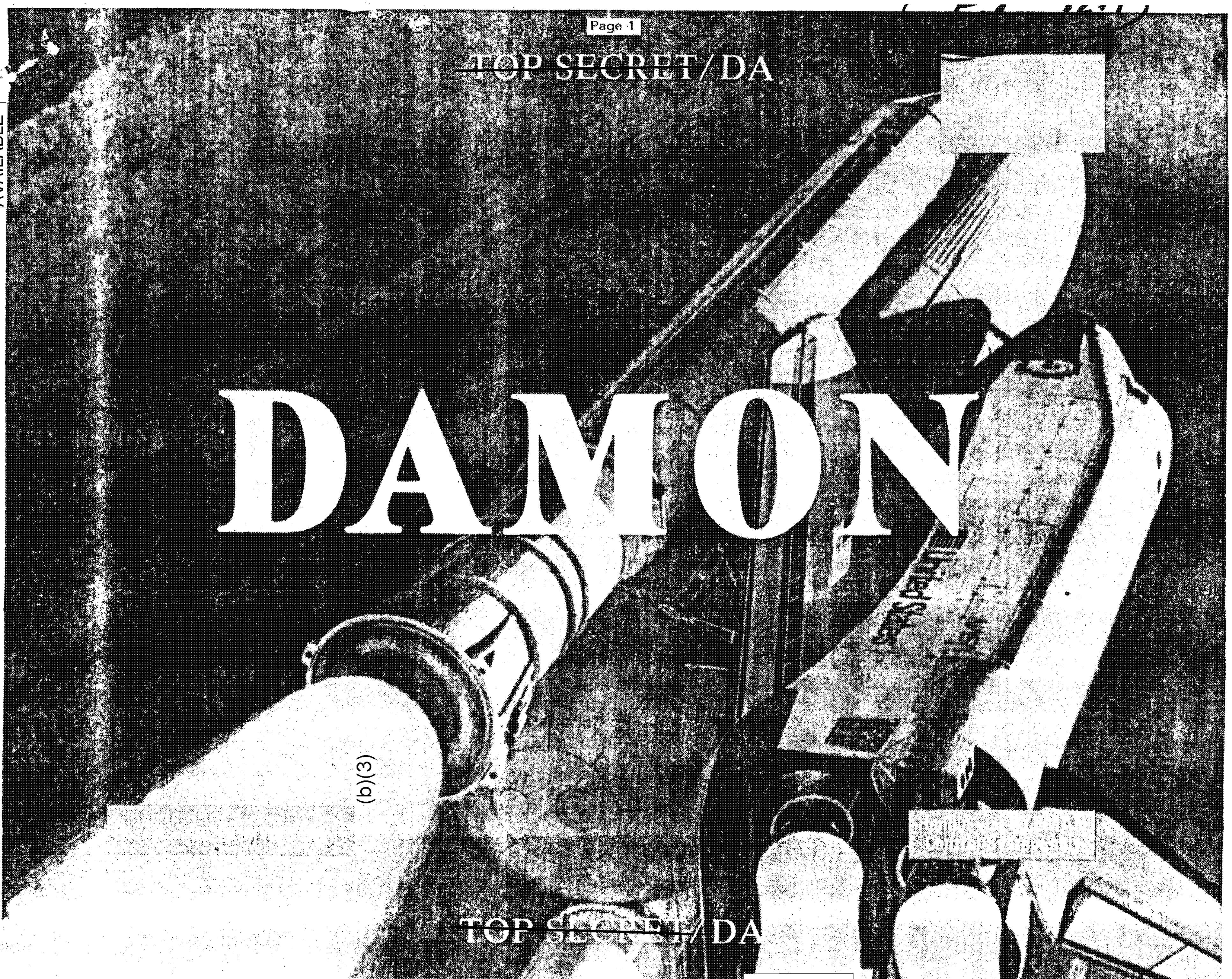


presentation to [illegible] 15 April [illegible]

Approved for Release: 2019/06/18 C05124091

~~TOP SECRET/DA~~

Handle via **BYEMAN** Control System only

TOP SECRET/ DA

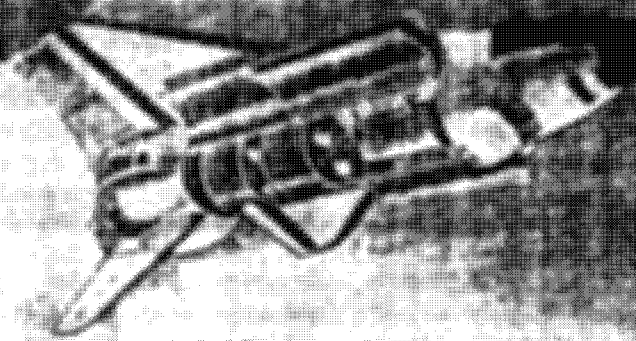
- Palletized Photo Recon System
- Shuttle Flights in 1982, 1983
- First DoD Shuttle Flight
- First NRO Shuttle Mission

Handle via BYEMAN Control System only

TOP SE

BYE-117545-80

Objectives



1. Establish Precedence Of Use Of The STS For Reconnaissance Operations
2. Develop Technical Data Inputs and Operational Experience Required to Develop and Integrate Operational Reconnaissance Systems
3. Acquire Useful Photographic Intelligence Comparable To Current Search Quality
4. Evaluate Benefits of Orbiter Support Systems
5. Develop a Data Source For Other Systems
6. Evaluate Man/System Interacting In Mission Accomplishment

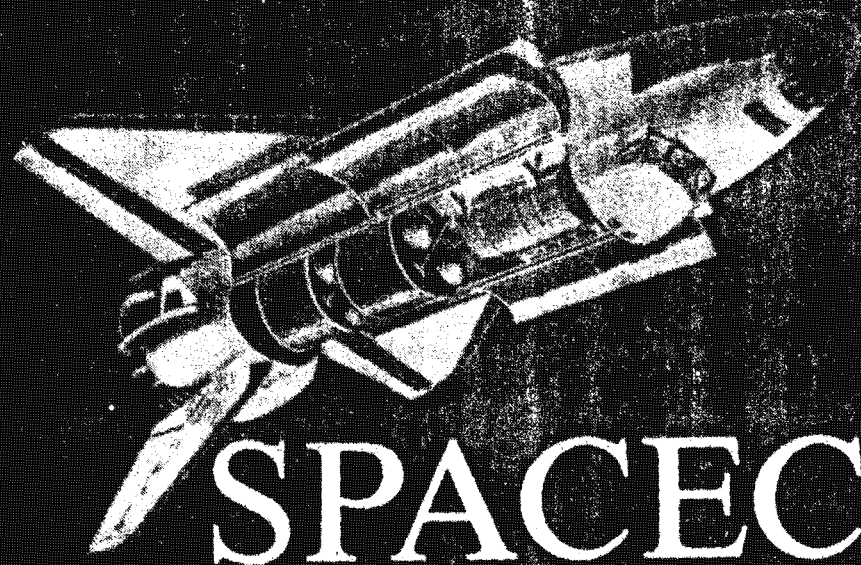
Handle via BYEMAN Control System only

Benefits

~~TOP SECRET~~/ DA

- FOR NRO
  - STS As Intelligence Platform
  - Security Requirements
- FOR DoD
  - STS/Spacecraft Interface Compatibility
  - STS Integration Procedures
  - [illegible] Experience
  - [illegible]tion of Orbiter Environments
  - [illegible] of Orbiter Support Systems
  - Growth Potential, Incorporation of Secondary Payloads
- FOR DoD AND NASA
  - Economic Planning
  - Field Maintenance
  - Scheduling
  - Manned Interface
  - Data Bank of Lessons Learned
- FOR INTELLIGENCE COMMUNITY
  - Significant Search Gap Filler Coverage

TOP SECRET/DA



SPACECRAFT DESCRIPTION

BYEMAN Control System only

TOP SECRET/DA

Approved for Release: 2019/06/18 C05124091

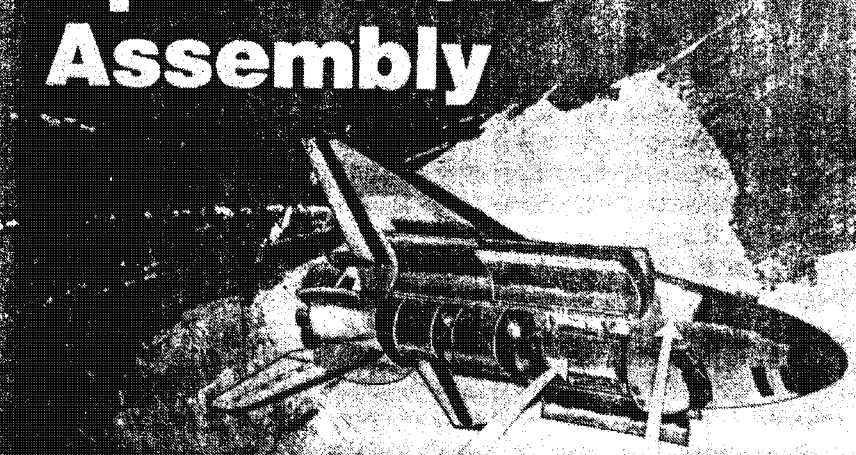
Spacecraft Assembly

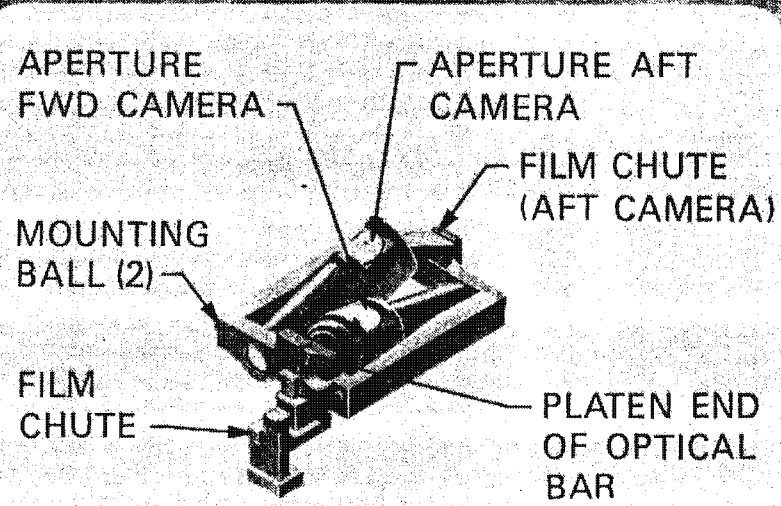
BYE-117505-80

Handle via BYEMAN Control System only

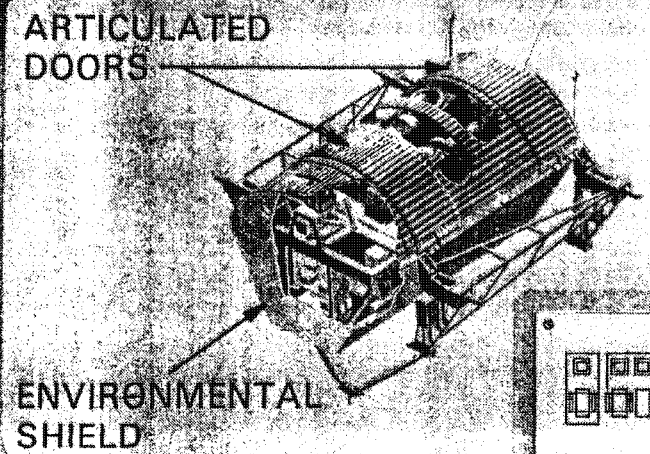
~~TOP SECRET~~/DA

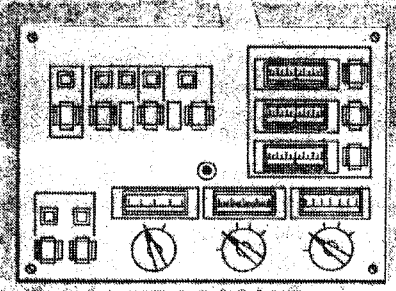
Spacecraft Assembly

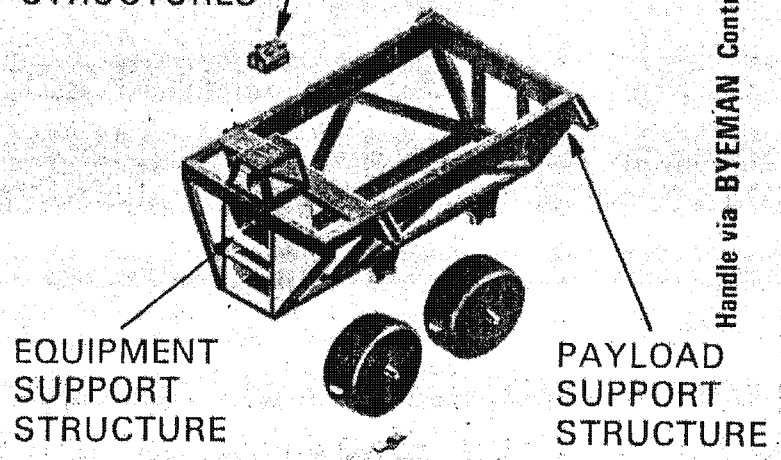




TWO-CAMERA ASSEMBLY (TCA) (PAYLOAD)







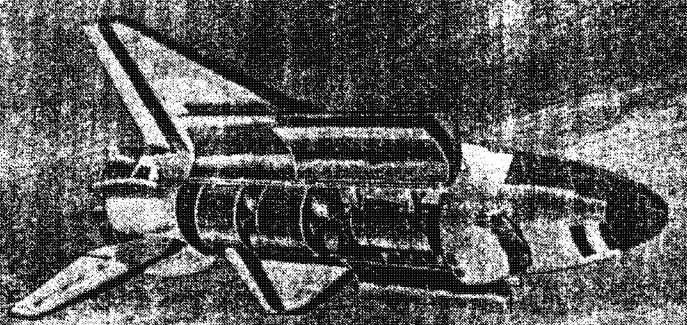
Handle via BYEMAN Control System only

~~TOP SECRET~~/DA

Approved for Release: 2019/06/18 C05124091

~~TOP SECRET~~/DA

Spacecraft Characteristics



- LENGTH: 13.5 FT
- WEIGHT: 9650 LBS
- PHOTOGRAPHY AT REFERENCE ORBIT
  - Resolution : Grd < 36 IN - 99% Of Center of Format Imagery
  - Area Collection ; 16.9 x 10^6 Square Nautical Miles (NM) - Stereo
  - Ground Location: Within 2 NM at Any Point in the frame
- COMMUNICATION: SGLS VCTS
  - Uplink Margin: 11 dB With Modulation Index (MI) of 0.3 Radians
  - Downlink Margin: 40 dB Main Carrier, 7.6 dB Subcarrier No. 2 With MI of 1.106 Radians
  - Uplink and Downlink Encrypted
- COMMAND STORAGE: 496 COMMANDS PER MEMORY
- TELEMETRY: PULSE-CODE MODULATED
  - Record: 90 Minutes Per Tape Recorder
  - Bit Rate: 32 KBS Record Mode, 128 KBPS Realtime Mode
  - Measurements: 1040 Points
- POWER
  - 3 - 15 KWH AgZn Primary Batteries With Capability of Fourth Battery
  - 12.5 KWH From Orbiter Bus
- THERMAL:
  - Environment Compatible for All Experiments

Handle via BYEMAN Control System only

~~TOP SECRET~~/DA

Approved for Release: 2019/06/18 C05124091

TOP SECRET/DA

Camera Image Path

Handle via BYEMAN Control System only

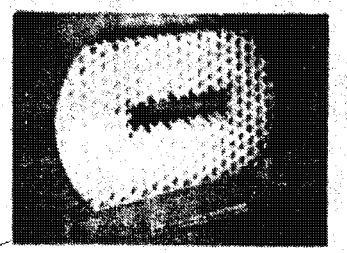
TOP SECRET/DA

Approved for Release: 2019/06/18 C05124091

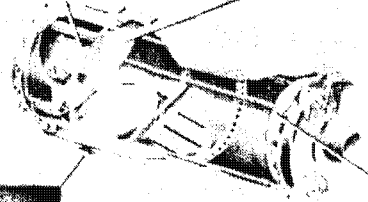
Camera Optical Assembly

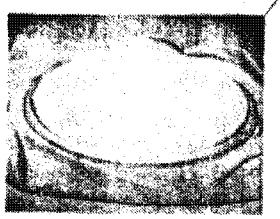
FIELD GROUP
λ/28 RMS

EACH SURFACE
λ/50 RMS

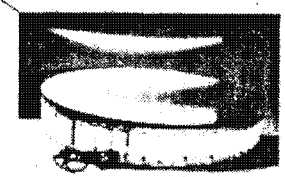


FOLDING FLAT
λ/40 RMS





CORRECTOR PLATE
a. FIRST SURFACE λ/30 RMS
b. SECOND SURFACE λ/60 RMS

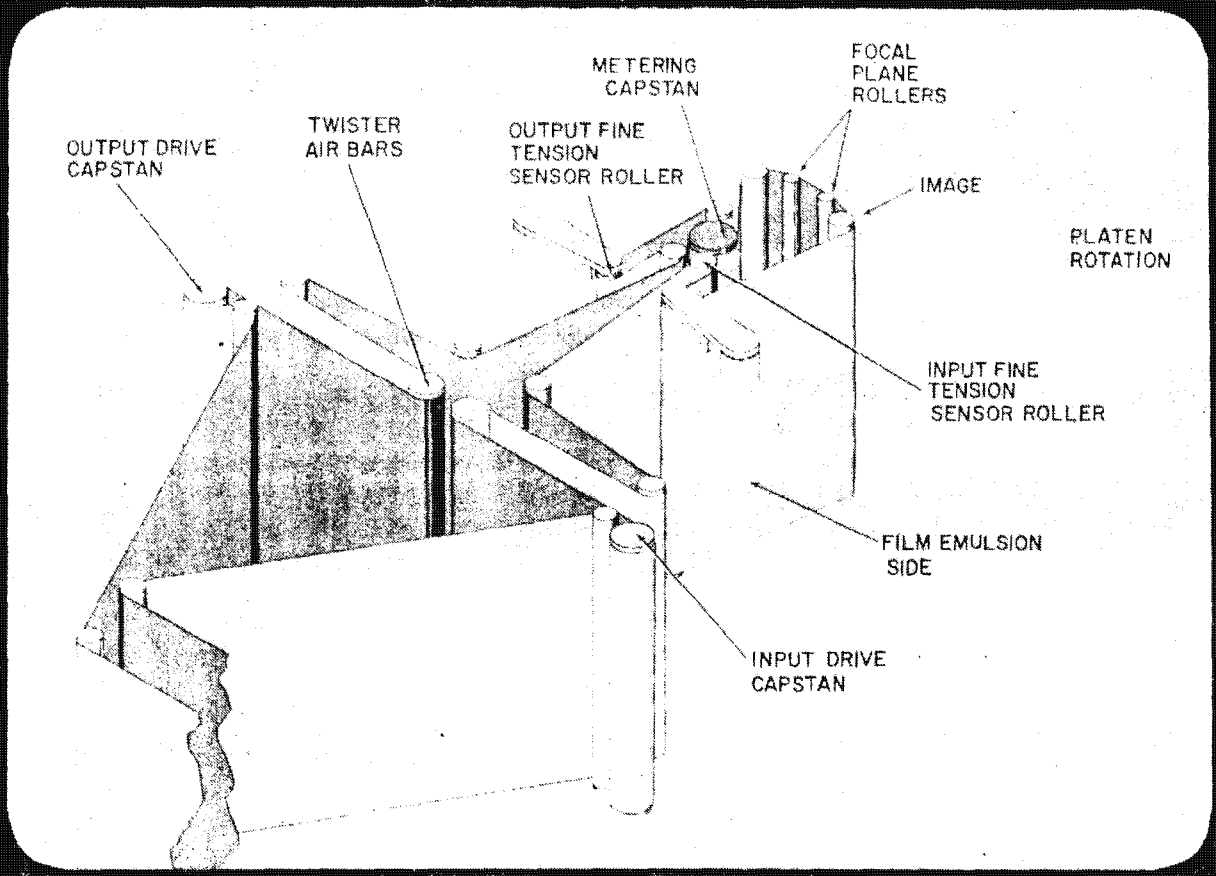


PRIMARY MIRROR
λ/50 RMS

Approved for Release: 2019/06/18 C05124091

TOP SECRET/DA

Fine Film Path



Handle via BYEMAN Control System only

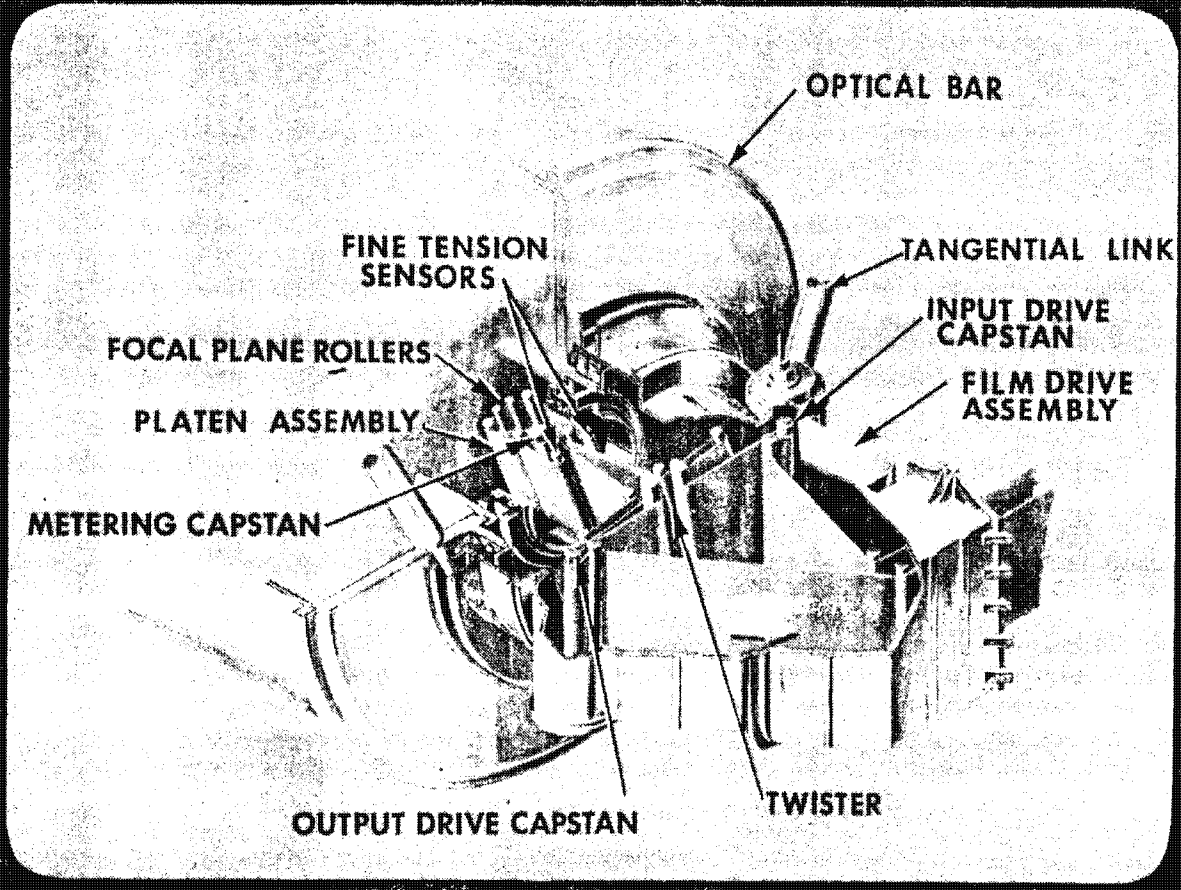
TOP SECRET/DA

Approved for Release: 2019/06/18 C05124091

TCA Major Assemblies

Handle via BYEMAN Control System only

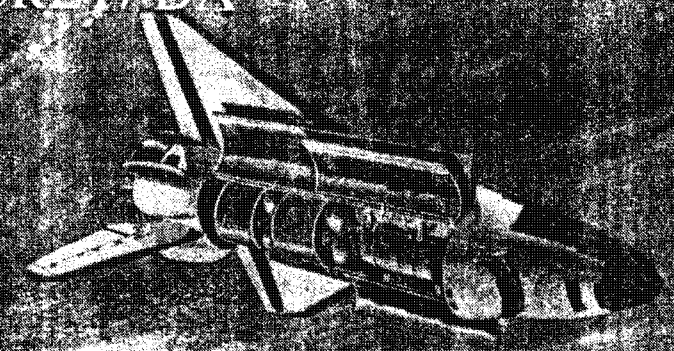
Platen and Film Drive



Approved for Release: 2019/06/18 C05124091

~~TOP SECRET~~/DA

Unique Film Systems Capabilities



- INHERENTLY COLLECT LARGE OPERATIONS E.G., 60,000 SQUARE MILES AT ONCE
  - Freezes Action: Mobile Targets, Disposition of Forces - MBFR Treaty
- Ideal For Map-Making: Reduces Defense Processing Effort at Ground Mapping Agency

[redacted] (b)(1) (b)(3)

- CHANGE FILM

[redacted]

- Applications To Intelligence, Economic Intelligence, And For Countering Camouflage

Handle via BYEMAN Control System

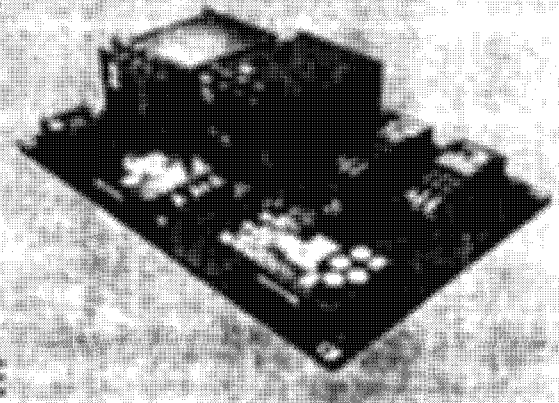
~~TOP SECRET~~/DA

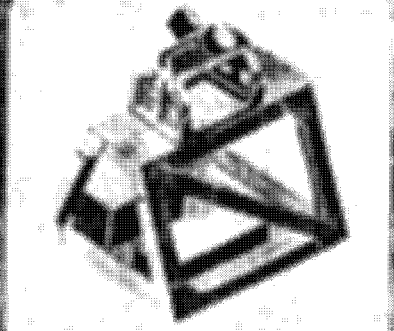
Approved for Release: 2019/06/18 C05124091

Subsystems

SPACE GROUND LINK

- RECEIVES AND TRANSMITS
  - Receives 1.76 to 1.84 GHz, phase modulated by command
  - Transmits 2.2 to 2.3 GHz, phase modulated by PCM
- RECORDS DATA
  - 32 or 64 kBPS
- TELEMETER (PCM)
  - Attitude reference data
  - Operational data
  - Diagnostic data





ATTITUDE REFERENCE

- SENSES SPACECRAFT ATTITUDE
- HARDWARE
  - Horizon sensors
  - Inertial reference assembly
  - Electronic assembly
- READOUT IN STS COCKPIT FOR COMPARISON TO STS ATTITUDE

Handle via BYEMAN Control System only

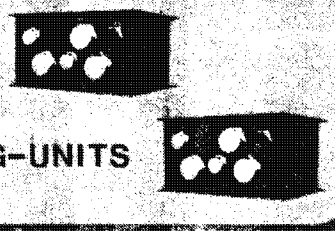
Subsystems

EXTENDED COMMAND SYSTEM (ECS)

ECS

- Realtime and stored program commands
  - 742 relay drivers for external command outputs (RTC, NSPC, and PSPC)
  - Master spacecraft timing
- Stored program commands can be scheduled to occur within 0.2 sec of a given time, at a rate of one every 0.2 sec

ENCRYPTION - DECRYPTION CAPABILITY



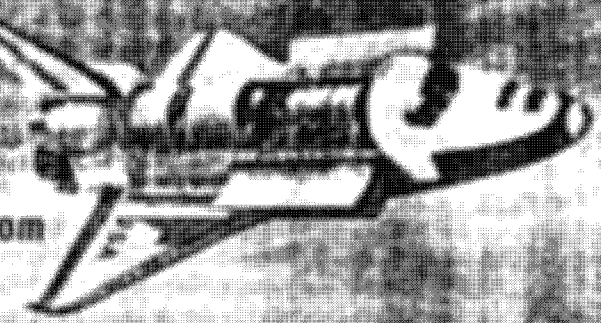
KG-UNITS

- Secure uplink for commands
- Secure downlink for telemetry

Handle via BYEMAN Control System only

Approved for Release: 2019/06/18 C05124091

Orbiter Interfaces



THERMAL

- GOAL: Decouple spacecraft from bay and cargo
  - High impedance structure decouples
  - Environmental enclosure controls radiation

DYNAMICS

- GOAL: Provide margins by stiffness and strength factors
  - Bridge and keel fittings provide high margins and allow for arbitrary location in bay

AFT FLIGHT DECK PANEL

- Displays spacecraft geodetic attitude
- Monitors and controls power
- Is adaptable to command spacecraft

Handle via BYEMAN Control System only

~~TOP SECRET~~/ DA

Factory Test Flow

MANUFACTURING
- SES Structure
- LES Structure
- PSS Structure
- EPS Structure

STRUCTURAL TESTS
- Static Test — 12/80
- Dynamic Test
- Acoustic Test — 2/81

EQUIPMENT INSTALLATION AND TEST
- GSE Verification
- Software Verification
- Functional Test — 10/81

EQUIPMENT INSTALLATION AND CHECKOUT
- LESS Processing — 10/81

SPACECRAFT ASSY AND TEST
- Alignment
- Wt and CG
- System-Integrated Acceptance Test
- Remote Test Verification — 10/81

SPACECRAFT ACOUSTIC TEST
- Pre-Acoustic Test
- Acoustic Exposure
- Post-Acoustic Test — 11/81

PAYLOAD THERMO-VACUUM TEST
- Pre Thermo-Vac Test
- Thermo Test
- Post Thermo-Vac Test — 12/81

SPACECRAFT PRE-SHIPMENT TESTING
- System-Integrated Verification Test
- Shipping Preparation
- Remote Test Verification — 1/82

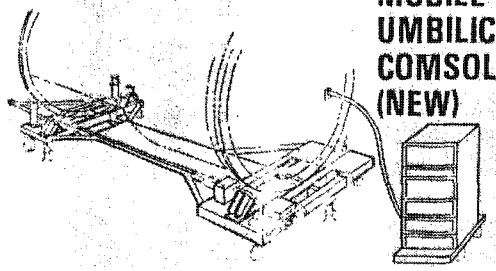
SHIPMENT
- Support GSE
- Payload
- Payload Support Structure — 3/82

~~TOP SECRET~~/ DA

~~TOP SECRET/ DA~~

Factory Test Flow

Ambient Area

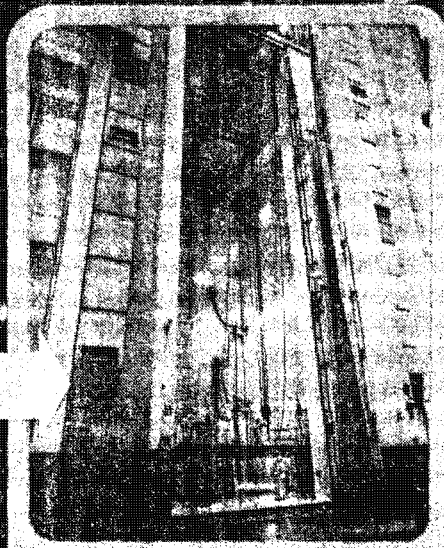


MOBILE UMBILICAL COMSOLE (NEW)

USED AT ALL TEST SITES

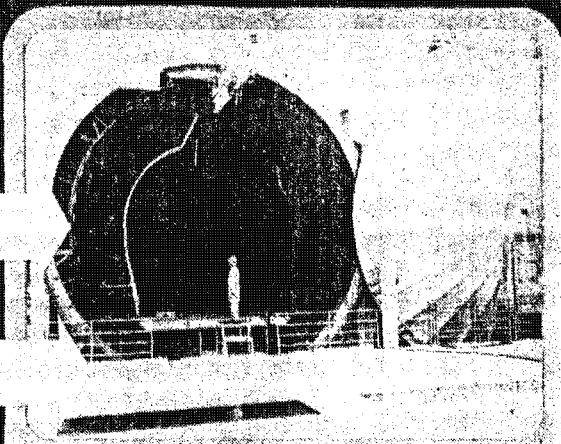
SYSTEM INTGRATED ACCEPTANCE TEST (SIAT)

Acoustic Chamber (Existing)



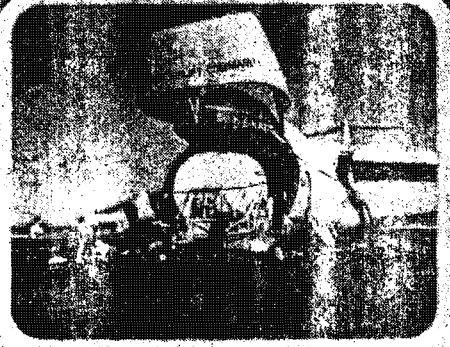
ACOUSTIC TEST

A-1 Chamber (Existing)



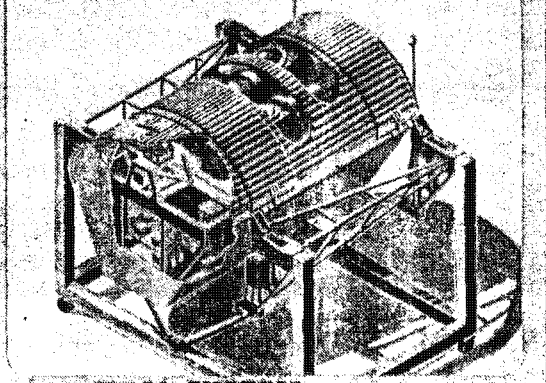
THERMO-VAC TEST

Ambient Area



SHIP TO CCAFS

Computer Facility (Existing)

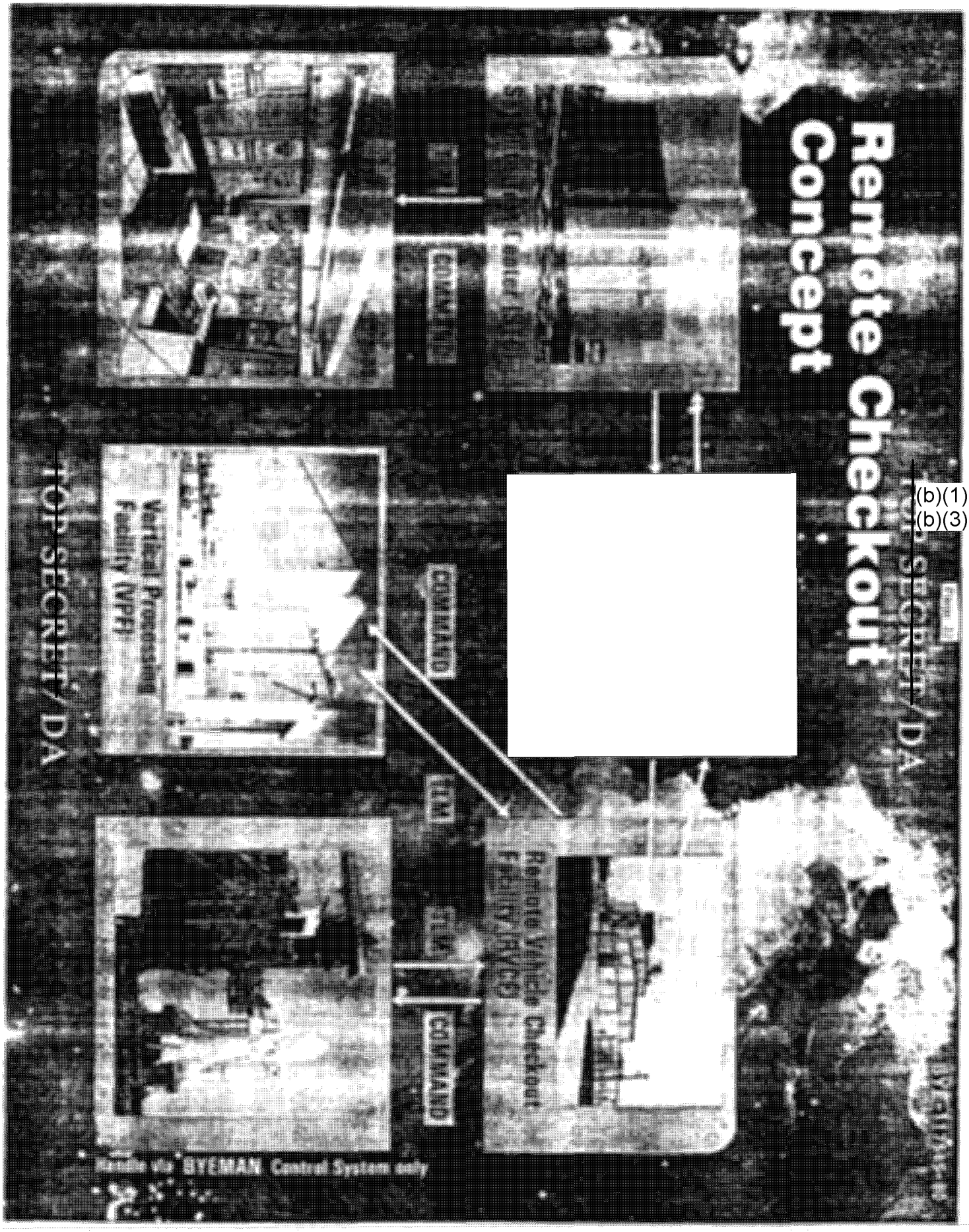


FINAL SYSTEM INTEGRATED VERIFICATION TEST (SIVT)

Handle via BYEMAN Control System only

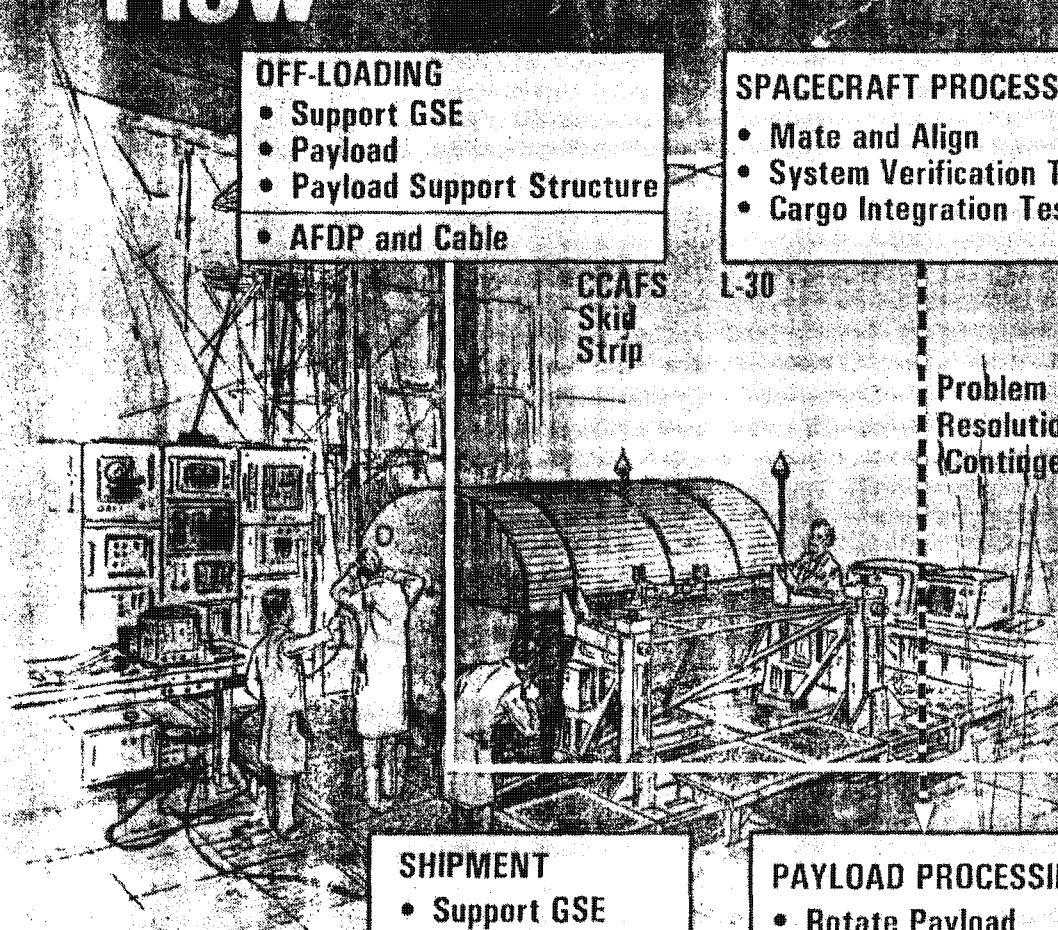
~~TOP SECRET/ DA~~

Approved for Release: 2019/06/18 C05124091



~~TOP SECRET~~/DA

Launch Base Test Flow



OFF-LOADING
- Support GSE
- Payload
- Payload Support Structure
- AFDP and Cable

CCAFS Skid Strip

L-30 — L-10

VPF

SPACECRAFT PROCESSING
- Mate and Align
- System Verification Test
- Cargo Integration Test

RSS

SPACECRAFT PROCESSING
- No Spacecraft Activity Required

L-9 — L-3

Problem Resolution (Contingency)

Launch Site

ORBITER ACTIVITY
- Interface Checks
- System Verification Test

L-57 Hours — T-0

Launch

OPF

PRELAUNCH
- Install AFDP and Cable
- Interface Check

POSTLAUNCH
- Remove Spacecraft
- Install Payload on Handling Dolly
- Remove AFDP and Cable

R + 36 Hours — R + 0

Flight

Recovery

SAB

SHIPMENT
- Support GSE
- Payload
- Payload Support Structure

CCAFS Skid Strip

PAYLOAD PROCESSING
- Rotate Payload
- Remove Data
- Prepare for Shipment

R + 52 — R + 38 Hours

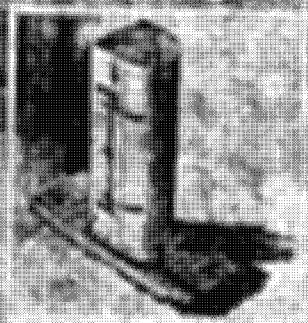
Data R + 46 Hours

~~TOP SECRET~~/DA

Handle via BYEMAN Control System only

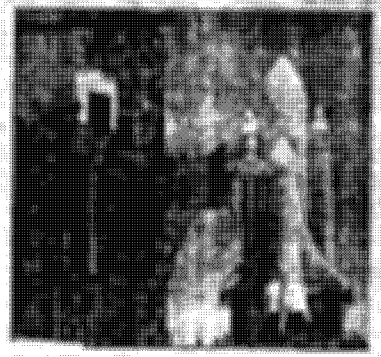
Launch Base Hardware Flow

VPF
S/C PROCESSING



MMSE
LAUNCH BASE
TRANSPORTATION

CCFS
S/C ARRIVAL

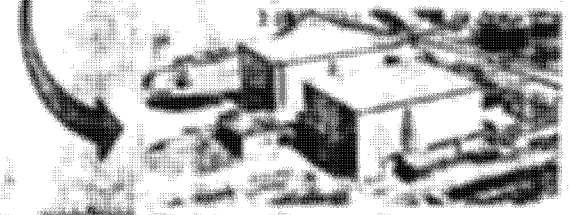


RSS
LAUNCH PREPARATIONS

SPACECRAFT/ORBITER
MISSION OPERATIONS

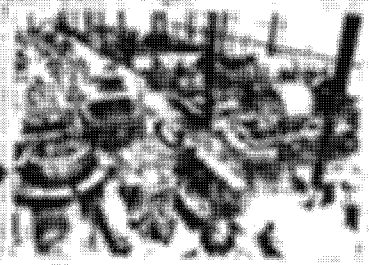
SECOND AND FOLLOWING
S/C CYCLE TO RSS

PRODUCT TO
INTELLIGENCE
COMMUNITY

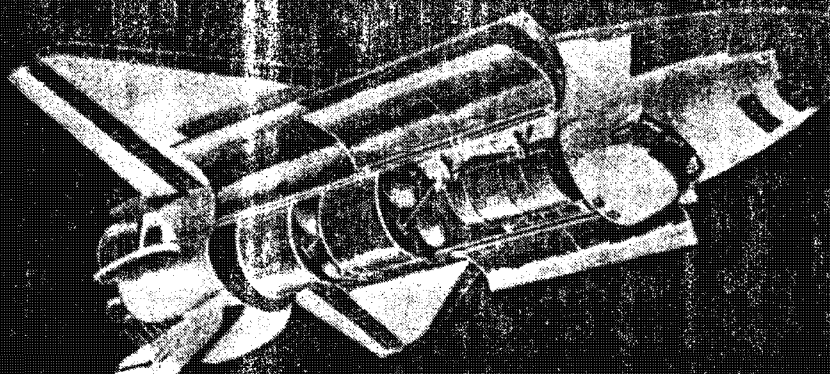


OPF
CARGO UNLOADING

SAB



FACTORY
S/C REFURBISHMENT

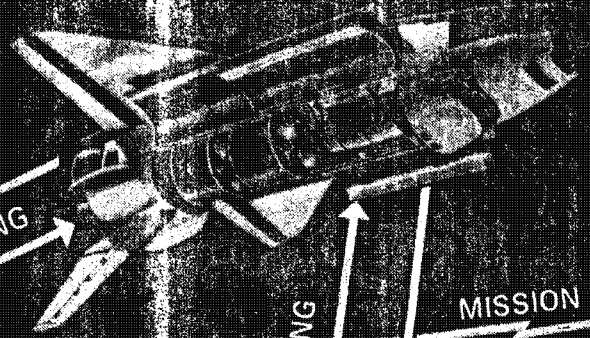


MISSION PROFILE

Approved for Release: 2019/06/18 C05124091

TOP SECRET/DA

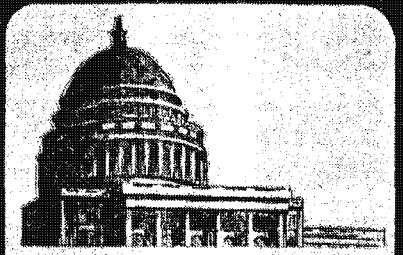
Damon Flight Operations



S/C TELEMETRY

S/C COMMANDING

MISSION TASKING



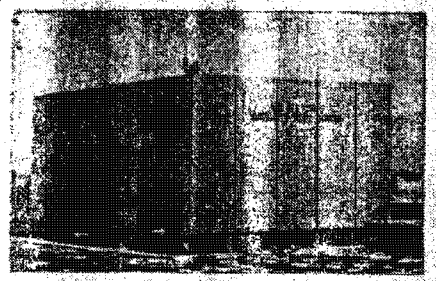
WASHINGTON, D.C.

ORBITER COMMANDING

ORBITER TELEMETRY

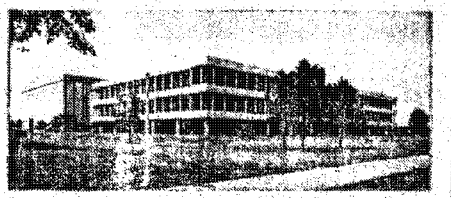
SPACECRAFT COMMAND LINK

TELEMETRY VERIFICATION



SATELLITE CONTROL FACILITY

COMMUNICATION COORDINATION



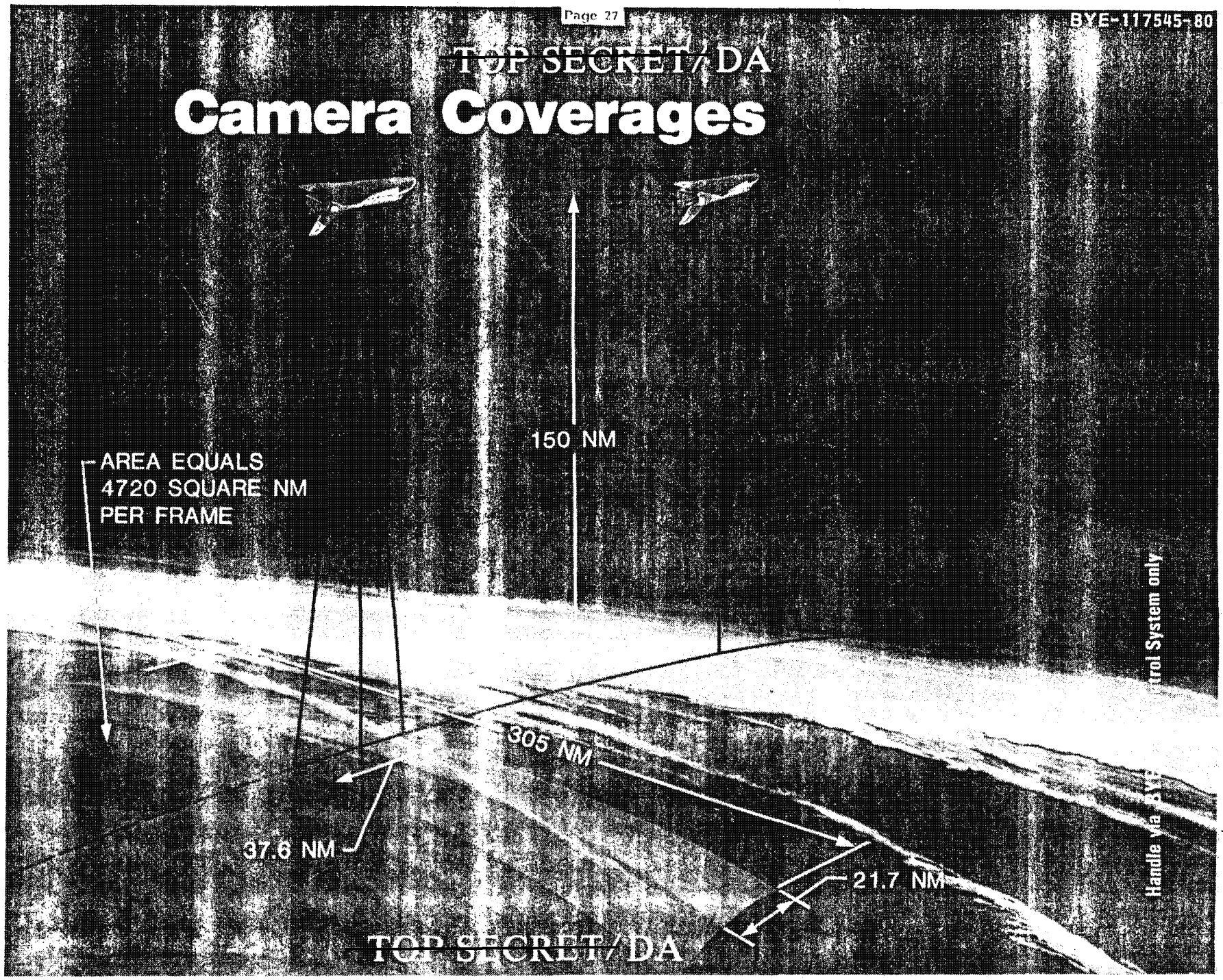
JOHNSON SPACE CENTER

KSC LAUNCH PAD

Handle via BYEMAN Control System only

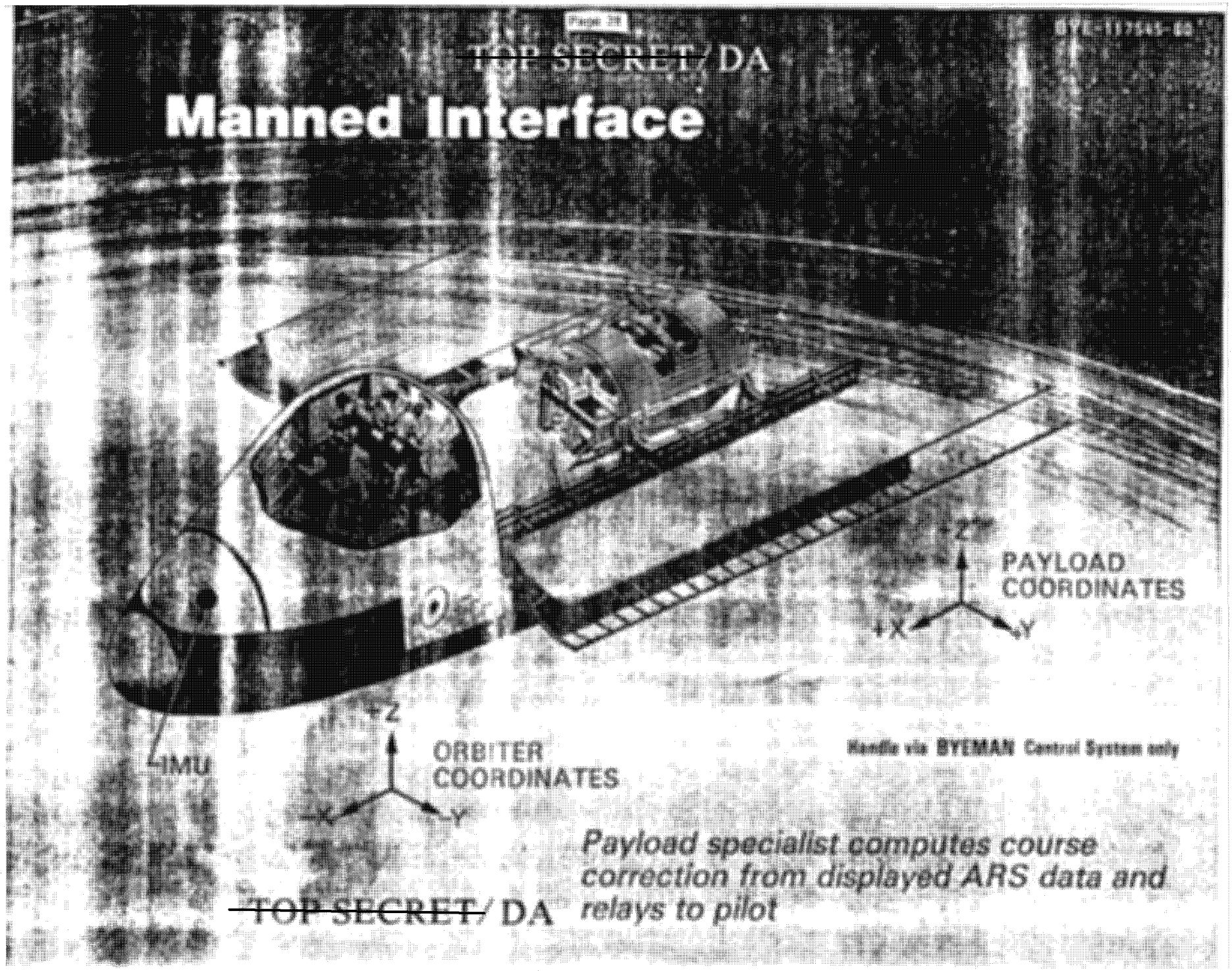
TOP SECRET/DA

Camera Coverages



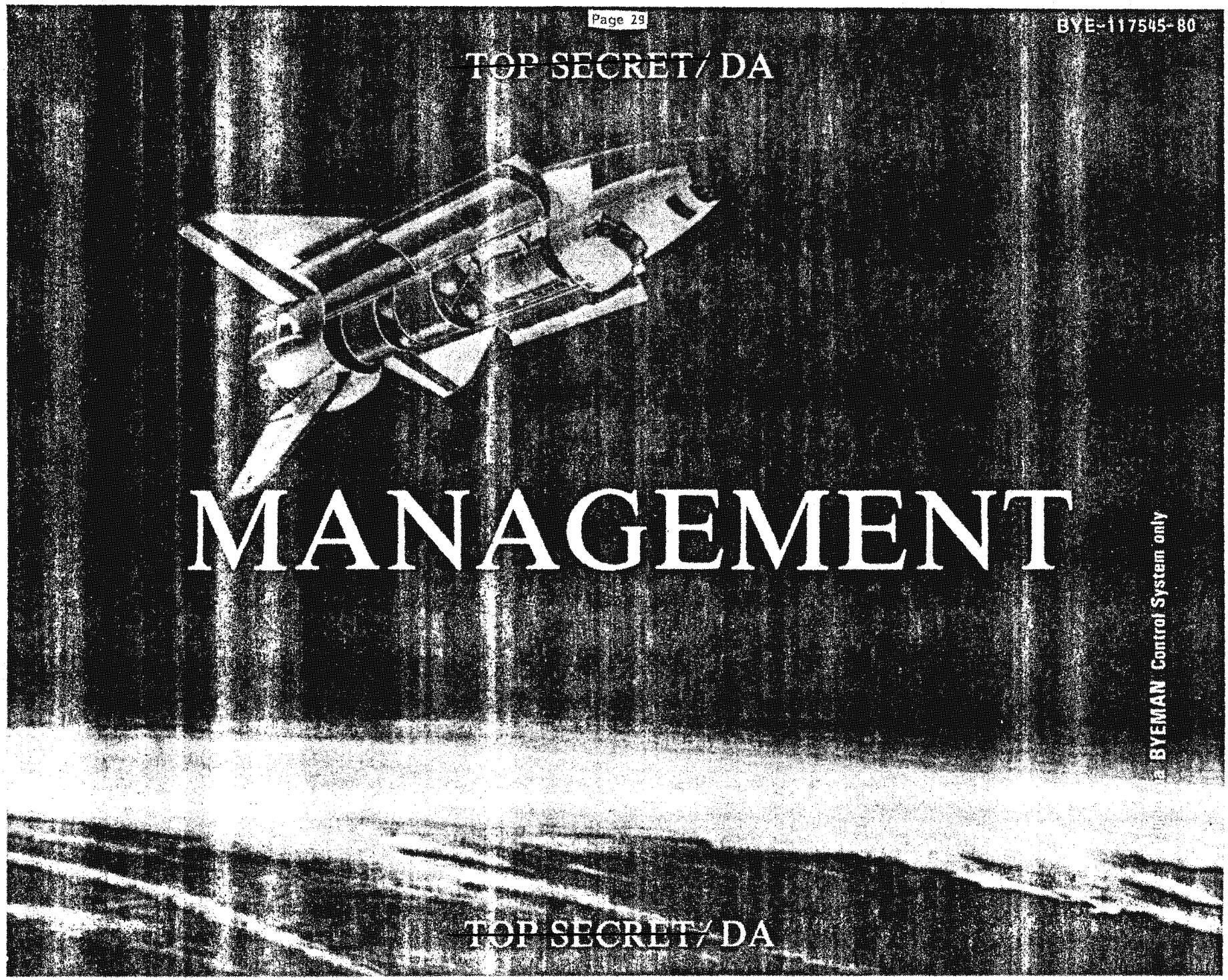
Approved for Release: 2019/06/18 C05124091

Manned Interface



Handle via BYEMAN Control System only

Payload specialist computes course correction from displayed ARS data and relays to pilot



MANAGEMENT

a BYEMAN Control System only

Approved for Release: 2019/06/18 C05124091

TOP SECRET/DA

Damon Program Office

(b)(1)
(b)(3)

Col. D.B. Hutchison
DIRECTOR

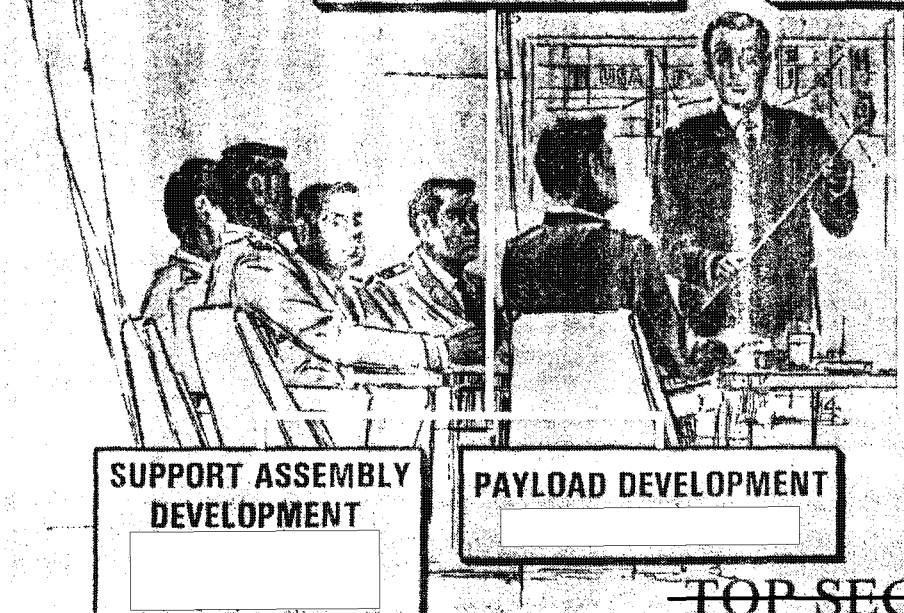
ADVANCED STUDIES

PROGRAM CONTROL
Lt. Col. D. DePree

SYSTEMS ENGINEERING

STS INTEGRATION

MISSION OPERATIONS



ORBITER INTERFACES

CREW TRAINING

GROUND OPERATIONS

MISSION PLANNING

SUPPORT ASSEMBLY DEVELOPMENT

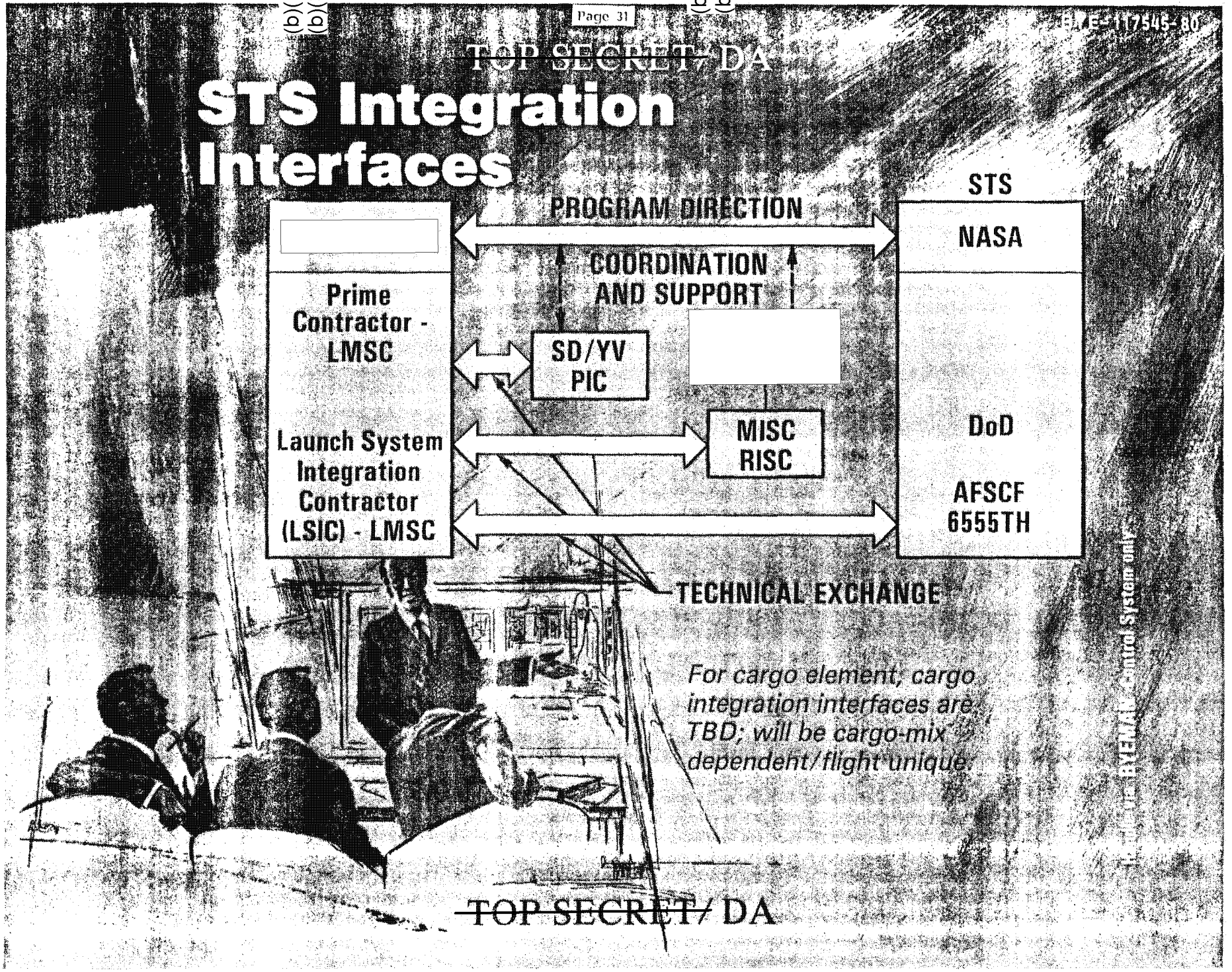
PAYLOAD DEVELOPMENT

~~TOP SECRET~~/ DA

Handle via **BYEMAN** Control System only

Approved for Release: 2019/06/18 C05124091

STS Integration Interfaces



(b)(1)
(b)(3)

~~TOP SECRET~~/DA

(b)(1)
(b)(3)

Contractor Organization

SPACE SYSTEMS DIVISION
F. C. E. Oder, VP and Gen Mgr
R.M. Powell, VP and AGM

ADVANCED VEHICLE SYSTEMS
R. C. Koche
Director

P-950 PROGRAM
[redacted]
Program Mgr

ADVANCED SPACECRAFT APPLICATIONS
[redacted]
Program Manager

P-950A

P-950B

CONCEPT A

P-380
[redacted]
Prog Mgr

CONCEPT B

~~TOP SECRET~~/DA

Program Organization

ADVANCED SPACECRAFT APPLICATIONS
P.A. Ragusa,
PROGRAM MANAGER
DAMON
B

DATA BANK
J.R. Cretcher

PROGRAM CONTROLS
A.D. Blackwell

LEGEND
B = BYEMAN ORGANIZATION

PAYLOAD SUBCONTRACTS MANAGER
P.B. Mulcaire
B

LSIC
R.E. McNulty
B
STS | I & O

LEMSCO AND I & O SUPPORT
R.R. Miley

SYSTEM SAFETY
L.J. Fistolera

EXPERIMENTS ENGINEERING
P.A. Coffman
B
SP PROGRAMS ENGINEERING

MANUFACT-URING
R.F.Williams

QUALITY ASSURANCE
E.D. Pearson

STS INTEGRATION
R.F. Witt

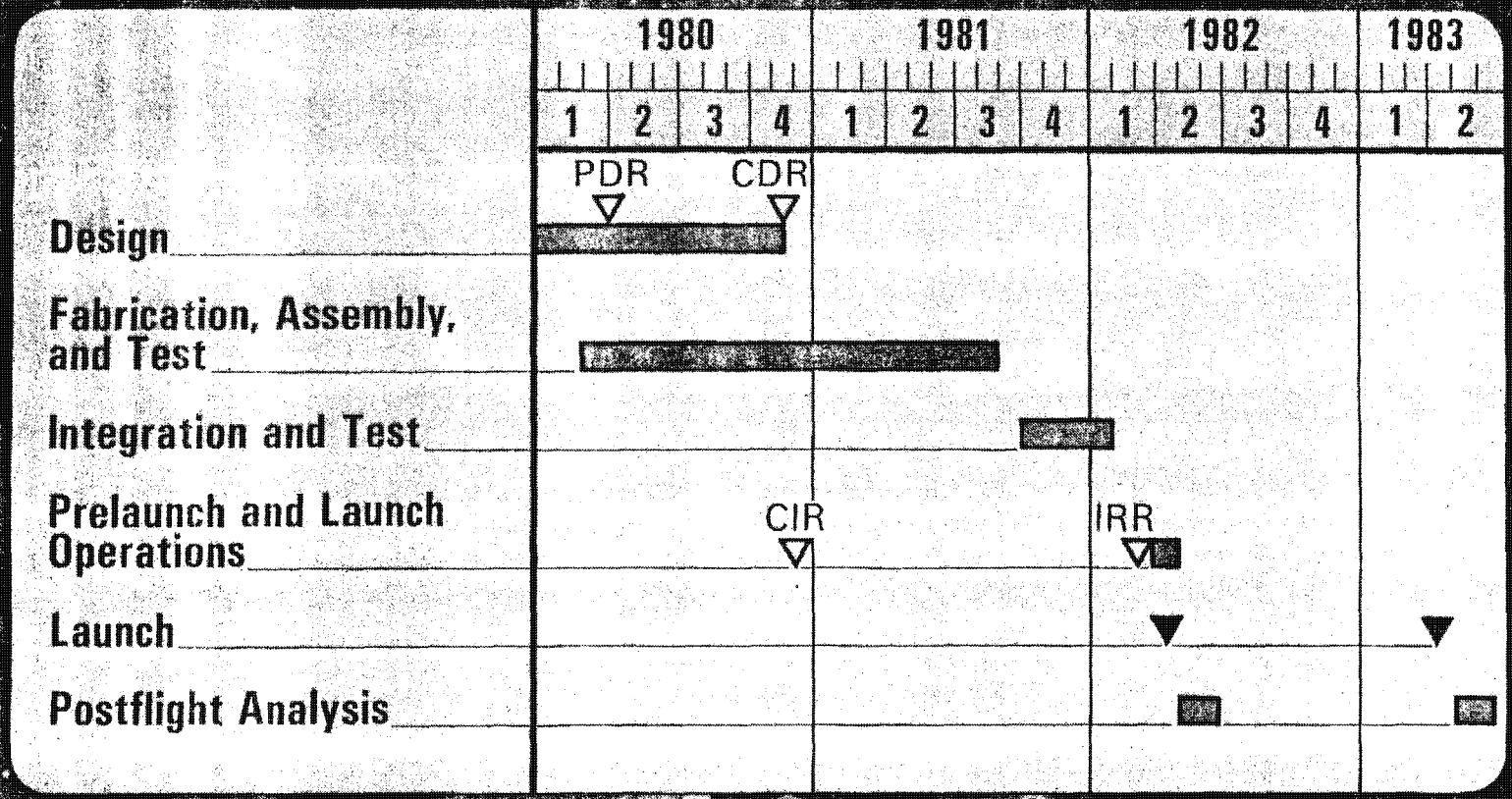
SYSTEMS ENGINEERING
H.F. Shodiss
B
SYSTEMS ENGINEERING

FLIGHT AND MISSION OPERATIONS INTEGRATION
L.W. Roberts

TEST AND EVALUATION
E.S. Rahe
B
TEST AND EVALUATION

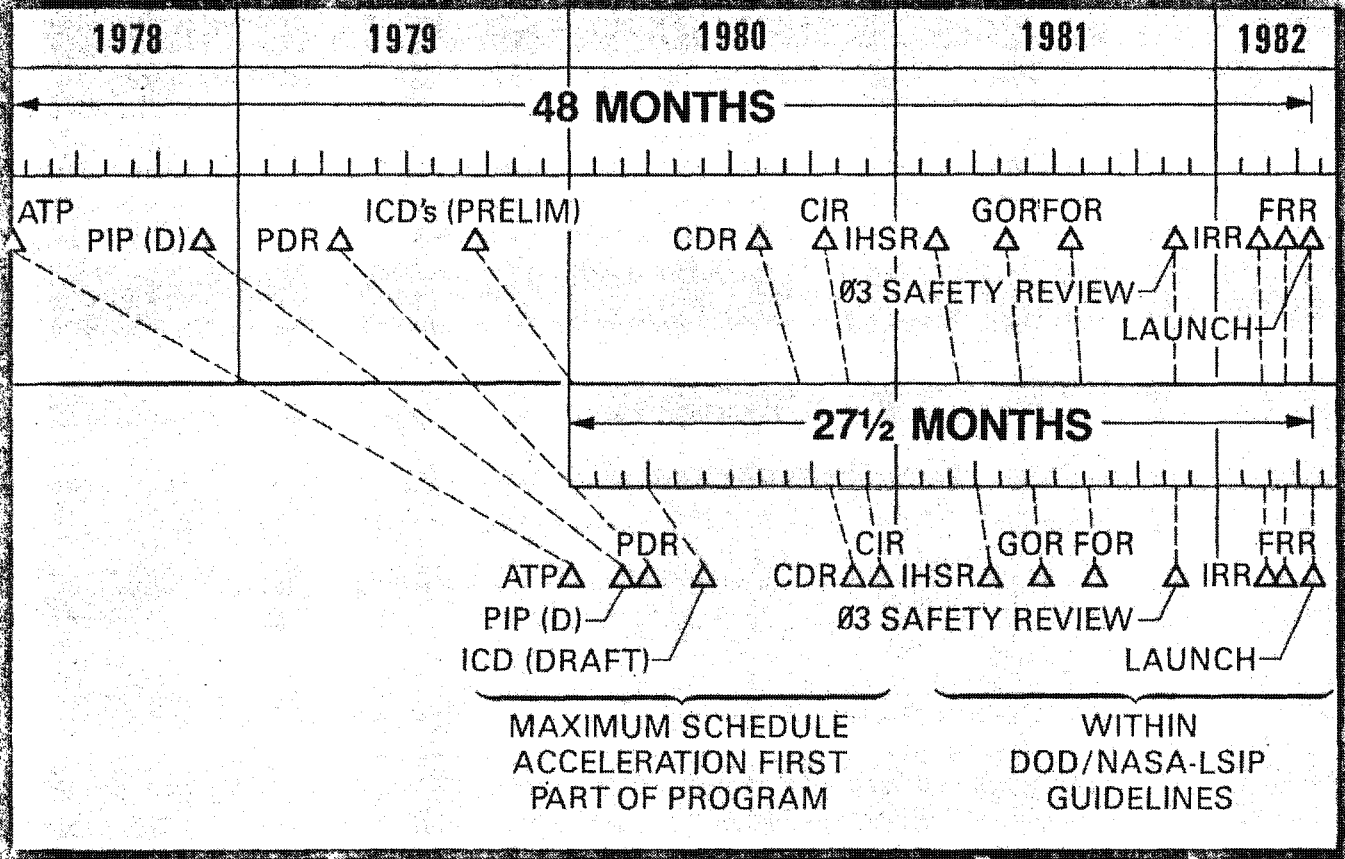
PERKIN ELMER
E. Belles
PROGRAM MANAGER

Summary Program Schedule



Accelerated Schedule Plan

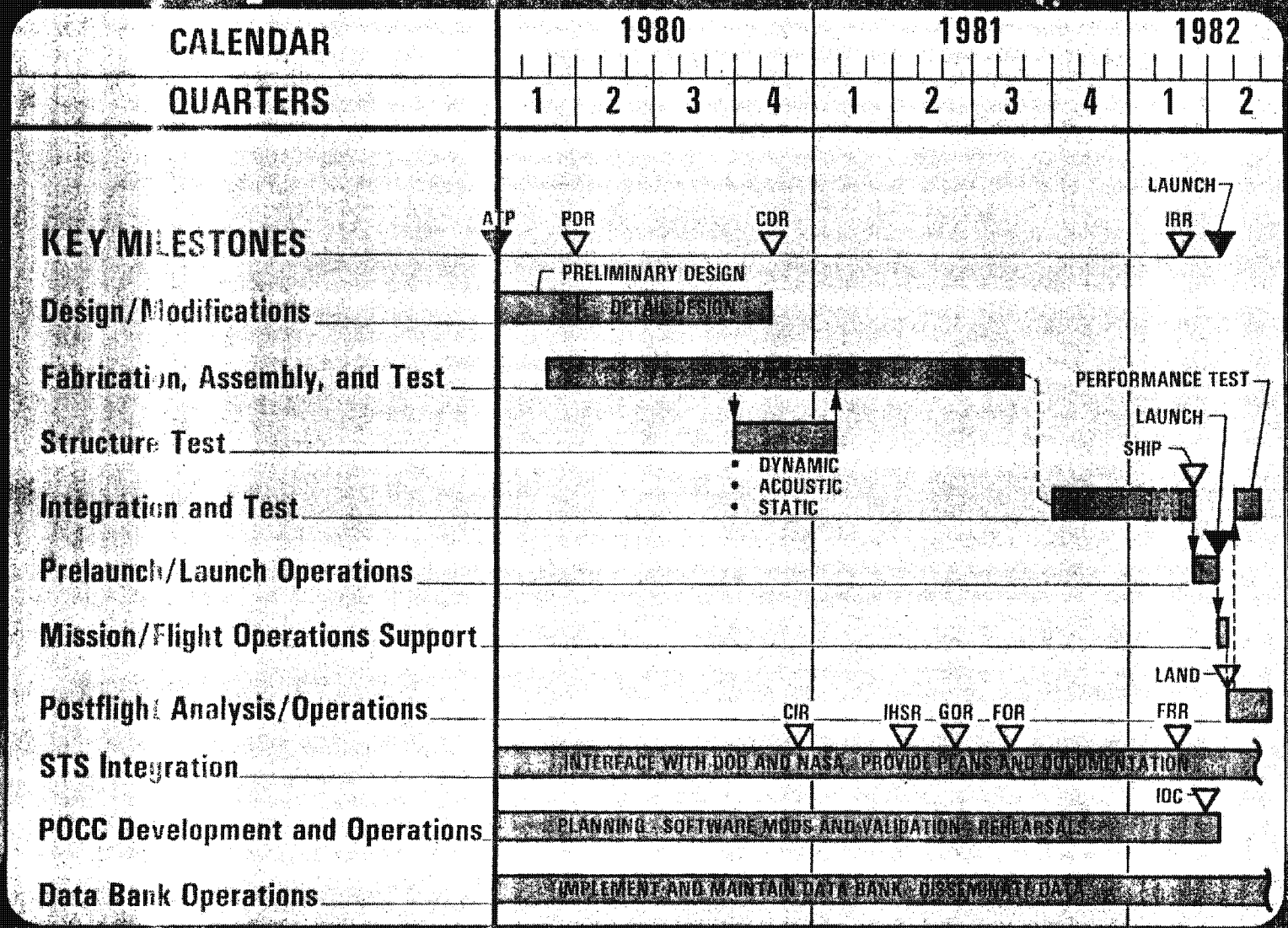
TYPICAL DoD STS INTEGRATION ACTIVITIES (REF LSIP VOL 1 FIG. 2-2, PAGE 8)



- Telescope Early Phases
- Concentrate on Long Lead Items
- Achieve Running Start
- Program Unscheduled Work Spans
- Critical Schedules—Constant Attention and Quick Reaction

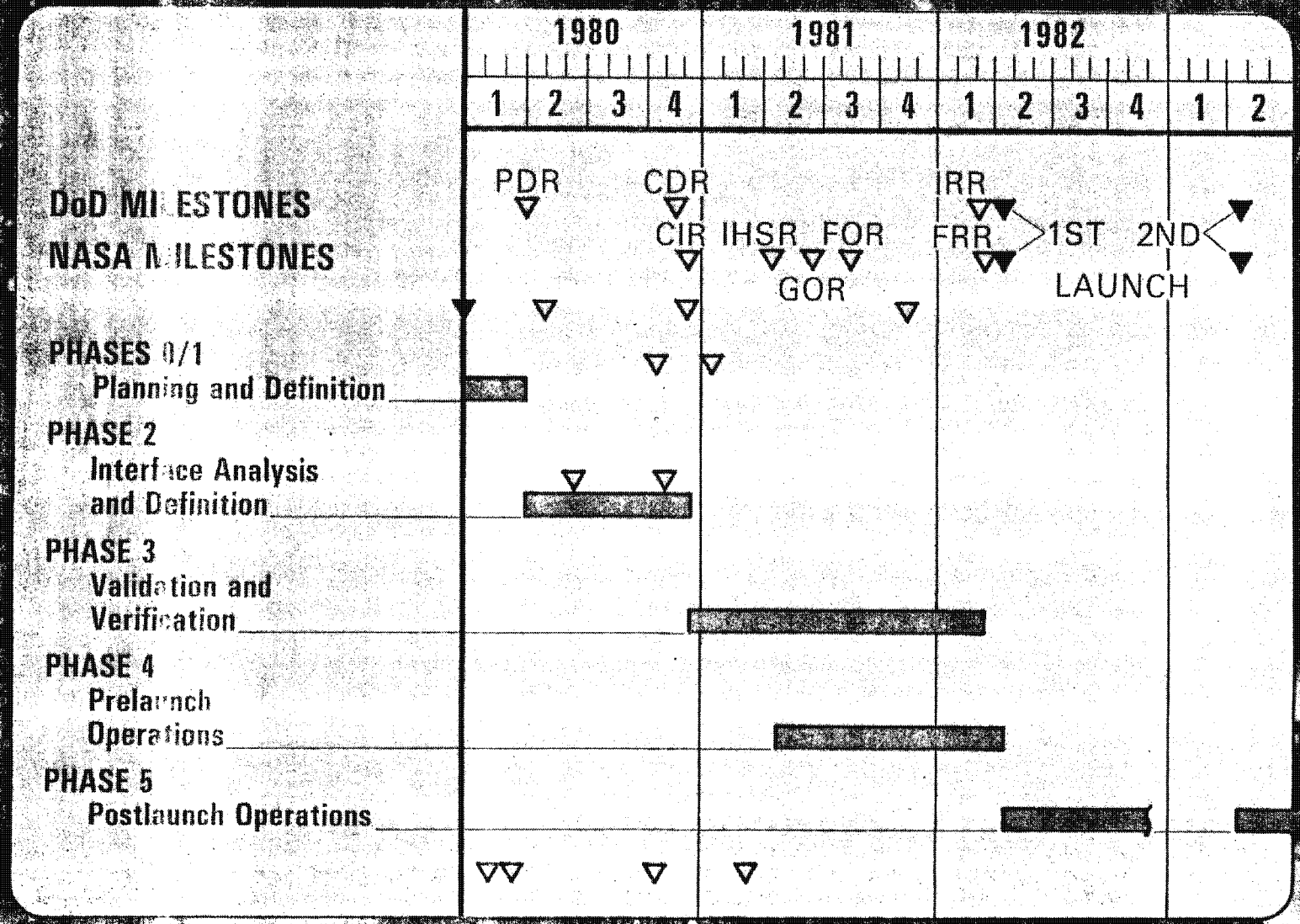
Approved for Release: 2019/06/18 C05124091

Spacecraft Hardware Development & Test Schedule



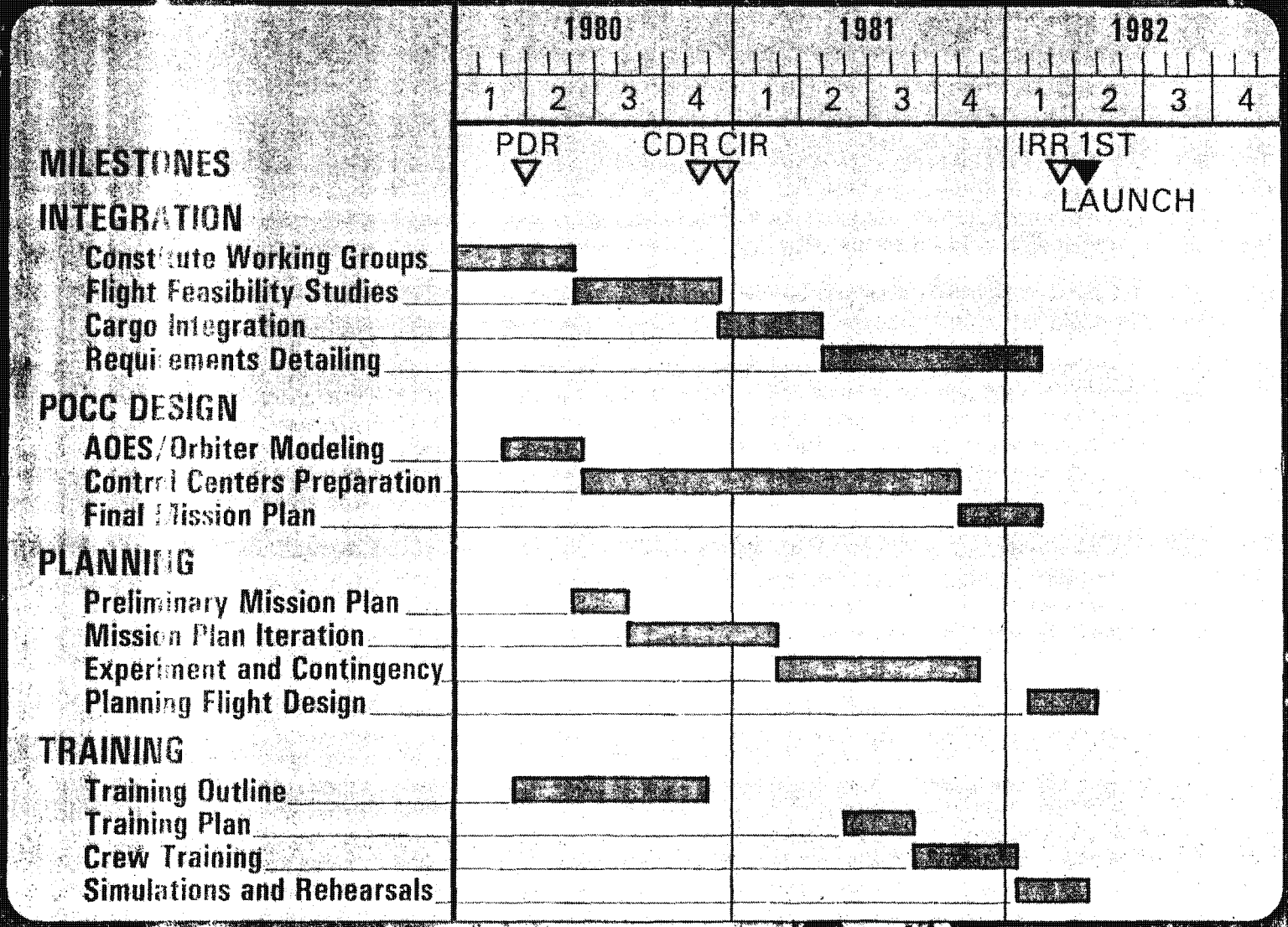
Approved for Release: 2019/06/18 C05124091

STS Integration Schedule



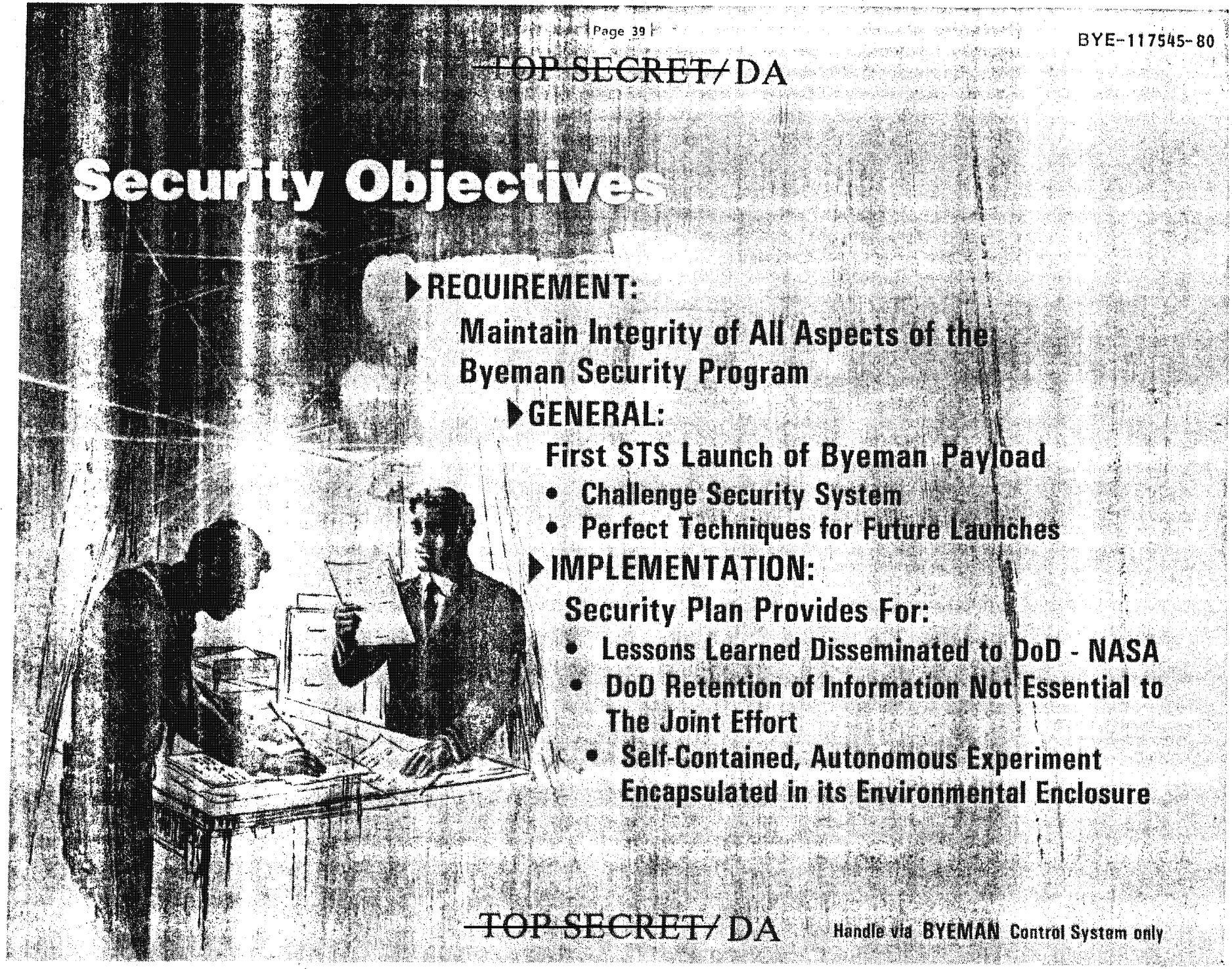
Approved for Release: 2019/06/18 C05124091

Flight and Mission Operations Schedule



Handle via BYEMAN Control System only

Security Objectives



- **REQUIREMENT:**
  - Maintain Integrity of All Aspects of the Byeman Security Program
- **GENERAL:**
  - First STS Launch of Byeman Payload
    - Challenge Security System
    - Perfect Techniques for Future Launches
- **IMPLEMENTATION:**
  - Security Plan Provides For:
    - Lessons Learned Disseminated to DoD - NASA
    - DoD Retention of Information Not Essential to The Joint Effort
    - Self-Contained, Autonomous Experiment Encapsulated in its Environmental Enclosure

Approved for Release: 2019/06/18 C05124091

~~TOP SECRET~~/ DA

Major Elements of Damon Classification Guide

ITEM	CLASSIFICATION
ASSOCIATION:	
Damon Program with AF Program 269	S/Da (BYE)
Damon Program With LMSC Advanced Spacecraft Application (ASA) Organization	S/Da (BYE)
Damon Mission With STS	S/ Da (BYE)
PRIME CONTRACTS (EXISTENCE AND IDENTIFICATION):	
Damon Hardware	S/Da (BYE)
AF 269 Integration and Operational Support	S/DoD
SUBCONTRACTS:	
Sensor Subsystem (P&E)	S/Da (BYE)
All Other Subsystems*	U

*Exception: SGLS Transponder Classified "CONFIDENTIAL" (DoD)

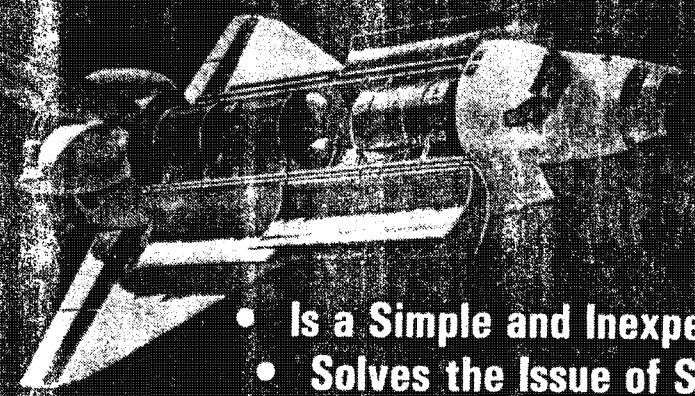
~~TOP SECRET~~/ DA Handle via BYEMAN Control System only

Major Elements of Damon Classification Guide (cont'd)

ITEM	CLASSIFICATION
HARDWARE:	
Spacecraft Structure And Equipment Section**	U
ENVIRONMENTAL PROTECTION SHIELD	U
PAYLOAD ASSEMBLY	S/Da (BYE)
MISSION OPERATIONS	
Intelligence Target Information	TS/Da (BYE)
Sensor System Performance	TS/Da (BYE)
OTHER SPACECRAFT SUBSYSTEM PERFORMANCE:	U-S Based On Content
STS Mission Data	U-S Based On Content

**Exception: ECS MOD IV Classified "SECRET" (DoD)

Summary



- Is a Simple and Inexpensive Experiment
- Solves the Issue of STS Involvement in Intelligence Collection
- Is Capable of Providing Early Significant Practical Experience With the STS
- Is Capable of Providing Critical Data to DoD and NRO to Facilitate STS Transition
- Provides Evaluation of New Concepts in the STS ERA Without Risk to a Vital, Expensive Program
  - Man in the Loop
  - Use of Orbiter Support Systems
  - Recycling Hardware
  - NASA in Operational Mode

Approved for Release: 2019/06/18 C05124091

GFE Hardware

- Photographic Payload
- Metric Experiment
  - Star Sensor
  - Doppler Beacon
  - Accelerometer
- Sonbe Sextant
- Extended Command System
- Space-Ground Link System
- Use of Existing Aerospace Ground Equipment

Approved for Release: 2019/06/18 C05124091

BYE-117545-80

~~TOP SECRET~~/DA

GF Labor Groundrules

LMSC

- Maximum use of mainline manpower without disturbing current contract estimates at completion
- Accept studies on Damon program up to $2 million over-run

HRP

Manpower authorized up to specific limits, currently 1203 manmonths

Priority

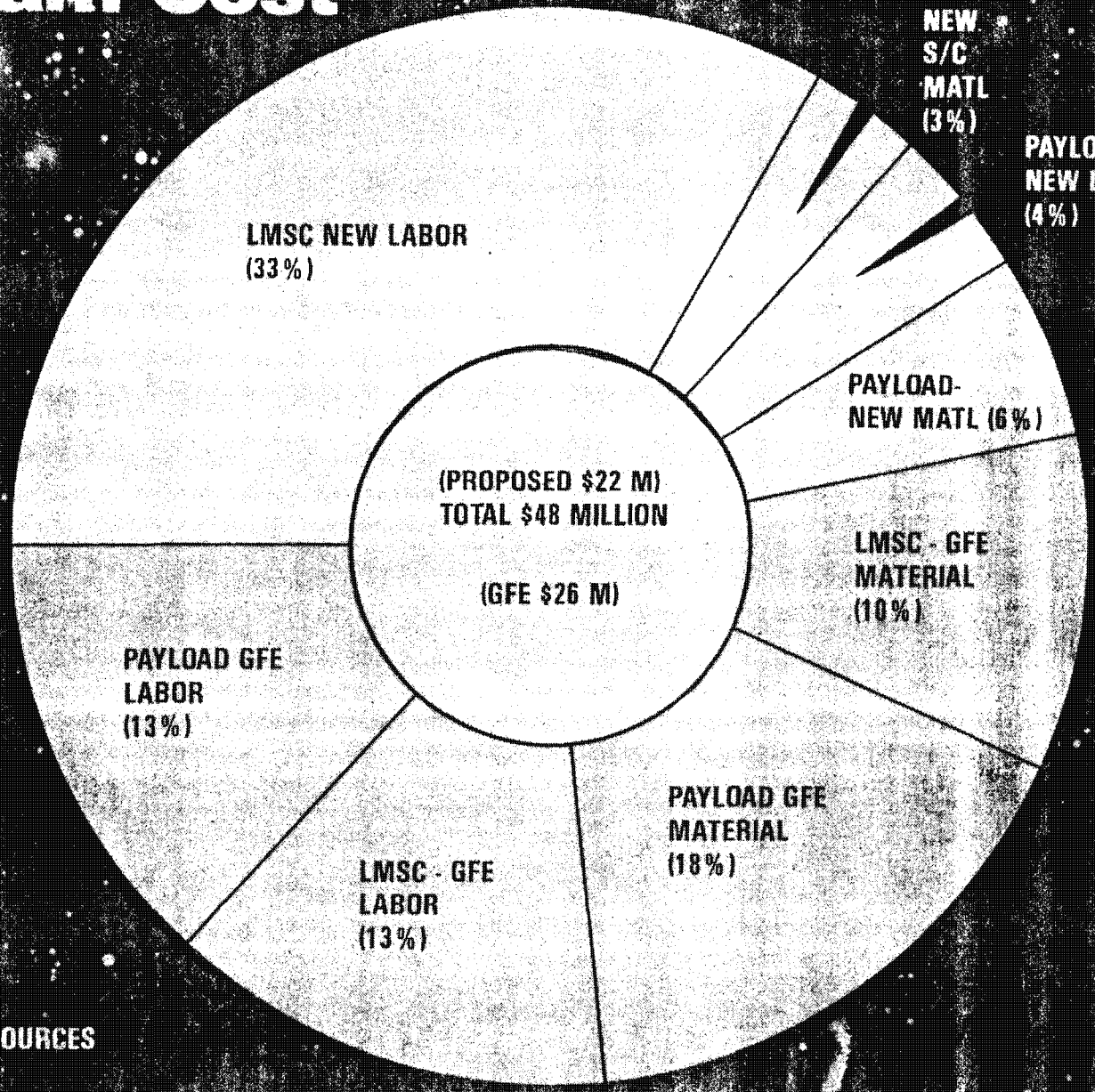
- P-467, P-110, P-269

Ground Rule

- Manpower usage will not affect mainstream programs

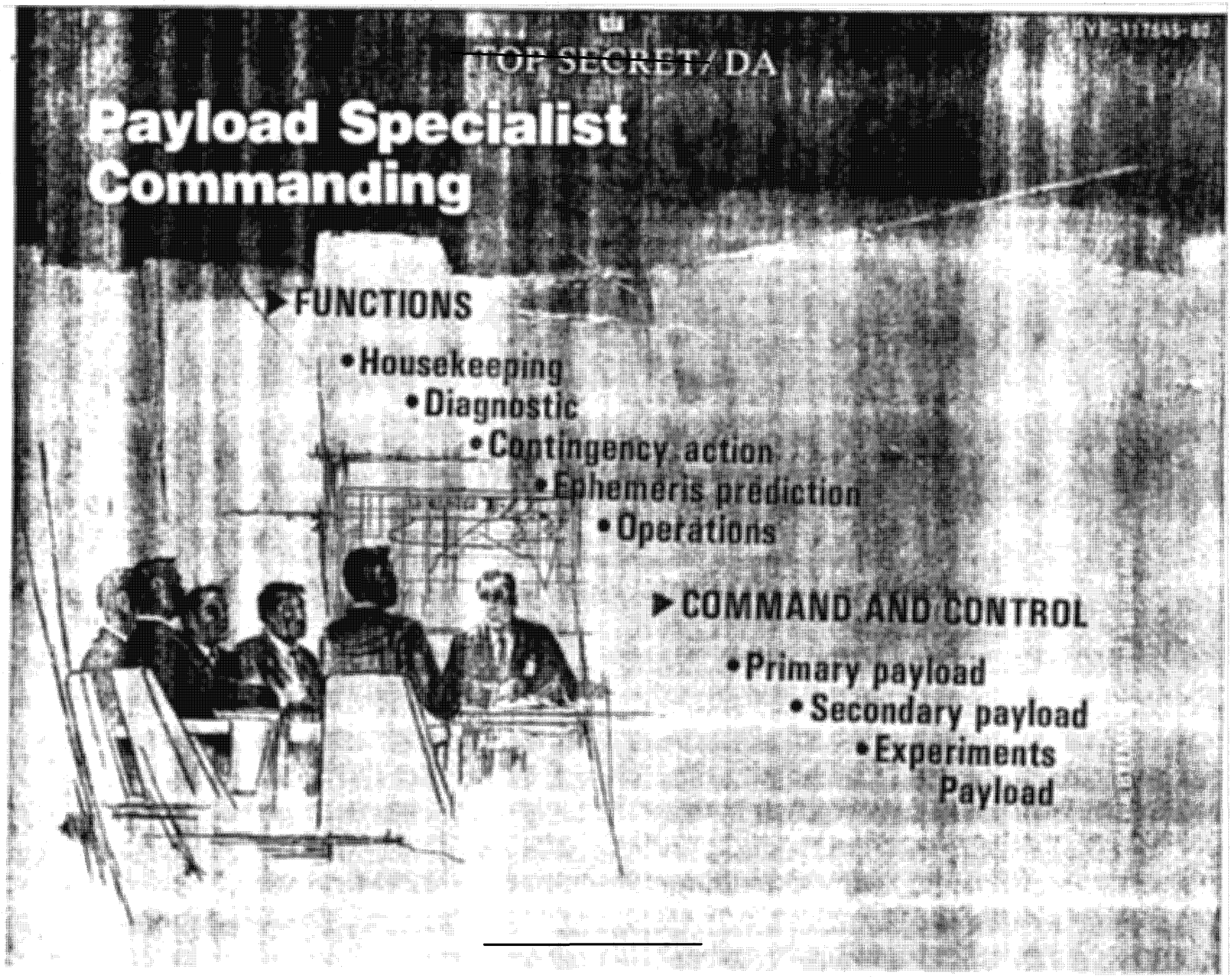
Approved for Release: 2019/06/18 C05124091

Program Cost



GFE RESOURCES

Payload Specialist Commanding



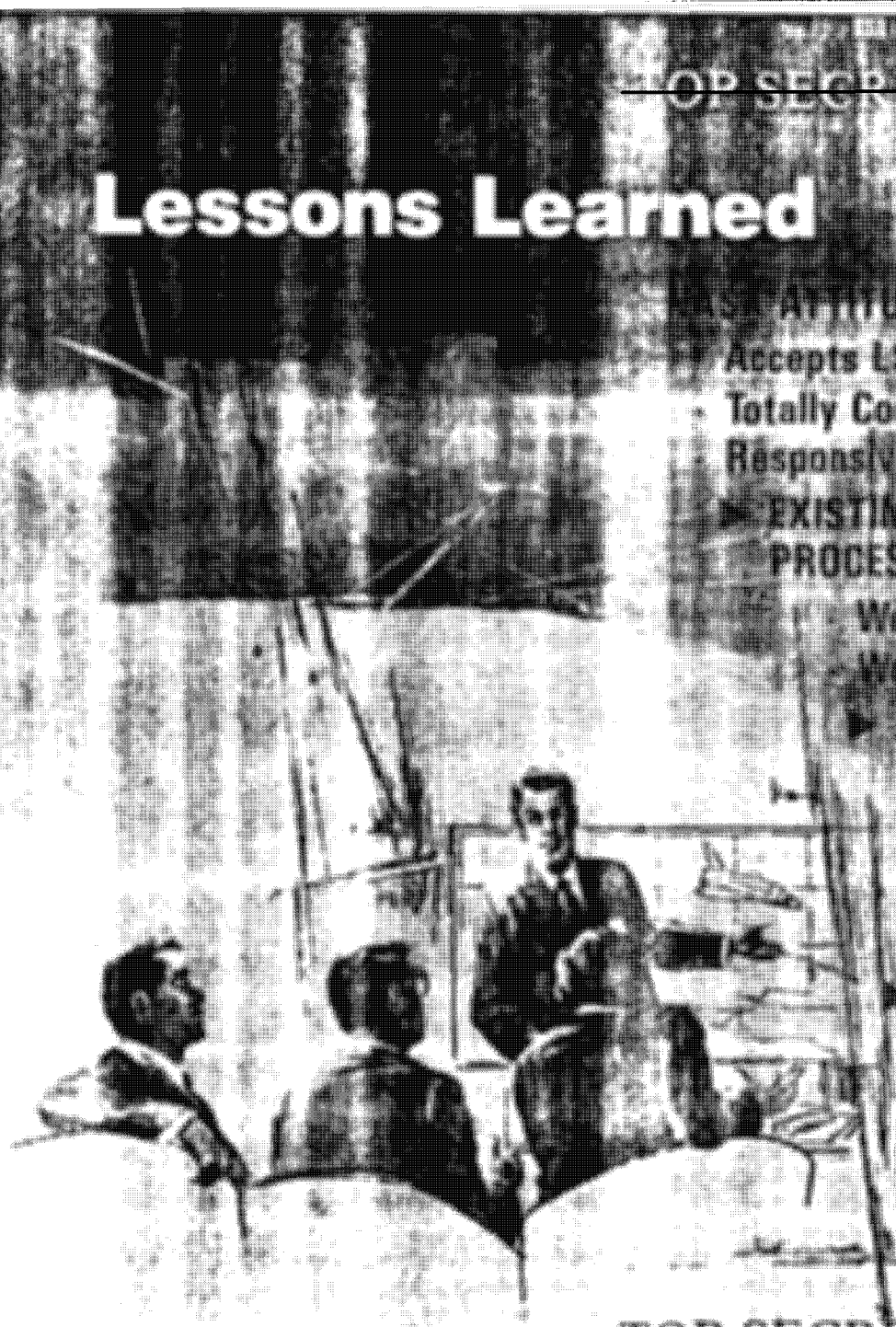
▶ FUNCTIONS

- Housekeeping
- Diagnostic
- Contingency action
- Ephemeris prediction
- Operations

▶ COMMAND AND CONTROL

- Primary payload
- Secondary payload
- Experiments Payload

Lessons Learned



- ESA ATTITUDE EXCELLENT
  - Accepts LS/C Concept
  - Totally Cooperative
  - Responsive and In Depth
- EXISTING NASA SHUTTLE INTEGRATION PROCESSES WITH JSC
  - Well Documented
  - Workable
- SIGNIFICANT TIMING IMPROVEMENT NECESSARY
  - Orbital Requirements Document
  - Payload Integration Plan
  - Security Guidelines
- NASA MILESTONE SCHEDULES NEED CLARIFICATION
  - Submilestone Set Back Times
- SECURITY
  - Excellent Attitude
  - Experience Lacking

Ready to BYEMAN Control System only

Approved for Release: 2019/06/18 C05124091

Contract Provisions

SCOPE

- Design, develop, and test a recyclable shuttle payload

FLIGHT SCHEDULE

• Basic	Two flights	April 82 and April 83
• Option 1	Added flight	August 82
• Option 2	Added flight	July 84

CONTRACT TYPE

- CPIF / Award Fee