIGN OBJECTIVES

Effective Ground Resolution..... 2 - 4 ft.

Coverage Access Swath.....200 300 nm

Target Coverage.....Continuous Sequential

Photographic Swath...5 - 10 nm

Vehicle Useful Lifetime.....Failure Limited

Ground Site Location.....CONUS

Recovery Lag.....Less Than 12 Hours

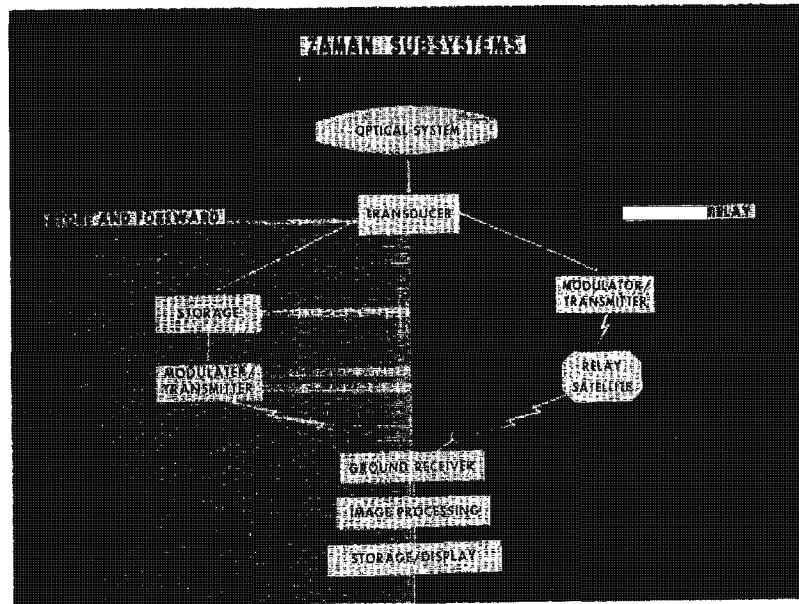
Data Link Security.....Private or Secure

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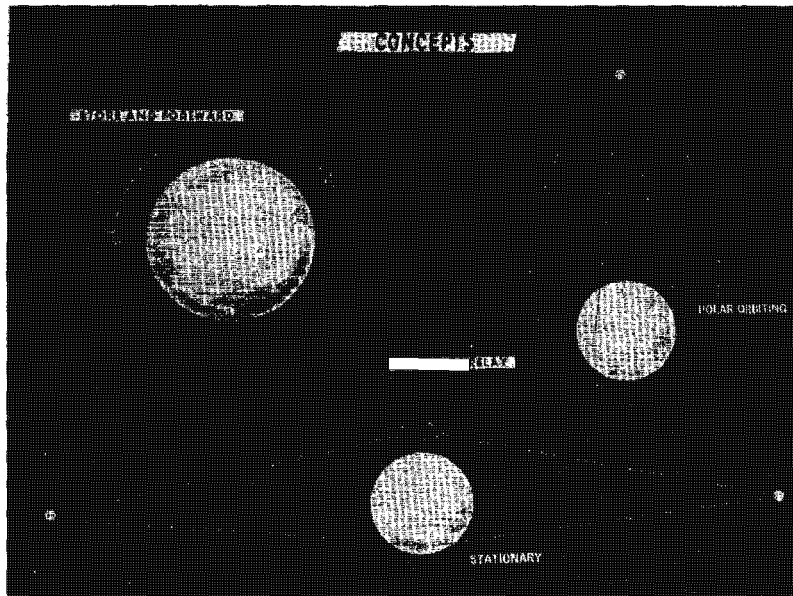
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PROGRAM STATUS

Systems Study (Zoster)..... Completed

Data Link Experiments.....Sponsored Work Completed

Systems Study..... Completed

Proposal..... Submitted

Transducer Development

materials feasibility study.....In Progress

photosensitive array development.....In Progress

solid state transducer study.....In Progress

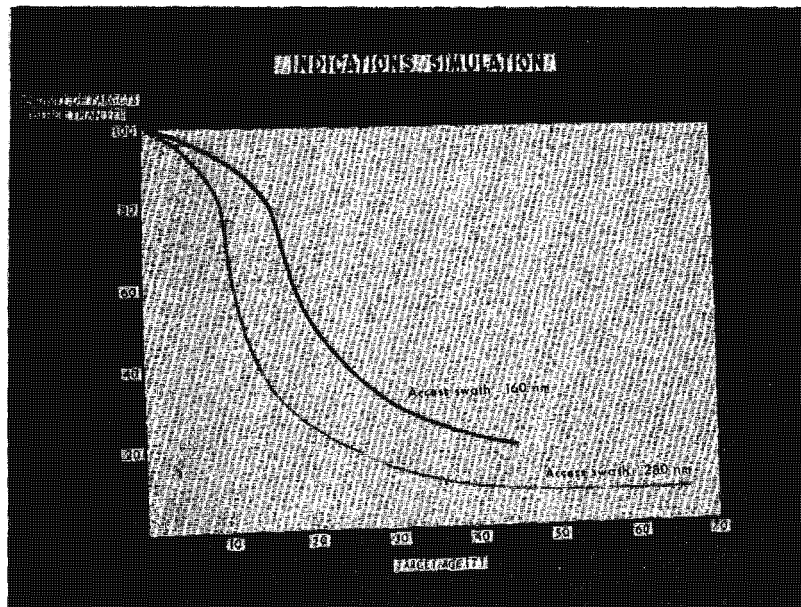
Requirements Analysis (In House).....Continuing

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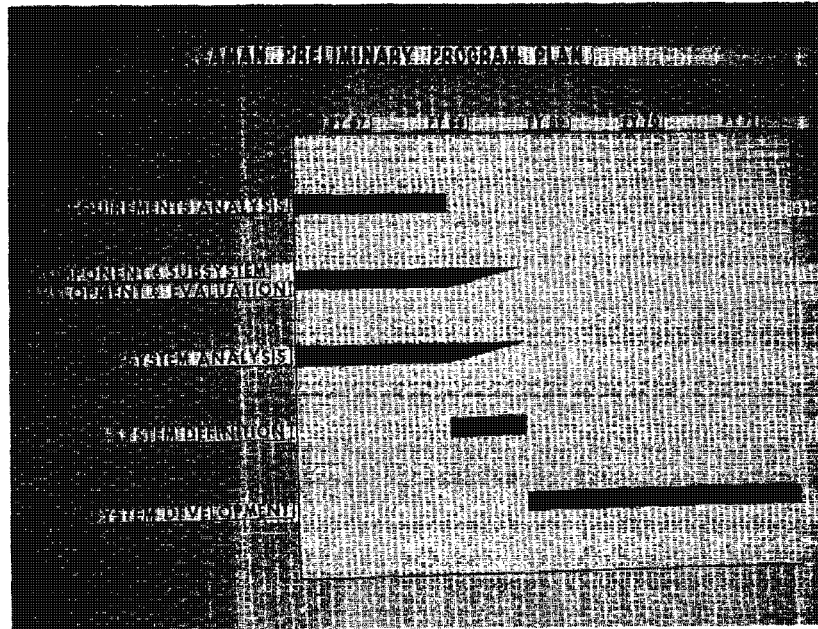


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- 22 TSO CIA
- 23
- 24-33 Asst Ops/NPIC
- 34, 35 CIA COMOR Member
- 36, 37 CGS
- 38, 39 Ch/PWG
- 40 Special Center TCO
- 41 CGS ReqBr/RecceGrp
- 42 D/OSI
- 43 DDP TCO
- 44 DDS&T ()
- 45 C/Action/DDS&T
- 46 C/SAS/DDS&T
- 47 D/OSP/DDS&T
- 48 D/OEL
- 49 D/SA
- 50 D/O/OSA
- 51 Intel/O/OSA
- 52 SS/OSA
- 53 SAL/OSA
- 54-58 SA(COMOR)/DDS&T

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BYE-56655-66

RUFF/DORIAN

~~TOP SECRET~~

Handle Via
BYEMAN TALENT-KEYHOLE COMINT
Control Systems Jointly