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ASD

GENERAL DYNAMICS
Land Systems Division

ABRAMS SYSTEM DEVELOPMENT

M1A1E2 CONFIGURATION

BRIEFING FOR

LTG. FREDERIC J. BROWN, COMMANDING GENERAL, FOURTH U.S. ARMY

Documents top 30 FORTUNE

70L-51457a

ABRAMS SYSTEM DEVELOPMENT DISCUSSION TOPICS

- Program Overview
  - Objectives
  - Structure
  - System Definition Process
- System Definition/ Operational Capabilities
  - Requirements
  - System Design
  - System Features
  - System Capabilities

The Abrams System Development Program is Ready to Transition into FSD with a System Integration and Verification Plan that Will Ensure the Fightability Improvements the Soldier's Need.

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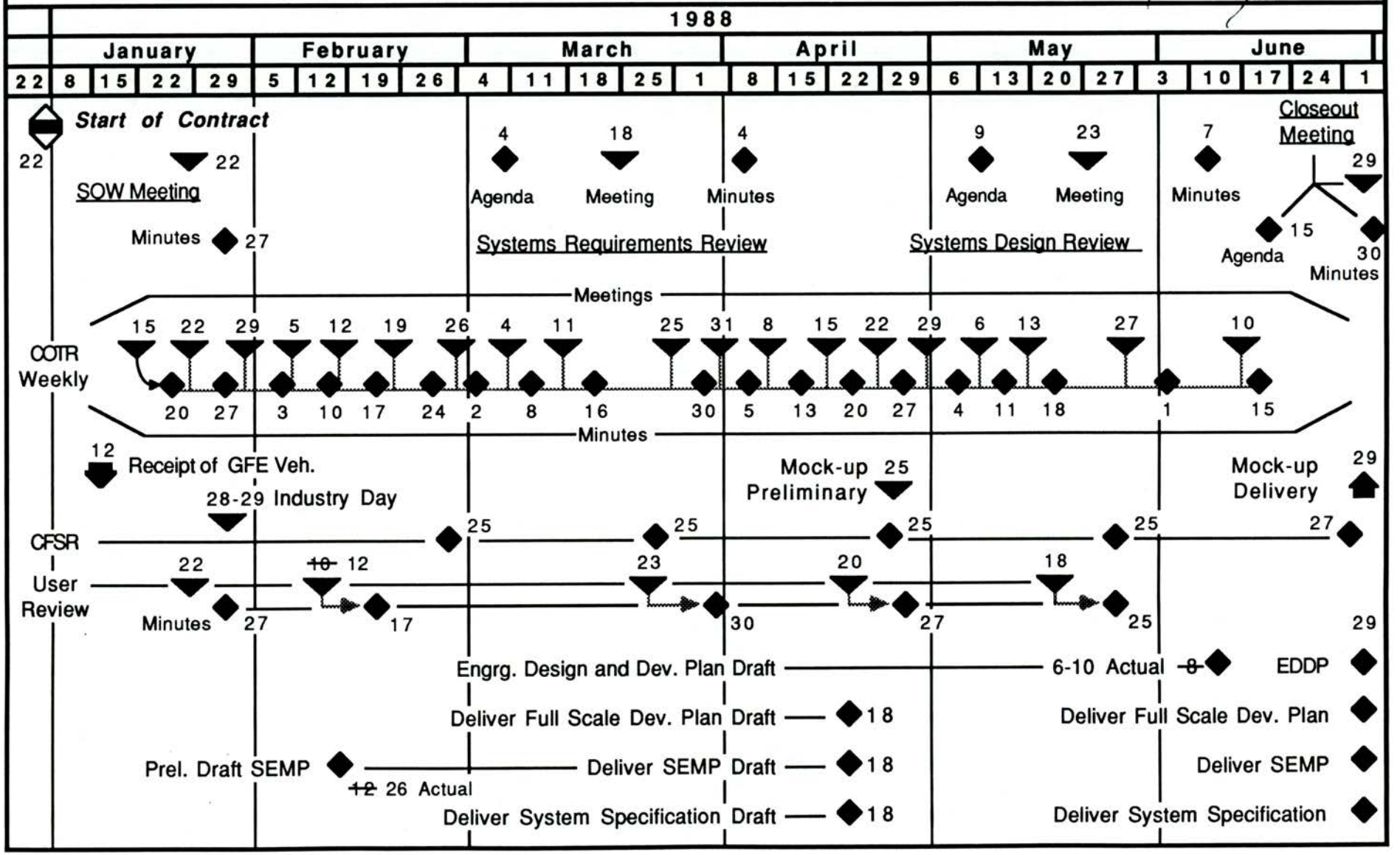
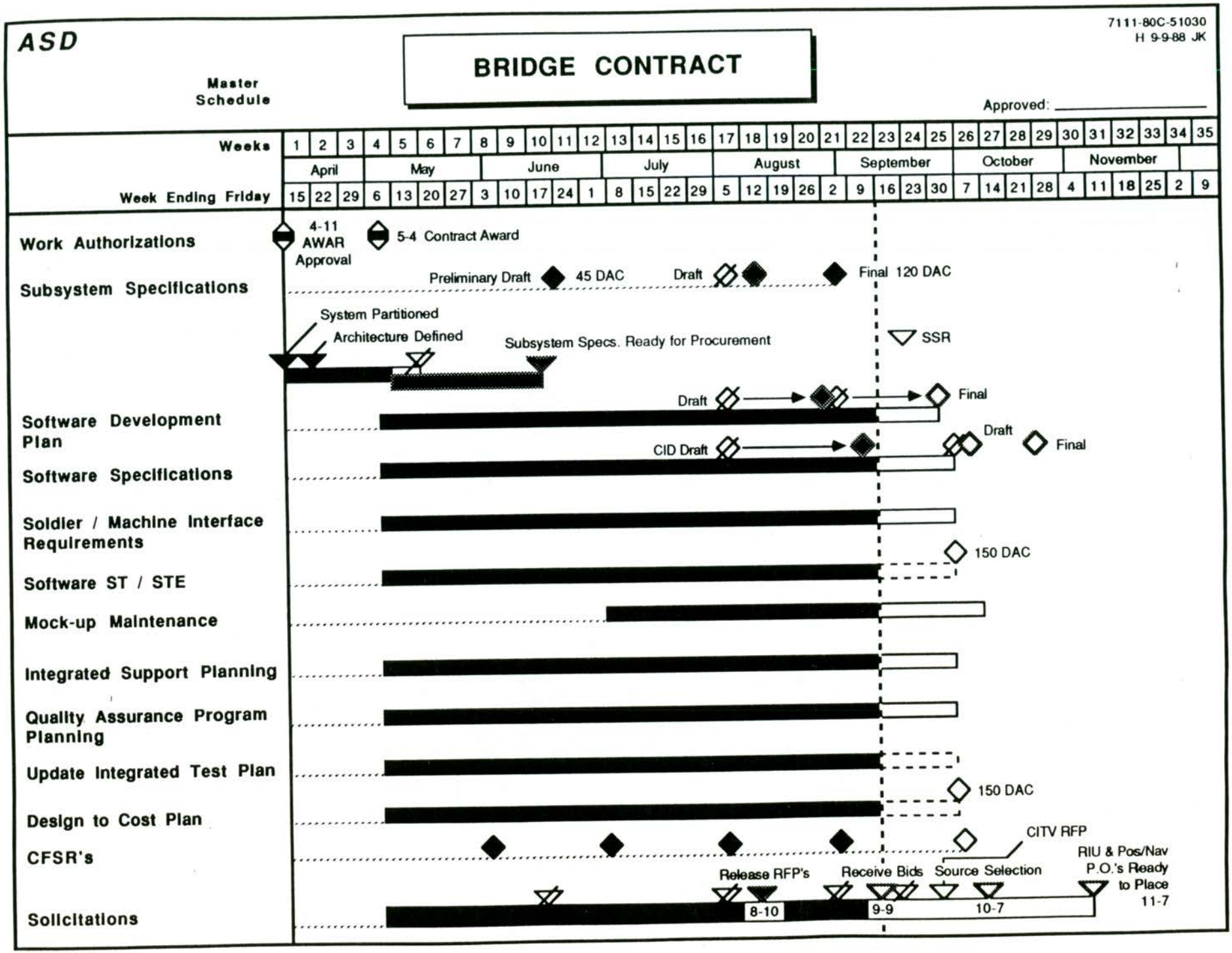
Master Schedule

ABRAMS SYSTEMS DEVELOPMENT CONTRACT CRITICAL MILESTONE CHART

7111-80A-50042
L 6-17-88 JK

Approved:

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Master Schedule
BRIDGE CONTRACT
7111-80C-51030
H 9-9-88 JK
Approved: _____
Weeks
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
April May June July August September October November
Week Ending Friday
15 22 29 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9
Work Authorizations
4-11 AWAR Approval
5-4 Contract Award
Subsystem Specifications
Preliminary Draft
45 DAC
Draft
Final 120 DAC
System Partitioned
Architecture Defined
Subsystem Specs. Ready for Procurement
SSR
Software Development Plan
Draft
Final
Software Specifications
CID Draft
Draft
Final
Soldier / Machine Interface Requirements
150 DAC
Software ST / STE
Mock-up Maintenance
Integrated Support Planning
Quality Assurance Program Planning
Update Integrated Test Plan
150 DAC
Design to Cost Plan
CFSR's
CITV RFP
Release RFP's
Receive Bids
Source Selection
RIU & Pos/Nav P.O.'s Ready to Place
Solicitations
8-10
9-9
10-7
11-7

80C-51030 H

PROGRAM OVERVIEW

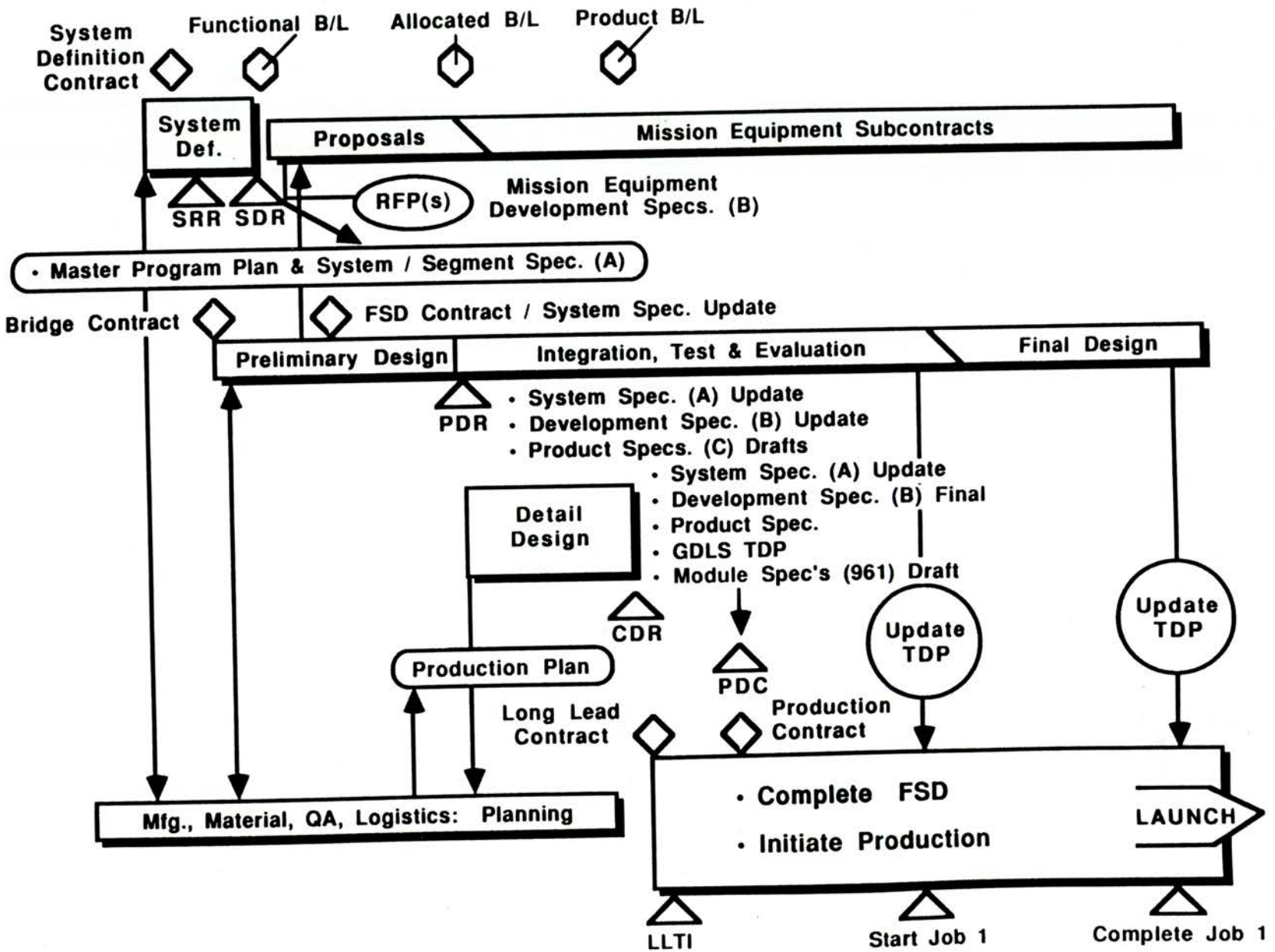
PROGRAM OBJECTIVES

- **Block Improved Abrams**
  - Increase the Combat Effectiveness of the Abrams Tank System to Deter and if Necessary Defeat a Rapidly Evolving Threat
  - Increase the Cost Effectiveness of the Abrams by Fielding a High Quality and Affordable Tank System
- **System Definition**
  - Establish System Requirements and Design Definition
  - Provide an FSD Program Plan for Incremental Block Upgrades Initiated in System Segments via Exercise of Contract Options

1. Block Improved Abrams is Defined to be the Next Type Designated Model of the Abrams Main Battle Tank.
2. Abrams System Development is the Name given to the System Definition, Transition to Full Scale Development, Full Scale Development and Transition to Production Phases of Block Improved Abrams Development per AR70-2.

PROGRAM OVERVIEW

ABRAMS SYSTEM DEVELOPMENT PROGRAM STRUCTURE

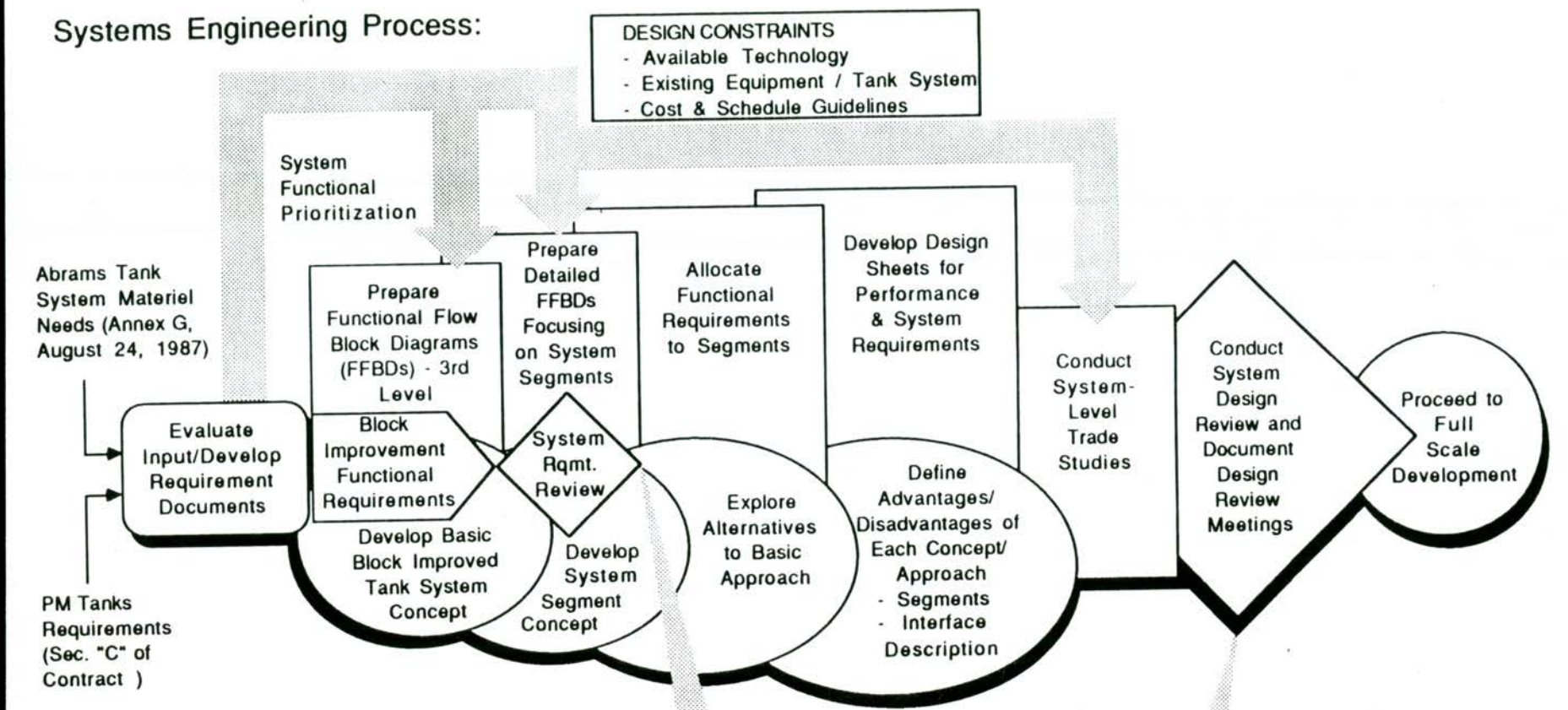


ASD CONTRACT SCOPE

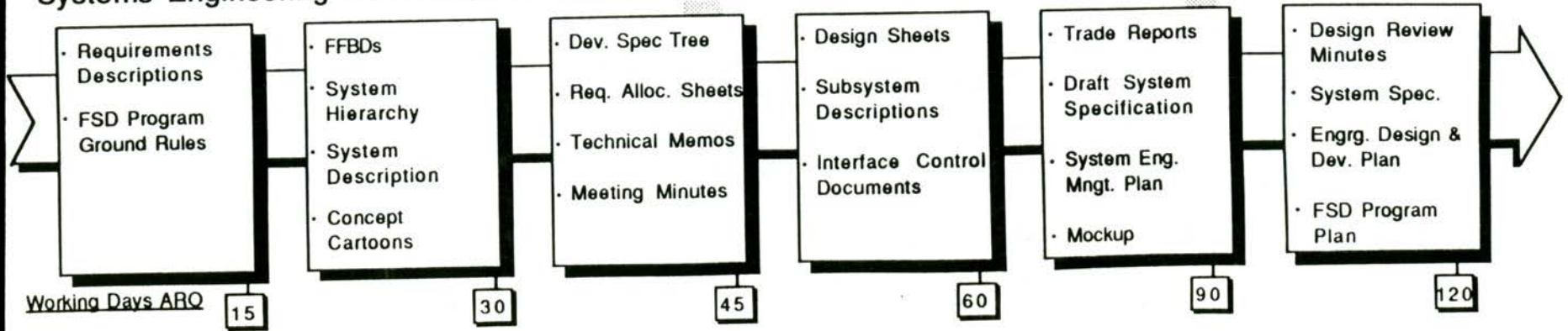
- Provide System Engineering to Define Detailed System Requirements and Design Definition for Specified System Functions
- Develop a System/Segment Specification for the Block Improved Abrams
- System Design Must Provide a Foundation for Future Growth: Other Product Improvements such as Multi-Sensor Target Acquisition System or Vehicle Integrated Defense System must be Defined Via GFI Specifications and/or Drawings and Agreed Upon by GDLS.
- Provide Essential Material for FSD Program Development:
  - System Engineering Management Plan
  - Engineering Design and Development Plan
  - Full Scale Development Program Plan
- Provide Implicit Program Development Tools:
  - Briefing Material
  - Mobilized Supplier Base

TECHNICAL APPROACH

Systems Engineering Process:



Systems Engineering Documentation And Contract Deliverables:



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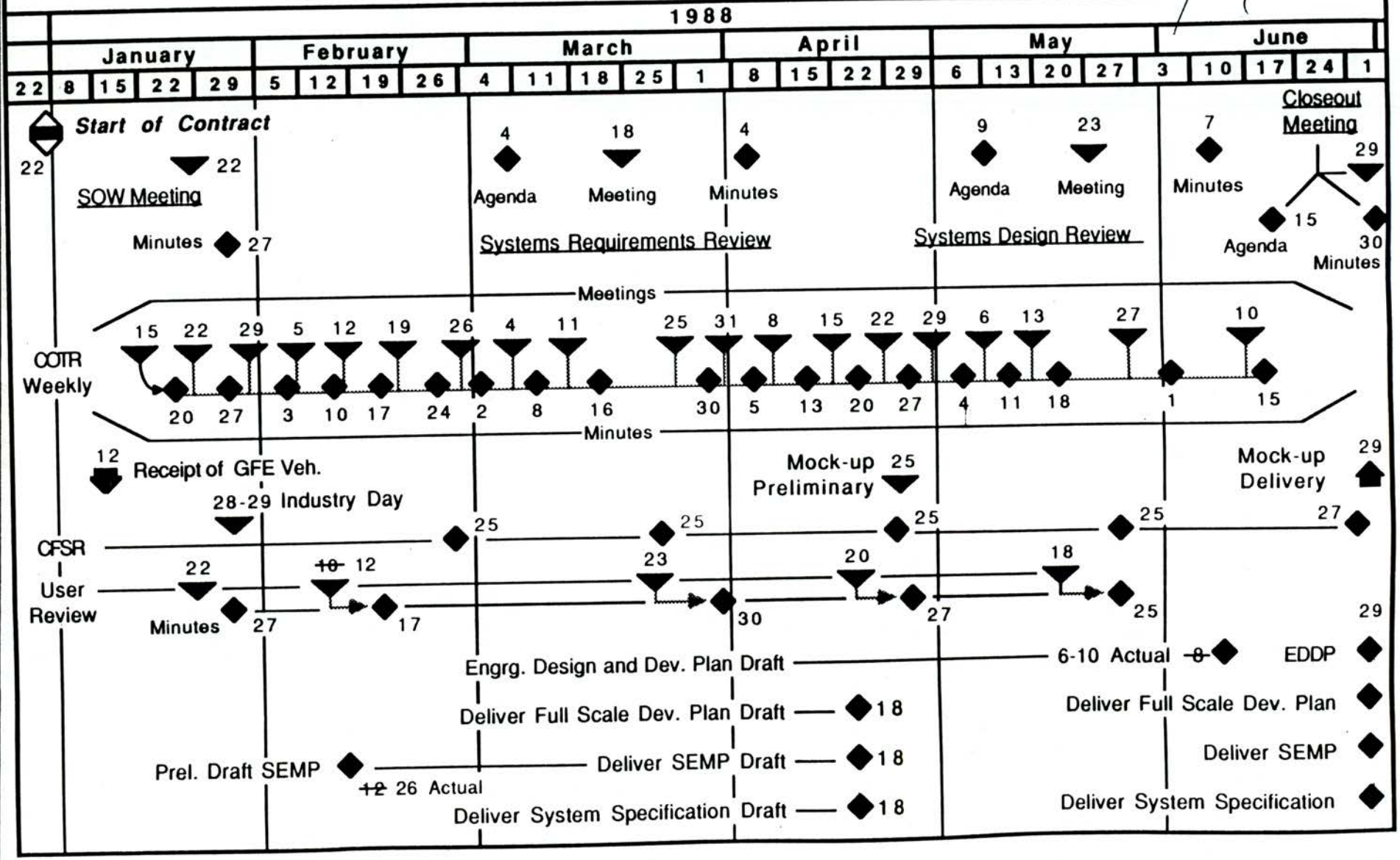
Master Schedule

ABRAMS SYSTEMS DEVELOPMENT CONTRACT CRITICAL MILESTONE CHART

7111-80A-50042
L 6-17-88 JK

Approved: _____



FORMAL DESIGN REVIEWS

- System Requirements Review (SRR) - Completed February 1988
- System Design Review (SDR) - Completed May 1988
- Software Specification Review (SSR) - Scheduled for October 1988.
- Preliminary Design Review (PDR) - Tentatively Scheduled for January 1989
- Critical Design Review (CDR) - Tentatively Scheduled for June 1989.

MISSION and REQUIREMENTS SUMMARY

- Tank's Mission Hasn't Changed
- The Threat Has Changed :
  - Reactive Armor
  - Armament
  - Helicopter ATGM
  - Directed Energy
  - More Vehicles
- So New Operational Requirements are Introduced :
  - System Survivability Must be Upgraded to Respond to Threat Advances
  - Air Threat Must be Addressed Within Inherent Tank Capabilities
  - Multi - Target Engagements Must be Accomplished

Spec. Para.
3.1.1 , 3.1.2

MISSION and REQUIREMENTS SUMMARY (CONT.)

- Mission Reaction Time Must be Shortened
  - Tactical Awareness
  - Increases Command Capabilities and Crew Efficiency : Tank Commander, Platoon Leader, Company Commander, Battalion Commander
- Addressing These New Operational Requirements Introduces Fightability Improvements to Enhance Crew Effectiveness

Spec. Para.
3.1.1, 3.1.2

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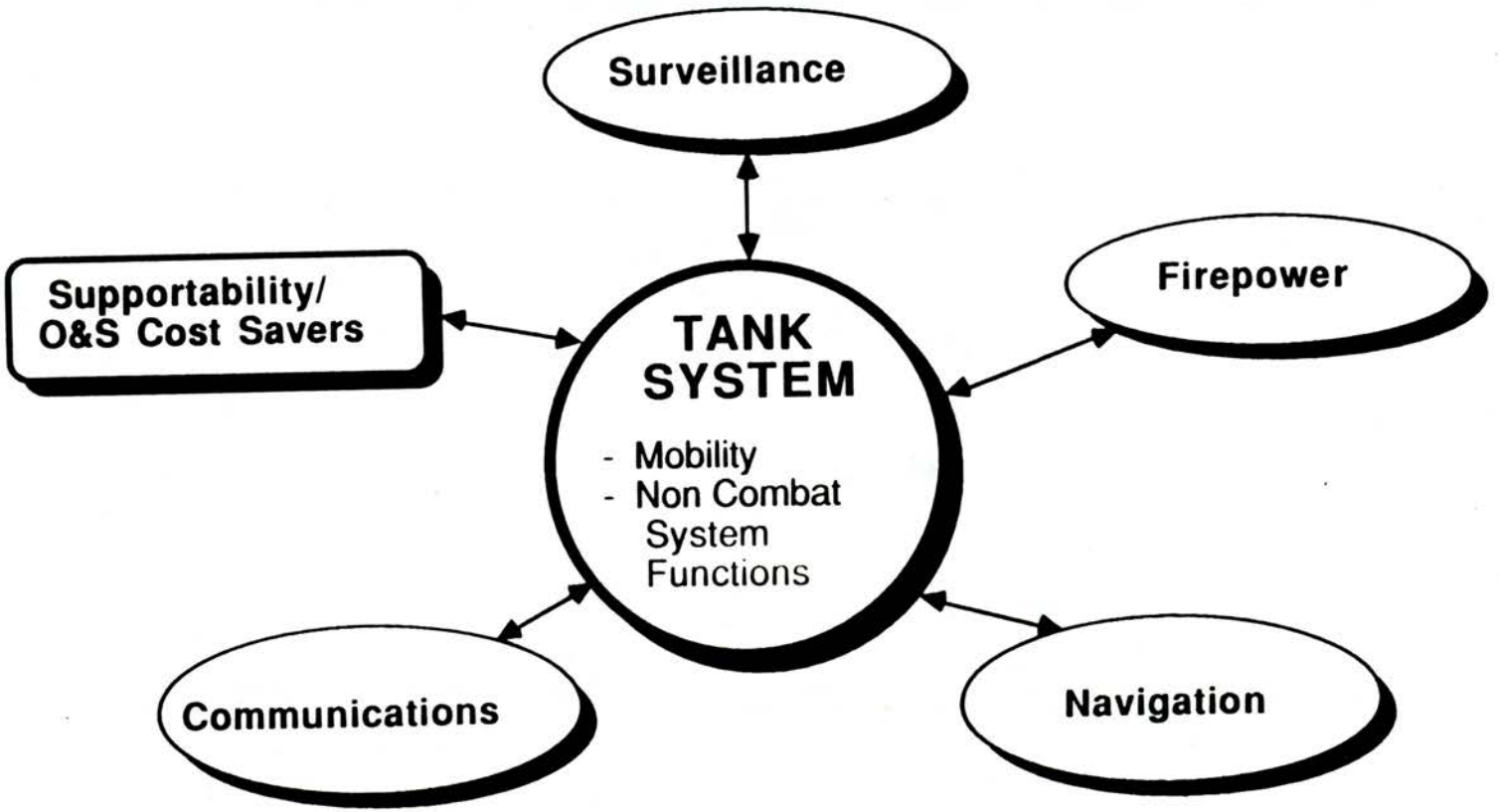
GENERAL DYNAMICS
Land Systems Division

BLOCK IMPROVED ABRAMS INTEGRATED SYSTEMS

COMBAT OPERATIONS/SYSTEMS FUNCTIONS



Key:

= Denotes System Function

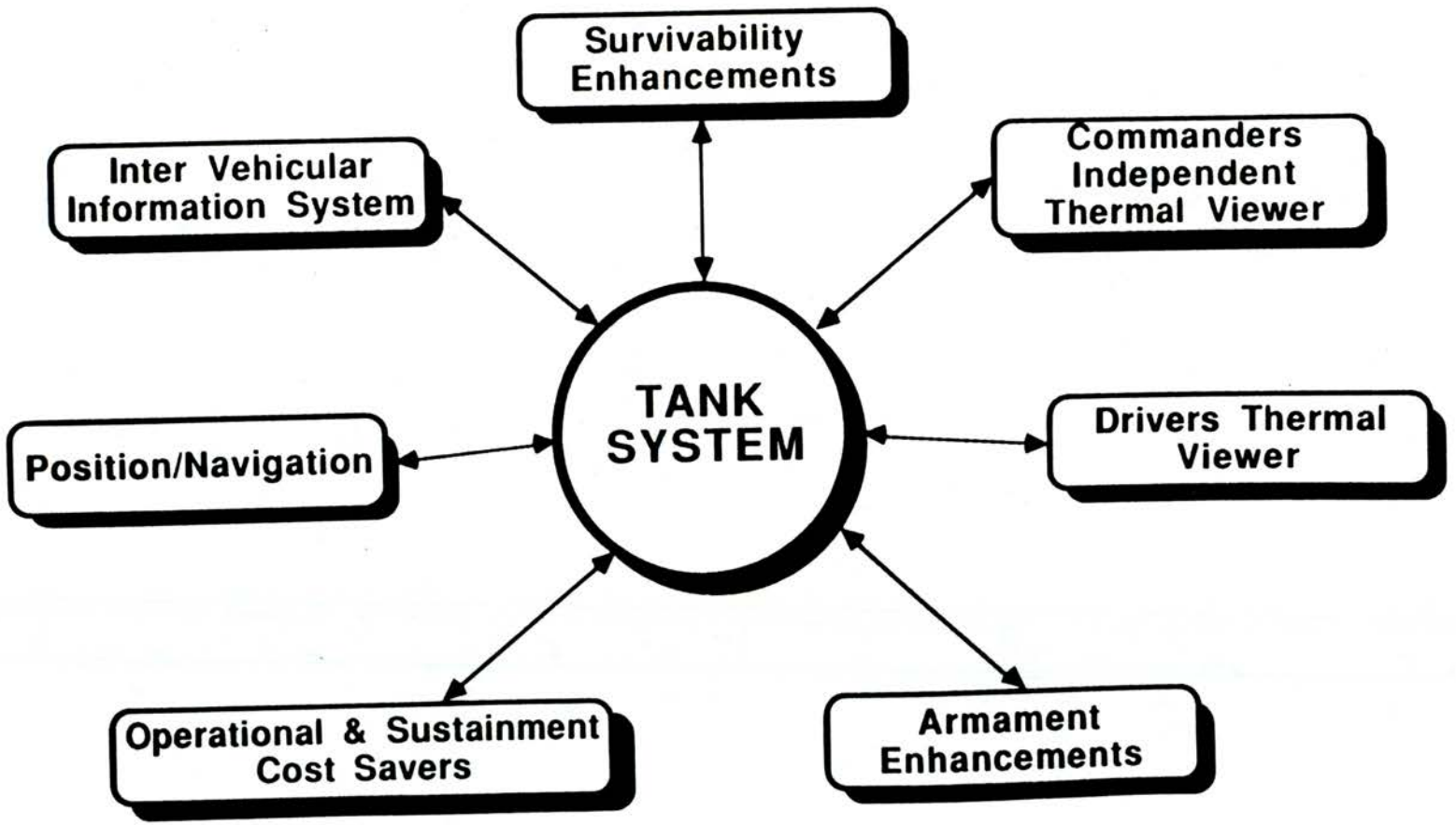
= Denotes Improvement Items

70C-50661D

Item removed to oversize Joint Box 20x24 Box 50, Folder 22

Diagram

BLOCK IMPROVED ABRAMS INTEGRATED SYSTEM
IMPROVEMENT ITEMS



KEY:

= Denotes Improvement Items

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GENERAL DYNAMICS
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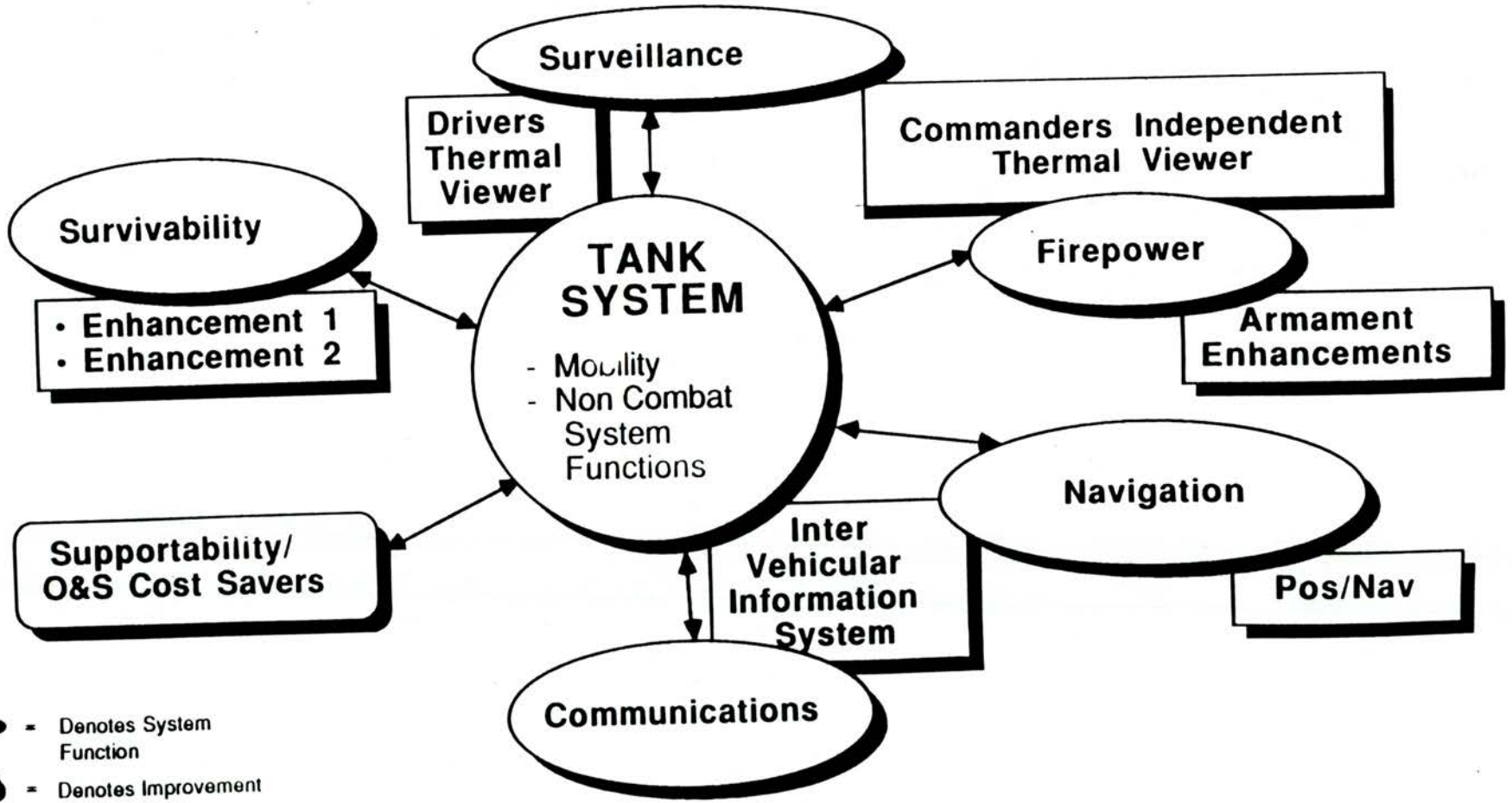
BLOCK IMPROVED ABRAMS INTEGRATED SYSTEMS

COMBAT OPERATIONS/SYSTEMS FUNCTIONS



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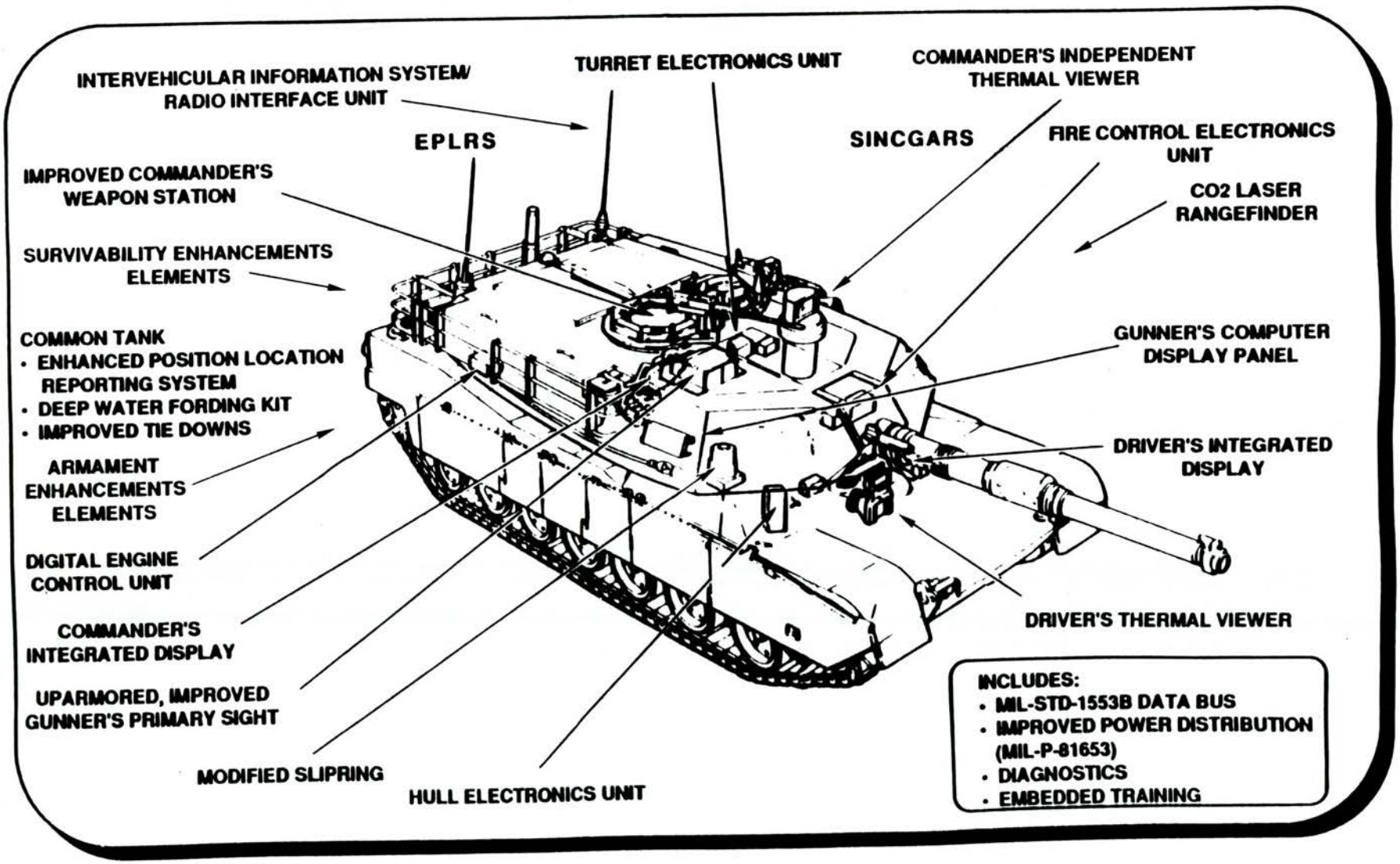
SYSTEM DEFINITION

BLOCK IMPROVED ABRAMS TANK WHICH INTEGRATES ...



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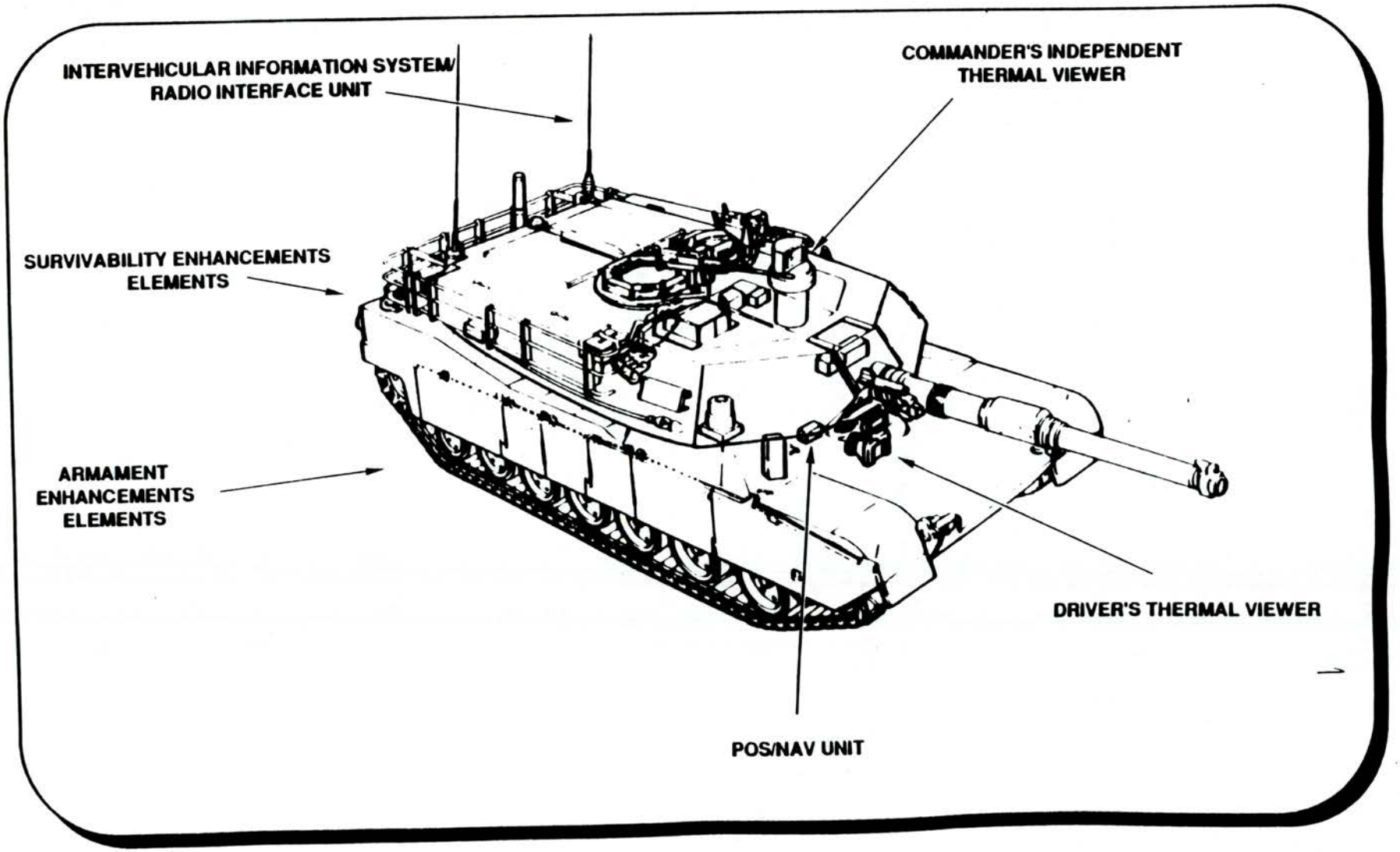
THE MISSION EQUIPMENT



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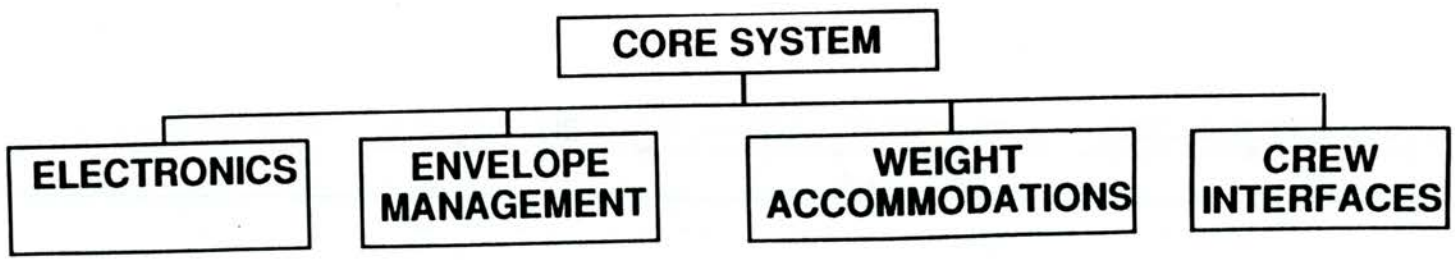
SINPAC DERIVED FROM REQUIREMENTS

- Provides Interfaces for Block Improved Abrams Mission Equipment.
- Accommodates Addition of New Mission Equipment / Functions.
- Functions Independently of Mission Equipment.
- Provides Conversion of M1A1 to the Block Improved Abrams Configuration.

SINPAC DEFINITION

A Systems Integration Package is a Fieldable Functional Tank with Provisions for Block Improvement Elements, i.e. Mission Equipment. A SINPAC Tank is Functional without the Mission Equipment (Survivability Enhancements, CITV, Pos/Nav, DTV, and IVIS) Installed. The SINPAC Tank Concept Supports Mission Equipment Tailoring.



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BLOCK IMPROVEMENTS SUPPORT THE IMPERATIVES OF AIRLAND BATTLE

INTEGRATION OF THE KEY OPERATING REQUIREMENTS, WHICH ARE FUNDAMENTALLY NECESSARY FOR SUCCESS ON THE BATTLEFIELD, IS ENHANCED THROUGH THE BLOCK IMPROVED ABRAMS

AIRLAND BATTLE IMPERATIVE	SYSTEM FUNCTION*	BLOCK IMPROVED ABRAMS ELEMENT
• Ensure Unity of Effort	• Communications	• IVIS, Pos/Nav
• Anticipate Events on the Battlefield	• Communications	• IVIS, Pos/Nav
• Concentrate Combat Power Against Enemy Vulnerabilities	• Communications	• IVIS
• Designate, Sustain, and Support the Main Effort	• Communications	• IVIS
• Press the Fight	• Firepower & Mobility	• CITV, AEI, DTV
• Move Fast, Strike Hard, and Finish Rapidly	• Firepower & Mobility	• CITV, AEI, DTV
• Use Terrain, Weather, Deception, and OPSEC	• Communications	• IVIS, Pos/Nav, SINCGARS
• Conserve Strength for Decisive Action	• Communications	• IVIS
• Combine Arms and Sister Services to Complement and Reinforce	• Communications	• IVIS, EPLRS
• Understand the Effects of Battle on Soldiers, Units, and Leaders	• Communications	• IVIS, SINCGARS

* System Functions are Common with the M1A1 and the Block Improved Abrams

70K-51642

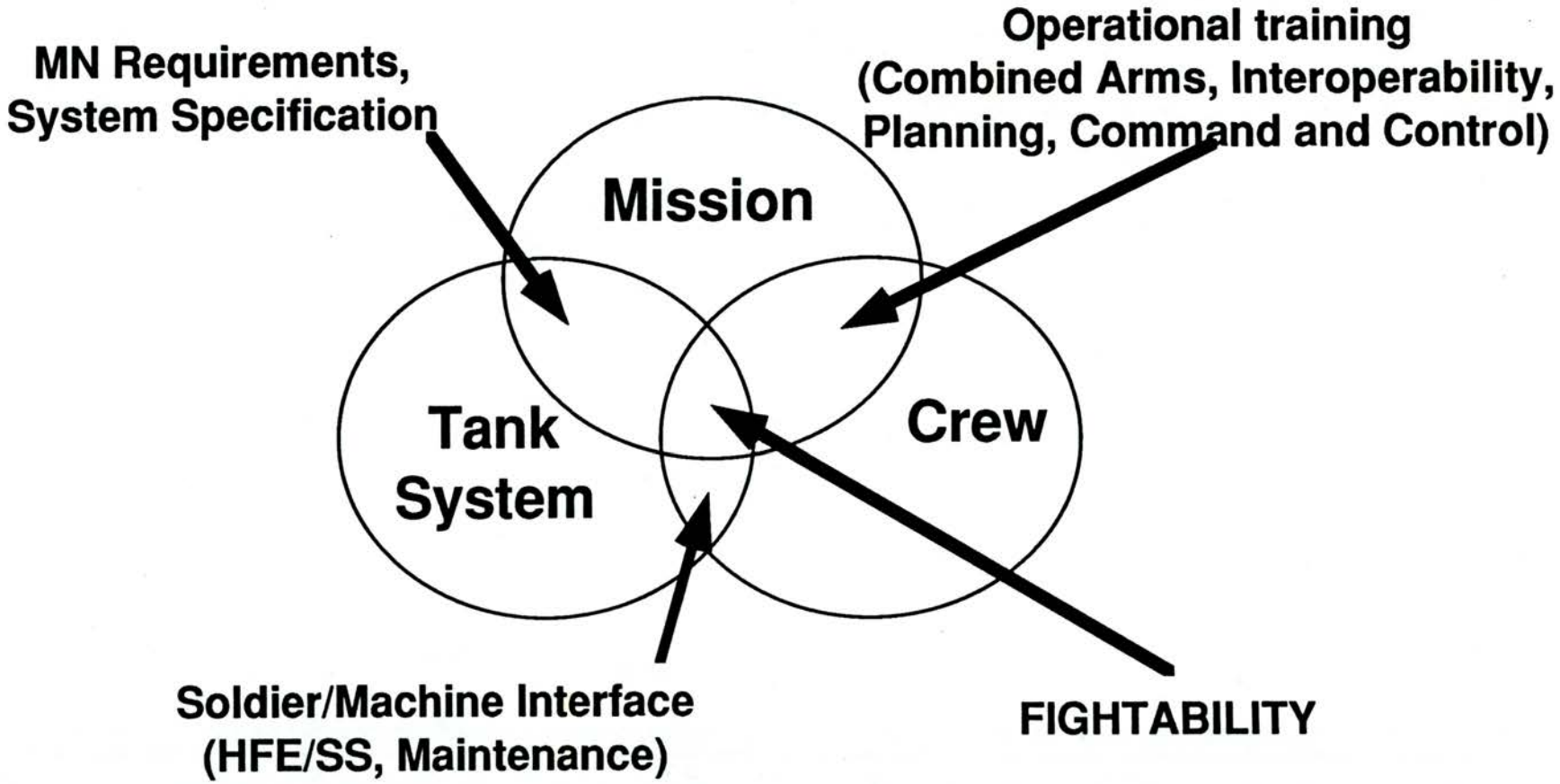
DRIVER

Task	Currently Performed	BIA Method
Tactical Tasks		
• Maintain Progress Toward Destination	• Dependant on CMDR for Navigation and Maintenance of Course	• "Steer To" Indicator on DID Used to Guide Driver by Providing Information About Relative Position of Destination
Observation		
• Assist in Surveillance and Target Acquisition	• Open Hatch, Vision Blocks, Night Vision Device	• Open Hatch, Vision Blocks, DTV
Operational Tasks		
• Prepare Station for Operation	• Visual Inspection of Numerous Displays and Indicators Dedicated Hard Switches for Most Functions	• Driver's Integrated Display Provides Control Interface and Status Information for Majority of Functions and Systems
• Engine Starts and Checks	• Dedicated Switches and Indicators • Some Checks are "Seat of Pants"	• DID Provides Control Interface and Status Info. On-Board Sensors Provide Feedback
• Power Down and Secure Station	• Hand Recording of Vehicle Operational History	• Vehicle Operational History Could be Stored Automatically in IVIS
Maintenance Tasks		
• Maintain Equipment Records	• Pencil and Paper	• Records can be Input to IVIS/DID or can be Maintained by IVIS/DID Automatically

FIGHTABILITY

- **Fightability Consists of Inherent Equipment Features that Allow a Weapons System to Support and Assist the Crew In Accomplishing a Specific Mission.**
- **Fightability Characteristics Can Generally be Grouped into 6 Functional Areas**
  - **Surveillance - Ability to See the Enemy in All Conditions**
  - **Communication - Ability to Effectively Exchange Information under All Conditions**
  - **Firepower - Ability to Kill all Threat Targets**
  - **Mobility - Move Rapidly over All Terrains thru all Environments**
  - **Survivability - The Ability of the System and Crew to Survive when Hit**
  - **Sustainability - Staying Power, the Ability to Stay on the Field and Continue Operations**
- **How Well a System Supports and Accommodates the Crew by Performing these Functions can be used to Measure the Relative Fightability of the System.**

FIGHTABILITY



FIGHTABILITY is the Crew's Ability to Utilize the Tank System to Successfully Complete a Combat Mission.

FIGHTABILITY DEFINITION

Functional Definition

- **The Inherent Fightability of a Weapon System (Equipment and Crew) is its Ability to Successfully Perform its Mission When Viewed from the Crew's Perspective.**
- **Fightability is a Function of System Effectiveness, Crew Efficiency, and Mission Reliability.**

A Functional Definition of Fightability is Important to the System Designer to Ensure that the Required Operational Characteristics are Specified and Integrated into the BIA.

FIGHTABILITY DEFINITION
(Cont.)

Qualitative Indicators

- System Effectiveness (for a Given MOS Level and Crew Size) Varies by System Configuration (Functional Characteristics) and is Indicated by the Loss Exchange Ratio (LER) in System Modeling.
- Crew Efficiency for a given MOS Level and Crew Size is a Function of the Closed Loop Information Channel Capacity (bits/second) for a Specified Task Difficulty and Mission Duration.

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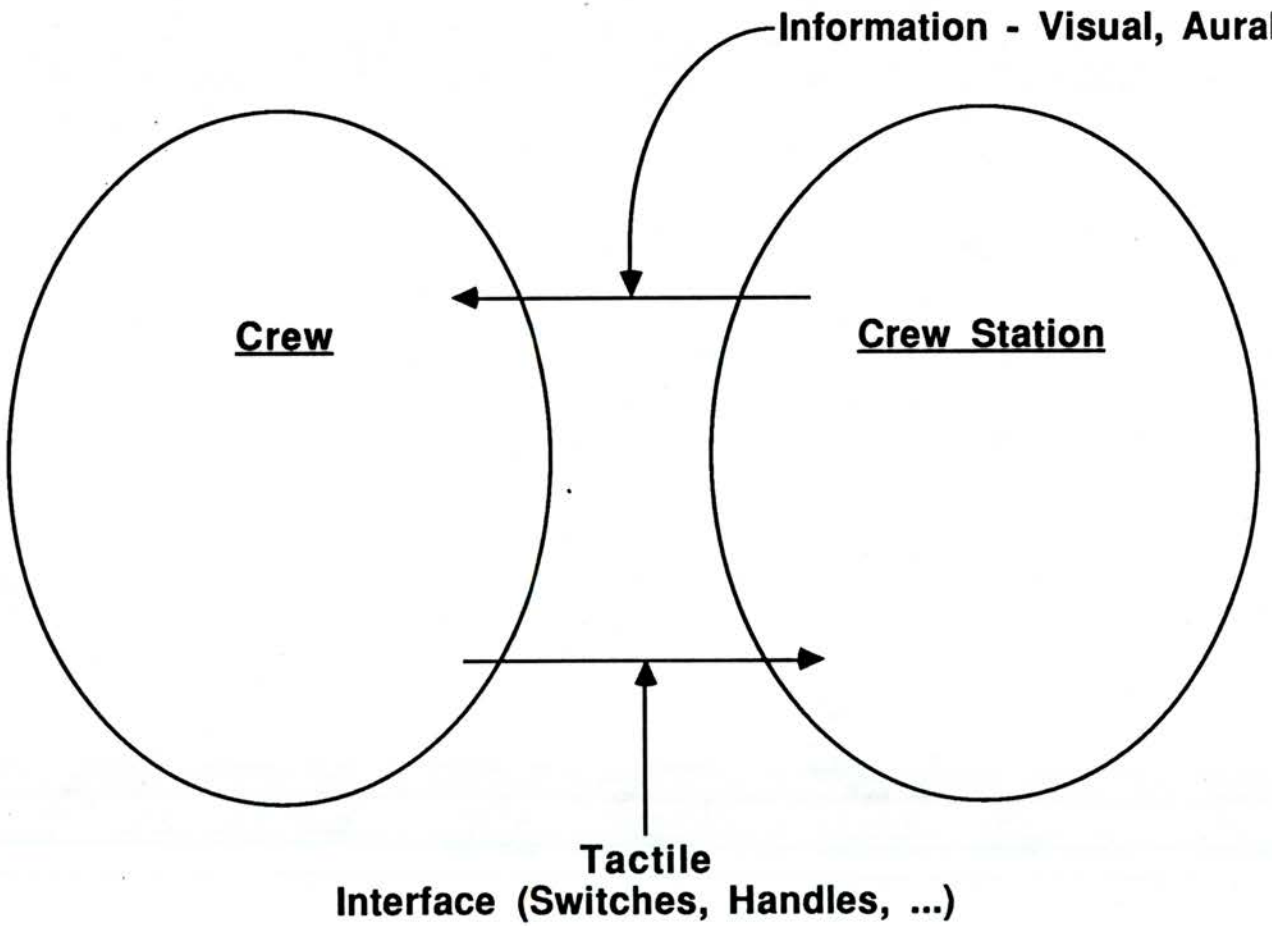
CREW/CREW STATION INTERACTION



Specification
Paragraph 3.2.9

INFORMATION

- **Information is Defined as the Appropriate Data for Decision Making and Task Performance at the Appropriate Time. Any Unnecessary Data is Noise.**
- **Closed Loop Information Channel Capacity for a Given Task can be Characterized by the Information Required to Successfully Perform it.**
- **The Human's Capacity to Perceive and Act on Information is Limited. Superior Soldier / Machine Interfaces will Allow More Rapid Information Transfer and Reduced Task Performance Time**
- **Information Channel Capacity (ICC):**

$$ICC = BW \log_2 \frac{(S+N)}{N}$$

BW = Human Bandwidth

S = Information

N = Unnecessary Data

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BIA INCREASES INFORMATION CHANNEL CAPACITY

Input to Crew:

• Obscured Visibility Surveillance	- CITV, DTV Provide Extra "Eyes" for Parallel Surveillance
• Target Acquisition / Engagement	- CITV Hunter / Killer Provides Surveillance and Engagement in Parallel
• Obscured Visibility Driving	- DTV Improves Quality of External View Over Driver's Night Viewer
• Navigation	- POS / NAV Steer - To Indictor Improves Quality of Data for Driver
• Text Displays	- POS / NAV Provides Immediate Accurate Position Data to Commander
• Graphics Displays	- Fast Transfer of Accurate Map Overlays to Whole Force at Same Time

BIA INCREASES INFORMATION CHANNEL CAPACITY

Output from Crew:

- **Spot / Contact Reports**
- **Graphics Data Distribution**
- **Textual Data Distribution**
- **Logistic / Historic Data**
- **Voice / Text / Graphic Data**
- **Transmission Protocol**

- **Automated Assembly of Position Data**
- **"Free Draw" and Simultaneous Transmission to all Recipients**
- **Pre-Formatted, Automated / Assisted Assembly**
- **Automated Logging of Data**

- **Optimized Mix Available with Voice Override Capability**
- **Automated**

MODES AND STATES OF TANK OPERATION

- **Mode**: System Configuration of Operational Capabilities Providing Operators an Optimized Method to Accomplish an Objective. This Approach Incorporates Operator Training and Knowledge into the BIA System Design.
  - Facilitate a Prioritized System Configuration
  - Provide Transfer of Training to Actual System Operation
  - Provide an Optimized Soldier-Machine Interface
- **State**: Specific Element Configuration Relative to a Given Set of Conditions within a Selected Mode

SPECIFICATION
PARAGRAPH 3.1.3

WHY MODES AND STATES

- Reduces Levels of Menus and Facilitates SW Driven Display Formats Tailored to the Operational Task
- Provides System Design Engineers the Data Necessary to Provide Dynamic System Reconfiguration, Such as :
  - HEU Data Bus Backup in the Event of TEU Failure
  - Commander's Turret/Gun Override
  - System Lockouts, e.g. Palm Switches
- Will Simplify Certain Operational Tasks
  - Silent Watch Accomplished by Single Control Input on CID

WHAT MODES AND STATES ARE NOT

- A Method of Defining or Changing Operational Tasks or Doctrine
  - Operational Tasks and Doctrine Must be Defined First. The Modes and States Result from These, as Necessary, to Accomodate Effective and Efficient System Design
- Words to Fill Paragraph 3.1.3 of the System/Segment to Comply with MIL-STD-490A
  - Per DI-CMAN-80008, This Paragraph is Optional and is Only Required "If the System can Exist in Various Modes"

Specification
Paragraph 3.1.3

BIA SYSTEM MODES

Operational:

- Combat
  - Attack
  - Defend
- Surveillance
  - Radio Watch
  - Silent Watch
- Pre- and Post- Combat
  - Check Equipment
  - Plan
  - Navigate
- Administration
  - Train
  - Maintain

Backup:

- Graceful Degradation

SPECIFICATION
PARAGRAPH 3.1.3

COMBAT MODE

- Possible Operational Conditions
  - Movement to Contact
  - Hasty Defense or Attack
  - Deliberate Defense or Attack
  - Bounding Overwatch
  - Overwatch
  - Helicopter Self Defense

- System Configuration (State)
  - Engine on, Tactical Idle on
  - NBC on
  - Fire Control, CITV Completely Activated
  - DTV Standby

SPECIFICATION
PARAGRAPH 3.1.3

SURVEILLANCE MODE

- Possible Operational Conditions
  - Deliberate Defense
  - Stationary Overwatch, Hull Defilade
- System Configuration (State)
  - Silent Watch
    - Engine off
    - CITV, GPS on
    - TIS Standby

SPECIFICATION
PARAGRAPH 3.1.3

PRE- AND POST-COMBAT MODE

- Possible Operational Conditions
  - Assembly Area Operations
  - Consolidation Activities
  - Road March
- System Configuration (States)
  - Check Equipment
    - Normal SW Disabled, BIT SW Operating
    - SMI Configured to Display BIT
  - Plan
    - SMI Configured for Easy Data Entry
    - Execution Matrix
    - Boundaries, Phase Lines, Coordination Points
  - Navigate
    - SMI, Pos/Nav Configured for Initialization
    - Grid MapDisplays Vehicle ICONs

SPECIFICATION
PARAGRAPH 3.1.3

ADMINISTRATION MODE

- Possible Operational Conditions
  - Motor Pool Operations
  - Training Operations
- System Configuration States
  - Train
    - Checklists Displayed on SMI
  - Maintain
    - Extended BIT
    - SRU Isolation Where Possible

SPECIFICATION
PARAGRAPH 3.1.3

BACKUP MODE

- May Exist for all Possible Operational Conditions
- Certain Operational Modes (Combat Surveillance ...) may not be Possible or will be Degraded Due to Failures
- Requires Many States Due to Possible Combinations of Failures

SPECIFICATION
PARAGRAPH 3.1.3

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GENERAL DYNAMICS
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ABRAMS TANK CONFIGURATION HIERARCHY

70S-57754

ABRAMS TANK - CONFIGURATION HIERARCHY

1. M1A1
2. M1A1 - 10th Year (GPS Armor)
3. Common Tank
   - Position Location Reporting System (PLRS)
   - Deep Water Fording Kit (DWFK)
   - Tie-downs
4. Contract Baseline
   - Identified ECP's
   - Improved Commander's Weapon Station (ICWS)
   - Carbon Dioxide Laser Rangefinder (CO LRF)
5. Integration Equipment
   - Power Management System
     - Utility Bus
     - Remote Switching Modules (RSM)
     - Analog Input Modules (AIM)
   - Improved Slip Ring Assembly
   - Data Management System
     - MIL-STD 1553B Data Bus
     - Turret Electronics Unit (TEU)
       - Power Module
       - System Processor

ABRAMS TANK - CONFIGURATION HIERARCHY

- Turret Electronics Unit(TEU) (cont)
  - Applications Processor
  - Data Bus Controller
  - Memory Module
  - Chassis
  - Versa Module European (VME) Backplane
  - I / O
- Hull Electronics Unit (HEU)
  - Power Module
  - System Processor
  - Applications Processor
  - Data Bus Controller
  - Memory Module
  - Chassis
  - VME Backplane
  - I / O
- Soldier / Machine Interface (SMI)
  - Commander's Integrated Display (CID)
    - 1553 RT
    - Power Supply
    - Graphics Controller
    - Panel Controller
    - Control Processor
    - Tactical Display
    - CITV Display
    - I / O
    - Chassis
    - VME Backplane
  - Driver's Integrated Display (DID)
    - 1553RT
    - Power Supply
    - Graphics Controller
    - Panel Controller
    - Control Processor
    - Display
    - I / O
    - Chassis
    - VME Backplane

ABRAMS TANK - CONFIGURATION HIERARCHY

- Gunner's Control & Display Panel - (GCDP)
  - 1553 RT
  - Power Supply
  - Panel Controller
  - Graphics Controller
  - Control Processor
  - Display
  - I / O
  - Chassis
  - VME Backplane

- Fire Control System
  - Fire Control Electronics Unit (FCEU)
    - 1553 RT
    - Power Supply
    - LOS Electronics Module
    - GTD Electronics Module
    - VME Back Plane
    - I / O
    - Chassis
    - H / T Position Sensor
      - Gear Assembly
      - Encoder
      - I / O
  - Single Channel Ground Air Radio System SINCGARS (GFE)
  - Digital Engine Control Unit - DECU (GFE)
  - Provisions for Mission Equipment

6. Mission Equipment

A. CFE

- Commander's Integrated Thermal Viewer (CITV) Units
- Position / Navigation (POS / NAV) Units
- Intra Vehicular Information System / Radio Interface Unit (IVIS / RIU)

B. GFE

- Enhanced Position Location Reporting System (EPLRS)
- Driver's Thermal Viewer (DTV)
- Survivability Enhancement Modules (SE)
- Armament Enhancements (AE)

CREW STATIONS

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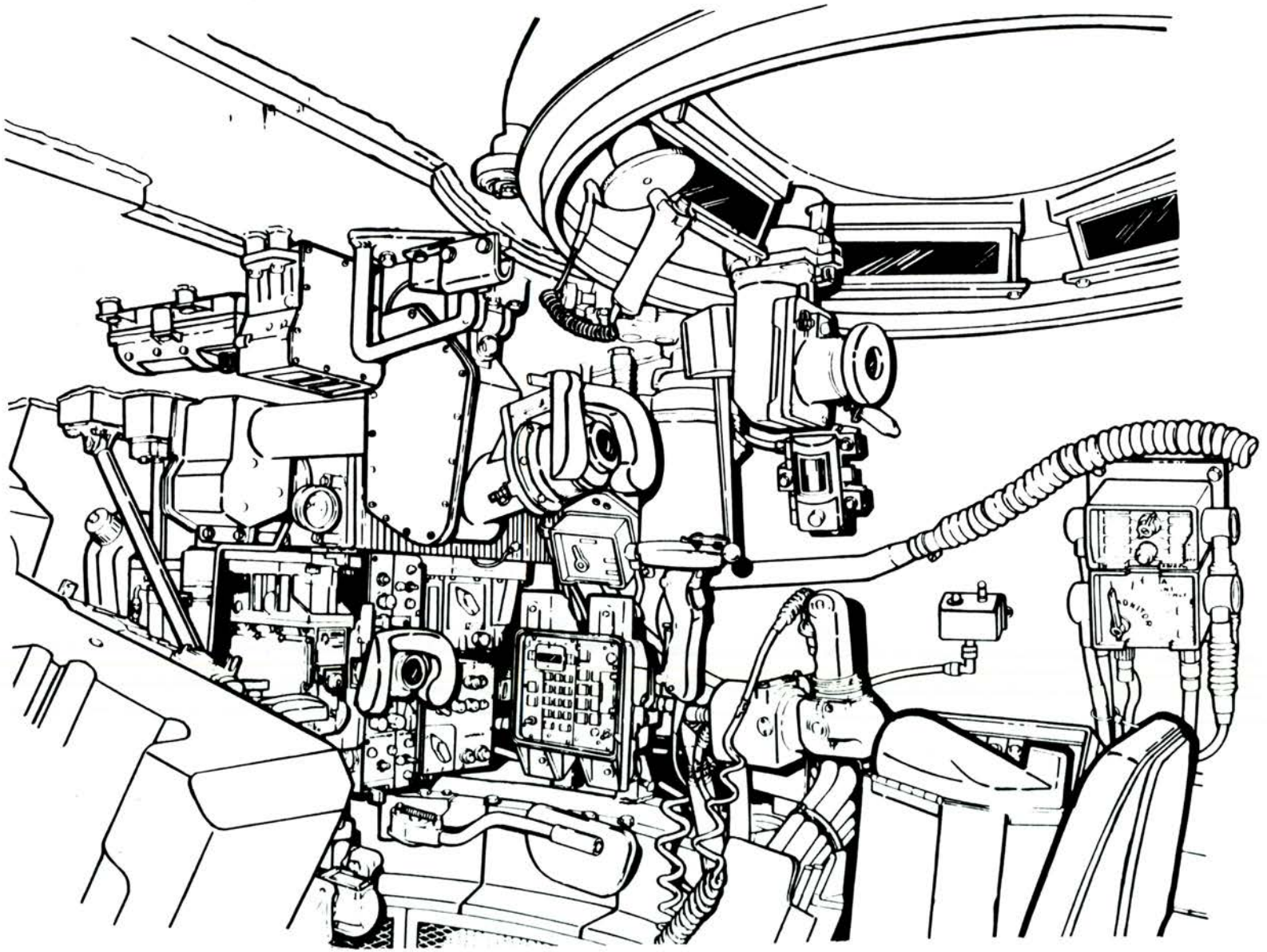
GENERAL DYNAMICS
Land Systems Division

COMMANDERS/GUNNERS STATION - M1A1



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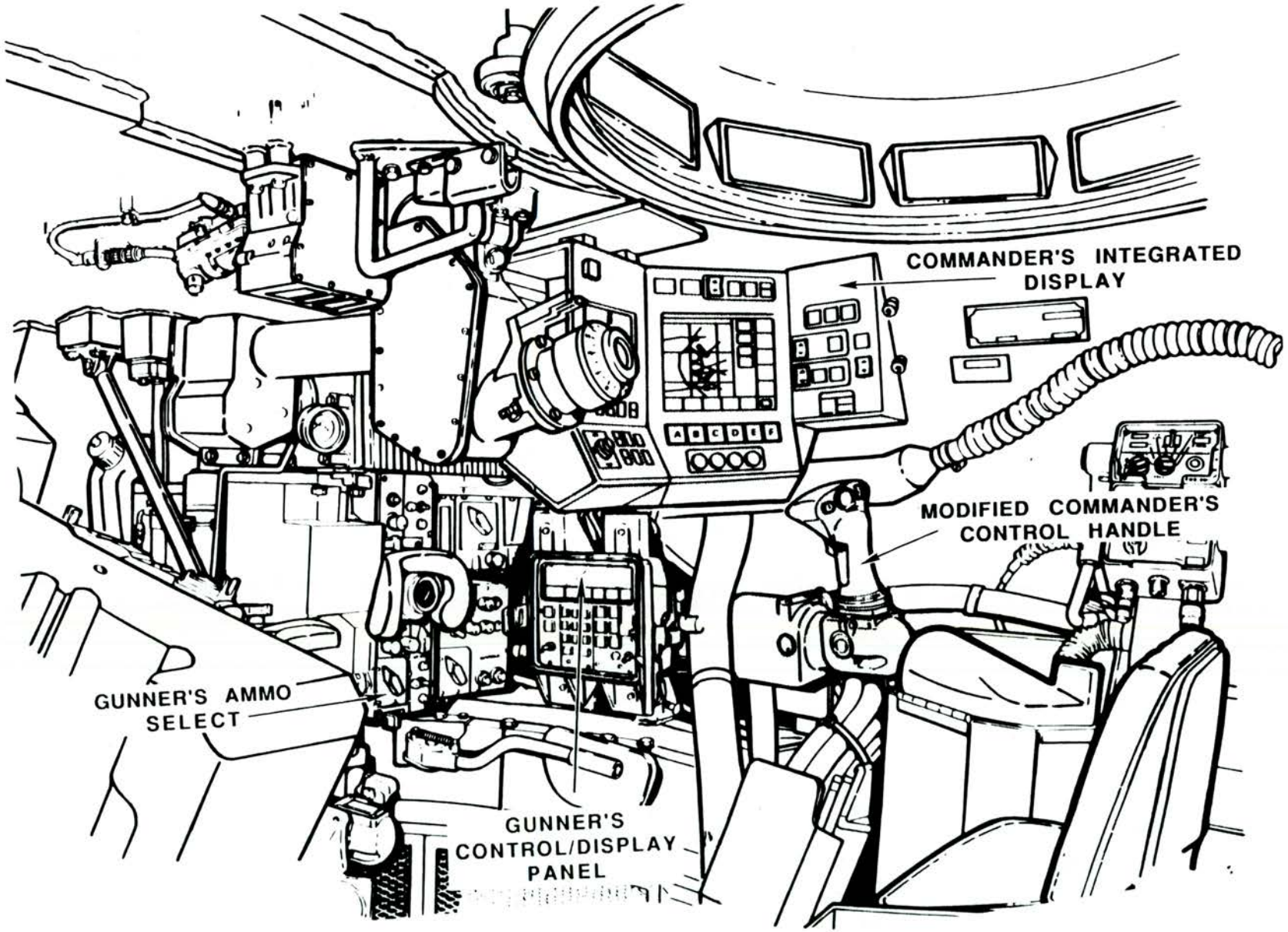
COMMANDERS/GUNNERS STATION - BIA



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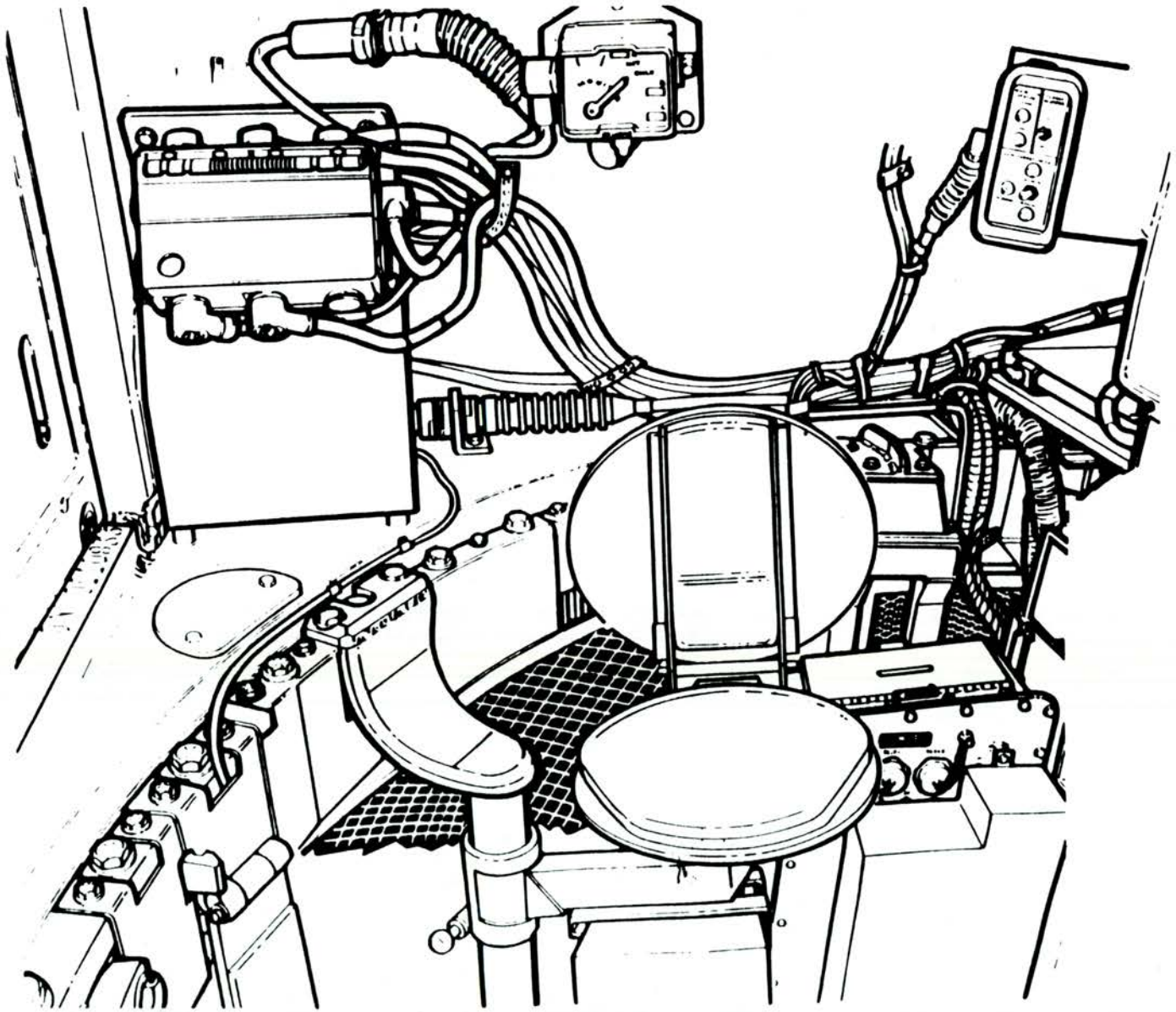
LOADERS STATION - M1A1



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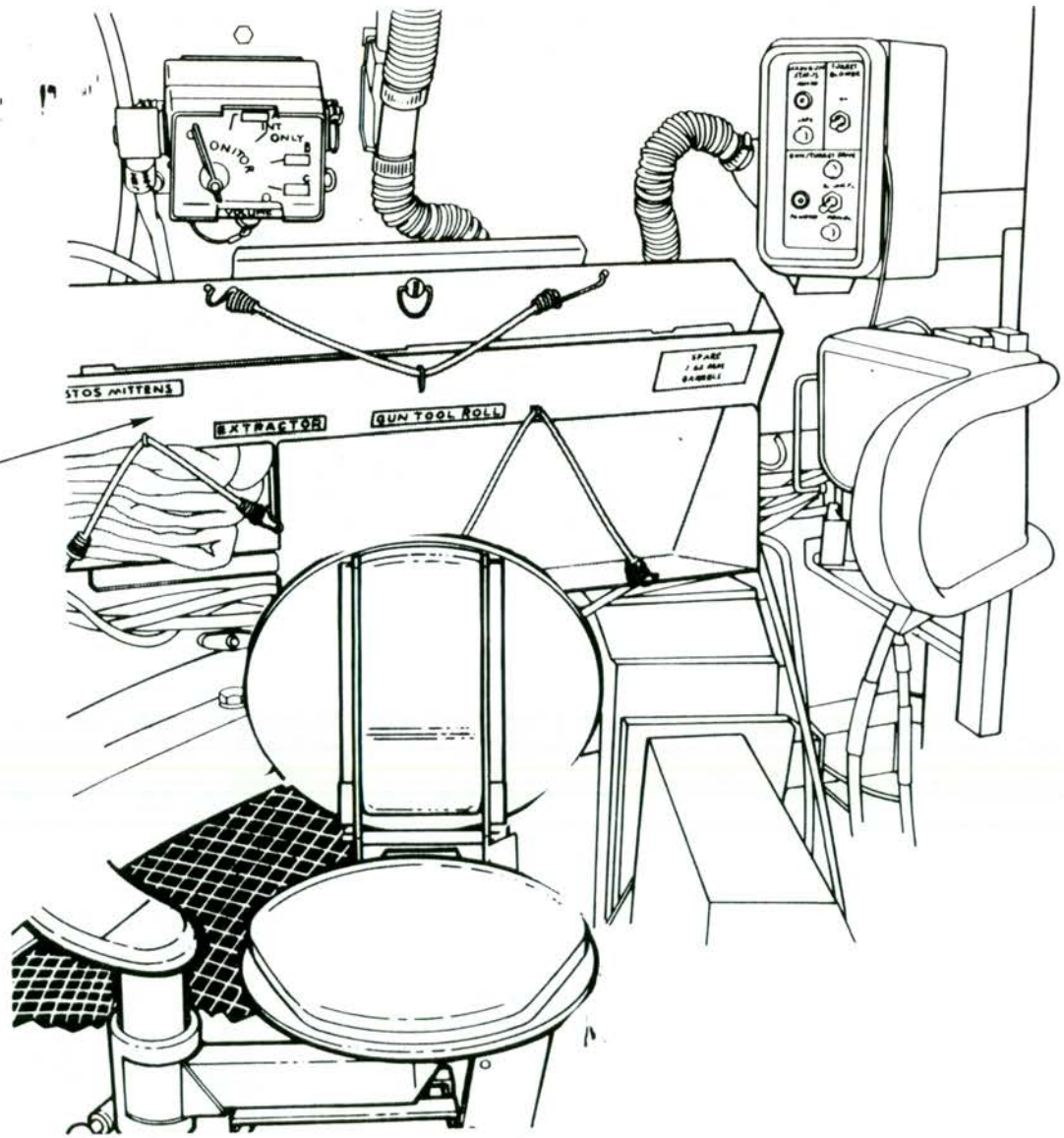
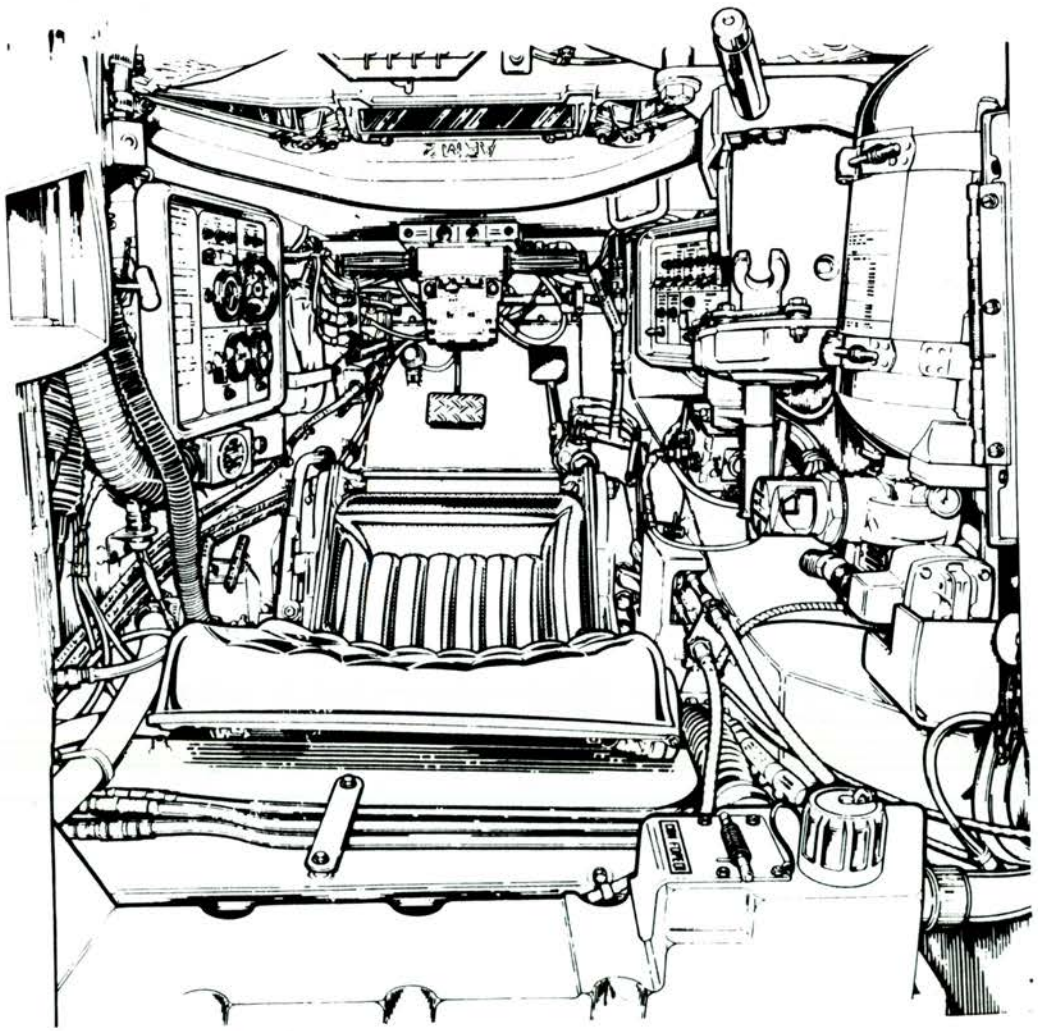
LOADERS STATION - BIA



DRIVERS STATION - M1A1



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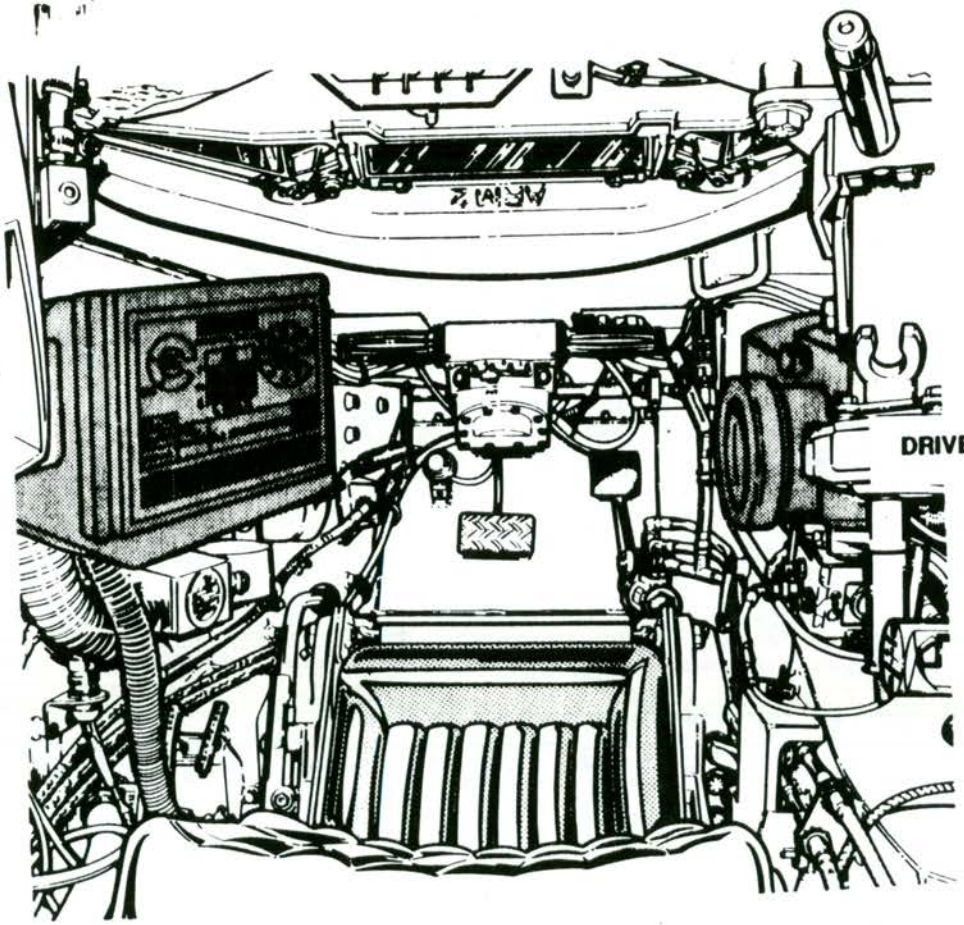
DRIVERS STATION - BIA

DRIVER'S INTEGRATED DISPLAY



DRIVER'S THERMAL VIEWER

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CONFIGURATION ITEM DESCRIPTIONS

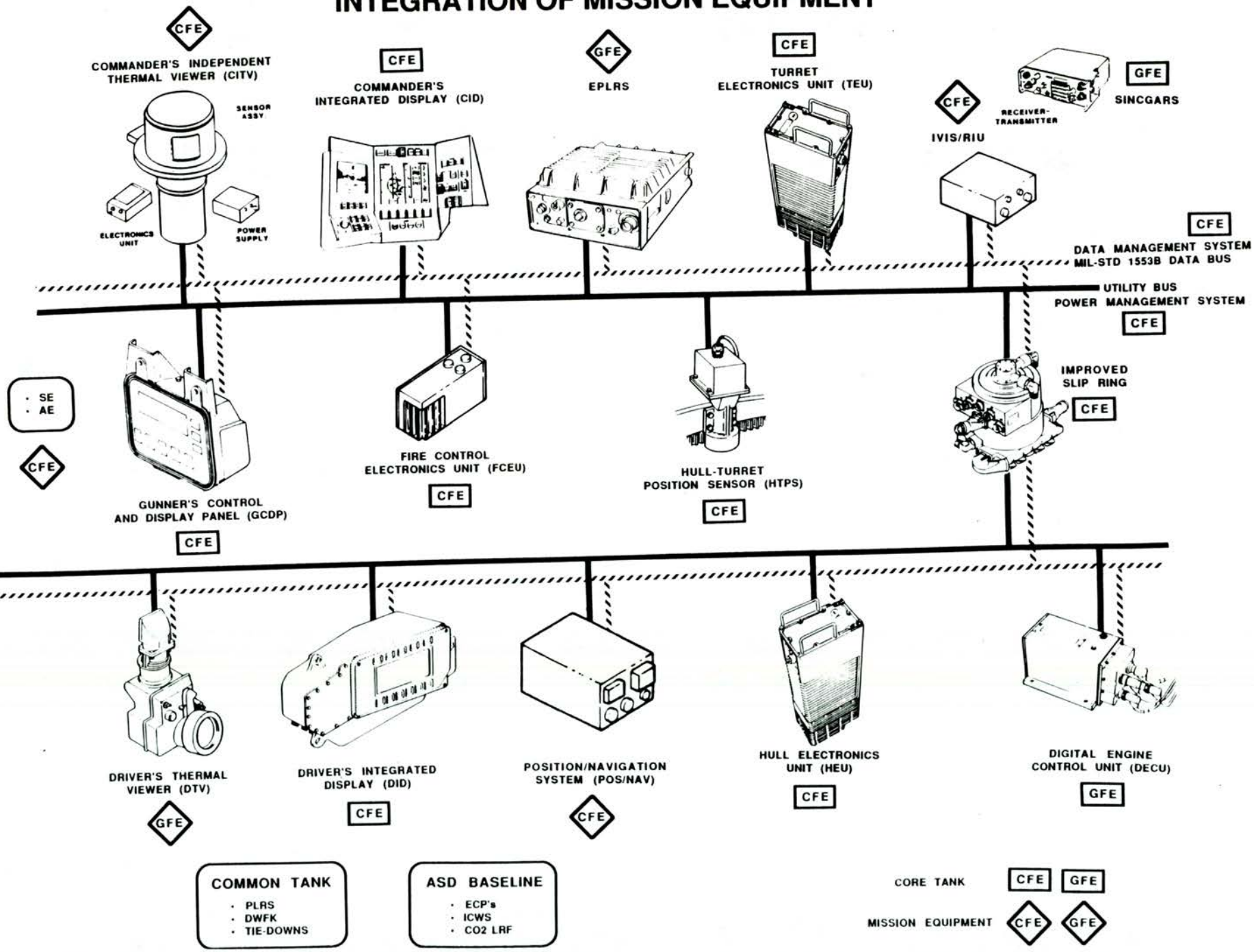
DATA AND POWER MANAGEMENT SYSTEM

- Turret Electronics Unit/Hull Electronics Unit
- 1553B Data Bus/Shielded Twisted pair
- Utility Bus (RS-485)
- Remote Switching Modules
- Analog Input Modules

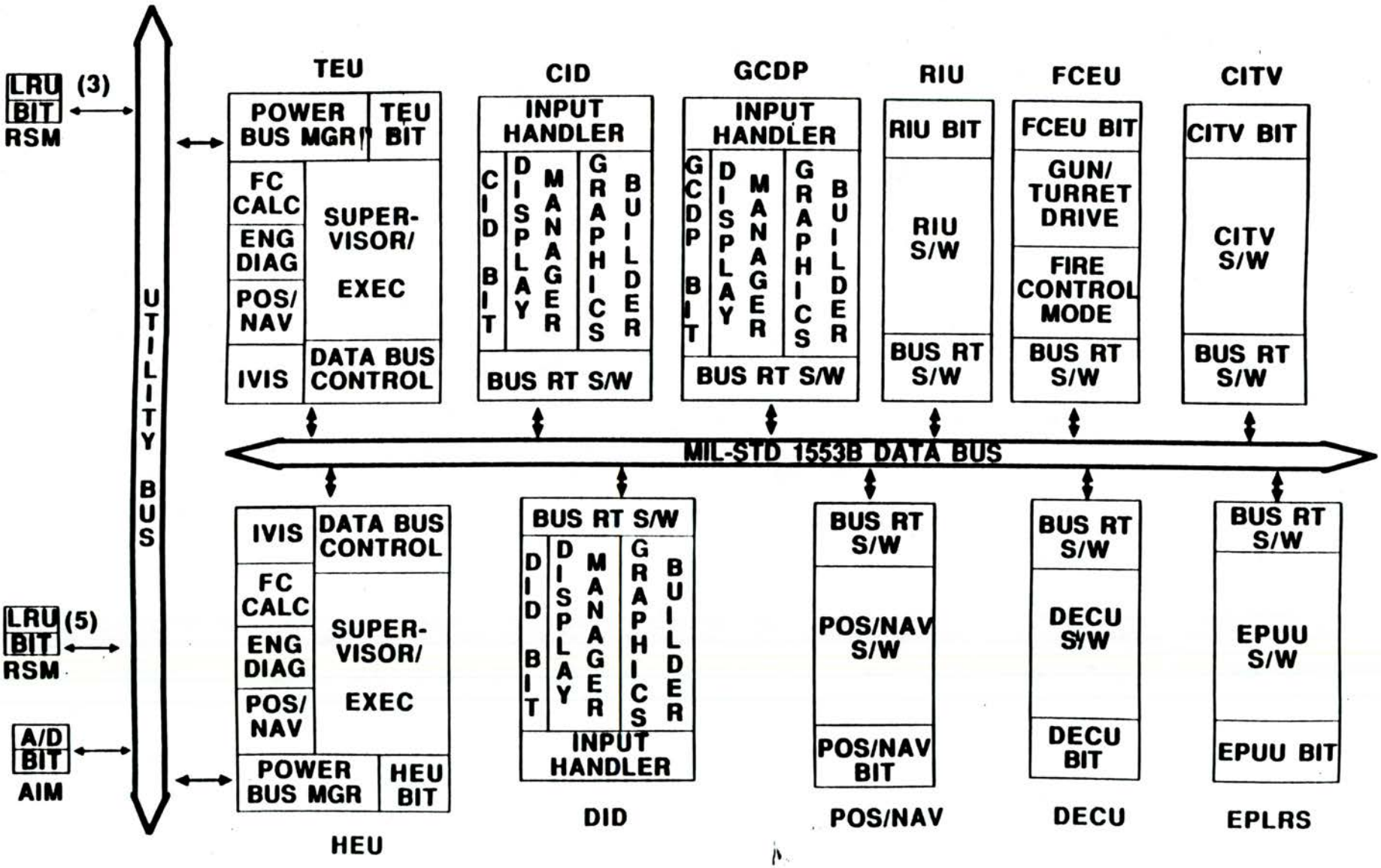
DATA MANAGEMENT SYSTEM
SYSTEM DESIGN SUMMARY

- **Turret Electronics Unit (TEU):**
  - Primary 1553B Data Bus Control
  - Primary System Supervisor/Executive
  - Inter-Vehicular Information System (IVIS) Management
  - Fire Control Computation
  - Auxiliary Power Management
  - TEU Built-In-Test
- **Hull Electronics Unit (HEU):**
  - Primary Utility Bus Control
  - Primary Power Management
  - Auxiliary System Management, i.e. Supervisor/Executive, Data Bus Control
  - Engine Diagnostics
  - Pos/Nav Computation and Management
  - HEU Built-In-Test

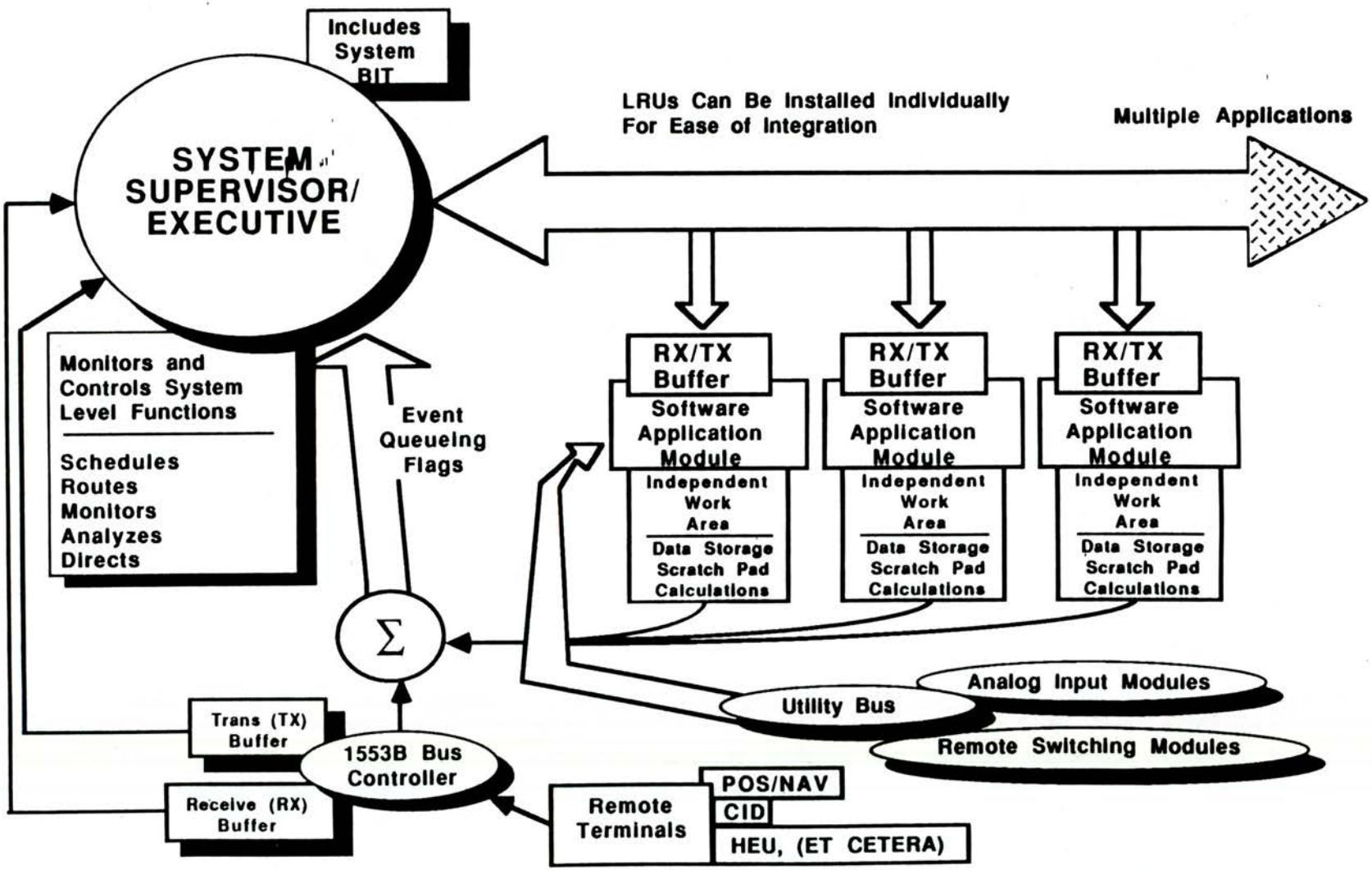
M1A2 SYSTEM INTEGRATION PACKAGE (SINPAK) PROVIDES COST EFFECTIVE INTEGRATION OF MISSION EQUIPMENT



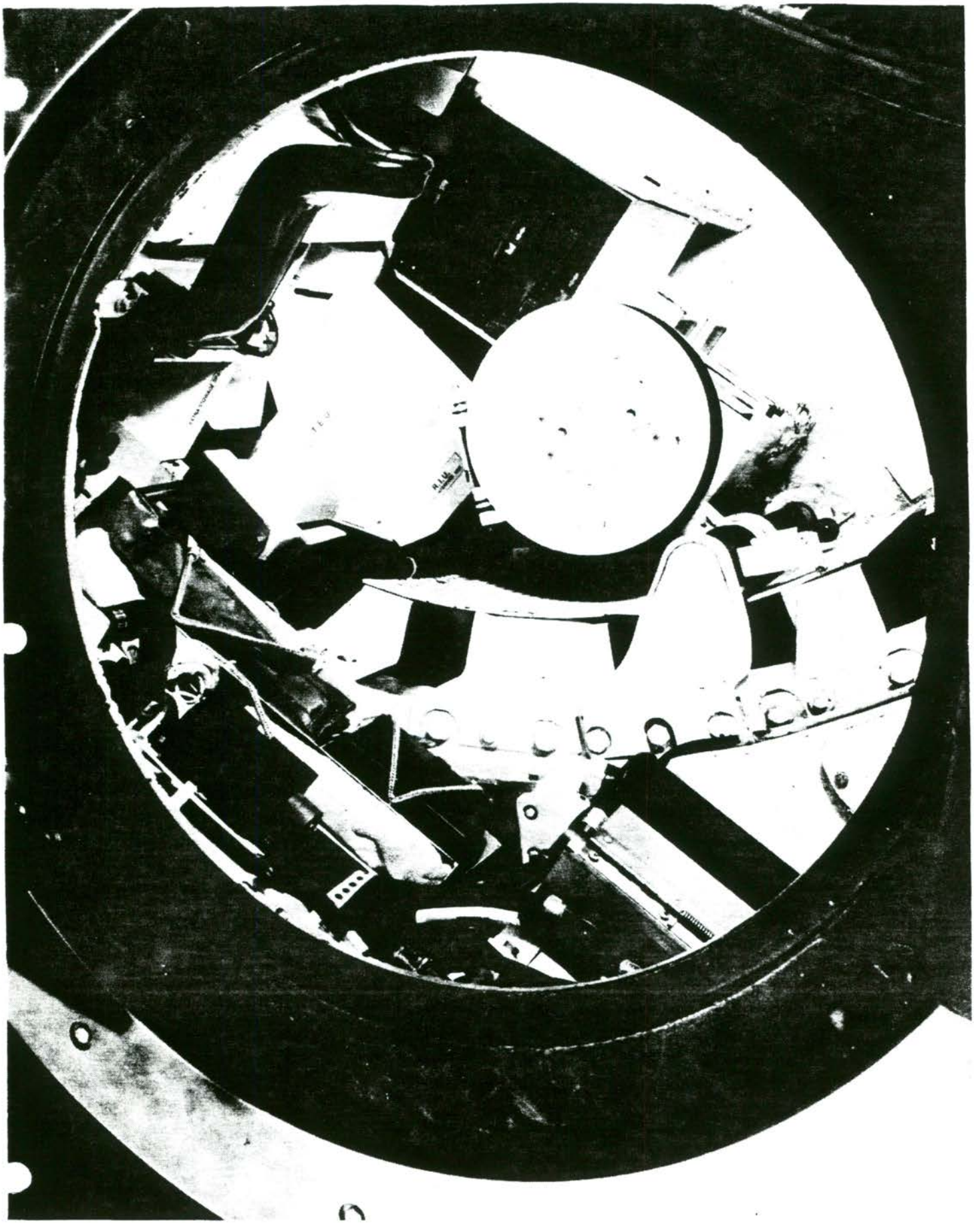
BIA TOP LEVEL SOFTWARE ARCHITECTURE

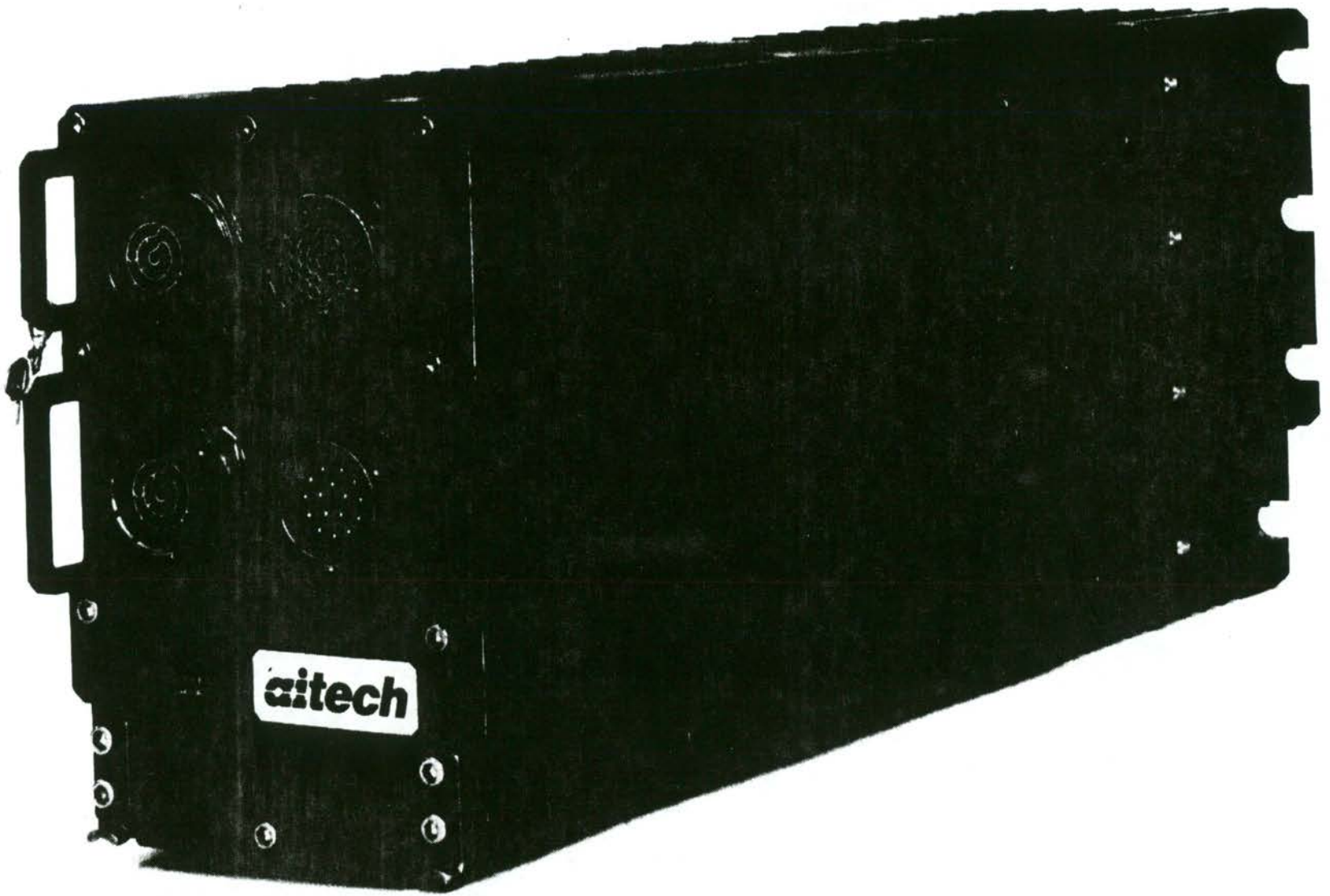


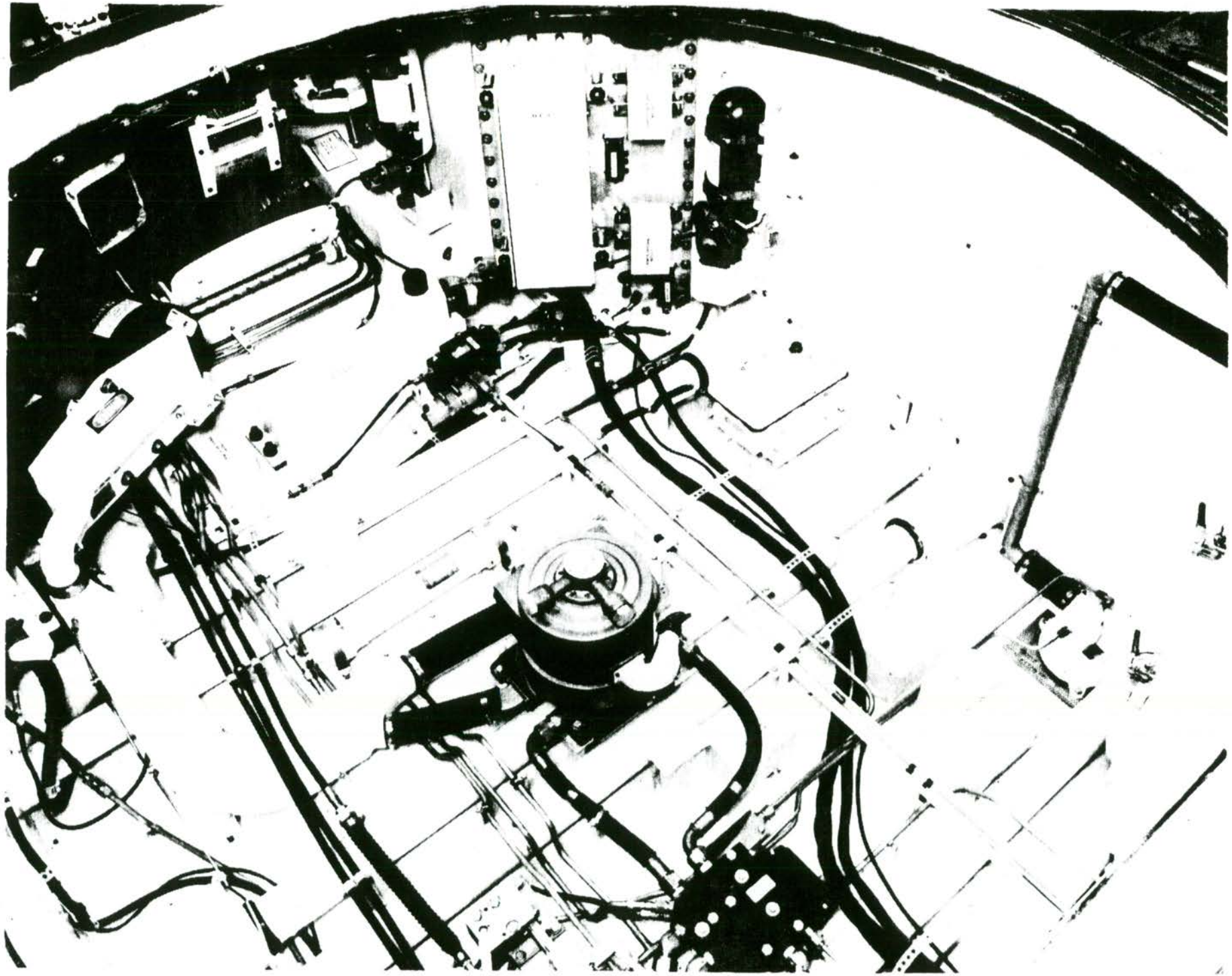
SYSTEM CONTROL AND MANAGEMENT STRUCTURE



The Deterministic Event Scheduling and Time Slice Data Processing System Provides Independently Structured Software that is Particularly Easy to Integrate and Debug (Modular Design Approach).




aitech



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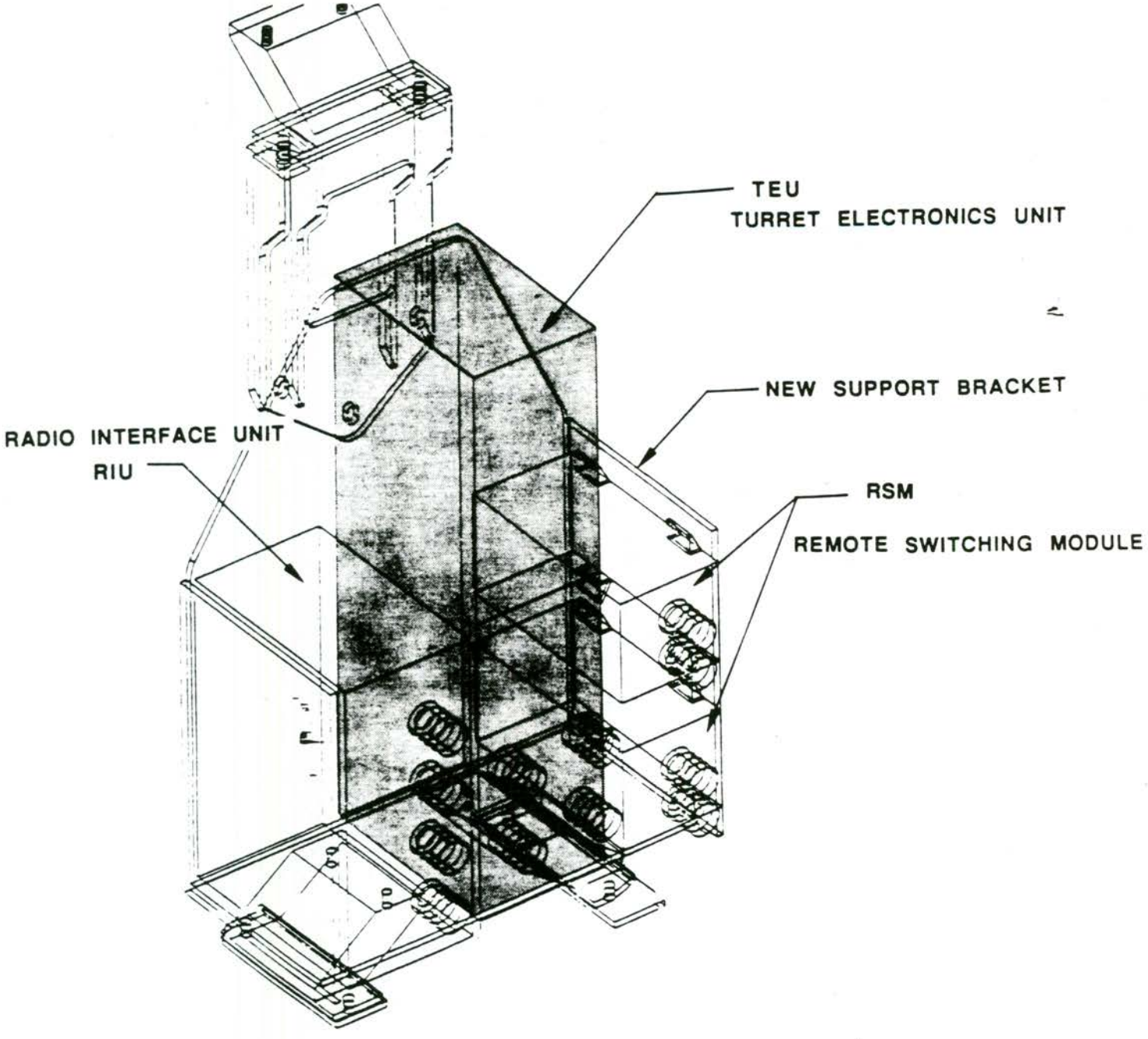
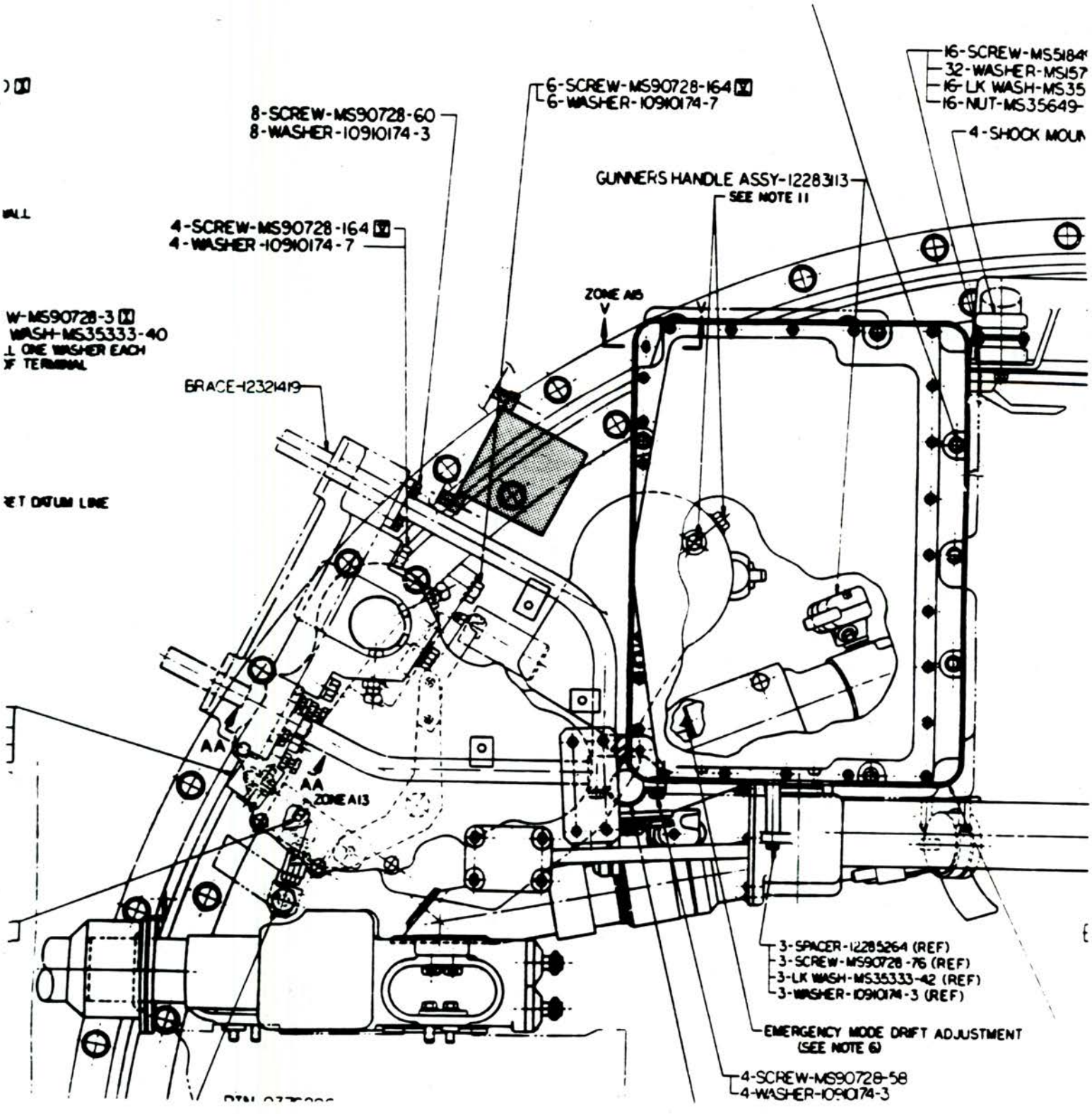
TEU / RIU MOUNTING ASSEMBLY

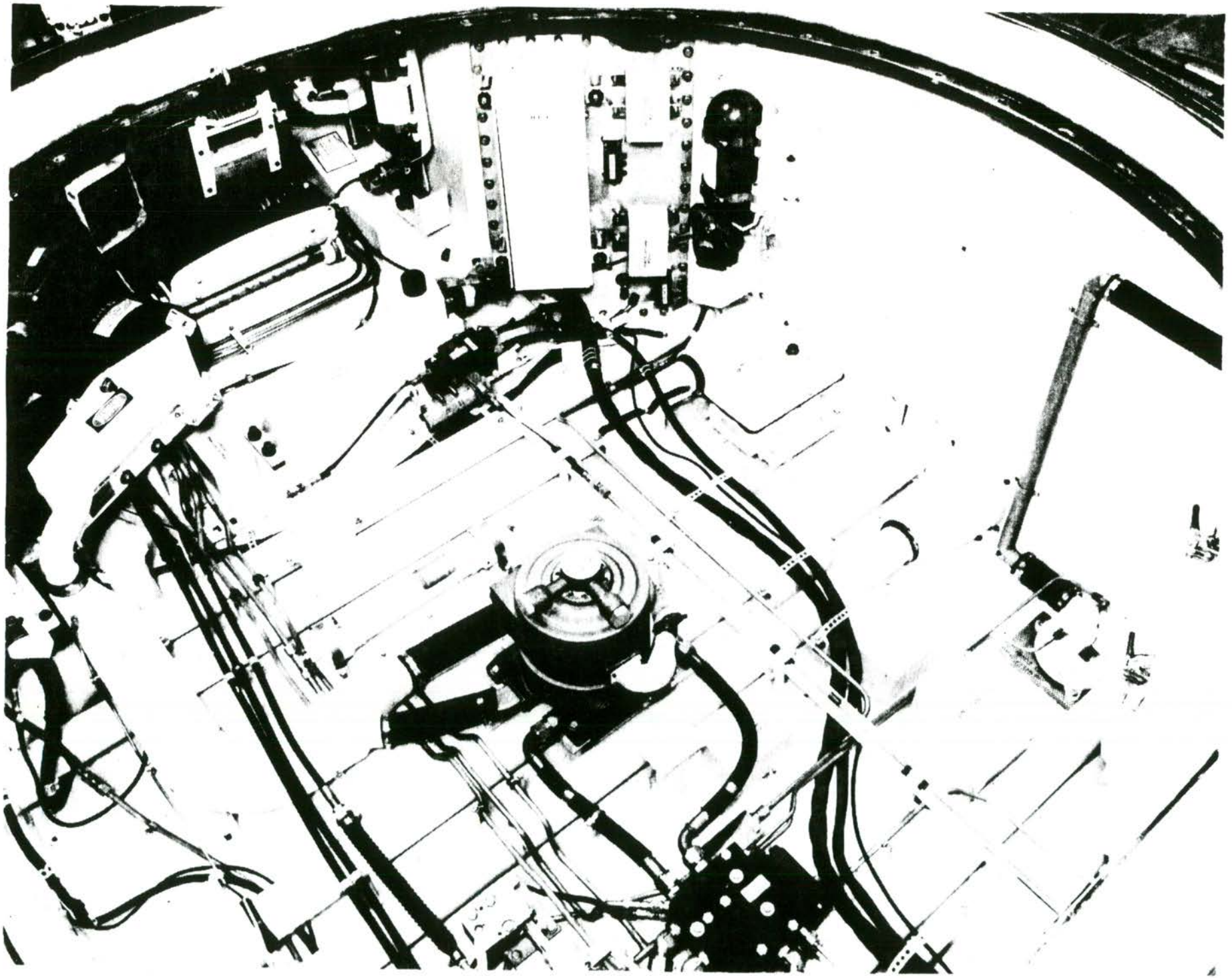


INTEGRATED POWER SYSTEM
SYSTEM DESIGN

- Provide Power Circuit Protection to Primary Loads - Automatic Circuit Resets (Reduced Crew Burden)
- Provide Power Switching (On/Off) to Secondary Loads
- Monitor Discrete and Analog Sensors
- Replace Most of the HNB and TNB Functions
- Provide Power System Status (Built-In-Test/Diagnostics)
- Replace STE Tests for Many Auxiliary LRUs
- Operational Functions to Reduce Crew Burden
  - Silent Watch
  - Controlled Power Shut Downs
    - Personnel Heater Cool Down
    - DECU Engine Shut Down
    - Pos/Nav Shut Down
- Automatic Power System Reconfiguration (Fault Tolerance)

LOCATION OF RSM FOR G.P.S. POWER





H.P.D.B.
MODIFIED

MODIFIED SLIP RING SYSTEM DESIGN SUMMARY

- Provide 360 Degree Continuous Rotation
- Electrical Connectors/Contacts Feed Through Between Hull and Turret
- Hydraulic Feed Through
- Air Feed Through

SOLDIER/MACHINE INTERFACE

- Commander's Integrated Display
- Gunner's Control and Display Panel
- Driver's Integrated Display

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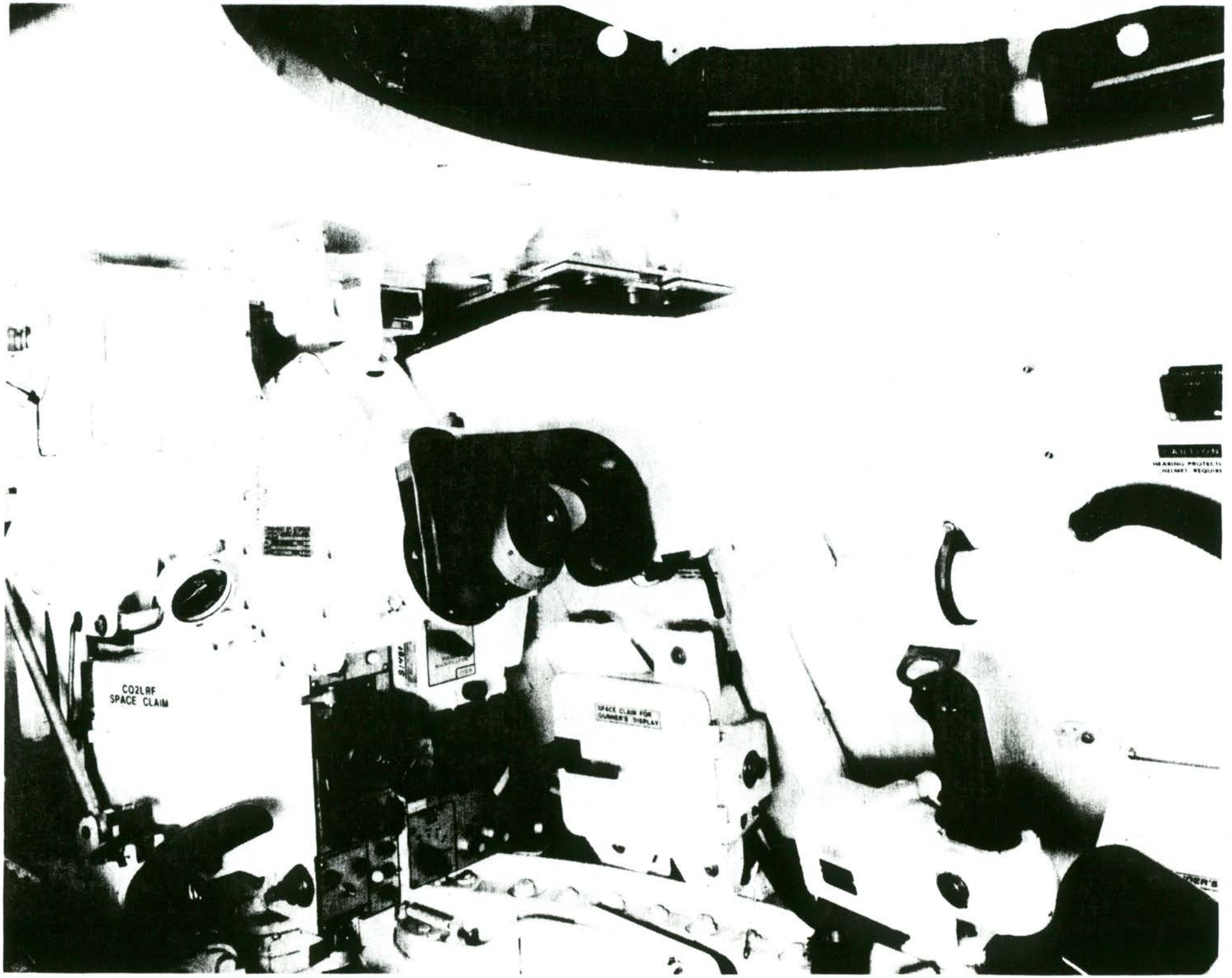
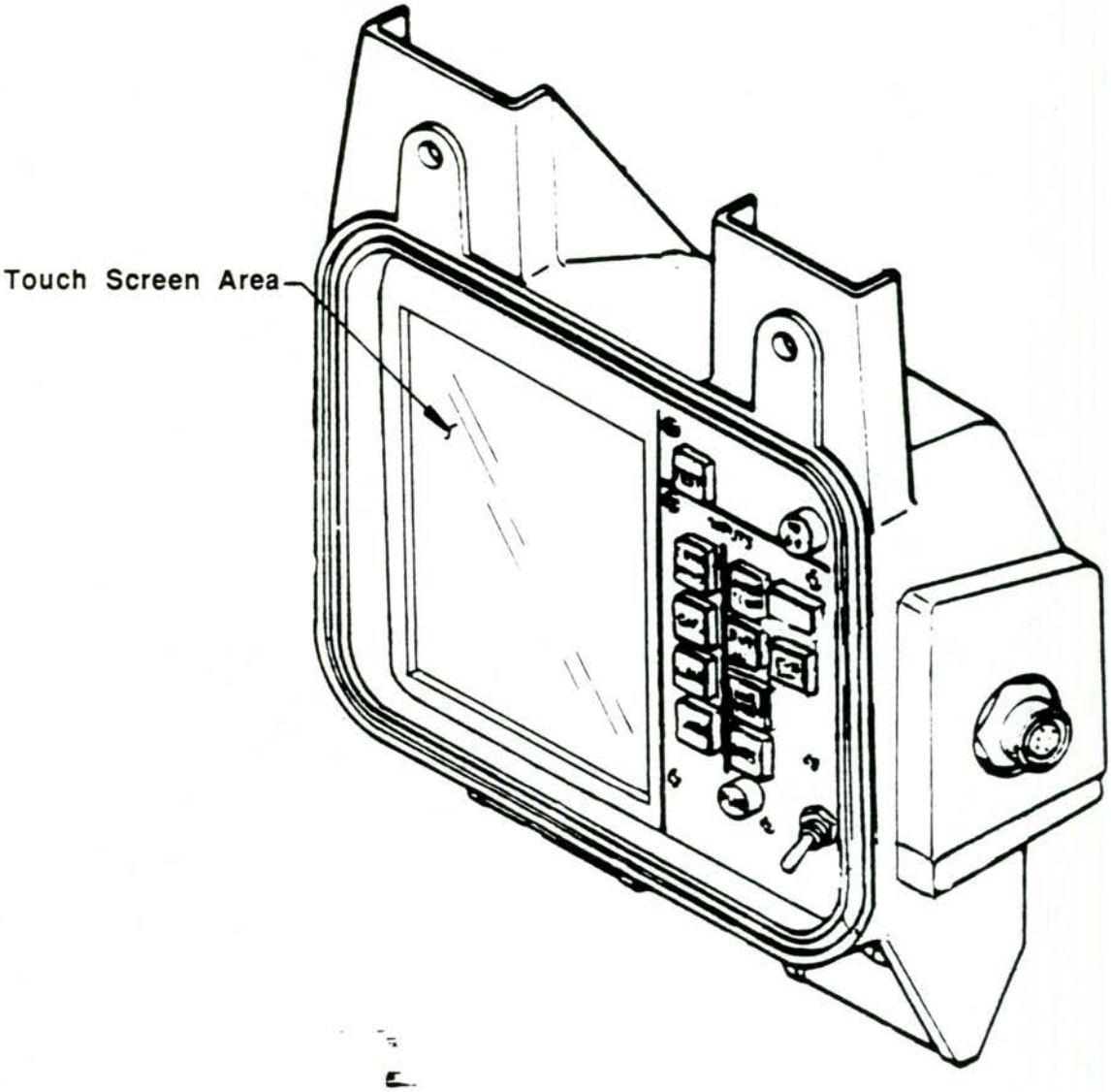
COMMANDER'S INTEGRATED DISPLAY SYSTEM DESIGN SUMMARY

- **CITV Control/Display**
  - Display of Real Time Video from CITV Sensor
  - Control of CITV Sight Adjustment
- **Tactical Control/Display**
  - Tactical Information
  - Generation of Reports, Orders, Messages
- **Display of System BIT and Diagnostics**
  - Control of System Level BIT Initiation
  - Resident Software to Perform BIT Functions to Isolate Failures to the LRU level
  - Display of BIT Status
- **Tank Commander's Panel Existing Functions**
  - Control of NBC System
  - Control of Master/Turret Power
  - Control of Smoke Grenades
- **Display Sensor Status and Control**
- **Commander's Handle Controls**
- **Enhanced PLRS User Unit - Display of EPLRS User Readout Functions**


CO2LRF
SPACE CLAIM
SPACE CLAIM FOR
GUNNER'S DISPLAY

GUNNER'S CONTROL AND DISPLAY PANEL (GCDP) SYSTEM DESIGN SUMMARY

- Computer Control Panel Existing Controls and Displays
- Expanded Ammunition Select Control
  - Provisions to include: XM829E2, XM830E1, XM943 and XM946 Rounds
- Gunner's Control Handles
- GCDP BIT
  - Resident Software to Initiate and Perform Own BIT



GUNNER'S COMMAND & DISPLAY PANNEL

DRIVER'S INTEGRATED DISPLAY SYSTEM DESIGN SUMMARY

- M1A1 Driver's Instrument Panel, Driver's Alert Panel, Driver's Master Panel Existing Functions
- Engine Control Unit Display
- Display Vehicle Heading and 'Steer To'
  - Data Received from Pos/Nav Unit via 1553B Data Bus
- Engine and Vehicle Automotive Command
- DID BIT
  - Resident Software to Initiate and Perform BIT Functions to Isolate Failures at the LRU Level
  - Display of BIT Status

NORMAL

FIRE CONTROL SYSTEM

- Commander's Independent Thermal Viewer
- Fire Control Electronics Unit
- Hull/Turret Position Sensor
- Armament Enhancements
- GPS Implications

CITV SYSTEM DESIGN SUMMARY

- Allocated Requirements
  - CITV Surveillance Performance as Good as GPS Thermal Viewer
  - CITV to Provide Hunter/Killer Mode and Back-Up Main Gun Firing
- Derived Requirements
  - Performance: MRT, MDT, MTF Per Classified Requirements
  - Accuracy for Firing Main Gun
  - System Interface - Compatibility with Core Tank
- Identified Interfaces
  - 1553B Interface
  - Video Interface
  - Stabilization Interface
  - Power Interface

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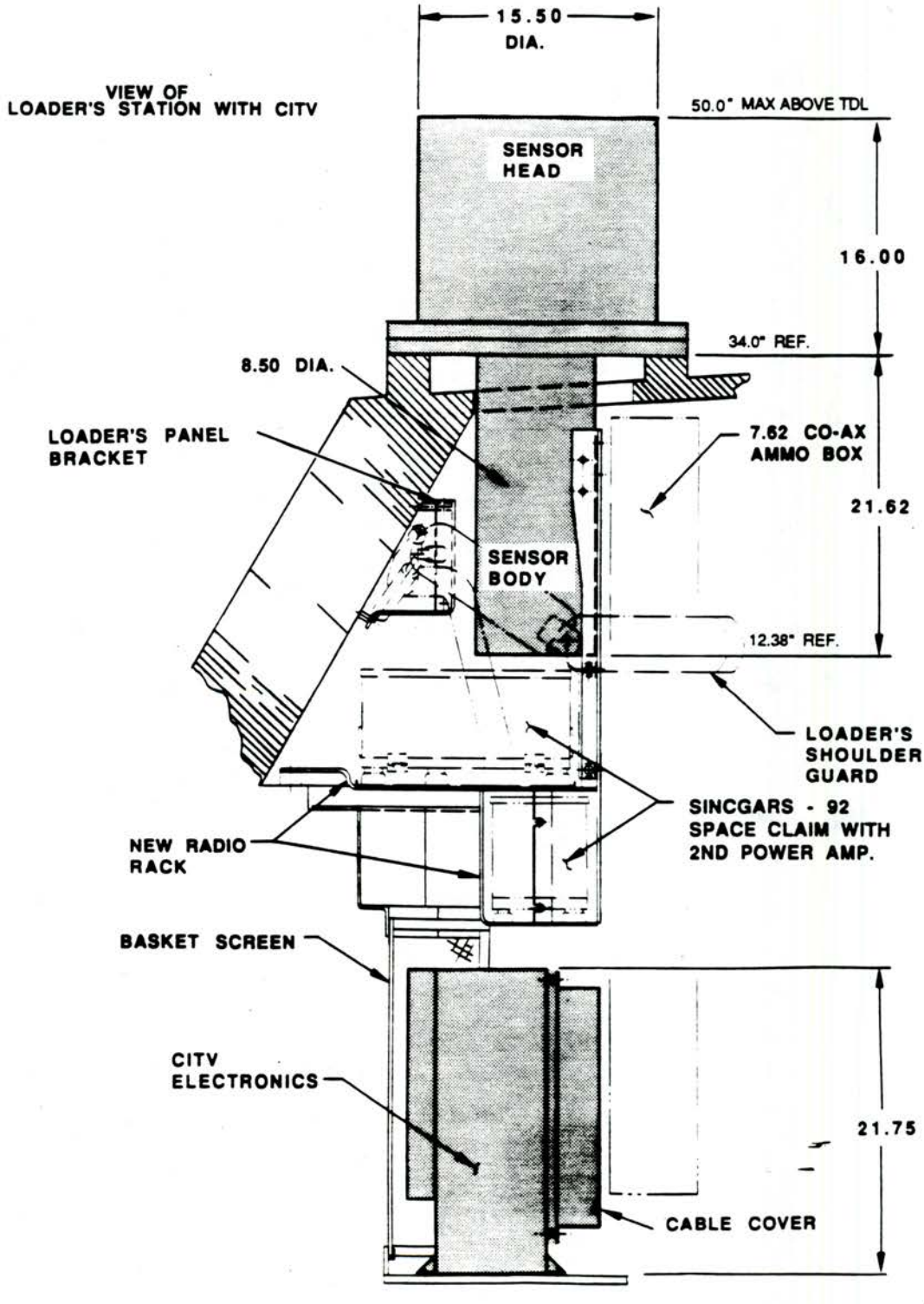
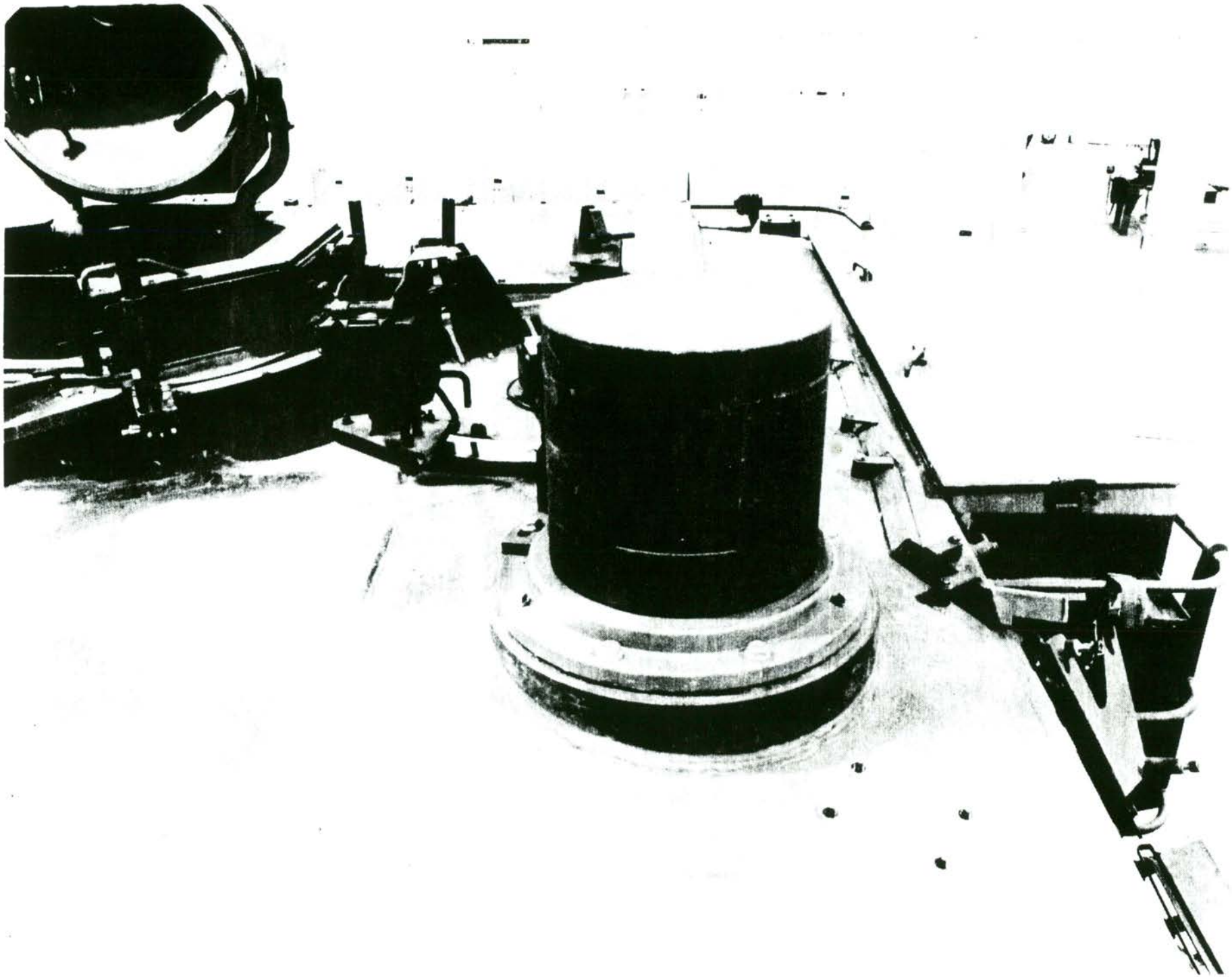
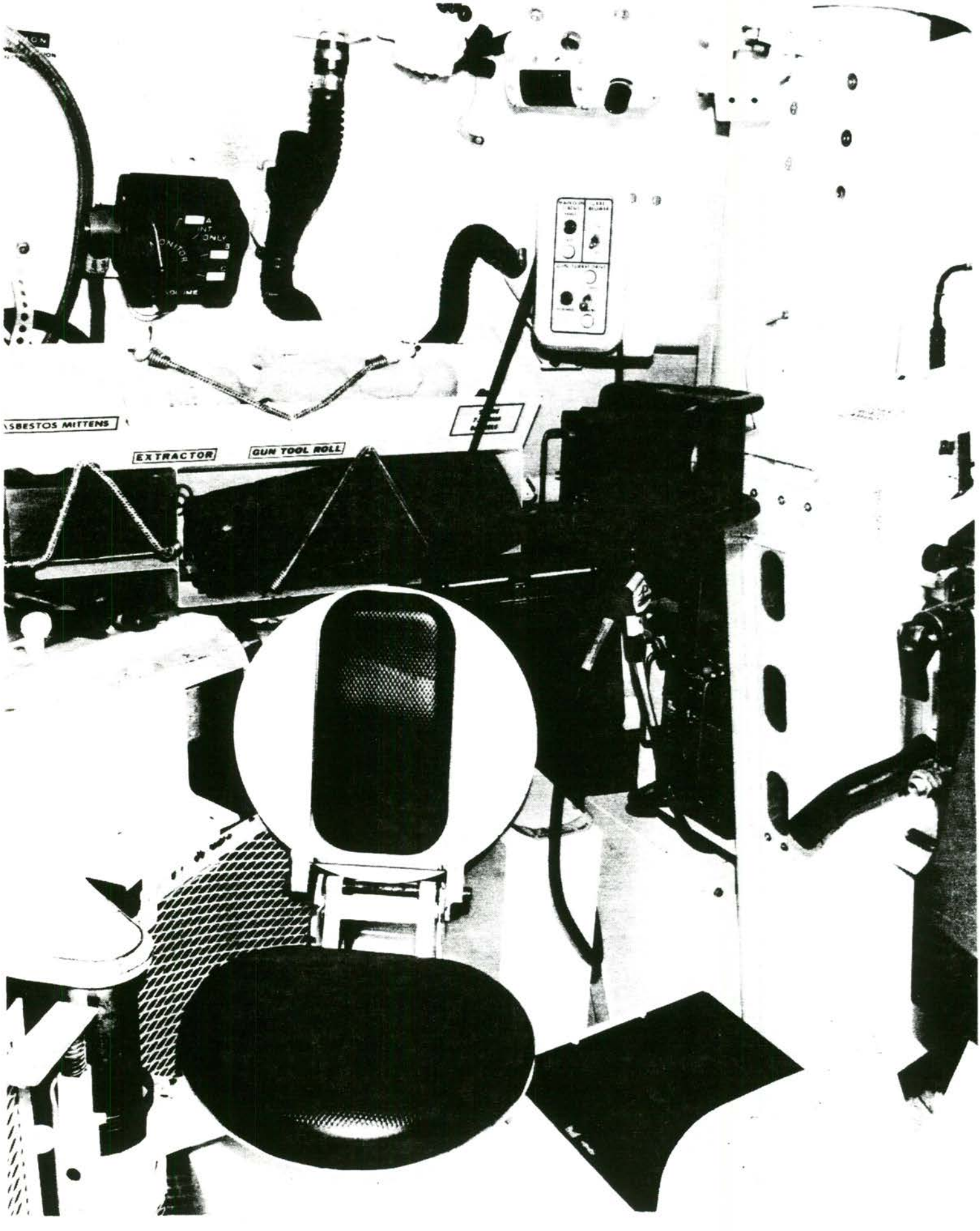
CITV ASSEMBLY



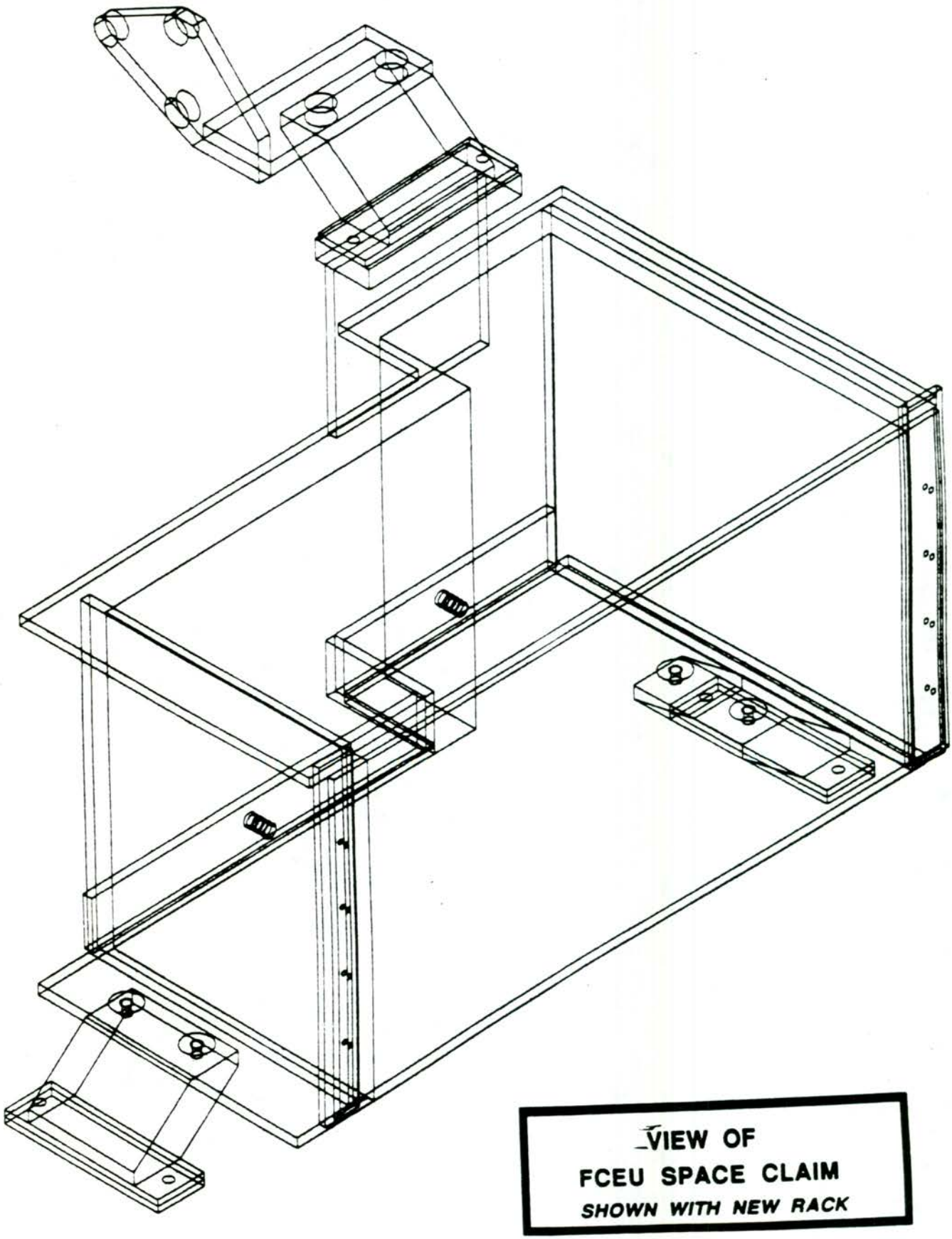



SBESTOS MITTENS
EXTRACTOR
GUN TOOL ROLL

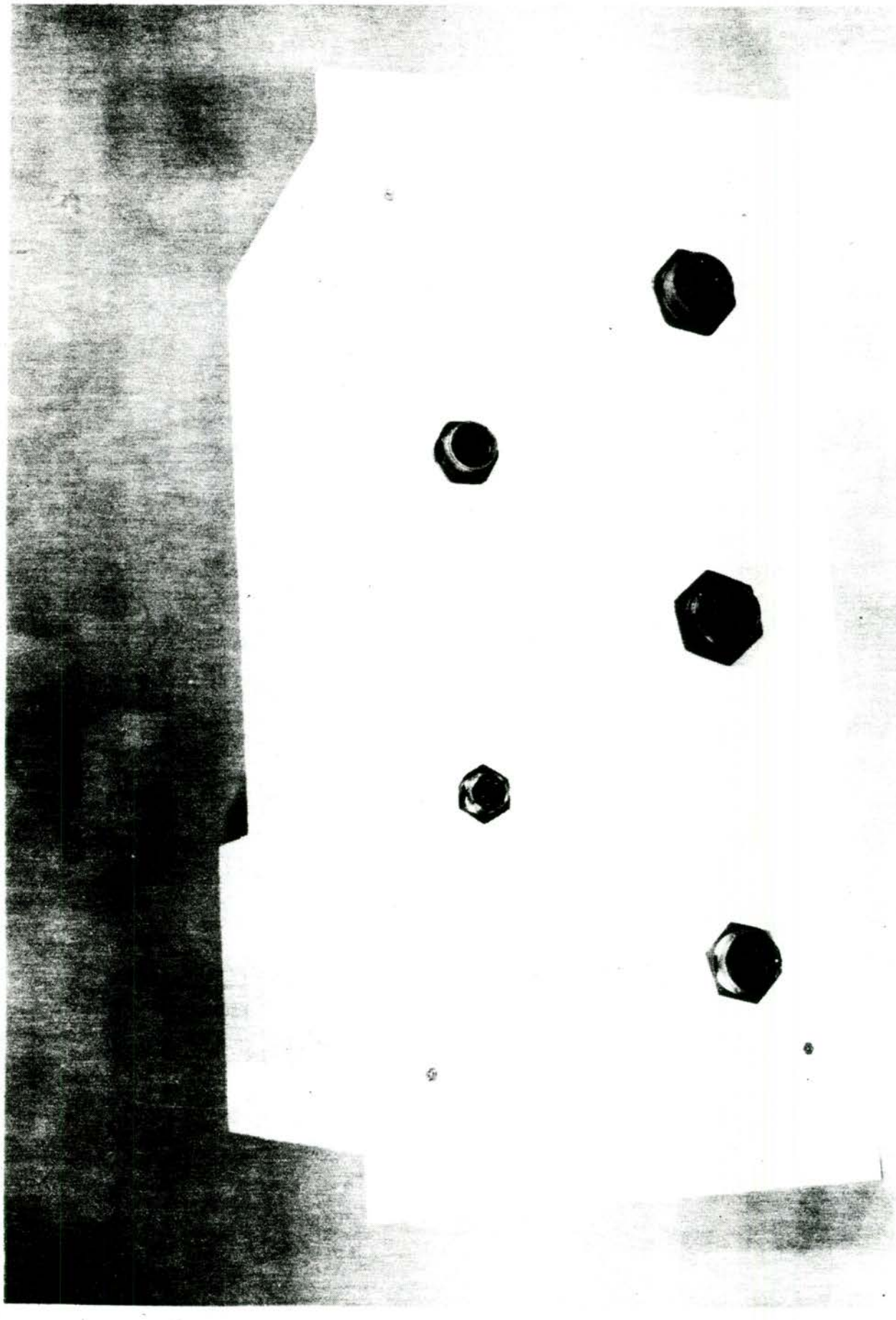
FCEU SYSTEM DESIGN SUMMARY

- Allocated Requirements
  - System Integration of Hunter/Killer Mode and Main Gun Firing
  - Incorporate Armament Enhancements into Fire Control System
- Derived Requirements
  - Integrated CITV with Fire Control System
    - Gun/Turret Drive Functions
    - Line of Sight/Data Link Functions
    - Turret Network Box Functions
  - Integrate Armament Enhancement Ballistics Changes with Fire control System
  - Integrate Hull/Turret Position Sensor
  - Reduce Space, Power, and Wiring Requirements
  - Improve BIT

FCEU is the Key to Turret Integration



VIEW OF
FCEU SPACE CLAIM
SHOWN WITH NEW RACK




AZIMUTH SENSOR

HULL / TURRET POSITION SENSOR

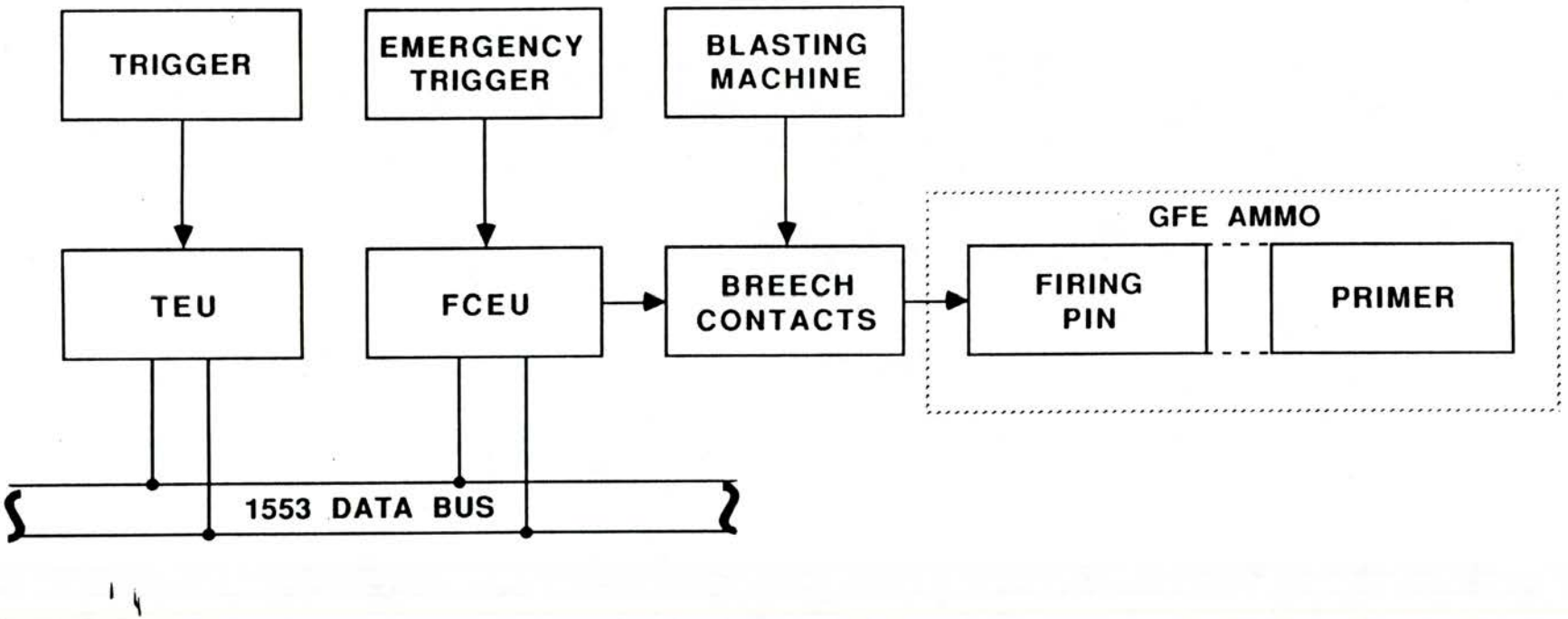
- **Provides Turret Angular Position Relative to Hull**

ARMAMENT ENHANCEMENT SYSTEM DESIGN

Improve the Lethality of the Vehicle by Providing Firing Capability for XM943, M829E2, M830E1, XM946, Enhanced 120 MM Rounds

- Operational
  - Improve Lethality
  - Defend Against Helicopter Threat
- Performance
  - Meet First Round Hit Probability with New Ammo Ballistic Offset Computation & Implementation
  - Protect Crew from New Ammo
  - Maintain Boresight
- System Interface
  - Provide Stowage
  - Provide Loading Capability
  - Provide Electrical Interface
  - Provide Stubcase Containment
  - Provide Compatible Optical Coatings
  - Provide Additional Ammo Selection

SIMPLIFIED BLOCK DIAGRAM FOR AE INTEGRATION



BLOCK IMPROVED ABRAMS VS EVASIVE TARGET REQUIREMENTS

- BIA using GPS
  - Will Not Meet AEI Required Hit Probability*
  - Will Not Meet Material Need Hit Probability for Evasive Ground Targets

- BIA using CITV or Improved GPS
  - Will Meet AEI Requirements for Hit Probability*
  - Will Meet Material Need Hit Probability for Evasive* Ground Targets
  - Thermal Vision for Engagement (Recognition of Target) Out to 4km Will be Marginal.

*AMSAA Analysis Results Presented to PM Abrams

SINPAK

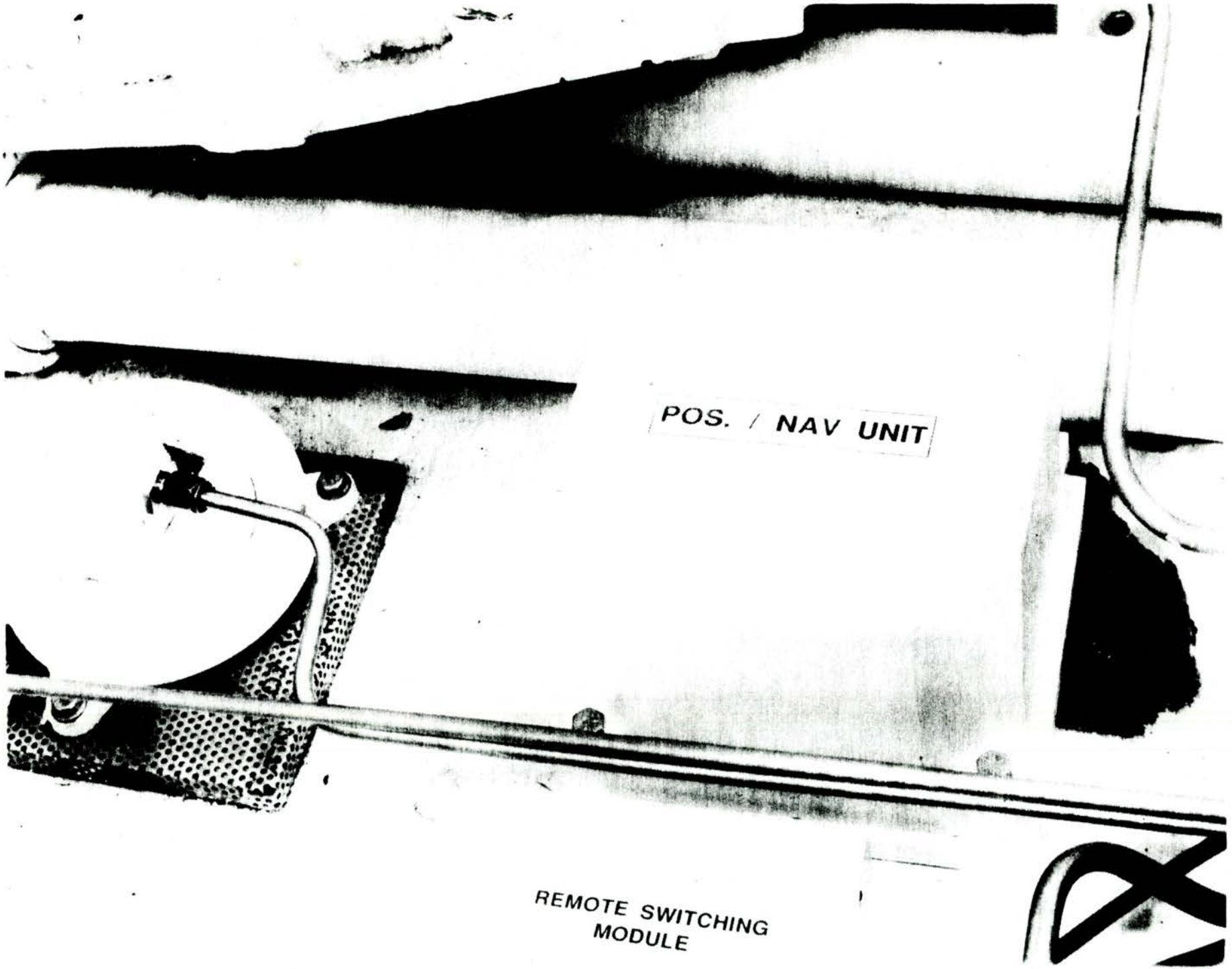
- **SINPAK - SYSTEM INTEGRATION PACKAGE**
  - **Power Management System**
  - **Improved Slip Ring Assembly (SRA)**
  - **Data Management System**
  - **Turret Electronics Unit (TEU)**
  - **Hull Electronics Unit (HEU)**
  - **Commander's Integrated Display (CID)**
  - **Driver's Integrated Display (DID)**
  - **Gunner's Control & Display Panel (GCDP)**
  - **Fire Control Electronics Unit (FCEU)**
  - **Provisions for Installation of Electronics LRU's**
  - **Survivability Enhancement Integration Provisions**

MISSION EQUIPMENT INTEGRATION

- CITV (Covered in Fire Control)
- Position / Navigation Unit
- Intervehicular Information System (IVIS) / Radio Interface Unit (RIU)

POSITION/NAVIGATION (POS/NAV) UNIT SYSTEM DESIGN SUMMARY

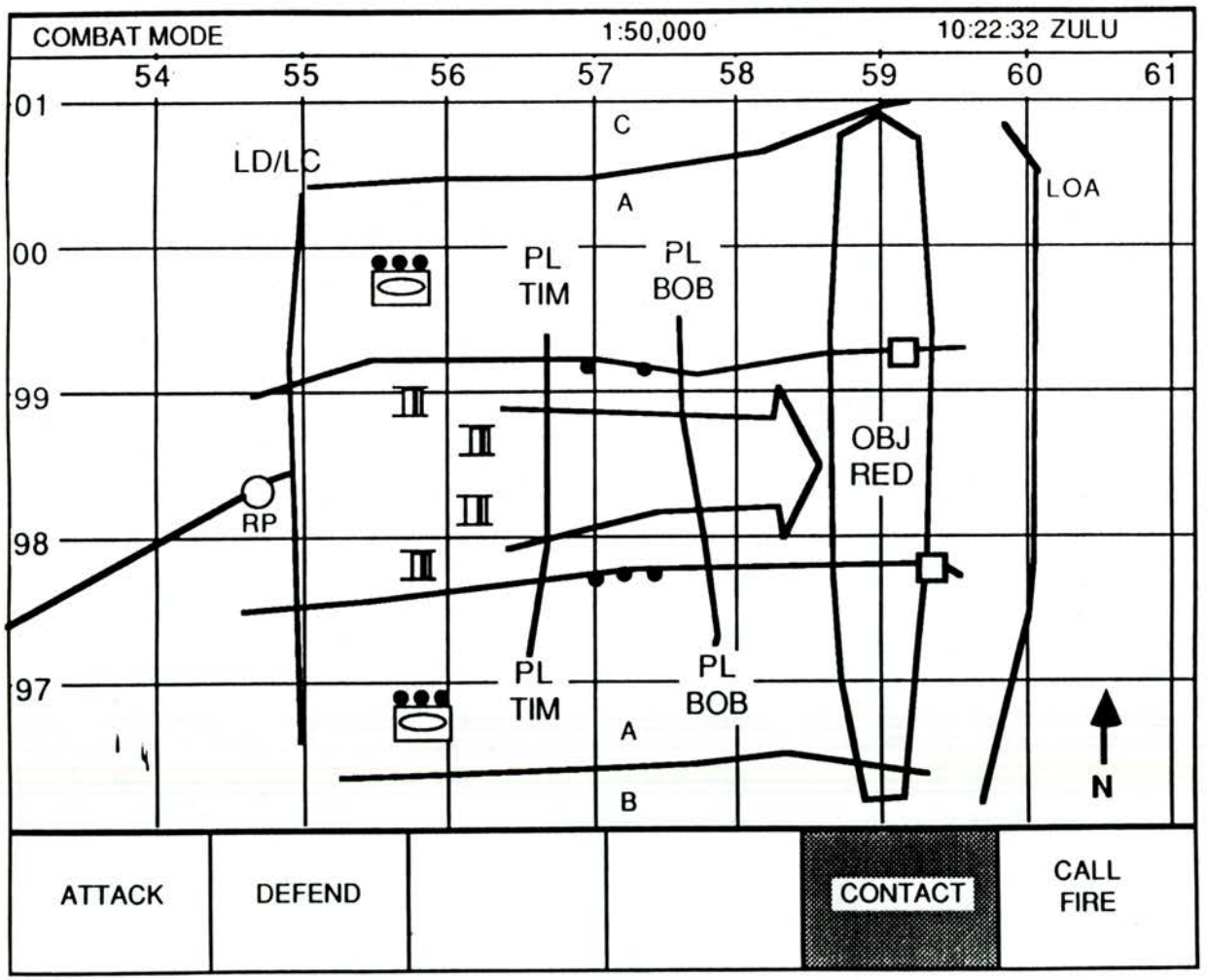
- **Allocated Requirements**
  - Self Initialized Heading (5 minutes) with 1 Degree Accuracy
  - Heading Drift Rate 1 Degree per Hour (1 sigma)
  - 11 Character MGRS Coordinates With 2% of Distance Traveled Accuracy (68% P.E.)
  - Integrated with LRF for Target Coordinate Calculation
  - Controls and Displays at Commander's and Driver's Stations
- **Derived Requirements**
  - 6 Inch Maximum Position/Navigation Unit Height
  - Azimuth Rate, Pitch Angle, and Roll Angle Outputs
  - Power Consumption - 50W Typical, 150W Maximum
- **Partitioning**
  - Pos/Nav Unit - Gyrocompass, Heading Reference, and Position Functions
  - CID/DID - Pos/Nav Unit Controls and Displays
  - TEU/HEU - Range and Bearing to Waypoint Calculations


POS. / NAV UNIT
REMOTE SWITCHING
MODULE

INTER-VEHICULAR INFORMATION SYSTEM DESIGN SUMMARY

- **Communications Management**
  - Message Formatting, Prioritization, Storage
- **Data Base Management Function**
  - Manages Tactical Display and Logistics Information
- **System Security**
  - Protect Against Unauthorized Use & Zero Memory

IVIS SCREEN ON COMMANDER'S TACTICAL DISPLAY



REPORTING TANK:

Actions Taken

Smoke.

Evasive Action

CONTACT

5 - 10:21 CONTACT WITH ENEMY

70Q-52006-1

RADIO INTERFACE UNIT SYSTEM DESIGN SUMMARY

- **Radio Net Management**
  - Establish Connectivity
  - Maintain Net Participation Status
- **Packet Processing**
  - Assemble Messages Into Packets for Burst Transmission
- **Message Buffering**
  - Store and Forward Messages Across Net
- **Error Detection and Correction**
  - Provide Algorithm for Correcting Errors During Transmission
- **Built-In-Test**

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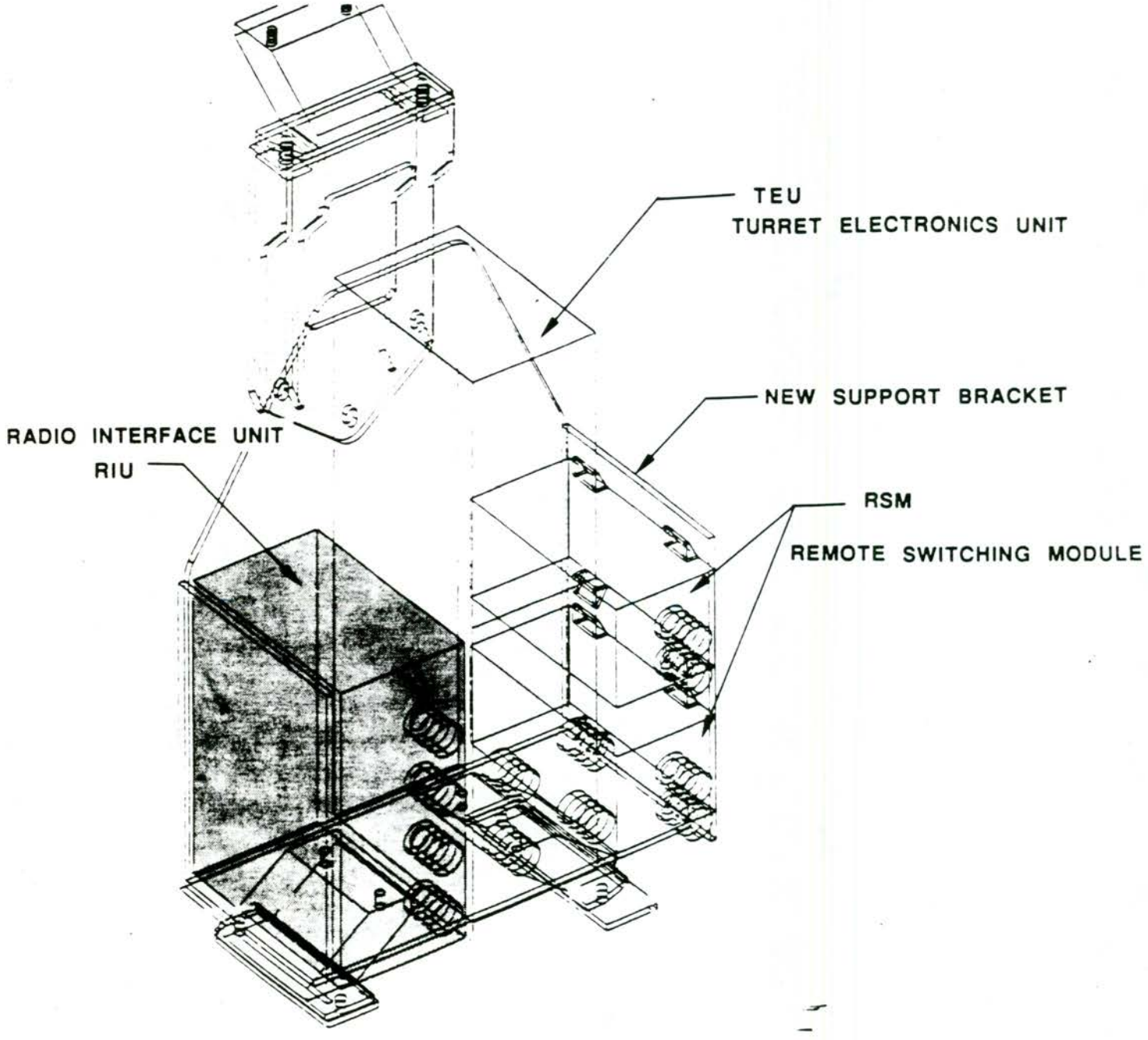
TEU / RIU MOUNTING ASSEMBLY

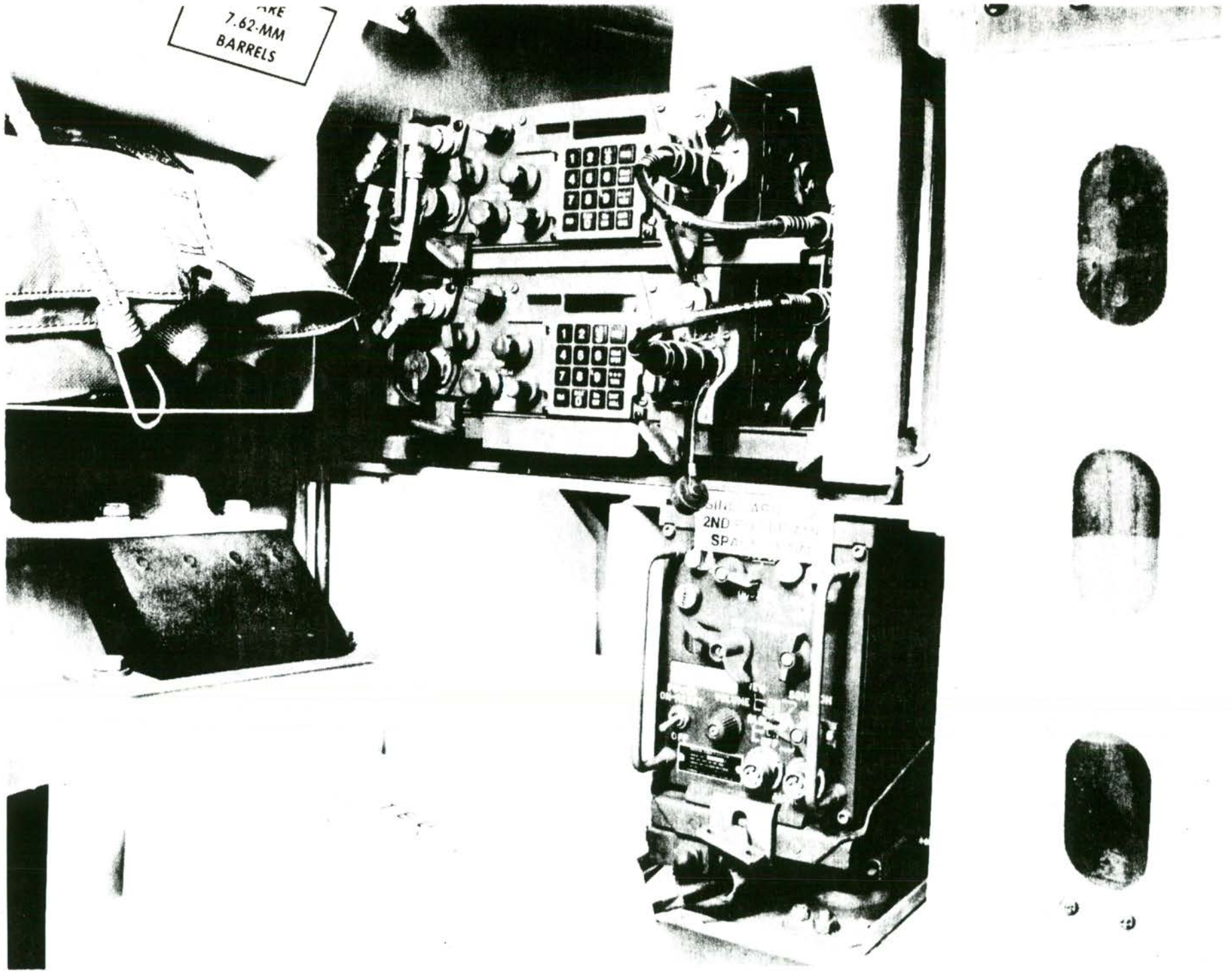


GFE INTEGRATION

- Single Channel Ground Air Radio System (SINCGARS)
- Digital Engine Control Unit (DECU)
- Driver's Thermal Viewer (DTV)

SINCGARS SYSTEM DESIGN SUMMARY

- **Allocated Requirements**
  - Integrate the SINCGARS AN/VRC-92A Into the Block Improved Abrams Tank
- **Derived Requirements**
  - Provide Electrical and Physical Installation
  - Integrate a Remote Control Function in Commander's Display
- **Functions**
  - SINCGARS Provides a Dual Radio Configuration With Integral COMSEC and Two Power Amplifiers
  - Transmits and Receives Voice and Digital Data
  - Security Through Integral COMSEC and Spread Spectrum Frequency Hopping


7.62-MM
BARRELS

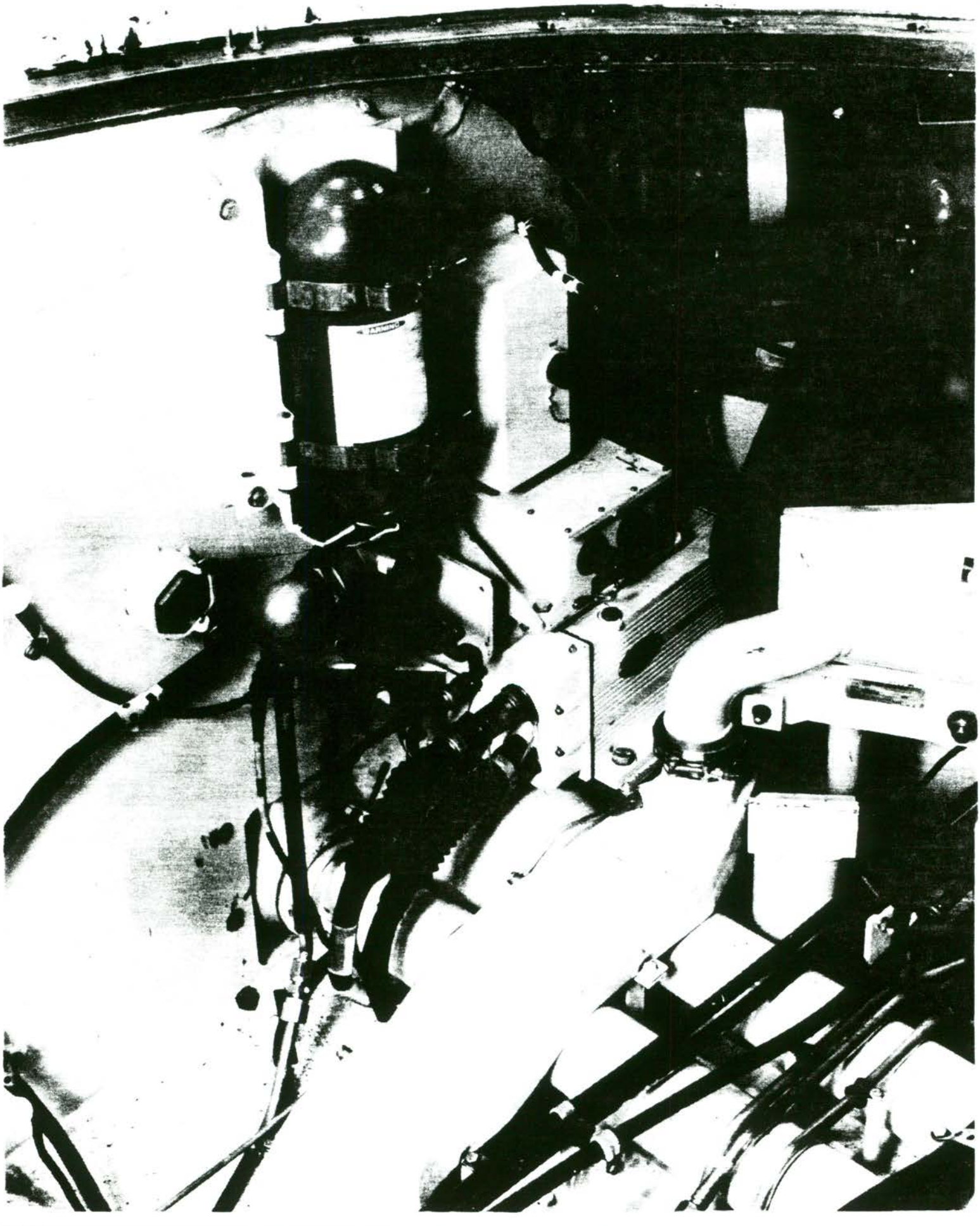
EPLRS SYSTEM DESIGN SUMMARY

- **Allocated Requirements**
  - EPLRS Shall be Integrated Into the Block Improved Abrams to Provide Threat Aircraft Alerts
- **Derived Requirements**
  - Integrate the Enhanced PLRS User Unit Into the Core Tank Via the MIL-STD-1553B Data Bus
  - Provide the Functionality of the EPLRS User Readout Unit Via the Commander's Integrated Display
- **Functions**
  - Provide Threat Aircraft Alerts
  - Provide Position Location

EPLRS
SPACE CLAIM

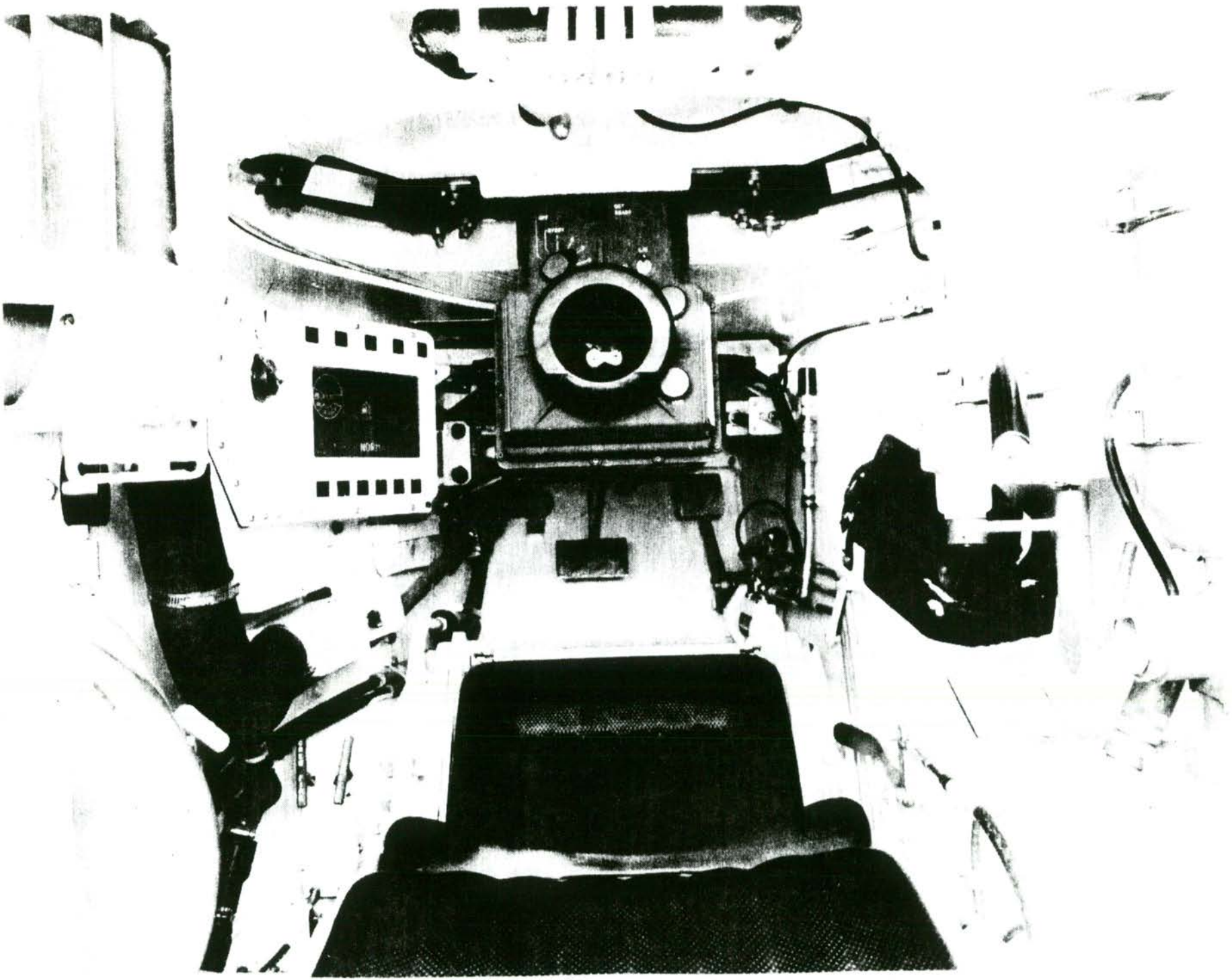
DECU SYSTEM DESIGN SUMMARY

- **Derived Requirements**
  - Hull Diagnostics (Engine) Requires the Integration of the DECU Into the Core Tank
  - Control and Display Via the Driver's Integrated Display Requires a Data Bus Interface
- **Functions**
  - The DECU Provides All the Functionality of the Existing Analog ECU With Additional Enhancements
  - Reduce Idle Fuel Consumption
  - Built-In-Test of Control Functions and Inputs/Outputs
  - Intermittent and Hard Faults Retained in Memory
  - Integral Rechargeable Battery for 1 Hour Operation
  - Improved Reliability
  - Provisions for Adding MIL-STD-1553B Data Bus Interface



DTV SYSTEM DESIGN SUMMARY

- Allocated Requirements
  - Improved Mobility in Obscured Conditions (All Weather Mobility)
  - Store a Spare Head Assembly
  - Integrate at Both Driver's and Loader's Stations
- Derived Requirements
  - Same Mounting Provisions as Current Night Viewer
  - Spare Head Stowage Accessible to the Driver
- Functions
  - Biocular Display with FOV 40° Az X 20° El
  - Aspect Ratio 2:1
  - Viewing in a Dirty Battlefield Environment (7.5 - 12μm)
  - White Hot / Black Hot
  - Operational Readiness < 10 Minutes



ONITOR
OLUME

SURVIVABILITY ENHANCEMENTS

- Integration of Modules - CFE
- Modules Could Be CFE or GFE

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SURVIVABILITY ENHANCEMENTS SYSTEM DESIGN SUMMARY

- Approved SRR Requirements
  - SE-I
  - SE-II
  - Automatic Weapons Fire
- Locations Identified for Armor
- Threats and Simulants Identified*
- Established Derived Requirements
  - Kits
  - Ballistic Protection
  - System Impact
  - Installation Removal
  - Environmental
  - HFE/Safety
  - Manufacturing
  - Security

* Original Threat Definition has Changed - Formal Direction to be Documented by Govt Letter to GDLS.

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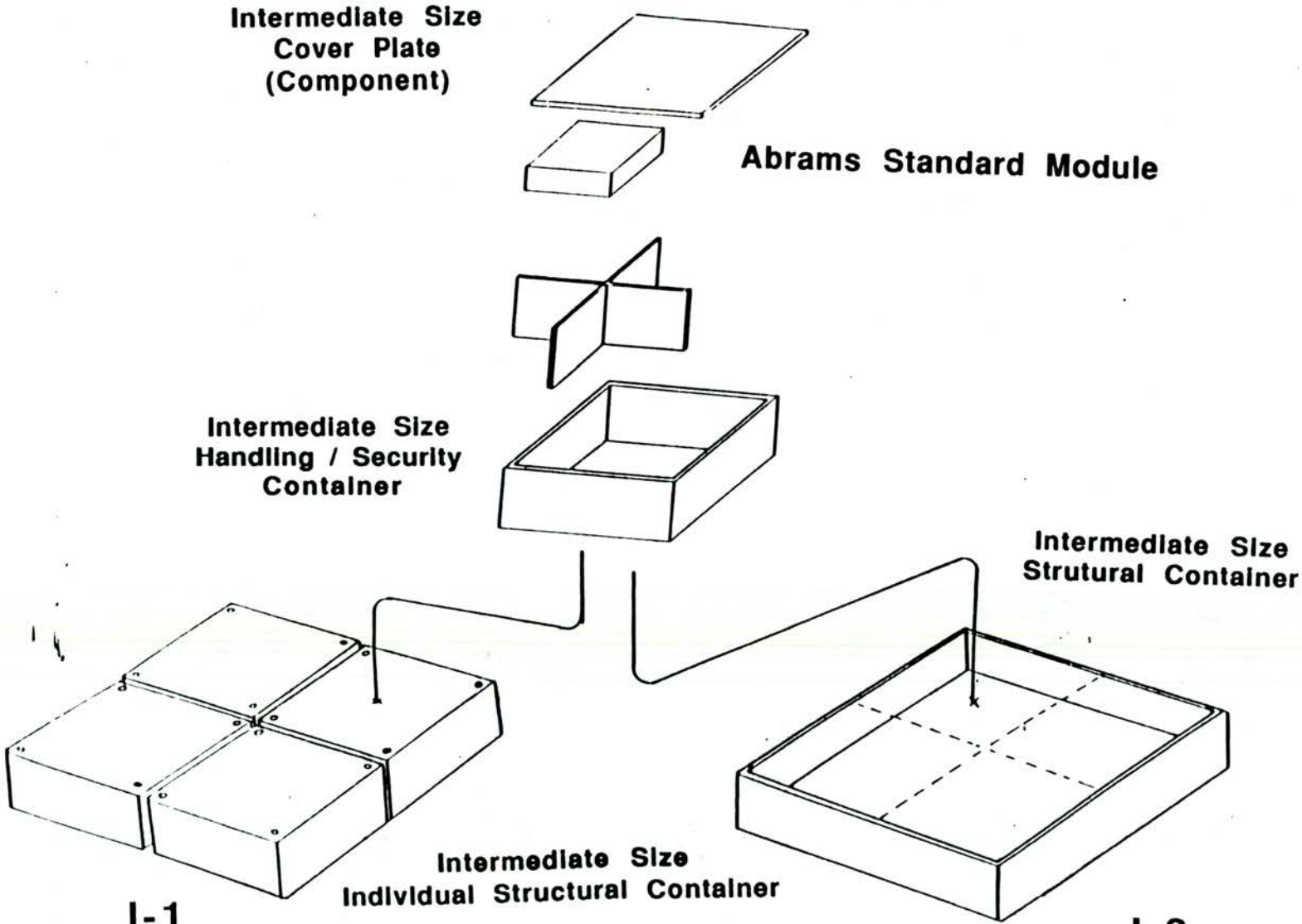
PACKAGING CONCEPT - INTERMEDIATE

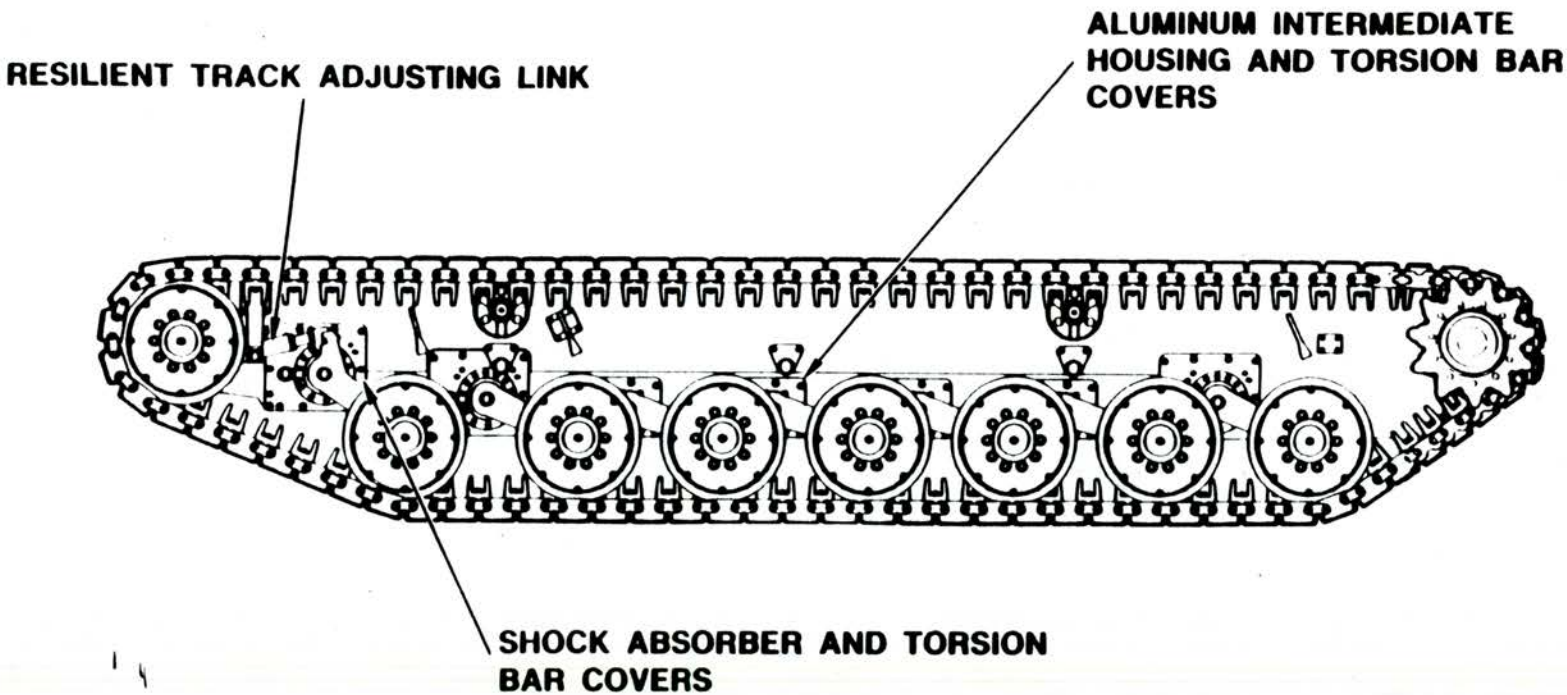


WEIGHT ACCOMODATION

WEIGHT ACCOMODATION PROJECT

- Improved Torsion Bar Suspension
- Powertrain Changes
  - Final Drive
  - Cooling

IMPROVED TORSION BAR SUSPENSION SYSTEM DESIGN SUMMARY



- NEW TRACK ADJUSTING LINK
- NEW SHOCK ABSORBERS
- NEW SHOCK ABSORBER HOUSINGS
- NEW TORSION BARS
- NEW TORSION BAR COVER SEAL SYSTEM
- NEW INTERMEDIATE HOUSINGS

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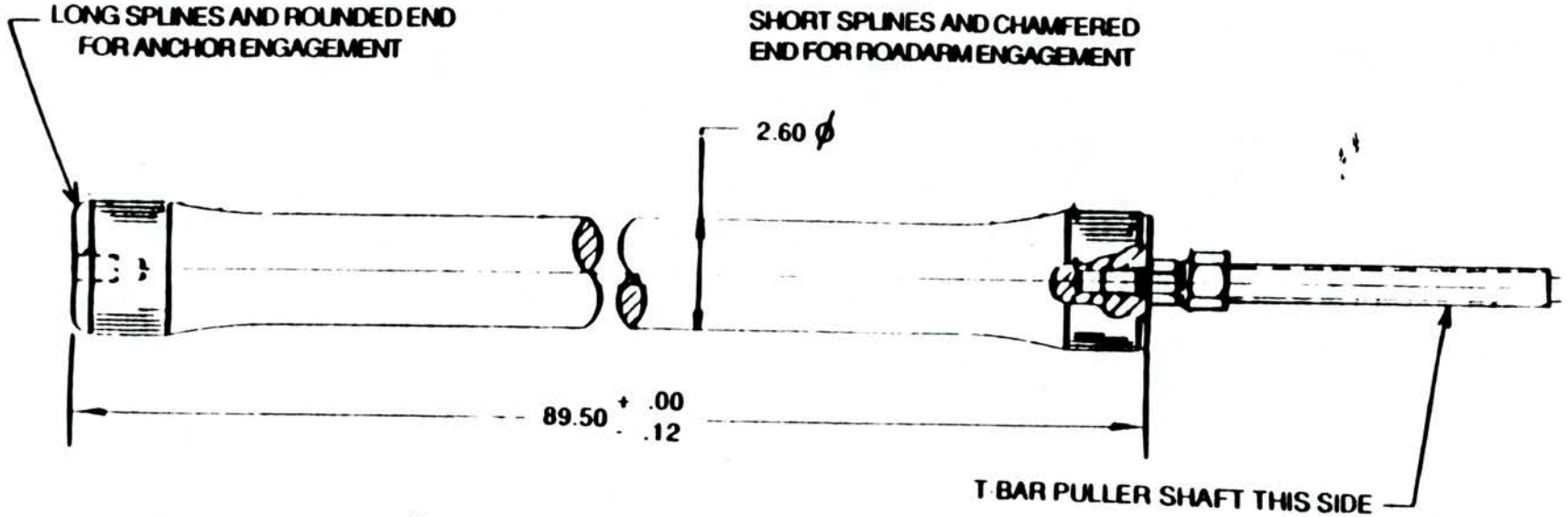
HEAVY TORSION BAR



- INCREASED T-BAR DIA. (.148 IN.) - 2100 LBS/DEG. INCREASE BAR LOAD CAPACITY
- COMMON SPLINES BOTH ENDS - INCREASED T-BAR STRENGTH
- INCREASED SPRING CONSTANT 26%
- DECREASED WIND UP ANGLE 3.6
- INCREASED WEIGHT - 6 T-BARS - 85.7 LBS/VEH.
  14 T-BARS - 200 LBS/VEH.