LEVEL II (3)

C76-131 #3

ADC020595

Advanced Naval Vehicle Concepts Evaluation (ANVCE).

DESIGN SUMMARY REPORT (NEAR TERM). (U)

LSES

FINAL TECHNICAL REPORT.

15 November 1976

G. R. Barte, Jr

Prepared Under
CONTRACT NO. N00024-74-C-0924
MODIFICATION NO. P00017
DATA ITEM D004

578

Classified by [illegible] (MOD P00017 &
NAVSEA INST 5511.[illegible] Encl. 3 [redacted]
Review on: 15 November 1986

[redacted]

ROHR MARINE, INC., P.O. BOX 23000, SAN DIEGO, CA 92123
A Subsidiary of
ROHR INDUSTRIES, INC., P.O. BOX 870, CHULA VISTA, CA 92012

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

~~CONFIDENTIAL~~
(This page is unclassified)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: C76-131
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): ANVCE SES-3 Design Summary Report (Near Term) (U)
5. TYPE OF REPORT & PERIOD COVERED: Final
6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)
8. CONTRACT OR GRANT NUMBER(s): N00024-74-C-0924 MOD P00017
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Rohr Marine, Inc. ~~San~~ Diego, California 92123 Chula Vista
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: CNO (OP96V) Washington, D.C. 20350
12. REPORT DATE: 15 November 1976
13. NUMBER OF PAGES: 429
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): NAVSEA Washington, D.C. 20362
15. SECURITY CLASS. (of this report): [redacted]
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: [redacted]
16. DISTRIBUTION STATEMENT (of this Report): [redacted]
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
18. SUPPLEMENTARY NOTES
19. KEY WORDS (Continue on reverse side if necessary and identify by block number):
Advanced Naval Vehicle Concepts Evaluation
ANVCE
Parametrics and Point Designs
Surface Effect Ship (Large)
Weaponized Testship

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The report describes the point design of a 3000-long ton Surface Effect Ship (SES) that meets the near term requirements of the Office of Advanced Naval Vehicle Concepts Evaluation (ANVCE). The point design is a weaponized testship, a concept that is a step toward a new class of fully combatant SES's and that is a logical progression from today's technology. The SES point design is described in overall terms of General Description, Vehicle Performance, Maneuvering, Range, Payload, Weights, Volumes, Stability, → next page

DD FORM 1473, 1 JAN 73 — EDITION OF 1 NOV 66 IS OBSOLETE

393 299

~~CONFIDENTIAL~~
UNCLASSIFIED (This page is unclassified)
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

20. (cont.)

Geometric-Form, and Ride Quality. The report also includes sections addressing Logistic Considerations; Survivability and Vulnerability; and Technical Risk. The near term point design SES is shown to be a cost-effective, minimum risk, and high performance means of satisfying ANVCE requirements.

Accession For	
NTIS GRA&I	X
DDC TAB	
Unannounced	
Justification	
By	
Distribution/	
Availability Codes	
Dist.	Avail and/or special
9	23

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

[redacted]

ANVCE
DESIGN SUMMARY REPORT
(NEAR TERM) (U)

FINAL TECHNICAL REPORT

15 November 1976

Prepared Under
CONTRACT ND. N00024-74-C-0924
MODIFICATION NO. P00017
DATA ITEM 0004

Prepared by:
G. R. Barté, Jr.
Principal Investigator

Approved:
P. Burke
Deputy Program Manager

Approved:
G. Luedeke, Jr.
Manager
Special Projects

Approved:
G. D. McGhee
Vice President
Program Manager

ROHR MARINE, INC., P.O. BOX 23000, SAN DIEGO, CA 92123
A Subsidiary of
ROHR INDUSTRIES, INC., P.O. BOX 870, CHULA VISTA, CA 92012

[redacted]

DISTRIBUTION

	No. of Copies
COMMANDING OFFICER SES PROJECT OFFICE (PMS 304) DEPARTMENT OF THE NAVY P.O. BOX 34401 WASHINGTON, D.C., 20034 ATTN: Hr. H. Robertson	18

ABSTRACT

(U) The report describes the point design of a 3000-long ton (29,892 kilo-Newton) Surface Effect Ship (SES) that meets the near term requirements of the Office of Advanced Naval Vehicle Concepts Evaluation (ANVCE). The point design is a weaponized testship, a concept that is a step toward a new class of fully combatant SES's and that is a logical progession from today's technology.

(U) The SES point design is described in overall terms of General Description, Vehicle Performance, Maneuvering, Range, Payload, Weights, Volumes, Stability, Geometric-Form, and Ride Quality. Subsystems further described are Structures; Propulsion; Electrical; Command, Control, and Communications; Auxiliary; Outfitting and Furnishings; and Combat System. The report also includes sections addressing Logistic Considerations; Survivability and Vulnerability; and Technical Risk.

(U) The near term point design SES is shown to be a cost-effective, minimum risk, and high performance means of satisfying ANVCE requirements.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENT5 (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF ILLUSTRATIONS (Continued)

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

1/ INTRODUCTION

(U) This report describes the point design of a near term (1980) Advanced Naval Vehicle Concept Evaluation (ANVCE) Study 3,080 LT (29,892.1 kN) Surface Effect Ship (SES). The point design has been developed in accordance with Modification P00017 to Contract N00024-74-C-0924 for the SES Project Office (PMS-304).

No way!

(U) The data in this report are for a weaponized test ship and were originally submitted in response to RFP N00024-76-5342(S). The SES was developed in accordance with 'Large Surface Effect Ship (LSES) Top Level Requirements (U)", Chief of Naval Operations, 28 May 1976, Rohr Document No. CDC-C-76-076 CONFIDENTIAL.

(U) The design was documented in Rohr Industries, Inc., 'Technical Proposal for Design and Construction of a Large Surface Effect Ship," in five (5) volumes tonsisting of 34 books and 16 appendices, dated 19 July 1976, CONFIDENTIAL, as amended by "Rest and Final Proposal for the Design and Construction of a 3,000-Ton Surface Effect Ship, Volume I - Management and Technical Change Summary," dated 12 October 1976 (with four (4) appendices). The near term SES design is not a combatant ship.

(U) The near term SES design is presented In the format specified in the Office of Advanced Naval Vehicle Concept Evaluation (ANVCE) document WP-005A, "Point Design Description,' dated 13 August 1976. The terms "3K", "near term ANVCE point design", and "1980 point design" SES are used synomously throughout the report to refer to the same design concept.

(U) The near term point design is described in English, as well as in SI (metric) units of measurement. The point design was developed with -English units as the primary standard of measurement. SX conversions shown in the text within parentheses conform to American National Standard Z210.1-1973, "Metric Practice Guide", 15 March 1973, American Society for Testing and Materials, which has been approved by the Department of Defense and its use stipulated by the ANVCE Project Office.

(U) The near term SES performance data for range and speed were developed in accordance with the ANVCE design guidelines with the following exceptions:

*Lightship margins were not computed on the basis of a 15% reservation including service life but rather on a 7% reservation plus a fixed 25 LT (249.1 kN) service life allowance.

- SWBS Croup-410, 440, 450, 460, 470, and 480, as well as 700 and military payload related variable loads, were not drawn from the near term "ANVCE Combat System Data Sheets for AAW, ASW, SSW (U)", Vol I and II, dated 30 June 1976, but were developed in accordance with 3KSES TLR specifications and government-furnished information received in the course of the performance of phase IIA 2000-ton SES program activities,

- The tail pipe (trapped fuel) allowance was adjusted to reflect ANVCE guidelines (2% deep tank, 5% flat tanks). In addition, range and payload data were presented on the basis of the ANVCE definition of payload contained in "Definition of Terms" ANVCE WP-002 dated 2 April 1976. Appendix A, Subsection A.2.11.1 contains a more detailed discussion of these areas,

- The marine fouling allowance was taken as that corresponding to a 1.0 mil (25.4 μm) surface finish.

(U) No engineering effort was expended to generate data for a near term SES point design report section or subsection where that information was not developed for the 3KSES in response to RFP N00024-76-5342(S).

(U) In addition, no engineering effort was expended where near term point design data existed, or where ANVCE format or design/environmental standards required a major effort in reformating for compatibility with ANVCE standards. Data in those instances are furnished in the formats used to meet 3KSES development specifications with appropriate notations delineating the assumptions and criteria utilized.

(U) This report contains the following major sections (subsections are delineated in more detail in the table of contents):

Section No,	Content
1/	Introduction
2/	Vehicle General Description
2.1	Principal Characteristics
2.2	Vehicle Performance
2.3	Ship Subsystem Descriptions
2.4	Survivability and Vulnerability
3/	Logistic Considerations
3.1	Reliability and Availability
3.2	Maintenance Concept8
3.3	Overhaul Concept
3.4	Supply Support Concept
3.5	Human Engineering
3.6	System Safety
4/	Technical Risk Assessment

(U) Appendices

A	Design Process
B	Drawings and Diagrams
C	Equipment Lists

(U) Finally, the LSES TLR of 28 May 1976 defined ship displacements in the following terms:

- o Full Load Displacement (FLD) would be approximately 3000 long tons (29,892.05 kN) and would characterize a ship complete and ready for service in every respect.
- o Light Ship Displacement would be a complete and empty ship with all operating fluids less fuel (SWBS Groups 100 through 700 plus margins).
- o Mean operating Displacement (MOD) would be character-terized for two conditions:
  - o MOD-50; A complete and loaded ship ready for service in every respect with not more than 50% usable fuel.,
  - o MOD-10; A minimum loading condition for maximum speed operation in any sea state where the ship was complete and ready for service in every respect for service in every respect with not less than 10% usable fuel.
- o Capacity Load Displacement would be a complete and loaded ship with all fuel tanks filled to maximum operating capacity and ready for service in every respect.

(U) A variety of performance and **design** data wexe developed in relation to these displacement definitions and for the near term SES point design they have been referenced in a number of the subsections that follow.

2/ VEHICLE GENERAL DESCRIPTION

(U) 2.1 PRINCIPAL CHARACTERISTICS

(U) 2.1.1 **SUMMARY** -- The Near Term Point Design SES illustrated in Figure 2.1-l is a weaponized testship, is designed for high speed operation in an open ocean environment, has an extended range capability, and carries a military payload. Primary missions are SES concept evaluation, demonstration of weapon system compatibility, and determination of potential military value. Characteristics are summarized in Table 2.1-1.

(U) The following subsections describe the ANVCE near term point design SES in detail -- Section 2.2 outlines Vehicle Performance, Section 2.3 contains ship subsystem descriptions, and Section 2.4 addresses survivability and vulnerability.

(U) The point design, in the on-cushion mode, operates on the captured air bubble principle to reduce hydrodynamic drag and achieve high speeds. In the off-cushion mode, it operates as a displacement hull. The ship is capable of maneuvering in both modes including turning, accelerating, decelerating, and backing, and can also hover in the on-cushion mode.

(U) The principal ship dimensions ore shown in Figure 2.1-2. The 266.25 feet (81.15 m) length overall and 108 feet (32.92 m) maximum beam satiafy the volumetric and performance requirements. The maximum beam permits transiting the Panama and Suez Canals. Effective cushion dimensions are 221 feet (67.36 m) length and 85 feet (25.91 m) beam. A cushion height of 18 feet (5.49 m) was selected to ease ship motions and structural loads in Sea State 6. The full load displacement is approximately 3,000 long tons (29,892.05 kN) including all contract margins and mission fuel load. Table 2.1-l shows the principal characteristics of the design.

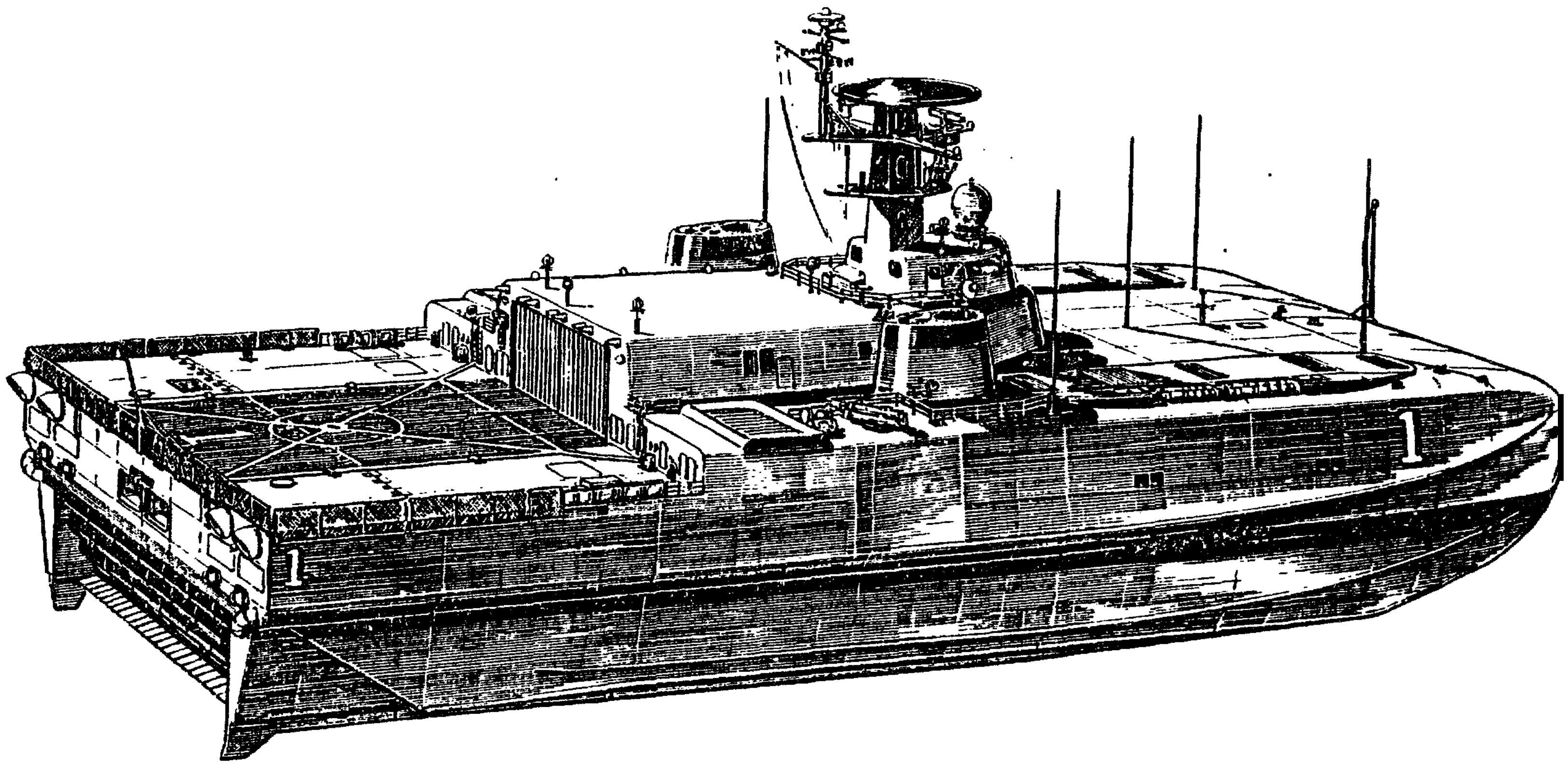


Figure 2.1-1 (U) Near Term Point Design SES — A Step Toward the 100-Knot Navy (U)

UN CLASSIFIED

Table 2.1-1 (C). Principal Characteristics of the Near Term 3000 Ton Point Design SES (U)

OPERATION:	Weaponized testship with primary missions of SES concept validation, demonstration of weapon system compatibility and evaluation of military utility.	
DIMENSIONS:		
• Length Overall (LOA) Ft. (m)	266.25	(81.15)
• Maximum Beam, Ft. (m)	108.00	(32.92)
• Wet Deck Height (above baseline = ABL), Ft. (m)	18.00	(5.49)
• Cushion Area, Ft.^{2} (m^2)	18,785.00	(1,745.13)
• Effective Cushion Length, Ft. (m)	221.00	(67.36)
• Main Deck Height (ABL), Ft. (m)	40.00	(12.19)
• Sidehull Fence Depth (BBL), Ft. (m)	3.33	(1.02)
• Stabilizer Fin Depth (BBL), Ft. (m)	10.39	(3.17)
• Hullborne Design Waterline (ABL), Ft. (m)	20.33	(6.20)
• Maximum Navigating Draft, Ft. (m)	30.72	(9.36)
POWER PLANTS:		
• Propulsion Engines	Four (4) General Electric (GE) LM-2500 or four (4) Turbo Marine FT-9A-2A	
• Propulsors	Four (4) Aerojet Liquid Racket Co. (ALRC) Waterjet Pumps	
• Lift Engines	Two (2) C.E. LM 2500's	
• Lift Fans	Six (6) ALRC Centrifugal, Variable Geometry	
CREW AND COMPLEMENT:		
• Vehicle	8 Officer, 8 CPO, 49 Enlisted	
• Secondary Vehielaa (Helicopters/RPV's)	4 Officer, 1 CPO, 14 Enlisted	
SYSTEMS:		
• Structures	All aluminum (5456), welded structure consisting of longitudinally stiffened plate supported by transverse web frames.	
• Electrical	Independent 60 Hz and 400 Hz subsystems, each powered by three (3) 375 kW Gas Turbine Generator Sets interconnected by a ring bus.	
• Steering	Thrust vectoring, differential thrust, and thrust reversal with the outboard waterjet pumps only.	
• Propulsion	Dual waterjet propulsors in each sidehull, driven by in-line gas turbines through separate reduction gear trains. Pump feed in each sidehull is with a single semi-flush inlet with variable roof ramp.	
• Lift	Three (3) centrifugal, variable geometry fans in each sidehull, driven by a single gas turbine through reduction gear.	

Table 2.1-l (C)(Cont'd)

SYSTEMS: (Cont'd.)	
• Seal.	Advanced, two-dimensional, planing bow and • tatu seals, enclosed between sidehulls.
a Ship Integrated Control	Closed loo ...rol for steering, propulsion, and lift syste ...utomatic control of ride (lift fans and/o valve). Performance monitoring of • uriliaz ...ctric plant, and distribution systems. c. ...ized ship damage control and integrated ...tion and collision avoidance.
• Outfit and Furnishings.	Hull compart ...tation, access and safety conforming to Navy standards with generous habitability provisions.
• Auxiliaries:	
• Heating, Ventilating and Air Conditioning (HVAC).	400 Hz powered, axial flow fan, packaged air conditioning (A/C) plants with dual-duct mixing boxes.
• Refrigeration. . , ... ,	Two (2) 400 Hz, powered centrifugal, packaged refrigeration plants.
• Firemain end Auxiliary Seawater . .	Open loop, horizontal system capable of 1600 gpm (0.10 m^3/s) at 125 psi (861.84 kPa).
• Scupper and Deck Drains . . . , .	Standard gravity drainage system utilizing glass reinforced plastic (GPR) piping.
• Plumbing Drains (Soil and Waste)	Vacuum assisted collection discharged overboard or to holding tank.
. Main Drain	Combines pumps and eductars for main machinery space dewatering and bilge water removal.
• Secondary Drain. . . . . ,	Seawater actuated eductora for miscellaneous drainage of spaces not served by main drain system.
• Potable and Brash Water. . , . . .	Standard shipboard system operated to minimize storage with GRP piping used extensively.
• Cooling Water and Auxiliary Fresh Water Cooling.	Two (2) systems (Freon and sea water cooled) are provided. Closed loop design meeting Navy standards
• Fuel Oil	Provides for filling, storage transfer and purification of JP-5 fuel for ship use.
• [illegible] Fuel.	Two (2) JP-5 fuel service tanks. filled from ships storage through filter coalescerr for helicopter service.
• Compressed Air . . . . ,	Low pressure sir from engine bleed and hieh pressure air from 3,000 psig (20.68 mPa) compressor are provided.
• Nitrogen	Charging system is capable of supplying 70 to 3.000 psig (0.48 to 20.68 MPa) of oil free nitrogen.
• Fire Extinguishing.	Consists of high capacity AFFF, fixed flooding halon and high expansion foam.
• Hydraulic	Closed 3,000 psig (20.68 MPa) system capable of delivering 274 gpm (0.017 m^3/s).

Table 2.1-1 (C) (Cont'd)

• **Auxiliaries (Cont'd.)**

. Replenishment at Sea (RAS)	VERTREP area, port/starboard alongside RAS for fuel, potable water stations, and vertical flow conveyor are provided.
. Anchoring	Utilizes a 3,000 Lb. (13.34 kN) Danforth anchor and associated cable winch.
. Mooring and Towing.	Comprised of three (3) capstans, as well as bits, chocks, and towing padeyes.
• Boat Handling and Stowage	Six (6) 25-man life rafts and an outboard motor driven, inflatable rescue craft with handling davit.

WEIGHTS:	LM 2500		FT-9	
• Full Load Displacement (FLD) (LT: kN)	3,000.0	(29,892.10)	3.000.0	(29,892.10)
• Empty Weight (Lightship + Margins) (LT: kN)	1,661.2	(16,552.40)	1,699.3	(16,931.60)
• Fuel Weight (Capacity) (LT; kN)	1,838.9	(18,323.80)	1,838.9	(18,323.80)
• Usable Fuel at FLD (LT; kN)	1,179.9	(11,756.50)	1,141.6	(11,374.90)
• Unusable Fuel(1) at FLD (LT; kN)	64.6	(643.68)	64.6	(643.68)
• Other Load (LT;kN)	91.8	(914.70)	91.8	(914.70)
. Fuel Volume (Capacity) (Ft^3; m^3)	80,985.00	(2,293.2)	80,985.0	(2,293.00)

MOBILITY/PERFORMANCE SUMMARY:	LM 2500		FT-9	
. Cushion Pressure (psf, kPa)	342.0	(16.38)	342.0	(16.38)
• Maximum Speed in Calm Water (kts; km/hr) at MCP and MOD-50	66.0	(122.0)	92.0	(170.0)
• Maximum Speed at 3.94 Ft. (1.20 m) Significant Wave Height and MOD-50 (knots; km/hr)	64.0	(119.0)	85.0	(157.0)
• Hump Margin at 3.94 Ft. (1.20 m) Significant Wave Height, MOD-50 and MIP (%)	28%	(28%)	72%	(72%)
• Best Range Speed, Calm Water (Kts; kM/Hr)	66.0	(122.01	90.0	(148.0)
• Best Range Speed at 3.94 (1.20 m) Significant Wave Height (Kts; km/Hr)	64.0	(119.0)	76.0	(141.0)
. Time to Accelerate to Cruise Speed in Calm Water (Sec)	330,0	(330.0)	120.0	(120.0)
• Time to Accelerate to Max Speed in Calm Water (Sac) (2)	330.0	(330.0)	260.0	(260.0)
• Time to Decelerate from Max Speed to 0 in Calm Water (Sac)	32.0	(32.0)	31.0	(31.0)
• Stopping Distance (Ft; km)	1,400.0	(0.43)	1.920.0	(0.59)
• Turn Radius at 40 Knots (20.58 m/s) speed (Ft: km)	4.009.0	(1.22)	3,200.0	(0.98)
• Range (nm; [illegible])	2,950.0	(5,472.0)	3.000.0	(5,565.0)
• Endurance (Hours)	42.0	(42.0)	39.0	(39.0)

(1) Per ANVCE Specification (2% deep tank, 5% flat tank.)

(2) MIP applied in last minute of acceleration to avoid an asymptotic approach to maximum speed.

Table 2.1-1 (C) (Cont'd)

COMBAT SYSTEM:	Qty	System
. Armament	1	MK92/3 FCS
	1	STIR (Space and Weight)
	1	Harpoon FCS
		Torpedo Fire Control Panel MK309
	1	UWFCS (MK48 Torpedo) (Space and Weight)
	8	Vertical Missile Launchers
	8	Standard Missile (RIM-66B Mod, No Reloads)
	8	Harpoon Launchers
	8	Harpoon Missile (RGM-84-1, No Reloads)
	2	Torpedo Tube MK25/1 (Space and Weight)
	2	MK48 Torpedo (Space and Weight)
	2	Torpedo Tube MK32/5
	6	MK46/1 Torpedo (No Reloads)
	2	Close-In Weapons System MK16/0 (Space & Weight)
. Underwater, Surface and Air Surveillance and EW	1	Air Search Radar AN/APS-125
		Surface Search Radar AN/SPS-55
	1	DPEWS AN/SLQ-31(V-2) or AN/SLQ-32(V-2)
		TACTASS AN/SQR-19
	1	Localization Sonar AN/AQS-13D
	1	CHF Telem Receiving Set AN/SKR-3A
	1	Sonar Receiving Set AN/UQR-1 (Mod)
	80	DIFAR Sonobuoy AN/SSQ-53
	80	DICASS Sonobuoy AN/SSQ-62
. Identification and Classification (IFF)	2	Interrogation Set AN/UPX-25(U)
	1	Transponder Set AN/UPX-28(U)
. Command and Control	1	computer AN/UYK-7 (V) (3)
		Display Croup AN/UYA-4 (V) (4)
	1	Link TT
• Secondary Sub-Vehicles		
. Sub-Vehicles	2	Helicopters SH-3H or 1 XV-8B VSTOL
	10	Mini-RPV (Space)
. Sub-Vehicle Armament	34	Torpedoes MK46/1

(3) Growth for an additional AN/UYK-7(V) Computer.

(4) Includes three (3) OJ-194(V)3 PPI Consoles with growth for two (2) additional consoles.

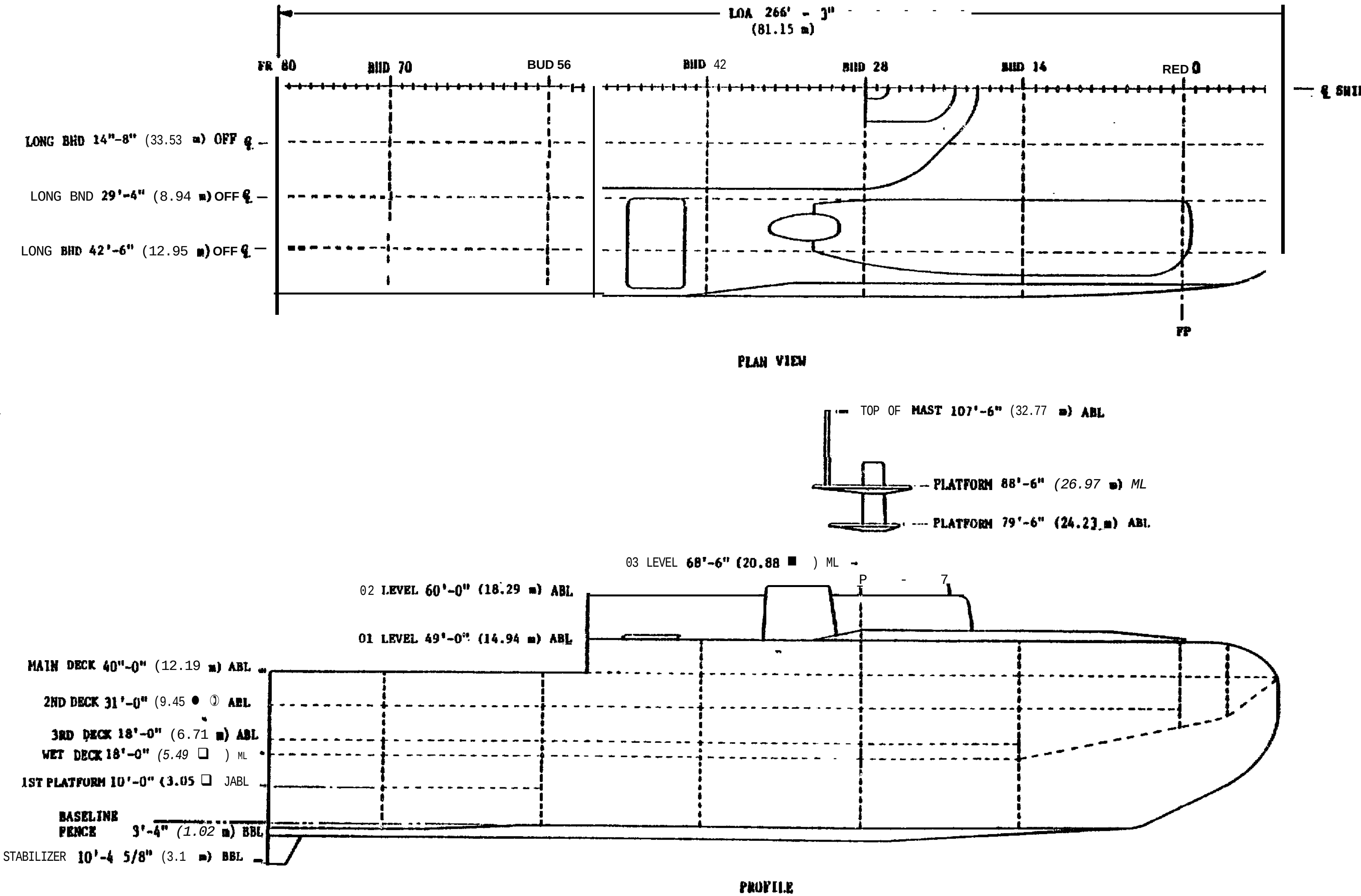


Figure 2.1-2 (U): Near Term Point Design SES Configuration (U)

UNCLASSIFIED

(U) 2.1.2 GENERAL ARRANGEMENT DRAWINGS -- The general arrangement drawings of the ship are contained in Appendix B. Topside combat system locations are shown on the drawings. The drawings are:

- Outboard Profile
- Inboard Profile
- 01 Level and Above
- Main Deck
- Second Deck
- Third Deck
- Wet Deck
- Transverse Section
- Sldehull Inboard Profile
- Bow and Stern Views
- Tank Arrangements and Tank Capacities

(U) The drawings are grouped in Appenxlx B, Section B.l, for consistency of report format and the benefit of the reader. These drawings are completely up to date and definitive in those cases where minor discrepancies may be found in supporting drawings used elsewhere in this report.

(U) 2.1.3 COMBAT SYSTEM DRAWINGS -- Weapons and sensor coverage on the near term SES are shown on drawings contained in Appendix B, Section B.2. The drawings illustrate coverage for:

- Air Surveillance Radar (AN/APS-125)
- Surface Search Radar (AN/SPS-55)
- Collision Avoidance Radar
- MK92 Fire Control System (CAS)
- STIR (MK54/0)
- MK16/0 Close-In-Weapon-System
- AN/SLQ-31 (V2) EW System - IR Sensor

(U) The drawings are grouped in Appendix B for consistency of report format and the benefit of the reader.

(U) 2.1.4 SHIP INTERFACES -- The near term SES is designed to functionally interface with other U. S. Navy ships, craft, shore commands and aircraft during operational deployment, and with Navy and other logistic facilities for support. The primary interface characteristics of the ship are:

- Vertical underway replenishment (VETREP) with the capability for rapid strike down.
- Underway alongside fuel and water replenishment (CONTREP)
- In-flight refuleing of helicopters (HIFR)
- Capability of being towed
- Capability of receiving support services, including power, water, fuel and replenishment stores, when secured to a shore facility.
- Capability for precision anchoring in depths not exceeding 40 fathoms (73.15 m)
- Mooring system to provide means for mooring alongside a pier or ship.
- Provide fuel and oil to helicopter and VTOL aircraft
- Capability of maintaining visual and radio communication with other ships, aircraft, and shore facilities

(U) 2.2 VEHICLE PERFORMANCE

(U) 2.2.1 THRIJST, DRAG, AND POWER -- The predicted drag/displacement ratios for the near.term SES, as a function of ship speed and significant wave height at FLD, are shown in Figure 2.2.1-1, Performance is shown with the ride control system off, and with the ride control system operating at a level sufficient to meet or better the Rohr ride criteria shown in Figure 2.2.1-2. Comparable data at the MOD-50 condition are shown in Figure 2.2.1-3. In addition, a plot illustrating the speed dependent character of the drag components is presented in Figure 2.2.1-4. These data are based on analytic predictions which have been validated and enhanced by correlation with model test data. While no allowance was made for marine fouling, a 1.0 mil surface finish was assumed for all hydrodynamically wetted surfaces.

(U) Figure 2.2.1-5 presents the propulsion system efficiency of the near term SES vs. speed and significant wave height. These data are based on the assumption that the propulsion power could be set at that level necessary to maintain a constant speed.

(U) The transport efficiency of the near term SES as a function of speed and significant wave height is shown in Figure 2.2.1-6. In accordance with the definitions presented in ANVCE WP-002, dated April 2, 1976, transport efficiency was defined by:

$$\frac{\text{Full Load Displacement (3000 LT; 29,892.1 kN) x Speed-(Independent Variable}}{\text{Total Power Required at Half Fuel (2400 LT; 23,913.6 kN) Condition}}$$

(U) Figure 2.2.1-7 presents the maximum speed performance vs. significant wave height for the half fuel (MOD-50) condition. These predictions are based on the ride-control-off data, Figures 2.2.1-1 and 2.2.1-5 through 2.2.1-7 and the available 'thrust plotted in Figure 2.2.1-8.

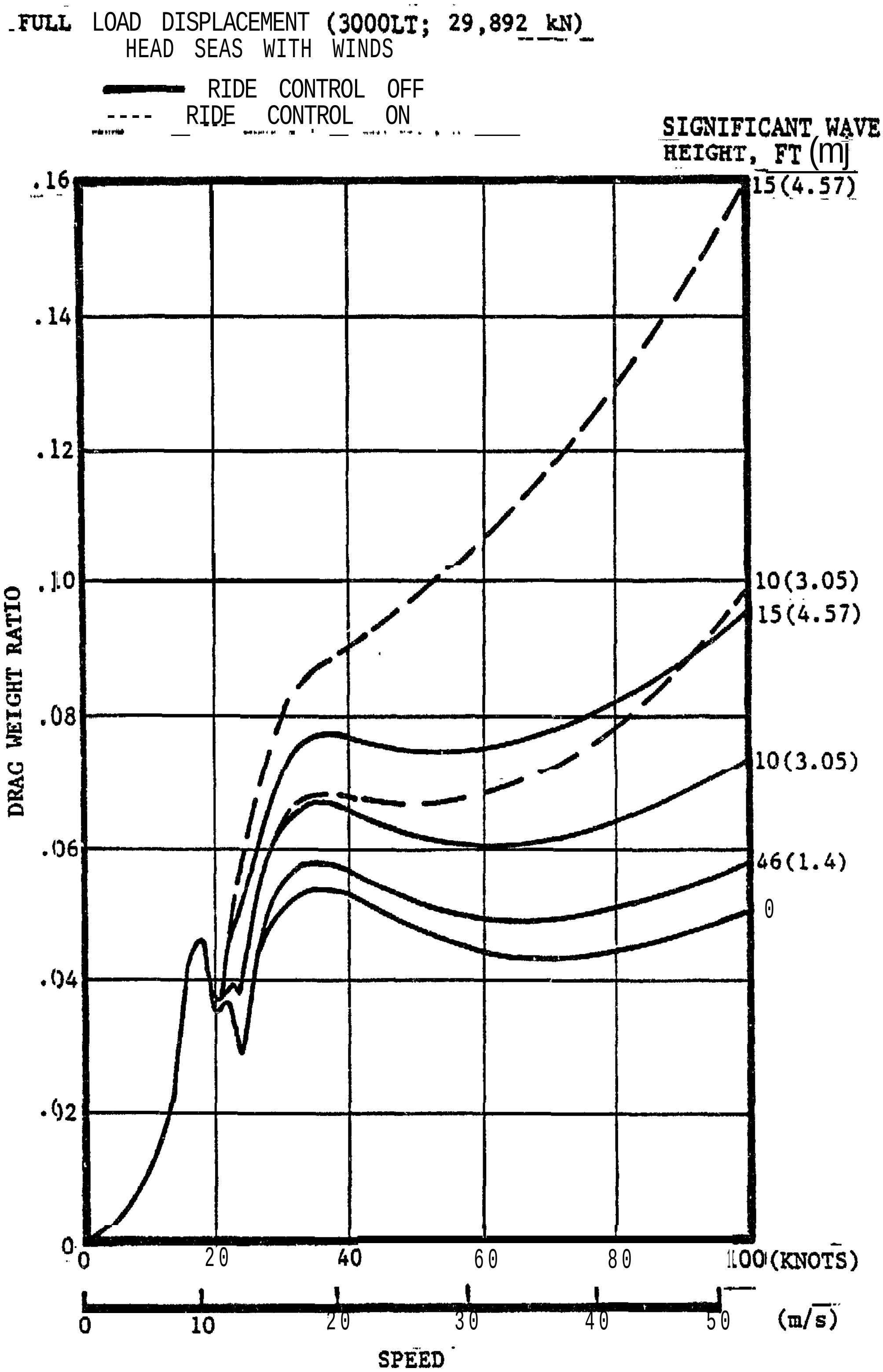


Figure 2.2.1-1 (c): Near Term SES Drag/Weight Ratio vs. Speed and Significant Wave Height (U)

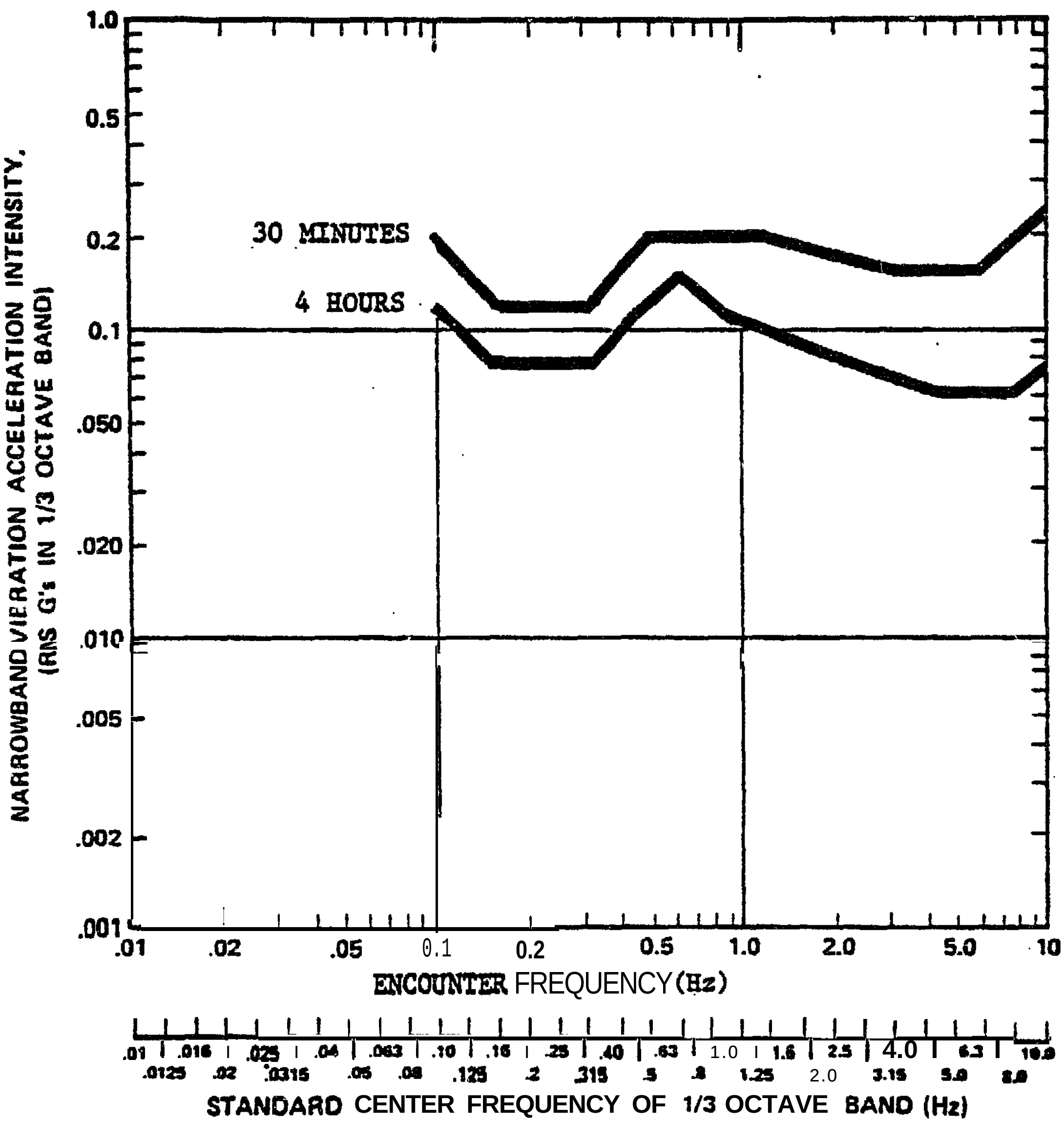


Figure 2.2.1-2 (U): Rohr SES Ride Criteria (U)

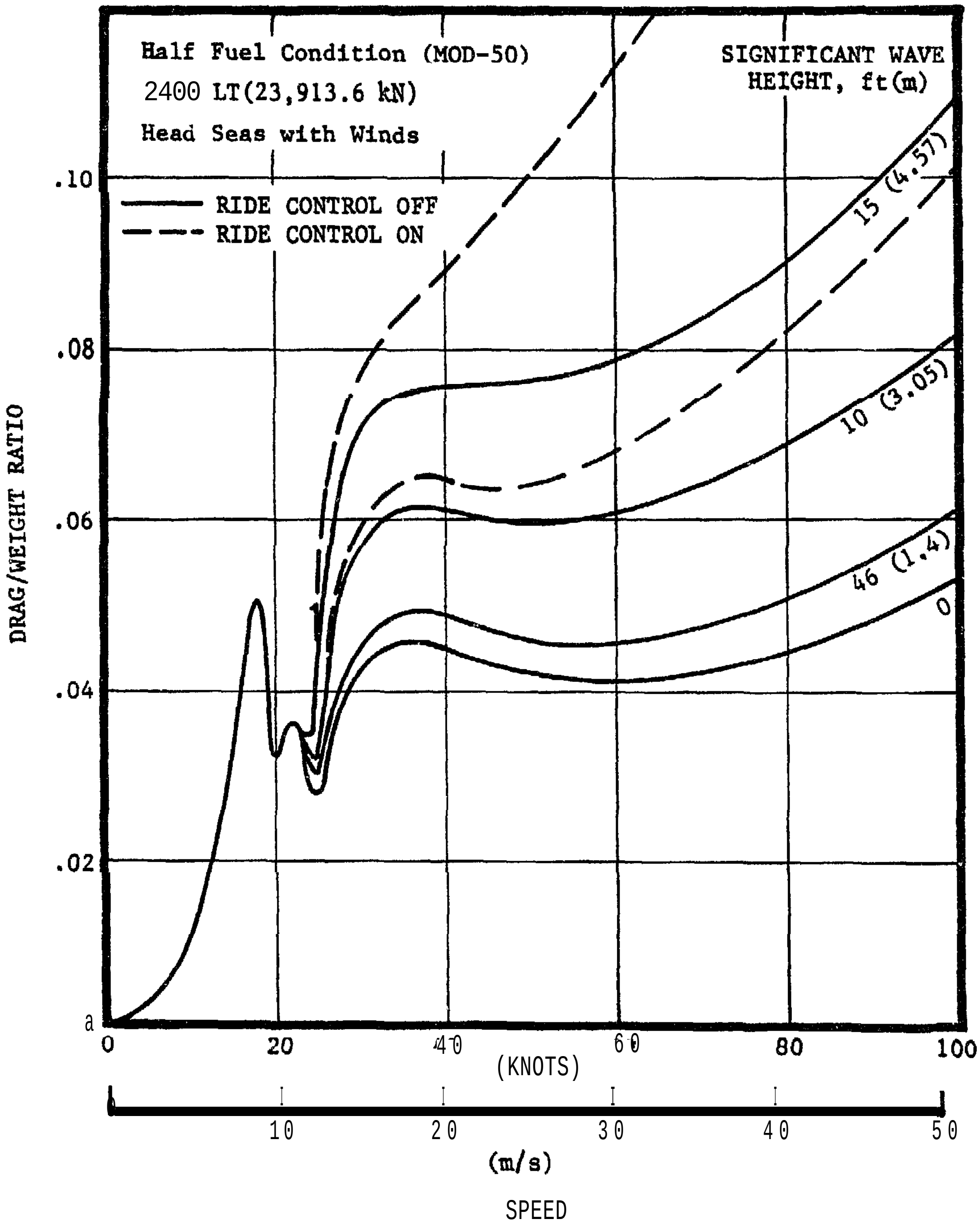


Figure 2.2.1-3 **(C): 3KSES Drag/Weight** Ratio Versus Speed and Significant Wave Height

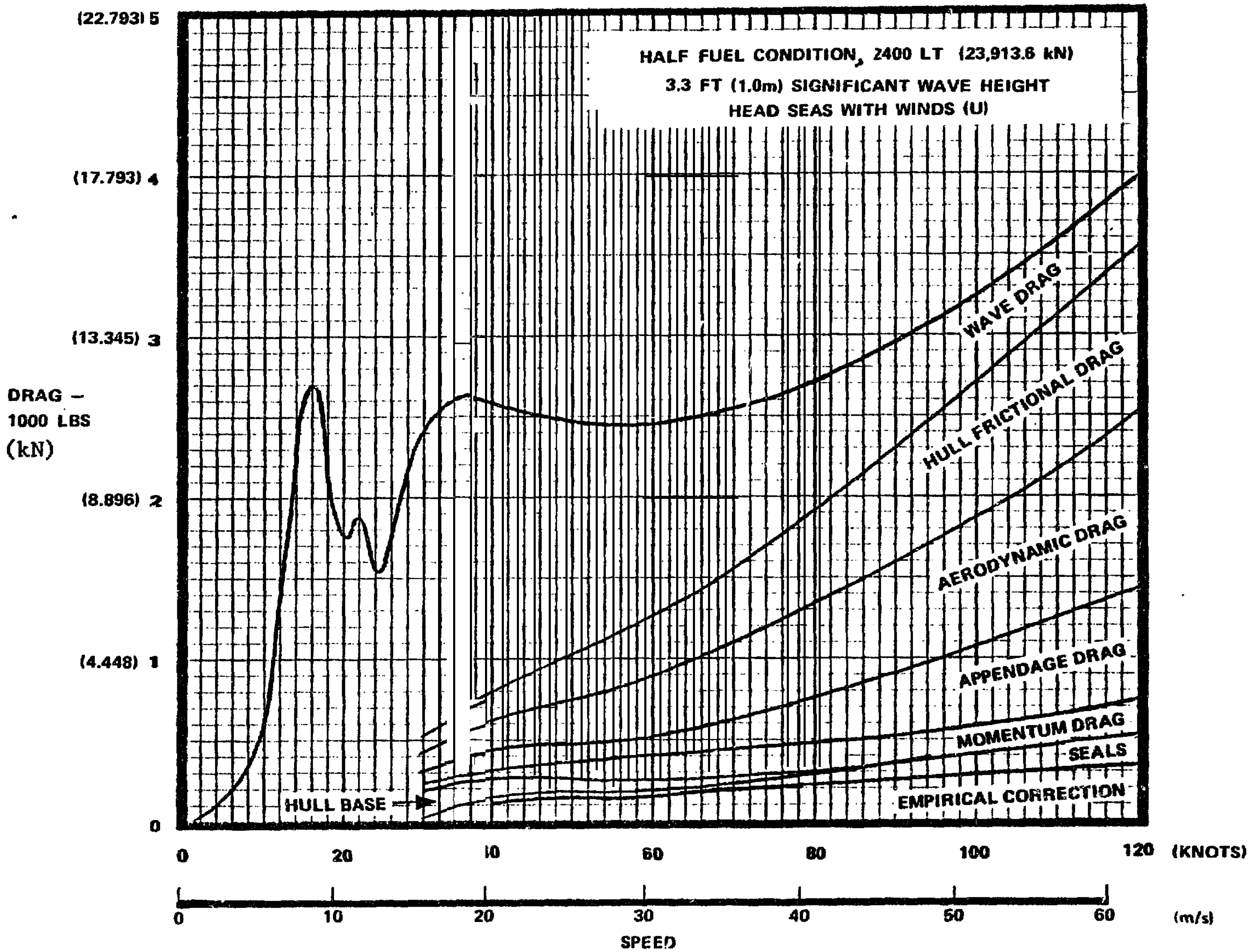


Figure 2.2.1-4 (C): Near Term SES Drag Breakdown (U)

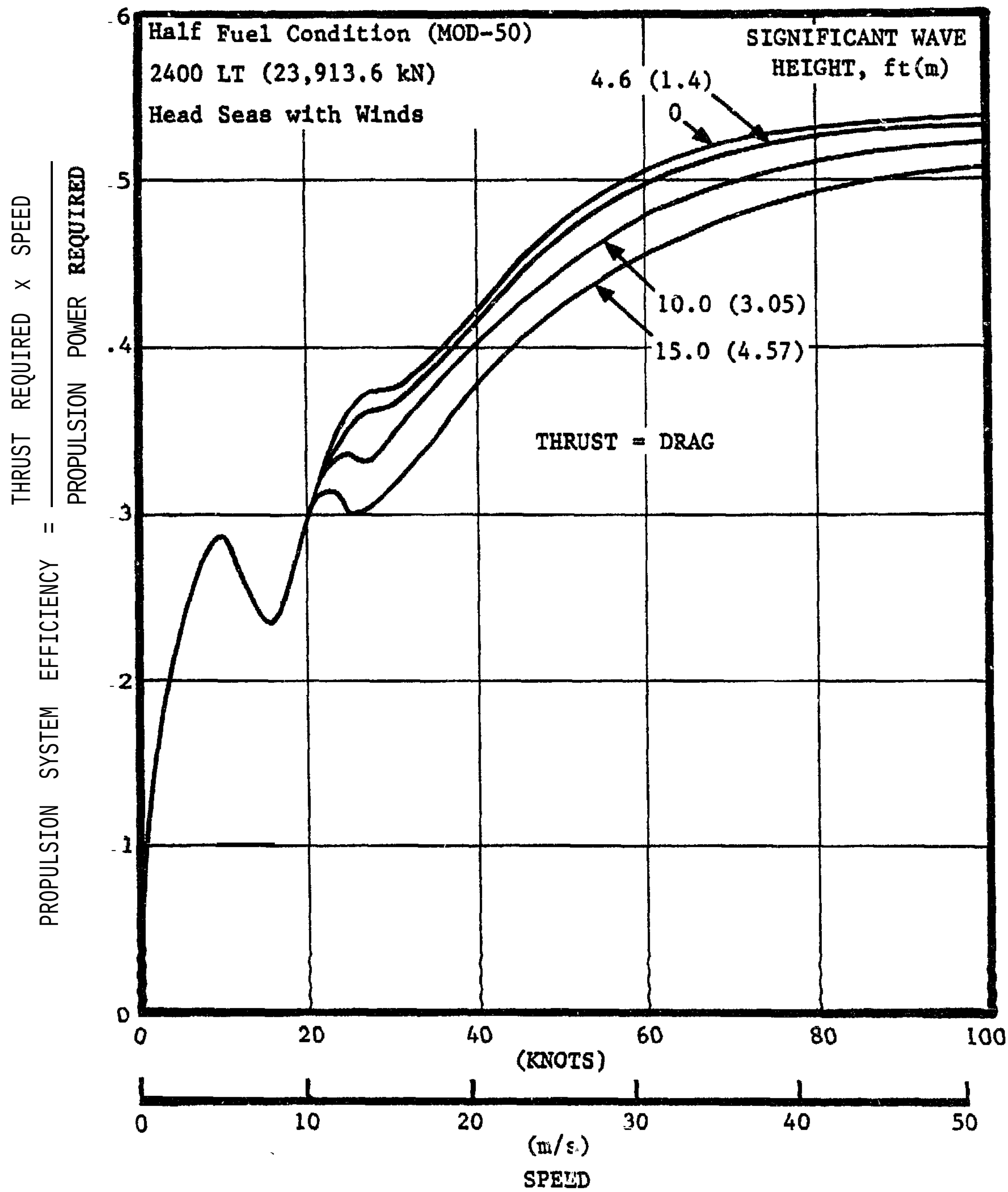


Figure 2.2.1-5 (C): Near Term SES Propulsive Efficiency Versus Speed and Significant Wave Height (U)

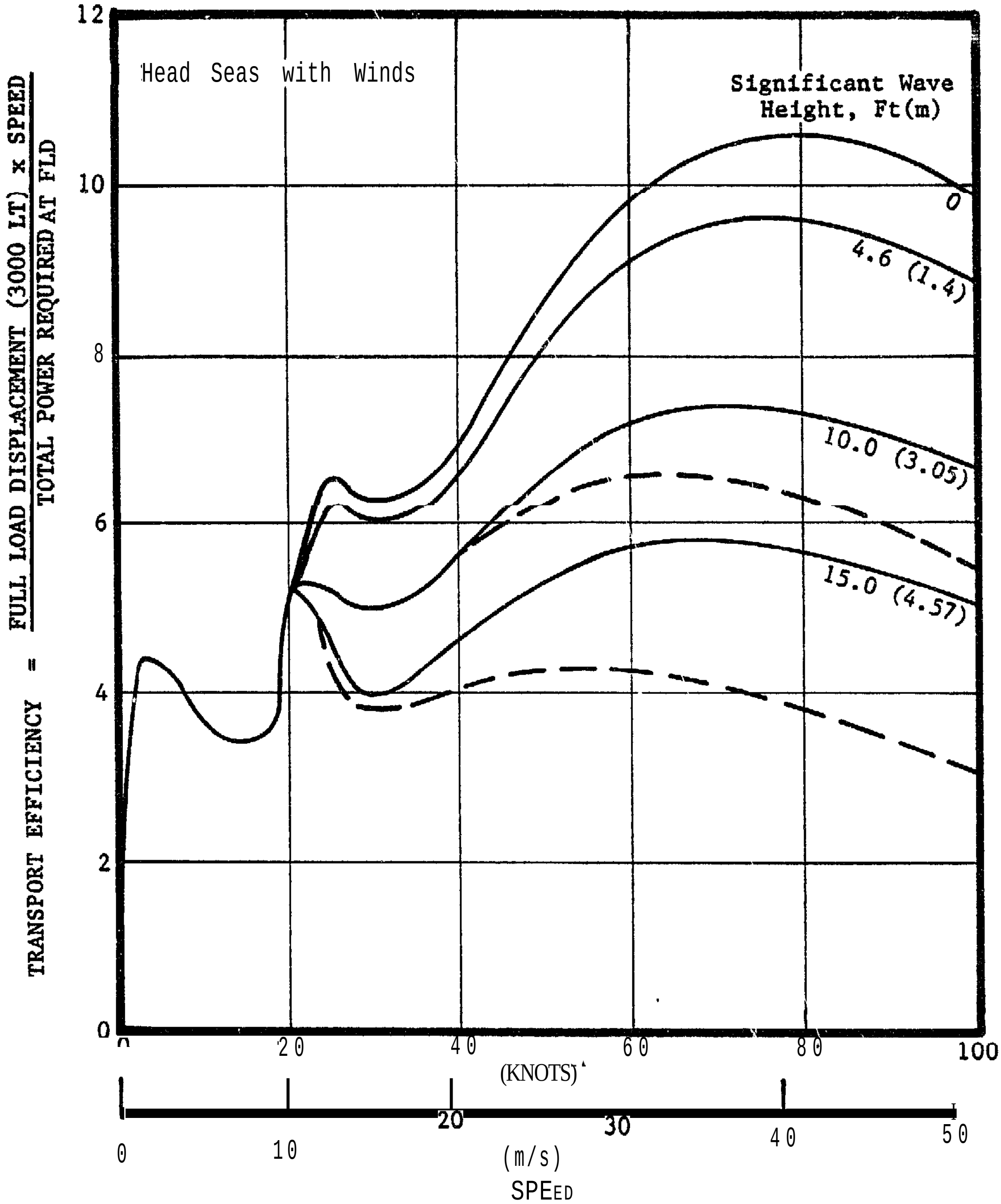


Figure 2.2.1-6 **(U):** Near Term SES Transport Efficiency Versus Speed **(U)**

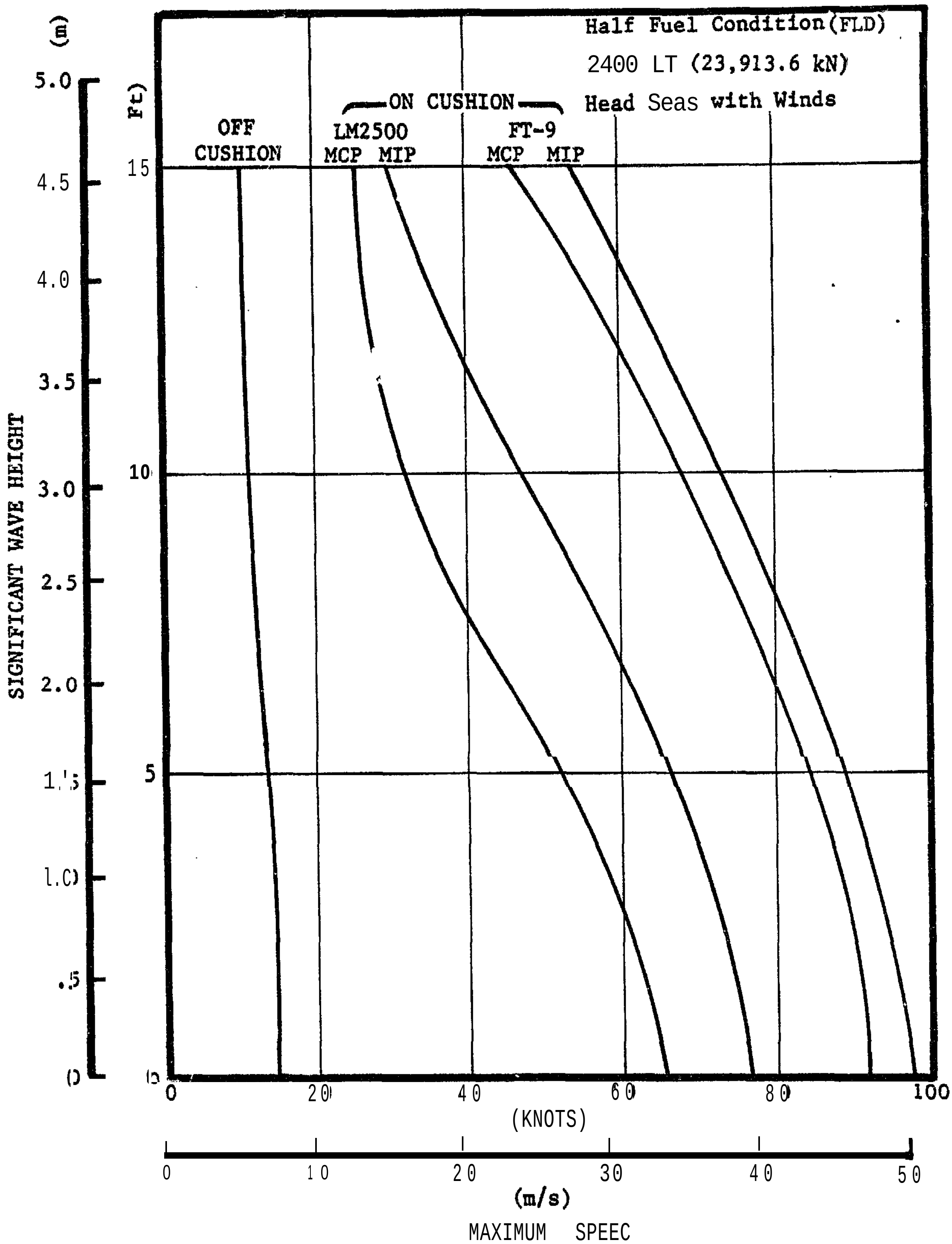


Figure 2.2.1-7 **(C):** Near Term SES Maximum Speed Versus Significant **Wave** Height **(U)**

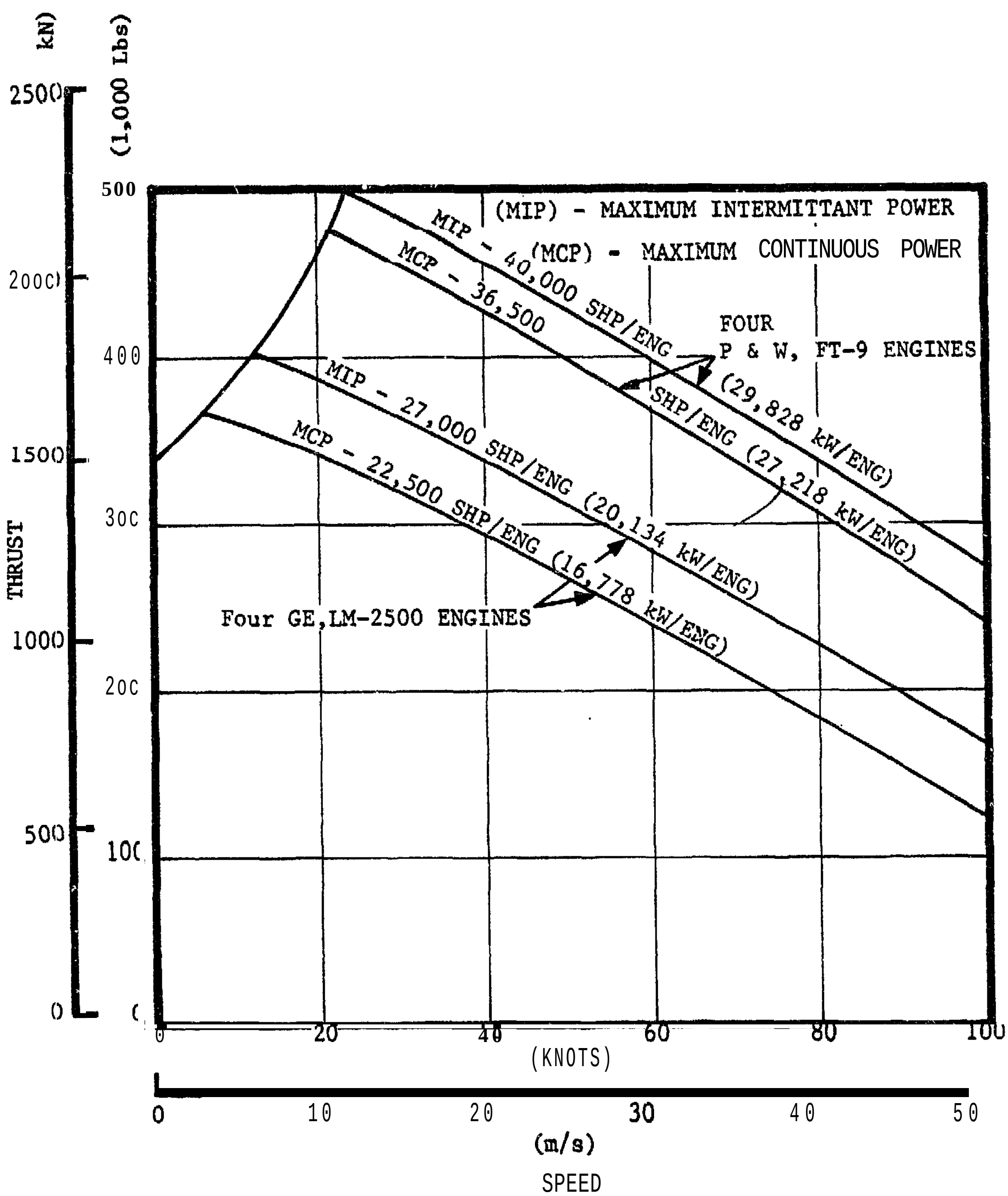


Figure 2.2.1-a (C): Near Term SES Available Thrust Versus Speed (U)

(U) 2.2.2 MANEUVERING -- The steady state on-cushion turn performance of the near term SES configured with P&W FT-9 propulsion engines, in calm water and at an 83 percent fuel condition (2800 LT; 27,899.2 kN), is shown in Figures 2.2.2-l and 2.2.2-2. After deceleration to a speed of 45 knots (23.15 m/s) for turns initiated at higher speeds, all four (4) waterjet pump nozzles are deflected an amount sufficient for the desired turn. The data shod the steady state turn performance characteristics after the initial lateral transient motions have decayed.

(U) Figures 2.2.2-3 and 2.2.2-4 present the acceleration times from a standing start as a function of speed and significant wave height for LM-2500 and FT-9 engines, respectively. These maneuvers were computed on the basis that both the lift and propulsion engines are set at MCP and that the bow seal is partly retracted through hump transition. At low speeds, however, the power levels were limited to those imposed by cavitation limits of the waterjet inlets or pumps. The use of MIP during the last minute of the acceleration maneuver avoids an asymptotic approach to the maximum speed.

(U) Figures 2.2.2-5 and 2.2.2-6 present the emergency deceleration performance as a function of speed and significant wave height for LM-2500 and FT-9 engines, respectively, as shown in Figures 2.2.2-7 and 2.2.2-8. Corresponding distances are shown in Figures 2.2.2-7 and 2.2.2-8. These maneuvers were accomplished by:

- Engaging the thrust reversers,
- Applying maximum continuous power to the outboard propulsion engines,
- Reducing the inboard engine power to "idle", and
- Retracting the stern seal by setting the stern seal fan variable geometry valves to "shut off."

(U) These procedures cause the ship to decelerate in a bow up attitude and avoid the possibility of undesirable pitch motions. Engagement of the thrust **reversers** requires 3.0 seconds. The remaining emergency stopping procedures are effected during this time interval.

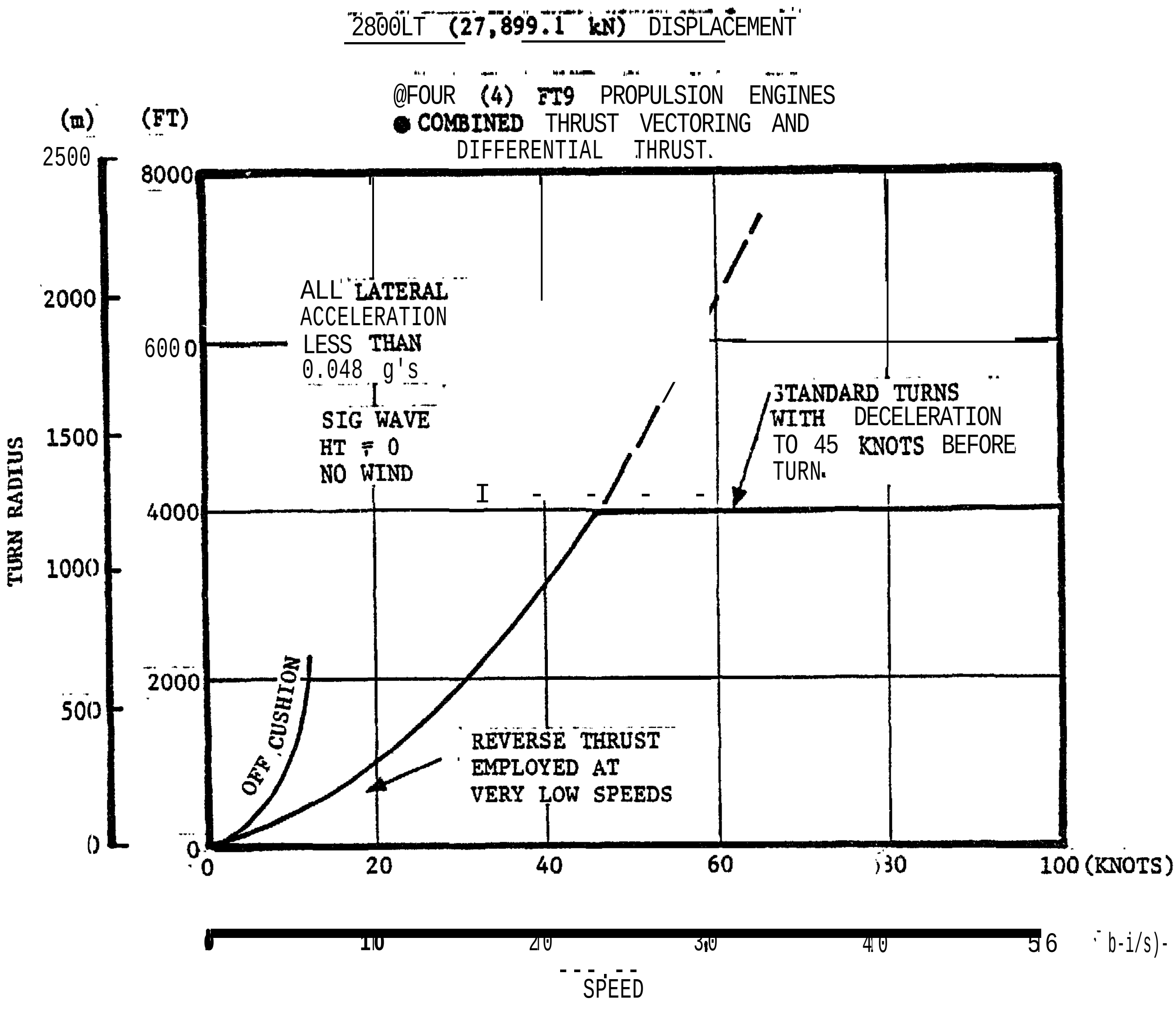


Figure 2.2.2-1 (U): Near Term SES Turn Radius Versus Speed (U)

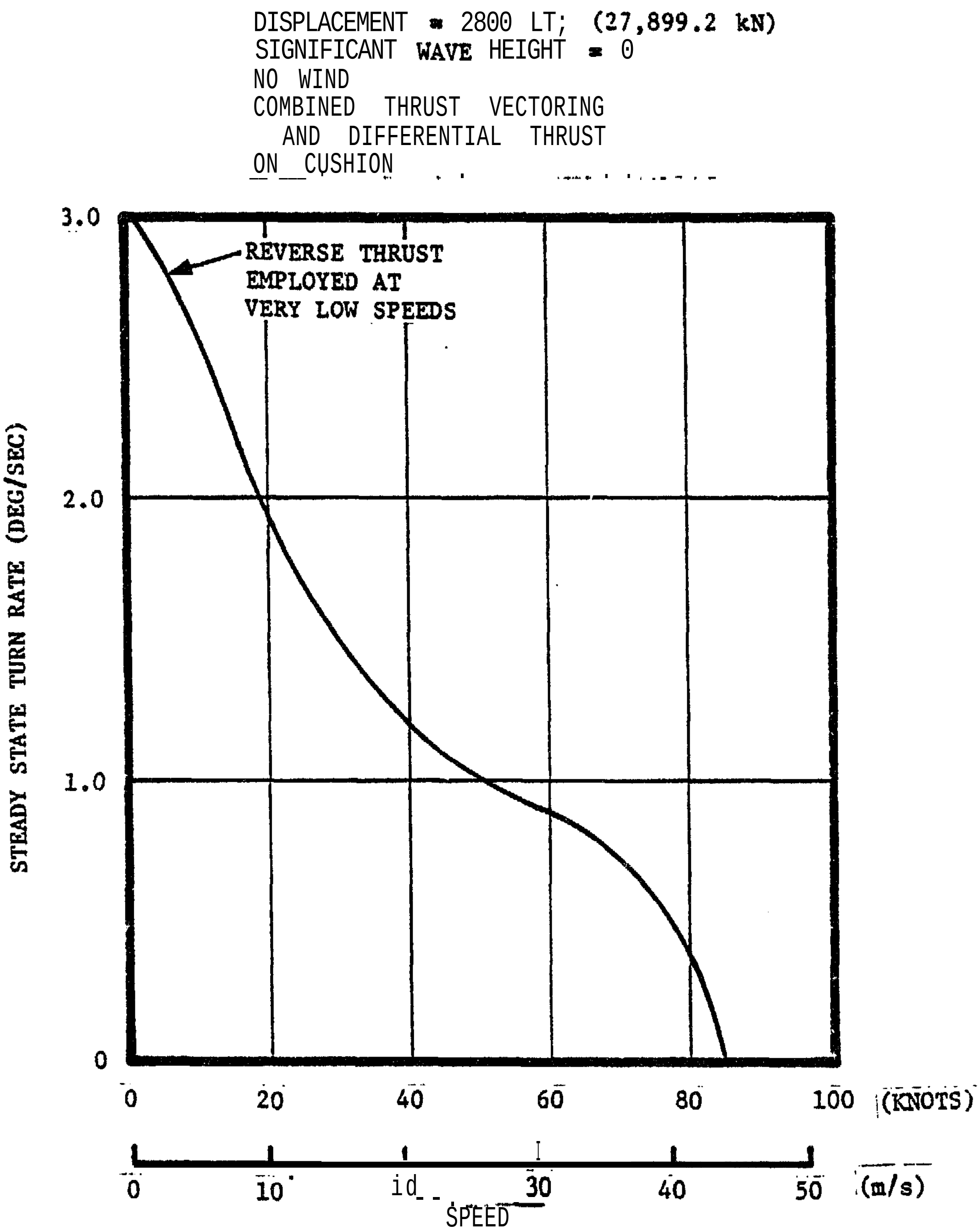


Figure 2.2.2-2 (C): Near Term Steady State Turn Rate Versus Speed (U)

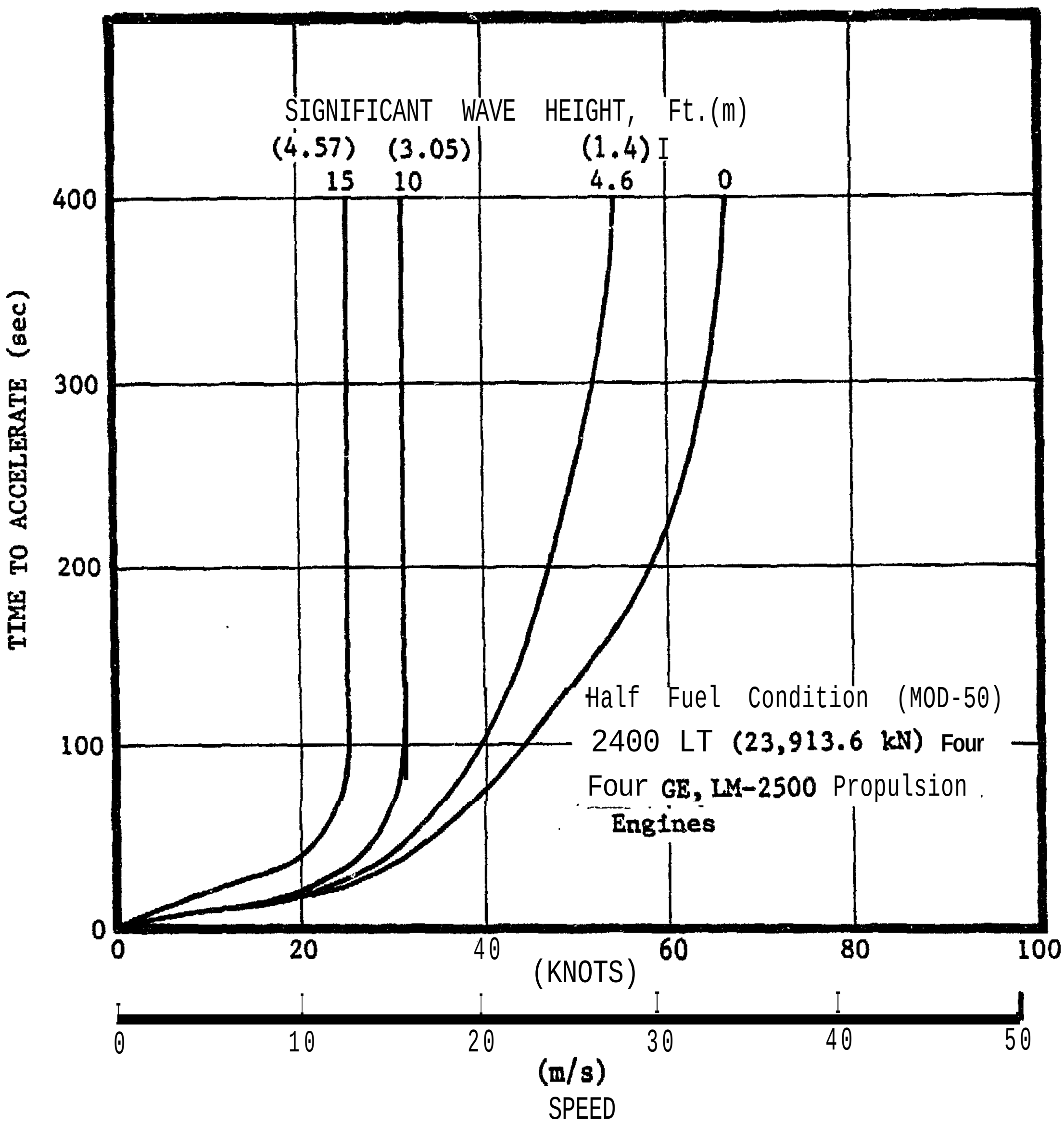


Figure 2.2.2-3 **(C):** Near Term SES Time to Accelerate Versus Speed **(U)**

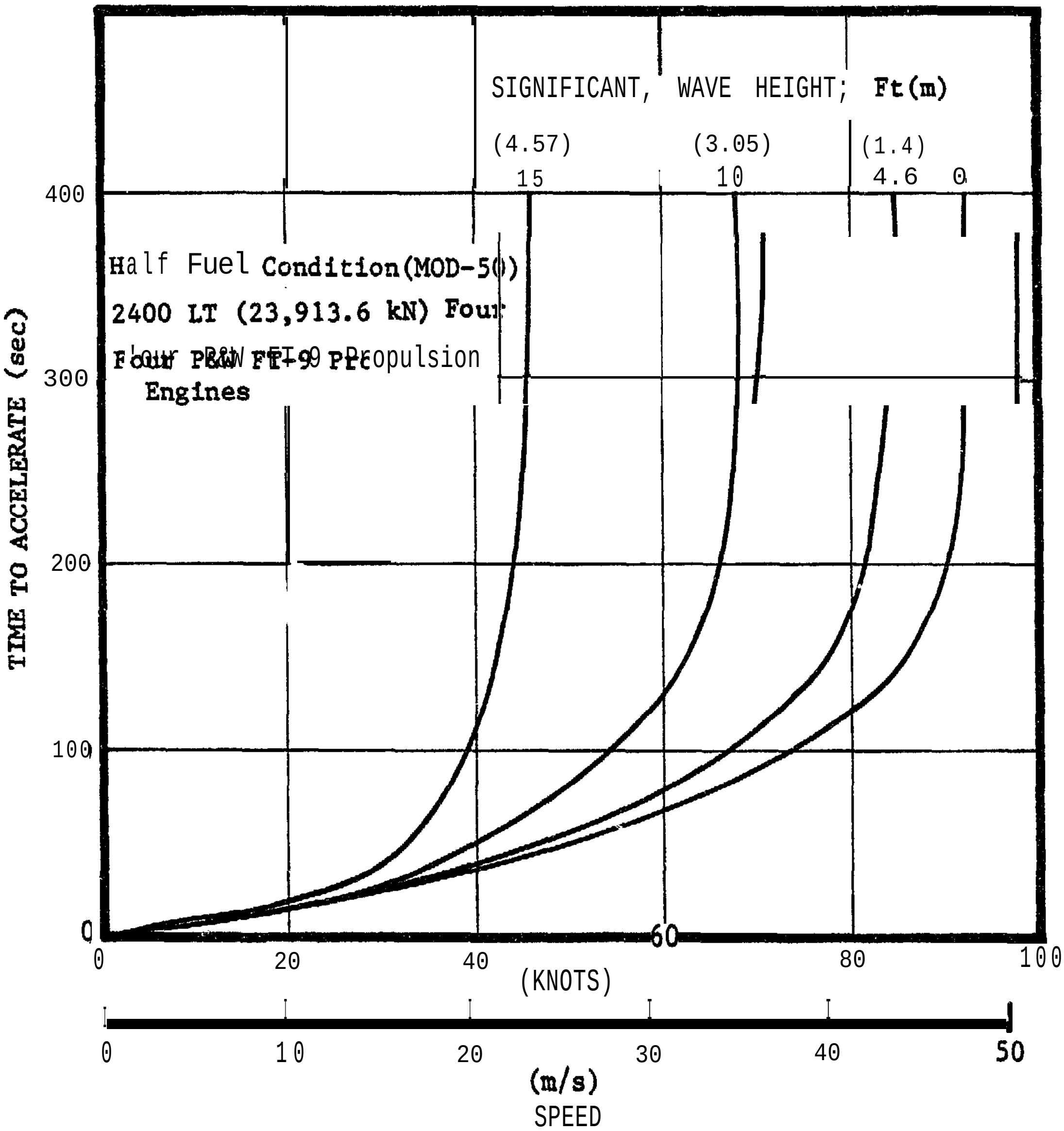


Figure 2.2.2-4 (C): Near Term SES Time to Accelerate Versus Speed (U)

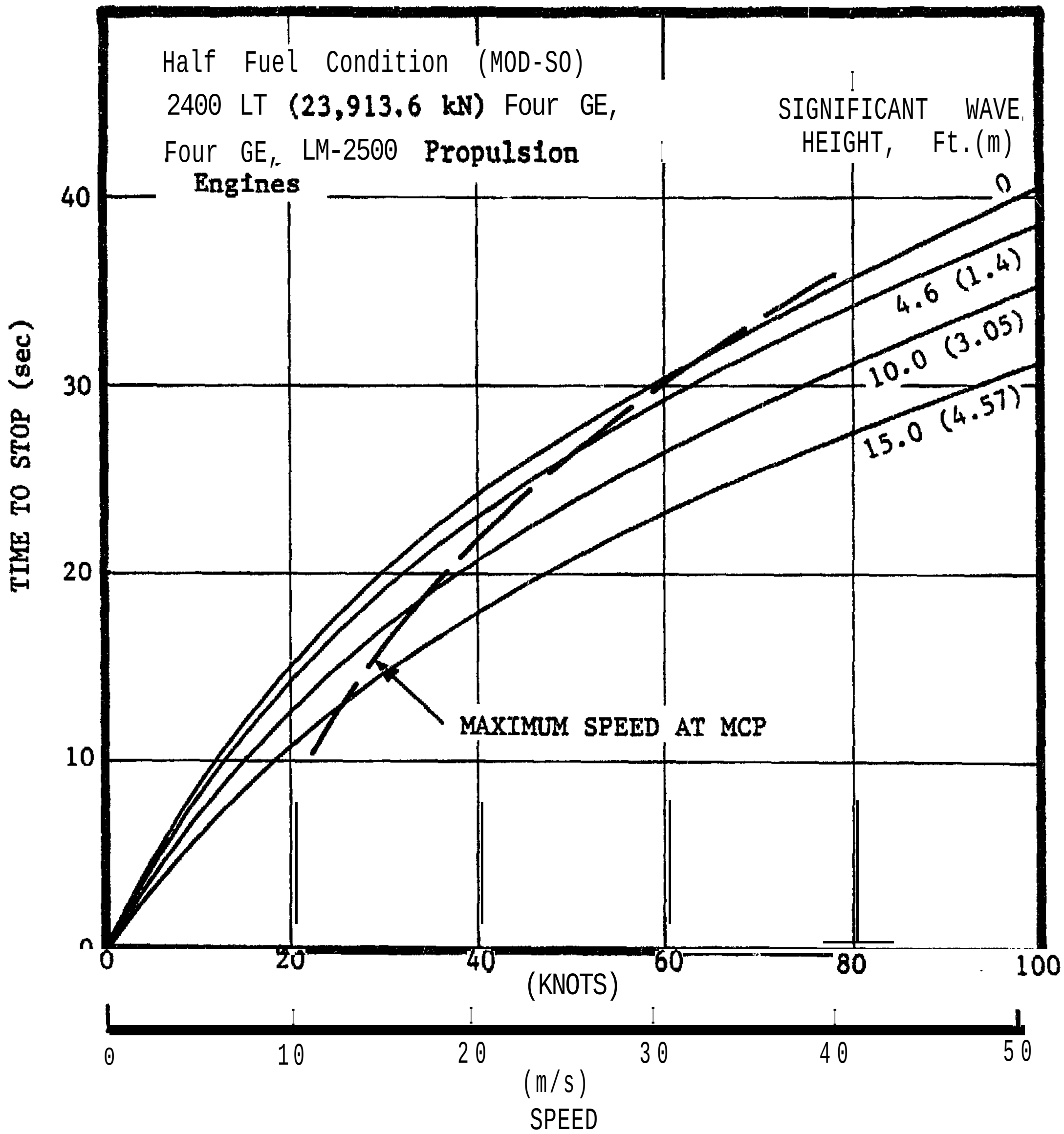


Figure 2.2.2-S **(C):** Near Term SES Time to Stop Versus Speed with LM2500 Engines **(U)**

Half Fuel Condition (MOD-50)
2400 LT **(23,913.6 kN)**
Four P&W FT-9 **Propulsion** Engines

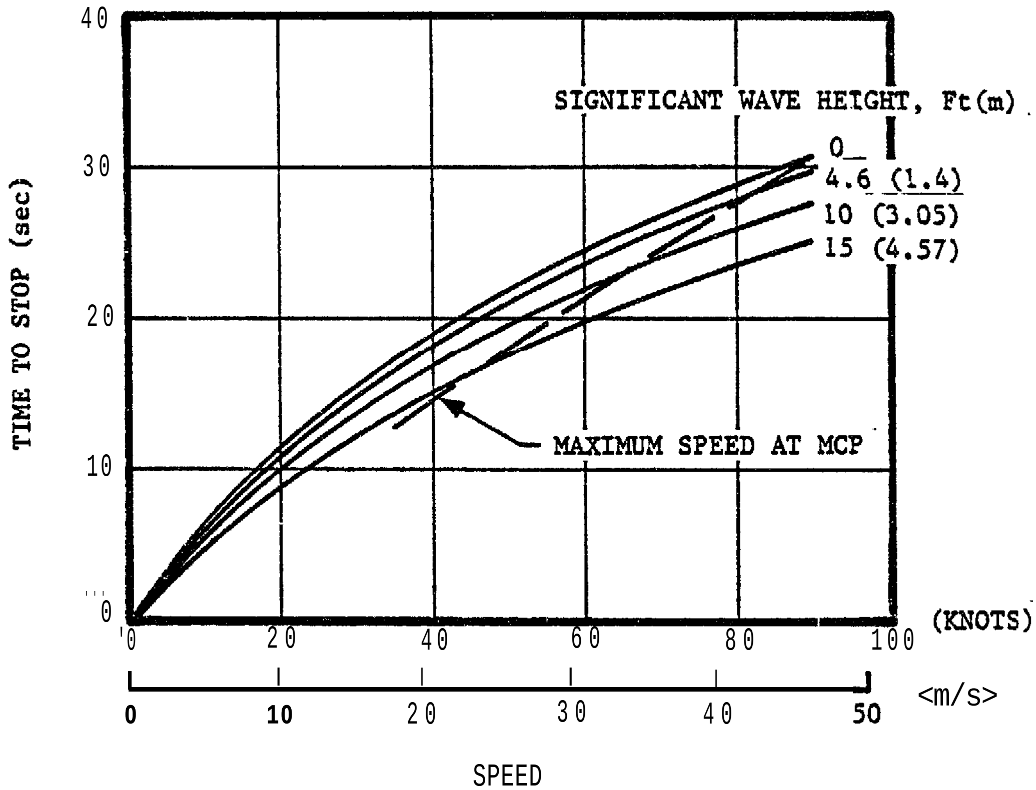


Figure 2.2.2-6 (C): Near Term SES Time to Stop Versus Speed with FT-9 Engines (U)

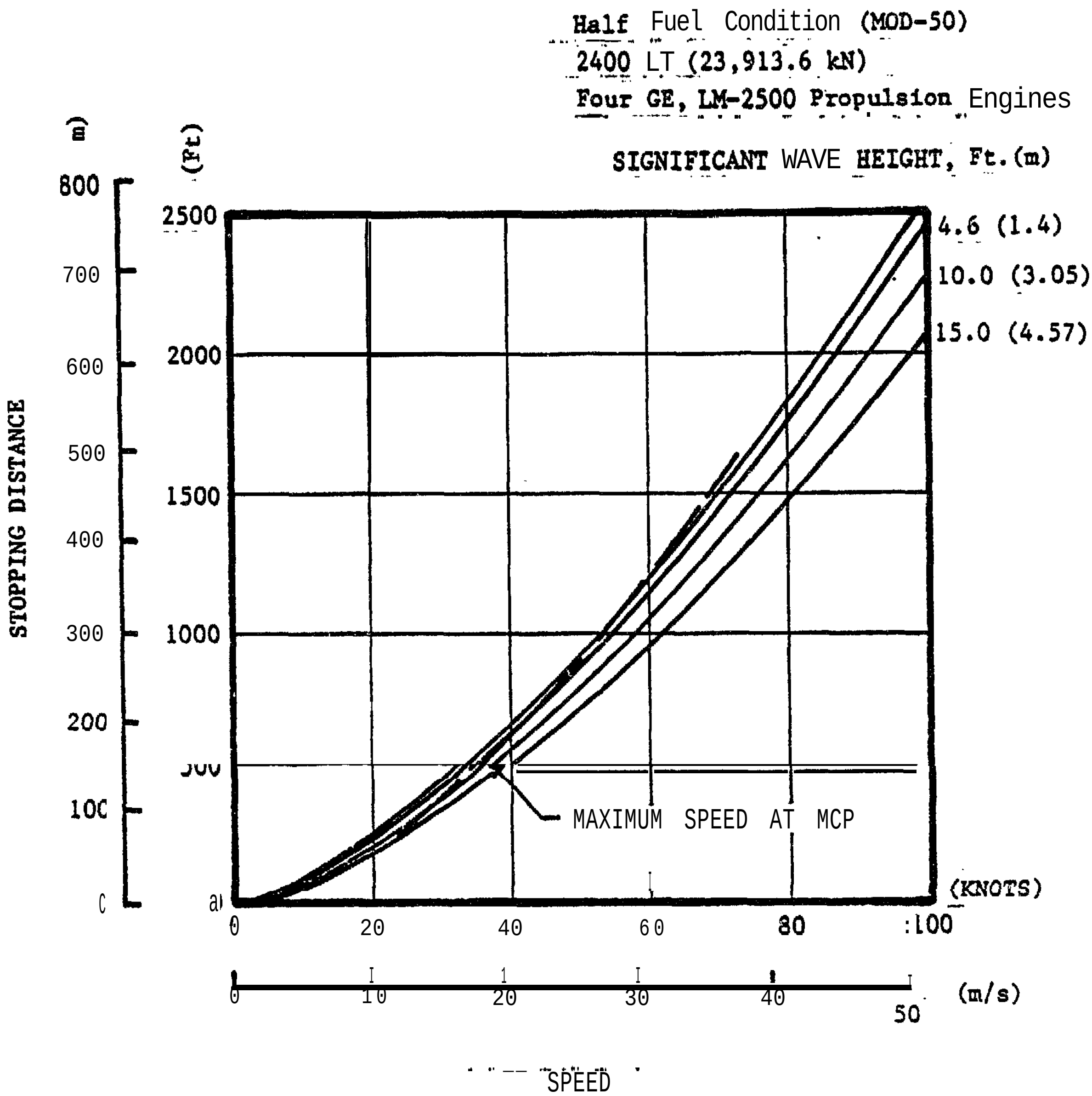


Figure 2.2.2-7 (C): Near Term SES Stopping Distance Versus Speed with LM2500 Engines (U)

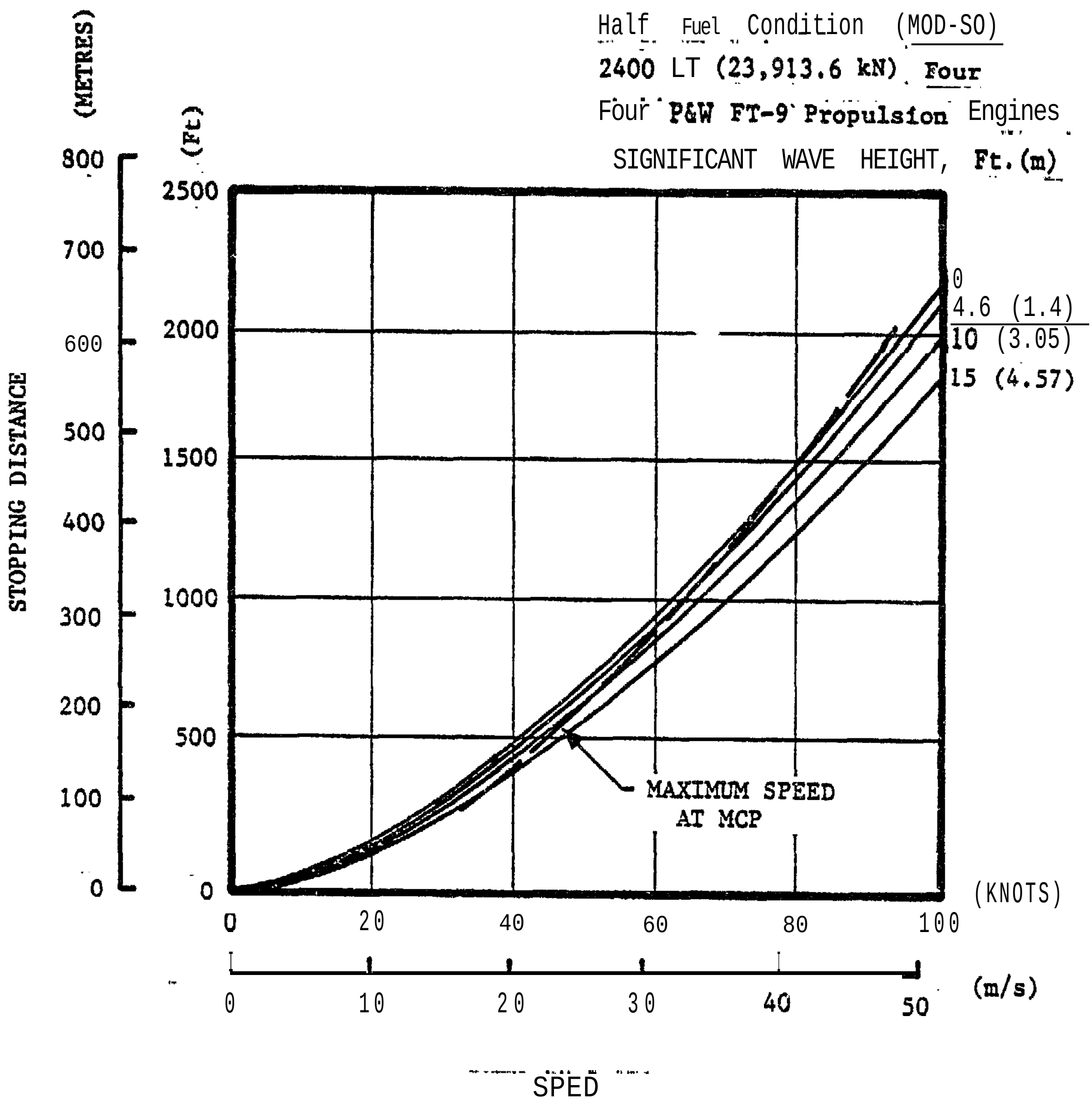


Figure 2.2.2-8 (C): Near Term SES Stopping Distance Versus Speed with FT-9 Engines (U)

(U) 2.2.3 RANGE AND PAYLOAD -- The near term ANVCE SES exceeds the required range by about 10 percent with FT-9 engines and nearly attains the goal with LM2500 engines. Range is computed by integrating speed and fuel rate over the interval from full load displacement (FLD) to the near empty weight of lightship displacement plus unusable fuel.

(U) The range and endurance characteristics are presented in Figures 2.2.3-l through 2.2.3-3, as influenced by speed, significant wave height and payload. The characteristics are shown with the ride control. system off and with the ride control system operating at a level sufficient to meet or better the ANVCE ride criteria. These data are based on the resistance data presented in Figures 2.2.1-1 and 2.2.1-3 and the propulsion system efficiencies reflected in the fuel consumption characteristics of FT-9 marine gas turbine engines presented in Figure 2.2.3-4.

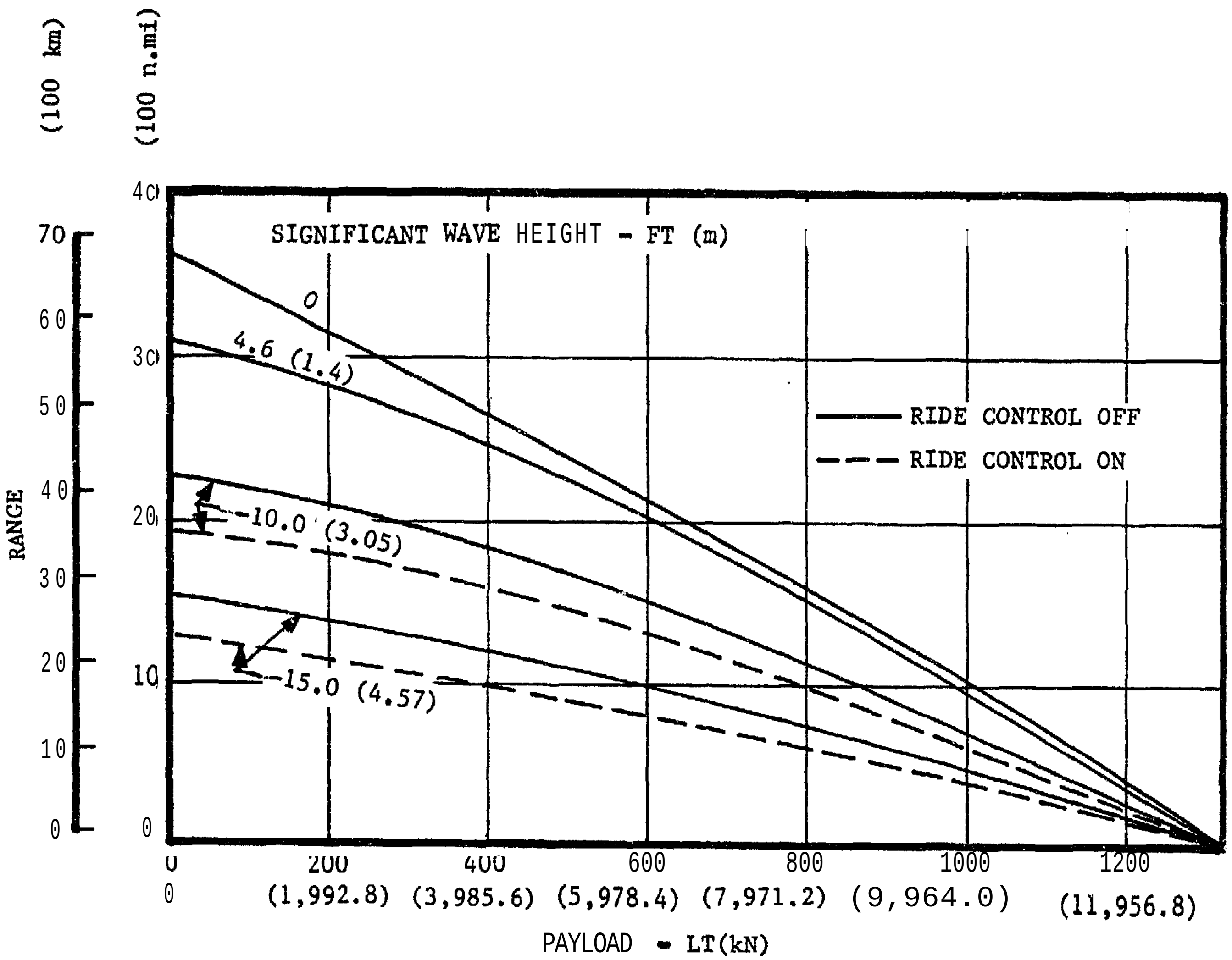


Figure 2.2.3-1(C) Range vs. Payload at Full Load Displacement for Head Seas with Winds (U)

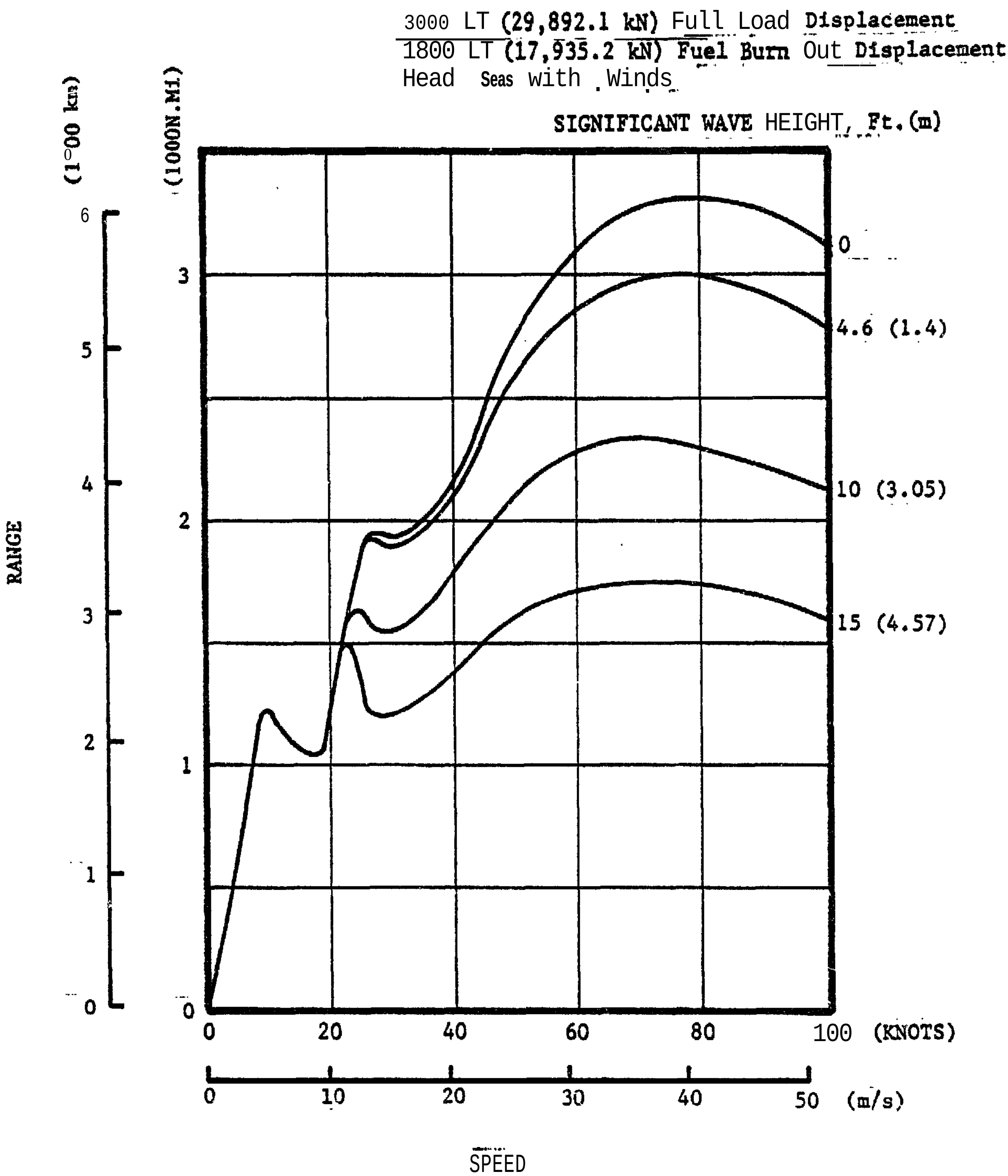


Figure 2.2.3-2 (C): 3KSES Range Versus Speed (U)

300b LT (29.892.1 kN) Full Load Displacement
1800 LT (17,935.2 kN) Fuel Burn Out Displacement
Head Seas with Winds

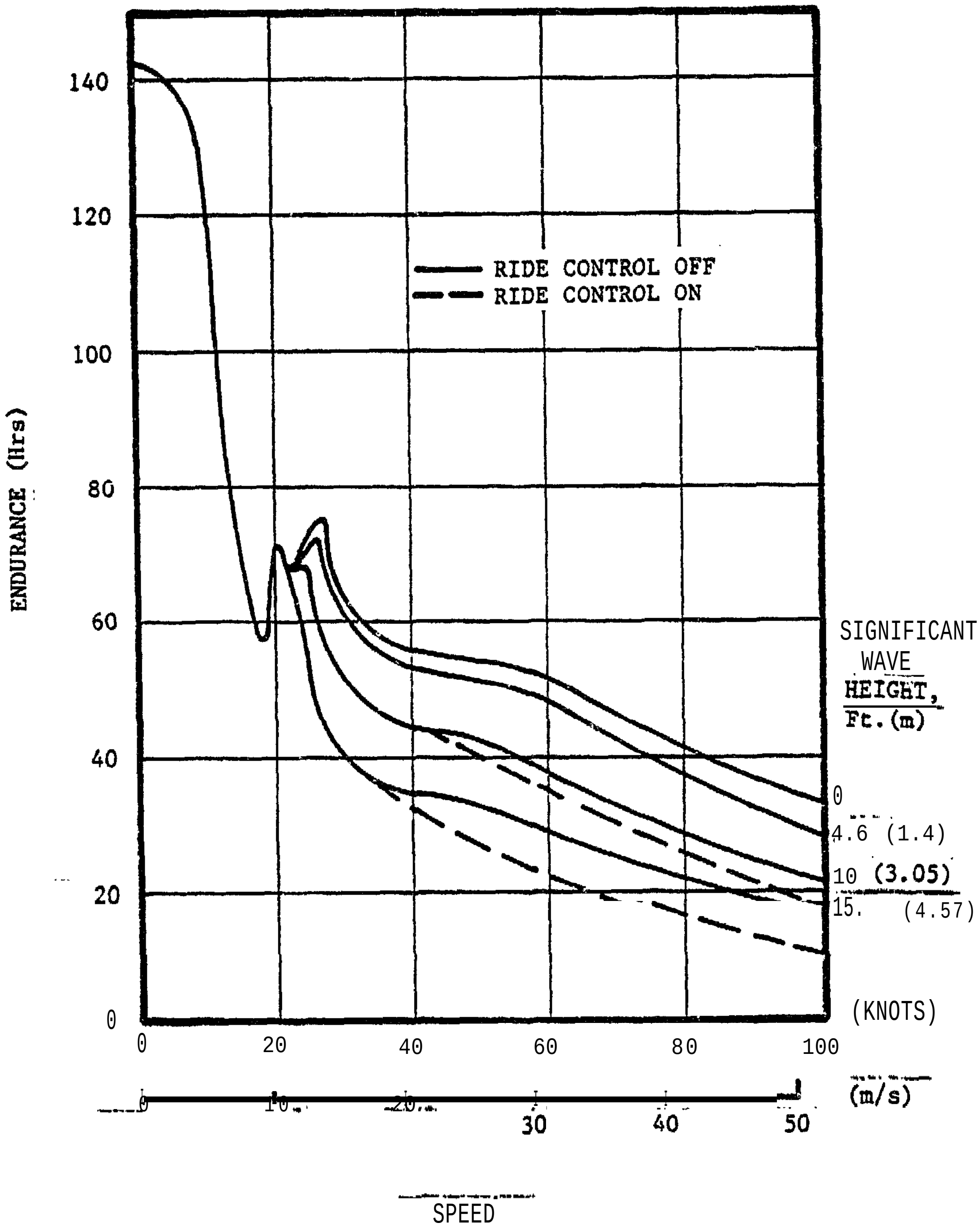


Figure 2.2.3-3 (C): 3KSES Endurance at Various Speeds and Significant Wave Heights (U)

CONFIDENTIAL

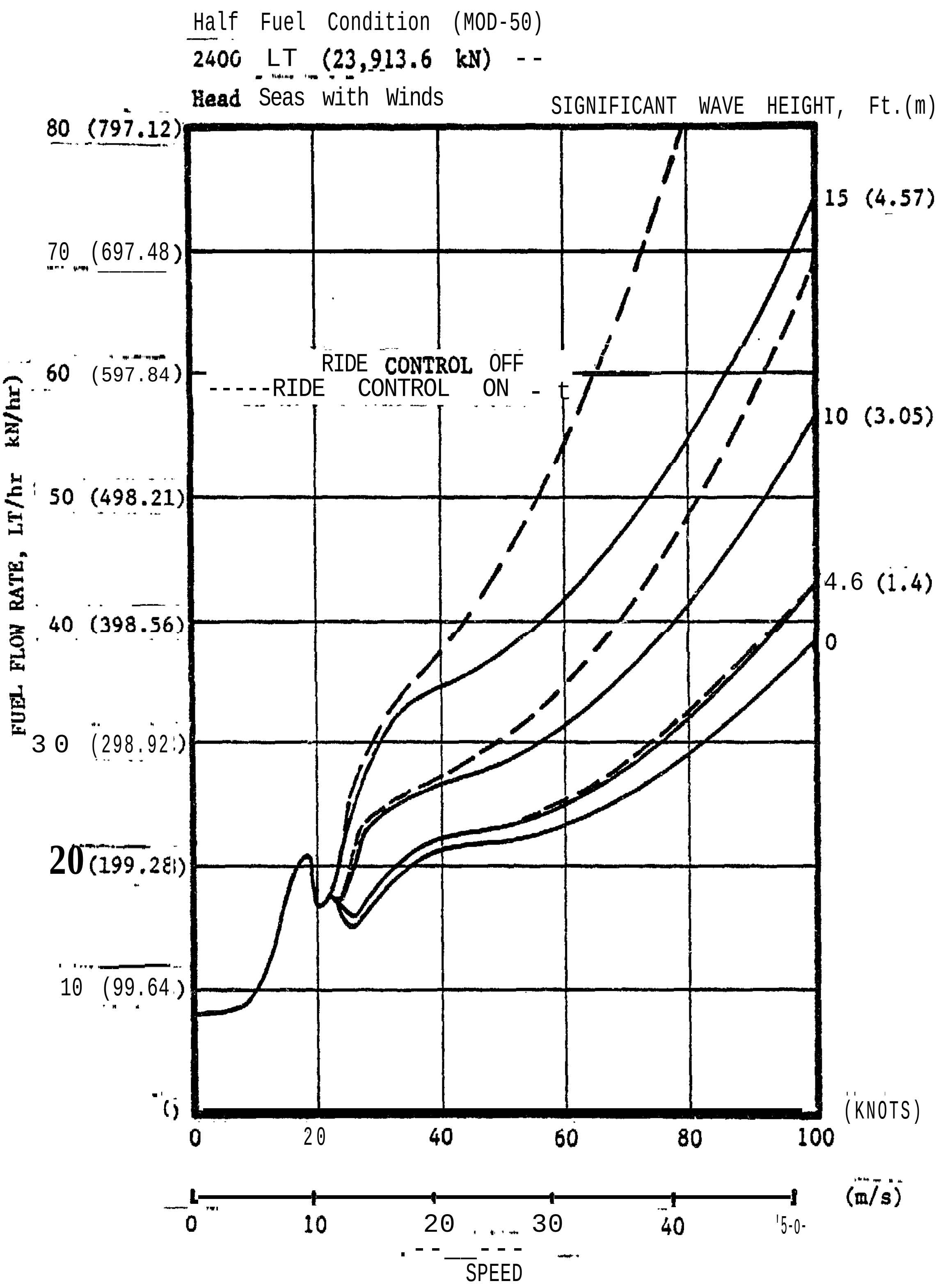


Figure 2.2.3-4 **(C):** **3KSES** Fuel Consumption Versus Speed (U)

CONFIDENTIAL

(U) 2.2.4 WEIGHT AND VOLUME SUMMARY -- A summary of the light ship weight, variable load, contract margins and full load weight of the ANVCE near term SES is presented in Table 2.2.4-l. The ANVCE near term SES ship weights are identical to those of the Rohr 3KSES. The summary represents the results of parametric studies, design iterations, and trade-off investigations performed during the ANVCE near term SES design effort.

(U) Table 2.2.4-2 is a summary of weights for a similar ship with FT-9 engines installed in place of the baselined LM 2500 engines for propulsion. The propulsion plant weight and contract margins were adjusted to reflect this substitution. The fuel weight was then reduced to arrive at a full load displacement of 3000 long tons (29,892.1 kN). The ship volume summary is presented in Table 2.2.4-3.

(U) The design light ship, the total of SWBS groups 100 through 700, is. the displacement of the ship ready for sea in every respect, but excluding all variable load items such as crew, stores, ordnance, and fuel. Operating fluids such as lube oil, hydraulic fluid, and entrained water in the inlet and propulsor are included in the design light ship. The variable load items include the 125 man crew; provisions and effects, stores and spares for a 15-day mission; ordnance; both ship and aircraft fuel; and fresh water for the ship when operating at FLD.

UNCLASSIFIED

TABLE 2.2.4-1 (U): WEIGHT SUMMARY WITH LM2500 ENGINES (U)

SWBS GROUP	WEIGHT			
	LONG TONS	SHORT TONS	METRIC TONS (1)	KILONEWTONS
100: HULL STRUCTUKE	805.0	901.6	817.9	8021.0
200: PROPULSION PLANT	190.5	213.3	193.5	1897.3
300: ELECTRICAL PLANT	61.8	69.3	62.9	616.2
400: COMMAND 6 SURVEILLANCE	67.0	75.0	68.0	667.3
500: AUXILIARY SYSTEM	196.6	220.2	199.7	1958.8
567: Lift System	96.8	108.4	98.3	964.3
600 OUTFIT AND FURNISHINGS	156.9	175.7	159.4	1563.0
700 ARMAMENT	51.4	57.6	52.3	512.6
DESIGN AND BUILDERS MARGIN	132.0	147.9	134.2	1315.6
EMPTY WEIGHT (LIGHT SHIP)	1661.2	1860.6	1687.9	3.6552.4
FOO: LOADS:				
Crews	14.7	16.5	15.0	146.7
Provisions	5.8	6.5	5.9	57.8
Stores	5.8	6.5	5.9	57.8
Fresh Water	18.6	20.8	18.9	185.2
Ordnance -- Main Vehicle	17.2	19.3	17.5	171.9
-- Sub-Vehicle	6.6	7.4	6.7	66.0
Sub-Vehicle	23.1	25.8	23.4	229.7
Fuel	1246.9	1396.6	1267.0	12424.6
FULL LOAD WEIGHT	3000.0	3360.0	3048.2	29892.1

(1) Non-SI units

UNCLASSIFIED

TABLE 2.2.4-2.(U): WEIGHT SUMMARY WITH FT-9 ENGINES (U)

SWBS GROUP	WEIGHT			
	LONG TONS	SHORT TONS	METRIC TONS (1)	KILONEWTONS
100: HULL STRUCTURE	805.0	901.6	817.9	8021.0
200 : PROPULSION	226.0	253.1	229.6	2251.7
300 : ELECTRICAL	61.8	69.2	62.8	615.6
400 : COMMAND & SURVEILLANCE	67.0	75.0	68.1	667.2
500: AUXILIARIES	196.6	220.2	199.8	1959.0
567: Lift System	96.8	108.4	98.4	964.4
600 OUTFIT AND FURNISHINGS	156.9	175.7	159.4	1563.1
700 ARMAMENT	51.5	57.7	52.3	513.3
DESIGN AND BUILDERS MARGIN	134.5	150.6	136.7	1339.8
EMPTY WEIGHT (LIGHT SHIP)	1699.3	1903.2	1726.6	16931.6
F00: LOADS:				
Crews	14.7	16.5	14.9	146.7
Provisions	5.8	6.5	5.9	57.8
Stores	5.8	6.5	5.9	57.8
Fresh Water	18.6	20.8	18.9	185.2
Ordnance -- Main Vehicle	17.2	19.3	17.5	171.9
-- Sub-Vehicle	6.6	7.4	6.7	66.0
Sub-Vehicle	23.1	25.9	23.5	229.7
Fuel	1208.6	1353.6	1228.0	12042.2
FULL LOAD WEIGHT	3000.0	3360.0	3048.1	29892.1

(1) Non-ST Units

UNCLASSIFIED

TABLE 2.2.4-3 (U): VOLUME SUMMARY (U)

FUNCTION	INTERNAL VOLUME[1]	
	CUBIC FEET	CUBIC METERS
Main Propulsion (including main machinery box, uptakes, shafting)	119,034	3,371
Lift System	109,881	3,112
Personnel (including living, messing and all personnel support and storage)	104,454	2,958
Auxiliary and Electrical (machinery spaces other than main propulsion and lift outside main machinery box)	100,962	2,859
Payload (internal volume only)	150,955	4,275
Other (including passageways, maintenance spaces and all other spaces not included in above)	147,663	4,182
TOTAL ENCLOSED VOLUME	732,949	20,758

(1) Total enclosed volume does not include tanks and other innerbottom spaces below third deck, or helo landing and any weather decks.

(U) 2.2.5 STABILITY -- The stability of the near term SES was addressed for both zero speed and underway conditions. The results show that the SES has adequate stability to meet the required operating ranges of speed, sea state and displacement.

(U) 2.2.5.1 Stability at Zero Forward Speed -- The hullborne stability at zero speed of the near term 3KSES has been evaluated in accordance with the Navy criteria of acceptability[1]. Two operating conditions that represent full,-load and minimum conditions were evaluated with:

a. A beam wind of 100 knots (185.2 km/hr), combined with rolling.

b. Topside icing

c. Crowding of personnel to one side

d. High speed turning for roll stability (per Navy criteria[1])

(U) The intact stability at the MOD-10 condition with a beam wind of 100 knots (195.32 km/hr) combined with rolling produced the critical condition but with adequate stability as shown in Figures 2.2.5-1 and 2.2.5-2.

(U) 2.2.5.1.1 Static Stability in Hullborne Intact Condition -- The static stability at zero speed was addressed by development of cross-curves of stability for a suitable range of ship displacement and for a range of heel angles from 0 through 90 degrees. The SES has a positive range of stability from 0 to 80 degrees as shown in Figure 2.2.5-3 and in Tables 2.2.5-1 and 2.2.5-2.

(U) 2.2.5.1.2 Stability in Damaged Condition -- The fundamental adequacy of the SES with respect to reserve buoyancy and stability under conditions of hull damage in an open ocean environment has been addressed for the

---

(1) "Stability and Reserve Buoyancy of U.S. Naval Surface Ships", DDS079-1, dated 1 August 1975, Department of the Navy, Naval Ship Engineering Center,

(U) full load and MOD-10 conditions per the Navy criteria and summarized for the following critical conditions:

a, Shell-to-shell flooding in compartments II and III, with the longitudinal extent of damage equivalent to 15 percent LOA. This produced the least freeboard as indicated in Figures 2.2.5-4 and 2.2.5-5. The criteria of acceptability is satisfied.

b. Unsymmetrical flooding with penetration up to the centerline and with a longitudinal extent equivalent to 15 percent LOA was investigated throughout the length of the hull. The worst case was found to be with the damage in compartment IV and V. The maximum heel in this case was 7.48 degrees. Figures 2.2.5-6 and 2.2.5-7 show this condition, Requirements of the criteria were satisfied.

c. Unsymmetrical flooding with penetration to the first longitudinal bulkhead (not less than 10 percent maximum beam) and a longitudinal extend equivalent to 50 percent LOA was investigated throughout the length of the hull. The worst case was found to be for compartments III and IV and V and VI flooded. However, the requirements of the criteria were satisfied. Figures 2.2.5-8 and 2.2.5-9 depict this condition.

(U) In summary, the ANVCE near term SES meets and exceeds the stability requirements at zero speed and the reserve buoyancy criteria for Large Surface Effect Ships of the U. S. Navy,

DATE 1JUN 28-76 I N T A C T S T A B I L I T Y A N A L Y S I S PAGE 1
COMPUTER OFFSET NO 1LSES0001
DWG. NO. 1 N/A

3KSES

LBP : 240.00 FEET BEAM : 108.00 FEET
LOA : 264.25 FEET NO. OF STATIONS : 51

BEAM WIND COMBINED WITH ROLLING (MEAN OPERATING (MOD-10) CONDITION)

HYDROSTATIC CHARACTERISTICS AT ZERO HEEL ANGLE

SEA WATER DISPLACEMENT =	1919.80 TONS	LONGITUDINAL CG (LCG) =	123.08 FT AFT FP
LONGITUDINAL CB (LCB) =	123.08 FT AFT FP	LONGITUDINAL CF (LCF) =	136.25 FT AFT FP
VERTICAL CG (KG) =	27.51 FT ABV BDWL	VERTICAL CB (KB) =	12.04 FT ABV BDWL
MAXIMUM FREE-SURFACE =	438.00 TON-FT	VERTICAL C.G. (KG) =	27.74 FT ABV BDWL
TRANSV. METACENTER (KMT) =	235.47 FT ABV BDWL	LONG. METACENTER (KML) =	910.74 FT ABV BDWL
TRANSVERSE CB (TCB) =	-0.01 FT FRM BDWL	MOMENT TO ALTER TRIM (MTT) =	598.77 TON-FT/INCH
TRIM (+VE : AFTWARD) =	-1.52 FT	DRAFT AT LCF (H) =	18.56 FT ABV BDWL
DRAFT AT AP (HA) =	18.31 FT ABV BDWL	DRAFT AT FP (HF) =	19.83 FT ABV BDWL

RIGHTING ARMS -VS- HEELS IN INTACT CONDITION

WIND SPEED = 100.00 KNOTS

HEEL :	-15.000	-10.000	-5.000	0.0	5.000	10.000	20.000	30.000	40.000	50.000	60.000	DEGREES
DRAFT:	16.750	16.708	18.307	18.944	18.255	16.721	11.905	4.436	-3.846	-12.857	-21.195	FEET
TRIM :	-8.806	-6.469	-3.859	-1.521	-3.441	-6.402	-10.333	-12.359	-14.187	-14.434	-16.204	FEET
GZ :	-32.413	-23.659	-13.639	-0.000	13.472	23.556	35.451	33.171	29.115	23.840	18.533	FEET
WARM :	3.189	2.403	1.711	1.147	1.760	2.398	4.046	5.958	7.918	9.774	11.444	FEET

D Y N A M I C S T A B I L I T Y

AREA A1 = 30383.43 TON-FT BETWEEN 0.4463 AND 40.0000 DEGREES
AREA A2 = 10013.17 TON-FT BETWEEN -14.5537 AND 0.4463 DEGREES

RATIO A1/A2 = 3.0343
PHI-C = 0.4463 DEGREES
RA-C = 1.2140 FT

CRITERIA SATISFIED

NOTE : GZ VALUES INCLUDES CORRECTION TERM 0.05 COS(HEEL) TO ACCOUNT FOR UNKNOWN UNSYMMETRICAL MOMENT
THE DYNAMIC STABILITY IS BASED ON MAXIMUM POSITIVE HEEL ANGLE OF 40.00 DEGREES

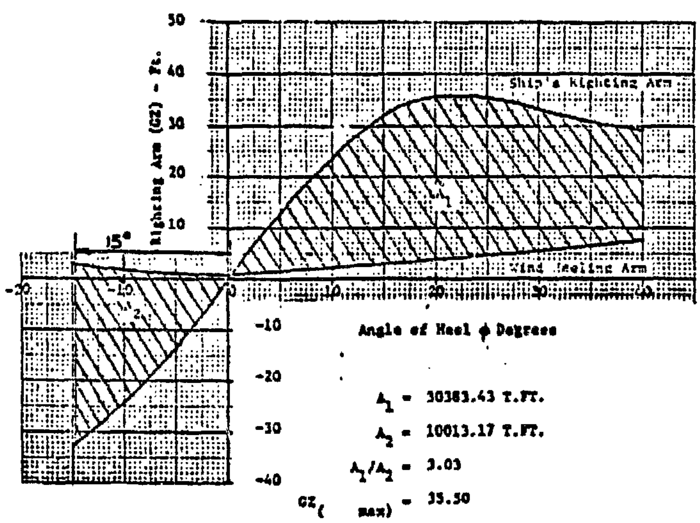


Figure 2.2.5-1 **(U):** 3KSES Hullborne Intact Stability (English Units) **(U)**

DATE : NOV 03-76 I N T A C T S T A B I L I T Y A N A L Y S I S PAGE 1
COMPUTER OFFSET NO : LSE58001
DRWG NO. : N/A

3KSES

LBP : 73.15 M BEAM : 32.92 M
LOA : 81.15 M NO. OF STATIONS : 51

BEAM WIND COMBINED WITH ROLLING : MEAN OPERATING (MOD_-10) CONDITION

HYDROSTATIC CHARACTERISTICS AT ZERO HEEL ANGLE

SEA WATER DISPLACEMENT	= 1901.90 CU-M		LONGITUDINAL CG (LCG)	= 17.52 M AFT FP
LONGITUDINAL CB (LCB)	= 37.52 M AFT FP		LONGITUDINAL CF (LCF)	= 41.53 M AFT FP
VERTICAL CG (VG)	= 8.39 M ABV RBWL		VERTICAL CB (KB)	= 3.67 M NIV RBWL
MAXIMUM FREE-SURFACE	= 1330.16 KN-M		VERTICAL C.G. (KG)	= 8.46 M ABV RBWL
TRANSV. METACENTER (KMT)	= 71.83 M ABV RBWL		LONG. METACENTER (KML)	= 377.55 M ABV RBWL
TRANSVERSE CB (TCB)	= 0.00 M FRM RBWL		MOMENT TO ALTER TRIM (MTI)	= 71.21 M**4/CM
TRIM (+VE : AFTWARD)	= -0.46 M		DRAFT AT LCF (H)	= 1.76 il ABV RBWL
DRAFT AT AP (HA)	= 5.58 M ABV RBWL		DRAFT AT FP (HF)	= 6.04 M ABV RBWL

RIGHTING ARMS -VS- HEELS IN INTACT CONDITION

WIND SPEED = 185.32 KM/HR

HEEL :	-15.000	-10.000	-5.000	0.0	1.000	10.000	20.000	10.000	40.000	50.000	60.000	DEGREES
DRAFT:	4.496	5.093	5.580	5.780	5.576	I.097	1.629	1.349	-1.172	-3.919	-6.460	M
TRIM :	-2.684	-1 .972	-1.176	-0.468	-1.049	-1.976	-3.150	-2.767	-4.300	-4.400	-5.122	M
GZ :	-9.531	-7.111	-4.157	-0.002	4.167	7.180	10.806	10.111	6.871	7.266	5.649	M
WARM :	0.972	0.711	0.522	0.186	0.111	0.731	1.233	1.813	2.111	a.979	3.488	M

D Y N A M I C S T A B I L I T Y

AREA A1 = 92271.00 KN-M BETWEEN 0.0463 AND 40.0000 DEGREES
AREA A2 = 30409.00 KN-M BETWEEN -14.5537 AND 0.0463 DEGREES

RATIO A1/A2 = 3.0343
PHI-C . 0.0463 DEGREES
RA-C = 0.3702 M

NOTE : SEA WATER DENSITY = 1.025 METRIC TONS/CU-M

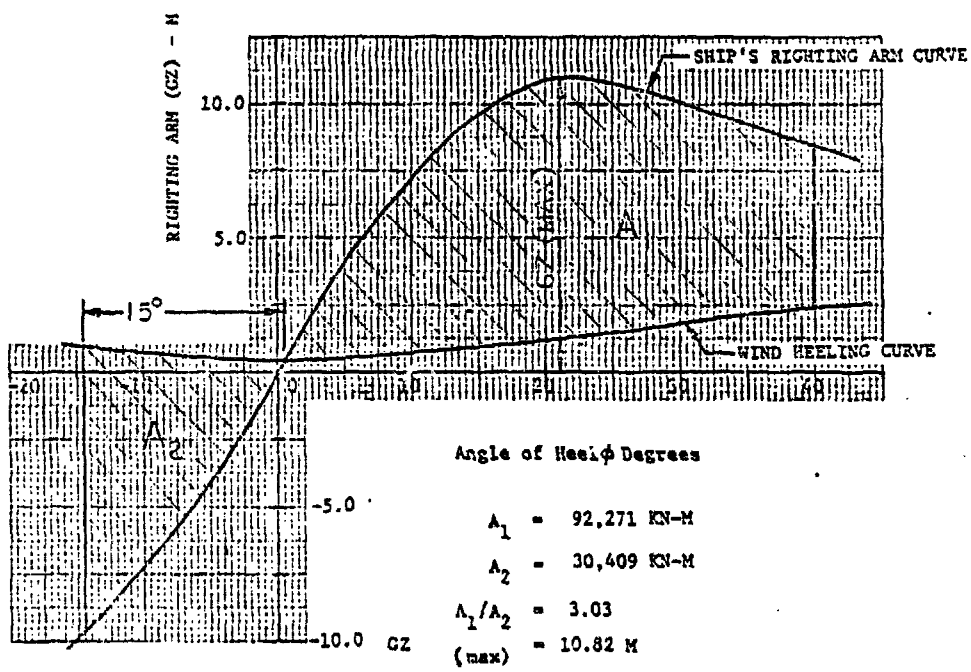


Figure 2.2.5-2 (U): 3KSES Hullborne Intact Stability (SI Units) (U)

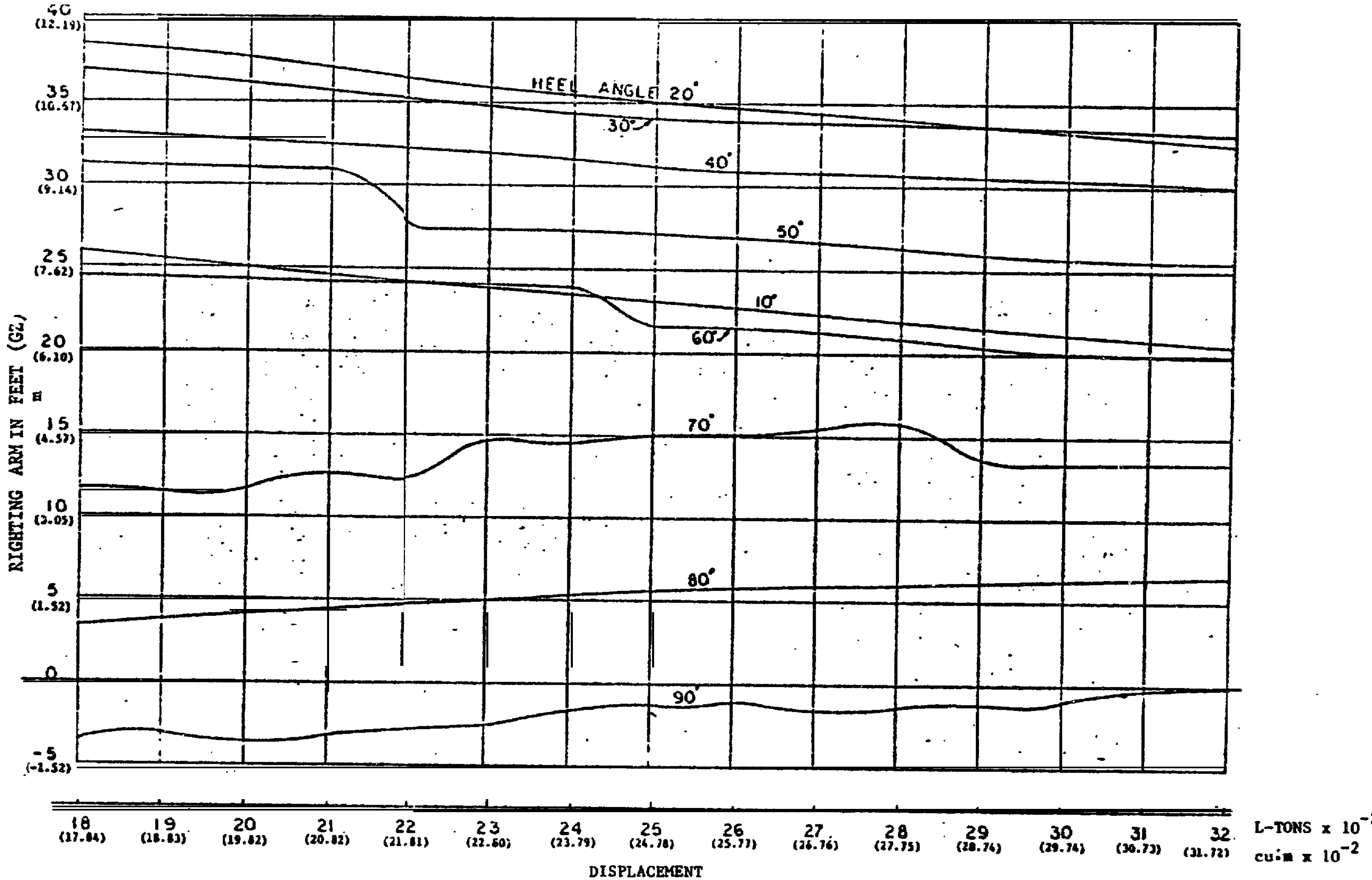


Figure 2.2.5-3 (U): Cross Curves of Stability in Intact Hullborne Condition (U)

UNCLASSIFIED

UNCLASSIFIED

DATE : JUN 28-76 — CROSS CURVES OF STABILITY — PAGE t
COMPUTER OFFSET NO : LSES0001
DRWG. NO. : RPT:890-801-23

3KSES

LBP : 240.00 FEET — BEAM : 108.00 FEET
LOA : 266.25 FEET — NO. OF STATIONS : 51

COMPUTATION IS BASED ON ASSUMED KG : IN INITIAL UPRIGHT CONDITION = 26.00 FT ABOVE RRWL

PHI : 0.0 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700.00	5900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	-0.00	-0.01	-0.01	-0.61	-0.01	-0.01	-0.01	-0.01	FEET
	LCB FROM FP :	129.57	130.39	130.95	131.43	131.85	132.33	133.55	133.86	FEET
PHI : 10.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	75.45	24.67	73.90	23.14	22.38	21.64	2F.92	20.71	FEET
	LCB FROM FP :	136.65	136.96	137.12	137.73	137.32	137.30	137.16	136.93	FEET
PHI : 20.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700.00	2500.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	38.13	37.30	35.95	35.15	34.46	33.74	32.91	32.20	FEET
	LCB FROM FP :	143.75	143.83	141.83	141.29	141.24	141.11	140.87	140.50	FEET
PHI : 30.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	36.33	35.43	35.16	34.18	32.96	33.70	33.41	33.10	FEET
	LCB FROM FP :	147.55	145.64	145.61	143.16	143.02	142.71	142.29	141.74	FEET
PHI : 40.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	non.00	2500 .oo	3100.00	3300.00	L.TONS
	RIGHTING ARM :	33.14	32.69	37.31	31.54	30.84	30.49	30.24	29.95	FEET
	LCB FROM FP :	150.92	149.68	148.32	146.37	144.31	143.36	142.66	141.82	FEET
PHI : 50.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500. no	2700.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	31.15	31.00	27.41	27.02	26.46	25 73	25.60	25.41	FEET
	LCB FROM FP :	161.20	160.45	149.03	147.58	145.54	142.96	142.18	141.25	FEET
PHI : CO.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300. no	2500.00	2700.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	94.35	24.28	24.12	21.51	21.21	20.48	19.88	19.80	FEET
	LCB FROM FP :	159.67	150.41	157.13	148.17	146.78	144.02	141.63	140.81	FEET
PHI : 70.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2900.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	11.42	12.65	14.77	15.10	15.41	13.54	13.40	13.43	FEET
	LCB FROM FP :	140.17	142.48	149.08	148.69	149.20	142.03	141.06	140.46	FEET
PHI : 80.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700.00	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	3.81	4.54	5.10	5.55	5.90	6.19	6.42	6.59	FEET
	LCB FROM FP :	138.44	136.79	139.18	139.51	139.79	140.04	140.25	140.12	FEET
PHI : 90.00 DEGREES	DISPLACEMENT :	1900.00	2100.00	2300.00	2500.00	2700. no	2900.00	3100.00	3300.00	L.TONS
	RIGHTING ARM :	-2.98	-3.14	-3.51	-1.28	-1.53	-1.14	-0.24	0.03	FEET
	LCH FROM FP :	141.04	137.30	137.82	141.58	138.63	131.95	141.91	142.00	FEET

Table 2.2.5-1 (U): Intact Range of Stability (English Units) (U)

UNCLASSIFIED

DATE : NOV 03-76   **C R O S S   C U R V E S   O F   S T A B I L I T Y**

COMPUTER OFFSET NO : LSES8001

DRWG. NO. : N/A

3KSES

LBP : 73.15 M   BEAM : 32.92 M

LOA : 81.15 M   NO. OF STATIONS : 51

COMPUTATION IS BASED ON ASSUMED KG IN INITIAL UPRIGHT CONDITION = 7.92 M ABOVE RBWL

PHI : 0.0 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	M
	LCB FROM FP :	39.49	39.74	39.91	40.06	40.19	40.33	40.71	40.80	M
PHI : 10.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.39	3270.60	CU-M
	RIGHTING ARM :	7.77	7.52	7.28	7.05	6.82	6.60	6.38	[illegible]	M
	LCB FROM FP :	41.66	41.75	41.79	41.83	41.86	41.85	41.91	41.74	[illegible]
PHI : 20.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.39	3270.60	CU-M
	RIGHTING ARM :	11.62	11.37	10.97	10.71	10.51	10.28	10.05	9.31	M
	LCB FROM FP :	43.82	43.84	43.23	43.07	43.05	43.01	42.94	42.[illegible]	M
PHI : 30.00 DEGREES	DISPLACEMENT :	1883.07	2081.[illegible]	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	11.07	10.80	10.72	10.42	10.35	10.27	10.18	10.09	M
	LCB FROM FP :	44.97	44.39	44.38	43.64	43.59	43.50	43.37	43.20	M
PHI : 40.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	[illegible]	3270.60	CU-M
	RIGHTING ARM :	10.10	9.96	9.82	9.61	9.40	9.29	9.22	9.13	M
	LCB FROM FP :	46.00	45.62	45.21	44.61	43.99	43.70	43.48	43.23	M
PHI : 50.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	9.51	9.45	8.35	8.24	8.07	7.84	7.80	7.74	M
	LCB FROM FP :	49.13	[illegible]	45.42	44.98	44.36	43.57	43.34	43.05	M
PHI : 60.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	7.43	7.40	7.35	6.56	6.46	6.24	6.06	6.04	M
	LCB FROM FP :	48.73	48.28	47.89	45.16	44.74	43.90	43.17	42.92	M
PHI : 70.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	3.48	3.86	4.50	4.60	4.70	4.13	4.09	4.09	M
	LCB FROM FP :	42.72	43.43	45.44	45.32	45.48	43.29	43.00	42.81	M
PHI : 80.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	1.10	1.38	1.55	1.69	1.80	1.89	1.96	2.01	M
	LCB FROM FP :	42.20	42.30	42.42	42.52	42.61	42.69	42.75	42.71	[illegible]
PHI : 90.00 DEGREES	DISPLACEMENT :	1883.07	2081.29	2279.51	2477.72	2675.94	2874.16	3072.38	3270.60	CU-M
	RIGHTING ARM :	-0.91	-0.96	-0.77	-0.39	-0.47	-0.35	-0.07	0.01	M
	LCB FROM FP :	42.99	41.85	42.01	43.15	42.25	42.35	43.25	43.28	M

Table 2.2.5-2 (U): Intact Range of Stability (SI Units) (U)

```
DATE                    : JUN-26-1976     D A M A G E     S T A B I L I T Y     A N A L Y S I S                PAGE   11
COMPUTER OFFSET NO : LSES8001
DRWG. NO.               :      N/A                           3KSES
                                                                          LBP :  240.00 FEET      BEAM : 105.00 FEET
                                                                          LOA :  266.25 FEET      NO. OF STATIONS : 51

                         SHELL-TO-SHELL FLOODING : FULL LOAD TRIM FORWARD CONDITION

                                  COMPARTMENTS FLOODING II+III (FRAME 0-28)

                                          SYMMETRICAL FLOODING

                                         SHIP IN FINAL CONDITION

FINAL DRAFT (LCF)          =      24.13  FT ABV. BRWL           FINAL DISPLACEMENT          =   3000.60  TONS
LCG IN FINAL CONDITION     =     117.26  FT FROM FP             LCB IN FINAL CONDITION      =    117.26  FT FROM FP
LCF IN FINAL CONDITION     =     112.68  FT FROM FP             TOTAL TRIM                  =    -21.78  FT

                              D A T A   F O R   L O S T   B U O Y A N C Y

LOST BUOYANCY              =    1638.78  TONS                   LCB OF LOST BUOYANCY        =     41.64  FT FROM FP
VCB OF LOST BUOYANCY       =      21.56  FT ABV BRWL            TCB OF LOST BUOYANCY        =     -0.02  FROM BRWL

FINAL DRAFT AT AP          =      12.58  FT ABV BRWL            FINAL DRAFT AT FP           =     34.36  FT ABV BRWL
FINAL HEEL                 =       0.0   DEGREES                FREE-SURFACE CORRECTION     =   2193.27  TON-FT
KG IN FINAL CONDITION      =      23.69  FT ABV BRWL            DAMAGE RIGHTING ARM (GZ)    =      0.0   FT

RESIDUAL FREEBOARD         =       3.01  FT                     DISTANCE FROM F.P.          =    -26.25  FT

                         HEEL TO MARGINLINE        =        3.96  DEGREES

             NOTE : KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLACK TANKS
```

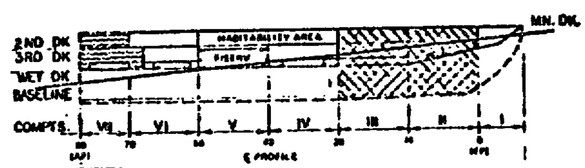


Figure 2.2.5-4 (U) Reserve Buoyancy with Shell-to-Shell Flooding (English Units) (U)

UNCLASSIFIED

UNCLASSIFIED

DATE : NOV 04-76 **DAMAGE STABILITY ANALYSIS** PAGE 11
COMPUTER OFFSET NO : LSES8001
DRWG. NO. : N/A

3KSES

LBP : 73.15 M BEAM : 32.92 M
LOA : 81.15 M NO. OF STATIONS : 51

SHELL-TO-SHELL FLOODING : FULL LOAD TRIM FORWARD CONDITION

COMPARTMENTS FLOODING II + III (FRAME 0-28)

SYMMETRICAL FLOODING

SHIP IN FINAL CONDITION

FINAL DRAFT (LCF)	=	7.36 M ABV. RBWL	FINAL DISPLACEMENT	=	2973.60 CU-M
LCG IN FINAL CONDITION	=	35.74 M FROM FP	LCB IN FINAL CONDITION	=	35.74 M FROM FP
LCF IN FINAL CONDITION	=	16.35 M FROM FP	TOTAL TRIM	=	-6.66 M

D A T A FOR LOST BUOYANCY

LOST BUOYANCY	=	1624.36 CU-M	LCG OF LOST BUOYANCY	=	12.69 M FROM FP
VCG OF LOST BUOYANCY	=	6.57 M ABV RBWL	KC OF LOST BUOYANCY	=	-0.01 FROM RBWL
FINAL DRAFT AT AP	=	3.83 M ABV RBWL	FINAL DRAFT AT FP	=	10.47 M ABV RBWL
FINAL HEEL	=	0.00 DEGREES	FREE-SURFACE CORRECTION	=	964.78 M**4
KG IN FINAL CONDITION	=	7.22 M ABV RBWL	DAMAGE RIGHTING ARM (GZ)	=	0.00 M
RESIDUAL FREEBOARD	=	0.92 M	DISTANCE FROM F.P.	=	-0.00 M

HEEL TO MARGINLINE = 3.96 DEGREES

NOTE : KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLACK TANKS

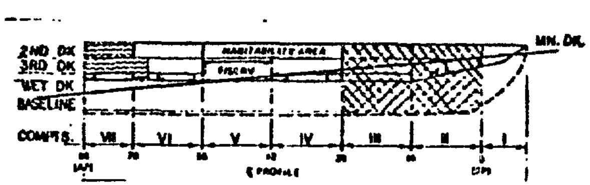


Figure 2.2.5-5 (U) Reserve Buoyancy with Shell-to-Shell Flooding (SI Units) (U)

UNCLASSIFIED

DATE	: JUN-28-1976	DAMAGE STABILITY ANALYSIS	PAGE 5
COMPUTER OFFSET NO	: ILSES8001	3KSES	
DWG. NO.	: N/A		

LBP : 240.00 FEET, BEAM : 108.00 FEET
LOA : 264.25 FEET, NO. OF STATIONS : 51

15% LOA DAMAGE : FULL LOAD NOMINAL CONDITION

FLOODING IN COMPARTMENTS IV-V PENETRATION TO C.L. OF SHIP

UNSYMMETRICAL FLOODING

SHIP IN FINAL CONDITION

FINAL DRAFT (LCF)	= 23.13 FT ABV. BRWL		FINAL DISPLACEMENT	= 3600.00 TONS	
LCG IN FINAL CONDITION	= 123.22 FT FROM FP		LCB IN FINAL CONDITION	= 123.22 FT FROM FP	
LCF IN FINAL CONDITION	= 111.19 FT FROM FP		TOTAL TRIM	= -2.86 FT	

DATA FOR LOST BUOYANCY

LOST BUOYANCY	= 1710.60 TONS	LCG OF LOST BUOYANCY	= 137.99 FT FROM FP
VCG OF LOST BUOYANCY	= 15.75 FT ABV BRWL	TCG OF LOST BUOYANCY	= 38.85 FROM BRWL
FINAL DRAFT AT AP	= 21.59 FT ABV BRWL	FINAL DRAFT AT FP	= 24.45 FT ABV BRWL
FINAL HEEL	= 7.48 DEGREES	FREE-SURFACE CORRECTION	= 3834.27 TON-FT
KG IN FINAL CONDITION	= 23.90 FT ABV BRWL	DAMAGE RIGHTING ARM (GZ)	= 0.0 FT
RESIDUAL FREEBOARD	= 8.28 FT	DISTANCE FROM F.P.	= -15.00 FT

HEEL TO MARGINLINE = 8.46 DEGREES

RIGHTING ARMS -VS- HEELS IN DAMAGE CONDITION

HEEL :	-15.000	-10.000	-5.000	0.0	5.000	10.000	15.000	25.000	35.000	45.000	55.000	DEGREES
GZ :	-30.475	-25.042	-17.897	-8.874	-2.471	2.719	8.737	19.146	20.245	22.298	9.435	FEET

NOTE : GZ VALUES INCLUDES CORRECTION TERM 0.05COS(HEEL) TO ACCOUNT FOR UNKNOWN UNSYMMETRICAL MOMENT
KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLACK TANKS

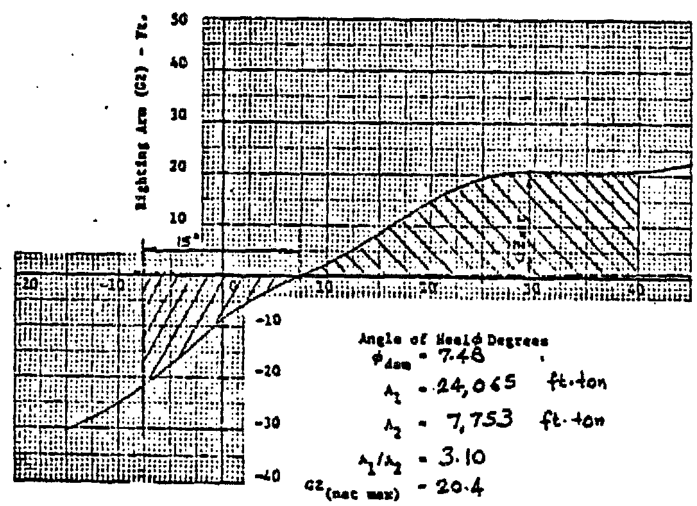


Figure 2.2.5-6 (U): Damaged Stability 15 Percent LOA Unsymmetrically Flooded (English Units) (U)

DATE : NOV 03-76
COMPUTER OFFSET NO : LSES3001
DRWG. NO. : N/A

DAMAGE STABILITY ANALYSIS

PAGE 5

3KSES

LBP : 73.15 m
LOA : 81.15 m

BEAM : 32.92.
No. OF STATIONS : 51

15% LOA DAMAGE : FULL LOAD NOMINAL CONDITION

FLOODING IN COMPARTMENTS IV+V PENETRATION TO C.L. OF SHIP

UNSYMMETRICAL FLOODING

SHIP IN FINAL CONDITION

FINAL DRAFT (LCF) = 7.05. ABV RRWL		FINAL DISPLACEMENT = 2973.27 CU-m	
LCG IN FINAL CONDITION = 37.56. FROM W		LCB IN FINAL CONDITION = 37.56 FROM	
LCF IN FINAL CONDITION = 33.89. FROM FP		TOTAL TRIM =	

DATA FOR LOST BUOYANCY

LOST BUOYANCY = 1695.44 CU-m
VCG OF LOST BUOYANCY = 4.90 m ABV RRWL
LCG OF LOST BUOYANCY = 42.06 m FROM FP
TCG OF LOST BUOYANCY = 11.23 FROM RRWL

FINAL DRAFT AT AP = 6.58 m ABV RRWL
FINAL HEEL = 7.48 DEGREES
KG IN FINAL CONDITION = 1.28 9 ABV RRWL
FINAL DRAFT AT FP = 7.45 ABV RRWL
FREE-SURFACE CORRECTION = 1097.85 m**4
DAMAGE RIGHTING ARM (GZ) = 0.00 m

RESIDUAL FREEBOARD = 2.52 m
DISTANCE FROM C.P. = -4.57

HEEL To MARGINLINE = 8.46 DEGREES

RIGHTING ARMS -VS- HEELS IN DAMAGE CONDITION

HEEL :	-15.000	-10.001	-5.000	0.000	5.000	10.000	15.000	25.000	35.000	45.000	55.000 DEGREES
GZ :	-9.280	-7.633	-5.394	-2.705	-0.814	0.829	2.663	5.836	6.171	6.793	2.937

NOTE : GZ VALUES INCLUDES CORRECTION TERM 0.05COS(HEEL) TO ACCOUNT FOR UNKNOWN UNSYMMETRICAL MOMENT
KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLAK TANKS
SEA WATER DENSITY = 1.025 METRIC TONS/CU-M

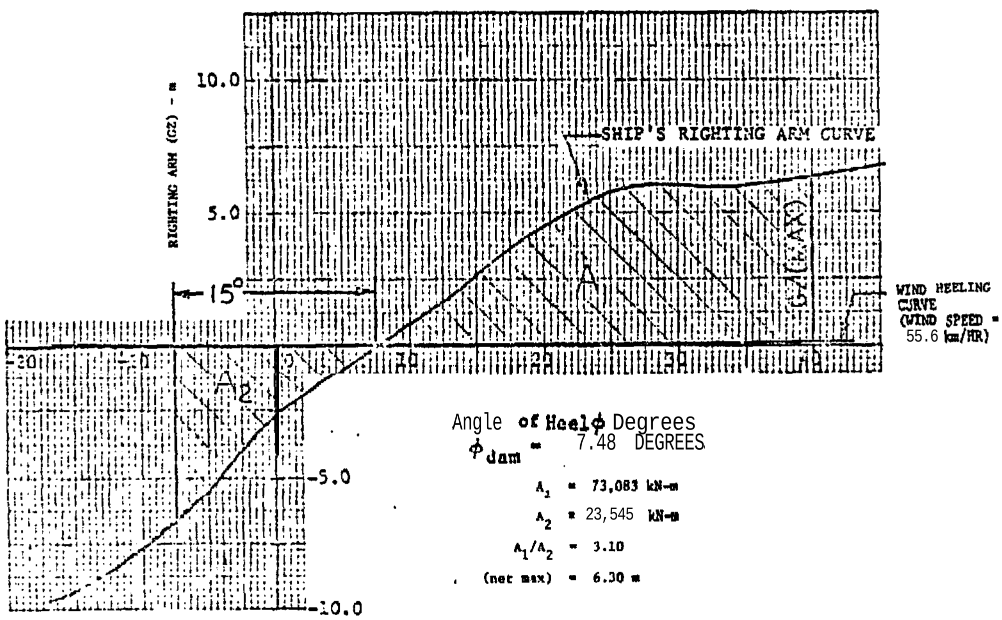


Figure 2.2.5-7 (U): Damaged Stability 15 Percent LOA Unsymmetrically Flooded (SI Units) (U)

DATE 1JUN-74-1974 DAMAGE STABILITY ANALYSIS PAGE 5
COMPUTER OFFSET NO (LSES8U01
DRWG. NO. : N/A

3KSES

LBP : 240.00 FEET BEAM : 108.00 FEET
LOA : 264.24 FEET NO. OF STATIONS : 51

50% LCA DAMAGE : FULL LOAD NOMINAL CONDITION

FLOODING IN COMPARTMENTS III-IV-V-VI PENETRATION TO 29.33 LONG. BHD.

UNSYMMETRICAL FLOODING

SHIP IN FINAL CONDITION

FINAL DRAFT (LCF)	=	22.79 FT ABV. BRWL		FINAL DISPLACEMENT	=	3088.00 TONS
LCB IN FINAL CONDITION	=	123.22 FT FROM FP		LCB IN FINAL CONDITION	=	123.22 FT FROM FP
LCF IN FINAL CONDITION	=	114.47 FT FROM FP		TOTAL TRIM	=	0.49 FT

DATA FOR LOST BUOYANCY

LOST BUOYANCY	=	1870.80 TONS		LCB OF LOST BUOYANCY	=	149.21 FT FROM FP
VCB OF LOST BUOYANCY	=	11.45 FT ABV BRWL		TCB OF LOST BUOYANCY	=	46.71 FROM BRWL
FINAL DRAFT AT AP	=	23.04 FT ABV BRWL		FINAL DRAFT AT FP	=	22.56 FT ABV BRWL
FINAL HEEL	=	5.65 DEGREES		FREE-SURFACE CORRECTION	=	3434.27 TON-FT
KG IN FINAL CONDITION	=	23.42 FT ABV BRWL		DAMAGE RIGHTING ARM (GZ)	=	0.0 FT
RESIDUAL FREEBOARD	=	7.89 FT		DISTANCE FROM F.P.	=	240.00 FT

HEEL TO MARGINLINE = 6.75 DEGREES

RIGHTING ARMS -VS- HEELS IN DAMAGE CONDITION

HEEL :	-15.000	-10.000	-5.000	0.0	5.000	10.000	15.000	20.000	35.000	45.000	55.000	DEGREES
GZ :	-32.366	-28.059	-20.606	-12.486	-4.977	0.442	6.471	14.939	15.557	17.431	5.050	FEET

NOTE : GZ VALUES INCLUDES CORRECTION TERM 0.05COS(HEEL) TO ACCOUNT FOR UNKNOWN UNSYMMETRICAL MOMENT
KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLACK TANKS

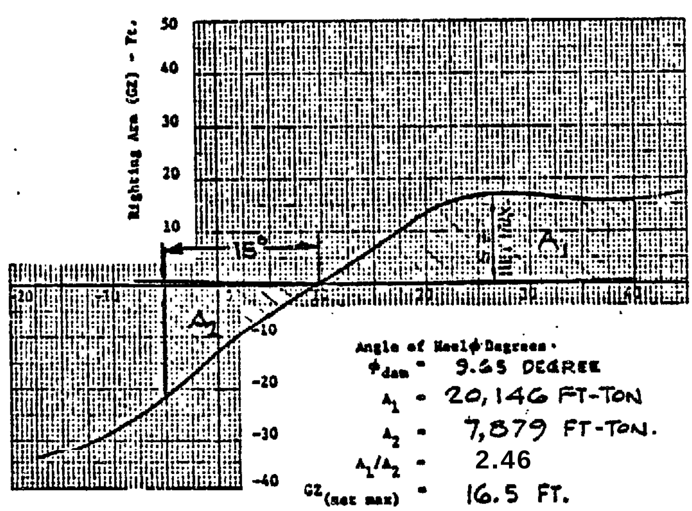


Figure 2.2.5-S (U): Damaged Stability 50 Percent LOA Unsymmetrically Flooded (English Units) (U)

DATE	:NOV 03-76	DAMAGE STABILITY ANALYSIS	PAGE 5
COMPUTER OFFSET NO	:LSES8001		
DRWG. NO.	: N/A	3KSES	

LBP : 73.15 m BEAM : 12.92 m
LOA : 81.15 m NO. OF STATIONS : 51

50% LOA DAMAGE : FULL LOAD NOMINAL CONDITION

FLOODING IN COMPARTMENTS III+IV+V+.T PENETRATION TO 5.94 LONG.BHD,

UNSYMMETRICAL FLOODING

SHIP IN FINAL CONDITION

FINAL DRAFT (LCF)	= 6.95 m ABV. RRWL		FINAL DISPLACEMENT	=	2973.27 CU-m
LCG IN FINAL CONDITION	= [illegible] FROM FP		LCB IN FINAL CONDITION	=	17.56 m FROM FP
LCF IN FINAL CONDITION	= [illegible] m FROM FP		TOTAL TRIM	=	0.15 m

DATA FOR LOST BUOYANCY

LOST BUOYANCY =	1654.13 CU-m	LCG OF LOST BUOYANCY =	45.49 m FROM PP
VCG OF LOST BUOYANCY =	3.49. ABV RRWL	TCG OF LOST BUOYANCY =	14.24 FROM RRVL
FINAL DRAFT AT AP =	7.02. NIV RRWL	FINAL DRAFT AT FP =	6.66 . ABV RRWL
FINAL HEEL =	9.65 DEGREES	FREE-SURFACE CORRECTION =	1097.65 m-4
KG IN FINAL CONDITION =	7.20 m ABV RRWL	DAMAGE RIGHTING ARM (GZ) =	0.00
RESIDUAL FREEBOARD =	2.16 m	DISTANCE FROM F.P. =	73.15 m

HEEL TO MARGINLINE	1.71 DEGREES

RIGHTING ARMS -VS- HEELS IN DAMAGE CONDITION

HEEL :	-15.000	-10.000	-3.000	0.000	5.000	10.000	15.000	25.000	35.000	45.000	55.000 DEGREES
GZ :	-9.865	-8.552	-6.366	-3.006	-1.711	0.135	1.972	5.163	4.864	5.313	1.519

NOTE: GZ VALUES INCLUDES CORRECTION TERM 0.05COS(HEEL) TO ACCOUNT FOR UNKNOWN UNSYMMETRICAL MOMENT
KG VALUE INCLUDES ALLOWANCE FOR FREE-SURFACE EFFECT FOR SLAK TANKS

SEA WATER DENSITY = 1.025 METRIC TONS/CU-M

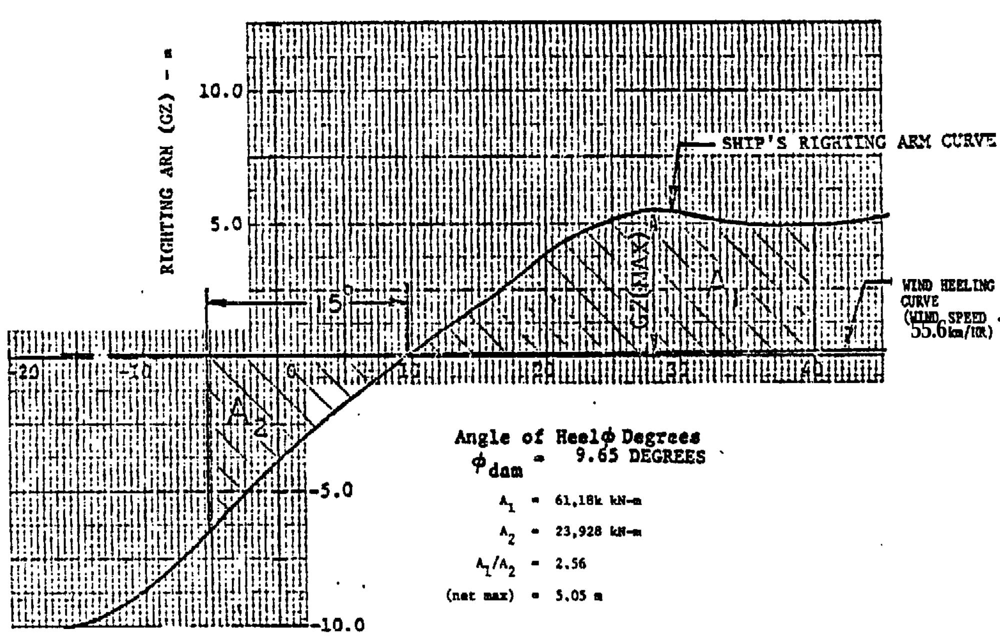


Figure 2.2.5-9 (U): Damaged Stability 50 Percent LOA Unsymmetrically Flooded (SI Units) (U)

(U) 2.2.5.2 Static Stability Underway

(U) 2.2.5.2.1 Off-Cushion Stability Underway -- Predicted off-cushion static pitch and roll stability characteristics for the ANVCE near term SES are presented in Figures 2.2.5-10 and 2.2.5-11, respectively. The ship has positive static stability with pitch and roll restoring gradients of approximately 99 x 10^6 ft-lb/degree (134.23 x 10^6 N·m degree) and 22 x 10^6 ft-lb/degree (29.83 x 10^6 N·m/degree), respectively. In the off-cushion mode, the SES is statically unstable in yaw but dynamically stable, thus providing satisfactory course keeping characteristics as influenced by the ride control system in a seaway.

(U) 2.2.5.2.2. On-Cushion Static Stability Underway -- The predicted on-cushion static stability data presented next shows that the ANVCE near term SES has positive stability in roll, pitch and yaw. Roll and pitch stability are shown at 40, 60 and 80 knots (20.58, 30.87 and 41.16 m/s); yaw stability data for 60 and 80 knots (30.87 and 41.16 m/s) only. The stability characteristics shown are for a nominal displacement of 2800 LT (27,899.2 RN) which approximates the Full Load Displacement condition.

(U) The positive on-cushion pitch stability of the SES at 40, 60 and 80 knots (20.58, 30.87 and 31.16 m/s) is shown in Figure 2.2.5-12. Predictions are plotted with zero moment occurring at the nominal pitch trim attitude for each speed (the ship is trimmed at the pitch attitude for minimum drag consistent with non-broaching operation). Speed variation at a constant weight primarily alters the minimum-drag pitch attitude. These predictions were derived by Froude scaling hydrodynamic model test data without other correction. Positive static stability is indicated by the degree of negative gradient of the moments with their corresponding attitudes.

(U) The average pitch restoring moment is approximately 18 x 10^6 ft-lb/degree (24.40 x 10^6 N·m/degree) for all speeds shown. The minimum gradient of about 8 x 10^6 ft-lb/degree (10.85 N·m/degree) occurs on the curve for 40 knots (20.58 m/s).

(U) The yaw stability characteristics are shown in Figures 2.2.5-13 and 2.2.5-14 at speeds of 60 and 80 knots (30.87 and 41.16 M/S) for three (3) pitch attitudes (1, 0 and +1 degrees) and at two (2) angles of roll (0 and +2 degrees). Positive static yaw stability is shown for all conditions except the high speed, negative pitch case (80 knots (41.16 m/s) and -1 deg. . trim). However, extrapolation of the dynamic stability indicates that the near term SES will be dynamically stable, in the directfonal sense, to bow down pitch angles as large as -2 degrees. In actual operation, a bow down trim attitude of this magnitude is difficult for the ship to achieve, and even more difficult to maintain. Strong pitch restoring moments ensure a rapid return to nominal attitudes even under failure mode conditions.

(U) The positive on-cushion roll stability of the near term SES at 40, 60 and 80 knots (20.58, 30.87 and 41.16 m/s) is shown in Figures 2.2.5-15 through 2.2.5-19, respectively. Predictions are plotted for pitch attitudes of zero and plus and minus 1 degree and for yaw angles of zero, -2 and -4 degrees. The roll restoring moment gradients vary slightly with speed and ship attitude. The maximum gradient shown is approximately 4.3 x 10^6 ft-lb/degree (5.83 x 10^6 N•m/degree) (at 80 knots) (41.16 m/s); the minimum is about 2.6 x 10^6 ft-lb/degree (3.53 x 10^6 N•m/degree) which occurs at 40 knots (30.87 m/s) at a -4 degree yaw angle. The principal roll restoring moments are due to the sidehull design.

(U) Two of the more significant features which contribute to the excellent stability characteristics of the ANVCE near term SES are the seal and sidehull designs, The Rohr advanced planing seals maintain their geometric integrity at all times, even in high sea states. The design precludes slope reversal in the pitch stability curve ("pitch clicks"), as exhibited on the 100B testcraft. The design also precludes catastrophic plow-in characteristics exhibited by other type seal designs at bow down attitudes.

(U) The [illegible]nced pl[illegible]ing seal design increases the effective cushion length as a direct function of bow immersion; as the bow goes down, the effective cushion length boundary moves forward, providing additional pitch and roll restoring moments.

(U) The design stiffness of the seals is a careful balance between stability requirements and ride quality. The Rohr design provides a degree of stiffness which maintains adequate roll and pitch stability while providing good ride qualities.

(U) The sidehull forward sections contribute additional pitch and roll restoring moments at bow down attitudes in the same way as the advanced planing bow seal. This effect is obtained by designing the bow stem to match the bow seal contour. In addition, the stem angle minimizes destabilizing moments at bow down attitudes. The low (45 degree) deadrise angle of the sidehull design provides better pitch and roll stability than higher deadrise sidehull configurations.

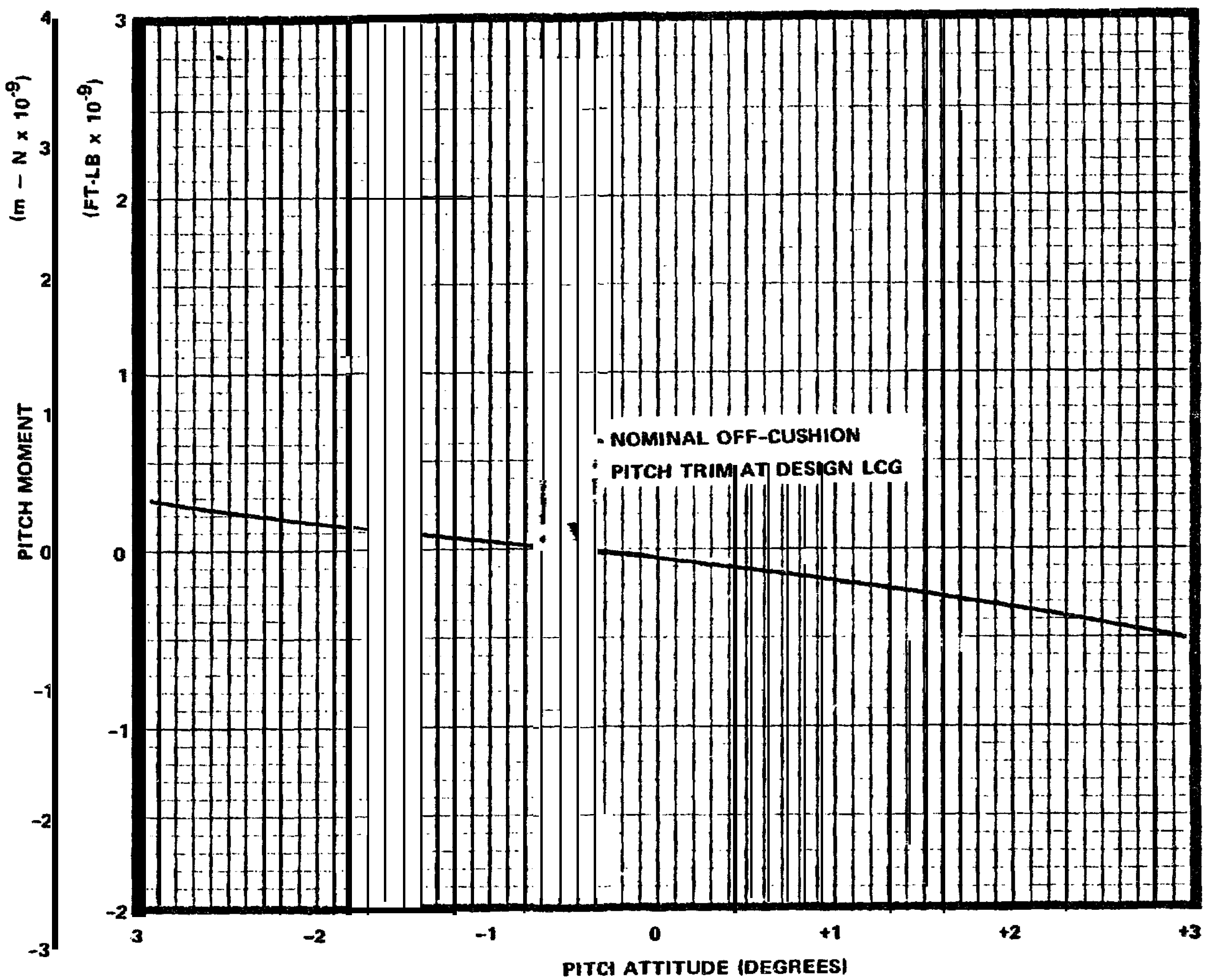


Figure 2.2.5-10 (U): 3KSES Static Pitch Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), Off Cushion (U)

UNCLASSIFIED

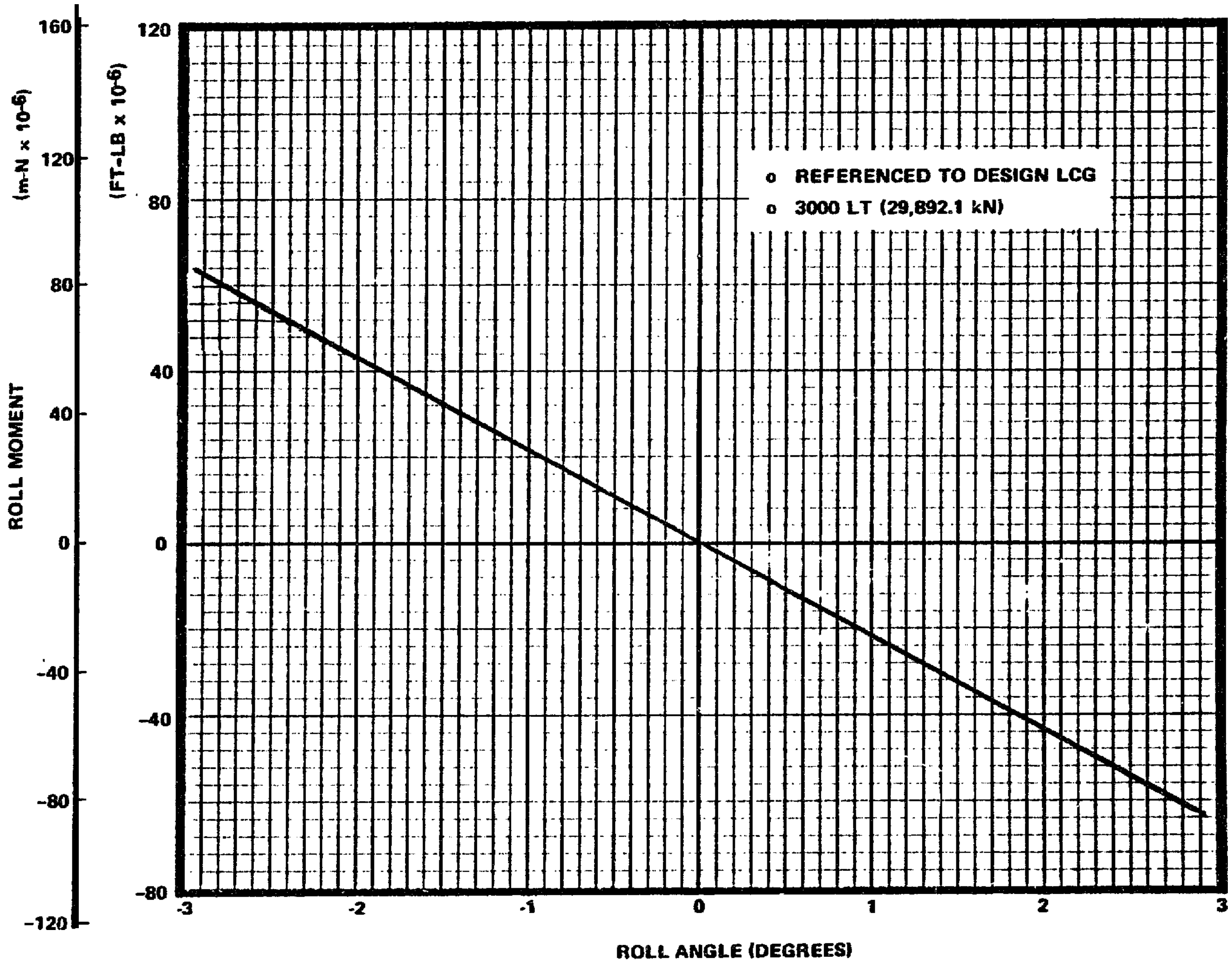


Figure 2.2.5-11 (U): 3KSES Static Roll Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), Off Cushion (U)

UNCLASSIFIED

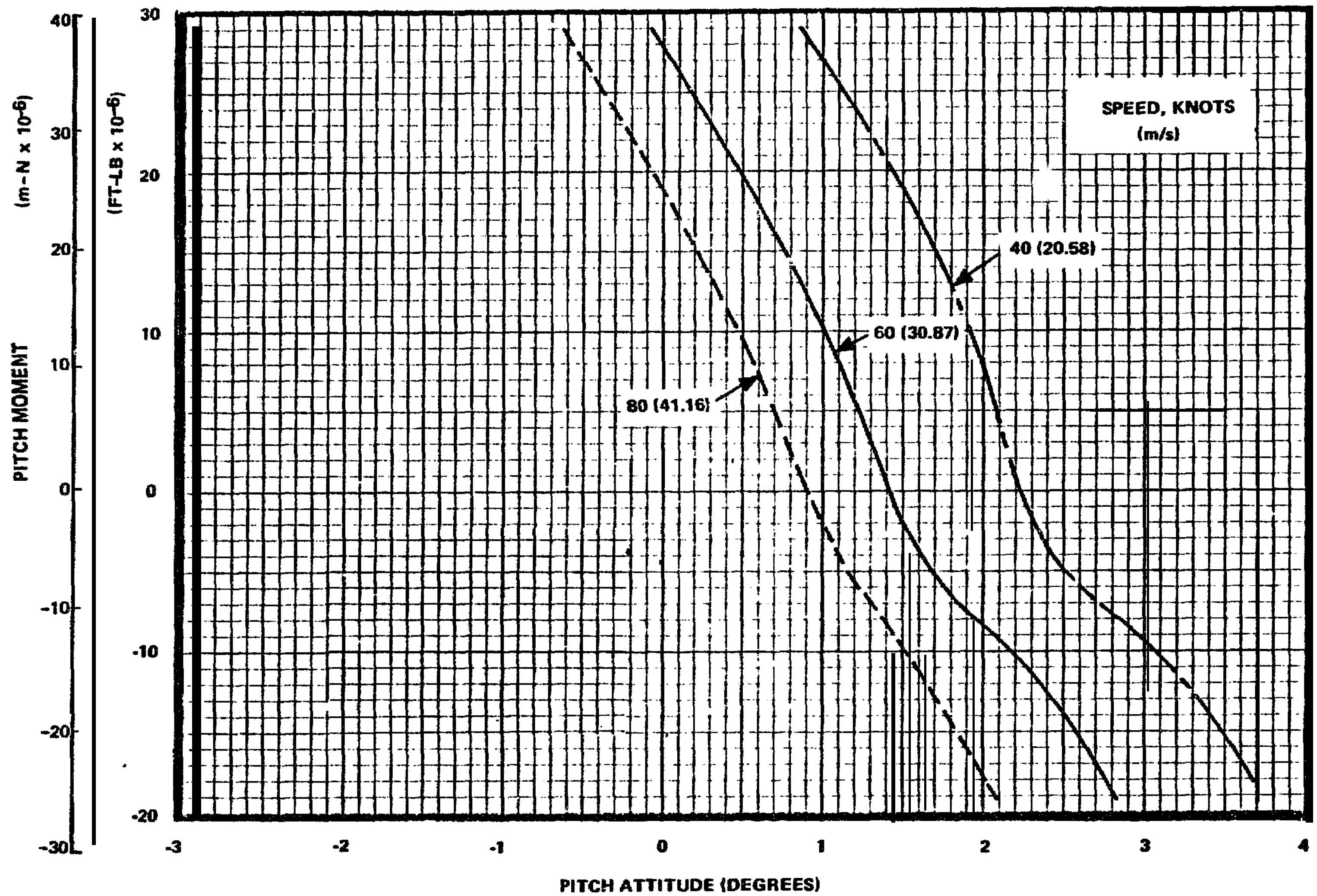


Figure 2.2.5-12 (U): 3KSES Static Pitch Stability, 83 Percent Fuel Condition (2800 LT; 27, 899.2 kN), on Cushion (U)

UNCLASSIFIED

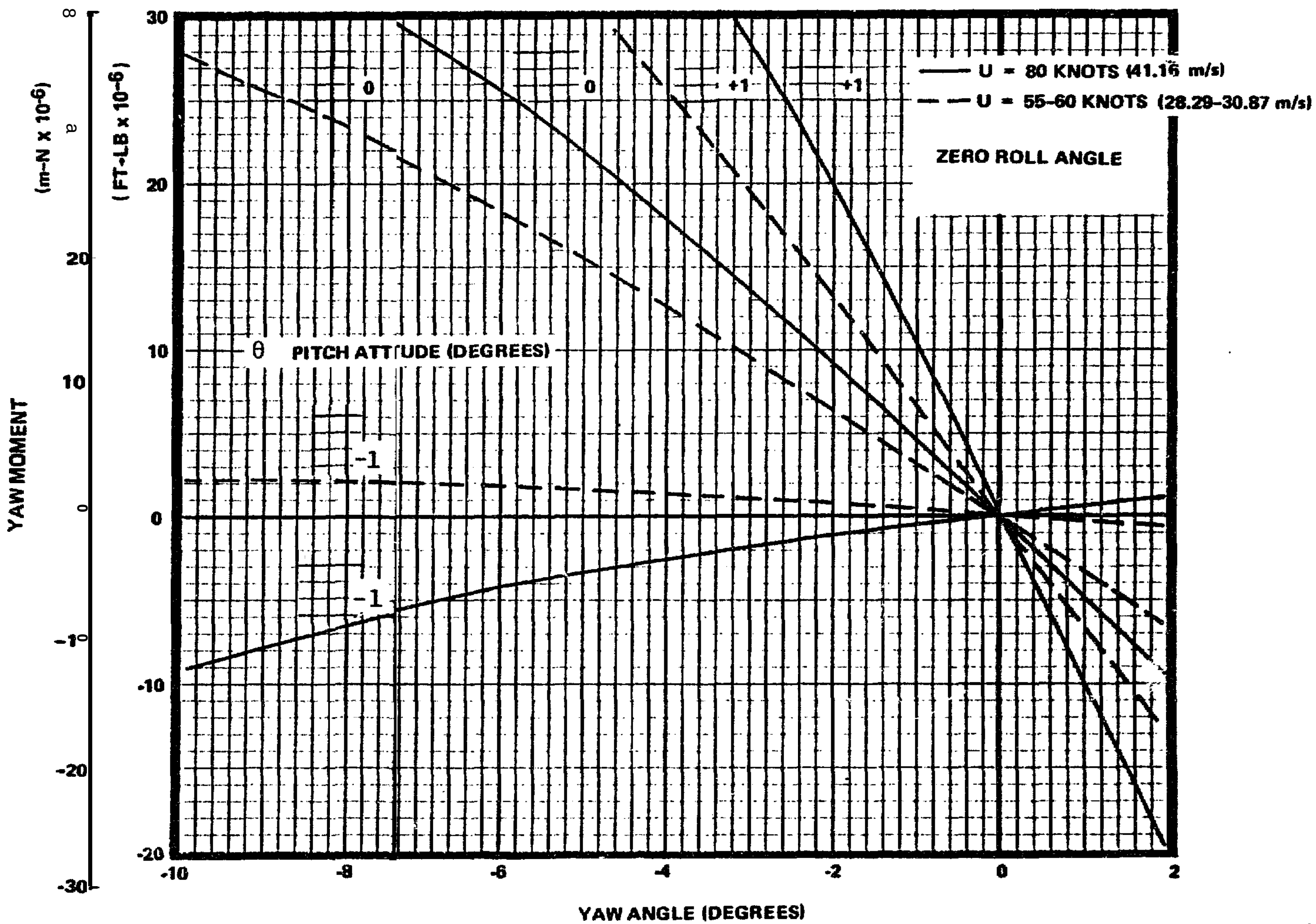


Figure 2.2.5-13 : 3KSES Static Yaw Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), on Cushion (U)

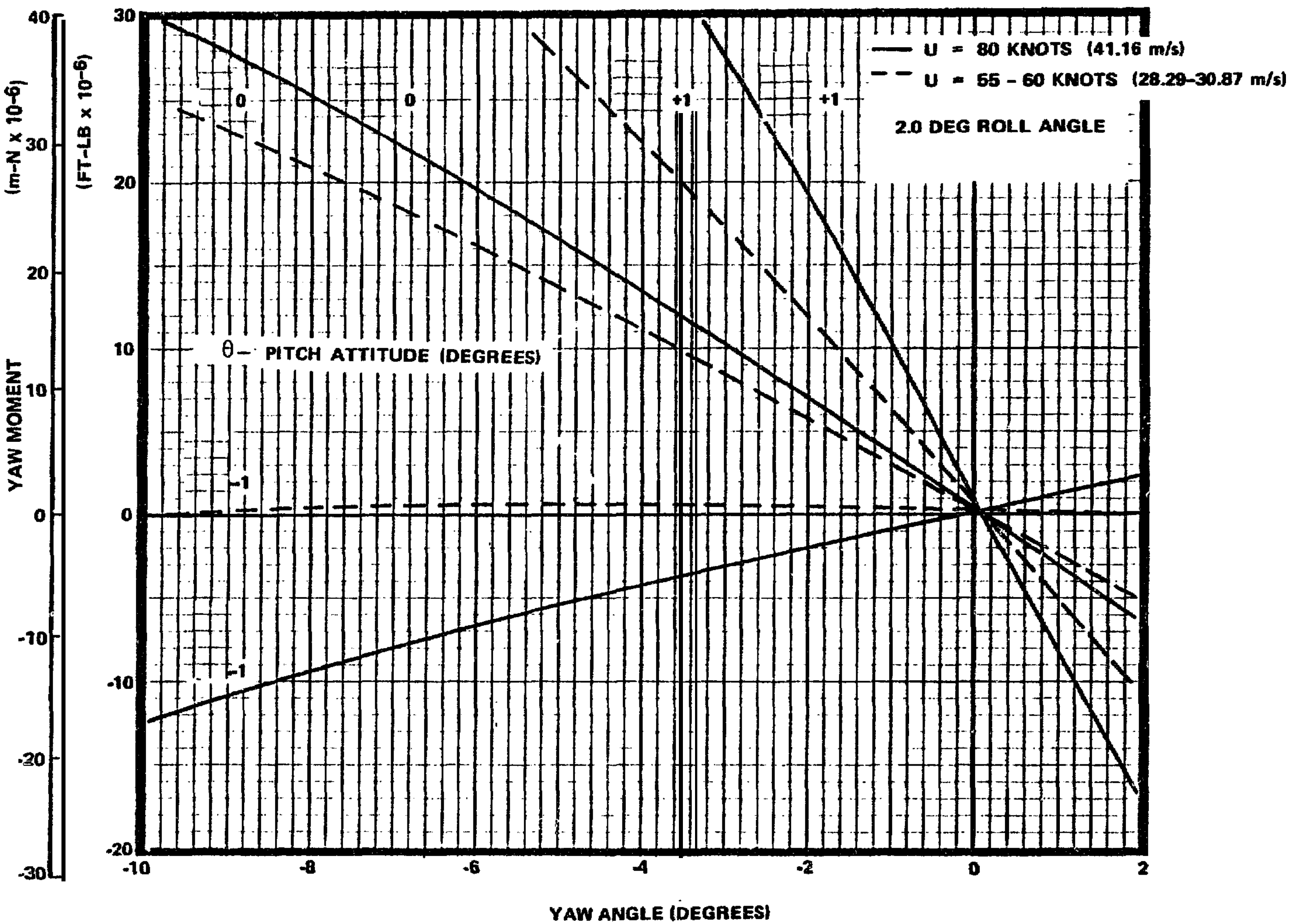


Figure 2.2.5-14 (U): 3KSES Static Roll Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 KN), On Cushion (U)

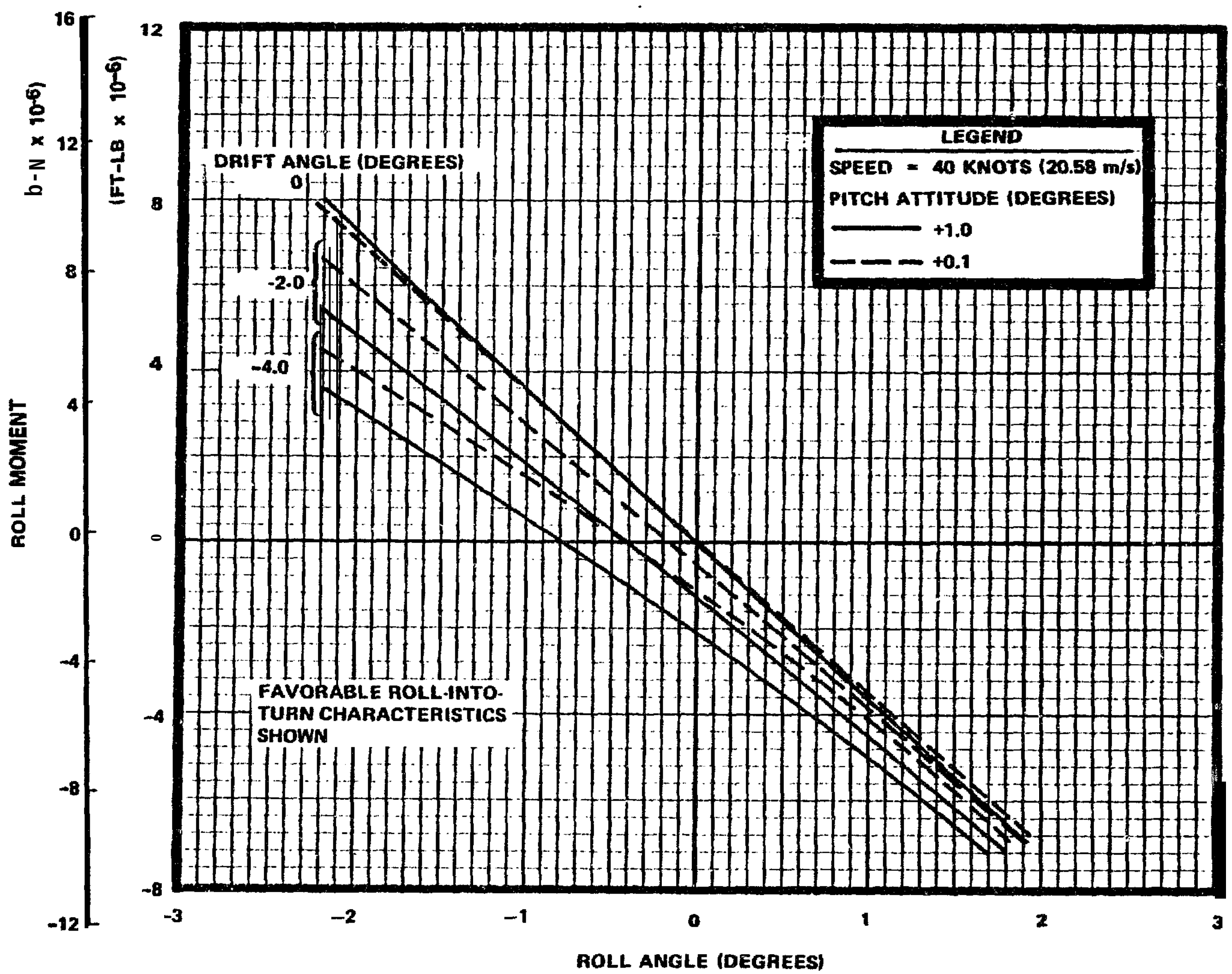


Figure 2.2.5-15 (U): 3KSES Static Yaw Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), On Cushion (U)

UNCLASSIFIED

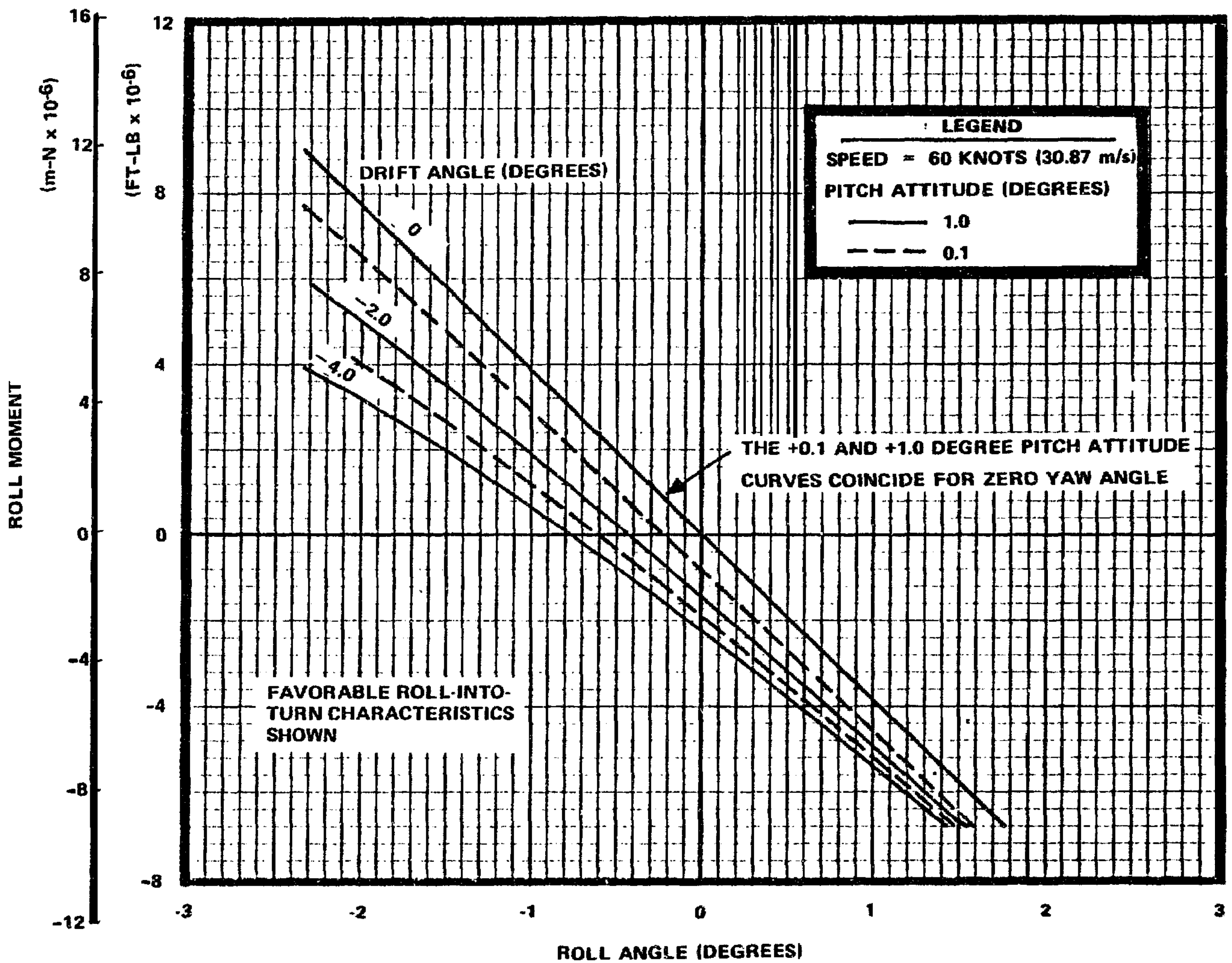


Figure 2.2.5-16 (U): 3KSES Static Roll Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), On Cushion (U)

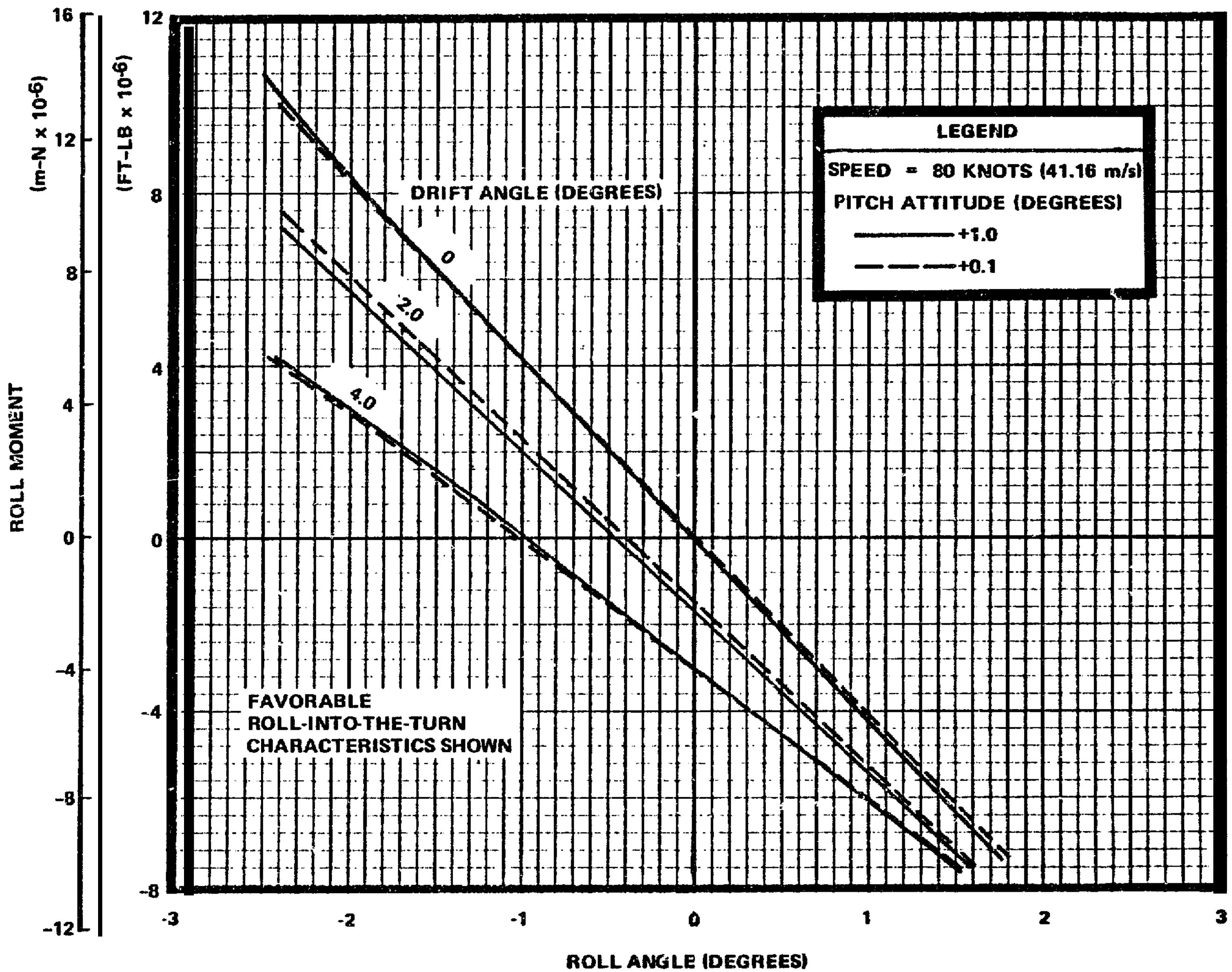


Figure 2.2.5-17 (U): 3KSES Static Roll Stability, 83 Percent Fuel Condition (2800 LT; 27,899.2 kN), On Cushion (U)

(U) 2.2.5.3 Dynamic Stability -- The predicted on-cushion dynamic stability characteristics for the near term SES are presented in Table 2.2.5-3. The values shown in the table are for the ship without ride control. Nominal pitch trim angles are included in the table for reference, At 40 knots (20.58 m/s), the yaw (directional) mode is overdamped for the nominal pitch trim angle; responses in yaw may then be characterized as a first order system with a time constant of about 4 seconds.

Table 2.2.5-3. (U) 3KSES Dynamic Stability Characteristics (U)

AXIS	SPEED KNOTS	SPEED m/s	NOMINAL TRIM DEGREES	FREQUENCY HZ	DAMPING RATIO
ROLL	40	20.58	2.2	0.17	0.15
	60	30.87	1.4	0.18	0.14
	80	41.16	0.9	0.19	0.13
PITCH	40	20.58	2.2	0.19	0.22
	60	30.87	1.4	0.20	0.20
	80	41.16	0.9	0.21	0.16
YAW	40	20.58	2.2	*	*
	60	30.87	1.4	0.15	0.80
	80	41.16	0.9	0.07	0.45
HEAVE	40	20.58	2.2	0.65	0.28
	60	30.87	1.4	0.66	0.29
	80	41.16	0.9	0.68	0.31

*Overdamped, τ = 4.0 seconds

(U) Figure 2.2.5-18 presents the significant pitch angle deviations as a function of speed and significant wave height. These data are based on analytic modeling of the ship's vertical plane dynamic characteristics as influenced by the ride control system in a seaway.

(U) Figures 2.2.5-19 through 2.2.5-21 present the significant roll angle deviations with speed, significant wave height, and seaway heading.

(U) These data are based on hydrodynamic model test data collected in the DTNSRDC maneuvering basin.

(U) Figure 2.2.5-22 presents the limit allowable drift angle as a function of speed. The angles are limited by propulsive control yaw moments available below hump and by operating boundaries (dictated by roll-yaw stability) above hump. The limit angles shown were derived from XR-1D testcraft model data and inlet broaching studies. (1)

(1) Barker, J., et al, "XR-1D Safety and Performance Prediction Report", Rohr Industries, Inc., Rept. No. RHR-75-266, 22 Aug. 1975 (Fig. 4-11 and 4-12).

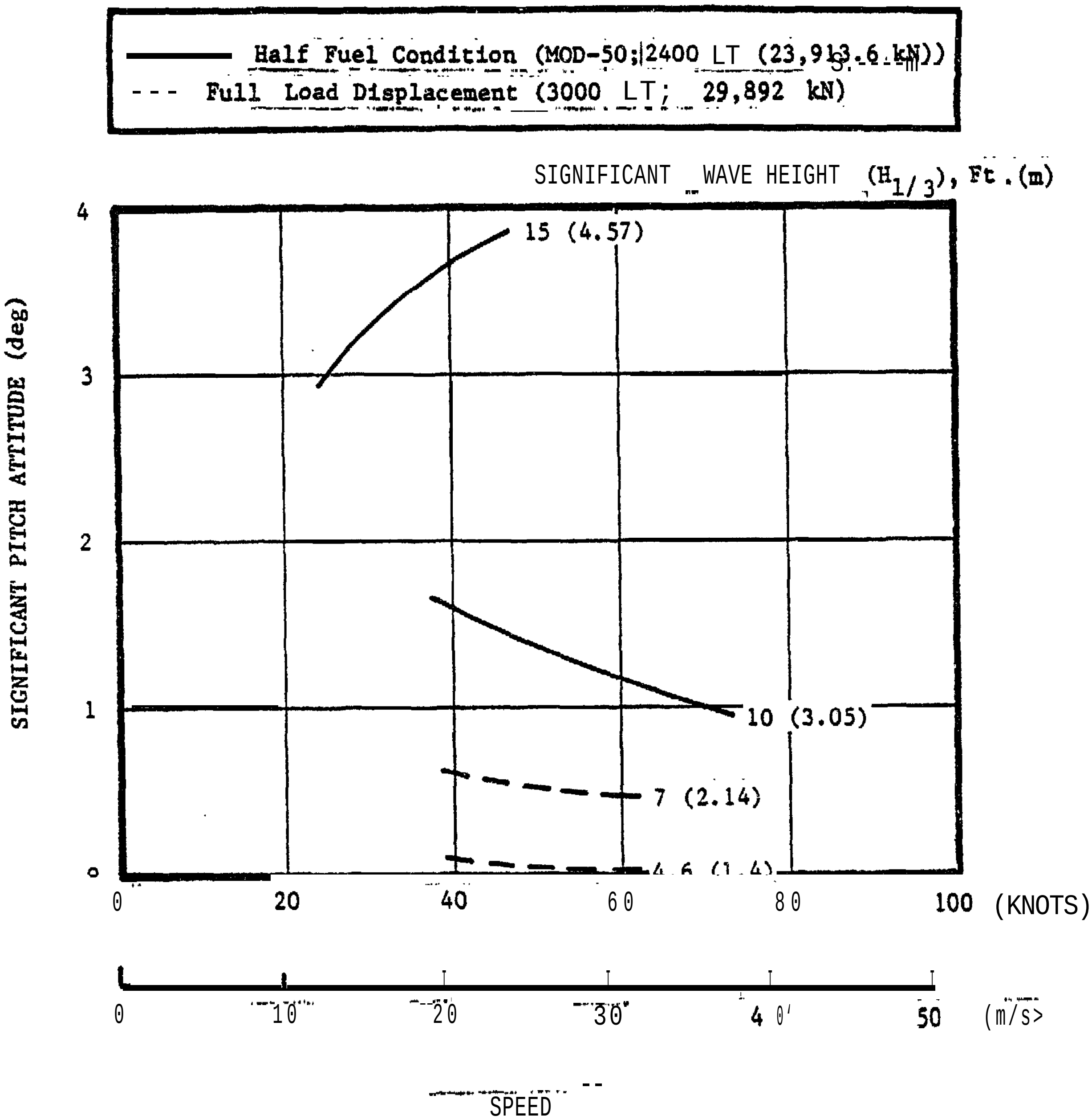


Figure 2.2.5-18 (U): 3KSES Pitch Deviation Versus Speed Head Seas (U)

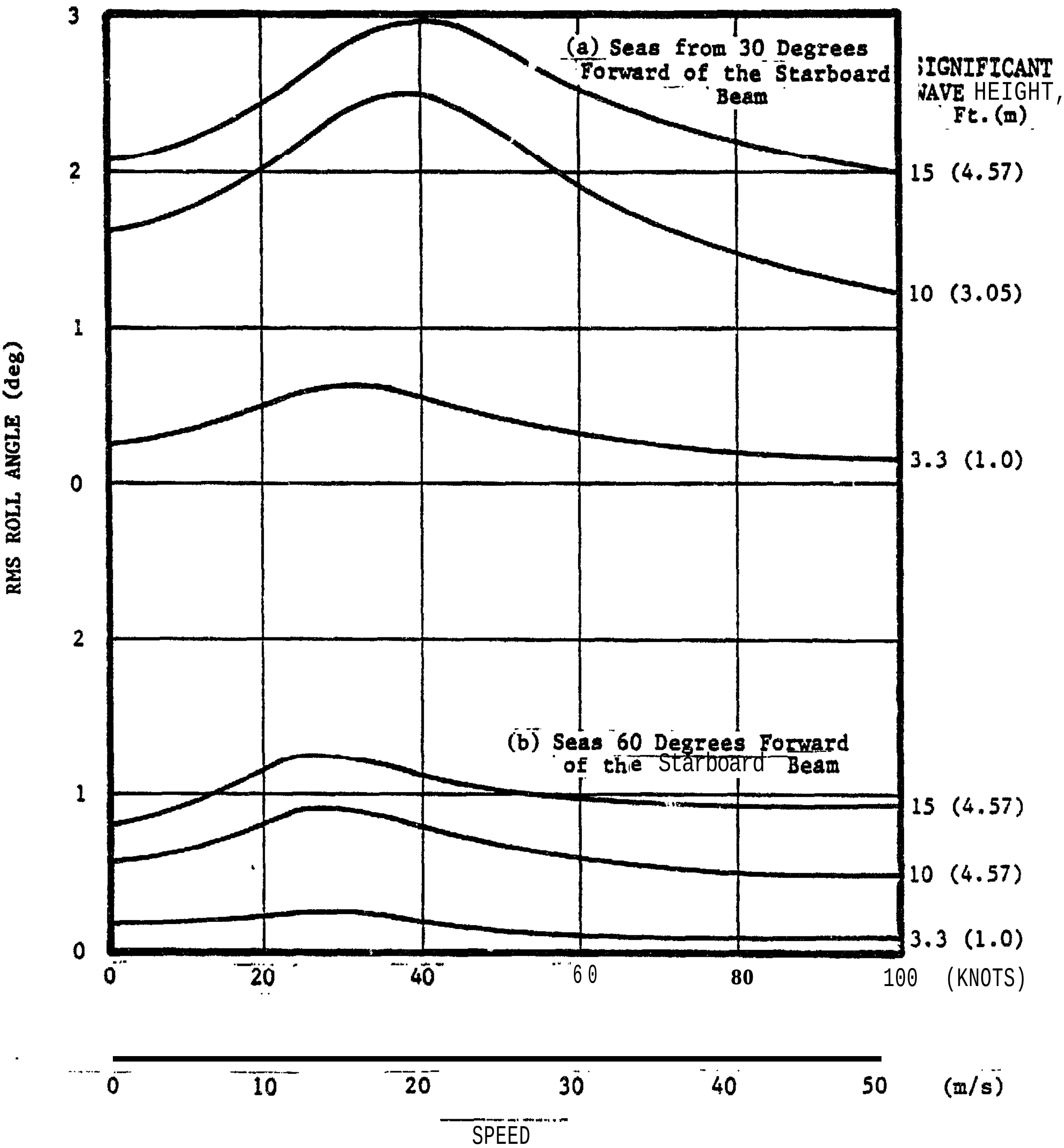


Figure 2.2.5-19 (U): 3KSES Roll Deviation Versus Speed (U)

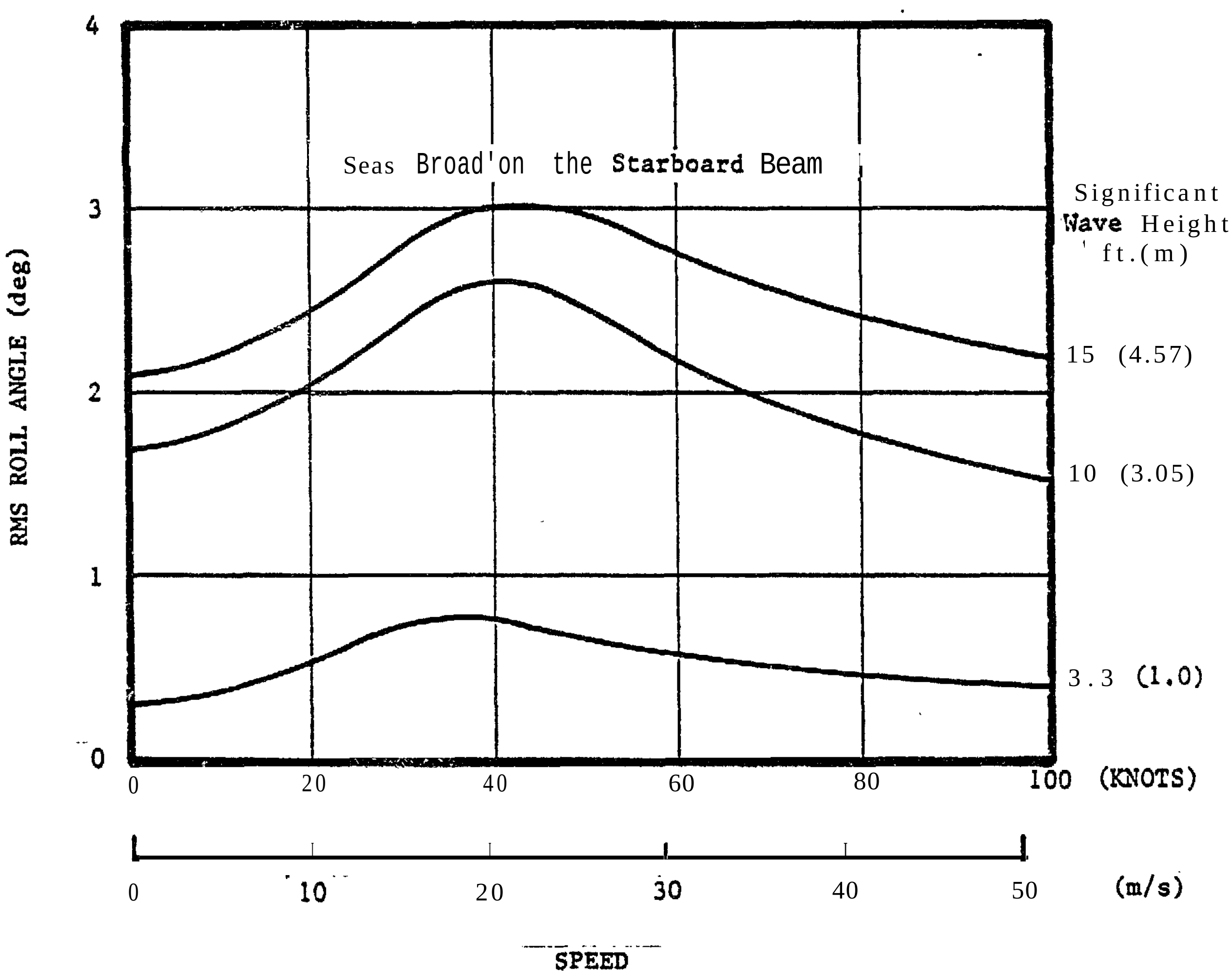


Figure 2.2.5-20 (U) : 3KSES Roll Deviation Versus Speed (U)

Seas from 30 Degrees Abaft the Starboard Beam

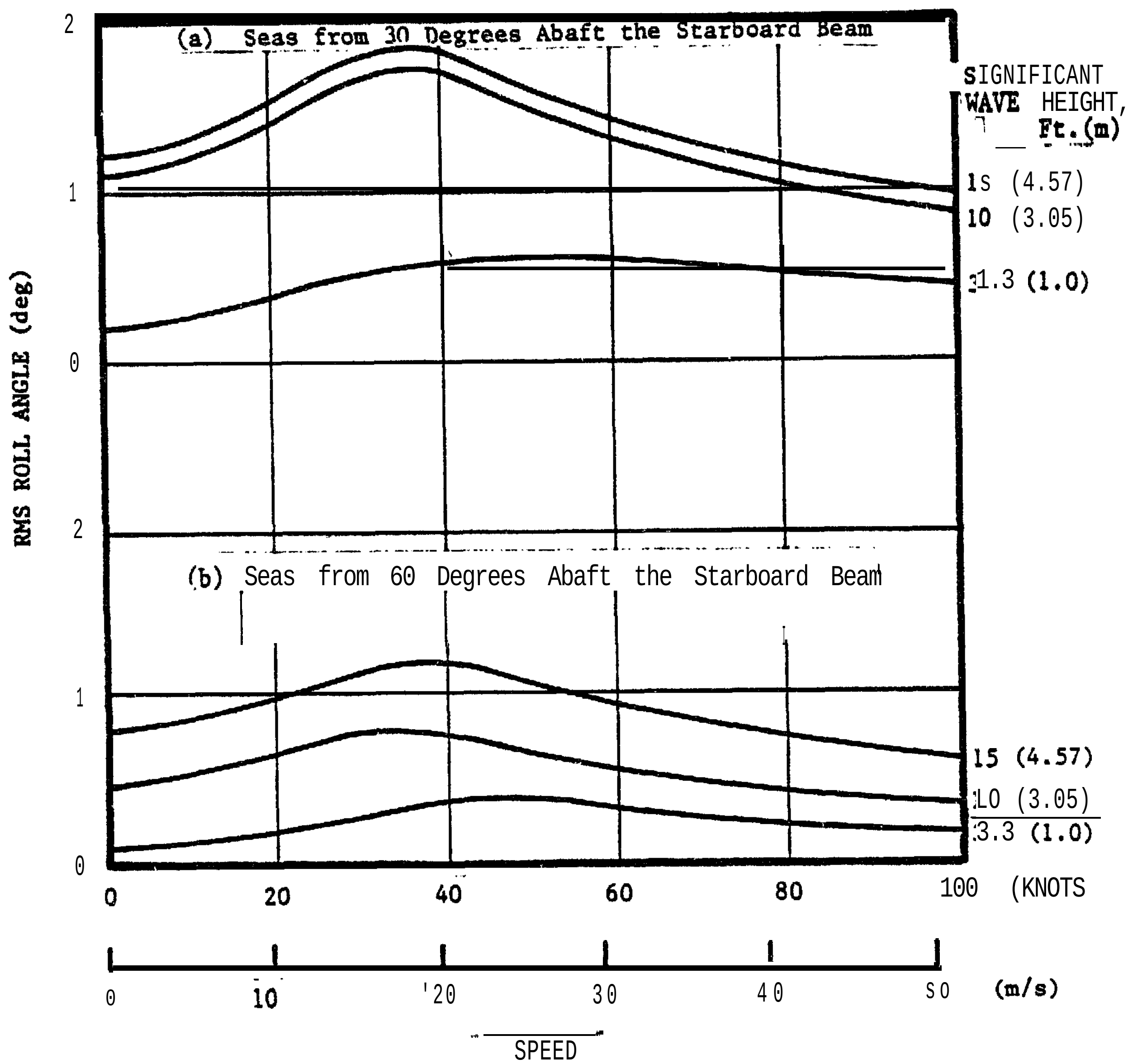


Figure **2.2.5-21(U):** 3KSES Roll Deviation Versus Speed **(U)**

Full Load Displacement (3000 LT; 29,892.1 kN)
Calm Water, On-Cushion

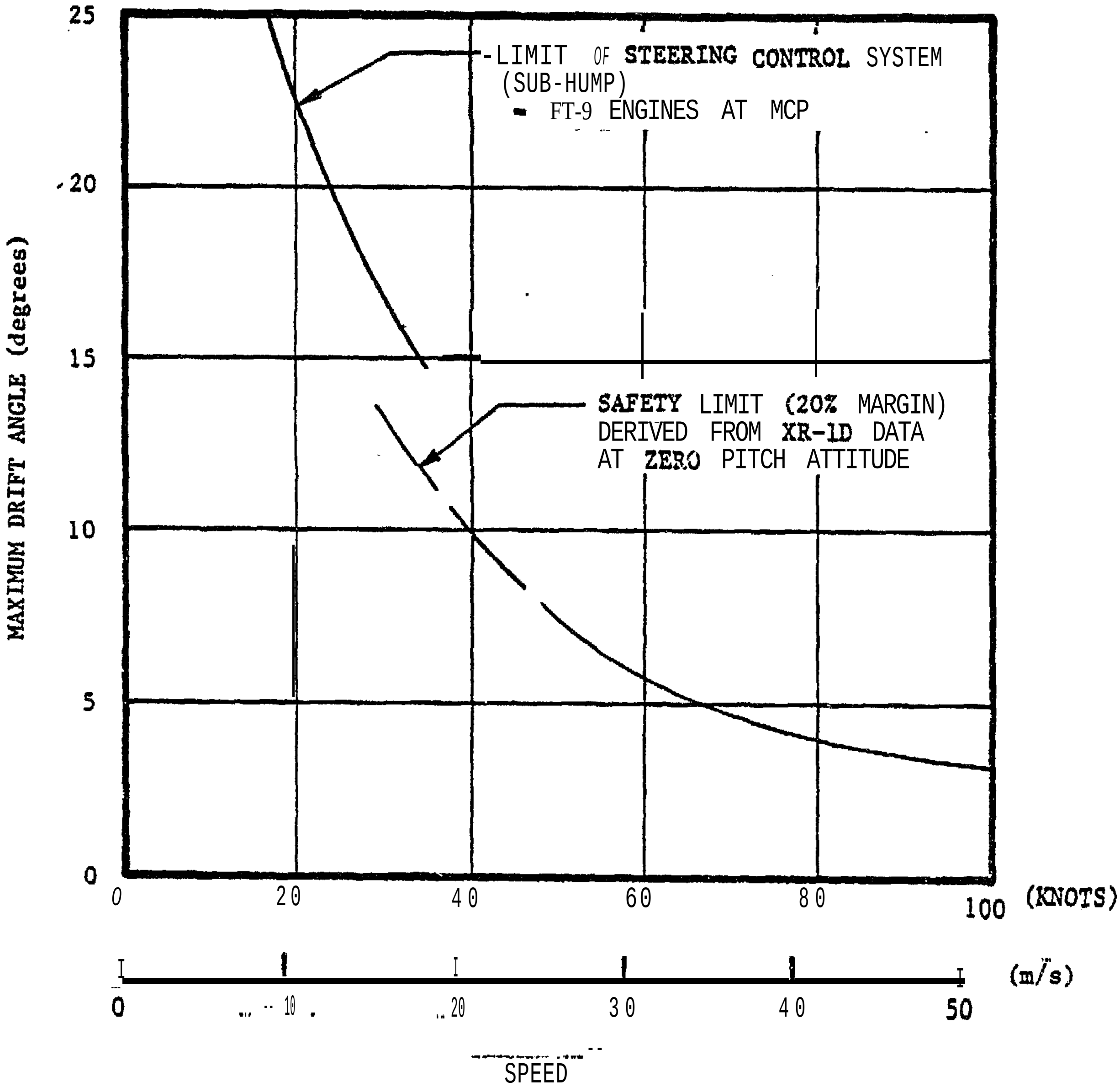


Figure 2.2.5-22 (U): Drift Angle Limit Versus Speed (U)

(U) 2.2.6 GEOMETRIC FORM -- The geometric form of near term SES is described by the hull lines and the control surface drawings of this section.

(U) 2.2.6.1 Hull Geometry -- The selection of the hull form is based on judicious compromises between overall hullborne and cushionborne performance; structural strength; manufacturing economy; volumetric requirements; combat suite; safety, survivability and efficiency of ship operations. The net result is shown in the lines drawing, Figure 2.2.6-l.

(U) The sidehull geometry is based on the effects of deadrise and ventilation cutouts on the overall hydrostatic and hydrodynamic performance parameters, bow seal interface, waterjet inlet configuration and structural atrength requirements. Hydrodynamic drag considerations have influenced the choice of a slender body sidehull concept.

(U) The full-length sidehulls enclose the sides of the bow seal, decreasing seal vulnerability to damage as compared with exposed bag and finger seal systems on partial-length sidehulls. The full-length sidehull vertical inner face also permits a simple bow seal/sidehull interface and allows the use of a two dimensional, modularized bow seal system.

(U) 2.2.6.2 Principal Dimensions -- The principal dimensions, as related to the proportions and form characteristics of the sidehulls and the centerbody, are based on the following considerations:

- Provision for the required cushion area in conjunction with space requirements for main propulsion machineries and waterjet inlets. The Panama Canal transit requirement established the maximum beam of 108 feet (32.918 m). The trace of the maximum beam follows 4 feet (1.219 m) above the upper chine and is canted inboard to the main deck and 01 level. The nominal tumblehome at Station 10 is 3 feet 7 inches (1.092 m).

- The overall length of 266 feet 3 inches (81.153 m) was established from the maximization of performance parameters as related to cushion length to beam ratio, bow and stern seal geometry design, overall utility, and volumetric requirements.

- The wet deck height was selected at 18 feet (5.486 m) above baseline to minimize wetdeck slamming and cushion induced dynamic response, The wet deck is horizontal except forward of Station 4 where it ramps upward to minimize pitch induced slam loads and to provide a flat interface with the forward seal in its retracted position,

- The selection of main deck height at 40 feet 0 inches (12,192 m) above baseline was based on requirements of hull girder strength, reserve buoyancy in damage situations, and overall volumetric and space demands. The high main deck also provides a drier environment for engine air intakes and for helicopter operation, relative to lower main deck configurations that were evaluated.

(U) 2.2.6.3 Control Surfaces -- The baseline design of the near term ANVCE SES incorporates two stern-mounted stabilizing fins, port and starboard, canted 28 degrees inboard from the bottom of the fence, as shown in Figures 2.2.6-l and 2.2.6-2. Fin section geometry is shown in Figure 2.2.6-3.

1. PRINCIPAL HYDROSTATIC PARAMETERS (OFF CUSHION)

BLOCK COEFFICIENT (C,), FULL LOAD	= 0.1662
PRISMATIC COEFFICIENT (Pc), FULL LOAD	= 0.8341
NETTED SURFACE, FULL LOAD	= 18,440 FT^2 (1713 m^2)
TRANSVERSE KM, FULL LOAD	= 273.81 FT (83.45 m)
VERTICAL CENTER OF BUOYANCY (KB)	= 10.62 FT (3.24 m)
TONS PER INCH IMMERSION (TPI)	= 43.91 TONS/INCH (17.23 kN/m)
LONGITUDINAL CENTER OF FLOTATION (LCF) (FROM FP)	= 137.11 FT (41.79 m)

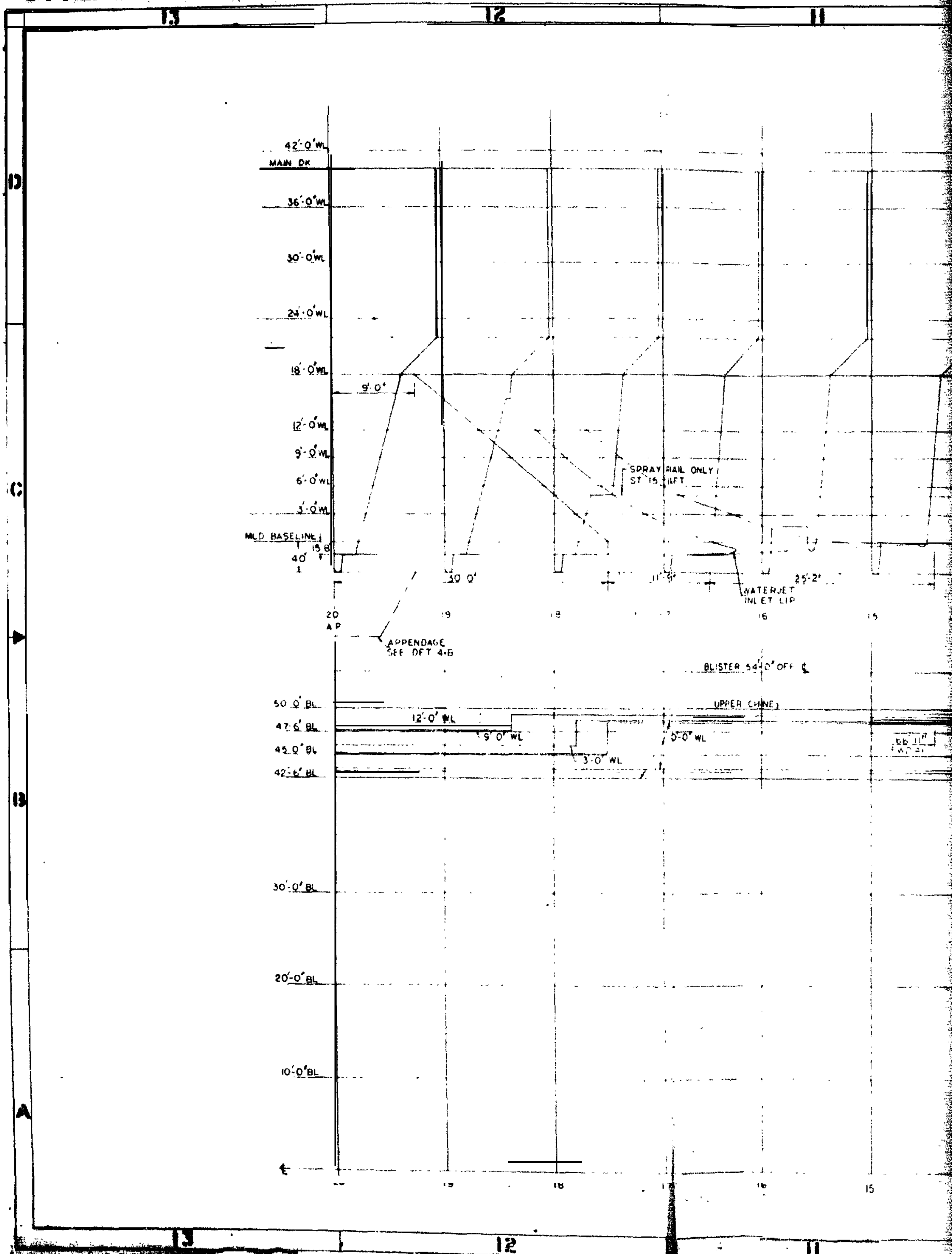
2. PRINCIPAL HYDRODYNAMIC PARAMETERS (ON CUSHION)

CUSHION LENGTH	= 221 FT (67.36 m)
CUSHION BEAM	= 85 FT (25.91 m)
CUSHION HEIGHT	= 18 FT (5.48 m)
LONGITUDINAL CENTER OF GRAVITY (FWD OF TRANSOM)	= 118 FT (35.89 m)
CUSHION LENGTH/BEAM	= 2.60
CUSHION BEAM/HEIGHT	= 4.72

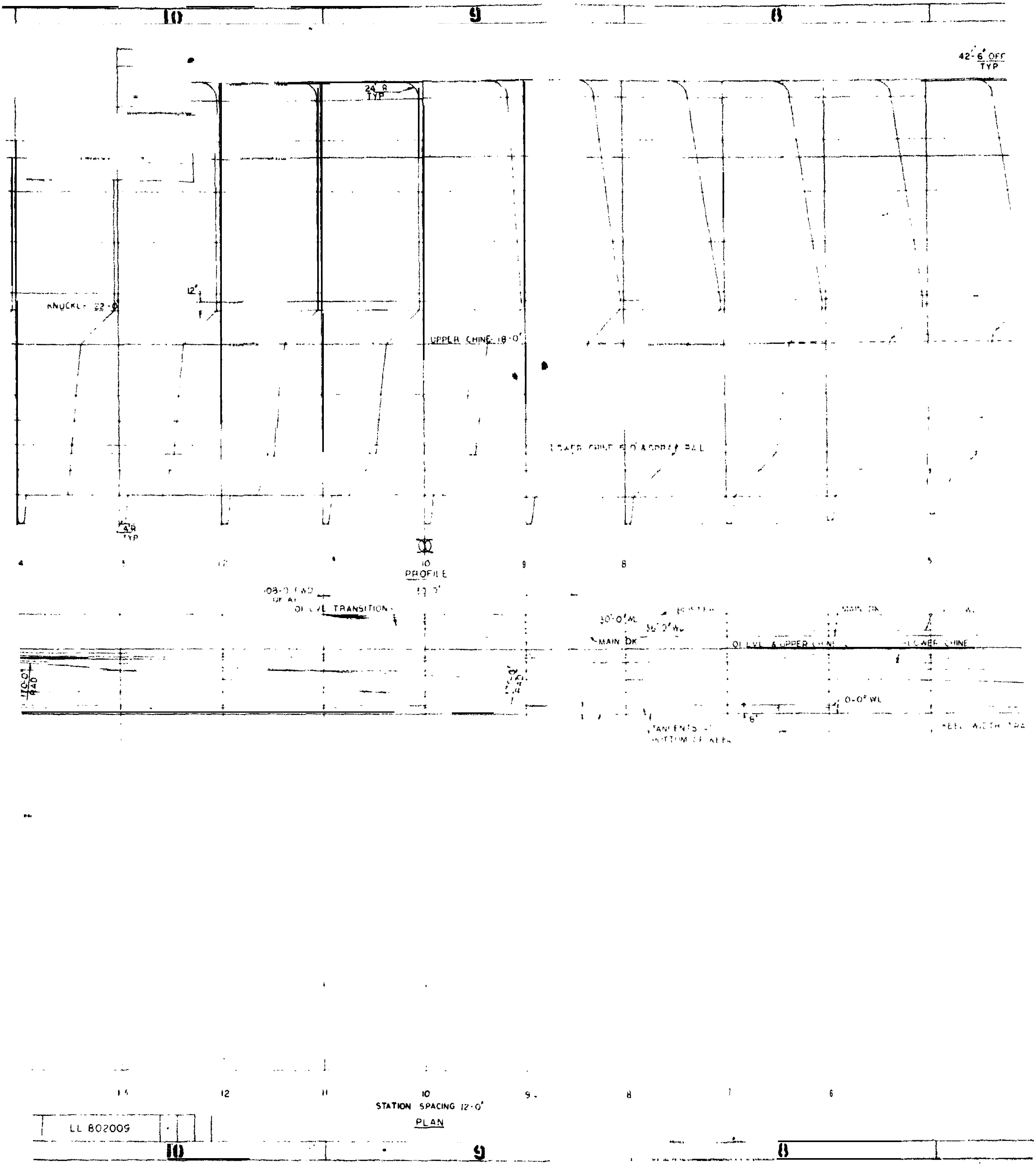
(ρ_{SW} = 1.025 METRIC TON/CU m)

Figure 2.2.6-1 (U): ANVCE-SES Hull Lines Drawing LL802009 (Sheet 2 of 2)

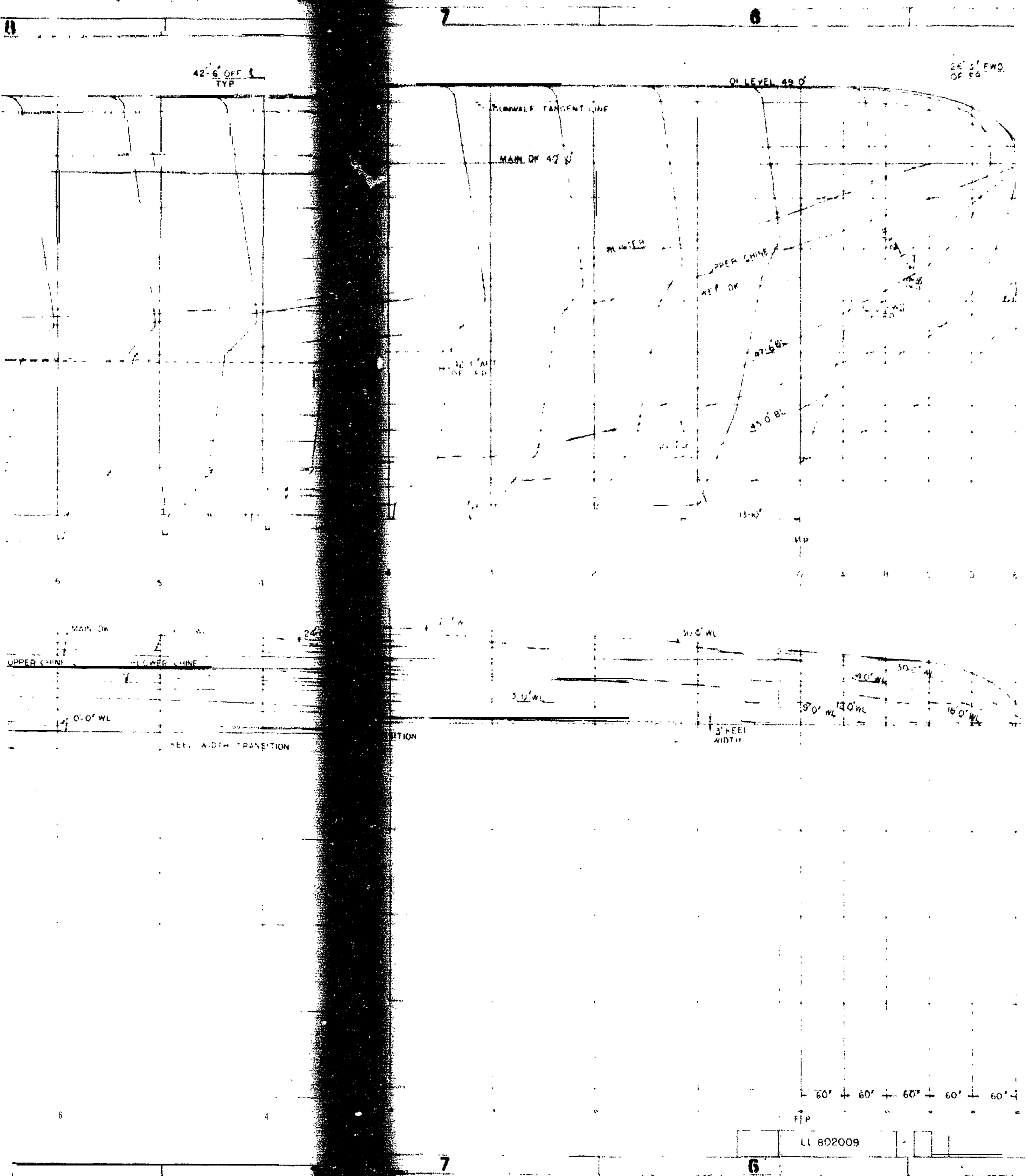
UNCLASSIFIED

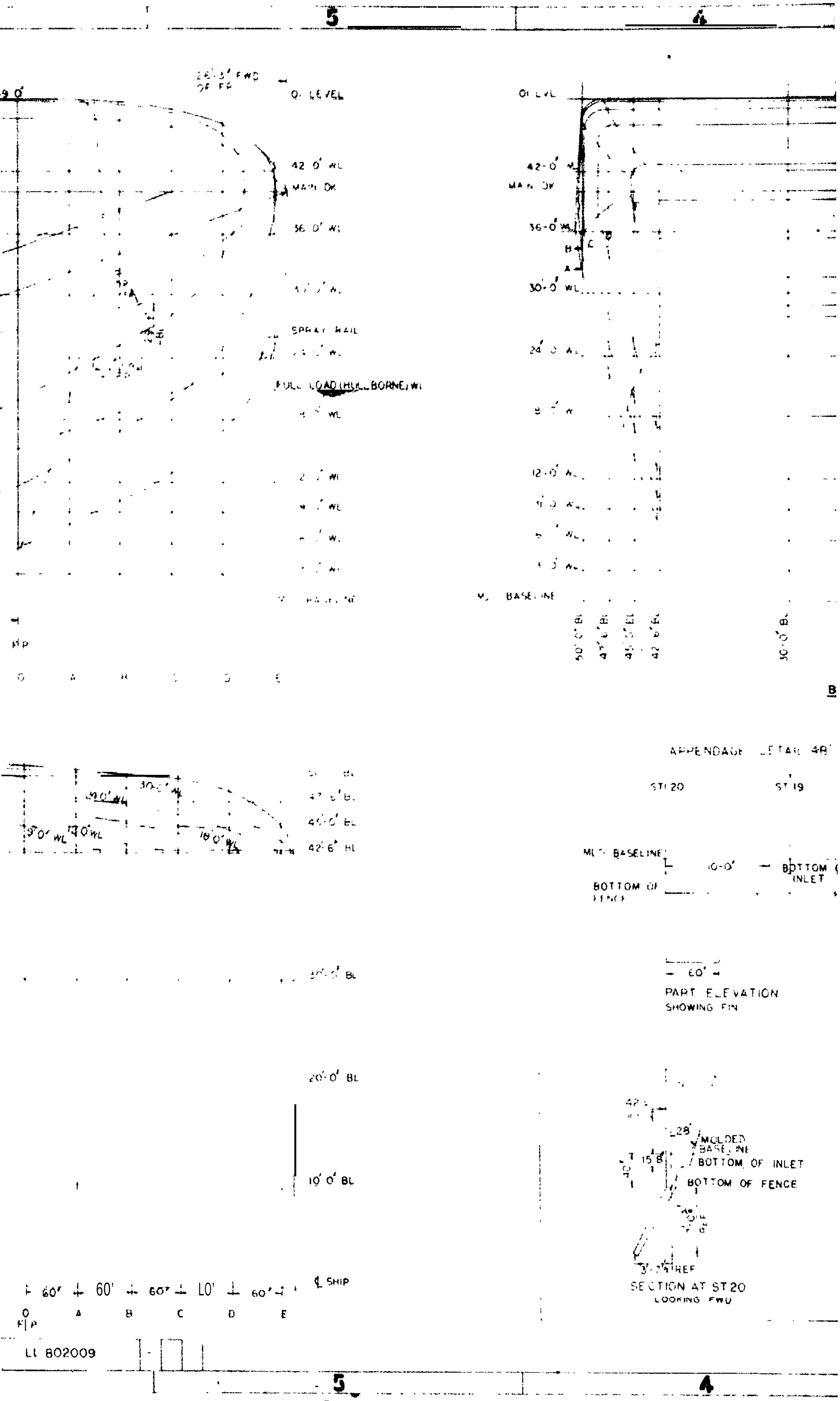


UNCLASSIFIED



10
9
8
42'-6" OFF
TYP
24" R
TYP
KNUCKLE 22'-0
12"
UPPER CHINE 18'-0"
PROFILE
OI LVL TRANSITION
30'-0" WL
36'-0" WL
MAIN DK
OI LVL & UPPER CHINE
LOWER CHINE
0-0" WL
STATION SPACING 12'-0"
PLAN
LL 802009

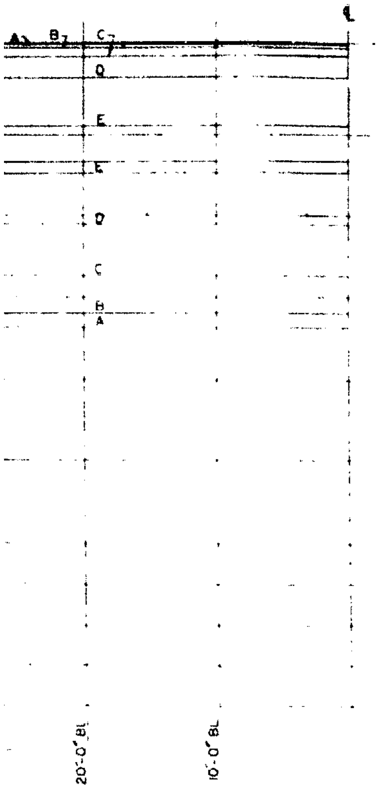

42'-6" OFF ℄ TYP
01 LEVEL 49'0"
GUNWALE TANGENT LINE
MAIN DK 41'0"
26'3" FWD OF FP
UPPER CHINE
WET DK
47'6" BL
45'0" BL
FP
MAIN DK
UPPER CHINE
LOWER CHINE
0'-0" WL
KEEL WIDTH TRANSITION
30'0" WL
5'0" WL
9'0" WL
13'0" WL
18'0" WL
3' KEEL WIDTH
60' 60' 60' 60' 60'
FP
LI 802009



5
4
01 LEVEL
42-0' WL
36-0' WL
30-0' WL
SPRAY RAIL
FULL LOAD (HULLBORNE) WL
12-0' WL
BASELINE
APPENDAGE DETAIL
ST 20
ST 19
BOTTOM OF FENCE
BOTTOM OF INLET
PART ELEVATION
SHOWING FIN
42-6" BL
30-0' BL
20-0' BL
10-0' BL
MOLDED BASELINE
BOTTOM OF INLET
BOTTOM OF FENCE
SECTION AT ST 20
LOOKING FWD
℄ SHIP
0 A B C D E
F P
LL 802009

3

ALL A REVISED TO INCORPORATE ECN NO L00003



BODY PLAN OF FWD STATIONS

PRINCIPAL DIMENSIONS

LENGTH OVERALL	266'-3"
LENGTH BETWEEN PERPENDICULARS	240'-0"
BEAM MAXIMUM	108'-0"
DEPTH MOLDED TO MAIN DK	40'-0"
DEPTH MOLDED TO 01 LEVEL	49'-0"
DEPTH MOLDED TO WET DK	18'-0"
DRAFT MLD FULL LOAD (HULLBORNE)	20'-11"
DRAFT NAV FULL LOAD (HULLBORNE)	31'-3½"
DISPL MLD SW (20'-11" WL)	3000 LTONS

NO	DWG NO	TITLE

REFERENCES

LSES
HULL LINES

LL 802009 A

SCALE ⅛" = 1'-0"

Figure 2.2.6-1

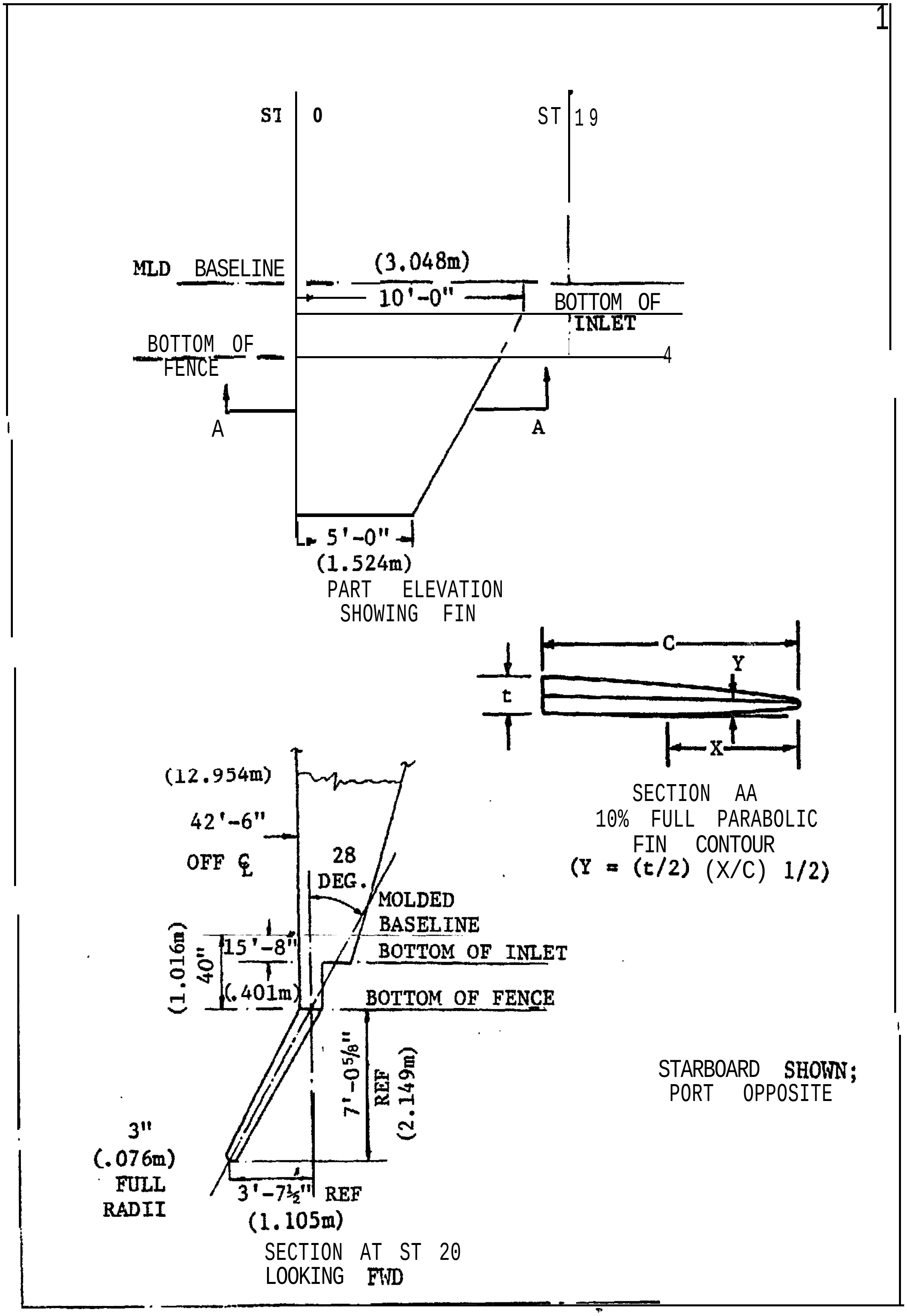


Figure 2.2.6-2 (U): Baseline Stabilizer Fin Geometry (U)

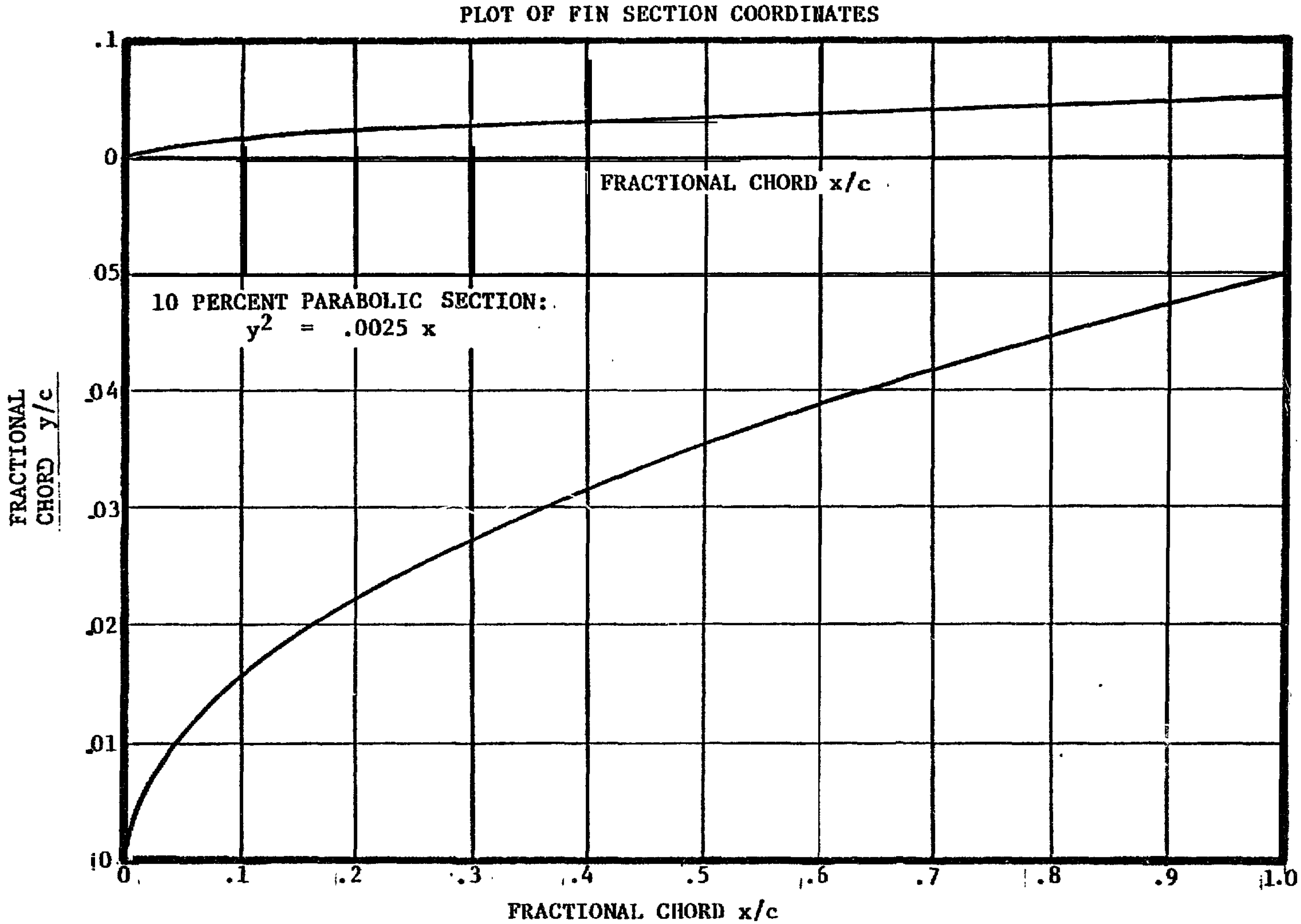


Figure 2.2.6–3 (U): Fin Section Geometry (U)

(U) 2.2.7 RIDE QUALITY

2.2.7.1 Near Term SES Ride Criteria -- Near term SES high speed operation in high sea states can result in vertical vibration modes not previously sustained by man over long periods of time. While considerable data exist on vibratory effects upon man, the heave acceleration environment of the near term SES centers in a portion of the frequency regime for which characterizing data are sparse. Certain near term SES resonances are predicted between 0.1 Hz and 5 Hz in the pricise range where human performance capability is most affected; primarily because the human body resonates at about 5 Hz., and because sailors may become seasick when ship motions traverse 0.1 to 0.5 Hz at energy levels above 0.06 g's (rms).

(U) The primary purpose of developing a ride criteria is to establish the motion limits that can be tolerated by operations, maintenance and off-duty crew for specific mission durations. The importance of these criteria is to ensure a reasonable level of operating efficiency if craft motions are maintained at or below the limits.

(U) The curves illustrated in Figure 2.2.7-1 were established from a comprehensive literature search by overlaying graphical data representing human performance decrement studies. The search encompassed hundreds of previous motion studies, experiments and simulations related to the adverse effects of vibratory environments on human performance. These data form the data base for the ride criteria, categorized by specific task type and correlated by rms g's versus the center frequencies of the one-third octave band. Although considerable vibration data and criteria exist above 1 Hz, very little is available to describe the effects on humans between 0.1 and 1 Hz. This influences the ride criteria since the predicted near term SES heave acceleration environment tends to center in this portion of frequency regime.

(U) Although the data points cover vastly different conditions and show varying degrees of performance or motion sickness, trends were established for short term and long term conditions. Trend lines were compared with all other data points and with previously developed habitability criteria to establish firm ride criteria.

(U) The present ride criteria represent 30 minute and 4 hour duration tolerance limits for adapted crews with ten to twenty percent expected performance decrement. In the frequency region of 0.1 to 0.5 Hz, ten percent of the crew could be expected to have some motion sickness. The actual task performance decrement of one of the ten percent displaying sickness might mean slower performance, increased errors or complete non-performance of assigned duties.

(U) The identification of the kind and level of performance decrement expected must consider the specific tasks to be performed. The reduced tolerance between 1.0 and 10 Hz refers primarily to tracking tasks decrement. The operation of a decimal input device (with proper arm support and restraints) would suffer no performance decrement at motion levels near or even slightly above the ride criteria curves.

(U) 2.2.7.2 Near Term SES Ride Quality – Figures 2.2.7-2 through 2.2.7-5 present the frequency spectra of the heave acceleration levels at an amidship station with the ride control system both on and off. The power expenditure to control the ride is tabulated in Figures 2.2.7-4 and 2.2.7-5.

(U) The influence of the ride control. system on the RMS heave acceleration levels at a speed of 60 knots (30.87 m/s) and 6.9 feet (2.1 m) significant wave height is illustrated in Figure 2.2.7-6. Then in Figure 2.2.7-7 through 2.2.7-13, the RMS vertical plane acceleration levels near the bow, amidship, and at the stern are plotted versus seaway heading for a number of speeds and significant wave heights. These data are based on hydrodynamic model test data collected in the David Taylor Naval Ship Research and Development Center (DTNSRDC) maneuvering basin.

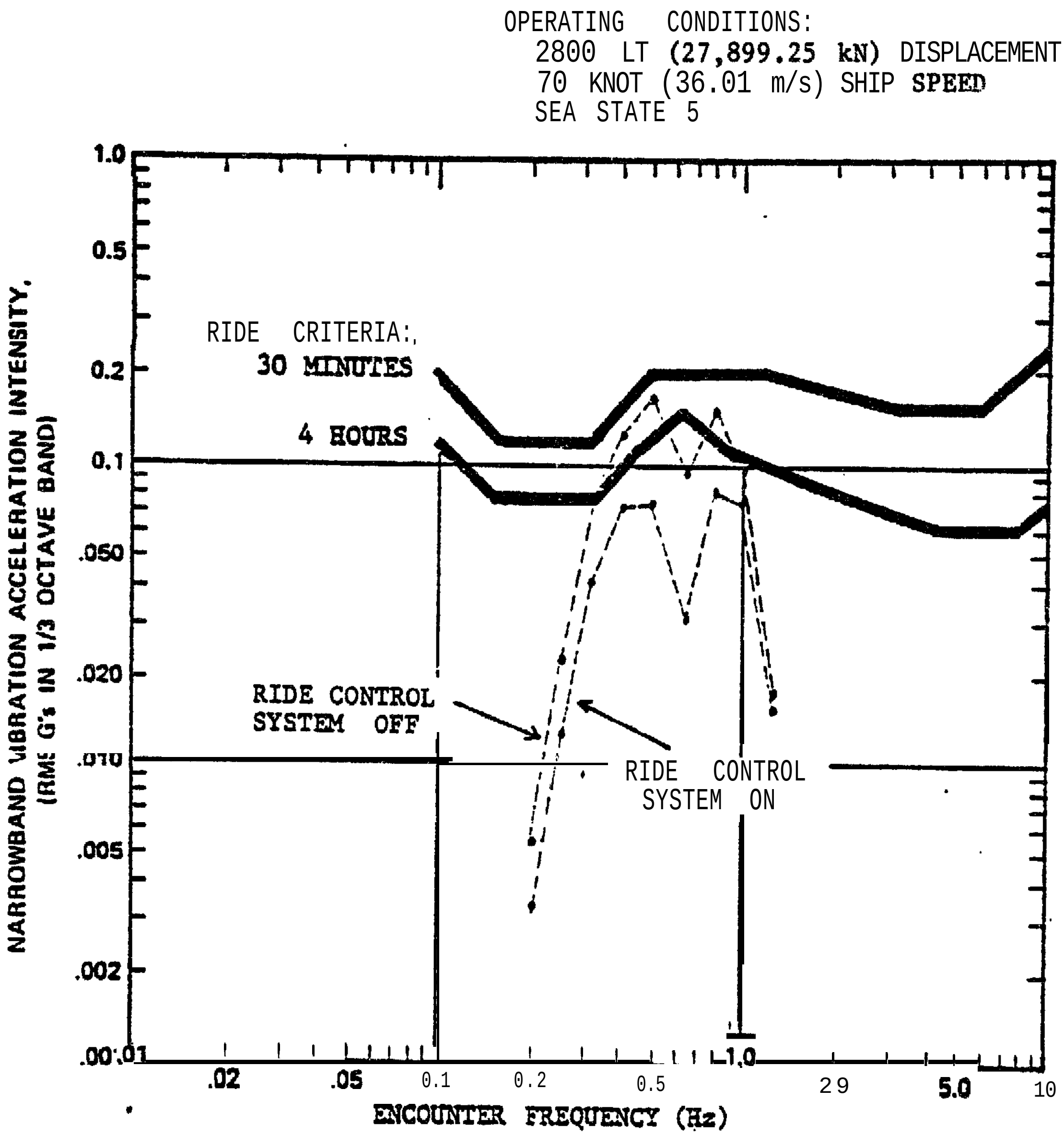


Figure 2.2.7-1 (U) The SES Controls Ship Vertical Motions (U)

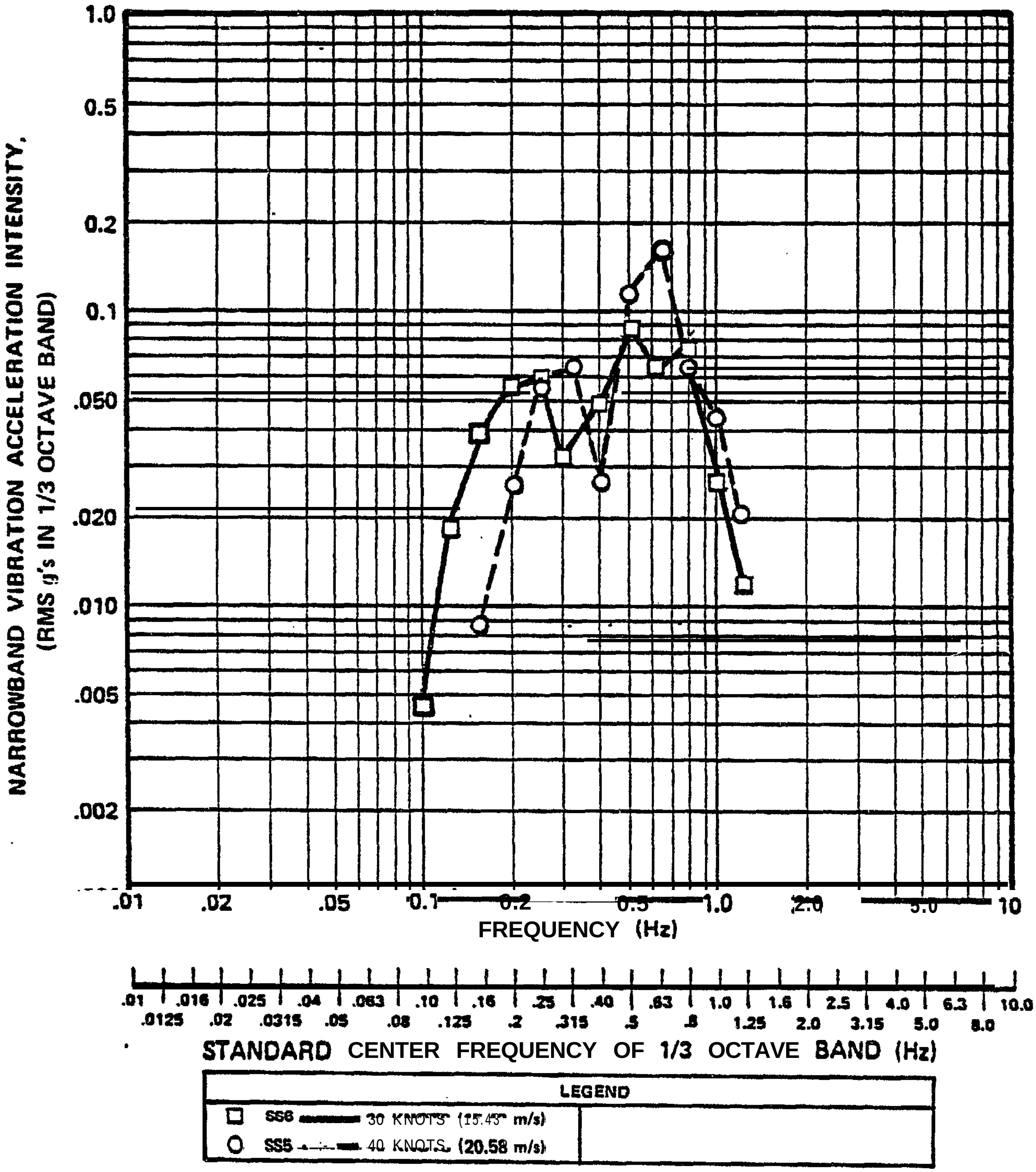


Figure 2.2.7-2 (U): 3KSES Half Fuel Condition (MOD-SO) 2400 LT (23,913.6 kN), Uncontrolled Ride (U)

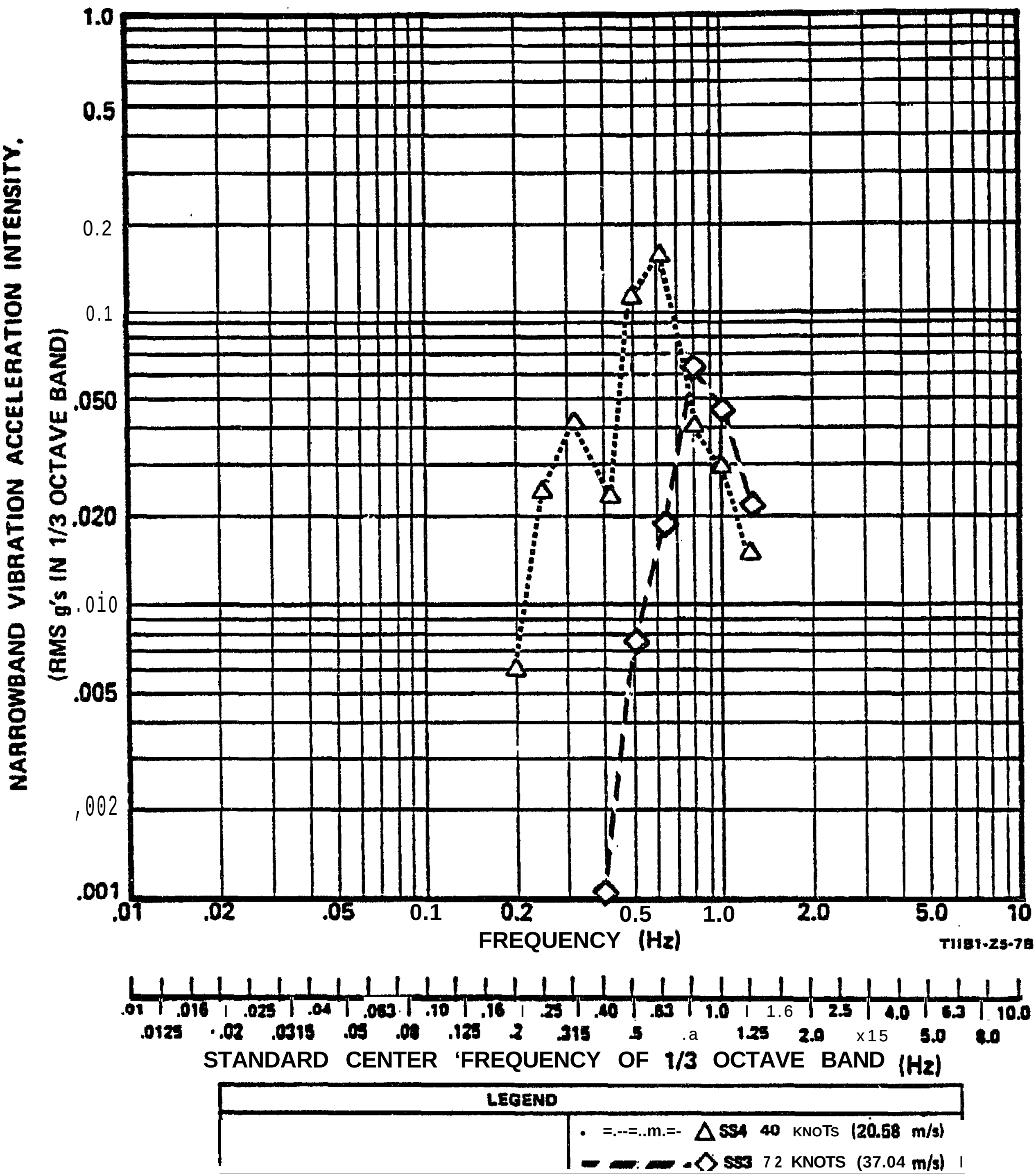


Figure 2.2.7-3 (U): 3KSES Full Load Displacement, 3000 LT (29,892.1 kN) Uncontrolled Ride (U)

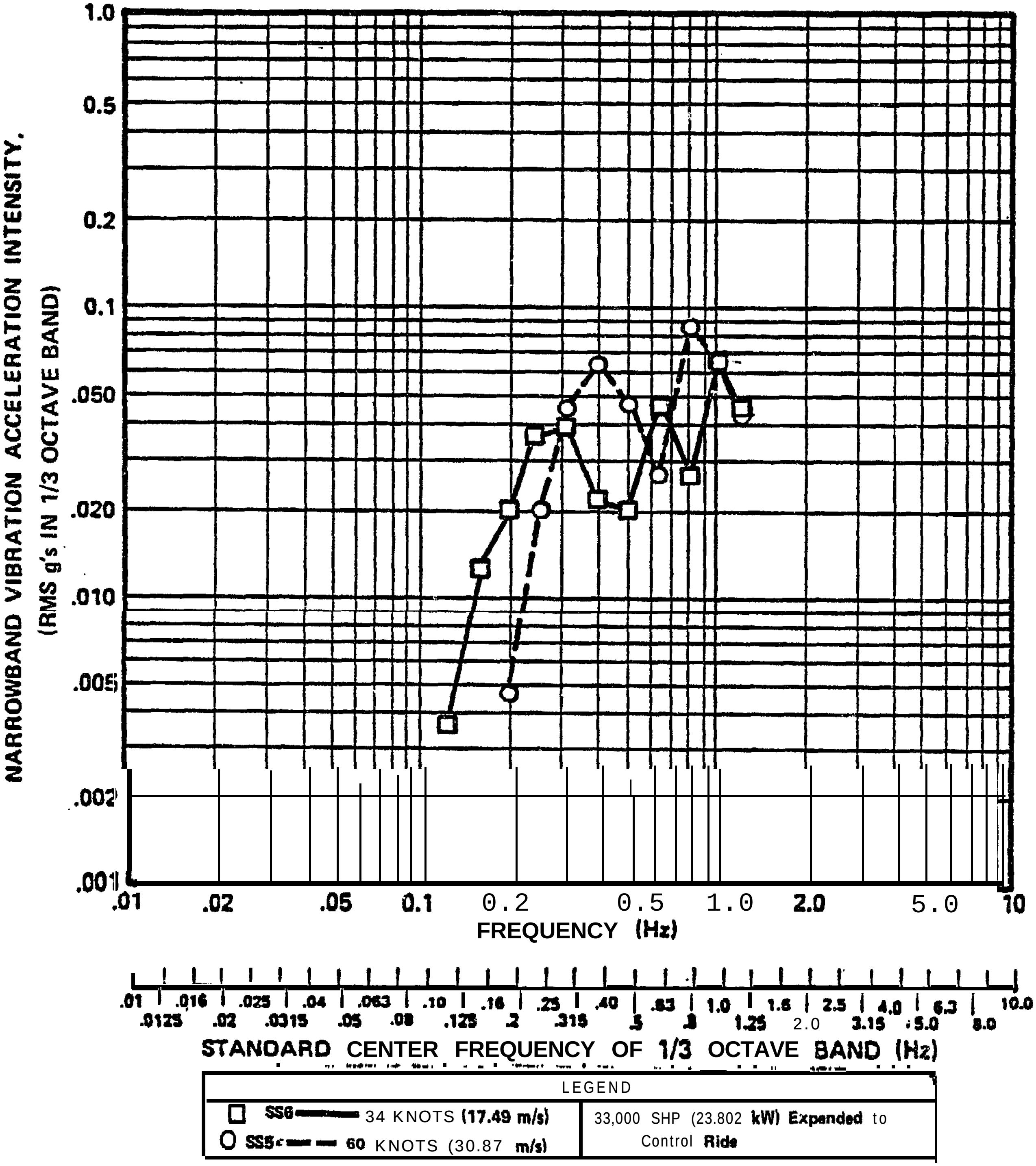
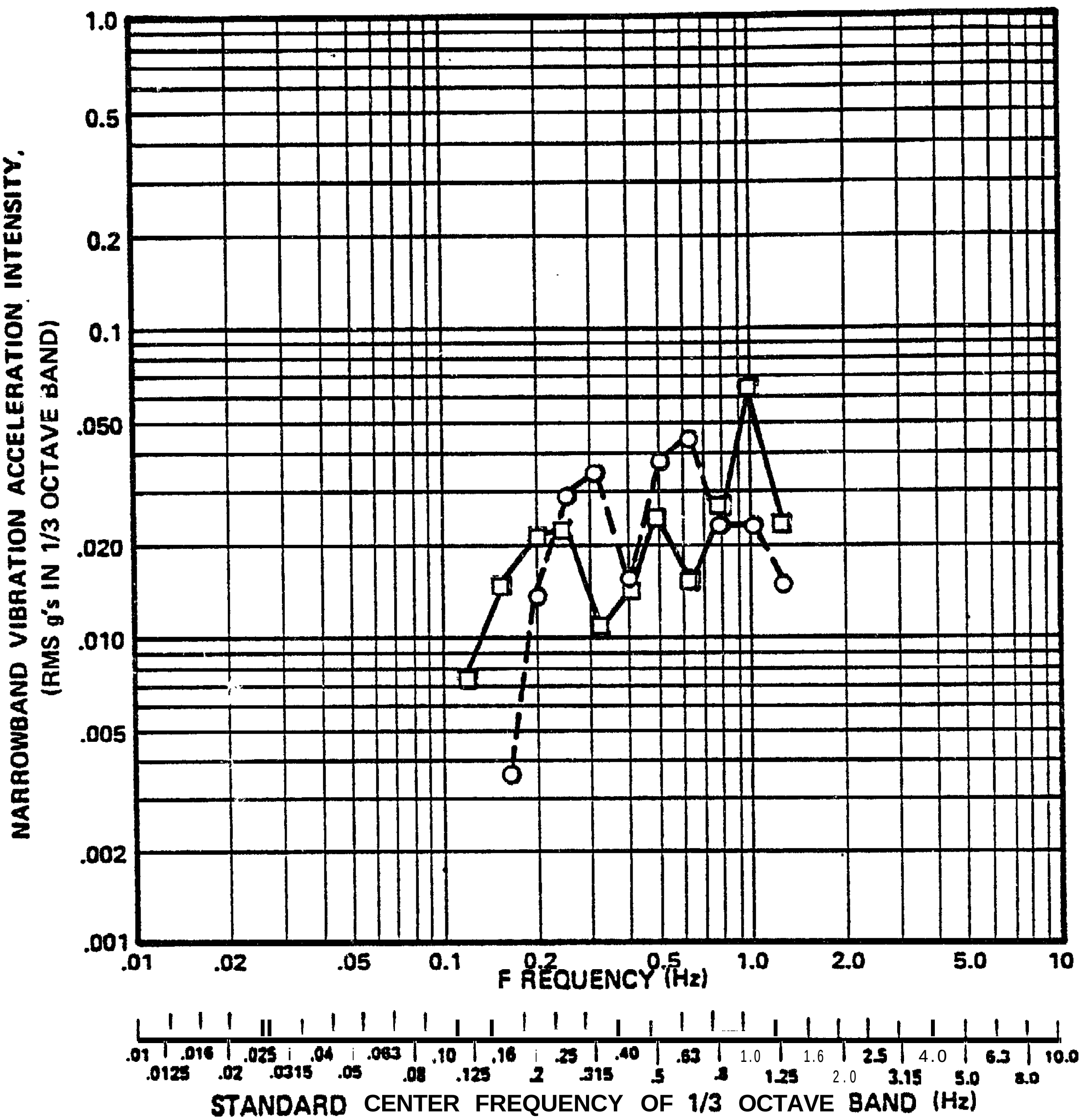


Figure 2.2.7-4 (U): 3KSES Half Fuel Condition (MOD-50) 2400 LT (23,913.6 kN), Controlled Ride (U)



LEGENO	
□ SS6 ——— 30 KNOTS (15.43 m/s)	27,500 SHP (20.507 kW) Expended to Control Ride
○ SS5 — — 40 KNOTS (20.58 m/s)	31,600 SHP (23,564 kW) Expended to Control Ride

Figure 2.2.7-5 (U): 3KSES Half Fuel Condition (MOD-50) 2400 LT (23,913.6 kN), Controlled Ride (U)

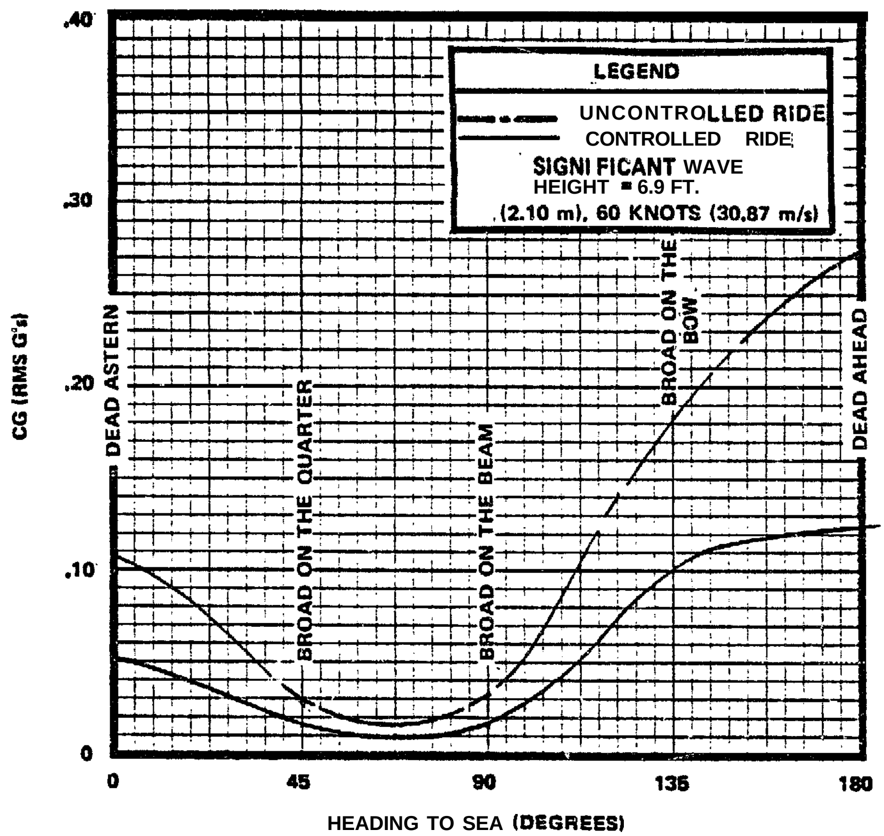


Figure 2.2.7-6 (U) 3KSES Variation in Vertical CG Acceleration with Heading at Full Load Displacement (U)

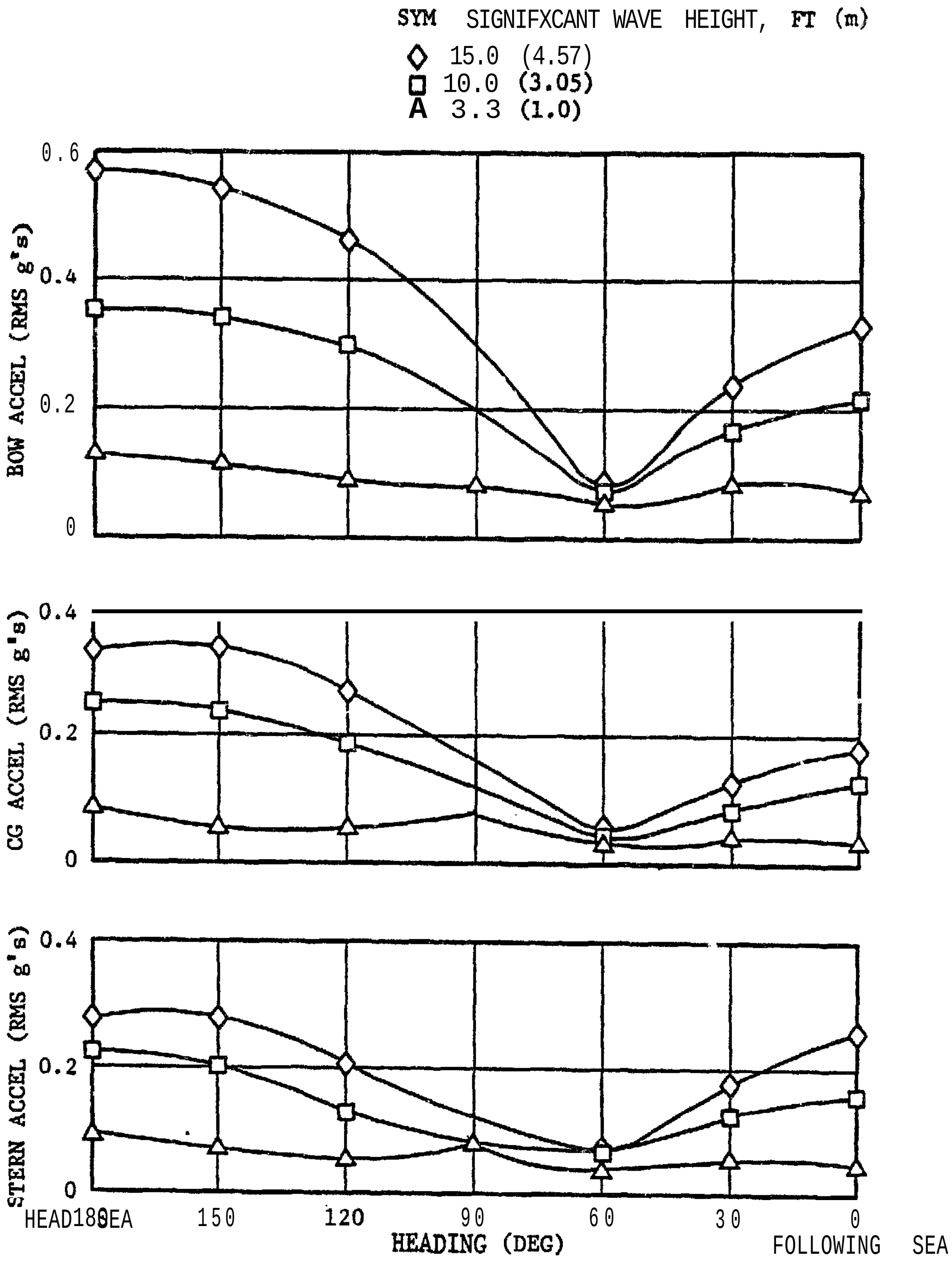


Figure 2.2.7-7 (U): 3KSES Variation of Bow, CG, and Stern Vertical Plane Accelerations with Heading at 60 Knots (30.86 m/s) (U)

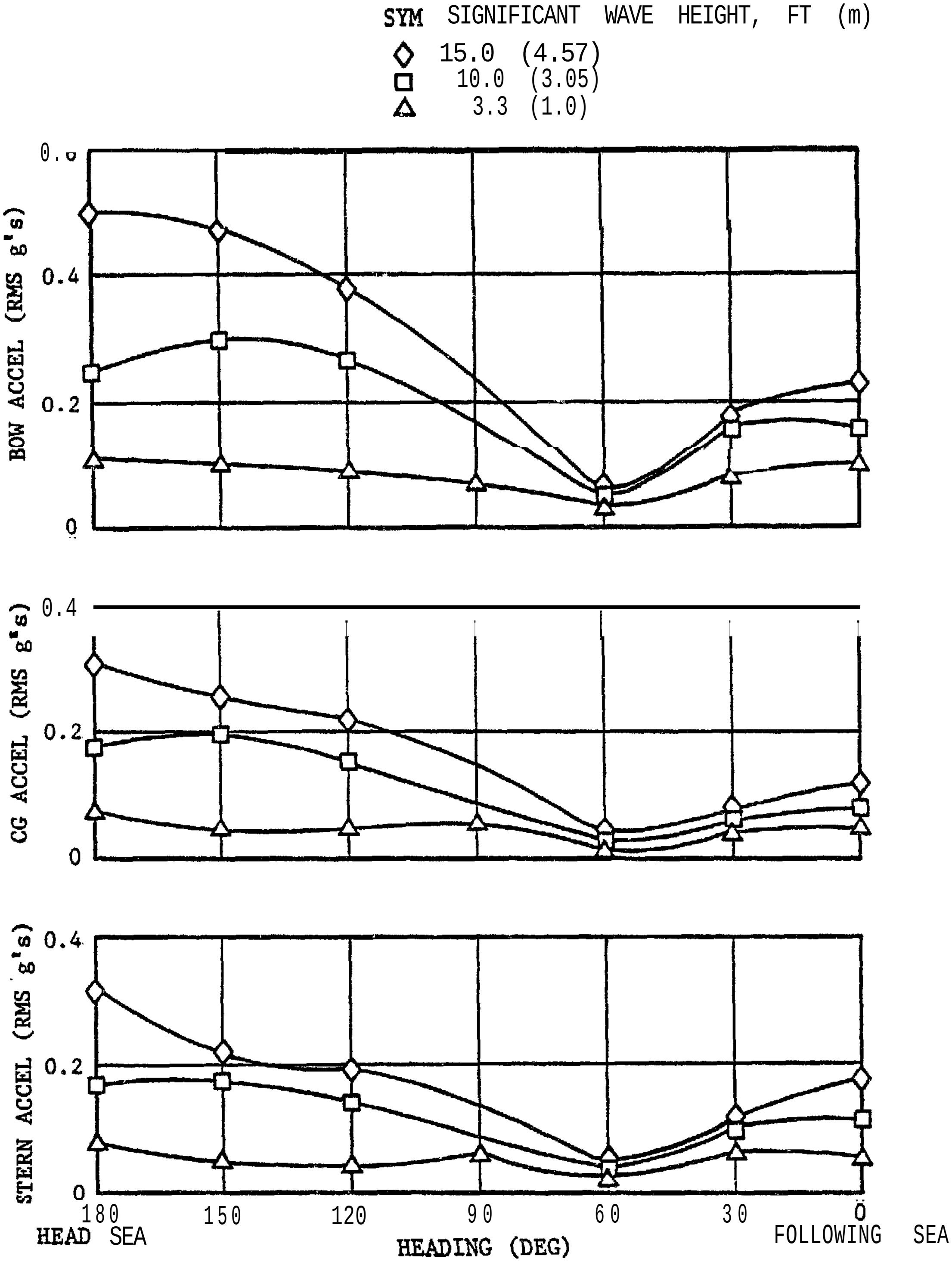


Figure 2.2.7-8 (U): 3KSES Variation of Bow, CG, and Stern Vertical Plane Accelerations with Heading at 50 Knots (25.72 m/s) (U)

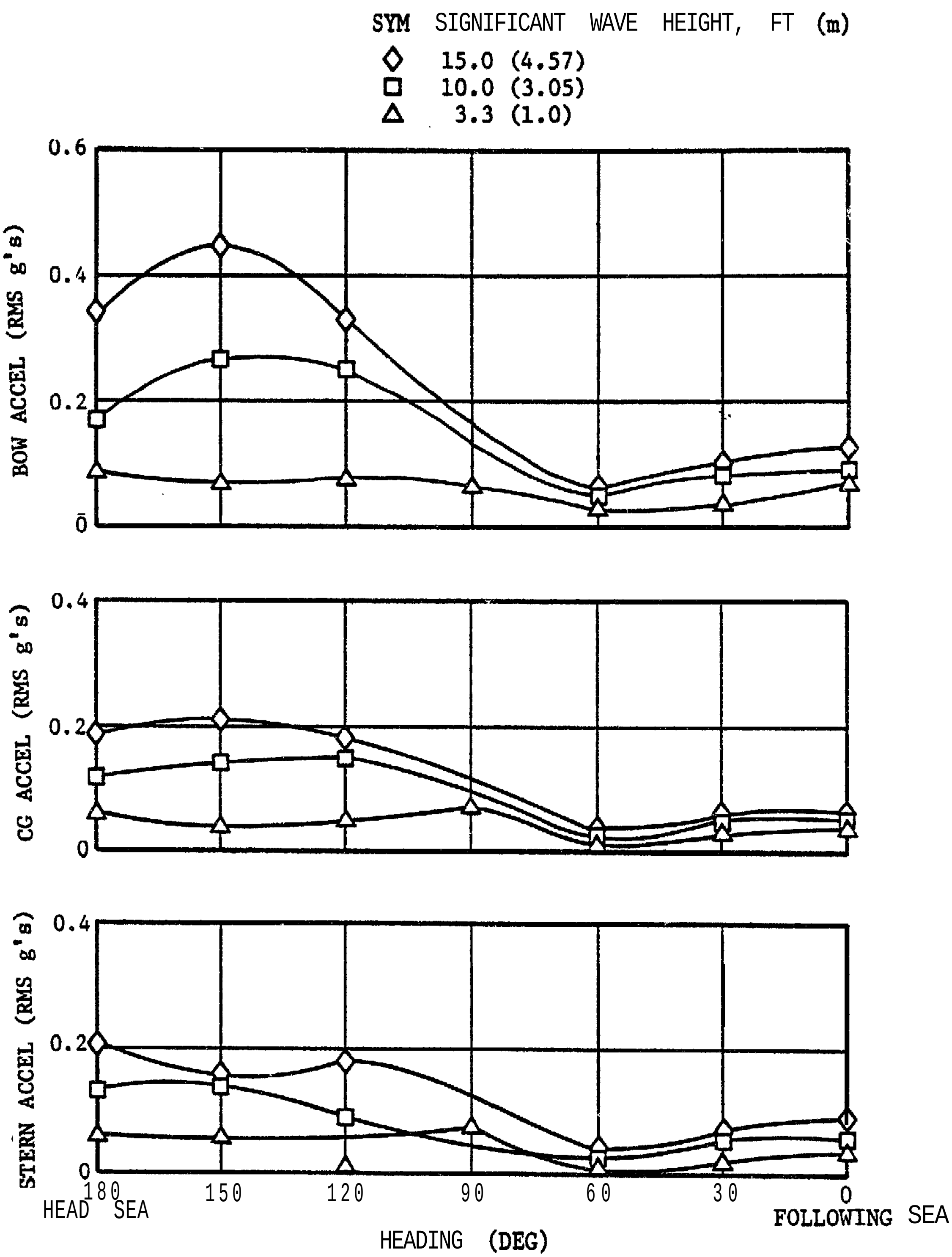


Figure 2.2.7-9 (U): 3KSES Variation of Bow, CG and Stern Vertical Plane Accelerations with Heading at 40 Knots (20.58 m/s) (U)

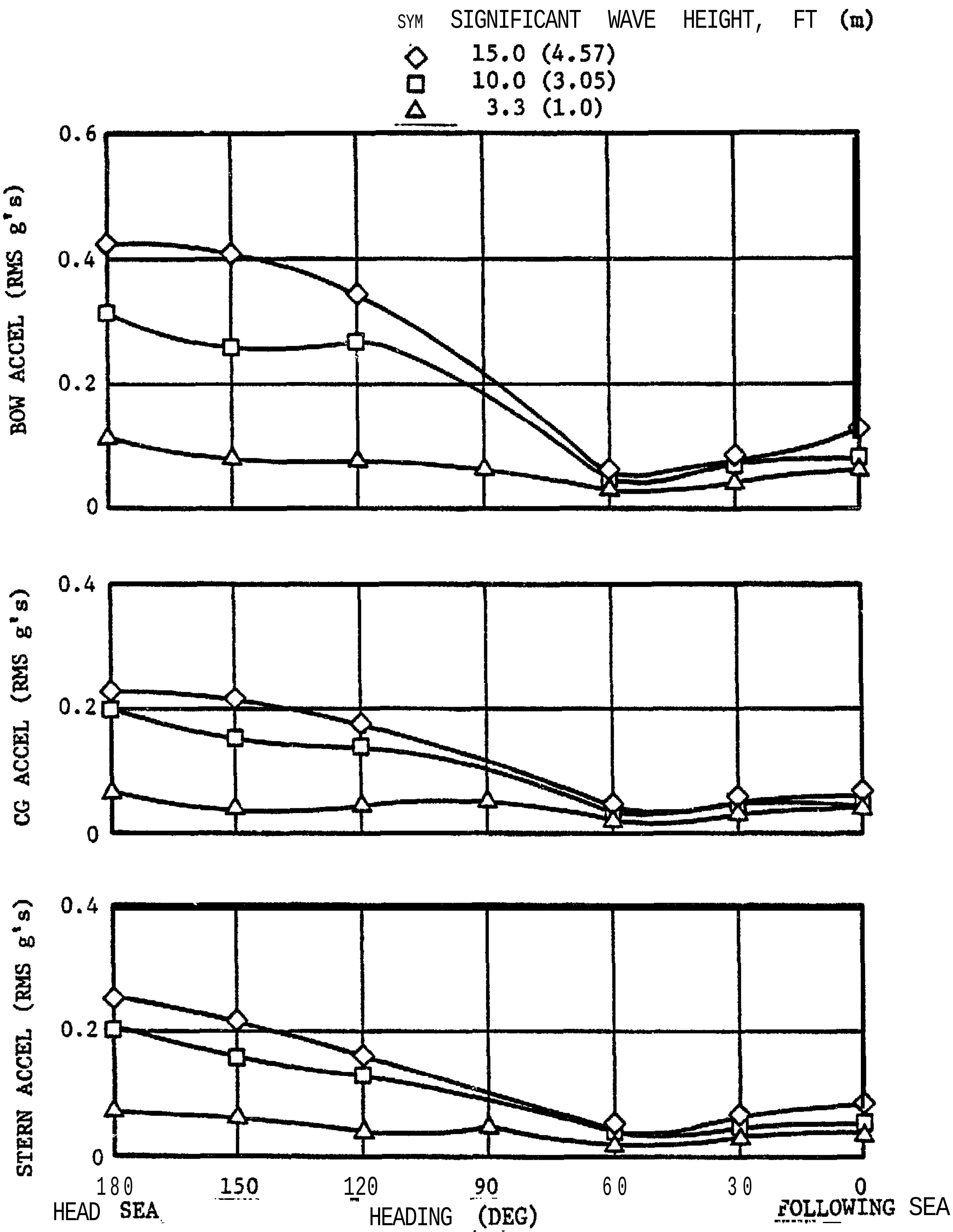


Figure 2.2.7-10 (U): 3KSES Variation of Bow, CG, and Stern Vertical Plane Accelerations with Heading at 35 Knots (18.01 m/s) (U)

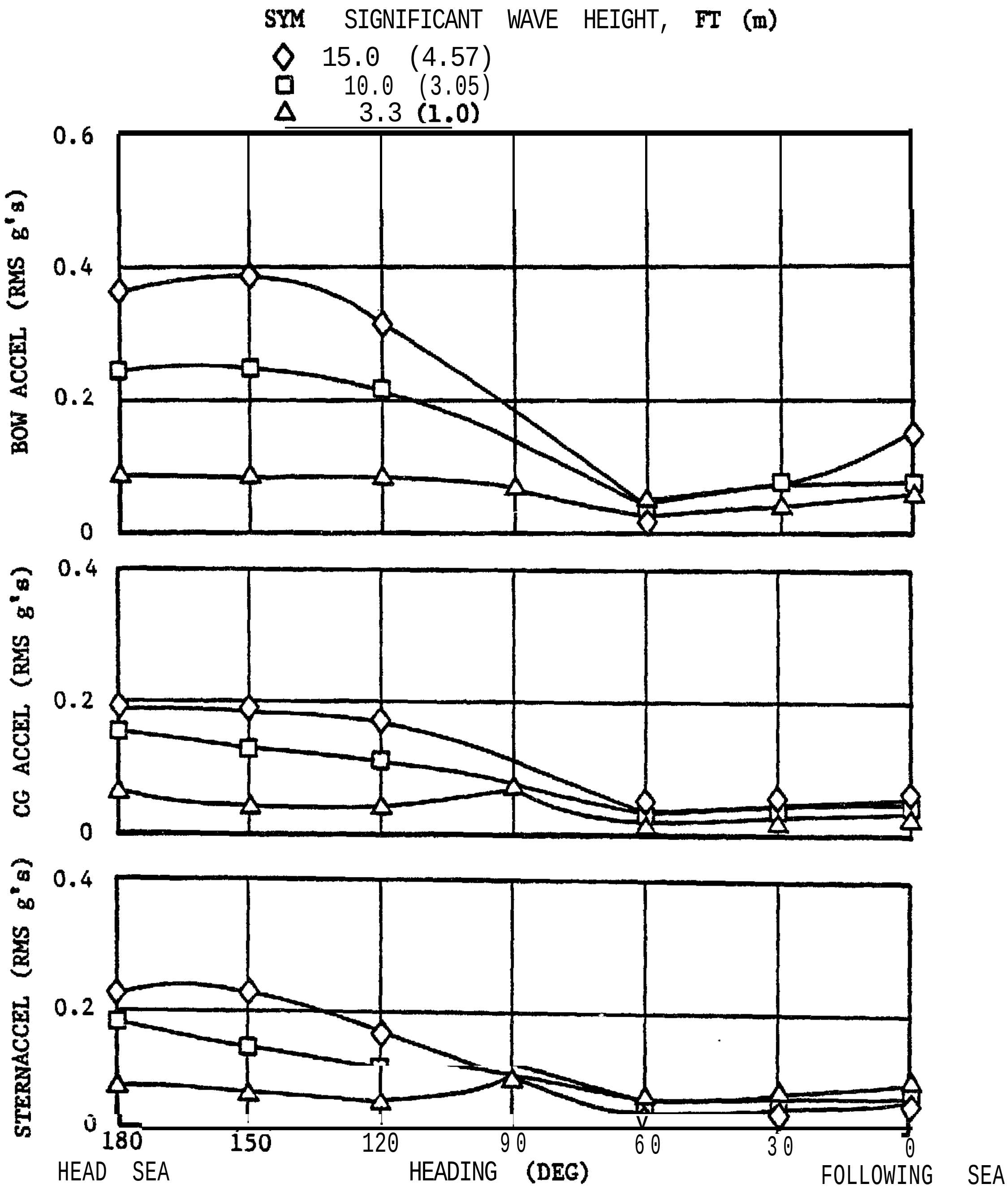


Figure 2.2.7-11 (U): 3KSES Variation of Bow, CC, and Stern Vertical Plane Accelerations with Heading at 32 Knots (16.46 m/s) (U)

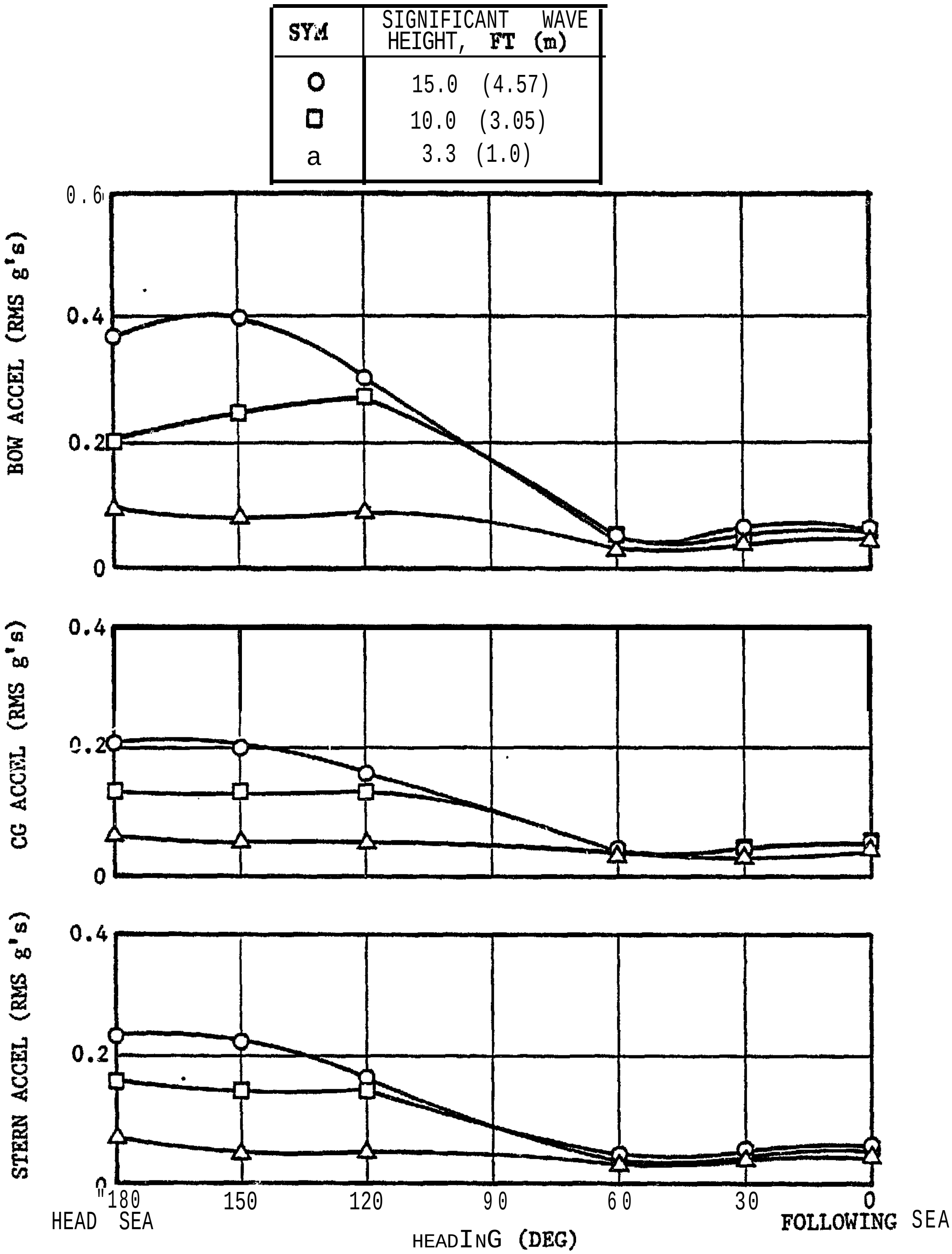


Figure 2.2.7-12 (U): 3KSES Variation of Bow, CG, and Stern Accelerations with Heading at 29 Knots (14.92 m/s) (U)

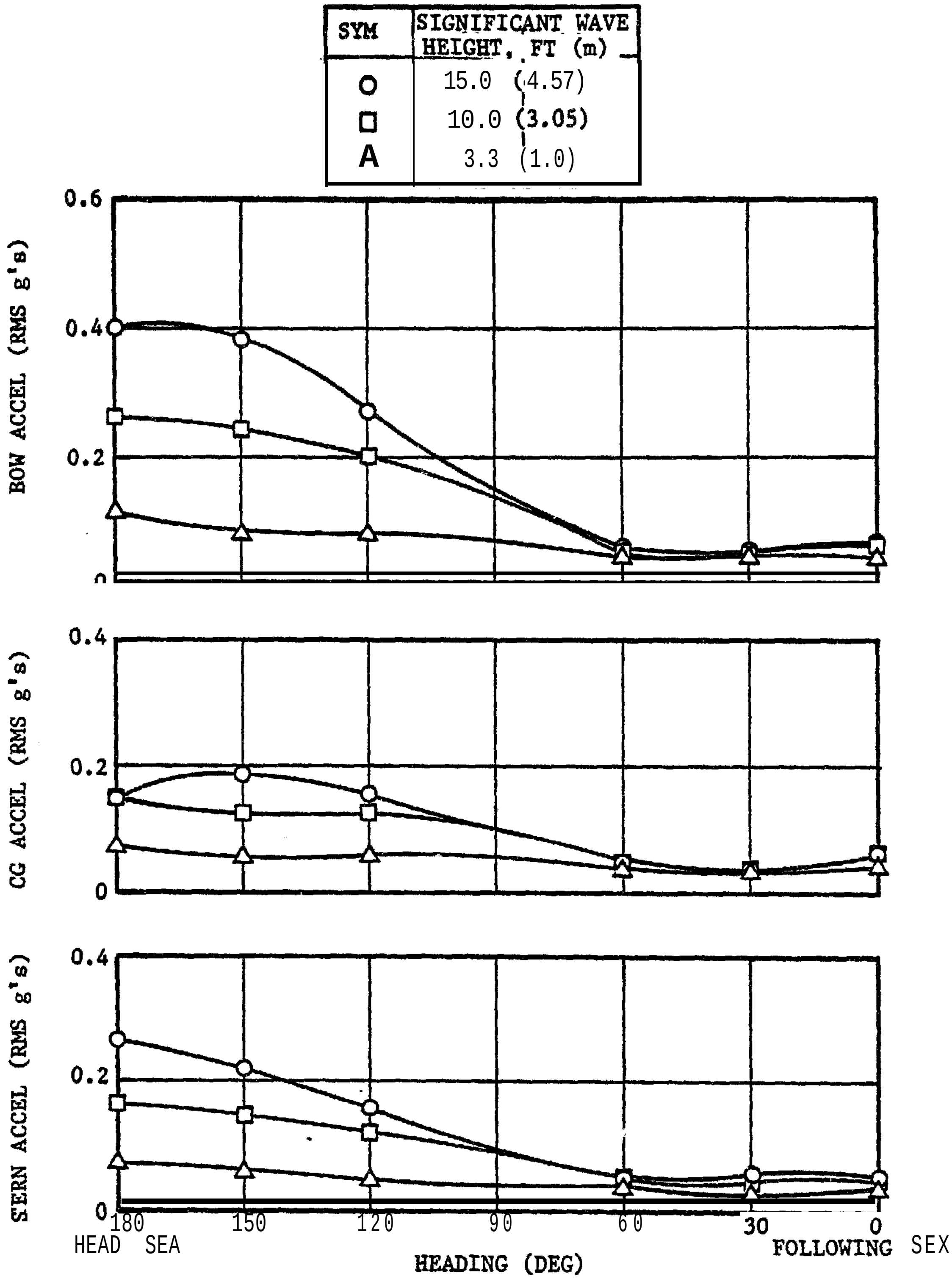


Figure 2.2.7-13 (U): 3KSES Variation of Bow, CG and Stern Accelerations with Heading at 26 Knots (13.38 m/s) (U)

(U) 2.2.8 MANNING

(U) The anning presented herein delineates the minimum quantitative and qualitative personnel essential to the operation, maintenance and support of the near term SES under stated missions and configurations. These requirements are termed Organizational Manning and were developed in general accordance with the "Guide to the Preparation of Ship Manning" document, OPNAV 1OP-23.

(U) The developed manpower requirements are sufficient for performing all operational, maintenance, administration and support tasks required for the near term SES under the following Readiness Conditions: Special Condition I (Battle Readiness) for Anti-submarine operations, Anti-air operations, and Surface operations, Condition IV (Peacetime Cruising Readiness) and Condition V (In-Port Readiness). Table 2.2.8-l displays the manning requirements in the prescribed format.

Table 2.2.8-l (U): Manning **(U)**

	OFFICERS	CPO	OTHER ENLISTED
VEHICLE			
	Commanding Officer	EMC	1 DS1
	Executive Officer	EMC	1 DS2
	Operations Officer	WCS	3 EM2
	First Lieutenant	HMC	I EN1
	Combat Systems Officer	ICC	1 EN2
	Electronics Material Officer	QMC	1 ENFN
	Engineer Officer	RMC	1 ET1
	Damage Control Assistant	SKC	1 ETN2
			1 ETR3
			1 EW2
			1 FTM1
			1 FTM3
			1 GMM2
			1 GMM3
			3 GS1
			I GS3
			1 GSFN
			1 HT1
			1 HTFN
			1 IC2
			1 ICFN
			1 MS1
			1 MS2
			2 MS3
			1 OS1
			1 OS2
			1 OSSN
			I OT1
			1 OT3
			1 SM2
			3 QMSN
			1 RM2
			1 SH3
			1 SK3
			1 YN1
			1 nt3
			6 SN
			1 PN
	08	08	50
SECONDARY VEHICLE			
	Helicopter Pilot	ADJC	1 ADJ1
	Helicopter Pilot		1 AMH1
	Helicopter Co-Pilot		1 AMH3
	Helicopter Co-Pilot		1 ANSI
			1 AT1
			1 AT3
			1 AE1
			1 AX2
			2 AW2
			2 AW3
			1 AO2
			1 AN
	04	01	14
TOTAL COMPLEMENT			
	12	09	64
		GRAND TOTAL	85

2.3 SHIP SUBSYSTEM DESCRIPTIONS

2.3.1 STRUCTURE

(U) 2.3.1.1 Summary -- The twin, full cushion length sidehulls of the near term SES are designed to be aerodynamically and hydrodynamically clean, and to contribute to good stability, maneuverability and performance characteristics. The ship houses the required weapon suite within its three (3) major decks and provides an operational helicopter capability. The survivability and reliability of the structural system is designed for 20 year life across the expected profile.

(U) The hull structure includes the shell plating, framing, structural bulkheads, decks, superstructure, structural closures, mast and foundations. The functional requirements of the hull structural system are: (1) to provide a watertight envelope which.houses all other subsystems, (2) to provide a structurally sound platform suitable to the performance goals of the craft, (3) to provide an envelope that can be conditioned for crew comfort and utility, and (4) to provide a platform for aircraft and weapon system operations.

(U) The hull structural configuration is a compromise between overall hullborne and cushionborne performance, manufacturing economy, functional space requirements, combat suite, habitability, survivability and safety within the overall constraint of meeting mission requirements. It is designed to meet a specified 20 year life requirement while retaining a realistic balance between minimum weight, structural reliability and cost construction.

(U) The near term SES hull is subjected to a wide variety of loading conditions, including impact loads, while operating at high speed. These loads would normally require a conservative, heavy structure; however, near term SES performance requirements dictate a more sophisticated and lightweight structure. For convenience, structural loads are subdivided into Primary and Local load categories. Combinations of these categories provide the basis for the development of structural design.

2.3

(U) Primary loads are defined as those loads affecting the entire hull structural girder. These include overall hull bending, torsion and shear resulting from ship weight, and hull buoyancy distributions when the ship is off-cushion or from a wave impact when the ship is traveling at high speed on cushion.

(U) Local loads are those applied over limited portions of the hull structure, such as loads resulting from hydrostatic or hydrodynamic pressure, desk burden, foundation and topside icing,

(U) The hull bending, torsion, and shear that result from weight and buoyancy distributions when off cushion, and wave impact loads when transiting at high speed on cushion were investigated. The NASTRAN and multi-cell girder load distribution programs established internal loads for stress analysis. A plate/stiffener analysis computer program was used for the stress analysis of all major structural areas. Loads considered were those due to hull bending, torsion, pressures, drydocking and equipment.

(U) Scantling design requires a delicate balance between structural weight and ease of fabrication, without sacrificing structural integrity. The scantlings were designed through the use of a computerized optimization program to vary frame, stiffener, and plate sizing with frame and stiffener spacing and provide comparisons of the resultant structural weight and the associated fabrication costs. A frame spacing of three feet with ten inch stiffener spacing was selected . In lightly loaded areas of the ship, such as superstructure, the frame and stiffener spacings were increased to provide light weight and faster ease of fabrication.

(U) Hull structure optimization has provided a basis for optimum structural design of scantlings, wetdeck height, wetdeck ramp angle, full length side" .lls, and keel length fences. The structure optimization has been instrumental in design decisions relating to the square bow near term SES.

(U) The main hull girder is composed of a centerbody and two rigid sidehulls. The main, second, third and wetdecks, as well as seven (7) longitudinal bulkheads, comprise generally continuous longitudinal members which contribute to the section modulus over the entire length. All stiffeners on these members, as well as shell plating stiffeners, run longitudinally.

(U) Bulkhead and deck penetrations are minimal, enhancing structural continuity, This result is a compromise between the location of structural bulkheads and the arrangement of machinery, equipment, and weapons systems. Minimizing the number of bulkhead and deck penetrations reduces the associated structural weight penalties which occur when primary load paths are interrupted and internal loads are redistributed through use of secondary load paths. Trusses are used to retain overall load carrying capability wherever large penetrations exist.

(U) The hangar and pilot house structure located above the weather deck is assigned a secondary structural role and does not carry primary hull bending or hull torsion. As a consequence, the hangar is designed with a six foot (1.83 m) frame spacing and a 16 inch (0.41 m) stiffener spacing to provide adequate strength.

(U) The hull transverse frames are relatively large aluminum extruded tees welded to the deck plates. These members function as beam sections to span across openings between decks and form the vertical frame columns. These members are capable of reacting axial, shear, and moment loads in the plane of the frame. The sidehull and innerbottom frames are lightest when designed as an open truss configuration. These trusses react the locally applied hydrodynamic pressures and function integrally with the non trussed portion of the transverse frame. Stiffened webs are used in place of the trusses to accommodate tank boundaries, foundations or local load conditions. Reactions to the bow seal and stern seal loadings are concentrated at locally reinforced transverse frames at the wetdeck level.

(U) Transverse bulkheads are spaced at 42 feet (12.80 m) intervals, with the exception of the aft most compartment where a 30 feet (9.14m) spaci[illegible] is used to accommodate the propulsion machinery. These bulkheads are all watertight. Vertically oriented tee members are spaced at 10 inche[illegible] (254 mm) on center. The longitudinal bulkheads are sized to resist primary loads, flooding loads and drydocking loads. Stiffeners are arranged 10 inches (254 m) on center, nominally.

(U) The all-welded aluminum hull structure is designed for ease of fabrication, for minimum weight, and to provide structural integrity under all loading conditions. Marine grade weldable aluminum alloys 5086 - H116/117 and 5456 - H116/117, are rated best overall for the primary hull structure because of mechanical, corrosion, manufacturing, and cost considerations. Of these two, 5456 - H117 (H111 extrusions) was chosen because of its 19 percent greater strength-to-weight ratio compared to that for 5086-H117. The H117 temper is free of continuous grain boundary networks which would be susceptible to exfoliation or severe intergranular corrosion in a marine environment.

(U) The basic ship structure would be fabricated in twenty (20) major structural assemblies including two (2) stabilizer fins (P&S) and the mast, Final assembly and erection would be accomplished outdoors in a building basin. All fabrication, subassembly, and assembly of the structures, from receipt of plate and extrusion until the assemblies are ready to be transported to the building basin for erection, would be performed indoors in a controlled environment. A 139,000 feet^2 (12,913.5 m^2) Marine Assembly Facility would be required. Operations have been planned and sequenced to maximize down-hand and automatic welding such that no overhead welding is required prior to erection of the hull structure in the building basin, Overhead

(U) welding required during erection would be less than **two** (2) percent of the total lineal footage of welding on the ship.

(U) Erection of the hull in the building basin would proceed from the stern forward. This erection sequence was selected after reviewing outfitting density and erection sequences to determine that sequence which provides the longest **possible** span for the highest density area of the ship with respect to outfitting and system testing.

(U) 2.3.1.2 Structural Drawings -- The **dra[illegible]s** that define the structural arrangement are contained in appendix B, Section B.3. They are:

- o Main Deck Plating
- o Longitudinal Bulkhead
- o Transverse Bulkheads
- o Transverse Frame
- o Bow Plating and Framing
- o Superstructure
- o Structural Extrusions
- o Plating Combinations

(U) The drawings are grouped in appendix B for consistency of report format and the benefit of the reader.

(U) 2.3.1.3 Key Structural Features -- Outstanding characteristics of the near term SES include the optimum choice of size and shape of the hull, seal interface, and structural layout of primary members. The design is characterized as being an exceptionally clean ship with smooth flowing lines.

(U) The functional design of the ship provides minimum air turbulence for helicopter operations while the minimum motion characteristics of the ship enhance the ability of helicopters to take-off and land.

(U) The physical constraints of the hull structure require that the craft have a beam of 108 feet (32.92 m) or less, a full load displacement of approximately 3000 tons (29892 kN.), and be capable of housing all required subsystems. Physical dimensions developed from parametric trade-offs established the following dimensions:

- o Overall length of 266 feet 3 inches (81.15 m)
- o Wet deck height of 18 feet (5.49 m)
- o Wet deck ramp angle of 13.7 degrees
- o Minimum main deck height of 40 feet above keel (12.19 m)

(U) Internal geometry of the hull structure has been optimized to the following and are shown on figure 2.3.1-1:

- o Stiffener spacing of 10 inches (0.25 m)
- o Frame spacing of 3 feet (0.91 m)
- o Transverse bulkheads spaced at 42 feet (12.80 m) intervals (aft bulkhead at 30 feet [9.14 m)
- o Longitudinal bulkheads at approximately 14 feet (4.27 m) spacing
- o Between deck height of 9 feet (2.74 m)
- o Third deck height above keel - 22 feet (6.71 m)
- o Second deck height above keel - 31 feet (9.45 m)
- o Main deck height above keel - 40 feet (12.19 m)
- o 01 deck at 49 feet (14.54 m)
- o 02 deck at 60 feet (control center deck) (18.29 m)

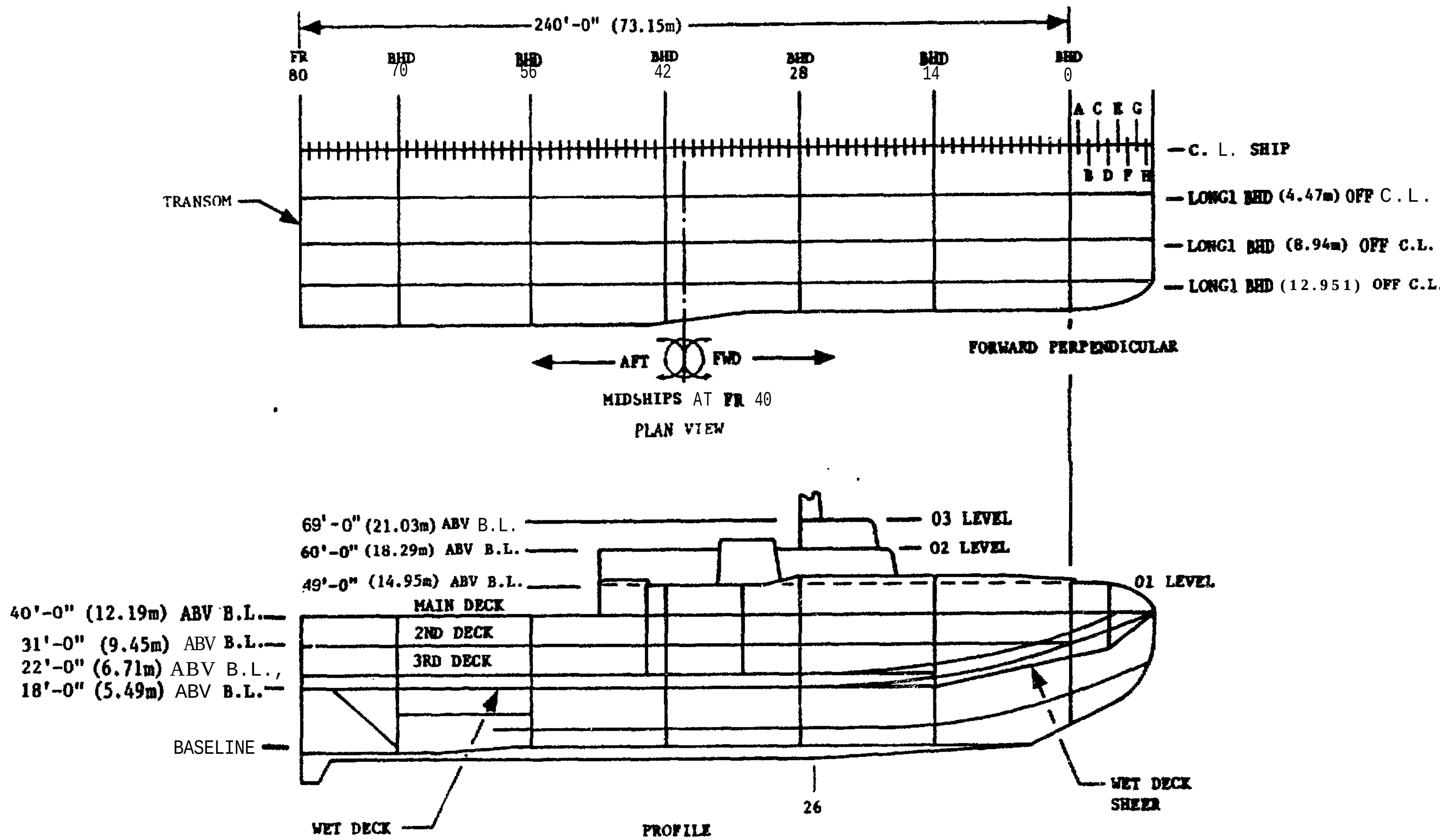


Figure 2.3.1-1 (U): Structural Configuration (U)

UNCLASSIFIED

(U) 2.3.1.4 Structural Weight Breakdown -- The structural weight breakdown of the hull and superstructure is shown in Table 2.3.1-l:

Table 2.3.1-1 (U) Structural Weight Breakdown (U)

SWBS	LONG TONS	KILONEWTONS	%
110	419.03	4175.2	52.1
120	152.79	1522.4	19.0
130	518.60	1580.3	19.7
150	14.49	144.4	1.8
160	19.11	190.4	2.4
170	2.78	27.7	0.3
180	38.20	380.6	4.7
100	805.0	8021.0	100

(U) 2.3.1.5 Structure Risk Assessment -- The hull of the near term SES is designed to realistic worst case loading conditions which are forecast to occur within the ship lifetime. These structural loads were obtained from an extensive Rohr 2KSES/3KSES model testing and analytical loads development program. The structural materials are commercially produced aluminum alloys which have been utilized in existing Navy ships, such as the PHM and SES 100B. The baseline design configuration features conventional built-up plate-stiffener combinations, a conventional ship'framing system, and state-of-the-art welding and producibility details to minimize construction problems. Consequently, structure of the near term SES is producible, competitive with respect to cost; and represents an optimum design configuration for performance of the specified mission.

(U) 2.3.2 PROPULSION -- The near term SES is powered by a **waterjet** propulsion plant, Its principle is the conversion of that mechanical energy supplied by the gas turbine-driven **waterjet** pumps into kinetic energy, by increasing the velocity of the seawater inducted at the **waterjet** seawater inlets and ejected through the **waterjet** pump exit nozzles. The general arrangement is shown on Figure 2.3.2-l.

(U) The SWBS breakdown of the propulsion plant is:

- Gas turbine system (234)
- Transmission system (242, 243, 244)
- **Waterjet** propulsor system (247)
- Combustion air intake system (251)
- Exhaust gas uptake system (259)
- Lube oil system (262)

2.3.2.1 Summary Description

(U) 2.3.2.1.1 Gas Turbine System -- A total of four (4) gas turbines, each driving a **waterjet** propulsor, are utilized in the near term SES propulsion plant. The four (4) turbines are arranged in pairs of two (2): one (1) pair is located'on the starboard side of the ship and the other pair is located on the port side. Each gas turbine is operationally independent of the other .

(U) The baseline propulsion gas turbine for the near term SES is the LM2500 gas turbine which is capable of delivering 22,500 continuous shaft horsepower (16,780 kW) and 27,000 intermittent shaft horsepower (20,130 kW). The alternate propulsion gas turbine is the FT9A-2A which delivers 36,500 continuous (27,220 kW) and 40,000 intermittent shaft horsepower (29,830 kW).

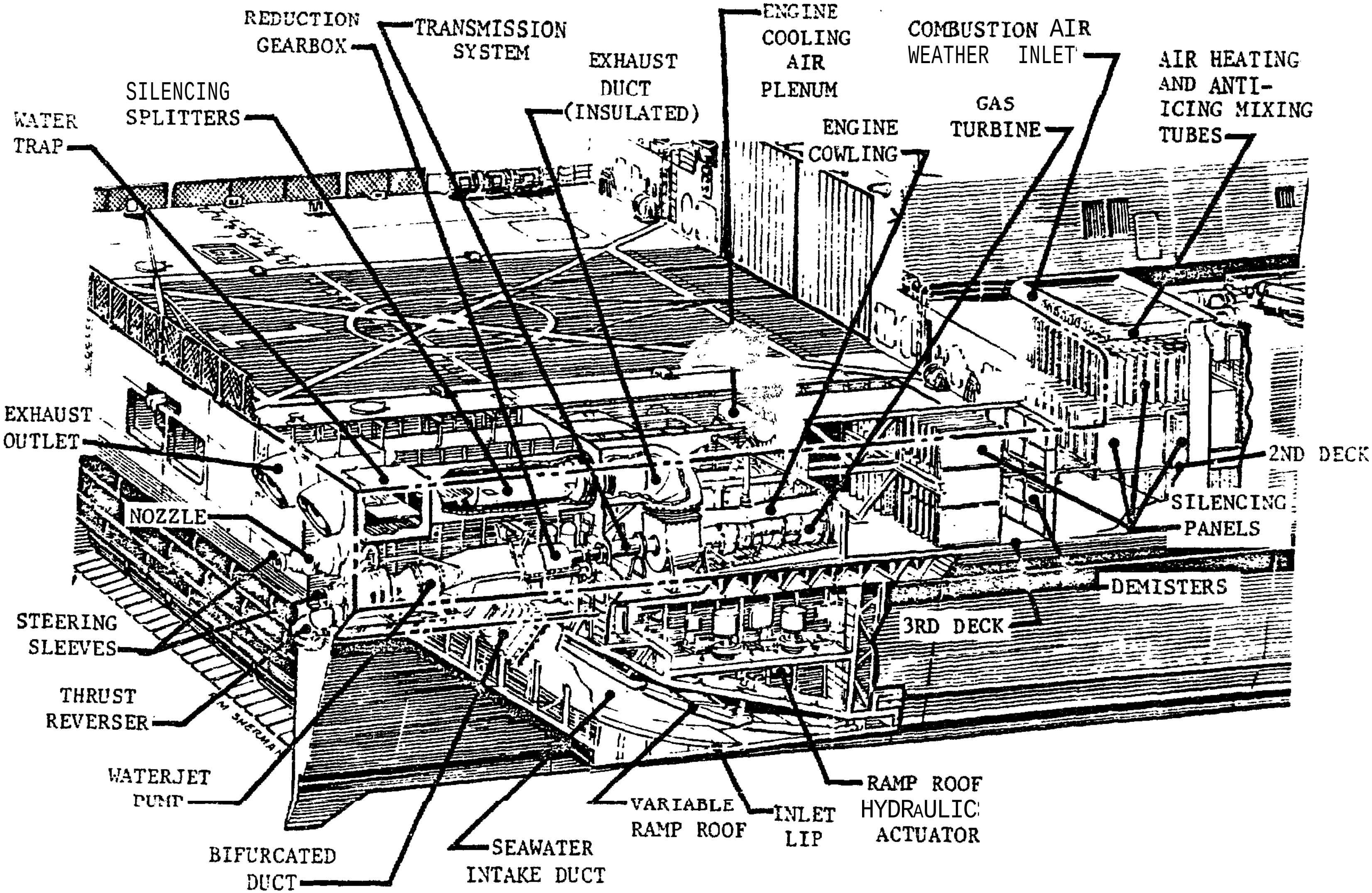


Figure 2.3.2-1 (U): Propulsion Plant General Arrangement, Starboard Side Only (U)

(U) The FT9A-2A system requires more space than the LM2500 system due to its increased turbine length. The FT9A-2A engine is installed further aft, which shortens the drive shaft length. The propulsion plant is designed for future installation of the alternate FT9A-2A engine with a minimum impact on the propulsion plant or other ship systems.

(U) The LM2500 marine gas turbine is derived from the TF39 military and CF-6 commercial turbo fan engines used respectively on the Lockheed C5A Galaxie and McDonnell Douglas DC-10 aircraft. The LM2500 gas generator consists of a variable vane 16-stage compressor; annular combustor; two-stage air-cooled turbine and associated gearboxes; controls; and accessories. The power turbine has six stages and is a low-speed, low stress design. The LM2500 engine, is presently in service on the DD963 class destroyers.

(U) The FT9A-2A engines are identical with the FT9A-2 engines currently being developed by the Navy, Minimum interface hardware revisions are required for the SES application. The progenitor engines for the FT9A-2A are the FT4 marine and JT9D aircraft engines. The FT9A-2A gas generator has a low and high pressure compressor, each driven by a separate turbine and an annular combustor. The power turbine is derived from the FT4 power turbine now in service.

(U) 2.3.2.1.2 Transmission System -- This system consists of the propulsion shafting, shaft flanges, shaft bearings with mounting structure, flexible couplings and torque meters. Each of the four transmission systems connect a propulsion gas turbine to a waterjet propulsor reduction gearbox input flange. The shaft, flanges, bearings, seals and bearing housing form the shaft/bearing module which is installed (or replaced) as a unit. Figure 2.3.2-2 illustrates the arrangement. The reduction gearbox is described next in the waterjet propulsor system description.

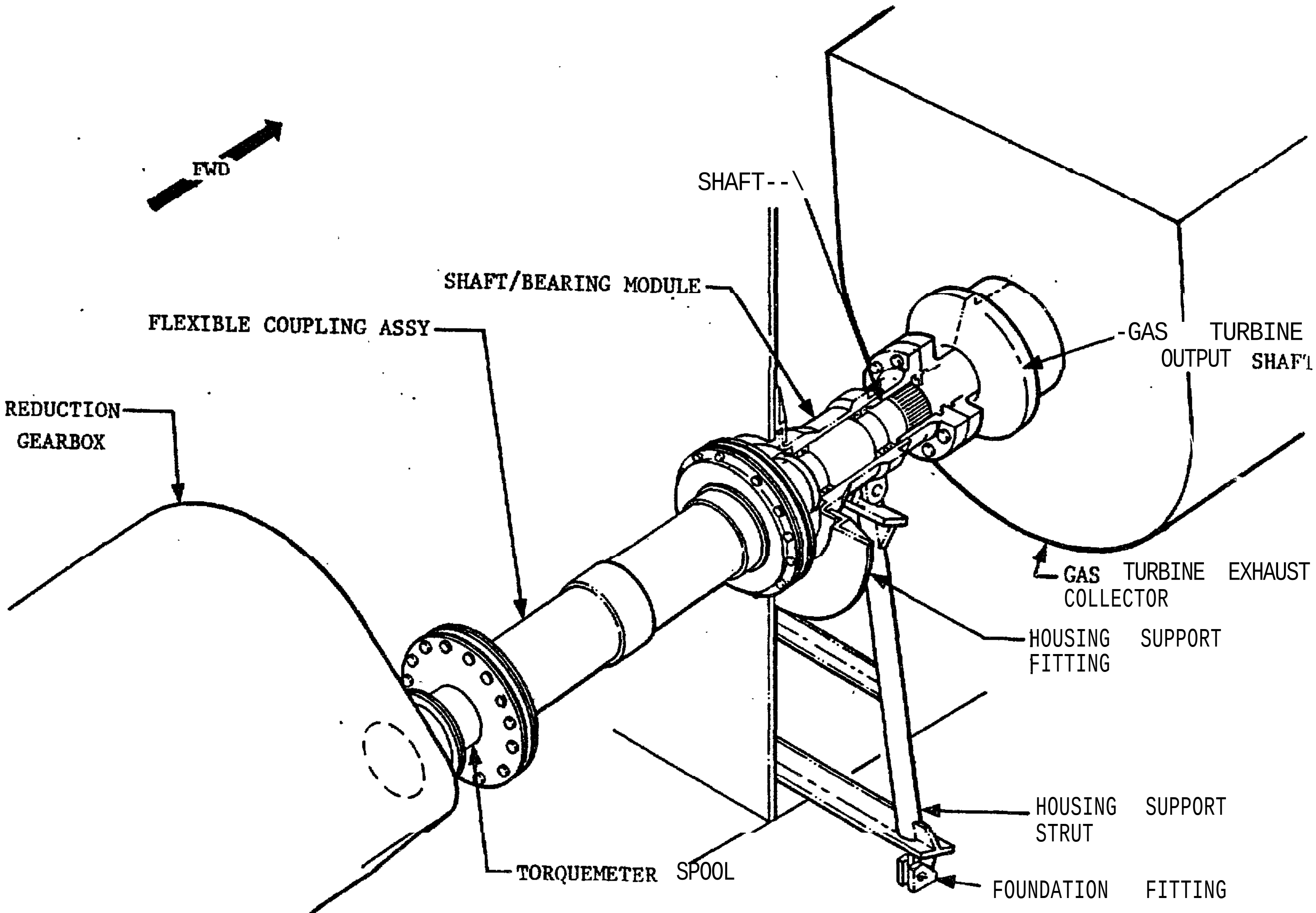


Figure 2.3.2-2. (U) Typical Propulsion Transmission System (U)

UNCLASSIFIED

(U) 2.3.2.1.3 **Waterjet** Propulsor System -- The **waterjet** propulsor system consists of the integral reduction gearboxes and **waterjet** pumps, instrumentation, mounting links, steering sleeves with hydraulic actuators, **waterjet** pump inlet flex joints, thrust reversers with hydraulic actuators, transom flexible seals, **waterjet** pump priming systems, attached lube oil pumps with minor lube oil system components and piping, seawater inlets, seawater intake diffusers, bifurcated ducts and variable ramp roofs with hydraulic actuators, A nozzle closure valve and a thrust bearing are contained within each **waterjet** pump. A shaft brake is attached to each reduction gearbox.

(U) Each reduction gearbox (four (4) total) contains necessary gearing to reduce the input speed and divide the power between the two (2) **waterjet** pump rotors which run at different speeds. The propulsor assembly gearbox details and gear train are shown in Figures 2.3.2-3 and 2.3.2-4.

(U) 2.3.2.1.3.1 **Waterjet** Propulsor Assembly -- The **waterjet** propulsor is a two-stage; two-speed design based on the hydraulically similar PHM propulsor. The first stage is an inducer designed to produce a sufficiently high head rise at low suction (cavitating) conditions to permit the second stage impeller to operate at high rotation speeds without cavitation. The power split between the inducer and impeller is approximately 30:70. The inducer rotates at about 1/4 engine speed, the impeller at about double this. The propulsor assembly is shown in Figure 2.3.2-S.

(U) 2.3.2.1.3.2 **Waterjet** Inlet -- Seawater for the four (4) **waterjet** propulsors is taken aboard through two semiflush inlets as shown in Figure 2.3.2-6. One inlet is located in each sidehull to serve the two **waterjet** pumps also located in each sidehull. Seawater for ship services is taken aboard through these inlets. The'sidehulls are enlarged through fairings from their nominal cross-sections to accommodate the inlets. **Waterjet** inlet area is varied by continuous plate flexible ramp roofs, actuated by a hydraulic cylinder to control the seawater flow into the system. The water

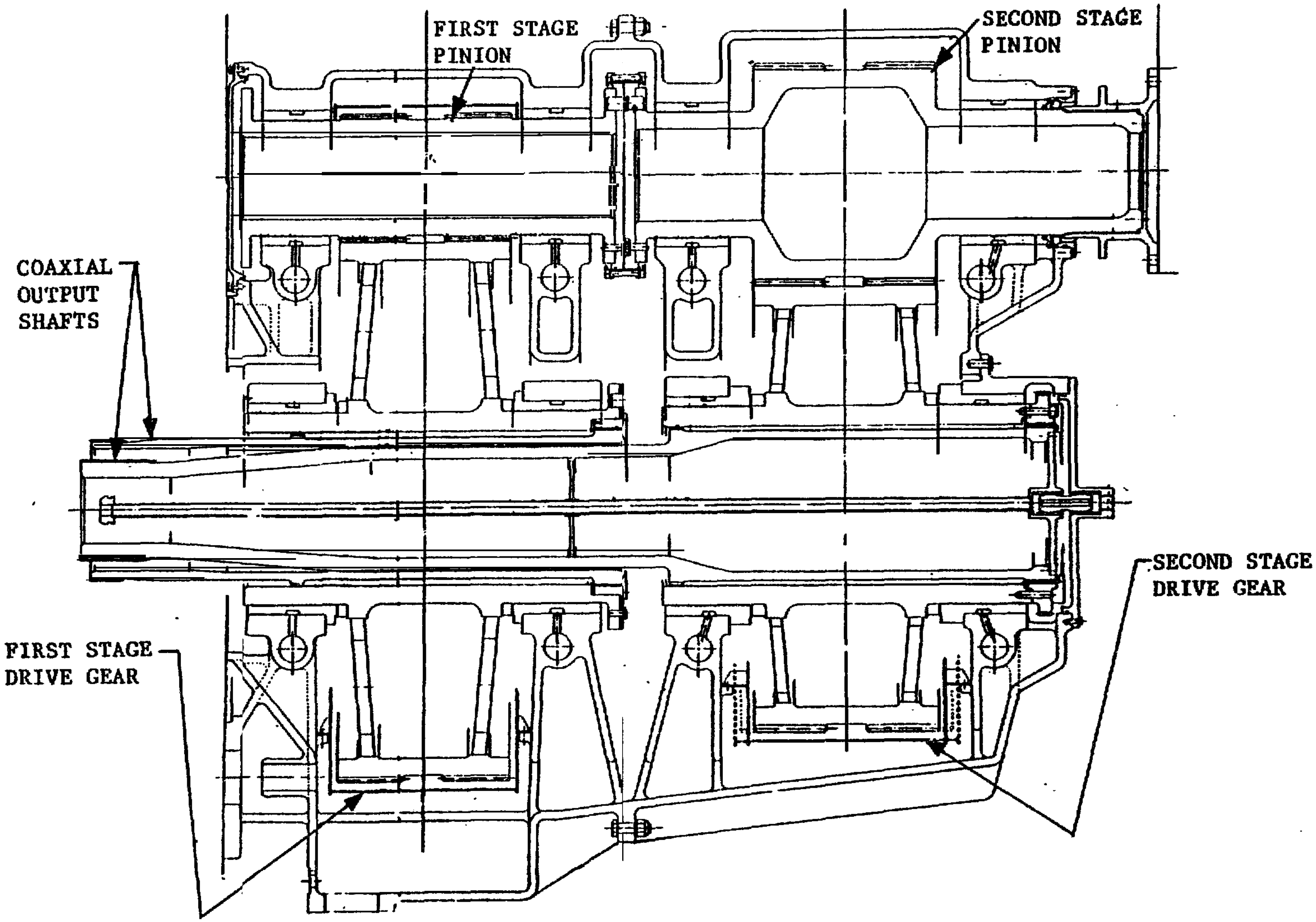


Figure 2.3.2-3. (U) Propulsor Assembly Gearbox Arrangement (U)

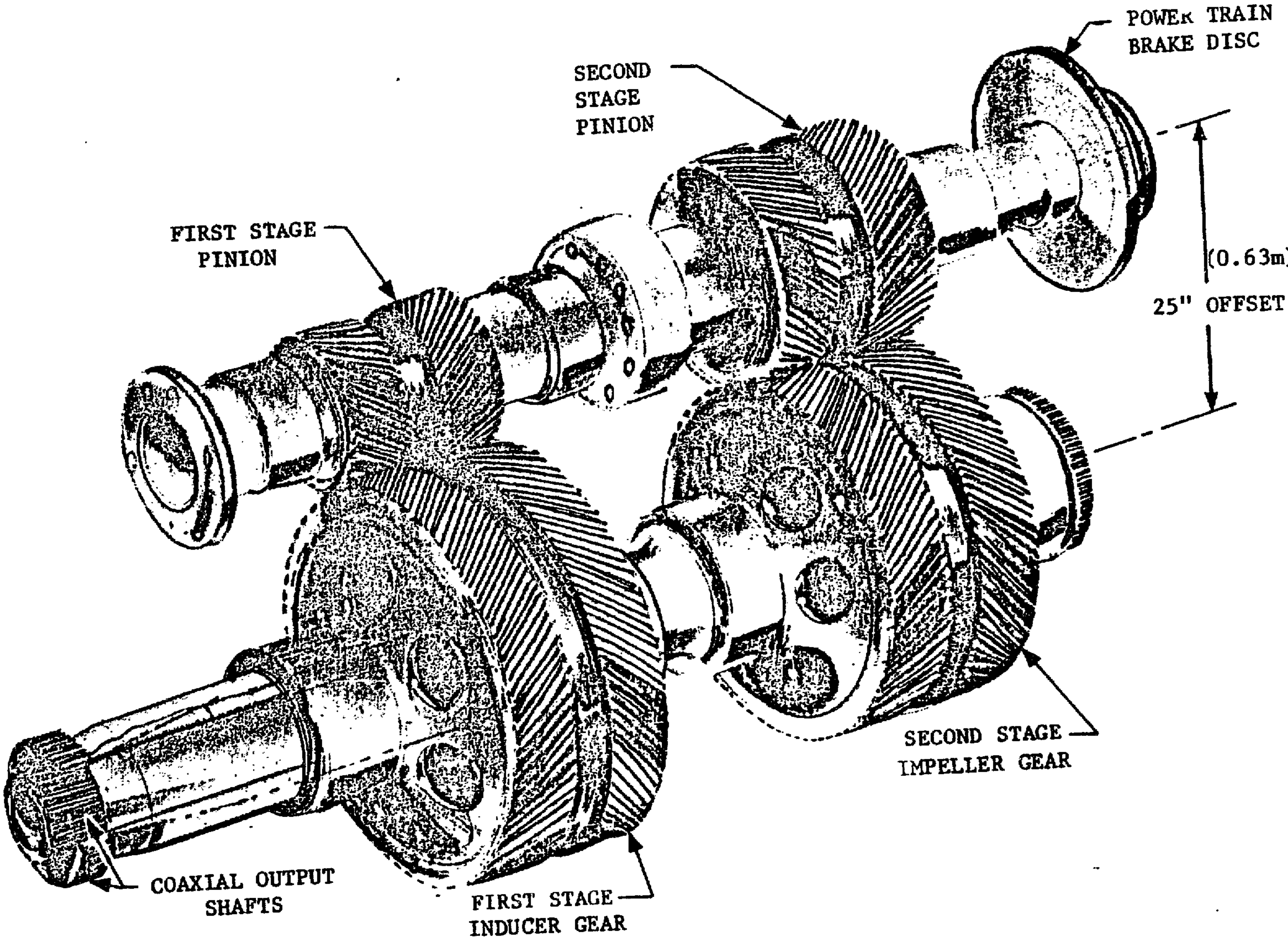


Figure 2.3.2-4 U): Propulsor Assembly Gear Train (U)

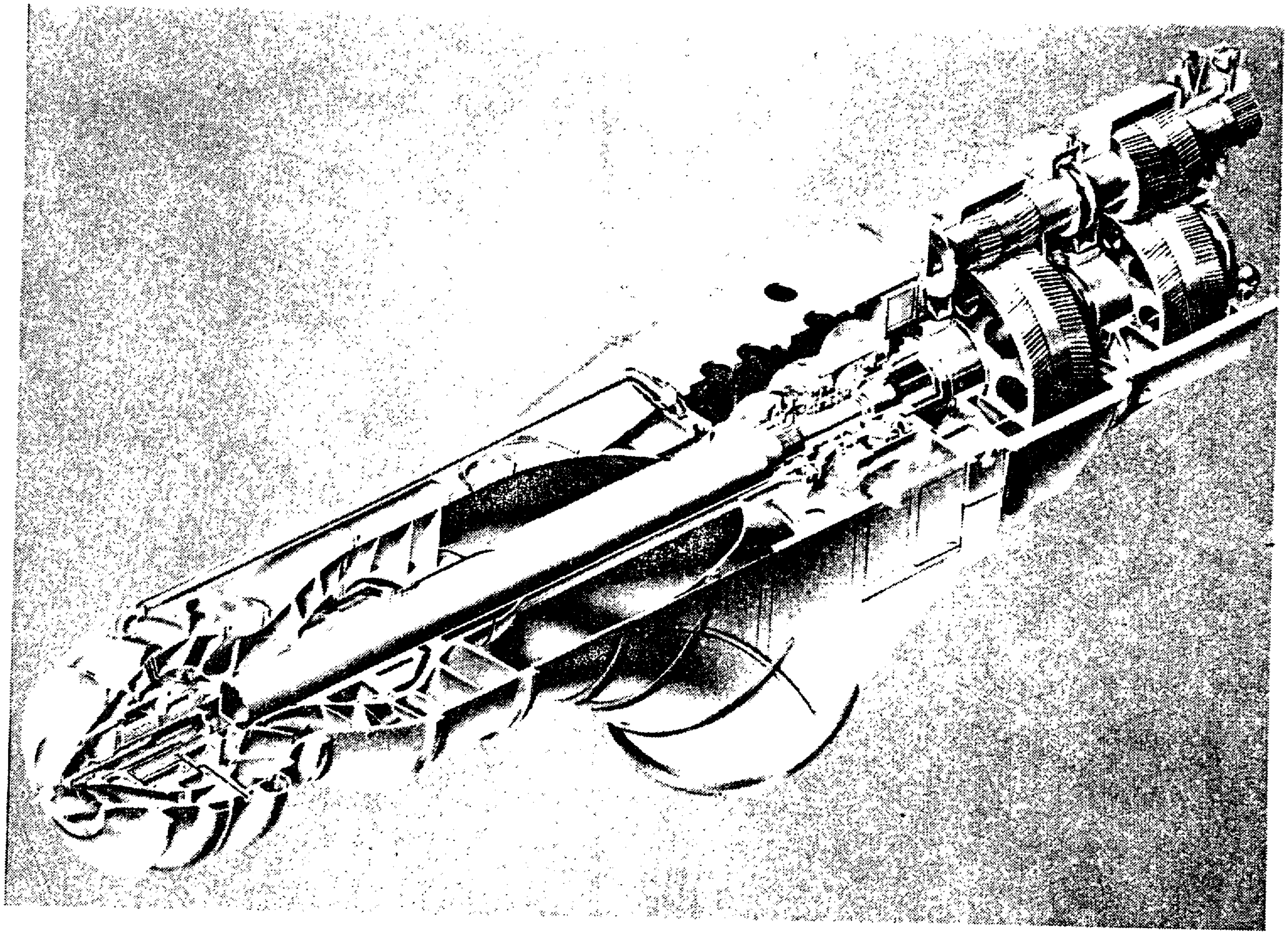


Figure 2.3.2-5 (U): Waterjet Propulsor Assembly (U)

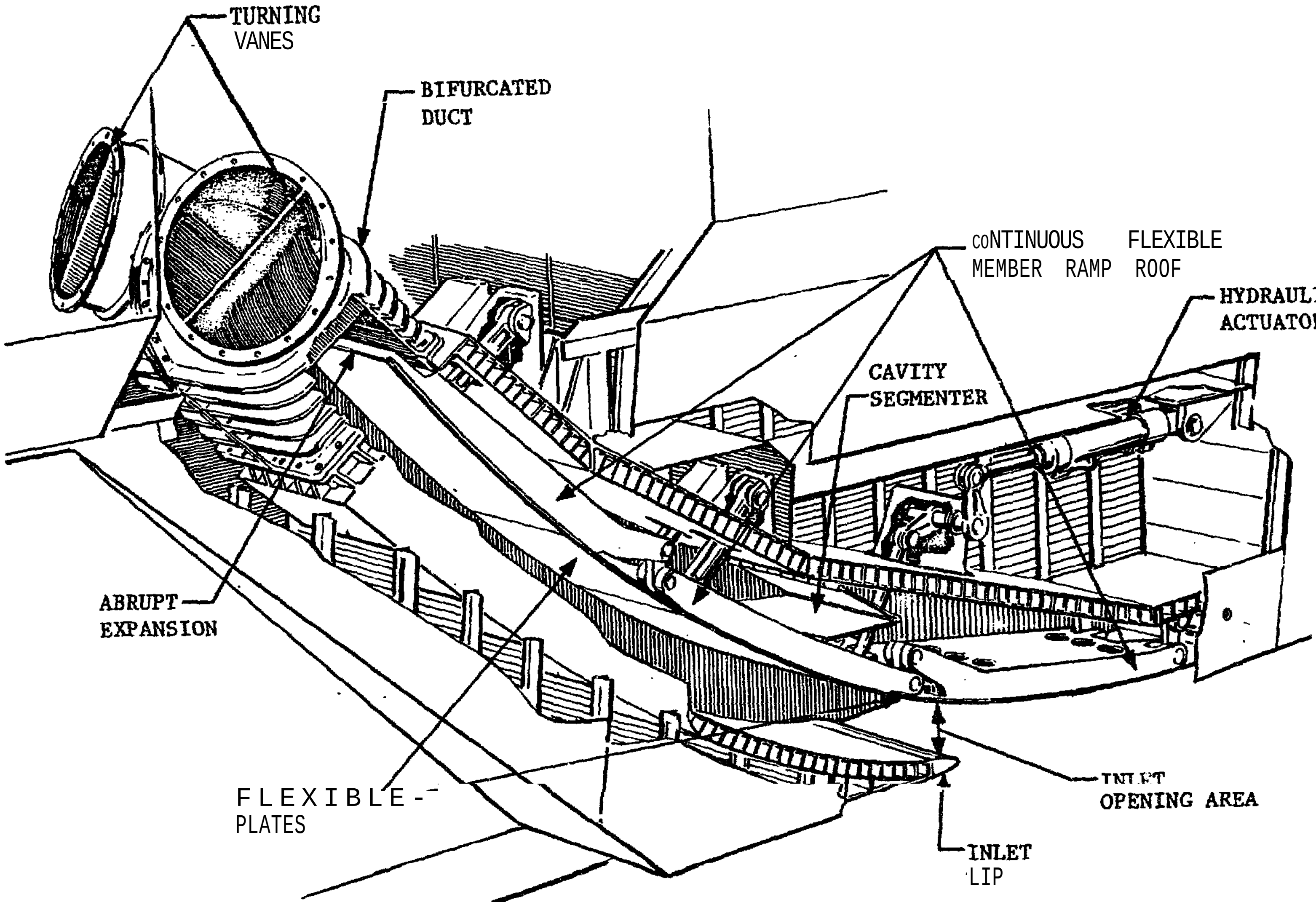


Figure 2.3.2-6 (U): **Waterjet** Intake Duct Ramp Roof **(U)**

(U) flow through each sidehull inlet passes into the diffuser section of the inlet duct and is distributed through a duct bifurcation to the two pumps. Water flows through the inlets by combination of pump action and ship forward motion, at a rate determined by the ship speed, inlet area settings and pump speed. The curved diffusers then turn and raise the water to the pumps through the bifurcated ducts. An abrupt expansion is used at the entrance to the bifurcated ducts. Each bifurcated duct is constant area, symmetrical and has integral turning vanes.

(U) 2.3.2.1.3.3 Steering and Reverser System -- Each waterjet propulsor has an associated steering sleeve and the two outboard propulsors have thrust reversers. The discharge water from each pump's single fixed-area nozzle passes coaxially through a flexible seal at the transom, and subsequently through a swiveling steering sleeve mounted on the transom. The steering sleeve deflects the waterjet to generate side forces on the ship. Each sleeve is hydraulically actuated, utilizing the ship hydraulic system, and is instrumented to permit position monitoring.

(U) The thrust reversers direct the waterjets in a forward direction. In operation, they are pivoted into the water streams by controllable position actuators. During reverse thrust operation, the high-velocity water is redirected forward, down, and slightly outboard to minimize spray and hazard to nearby objects. The thrust reversers are variable position to give full forward through full reverse thrust on the outboard waterjets.

(U) 2.3.2.1.4 Combustion Air Intake System -- The internal configuration of the combustion air intake system and the location of the demister banks, acoustic panels, gas turbine plenums, air heating system, and external opening of the air inlet are shown in Figure 2.3.2-7. The features of the intake design which reduce salt spray are the coaming projecting above the 01 level; the vertical portion of the intake which requires the air to turn 90 degrees to enter the demister banks; and the drainage sump at the third deck level.

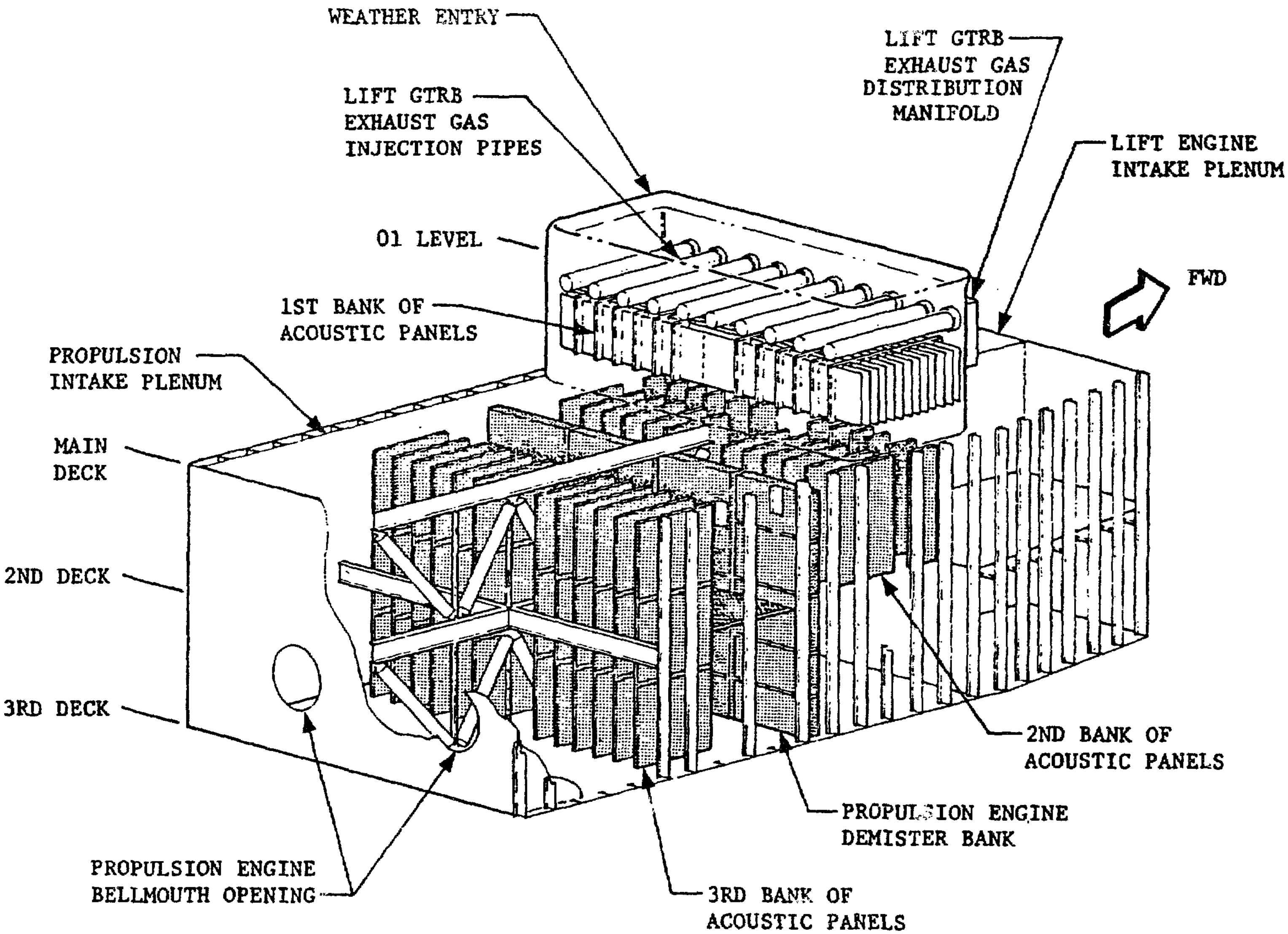


Figure 2.3.2-7. (U) Combustion Air Intake System Arrangement (U)

UNCLASSIFIED

(U) The intake contains sound supression panels in three locations to attenuate engine noise to acceptable levels, The panels in the section between the 01 level and main deck are comprisedof six inch (0.15 m) spaced perforated panels, installed in the athwartship direction. Thin aluminum splitters between the panels form six inch (0.15 m) rectangular ducts.

(U) The intake system is designed to accommodate the LM2500 or the FT9A-2A engine. The design considers all combination s of these engines for propulsion and lift. The only modification required when the FT9A-2A engines are employed is an increase of demiscer face areas.

(U) Anti-icing, de-icing, and pre-heating of the intake system for the engines is accomplished by recirculation and mixing of lift engine exhaust gas at the weather inlet on each side of the ship, as is shown schematically in Figure 2.3.2-8. Each combustion air intake system supplies air to one lift engine, two propulsion engines, gas turbine generator(s), and the gas turbine cooling systems.

(U) 2.3.2.1.5 Exhaust Gas Uptake System -- This system consists of the exhaust ducts (including supports and insulation) which are routed from the propulsion gas turbines to the transom, where the combustion products are exhausted; The design incorporates a water trap at the transom to provide stern wave protection, Each exhaust duct is acoustically treated to attenuate noise.

(U) 2.3.2.1.6 Propulsion Lube Oil System -- This system provides lubrication for the bearings in the transmission system and for the waterjet propulsor assembly. The reduction gear system is of the dry sump type and the pump thrust bearing and seal module require most of the oil in the system. The reduction gear carries driven pressure and scavenge pumps. The lube oil system upstream of the mechanically driven pressure pump, and downstream

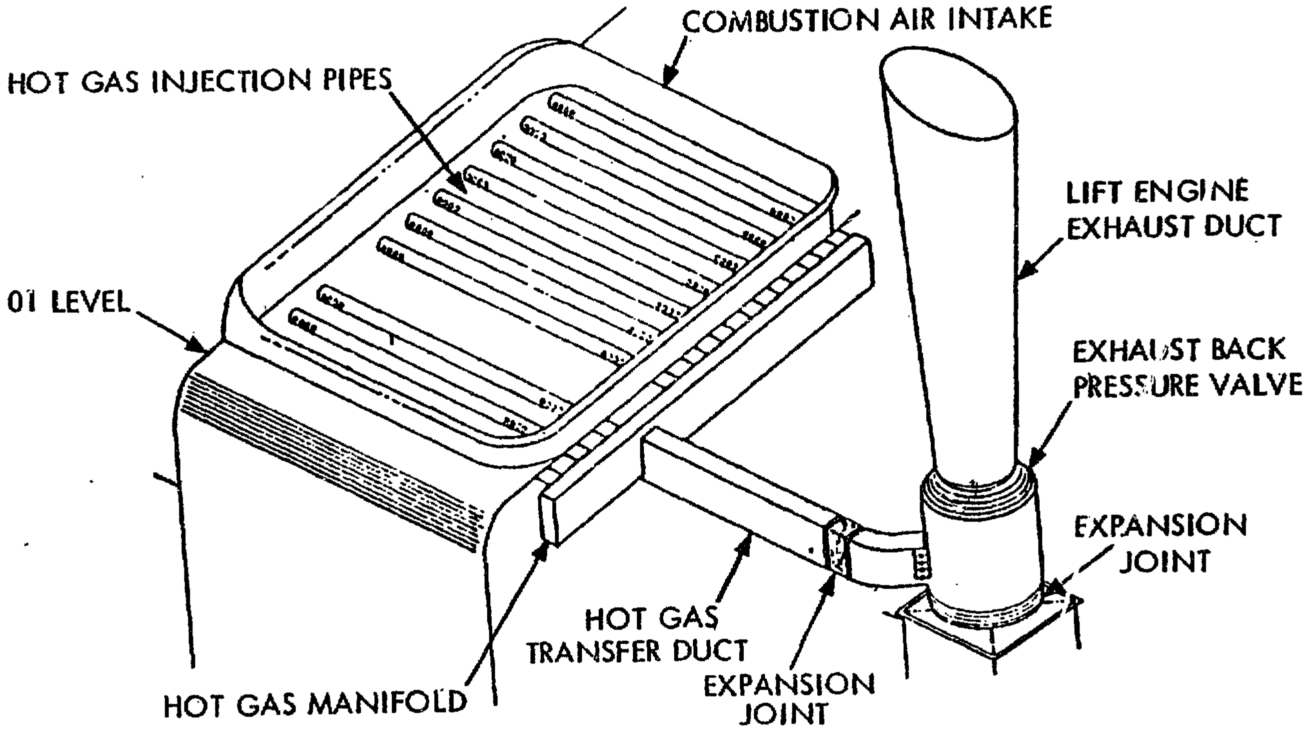


Figure 2.3.2-8 (U): Anti-Icing and Intake Air Heating System (U)

(U) of the mechanically driven scavenge pump, is defined as the propulsion lube oil system, Each propulsion drive train has its own dedicated propulsion lube oil system (four total). The lubricant used is 2190 TEP per MIL-L-17331.

(U) 2.3.2.2 Operation

(U) 2.3.2.2.1 Start-Up -- The gas turbines are pneumatically started from the ship system. This system provides sufficient compressed air to start one gas turbine. The pneumatic (start air) system cross connects all propulsion and lift engines such that any one engine can start another by supplying bleed air from its compressor into the system. The start control sequence is automatic but manual start controls provisions are provided for back up. Each gas turbine engine can be started and ready to deliver power in approximately 90 seconds.

(U) The waterjet propulsors are above the ship off-cushion waterline and thus require priming. Priming is accomplished in these successive steps: apply transmission brake to prevent rotation of the dry pump; shut nozzle closure; supply auxiliary water to rubber bearings; operate the air ejector that connects to both pump pairs; and when pumps are primed, water then covers the pump inducer centerline.

(U) The brake is then released and the pump rotated enough to produce a static head of about 15 ft (4.57 m) H_2O. When the nozzle closure is opened, the pump begins to deliver water, the ejector system and auxiliary water supply are shut off and the priming is completed. These features of the priming system *are* shown on Figure 2.3.2-9.

(U) 2.3.2.2.2 Low Speed -- Low ship speed operation of the propulsion plant requires the ship to be *in* the off-cushion mode to reduce the possibility of broaching which could unprime the propulsors. Additionally, with the ship off-cushion, inlet head to the pump inducer is maximized to reduce suction specific speed. The steering sleeves and reverser may be configured to

UNCLASSIFIED

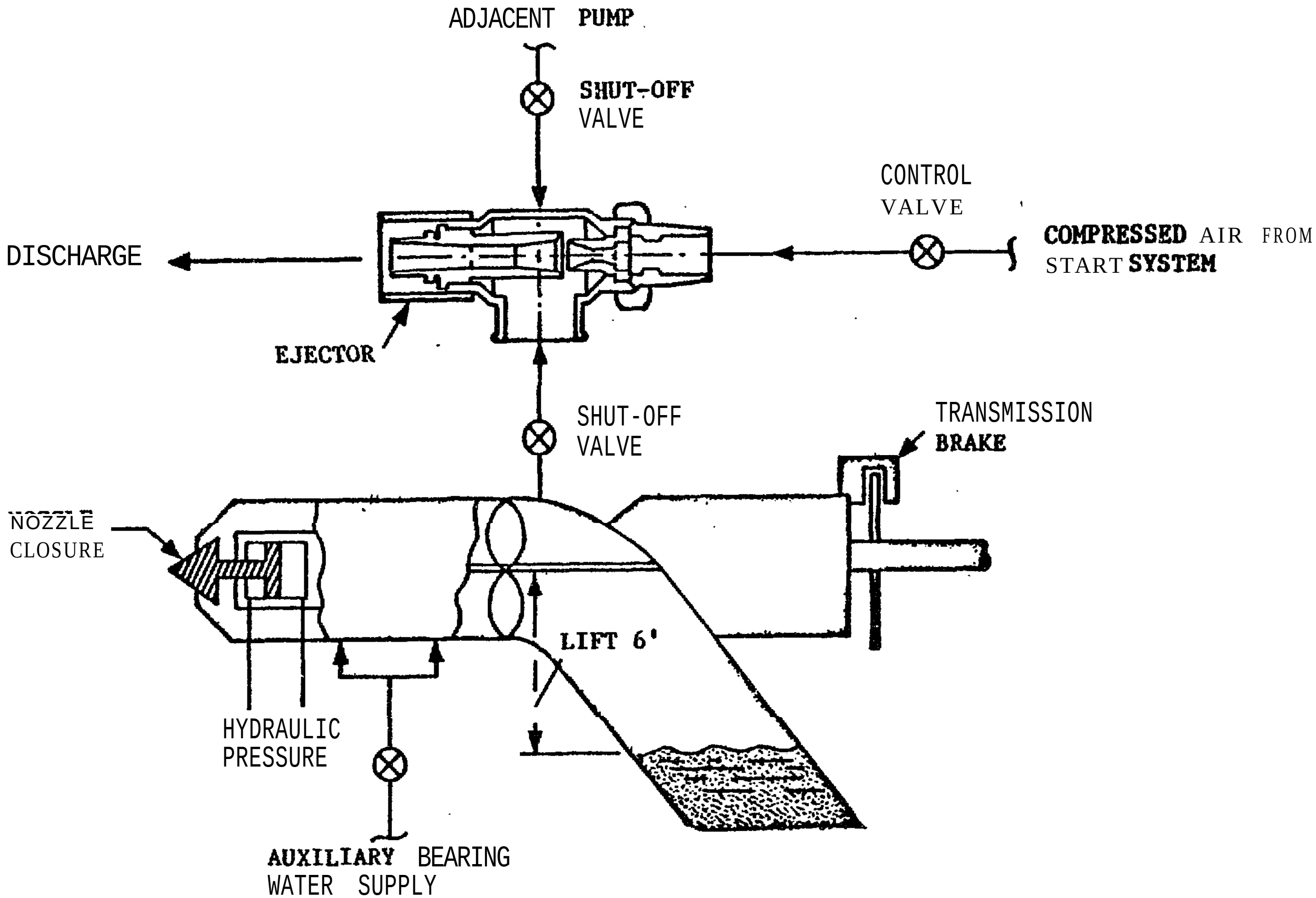


Figure 2.3.2-9 (U): Propulsor Priming System Schematic, Port and Starboard (U)

UNCLASSIFIED

(U) give low speed forward, astern, turning and sideways translation of the ship for undocking and maneuvering in a seaway. The power level is limited by the suction specific speed line of the propulsors to limit cavitation erosion of the pump components.

(U) The seals are extended to a height/speed schedule when above 10 knots (5.14 m/s) ship speed to avoid reaching limit suction specific speed. The waterjet inlet is generally wide open in the low speed mode.

(U) 2.3.2.2.3 Hump Transftion -- Hump transition requires the use of high power settings and, in the case of a heavily loaded ship and/or high sea state, may require use of the intermittent power level to produce the desired margin of thrust over drag. During transit, the waterjet inlet area is varied according to pump speed (power), ship speed and engine throttle setting. Suction specific speed limitations are not present at trans-hump speeds.

(U) Ship heading control will require use of a combination of differential thrust, assymetrical throttle settings on the fan engines, and thrust vector control with the steering sleeves. The ships control system automatically determines the required combination and the mix of control forces that provides heading control with minimum fuel consumption.

(U) 2.3.2.2.4 High Speed Cruise -- At cruise conditions, throttle settings for steady state conditions (and the associated inlet opening) are maintained by the propulsion control system.

(U) 2.3.2.3 Machinery Characteristics -- The machinery characteristics are presented in the following tables:

Table 2.3.2-1:(U) Engine Characteristics (U)

ITEM	CHARACTERISTICS	
	LM 2500	FT9A-2A
Turbine Inlet Temperature - °F(°C)	2300 (1260)	2255 (1235)
Air Flow - lb/sec (N/Sec)	146 (649)	250 (1112)
Dry Weight - lbs (kN)	10,405 (46.281)	21,300 (94.742)
Compression Ratio at Max. RPM	15:1	21:1
SFC - lb/HP-hr (kN/w-hr)	.381(2.28)	.397(2.36)
Max. Power at Sea Level- HP @ 80°F (kW @ 27°C)	27,000 (20,134)	40,000 (29,828)
No. of Compressor Stages	16	17
No. of Turbine Stages	8	5
No. of Combustors	1	1
Combustor Type	Annular	Annular
Length-Inches (m)	257 (6.528)	337 (8.560)
Diameter (Max) - Inches (m)	87 (2.210)	73 (1.854)

Table 2.3.2-2 (U) Reduction Gear and Transmission (U) Characteristics

ITEM	CHARACTERISTICS
Reduction Gear	
Speed	4100 RPM
Power	40,000 SHP (29830 kW)
Weight (Dry)	9489 lb (42.21 kN)
Length	76 inch (1.93 m)
Width	59.50 inch (1.51 m)
Lubricant	2190 TEP per Mil-L-17331
Gears	Double-Helical 9310 steel one-piece pinion and shaft
Ratio	
First stage	4.359
Second Stage	2.0508
Bearings	Journal, Babbit lined
Casting	Cast Aluminum A356-T6
Transmission	
Length	138 inch (3.50 m)
Diameter	22 inch (.56 m)
Bearings	Fwd - Duplex ball thinwall Aft - Roller thinwall
Shaft and Flanges	4340 forgings
Flexible Coupling	Double diaphragm $\pm$ 1/2° misalignment capability
Torquemeter	Accurex Strain type

Table 2.3.2-3: (U) Waterjet Propulsor Characteristics (U)

ITEM	CHARACTERISTICS
Speed	4100 RPM
Power	40000 SHP (29830 kW)
Weight (wet)	22571 lb (100.396 kN)
Length	203 inch (5.16 m)
Height	70 inch (1.78 m)
Diameter	49.5 inch (1.26)
Efficiency *	88.5%
Headrise *	999 ft H_2O (304.5 m H_2O)
Flow rate *	135,154 GP.M (8.527 m^3/sec)
Gross Thrust *	161,200 lbf (717.018kN)
Nozzle Diameter	17.52 inch (.45 m)
Speed Inducer *	940 RPM
Speed Impeller *	1999 RPM
Suction Specific Speed Limit	2,4250 at Inducer Centerline

*Values at RPM and Power quoted and total inlet head of 203 ft. H_2O (61.9 m H_2O)

Table 2.3.2-4: (U) Waterjet Inlet (U)

ITEM	CHARACTERISTIC
Width	48 inch (1.22 m)
Drop Fraction	0.5
Max Opening Area	14 ft^2 (1.301 m^2)
Min Opening Area	4 ft^2 (.372 m^2)
Max Flow Rate	286,282 GPM (18.06 m^3/s)
Variable Roof.	3 section continuous flexible plate
Bifurcation	Equal legs with turning vanes

(U) 2.3.2.4 Arrangements -- The drawings and sketches depicting the near term SES propulsion system are contained in Appendix B.4. They are:

- Propulsion System
- Waterjet Inlet

(U) The drawings are grouped in Appendix B.4 for consistency of report format and benefit of the reader, A sketch of a section of the demister is shown as Figure 2.3.2-10.

(U) 2.3.2.5 Propulsion System Weights -- Weights within the propulsion system SWBS 200 are shown in Table 2.3.2-5.

Table 2.3.2-5 (U). Propulsion System Weights (U)

SWBS	Subgroup	Weight LT	Weight kN	Weight Percentage
234	Gas Turbines	21.56	214.8	11.3
241	Reduction Gears	16.07	160.11	8.4
242	Couplings	.71	7.07	.4
243	Shafting	1.19	11.86	.6
244	Shaft Bearings	.60	5.98	.3
247	Waterjet Propulsors	50.82	506.3	26.7
251	Combustion Air System	20.12	200.47	10.6
252	Control System	.46	4.58	.2
259	Uptakes	14.21	141.58	7.5
261	Fuel Service System	.11	1.10	.1
262	Lubeoil System	4.60	45.83	2.4
298	Operating Fluids	59.56	593.43	31.3
299	Repair Parts	.44	4.38	.2
200	Propulsion System	190.46	1897.65	100.0

(U) Table 2.3.2-6 shows the estimated functional weight percentage of major components within the propulsion system for an LM 2500 and FT9A-2A system.

Table 2.3.2-6 (U). Weight Percentage of LM2500 and FT9A-2A Propulsion System (U)

SUBSYSTEM	PERCENT OF SYSTEM	
	LM2500	FT9A-2A
Engines	9.1	16.9
Gearboxes	a.4	7.1
Propulsors	12.6	10.6
Comb Air System	10.6	11.2
Comb Exh System	7.5	10.3
Oper. Fluids	31.3	26.4
Miscellaneous	19.9	17.7

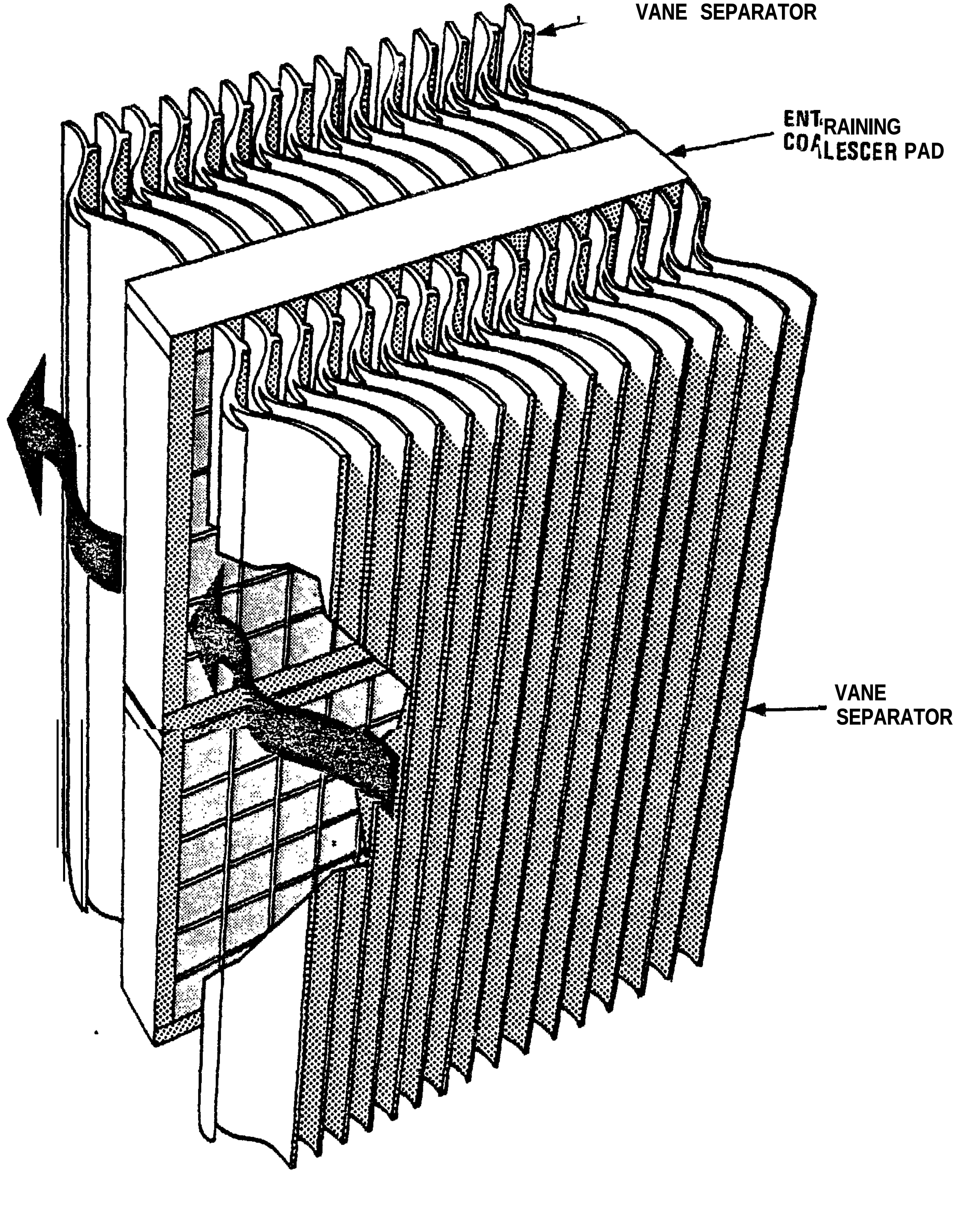


Figure 2.3.2-10 **(U):** Propulsion Inlet Water Demister **(Coalescer)** (U)

2.3.2.6 Propulsion System Technical Risk Summary

(U) Engines -- The GE LM2500 gas turbine engine is in production with a proven capability up to 21,500 SHP (16,033 kW), is low weight, and in use for other marine applications. The Pratt and Whitney FT9A-2A alternate engine is developmental and requires design and test effort; it will be in production after a few years; and component testing has begun, Current development efforts are limited to 33,000 SHP (24,608 kW).

(U) Transmission -- The propuision transmission system is designed to transmit all anticipated alternating and continuous torques between the propulsion engine and the propulsor assembly without failure over a 20-year life span with specified overhaul of the life limited components; to have not more than 10 percent failures prior to the scheduled overhaul period of 5,000 hours minimum (10,000 hours goal) for the life limited components; to withstand a limit torque of 1,229,764 inch pounds (138.94 kN·m) without degradation of performance or failure; and to eliminate any critical speed (of any component) which is less than 125 percent of the system maximum operating speed.

(U) Waterjets -- The propulsor is hydraulically similar to the PHM pump now in operation. Comprehensive model tests have already been successfully conducted for the 40,000 SHP (29,828 kW) propulsar. The waterjet inlet has been extensively tested with models and with similar inlets of the operational SES-100A and XR-1 testcraft. The installation design of the waterjet propulsor assembly will withstand all anticipated input powers, thrusts and external loads due to ship accelerations and equipment malfunctions without failure for a 20-year design life and with specified overhaul. The waterjet seawater inlet duct system has been optimized to improve performance, cavitation characteristics, drag and structural weight on the basis of substantial analysis and model testing.

(U) The propulsion lube oil system, combustion air intake system, and exhaust gas uptake system are typical of present gas turbine ship installations. All components are presently available and proven in service. For the combustion air inlet, anti-ice protection by exhaust gas mixing is the accepted method of General Electric, Pratt and Whitney, and Garrett.

(U) 2.3.3 ELECTRICAL SYSTEM

(U) 2.3.3.1 Summary of Key Features -- Primary 450 Volts power for the near term SES is generated at 60 Hz and 400 Hz frequencies by six gas turbine generator (GTG) sets. Three (3) identical GTGs rated 375 kW 60 Hz and three identical GTGs rated 375 kW 400 Hz provide a total system capacity of 2250 kW. All six (6) GTGs are driven by Garrett ME 831-800 turbines.

(U) The distribution system is arranged to provide an operational choice of ring-bus or split-plant operation. Six (6) ship service switchboards are provided, three (3) for 400 Hz service and three (3) for 60 Hz service.

(U) The lighting arrangement is based upon dividing the ship into four (4) lighting zones or "cubes". Three cubes comprise the internal illumination distribution system, while the fourth cube services the specialized needs of the helicopter hangar and landing lights. Lights throughout the ship are predominately of the fluorescent type and are energized by the 60 Hz system,

(U) 2.3.3.1.1 Type of System -- A block diagram depicting the functional integration of the electrical system is shown in Figure 2.3.3-1. The power generation system provides all anticipated ship service primary and secondary electrical power with minimum weight, minimum development risk and maximum assurance of required performance, reliability, and flexibility. Both the 60 Hz and 400 Hz systems generate power at 450 V, 3 phase, ungrounded delta. Power quality meets or exceeds the requirements for Type II 400 Hz power and Type I 60 Hz power per MIL-STD-1399/ 103.

(U) In addition to driving the 60 and 400 Hz generators, the ME 831-800 gas turbines provide bleed air for starting the propulsion and lift engines (LM2500 or FT9) and also provide a small amount of continuous bleed air for the ship's compressed air system.

(U) The near term SES' operating loads are approximately 50% on the 400 Hz system and 50% on the 60 Hz system. The ship's 400 Hz operating loads are distributed evenly among the three 400 Hz switchboards, each of which serves consumers located nearest to the particular switchboard. Each switchboard is connected to the other switchboards by bus ties which form a ring bus arrangement.

(U) Two of the three generating plants are generally connected to the ring bus arrangement for all operating modes, allowing the third unit to be in a standby mode. Generators may be added or deleted as the power demand dictates when operating with the ring bus system,

(U) The 60 Hz power distribution system is similar to the 400 Hz system.

(U) The lighting system provides adequate and reliable illumination in all areas of the ship, regardless of operating mode or condition. Special and detail lighting is provided for specific tasks. The lighting fixture arrangement is spaced to provide the prescribed levels of working surface illumination, as well as uniform, shadow free illumination for all areas. The system provides the following illumination services throughout the ship:

- General white illumination in all spaces
- Detail illumination according to work task
- Low-level, red-band illumination for darkened ship
- Two levels of blue-band lighting in the Combat Information center
- Automatic and manual battery operated battle lanterns
- helicopter platform visual landing aid and VERTREP platform illumination for night operation
- Navigation and running lights

(U) The lighting system utilizes 60 Hz power for economic reasons since a 400 Hz system offers no appreciable weight savings and would be appreciably higher in cost. The lighting system also provides power for numerous non-lighting loads wherever this arrangement yields weight savings.

(U) The system utilizes the Navy concept of dividing the ship into vertical volumes, each approximately a cube, for optimum distribution. The ship is divided info four cubes. One cube is dedicated to the helicopter landing area and supporting lighting. The remaining three cubes are divided into the forward, middle and aft portions of the ship. The lighting distribution system is fed from the three 60 Hz switchboards. Each of the three ship cubes contains two transformer banks fed from different switchboards. One transformer bank in each cube receives two separate power sources via a two-way automatic bus transfer, for supplying power to all areas containing vital lighting. The other transformer bank in the cube receives power from one switchboard. Figure 2.3.3-2 illustrates this arrangement.

(U) Lighting fixtures are designed to provide satisfactory illumination with optimum operational economy and minimum maintenance. Fluorescent lighting is used predominantly wherever feasible, owing to its superior lighting qualities and lower power consumption, Incandescent lighting is utilized only where a suitable fluorescent fixture is not available.

(U) Standard Navy fixtures are normally used because of their proven qualities; in exceptional cases, other suitable fixtures may be selected where a functional advantage exists, or where an appreciable weight or cost saving can be achieved with no degradation in either service or reliability.

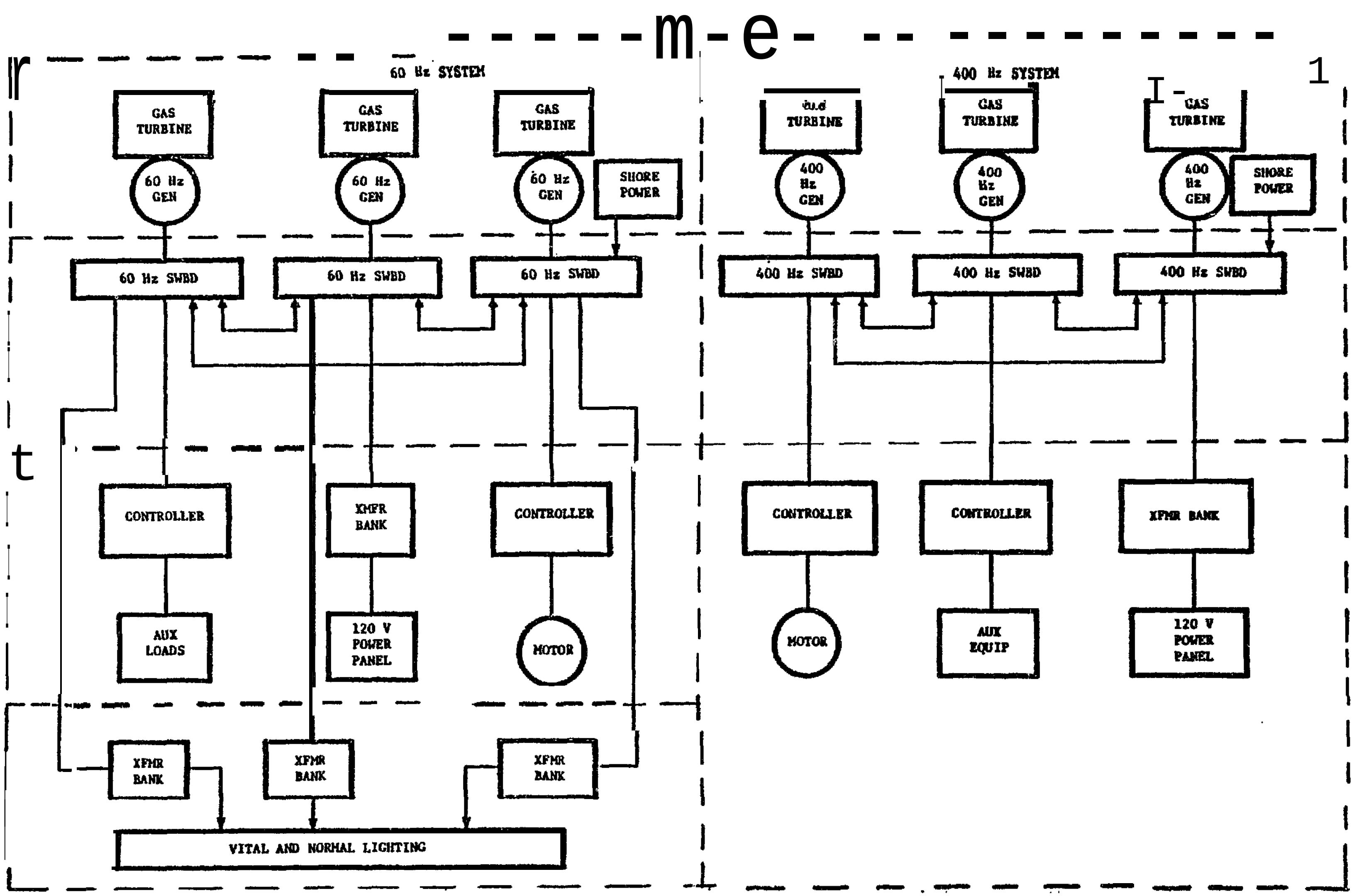


Figure 2.3.3-1 (U): Electrical Plant Functional Block Diagram Illustrating Independent 400 Hz and 60 Hz Systems and Ring Bus Arrangement Which Precludes Total Loss of Power (U)

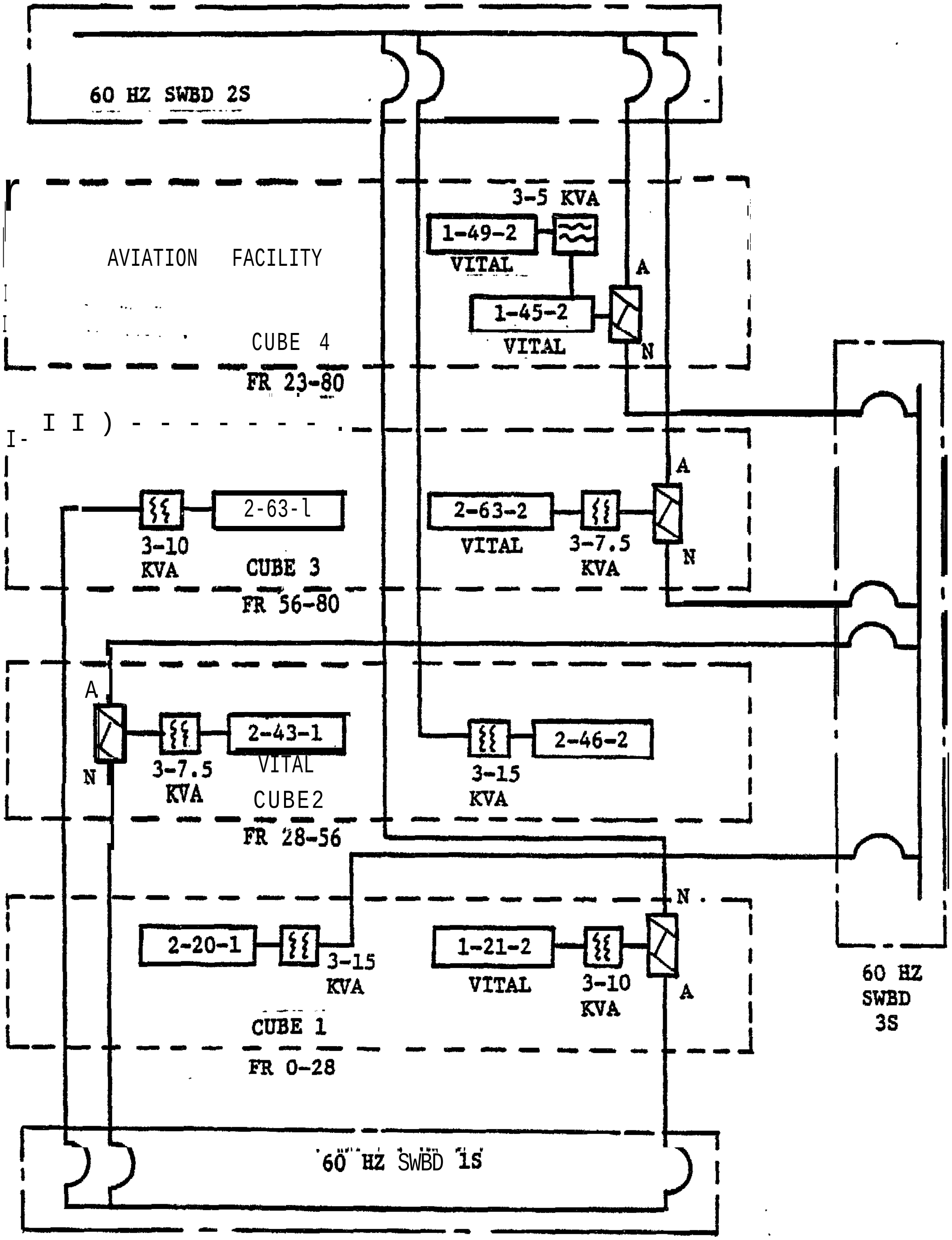


Figure 2.3.3-2 (U): Lighting System, One-Line Diagram (U)

(U) 2.3.3.1.2 Type of Components -- The GTG prime movers are Garrett ME 831-800 turbines currently being qualified for the Navy PHM program. The 831 series engine has four million hours of operational experience in protected and unprotected environments.

(U) The 400 Hz GTG system is very similar to the PHM patrol hydrofoil generator set: each employs an ME 831-80-O turbine, gearboxes with identical basic castings, bearings, and primary gears (i.e., gears that drive the 400 Hz generator), and identical turbine auxiliaries. The 400 Hz generator is also very similar to the generator used on the PHM patrol hydrofoil generator set (same design and frame size), differing only by a slightly longer lamination stack to provide a higher power level output.

(U) In addition to the 60 Hz GTG use of the same gas turbine as the 400 Hz GTG, the other major components (such as the fuel system, lube system, and governors) differ very little between the two power frequency systems. The gearboxes are fundamentally identical except for the output gears which provide shaft speeds of 1800 RPM for the 60 Hz generator and 8000 RPM for the 400 Hz generator.

(U) Each GTG set comprises a gas turbine, reduction gear, generator, governor, fuel system, self-contained lube system, enclosure and control system. Figure 2.3.3-3 and 2.3.3-4 show the turbine prime mover major components, envelope, and weight for the 60 Hz and 400 Hz units, respectively,

(U) Each GTG is equipped with an electrical starter operating from its own dedicated 24 V dc battery system. On starting, in-rush currents of 2000 amperes exist and voltage dips below 15 volts will occur. These 1 rge voltage dips dictate the need for an individual, dedicated battery and charger/power supply for each of the GTG's. This arrangement also ensures very high starting reliability, positively guaranteeing "blackship" starts.

(U) The ME 831-800 gas turbine engine provides bleed air from its compressor. This source of compressed air constitutes a cost and weight effective means for starting the lift or propulsion gas turbine engines. The maximum air bleed rate is 104 lbm (0.786 Kg/s) from each turbine, and the output of two turbines, cooled through a heat exchanger is required to start the LM2500 (or FT9 A-2A). The bleed air power drain is substantial during the engine starting cycle, so the off-line GTGs are available to perform this function without disturbance of normal power generation.

(U) The 400 Hz and the 60 Hz distribution switchboards are identical in construction. Typical outline dimensions are shown in Figure 2.3.3-5, Local control devices and instrumentation for GTG's are provided within a control cabinet located on the GTG. Switchboards are of the free-standing, dead front type, constructed with aluminum framing and sheeting. Access space is provided at both front and rear of each switchboard. All devices for the remote control and monitoring of the switchboards are conveniently terminated at terminal boards in the rear of the switchboard to facilitate connection of the ship's cables. Reverse power protection for the generator sets is provided within the switchboards.

(U) Circuit breakers mounted within the switchboard are of the proven reliable MIL-SPEC type. Molded case AQB Type circuit breakers are used within the distribution system to achieve reduced system weight and cost. The AQB Type bus tie and shore power circuit breakers are equipped with motor operated devices to enable remote operation. The generator circuit breakers are ACB Type.

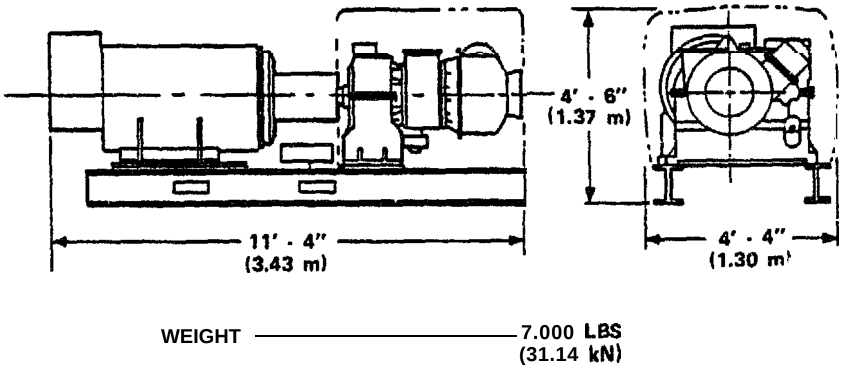


Figure 2.3.3-3 (U) The 60 Hz Gas Turbine Generator Set is a Compact Unit (U)

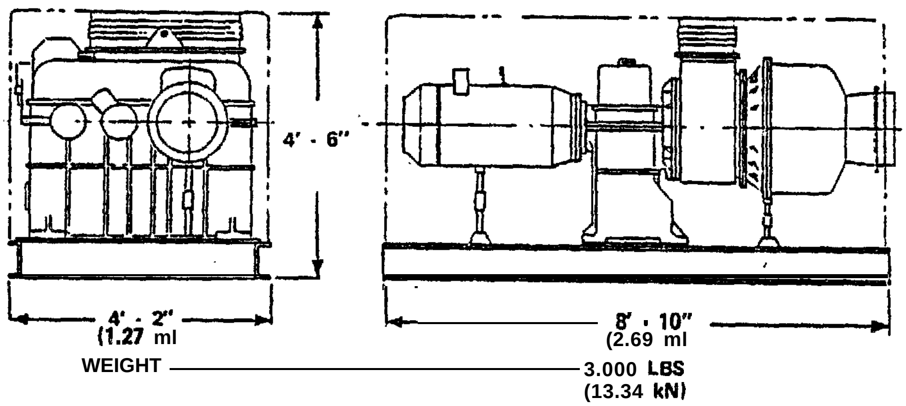


Figure 2.3.3-4 (U): The 400 Hz Gas Turbine Generator Set is Similar to the PHM GTG (U)

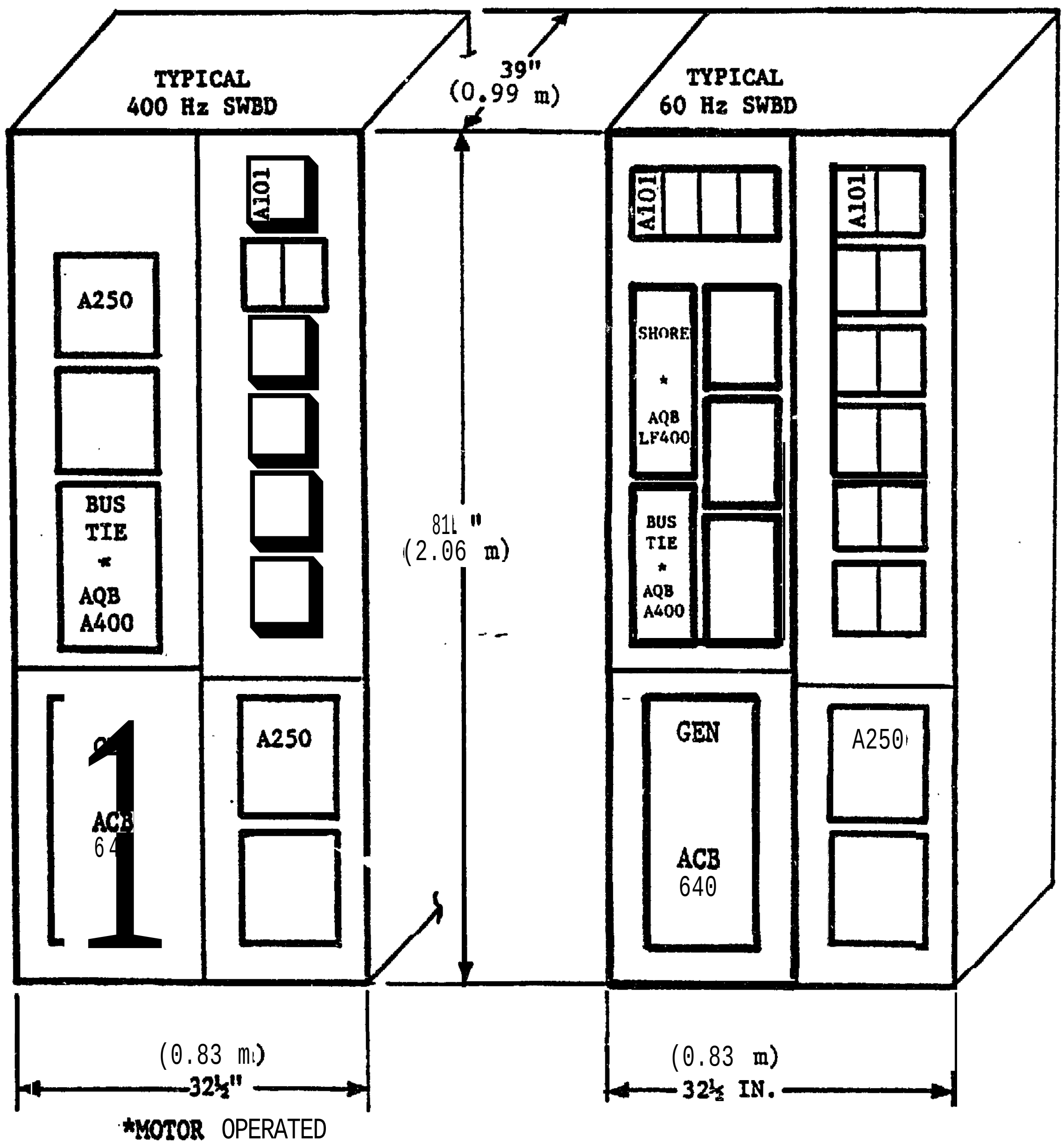


Figure 2.3.3-5 (U): Switchboard Arrangement (Typical) (U)

(U) 2.3.3.2 General Schematic -- An electrical system general schematic is shown in Figure 2.3.3-6, This shows the complete independence of the two primary power systems (60 Hz and 400 Hz) from each other. Each generator, both 60 Hz and 400 Hz, have an associated switchboard located in the same room with its generator, The locations of the generators have been made so that the three units for either system are dispersed one from the other, with two being low on the third deck and one high on the main deck.

(U) Shore connections for both 400 Hz and the 60 Hz systems are made at connector receptacles located near the centerline on the 02 level. Inter locking is provided between the shore connection and the switch-board-mounted shore power circuit breaker to prohibit make-or-break of the shore connection under load.

(U) Each circuit breaker has been selected to provide adequate protection in the event of a fault. A sequenced opening of breakers will occur with the generator breaker operating last. Should distribution circuit breakers open, manual resetting of the breakers is required as a safety feature to ensure that the fault or overload is first removed. Selected breakers may be remotely opened for damage control purposes but manual reset is required. Large power consumers are fed directly from switchboards while smaller consumers are routed to power distribution panels located throughout the ship. Transformers are located in close proximity to distribution panels for loads requiring voltages other than generated voltage. Voltage and frequency monitors (VFM) are provided where required for protection of 400 Hz electronics.

UNCLASSIFIED

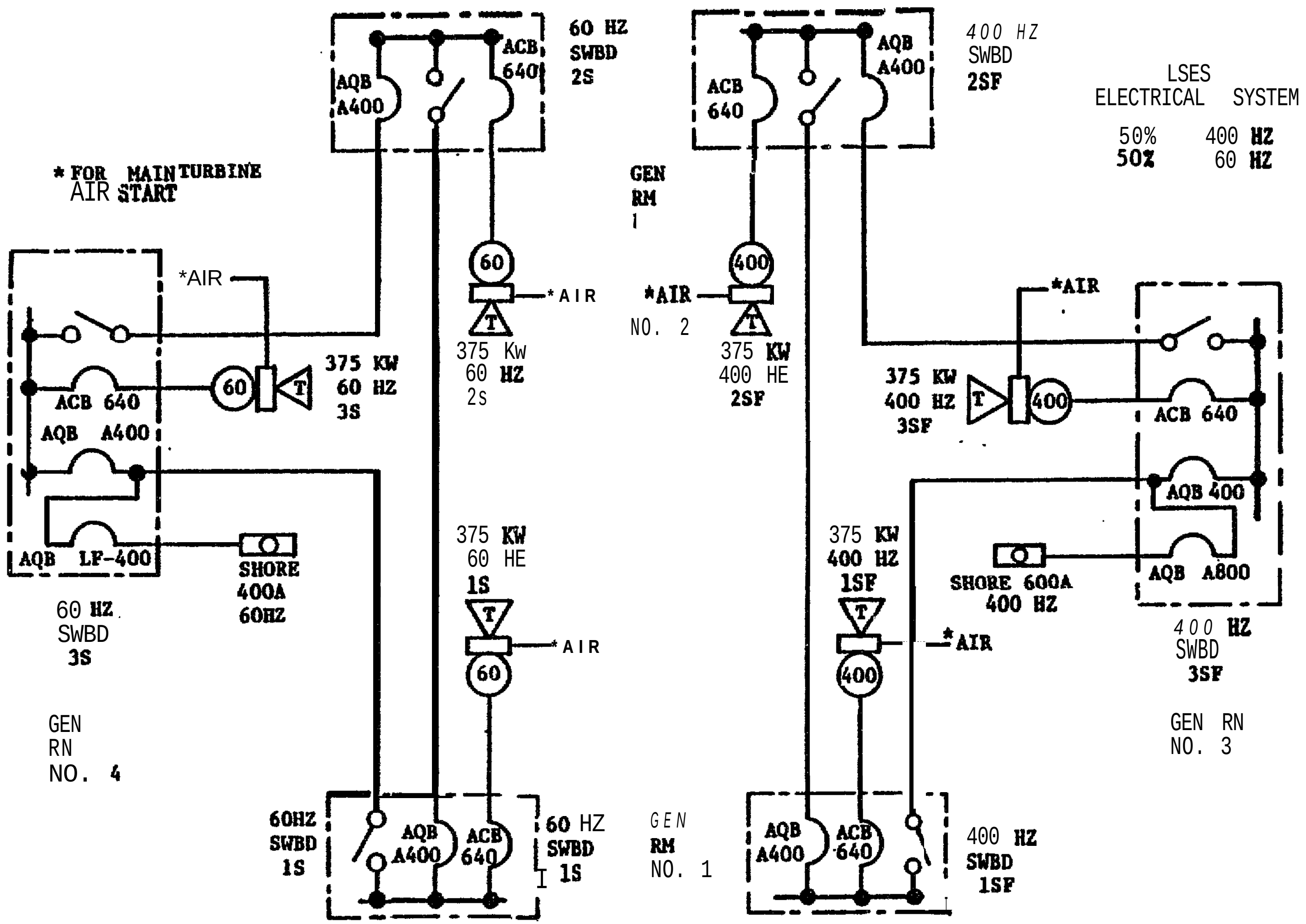


Figure 2.3.3-6 (u): Electrical System General Schematic, Illustrating Flexibility and Availability Provided by Multiple **GTGs** and Ring Bus Interconnection of Switchboards **(U)**

UNCLASSIFIED

W2.3.3.3 General Arrangement -- The six GTG sets are installed in four different rooms, separated from each other by at least two water-tight bulkheads GTG Rooms 1 and 2 are symmetrically arranged and located on the third deck at the outboard extremes of the ship, as illustrated in Figure 2.3.3-7. Figure 2.3.3-7 also shows the location of the two GTGs (one 60 Hz and one 400 Hz) within each room.

(U) GTG Rooms 3 and 4 are located port and starboard on the main deck, just forward of the combustion air inlet plenum. Room 3 contains one 400 Hz GTG as shown in Figure 2.3.3-8. Room 4, on the port side, contains one 60 Hz GTG and is arranged similarly to Room 3. The starting/control battery, battery charger and switchboard for each of these GTGs are also located within the rooms.

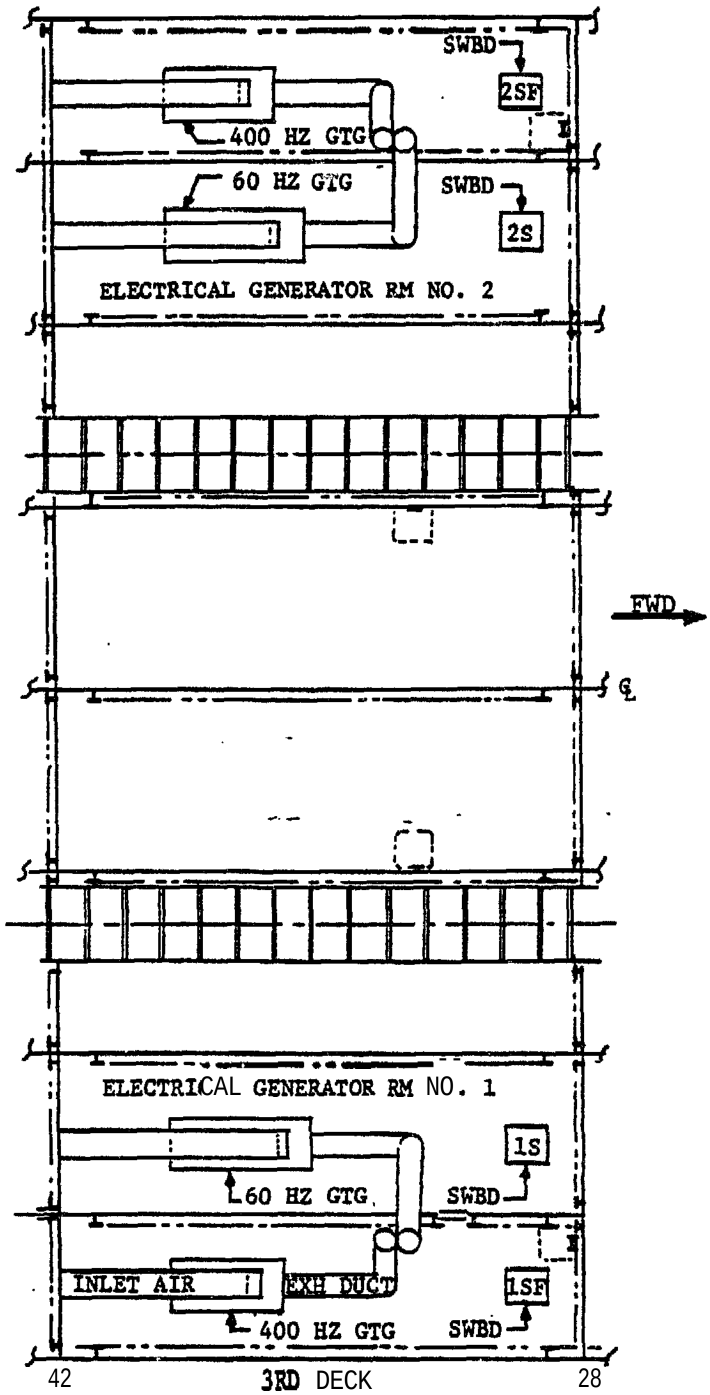


Figure 2.3.3-7 (U): Electrical Generator Rooms 1 & 2 (U)

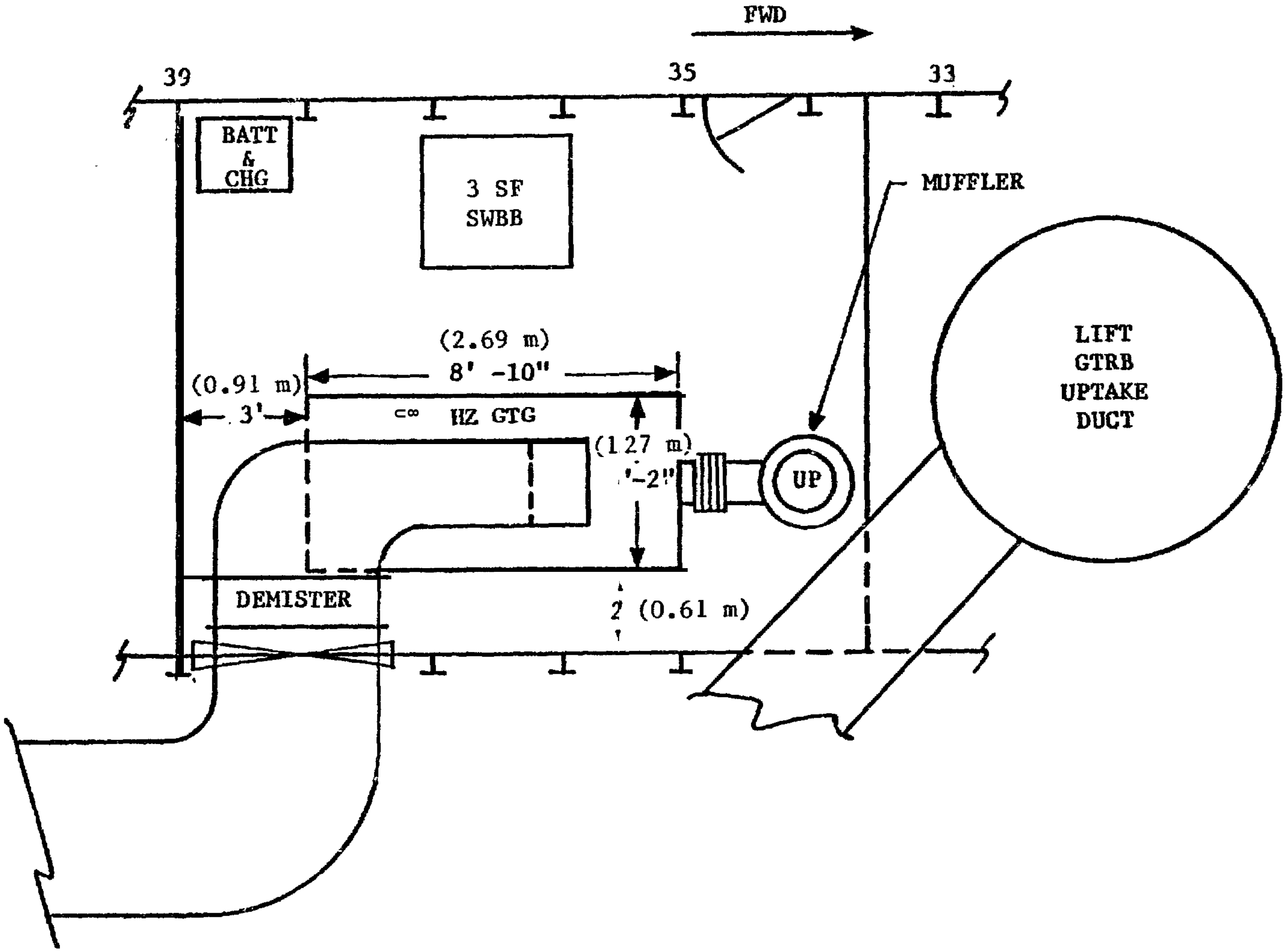


Figure 2.3.3-8 (U): Baseline GTG Room No. 3 (U)

UNCLASSIFIED

(U) 2.3.3.4 Electrical System Characteristics -- The estimated load under the most demanding condition is approximately 500 kW of 60 Hz power and 500 kW of 400 Hz power. Therefore, the normal operating configuration requires two each of the 60 Hz and 400 Hz generators to be running, leaving one of each type in reserve. These off-line reserve generators are automatically started when required, and are thus functionally equivalent to conventional "emergency" generators.

(U) The GTG sets and associated switchboards are arranged for remote control and monitoring and for limited local control. Automatic and manual controls are provided for remotely paralleling the three 60 Hz generators and for remotely paralleling the three 400 Hz generators. Both the 60 Hz and 400 Hz systems are equipped with voltage and frequency trim controls, load shedding, load sharing, malfunction shutdown, overload controls, and warning alarms.

(U) The control systems provide corrective measures for sustained overload or a generator failure. These provisions include automatic start of an off-line generator and automatic paralleling with the system bus. In the event of failure of an on-line generator, an automatic load shedding scheme protects the remaining vital loads. Manual reset of breakers is required following load shedding as a safety precaution. Sustained generator overloads activate an automatic sequence to shed non-vital consumers, and to start up and parallel an off-line generator if necessary. Failure or malfunction of an operating generator also results in immediate automatic startup and parallel operation of an off-line generator. The system provides ample capacity for across line motor starting of the largest motors currently identified or anticipated for consumers.

(U) Two power sources are supplied for all vital loads. The lighting, "Circle W" ventilation, electronics, fire pumps and ship's control receive normal power from one switchboard and an alternate supply from a different switchboard via a bus transfer device located near the using equipment. Other vital consumers are supplied from a different switchboard for each element of a vital equipment pair, to assure continuity of service. Thus, in the event of a failure or casualty of the power supply to any vital load, all that systems' generators or switchboards (60 Hz or 400 Hz) would have to fail to create a total loss of power.

(U) A radial lighting distribution system is employed that consists of 450 V, 60 Hz feeders from the ship's switchboards reduced through suitable transformer banks to 120 V distribution panels within each cube. The distribution panels supply centrally located distribution boxes, which distribute power to individual local lighting circuits. Vital lighting in spaces, as defined under "Emergency Lighting System" in Section 331b of the GSS,[(1)] IS provided with a normal and alternate source of power through automatic bus transfer equipment, since this results in the simplest back-up arrangement.

(U) Red low-level illumination is provided for standing lights, access routes and spaces requiring dark-adapted vision. Battery powered hand lanterns are provided throughout the ship to supply a limited amount of illumination in the event that other lighting sources fail.

(U) 2.3.3.5 Electric Plant Weight Breakdown -- The following Table 2.3.3-l shows the estimated percentage weights of the major equipments and components of the electrical system.

Table 2.3.3-l (U): Electric Plant Weight Breakdown(U)

SUBSYSTEM	PERCENT OF SYSTEM
Gas Turbine Generator Sets	20.0
Turbine support equipment	14.0
Switchgear, panels, fixtures	35.2
Electrical Cable	20.5
Miscellaneous	10.3

(1) General Specification for Ships of the U. S. Navy

(U) 2.3.3.6 Technical Risk Areas -- The electrical system provides high confidence that the requirements for electrical power will be completely met, regardless of operating condition, The associated trade-off studies provide assurance that the baseline system can be implemented with off-the-shelf equipment and at competitive prices. This system features six generators, of which only four are required to supply the maximum load. This offers advantages over other configurations which depend on a smaller number of larger generators. These advantages include:

- A turbine or switchboard failure has less impact on total power generation capability.
- Major components are smaller and easier to remove for depot repair or replacement.
- Smaller GTG envelope and smaller exhaust piping allows greater installation arrangement flexibility.
- Set enclosures are smaller and easier to remove in confined GTG rooms.
- It is feasible to provide a reserve GTG for each power frequency.

(U) The power distribution system is closely patterned after those standard Navy practices presented in GSS Sections 300 and 320 and in appropriate Design Data Sheets. Minor variations only have been made, including (1) the addition of a ring bus arrangement for added flexibility and reliability, and (2) substitution of disconnect switches for circuit breakers at one end of each bus tie cable to achieve weight and cost savings. Therefore, with high confidence, the system will provide satisfactory and reliable system performance.

(U) The composite design of the electrical system and the definition of its individual components functional and physical characteristics is considered a source of low risk. This conclusion is based on the ready availability of the chosen hardware, as well as its statistically proven performance and the straightforward integration of the overall system.

2.3.4 COMMAND, CONTROL AND COMMUNICATIONS (C^3)

(U) 2.3.4.1 Summary Description -- C^3 functions are accomplished by subsystems and equipments arranged and integrated to optimize the collection, evaluation, display, and dissemination of data and intelligence supporting command and control. The C^3 system includes equipments for:

- Display
- Data processing
- Navigation and collision avoidance
- Interior communications
- Exterior communications

(U) The C^3 system interfaces with Combat System elements for underwater, surface and air surveillance, as well as Combat System fire control and weapons elements.

(U) Worldwide navigation capability and continuous absolute and relative position as well as ship's speed, heading, drift angle and attitude, are provided by the navigation system. The navigation system includes the hardware and data processing necessary to receive and integrate signals from an inertial navigation system (SHIPS-G-5683; TYPE II), and from Omega (SRN-17) and satellite radio mavigation (AN/WRN-5; SATNAV).

(U) The surrounding surface environment is monitored to provide the capability to sense and quantitatively measure potential collision situations. The collision avoidance subsystem displays the surface situation and computes trial evasive maneuvers so that the ship may safely avoid predicted areas of danger. Navigation aids, shoals, and other significant data are stored for display as a synthetic map along with radar derived data as an aid in coastline, harbor, river, and shoal area piloting.

(U) 2.3.4.2 List of C^3 Equipment -- The list of C^3 equipment is contained in Appendix C. Interior Communications and Navigation Equipment are separately identified. The list itemizes equipment physical characteristics, weight and ship services requirements.

(U) Collection, evaluation, display and dissemination of information relative to the friendly and enemy environment, and control of sensors and weapons is centralized in a combat information center (CIC). Equipment and operator stations are arranged on the basis of functional adjacency requirements to improve reaction time and permit positive control over weapons and sensors.

(U) The CIC arrangement permits evaluation of the air, surface or subsurface environment from a centralized station. The CIC operators exercise control of all weapons, sensors and displays and keep the commanding officer apprised of the tactical situation.

(U) Multiple path exterior communications are provided, and communications equipment is arranged functionally in a manner consistent with minimum manning. Transmitter and receiver groups are located in the transmitter room adjacent to the communication center. Remote control devices for transmitter and receiver groups are centrally located in the communication center.

(U) 2.3.4.3 C^3 System Weights -- The following table 2.3.4-l delineates the weights of major C^3 subsystems.

Table 2.3.4-l (U): C^3 Subsystems Weights(U)

SUBSYSTEM	WEIGHT		
	LT	kN	% OF TOTAL
Command & Control System	5.0	49.82	15.5
Navigation System	3.5	34.87	10.9
Interior Communi-cations	14.7	146.47	45.6
Exterior Communi-cations	9.0	89.68	28.0
System Total	32.2	320.84	100.0

(U) 2.3.4.4 C^3 System General Arrangements and Function Block Diagrams -- C^3 system arrangements of the ANVCE Near Term Point Design SES are contained in Appendix B, Section B.S. Also included is an overall system block diagram encompassing only C^3 elements but also elements of the ship's combat system described in Section 2.3.7 of this report and a matrix of interior communications voice systems on the ship.

(U) The drawings are grouped in the Appendix for consistency of report format and the benefit of the reader.

(U) 2.3.4.5 C^3 Risk Assessment -- Only Navigation and IC Systems were evaluated in terms of risks. The remainder of C^3 systems are comprised of government furnished or government nomenclatured equipment with minimal risk to the near term SES design.

(U) Since the Navigation and Collision Avoidance Systems (CAS) are comprised almost entirely of government nomenclatured equipments, there is low technical risk in its implementation. Modifications to the AN/APS-116 radar constitute the principal departure from nomenclatured equipment. There is low technical risk involved in developing the required NAVCAS computer programs. The CAS consists of the following elements:

a. CAS control and display

b. AN/APS-116M Collision Avoidance Radar Subsystem with its own dedicated control unit

c. CAS data processor and computer programs (AN/UYK-20(V))

d. CAS water depth sensor

e. CAS map data storage

f. Low light level television (space and weight)

g. Radar Beacon (space and weight)

h. Back-up search radar AN/SPS-55 (part of Surface Surveillance, Section 4.4.6)

(U) Navigation and collision avoidance equipment was selected from Navy inventory items to meet the accuracy, reliability and special requirements of the near term SES. The interior communication system (IC) equipment group provides the means and methods for directing functions within the near term SES, other than for weapons control, by the transmission and reception of orders and the exchange of information by electrical and audible means. The IC equipment group also provides audio and television entertaiament. All IC system equipments are standard equipments and involve minimum risk.

2.3.5 AUXILIARY SYSTEMS

(U) 2.3.5.1 Auxiliary Systems Less Lift System -- The near term SES auxiliaries combine traditional shipbuilding experience with innovative design. The auxiliary systems were developed for operational requirements with performance, reliability and low weight as primary objectives.

(U) 2.3.5.1.1 Climate Control System -- The Climate Control System consists of the compartment heating, ventilation, and air conditioning (HVAC) system; machinery space ventilation; and rhe ship's stores refrigeration system.

(U) Heating, Ventilation and Air Conditioning (HVAC) -- The HVAC System provides conditioned air to various spaces and/or major equipment located throughout the ship. The system combines electrical resistance heating; meachnical fresh air supply and exhaust; and recirculating air conditioning. The system features 400 Hz electric motor powered packaged air conditioning plants and 400 Hz electric motor driven axial flow fans.

(U) Machinery Space Ventilation -- Thirteen air supply systems supply 100 percent summer cycle outside air to all auxiliary machinery rooms, electrical generator rooms, lift fan rooms, lift fan engine rooms, and main propulsion engine rooms. There are no duct preheaters for heating air in winter cycle.

(U) Refrigeration System -- Two separate 400 Hz motor driven centrifugal, packaged type, refrigeration plants are provided for ship's stores refrigeration. Each refrigeration machine supplies freon to the cooling coils in the freezer and chiller spaces. One unit maintains the required temperatures for both spaces during normal operation with redundancy provided by the second machine; two refrigeration machines are used for pulldown.

(U) 2.3.5.1.2 Seawater Systems -- The Seawater Systems consist of all seawater supply and drainage systems. These include fire main, sprinkling, auxiliary seawater, scuppers and deck drains, plumbing drains, and drainage systems.

(U) **Firemain** and Auxiliary Seawater System -- The seawater services are furnished by a single combined **firemain** and auxiliary seawater system.

The system is arranged as a **firemain** for damage control considerations, and separated into fire and auxiliary service functions at the respective required pressures. Four each centrifugal Dumps are used. They are each capable of a delivery of 400 gpm (.252mm ^{3}/s) at 125 psig (0.862 kPa).

(U) **Scuppers** and Deck Drains -- The scuppers and deck drains consist of all space deck drains at and above the second deck. Space deck drains (with GRP piping) from wet spaces and fan rooms are combined and directed overboard via **scupper** valves, The overboards are located on the third deck above the full load waterline to reduce drag.

(U) **Plumbing** Drains -- The plumbing drains are vacuum assisted which collect soil wastes from water closets and urinals, and waste drains from showers, lavatories, sinks, laundry, galley, and scullery. The drains are led to a vacuum collection tank from which wastes are either discharged overboard or directed to the collecting holding and transfer tank (CHT). Connections are also provided for discharge to shore receiving facilities.

(U) Drainage System -- The drainage system consists of a main and secondary drainage system which provides the drainage for the machinery spaces and other spaces on and below the third deck. The main drainage **eductors** of 500 gpm (0.317 mm^3/s) capacity are provided for the **propulsion engine rooms** and the **waterjet** pump rooms. **Eductor** actuating **water is** provided by the fire main and auxiliary sea water system. Discharge is overboard above the full-load off-cushion waterline,

(U) 2.3.5.1.3 Fresh Water Systems -- Fresh water systems include the distilling plant, the potable water system, the turbine water wash systems, the cooling water system, and the auxiliary fresh water cooling system.

(U) Potable and Fresh Water System -- The potable water system is basically a standard shipboard system. The fresh (wash) water system operation is managed to reduce storage requirements. GRP piping is utilized to the maximum extent practical.

(U) Cooling Water System and Auxiliary Fresh Water Cooling Systems -- Two electronic cooling water systems are provided: the cooling water system (freon cooled) and the auxiliary fresh water cooling system (seawater cooled). Cooling water for electronic equipment is provided by a closed loop system in accordance with pertinent NAVSHIPS drawings.

(U) 2.3.5.1.4 Fuels and Lubricants Systems -- The light weight fuel and lubricants system is a straightforward design featuring common functional manifolds and minimal connections. The system consists of the ship's fuel oil system and the aviation fuel system, where a common fuel (JP-5) is used for all ship fuel services.

(U) Ship's Fuel Oil System -- The ship's fuel oil system consists of the fill, transfer and service.

- Fuel Oil Fill -- Fueling of the ship is provided at port and starboard fill stations. The fueling stations utilize seven inch (0.18 m) probe receivers, each capable of 3000 gpm (1.89 mm^3/s). There are 23 fuel tanks.
- Fuel Oil Transfer -- Provision is made for transferring fuel between tanks to shift the ship's center of gravity for optimum operating conditions. The 400 gpm (.252 mm^3/s) pumps also transfer fuel to the fuel oil storage tanks,

c. Fuel Oil Service -- The two deep fuel oil service tanks are located amidships, port and starboard, with their adjacent fuel centers including functional manifolds, pumping equipment, filter coalescers and proper distribution lines. The port and starboard fuel service subsystems have the capability of cross-feed (redundancy) in emergency conditions.

(U) Aviation Fuel System -- The aviation fuel system consists of the helicopter fueling and service system. The system includes two service tanks that are filled from the ship's storage tanks through filter coalescers.

(U) 2.3.5.1.5 Air, Gas and Miscellaneous Fluids -- The air, gas and miscellaneous fluids consists of compressed air systems, nitrogen systems, fire extinguishing systems, and hydraulic fluid systems.

(U) 'Compressed Air Systems -- Both low pressure and high pressure air systems are provided.

- Low Pressure Air System -- The low pressure compressed air system is furnished by bleed air from the GTG and main propulsion engine gas turbine. The low pressure compressed air system consits of ship's service, control air, and starting air system.
- High Pressure Air System -- A high pressure air system is provided for charging MK-32 torpedo tubes. A nominal 3000 psig (20.68 MPa) compressor, dehydrator and air flasks are used for this particular launch activity.

(U) Nitrogen System -- A Nitrogen System is provided for helicopter services. The nitrogencharging station in the helicopter hangar consists of five cylinders and a variable regulator capable of supplying 70 to 3000 psig (.048 to 20.68 MPa)of oil free nitrogen for helicopter tire inflation and other helicopter services.

(U) Fire Extinguishing Systems -- The fire extinguishing systems on the ship consist of AFFF, Halon (FE 1301) fixed flooding systems, hi-expansion foam, and portable Halon extinguishers.

- A high capacity AFFF proportioning system is provided for the helicopter hangar and landing area. A fixed sprinkling system is provided for the hangar and two hose stations are provided port and starboard on the landing platform.

- Fixed flooding Halon systems which meet the requirements of NFPA No, 12A, are the primary fire extinguishing systems for propulsion engine rooms; lift fan engine rooms; auxiliary machinery rooms; waterjet pump room; and electrical generator rooms.

- A high expansion (Hi-X) foam system is provided as a secondary (backup) system for the Halon fixed flooding systems, Port, starboard, and amidships proportioning units are supplied from the fire.main system.

(U) -Hydraulic System -- A centralized hydraulic system provides hydraulic flow for the subsystems and incorporates a lightweight flexible power distribution system capable of rapid response. Operating mode evaluations indicate that the main dydraulic power can be delivered by two hydraulic pumps driven by the lift fan engines. These pumps will be augmented by electric motor-driven pumps of comparatively small flow rate during peak hydraulic load activities. The motor-operated pumps will also be used during off-cushion and in-port operations.

(U) The maximum system hydraulic power available is 273.5 gpm (0.173 mm^3/s) at 3000 psig (26.68 MPa); hydraulic fluid in accordance with MIL-H-83282 w-ill be used,

(U) 2.3.5.1.6 Underway Replenishment System -- The Underway Replenish-. ment System comprises the Replenishment-at-Sea System and the Ship Stores and Personnel and Equipment Handling.

(U) Replenishment at Sea -- Replenishment at sea is provided for by VERTREP and alongside refueling. A combined VERTREP, HIFR, and Helicopter Landing area is provided on the main deck aft of the hangar.

(U) Stores, Personnel and Equipment Handling -- Strikedown has been simplified as much as possible by arrangement of magazines, storerooms and refrigerated spaces on the main and second deck for each of access. Handling on the main deck will be by hand pallet trucks, package truck, and manual means. Materials to be struck down to the second deck will be conveyed by a vertical conveyor, located starboard. A stores handling area is provided on the second deck. Heavy items will be handled by davit and monorail, The co-location of galley and refrigerated spaces eliminates need for a dumbwaiter.

(U) 2.3.5.1.7 Mechanical Handling System -- The mechanical handling systems are the anchor handling, mooring and towing, boat handling, hangar door, and the helicopter securing-and traversing system.

(U) Anchor Handling System -- The basic requirements are anchoring with a 70 knot (36.01 m/s) wind velocity, a 4 knot (2.06 m/s) current velocity, and in 40 fathoms (73.15 m) water depth,

(U) A single anchor, of the Danforth Hi Tensile type, was selected on the basis of the recommended criteria.

(U) Mooring and Towing. System --Three line handling capstans are provided to facilitate mooring alongside piers and other ships.

(U) Boat Handling and Stowage -- Boat handling facilities consist of abandon ship equipment and an inflatable hard bottom boat for use during helicopter plane guard operations and for man overboard recovery. Six MK-V inflatable CO_2 twenty five-man life rafts are provided in standard containers.

(U) Hangar Door System -- Horizontally deployed hangar doors are used and consist of vertical hinged panels which travel on horizontal tracks. The doors are mounted under constant tension by spring loaded lower roller bearings that apply tension to upper roller bearings. Door operation is by an electric motor and gearbox drive.

(U) Helicopter Securing and Traversing -- A helicopter securing and traversing system will be installed, but its final design has not been made. Alternatives which will meet the design requirement with use of minimum space and weight include a present preference for a modified version of the prototype being developed by the Navy for use aboard aviation facility ships. The unit is modified to accommodate two (2) helicopters.

(U) 2.3.5.1.8 Special Purpose Systems -- The Special Purpose Systems consist only of the Environmental Pollution Control System. The Environmental Pollution. Control System is concerned primarily with the solid and liquid wastes produced by the ship. The primary item is the Collecting, Holding and Transfer (CHT) tank which collects all plumbing and fresh water drains. The holding tank is sized to accommodate one day's waste. A sewage pump is used to discharge waste from the vacuum collection tank to the CHT. This same pump (a standby pump is provided) is used to discharge the CHT to a shore connection. A sewage eductor is used outside of the contiguous zone.

(U) Garbage is ground and flushed, via the vacuum collection tank, to the CHT, Solid trash is treated by compaction and retained aboard for disposal at a shore facility.

(U) Contaminated oil drains (fuel, lube oil, helo defuel, stripping lines, etc.) are discharged into an oily water drain tank. They are pumped to share facilities by the waste oil drain pump.

(U) 2.3.5.1.9 Auxiliary Systems Percentage Weight Breakdown -- Table 2.3.5-l shows the estimated percentages for major auxiliary subsystems less the lift system.

Table 2.3.5-l (U): Auxiliary Systems Percentage Weight Breakdown (Less Lift System) (U)

SUBSYSTEM	% OF SYSTEM
Heating, Ventilation, and Air Conditioning	13.4
Seawater	15.4
Fresh Water	9.1
Fuels and Lubricants	10.6
Handling and Storage Air, Gas, and Misc. Fluids	19.9
Mechanical Handling	19.0
Special Purpose System	11.3
Miscellaneous	1.3

(U) 2.3.5.2 Lift System

(U) 2.3.5.2.1 Air Distribution Summary Description -- Lift system air distribution consists of two sets of lift machinery and ride control equipment schematically shown in Figure 2.3.5.2-1. Each set of lift machinery is arranged in an in-line configuration, one set on each side of the ship. Power for each set of lift machinery is supplied by an LM 2500 gas turbine engine. The required power and speed is delivered to the lift fans via the lift power transmission system which consists of the reduction gear unit, shafting, and associated components. The lift fans draw air through inlets on the ship's deck, and discharge into separate and independent air distribution ducts. The forward fan on each side of the ship supplies air to the bow seal, the center fan supplies the cushion, and the aft fan discharges into the stern seal. Each fan duct is supplied with a shut-off valve to prevent back flow when the fan is not operating.

(U) 2.3.5.2.2 Seals Summary Description -- The design for the bow and stern seals utilizes a series of flexibly connected fiberglass planers at the water interface. A nylon/elastomer pressure bag behind the planers provides the force to contour and support the planers. Entitled the Advanced Planing Seals, they are a new, improved concept in SES seals that combines excellent low drag performance with rugged, high wear resistance qualities. The excellent wear resistance of the planing seals is exemplified by high speed water impact erosion of the glass reinforced plastic (GRP) elements, orders of magnitude less than that occurring with the rubberized fabric material of the common bag and finger seal systems. The advanced planing seals also perform the normal and vital functions of containing the air in the cushion, contributing to ship ride quality, and providing pitch and roll restoring forces to the ship.

(U) 2.3.5.2.3 General Arrangement -- The air distribution and seals are arranged as shown in Figure 2.3.5.2-2. Details of the air distribution and seals combined system are discussed in the next paragraph.

(U) Power Units -- A total of two gas turbines, each driving three VG fans through a reduction gearbox, are utilized in the SES lift system. One LM 2500 is located on the starboard side of the ship and the other on the port side. Each gas turbine is independent of the other, and can deliver 22,500 (16.78 kW) continuous shaft horsepower and 27,000 (20.13 kW) intermittent shaft horsepower. The link mounting system is identical to that used for the propulsion plant LM 2500 gas turbines.

(U) Power Transmission System -- The power transmission system begins at the flange which connects the power turbine to the reduction gearbox shaft. A disc type brake is mounted on the gearbox at the input shaft. At the output side of the reduction gearbox, a torsionmeter is installed, Two diaphragm type flexible couplings are installed between the torsionmeter (gearbox output shaft) and the first lift fan, one at each end of the shaft. The driven power to the fan rotor is picked up through the integral fan couplers. The integral fan couplers are those sections of drive shaft within, and integral to, the fans which permit decoupling of any fan. Flange couplings are used at each end of the fan through-shaft to connect to the drive shaft. A length of shafting and two shaft bearing supports with associated couplings are situated between the fan couplers of the second and third fans. Seals are provided where the life shaft penetrates watertight bulkheads,

(U) The lift reduction gearbox is a parallel shaft design with an overall reduction ratio of 1.93 to 1. The gearing is external double helical of involute form and is case hardened and ground to AGMA quality 12 or better. The gear case is an aluminum casting.

(U) The power transmission system for each set of lift fans is designed to transmit a maximum of 27,000 bhp (20.13 kW) from the gas turbine through the reduction gears to the lift fans. The system is designed to accommodate a maximum input shaft speed of 3,600 rpm (60 r/s) from the turbine and a maximum output shaft speed of 1,865 rpm (3108 r/s) from the reduction gear to the fans.

(U) Lift Fans -- The Lift and Ride Control System uses a total of six lift fans. The fans are symmetrically located, three port and three starboard, with each group positioned in line on a common shaft.

(U) All of the lift fans are identical except for assembly differences that depend on fan location. The fans are centrifugal type with an 86-inch (2.18m) diameter rotor, a housing, and variable geometry elements. They incorporate double axial inlet design, airfoil shaped radial blades, constant velocity volute housings, and a single circular discharge. The variable geometry fan elements (translating sleeve in each of the inlets) are included for modulating the air flow for ride control purposes. The fan is shown in Figure 2.3.5.2-3.

(U) Included in the fan envelope are the self-contained rotor decoupler, rotor bearings and coaxial line shafting that permft independent decoupling of any fan while operating under any design load. The mechanisms additionally provide for remotely activated recoupling of fans from an at-rest condition.

(U) Lift Ducting -- The lift air is delivered through ducts to the bow seal, cushion, and stern seal. The bow and cushion air ducts are short, conical sections which act as diffusers to reduce high velocity losses. The stern seal air duct is long in comparison and employs turning vanes in most elbows to reduce pressure losses. The long stern seal duct was selected in favor of long shafting as a result of trade-off studies. Ducting sizes are optimized for the system operating conditions. Attention is given to the velocity of the air balanced against the space allocation for the ducts,

(U) The four forward ducts have hydraulically operated butterfly type shut-off valves located near the fans. A louvered type shut-off valve is located over the stern seal in the long supply duct from the aft fan. These shut-off valves prevent back flow from the pressurized cushion if a fan is not operating for any reason. A pair of stern seal transfer ducts is also included in the lift system. These ducts provide stern seal to cushion air flow and contain throttling valves for stern seal to cushion pressure ratio regulation.

(U) Lift Air Intakes -- The lift fan inlets supply atmospheric air to the lift fans for pressurization and subsequent distribution into the cushion, bow seal and stern seal. Five openings are provided in the deck, port and starboard, to supply air for each group of three fans. The intake openings are positioned directly above the lift fan bellmouths. Four of the inlets are 12.2 feet (3.72 m) wide by 4.4 feet (1.34 m) long; the fifth inlet, which supplies the adjacent inlets of the mid and aft fans is 12.2 feet (3.72 m) wide by 8.9 feet (2.71 m) long,

(U) A fairing is provided around the openings to eliminate the ship boundary layer air and surface water flowing on the deck from entering the fan air inlets. The inlet design incorporates aerodynamic turning vanes to direct the air flow downward into the fan rooms. The vanes permit recapture of about half the air velocity head across the deck. An electrical heating system is incorporated in the vanes to provide anti-icing capability. The vane walls of each flow passage are treated , to provide the necessary sound attentuation,

(U) Ride Control System -- The ride control system integrates the variable geometry lift fans and vent valves and their associated actuators with appropriate ship motion sensors and the controller electronics into an active system. The total active system modulates the seal and cushion airflows to reduce the ship's heave accelerations to an acceptable level. The primary ride control system uses the variable geometry fans to control airflow. Vent valves are provided to expand the flow range

(U) available in high seas and to provide maximum versatility for RCS development.

(U) The variable geometry feature of the fans consists of hydraulically translated sleeves in the fan inlets, The sleeves have a maximum travel range of 18 inches (0.46 m). When fully closed, they reduce fan flow to less than 10 percent of design point conditions. The frequency response bandwidth of the sleeve actuating system is 0 to 2 Hz, The nominal maximum slew rate is 57 inches/second (1.45 m/s),

(U) The cushion vent system consists of two identical valve and duct arrangements at the stern of the ship near the centerline. The ducts, as shown in Figure 2.3.5.2-4 extend from the two wet deck cushion openings just forward of the stern seal into the third deck area and out of the transom of the ship. Discharging the vented air aft generates some propulsive thrust. Hydraulically operated, fast response, louvered valves are positioned in the ducts at the third deck level. The valves, as pictorially shown in Figure 2.3.5.2-S are designed as a battery of modules for fast response, reliability, and ease of replacement, The cushion vent ducting and valves accommodate flow rates up to 60,000 cfs (28.3 m^3/s). The valves are designed for a maximum pressure differential of 600 psi (4.14 MPa). Vent valve frequency response bandwidth is 2 Hz. Nominal maximum slew rate is 2.5 full strokes (close-open-close) per second.

(U) <u>Advanced Planing Bow Seal</u> -- The advanced planing bow seal is illuscrated in Figure 2.3.5.2-6. Geometry of the seal is given in Figure 2.3.5.2-7. The seal consists of four main elements which are next described.

(U) An elastomer pressure bag is attached to the bow at the 40 foot (12.19 m) waterline and normally extends aft in a continuous circular arc and connects to the wetdeck. The bag is configured of eight identical modules with elastomer end caps at the sidehull interfaces, The bag

(U) and end caps provide a flexible structure which contains the bow seal air while minimizing water ingress into the seal. The aft loop of the bow bag contains slotted openings of fixed width to provide controlled air flow between the seal and the cushion and to assure rapid water drainage.

(U) The planer/stay portion of the seal consists of thirty-two (32) modules across the beam of the craft. These planer/stay modules are constructed of glass reinforced plastic (GRP) and are attached to the wetdeck at the 40 foot (12.19 m) waterline. The upper forward portion, or stay, has relatively low stiffness allowing it to conform to the curvature of the forward portion of the bow bag. Near the lowest portion of the bow bag loop, the stays widen and are joined together by flexible sealing strips to form a continuous fiberglass planer surface.

(U) A 31-inch wide tapered GRP feather edge is attached to the trailing end of each bow seal planer module. This feather edge, having increased flexibility is used to attentuate the effective wave impact on the seal, assist in cushion sealing and improve the seakeeping capability of the craft,

(U) Each planer is supported by a geometry strap and a retract strap. The strap provides mid span support and geometric control of the planer through the full range of sea states. The geometry strap normally carries a tension load due to the cushion pressure acting on the planers, but may be unloaded for a short duration when encountering high waves at a higher velocity.

(U) A seal retract strap is attached to the retraction reel recessed inside the hull and extends down to an attachment at the aft edge of each planer, The straps provide for full retraction of the seals against the wetdeck for off-cushion operation and also for adjustments and trimming of the seals for minimum drag during hump transit, partial-cushion and full-cushion operation.

(U) The 32 straps pass through slots in the wetdeck structure, and over sheaves, before attachment to the retraction reel drums. Provision is made at each drum for unlimited strap length adjustment. Locks at the retraction drive outputs prevent inadvertent seal extension by high loadings. The drive units allow for high and low speed seal retraction, low speed extending adjustment, and the rapid free-wheeling extention associated with the craft going on-cushion

(U) Advanced Planing Stern Seal -- The stern seal is illustrated in Figure 2.3.5.2-8 and the seal geometry is given in Figure 2.3.5.2-9. Planer/stay elements are attached to the wetdeck and extend to waterline 0. These elements are similar to those of the bow seal, i.e., tapered trailing edge. I-beam reinforced planing section, and highly flexible stay section, with the exception being that the stays are the width of the planer module. Thirty-two modules span the beam of the craft. The full width stays protect the elastomer bag membrane from the erosive effects of direct high speed water impact. The planer attachments are identical to those of the bow seal.

(U) A four-lobed bellows bag is attached between the wetdeck and planer to contain air pressure within the stern seal. The bellows bag is built in modular sections and is fabricated of the same nylon/elastomer material as the bow seal bag, Holes are located along the lower lobe of the bellows bag and sized to permit rapid drainage of water. The four-lobe bellows is optimum for seal spring rate requirements and for tensile loading in the membrane.

(U) Convolute tension cables are connected between the wetdeck and the junctions of the lobes of the bellows bag in order to maintain the geometry of the bellows bag through the entire deflection of the seal. A set of lower geometry straps, connected between the wetdeck and the planer at the bellows bag/trailing edge junction, restrain the aft movement of the seal. Retract straps are attached to each planer near the planer's trailing edge and are connectad to the retract system

(U) reel in a manner similar to the bow seal system. The stern seal retraction system is similar to the bow system.

(U) 2.3.5.2.4 Tabulation of Key Parameters -- The key parameters of the lift system are presented in Tables 2.3.5.2-1, Lift System Physical Parameters, Table 2.3.5.2-2, Lift System Point Design, and Table 2.3.5.2-3, Seals Design Parameters.

Table 2.3.5.2-1 (U): Lift System Physical Parameters (U)

	UNITS		VALUES	
	ENGLISH	**(SI)**	ENGLISH	**(SI)**
1. Engine **- LM2500,** 2 Required				
Design Rotational Speed	**RPM**	**(r/a)**	3500	(58.33)
Maximum Continuous Power (MCP)	**HP**	**(kW)**	22500	(16785)
Specific **Fuel** Consumption (SFC)	**Lb/SHP-Hr**	**(kN/kW-Hr)**	**.40**	(2.39)
Maximum Intermittent Power **(MIP)**	**HP**	**(kW)**	27000	(20142)
Volume	**Ft^3**	**(m^3)**	1064	(30.129)
Basic Engine Weight	Lb	**(kN)**	10300	(45.817)
2. Reduction Unit With Brake, 2 Req.				
Power Capacity	UP	**(kW)**	27000	(20142)
Gear Ratio			1.93	
Gear Type: Single Reduction, Dougle **Helical** Involute Tooth				
Volume	**Ft^3**	**(m^3)**	114	(3.228)
Weight Port	Lb	**(kN)**	4922	(21.894)
Weight Starboard	Lb	**(kN)**	3762	(16.734)
3. Lift Fans (ALRC) 6 Required				
Type : Centrifugal, Dual Inlet, Constant Velocity Volute, Variable Geometry, Decoupling Device				
Rotor Diameter	In	**(m)**	86	(2.184)
Rotational Speed	RPM	**(r/s)**	1450	(24.17)
Tip Velocity	FPS	**(m/s)**	544	(165.8)

UNCLASSIFIED

Table 2.3.5.2-l (U): Lift System Physical Parameters Continued (U)

	UNITS		VALUES	
	ENGLISH	(SI)	ENGLISH	(SI)
3. Lift Fans (ALRC) Continued				
Design Head Rise	PSF	(k/Pa)	333	(15.9)
Design Flow	CFS	(m^3/s)	6039	(171.005)
Design Efficiency, Fan Percent			84	
Specific Speed, $N_S = \frac{NQ^{1/2}}{H^{3/4}}$			144	
Exit Diameter	In	(m)	82.5	(2.096)
Design Exit Velocity	FPS	(m/s)	163	(49.7)
Maximum Rotational Speed	RPM	(r/s)	1865	(155.42)
Maximum Flow (Approximate)	CFS	(m^3/s)	10000	(283.2)
Maximum Power	UP	(kW)	9000	(6714)
4. Transfer Shafting				
Total Length (1) Per Ship	Ft	(m)	104	(31.699)
Total Weight (2)	Lb	(kN)	8756	(38.948)
5. Distribution Ducting				
Total Length (3) Per Ship	Ft	(m)	532	(162.154)
Total Weight (4)	Lb	(kN)	26631	(118461)
6. Fan Inlets				
Type: Flush Horizontal with Acoustic Turning Vanes.				
Velocity Ratio (IVR) at 80 Knots (Free Stream/Inlet Velocity)			.70	
Weight	Lb	(kN)	11910	(52.978)

Table 2.3.5.2-l (U): Lift System Physical Parameters, Continued **(U)**

(1) Total length from gear box interface to last fan. Pan internal shafting not included.

(2) Includes shafting flex couplings and bearing pedestals.

(3) Includes ride control ducting.

(4) Includes flex coupling and values.

Table 2.3.5.2-2 (U): Lift System Point Design (U)

Ship Weight:	LT (kN)	3000 (2.9892 E+04)
Wave Height $H_{1/3}$:	Ft (m)	4.6 (1.40)
Ship Speed :	Knots (m/s)	80 (41.2)
Pressures:	PSF (kPa)	
Bow:		349 (16.71)
Cushion :		342 (16.38)
Stern:		376 (18 .00)
Total Flow Rate:	CFS (m^3/s)	37500 (I 061.88)
Lift System Efficiency:	%	76.1
Duct Losses:	PSF (kPa)	
Bow :		28 (1.34)
Cushion:		24 (1.15)
Stern:		39 (1.87)
Fan Parameters:		
Speed:	RPM	1535
Total Shaft Power	HP (kW)	29743
Flow:	CFS (m^3/s)	
Bow:		13146 (372.253)
Cushion:		13650 (385.525)
Stern:		10721 (303.585)
Engine Parameters (LM2500)		
Speed :	RPM	3266
Total Brake Power	HP (kW)	30661 (22873.1)
Total Fuel Flow	Lbs/Hr (N/s)	13556 (16.750)
SFC	$\frac{Lbs}{BHP\text{-}Hr}$ ($\frac{N}{kW\text{-}Hr}$)	.442 (2.636)

Table 2.3.5.2-3 (U): Seals Design Load Parameters (U)

1. BOW SEAL LOADS

ELEMENT	DESIGN[1] FACTOR (MINIMUM)	NOMINAL WORKING LOADS	MAXIMUM LOADS
Wet Deck Stay Attachment	2	2800 lbs/ft (114,000 N/m)	13,300 lbs/ft (202,000 N/m)
Fwd Wet Deck Bag Attachment	1.5	610 lbs/ft (8,900 N/m)	19,200 lbs/ft (280,000 N/m)
Aft Wet Deck Bag Attachment	1.5	380 lbs/ft (5,600 N/m)	13,200 lbs/ft (192,500 N/m)
Geometry Strap	2	20,990 lbs/strap (93,300 N/strap)	43,010 lbs/strap (142,000 N/strap)
Retract Strap	2	1,000 lbs/strap (4,450 N/strap	38,250 lbs/strap (171,500 N/strap)
Module-to-Module Joint	2.0	340 lbs/ft (5,000 N/m)	975 lbs/ft (14,200 N/m)
Planer-to-Planer	2.0	1,000 lbs/ft (14,600 N/m)	5,000 lbs/ft (73,000 N/m)

[1] Maximum load multiplied by its respective design factor is the ultimate design load.

Table 2.3.5.2-3 (U): Seals Design Load Parameters (Continued) (U)

2. STERN SEAL LOADS

ELEMENT	DESIGN FACTOR (MINIMUM) (1)	NOMINAL WORKING LOADS	MAXIMUM LOADS
Planer Attachment to Wet Deck	2	710 lbs/ft (10,500 N/m)	8,650 lbs/ft (126,000 N/m)
Geometry Strap		1,420 lbs/strap (6,320 N/strap)	36,400 lbs/strap (162,000 N/strap)
Wet Deck Attachment, Geometry Strap	1.5	1,440 lbs (6,400 N)	44,000 lbs (196,000 N)
Convolute Cable	2	8,426 lbs/cable (37,400 N/cable)	15,690 lbs/cable (69,700 N/cable)
Retract Strap	2	9,000 lbs/strap (40,000 N/strap)	39,550 lbs/strap (176,000 N/strap)
Stern Bag Wet Deck Attachment	1.5	830 lbs/ft (12,100 N/m)	13,200 lbs/ft (193,000 N/m)
Planer-to-Planer Joint	2.0	1,000 lbs/ft (14,600 N/m)	5,000 lbs/ft (73,000 N/m)

(1) Maximum load multiplied by its respective design factor is the: ultimate design load.

Table 2.3.5.2-4 (U): Seal Materials Physical Properties (U)

Planer Materials -- Gloss Reinforced Fabric	UNITS English	UNITS (SI)	VALUES (1) English	VALUES (1) (SI)
	%	%		
neric Materials				
S-Type Class				
Epoxy Resin				
sin Content				
nsile Strength	10^3psi	10^4Pa	29	(29)
Longitudinal			128	(610)
Transverse			110	(525)
exible Strength	10^3psi	10^4Pa		
Longitudinal			164	(795)
Transverse			142	(680)
lexural Modules	10^6psi	10^7pa		
Longitudinal			4.6	(21.0)
Transverse			3.7	(17.7)
Pressure Bag Materials -- Elastomer Coated Fabric				
neric Materials				
Nylon Fabric				
Neoprene Elastomer				
nsile S:rength	lbs/inch	(N/m)		
Warp			1805	316.00
Fill			1620	284,00
longation, Ultimate	%	%		
Warp			53	53
Fill			72	72
Pressure Bag Materials -- Elastomer Coated Fabric	**UNITS English**	**UNITS (SI)**	**VALUES English**	**VALUES (SI)**
eight	oz/sq. yd	(kg/m^2)	90	3.05
oating Adhesion	lbs/inch	(N/m)		
Warp			70	12.200
Fill			62	10,850
age	inches	(m)	0.100	0.00254

(1) Values for 0/90 degree eleven ply laminates

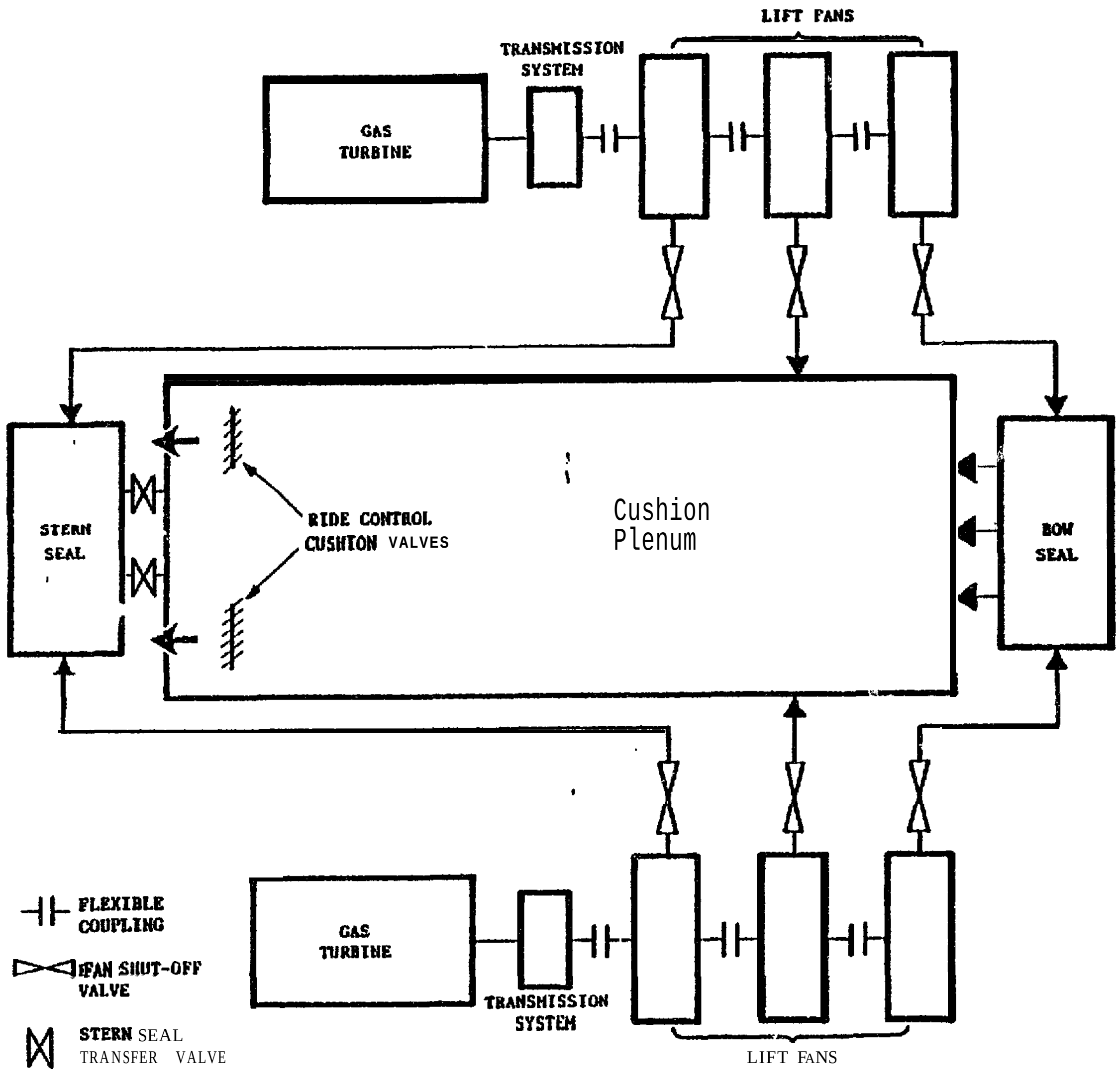


Figure 2.3.5.2-1 (U): Lift System Air Distribution Schematic (U)

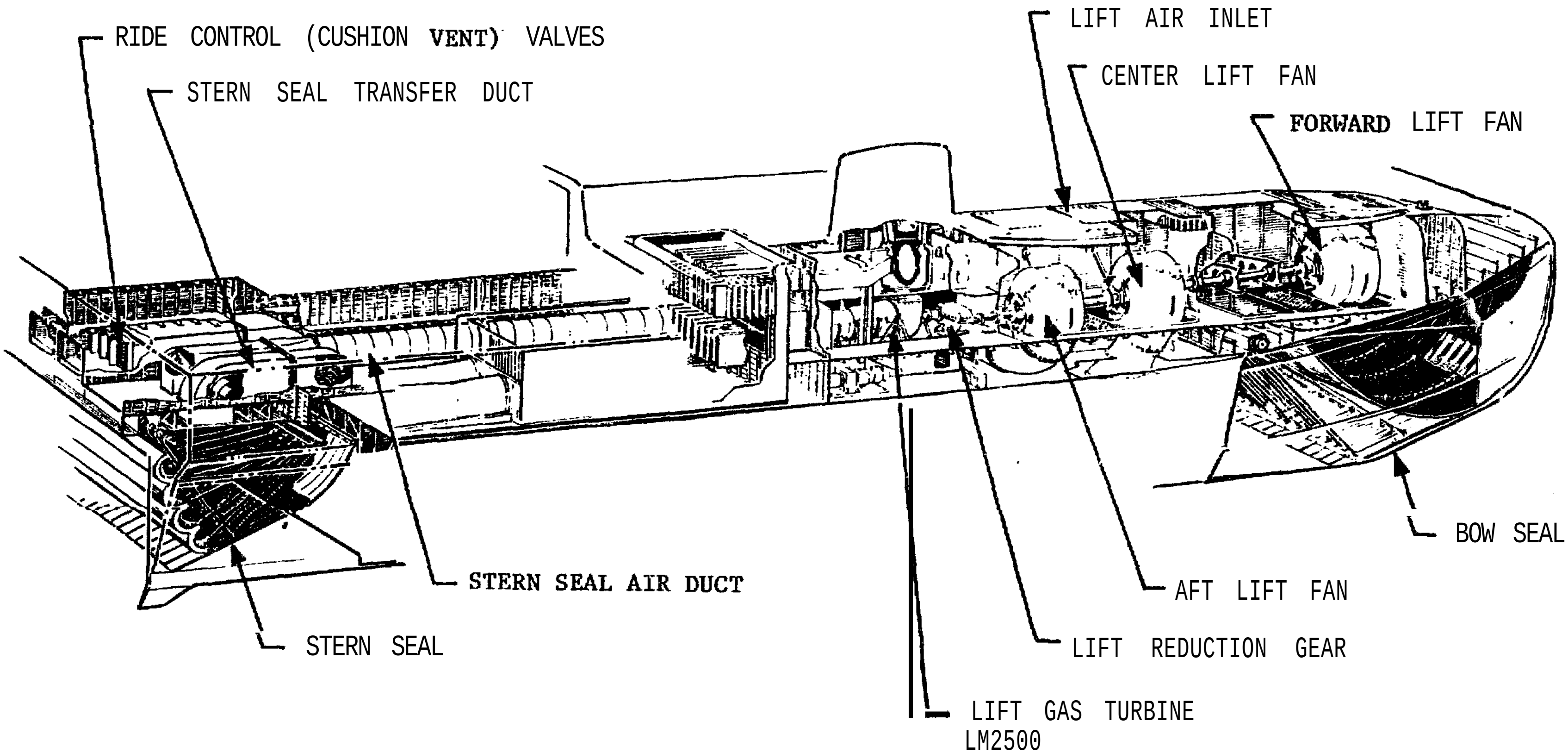


Figure 2.3.5.2-2 (U): SES Lift System Arrangement (U)

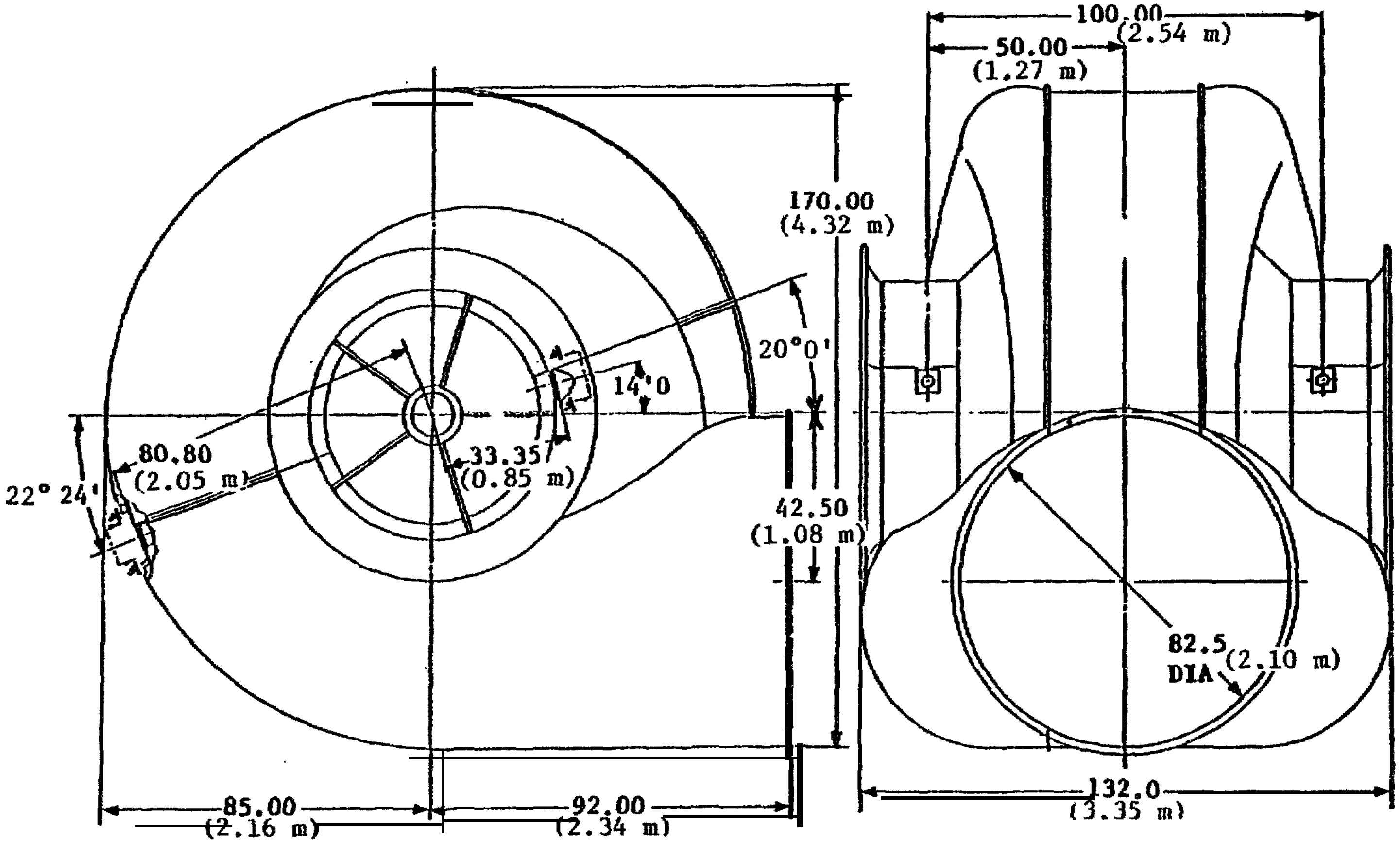


Figure 2.3.5.2-3 (U): Lift Fan Envelope - 86 Inch (2.18 m) Diameter Rotor (U)

UNCLASSIFIED

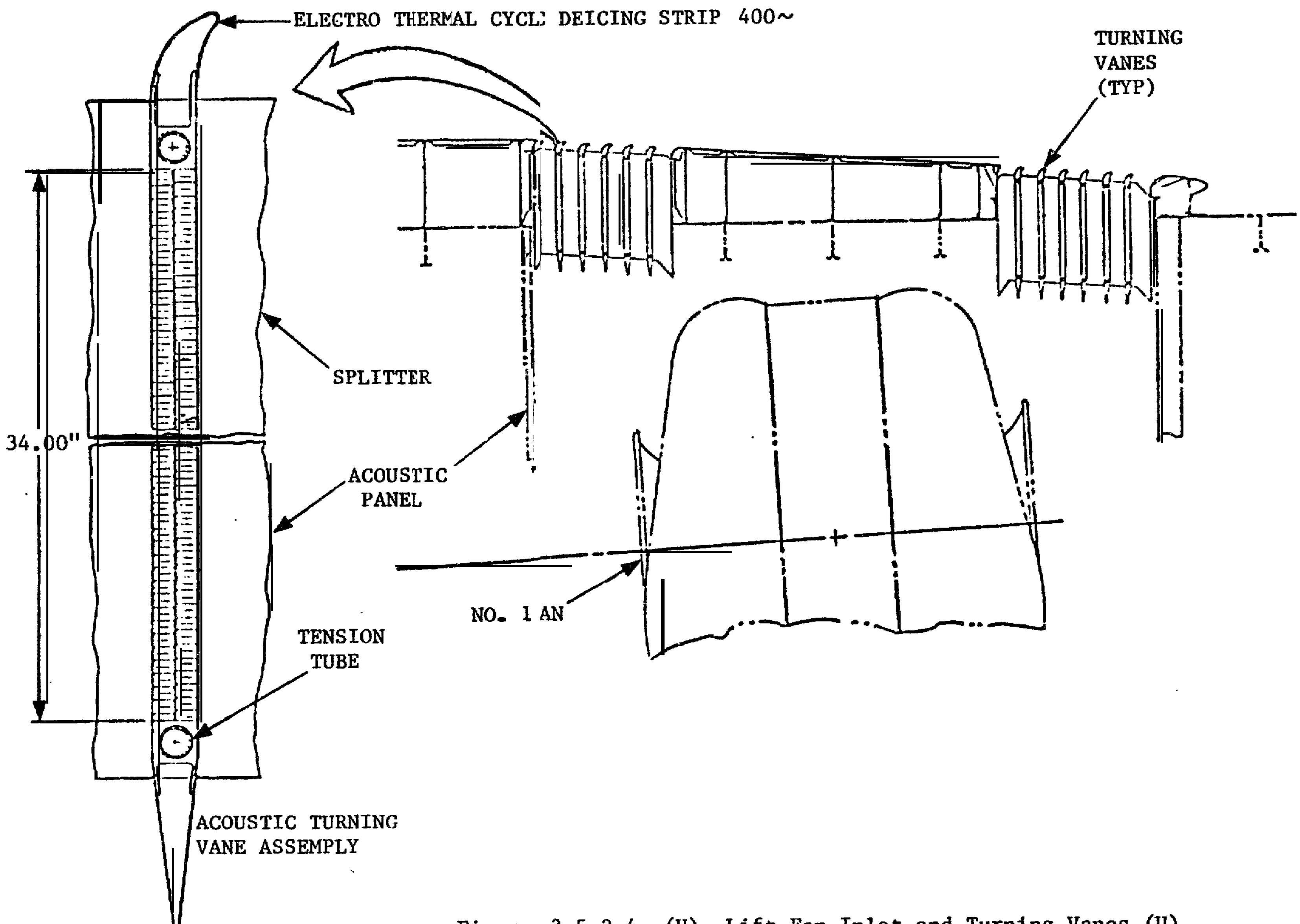


Figure .3.5.2-4 (U) Lift Fan Inlet and Turning Vanes (U)

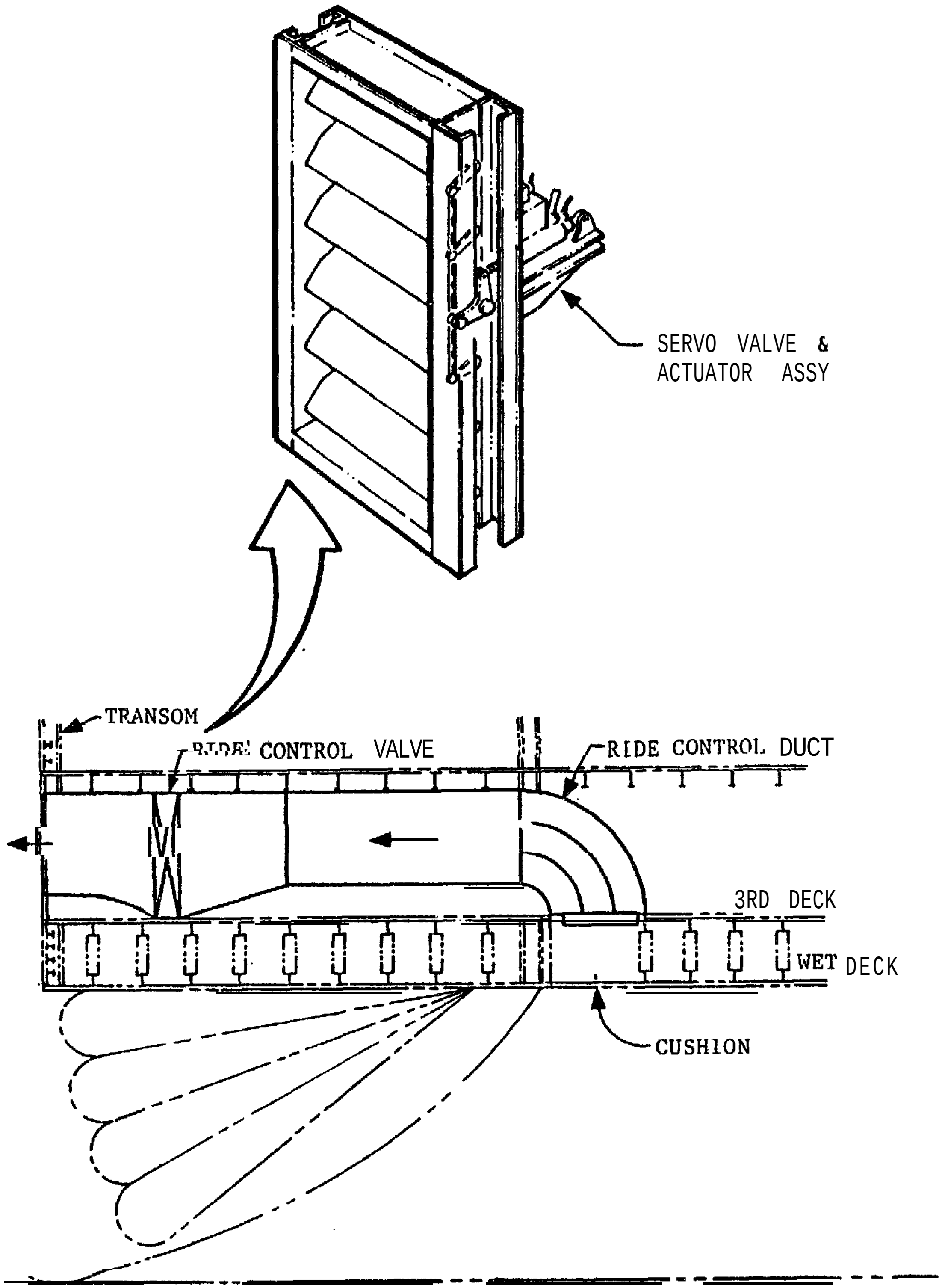


Figure 2.3.5.2-5 (U): Cushion Vent System (U)

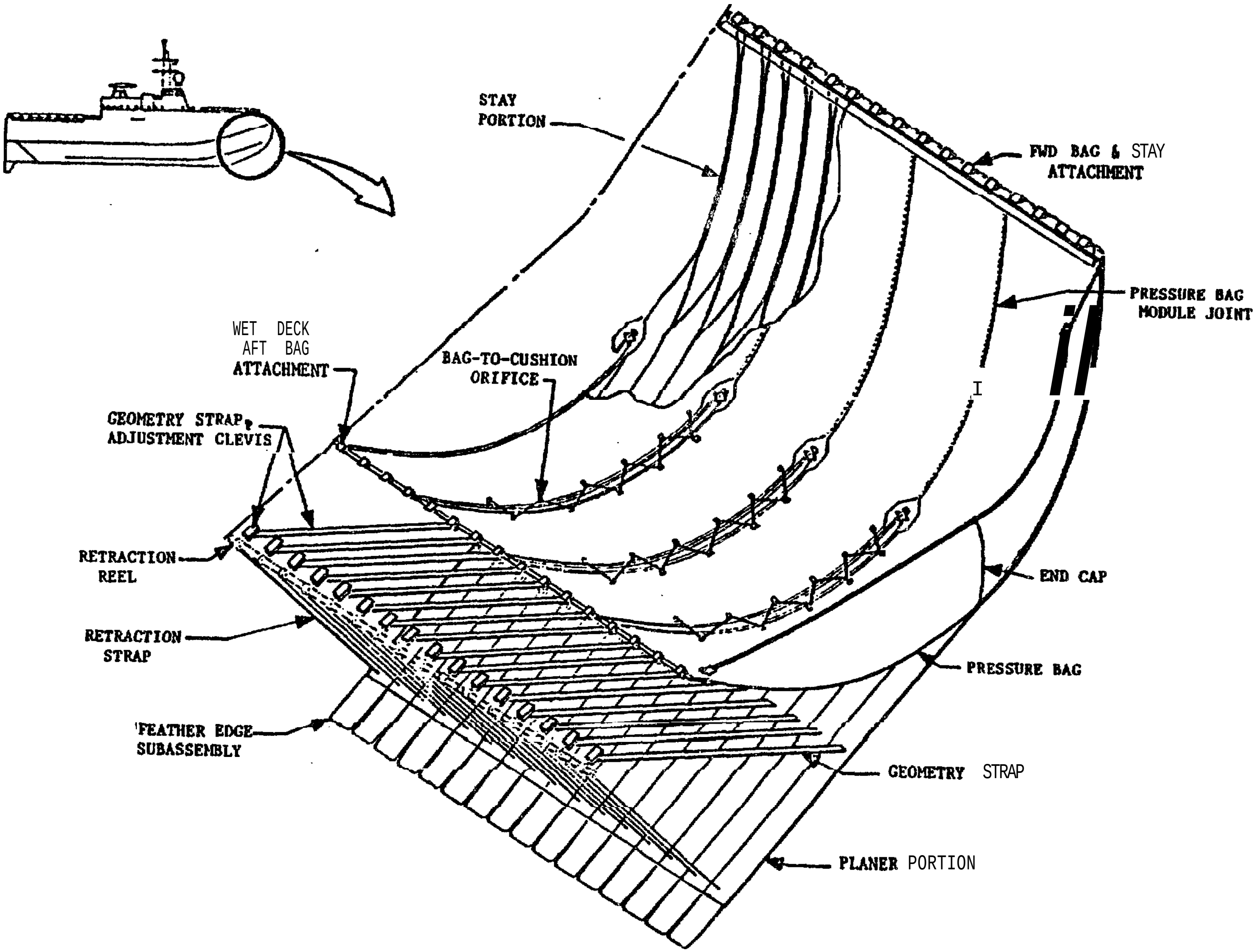


Figure 2.3.5.2-6 (U): Advanced Planing Bow Seal (U)

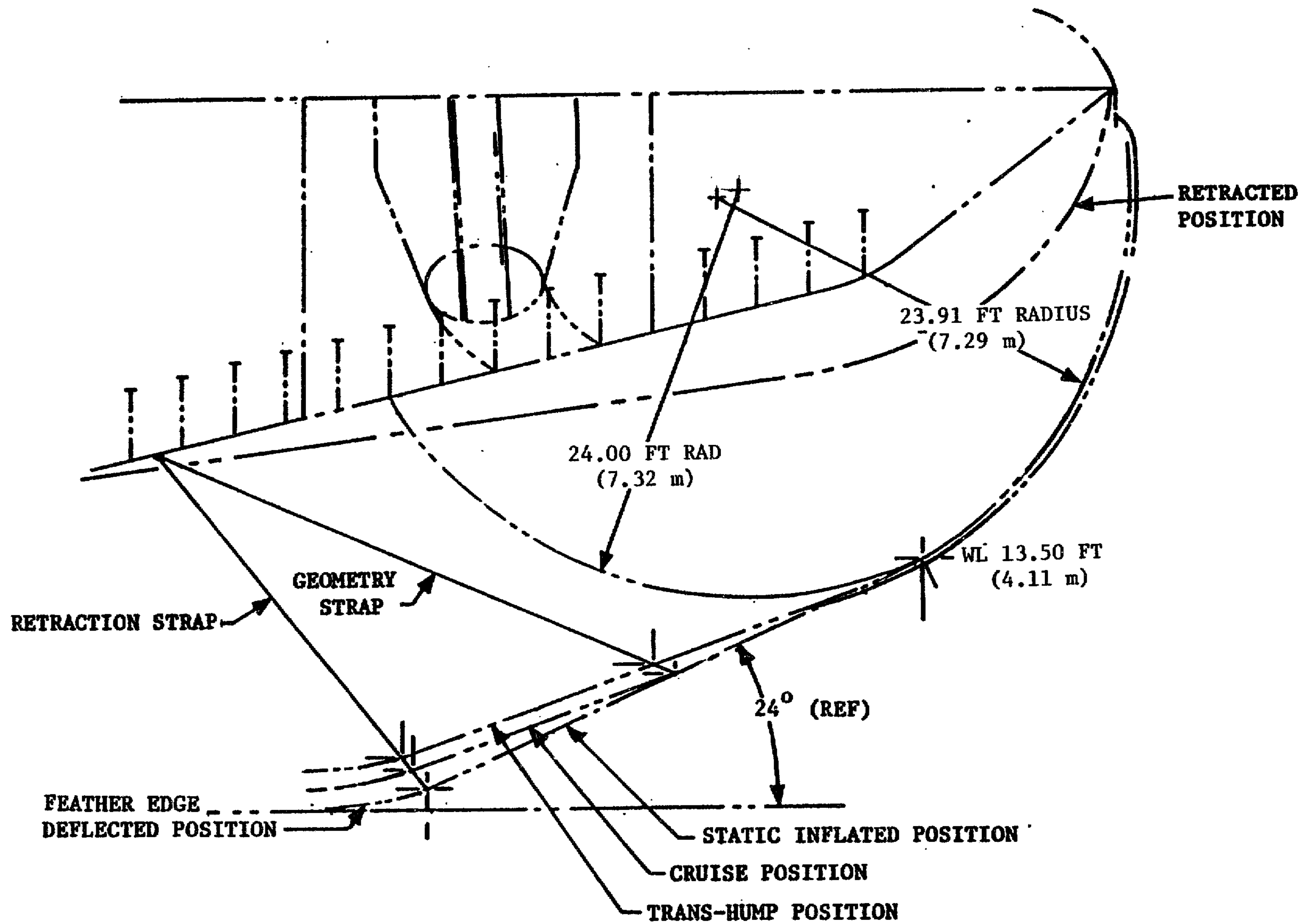


Figure 2.3.5.2-7 (U): Advanced Planing Bow Seal Geometry (U)

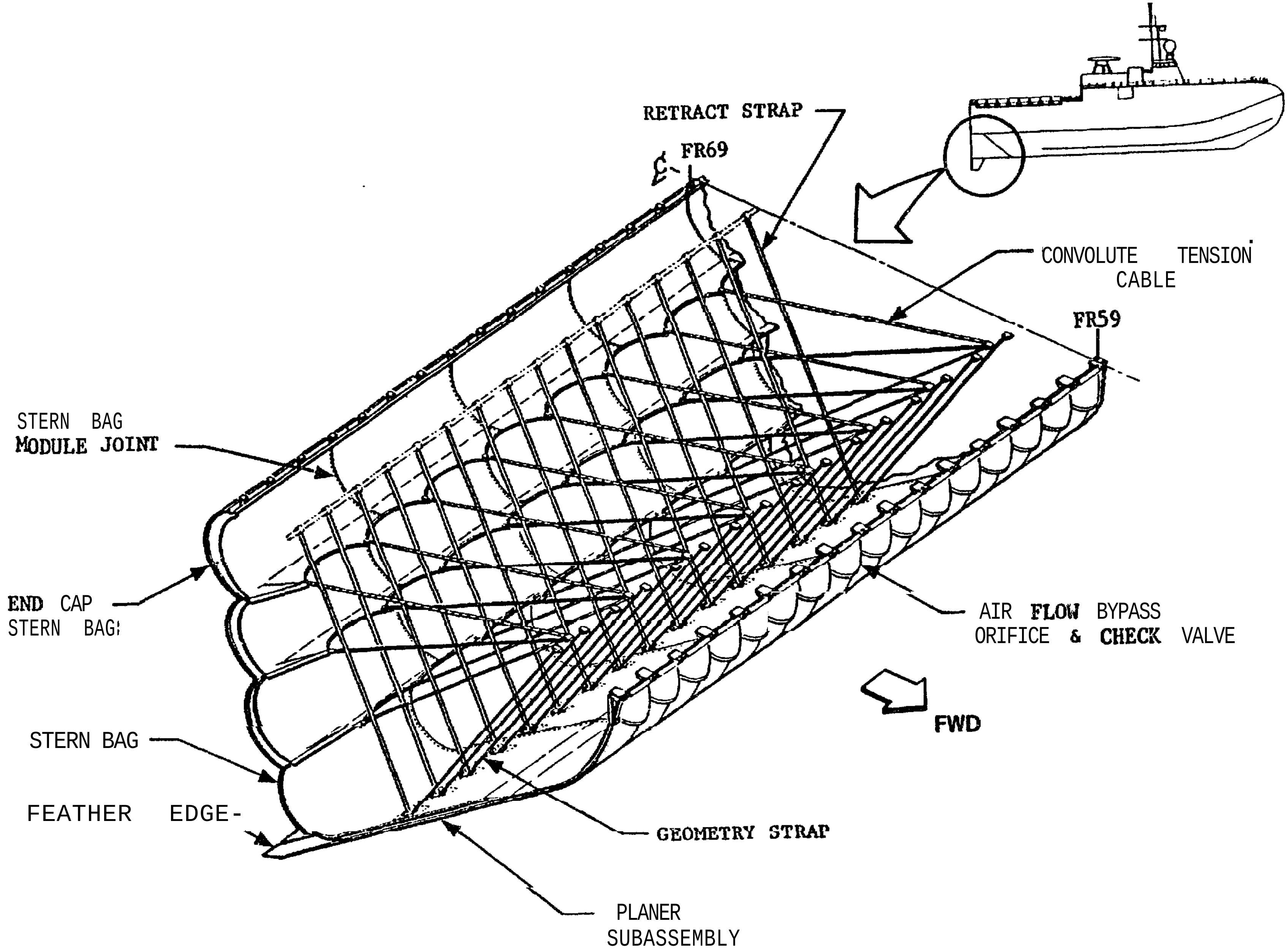


Figure 2.3.5.2-8 (U): Advanced Planing Stern Seal Assembly (U)

UNCLASSIFIED

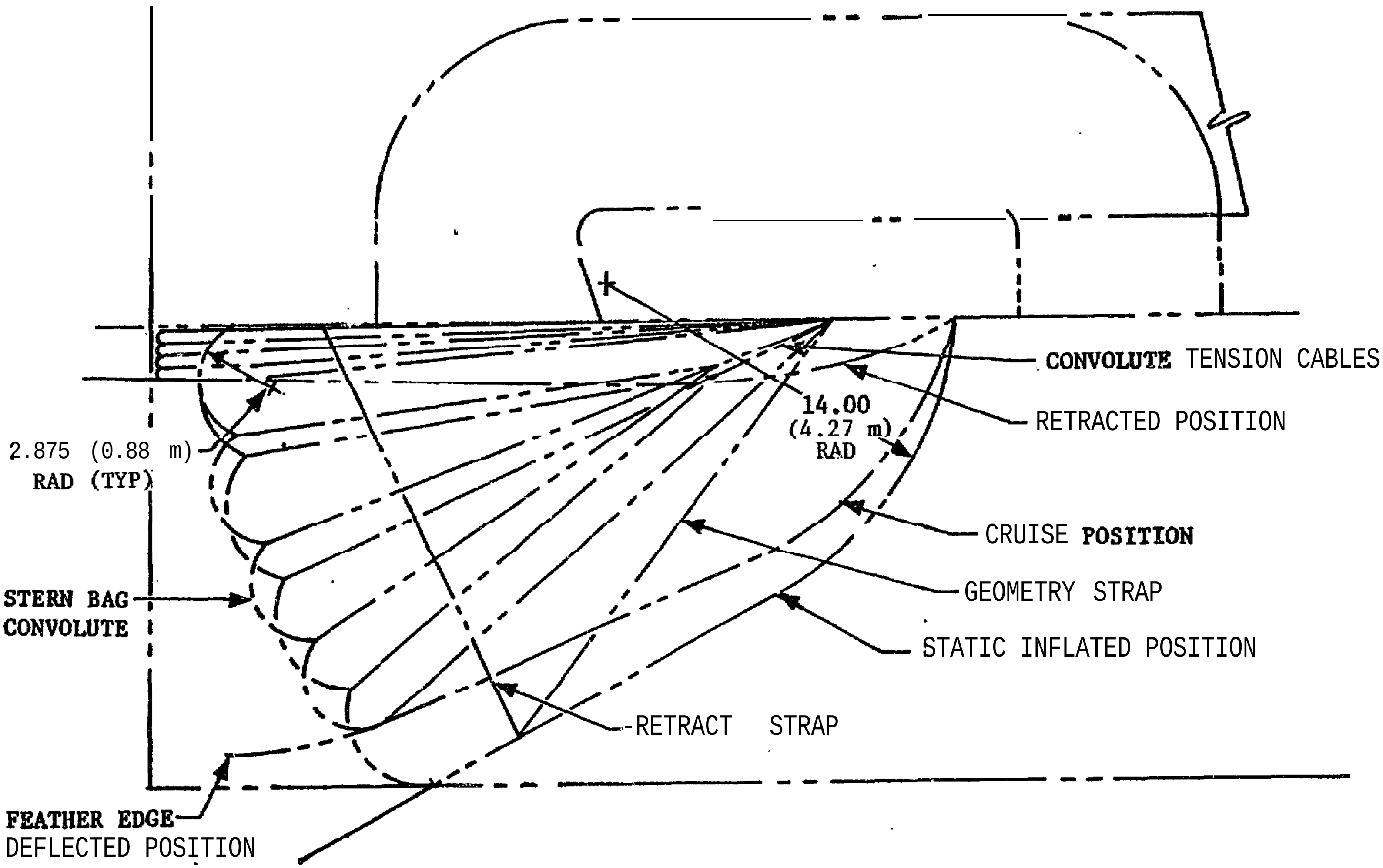


Figure 2.3.5.2-9 (U): Advanced Planing Stern Seal Geometry

UNCLASSIFIED

(U) 2.3.5.2.5 Lift System Weight Breakdown -- Table 2.3.5.2-5 shows the weight of each major lift system subsystem and each subsystem's percentage of the Lift System total.

Table 2.3.5.2-5 (U). Lift System Weight Breakdown (U)

SUBSYSTEM	WEIGHT		
	LT	kN	% OF TOTAL
Engines	10.5	104.62	10.9
Fans	20.5	204.26	21.2
Reduction Gear and Shafting	8.2	81.70	8.5
Seals	31.1	309.88	32.2
Ducting	7.4	73.73	7.7
Valving	4.5	44.84	4.7
Intakes	8.8	87.68	9.1
Uptakes	1.9	18.93	2.0
Support System	3.7	36.87	3.8
LIFT SYSTEM TOTAL	96.6	962.52	100.0

(U) 2.3.5.2.6 Lift System Technical Risk -- The total lift system risk depends upon the individual component risks. Considering the diversification of functions and the number of components included in the lift system (lift air machinery, ride control elements, seals), the overall risk is subjective and is based on the relative importance of each function as follows:

- Lift Gas Turbine Engine System -- The LM2500 gas turbine engine is a production unit and is in use in other marine applications. The integration of this power unit into the lift system is well within present technological capabilities.
- Power Transmission System -- Reduction gear design employs proven technology and similar gearbox designs have been utilized for marine applications. The transmission system arrangement and component selection are proven and within the present state-of-the-art. There is no apparent development risk for this system.
- Variable Geometry Fan -- The variable geometry fan concept has been proven feasible by test at a number of scaled sizes. Especially significant is the use of 1/4-scale ALRC lift fans with VG on the XR-1 testcraft. The lift fan design must be verified in terms of full-size ship requirements and integrative ramifications.
- Duct Configuration -- The analysis of the lift system duct configurations predicts the pressure losses with a high degree of confidence. The construction uses proven marine/aircraft concepts.
- Lift Air Inlet -- The analysis supporting the lift inlet design is based on existing aerodynamic flow concepts. The materials and the shaping of the turning vanes are well within the current technology of the marine/aircraft industry.
- Ride Control Valves -- The ride control valves are a type similar to that used successfully in the 100A program. Proven

(U) off-the-shelf type components are used throughout the system. To further improve reliability, the mechanism is a simple straight-forward linkage design similar to aircraft linkage systems that are presently in use.

- Advanced Planing Seals -- The success of the advanced planing seals in the most recent model tests lends a high degree of confidence in the design. The analysis of loads for the full-scale configuration, along with the design objectives and materials selections, indicate that all considerations are well within the present state-of-the-art.

(U) 2.3.6 OUTFITTING AND FURNISHINGS

(U) 2.3.6.1 Key Features of O & F System -- Outfit and furnishings (O&F is composed of a number of subsystems whose functional requirements include providing (1) habitable living and functional working spaces for the ship's crew, (2) safety features and fittings such as rails and lifelines, (3) ease of access to the working and living spaces, (4) protection against abrasion or galvanic corrosion for the hull structure (5) insulation to provide passive thermal, fire and acoustic protection and (6) storage and service spaces as required for the ship and its crew to perform their mission., All O&F subsystems conform to General Specifications for Ships of the U.S. Navy and OPNAVINST 9330.7A (proposed).

(U) 2.3.6.1.1 Habitability -- Crew living spaces are compartmented with a maximum of 12 men to a compartment. CPO living spaces are compartmented with a maximum of 5 men to a compartment. Officers staterooms are double occupancy except that the Commanding Officer and Executive Officer each have single, separate staterooms.

(U) Messing areas are located within a convenient distance of respective crew living spaces. Cross-traffic has been avoided. The galley is centrally located to serve the crew from one side and the CPO and commissioned officers from the other, again, eliminating cross-traffic.

(U) Recreation areas are also located within a convenient distance of the respective crew living spaces. The habitability spaces are all located on the second deck and the watch stations are readily accessible for all hands.

(U) 2.3.6.1.2 Stowage -- Dry provisions, chill storage and freeze storage are located next to the galley. The vertical conveyor is located within a few steps of the galley and each storage area. Supply Department storerooms and spare parts storerooms were located in areas of the ship convenient to users (e.g., repair shops).

(U) Deck gear lockers are located near each mooring and towing station. This provides convenience for stowing deck gear and facilitates keeping the decks clear at all times.

(U) 2.3.6.2 Passive Fire Protection -- A fire protection system is necessary as an element of damage control and must incorporate within the system both active and passive means. The **active** fire protection system is described in **2.3.5.** The passive fire protection system is designed to protect the primary structure until the active system is brought into play.

(U) For the design of the fire protection system, the ship spaces were grouped into two major classifications: Group 1, liquid fuel fire hazard spaces; and Group 2, solid combustible fire hazard spaces. In addition to fire protection for these spaces, passive fire protection is provided for the torpedo and small arms magazines.

(U) 2.3.6.2.1 Group 1 - Liquid Fuel Fire Hazard Spaces -- Group 1 consists of all engine rooms, auxiliary machinery spaces, gas turbine generator rooms and the helicopter hangar,

(U) Passive fire protection for bulkheads and overhead structures for all Group 1 spaces are provided by a ceramic fibrous felt sandwich panel.

(U) Panel Design -- The panel (see Figure 2.3.6-1) **consists** of one inch (2.54 **mm)** thick refractory fiber felt of four (4) **lb_f/ft^3** (191.46 **N/m^3)** density (Carborundum Fiberfrax **felt** or equivalent) between 0.010 inch **(.25** mm) corrosion resistant steel **(CRES)** half-hard front face sheet and 0.012 inch **(.30** mm) aluminum, marine grade, back face sheet. Ceramic tubular spacers 0.5 inch (12.7 mm) outer diameter x 0.156 inch (3.97 **mm)** inner diameter with **#6 CRES** screws and nuts are employed on a lo-inch (254 **mm)** grid pattern to maintain the panel thickness and hold the face sheets together.

(U) Close-out members of the panel are 0,010 inch (.25 mm) CRES half-hard channels with 1/2 inch (12.7 mm) flanges seam half-hard channels with 1/2 inch (12.7 mm) flanges seam welded to the front face sheet and riveted to the back face sheet.

(U) Panel Attachment -- The panels are attached to the structure by screw attachment with #6 CRES screws to 0.06 inch x 0.5 inch x 1.0 inch (1.52 mm x 12.7 mm x 25.4 mm) aluminum rectangular tubing "furring strips", The furring strips are attached to the structure by adhesive honding with an adhesive modified with a fire retardant. The panels are spaces from the primary structure with a 1/2 inch (12.7 mm) air gap.

(U) Panel Joints -- Panel joints (see Figure 2.3.6-Z) are sealed from vapor penetration as well as heat penetration by sandwiching the panel ends between two strips of refractory fiber felt which are compressed between a 0.060 inch (1.52 mm) aluminum strip at the back of the joint and a 0.030 inch (.76 mm) CRES strip at the front or fire threat side of the joint. Corner joints are similarly sealed with 0.060 inch (1.52 mm) aluminum angles and 0.030 inch (.76 mm) CRES angles which are used as corner trim. Wicking would be prevented by inserting the panels in aluminum channels which are adhesive bonded to the deck with a fire retarded adhesive. A silicone sealant would then be used to seal the panel in the channel.

(U) Decks -- The decks in Group 1 areas are protected with a 0.25 inch (6.35 mm) thick ceramic fiber moist felt insulation (Refractory Products Company WRP-X-AQ or equivalent). It is a moldable fibrous ceramic felt in an inorganic colloidal silica binder and has a density of 15 lb/ft^3 (717.99 N/m^3). The felt is packed in plastic bags during

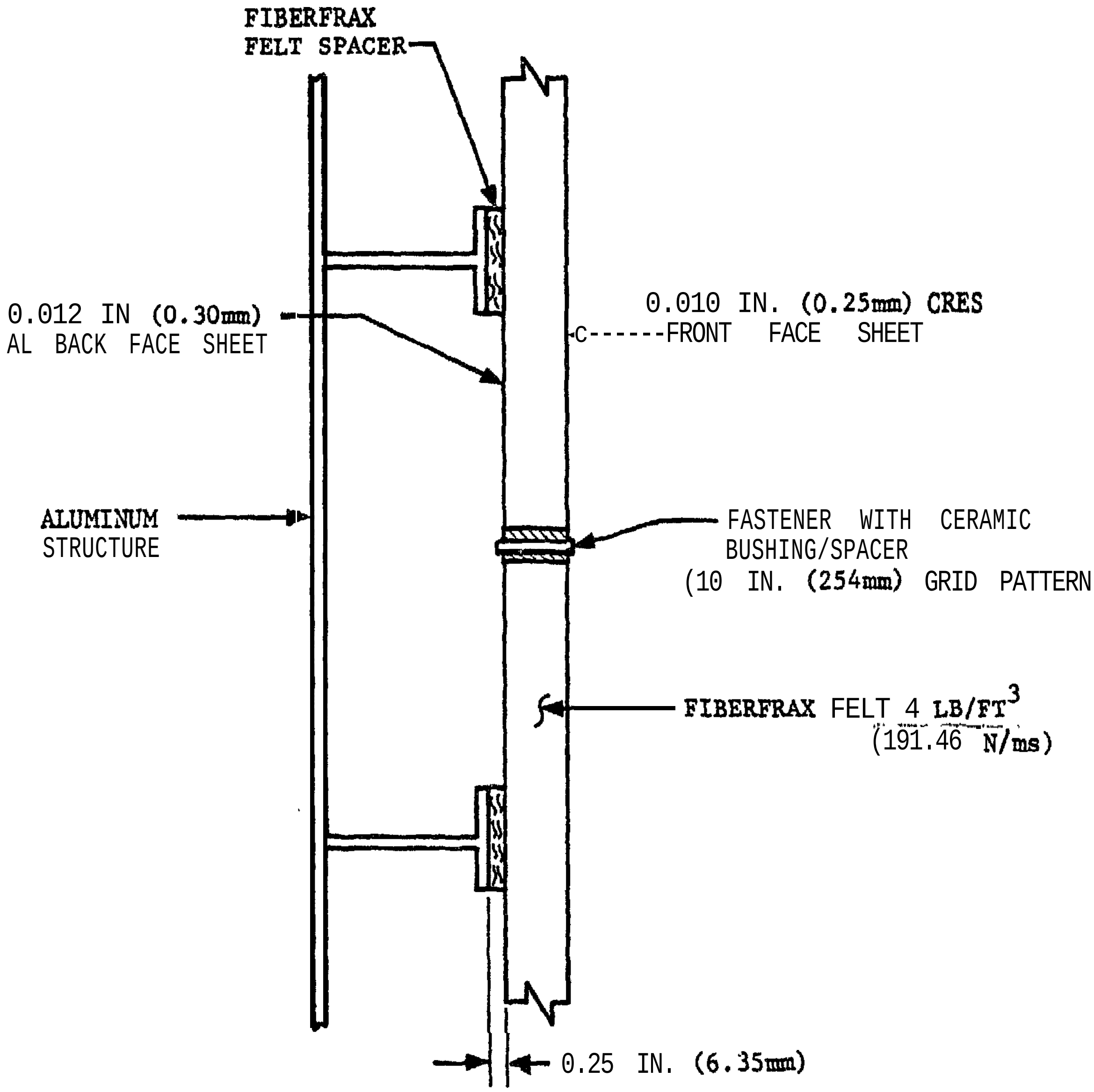


Figure 2.3.6-1 (U): Insulation Panel Design (U)

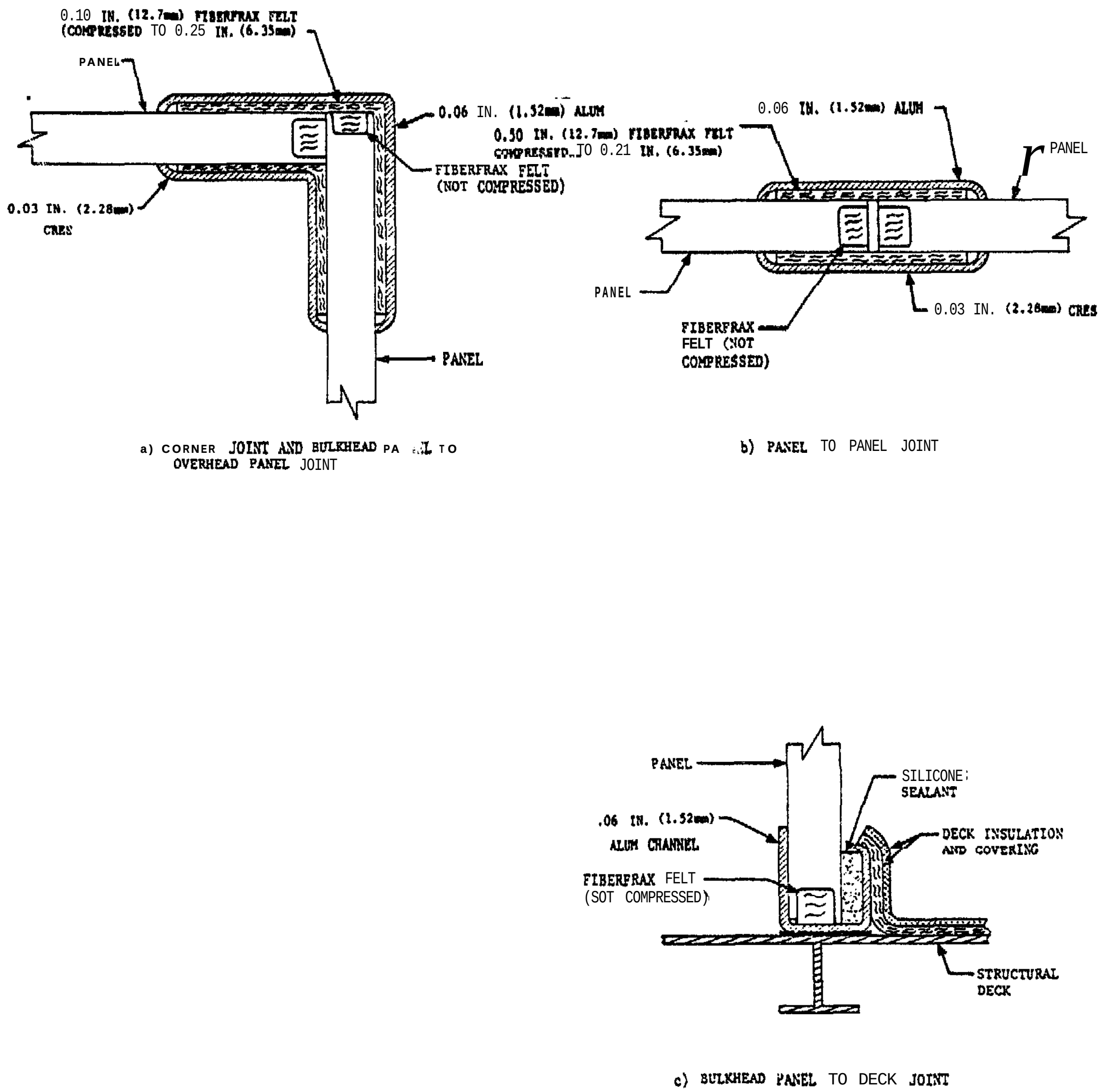


Figure 2.3.6-2 (U): Panel Joints Designed to Prevent Vapor Leakage In a JP-5 Fuel Fire (U)

(U) shipment and storage to prevent drying. After adhesive bonding the felt to the deck, it is allowed to air dry and harden. The felt is bonded to the deck with an air-setting ceramic cement (Carborundum QF-180 or equivalent), which has a layer thickness of 0,010 inch (.25 mm). After air drying, the felt is faced with fiberglass cloth impregnated with a fire retarded epoxy resin. The cloth is an 1800 plain weave with a weight of 10 oz/yd^2 (3.33 N/m^2). The epoxy resin is room temperature curing (Shell Epon 934 modified with fire retardant agents or equivalent).

(U) Stanchions, Penetrations and Ladders -- Stanchions are protected by wrapping with 0.750 inch (19 mm) thickness of the moldable fiber moist felt insulation. The moist felt is bonded to the stanchion with ceramic cement. The moist felt is overlapped 1.5 inch (38.1 mm) to prevent a direct path to the protected member. All penetrations are sealed to prevent passage of vapors. Where the penetrating member is exposed to a fire hazard, it would be protected from structural collapse with moist felt insulation and/or intumescent paint. Ladders would be fabricated from corrosion resistant steel.

(U) **2.3.6.2.2** Group 2 -- Solid Combustible Fire Hazard Spaces -- Group 2 consists of all electro ic spaces, living spaces and command centers.

Passive fire protection for bulkhead and overhead structure for all Group 2 spaces is provided by a refractory fiber felt sandwich panel similar to the panels used for Group 1 spaces but with a panel thickness of 0.5 inch (12.7 mm).

(U) The decks are protected with deck covering underlay material and tile or carpeting in these spaces, Stanchions, penetrations and ladders would be treated as described for Group 1.

(u) 2.3.6.2.3 Magazines -- The passive protection for the magazines is one inch (25.4 mm) thick lightweight glass thermal insulation on the interior surfaces of the compartments and 0.5 inch (12.2 mm) thick fire protection panels on the exterior surfaces of the compartments.

(U) 2.3.6.3 Estimated Percentage Weight Breakdown -- Table 2.3.6-1 shows the estimated weight percentage of the major components of the O&F System.

Table 2.3.6-l (U). Estimated Weight Percentage of Major Components of the O&F System (U)

SUBSYSTEM	% OF SYSTEM
Ship Fittings	2.6
Hull Compartmentation	11.5
Presserve and Coverings	18.6
Hull Insulation	42.9
Furnishings	24.0
Miscellaneous	0.4

(U) 2.3.6.4 O&F Arrangement Drawings -- Arrangements of O&F subsystems are shown in the drawings contained in Appendix B, Subsection B.l. The Hull Insulation, Sheathing and Deck Covering System for the near term SES is shown on drawings contained in Appendix B, Subsection B.6.

(U) 2.3.6.5 Outfit and Furnishings Risk Assessment -- The fittings, furnishings, coatings, and outfit items used on the ANVCE near term SES possess proven shipboard capability, and are not peculiar to the SES. Passive fire protection system concepts have been proven by an extensive test program. Consequently, the risk involved is considered minimal and is no greater than that of the outfit and furnishings subsystems of conventional Navy Surface Ships.

(U) 2.3.7 COMBAT SYSTEM -- The combat systems of the ANVCE Near Term Point Design SES consist of systems that provide a capability in demonstrating the military value of an SES that performs anti-submarine warfare (ASW), anti-air warfare (AAW) and surface warefare (SUW) naval missions. These equipments are listed in Appendix C which contain6 weight, volume, geometry, and service requirements for each item,

(U) The combat system6 comprise subsystem6 for underwater, air and surface surveillance. The subsystems consist of surface and air search radars, passive ESM systems, towed and dipping sonar devices, and dispensed sonobuoys. Target identification and classification is accomplished by an IFF system.

(U) Fire control systems are provided for surface-to-&r, surface-to-surface, and underwater weapons. Surface-to-air and point defense weapons consist of vertially launched Standard missiles, and dual Close-In-Weapon System (CIWS) installations (space and weight). The anti-shipping weapons are Harpoon and MK48 torpedo. The ASW self-defense and offensive weapon is the MK46/1 torpedo. Weapons and sonobuoy delivery for offensive ASW operations is accomplished by helicopter (SH-3H). Space reservations have been made for future applications of mini-RPV's for SUW target localization and weapon terminal guidance, as well a6 for relaying sonobuoy field telemetry data.

(U) 2.3.7.1 Surveillance -- Air surveillance is provided by the air search radar AN/APS-125 and DPEWS AN/SLQ-31(V2) or AN/SLQ-32(V2) systems. A backup capability is provided by the MK92/3FCS.

(U) Surface Surveillance is accomplished by the surface search radar AN/SPS-55, with a backup capability furnished by the collision avoidance and navigation system.

(U) Underwater surveillance is provided by the TACTASS AN/SQR-19 and AN/AQS-13D sonars. DIFAR An/SSQ-53 and DICASS AN/SQ-62 sonobuoys are dispensed by helicopter (SH-3H). Sonobuoy data link is via UHF telemetry receiving sets AN/SKR-3A.

(U) 2.3.7.2 Armament -- Armament includes surface-to-air missiles, surface-to--surface missiles, missile launching systems and air drop and over-the-side launched torpedoes. Small arms and pyrotechnic devices, hi-rate gun munitions handling, and stowage facilities are also provided. Armament missile systems are controlled by the fire control system elements of Command and Surveillance. Torpedoes are controlled by underwater fire control elements.

(U) Armament provides the ship with weapons and a means for delivery of those weapons to counter air, surface, and subsurface threats with provisions for the following:

- o Eight environmentally sealed and protected Harpoon missiles carried in four lightweight launchers, each holding two cannister launched missiles.
- o Eight environmentally sealed and protected SM-1 missiles carried in four lightweight vertical launchers, each holding two cannister launched missiles.
- o Two MK-32 triple torpedo tubes for the over-the-side launch of MK-46 torpedoes.
- o Miscellaneous ordnance and small arms.
- o Space and weight reservations for two MK-?5 MOD V torpedo tubes for ship launch of two MK-48 torpedoes.
- o Space and weight reservations for two MK-15 MOD 0 Close-In Weapon Systems (CIWS)

(U) 2.3.7.3 List of Combat System Equipment -- The list of combat system equipment (non-variable load items) is contained in Appendix C. The list itemizes equipment physical characteristics, weight, and ship services requirements.

(U) 2.3.7.4 Combat System and Military Payload Weights -- Table 2.3.7-l presents the weights of major components within the combat system and includes variable load elements. Table 2.3.7-2 shows military payload weights (C^3 + Combat System) In accordance with ANVCE WP-002 definitions.

Table 2.3.7-l (U) COMBAT SYSTEM WEIGHTS (U)

SWBS	TITLE	WEIGHT		
		LT	kN	% OF TOTAL
450 & 460	Surveillance Sys.	20.4	203.26	23.9
470	ECM	1.3	12.95	1.5
480	Fire Control	1-2.2	121.56	14.3
711	Guns	11.4	113.59	13.3
721	Launch Devices	10.6	105.62	12.4
751	Torpedo Tubes	27.5	274.01	32.2
761	Small Arms	0.4	3.99	.5
782	Aircraft Weapon Handling	0.5	4.98	.6
783	Aircraft Weapons Stowage	1.1	10.96	1.3
COMBAT SYSTEM TOTAL		85.4	850.92	100.0

Table 2.3.7-2 (U) MILITARY PAYLOAD WEIGHTS (U)

SWBS	TITLE	WEIGHT LT	WEIGHT kN	WEIGHT % TOTAL
400	C&S Less Nav & Internal Communications	49.5	493.82	2:
700	Armament	52.3	520.92	29.1
F21-27	Ordnance	47.7	475.08	26.5
F42	Helicopter JP-5	30.5	303.70	16.9
MILITARY PAYLOAD TOTAL		180.00	1793.52	100.00

(U) 2.3.7.5 Combat System General Arrangements -- The arrangements of the near *term* SES Combat Systems are shown in drawings contained in Appendix B, Section **B.1** and B.7. The coverage of the weapons and sensors are shown on the figures contained in Appendix B, Section B.2. The armament system functional block diagram is contained in Appendix B, Section B.7.

(U) 2.3.7.6 Combat System Risk Assessment -- The specified combat weapons and sensors suite is entirely Government-defined and has the minimal risk associated wit;. well-funded development and selections from **off-**the-shelf equipment items.

(U) 2.4 SURVIVABILITY AND VULNERABILITY

(U) 2.4.1 SIGNATURE CHARACTERISTICS

(U) 2.4.1.1 Radar Cross Section (.3-18GH_Z) -- Radar cross section not provided. Data not available.

(U) 2.4.1.2 Microwave Signature -- Microwave signature not provided. Data not available

(U) 2.4.1.3 Infrared Signature -- Infrared signature not provided. Data not available.

(U) 2.4.1.4 Visibility -- Visibility not provided. Data not available.

(C) 2.4.1.5 Acoustic Signature -- The airborne radiated noise signature comes primarily from the engine combustion air inlets, propulsion exhausts and lift fan air inlets. The total signature at a distance of one (1) metre would be approximately 100 dB re 20μPa in the 250 Hz band. Including spreading and absorption, a 45 dB sound pressure level in the 250 Hz band will be reached at approximately 500 metres.

(U) Target strength, dB at a one (1) yard (0.9144 m) reference distance (dB re 1 yd.), is shown in Table 2.4.1-1 and the underwater radiated noise signature (dB re 1μPa) is shown in Table 2.4.1-2.

(C) The near term point design SES probably has a distinctive line spectra at approximately 500 Hz. This relates to the blade passage frequency of the lift fans. The acoustic signature will probably show directionality abeam and abaft the waterjets.

(C)Airborne radiated noise signature may be reduced by treating the combustion inlet, propulsion exhaust, and fan inlets with additional splitters. Underwater radiated noise signature may be reduced by suitably treating

TABLE 2.4.1-l (C): Estimated Target Strength **(dB) (U)**

SHIP CONDITION \ ASPECT	BEAM	STERN/BOW
On Cushion	15	2
Off Cushion	20	10

(C) the engine and fan mountings. This will reduce distinct spectral lines, but will virtually do nothing to reduce the overall level in any given 1/3 octave band, since most of the energy in any band results from the impingement of the **waterjet** stream on the ocean's surface.

(U) 2.4.2 . **HARDNESS** -- Hardness features are not furnished. The near term SES is not designed to warship hardness standards nor does it feature armor protection.

TABLE 2.4.1-2 (C): Estimated Underwater Radiated Noise Signature (dB re 1μPa) (U)

INTENSITY	SHIP SPEED			
	10 knots (5.14 m/s)	50 knots (25.72 m/s)	80 knots (41.14 m/s)	120 knots (61.74 m/s)
Intensity of Highest Line (0-100 Hz)	180	174	168	160
Intensity of Highest Line (≥ 100 Hz)	170	164	158	1.50
Intensity of 1/3 Octave Band 2kHz	180	175	170	160

3 / LOGISTIC CONSIDERATIONS

(U) The principal logistic elements contributing to the near term SES design baseline are maintenance planning, supply support, ship manning, training, technical publications, and support system requirements, Interdependently and interacting with other requirements, these elements affect ship sizing, light ship weight, variable load weight, and inherent design capabilities for performing selected missions. The overall approach to logistics will support the near term SES design, construction and fleet use.

(U) The support system provides the logistic support resources required to maintain the ship in an operational readiness condition capable of meeting the availability requirement of the missions. The logistic support resources include personnel and training, initial and back up inventory of spares and repair parts, industrial support facilities (intermediate and depot support levels) and common/peculiar support equipment (intermediate and depot repair shops). These logistics elements are displayed in the support system block diagram, Figure 3-l. The support 'system is compatible to the maximum degree possible with U. S. Navy and other existing logistics support activities.

SECTION 3

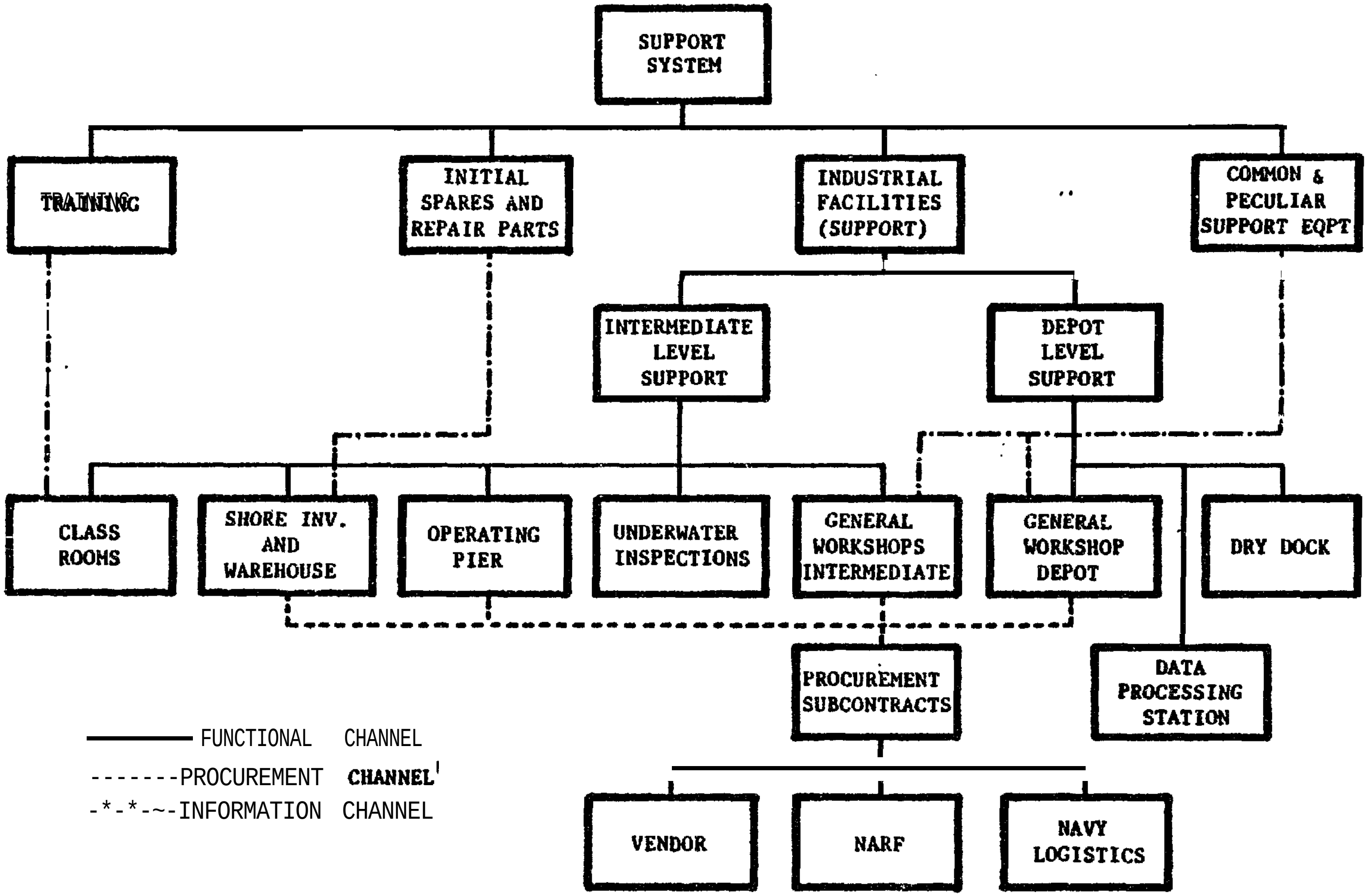


Figure 3-1 (U): Support System Block Diagram (U)

(U) 3.1 RELIABILITY AND AVAILABILITY

Since Rohr Marine, Incorporated, is not conducting the Supportability/ Availability analyses (ANVCE WP-008)[1], availability block diagrams are not a part of this report; however, subsystem availability predictions applicable to the near term SES are a part of this report. In addition, MTBF and MTTR data for major components of SES Subsystems are listed in Paragraph 3.1.3 along with a utilization factor.

(U) 3.1.1 SES UTILIZATION (Not Provided)

(U) 3.1.2 SES SYSTEM AND SUBSYSTEM -- The predicted availability for the near term SES is shown in Table 3.1-1. The predictions are based on a ten-day mission. Availability is defined as the ratio of mission uptime to total at sea time scheduled for the mission. The predicted availability for the near term SES is high due to:

- High reliability and maintainability of the stay-stiffened planing bow and stern seals (e.g., all seal components can be replaced without dry docking)
- Redundancy in the Lift and Propulsion Systems
- High availability of the Electrical, Auxiliary, and Command and Surveillance Systems
- A Design approach that emphasizes RMA

(U) The availability predictions listed in Table 3.1-1 are relative to a mature design. Furthermore, these predictions are for a ship maintained in accordance with the Maintenance Concept outlined in Paragraph 3.2. The combat functions have not been considered in computing these predicted availabilities.

---

(1) This is the understanding derived from the 20 September 1976 meeting at PMS-304. Rohr Marine, Inc., was to receive a "questionnaire/list of required data" from NAVSEC. In the interim, the information submitted in this report presents data used in the Rohr Marine, Inc. RMA analysis.

Table 3.1-1 (U). SES Availability Prediction for the Near Term SES (U)

SUBSYSTEM	AVAILABILITY PREDICTION
Hull Structures	0.9990
Propulsion Plant	0.9627
Electric Plant	0.9990
Command and Surveillance	0.9828
Auxiliaries Systems	0.9874
Lift System	0.9768
Overall Ship	0.91

(U) 3.1.3 RELIABILITY AND MAINTAINABILITY DATA -- The R/M data provided in this subsection are for only mission essential equipments. Not listed are equipment in the combat or C3 systems with the exception of those functions required for maneuvering and navigation. The equipment R&M data is listed by subsystem. The following definitions apply to the data lists:

- EQUIPMENT - Major equipment group of function
- MTBF - Mean Time Between Failures, hours
- MTTR - Mean Time to Repair or Restore (the times listed include a 50 percent allowance for conditions at sea)
- UTIL - Utilization Factor. That portion of time that the item is in use during the mission, hours.
- NR - Non-Repairable at sea.

(U) 3.1.3.1 Propulsion Plant R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Combustion Air Supply Heating (NR)	11,500	5.0	0.5 <
Combustion Air Supply	244,000	1.5	1.0
Combustion Air Supply (NR)	81,300	5.0	1.0
Gas Turbine	6,450	3.0	1.0
Gas Turbine (NR)	10,500	24.0	1.0
GTRB Lube Oil Cooler	90,000	4.5	1.0
GTRB Luve Oil Filter - Supply	60,000	4.5	1.0
GTRB Lube Oil Filter - Scavenge	60,000	4.5	1.0
Flex Coupling (NR)	72,780	4.0	1.0
Tongue Meter	10,000	1.5	1.0
Shafting and Bearings (NR)	11,600	6.0	1.0
Thrust Reverser	6,150	6.0	0.1 <
Propulsor (NR)	6,700	8.0	1.0
Waterjet - Steering	6,150	6.0	1.0
Exhaust Duct	62,000	4.5	1.0
Exhaust Duct (NR)	300,000	15.0	1.0
GTRB Cooling Blower	18,250	2.25	1.0
Lube Oil Pump - Pressure	21,800	3.0	1.0
Att. Lube Oil Pump - Press.	34,500	4.5	1.0
Lube Oil Pump - Scavenge	21,800	3.0	1.0
Att. Lube Oil Pump - Scavenge	34,500	4.5	1.0
Lube Oil Filter/Separator	30,000	4.5	1.0
Lube Oil Control Manifold	46,730	3.0	1.0
Lube Oil Cooler	45,000	4.5	1.0
Vacuum Pump	18,250	2.25	1.0
Inlet Sensors and Control	5,000	1.5	1.0
Inlet Ramp Actuator	6,100	3.7	1.0
Inlet - Miscellaneous	91,000	3.0	1.0
Inlet (NR)	45,000	15.0	1.0
Propulsion System - Misc.	10,000	3.0	1.0
Sensors for System Control	10,000	1.5	1.0

(U) 3.1.3.2 Electric Plant R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Engine Air Supply	70,000	1.5	1.0
Gas Turbine Generator 60 Hz	8,330	3.0	1.0
Gas Turbine Generator 60 Hz (NR)	12,500	8.0	1.0
Gas Turbine Lube Gil Cooler	90,000	4.5	1.0
Exhaust Duct (NR)	26,000	5.8	1.0
60 Hz Switchboard	645,000	1.5	1.0
60 Hz Power Panel	173,580	1.5	1.0
60 Hz Transformer	1,000,000	1.5	1.0
400 Hz Switchboard	645,000	1.5	1.0
400 Hz Power Panel	173,580	1.5	1.0
400 Hz Transformer	1,000,000	1.5	1.0
Cooling Fan	18,250	2.25	1.0
Lighting Vital Spaces (each light)	1,000,000	1.5	1.0
Gas Turbine Generator 400 Hz	10,000	3.c	1.0
Gas Turbine Generator 400 Hz (NR)	15,000	8.0	1.0
28 VDC Rectifier	36,000	1.5	1.0
28 VDC Distribution Box	28,930	1.5	1.0
28 VDC Power Panel	43,395	1.5	1.0

(U) 3.1.3.3 Navigation and Collision Avoidance System R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Anti-Clutter Collision Avoidance Radar AN/APS-116	1,100	4.5	1.0
Anti-Clutter Collision Avoidance Radar AN/APS-116 (NR)	10,000	3.0	1.0
Surface Search Radar SPS-55	1,300	2.7	1.0
Surface Search Radar SPS-55 (NR)	12,000	1.8	1.0
Collision Avoidance Computer AN/UYK-20	2,000	0.4	1.0
Navigation Computer AN/UYK-20	2,000	0.4	1.0
Navigation Data Switchboard	2,000	1.5	1.0
SAT-NAV	500	0.75	1.0
OMEGA	1,500	1.5	1.0
Inertial Nav	5,600	1.0	1.0
Gyro (Types I and II)	5,600	1.0	1.0
Depth Sounder AN/UQN-4	5,700	0.75	0.5
Doppler Speed Sensor	1,000	1.5	1.0
Interior Communications	20,000	1.5	1.0
HF Transceiver	. 1,100	0.5	1.0
UHF Transceiver	2,100	0.5	1.0
VHF Transceiver	2,500	9.5	0.1
VHF Antenna (NR)	25,000	2.0	1.0
Transfer Switchboard	16,000	0.7	1.0

(U) 3.1.3.4 C^3 Ship Controls R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Wheei	5,000	1.5	1.0
Autopilot	1,666	1.0	1.0
Propulsion Power Lever Actuator	5,000	1.0	1.0
Lift Throttle	5,000	1.0	1.0
Lift Control (Ship's Control Console and Propulsion Control Console)	5,000	1.0	1.0
Autopilot Control Display Unit	5,000	1.0	1.0
Navigation - Collision Avoidance Display	4,000	1.0	1.0
Central Processing Unit	2,000	1.0	1.0
Fire Protection Controls	1,000	1.0	1.0
Electric System Control	1,000	1.0	1.0
Fuel Management Control	1,000	1.0	1.0
Auxiliaries Control	1,000	1.0	1.0
Pbwer Supply	90,000	1.5	1.0
PPI Display	4,000	3.0	1.0
PPI Display (NR)	4,000	3.0	1.0
Commanding Officer Communications Console	50,000	1.0	1.0
Ship's Control Console - Monitoring'	10,000	1.0	1.0
Propulsion Control Console - Monitoring	10,000	1.0	1.0

(U) 3.1.3.5 Auxiliaries R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Air Conditioning Unit	12,650	4.0	0.5
Recirculating Fan	13,880	3.0	1.0
Mixing Box	38,080	3.0	1.0
Supply Fan	18,250	3.0	1.0
Exhaust Fan	18,250	3.0	1.0
Supply Fan - Machinery Space'	18,250	3.0	1.0
Exhaust Fan - Machinery Space	18,250	3.0	1.0
Fire Pump (NR)	10,500	8.0	1.0
Distiller	2,000	4.0	1.0
Distiller (NR)	6,000	9.8	1.0
Pump - Potable Water	15,150	3.0	0.5
Pump - F.W. Transfer	15,150	6.0	1.0
Pump - Coolant, Electronic	15,150	4.5	1.0
Demineralizer	32,860	4.4	1.0
Heat Exchanger	90,000	4.5	1.0
Valve, Temp. Control	11,700	3.0	1.0
Pump, Fuel Transfer	3,760	4.5	0.3
Pump, Fuel Service	3,760	4.5	1.0
Pump, Fuel Trim	3,760	4.5	0.5
F.O. Filter	60,000	4.5	1.0
Manifold, Fuel	10,000	3.0	0.75
Heat Exchanger	90,000	4.5	1.0
Mass Flow Multiplier	50,000	4.5	0.1
Valve, Motor Operated	20,000	3.0	0.05
Regulator, Air	46,730	3.0	0.05
Air, Receiver	16,700	4.5	1.0
Hydraulic Pump - Att.	15,000	'3.0	1.0
Hydraulic Pump - Motor Drive	10,500	3.0	1.0
Filter, Hydraulic	60,000	4.5	1.0
Cooler, Hydraulic	90,000	4.5	1.0
Control, Hydraulic System	50,000	4.5	1.0

(U) 3.1.3.5 Auxiliaries R/M Data (Continued)

EQUIPMENT	MTBF	MTTR	UTIL
Regulator, Hydraulic Resevoir	23,365	3.0	1.0
Anchor Windlass (NR)	3,350	5.0	0.05
Capstan Mooring (NR)	3,350	5.0	0.05
Fuel, Probe-Receiver	50,000	3.0	0.10
Pollution Control System	10,000	3.0	1.0
Hangar Door - Actuation	10,000	4.5	0.05
Hangar Door - Manual	10,000	4.5	0.05
Sensors for System Control	10,000	4.5	1.0
Auxiliaries - Misc.	5,000	3.0	1.0
Fire Detection	2,000	1.5	1.0

(U) 3.1.3.6 Lift System R/M Data

EQUIPMENT	MTBF	MTTR	UTIL
Gas Turbine	6,450	3.0	1.0
Gas Turbine (NR)	10,500	24.0	1.0
GTRB Cooling Blower	18,250	2.25	1.0
GTRB Lube Oil Cooler	90,000	4.5	1.0
GTRB Lube Oil Filter - Supply	60,000	4.5	1.0
GTRB Lube Oil Filter - Scavenge	60,000	4.5	1.0
Torsionmeter	10,000	1.5	1.0
Exhaust Duct (NE)	26,000	5.8	1.0
Reduction Gear (NR)	188,000	8.0	1.0
Pump - Lube Oil Pressure	21,800	3.0	1.0
Pump - Lube Oil Pressure - Attached	34,500	4.5	1.0
Pump - Lube Oil Scavenge	21,800	3.0	1.0
Pump - Lube Oil Scavenge - Attached	34,500	4.5	1.0
Filter Separator - Lube Oil	30,000	4.5	1.0
Control Manifold - Lube Oil	46,730	3.0	1.0
Lube Oil Cooler	90,000	4.5	1.0
Vacuum. Pump	18,250	2.25	1.0
Shafting & Bearings (NR)	41,000	6.0	1.0
Demister	23,200	1.5	1.0
Lift Fan	28,190	3.0	1.0
Lift Fan (NR)	8,000	18.0	1.0
Shut Off Control Valve	5,900	4.5	1.0
Control - Ride Control Valves	10,000	3.0	0.1
Ride Control Valve	5,900	4.5	0.1
Bow Seal (NR)	6,965.	4.3	1.0
Stern Seal (NR)	6,965	4.7	1.0
Bow Seal Retract	9,120	4.5	0.05
Control - Bow Seal Ret.	5,000	1.5	0.05
Stern Seal Retract	9,120	4.5	0.05
Control - Stern Seal Ret.	5,000	1.5	0.05
Misc. Valves 6 Piping	10,000	1.5	1.0
Sensors for System Control	10,000	1.5	1.0
Transfer Valves	5,900	4.5	1.0

(U) 3.2 MAINTENANCE CONCEPTS

In consonance with the 3KSES TLR, the maintenance concept for meeting the objectives and availability goal is to: (1) perform the preventive/corrective maintenance on critical equipment onboard; (2) accomplish the emergency repair of non-critical equipments with helo provided (VERTREP) augmentation from the intermediate level support resources; and (3) defer/schedule all non-essenti equipments/components maintenance for in-port availabilities. For design purposes, particular emphasis was to be given to: (1) maximization of the use Of existing and projected Navy equipments to permit use of standard maintenance procedures and supply support, (2) use of performance/condition monitoring for detecting incipient failures for critical equipments, and (3) provisions for equipment accessibility to support a component/module replacement strategy. The replacement strategy includes scheduled replacement, replacement on condition, and replacement at failure depending on the subsystem/equipment criticality. Therefore, the maintenance concept in support of near term SES availability and mission is based on a number of objectives and constraints.

(U) The maintenance objectives of the near term SES are:

- Support the SES in the achievement of assigned test and demonstration missions while assuring safety of ship and personnel, and meeting availability requirements,
- Use the inherent maintenance capability of operator personnel.
- Minimize shipboard maintenance manning.
- Minimize "at sea" repair to the vital and critical equipments and components.
- Minimize ship carried weight of logistic resources,
- Use the most cost-effective distribution of effort between shipboard and off-ship maintenance.
- Use helicopte service (V'ERTREP) to provide logistics resources not carried on board, i.e., personnel skills, special tools and test equipment, spares, etc.

- o Use the replace and restore concept to the maximum, vice piece-part repair.
- o Provide adequate accessibility for servicing to minimize secondary removals/replacements.
- o Maximize the use of existing and projected Navy equipments to permit use of standard maintenance procedures and supply support. Navy rotatable pool stocks will be used as applicable.
- o Achieve incremental subsystem overhaul by maintenance actions and scheduled replacement of subsystems accessories and related auxiliaries consistent with the major item replacement cycle.

(U) The maintenance constraints placed on the near term SES are:

- o Accomplish both preventive and corrective maintenance actions, to the maximum extent possible, while in port.
- o In view of the perennial need to minimize shin weight, a single item weight limitation of 160 Lbs (711.72 N), will relegate a few "potentially repairable at sea" maintenance tasks, on critical equipments, to a non-repairable at sea category.
- o At sea maintenance shall be limited to that required, consistent with ship speeds and sea states.

(U) 3.2.1 INTERMEDIATE LEVEL SUPPORT -- Intermediate Maintenance Activities (IMA's) will accomplish PM not within the capacity of the ship's crew. The IMA will provide condition monitoring services not otherwise within the capabilities of the monitoring equipment aboard ship, during upkeep or Maintenance Availabilities of the ship. Intermediate-level maintenance for the near term SES will include support from shore based and afloat Intermediate Maintenance Activities.

(U) 3.2.1.1 Shore Based Intermediate Facilities -- The shore based intermediate level support will provide the following types of facilities to meet the operating, maintenance, training and supply support requirement of the near term SES:

- Operating pier -- will provide for safe and efficient mooring of the ship for servicing, maintenance and/or testing. The mooring provisions will be designed to be specifically compatible with the ship. An unobstructed access and a sufficient depth of water are required. Bits and chocks will provide the capability of withstanding wind loading up to 100 knots (51.44 m/s). Compatible dockside fittings for fueling/defueling, fresh water, compressed air, 60 and 400 Hz electrical power and telephone connections to the SES will be provided. Crane services for loading/unloading equipments/components and materials, gangways and/or ramps for personnel access/egress will be provided. Emptying the collecting/holding tanks (CRT) of sewage and other liquid wastes will be accomplished by appropriate sludge barges and receiving vehicles. Solid trash (compaction) disposal will be provided.
- Intermediate level maintenance ships/capability such as:

  (1) Ship fitters/welding/pipefitters

  (2) Mechanical - pumps/auxiliary machinery

  (3) Electrical - generators/switchboards

(4) Electronics/test instrumentation

(5) Underwater inspection/repair support shop including photographic service

(6) Operational computer program maintenance

- Training classroom8
- Supply warehousing and storerooms
- The administrative space, personnel, furnishing and equipments necessary to coordinate the logistics resource support, including the planning and scheduling of the resupply services to support the SES while at sea. Support shall be provided for logistics resources not carried on board (i.e., personnel skills, special tools and test equipment, spares, etc.).

(U) 3.2.1.2 Afloat Intermediate Facilities -- The afloat intermediate level activity will provide the following types of maintenance shop/capability support:

- Ship fitters/welding/pipefitters
- Mechanical - pumps/auxiliary machinery
- Electrical - generators/switchboards
- Electronics/test instrumentation
- Underwater inspection/repair support shop, including photographic service.

(U) 3.2.2 DEPOT LEVEL SUPPORT -- Depot-level support maintenance of the near term SES will include the following:

- Preserving the underwater body, and maintaining sea-connected tanks, valves, pipes, and fittings.

- Performing repairs requiring heavy lift capability and special tools and test equipment (examples: bow/stern seals, radar antennas, gas turbines, waterjet propulsor, electrical generators).
- Removing, installing, and testing certain equipments identified as stock rotating spare items (example: main propulsion and lift gas turbines),
- Stocking and repairing designated stock rotating spares items at selected depot maintenance activities.

(U) The depot level support will provide a dry dock and the necessary work shops for systems/equipments for overhaul and/or repair beyond the capability of the intermediate maintenance activity. The depot level support will provide general workshop and drydock facilities and services.

(U) 3.2.2.1 General Workshops -- Depot level maintenance shops/capability will provide maintenance for the waterjet propulsor, lift fans, seals, structural/welding, computers, consoles and related electronics, and gas turbine generators. A Naval Rework Facility is required for gas turbine maintenance. Overhaul points for communications, sensors, computers, displays, and related electronics must be designated. A facility, either Government or Contractor, is required for the maintenance of operational computer programs.

(U) **3.2.2.2 Drydock** -- A safe and efficient facility capable of drydocking the ship. Cranes, temporary pdwer, compressed air, fresh water, salt water, firemain, sewage collection and disposal shall be available at the dock site.

(U) 3.3 OVERHAUL CONCEPT

Regular overhauls, as now understood, are to be eliminated by intensive use of the upkeep periods as maintenance availabilities. The near term SES will employ the concept of progressive overhaul. Equipment replacement and alteration will be accomplished progressively during relatively frequent maintenance availability periods of short duration. Dry-docking will be accomplished, primarily to provide for major emergency repairs and/or ship alterations. The ship system will be designed to be capable of incremental overhaul of its subsystems and subsystem accessories and related auxiliaries. Operational usage and schedule replacement will be consistent with the major item replacement schedule.

(U) 3.3.1 SCHEDULING (Not provided)

(U) 3.3.2 PIPELINE REQUIREMENTS (Not provided)

(U) 3.3.3 SHIPYARD OVERHAUL FACILITIES (Not used; see Section 3.2.2)

(U) 3.3.4 LAND-BASED TEST FACILITIES (Not provided)

(U) 3.3.5 MAINTENANCE PROGRAM INTERFACE (Not provided)

(U) 3.4 **SUPPLY SUPPORT CONCEPT**

The sizing of near term SES storerooms, commissary system and other supply spaces are constrained by design requirements and indirectly by the maintenance concept and the personnel requirements. Within the permissible volumetric and weight limits, the near term SES design provides the necessary supply support capability. The design supports the requirements for 10 and 15-day missions in accordance with LSES TLR mission profiles. A salient design consideration is the frequency of underway replenishment, including helicopter (VERTREP) delivery of required logistics resources, and the requirement for underway refueling.

(U) The supply support concept provides material support for the assigned miss ions. The support includes initial outfitting of provisions, medical supplies and spares and repair parts as well as replenishment,

(U) The supply concept provides for the fitting out of the SES. It provides for the material to be assembled in a shore warehouse prior to loading on board. The l ›ading of spares and repair parts and equipage will be kept to a minimum consistent with space and weight constraints, necessary to support availability and mission requirements. Tailored loads of support for specific missions will be utilized,

(U) Replenishment for all repaitables, consumables, and spares will be provided through underway Replenishment Groups at sea and through normal resupply methods in port. Supply requirements, for at sea emergencies, will be accomplished by the utilization of helicopter deliveries. Maximum utilization of in-port delivery for all repairables, consumables, and spares, will be a program objective.

(U) 3.4.1 MODIFICATIONS TO MOBILE LOGISTIC SUPPORT FORCE SHIPS (Not provided)

(U) 3.4.2 UNIQUE SHORE FACILITIES (Not used; see Sections 3.2.1 and 3.2.2).

(U) 3.4.3 UNIQUE REPLENISHMENT TECHNIQUES (Not provided).

(U) 3.4.4 UNIQUE SUPPLY SUPPORT PROCEDURES (Not provided)

(U) 3.5 HUMAN ENGINEERING

The human engineering effort on the near term SES encompassed three basic areas: (1) design of major work stations; (2) design of maintenance access; and (3) evaluation of the design in terms meeting habitability criteria requirements.

(U) 3.5.1 DESIGN OF WORK STATIONS -- The pilot house, chart room, Central Operating Station (COS) and CIC were analyzed with regard to man-machine interfaces and functional adjacencies between operating personnel. The pilot house and COS are equipped with integrated display-control consoles to allow minimum manning at these stations. These work stations have also been designed for seated operations to ensure a high level of operability during operation in all sea states and at all ship speeds.

(U) 3.5.2 MAINTENANCE ACCESS -- All ship spaces and equipments within these spaces were analyzed to determine if sufficient space had been allocated for both corrective and preventative maintenance. The analysis revealed that all subsystems and equipments can be installed, serviced and removed with a minimum of effort. Particular attention was given to the waterjet propulsors, propulsion gas turbines, lift gas turbines and the lift fans with regard to maintenance removal requirements.

(U) 3.5.3 HABITABILITY -- The point design was compared with the habitability criteria stated in OPNAVINST 9330.78. The space allocations for crew living areas meet or exceed those requirements for berthing, sanitation spaces, recreation spaces, galley and messing. The crew living areas occupy a single deck to minimize the need for crew members to move about the ship whether on- or off-duty. Therefore, these design features are provided: (1) all off-duty crew spaces are on the same level to minimize the use of ladders; (2) within the constraints of crew/CPO officer off-duty separatlon, the best possible adjacency between mess rooms, recreation rooms, and berthing

(U) spaces, has been provided; (3) sanitary spaces are located within the living spaces,

(U) Noise/thermal separation between living and machinery spaces ensures a more comfortable off-duty crew environment. Off-duty spaces are separated from machinery spaces/engine rooms by passageways, storerooms or other effective noise and thermal barriers. This lessens ship weight allocation for insulation material while improving habitability.

(U) The ride quality to be expected by the crew at higher sea states, in combination with higher ship speeds, was examined. Large amplitude vertical accelerations can exceed human tolerance levels to a point where human performance can be affected. To ensure that human performance is not degraded, Human Factors developed ride criteria limits that were used to verify the adequacy of the ride control system in limiting vertical accelerations within the operational sea state and speed envelope.

(U) 3.6 SYSTEM SAFETY

The primary intent of safety program requirements is the elimination or control of hazards inherent in the design and in the operation of the SES in its environment. Particular attention was given to safe ship survival in any singular hardware malfunction of the lift, propulsion, steering, reversing, or sidehull damage from foreign objects, regardless of sea state, speed, displacement, or maneuver at the time of the casualty, Safe survival of personnel functional capabilities and preclusion from injury during and operatfonal or maintenance phase is euqally important.

(U) 3.6.1 PRELIMINARY HAZARDS ANALYSIS -- The entire ship design was reviewed for gross hazard failure modes. Design characteristics singular to the SES were given emphasis. A major effort was placed on hull arrangement and structure, lift system, seals, waterjet pump, fire protection integration, operation and maintenance hazards, selected control aspects, and outfit and furnishings.

(U) In most instances, operational ambient failure conditions were defined to aid the designer in eliminating a hazard, rather than relying on preventative manned reaction and cautionary training. Where ship critical or catastrophic conditions were predictable, equipment failure modes and personnel hazards were examined as possible sequences or parallel events. Closely examined were seals, the lift system machinery, fire detection, and extinguishment integration, selection of passive fire protection materials, and personnel protective gear for use while underway,

(U) 3.6.2 SAFETY TRADE-OFF STUDIES -- System Safety Personnel investigated or supported all safety critical trade-off studies. Selected subjects of design safety trade-offs, applicable to the 1980 (near term) point design, follow.

(U) 3.6.3 FIRE PROTECTION -- System Safety actively participated in the design of the fire protection system. Safety required that a

(U) bulkhead be capable of sustaining a fuel fire for 30 minutes on the insulated side, with the non-insulated side not to exceed 400°F (204°C). This is achieved by a passive fire protection design with a stainless steel face shield backed-up by varying thicknesses of fiberfrax.

(U) Auto/remote/local Halon 1301 fixed flooding with interconnect capability, and HI-X foam generators for back-up are used in fire suppression. Critical electronic spaces are similarly protected except without Hi-X foam. All other ship spaces are protected with standard Navy fire extinguishing systems. For example, the Helicopter hangar and flight deck are protected by AFFF foam sprinkling and hose reels and the torpedo room and missile stations with seawater sprinkling,

(U) 3.6.4 LIFT SYSTEM AND SEALS -- The ride control and lift system design and development has been under continuous surveillance for its safety impact. Maintenance access and interlocking alarms into the fan compartments have been provided, The near term SES incorporates guide vanes on 0.5 Ft. (0.15m) centers at the fan inlet that preclude a personnel falling hazard,

(U) 3.6.5 RIDE CONTROL -- Safety features for maintaining control of body motions underway include: safety/shoulder harness restraining devices for seated positions, arm restraints for console operators, padded barriers and railings for walking and standing functions, non-skid deck surfaces, and head protective gear. Non-critical maintenance activities are minimal while underway in high sea states to minimize personnel injury from random vertical accelerations.

(U) 3.6.6 HELICOPTER CONTROL STATION -- The helicopter control station was located at the port side of the Helicopter Hangar at the 01 level. This provides greater visibility and safety in the event of a helicopter crash or platform fire. In the event of a hangar fire, emergency egress to the 01 level is readily available.

(U) 3.6.7 DECK EDGE CURVATURE -- The deck edge curvature provided for aerodynamic purposes has a two foot (0.61m) radius. This maximizes deck hand safety compared to larger radii, particularly during installation or removal of portable life lines and stanchions from the deck edge perimeter and the replenishment of stores and ordnance while underway.

(U) 3.6.8 ANTENNA LOCATION -- The AN/APA-171 antenna is located on the main mast, approximately 30 feet (9.14m) above the weather deck, This lowers the personnel RADHAZ level on the helicopter platform and avoids radiating energy into the Pilot House, compared to possible alternate locations farther aft and closer to the 01 deck.

4 / TECHNICAL RISK ASSESSMENT

(U) One of the design objectives has been to incorporate standard practices and parts to the maximum degree. Equipments developed and available from existing Government inventory have been preferred over new equipments to be developed. Qualification by extension of existing designs has been used to the extent practicable in lieu of development of new items.

(U) The ship configuration is a viable concept and can be developed with minor or acceptable levels of risk. Furthermore, the near term ANVCE SES has been configured to accept further design alternatives which may enhance ship performance, utility and reliability. The overall technical risk is assessed as follows:

(U) Hull Structure -- The hull is designed to realistic worst case loading conditions forecast to occur within the ship lifetime. The materials are commercially produced aluminum alloys which have been utilized in existing Navy ships, such as the PHM and SES-100B. The baseline configuration is conventional with state-of-the-art details to minimize construction risk. The hull as presently configured is producible, cost effective, and adequate to perform the specified mission.

SECTION 4

(U) Propulsion System -- The proven LM 2500 and the developmental FT9A-2A alternate engines were chosen on the basis of proven capability and advanced developmental status, respectively. The transmission design features high state-of-the-art reliability and performance. The waterjet propulsor and inlet design has been optimized on the basis of extensive analysis and sub-scale tests. All other components are typical of PHM, SES-100A, and XR-ID practice; are presently available and proven in service.

(U) Electrical System -- The baseline system design can be implemented with off-the-she&? equipment. The design is low risk, cost effective, and will provide satisfactory and reliable performance with high confidence.

(U) Command, Control, and Communication (C^3) -- The C^3 systems are comprised almost entirely of Government Nomenclatured Equipments with attendant low risk in their use, The only potential risk is HF communications during on and off cushion ship operations that would effect the antenna ground plane. The risk associated with other C^3 equipment is low or well within the state-of-the-art and absorbed by substantial, funded ongoing programs.

(U) Lift System -- The LM 2500 gas turbine is a production unit used in other marine applications. Lift fan development is based on extensive subscale testing. The other elements of the air distribution system are typical of present gas turbine ship installations and within the present state-of-the-art. The advanced bow and stern planing seals have proved highly successful in sub-scale tests. While there are no historical research or performance data on this particular SES application, full-scale loads analysis and materials selection indicates that all considerations are within the state-of-the-art.

(U) Outfit and Furnishings (O&F) -- Nearly every item in the O&F system is a proven shipboard item not peculiar to the SES. The risk is equivalent to that of O&F on conventional Navy ships. Passive thermal/fire and acoustic protection systems are based on extensive testing and material evaluations, The risks associated with their application will be minimal.

(U) Combat System -- The risk is that associated with ongoing Government development of the combat system equipments. The interface design risk is low.

APPENDIXA

DESIGN PROCESS

(U) The various near term ANVCE Point Designs will be arrived at from different technology bases. Different standards, criteria and assumptions are used because of the different program offices and other Navy organizations involved. For example, structural safety factors between different vehicles are not the same, weight margins are frequently different and different ambient conditions may be assumed in quoting engine performance.

(U) The near term SES point design concept outlined in this report adheres, wherever practicable, for consistency to information **provided** in such ANVCE documents as:

<u>ANVCE Primary Documentation</u>

- WP-010 - dated 27 August 1976 - "Environmental Conditions"
- WP-008 - dated 20 August 1976 - "Supportability/Availability"
- WP-007 - dated 30 July 1976 - "Point Design Guidance
- WP-005A - dated 13 August 1976 - "Point Design Description"
- UP-002 - dated 2 April 1976 - "Definition of Terms'

ANVCE Supplementary Documentation

- "Design Standards for Surface Point Designs, Revision A", **ANVCE Memorandum 90-76,** dated 10 August 1976

(U) WP-005A was used as the basis for the data developed in this report and was assumed as having precedence over other stated documentation requirements in cases of conflict. As a further aid to making proper evaluation of the near term SES point design presented in this report, this Appendix provides a basis for the insight needed into the design approach, criteria, philosophy and trade studies used in arriving at the design. This Appendix collects in summary form those pieces of information needed to identify the source of data and the design process used.

(U) A.1 APPROACH

For a basic vehicle configuration and the major subsystems, several methods of establishing characteristics exist. They may be classified into three groups:

- Scaling -- projection of characteristics based on ratioing up or down from a chosen vehicle
- Modification -- development of characteristics based on small changes to an existing vehicle
- Synthesis -- development of characteristics based on design data, parametric analysis and theoretical investigations

(U) The approach primarily used for the Rohr version of the ANVCE near term SES Point Design is modification to the Rohr 3KSES proposed design. This proposed design is, in turn, based upon scaling of appropriate model and testcraft data, as well as upon synthesis as just defined. The specific approaches in each disciplinary area are next identified and presented in concise form.

(U) A.2 DESIGN CRITERIA

-Those pertinent design criteria, standards and assumptions used in the Point Design are provided in the following areas: hull structure, propulsion, electrical plant, command and surveillance, auxiliary systems, lift system, outfit and furnishings, armament, loads, weight margins, and vehicle. Tabular forms and references are used as appropriate in the sections that follow for each of these areas.

(U) A.2.1 HULL STRUCTURE -- Loads were developed that correspond to a number of operational definitions. The selected loading conditions are the result for a ship operating over a 20-year life anywhere within its operational envelope.

(U) The following load cases are considered "operational" and the required safety factors used when applying these loads are 1.30 on the minimum yield strength and 1.80 on the ultimate strength:

- Load Case 1 -- Cushionborne, Operational - This case is based on on-cushion operation anywhere within the operational envelope. There are no heading or speed restrictions.
- Load Case 2 -- Hullborne, Low Sea State - This case represents hullborne operation (entirely off-cushion) in sea states 5 and below. There are no heading or speed restrictions.
- Load Case 3 -- Partial Cushion, High Sea State - This case is for partial-cushion operation (not entirely off-cushion) in sea states 6 and above. There are no heading or speed restrictions.

(U) The following load cases were considered as emergencies due to system(s) failures, Because the ship is in an emergency mode, operational maneuvers to alleviate loads and motions would be deemed appropriate, The

(U) safety factors used for the following two conditions are 1.0 based upon the minimum yield strength and 1.50 based upon the ultimate strength:

- Load Case 4 -- **Hullborne/Lift** System Failure in High Sea States - This condition is for a lift system failure in sea states 6 and above. Headings within 45 degrees of head seas are not considered, but there is no restriction on speed.

- Load Case 5 -- **Hullborne/Lift** and Propulsion Failure in High Sea States - This condition is for lift and propulsion system failures in sea states 6 and above. Speed is considered to be zero, but there is no restriction upon heading.

(U) A final load condition considered was for ship damage with subsequent flooding. The safety factor applied was 1.20 on the minimum ultimate strength. No safety factor is used for yield strength since the ship would already have suffered structural damage; therefore, local yielding was permissible.

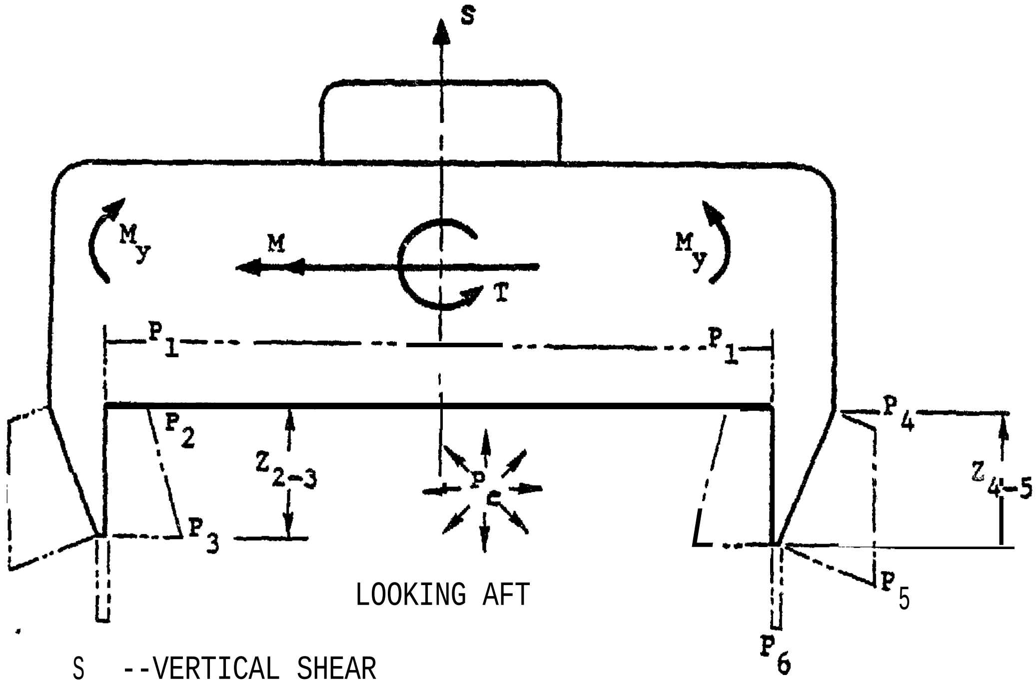
- Load Case 6 - Damaged Ship - This condition is for the ship suffering maximum damage (two compartments flooded). Still water bending moments are considered along with hydrostatic loads due to flooding to the "V-Lines".

(U) The 3KSES hull structure is designed to the predicted maximum once per lifetime loads that the ship will experience in a twenty-year life. These loads are not considered singly since those sea and weather conditions which produce the most severe loads, such as longitudinal bending, also produce other associated loads, such as shear, torsion and those due to hydrodynamic pressure forces. Figure **A.2.1-1** presents the load nomenclature and definitions used in the description of the structural load cases which follow. Figure **A.2.1-2** presents the maximum cushionborne bending moment and the shear, hydrodynamic pressures and vertical accelerations associated with

(U) Load Case 1. The loads resulting from the conditions of Load Cases 2, 3 and 4 are presented in Figures A.2.: -3, A.2.1-4, and A.2.1-5, respectively. The loads resulting from Load Case 5 were found to be significantly less than those of Load Case 4, and are not presented. The many possible damage conditions of Load Case 6 are too numerous and complex to discuss in this document, However, the hydrostatic heads associated with flooding to the V-Lines were the loads which determined the scantlings of many structural elements.

(U) While the hull structure is adequate to withstand the aforementioned loads with the safety factors specified in the load cases, the hull structure was originally designed to somewhat higher loads but lower required factors of safety. These high loads were the result of off-cushion ship operation in high sea states (sea states 6 through 9). Model testing and analysis demonstrated the advantage of partial-cushion operation in those high sea states, and this mode has been adopted for operation in that portion of the operational envelope. With completely off-cushion operation in sea states 6 and above due to an emergency, such operational maneuvers as implied by the speed and heading restraints of Load Cases 4 and 5 are deemed appropriate. The near term SES hull structure adequately withstands the developed loads and adopted factors of safety.

(U) Fatigue Considerations -- A well established fatigue life (FATLF) computer program, along with accelerated time and fatigue testing of full scale welded panels, was used for verification of the endurance capabilities of the ship structure. Fatigue life of those test panels was increased significantly through the use of special fabrication and welding techniques. Basic joint design, along with controlled and scheduled welding and an in-service failure prevention plan, should assure a safe operational lifetime.



S --VERTICAL SHEAR
T - TORSION
M - BENDING MOMENT (POSITIVE MOMENT INDICATES UPPER DECKS IN COMPRESSION)
M_Y - TRANSVERSE BENDING MOMENT (POSITIVE MOMENT INDICATES UPPER DECKS IN COMPRESSION)

Figure A.2.1-1 (U): Loads Nomenclature and Reference System (U)

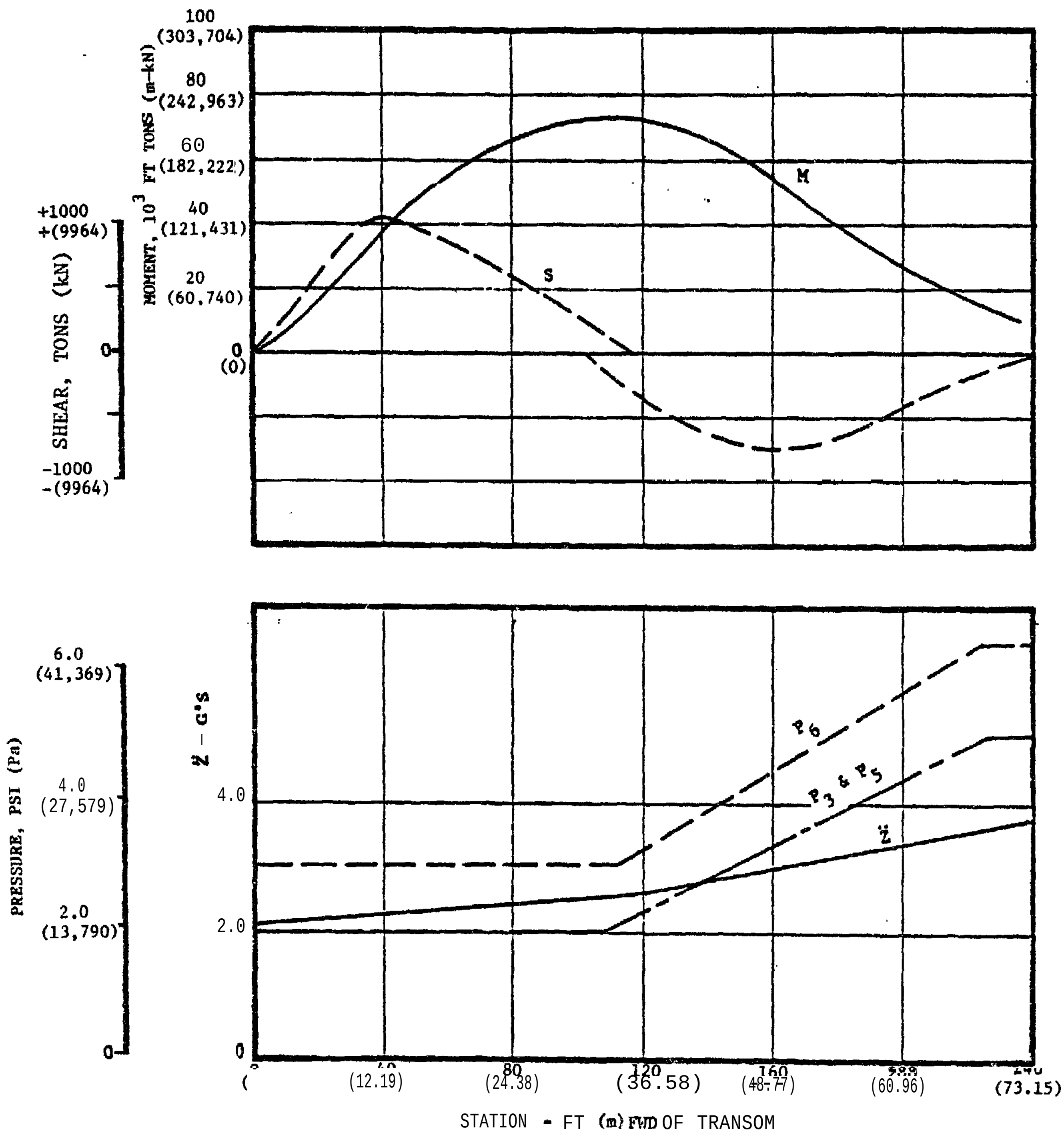


Figure A.2.1-2 (U): Shear Loads, Bending Moments, Hydrodynamic Pressures, and Vertical Accelerations Corresponding to Load Case 1 (U)

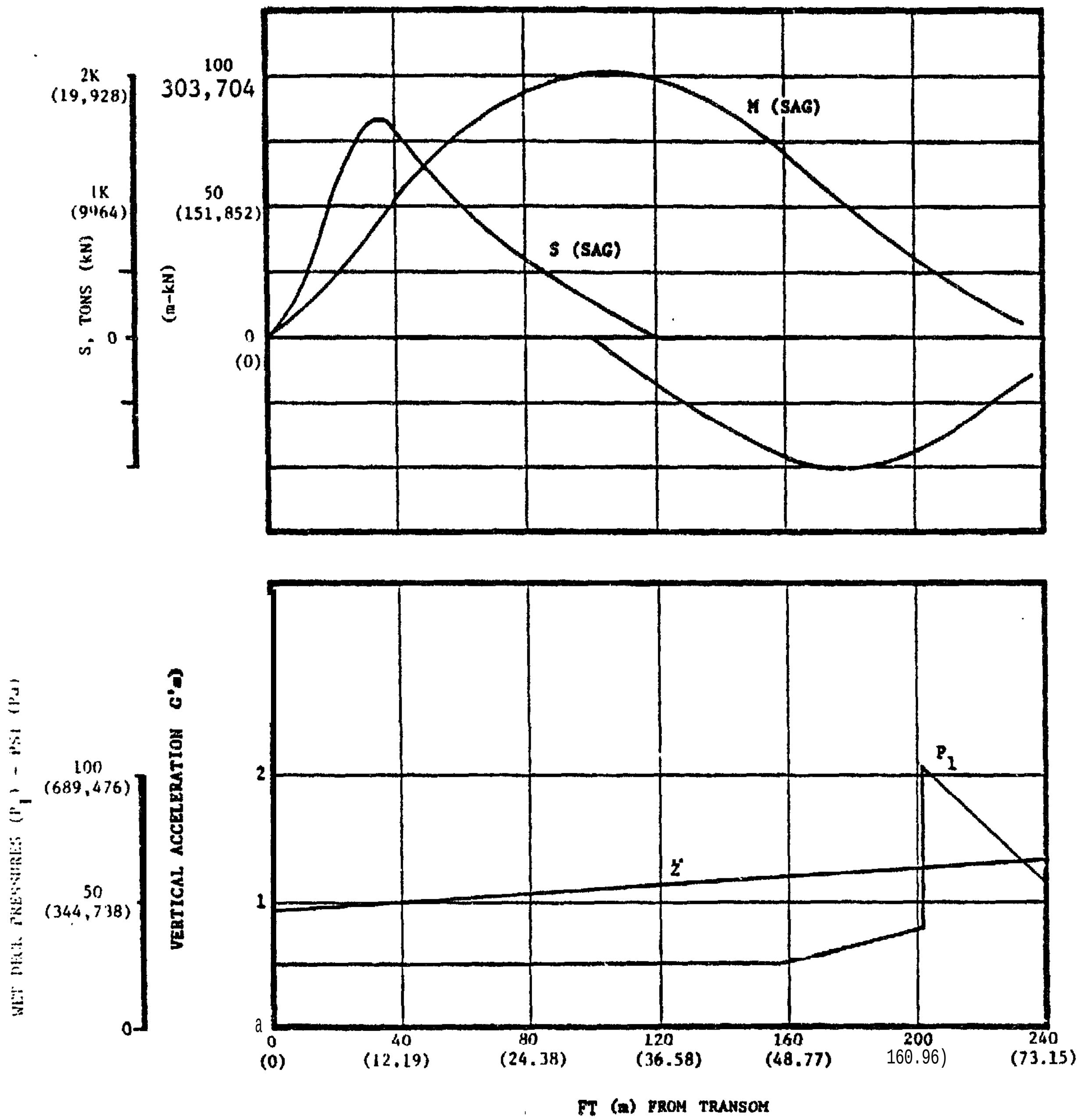


Figure A.2.1-3 (U): Shear Loads, Bending Moments, Hydrodynamic Pressures, and Vertical Accelerations Corresponding to Load Case 2 (U)

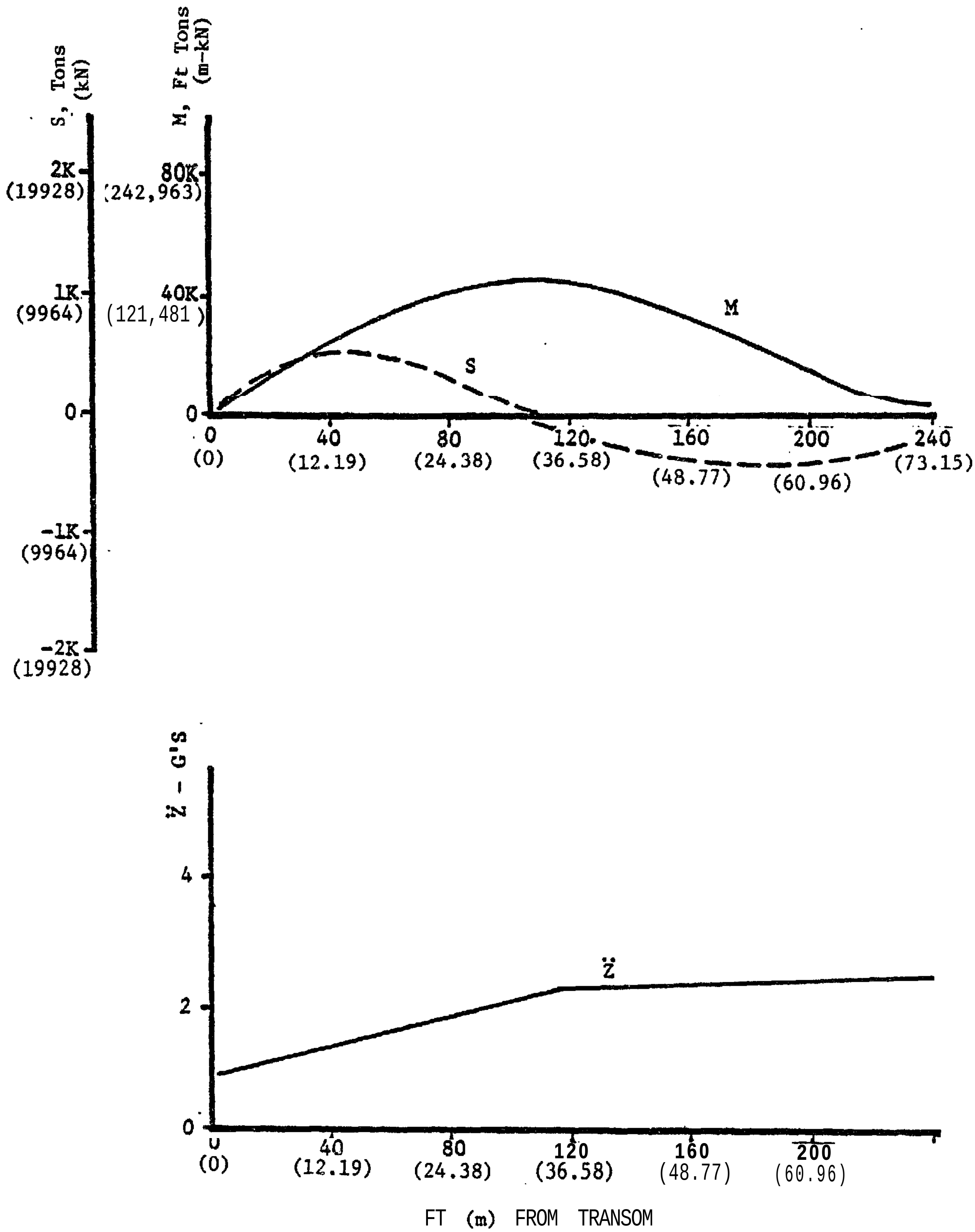


Figure A.2.1-4 (U): Shear Loads, Bending Moments, and Vertical Accelerations Corresponding to Load Case 3 (U)

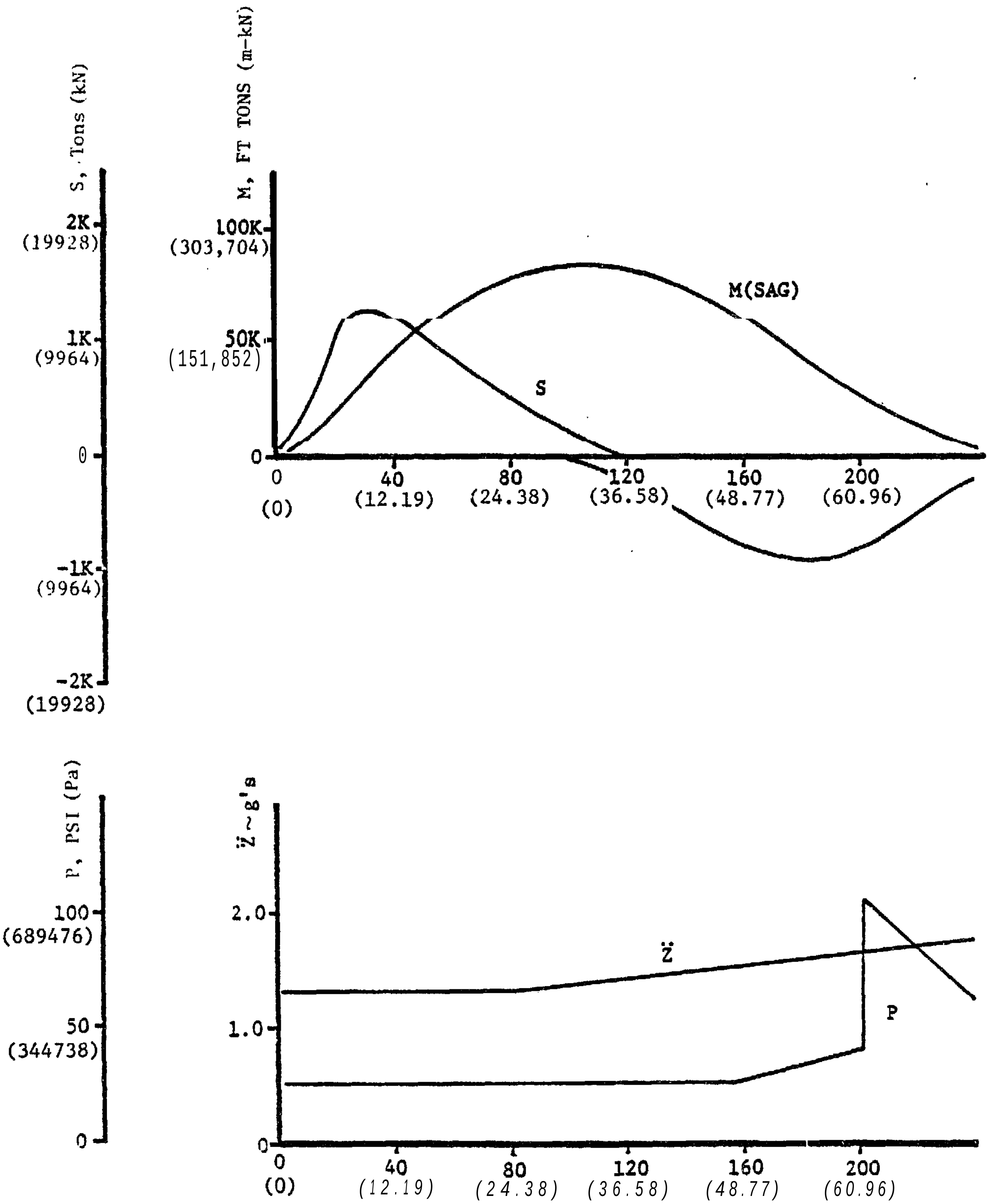


Figure A.2.1-5 (U): Shear Loads, Bending Moments, Hydrodynamic Pressures, and Vertical Accelerations Corresponding to Load Case 4 (U)

(U) A.2.2 PROPULSION -- General design criteria for the near term SES propulsion system includes maximization of performance, reliability, maintainability and simplicity. The propulsion machinery spaces are designed to accommodate either G.E. LM2500 or P&W FT9A-2A gas turbine engines. Specific design criteria applied to the point design are:

- o All machinery accessible for maintenance off-cushion without dry-docking, No corrosive air/water interfaces.
- o Short, straight drive shafts with no alignment and vibration problems. Flexible couplings to absorb dynamic misalignments.
- o Overspeed gas turbine engine control for protection against propulsion inlet air ingestion without complete engine shutdown.
- o Non-redundant link mounted propulsion components. The link mounted propulsor has less deflection than a gun mount. This simplified alignment, steering, and reversing interface and reduces vibration problems.
- o Low loss combusion air inlet system designed for 2.9 inches (7.36 cm) H_2O loss for LM2500 and 4.9 Inches (0.12 m) H_2O loss from FT9A-2A installation. Sufficient interval flow area to install a three stage inertial coalescer-interid moisture separator operating at a face velocity of 17.5 ft/sec (5.33 m/sec). The total salt ingestion goal is 0.00136 ppm with a projected water wash interval of 450 hours. Capability to withstand a 4 foot (1.22 m) wave of green water on the 01 level without demister flooding and resultant breakthrough. Sufficient volume forward of the engine bellmouths to reduce pre-swirl and counter swirl to less than 5 and 12 degrees, respectively, and to keep distortion below 10 percent,

(U)

- Low loss propulsion exhausts - the design criteria for sizing the exhausts is based on obtaining maximum net thrust to the ship with low weight, back pressure, fuel consumption and jet thrust within a maximum limit of 6 inches (0.15 m) H_2O.
- Acoustically treated intake and exhaust to meet Navy Category E requirements on the flight deck.
- Anti-icing system designed to provide protection to -20^oF (-28.9%).
- Engine cowling designed to limit potential personnal contact areas to 125^oF (51.7^oC).
- Minimum number of moving parts in the flexible ramp roof variable area waterjet inlet. Smooth roof contour at any opening position. Vented roof cavities and pressure balanced to reduce structural loads and weight. Symmetrically configured bifurcated duct for low velocity distortion,
- Propulsion inlet designed to provide cavitation free operation to ship speeds exceeding the maximum ANVCE specified speed.

(U) A.2.3 ELECTRIC PLANT -- The near term SES Electric Plant design .has been guided and controlled by a set of design criteria, standards, and a system design philosophy, collectively oriented toward the design of an uncomplicated and flexible system featuring minimum weight, cost, and fuel consumption. The current design highlights the following:

- o Adequate generated power, measured by operating margins, off-line reserves, and power quality
- o Weight and envelope minimization
- o Environmental compatibility
- o Minimal technical risk
- o Interface compatibility with ship structure
- o Adequate RMA and Safety considerations
- o Use of proven components where practicable
- o Use of standard Navy design precepts for the power distribution system

(U) The system design philosophy emphasizes the criticality of a continuous source of electrical power, with judicious minimization of system weight, envelope size, and cost of components and installation. Every effort is made to strike a proper balance between innovative and traditional design. Modernization to include superior materials or components is encouraged, particularly where significant benefits accrue in reduced life-cycle costs, enhanced safety, or performance improvements. A number of standards were incorporated in the design methodology to ensure suitability for Navy use and compatability with the anticipated marine environment. Among these were:

MILITARY SPECIFICATIONS AND STANDARDS

MIL-E-917	Electric Power Equipment, Basic Requirements (Naval Shipboard Use)
MIL-STD-454	Standard General Requirements for Electronic Equipment

MIL-STD-1399/ 103	Interface Standard for Shipboard Systems Section 103 Electric Power, Alternating Current
MIL-S-16036	Switchgear, Power, Naval Shipboard
NIL-C-17361	Circuit Breakers, Air, Electric, Insulated Enclosure (Shipboard Use)
MIL-C-17587	Circuit Breakers, Air, Electric, Open Frame Removable Assembly (Shipboard Use)
MIL-C-17588	Circuit Breakers (Automatic - ALB) and Switch, Toggle (Circuit Breaker, Non-Automatic - NLB), Air, Insulated Enclosure, 125 Volts and Below, AC or DC, Naval Shipboard
MIL-G-3124	Generator, Alternating Current, 60-Cycle (Naval Shipboard Use)
MIL-G-21480	Generator System, 400 Hz AC, Aircraft
MIL-G-22077	Generator Sets, Gas Turbine, Direct-and Alternating-Current, Naval Shipboard Use
0902-001-5000	General Specifications for Ships of the U. S. Navy (GSS); Naval Sea Systems Command (NAVSEA)
DDS-300-2	Design Data Sheet, AC Fault Current Calculations
DDS-311-3	Design Data Sheet, Ship Service Electric Power System, Application and Coordination of Protective Devices
DDS-304-2	Electrical Cables, Rating and Characteristics
DDS-311-Z	Design Data Sheet, Voltage Regulation for AC Ship Service Electric Power Systems

(U) A.2.4 COMMAND AND SURVEILLANCE -- The Combat System, including command and surveillance, armament and navigation and collision avoidance, was dictated by the 28 May 1976, LSES Top Level Requirements Document. Equipment lists were provided by the U. S. Navy.

(U) The Ship Control System design was based on utilization of existing, approved equipments, such as FFG control system components and the AN/UYK-20 computer, to provide integrated control of ship operations, damage control, and auxiliaries and ship plant monitoring by a minimum of crew members.

(U) A.2.5 AUXILIARY SYSTEMS

(U) A.2.5.1 AIR CONDITIONING -- Requirements for the near term SES air conditioning system are:

- o The decentralization of the air conditioning system by dividing the load in small serviced areas, and by using the fan rooms to accommodate the cooling/heating/fan integral units.
- o Replacement of the chilled water system by straight air and hot-cold mixing boxes, and selection of lightweight foam type reinforced materials for ducting.
- o Existence of state-of-the-art components already qualified by commercial and/or military requirements and in actual operation.

The results foreseen are:

- o Pseudo redundancy, since failure of one unit will bring only fractional failure to the subsystem.
- o Weight savings inherent to aircraft components.
- o Energy savings by proper management and more efficient equipment.
- o Reliable system by the use of qualified components.

(U) A.2.5.2 LUBE SYSTEM -- A number of subsystems on board require lubrication. The prime thermal drivers for propulsion and lift and the electric power generating units will be self-contained; others like propulsion gearing, power transmission, waterjet pump and lift gearing, fans and power transmission will require dedicated lube subsystems.

(U) The concept of a single centralized lube system versus multiple, dedicated systems was analyzed on the basis of: weight, cross contamination, cooling requirements, length of lines and bulkhead penetrations involved, reliability, and redundancy. Decision was made to employ the multiple, dedicated systems conceptual approach.

(U) The standard way of using cooling seawater should be accepted only if it does not demand extra loading on the seawater subsystem, as for propulsion gear-pump units where water is available from the waterjet pump (second-stage cavity). The lift system should employ air as cooling media, and the location of the heat exchanger (oil to air) should be established (inlet or outlet of fans).

(U) Pre- and post-operation lube oil circulation should be provided, as well as standby lubrication to assist main lube pump in low speed operation. The aeration of lube oil should be considered and the quality of lube oil should be closely controlled. High holding capacity for particulate contaimination and dewatering (vacuum plus coalescers) filters is inherent in the use of advanced practices and state-of-the-art components. A closed lube system should be compared with alternate schemes.

(U) Short coupled lines should be used as exemplified by advanced systems used in other industries (petrochemical), and the clustering of fittings and components should be replaced by functional manifolds. The material for transmission lines should be compatible with that for gears and bearings, and should reflect low weight, fatigue strength compatibility and ease of handling. The lines should be supported by resilient mounts.

(U) The results foreseen from this approach are enhanced system functioning, weight savings, energy savings (by using cooling media already available), and improved reliability by use of qualified components, practices in other industries, and application of naval operation experience.

(U) A.2.5.3 SEAWATER SYSTEM -- An integrated seawater system serves firemain, seawater service and sprinkling functions with an appreciable weight reduction. Additional weight savings were effected by installation of an open horizontal loop, i.e., elimination of the wet weight cross connection.

(U) Installation of GRP piping for seawater, auxiliary system and wet firemain removes corrosion problems and effects weight savings of approximately one-third, compared to that for an equivalent copper-nickel system. Components to be used are readily available and qualified for marine use.

(U) A.2.5.4 POTABLE AND FRESH WATER SYSTEMS -- Generation of potable and fresh water from seawater requires selection of the desalination process, i.e., reverse osmosis versus one of the several types of distilling processes. The inability of presently available reverse osmosis units to meet the salinity requirements of the general ship specifications prohibited its use.

(U) The trade-off of potable and fresh water systems involved investigation of components and configurations possessing potential weight savings. This led to the selection of vacuum-assisted water closets and low water demand showers. The resulting weight reduction is due to the reduced quantity of water collected and stored via'the drainage system and the reduced pumping capacity requirement. Further weight reduction was obtained with GRP piping,

(U) A three-distiller configuration to reduce the stored potable water tonnage was investigated. Each unit was capable of supplying the ship's daily demand, and the tank tonnage was reduced by one-third of the required 40 GPM (25.24 mm^3/s) per accommodation. The fresh water storage tonnage was reduced by restricting the utilization of fresh water (demineralized) to gas turbine engine washing and to make-up water for the auxiliary fresh water electronic cooling system.

(U) The selection of electrical power (in lieu of gas or steam) was made upon its ready availability. The 400 Hz supply was selected for all pump motors, on the basis of weight savings over 60 Hz types,

(U) A.2.5.5 DISTILLING PLANT -- The selection of the type and capacity of distilling plant(s) requires the consideration of ease of maintenance and operation, quantity and form of energy available, and the fresh water requirements. The three basic types of distillers for naval ships are vapor compression, submerged tube, and flash. Each was evaluated in the trade process of optimal design selection.

(U) A.2.5.6 FUEL SYSTEM -- The fuel system performs the following functions: provides fuel of proper quality to all the thermal drivers for propulsion, lift, and electric power generation provides CG location management by using fuel transfer as a means of trimming; provides storage and service of fuel for the aircraft on board.

(U) Designated tanks are established for: trimming and storage, storage, service for on board equipment, and service for aircraft. The need of interconnecting tanks for functional operation dictates the use of multiple controls and a well planned distribution system that provides redundancy. Fluid lines with mechanically assembled joints of well known reliability are used in sections which may need to be removed and replaced; otherwise, butt weld connections are used. Proliferation of connections is avoided by use of functional manifolds. Due to high flow conditions, valves must have defined times for the close-to-open or open-to-close cycles to avoid hammering. Lines should be supported by resilient mounts to avoid premature fatigue and undue noise or vibration coupling, Underway fueling should be in agreement with naval practices.

(U) The quality of the fuel should be closely controlled by use of high capacity filters for particulate contamination and water removal in lines between storage tanks and service tanks, and between service tanks and thermal driver units or aircraft.

(U) The results foreseen are: weight savings, by a judicious selection of componnets and materials, and reliability by the use of redundancy and qualified components.

(U) A.2.5.7 COMPRESSED AIR SYSTEM -- The compressed air system permits propulsion and lift turbine starting. It supplies air for actuation of back pressure valves, exhaust gas transfer valves and propulsion engine exhaust doors, and for miscellaneous uses as required. Weight reduction of the compressed air system was acheived by starting the GTG's by electric battery power. Several tons of high pressure charged air bottles were thereby eliminated. Practically all of the compressed air system components would be selected from available and qualified light-weight components.

(U) A.2.5.8 FIRE EXTINGUISHING SYSTEM -- A trade-off study was made to provide the design criteria and rationale for selection of the best flooding extinguishing agent. CO2 and Halon 1301 extinguishing systems were compared, and a Halon 1301 system was found to require less weight and to discharge a much shorter time as shown here:

Agent	Compartment	Quantity of Agent	Total Discharge Time	Weight	Toxicity Class
CO_2	5000 Ft^3 (850 m^3)	250 Lb (1.11 kN)	90 Sec	825 Lb (3.67 kN)	5a
Halon 1301	5000 Ft^3 (850 m^3)	141 Lb (627 N)	10 Sec	263 Lb (1.17 kN)	6

(U) A.2.5.9 HYDRAULIC SYSTEM -- The choice of hydraulically-powered actuators/motors in lieu of either electrical or pneumatic equipment included weight, performance, cost, compatibility of design, installation and environment factors in each application. A trade-off study indicated a weight saving of several tons by employing hydraulically-powered -equipment. The studies resulted in selection of the following system features:

- Hydraulic Fluid: MIL-H-83282 was selected due to its ability to be operated at fluid temperatures up to 400°F (204°C); it is a synthesized hydrocarbon fluid that is interchangeable with MIL-H-5606.
- System Pressure: 3000 psi (20.68 kPa) is recommended as the system pressure; it is the most widely used high pressure, and consequently, a great variety of qualified components are marketed from which to choose.
- Optimum Fluid Temperature: A fluid system temperature between 100 to 130°F (54°C) is recommended for stable fluid operation.
- Pump Selection: Variable displacement constant pressure pumps of aircraft type were selected for lightweight and input horsepower economics proportionate to flow rate.
- Reservoir: Pressurized reservoirs (bootstrap type) are substantially lighter and require less stored fluid (fluid weight alone is reduced by 1600 lbs (7117 N) minimum). These reservoirs are sized to deliver the required pump inlet pressure and maintain the entire return system pressurized which avoids external contamination.
- Rigid Tubing: CRES 304 is the selected material; it is readily available in the required diameters, relatively easy to bend and weld, and is appreciably less costly than tubing made from 21Cr-6Ni-9Mg. Welding was selected in preference to the use of fittings in the interest of

minimizing leakage. Welding is also preferred to brazing on the basis of fabrication and inspection considerations.

- Flexible Tubing: Flexible tubing is Teflon-lined to avoid static charges and dirt contamination associated with rubber (which also "sluffs off" particles which can dam servo valves).
- Cleanliness and Filtration: Hydraulic fluid cleanliness must be enforced, fluid must be purchased to Class 1, components must be clean to Class 2 prior to installation, and the entire system must be maintained at Class 3 by adequate on-board filtration.

(U) A.2.5.10 POLLUTION CONTROL -- The pollution control systems are for wastewater and oil. Wastewater includes sewage (human body wastes, blackwater, soil lines) and sanitary (or gray) water, which includes shower, laundry and galley water). The selection of a marine sanitation device includes evaluating the regulations, technical and operational factors, installation, and maintenance, and the cost of the system.

(U) A weight trade-off analysis for the marine sanitation device was made on the basis of a one-day operational period to disclose a weight saving through use of a no-discharge type compared to a flow-through type. A waste oil tank, sized for a 15-day mission provides storage of collected waste oil from machinery and equipment drains for subsequent disposal at a shore facility, thereby conforming to the zero oil discharge regulation.

(U) A.2.6 LIFT SYSTEM

(U) A.2.6.1 AIR MANAGEMENT -- The design criteria applied to the development of the near term SES lift system air management concept were:

- The total nominal cushion flow rate at low sea states, to be 37,500 CFS (1061.88 m^3/s).
- The cushion pressure for a 3KSES point design would be 342 PSF (16.38 kPa).
- Approximately 1/3 equal parts of total air supply to be delivered to the bow seal, cushion and stern seal.
- A system efficiency shall be at least 75 percent. The system efficiency is defined as

$$\frac{(P_c \times Q)/550}{BHP} \times 100$$

where P_c = cushion pressure at rated design

Q = total cushion flow

BHP = prime mover horsepower output

- All machinery should be capable of withstanding the following ship acceleration levels in g's: 6 up, 4 down, 2 forward, 3 aft and 0.5 thwartships.
- The lift system should have a minimum availability factor of 0.9285. Availability is defined as the ratio of mission uptime to total planned mission length.
- There would be no requirement for blast resistance.
- Machinery spaces'would be acoustically treated to meet categories A through H.

- Aircraft structural design practices would be applied to the design of machinery components in a marine environment with the goal of producing high strength-to-weight ratio components with a correspondingly high reliability.
- Mechanical vibration requirements for all ship machinery and equipment would be in accordance with Section .073c of the GSS.

(U) In support of these criteria, thirty-three separate component specifications were developed to govern the lift system design.

(U) A.2.6.2 SEALS SYSTEM

(U) **A.2.6.2.1** Seals Design -- The **seals** design was developed within requirements which include :

- o sealing of the cushion **with** a minimum drag and minimal leakage of cushion air;
- o design for a minor influence upon ship pitching motion in the absence of ride control;
- o in concert with ride control devices, aids in reducing bow and CG accelerations to a level compatible with ride quality requirements; and
- o exhibits lateral compliance while operating in waves other than those dead ahead or astern.

(U) The seals are of modular design with the flexible seal material modules separated by tear inhibiting attachment fittings to reduce seal vulnerability. They are designed to minimize water ingress into the pneumatic bags and to provide for the rapid drainage of water that enters the bag. **Standardization** was emphasized in all portions of the design. Seal system weight was minimized with total design weight less than the following:

	Maximum Acceptable	Target
Bow Seal, lb (N)	33,000 (147,000)	25,000 (111,000)
Stern Seal, lb (N)	32,000 (142,000)	25,000 (111,000)

(U) Attachment fittings were designed to minimize weight, be simple to remove and replace, to minimize structural fatigue of the flexible seal pressure bag material, to resist the effects of the marine environment, and (between hard structure and fabric) to be designed such that rubbing and impacting between the two structures is minimized to reduce wear. Further constraints included requirements that any seal system operational failure mode would not result in an unsafe ship operating condition and that retraction would be provided for off and partial cushion operation.

(U) The result is seal systems that feature ease of maintenance, repair and replacement with simple tooling and procedures in drydock, at dockside, and at sea. Non-elastomeric surfaces were employed on the planing bow and stern seals at the seal water interface to minimize hydrodynamic drag and maximize seal service life. The major seal system components were designed to MTBF characteristics of:

Seal System Component	Minimum Acceptable	Target Service Life
Planing Surface at Seal/Water Interface	400 Operating Hours	100 hours at 80 knots (41.16 m/s)
Bag and Upper Loop Seal Structures	I.000 Operating Hours	2000 Operating Hours

(U) A.2.6.2.2 Seal Materials -- Tear strength of the coated fabric pressure bag material was specified as a minimum of 300 pounds (1,333 N) with a target of 500 pounds (2,220 N), for tear propagation in the fill direction. (Tear strength is considered to be the controlling factor in the selection of the pressure bag material.) Tensile strength of the pressure bag material has a required minimum of 1000 pounds per inch (175,000 N/m) in the warp direction and 800 pounds per inch (140,000 N/m) in the fill direction. The pressure bag material is required to possess good environmental resistance, consistent with the seal system design specifications. The weight of the pressure bag material is minimized, consistent with the other requirements, with a maximum weight of 100 oz sq yd (33.25 N/m^2).

(U) The pressure bag material requirements included surviving 10^6 cycles at 20 percent of ultimate tensile strength in the warp direction (R=0.2); the goai was 10^6 cycles at 30 percent of ultimate tensile strength (R=0.2). Seams in the pressure bag material must meet the requirements for the coated fabric. The seams must also be relatively flexible and stiffness discontinuities in the joint minimized.

(U) Flexural fatigue strength of the glass reinforced plastic (GRP) planer material shall be a minimum of 90,000 psi (6.20 x 108 Pa) in the

(U) longitudinal direction and 85,000 psi (5.85 x 10^8 Pa) in the transverse direction. Target values are 135,000 psi (9.30 x 10^8 Pa) in the longitudinal direction and 105,000 psi (7.25 x 10^8 Pa) in the transverse direction.

(U) Maximum acceptable decrease in flexural fatigue strength of the planer material after aging in hot water shall be 18 percent. The target value is 12 percent. Tensile strength of the planer material shall be a minimum of 70,000 psi (4.83 x 10^8 Pa) in the longitudinal direction and 60,000 psi (4.14 x 10^8 Pa) in the transverse direction. The corresponding target values are 107,000 psi (7.38 x 10^8 Pa) and 90,000 psi (6.20 x 10^8 Pa). Tensile modules of the planer material shall be a minimum of 3.7 x 10^6 psi (2.5 x 10^{10} Pa) in the longitudinal direction and 3.4 x 10^6 psi (2.3 x 10^{10} Pa) in the transverse direction. The corresponding target values are 5.0 x 10^6 psi (3.4 x 10^{10} Pa) and 4.2 x 10^6 psi (2.9 x 10^{10} Pa).

A.2.7 OUTFIT AND FURNISHINGS

(U) 'A.2.7.1 HABITABILITY -- The habitability standards should conform or exceed General Specifications for Ships of the U. S. Navy and OPNAVINST 9330.74 (proposed). Crew accommodations are as follows (based on manning requirements of the TLR):

	"ERTHING BREAKDOWN				
	TLR CREW	TLR GROWTH	TLR RESERVATIONS	TOTAL BERTHS PROVIDED	ACTUAL CREW
Enlisted	85	2	8	95	63
CPO	10	2	1	13	9
Officer	15	0	2	17	12
TOTAL	110	4	11	125	84

(U) A.2.7.2 PASSIVE FIRE PROTECTION -- The design philosophy for treatment of spaces in Group 1 implies prevention of primary aluminum structure from reaching 400° F (204° C) for a period of 15 minutes. This conservative approach in an active system design results in detection and extinguishment of a fire in within 5 minutes maximum.

The Fiberfrax panel system was selected for its superior performance relative to other lightweight systems considered. The methodology used to establish the insulation thickness is described in the following steps:

a. A computerized thermal analysis established the relationship between felt insulation thickness and temperature of the structure under fire conditions.

b. A full-scale JP-5 fuel fire test was conducted and the temperature distribution of the front face sheet of the insulation panels was monitored throughout the test.

(U) c. The temperature/time profile obtained during the tests was used as an input to thermal analysis, and temperature/ time curves were obtained for several insulation thicknesses (see Figure A.2.7.2-1 and A.2.7.2-2).

d. From the curves of Figures A.2.7.2-1 and A.2.7.2-2, plots were made of insulation thickness versus time for the structure to reach 400° F (204° C) (See Figure A-2.7.2-3).

(U) The passive fire protection material for Group 2 spaces was also selected on the basis of smoke and toxic properties in a fire environment. The concern stems from the direct threat to personnel and from restricted visibility along escape routes. The very low smoke and toxic gas emission properties of Fiberfrax made this material attractive for application in Group 2 spaces.

(U) The design approach to treatment of spaces in Group 2 is based on a modification of the fire loading concept described in the Society of Naval Architects and Marine Engineers (SNAME) Aluminum Fire Protection Guidelines. The fire loading of a space is a measure of the quantity of combustibles per unit deck area. It is expressed as pounds of wood per square foot with combustibles other than wood related to wood with a heat capacity of 8000 BTU/lb (1.86 x 10^7 J/kg), The methodology used to establish the amount of protection (insulation thickness) is described in the following steps:

a. Full scale fire tests were conducted with fire loadings of 12.5, 10, 7.5, 5 and 2.5 lbs mass of wood per square foot (61.0, 48.8, 36.6, 24.4 and 12.2 kilograms of wood per square meter).

b. The temperature/time profiles of the front face of the insulation panels during the tests were used as input to the thermal analysis computer program. Figure A.2.7.2-4 shows the temperature/time profiles for the various fire loadings.

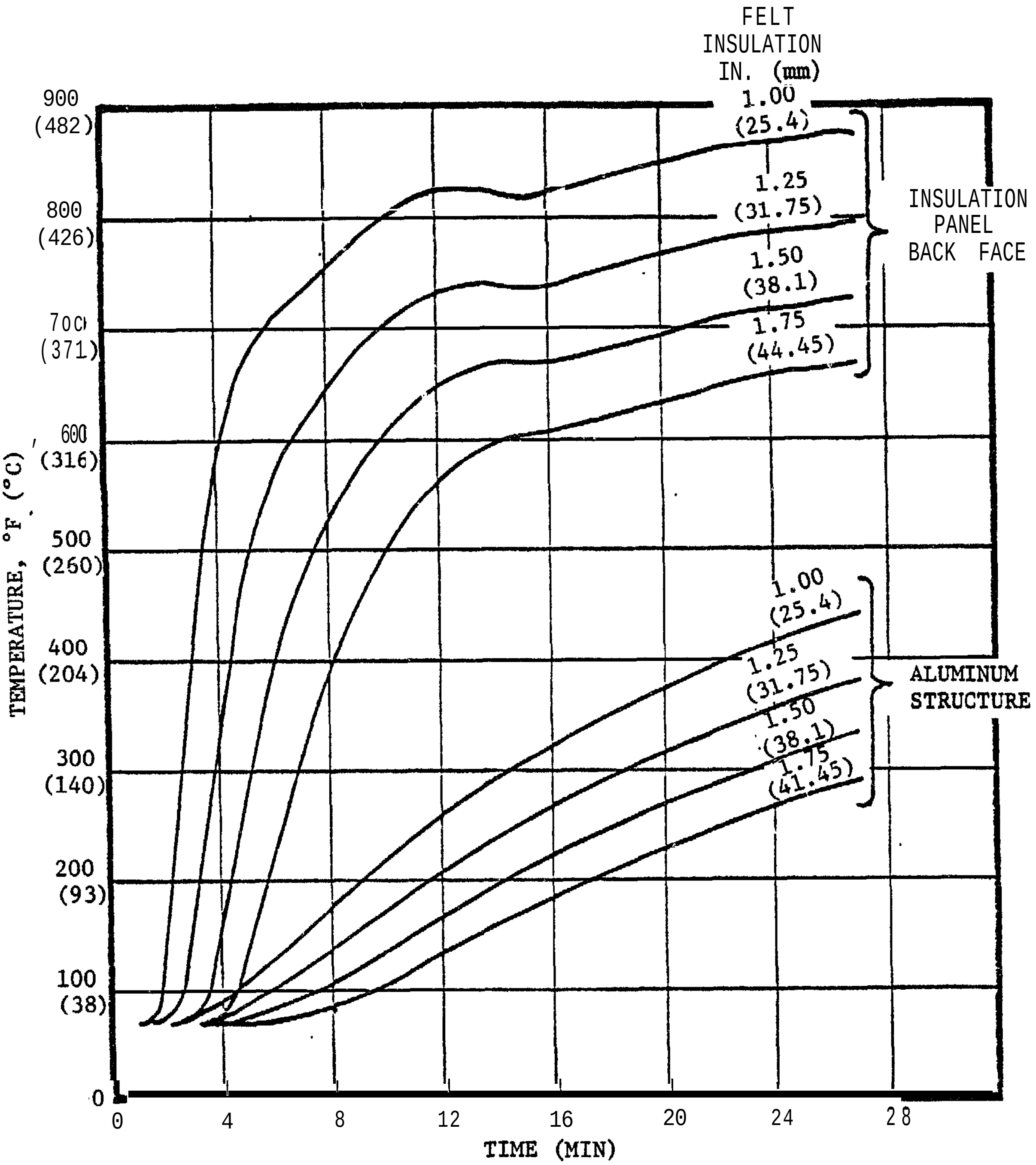


Figure A.2.7.2-1 (U): Temperature/Time Curves of Back Face of Insulation Panel and Aluminum Structure for Various Insulation Thicknesses in a JP-5 Fuel Fire (Structure Not Insulated on Far Side) (U)

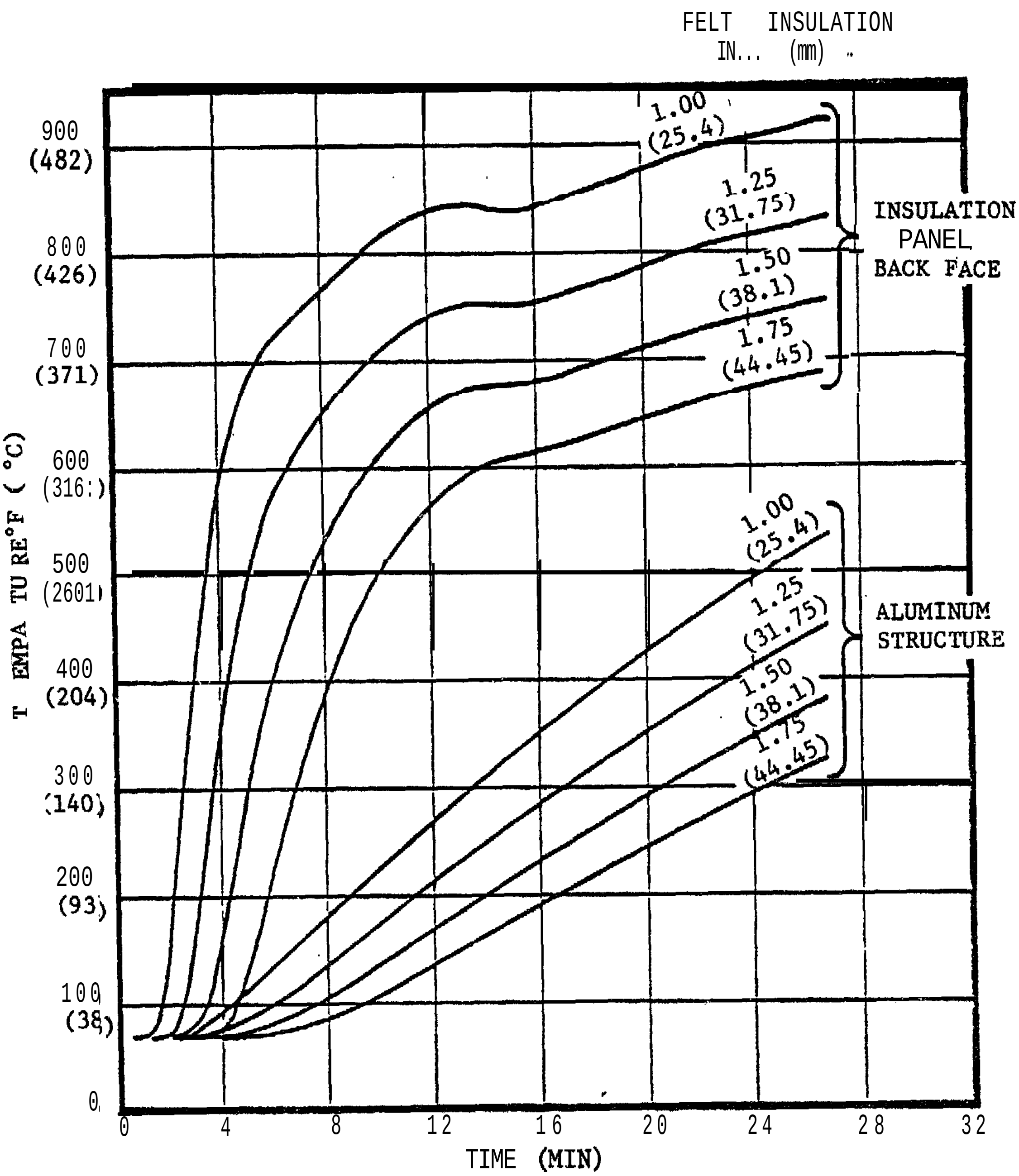


Figure A.2.7.2-2 (U): Temperature/Time Curves of Back Face of Insulation Panel and Aluminum Structure for Various Insulation Thicknesses in a JP-5 Fuel Fire (Structure Insulated on Far Side) (U)

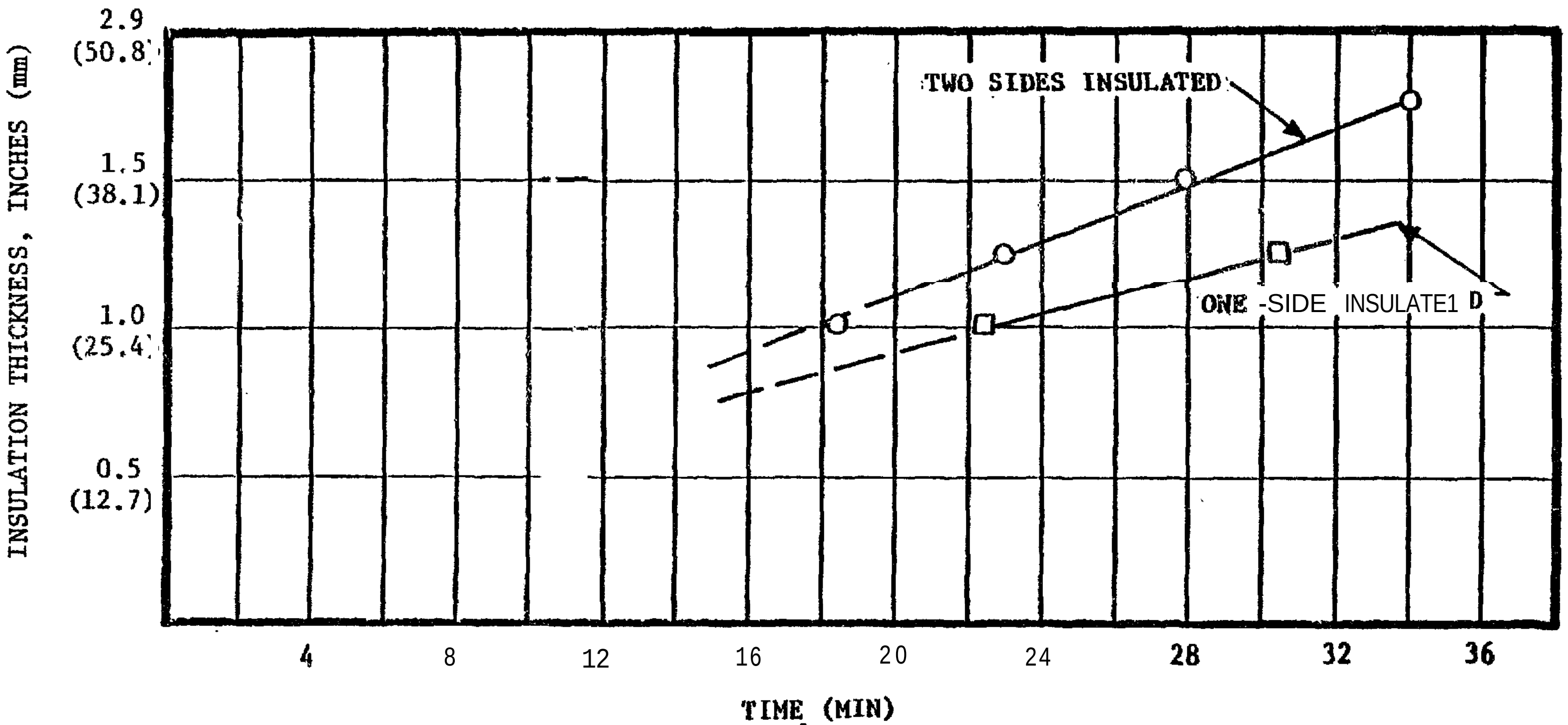


Figure **A.2.7.2-3 (U):** Insulation Thickness Vs Time for Aluminum Structure to Reach 400 Degrees I? in JP-5 Fuel Fire **(U)**

UNCLASSIFIED

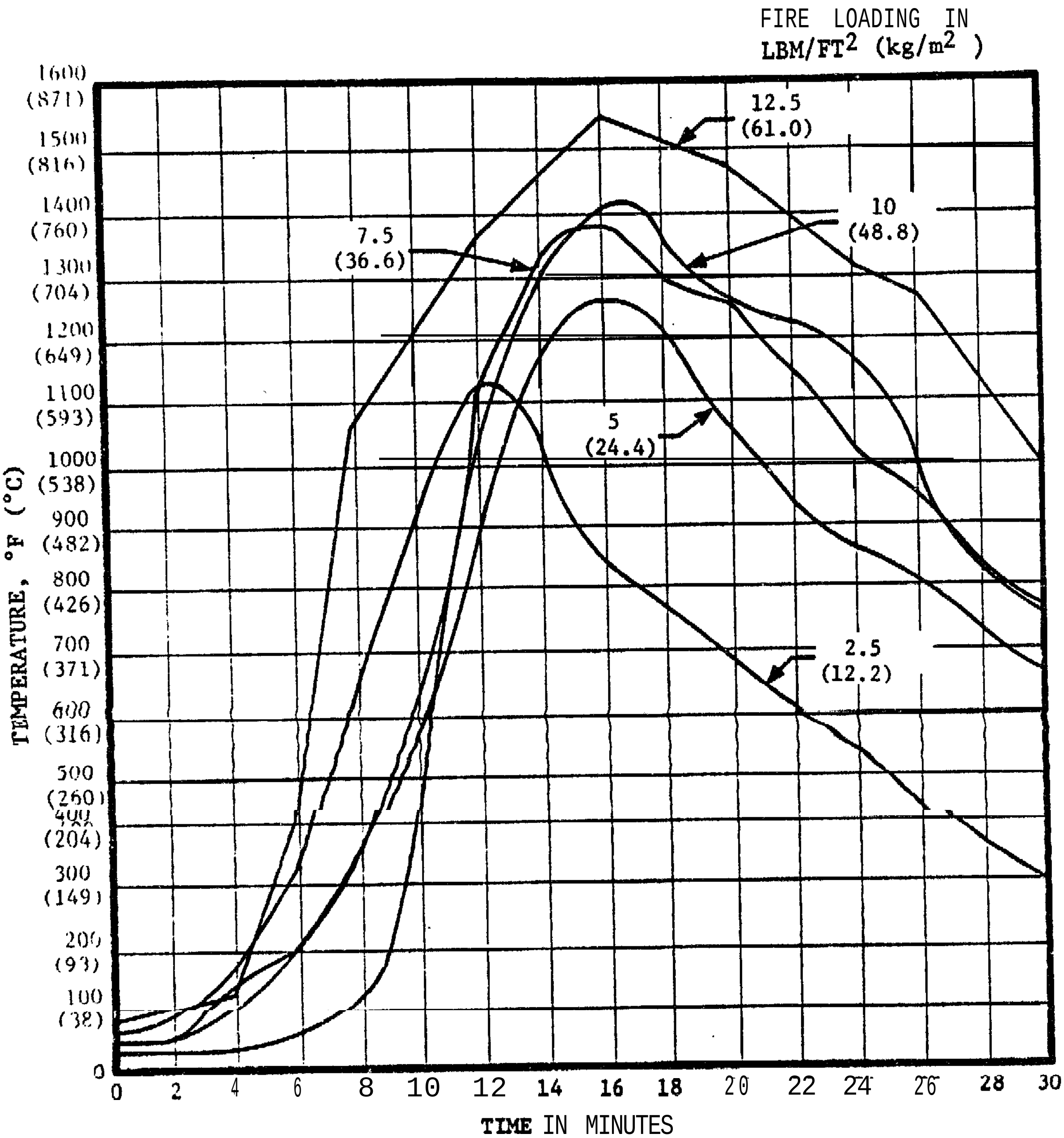


Figure A.2.7.2-4 (U): Temperature/Time Profiles on Front Face of Insulation Panels in Wood Crib Fires with Various Fire Loadings (U)

c. The program output the temperature/time envelope of the aluminum structure for various amounts of insulation thickness. The maximum temperature of the structure with a given insulation thickness for each fire loading is plotted in Figures A.2.7.2-5 and A.2.7.2-6.

d. From the curves of Figures A.2.7.2-5 and A.2.7.2-6, plots were made of insulation thickness versus fire loading for one-side and two-side insulated structures (see Figure A.2.7.2-7).

e. The insulation thickness was selected from these curves. (Panel thicknesses in increments of 0.25 in. (6.35 mm) were selected for practical manufacturing and ready material availability.)

(U) The primary need in protecting magazines is to provide cooling when there is an adjacent fire hazard. Water sprinkling is the most efficient means to cool these spaces. Likewise, glass thermal insulation can be used more efficiently than refractory fibrous insulation in these spaces to prevent heat from entering,

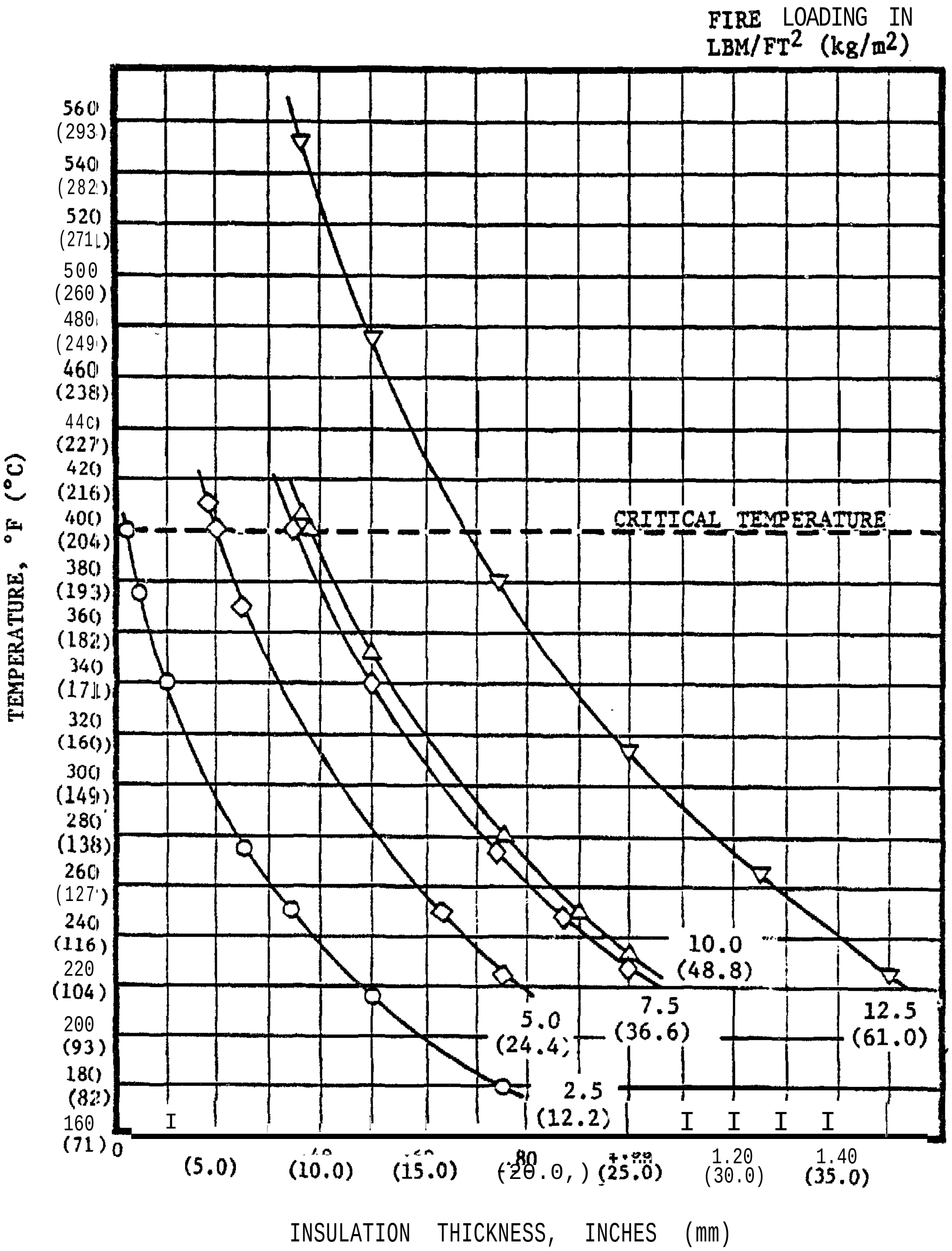


Figure A.2.7.2-5 (U): Maximum Temperature of Aluminum Structure Versus Insulation Thickness for Various Fire Loadings in Solid Combustibles Fires (Structure Insulated on Far Side) (U)

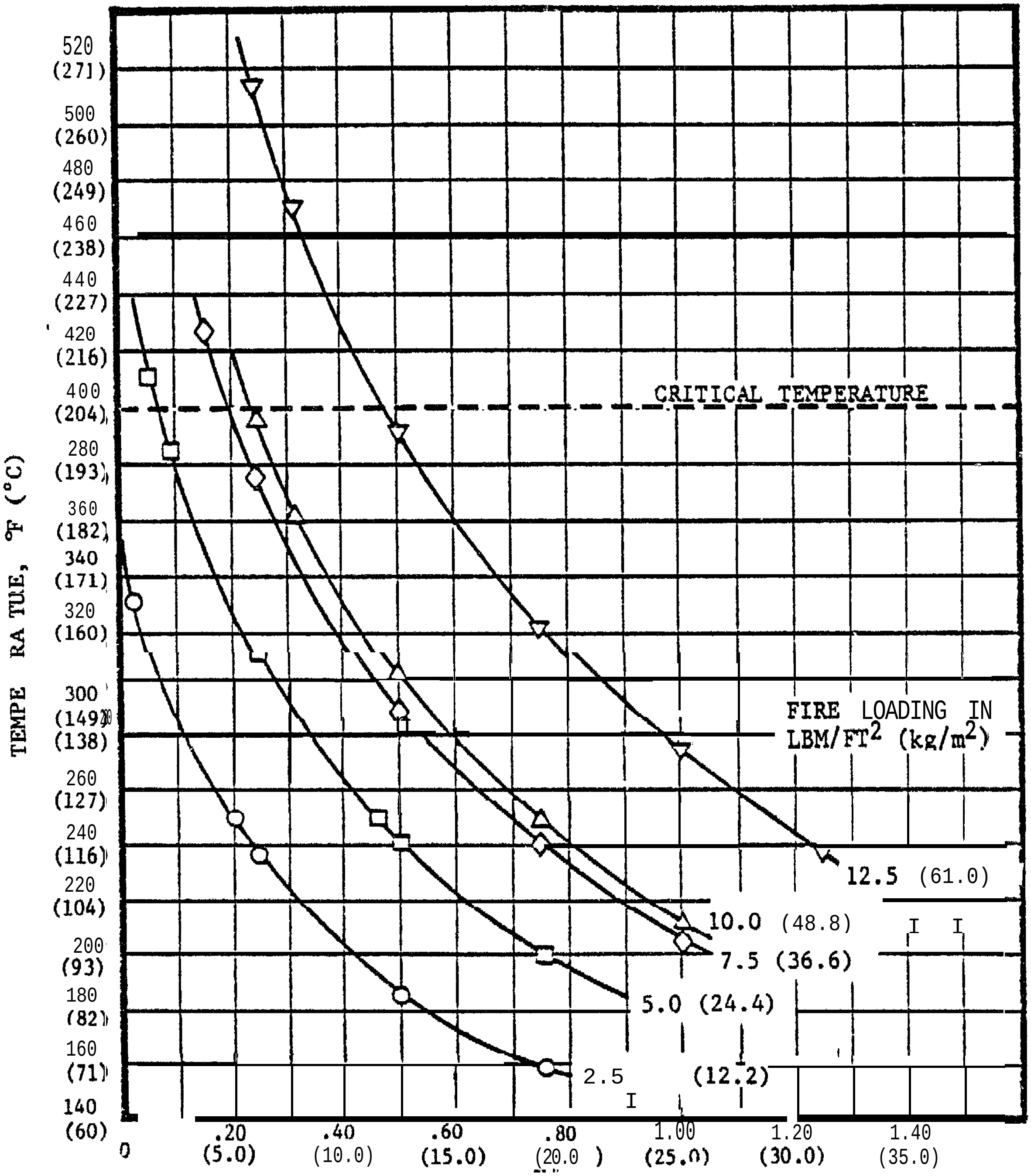


Figure A.2.7.2-6 (U): Maximum Temperature of Aluminum Structure Versus Insulation Thickness for Various Fire Loadings in Solid Combustibles Fires (Structure Not Insulated on Far Side) (U)

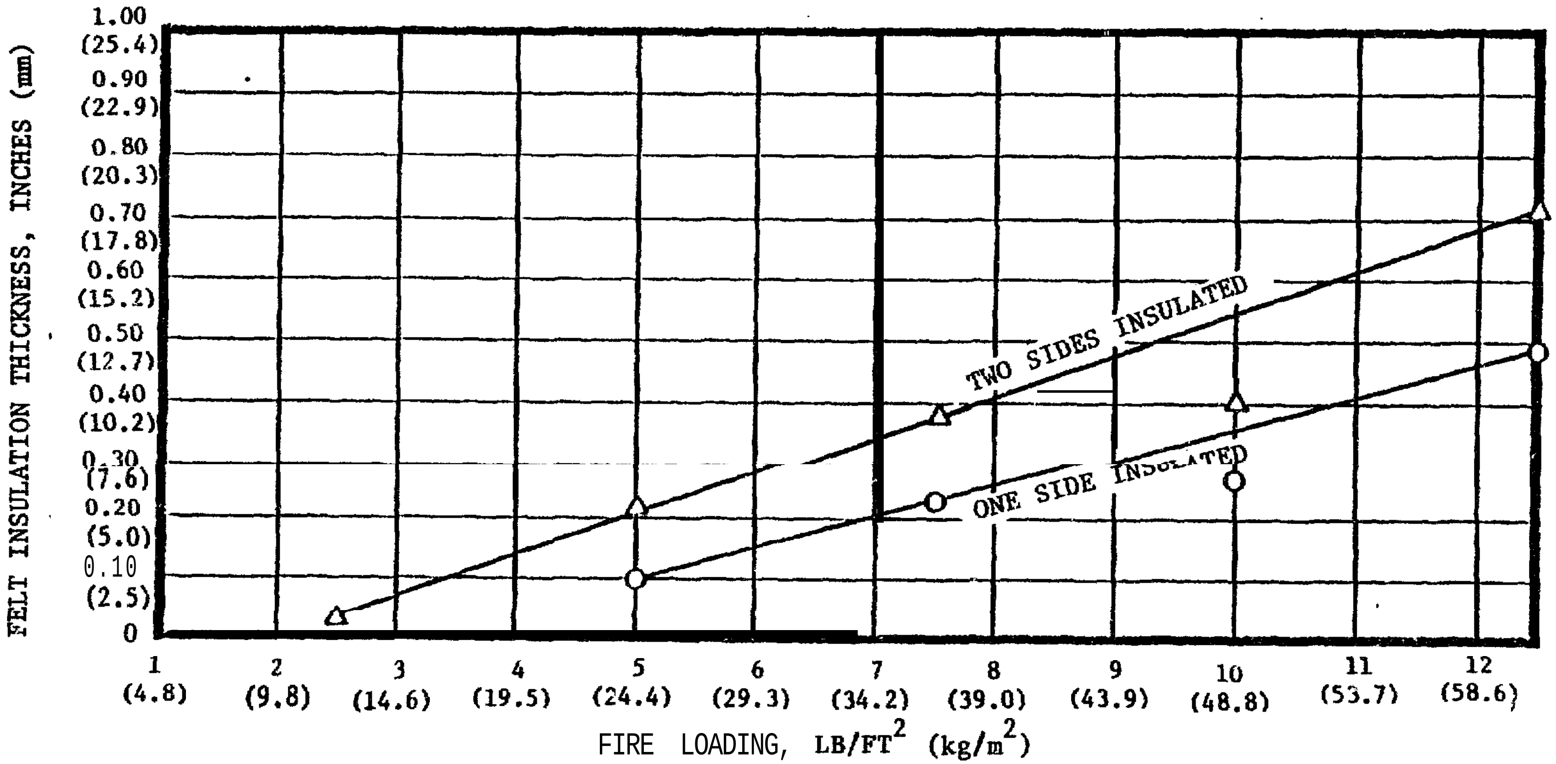


Figure A.2.7.2-7 (U): Felt Insulation Thickness Versus Fire Loading to Prevent Aluminum Structure from Exceeding 400 Degrees F (U)

UNCLASSIFIED

(U) A.2.8 **ARMAMENT** - All topside sensors and armament were required to have as great an unobstructed coverage envelope as practicable. The order of precedence for coverage in descending order for the near term SES is:

- o TACAN
- o EW System AN/SLQ-31 or -32(V2)
- o Air Search Radar (AN/APS-125)
- o Surface Search (AN/SPS-55)
- o Collision Avoidance Radar (CAB)
- o FCS MK92
- o STIR
- o CIWS (MK15/0)

(U) Harpoon launchers are fixed and should be facing forward. Both Harpoon and the vertical launchers for the Standard missile were to be located to result in minimal plume ingestion problems for the main combustion air intakes. Torpedo launchers were to be located to facilitate 0 - 45 deg options for firing MK46 torpedoes and a fixed athwartship axis for MK48 torpedoes (based on NAVORD studies). Appendix B contains diagrams outlining the coverage of the major near term SES weapons and sensors.

(U) The near term SES would only have a reload capability at sea for the MK46 torpedoes used in helicopter related ASW operations. As specified in the 3KSES TLR, no reload-at-sea capabilities would be provided for vertical missiles, MK48 torpedoes, surface launched MK46 torpedoes or Harpoon missiles.

A.2.9 LOADS

(U) The weight allowances for variable load items were derived from Naval Ships Technical Manual dated 1 March 1974, Chapter 9290, Paragraph 173.1, titled "Detailed Description of Conditions of Loading for Surface Ships." Paragraph 173.1(a) covers weight allocations for crew and effects as follows:.

	Pounds (Newtons) Per Man
Officers (commissioned or warrant)	400 (1779)
Chief Petty Officers	330 (1468)
Other Enlisted Personnel	230 (1023)

(U) The 3KSES TLR used as the near term SES requirement specifies a ship personnel complement of 17 officers, 13 chief petty officers and 95 enlisted men. The weight allowances then are:

Personnel	Qty	Weight Lbs.	Weight (kN)
Officers	17	6800	(30.24)
Non-Corns	13	4290	(19.08)
Enlisted	95	21850	(97.19)
TOTAL	125	32940	(146.5)

(U) This 146.5 kN total corresponds to 14.71 long tons (F10).

(U) Paragraphs 173.1(c) and (d) of the referenced Technical Manual cover weight allocations for provisions, personnel stores, and general stores as follows:

Provisions	Pounds (Newtons) Per Man Per Day
Dry	3.20 (14.23)
Freeze	1.11 (4.94)
Chill	1.65 (7.34)
Clothing and Small Stores	0.07 (0.31)
Ship's Store	0.80 (3.56)
General Stores	1.06 (4.72)

(U) The ship provisions, personnel stores, and general stores using those provisioning allowances for a X-day mission follow:

Provisions and Personnel Stores:

6.83	pounds/man/day	30.38 N/man/day
x 15	days	15 days
102.45	pounds/man	455.7 N/man
x 125	men	125 men
12,806	pounds ÷ 2240 =	5.71 long tons (F31)
(56.96 kN)		(56.96 kN)

General Stores

1.06	pounds/man/day	4.72 N/man/day
x 15	days	15 days
15.9	days	70.73 N/man
x 125		125 men
1,988	pounds+2240 =	0.89 long tons (F32)
(8.84 kN)		(8.84 kN)

(U) The 3KSES TLR requires support for two SH-3H helicopters for a 15-day mission at the rate of 45 flight hours per month. The SH-3H has a nominal fuel consumption rate of 215 gallons per hour (0.0027 m^3/hr) and JP-5 weighs 6.8 lbs per gallon (6654 N/m^3). Therefore,

215	gallons/hour	(.0027 m^3/hr)
x 6.8	pounds/gallon	(6654 N/m^3)
1,462	pounds/hour	(1.80 N/hr)
x 45	hours/month	45 hours/month
65,790	pounds/month/helicopter	(292.6 kN)

(U) 65,790 lb. ÷ 2 **(15-day** mission) = 32,895 pounds/helicopter

x 2 helicopters

65,790 pounds

(292.6 **kN)**

65,790 lb.+ 2240 pounds/ton = 29.3 long tons (292.6 **kN)**

helicopter fuel allocation

A.2.10 WEIGHT MARGINS

(U) The near-term ship weight margins were allocated in the same manner as for the 3KSES. The weight margin policy for the 3KSES was outlined in Navy letter PMS304-20 SER 2091; dated 12 June 1975. The weight margins were applied as in the cited letter with the exception of Ml3 (preliminary design and advanced development margin) which was depleted because the appropriate design phase has been completed for the 3KSES. The following Table A.2.10.1 outlines the margins as applied.

TABLE A.2.10-1 (U): Near Term SES Weight Margins (U)

SWBS No.	DESCRIPTION	ALLOCATION
Ml1	Detail design margin	2.5% LS(1)
M12	Building Margin	1.0% LS
Ml3	Preliminary Design and Advanced Development Margin	3.0% LS
M21	Contract design margin	2.0% LS
M22	Contract Mod. margin	1.0% LS
M23	GFM Margin	0.5% LS
M25	Service life Margin	25 LT (249.10 kN)

(1) LS = Light Ship

A.2.11 VEHICLE

(U) A.2.11.1 Payload Weight Breakdown -- The vehicle weight summaries shown in Table A.2.11-1 and A.2.11-2 detail the near term ship as defined in ANVCE WP-002, "Definition of Terms", dated 2 April 1976, Section III. The contract margins are included in the vehicle empty weights. These weight breakdowns support range and payload performance projections in Section 2.2.3.

TABLE A.2.11-1 (U): Vehicle Weight Summary (FT9A-2A) (U)

SYMBOL	TITLE	LONG TONS	SHORT TONS	METRIC TONS	KILO NEWTONS
$W_E{}^1$	Empty Weight Less fixed payload items	1561.0	1748.3	1586.0	15,554
W_C	Ship's Complement and Effects & Stores	21.4	24.0	21.7	213.2
W_P	Payload	177.2	198.4	180.0	1,765
W_F	Liquids	1240.5	1389.3	1260.4	12,360
W	Vehicle Weight	3000.0	3360.0	3048.2	29,892

TABLE A.2.11-2 (U): Vehicle Weight Summary (FT9A-2A) (U)

SYMBOL	TITLE	LONG TONS	SHORT TONS	METRIC TONS	KILO NEWTONS
W_E [1]	Empty Weight less fixed payload items	1599.0	1790.9	1624.7	15,932
W_C	Ship's Complement and effects & storks	21.4	24.0	21.7	213.:2
W_P	Payload	177.2	198.5	180.0	1,765
W_F	Liquids	1202.4	1346.7	1221.7	11,981
W	Vehicle Weight	3000.0	3360.0	3048.2	29,892

(U) A.2.11.2 STABILITY AND RESERVE **BUOYANCY --** The near term SES must **survive,** with margin, the operational hazards of the open ocean, as specified in the criteria of:

- Goldberg, L. L., Tucker, R. G., "Current Status of Stability and Buoyancy Criteria Used by the U. S. Navy for Advanced Marine Vehicles?, Naval Engineers **Journal,** October 1975.
- Sarchin, T. H., Goldberg, L. L., "Stability and Buoyancy Criteria for U. S. Naval Surface Ships", Transactions of the **SNAME**[1], Volume 70, 1962.

(U) The freeboard and internal subdivision of the near term SES must be selected to satisfy the qualification of the criteria for reserve buoyancy and stability in terms of:

- Hullborne intact stability
- Reserve buoyancy under conditions of hull damage
- Damaged stability

(U) Analysis has demonstrated that the near term SES design would meet the Navy criteria established for Large **SES's** as set forth in the cited references for displacements in excess of 3000 tons.

---

[1] Society of Naval Architects and Marine Engines

(U) A.2.12 MANNING

The Rohr selection criteria for crew size and composition, and some of the design alternatives by which the near term SES crew size and composition was developed, are the result of a Rohr-developed methodology that utilized the LSES TLR and the "Guide to the Preparation of Ship Manning" (OPNAV 10P-23), to impact design and trade-off studies.

(U) A.2.12.1 MANNING CRITERIA -- In arriving at the crew size and composition, the following criteria were used:

- o The design of the near term SES supports demonstration of the feasibility of platform performance, including that at high speed, and combat capability.
- o The near term SES was not designed to meet existing Navy standards for wartime use, but incorporates salient features of a combatant ship for evaluation purposes.
- o Required operational capabilities (ROC) as defined in the LSES TLR of 28 May 1976 were employed to identify requirements for manned stations and their location, control equipment, and manned station layouts and support systems. The ROC are projected for performance of military value demonstration and combat system compatibility.
- o The Projected Operational Environment in Fleet Operations was derived from the TLR to delineate specific capabilities which the fully-ready LSES should achieve as goals as follows:

  1) At sea in peace time, Readiness Condition IV and for Battle Readiness, Special Condition I.
  2) A capability to perform anti-air, anti-submarine, and surface warfare on a non-simultaneous basis.
  3) A capability to meet emergency contingencies.
  4) A capability to perform maintenance for which the crew is assigned responsibility.

(U) A.2.12.2 READINESS CONDITION -- Conditions of readiness for the purpose of determining operational, maintenance, administrative and support capabilities required to support the SES are as follows:

- o Special Condition I - Battle Readiness -- These conditions for the near term SES are:

  1) Condition I ASW: Anti-submarine operations
  2) Condition I AAW: Anti-air operations
  3) Condition I SUW: Surface operations

  All required personnel continuously alert. All required operational systems manned and operating. No maintenance expected except that associated with critical and vital equipment repair. Reduced readiness requires changes from the Required Operational Capabilities approved by the Chief of Naval Operations for Special Condition I.

- o Condition IV: Peacetime Cruising Readiness -- Operational systems are normally manned only to the extent necessary for effective ship control, propulsion and security. Accomplishment of all underway maintenance, support and administration functions is expected. Maximum advantage is taken of training opportunities. Expected endurance at Condition IV is 15 days.

- o Condition V: In-Port Readiness -- Systems are manned to the extent necessary for effective operation. Watch stations are assigned as required to provide adequate security. Personnel on board are adequate to meet anticipated in-port emergencies and perform in-port functions as prescribed by unit ROC. Accomplishment of all required maintenance, support and administrative functions is expected. Maximum advantage is taken of training opportunities and (subject to the foregoing requirements), the crew has a maximum opportunity for rest, leave, and liberty.

(U) A.2.12.3 **MANNING ALTERNATIVES** -- The following design alternatives were instrumental in the development of the crew size and composition:

- The near term SES Ship's crew was developed within the implied requirements of the combat system concept for a weaponized test ship, rather than for a lead ship of its class.

- The administrative office requirements were combined into two adjoining offices to provide adequate working areas rather than individual office spaces per man. The combined offices are:

  1) Operations Office, Weapons Office, Engineering Office -- The combination of these offices into the department office provides working space for the department heads, ship's 3-M coordinator, and engineering personnel.
  2) Data Bank/Technical Library - Within the data bank there are work areas for research and equipment, for making copies of stored data and for conference purposes.

  This central administrative complex is interconnected by arches providing access to each function performed. The design is economical in terms of equipment, furniture, space, and manpower utilization, and results in weight reduction.

- The central (rather than remote) control concept has resulted in more efficient utilization of manpower. Ship automation features include full control of ship's steering, propulsion, auxiliaries and damage control from the pilot-house and Central Operating Station (COS). The minimum required watch positions for the SES are:

  1) OOD/Ship Control Officer
  2) JOOD/Asst. Ship Control Officer
  3) Lookout/Signalman
  4) Propulsion Control Console Operator
  5) Damage Control/Auxiliary Console Operator

(U) A.2.12.4 OPERATIONAL MANNING **REQUIREMENTS** -- Operational manning is the sum of quantitative and qualitative naval manpower needs to man essential operating stations during a specified condition of readiness. The operational manning requirement for a condition of readiness is expressed in terms of the related condition watch organization. The minimum essential **operational stations** developed for the near term SES are:

- Special Readiness Condition I, manned on a one-section basis, requires 79 operational stations.
- Readiness Condition IV, manned on a three-section basis, requires 5 operational stations (15 personnel). The minimum number of personnel required for Readiness Condition IV is 54 (duty **and watch).**
- Readiness Condition V, manned on a one-in-three watch rotation within each of six duty section basis, requires two operational stations (36 personnel).
- Flight quarters, manned on a one-section basis, requires 37 operational stations.

(U) A.2.12.5 ORGANIZATIONAL MANNING -- The organizational manning requirements developed for the near term SES are:

	Officers	CPO's	Other Enlisted	Total
Crew	08			
Helo Det.	04	01 / 08	14 / 50	19 / 66
TOTAL	12	09	64	85

(U) A.2.13 PERFORMANCE

The proposed 3000 LT (29,892 kN) near term SES includes all of the fuel (for both ship and helicopters), sensors and weapons specified in the 28 May 1976 3RSES TLR. The basis upon which the near term SES design performance was developed compared with 3RSES TLR requirements is:

Design Parameter	3KSES TLR LT (kN)	ANVCE Near Term SES LT (kN)
Full Load Displacement (LT; kN) Mean Operating Displacement (LT; kN)	3000 (29,892) 1920[1] (19,131)	3000 (29,892) 2400[2] (23,914
Wind Speeds	Pierson Moskowitz Sea Spectra (no attitude gradient)	
Tail Pipe (Trapped Fuel) Allowance (LT; kN)	46 (458)	64.6 (644)
Marine Fouling Allowances	1 mil Surface Finish	
Ambient Temperatures - air water	80°F (26.67°C) 59°F (15°C)	

(1) Mean Operating Displacement at 10% fuel load (LM2500 propulsion)
(2) Mean Operating Displacement at 50% fuel load (LM2500 propulsion)

(U) Detailed comparisons between performance of the 3KSES design and the 28 May 1976 TLR requirements regarding speed, hump margin, acceleration and deceleration, turning, range, and operational Sea State performance are outlined in the following sections:

(U) A.2.13.1 SPEED -- The predicted speed capability and requirements are shown in Table A.2.13-1. All speed requirements at a full load displacement of 3000 LT are met, including the requirement of 30 knots (15.4 m/s) with a significant wave height of 15 ft (4.57 m), FT9A-2A engines at maximum continuous power (MCP), and for headings up to 60 deg or more from a head seas condition. Off-cushion, the SES provides operational speed capability approaching the goals.

(U) A.2.13.2 HUMP THRUST MARGIN -- Comparison between the predicted and required hump thrust margins for the 3KSES are shown in Table A.2.13-2. The near term SES betters the deceleration goals specified with either the LM 2500 or FT9A-2A configuration. The acceleration goal is met with the LM 2500 configuration; however, the FT9A-2A configuration requires almost twice the acceleration goal time interval.

(U) A.2.13-4 TURNING -- The TLR specified that the 3KSES must meet the following:

- o On and off-cushion, ahead and astern, control of heading for docking, undocking and low speed maneuvering in a seaway.
- o Maximum Tactical Diameter of 4500 Et (1.37 km) at speeds below hump speed.
- o Maximum Tactical Diameter of 15,000 ft (4.57 km) when entering a turn at maximum speed. (The SES is not required to maintain constant speed in turns above hump speed).

Table 2.3.13-l (C) Maximum Speed Performance (U)

Operation	Configuration	Significant Wave Height Ft.(m)	Requirement Knots (m/s)		Predicted Capability Knots (m/s)
			Coal	Min.	
Ahead On-Cushion	Mean Operating Displacement LM2500 at MCP	0 3.3 (1.0) 15.0 (4.57)	100 (51.4) 80 (41.2) 40 (20.6)	-- 70 (36.0) 30 (15.4)	76 (39.1) 70 (36.0) 31 (15.9)
	Full Load Displacement FT9 at MCP	0 3.3 (1.0) 15.0 (4.57)'	100 (51.4) 80 (41.2) 40 (20.6)	-- 70 (36.0) 30 (15.4)	81 (41.7) 73 (37.6) 30 (15.4)
Ahead Off-Cushion	Full Load Displacement Engine at MCP	0	15 (7.7)	--	14 (7.2) LM2500 15 (7.7) FT9
		15.0 (4.57)	10 (5.1)	--	9 (4.6) LM2500 9 (4.6) FT9
Astern Off-Cushion	Full Load Displacement Engines at MCP	0	10 (5.1)	--	5 (2.6) LM2500 5 (2.6) FT9
		10.0 (3.05)	5 (2.6)	--	4 (2.0) LM2500 4 (2.0) FT9

CONFIDENTIAL

Table A.2.13-2 (C). Hump Thrust Margln (U)

Operation	Configuration	Significant Wave Height Ft. (m)	Requirement-%		Predicted Capability %
			Goal	Min.	
Ahead On-Cushion	Mean Operating Displacement LM2500 at MIP (1920 LT; 19,131 kN)	3.3 (1.0)	15	10	86
	Full Load Displacement FT9 at MIP (3000 LT; 29,892 kN)	3.3 (1.0)	30	20	21

[redacted]

Table A.2.13-3 (C). Acceleration/Deceleration (U)

Operation	Configuration	Sea State	Requirement		Predicted Capability	
			Goal	Min.	LM2500	FT9
Ahead On-Cushion Acceleration to Full Speed	Full Load Displacement	0	180 Sec.	-	92* Sec.	330 Sec.
Ahead On-Cushion Deceleration from Full Speed	Full Load Displacement	0	3000 Ft. (914.4 m)	-	735 Ft. (224.0 m)	2955 Ft. (900.7 m)

*This value is seemingly low only because the LM2500 configuration is limited to sub-hump operations at FLD.

CONFIDENTIAL

(U) Figure A.2.13-1 depicts several turns attainable with the FT9A-2A configured near term SES at full load displacement. The figure shows that the SES can better the TLR's on- and off-cushion turn requirements.

(U) A.2.13.5 RANGE -- The predicted range performance characteristics are compared with the TLR range requirements. The range capability of both the LM2500 and the FT9A-2A configuration is computed on the basis of an average speed greater than 63 knot8 (31 m/s); the LM2500 configuration nearly attains its goal, bettering the requirement by more than 15 percent. The FT9A-2A configuration better8 the requirement by about 10 percent. Range performance is shown in Table A.2.13-4.

(U) A.2.13.6 MAXIMUM OPERATIONAL SEA STATE -- The relationships between ship operating mode and the operational envelope are shown in Figure8 A.2.13-2 and A.2.13-3. These figure8 define the operating envelope8 in term8 of the operating mode, speed and sea state. Figure A.2.13-2 define8 operating envelopes which are based on the Navy's Top Level Requirement8 (TLR) of 28 May 1976 while Figure A.2.13-3 defines the envelopes which are TLR goals. The on-cushion envelopes define the operation with respect to the propuision system gas turbine engine. The baseline engine is the LM2500 and the alternate is the FT9A-2A.

U KTS,	(m/s)	DECEL TIME, SEC	TURN TIME, SEC	ACCEL TIME, SEC	TACTICAL DIAMETER FEET	(m)
30	(15.4)	30	139	255	4500	(1371.6)
45	(23.1)	21	245	202	11900	(3627.1)
55	(28.3)	18	245	150	14500	(9419.6)

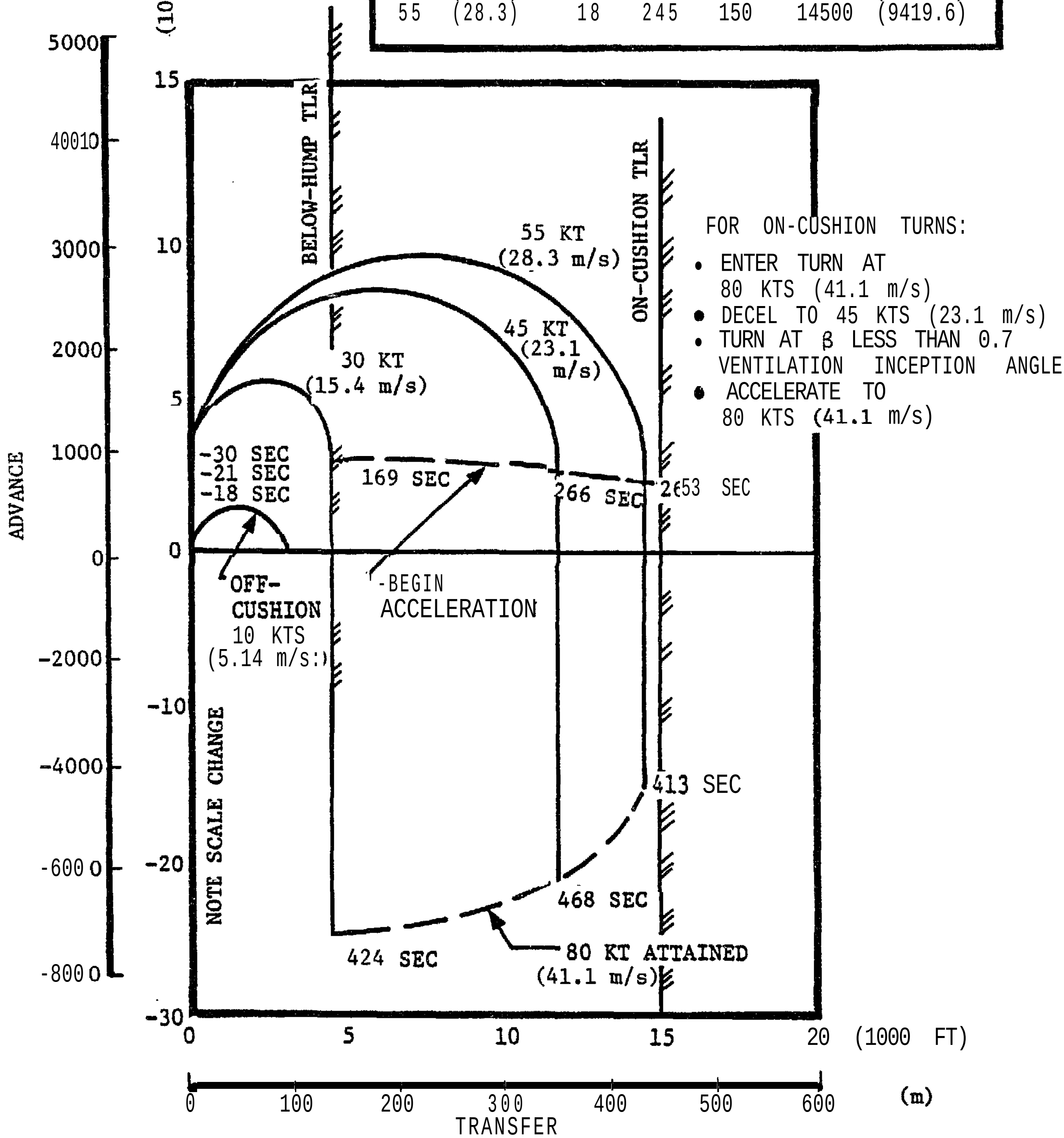


Figure A.2.13-1 (U): 3KSES Turhing Capability (U)

Table A.2.13-4 (C). Range (U)

Operation	Configuration	Significant Wave Height Ft. (m)	Requirement NM (km) Goal	Requirement NM (km) Min.	Predicted Capability NM (Km)
Ahead On-Cushion	Full Load Displacement LM2500 Average Speed , 60 Kts (31 m/s)	3.3 (1.0) (No Wind)	3000 (5556)	2500 (4630)	2960 (5482)
	Full Load Displacement FT 9 - Speed 60 Kts (31 m/s)	3.3 (1.0) (No Wind)	3500 (6482)	3000 (5556)	3295 (6102)

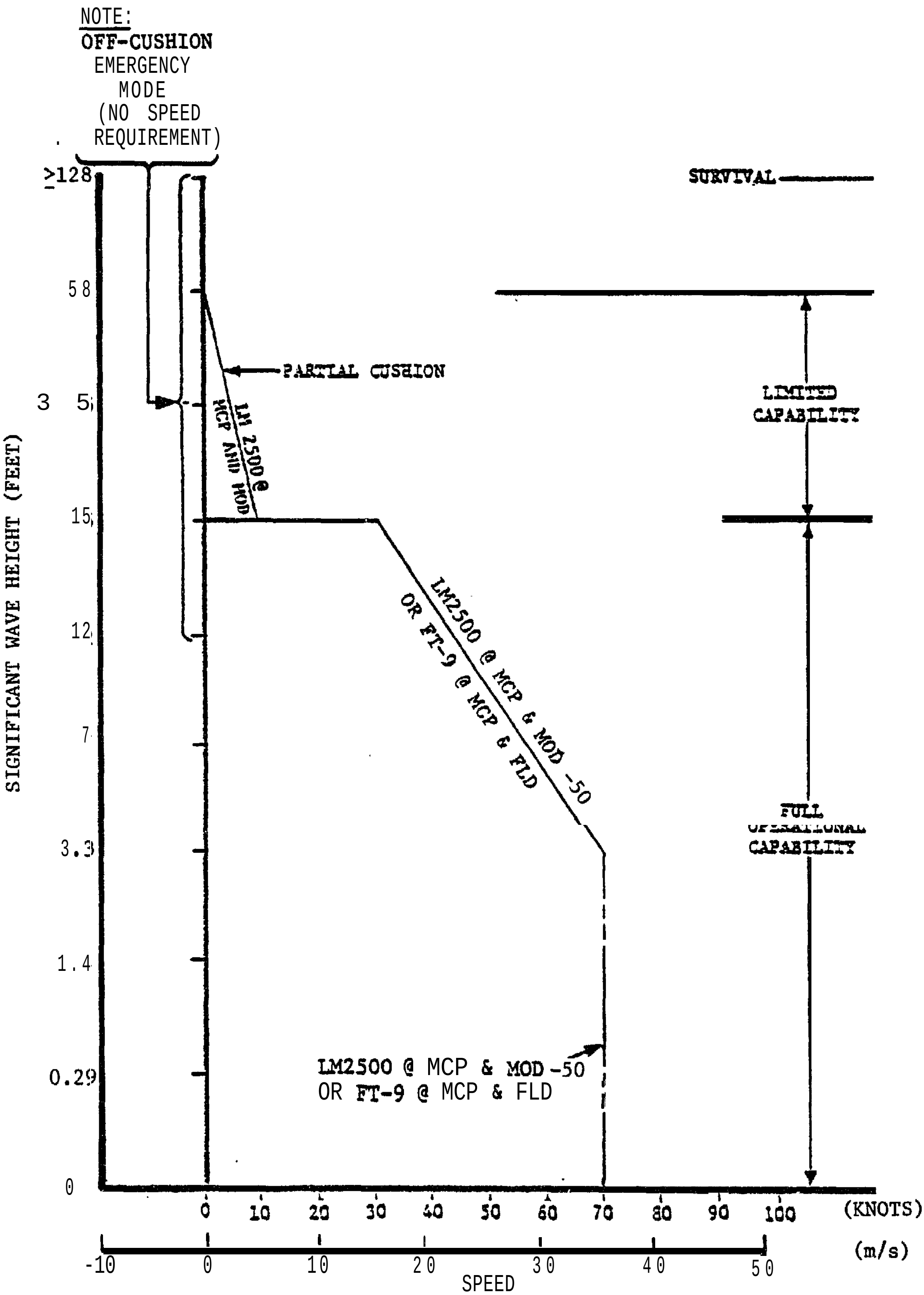


Figure A.2.13-2 (C): 3KSES Operational Envelope - Requirements (U)

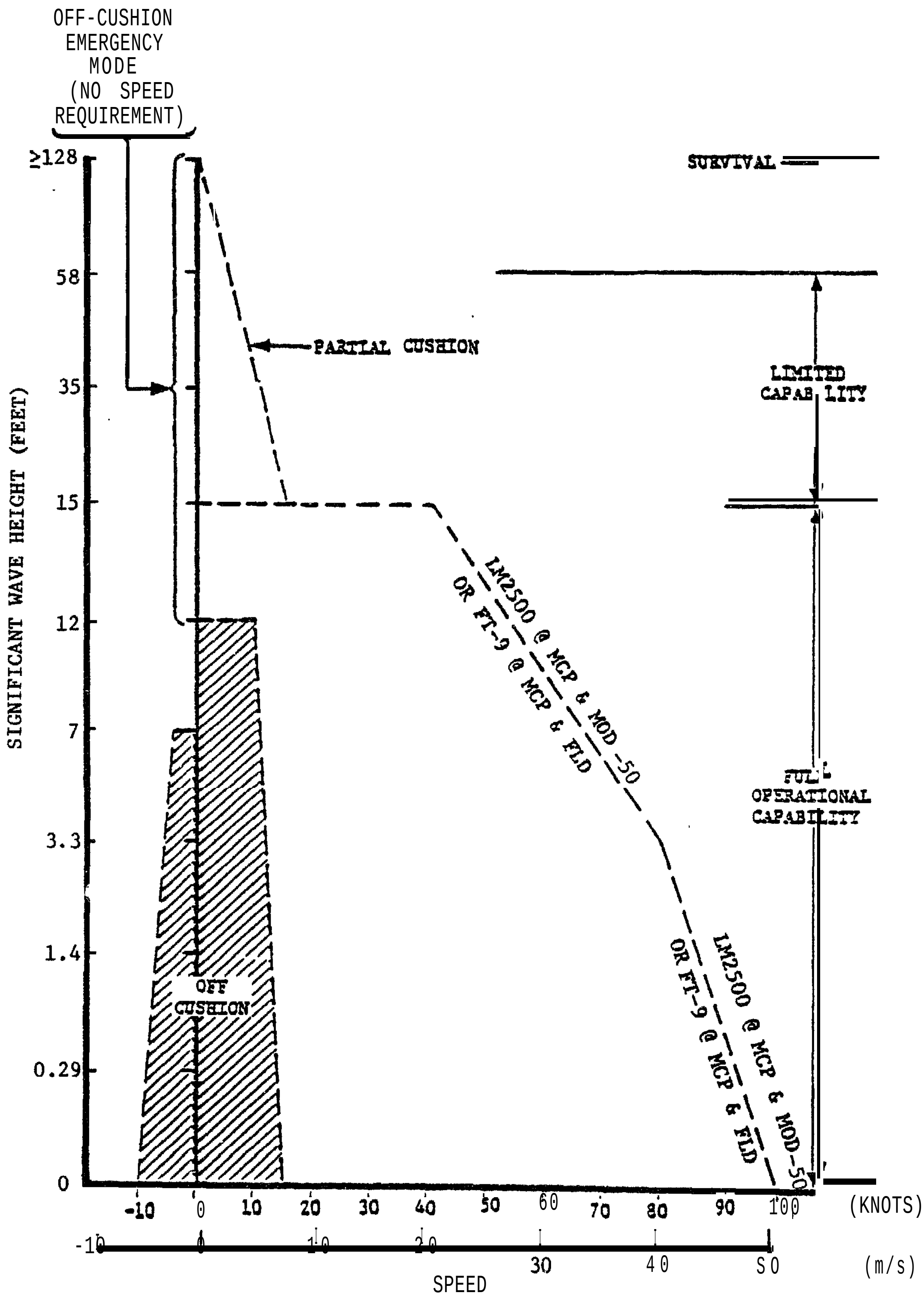


Figure A.2.13-3 (C): 3KSES Operational Envelope - Goals (U)

[redacted]

A.3 DESIGN PHILOSPHY

(U) The overriding philosophy of the near term point design SES design for the capability of demonstrating that the SES concept can fulfill a role as an operational fleet unit. Every design decision has supported this philosophy. The result is a balanced design in which no single feature is dominant. All subsystems and their components were accorded careful development and engineered to meet the specified Top Level Requirements (TLR).

(U) The ANVCE near term SES is a cost effective design, inhabited and operated by sailors, which provides superior performance, seaworthiness, and survivability in high sea states. The design philosophy is manifest in the ship's performance and subsystems design.

(U) The SES meets or betters Top Level Requirements for speed, range, and hump margin in all sea states at a full load displacement of 3,000 LT (29,892.1 kN). The available range margin can be traded off against producibility, weight or increased payload. It betters all requirements for turns, Translation and rotation maneuvers are easily made at zero and low forward speeds for docking, harbor operations, and certain tactical situations. It comes to a full stop from maximum speed in 1000 yards (914.4 m).

(U) The ride quality is much better than required for crew comfort and performance of precision tasks. The superior ride quality is maintained over the entire operational envelope and has been proven at sea. A destroyer (DD-963) cruising at 10 knots, sea state 5, meets the established 4 hour limits. The near term point design SES operating at 60 knots, sea state 5, easily meets and can exceed the same 4 hour ride criteria.

(U) The design is inherently stable. It is safely operable well beyond tha limits of the operational requirements. It is functional in sea state 6.

(U) It is designed to survive hurricane conditions. Extensive digital computer simulation and 3,800 hours of tow tank testing confirmed the design as stable and safe.

(U) It is a habitable and highly maintainable ship due to careful attention given to functional space arrangements and by designing the ship with 9 foot (2.74 m) deck heights to assure adequate head room in all spaces where activity is required. Duty stations and living spaces are located away from noise and vibration producing machinery. All living spaces and messing areas are located for best ride quality and with least noise.

(U) The lift and ride control system is unique and effective. It is a proven system. The ride control system (RCS) attenuates vertical motions to levels within ride criteria limits.

(U) It utilizes an advanced planing seal concept which easily meets the trans-oceanic requirements of long life and high reliability. The seals are a marked advance in the state-of-the-art.

(U) The propulsion system is designed for operational use. It is a simple, proven system sized for growth. It is a symmetrical system port and starboard that is easily aligned and maintained,

(U) The near term point design SES incorporates an integrated ship control system which enables five (5) men to operate the ship in complete safety. It is designed for centralized operation, operational simplicity, full exploitation of the SES potential, and fail safe operation. Reliability and safety are fully integrated into the design.

(U) A.4 TRADE-OFF STUDIES

Many design variations were considered during the development of the near term SES point design. These required various trade-off studies in the general areas of ship configuration, subsystems, and performance.

(U) A.4.1 CONFIGURATION TRADE-OFFS -- The near term SES is a full langth sidehull ship with an effective length-to-beam (L/B) ratio of 2.60. The choice of full length sidehulls over partial length sidehulls was the result of trade studies that included consideration of parameters such as drag, static and dynamics stability, sea worthiness, seal design, maneuverability and structural weight fraction.

(U) The selected seals design resulted from trade-offs that considered the application of a two-dimensional, planing type seal, or a bag-and-finger type seal. Factors evaluated in the definition of the seal baseline included design simplicity, durability, response characteristics, high speed drag, performance and off-cushion drag penalties.

(U) Lateral directional stability at high yaw angles is provided by fixed ventral fins. The specification of these devices and their related fences are the results of trade-off studies considering various geometries and evaluating their drag, waterjet inlet broaching, and maneuvering performance.

(U) The configuration also includes semi-flush waterjet inlets and related ventilation cutouts. T' 3 location and geometry of the inlets and ventilation cutouts are the result of trade studies involving drag, weight, propulsion efficiency, and machinery location considerations.

(U) A number of trade-offs were made to determine the impacts of variation in bulkhead spacing, frame and stiffner spacing and number c decks within the hull. The considerations were optimization of the structural weight fraction while providing sufficient enclosed volume to accommodate the required ship company, machinery fuel, and specified military payload.

(U) A.4.2 KEY SUBSYSTEMS TRADEOFFS

(U) A.4.2.1 Main Propulsion System -- Trade-offs for the propulsion machinery subsystem emphasized criteria which resulted in a design that provides optimum performance, low development risk, minimum complexity, high reliability,, maximum protection from environmental elements, good habitability and replacement of most major components without drydock of the ship. The primary tradeoff was between waterjet propulsors and partially submerged, supercavitating propellers, Waterjets were chosen because the produce much lower noise and vibration levels, are less susceptible to damage by floating debris, have less complex transmission systems, can be maintained without drydock (except for some elements of the waterjet inlet), and can be acquired at lower cost and with less developmental risk.

(U) The propulsion system utilizes four LM2500 gas turbines identical to those in service on the DD963 ships, The LM2500 engine has low fuel consumption, adequate power, long life and high reliability. However, all components of the propulsion subsystem are sized to accommodate the higher rated FT9A engines, with but minor modifications.

(U) Other major tradeoffs were in the propulsion machinery arrangement, combustion air system, and waterjet inlet. All propulsion components, except the waterjet inlet, are located above the wet deck to obtain good maintainability and minimize complexity. Use of seemingly available space in the sidehulls resulted in poor installations with disadvantages outweighing the marginal advantages in performance, Similarly, the combustion air system was generously sized to minimize engine power losses and maximize accessability, salt removal, and noise suppression.

(U) The selected waterjet inlet is a flush, variable roof arrangement that provides superior cavitation and recovery performance, simplicity and low drag.

(U) A.4.2.2 Lift System -- An intensive parametric tradeoff study of both axial, mixed flow and centrifugal fans resulted in the selection of dual inlet, single discharge, constant velocity volute, centrifugal fans because of their low weight, compact geometry, and favorable performance properties. A further tradeoff resulted in consideration and rejection of two circulation control designs when compared to the fan concept. Circulation control was found relatively complex and not as advanced as the technology for fans; a proven 1/4 scale fan model was in operational use. The selection of the lift prime mover was based upon the fan power requirements which matched the proven LM2500 with no other GT available in the power range for comparison.

(U) Trade-offs of various fan locations and their attendant shafting and ducting complexity were performed. The result was a design featuring simple inline shafting, minimum ducting length and minimum use of duct elbows. The inline shafting employs proven marine helical gear sets (single reduction) over more complex planetary gears.

(U) Ducting trade-offs are closely related to those for the power transmission, With fan locations and air delivery points established, further trade-offs determined the minimum weight ducting configuration, with no common plenum or duct plenum, no duct air spliting, and use of round ducts. The fair-weather intake design resulted from trade-off studies concerning free stream pressure recovery, noise control, fabrication techniques, base drag, weight, and water ingestion.

(U) The location of the ride control ducting and valving was determined through trade-offs involving ship's available space, thrust augmentation, and weight impact.

(U) Major trade-offs for the seals were in seal geometry, modularization, and selection of detail hardware and materials. The seals geometry trade-offs compared planing seals with bag-and-finger seals. The planing seal geometries included both two- and three-dimensional (curved bow planform) seals in concert with the square bow/full length sidehull tradeoff.

(U) The planing seal was selected for its demonstrated lower drag forces, improved wear resistance and the durability of glass reinforced plastic planar elements. The two-dimensional plan g bow seal was selected along with the square bow/full length sidehull b..cause together they offered a more simplified seal design, modulariza ion of components, and improved seal maintainability and reliability.

(U) Modularization trade-offs were performed to optimize seal maintenance, to minimize loads and, to assure high performance in a seaway. Components included were number and type of restraints (straps and cables) and quantity of planers and bag modules,

(U) Significant hardware and seal mater trade-offs included comparisons of (1) straps and cables, (2) mater s for planers, pressure bags, restraints, attachments, and modular oints and (3) planer-to-strap transition attachments. Key criteria in these trade-offs were weight, reliability, maintainability, ease of fabrication, and methods of design verification.

(U) A.4.2.3 Trade-offs optimized the electrical power generation and conversion subsystem design. The weight was reduced by almost 50% by increasing the use of 400 Hz power. The power requirements were adjusted through judicious selection of user equipment so that 400 Hz and 60Hz power consumptions were equal. The weight savings resulted from the extensive use of 400 Hz generators and motors, which weigh less than one-eighth as much as their 60 Hz counterparts.

(U) Direct generation of 400 Hz power by generators powered by aircraft-derivative turbines (in lieu of 60 to 400 Hz converters) was a principal factor in this accomplishment. While impressive weight savings at reasonable dollar cost were made, further conversion to 400 Hz usage would result in sharply increased costs, owing to the need for special equipment development.

(U) Auxiliaries -- Weight trade-offs were made of 12 air conditioning systems and equipment items as a result of this study. A decentralized system was selected. This system divides the load into smaller serviced areas, each using packaged air conditioning units.

(U) Single centralized and multiple dedicated lube systems were analyzed on the basis of weight, cross contamination, cooling requirements, length of lines, bulkhead penetrations, reliability, and redundancy. A multiple dedicated system was selected.

(U) The trade-offs for the potable and fresh water systems involved investigation of components and configurations possessing potential weight savings. Vacuum-assisted water closets and low water demand showers were selected. Weight was reduced through reduced quantities of collected and stored water via the drainage system and the reduced pumping capacity requirement. Further weight reduction was obtained by selecting GRP piping.

(U) A trade-off study was made to provide the design criteria and rationale for the most advantageous total flooding extinguishing agent. CO^2 and Halon 1301 extinguishing systems were compared, and a Halon 1301 system was preferred over a CO_2 system for its lower weight and shorter discharge time.

(U) Hydraulically-powered actuators, motors, and pumps were compared to electrical and pneumatic equipment on the basis of weight, cost, compatibility installation requirements and operating environment. Trade-off comparisons indicated a weight saving of several tons by employing hydraulically-powered equipment. In some instances, the electric motor-driven actuators appeared so bulky and cumbersome as to be essentially impractical. In the case of high-per-

(U) formance servo-driven devices such as the ride control valves, low inertia servo-motors with power ratings not readily obtainable would be required.

(U) Weight trade-offs for marine sanitation on the basis of a one-day operational period disclosed weight savings by utilizing a no-discharge type compared to a flow-through type.

(U) A.4.2.5 Outfittings and Furnishings -- Trade-offs were made for the insulation and protection (fire, thermal and acoustical) of the aluminum structure. A rigid panel placed outside the frames was compared to a flexible blanket placed against the structure. The rigid panel design was selected because of:

- Ease of installation
- Reusability of panels after removal for inspection of structure
- Ease of modular panel replacement
- Elimination of separate sheathing and false ceilings
- Resistance to deterioration during normal shipboard use
- Efficient thermal protection of structure through utilization of an air gap between the panel and structure and a reflective surface facing the fire threat and
- Elimination of insulating against fire for the cabling and piping systems.

(U) Contrariwise, the advantages of flexible blanket design are lower cost, slightly lower weight, increased space, and elimination of the hazard of fire penetration behind the insulation panel. However, the development of an effective and practical seal for panel joints to prevent fire penetration offset the advantages of flexible blanket design.

(U) The large amount of insulated and sheathed cabling and piping external to the flexible blanket design, coupled with the relatively close frame spacing of 3 feet, further minimized the increased space advantage of the flexible blanket design and imposed a weight and cost disadvantage.

(U) A.4.3 PERFORMANCE TRADEOFFS -- Maximum performance of the selected design configuration was optimized with respect to:

1) Speed (at minimum drag) with maximum continuous power.

2) Thrust margin at hump speed with maximum intermittent power.

3) Range.

(U) Optimization of each of these performance factors involved selecting a best operating policy (i.e., the determination of operating trim and draft), lift system airflow settings, and seal adjustments within the adjustment latitude and constraints of the design. While this selection could be an n-dimensional optimization process of great complexity, only a limited number of major effects need be considered in practice. The key trade-offs are:

1) Trim and Draft for Least Drag - Ship operating attitude for minimum drag is determined by comparing tank test data with analytically-derived relationships. The resulting policy is checked against system constraints to assure that the desired attitudes can be achieved with the available adjustments.

(U) 2) Lift System Optimization - Airflow distribution, pressure ratios and seal settings are optimized with empirical data in conjunction with analytical characterizations of the lift system. Policies for least drag and least total fuel rate are developed,

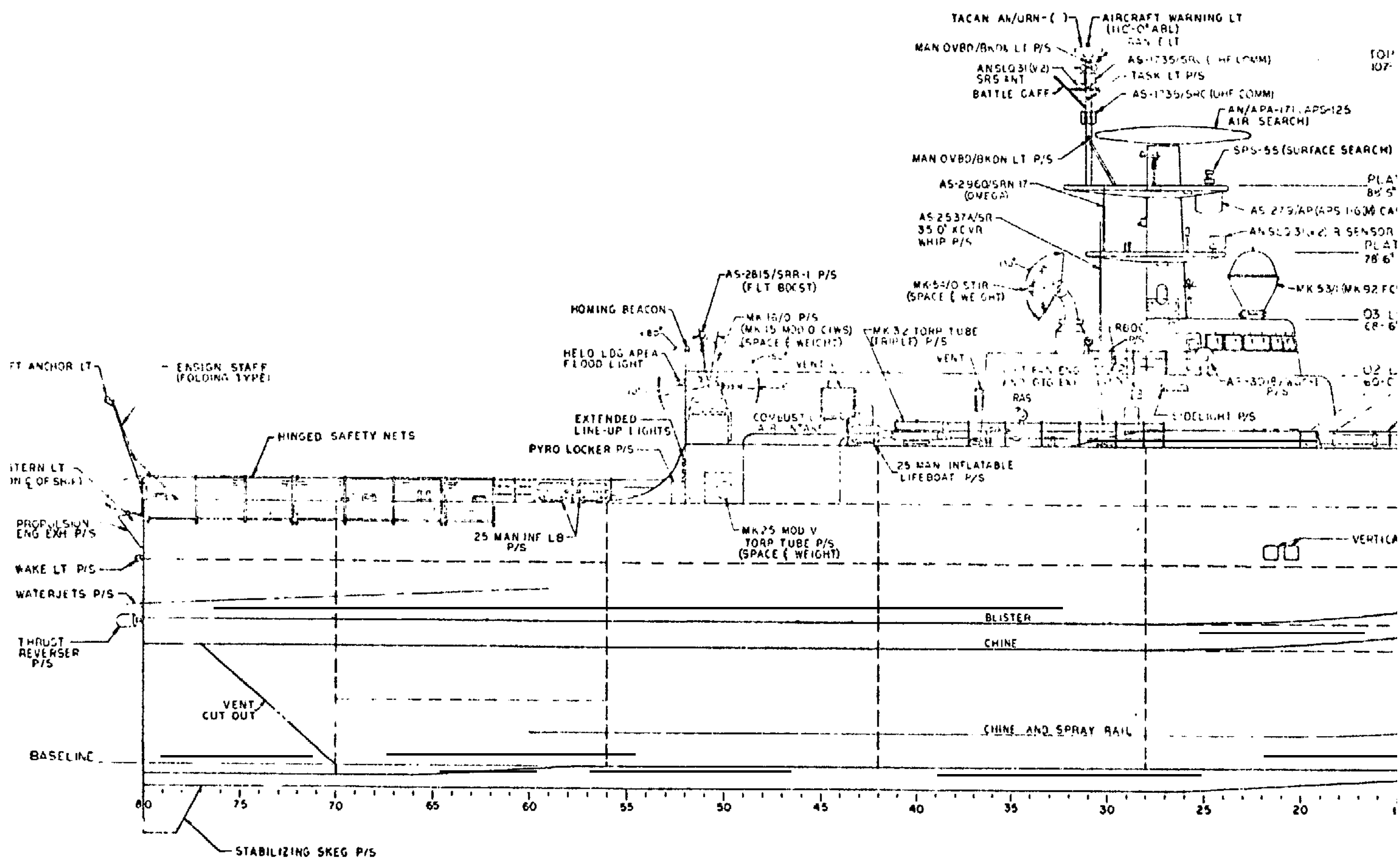
3) Optimum Cruise Speed - There is a speed at which range is maximized for each vehicle weight between zero and 100 percent fuel. This speed is found recursively by a performance computer program that includes appropriate representations of drag, lift system and propulsion system characteristics.

APPENDIX B: DRAWINGS AND DIAGRAMS

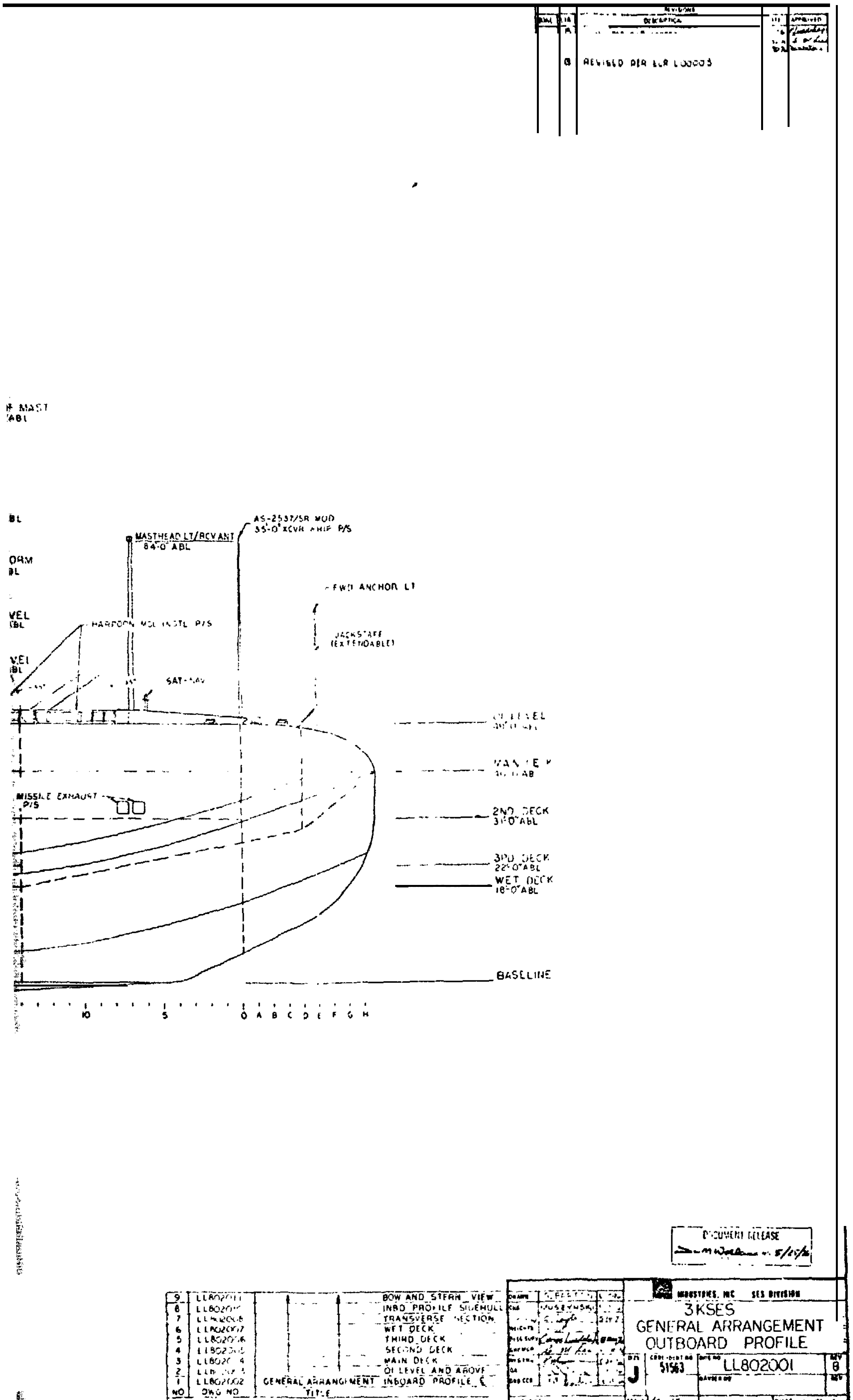
(U) B.1 GENERAL ARRANGEMENT DRAWINGS

(U) This section of Appendix B contains the general arrangement drawings for the near term ANVCE SES Point Design. These drawings are as follows:

Figure	G/A Title	Dwg. Ref.
B.1-1	Outboard Profile	LL802001
B.1-2	Inboard Profile	LL802002
B.1-3	01 Level and Above	LL802003
B.1-4	Main Deck	LL802004
B.1-5	Second Deck	LL802005
B.1-6	Third Deck	LL802006
B.1-7	Wet Deck	LL802007
B.1-8	Traverse Section	LL802008
B.1-9	Inboard Profile	LL802010
B.1-10	Bow and Stern Views	LL802011
B.1-11	Tank Arrangement and Tank Capacities	LL801001

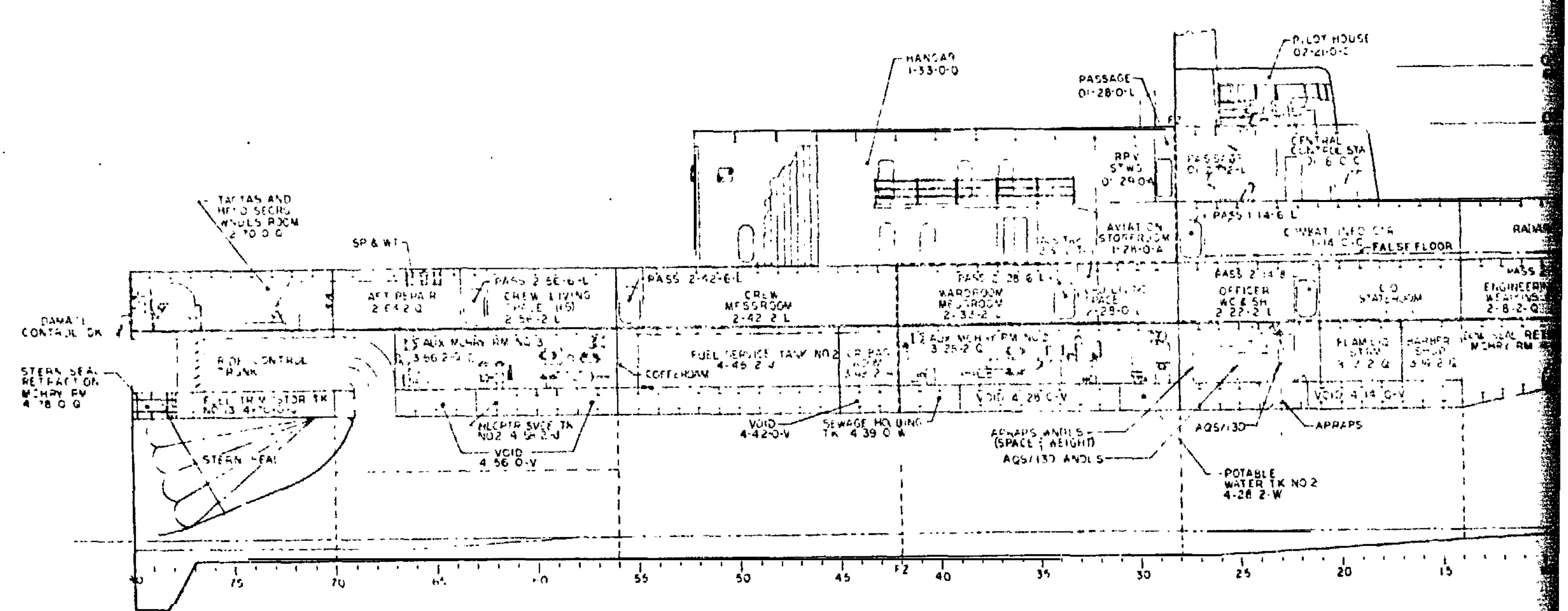


TACAN AN/URN-( )
AIRCRAFT WARNING LT
MAN OVBD/BKDN LT P/S
BATTLE GAFF
AN/APA-171, APS-125 AIR SEARCH)
SPS-55 (SURFACE SEARCH)
AS-2960/SRN 17 (OMEGA)
AS-2537A/SR 35.0' RCVR WHIP P/S
AS-2815/SRR-1 P/S (FLT BCST)
HOMING BEACON
MK 32 TORP TUBE (TRIPLE) P/S
HELO LDG AREA FLOOD LIGHT
ENSIGN STAFF (FOLDING TYPE)
EXTENDED LINE-UP LIGHTS
HINGED SAFETY NETS
PYRO LOCKER P/S
25 MAN INFLATABLE LIFEBOAT P/S
PROPULSION ENG EXH P/S
25 MAN INF LB P/S
MK25 MOD V TORP TUBE P/S (SPACE & WEIGHT)
WAKE LT P/S
WATERJETS P/S
BLISTER
THRUST REVERSER P/S
CHINE
VENT CUT OUT
CHINE AND SPRAY RAIL
BASELINE
80
75
70
65
60
55
50
45
40
35
30
25
20
STABILIZING SKEG P/S



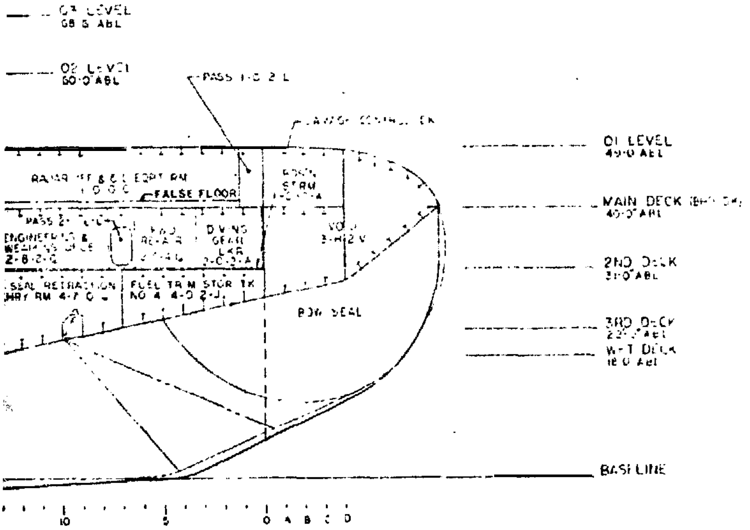
MASTHEAD LT/RCV ANT
84'-0" ABL
FWD ANCHOR LT
JACKSTAFF (EXTENDABLE)
SAT-NAV
MISSILE EXHAUST P/S
2ND DECK
31'-0" ABL
3RD DECK
22'-0" ABL
WET DECK
18'-0" ABL
BASELINE
DOCUMENT RELEASE
SES DIVISION
3KSES
GENERAL ARRANGEMENT
OUTBOARD PROFILE
51563
LL802001
BOW AND STERN VIEW
INBD PROFILE SIDEHULL
TRANSVERSE SECTION
WET DECK
THIRD DECK
SECOND DECK
MAIN DECK
01 LEVEL AND ABOVE
GENERAL ARRANGEMENT INBOARD PROFILE
REFERENCES

Figure B.1-1 (U)



INBOARD PROFILE AT CENTERLINE

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	[illegible]		
	B	REVISED PER ECR LC0008		



DOCUMENT RELEASE

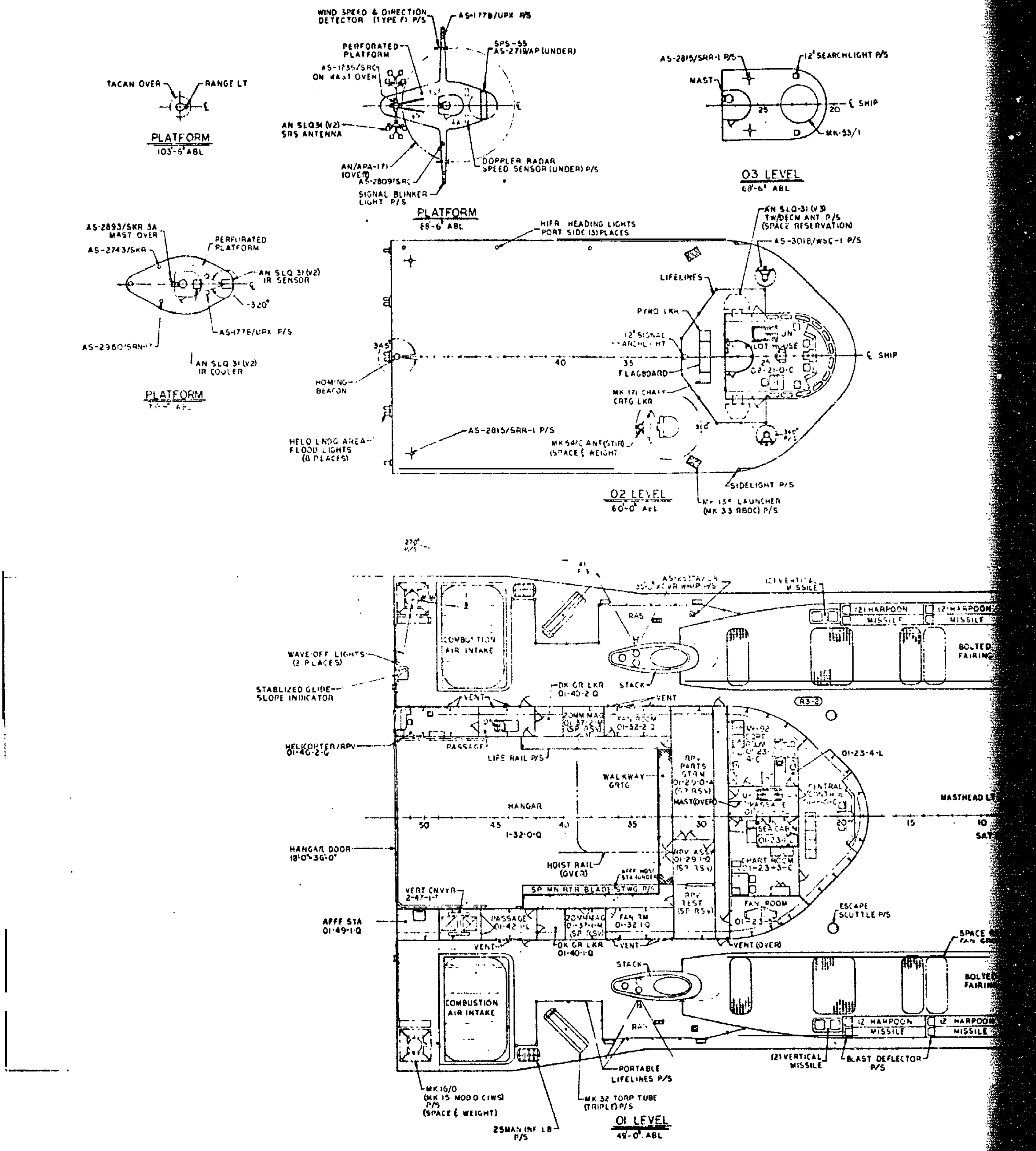
NO	DWG NO	TITLE
1	LL802001	GENERAL ARRANGEMENT OUTBOARD PROFILE
2	LL802003	01 LEVEL & ABOVE
3	LL802004	MAIN DECK
4	LL802005	SECOND DECK
5	LL802006	THIRD DECK
6	LL802007	WET DECK
7	LL802006	TRANSVERSE SECTION
		INBD PROFILE-SIDEHULL
		BOW & STERN VIEW
		REFERENCES

INDUSTRIES, INC SES DIVISION

3KSES GENERAL ARRANGEMENT INBOARD PROFILE

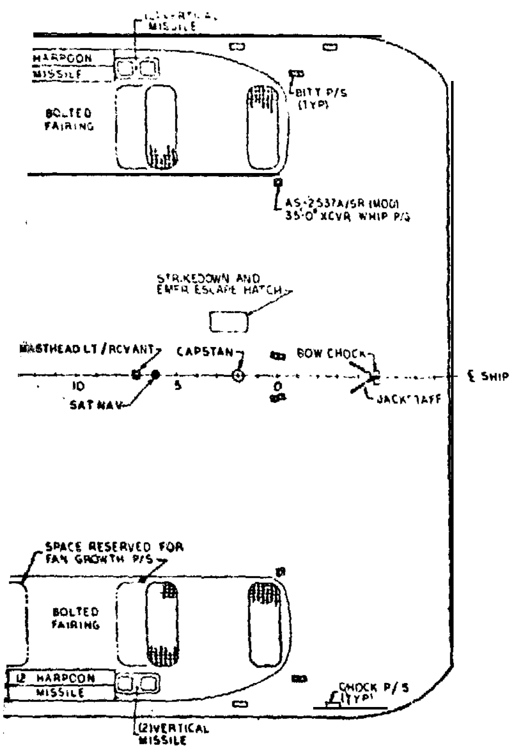
J 51502 LL802002 B

Figure B.1-2 (U)



UNCLASSIFIED

	A	REVISED PER ECR L00005	
	B	REVISED PER ECR L00008	



DOCUMENT RELEASE

NO	DWG NO	TITLE	
9	LL802011		BOW AND STERN VIEW
8	LL802010		INBD PROFILE SIDEHULL
7	LL802008		TRANSVERSE SECTION
6	LL802007		WET DECK
5	LL802006		THIRD DECK
4	LL802005		SECOND DECK
3	LL802004		MAIN DECK
2	LL802002		INBOARD PROFILE ℄
1	LL802001	GENERAL ARRANGEMENT	OUTBOARD PROFILE

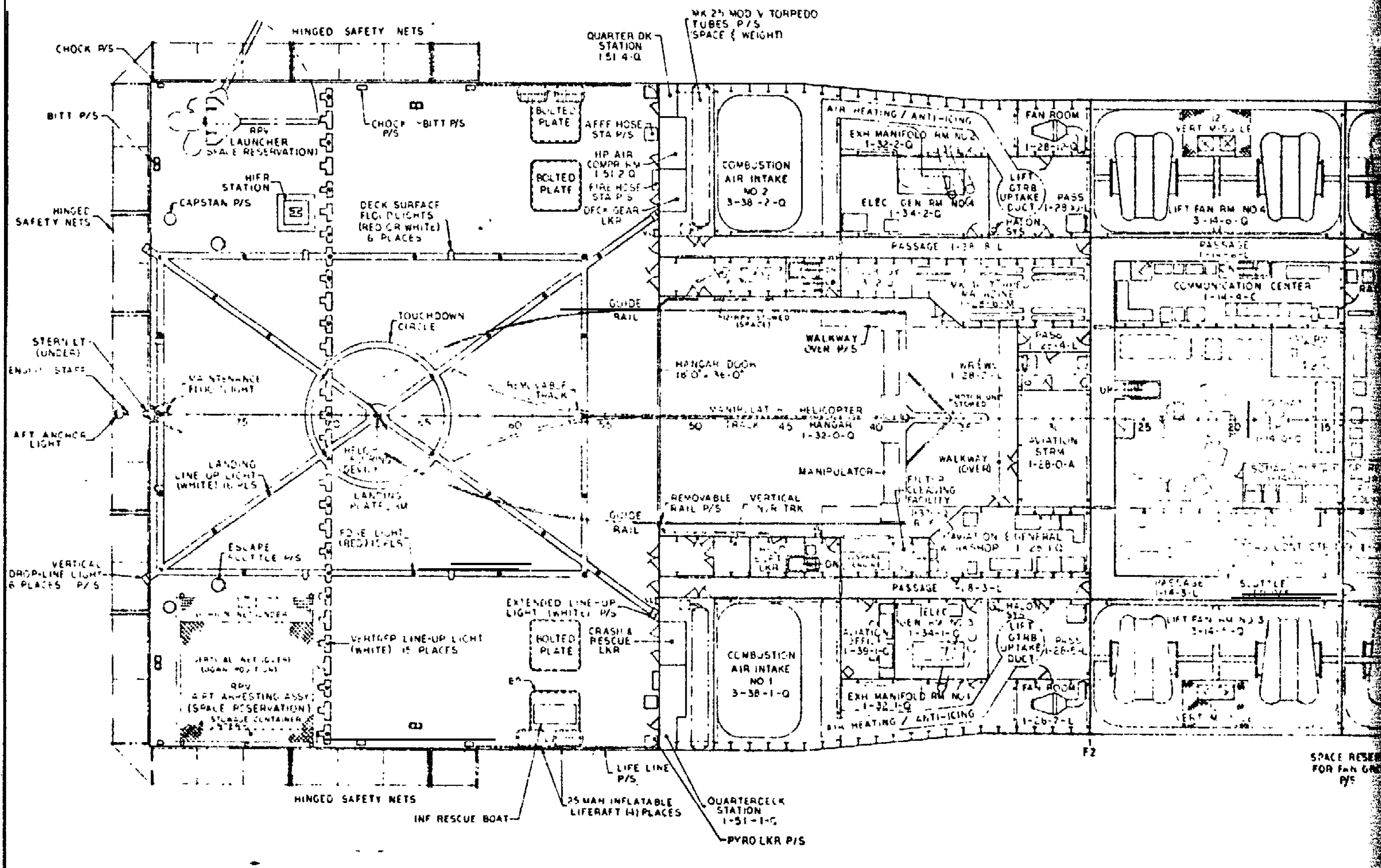
REFERENCES

INDUSTRIES, INC SES DIVISION

3KSES
GENERAL ARRANGEMENT
01 LEVEL AND ABOVE

J LL802003

Figure B.1-3 (U)



HINGED SAFETY NETS
CHOCK P/S
BITT P/S
HINGED SAFETY NETS
CAPSTAN P/S
RPV LAUNCHER (SPACE RESERVATION)
HIFR STATION
CHOCK - BITT P/S
BOLTED PLATE
BOLTED PLATE
AFFF HOSE STA P/S
HP AIR COMPR RM 1-51-2-Q
FIRE HOSE STA P/S
DECK GEAR LKR
QUARTER DK STATION 1-51-4-Q
MK 25 MOD V TORPEDO TUBES P/S (SPACE & WEIGHT)
DECK SURFACE FLOODLIGHTS (RED OR WHITE) 6 PLACES
COMBUSTION AIR INTAKE NO 2 3-38-2-Q
AIR HEATING / ANTI-ICING
EXH MANIFOLD RM NO 2 1-32-2-Q
ELEC GEN RM NO 4 1-34-2-Q
FAN ROOM
LIFT GTRB UPTAKE DUCT
PASS
HALON SYS
LIFT FAN RM NO 4 3-14-6-Q
PASSAGE
COMMUNICATION CENTER
STERN LT (UNDER)
ENSIGN STAFF
AFT ANCHOR LIGHT
TOUCHDOWN CIRCLE
MAINTENANCE FLOODLIGHT
REMOVABLE TRACK
GUIDE RAIL
HANGAR DOOR
WALKWAY OVER P/S
MANIPULATOR HELICOPTER TRACK
HANGAR 1-32-0-Q
MANIPULATOR
WALKWAY (OVER)
AVIATION STRM 1-28-0-A
LANDING LINE-UP LIGHT (WHITE)
LANDING PLATE
REMOVABLE RAIL P/S
VERTICAL
GUIDE RAIL
AVIATION & GENERAL WORKSHOP
ESCAPE SCUTTLE P/S
VERTICAL DROP-LINE LIGHT 6 PLACES P/S
PASSAGE
EXTENDED LINE-UP LIGHT (WHITE) P/S
BOLTED PLATE
CRASH & RESCUE LKR
VERTICAL LINE-UP LIGHT (WHITE) 15 PLACES
RPV AFT ARRESTING ASSY (SPACE RESERVATION)
COMBUSTION AIR INTAKE NO 1 3-38-1-Q
EXH MANIFOLD RM NO 1 1-32-1-Q
AIR HEATING / ANTI-ICING
HALON SYS
LIFT GTRB UPTAKE DUCT
PASS
FAN ROOM
F2
SPACE RESERVATION FOR FAN GR P/S
LIFE LINE P/S
HINGED SAFETY NETS
INF RESCUE BOAT
25 MAN INFLATABLE LIFERAFT (4) PLACES
QUARTERDECK STATION 1-51-1-Q
PYRO LKR P/S

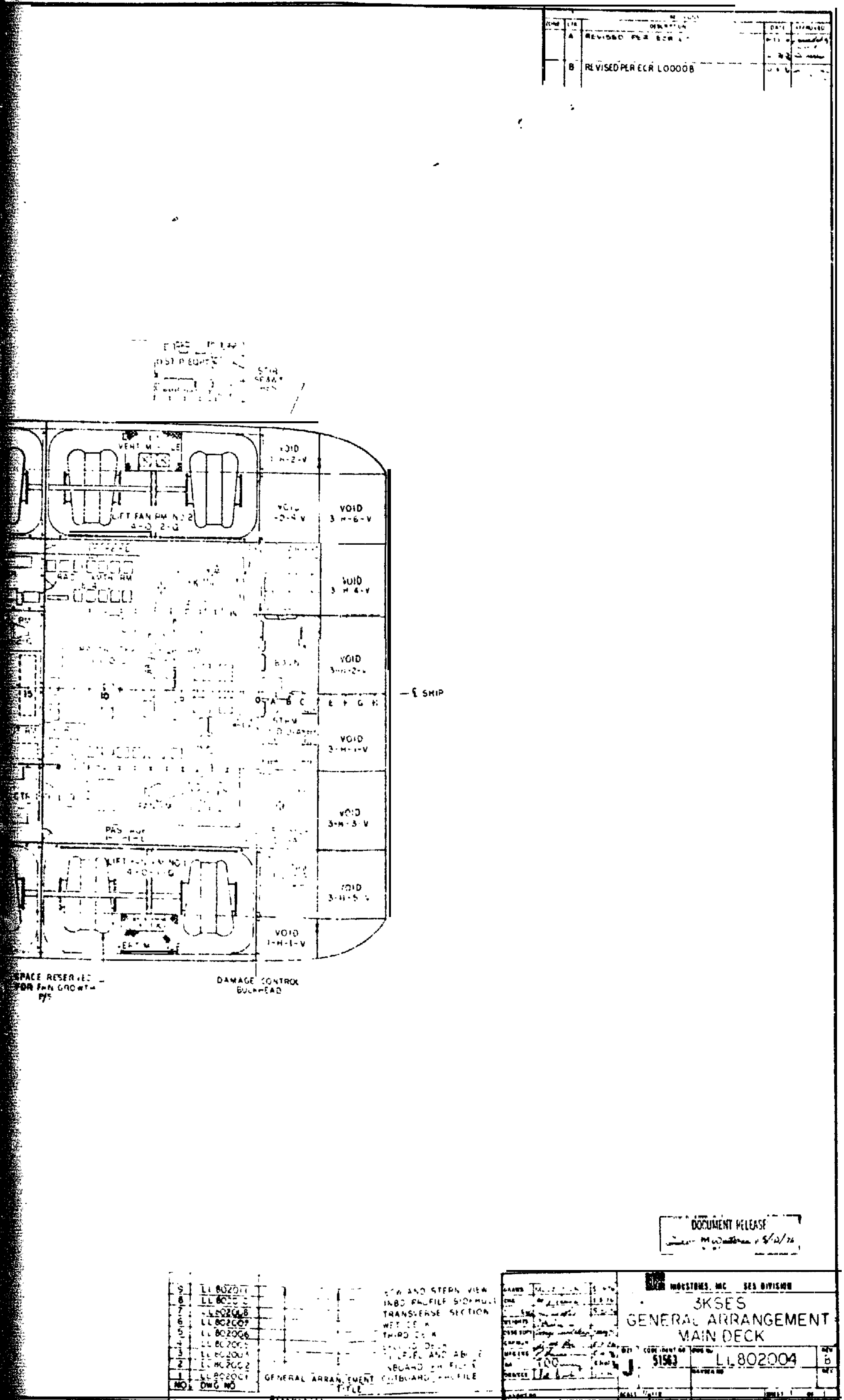
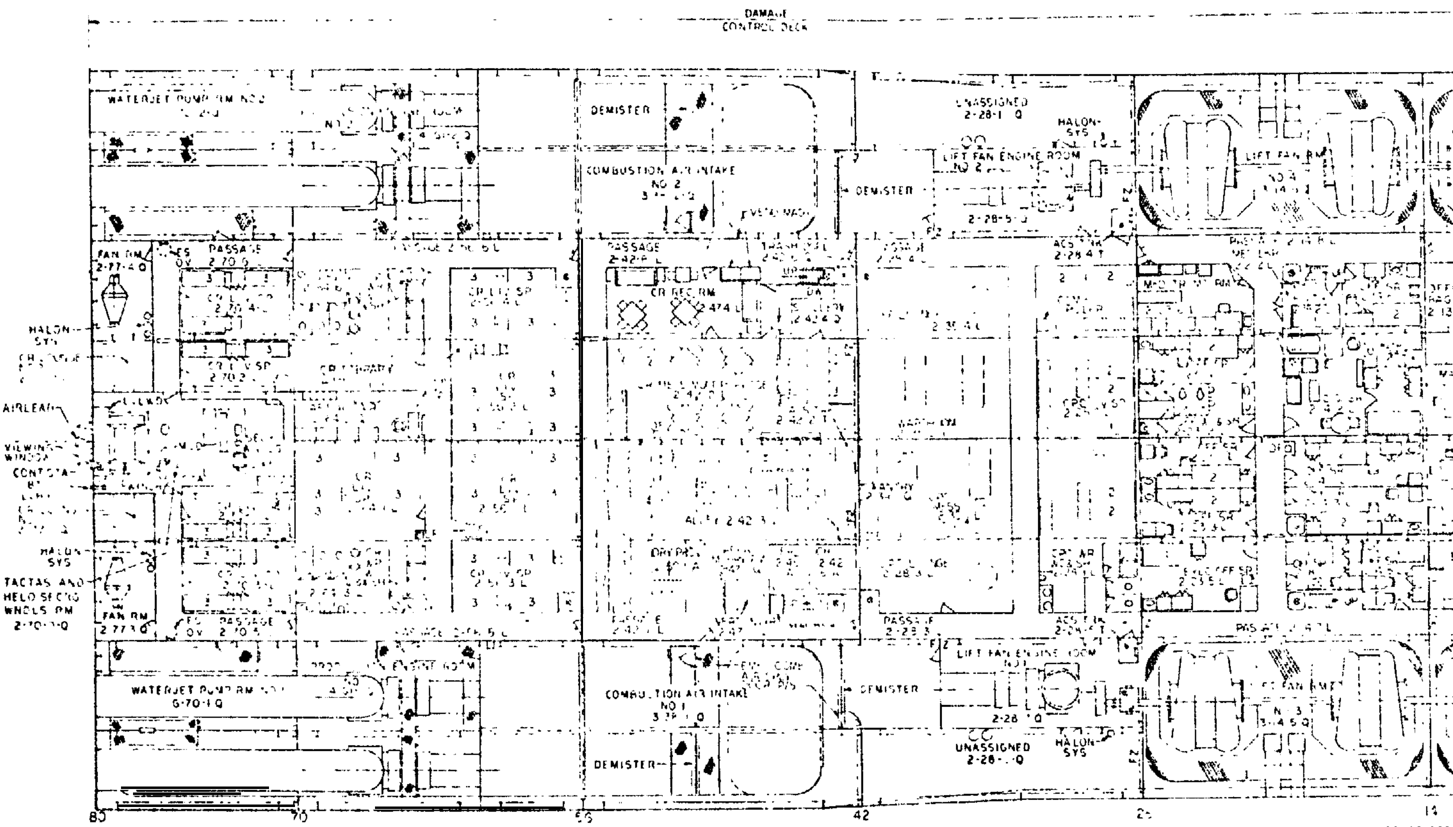
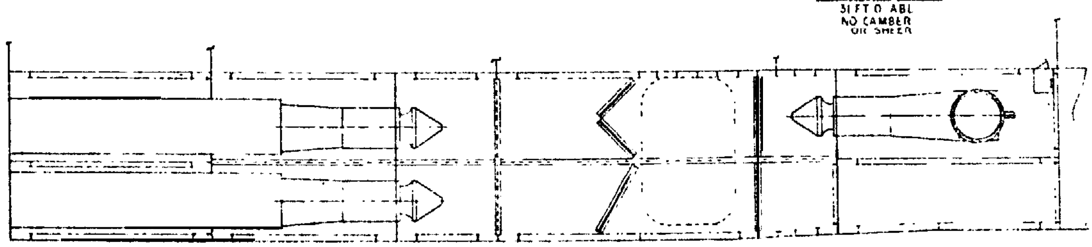

REVISED PER ECR L00008
VOID
LIFT FAN RM NO 2
VOID
3-H-6-V
VOID
3-H-4-V
VOID
VOID
3-H-3-V
VOID
1-H-1-V
SPACE RESERVED FOR FAN GROWTH P/S
DAMAGE CONTROL BULKHEAD
℄ SHIP
DOCUMENT RELEASE
3KSES
GENERAL ARRANGEMENT
MAIN DECK
51563
LL802004
GENERAL ARRANGEMENT
TITLE
NO. DWG NO
REFERENCES

Figure B.1-4 (U)



LM 2530 ENGINE SYSTEM.

SECOND DECK
31 FT 0 ABL
NO CAMBER OR SHEER

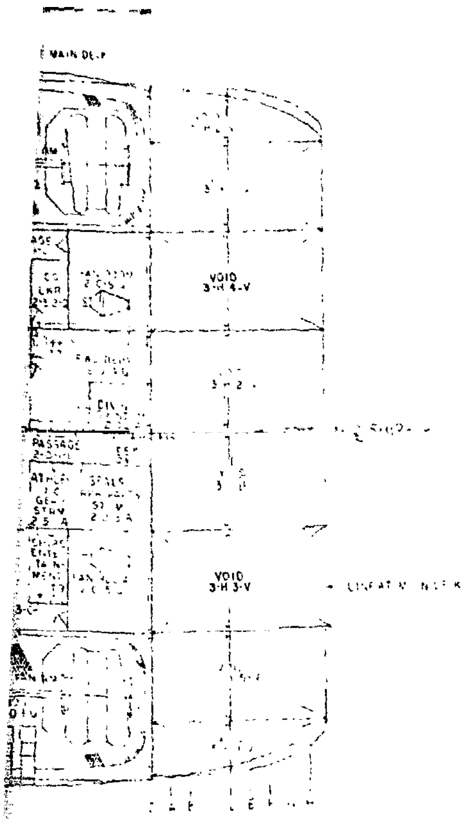


FT-9 ENGINE SYSTEM

9	LL
8	LL
7	LL
6	LL
5	LL
4	LL
3	LL
2	LL
1	LL
NO	

UNCLASSIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	[illegible]		
	B	REVISED PER ECN L0000B		



REFERENCES	TITLE
	BOW & STERN VIEW
	INBD OF SIDEHULL
	TRANSVERSE SECTION
	WET DECK
	THIRD DECK
	MAIN DECK
	01 LEVEL & ABOVE
	INBOARD PROFILE
	GENERAL ARRANGEMENT OUTBOARD PROFILE

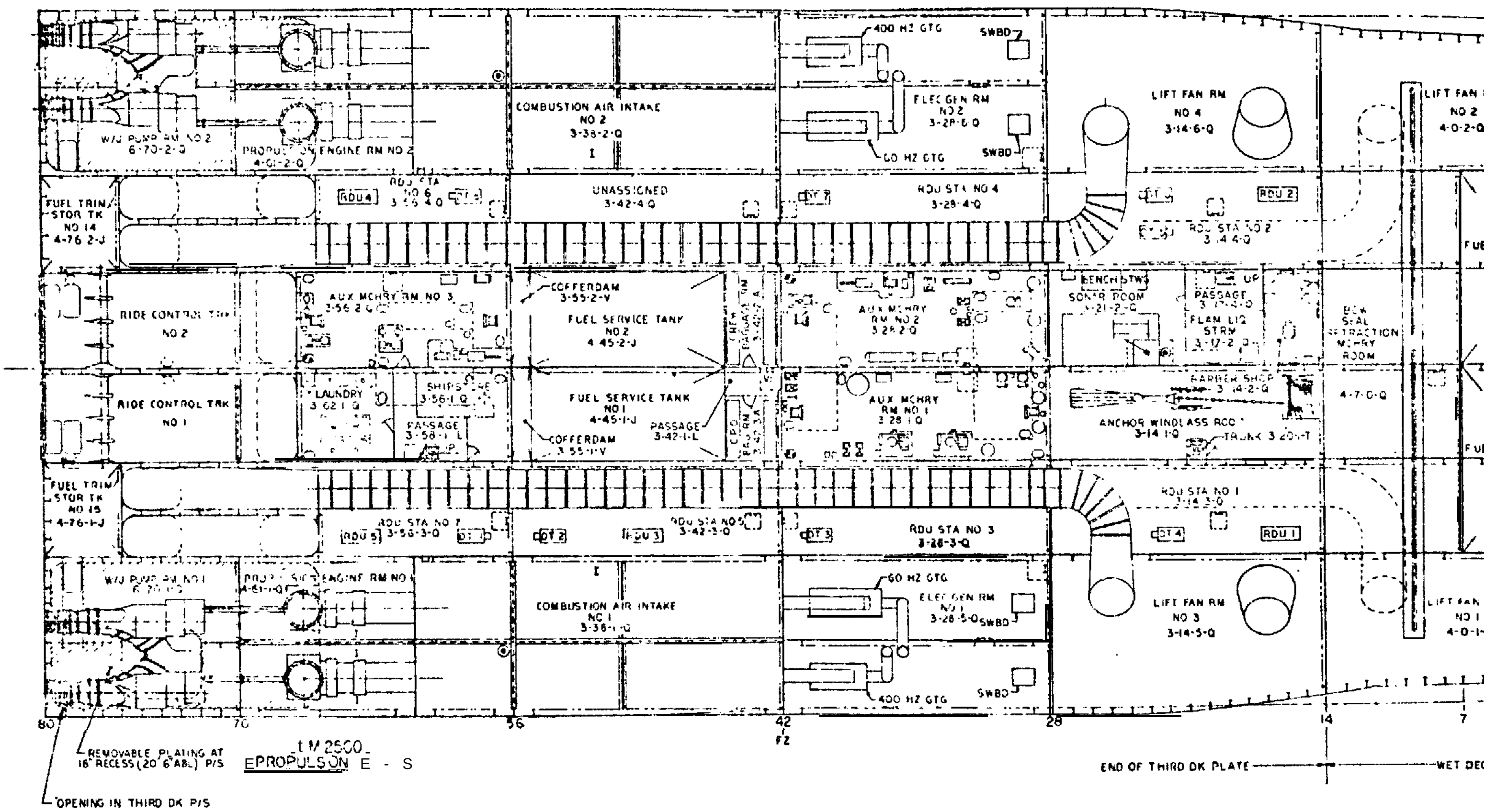
INDUSTRIES, INC — SES DIVISION

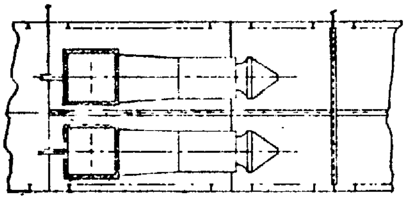
3KSES
GENERAL ARRANGEMENT
SECOND DECK

SIZE J | CODE IDENT NO 51563 | DWG NO LL802005 | REV B

Figure B.1-5 (U)

UNCLASSIFIED





FT-9
EPROPULSION

THIRD DECK
22 FT-0 ABL
NO CAMBER

NO	DWG NO	
9	LL802011	
8	LL802010	
7	LL802008	
6	LL802007	
5	LL802005	
4	LL802004	
3	LL802003	
2	LL802002	
1	LL802001	GENERA

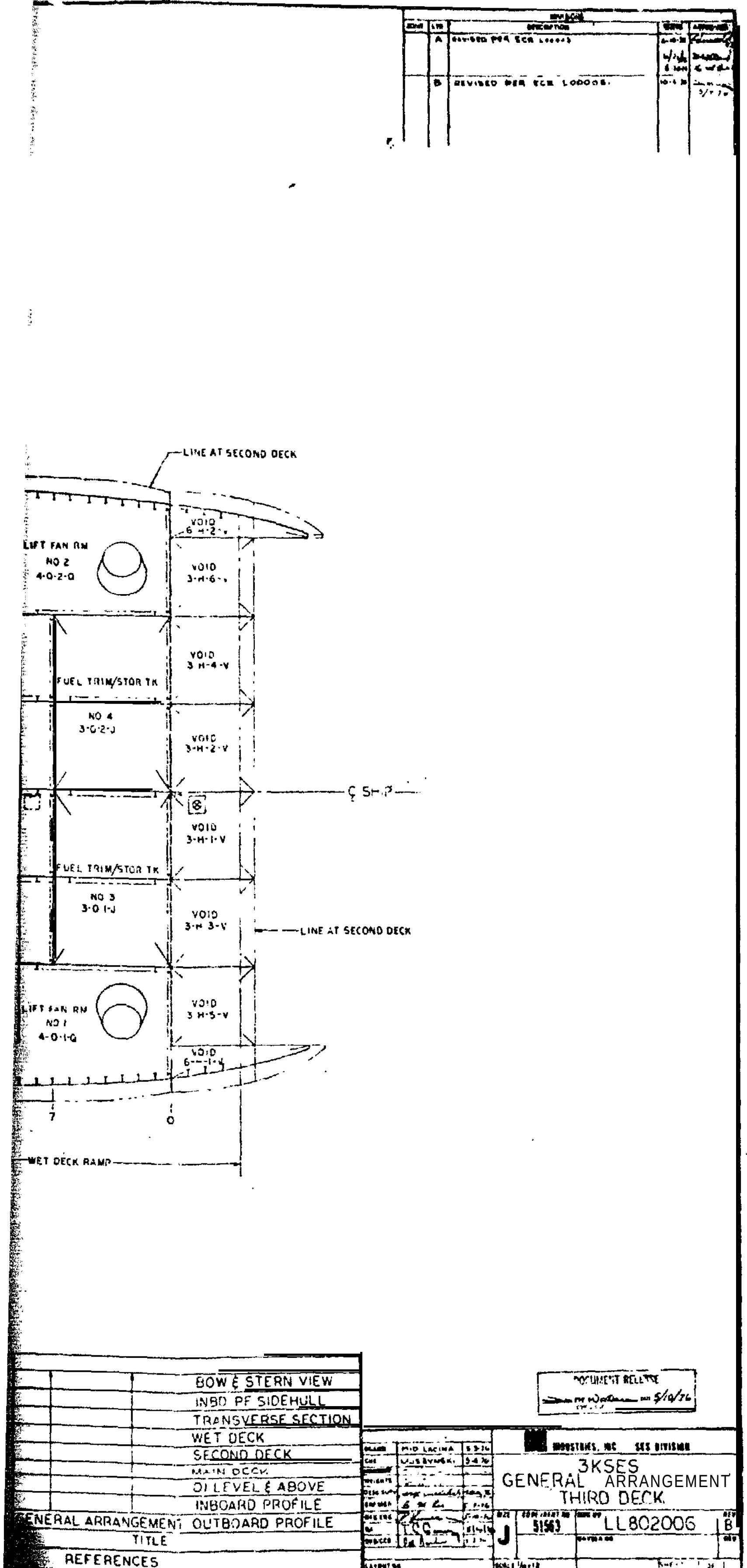
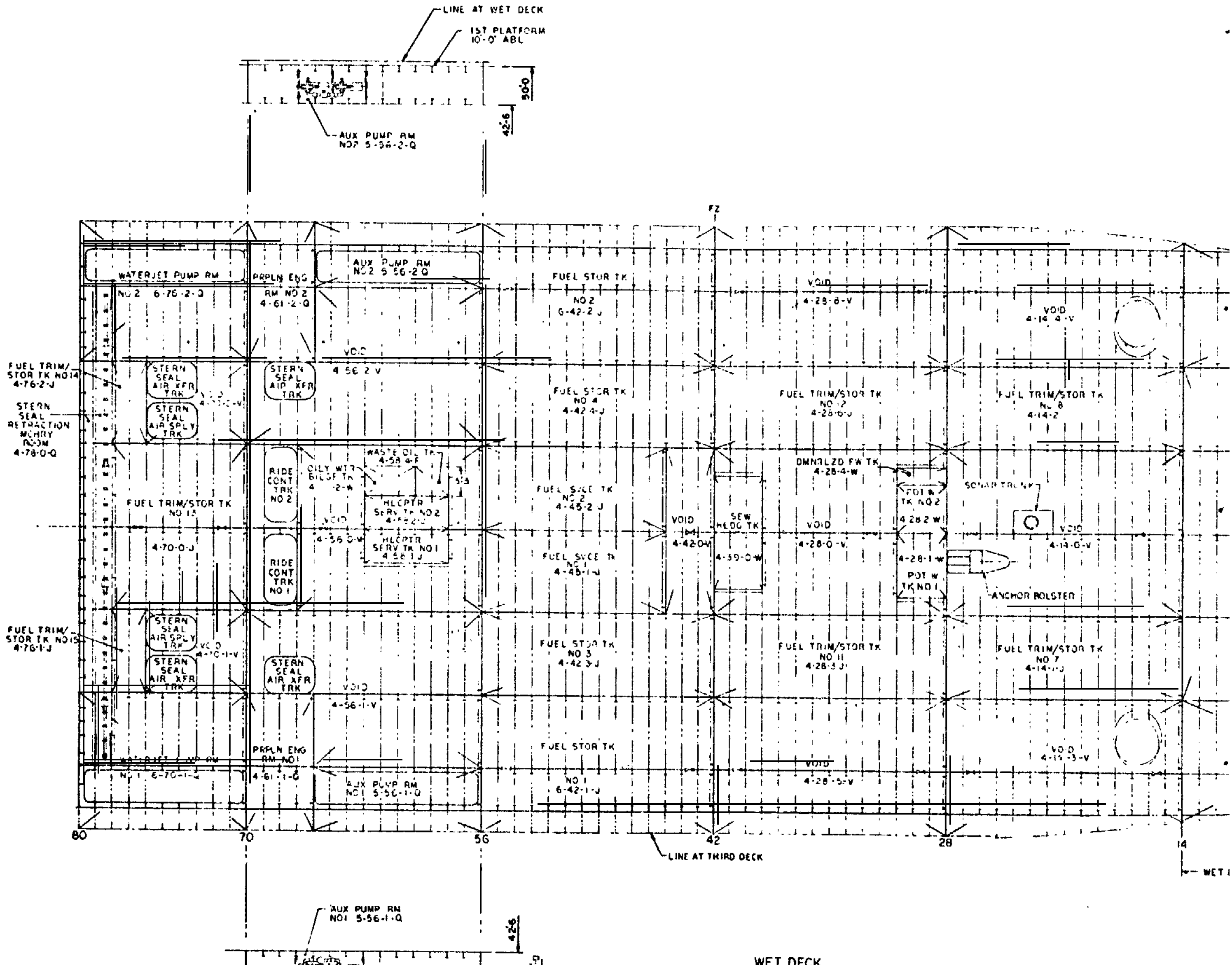

LINE AT SECOND DECK
VOID 6-H-2-V
LIFT FAN RM NO 2 4-0-2-Q
VOID 3-H-6-V
VOID 3-H-4-V
FUEL TRIM/STOR TK
NO 4 3-0-2-J
VOID 3-H-2-V
℄ SHIP
VOID 3-H-1-V
FUEL TRIM/STOR TK
NO 3 3-0-1-J
VOID 3-H-3-V
LINE AT SECOND DECK
LIFT FAN RM NO 1 4-0-1-Q
VOID 3-H-5-V
VOID
7
0
WET DECK RAMP
BOW & STERN VIEW
INBD PF SIDEHULL
TRANSVERSE SECTION
WET DECK
SECOND DECK
MAIN DECK
01 LEVEL & ABOVE
INBOARD PROFILE
GENERAL ARRANGEMENT
OUTBOARD PROFILE
TITLE
REFERENCES
DOCUMENT RELEASE
INDUSTRIES, INC SES DIVISION
3KSES
GENERAL ARRANGEMENT
THIRD DECK
J
51563
LL802006
B

Figure B.1-6 (U)



WET DECK
18 FT 0 ABL
NO CAMBER

10	LL8010
9	LL8020
8	LL8020
7	LL8020
6	LL8020
5	LL8020
4	LL8020
3	LL8020
2	LL8020
1	LL8020
NO	DWG N

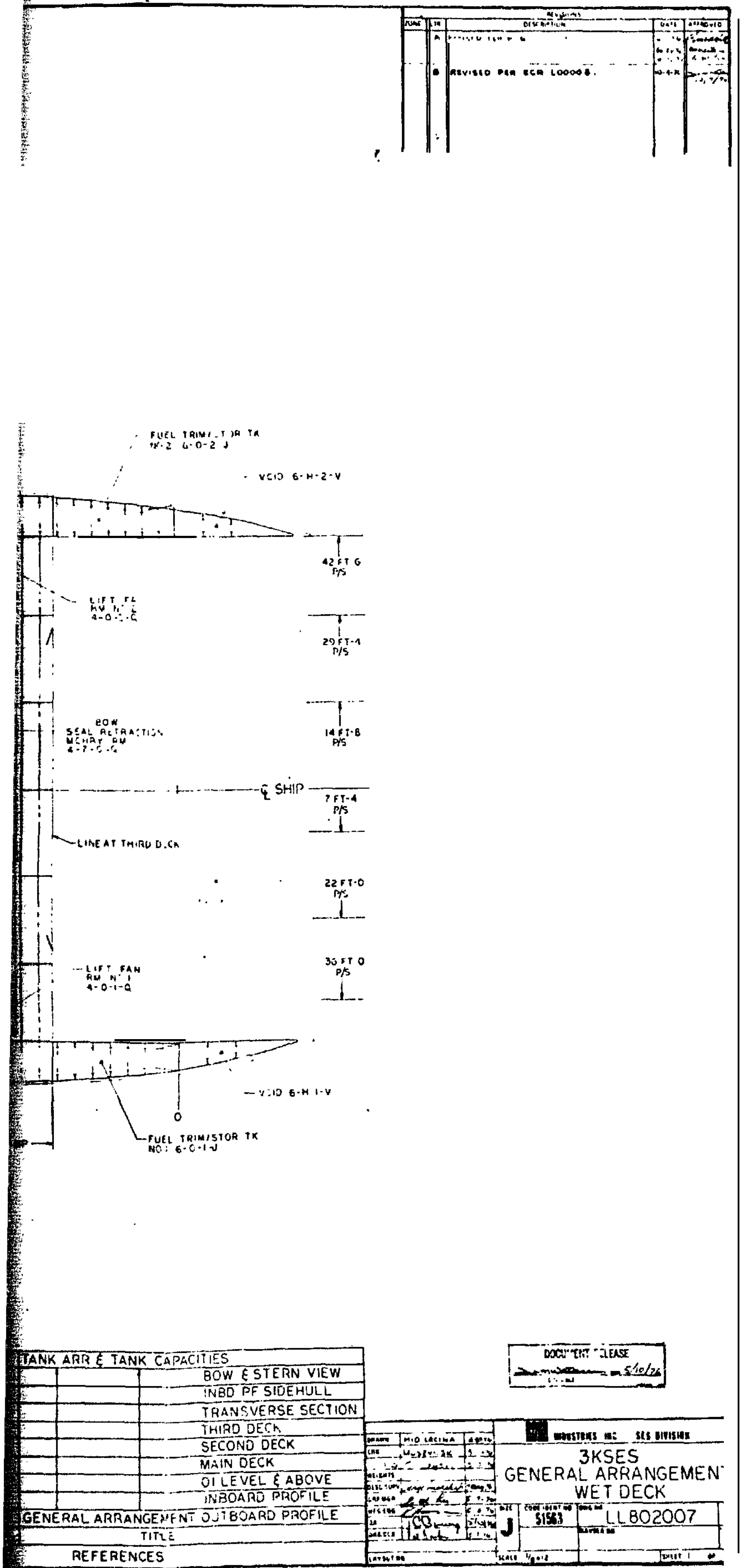
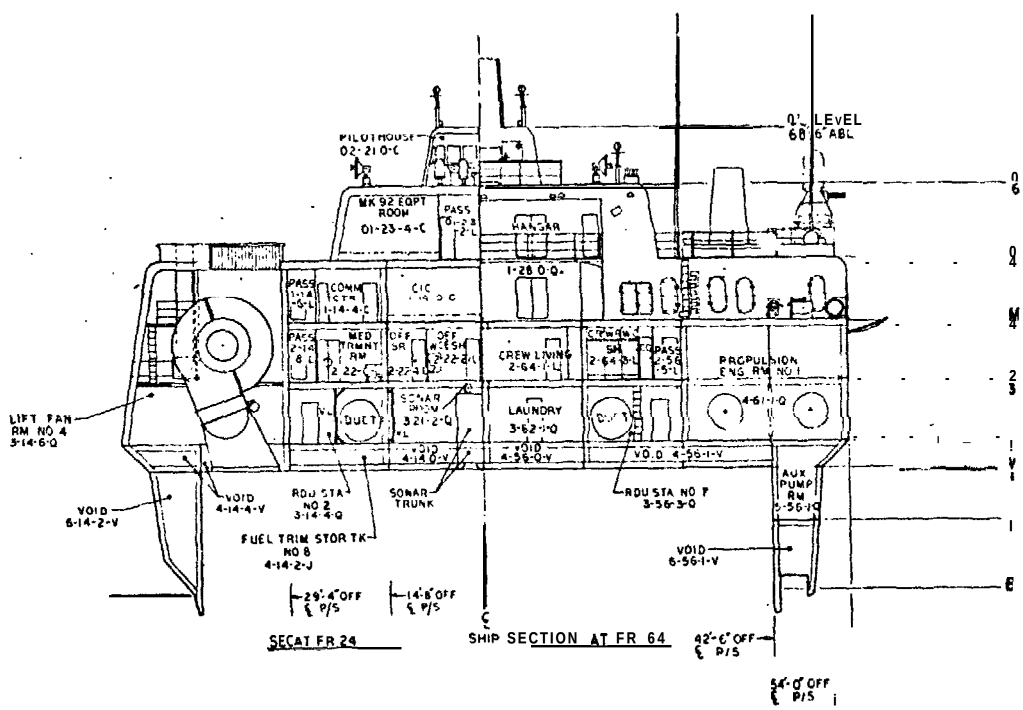
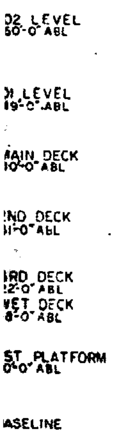

REVISED PER ECR L0000 8.
FUEL TRIM/STOR TK
VOID 6-H-2-V
42 FT 6
P/S
LIFT FAN
29 FT-4
P/S
BOW
SEAL RETRACTION
MCHRY RM
14 FT-8
P/S
℄ SHIP
7 FT-4
P/S
LINE AT THIRD DECK
22 FT-0
P/S
LIFT FAN
4-0-1-Q
35 FT 0
P/S
VOID 6-H-1-V
0
FUEL TRIM/STOR TK
NO. 1 6-0-1-J
TANK ARR & TANK CAPACITIES
BOW & STERN VIEW
INBD PF SIDEHULL
TRANSVERSE SECTION
THIRD DECK
SECOND DECK
MAIN DECK
01 LEVEL & ABOVE
INBOARD PROFILE
GENERAL ARRANGEMENT OUTBOARD PROFILE
TITLE
REFERENCES
DOCUMENT RELEASE
5/10/76
SES DIVISION
3KSES
GENERAL ARRANGEMENT
WET DECK
J
51563
LL802007

Figure B.1-7 (U)



TRANSVERSE SECTION
LOOKING FWD

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER ECR L00003		
	B	REVISED PER ECR L00008.	10 4 76	



DOCUMENT RELEASE

9	LL802011			BOW & STERN VIEW
8	LL802010			INBD PF SIDEHULL
7	LL802007			WET DECK
6	LL802006			THIRD DECK
5	LL802005			SECOND DECK
4	LL802004			MAIN DECK
3	LL802003			01 LEVEL & ABOVE
2	LL802002			INBOARD PROFILE
1	LL802001	GENERAL ARRANGEMENT OUTBOARD PROFILE		

G. BARTON

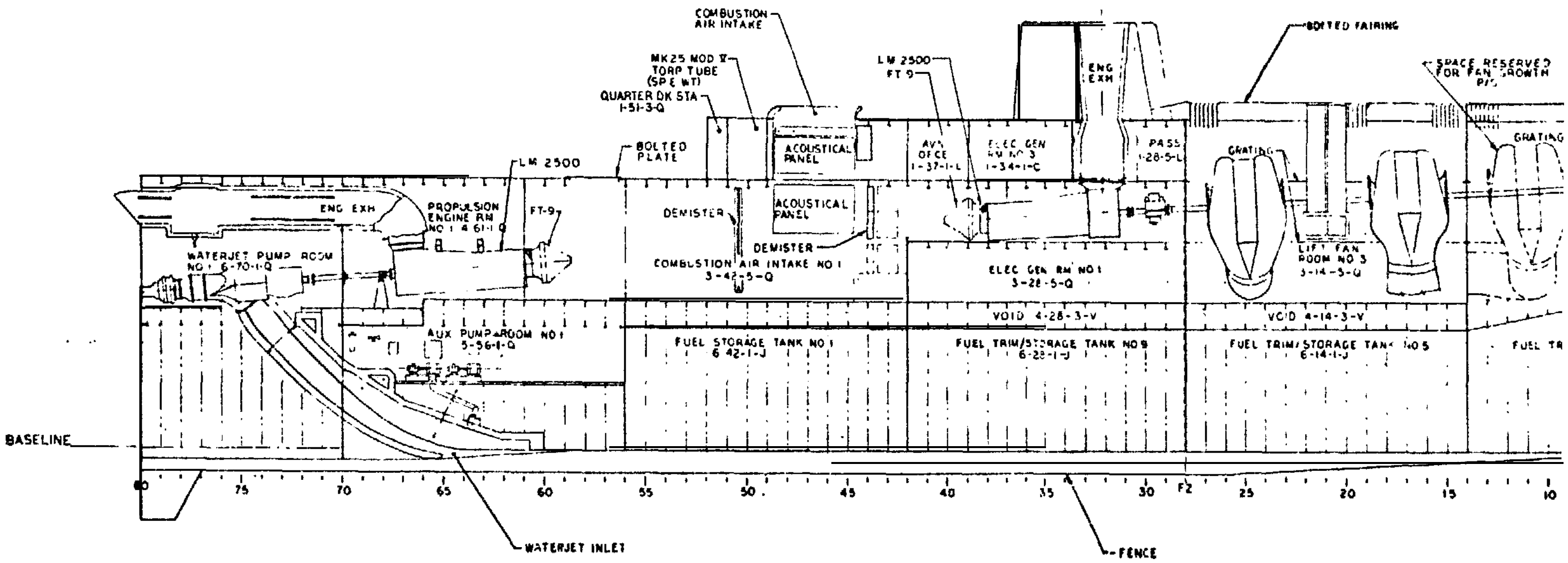
INDUSTRIES INC. SES DIVISION

3KSES
GENERAL ARRANGEMENT
TRANSVERSE SECTION

J 51583 LL802008 B

SCALE 1/8 = 1'-0"

Figure B.1-8 (U)



SIDEHULL INBOARD PROFIL
STARBOARD SIDE LOOKING TO PORT.

BELOW 3RD DK SECTION PLANE IS APPROXIMATELY 44'-0" OFF ℄ SHIP
ABOVE 3RD DK SECTION PLANE VAR ACCORDING TO EQUIPMENT SHOWN

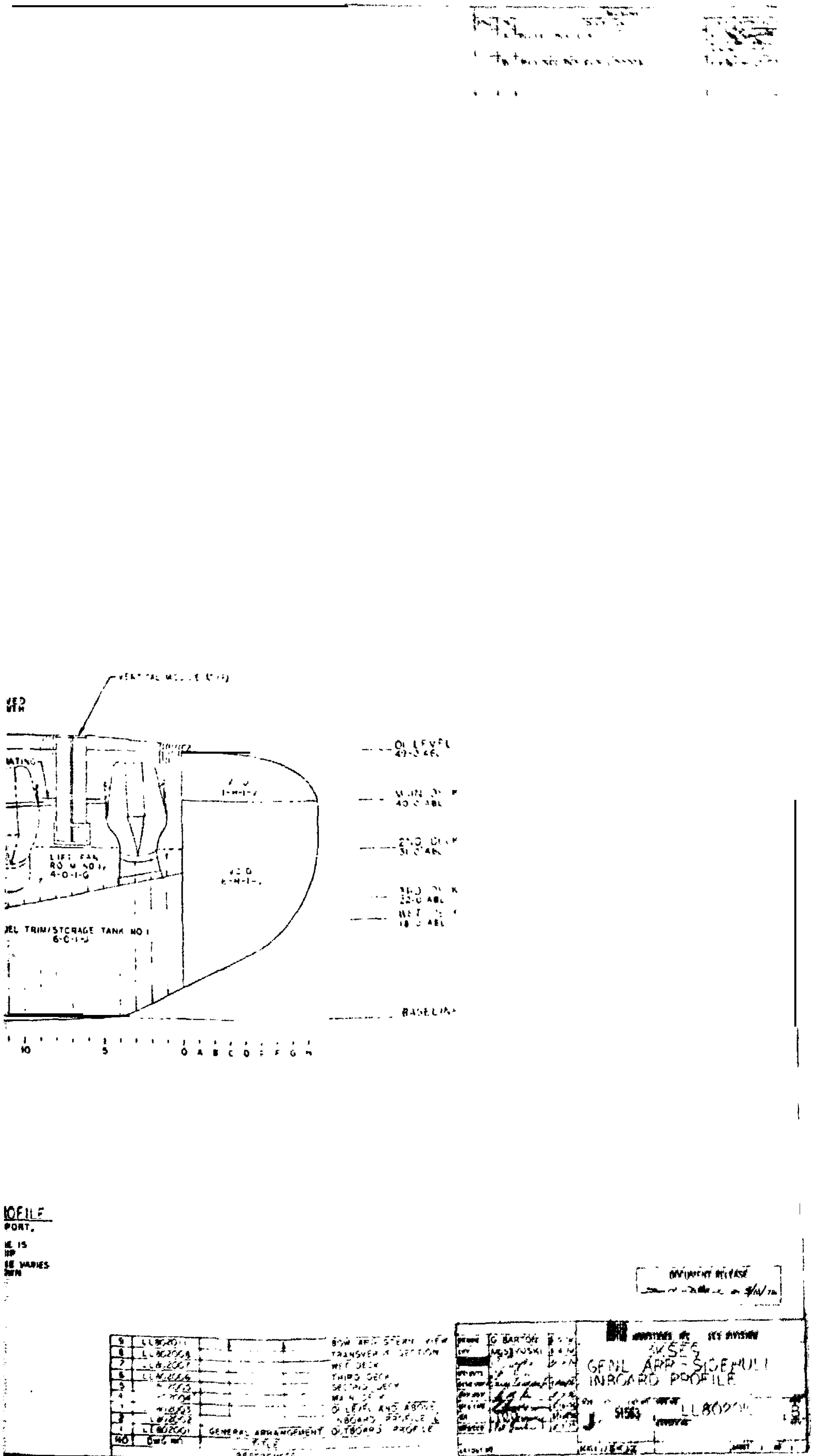
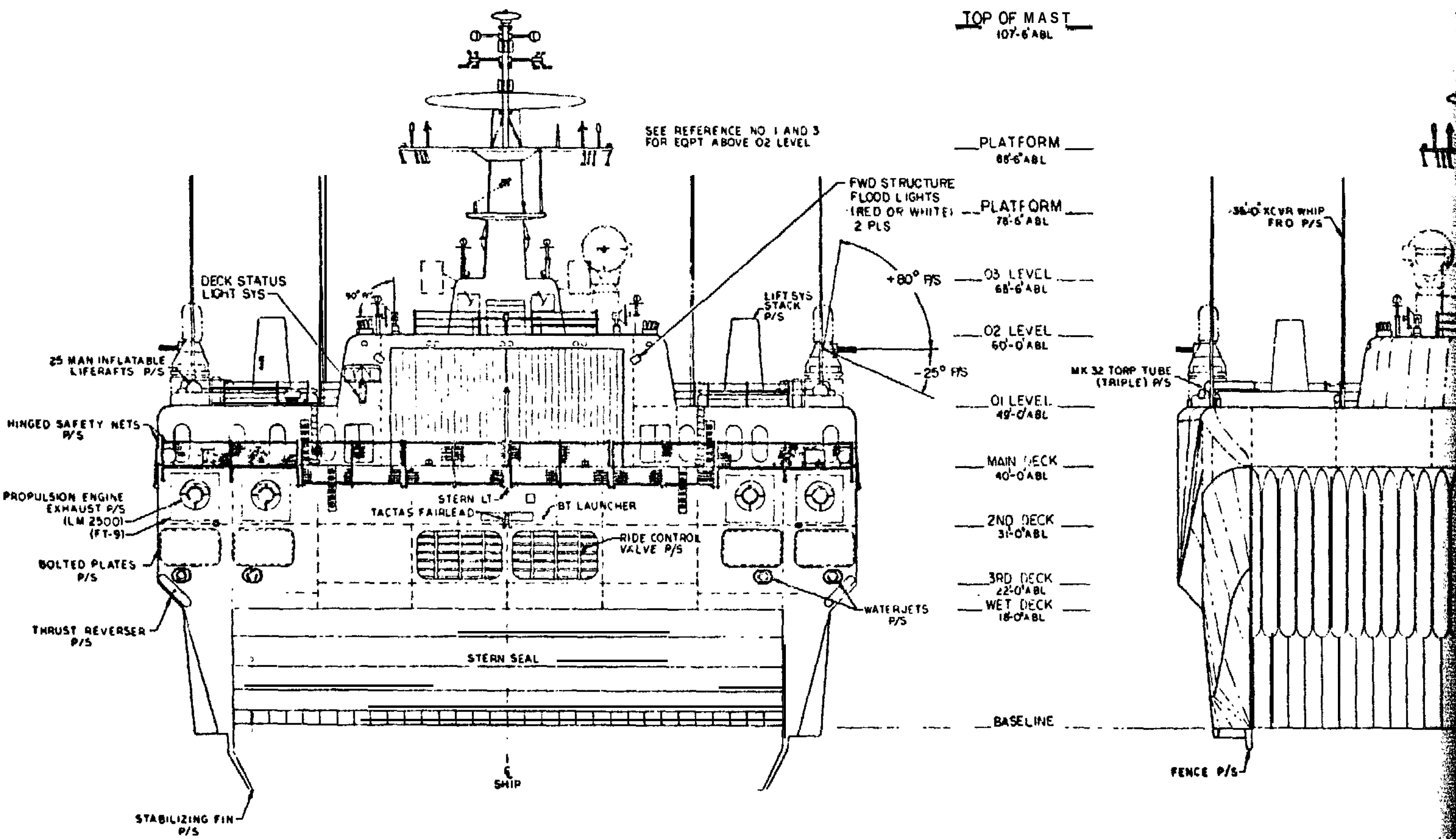
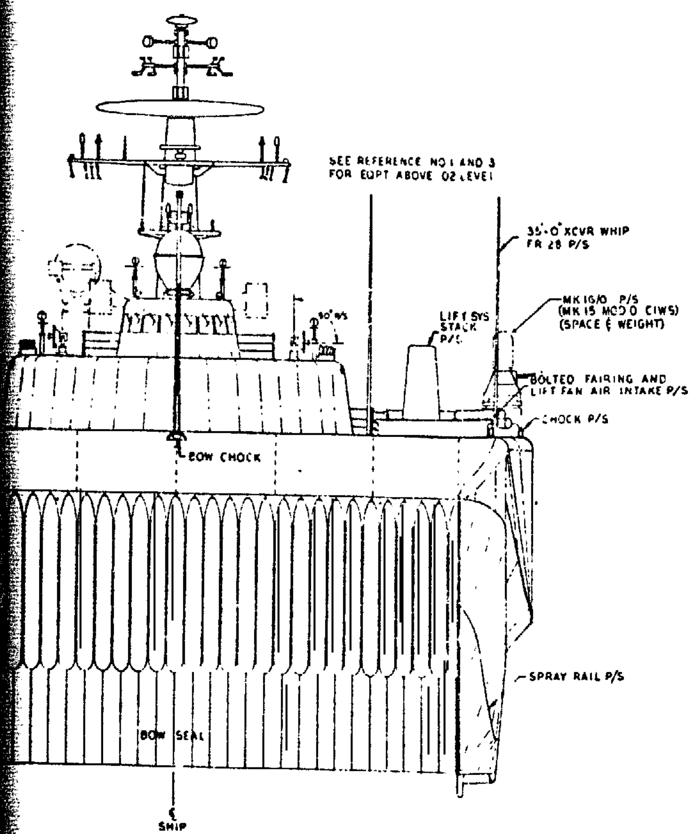

LIFT FAN
TRIM/STORAGE TANK NO 1
BASELINE
DOCUMENT RELEASE
GENL ARR - SIDE HULL
INBOARD PROFILE
GENERAL ARRANGEMENT
OUTBOARD PROFILE
REFERENCES

Figure B.1-9 (U)


TOP OF MAST
107'-6" ABL
PLATFORM
86'-6" ABL
PLATFORM
78'-6" ABL
03 LEVEL
68'-6" ABL
02 LEVEL
60'-0" ABL
01 LEVEL
49'-0" ABL
MAIN DECK
40'-0" ABL
2ND DECK
31'-0" ABL
3RD DECK
22'-0" ABL
WET DECK
18'-0" ABL
BASELINE
SEE REFERENCE NO. 1 AND 3 FOR EQPT ABOVE 02 LEVEL
FWD STRUCTURE FLOOD LIGHTS (RED OR WHITE) 2 PLS
+80° P/S
-25° P/S
DECK STATUS LIGHT SYS
25 MAN INFLATABLE LIFERAFTS P/S
HINGED SAFETY NETS P/S
PROPULSION ENGINE EXHAUST P/S (LM 2500) (FT-9)
BOLTED PLATES P/S
THRUST REVERSER P/S
STABILIZING FIN P/S
LIFT SYS STACK P/S
STERN LT
TACTAS FAIRLEAD
BT LAUNCHER
RIDE CONTROL VALVE P/S
WATERJETS P/S
STERN SEAL
℄ SHIP
XCVR WHIP
MK 32 TORP TUBE (TRIPLE) P/S
FENCE P/S

STERN VIEW

B	REVISED PER ECR L00008	10.4.76	



BOW VIEW

DOCUMENT RELEASE

NO	DWG NO	TITLE	
9	LL802010		INBD PROFILE SIDEHULL
8	LL802008		TRANSVERSE SECTION
7	LL802007		WET DECK
6	LL802006		THIRD DECK
5	LL802005		SECOND DECK
4	LL802004		MAIN DECK
3	LL802003		01 LEVEL AND ABOVE
2	LL802002		INBOARD PROFILE ℄
1	LL802001	GENERAL ARRANGEMENT	OUTBOARD PROFILE

REFERENCE

DRAWN G. BARTON
CHK MUSZYNSKI

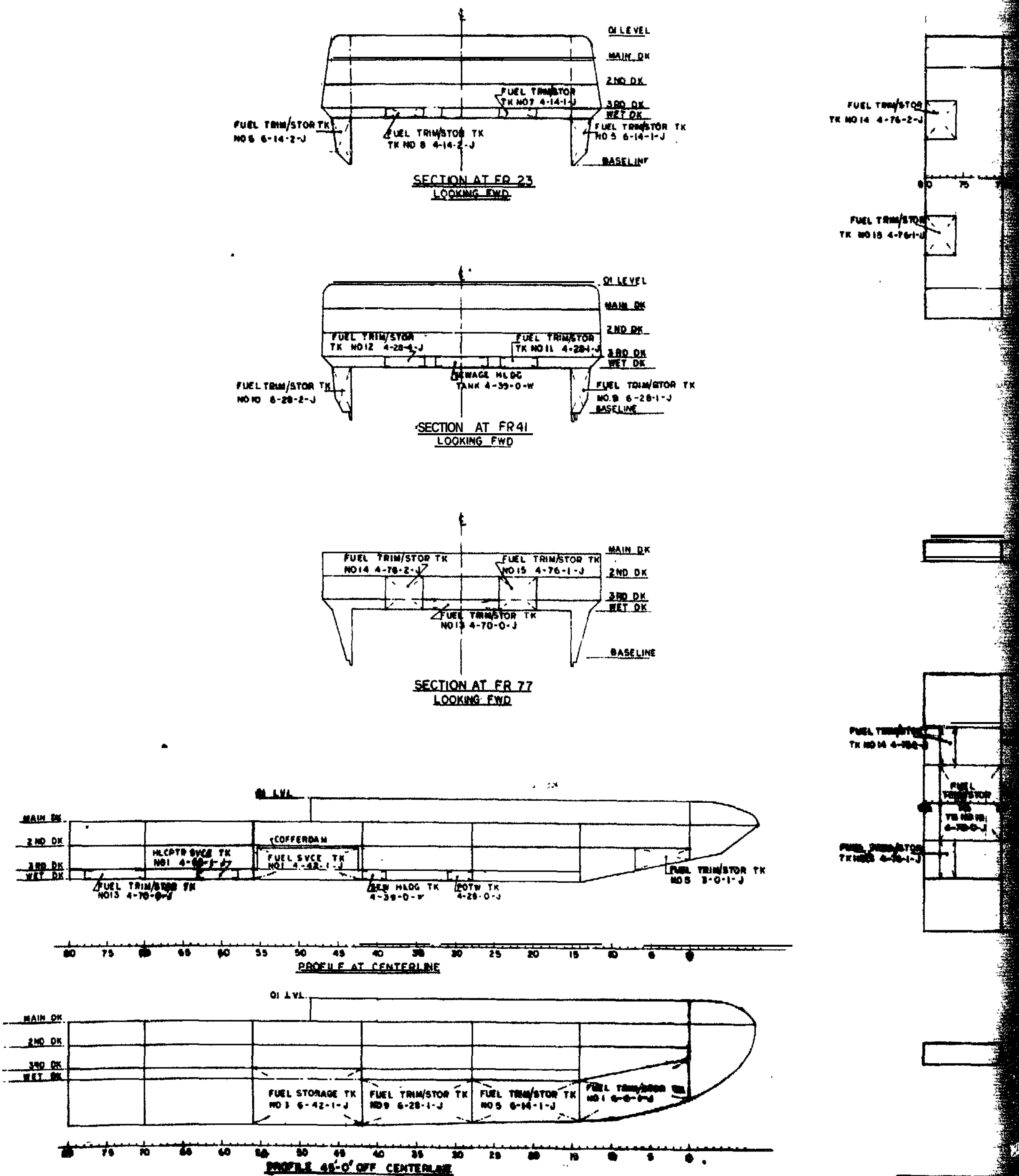
[redacted] INDUSTRIES, INC SES DIVISION

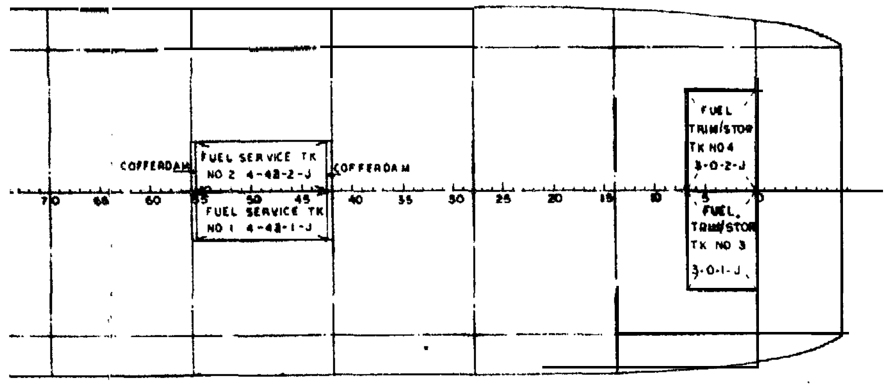
3KSES
GENERAL ARRANGEMENT
BOW & STERN VIEWS

SIZE J — CODE IDENT NO 51583 — DWG NO LL802011 — REV B

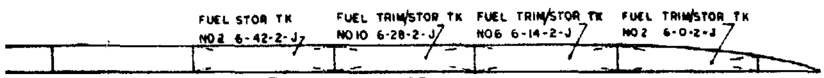
SCALE 1/8" = 1' — SHEET 1 OF 1

Figure B.1-10 (U)

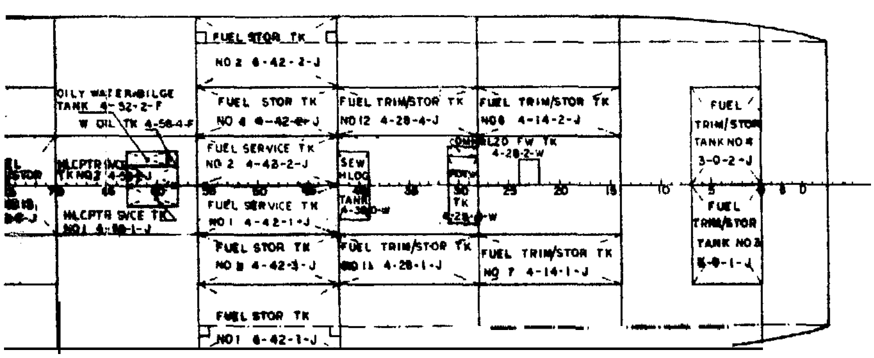

01 LEVEL
MAIN DK
2ND DK
3RD DK
WET DK
BASELINE
FUEL TRIM/STOR TK NO 7 4-14-1-J
FUEL TRIM/STOR TK NO 6 6-14-2-J
FUEL TRIM/STOR TK NO 8 4-14-2-J
FUEL TRIM/STOR TK NO 5 6-14-1-J
SECTION AT FR 23
LOOKING FWD
FUEL TRIM/STOR TK NO 12 4-28-4-J
FUEL TRIM/STOR TK NO 11 4-28-1-J
FUEL TRIM/STOR TK NO 10 6-28-2-J
SEWAGE HLDG TANK 4-39-0-W
FUEL TRIM/STOR TK NO 9 6-28-1-J
SECTION AT FR41
LOOKING FWD
FUEL TRIM/STOR TK NO14 4-76-2-J
FUEL TRIM/STOR TK NO15 4-76-1-J
FUEL TRIM/STOR TK NO13 4-70-0-J
SECTION AT FR 77
LOOKING FWD
01 LVL
COFFERDAM
HLCPTR SVCE TK NO1 4-60-1-J
FUEL SVCE TK NO1 4-42-1-J
FUEL TRIM/STOR TK NO13 4-70-0-J
SEW HLDG TK 4-39-0-W
POTW TK 4-28-0-J
FUEL TRIM/STOR TK NO5 3-0-1-J
PROFILE AT CENTERLINE
FUEL STORAGE TK NO 3 6-42-1-J
FUEL TRIM/STOR TK NO9 6-28-1-J
FUEL TRIM/STOR TK NO5 6-14-1-J
PROFILE 45'-0" OFF CENTERLINE



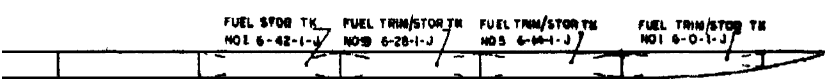
PLAN AT 3RD DECK



PLAN VIEW OF PORT SIDEHULL
BELOW WETDECK



PLAN AT WET DK



RAN VIEW OF STBD SIDEHULL
BELOW WET DECK

TANK		LOCATION DECK	LOCATION FRAMES	VOL 100% FULL (FT³)	VOL 95% FULL (FT³)	DENSITY CUFT/TON	WEI (TO
FUEL TRIM/STOR TK	NO 1	S/HULL	0-7	4108 9	3913 2	44 04	88
	NO 2	↓	0-7	4108 9	3913 2		88
	NO 3	WET	0-7	3896 4	3710 9		84
	NO 4	↓	0-7	3896 4	3710 9		84
	NO 5	S/HULL	14-28	4163 2	3965 0		90
	NO 6	↓	14-28	4163 2	3965 0		90
	NO 7	WET	14-28	2409 2	2294 5		52
	NO 8	↓	14-28	2409 2	2294 5		52
	NO 9	S/HULL	28-42	4373 9	4165 7		94
	NO 10	↓	28-42	4373 9	4165 7		94
	NO 11	WET	28-42	2409 2	2294 5		52
	NO 12		28-42	2409 2	2294 5		52
	NO 13		70-78	2620 5	2751 5		5
	NO 14		76-78	1892 9	1802 8		4
↓	NO 15	↓	76-78	1892 9	1802 8	↓	4
SUB-TOTAL							106
FUEL STORAGE TK	NO 1	S/HULL	42-56	8416 7	8015 9	44 04	18
	NO 2	↓	42-56	8416 7	8015 9		18
	NO 3	WET	42-56	2409 2	2294 5		5
↓	NO 4	↓	42-56	2409 2	2294 5	↓	5
SUB-TOTAL							40
FUEL SERVICE TK	NO 1	WET	42½-55½	6709 6	6390	44 04	14
↓	NO 2	↓	42½-55½	6709 6	6390 1	↓	14
SUB-TOTAL							29
HLCPTR SVCE TK	NO 1	WET	58-63	352 8	335 1	44 04	
↓	NO 2	↓	58-63	352 8	335 1	↓	
SUB-TOTAL							
WASTE OIL TANK		WET	58-59	47 0	44 7	38 96	
OILY WATER BILGE TK		WET	59-63	188 2	178 8	↓	
SUB-TOTAL							
POTABLE WATER TANK		WET	28-31	705 6		36 00	
DEMINERALIZED FW TANK		WET	28-31	105 8		↓	
SUB TOTAL							
SEWAGE HOLDING TANK		WET	39-42	705 6		35 00	

WEIGHT (TONS)	CG VERT (FT)	CG LONG (FT)	CG TRANS (FT)	FS MOMS (FT TONS)
[illegible]·9	13 82	218·30	+45·18	15·7
[illegible]·9	13 82	218·30	-45·18	15 7
[illegible]·3	27 46	228 25	+14 66	943·6
[illegible]·3	27 46	228·25	-14·66	943·6
[illegible]0·0	10·03	176·61	+45 56	29 8
[illegible]0·0	10 03	176 61	-45 56	29·8
[illegible]2·1	19·90	177·00	+22·00	236·2
[illegible]·1	19·90	177·00	-22·00	236·2
[illegible]·6	9·87	134 88	+45·66	31·2
[illegible]·6	9·87	134 88	-45·66	31·2
[illegible]·1	19 90	135·00	+22·00	236·2
[illegible]·1	19·90	135·00	-22·00	236·2
[illegible]9·5	19·90	18 00	0	1077·3
[illegible]0·9	25·03	6·57	-22 00	67 5
[illegible]0·9	25·03	6·57	+22 00	67·5
[illegible]5 3	17·03	158·38	0	4197·7
[illegible]2·0	13·87	92·83	+43·63	1064 9
[illegible]2 0	13 87	92 83	-43·63	1064 9
[illegible]52·1	19·90	93 00	+22 00	236 2
[illegible]2·1	19 90	93 00	-22·00	236·2
[illegible]68 2	15·21	92 87	0	2602 2
[illegible]5·1	23·70	93 00	+7·33	219 1
[illegible]5·1	23 70	93 00	-7 33	219·4
[illegible]0·2	23·70	93 00	0	438 2
[illegible]7·6	19·90	181 5	+3 0	5 8
[illegible]7·6	19·90	184 5	-3 0	5 8
[illegible]15·2	19 90	181·5	0	11 6
[illegible]1·2	19·90	175·5	-8·0	0·4
[illegible]4·6	19·90	183·0	+8 0	1 6
[illegible]5·8	19·90	181·3	0	2 0
[illegible]9·6	20·00	88·5	+1 5	156·9
[illegible]2·9	20·00	88·5	-10·0	0·5
[illegible]2·5	20 00	88 5	0 02	157 4
[illegible]20·2	20·00	121 5	0	161·4

GENERAL NOTES

1. CENTER OF GRAVITY LOCATIONS -
   VERTICAL IS MEASURED ABOVE BASELINE
   LONGITUDINAL IS MEASURED FORWARD a THE TRANSOM (FRAME NO SC,
   TRANSVERSE IS MEASURED OUTBOARD ff THE CENTERLINE
   STBD +VE PORT -VE
2. TANKS GEOMETRY IS BASED ON HULL LINES DRAWING NO LL 802009 REFERENCE NO 1
3. TANK NUMBERING IS BASED Oh GENERAL SPECIFICATIONS FOR SHIPS OF THE US NAVY, REFERENCE NO2
4. TANK CAPACITIES & CENTERS SHOWN HEREIN ARE DERIVED FROM REPORT NO 890-801-23 REFERENCE NOS.
5. THE DENSITY OF THE JP 5 FUEL IS DERIVED FROM PROPERTIES OF FLUIDS & GASSES TABLE P 5.16 REFERENCE NO 4

DOCUMENT RELEASE

NO	DWG NO	TITLE
4		SAWE WEIGHT ENGR HANDBOOK DATED DEC 1968
3	890·801-23	LSES TANK ARR & TK CAP REPORT DATED 5-21-76
2	MS 0902-001-5000	GEN SPECS FOR SHIPS OF THE US NAVY.
1	LL 802009	LSES HULL LINES DATED 4-6-76

REFERENCES

INDUSTRIES, INC. SES DIVISION

LSES
TANK ARRANGEMENTS & TANK CAPACITIES.

LL 801001

SHEET 1 OF 1

Figure [illegible] (U)

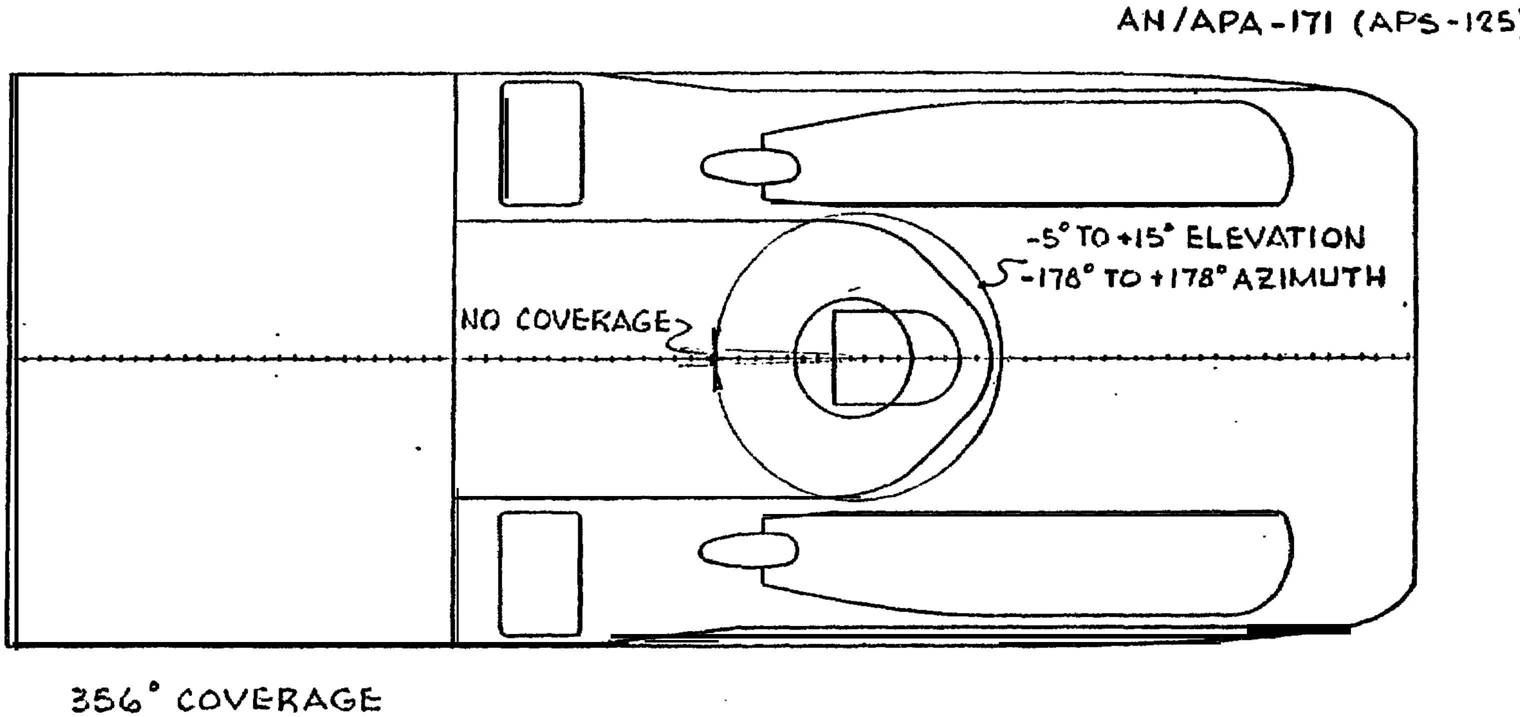
(U) B.2 WEAPON AND SENSOR COVERAGE DIAGRAMS

(U) This section of Appendix B contains the weapon and sensor coverage diagrams for the ANVCE near term SES Point Design. These diagrams are:

(U) **B.2-13** The Forward Location of the IR Sensor in the EW Suite Covers Critical Threat Approach Corridors

B.2-14 The Forward IR Sensor has an Elevation Coverage Providing an Unrestricted Field-of-View

(U) These diagrams each have descriptive titles that emphasize the features of the weapon and sensor coverage inherent in the near term SES.



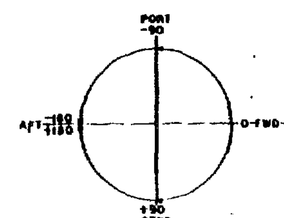


Figure B.2-1.(U): APS-125 Air Surveillance Coverage is Unobstructed (U)

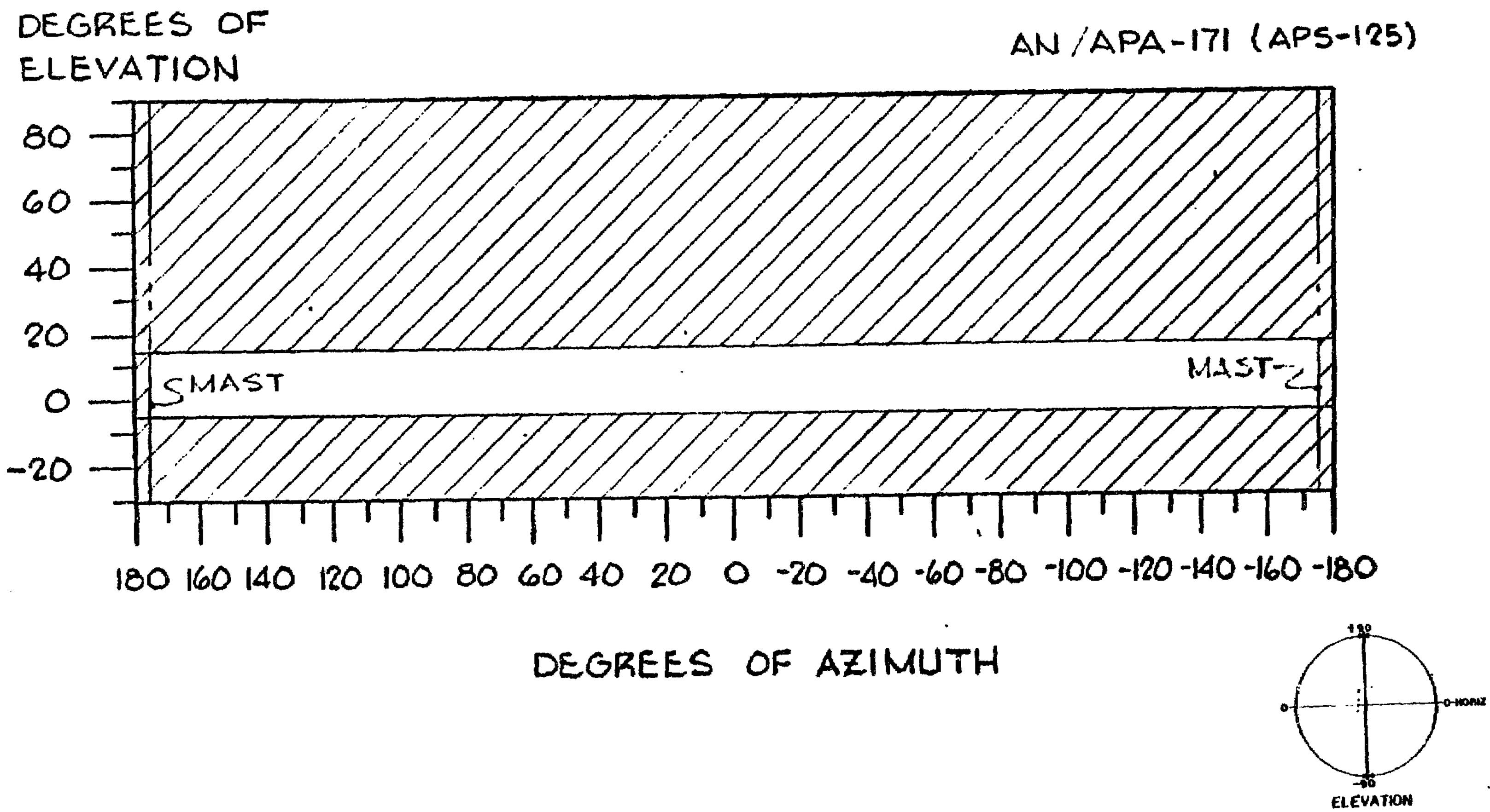


Figure B.2-2 (U): Elevation Coverage from the High APA-171 Antenna Position Extends the Radar Horizon for "Pop-Up" Threat Detections (U)

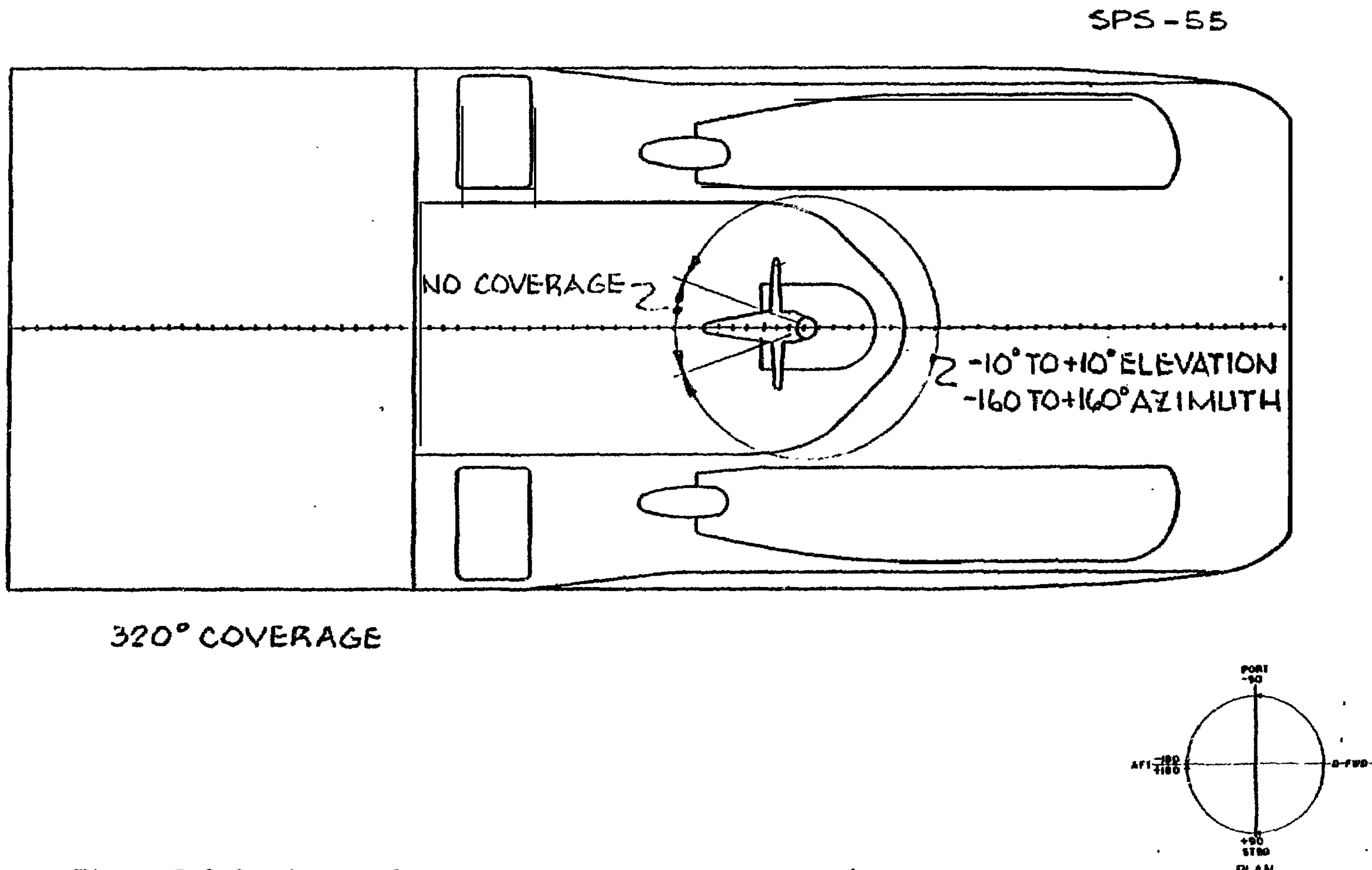


Figure B.2-3 U): Surface Search Coverage with the AN/SPS-55 is *Extensive for Maneuvering, Piloting and SUW (U)*

UNCLASSIFIED

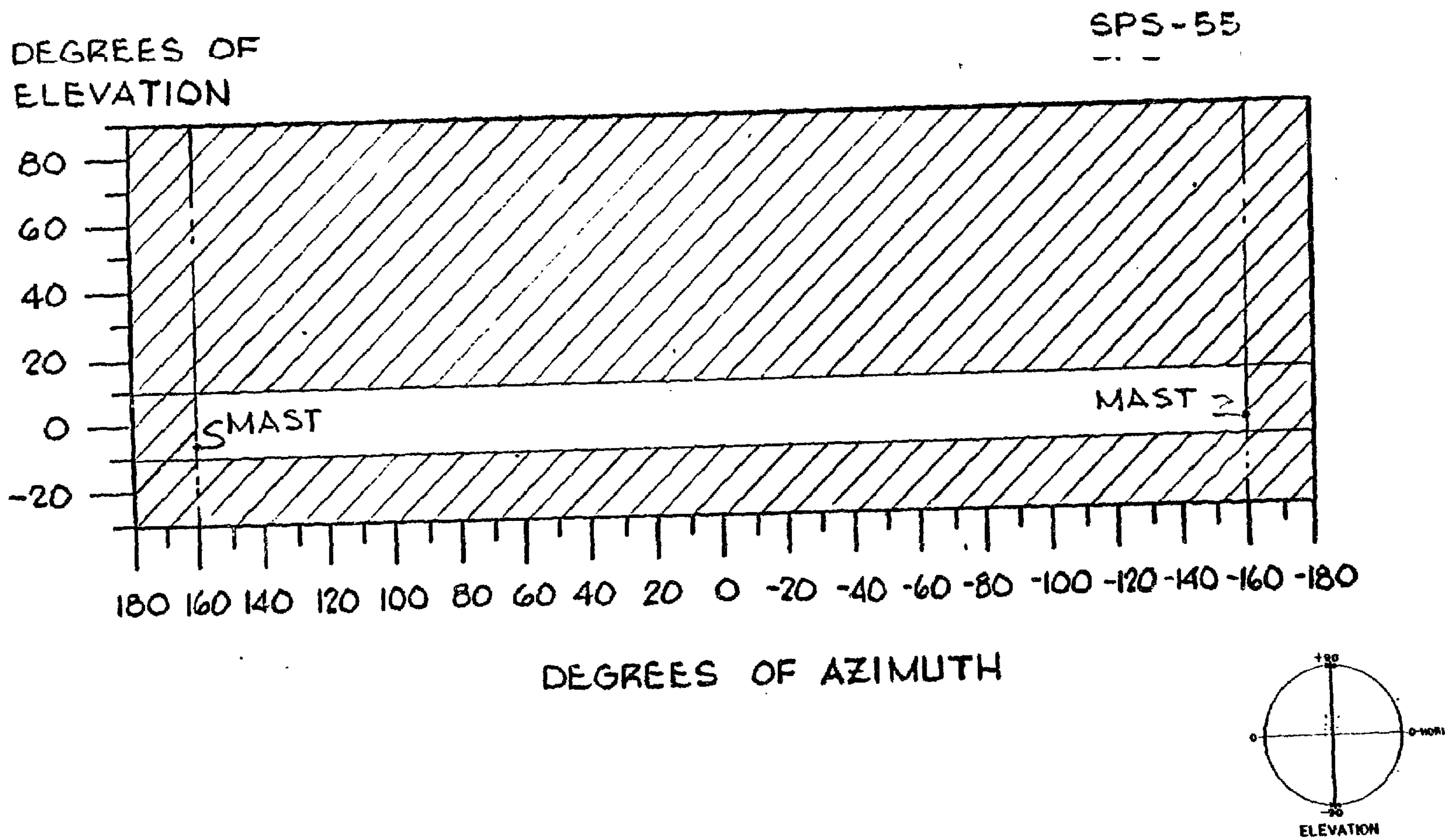


Figure B.2-4 (U): Elevation Coverage for Surface Search is not Obstructed Along Critical Azimuth Bearings (U)

UNCLASSIFIED

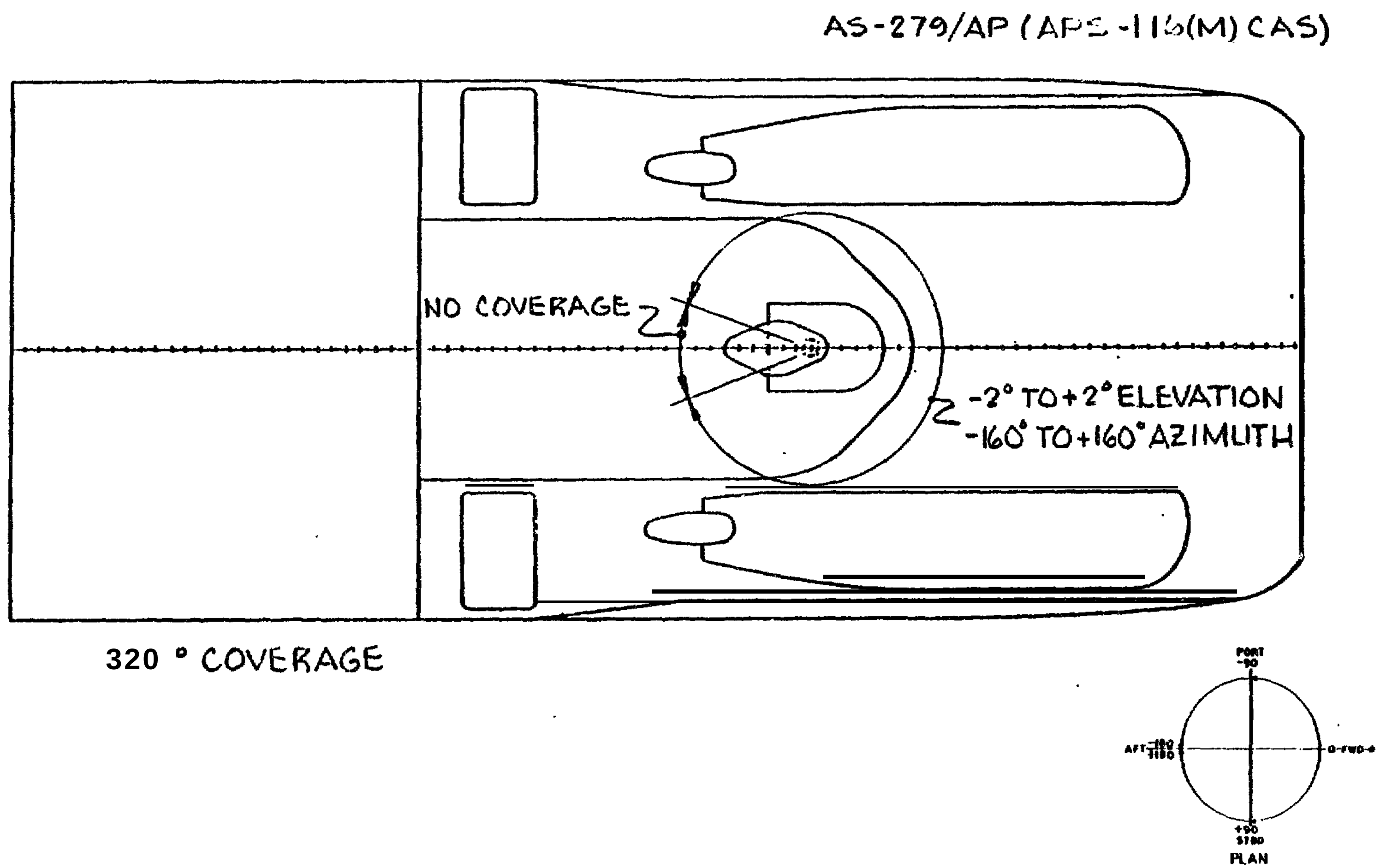


Figure 3.2-5 (U): Collision Avoidance Coverage is Unobstructed for Critical Sectors and Ship Maneuvering Options(U)

UNCLASSIFIED

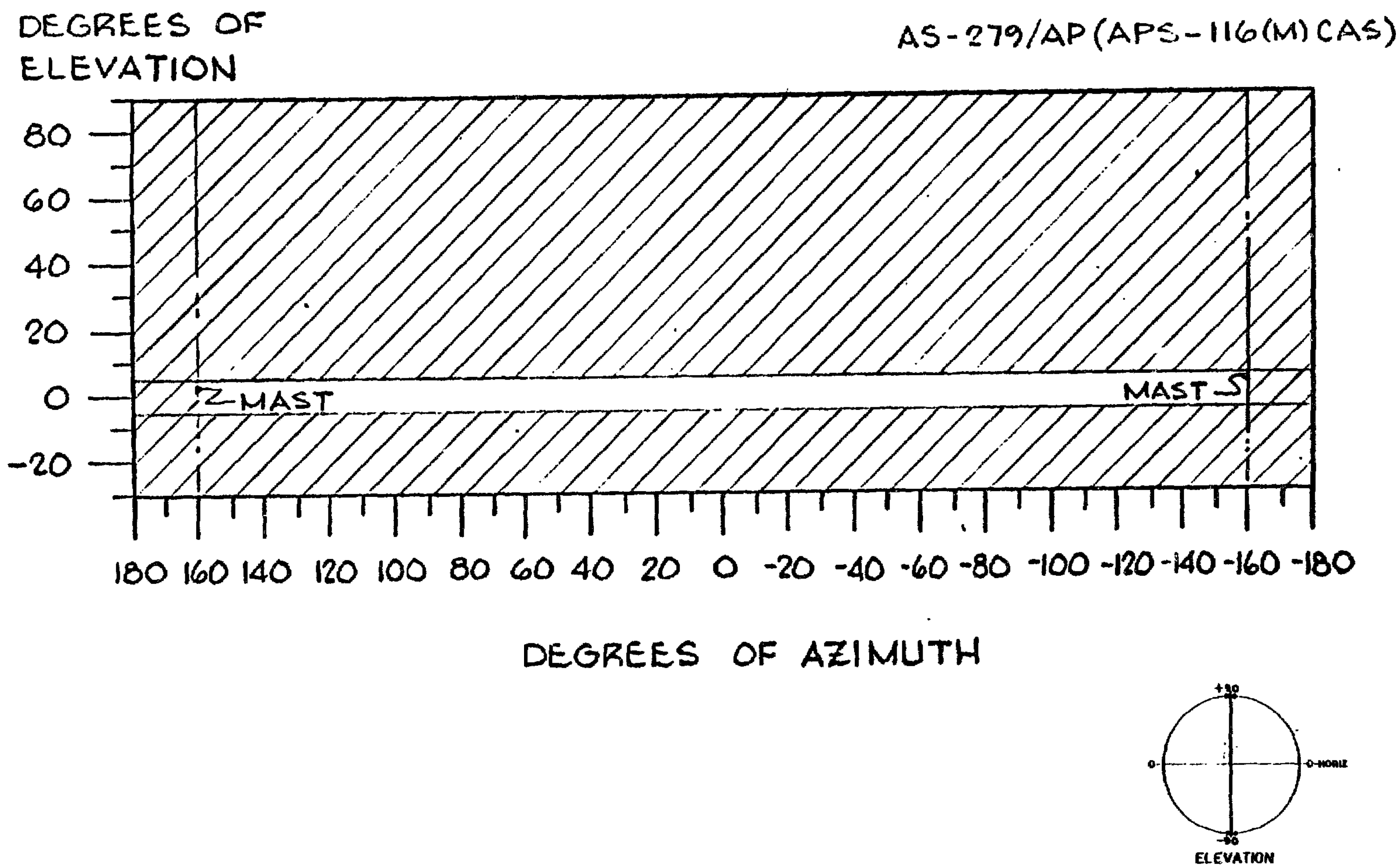


Figure B.2-6 (U): Elevation Coverage is Unobstructed for Debris Detection Close to the Ship's Bow, Dead Ahead (U)

UNCLASSIFIED

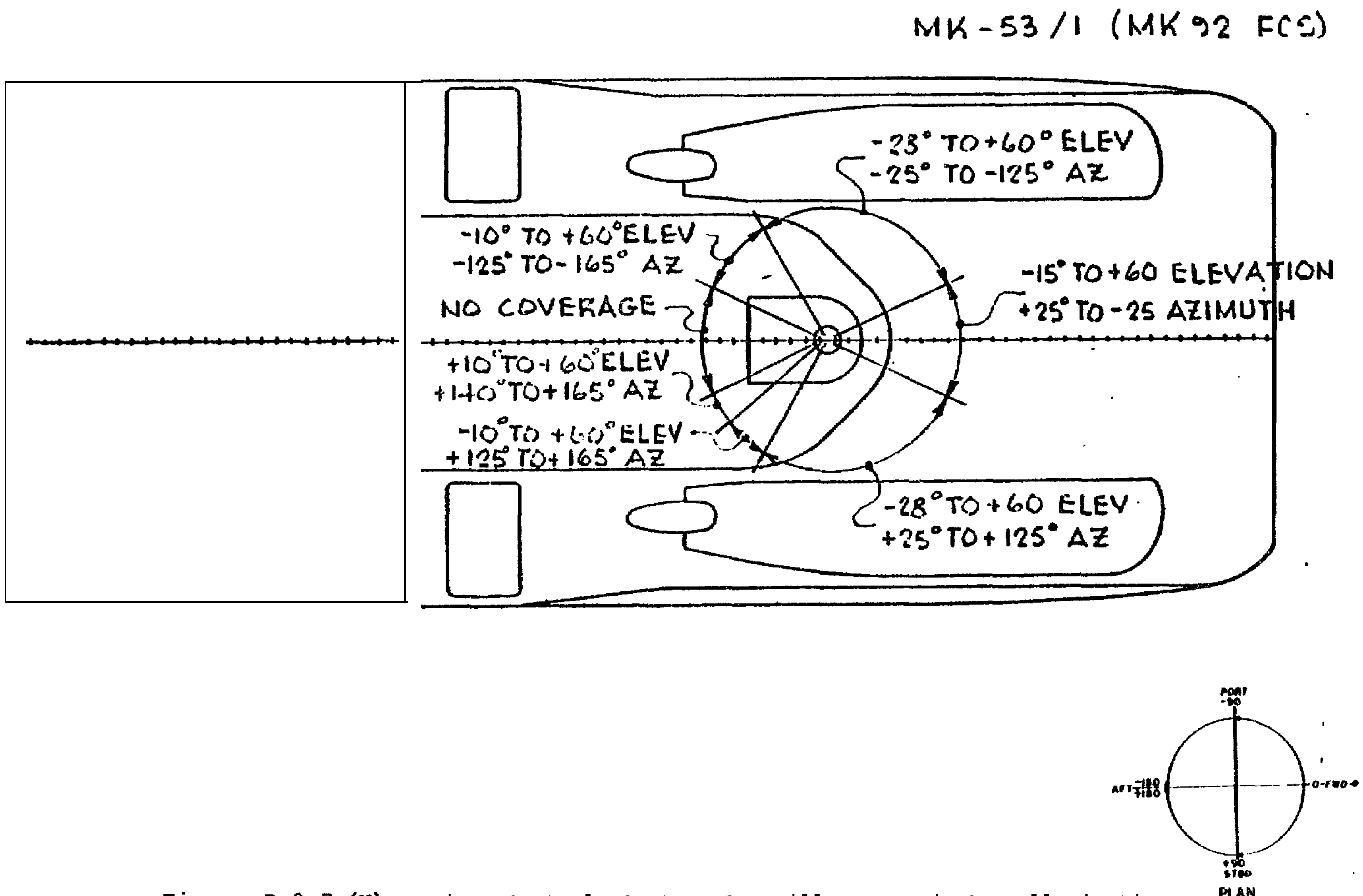


Figure B.2-7 (U): Fire Control System Surveillance and CW Illumination Coverage is Extensive (U)

UNCLASSIFIED

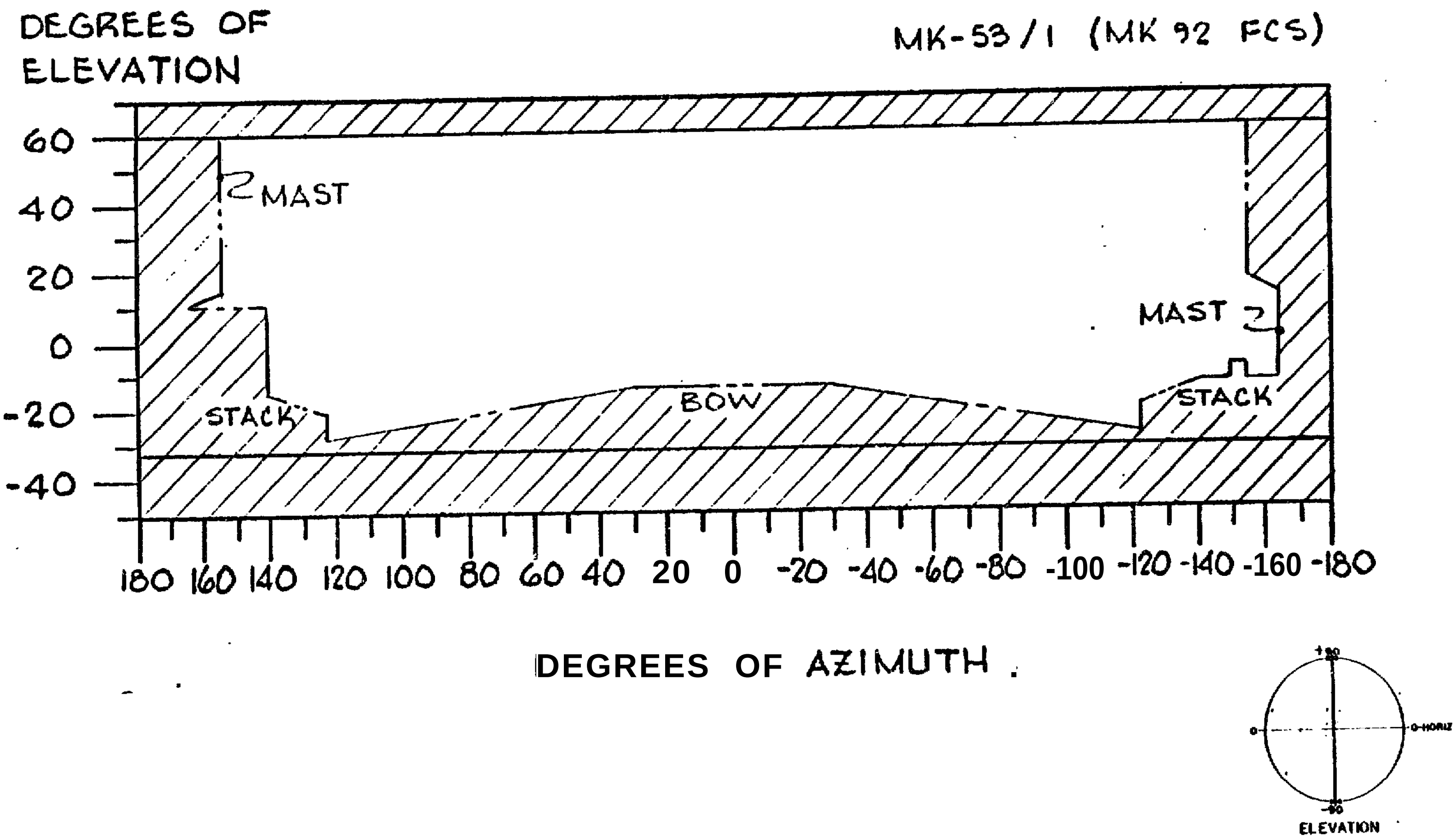


Figure B.2-8 (U): Elevation Coverage Provides Full Capability for AAW and ASMD Fire Control(U)

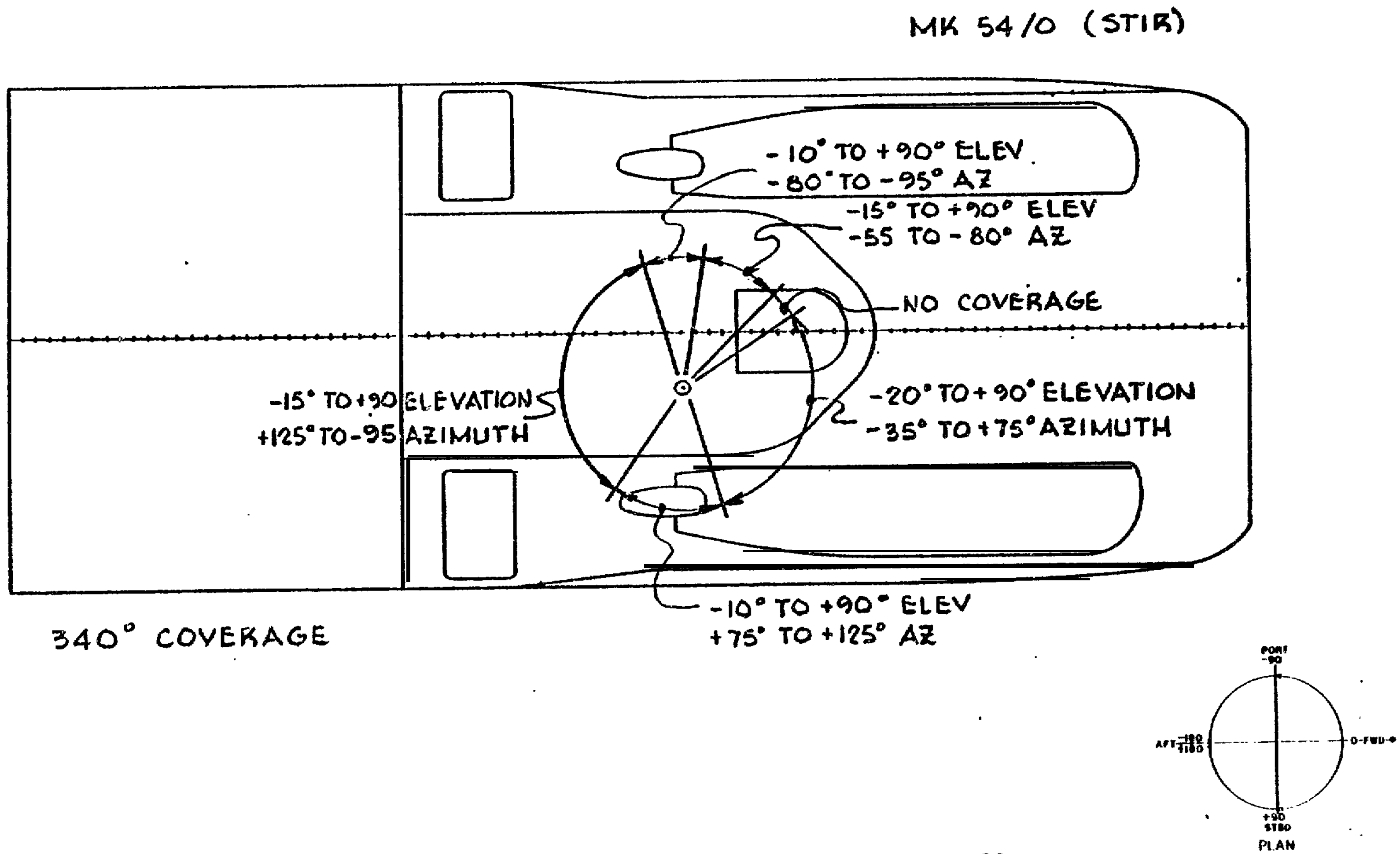
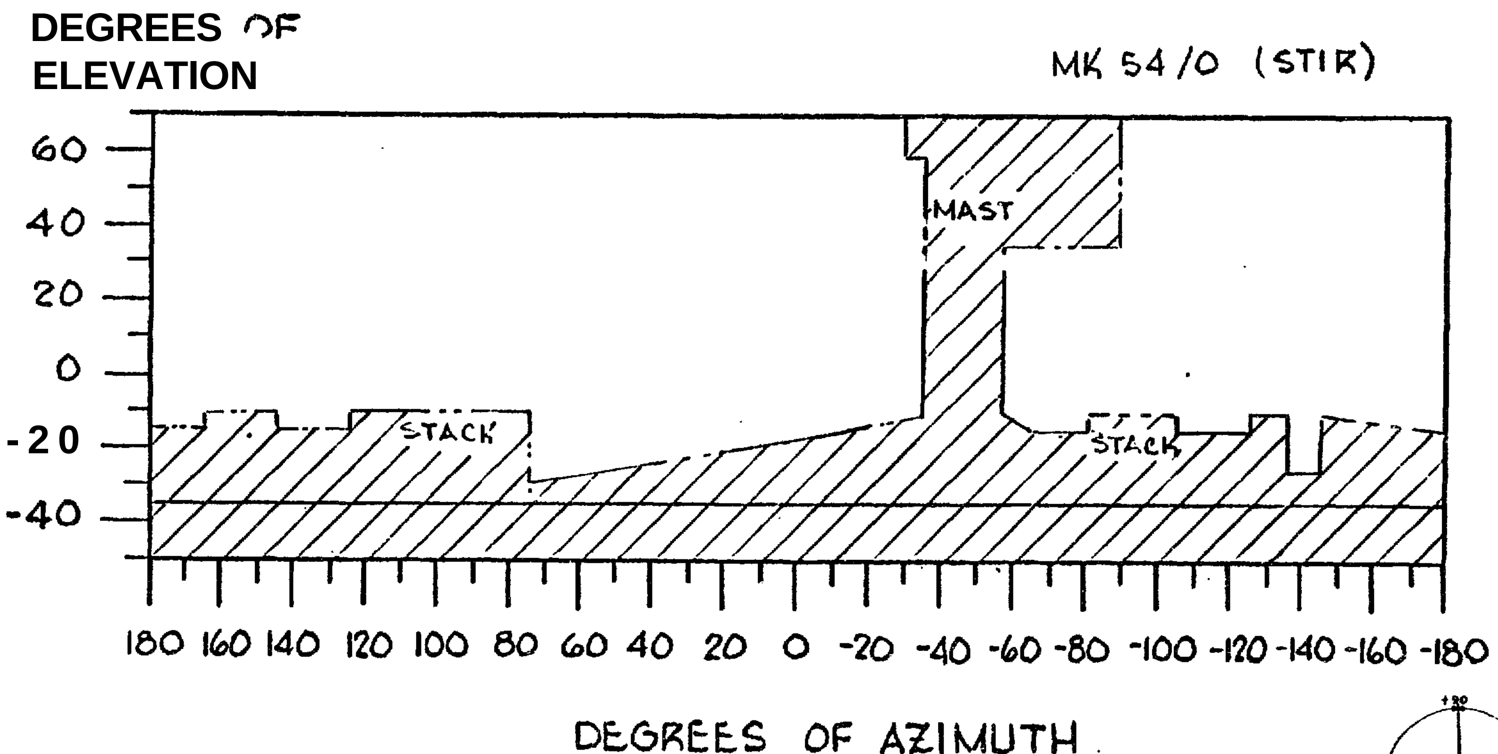


Figure B.2-9 (U): The MK 54 MOD 0 Antenna Site Augments MK92 FCS Coverage (U)



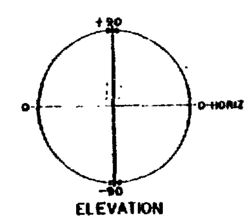


Figure B.2-10 (U): Full STIR Elevation Coverage for Sea Skimmer and Zenith Threats (U)

UNCLASSIFIED

UNCLASSIFIED

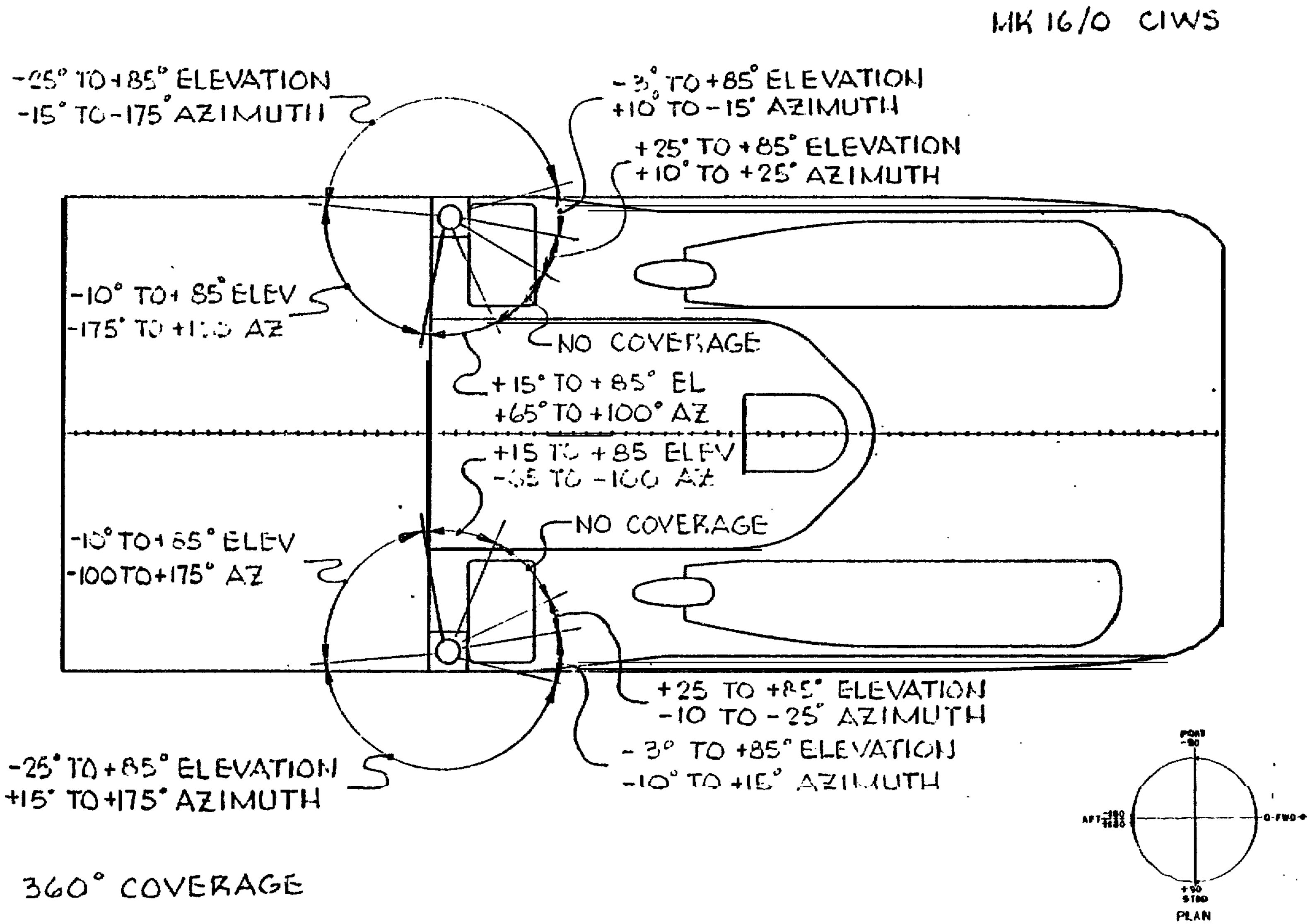
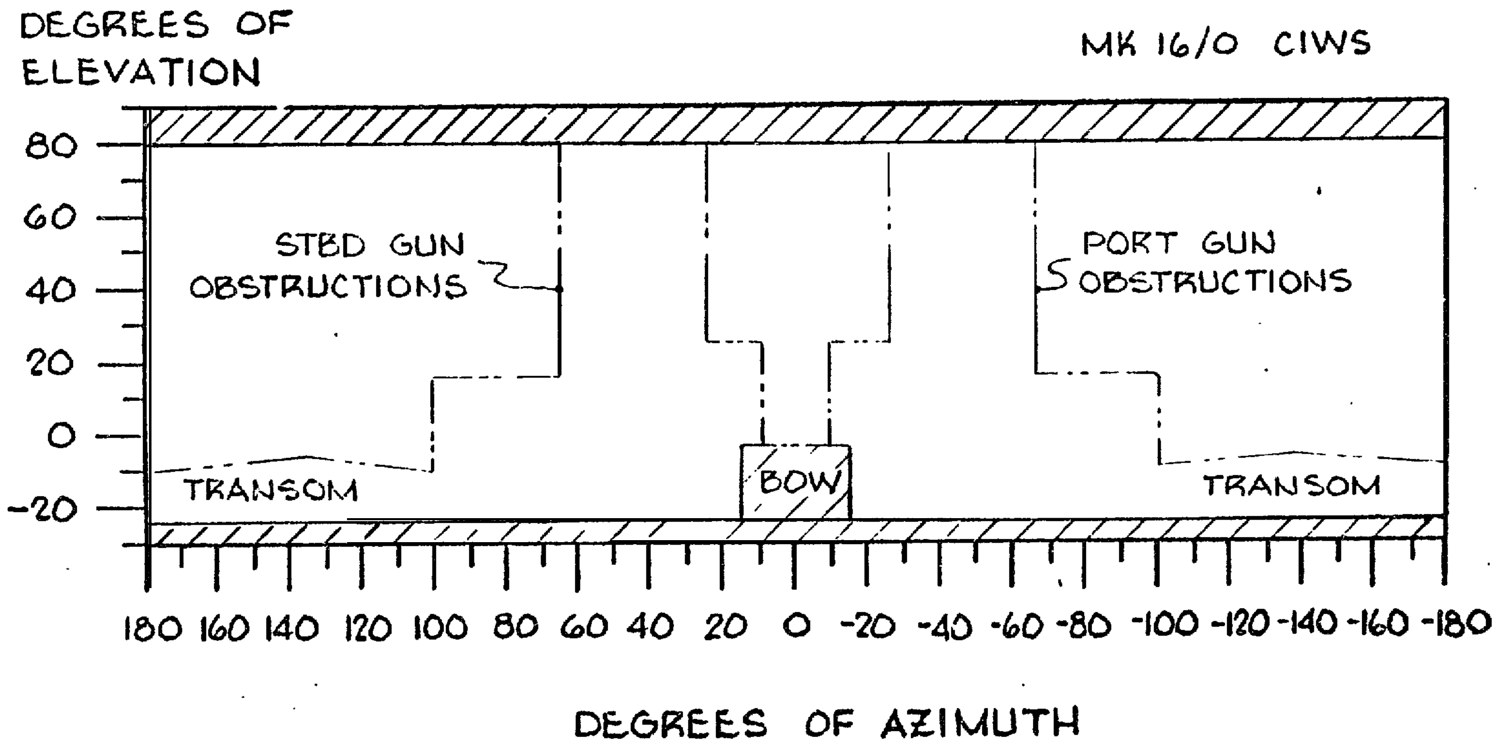


Figure B-2-11 **(U)**: The CIWS Weapons Groups Provide Complete 360-Degree ASMD Azimuth Coverage **(U)**

UNCLASSIFIED



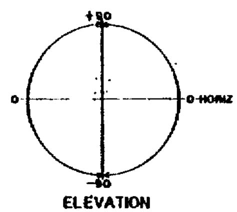


Figure B.2-12 (U): Full CIWS Weapons Group Elevation Limits are Only Reduced in Depression for a Small Sector Dead Ahead (U)

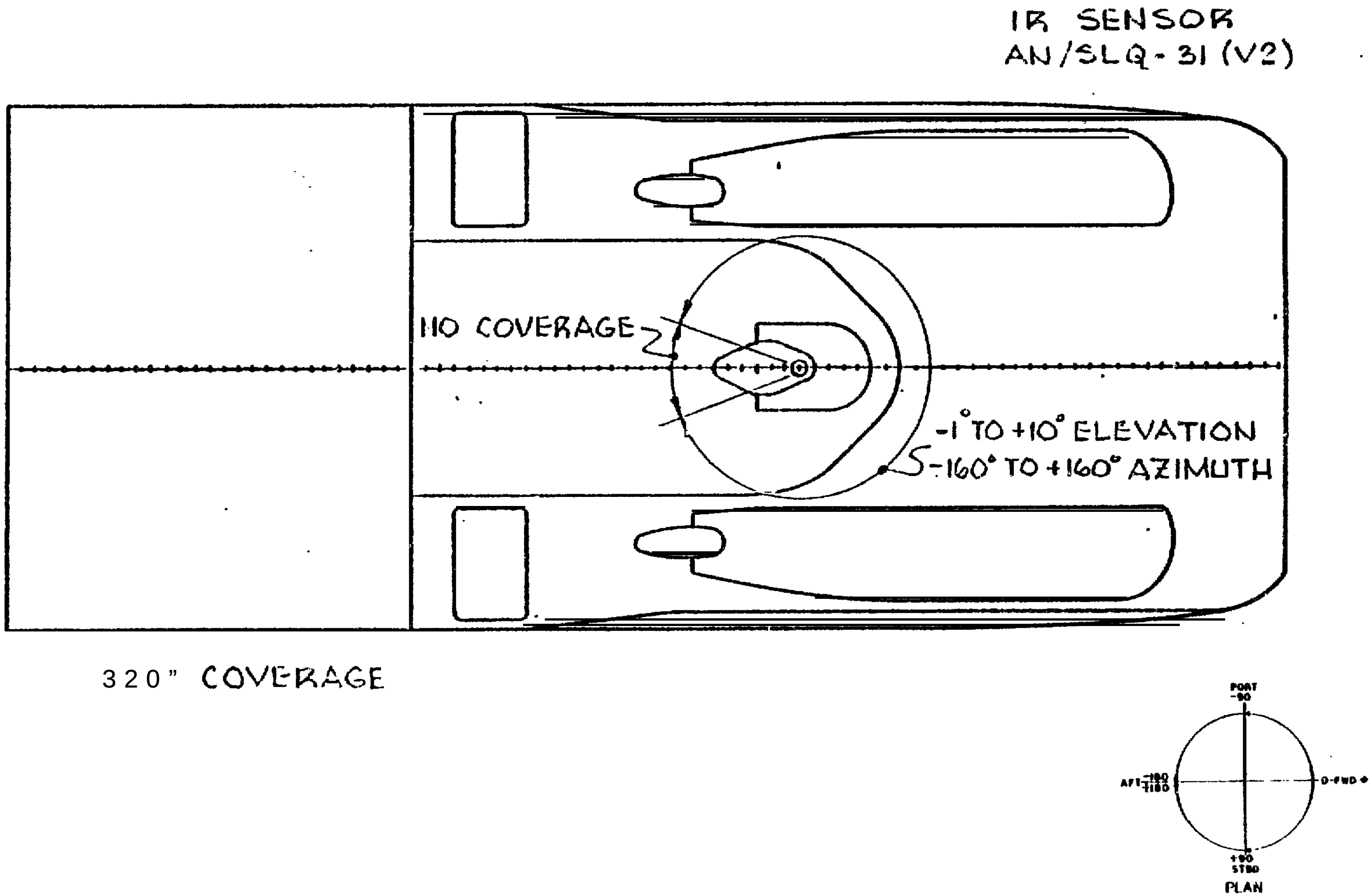
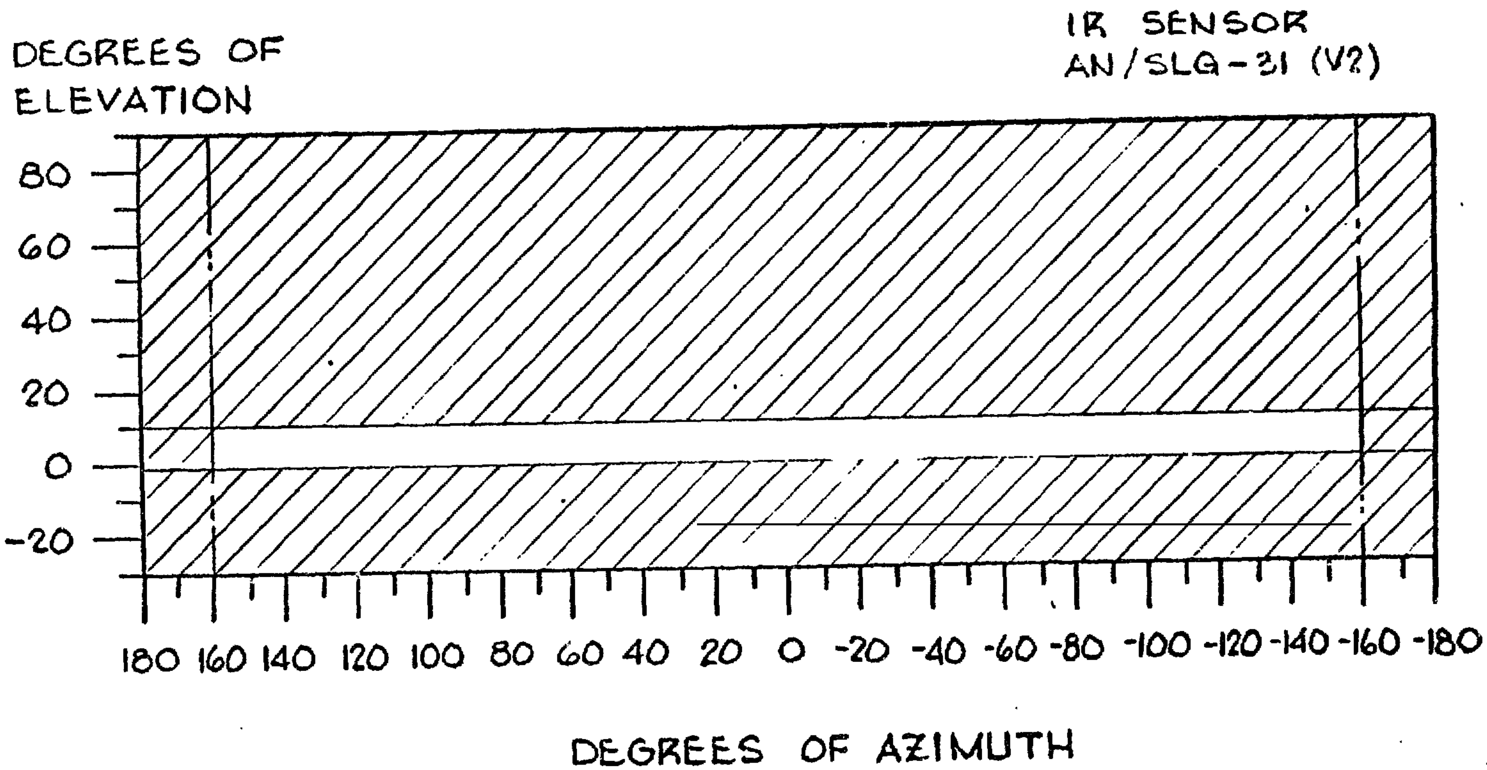


Figure B.2-13 (U): The Forward Location of the IR Sensor in the EW Suite Covers Critical Threat Approach Corridors (U)

UNCLASSIFIED



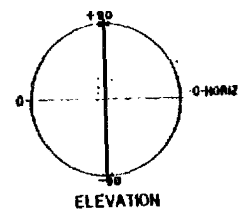
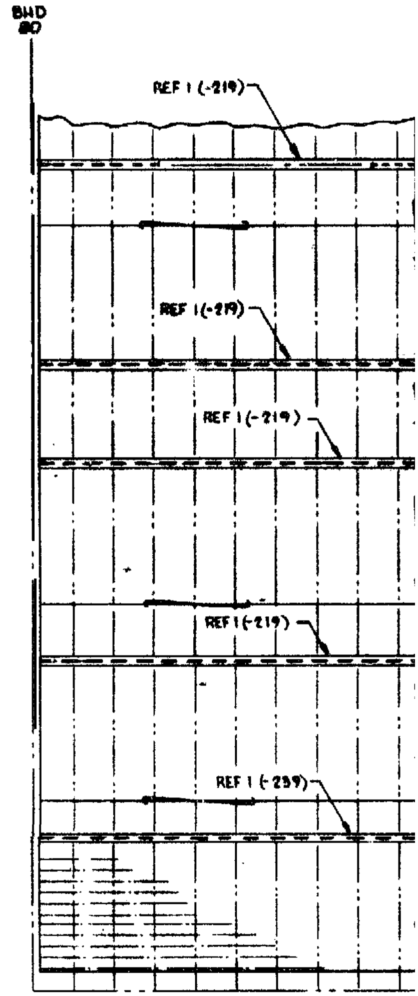


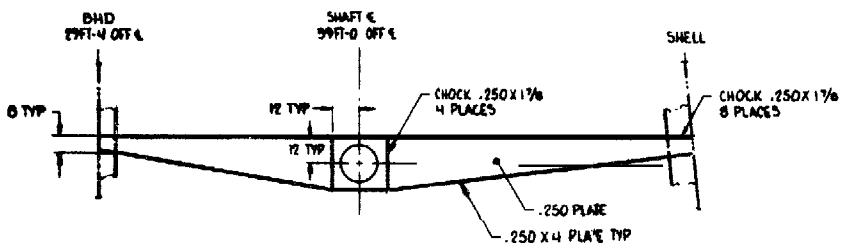
Figure B.2-14 (U): The Forward IR Sensor has an-Elevation Coverage Providing an Unrestricted Sensor Field of View (U)

(U) B.3 STRUCTURE DRAWINGS

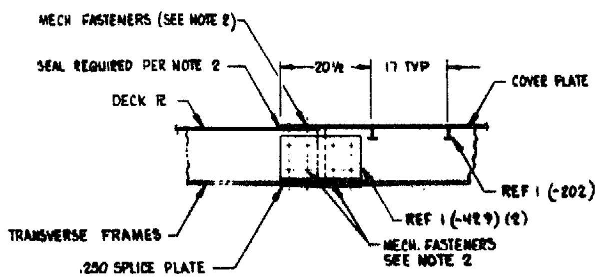
(U) This section of Appendix B contains the structure drawings for the ANVCE near term SES Point Design. These drawings are:

Figure	Title
B.3-1	Deck Plating - Main Deck
B.3-2	Bulkhead - Long, CL
B.3-3	Transverse Bulkheads
B.3-4	Transverse Frame
B.3-5	Bow Plating and Framing
B.3-6	Superstructure
B.3-7	Extrusions - Structural
B.3-8	Tabulation - Plating/Tee

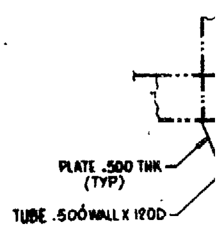




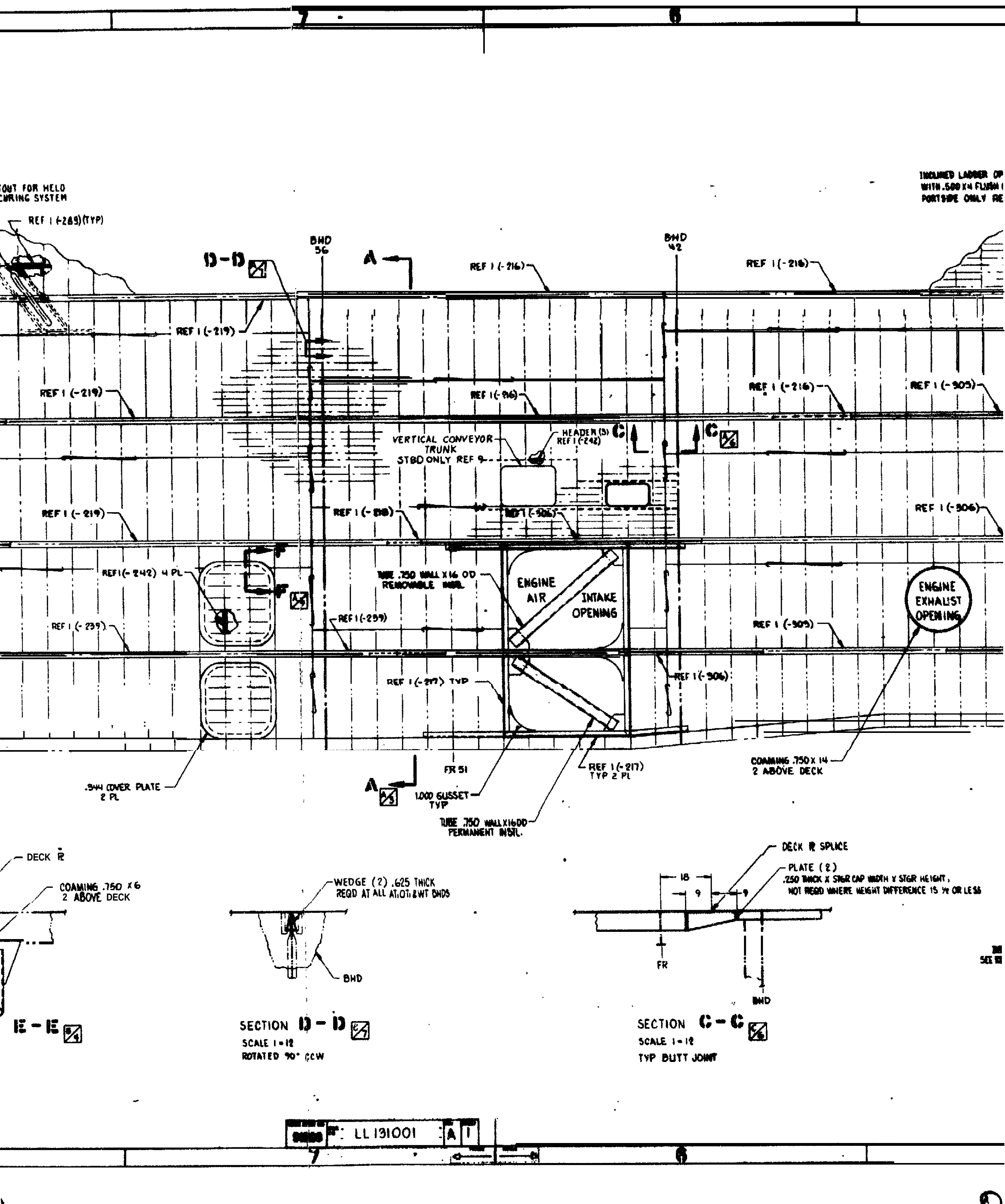
SECTION G-G
SCALE 1/2
ROTATED 90°
FAN SHAFT SUPPORT FRAME TYP 2 PL
FOR 3 FAN CONFIGURATION ONLY



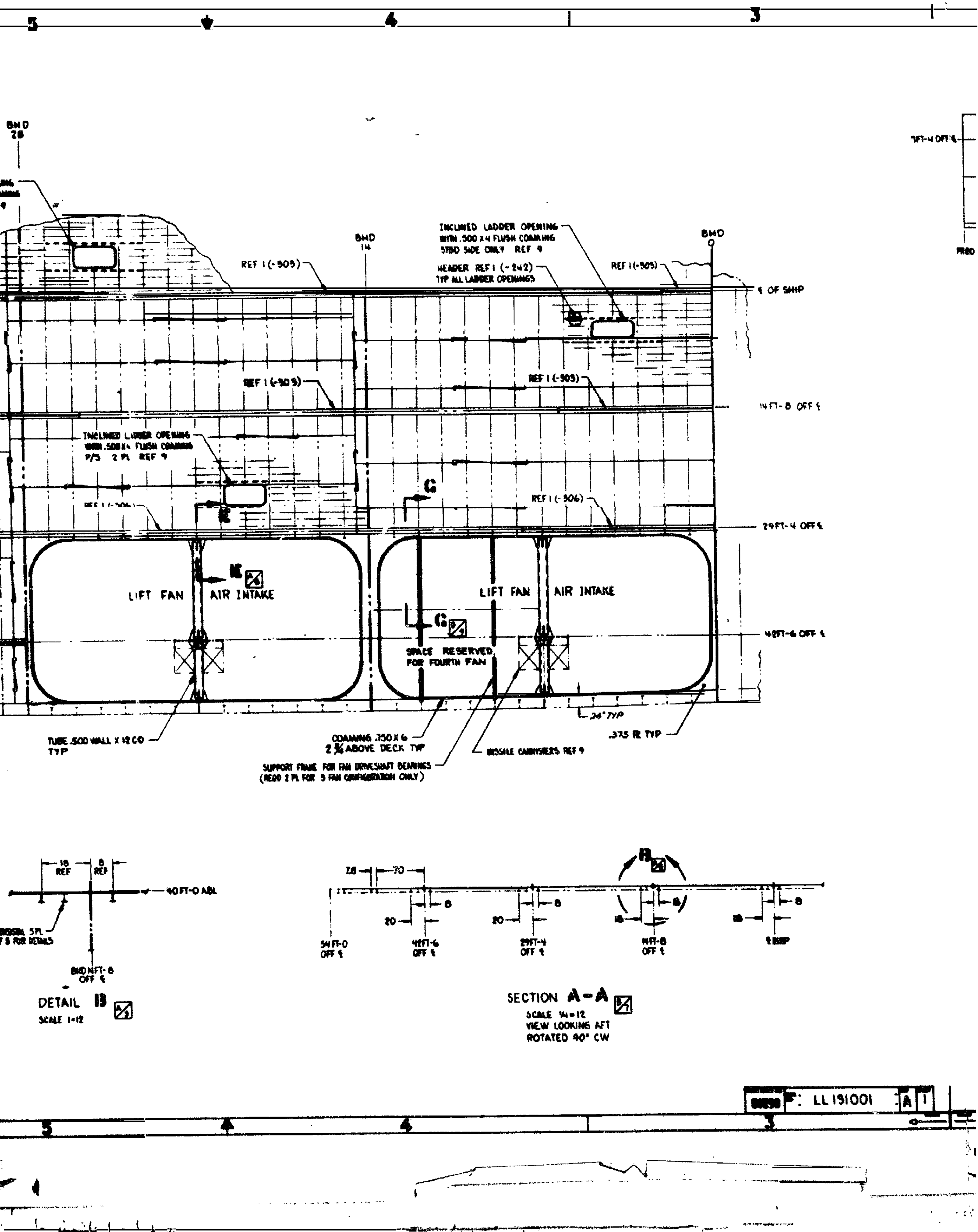
SECTION F-F
SCALE 1 = 12
ROTATED 90° CCW
TYP PLATE & FRAME SPLICE



SEC
SCA

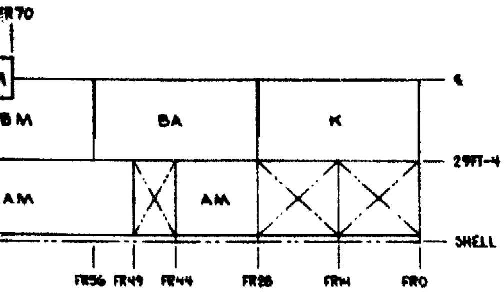


7
6
OUT FOR HELO
CURING SYSTEM
REF 1 (-289)(TYP)
D-D
BHD 56
A
REF 1 (-216)
BHD 42
REF 1 (-216)
INCLINED LADDER OP
WITH .500 X4 FLUSH
PORTSIDE ONLY RE
REF 1 (-219)
REF 1 (-219)
REF 1 (-216)
REF 1 (-216)
REF 1 (-305)
VERTICAL CONVEYOR
TRUNK
STBD ONLY REF 9
HEADER (5)
REF 1 (-242)
C
C
REF 1 (-219)
REF 1 (-218)
REF 1 (-306)
REF 1 (-306)
REF 1 (-242) 4 PL
TUBE .750 WALL X 16 OD
REMOVABLE INSTL
ENGINE
AIR
INTAKE
OPENING
ENGINE
EXHAUST
OPENING
REF 1 (-239)
REF 1 (-239)
REF 1 (-305)
REF 1 (-217) TYP
REF 1 (-306)
FR 51
REF 1 (-217)
TYP 2 PL
COAMING .750 X 14
2 ABOVE DECK
.344 COVER PLATE
2 PL
A
1.000 GUSSET
TYP
TUBE .750 WALL X 1600
PERMANENT INSTL.
DECK PL
COAMING .750 X 6
2 ABOVE DECK
WEDGE (2) .625 THICK
REQD AT ALL AT, OT, & WT BHDS
BHD
DECK PL SPLICE
PLATE (2)
.250 THICK X STGR CAP WIDTH X STGR HEIGHT,
NOT REQD WHERE HEIGHT DIFFERENCE IS ½ OR LESS
18
9
9
FR
BHD
E-E
SECTION D-D
SCALE 1=12
ROTATED 90° CCW
SECTION C-C
SCALE 1=12
TYP BUTT JOINT
LL 131001
A
1
7
6



BHD 28
INCLINED LADDER OPENING WITH .500 X 4 FLUSH COAMING STBD SIDE ONLY REF 9
BHD 14
BHD 0
REF 1(-303)
HEADER REF 1 (-242) TYP ALL LADDER OPENINGS
REF 1(-303)
¢ OF SHIP
REF 1(-303)
REF 1(-303)
14 FT-8 OFF ¢
INCLINED LADDER OPENING WITH .500 X 4 FLUSH COAMING P/S 2 PL REF 9
G
REF 1(-306)
29 FT-4 OFF ¢
LIFT FAN AIR INTAKE
LIFT FAN AIR INTAKE
42FT-6 OFF ¢
SPACE RESERVED FOR FOURTH FAN
24" TYP
.375 R TYP
TUBE .500 WALL X 12 OD TYP
COAMING .750 X 6 2 3/4 ABOVE DECK TYP
MISSILE CANNISTERS REF 9
SUPPORT FRAME FOR FAN DRIVESHAFT BEARINGS (REQD 2 PL FOR 3 FAN CONFIGURATION ONLY)
18 REF
8 REF
40 FT-0 ABL
BHD 14FT-8 OFF ¢
DETAIL B
SCALE 1=12
70
20
8
54 FT-0 OFF ¢
42FT-6 OFF ¢
29FT-4 OFF ¢
14FT-8 OFF ¢
¢ SHIP
B
SECTION A-A
SCALE 1/4=12
VIEW LOOKING AFT
ROTATED 90° CW
LL 191001
A

A REVISED PER EED LC0009



PLATING/STRINGER DIAGRAM
FOR DETAILS OF PL & STGR SEE REF 2
SCALE – NONE

9. FOR LOCATION PROPORTION AND CLOSURE REQUIREMENTS OF ALL OPENINGS SEE REF 9

8. FILLET WELDS AROUND ENDS OF WELDED MEMBERS TO FORM CLOSED LOOP.

7. ABBREVIATIONS PER MIL-STD-12.

6. SEE DIAGRAM (ZONE D 2) FOR PLATING AND STRINGER COMBINATIONS.

5. STARBOARD SIDE SHOWN – PORT SIDE OPPOSITE EXCEPT AS NOTED.

4. FRAME SPACING 36 in. EXCEPT AS NOTED.

3. GENERAL STIFFENER SPACING 10 in. EXCEPT AS NOTED.

2. FABRICATE WELD AND INSPECT PER NAVSHIPS 0900-060-4010. (SEE 2K SES PROGRAM DIRECTIVES 500.12, 500.16, 500.19, 500.20)

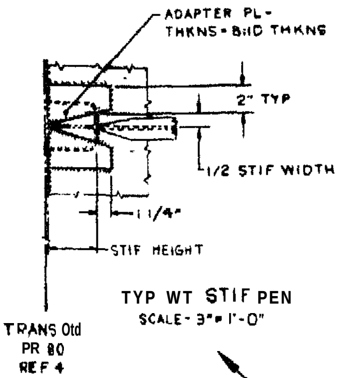
1. MATERIAL: (SHEET & PLATE) 5456 AL ALY COND H116/H117 FOR THICKNESSES .188 AND ABOVE, COND H323 FOR THICKNESSES BELOW .188, PER FED SPEC QQ-A-250/20. (EXTRUSIONS) 5456 AL ALY COND H111 PER FED SPEC QQ-A-200/7.

NOTES:

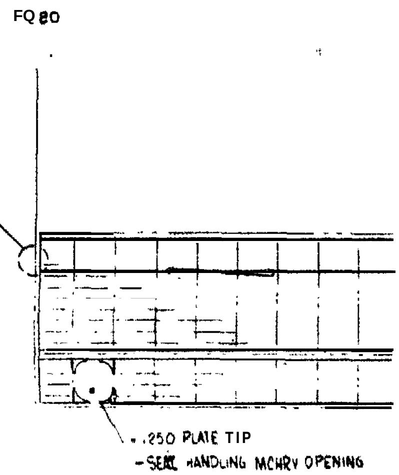
REF	DRAWING NO.	TITLE
9	LL 802004	GENERAL ARRANGEMENT MAIN DECK
8	LL 122001	BULKHEADS TRANSVERSE
7	LL 121004	BHD LONG 42FT-6 OFF ℄
6	LL 121001	BHD LONG CL
5	LL 117001	FRAMES TRANSVERSE
4	LL 111001	SHELL PLATING
3	LL 110001	BOW
2	LL 101005	PLATING/TEE TABULATION
1	LL 101004	STRL EXTRUSIONS

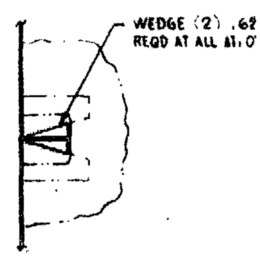
LSES DECK PLATING – MAIN DECK

J LL131001

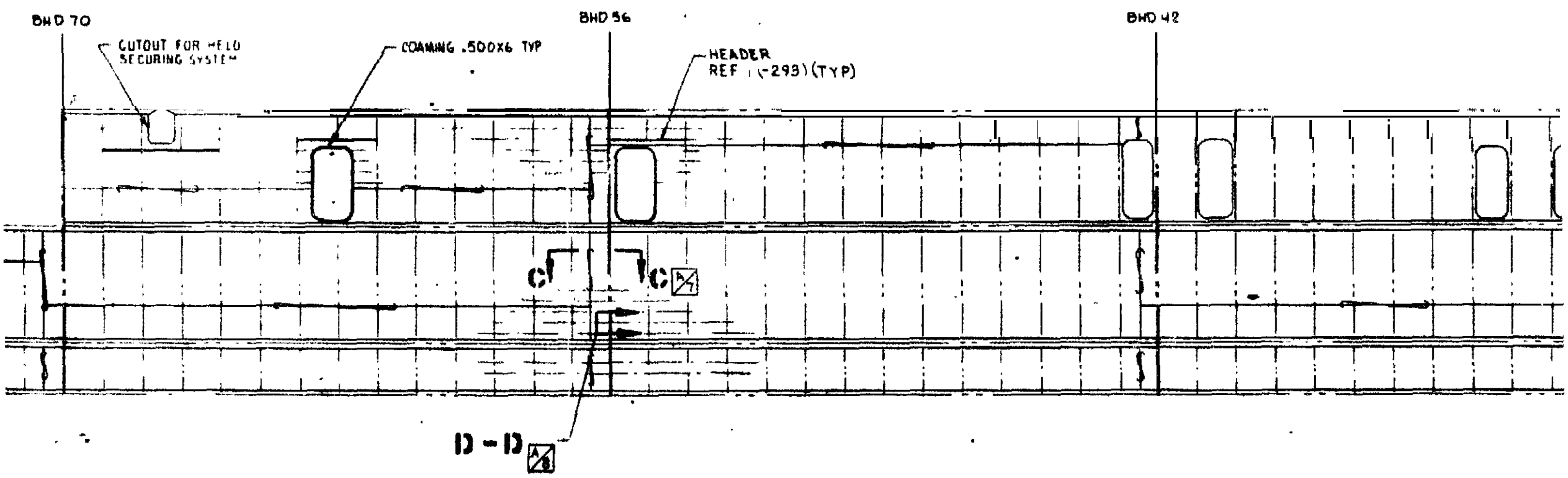


TYP WT STIF PEN
SCALE - 3" = 1'-0"

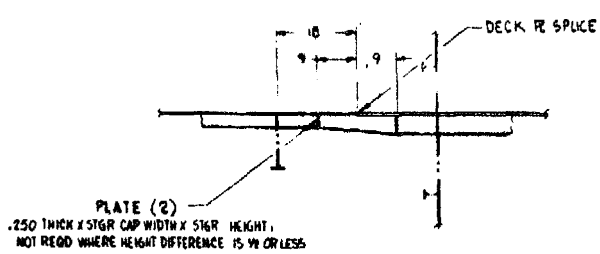




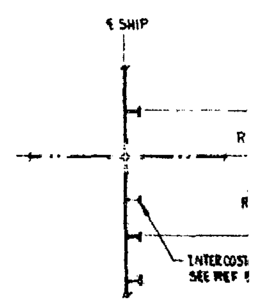
SECTION B - B
SCALE - NONE



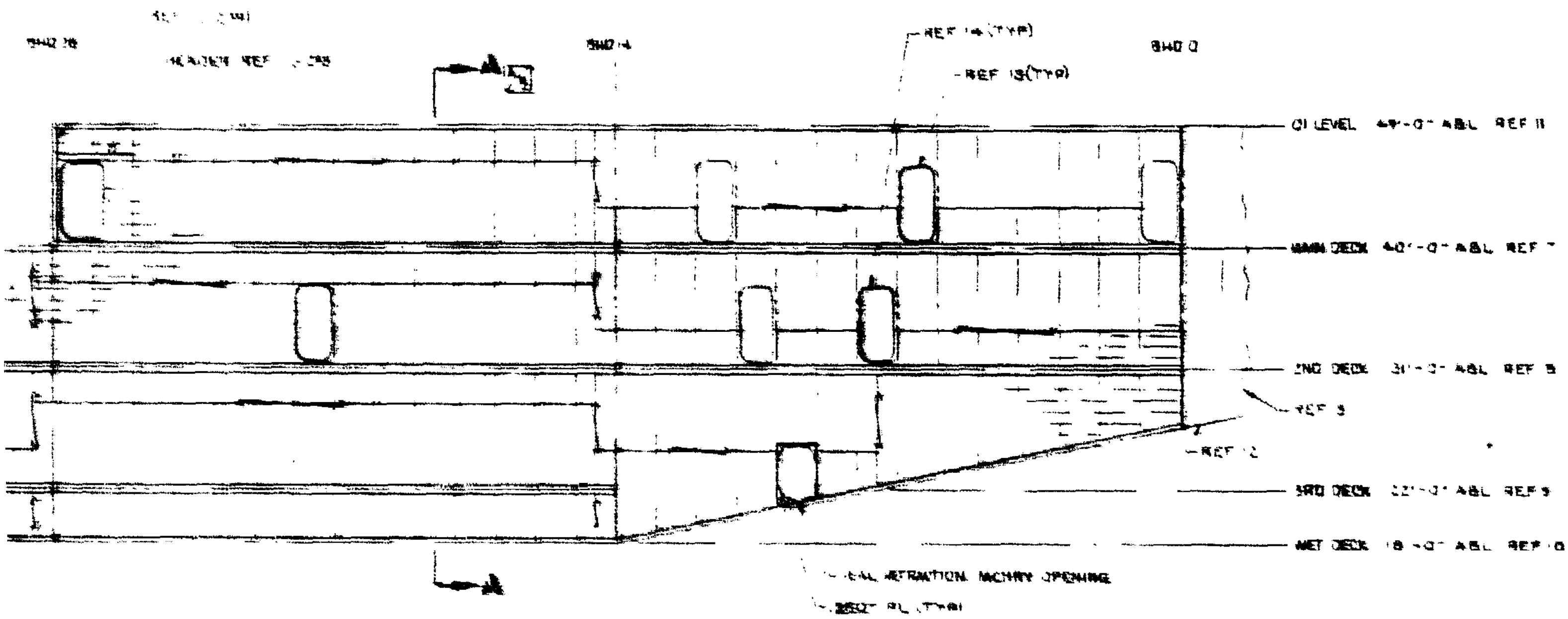
.25 THICK
DT & WT BHDS

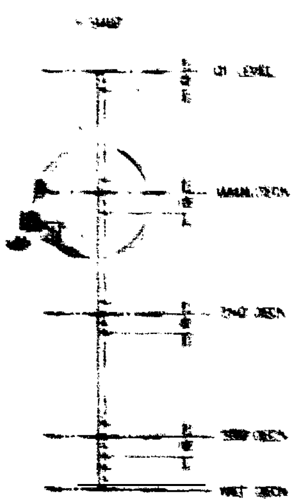


SECTION C - C
SCALE - NONE
TYP BUTT JOINT



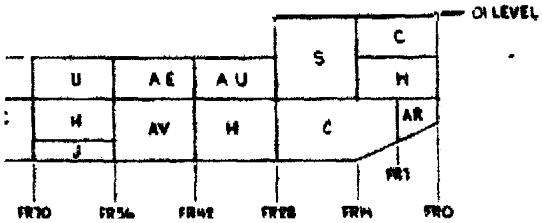
DETAIL B
SCALE 1=12





SECTION A-A
SCALE - NONE

EL121001



PLATING/STRINGER DIAGRAM
FOR DETAILS OF R & STGR SEE REF 2
SCALE - NONE

9. FOR LOCATION PROPORTION AND CLOSURE REQUIREMENTS OF ALL OPENINGS SEE REF 13&14

8. FILLET WELDS AROUND ENDS OF WELDED MEMBERS TO FORM CLOSED LOOP.

7. ABBREVIATIONS PER MIL-STD-12.

6. SEE DIAGRAM (ZONE D2) FOR PLATING AND STRINGER COMBINATIONS.

5. STARBOARD SIDE SHOWN - PORT SIDE OPPOSITE EXCEPT AS NOTED.

4. FRAME SPACING 56IN EXCEPT AS NOTED.

3. GENERAL STIFFENER SPACING 10IN EXCEPT AS NOTED.

2. FABRICATE WELD AND INSPECT PER NAVSHIPS 0900-060-4010. (SEE 2KSES PROGRAM DIRECTIVES 500.12, 500.16, 500.19, 500.20)

1. FOR THICKNESSES .188 AND ABOVE, COND H321 FOR THICKNESSES BELOW .188, PER FED SPEC QQ-A-250/20. EXTRUSIONS 5456 AL ALY COND H111 PER FED SPEC QQ-A-200/7.

NOTES:

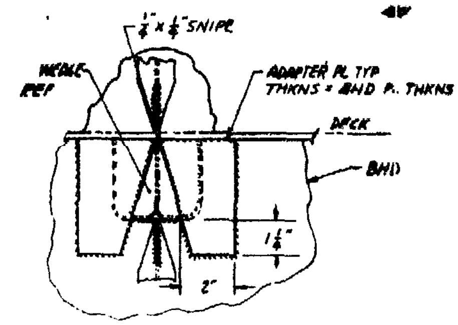
REF	DRAWING NO.	TITLE
14	LL802005	GEN ARRANGEMENT - 2ND DECK
13	LL802004	GEN ARRANGEMENT - MAIN DECK
12	LL802009	LSES HULL LINES
11	LL136001	DECK PLATING - 01 LEVEL
10	LL134001	DECK PLATING - WET DECK
9	LL133001	DECK PLATING - 3RD DECK
8	LL132001	DECK PLATING - 2ND DECK
7	LL131001	DECK PLATING - MAIN DECK
6	LL122001	BULKHEADS - TRANSVERSE
5	LL117001	FRAMES - TRANSVERSE
4	LL111001	SHELL PLATING
3	LL110001	BOW
2	LL101005	PLATING/TEE TABULATION
1	LL101004	EXTRUSIONS - STRUCTURAL

LSES BULKHEAD - LONG, CL

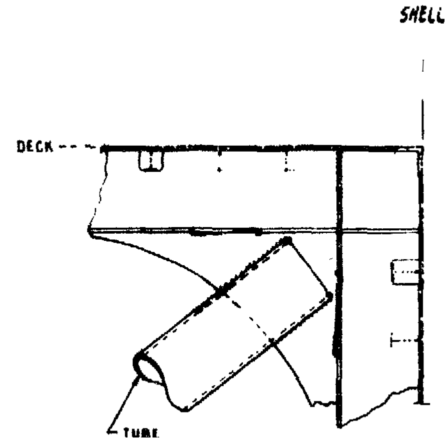
J LL121001 A

4

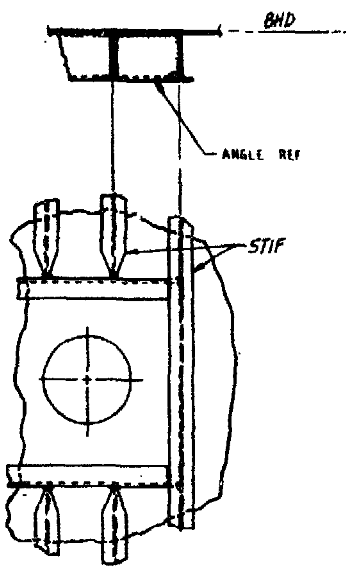
UNCLASSIFIED



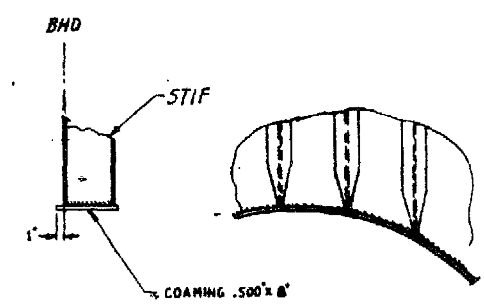
DETAIL D A/5
SCALE: $\frac{1}{2}$" = 1"
REQ'D AT ALL AT, OT & WT LONG BHDS, SHELL & DECKS REF 14, 5, 6 & 8



DETAIL A D/6
SCALE: 1$\frac{1}{2}$" = 1'-0"
(TYP TRUSS DETAIL)

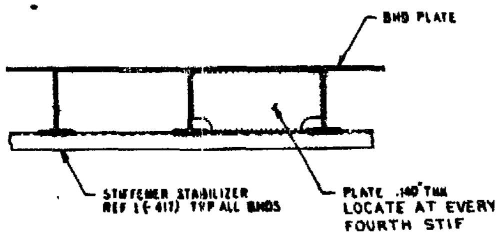


DETAIL C A/7
SCALE: 1$\frac{1}{2}$" = 1'-0"

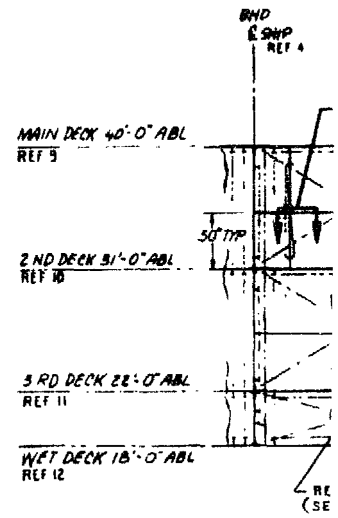


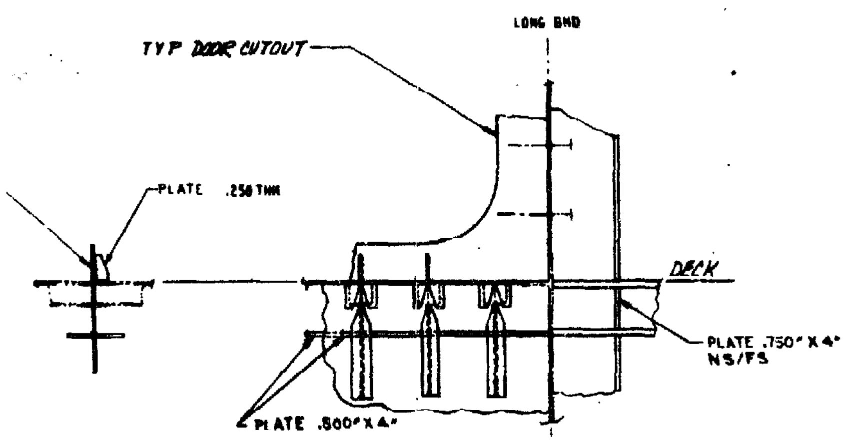
DETAIL B C/5
SCALE: 1 1/2" = 1'-0"

UNCLASSIFIED

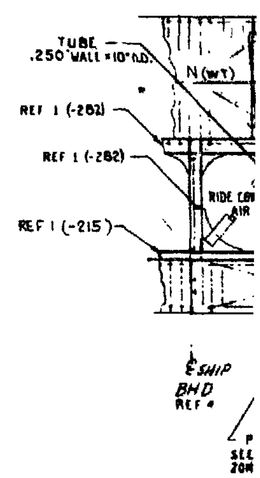


SECTION G-G
SCALE: 3"=1'-0"

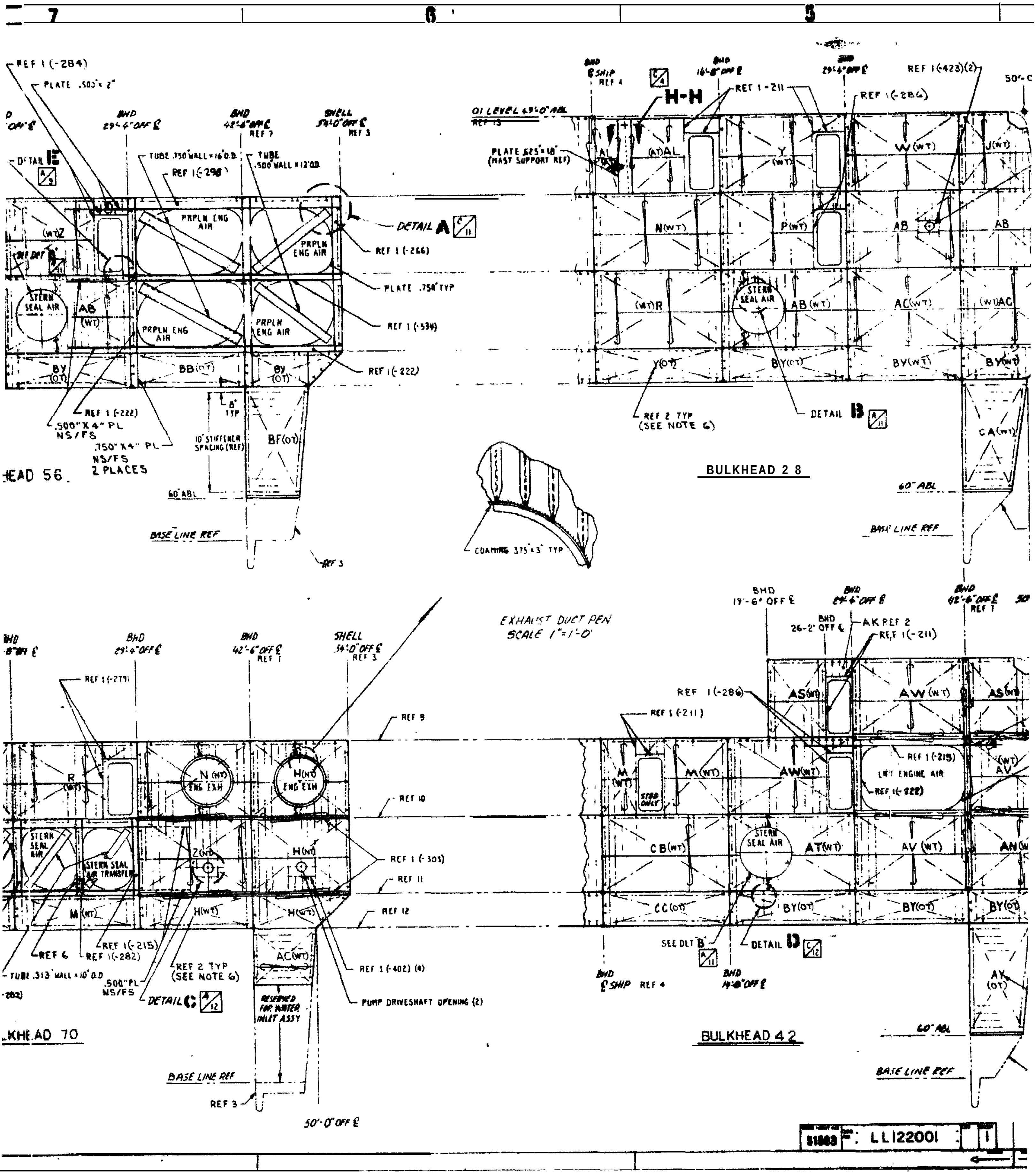




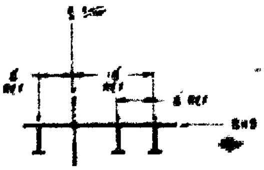
DETAIL E
SCALE 1½"=1'-0"

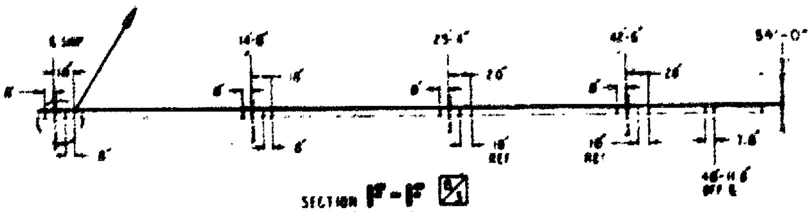


LL 122001

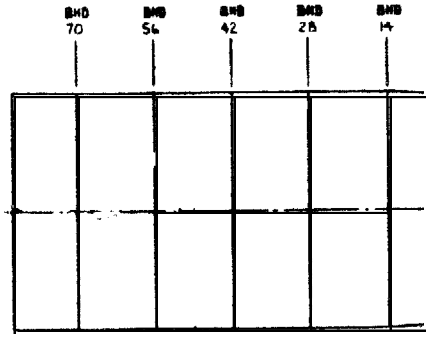


7
6
5
BULKHEAD 56
BULKHEAD 2 8
H-H
DETAIL A
DETAIL B
EXHAUST DUCT PEN
SCALE 1"=1'-0"
COAMING 375 x 3" TYP
BULKHEAD 70
BULKHEAD 4 2
DETAIL C
DETAIL D
PRPLN ENG AIR
STERN SEAL AIR
STERN SEAL AIR TRANSFER
ENG EXH
LIFT ENGINE AIR
BASE LINE REF
60" ABL
01 LEVEL 49'-0" ABL
PLATE .625"x18" (MAST SUPPORT REF)
PLATE .750" TYP
.500" X 4" PL NS/FS
.750" X 4" PL NS/FS 2 PLACES
10" STIFFENER SPACING (REF)
REF 2 TYP (SEE NOTE 6)
PUMP DRIVESHAFT OPENING (2)
RESERVED FOR WATER INLET ASSY
50'-0" OFF ℄
LL122001

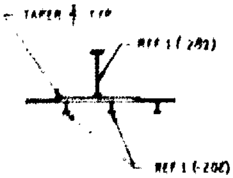




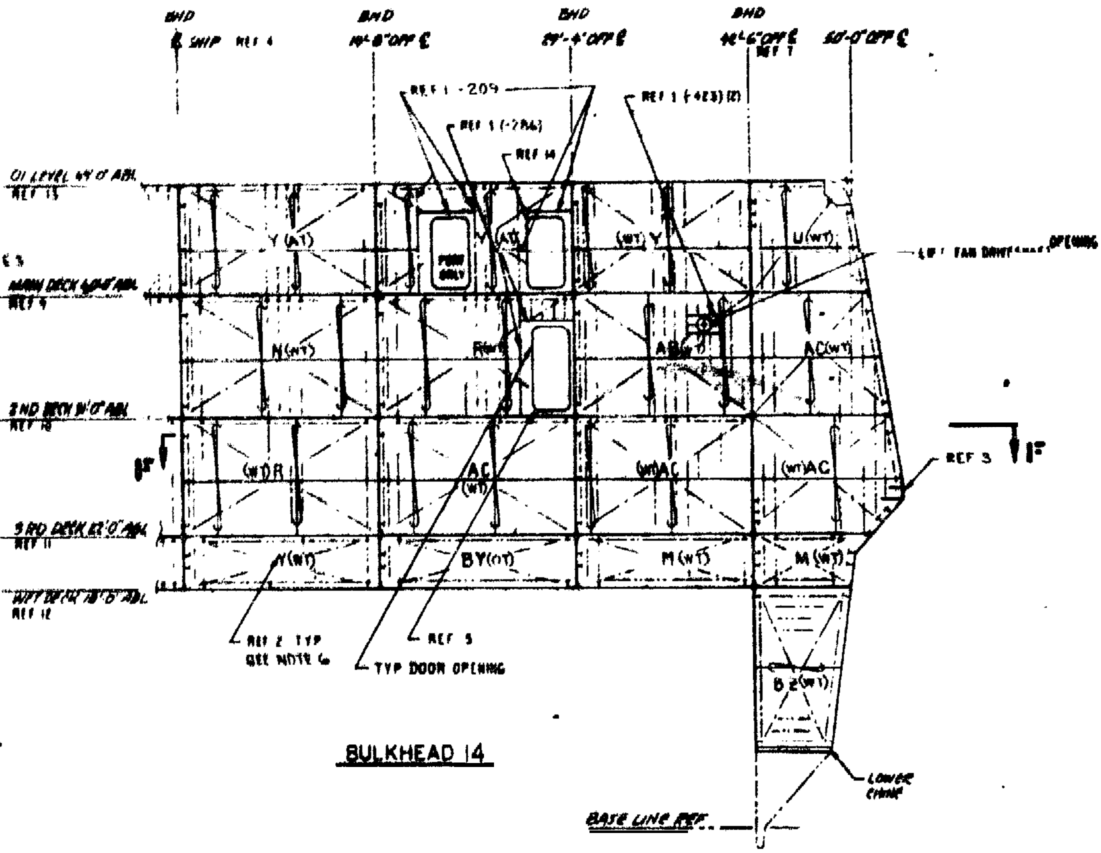
SECTION F-F
TYP STIFFENER SPACING
ALL BHDS



ORIENTATION VIEW
SCALE: NONE

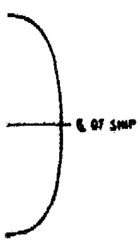


SECTION H-H



BULKHEAD 14

17	
16	
15	
14	LL802004
13	LL136001
12	LL134001
11	LL133001
10	LL132001
9	LL131001
8	LL802007
7	LL121004
6	LL802006
5	LL802005
4	LL121001
3	LL111001
2	LL101003
1	LL101004



NOTES:

1. MATERIAL: (SHEET & PLATE) 5456 AL ALY COND H116/117 FOR THICKNESSES .188 AND ABOVE. COND H323 FOR THICKNESSES BELOW .188, PER FED SPEC QQ-A-250/20. (EXTRUSIONS) 5456 AL ALY COND H111 PER FED SPEC QQ-A-200/7
2. FABRICATE, WELD AND INSPECT PER NAVSHIPS 0900-060-4010 (SEE 2KSES PROGRAM DIRECTIVES 500.12, 500.16, 500.19 & 500.20).
3. GENERAL STIFFENER SPACING 10" EXCEPT AS NOTED.
4. FRAME SPACING 36" EXCEPT AS NOTED.
5. STARBOARD SIDE SHOWN - PORT SIDE OPPOSITE EXCEPT AS NOTED.
6. SEE REF 2 TABULATION CODE IDENT ON F/D FOR PLATING & STRINGER COMBINATIONS.
7. ABBREVIATIONS PER MIL-STD-12.
8. FILLET WELDS AROUND ENDS OF WELDED MEMBER TO FORM CLOSED LOOP.
9. FOR LOCATION, PROPORTION AND CLOSURE REQUIREMENTS OF ALL OPENINGS SEE REF 14, 15, 16 & 17.
10. FOR DETAILS OF PLATING & STRINGERS SEE REF 2.

ARRANGEMENT MAIN DECK
PLATING - 01 LEVEL
PLATING - WET DECK
PLATING - 3RD DECK
PLATING - 2ND DECK
PLATING - MAIN DECK
ARRANGEMENT WET DECK
[illegible] 42-6" OFF ℄
ARRANGEMENT 3RD DECK
ARRANGEMENT 2ND DECK
LONG ℄
[illegible] PLATING
[illegible] TEE TABULATION
[illegible]SIONS - STRL

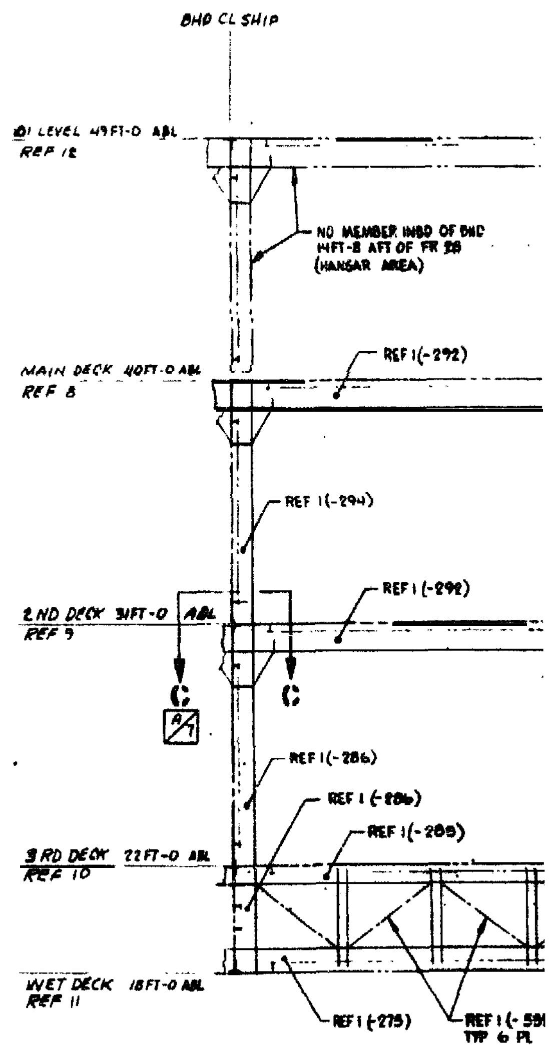
LSES
TRANSVERSE
BULK HEADS

J LL122001

5

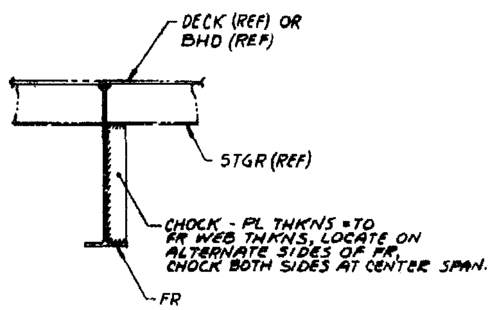
8 7

D



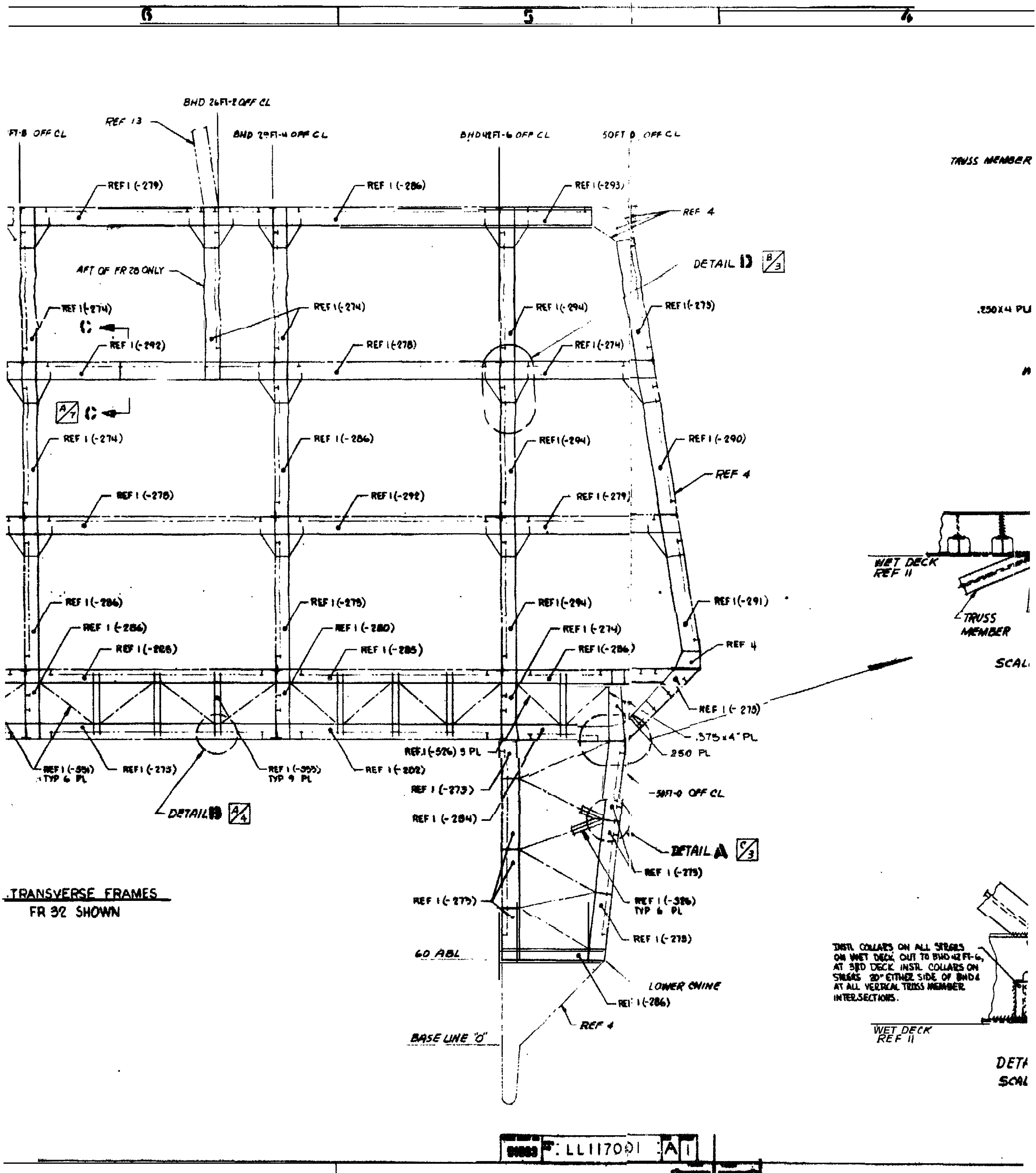
C

B

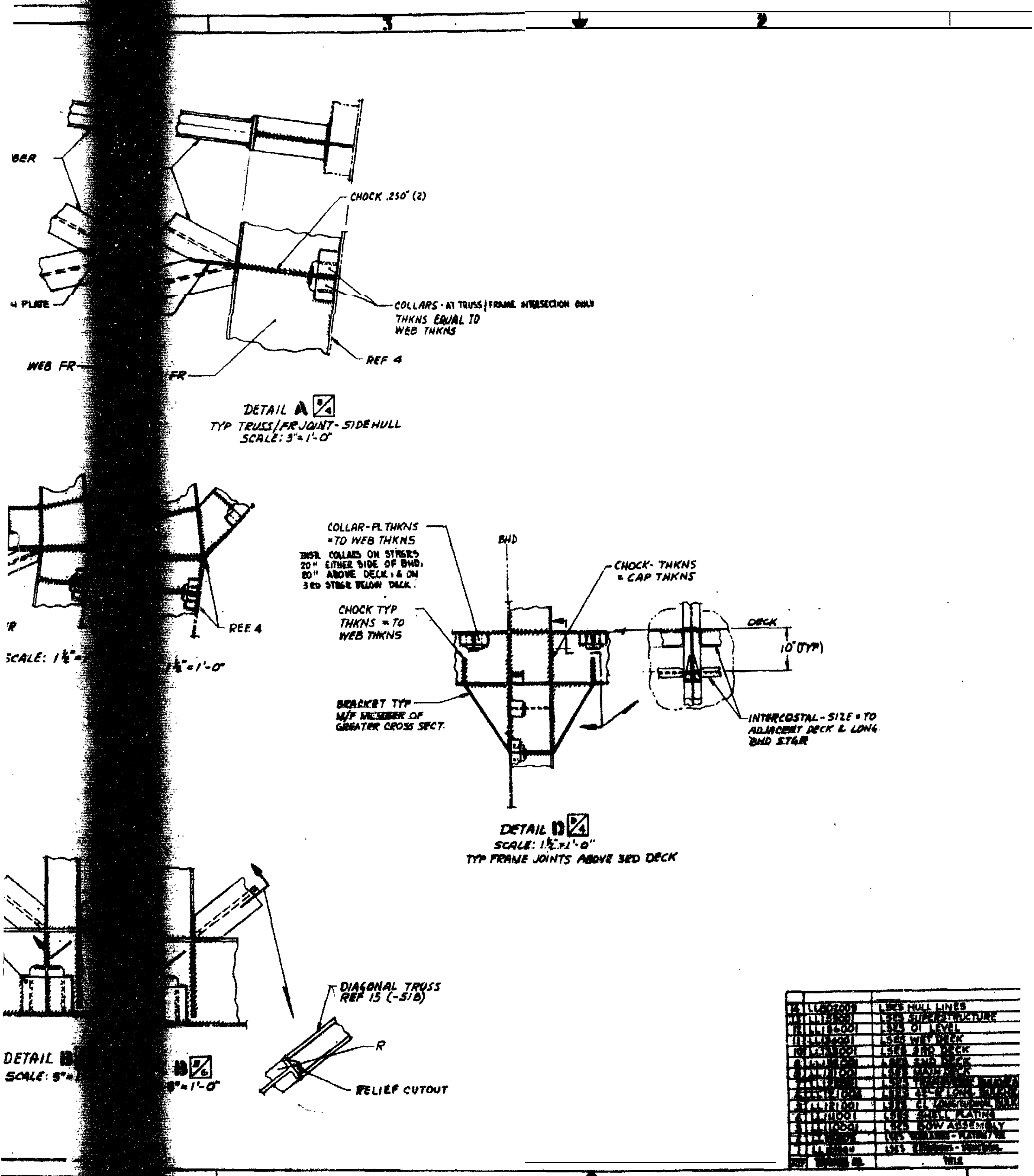


A

SECT. C-C C/7 C/6
SCALE: 3"=1'-0"
TYP ALL FRAMES



6
5
4
BHD 26FT-2 OFF CL
REF 13
FT-8 OFF CL
BHD 29FT-4 OFF CL
BHD 42FT-6 OFF CL
50FT 0 OFF CL
TRUSS MEMBER
REF 1 (-279)
REF 1 (-286)
REF 1 (-293)
REF 4
DETAIL B B/3
AFT OF FR 28 ONLY
REF 1 (-274)
REF 1 (-294)
REF 1 (-275)
.250X4 PL
C
REF 1 (-292)
REF 1 (-278)
A/7 C
REF 1 (-286)
REF 1 (-290)
REF 4
REF 1 (-278)
REF 1 (-292)
REF 1 (-279)
WET DECK REF 11
REF 1 (-286)
REF 1 (-275)
REF 1 (-294)
REF 1 (-291)
TRUSS MEMBER
REF 1 (-280)
REF 1 (-274)
REF 1 (-285)
REF 4
SCAL
REF 1 (-275)
.375x4" PL
.250 PL
REF 1 (-526) 5 PL
REF 1 (-202)
REF 1 (-273)
-50FT-0 OFF CL
REF 1 (-284)
DETAIL B A/4
DETAIL A C/3
TRANSVERSE FRAMES
FR 32 SHOWN
REF 1 (-279)
60 ABL
LOWER CHINE
REF 1 (-286)
REF 4
BASE LINE "0"
INSTL COLLARS ON ALL STRGRS ON WET DECK OUT TO BHD 42 FT-6, AT 3RD DECK INSTL COLLARS ON STRGRS 20" EITHER SIDE OF BHD & AT ALL VERTICAL TRUSS MEMBER INTERSECTIONS.
WET DECK REF 11
DETA
SCAL
LL117001
A
1


CHOCK .250" (2)
COLLARS - AT TRUSS/FRAME INTERSECTION ONLY
THKNS EQUAL TO WEB THKNS
REF 4
WEB FR
4 PLATE
DETAIL A
TYP TRUSS/FR JOINT - SIDE HULL
SCALE: 3" = 1'-0"
REF 4
COLLAR - PL THKNS = TO WEB THKNS
CHOCK - THKNS = CAP THKNS
CHOCK TYP THKNS = TO WEB THKNS
BHD
DECK
10" (TYP)
BRACKET TYP
INTERCOSTAL - SIZE = TO ADJACENT DECK & LONG BHD STGR
DETAIL D
SCALE: 1½" = 1'-0"
TYP FRAME JOINTS ABOVE 3RD DECK
DIAGONAL TRUSS REF 15 (-518)
R
RELIEF CUTOUT
DETAIL B
LSES HULL LINES
LSES SUPERSTRUCTURE
LSES WET DECK
LSES 3RD DECK
LSES SHELL PLATING
LSES BOW ASSEMBLY
TITLE

UNCLAS

A	INC ECO L00005	ADE

D

C

B

A

ES:

MATERIAL: (SHEET & PLATE) 54
ALY COND H(?) FOR THICKNESS
AND ABOVE. COND H32S FOR T
NESSES BELOW .188" PER FE
QQ-A-250/20. (EXTRUSIONS)
ALY COND H111 PER FED SPEC QQ

FABRICATE, WELD AND INSPEC
PER NAVSHIPS 0900-060-
(SEE 2KSES PROGRAM DIRECT
500.12, 500.16, 500.19 & 500.

GENERAL STIFFENER SPACIN
10" EXCEPT AS NOTED.

FRAME SPACING 86" EXCE
AS NOTED.

STARBOARD SIDE SHOWN-
SIDE OPPOSITE EXCEPT AS

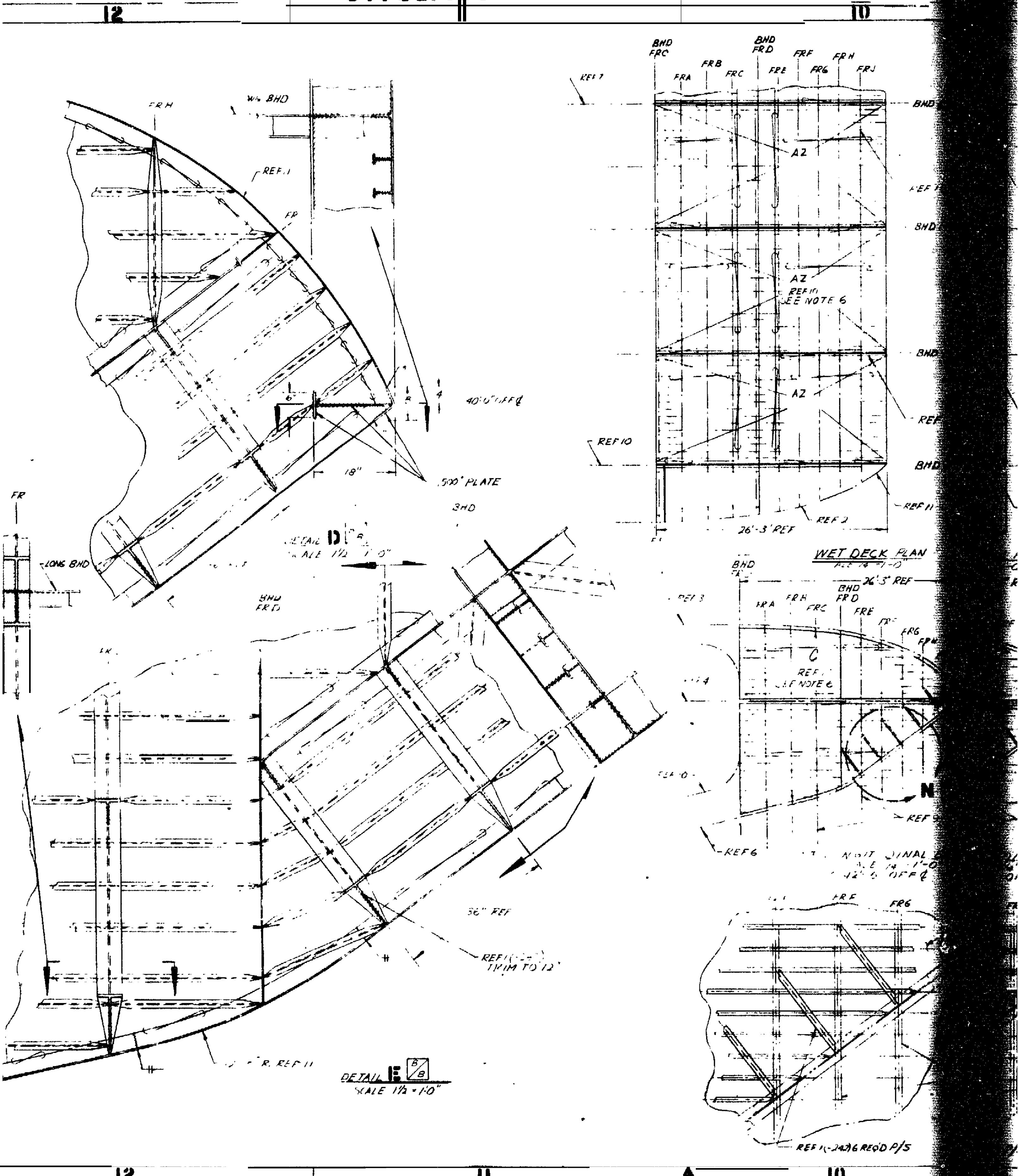
ABBREVIATIONS PER MIL-S

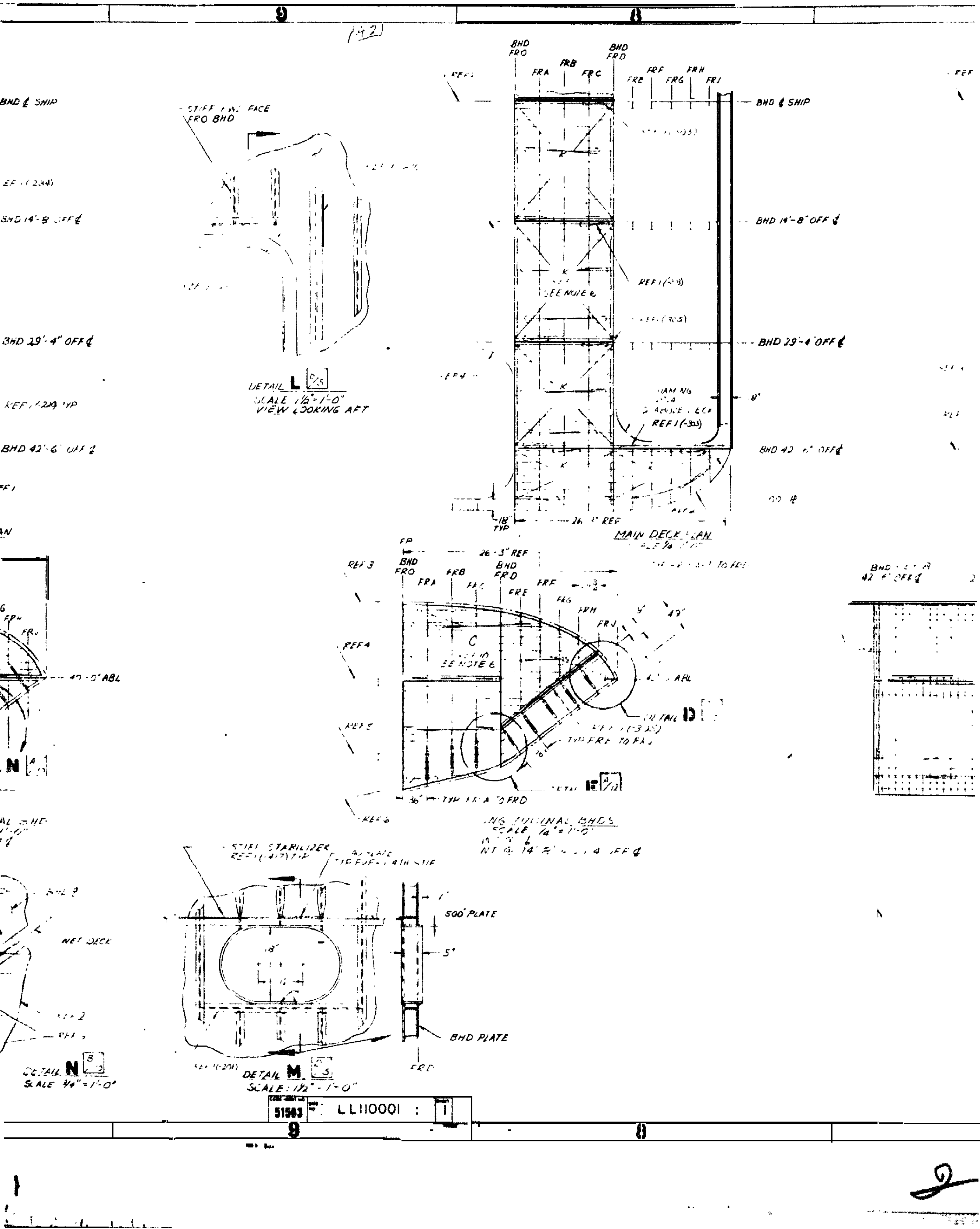
FILLET WELDS AROUND
OF WELDED MEMBERS TO FO
CLOSED LOOP.

LSES TRANS
FRAME

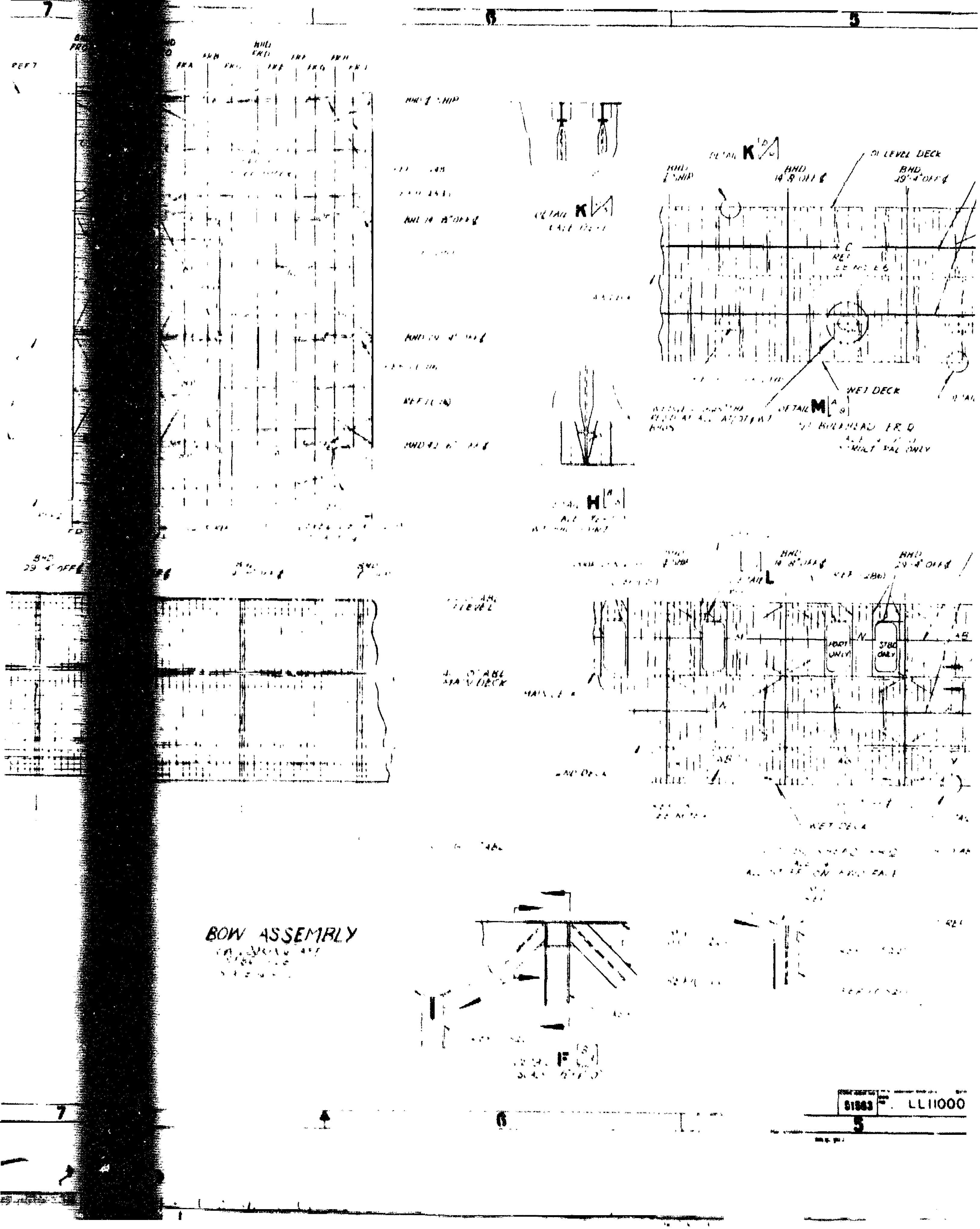
J

UNCLAS

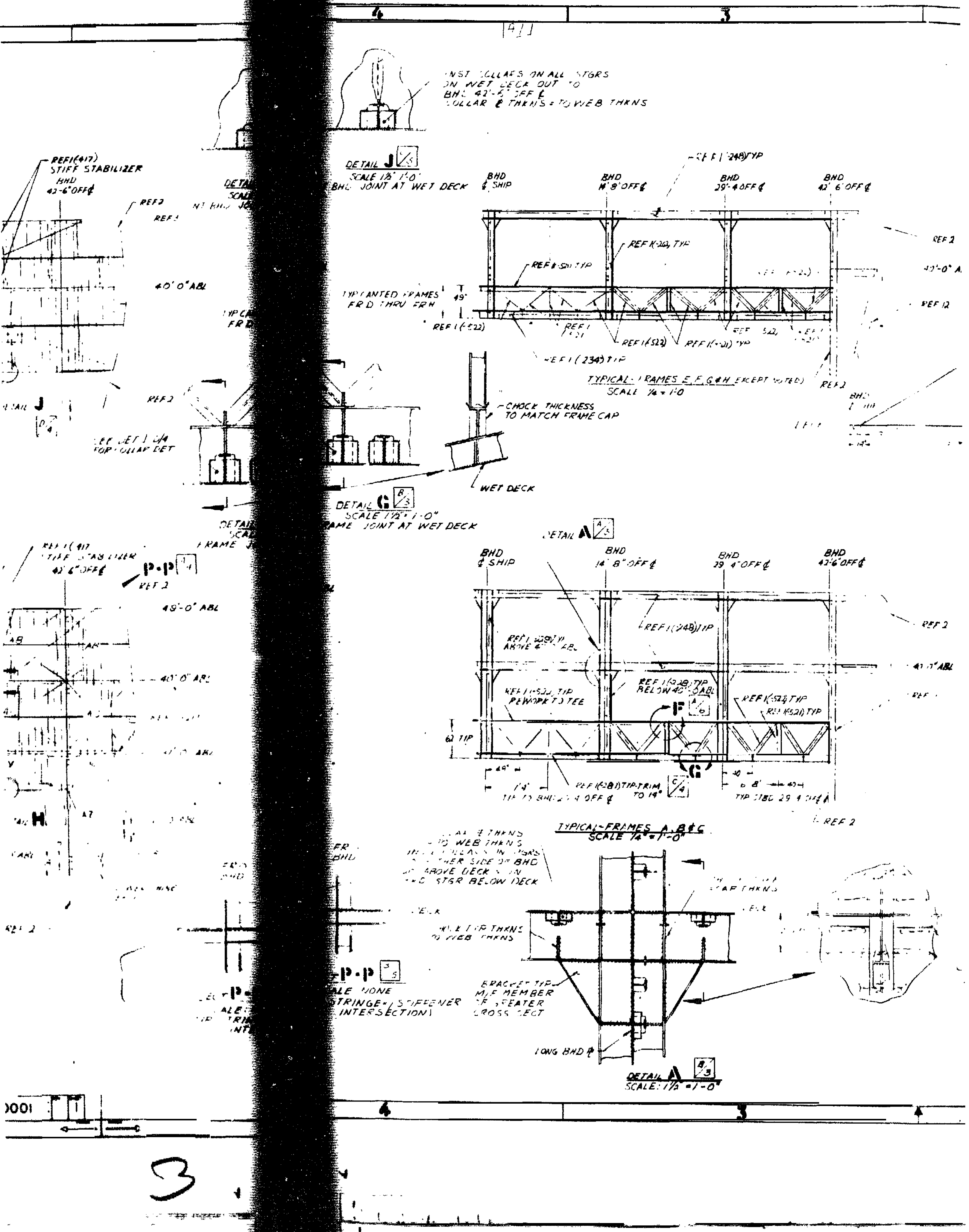

DETAIL D
SCALE 1½" = 1'-0"
.500" PLATE
40'-0" OFF ℄
18"
WET DECK PLAN
26'-3" REF
AZ
SEE NOTE 6
REF 10
REF 11
REF 2
REF 6
DETAIL E
SCALE 1½" = 1'-0"
36" REF
TRIM TO 12"
REF (-2426 REQ'D P/S

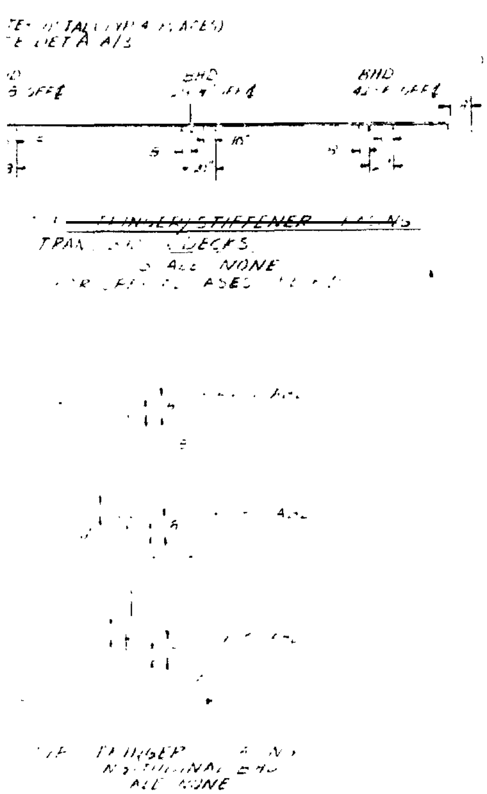


9
8
BHD FRO
BHD FRD
FRA
FRB
FRC
FRE
FRF
FRG
FRH
FRJ
BHD ℄ SHIP
BHD 14'-8" OFF ℄
BHD 29'-4" OFF ℄
BHD 29'-4" OFF ℄
BHD 42'-6" OFF ℄
SEE NOTE 6
REF 1(-303)
MAIN DECK PLAN
DETAIL L
SCALE 1½"=1'-0"
VIEW LOOKING AFT
STIFF FRO BHD
26'-3" REF
REF 3
REF 4
REF 5
REF 6
C
SEE NOTE 6
DETAIL D
DETAIL E
TYP FRE TO FRJ
TYP FR A TO FRD
STIFF STABILIZER
500" PLATE
BHD PLATE
FRD
DETAIL N
SCALE ¾"=1'-0"
DETAIL M
SCALE: 1½" - 1'-0"
51563
LL110001
1



BOW ASSEMBLY
DETAIL K
01 LEVEL DECK
BHD 14'-8" OFF ℄
BHD 49'-4" OFF ℄
WET DECK
DETAIL M
DETAIL H
DETAIL L
BHD 29'-4" OFF ℄
PORT ONLY
STBD ONLY
DETAIL F
LL11000


INST COLLARS ON ALL STGRS
ON WET DECK OUT TO
BHD 42'-6" OFF ℄
COLLAR ℄ THKNS = TO WEB THKNS
DETAIL J
SCALE 1½" = 1'-0"
BHD JOINT AT WET DECK
REF I(417)
STIFF STABILIZER
BHD
42'-6" OFF ℄
40'-0" ABL
REF 2
BHD
℄ SHIP
BHD
14' 8" OFF ℄
BHD
29'-4 OFF ℄
BHD
42'-6" OFF ℄
REF I(248) TYP
REF I(520) TYP
TYP CANTED FRAMES
FR D THRU FR H
49"
REF I(522)
REF I(522)
REF I(234) TYP
TYPICAL - FRAMES E, F, G & H EXCEPT NOTED
SCALE ¼" = 1'-0
CHOCK THICKNESS
TO MATCH FRAME CAP
WET DECK
DETAIL G
SCALE 1½" = 1'-0"
FRAME JOINT AT WET DECK
DETAIL A
BHD
℄ SHIP
BHD
14' 8" OFF ℄
BHD
29 4" OFF ℄
BHD
42'-6" OFF ℄
49'-0" ABL
40'-0" ABL
REF I(248) TYP
REF I(528) TYP
BELOW 40'-0 ABL
REF I(524) TYP
REF I(521) TYP
REWORK TO TEE
62 TYP
49"
TYP TO BHD 29 4 OFF ℄
TO 19"
TYPICAL - FRAMES A, B & C
SCALE ¼" = 1'-0"
P-P
REF 2
BRACKET TYP
M/F MEMBER
OF GREATER
CROSS SECT
LONG BHD ℄
DETAIL A
SCALE: 1½" = 1'-0"
P-P
SCALE NONE
STRINGER STIFFENER
INTERSECTION
WEB THKNS
STGR BELOW DECK
0001
3



NOTES:

1. MATERIAL (SHEET & PLATE 5456 AL ALY COND H116 FOR THICKNESSES .188 AND ABOVE, COND H323 FOR THICKNESSES BELOW .188 PER FED SPEC QQ A 250/20. (EXTRUSIONS) 5456 AL ALY COND H111 PER FED SPEC QQ-A 200/7
2. FABRICATE, WELD AND INSPECT PER NAVSHIPS 0900 060 4010 (SEE LSES PROGRAM DIRECTIVES 500.12, 500.16, 500.19 & 500.20).
3. GENERAL STIFFENER SPACING 10 EXCEPT AS NOTED.
4. FRAME SPACING 36" EXCEPT AS NOTED.
5. STARBOARD SIDE SHOWN - PORT SIDE OPPOSITE EXCEPT AS NOTED
6. [illegible] PLATING [illegible]
7. ABBREVIATIONS PER MIL-STD-12.
8. FILLET WELDS TO BE EXTENDED AROUND ENDS OF WELDED MEMBER TO FORM CLOSED LOOP

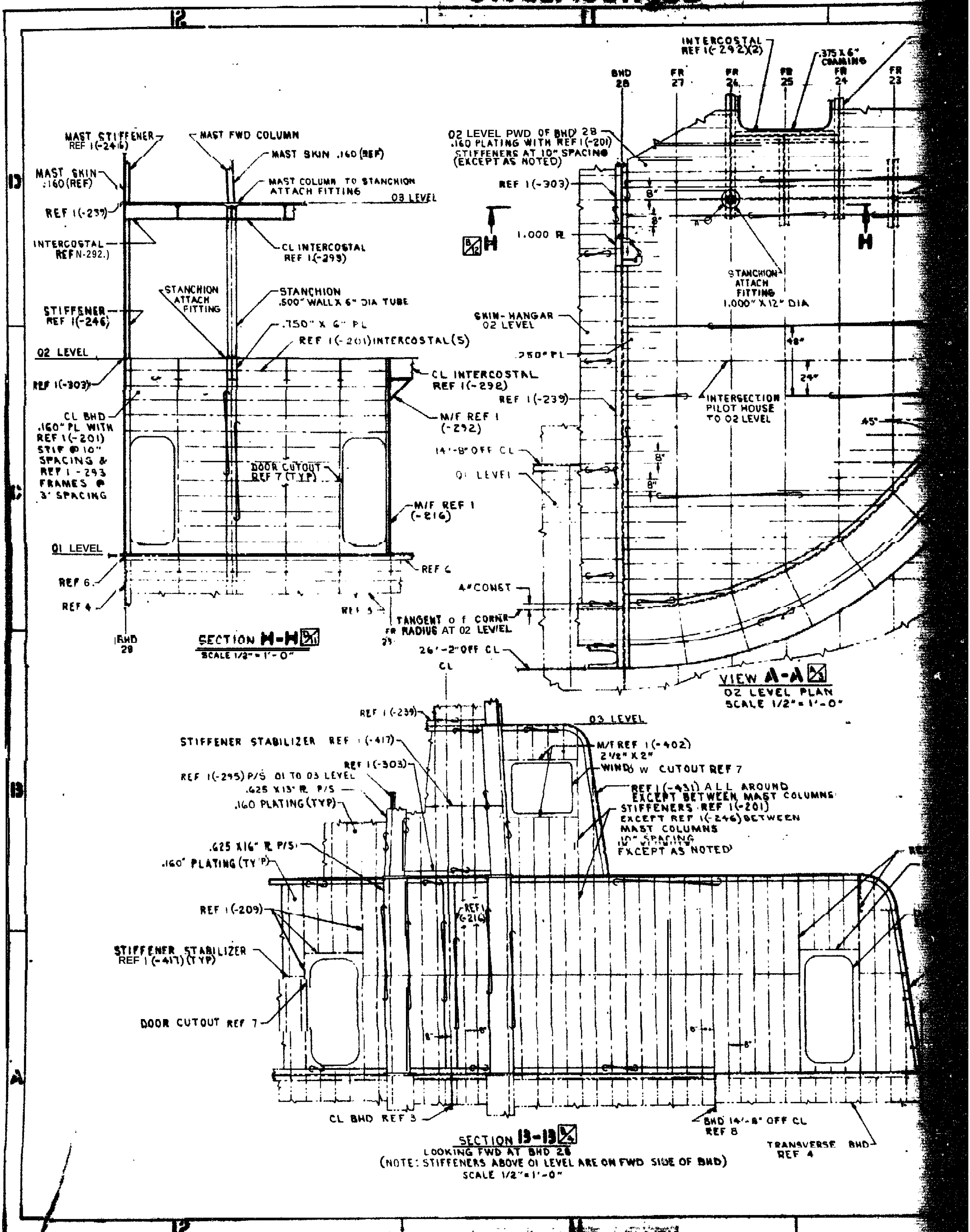
REF	DRAWING NO.	TITLE
15		
14		
13		
12		
11	[illegible]	[illegible]
10	[illegible]	PLATE TEE COMBINATIONS
9	[illegible]	BEAM
8	[illegible]	[illegible]
7	LL121001	LONGITUDINAL BHD - ℄ SHIP
6	LL134001	DECK - WET
5	LL132001	DECK - 2ND
4	LL131001	DECK - MAIN
3	LL136001	DECK - 01 LEVEL
2	LL111001	SHELL PLATING
1	LL101004	STRUCTURAL EXTRUSIONS

LSES BOW - PLATING & FRAMING

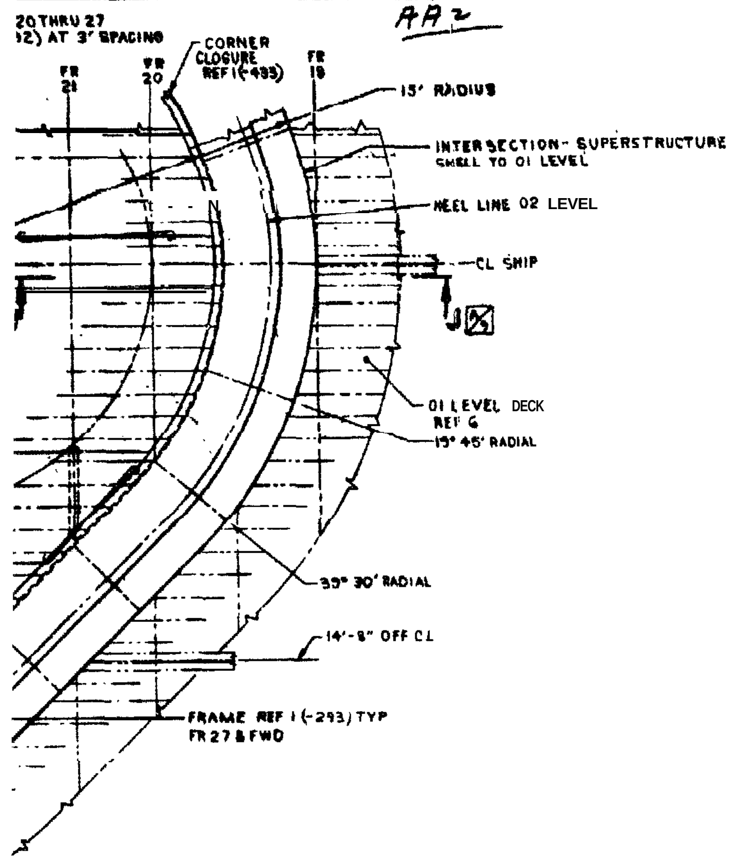
J LL110001

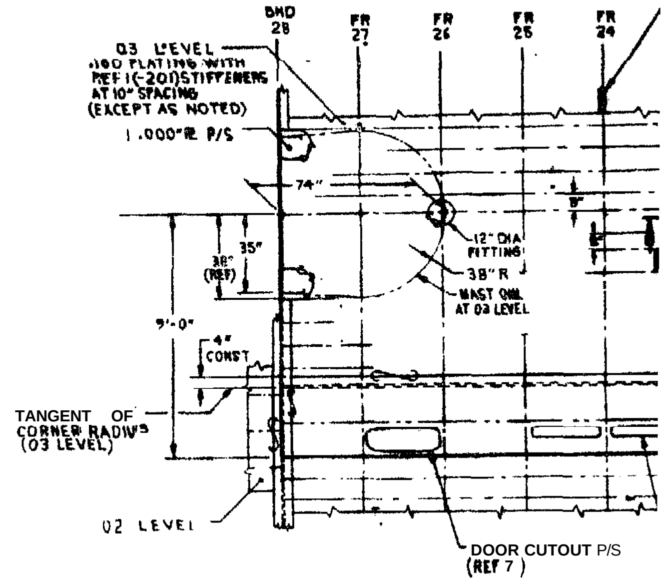
Figure B.3-5 (U)

UNCLASSIFIED

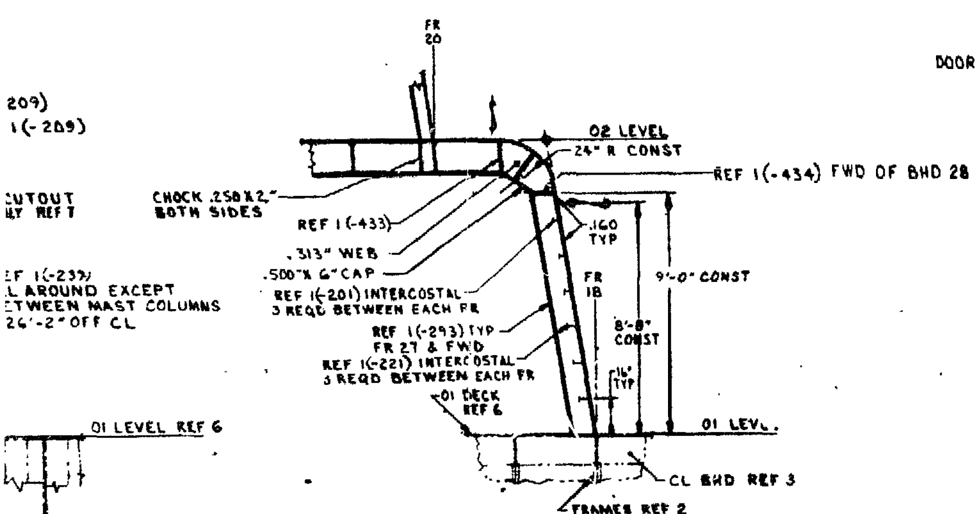


UNCLASSIFIED

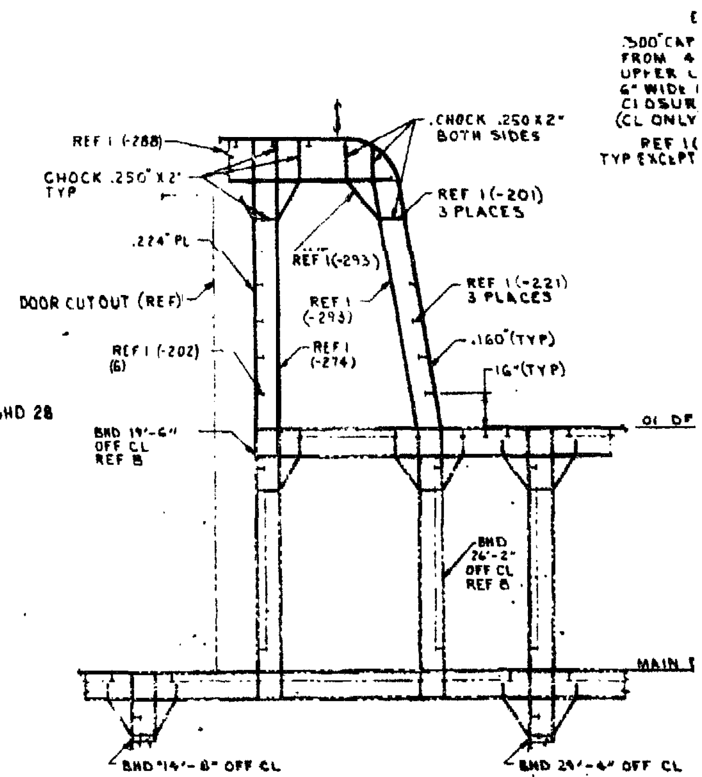




VIEW C-C
03 LEVEL PLAN
SCALE 1/2" = 1'-0"

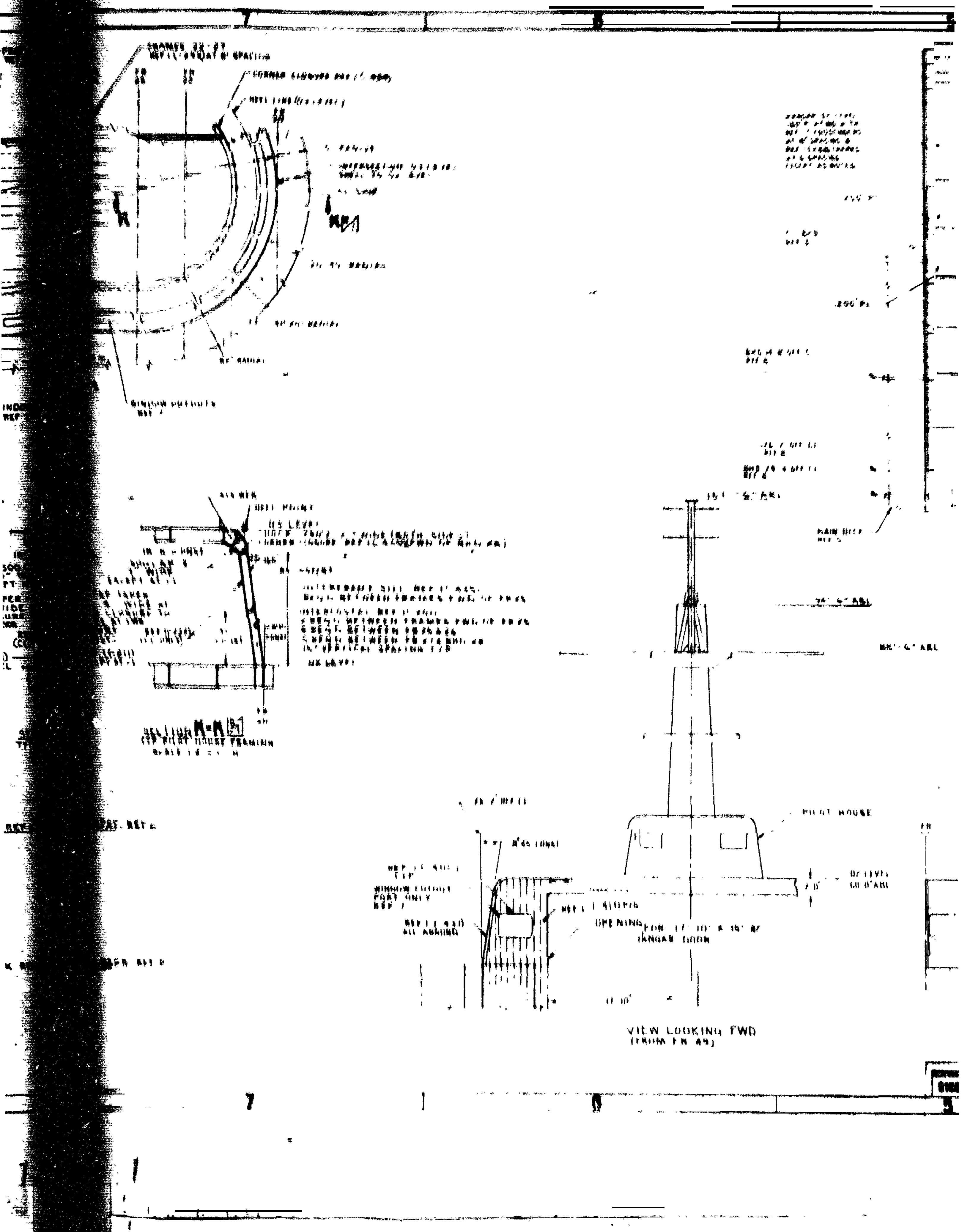


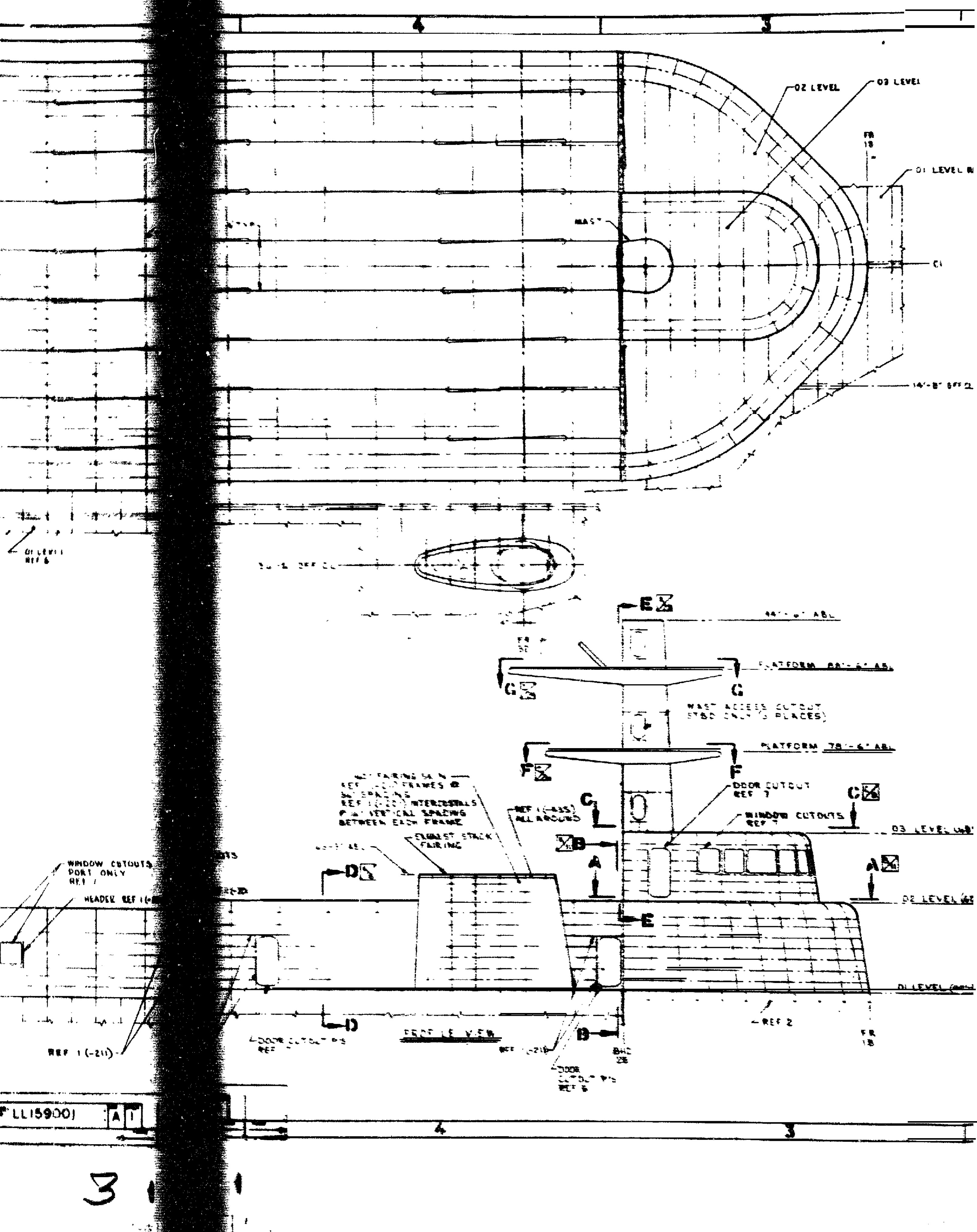
SECTION J-J
TYP FRAMING FWD OF BHD 28
SCALE 1/2" = 1'-0"



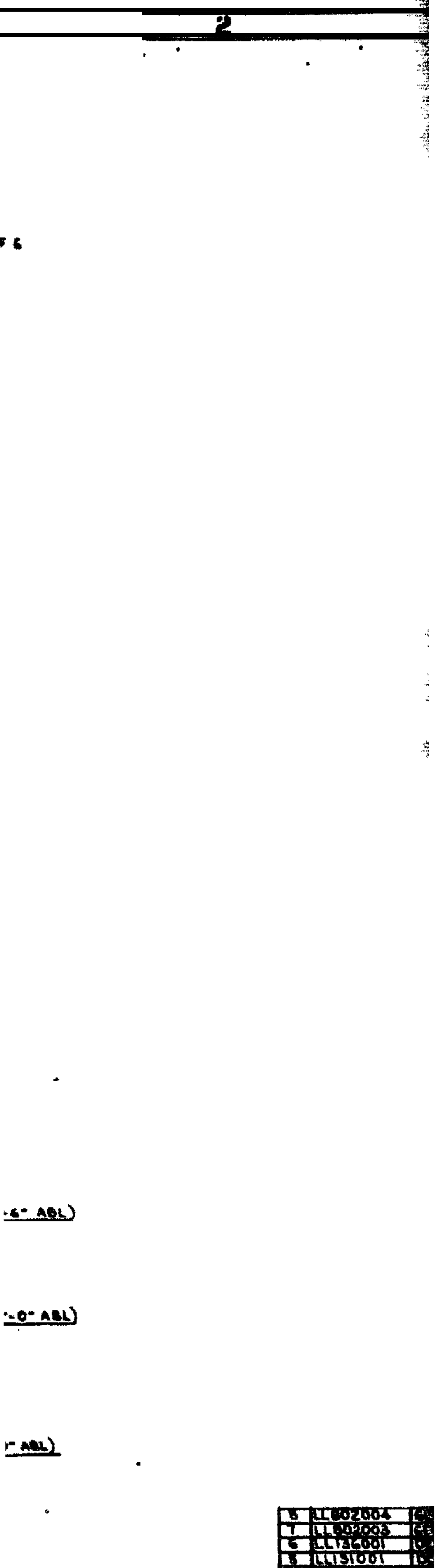
SECTION D-D
TYP HANGAR FRAMING
SCALE 1/2" = 1'-0"

FLL 159001 A 1


PILOT HOUSE
OPENING
HANGAR DOOR
VIEW LOOKING FWD
(FROM FR 49)



4
3
02 LEVEL
03 LEVEL
01 LEVEL
MAST
CL
PLATFORM 78'-6" ABL
MAST ACCESS CUTOUT STBD ONLY (3 PLACES)
DOOR CUTOUT REF 7
WINDOW CUTOUTS REF 7
03 LEVEL
02 LEVEL
01 LEVEL
EXHAUST STACK FAIRING
REF 1(-455) ALL AROUND
WINDOW CUTOUTS PORT ONLY REF 1
REF 1(-211)
REF 2
FR 18
BHD 28
LL15900I
A 1



REF	DRAWING NO	
8	LL802004	[illegible]
7	LL802003	[illegible]
6	LL136001	[illegible]
5	LL131001	[illegible]
4	LL122001	[illegible]
3	LL121001	[illegible]
2	LL117001	[illegible]
1	LL101004	[illegible]

2

Figure 1.3-6 [illegible]

A REVISED PER LLG LOADS

D

C

NOTES:

1. MATERIAL: (SHEET & PLATE) 5456 AL ALY, COND H116/H117 FOR THICKNESSES .188 AND ABOVE, COND H323 FOR THICKNESSES BELOW .188, PER FED SPEC QQ-A-250/20. (EXTRUSIONS) 5456 AL ALY, COND H111 PER FED SPEC QQ-A-200/7. (FIBERGLASS) 1581 LAMINATE.
2. FABRICATE, WELD AND INSPECT PER NAVSHIPS 0900-060-4010. (SEE 2KSES PROGRAM DIRECTIVES 500.12, 500.16, 500.15 & 500.20).
3. FILL ALL GAPS WITH PROSEAL 890B-2 (OR EQUIV).
4. WET INSTALL ALL FASTENERS, USING PROSEAL 890C (OR EQUIV).
5. STARBOARD SIDE SHOWN, PORT SIDE OPPOSITE EXCEPT AS NOTED.
6. ABBREVIATIONS PER MIL-STD-12.
7. FILLET WELDS AROUND ENDS OF WELDED MEMBERS TO FORM CLOSED LOOP.
8. FOR LOCATION, PROPORTION & CLOSURE REQUIREMENTS OF ALL OPENINGS SEE REF 8.

B

DOCUMENT RELEASE

A

TITLE

LSES
SUPERSTRUCTURE

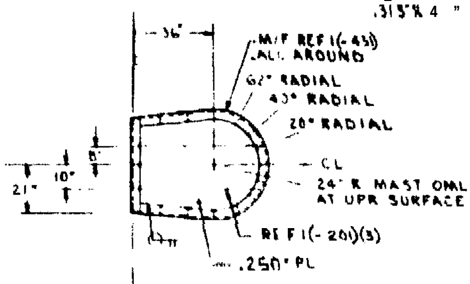
J

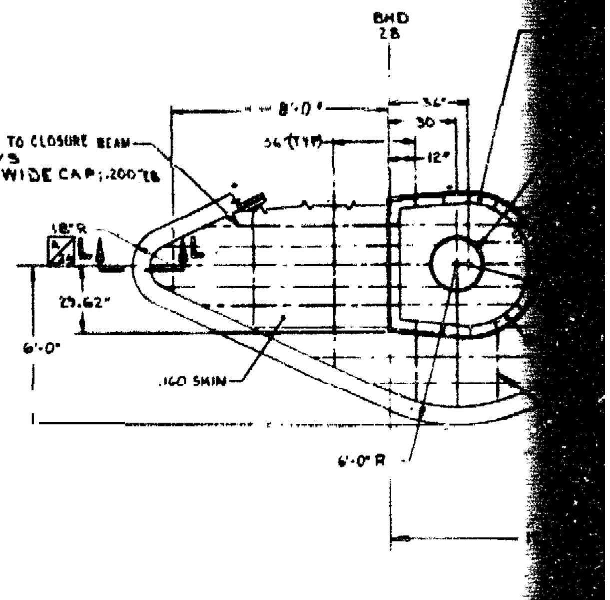
LL159001

A

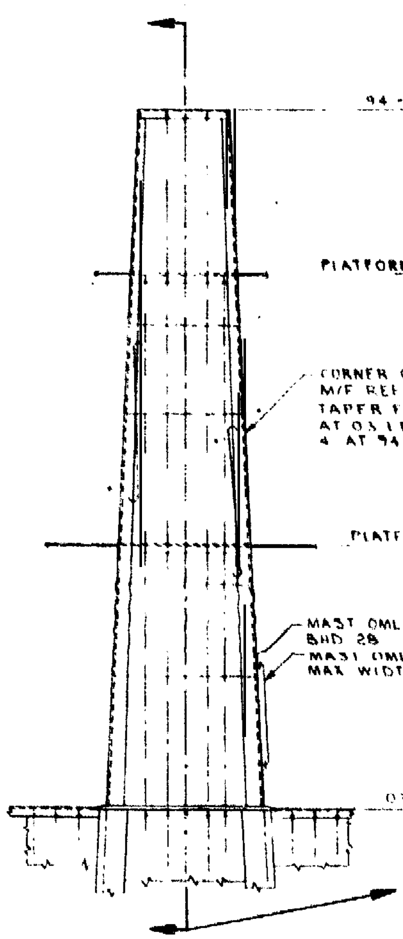
UNCLASSIFIED

5

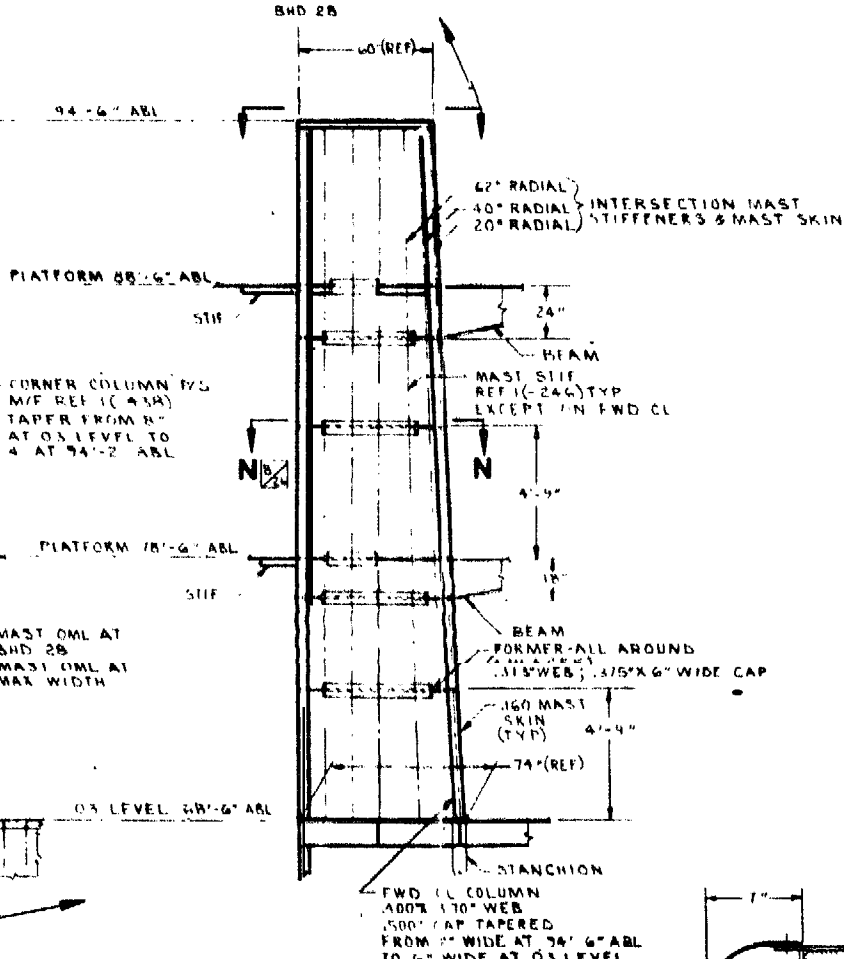


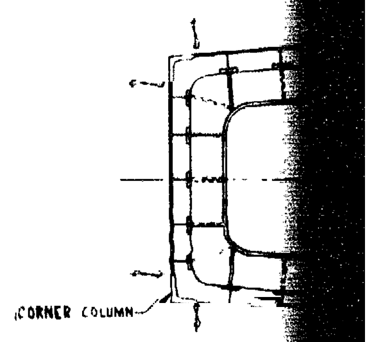


VIEW F-F
PLATFORM 78'-6" AB

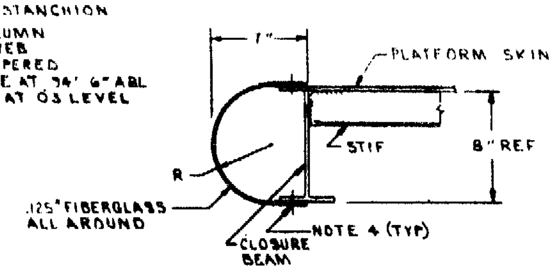


VIEW E-E
VIEW LOOKING FWD AT BHD 28
NOTE: ALL STIF ON FWD SIDE

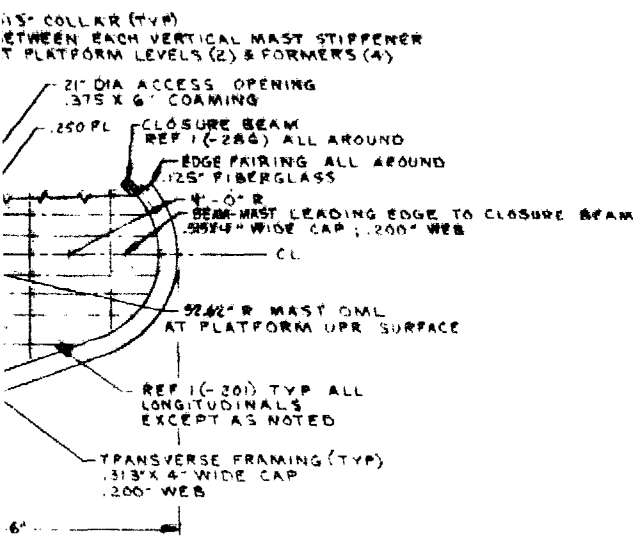


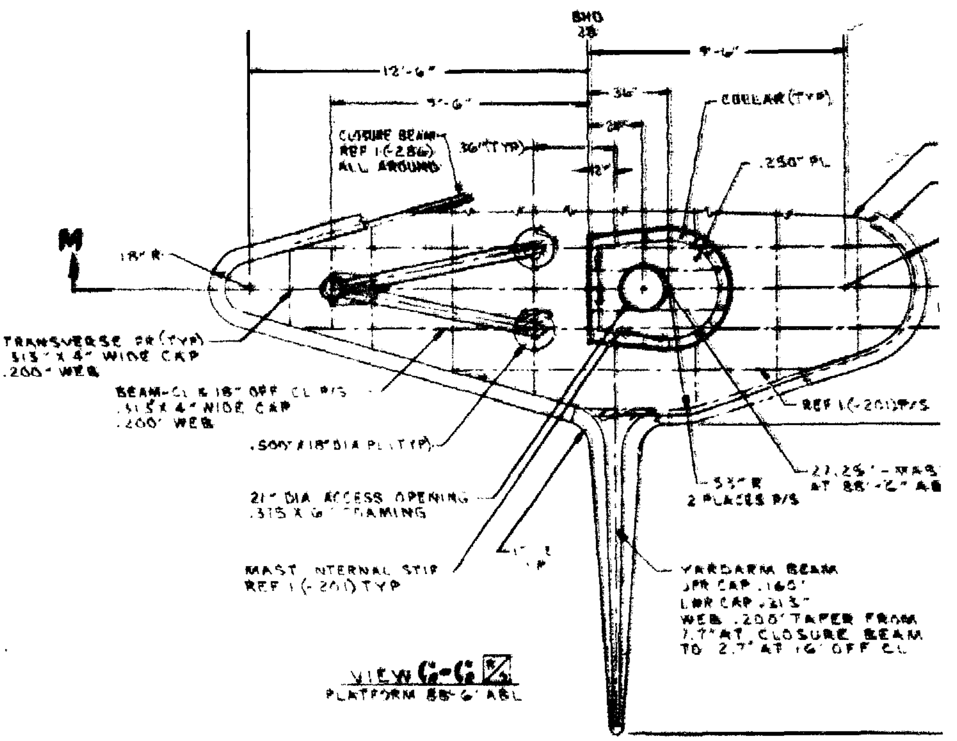


SECTIO
TYP FOR
SCALE

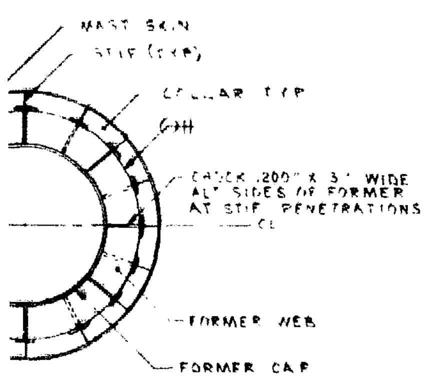


SECTION L-L
SCALE 3"=1'-0"

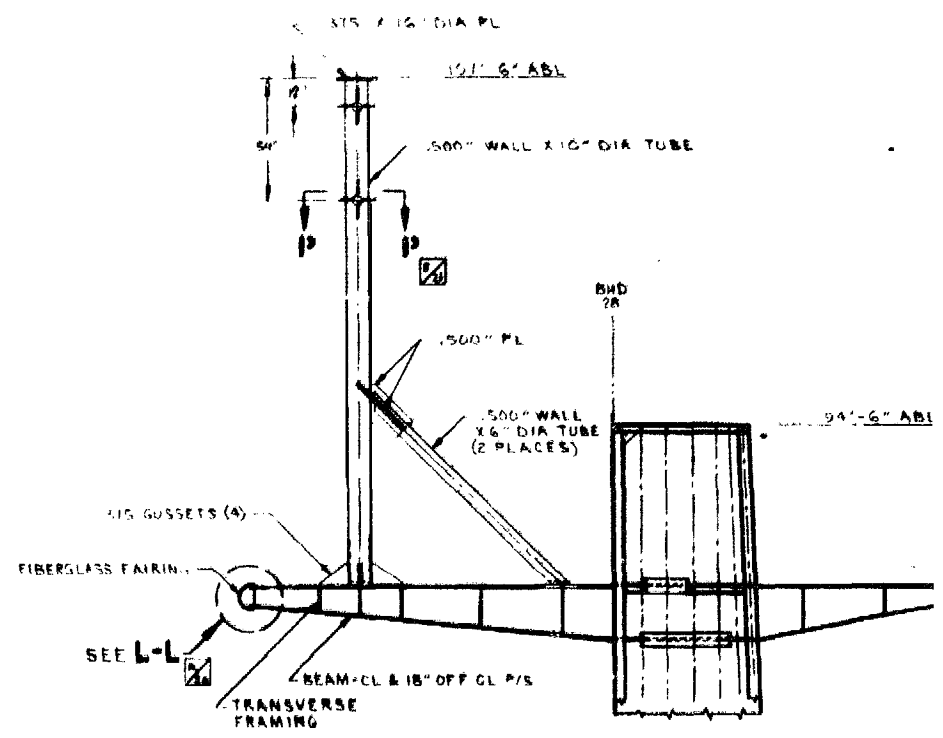




VIEW G-G
PLATFORM 88'-6" ABL



N-N
R CONFIGURATION



SECTION M-M

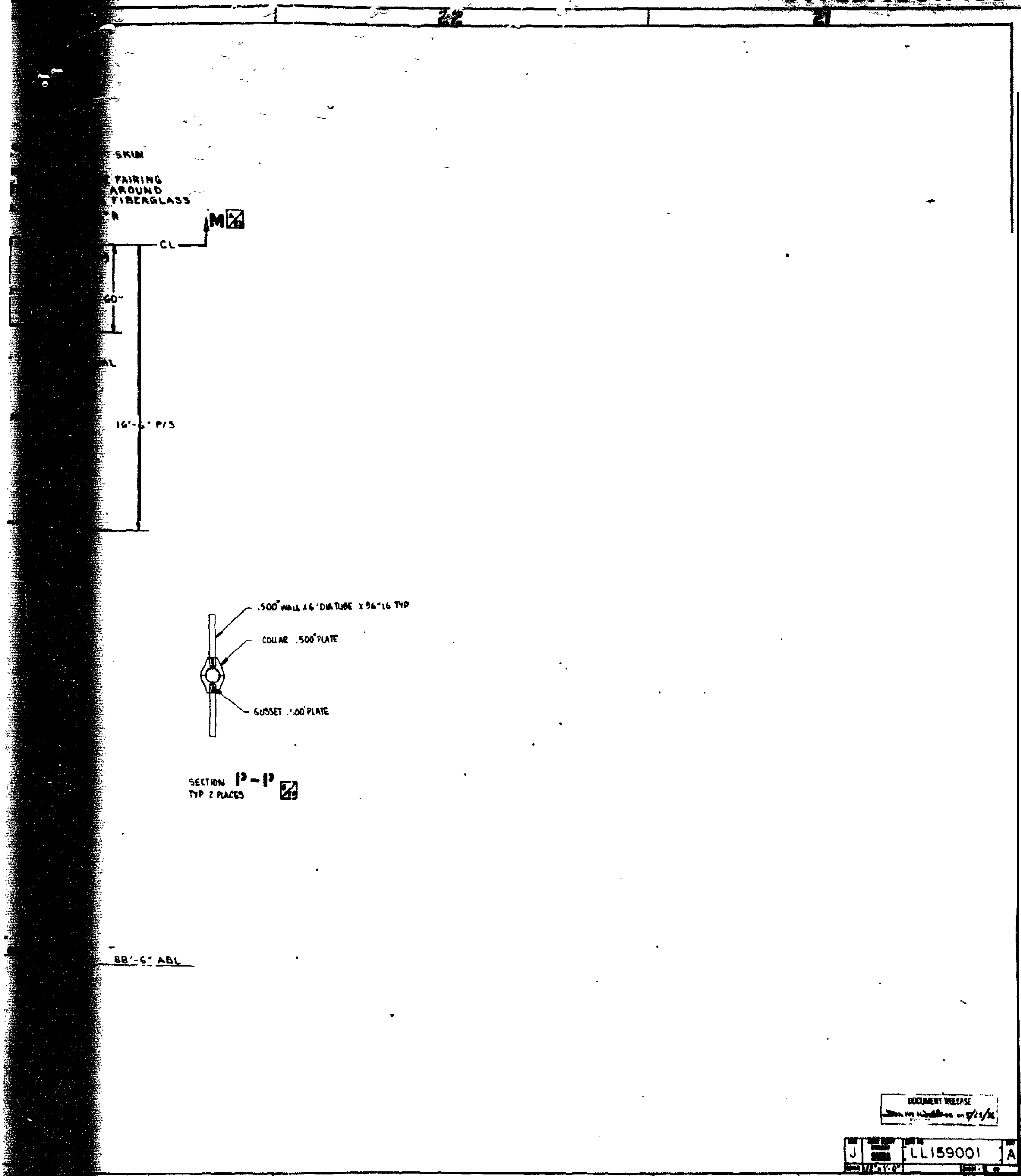


Figure B.3-6 (Sheet 2 of 2) (U)

UNCLASSIFIED

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	INC ECO L00003. K.D. NICHOLS 6-11-76	6/30	

7. MINIMUM FILLET RADIUS = 0.125
6. WELDED SECTIONS MAY BE SUBSTITUTED FOR ANY EXTRUSION; UTILIZING 5456 AL ALY SHEET & PLATE, COND H 117 FOR THKNS .188 & ABOVE & COND H 323 FOR THKNS BELOW .188, PER FED SPEC QQ-A-250/20. FABRICATE, WELD, & INSPECT PER NAVSHIPS 0900-060-4010. (SE& 2K SES PROGRAM DIRECTIVES 500.12, 500.16, 500.17 & 500.20).
5. PACKAGING PER MIL-STD-649.
4. MARKING PER FED-STD-184.
3. MATERIAL: 5456 AL ALY COND H111 PER FED SPEC QQ-A-200/7.
2. TOLERANCES PER FED-STD-245.
1. DIMENSIONS ARE IN INCHES.

NOTES:

DOCUMENT RELEASE
DATE 5/25/76

REF	DRAWING NO.	TITLE
13	LL 117001	FRAMES - TRANSVERSE
12	LL 159001	SUPERSTRUCTURE
11	LL 136001	DECK PLATING - 01 LEVEL
10	LL 134001	DECK PLATING - WET DECK
9	LL 133001	DECK PLATING - 3RD DECK
8	LL 132001	DECK PLATING - 2ND DECK
7	LL 131001	DECK PLATING - MAIN DECK
6	LL 122001	BULKHEADS - TRANSVERSE
5	LL 121004	BULKHEAD - LONG., 42FT-6 OFF ℄
4	LL 121001	BULKHEAD - LONG., CL
3	LL 111001	SHELL PLATING
2	LL 110001	BOW
1	LL 101005	PLATING/TEE TABULATION

DRAWN	J.A. JACOBS	5/6/76
CHK		5/19/76
STRESS		
WEIGHTS		5/25/76
DESG SUPV		5/20/76
GRP MGR		5-20-76
MFG ENG		
QA		5/25/76
ORG/CCB		5-24-76
P.O.	C. Smyl	5-25-76
LAYOUT NO		

BELL INDUSTRIES, INC. SES DIVISION

LSES EXTRUSIONS - STRUCTURAL

SIZE	CODE IDENT NO	DWG NO	REV
B	51563	LL 101004	A

SCALE NONE SHEET 1 OF 5

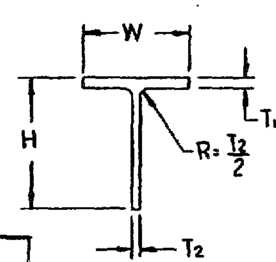
Figure B.3-7 (Sheet 1 of 5) (U)

UNCLASSIFIED

EXT	H	W	T_1	T_2	LB/FT
-201	2.50	1.65	.100	.100	.474
-202	2.50	1.65	.125	.125	.587
-203	3.00	1.75	.100	.100	.543
-204	3.00	1.75	.125	.125	.674
-205	3.50	1.75	.125	.125	.746
-206	3.50	1.75	.150	.150	.889
-207	4.50	2.25	.150	.150	1.148
-208	5.00	2.50	.175	.175	1.484
-209	5.00	2.50	.200	.200	1.690
-210	5.50	2.75	.350	.350	3.200
-211	6.00	3.00	.200	.200	2.095
-212	6.50	3.25	.250	.250	2.744
-213	7.00	3.50	.350	.350	4.108
-214	7.00	3.50	.450	.450	5.295
-215	7.00	3.50	.600	.600	6.887
-216	4.00	8.00	.375	.375	5.039
-217	8.00	8.00	1.000	1.000	17.404
-218	4.00	8.00	.750	.750	9.790
-219	4.00	8.00	.500	.375	6.137
-220	4.00	8.00	.313	.180	3.657
-221	4.00	2.50	.150	.120	.972
-222	10.00	8.00	.750	.750	14.974
-223	3.50	1.75	.160	.160	.946
-226	18.00	6.00	.750	.500	15.151
-228	8.00	6.00	.750	.750	11.518
-229	8.00	6.00	.500	.250	5.624
-230	6.00	6.00	.750	.500	8.239
-231	4.00	8.00	.160	.160	2.190
-232	6.00	6.00	.250	.250	3.392
-233	4.00	8.00	.500	.250	5.624

EXT	H	W	T_1	T_2	LB/FT
-234	12.00	6.00	.750	.500	11.695
-239	4.00	8.00	.250	.250	3.392
-242	12.00	2.50	.350	.190	3.566
-246	4.00	2.00	.250	.150	1.232
-248	12.00	3.00	.160	.160	2.743
-257	8.00	8.00	.600	.575	8.744
-258	12.00	4.00	.500	.250	5.624
-266	12.00	4.00	1.000	.500	10.975
-273	12.00	4.00	.225	.175	3.418
-274	8.00	4.00	.275	.125	2.387
-275	10.00	6.00	.700	.400	9.144
-276	8.00	4.00	.950	.375	7.441
-277	15.00	6.00	.700	.350	10.619
-278	15.00	6.00	.400	.225	6.557
-279	12.00	4.00	.325	.200	4.195
-280	12.00	4.00	.625	.325	7.152
-281	10.00	4.00	.600	.350	6.570
-282	10.00	4.00	.950	.325	7.779
-283	8.00	4.00	.400	.700	8.033
-284	8.00	4.00	.400	.300	4.481
-285	8.00	4.00	.575	.350	5.659
-286	8.00	4.00	.325	.200	3.274
-287	15.00	6.00	.800	.450	12.916
-288	18.00	6.00	.300	.200	6.157
-289	15.00	6.00	.425	.250	7.143
-290	12.00	4.00	.550	.200	5.180
-291	12.00	4.00	.700	.225	6.162
-292	15.00	6.00	.375	.200	5.969
-293	10.00	4.00	.425	.175	3.896
-294	8.00	3.00	.250	.125	1.988

EXT	H	W	T_1	T_2	LB/FT
-295	10.00	6.00	.625	.625	11.118
-296	8.00	6.00	.500	.750	10.006
-297	15.00	6.00	.700	.275	9.378
-298	12.00	4.00	1.000	.750	14.182
-299	4.00	8.00	.375	.500	5.575



DOCUMENT RELEASE

CONFIG MGT DATE 5/25/76

SEE SHEET 1 FOR NOTES & REVISIONS

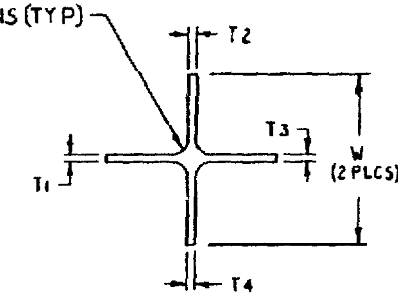
SIZE	CODE IDENT NUMBER	DWG NO	REV
B	51563	LL101004	A
SCALE NONE		SHEET 2 OF	

Figure B.3-7 (Sheet 2 of 5) (U)

UNCLASSIFIED

EXT	W	T1	T2	T3	T4	LB/FT
-302	8.00	.180	.180	.180	.180	3.409
-303	8.00	.250	.250	.250	.250	4.764
-304	8.00	.344	.344	.344	.344	6.672
-305	8.00	.500	.500	.500	.500	9.917
-306	8.00	.750	.750	.750	.750	15.405

R = 2 x MAX THKNS (TYP)
EXCEPT AS NOTED



DOCUMENT RELEASE

SEE SHEET 1 FOR NOTES & REVISIONS

SIZE	CODE IDENT NUMBER	DWG NO	REV
B	51563	LL101004	A
SCALE NONE		SHEET 3 OF	

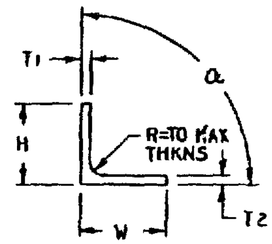
UNCLASSIFIED

UNCLASSIFIED

Figure B.3-7 (Sheet 3 of 5) (U)

EXT	H	W	T1	T2	α	LB/FT
-402	3.00	3.00	.200	.200	90°	1.346
-417	1.25	1.25	.125	.125	90°	.346
-423	6.00	2.00	.375	.375	90°	3.329
-428	12.00	4.00	.300	.300	90°	5.448
-429	7.00	3.00	.260	.260	90°	2.934
-431	4.00	4.00	.250	.250	90°	2.247
-433	15.00	4.00	.200	.375	90°	5.132
-434	10.00	4.00	.125	.125	90°	3.382
-435	6.00	4.00	.125	.200	90°	1.767
-436	6.00	6.00	.750	.750	90°	9.859
-437	4.00	4.00	.375	.375	90°	3.329
-438	8.00	8.00	1.000	1.000	90°	17.527
-439	8.00	8.00	.750	.750	90°	13.315

EXT	H	W	T1	T2	α	LB/FT



DOCUMENT RELEASE

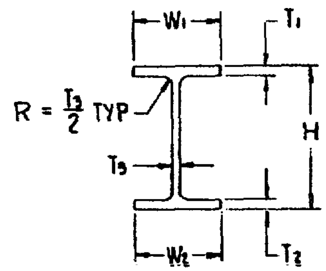
SEE SHEET 1 FOR NOTES & REVISIONS

SIZE	CODE IDENT NUMBER	DWG NO	REV
B	51563	LL101004	A
SCALE NONE		SHEET 4 OF	

Figure B.3-7 (Sheet 4 of 5) (U)

UNCLASSIFIED

EXT	H	W1	W2	T1	T2	T3	LB/FT
-510	12.00	3.00	3.00	.420	.420	.250	6.132
-515	10.00	3.00	3.00	.250	.250	.250	4.479
-517	10.00	8.00	8.00	.500	.500	.375	13.139
-518	6.00	6.00	6.00	.375	.375	.250	6.711
-519	12.00	8.00	8.00	.500	.500	.375	14.003
-521	6.00	6.00	6.00	.250	.250	.250	5.055
-522	6.00	6.00	6.00	.750	.750	.500	13.022
-525	8.00	6.00	6.00	.300	.300	.125	5.228
-526	3.00	3.00	3.00	.200	.200	.125	1.772
-531	4.00	5.50	5.50	.300	.300	.550	6.031
-532	4.00	4.00	4.00	.200	.200	.125	2.377
-533	6.00	4.00	4.00	.200	.200	.200	3.149
-534	8.00	8.00	8.00	1.000	1.000	1.000	25.592



SEE SHEET 1 FOR NOTES & REVISIONS

DOCUMENT RELEASE
DATE 5/20/76

SIZE	CODE IDENT NUMBER	DWG NO	REV
B	51563	LL 101004	A
SCALE NONE		SHEET 5 OF	

Figure B.3-7 (Sheet 5 of 5) (U)

UNCLASSIFIED

IDENT	PL THKNS	⚠1 TEE
A	.140	-201
B	.140	-203
C	.160	-201
D	.160	-203
E	.160	-204
F	.160	-205
G	.160	-207
H	.180	-201
J	.180	-203
K	.180	-204
L	.180	-205
M	.180	-207
N	.180	-208
P	.180	-209
R	.180	-211
S	.200	-201
T	.200	-202
U	.200	-203
V	.200	-204
W	.200	-205
Y	.200	-207
Z	.200	-208
AA	.200	-206
AB	.200	-211
AC	.200	-212
AD	.224	-202
AE	.224	-204
AF	.224	-205
AG	.224	-206
AH	.250	-206
AJ	.224	-208
AK	.160	-208

IDENT	PL THKNS	⚠1 TEE
AL	.224	-207
AM	.250	-202
AN	.250	-204
AP	.250	-205
AR	.250	-207
AS	.250	-208
AT	.250	-212
AU	.281	-206
AV	.281	-207
AW	.281	-208
AY	.281	-213
AZ	.313	-213
BA	.344	-208
BB	.344	-209
BC	.344	-210
BD	.344	-212
BE	.344	-213
BF	.344	-214
BG	.313	-207
BH	.406	-210
BJ	.375	-212
BK	.406	-214
BL	.406	-215
BM	.500	-212
BN	.500	-214
BP	.344	-223
BR	.375	-223
BS	.313	-206
BT	.200	-209
BU	.375	-209
BV	.313	-208
BW	.406	-212

IDENT	PL THKNS	⚠1 TEE
BY	.250	-209
BZ	.375	-214
CA	.313	-214
CB	.281	-215
CC	.281	-211

DOCUMENT RELEASE
DATE 5/25/76

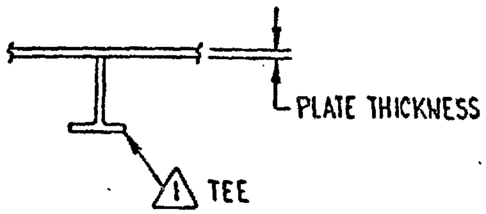
SIZE	CODE IDENT NUMBER	DWG NO	REV
B	51563	LL101005	
SCALE NONE		SHEET 2 OF 2	

Figure B.3-8 (Sheet 1 of 2) (U)

UNCLASSIFIED

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



ORIENTATION DETAIL

REF	DRAWING NO.	TITLE
12	LL 159001	SUPERSTRUCTURE
11	LL 136001	DECK PLATING - 01 LEVEL
10	LL 134001	DECK PLATING - WET DECK
9	LL 133001	DECK PLATING - 3RD DECK
[illegible]	LL 132001	DECK PLATING - 2ND DECK
7	LL 131001	DECK PLATING - MAIN DECK
6	LL 122001	BULKHEADS - TRANSVERSE
5	LL 121004	BULKHEAD - LONG., 42FT-6 OFF ℄
4	LL 121001	BULKHEAD - LONG., CL
3	LL 111001	SHELL PLATING
2	LL 110001	BOW
1	LL 101004	EXTRUSIONS - STRUCTURAL

NOTE:

⚠1 SEE REF 1 FOR TEE DEFINITION.

DOCUMENT RELEASE
DATE 5/25/76

DRAWN	J.A. JACOBS	5/6/76
CHK		
STRESS		
WEIGHTS		5/25/76
DESG SUPV		5/20/76
GRP MGR		5-20-76
MFG ENG		5/25/76
QA		
DRB/CCB		
P.O.		
LAYOUT NO		

INDUSTRIES, INC. SES DIVISION

LSES TABULATION - PLATING/TEE

SIZE	CODE IDENT NO	DWG NO	REV
B	51563	LL 101005	—
		NAVSEA NO	REV
SCALE NONE		SHEET 1 OF 2	

Figure B.3-8 (Sheet 2 of 2) (U)

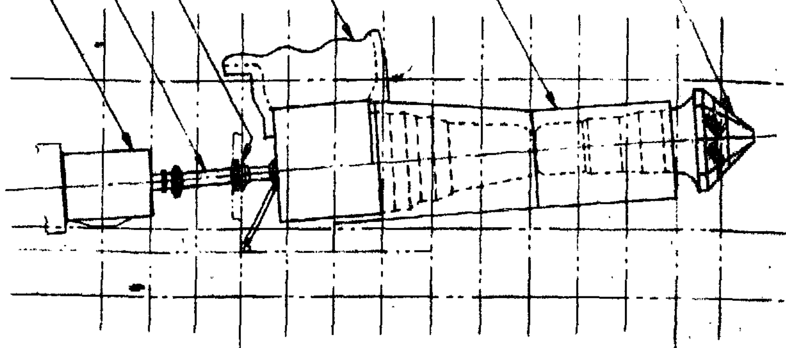
UNCLASSIFIED

(U) B.4 PROPULSION SYSTEM DRAWINGS

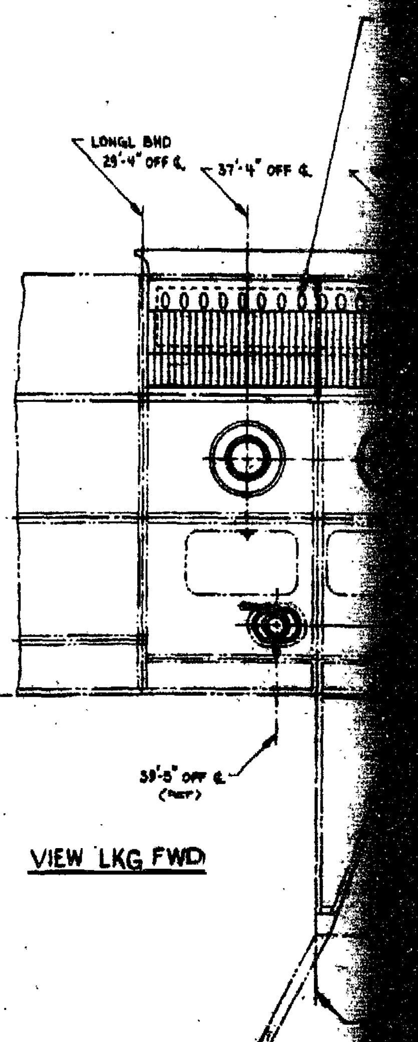
(U) This section of Appendix B contains the following propulsion system drawings:

Figure	Title
B.4-1	Main Propulsion Machinery Arrangement, P/S
B.4-2	Waterjet Inlet Arrangement, Port and Starboard

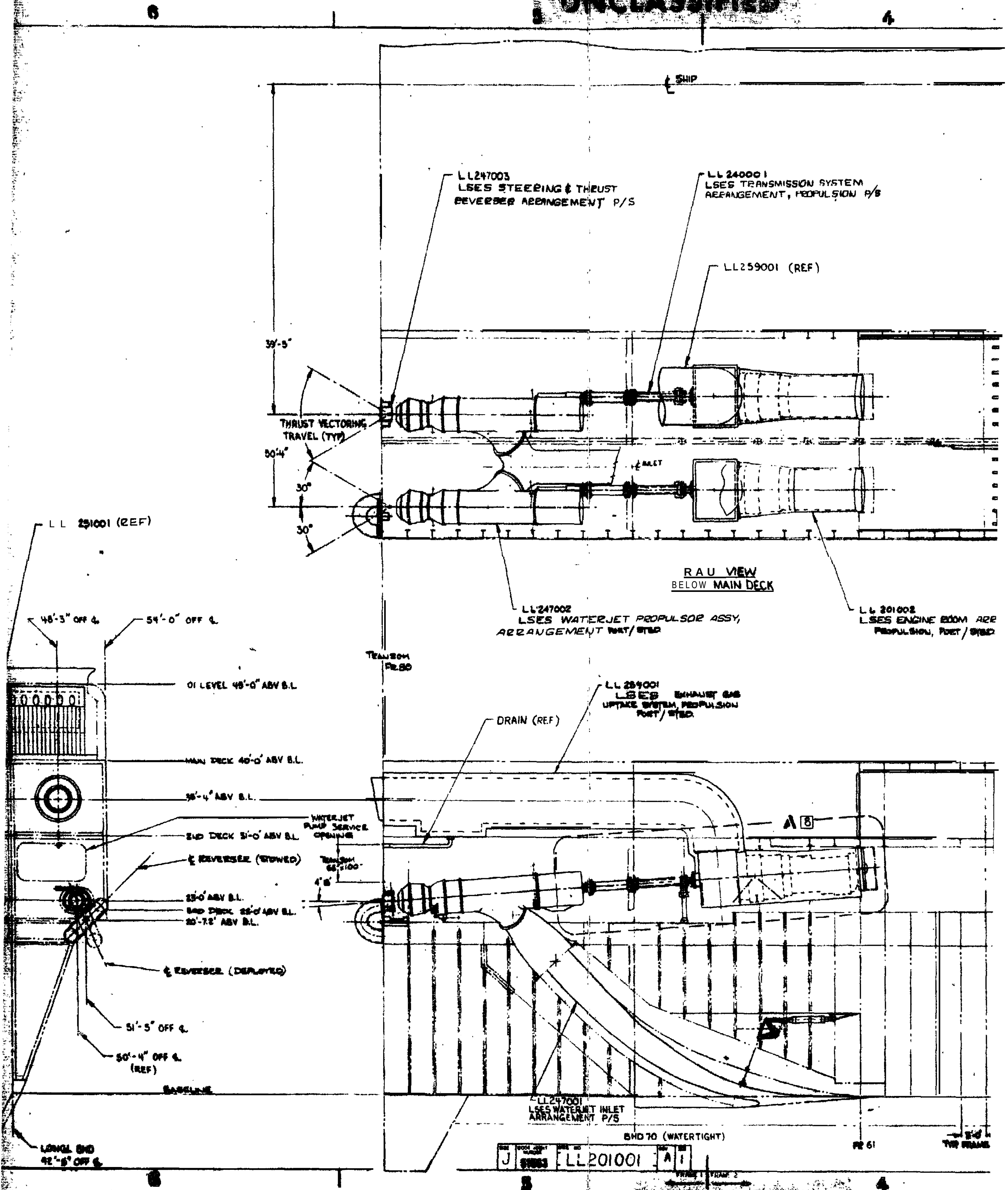
(U) The remainder of the detailed propulsion system description for the ANVCE near term SES is contained in Section 2.3.2.



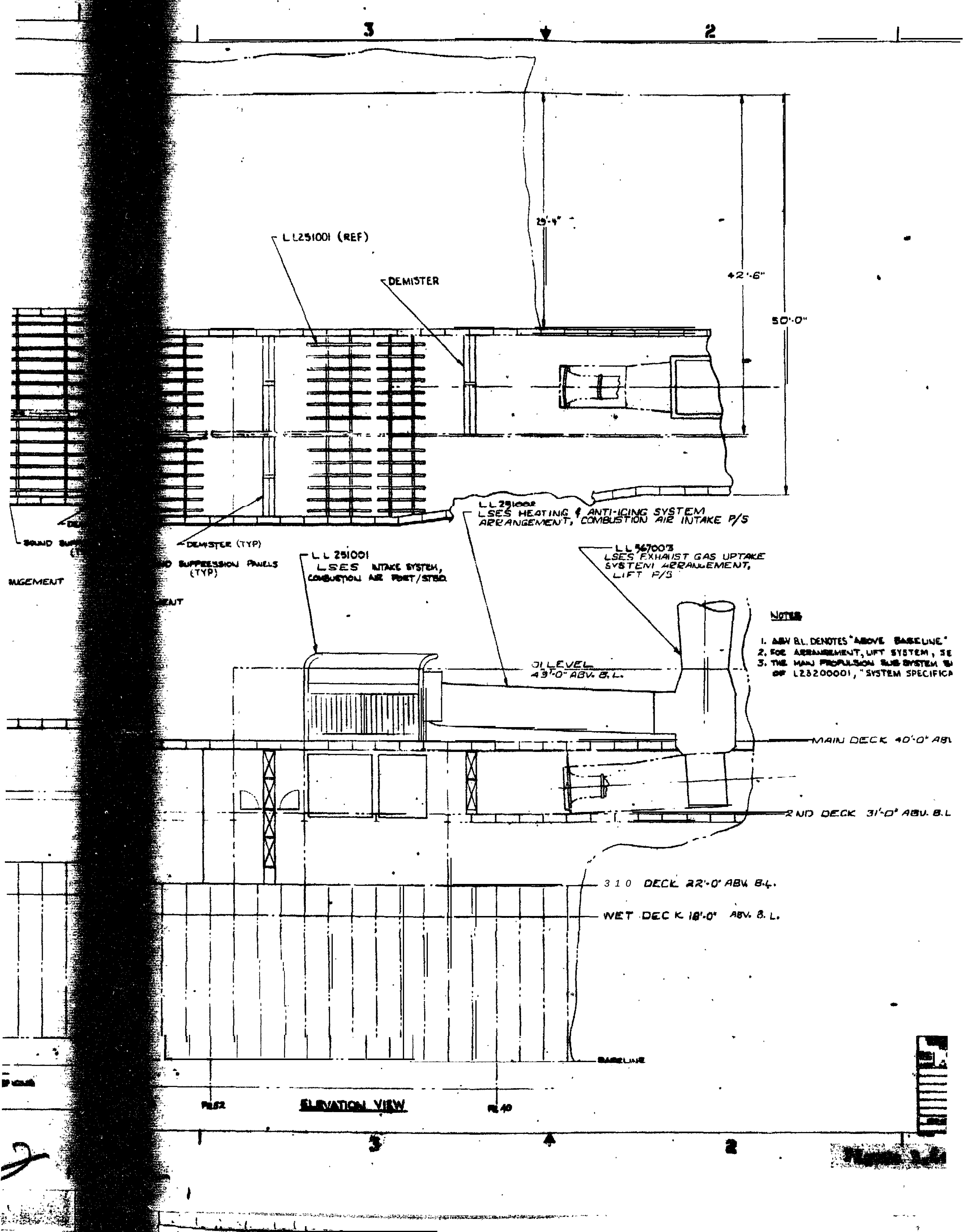
VIEW A 4
SCALE : NONE
ALTERNATE ENGINE



VIEW LKG FWD



6
5
4
℄ SHIP
LL247003
LSES STEERING & THRUST REVERSER ARRANGEMENT P/S
LL240001
LSES TRANSMISSION SYSTEM ARRANGEMENT, PROPULSION P/S
LL259001 (REF)
39'-5"
THRUST VECTORING TRAVEL (TYP)
30'-4"
30°
30°
LL 251001 (REF)
RAU VIEW
BELOW MAIN DECK
LL247002
LSES WATERJET PROPULSOR ASSY, ARRANGEMENT PORT/STBD
LL 201002
LSES ENGINE ROOM ARR PROPULSION, PORT/STBD
48'-3" OFF ℄
54'-0" OFF ℄
TRANSOM FR.80
01 LEVEL 48'-0" ABV B.L.
LL 284001
LSES EXHAUST GAS UPTAKE SYSTEM, PROPULSION PORT/STBD
DRAIN (REF)
MAIN DECK 40'-0" ABV B.L.
38'-4" ABV B.L.
WATERJET PUMP SERVICE OPENING
2ND DECK 31'-0" ABV B.L.
℄ REVERSER (STOWED)
A 8
4'-8"
23-0 ABV B.L.
3RD DECK 22'-0" ABV B.L.
20'-7.2" ABV B.L.
℄ REVERSER (DEPLOYED)
51'-5" OFF ℄
50'-4" OFF ℄ (REF)
BASELINE
LL247001
LSES WATERJET INLET ARRANGEMENT P/S
BHD 70 (WATERTIGHT)
FR 61
LONG'L BHD 42'-6" OFF ℄
J
LL201001
A
1
6
5
4



3
2
29'-4"
42'-6"
50'-0"
L L251001 (REF)
DEMISTER
L L 251002
LSES HEATING & ANTI-ICING SYSTEM ARRANGEMENT, COMBUSTION AIR INTAKE P/S
DEMISTER (TYP)
SUPPRESSION PANELS (TYP)
L L 251001
LSES INTAKE SYSTEM, COMBUSTION AIR PORT/STBD
L L 567003
LSES EXHAUST GAS UPTAKE SYSTEM ARRANGEMENT, LIFT P/S
NOTES
1. ABV B.L. DENOTES "ABOVE BASELINE"
2. FOR ARRANGEMENT, LIFT SYSTEM, SE
3. THE MAIN PROPULSION SUB SYSTEM
OF L23200001, "SYSTEM SPECIFICA
01 LEVEL 43'-0" ABV. B.L.
MAIN DECK 40'-0" ABV
2ND DECK 31'-0" ABV. B.L
3 1 0 DECK 22'-0" ABV B.L.
WET DECK 18'-0" ABV. B.L.
BASELINE
FR 52
ELEVATION VIEW
FR 40
3
2

UNCLA

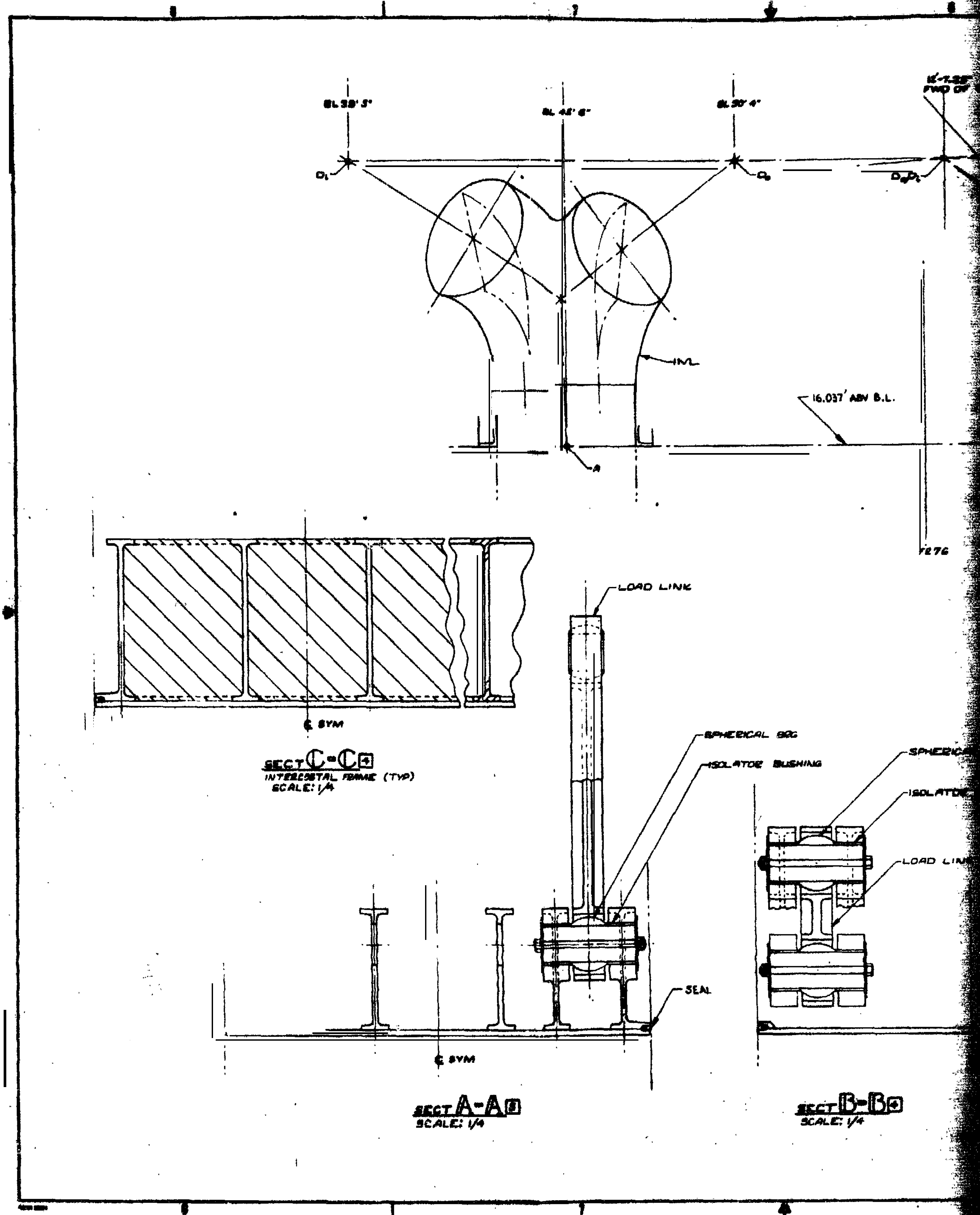
4B 28	A	REVISED SHEET 1 AND DELETED SHEET 2 PER ECR L00003.

7012.
ET THE REQUIREMENTS
FOR THE LSES PROPULSION PLANT."

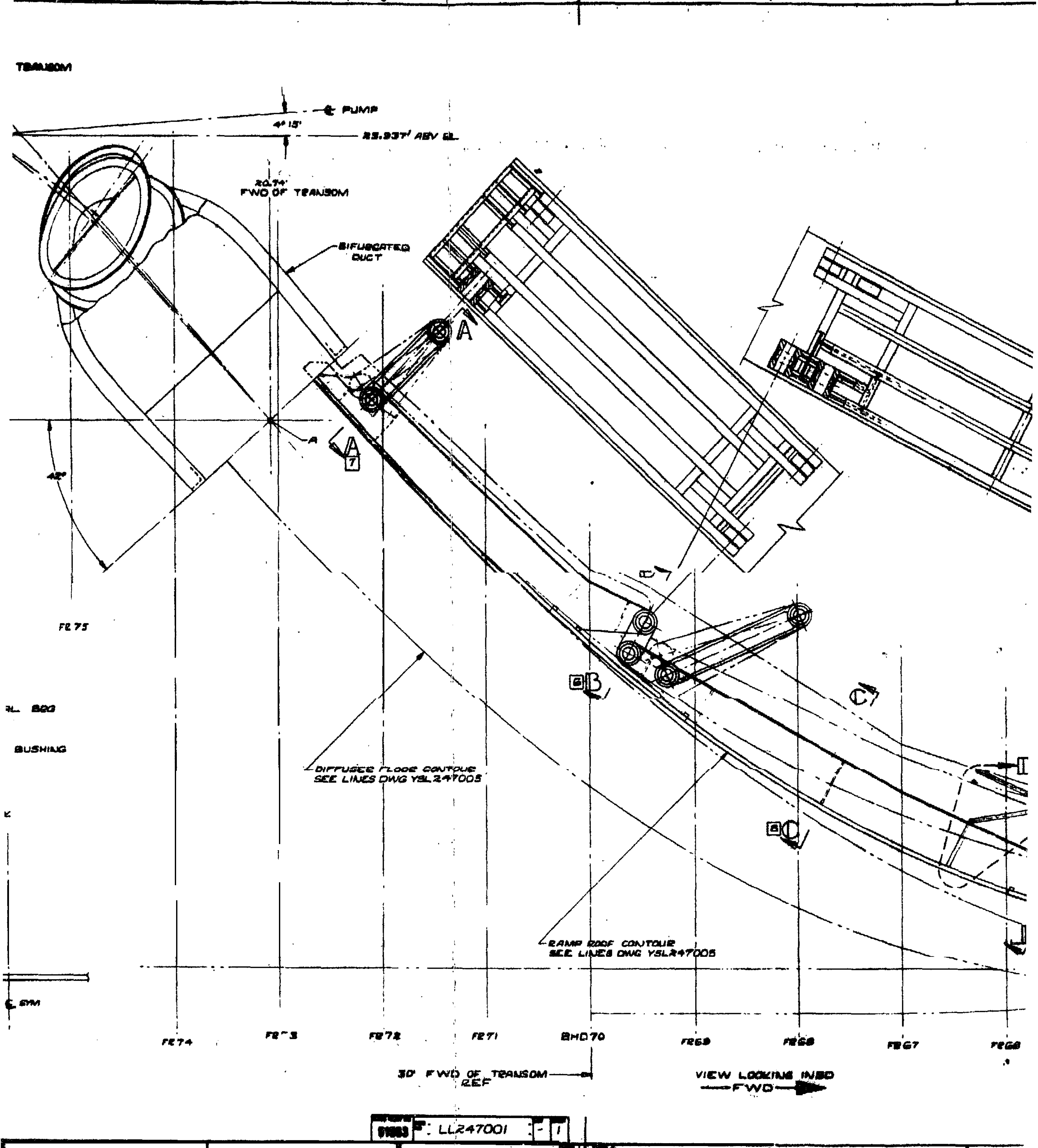
LSES M
PROPULS
MACHINE
ARRANGE

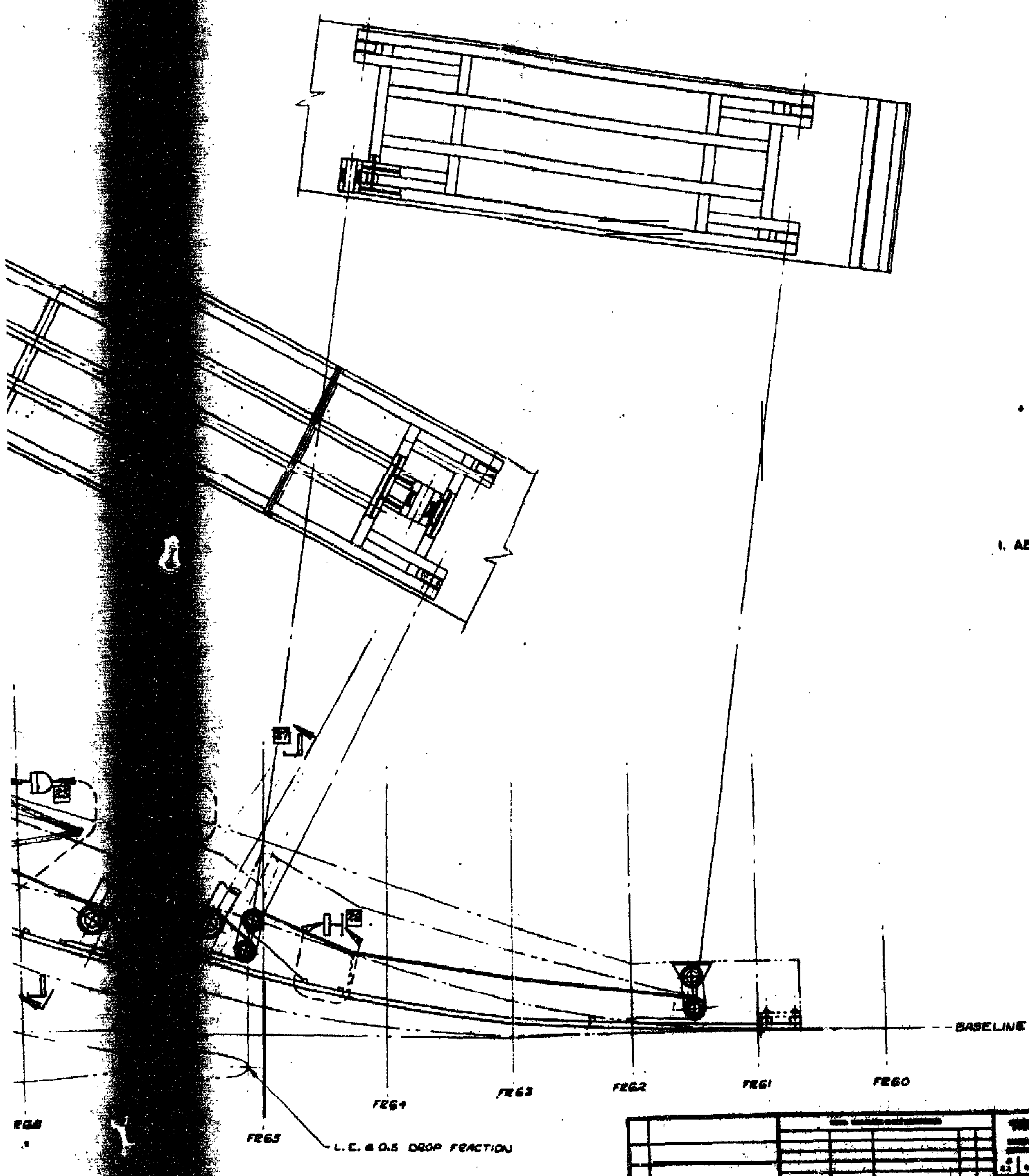
UNCLA

3



IML
16.037' ABV B.L.
LOAD LINK
SPHERICAL BRG
ISOLATOR BUSHING
SEAL
SYM
SECT C-C
INTERCOSTAL FRAME (TYP)
SCALE: 1/4
SECT A-A
SCALE: 1/4
SECT B-B
SCALE: 1/4


TRANSOM
℄ PUMP
4° 15'
25.937' ABV BL
20.74'
FWD OF TRANSOM
BIFURCATED
DUCT
A
42°
FR 75
BUSHING
DIFFUSER FLOOR CONTOUR
SEE LINES DWG YSL247005
RAMP ROOF CONTOUR
SEE LINES DWG YSL247005
B
C
℄ SYM
FR 74
FR 72
FR 71
BHD 70
FR 69
FR 68
FR 67
30' FWD OF TRANSOM
REF
VIEW LOOKING INBD
FWD
LL247001

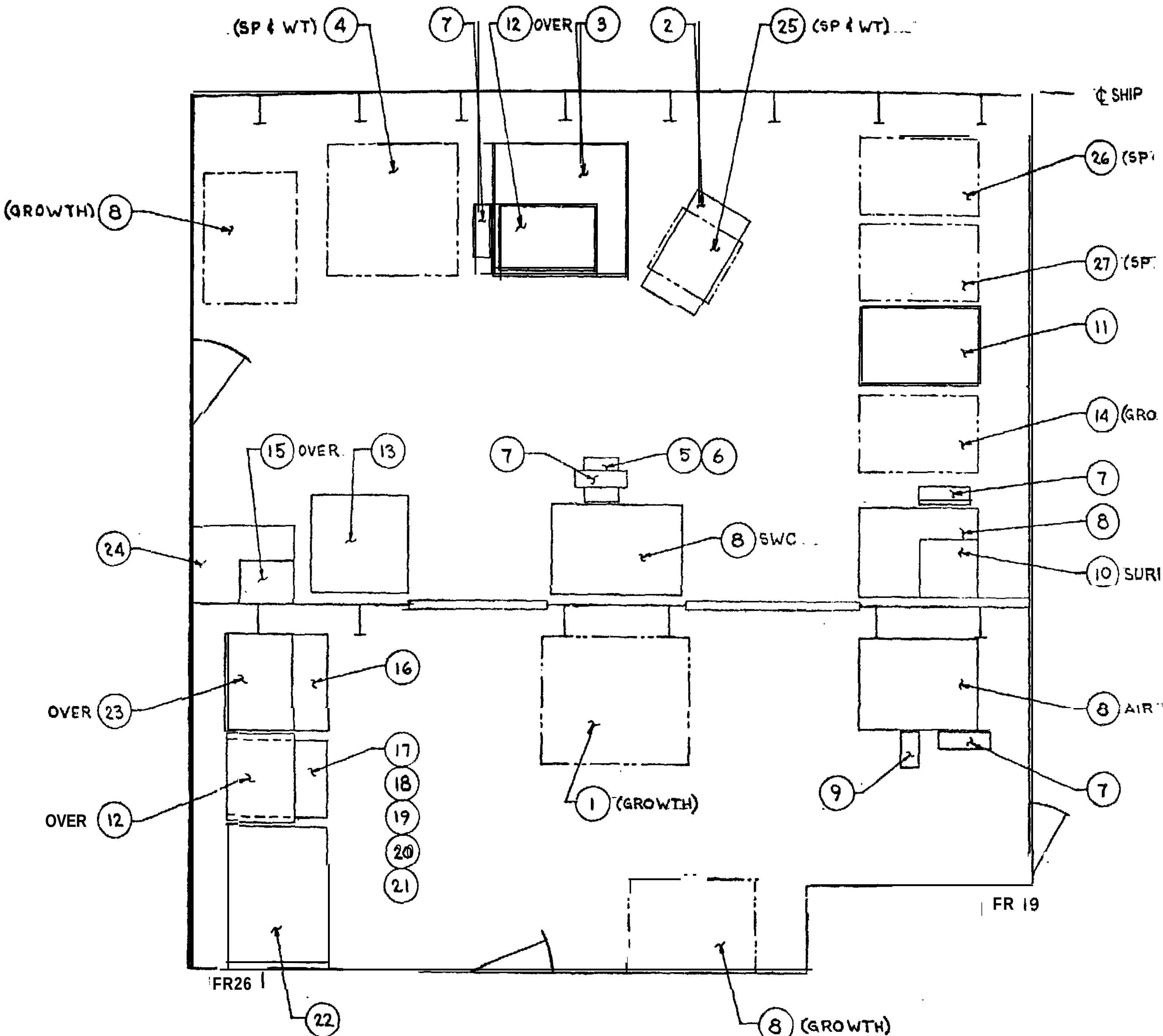


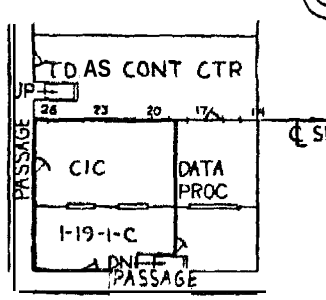
NOTES

1. ABV B.L. DENOTES "ABOVE BASE

(U) B.5 C^3 ARRANGEMENT DRAWINGS AND BLOCK DIAGRAMS

(U) This section of Appendix B contains the command, control, and communications (C^3) arrangement drawings and block diagrams for the near term ANVCE SES. They are:





KEY PLAN
COMBAT INFORMATION CTR
MAIN DECK
SCALE 1/16" = 1'0"

DOCUMENT RELE

CONFIG MGT

SYM | EFFECTIVITY

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-24-76 6-30-76 6-30-76	

WD—

r)

ı)

IT TRKG • OVER

TRKG

PC NO	DESCRIPTION	QTY
27	MK 81 CONSOLE (SPACE & WEIGHT)	1
26	MK 48 TORPEDO FIRING PANEL (SPACE & WEIGHT)	1
25	CLOSE IN WEAPONS SYSTEM REMOTE CONTROL PANEL (SPACE & WEIGHT)	1
24	RADIO PHONE TALKER DESK	1
23	TORPEDO FIRE CONTROL PANEL MK 309	1
22	SONAR RECEIVING SET DISPLAY CONSOLE AN/UQR-1 (MOD)	1
21	EQUIPMENT CABINET	1
20	BT RECORDER RO-326B/SSQ-56	1
19	COMM SET C-7440/WQC-2	1
18	RECORDER ASSEMBLY RO-358/AQS-13A	1
17	RECEIVER/INDICATOR ASSEMBLY	1
16	ACOUSTIC DISPLAY CONSOLE AN/UYQ-( )	1
15	IC STATION LS-537A	1
14	RPV CONSOLE (GROWTH)	1
13	CO POSITION	1
12	REMOTE DATA READOUT OA-8337(V)2/UYA-4(V)	2
11	ELECTRONIC WARFARE CONSOLE AN/SLQ-31	1
10	RADAR SET CONTROL C-9447/SPS-55	1
9	RADAR SET CONTROL AN/APS-125	1
8	PPI DISPLAY CONSOLE OJ-194(V)3/UYA-4(V) (INCLUDING TWO GROWTH)	5
7	VIDEO DECODER KY-761(P)/UPA-59A(V)	4
6	ADDRESS CONTROL INDICATOR C-9062/U	1
5	DATA SET CONTROL C-9063/USQ-59	1
4	STIR WEAPON CONTROL CONSOLE (SPACE & WEIGHT)	1
3	MK 92 WEAPON CONTROL CONSOLE	1
2	HARPOON WEAPON CONTROL CONSOLE	1
1	OPERATIONS SUMMARY CONSOLE OJ-197/UYA-4(V) (GROWTH)	1

PARTS AND MATERIAL LIST

NOTE: THIS BLOCK IS NOT MAINTAINED

NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.010	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

DRAWN S. RHODES 3/30/76

5/7/76

5-12-76

5-13-76

5/13/76

5-7-76

5/13/76

CHULA VISTA, CALIF.

ROHR INDUSTRIES, INC.

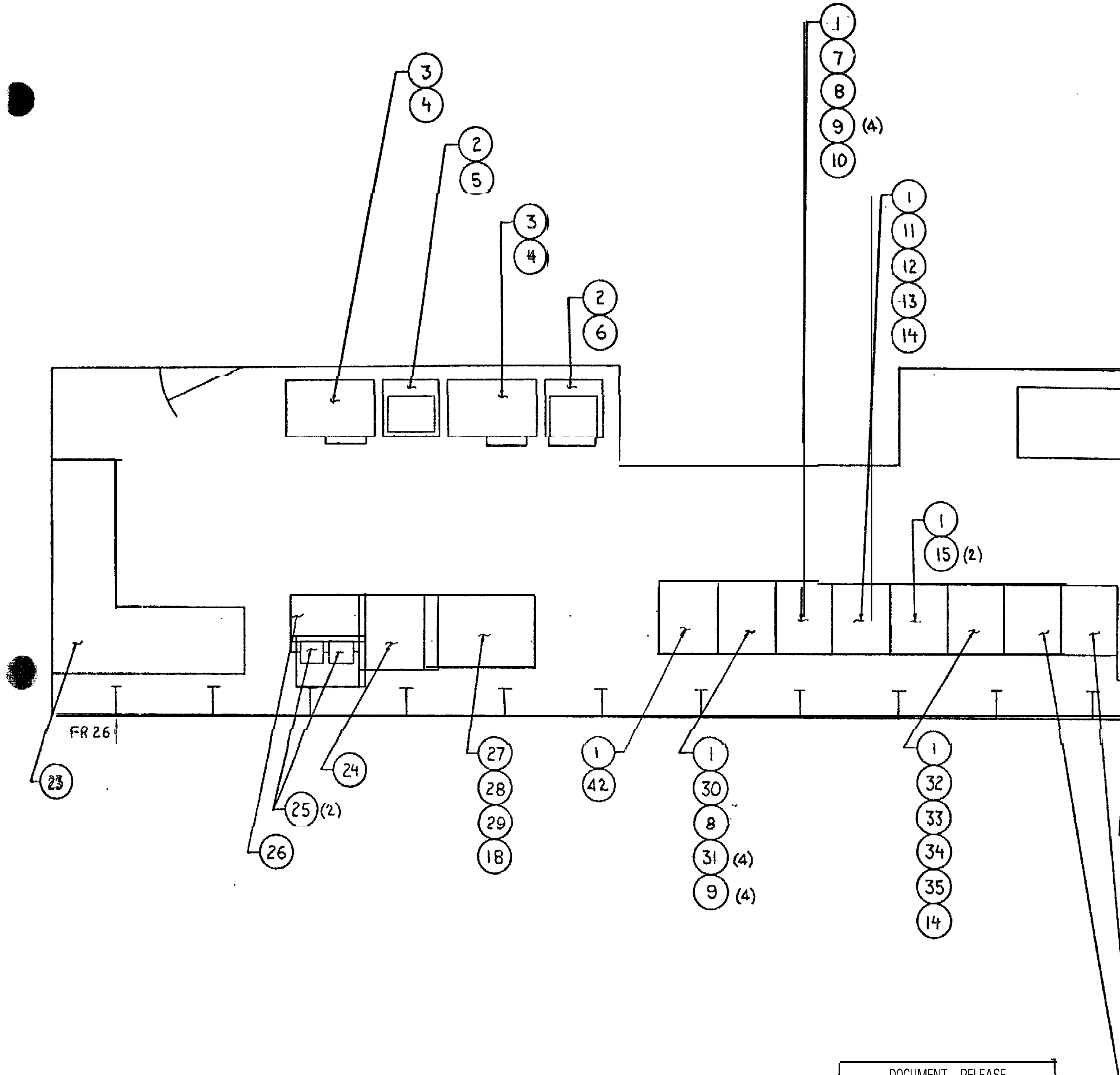
COMBAT INFORMATION CENTER ARRANGEMENT MAIN DECK

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL 411001	A

SCALE 1/2"=1' SHEET 1 OF 1

Figure B.5-1 (U)

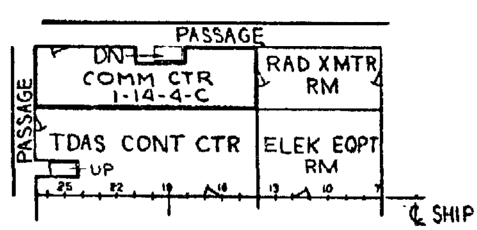
UNCLASSIFIED



DOCUMENT RELEASE

M Wallace DATE 5/13/76

CONFIG MGT

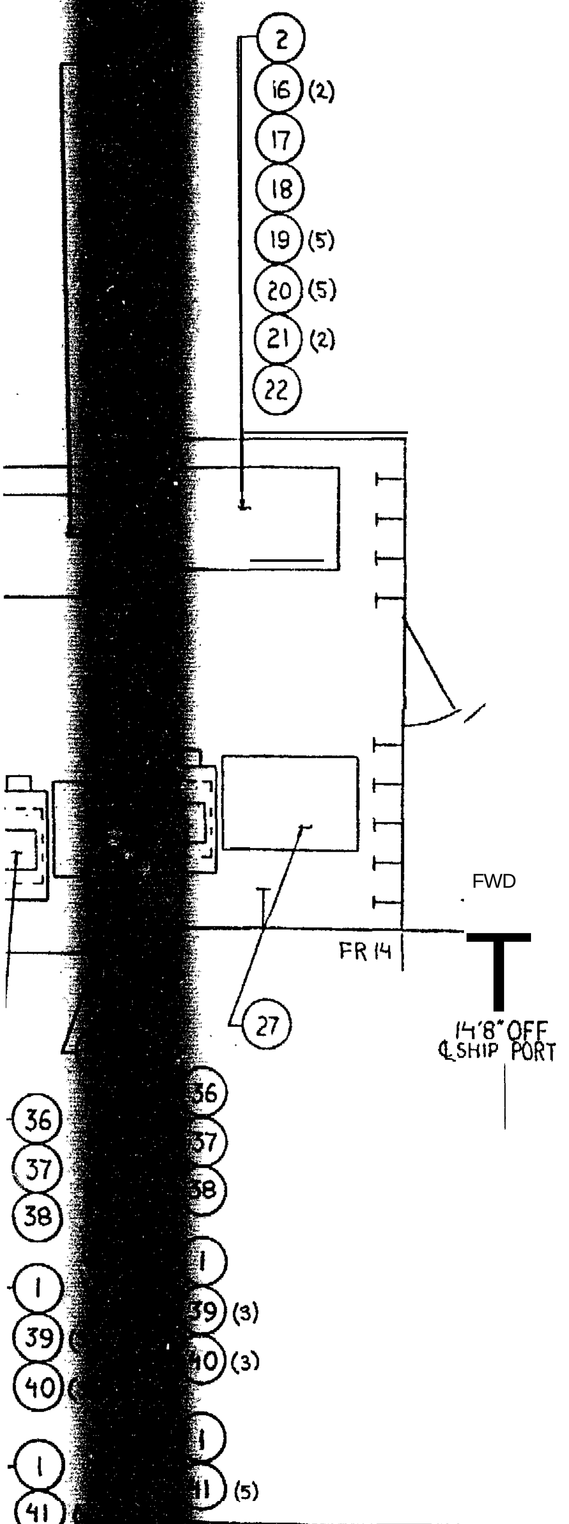


KEY PLAN
COMMUNICATION CENTER
MAIN DECK
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

UNCLASSIFIED

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-23-76 6-30-76	



PC NO	DESCRIPTION	QTY
42	COMM SECURITY SYSTEM	1
41	SECURITY EQUIPMENT TSEC/KG-14	5
40	SECURITY EQUIPMENT TSEC/KW-7	3
39	FIXED PLANT ADAPTER KWX-11/TSEC	3
38	SECURITY EQUIPMENT TSEC/KL-47	1
37	SECURITY EQUIPMENT TSEC/HL-1B	1
36	SAFE TYPE 8	1
35	COMPUTER AN/UYK-20	1
34	RECORDER-REPRODUCER RD-396/U	1
33	RECORDER-REPRODUCER RD-397/U	1
32	INTERCONNECTING GROUP ON-143(V)/USQ	1
30	DEMULTIPLEXER TD-1063/SSR-1	1
29	CONTROL INDICATOR C-9351/WSC-3	1
28	SECURE TELEPHONE SET TA-840/U	1
27	DESK TYPEWRITER	2
26	TELEPRINTER TT-624/UG	1
25	REPERFORATOR TT-605/UG	2
24	PAGE PRINTER SET AN/UGR-10A	1
23	MESSAGE PROCESSING WORK STATION	1
22	TRANSFER SWITCHBOARD SB-3195/U	1
21	SECURITY EQUIPMENT TSEC/KWR-37	2
20	SECURITY EQUIPMENT KYB-6/TSEC	5
19	POWER SUPPLY HYP-2/TSEC	5
18	TRANSFER SWITCHBOARD SB-1039/SRT	2
17	SECURITY EQUIPMENT TSEC/KG-36-4	1
16	SECURITY EQUIPMENT TSEC/KY-75 (SPACE AND WEIGHT)	2
15	COMM PATCHING SWITCHBOARD (TRANSMITTER) SB-2744/SRT	2
14	COMM PATCHING SWITCHBOARD (DC) SB-2727/SRR (MOD)	2
13	MULTICHANNEL TELEGRAPH TERMINAL AN/UCC-1D(V)-R4	1
12	FSK/AFTS KEYER CONVERTER CV-2460/SGC	2
11	CONVERTER COMPARATOR TELETYPE AN/URA-17D	1
10	COMBINER DEMODULATOR MD-900/SSR-1	1
9	HF RADIO CONTROL C-9058/URC	8
8	COMM PATCHING SWITCHBOARD SB-2727/SRR	2
7	ANTENNA CONTROL C-9597/WSC-1(V)	1
6	TELETYPE SET (KSR) AN/UGC-77	1
5	PAGE PRINTER AN/UGR-9	1
4	FUNCTION REMOTE UNIT KWX-8/TSEC	2
3	TELETYPE SET (ASR) AN/UGC-48	2
2	EQUIPMENT RACK	3
1	EQUIPMENT CABINET	8

PARTS AND MATERIAL LIST

NOTE. THIS BLOCK IS NOT MAINTAINED

NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.010	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

DRAWN	S. RHODES	5/4/76
APPROVED	[signature]	5/7/76
CHECKED	[signature]	5-?-76
	[signature]	5-12-76
	[signature]	5-13-76
STRESS		
WGT		
MG ENGRG		
	[signature]	5/13/76
	[signature]	5-7-76
	[signature]	5/13/76

CHULA VISTA, CALIF.

ROHR INDUSTRIES, INC.

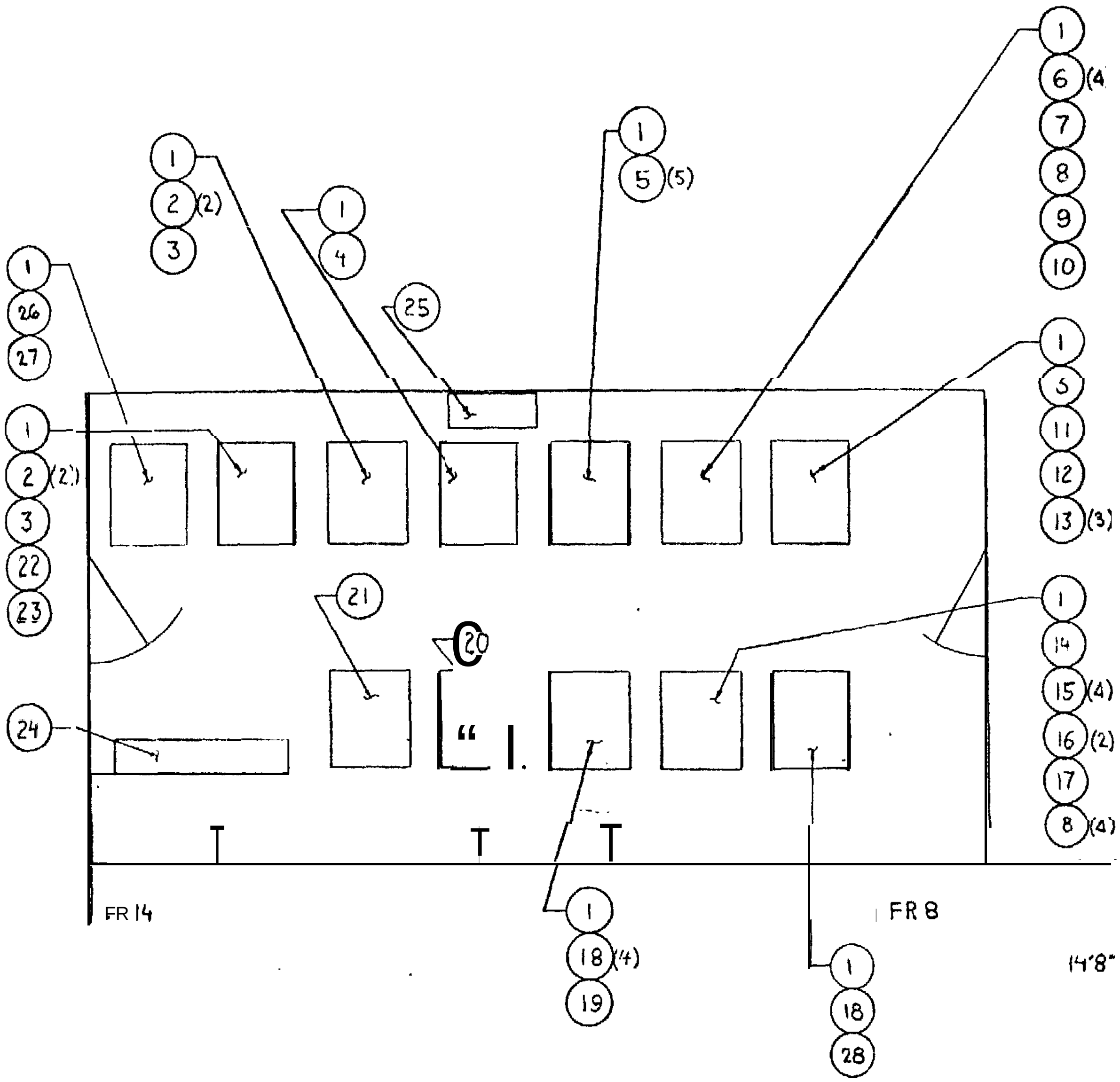
COMMUNICATION CENTER ARRANGEMENT MAIN DECK

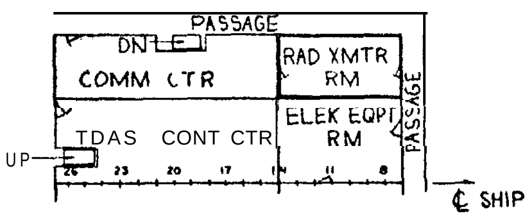
SIZE	CODE IDENT	DWG NO	REV
D	51563	LL440003	A

SCALE 1/2"=1' SHEET 1 OF 1

Figure B.5-2 (U)

UNCLASSIFIED





KEY PLAN
RADIO TRANSMITTER RM
MAIN DECK
SCALE 1/16" = 1'0"

SYM	EFFECTIVITY

UNCLASSIFIED

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-22-76 6-30-76 6-30-76	

FWD

℄ SHIP PORT

PC NO	DESCRIPTION	QTY
28	UHF NTDS TRANSCEIVER	1
27	HF NTDS TRANSCEIVER	1
26	LF/MF RECEIVER	1
25	DUMMY LOAD DA-242A/U	1
24	PATCH PANEL MATRIX SB-3721/SKR-3	1
23	TEST SET TS-333[illegible]/SKR-3	1
22	PATCH PANEL MATRIX SB-3720/SKR-3	1
21	TELEMETRY RECEIVER R-1039/SKR-3	1
20	DEMODULATOR MD-[illegible]/SKR-3	1
19	UHF LOCAL CONTROL UNIT C-9059/URC	1
18	UHF TRANSCEIVER AN/URC [illegible]	5
17	FREQUENCY STANDARD AN/URQ-23	1
16	RF DISTRIBUTION AMPLIFIER AM-2123A/U	2
15	BANDPASS FILTER F-332/U	4
14	UHF MULTICOUPLER TD-1046/URC	1
13	HF RECEIVER AN/URR-67	4
12	FILTER LP-101C	4
11	RECEIVER MULTIPLEXER 512J-2	1
10	RF SWITCHING UNIT SA-2000/WSC-3	1
9	ANTENNA- CONTROL C-9597/WSC-1	1
8	TRANSCEIVER SWITCH SA-1712/SG	5
7	UHF LOS/SATCOM TRANSCEIVER RT-1107/WSC-3	1
6	ANTENNA COUPLER CONTROL C-3698/URA-38	4
5	COUPLER ADAPTER MX-4845/SR	5
4	RF SWITCHING UNIT SA-1070/UR	1
3	HF RADIO SET CONTROL C-9058/URC	3
2	HF RADIO SET AN/URC-81	4
1	EQUIPMENT CABINET	10

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT DATE 5/13/76

NOTE THIS BLOCK IS NOT MAINTAINED

NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.010	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

S RHODES 4/16/76
5/7/76
5-12-76
5-13-76
5/12/76
5-7-76
5/13/76

CHULA VISTA, CALIF.

ROHR INDUSTRIES, INC.

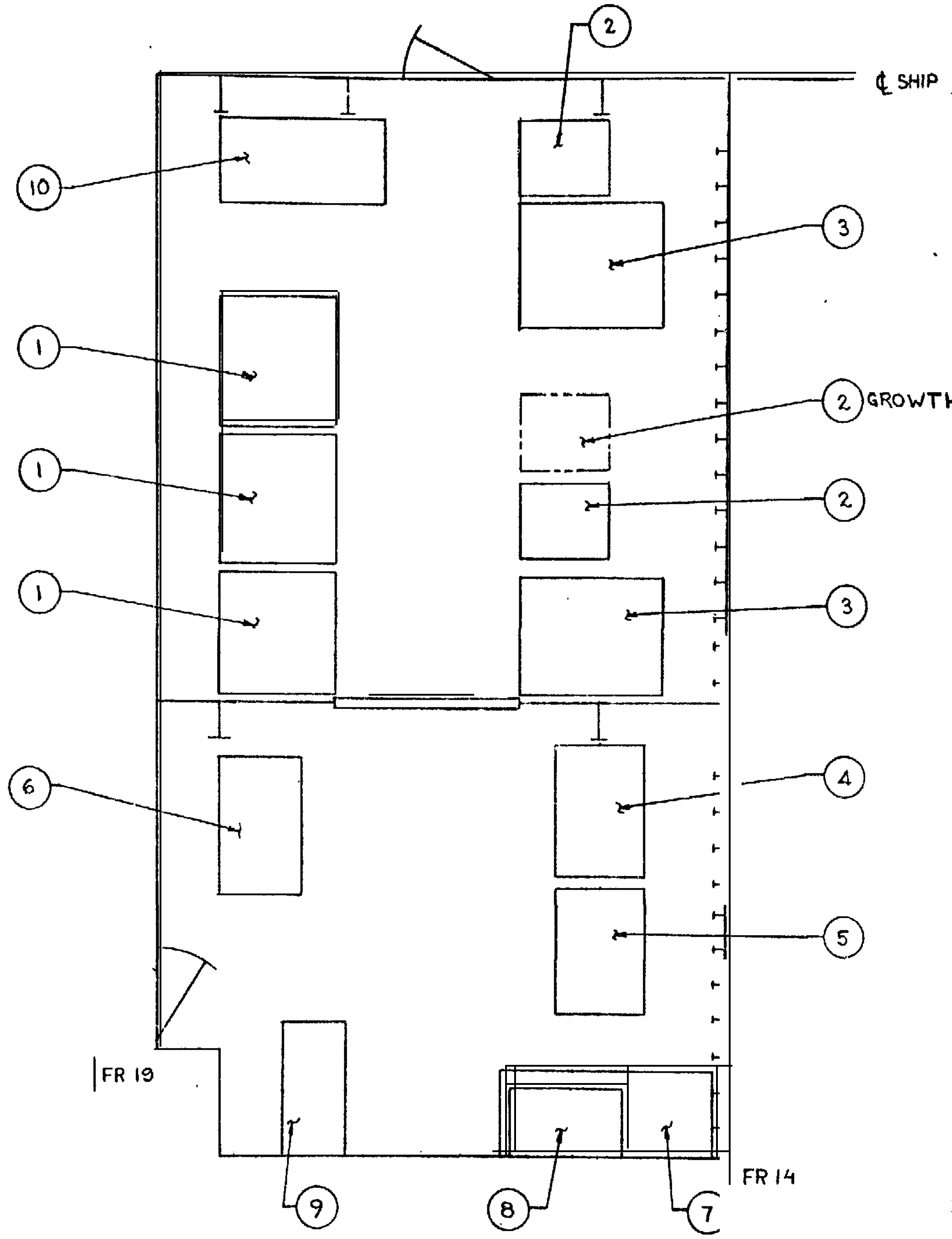
RADIO TRANSMITTER ROOM
ARRANGEMENT
MAIN DECK

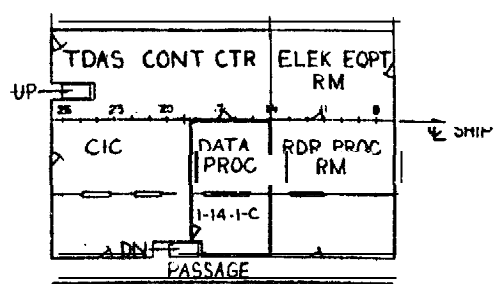
SIZE	CODE IDENT	DWG NO	REV
D	51563	LL441001	A

SCALE 1/2"=1' SHEET 1 OF 1

Figure B.5-3 (U)

UNCLASSIFIED





KEY PLAN
DATA PROCESSING ROOM
MAIN DECK
SCALE 1/16" = 1'0"

SYM	EFFECTIVITY

UNCLASSIFIED

HR 3282-1

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-24-76 6-23-76 6-30-76	

FWD →

PC NO	DESCRIPTION	QTY
10	MONITOR CONTROL CONSOLE OJ-200/UYA-4(V)	1
9	COMM PATCH PANEL SB-2781/UYA-4(V)	1
8	TEST SET TS-2460/UYA-4	1
7	WORK BENCH	1
6	RADAR DATA DISTRIBUTION SWITCHBOARD SB-2780/UYA-4(V)	1
5	CENTRAL EQUIPMENT GROUP OU-91(V)3/UYA-4(V)	1
4	SIGNAL DATA CONVERTER CV-2953/UYK-7(V)	1
3	INPUT/OUTPUT CONSOLE OJ-172/UYK-7(V)	2
2	COMPUTER AN/UYK-7(V) (INCLUDING GROWTH)	3
1	COMMAND AND SURVEILLANCE SYSTEM SWITCHBOARDS	3

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT DATE 5/28/76

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER | NEXT ASSY | MODEL NO. | NEXT ASSY | FINAL ASSY
APPLICATION | QTY REQD

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±.1 .XX ±.03 .XXX ±.010 ANGLES ±2°
GENERAL SPECIFICATION

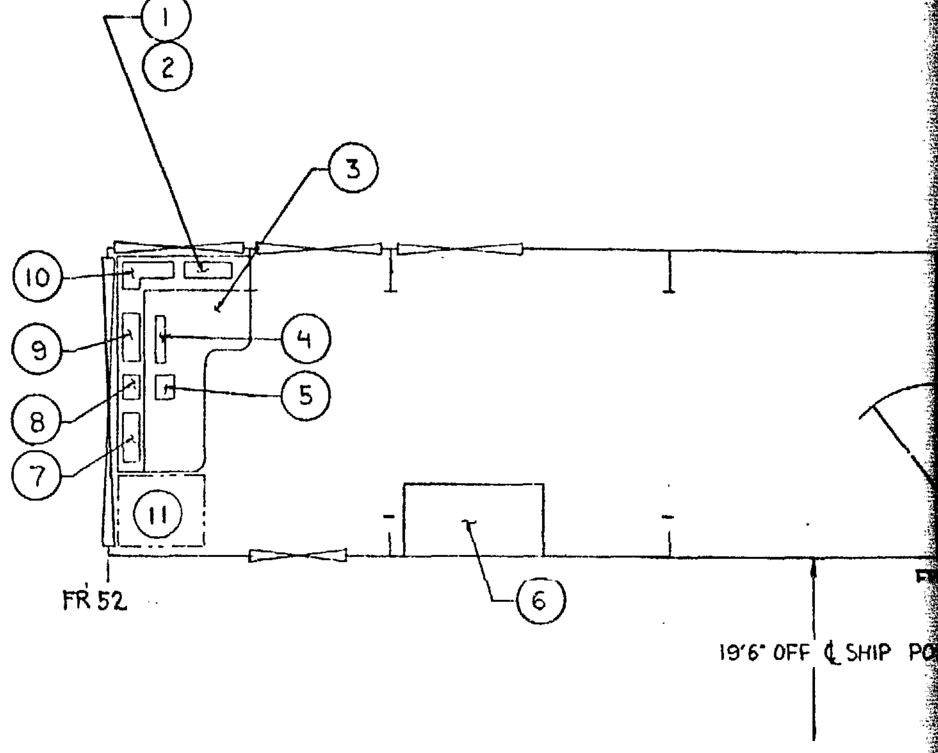
DRAWN S. RHODES 4/2/76
APPROVED 5/1/76
5-6-76
5-12-76
5-13-76
STRESS
MFG
IND ENGRG
5/13/76
5-7-76
5/13/76

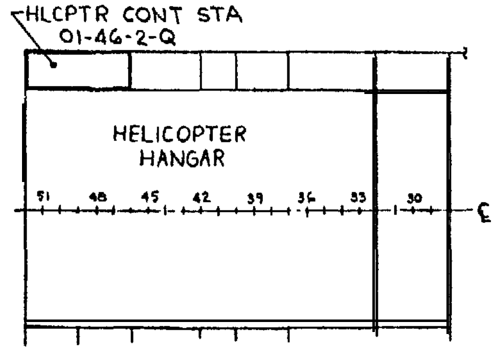
CHULA VISTA, CALIF.
ROHR INDUSTRIES, INC.

DATA PROCESSING ROOM
ARRANGEMENT
MAIN DECK

SIZE D | CODE IDENT 51563 | DWG NO LL412001 | REV A
SCALE 1/2"=1' | SHEET 1 OF 1

Figure B.5-4 (U)

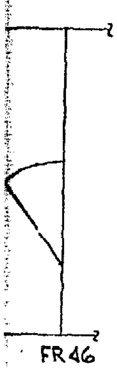




KEY PLAN
HELICOPTER CONTROL STA
01 LEVEL
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

MICROFILM SYMBOL	REVISIONS				
	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-22-76 5-30-76 6-30-76	



PC NO	DESCRIPTION	QTY
11	CONTROL CONSOLE, RPV (SPACE ONLY)	1
10	VISUAL LANDING AIDS CONTROL PANEL	1
9	IC ALARM AND WARNING PANEL	1
8	ANEMOMETER AND COURSE INDICATOR	1
7	UHF TRANSCEIVER CONTROL C-9059/URC	1
6	EQUIPMENT RACK	1
5	SECURING AND TRAVERSING CONTROL	1
4	ALARM PANEL (WAVEOFF/CRASH/FIRE ALARMS)	1
3	CONSOLE	1
2	LIGHT PANEL	1
1	HEATING/VENTILATION/AIR CONDITIONING CONTROL PANEL	1

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT DATE 5/13/76

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.010	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

DRAWN	S. RHODES	5/11/76
APPROVED		5/11/76
		5-11-76
		5-12-76
		5-13-76
STRESS		
MFG		
AUTHORIZ		
		5/13/76
		5-11-76
		5/13/76

CHULA VISTA, CALIF.

ROHR INDUSTRIES, INC.

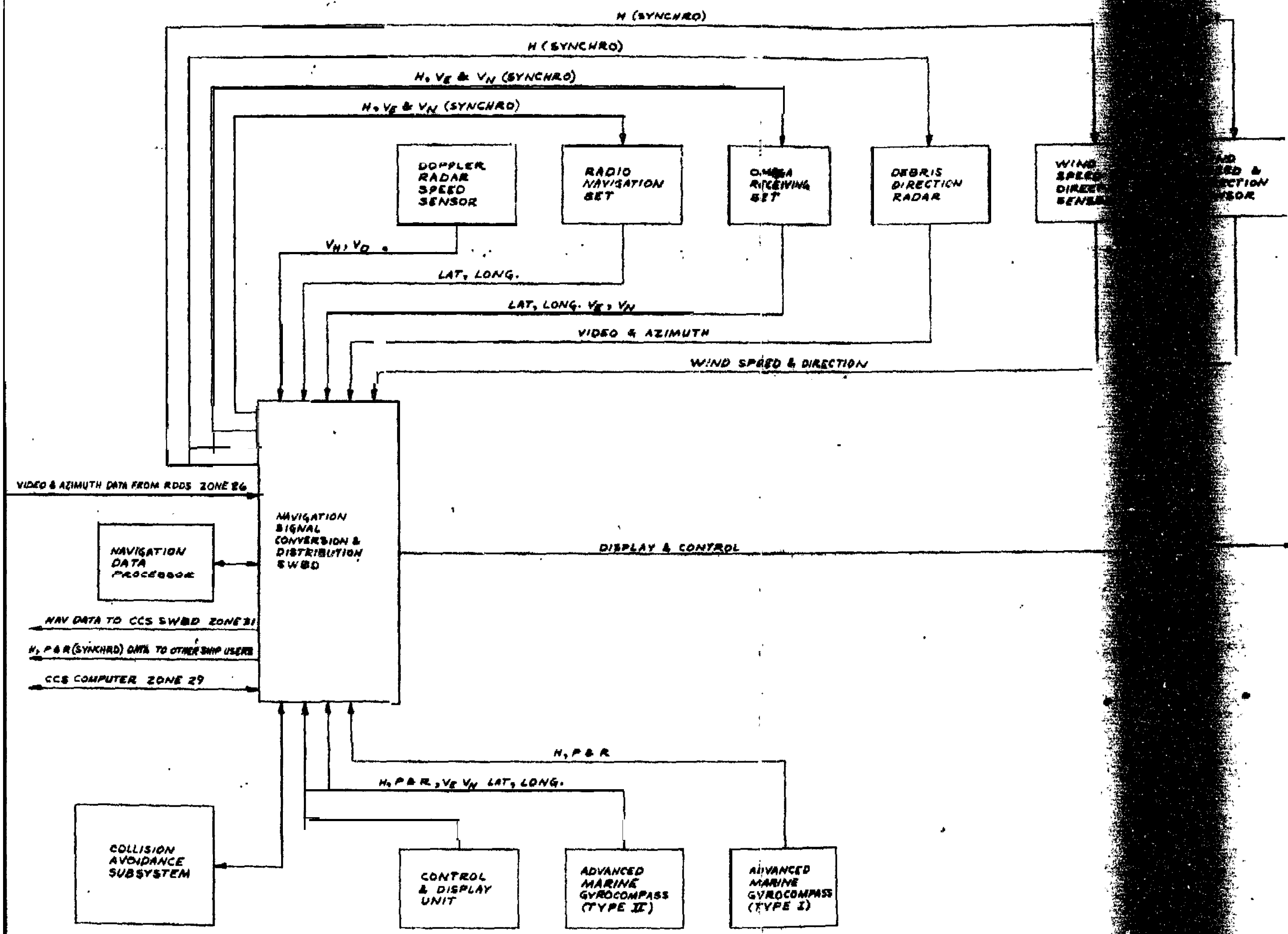
HELICOPTER CONTROL STA ARRANGEMENT 01 LEVEL

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL440002	A

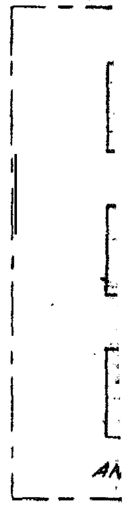
SCALE 1/2"=1'0" SHEET OF

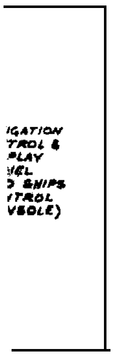
Figure B U)

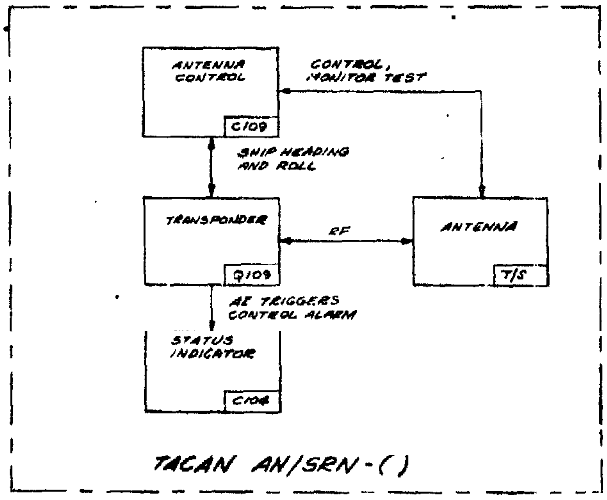
UNCLASSIFIED

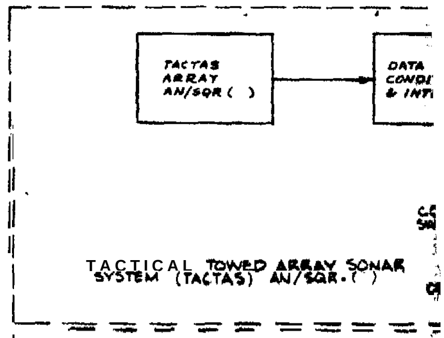

H (SYNCHRO)
H (SYNCHRO)
H, V_E & V_N (SYNCHRO)
H, V_E & V_N (SYNCHRO)
DOPPLER RADAR SPEED SENSOR
RADIO NAVIGATION SET
RECEIVING SET
DEBRIS DIRECTION RADAR
V_H, V_D
LAT, LONG.
LAT, LONG. V_E, V_N
VIDEO & AZIMUTH
WIND SPEED & DIRECTION
VIDEO & AZIMUTH DATA FROM RDDS ZONE 26
NAVIGATION SIGNAL CONVERSION & DISTRIBUTION SWBD
NAVIGATION DATA PROCESSOR
DISPLAY & CONTROL
NAV DATA TO CCS SWBD ZONE 31
H, P & R (SYNCHRO) DATA TO OTHER SHIP USERS
CCS COMPUTER ZONE 29
H, P & R
H, P & R, V_E V_N LAT, LONG.
COLLISION AVOIDANCE SUBSYSTEM
CONTROL & DISPLAY UNIT
ADVANCED MARINE GYROCOMPASS (TYPE II)
ADVANCED MARINE GYROCOMPASS (TYPE I)

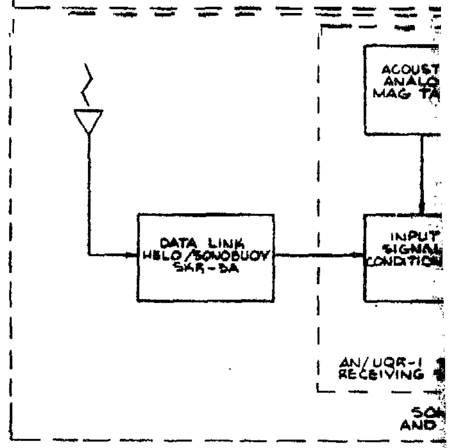
NAV SYSTEM



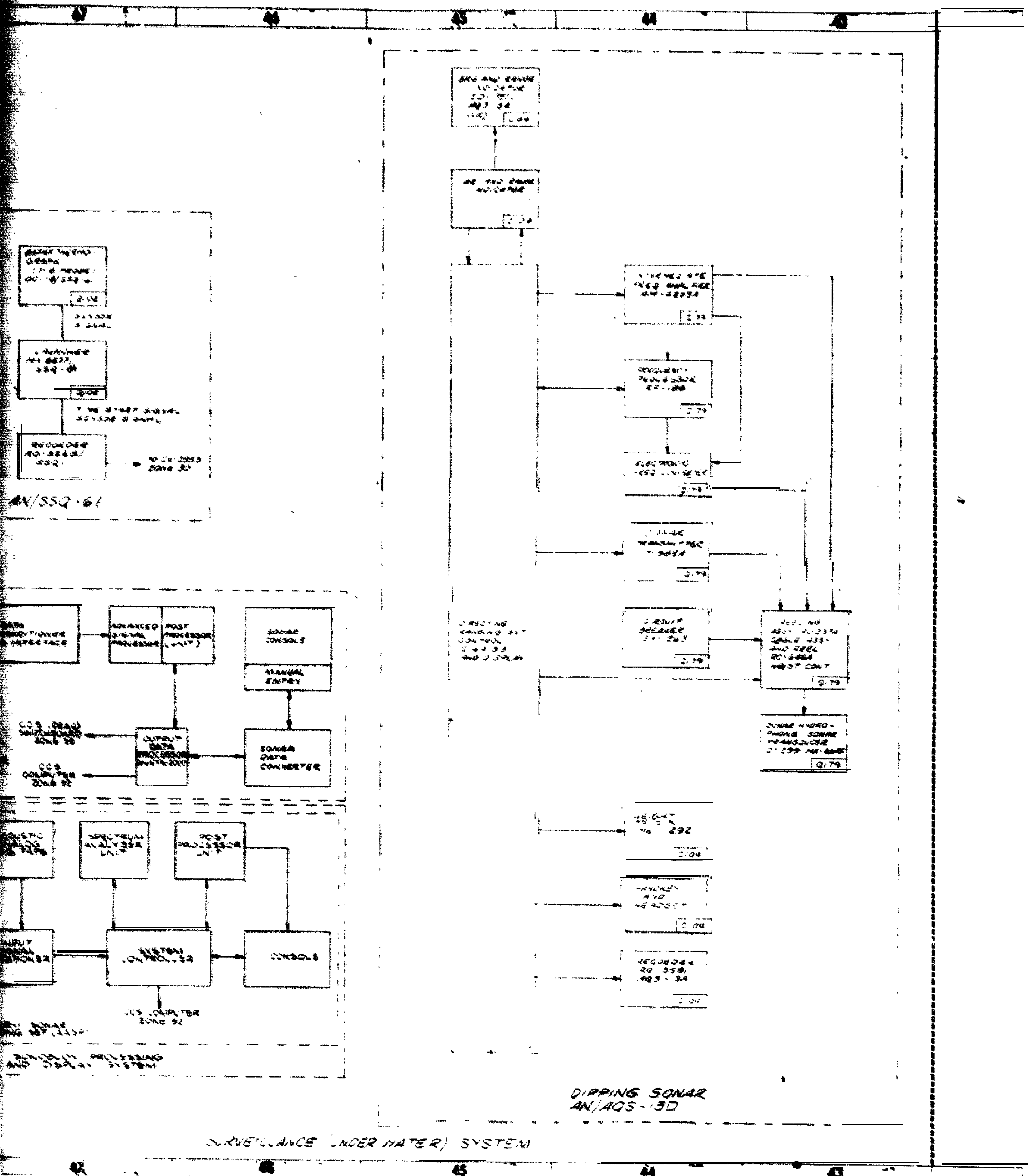




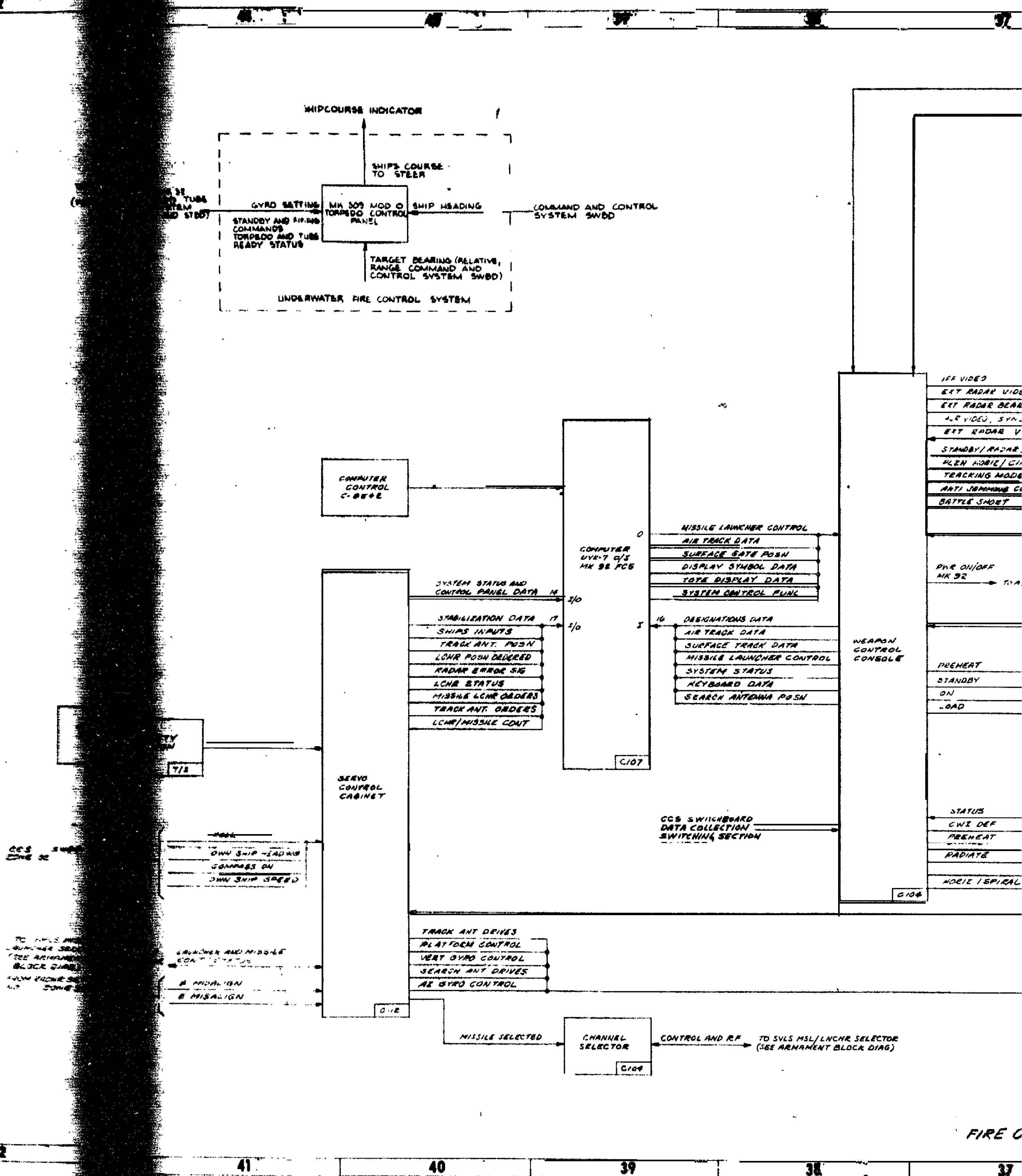




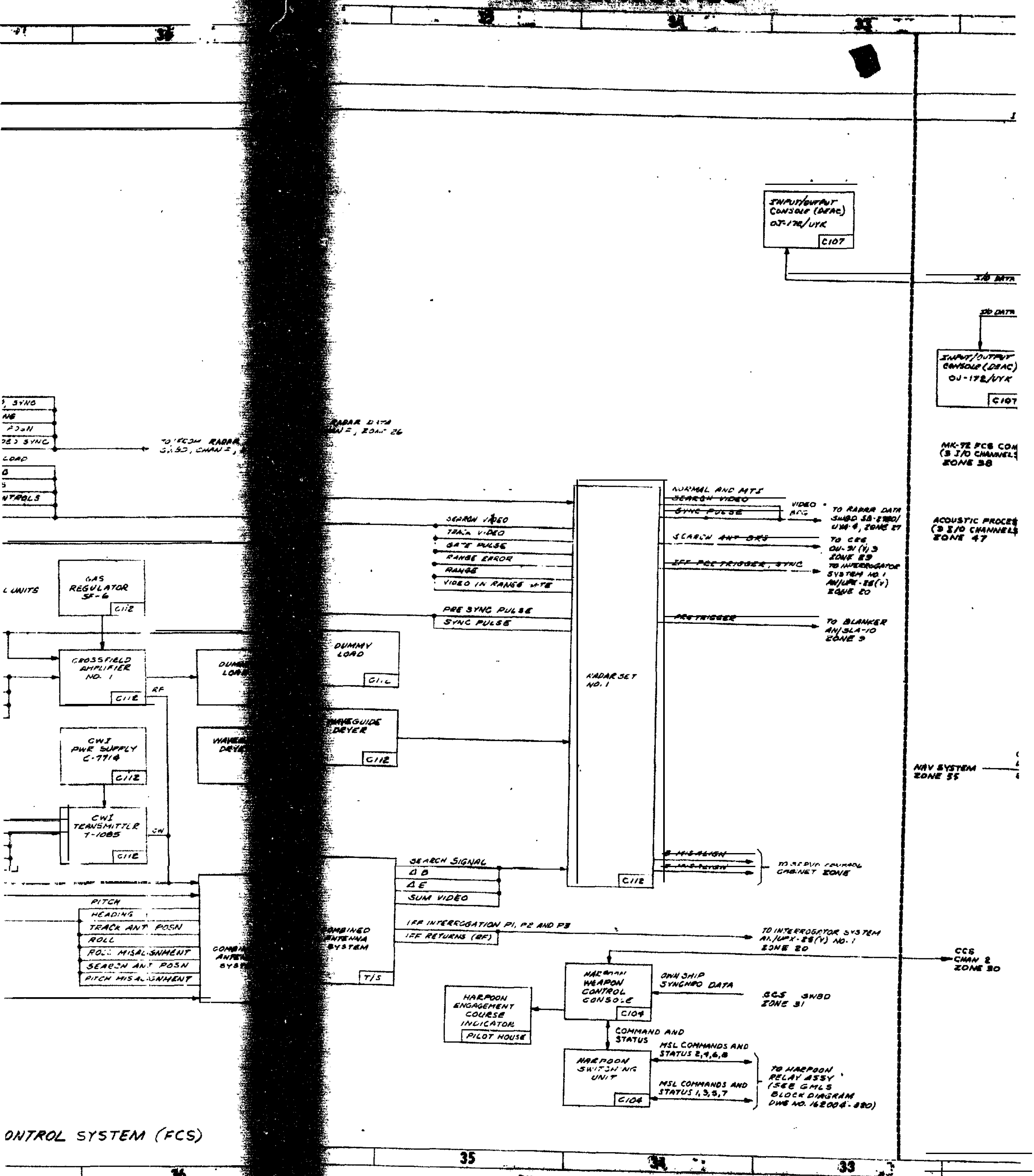
SPECIAL PURPOSE



47
46
45
44
43
SONAR CONSOLES
MANUAL ENTRY
SONAR DATA CONVERTER
SPECTRUM ANALYZER UNIT
POST PROCESSOR UNIT
SYSTEM CONTROLLER
CONSOLES
AN/SSQ-61
DIPPING SONAR
AN/AQS-13D
SURVEILLANCE (UNDER WATER) SYSTEM

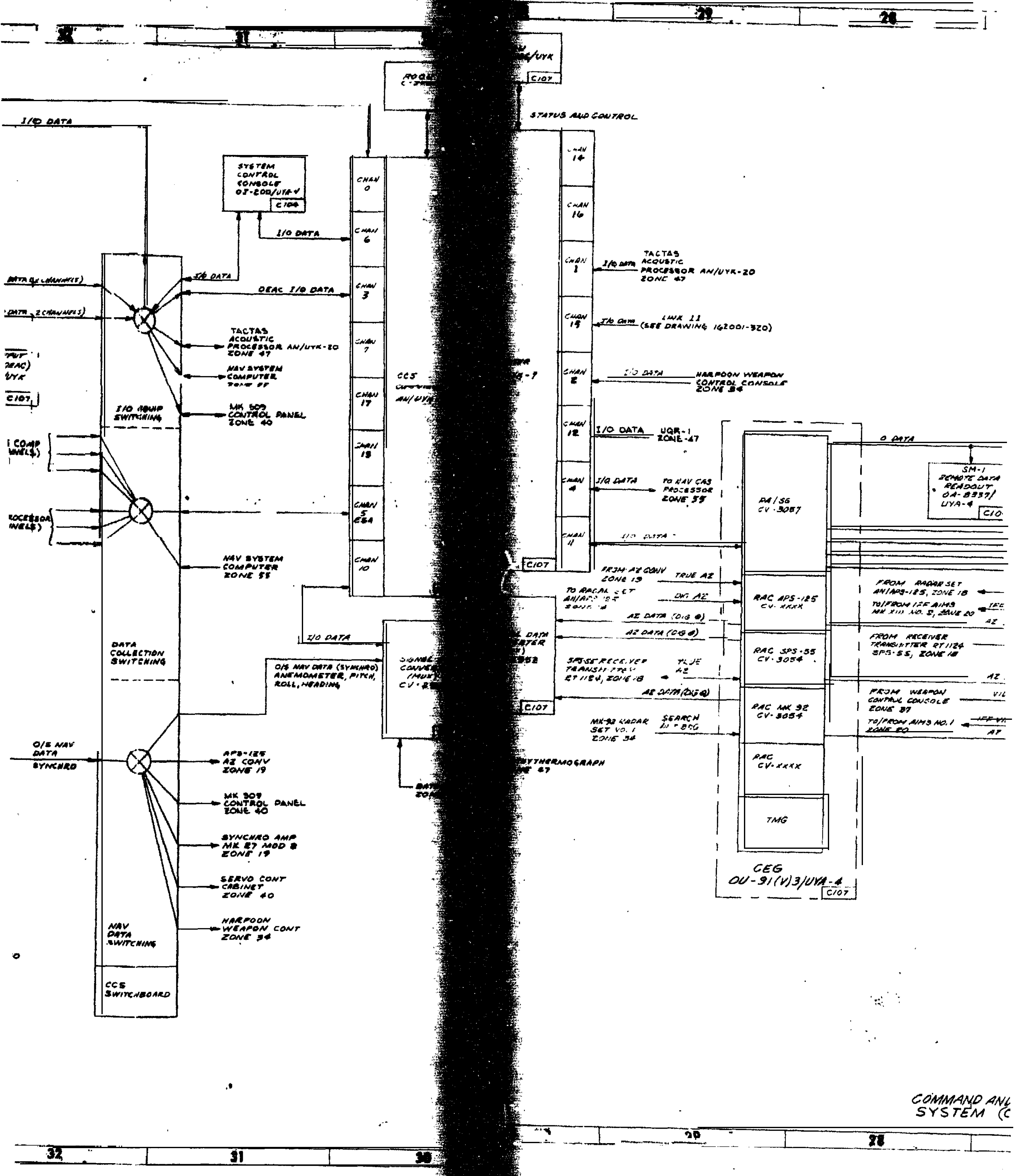


SHIPCOURSE INDICATOR
SHIPS COURSE TO STEER
GYRO SETTING
MK 309 MOD 0 TORPEDO CONTROL PANEL
SHIP HEADING
COMMAND AND CONTROL SYSTEM SWBD
STANDBY AND FIRING COMMANDS TORPEDO AND TUBE READY STATUS
TARGET BEARING (RELATIVE, RANGE COMMAND AND CONTROL SYSTEM SWBD)
UNDERWATER FIRE CONTROL SYSTEM
COMPUTER CONTROL
COMPUTER UYK-7 O/I MK 92 FCS
MISSILE LAUNCHER CONTROL
AIR TRACK DATA
SURFACE SATE POSN
DISPLAY SYMBOL DATA
TOTE DISPLAY DATA
SYSTEM CONTROL FUNC
SYSTEM STATUS AND CONTROL PANEL DATA
STABILIZATION DATA
SHIPS INPUTS
TRACK ANT. POSN
LCHR POSN ORDERED
RADAR ERROR SIG
LCHR STATUS
MISSILE LCHR ORDERS
TRACK ANT. ORDERS
LCHR/MISSILE CONT
DESIGNATIONS DATA
AIR TRACK DATA
SURFACE TRACK DATA
MISSILE LAUNCHER CONTROL
SYSTEM STATUS
KEYBOARD DATA
SEARCH ANTENNA POSN
C107
WEAPON CONTROL CONSOLE
IFF VIDEO
EXT RADAR VIDE
EXT RADAR BEAR
EXT RADAR V
STANDBY/RADAR
TRACKING MODE
BATTLE SHORT
PWR ON/OFF MK 92
PREHEAT
STANDBY
ON
LOAD
SERVO CONTROL CABINET
CCS SWITCHBOARD DATA COLLECTION SWITCHING SECTION
STATUS
CWI DEF
PREHEAT
RADIATE
HORIZ / SPIRAL
C104
OWN SHIP HEADING
COMPASS ON
OWN SHIP SPEED
TRACK ANT DRIVES
PLATFORM CONTROL
VERT GYRO CONTROL
SEARCH ANT DRIVES
AZ GYRO CONTROL
LAUNCHER AND MISSILE
A MISALIGN
B MISALIGN
MISSILE SELECTED
CHANNEL SELECTOR
C104
CONTROL AND RF
TO SVLS MSL/LNCHR SELECTOR (SEE ARMAMENT BLOCK DIAG)
FIRE C
41
40
39
38
37

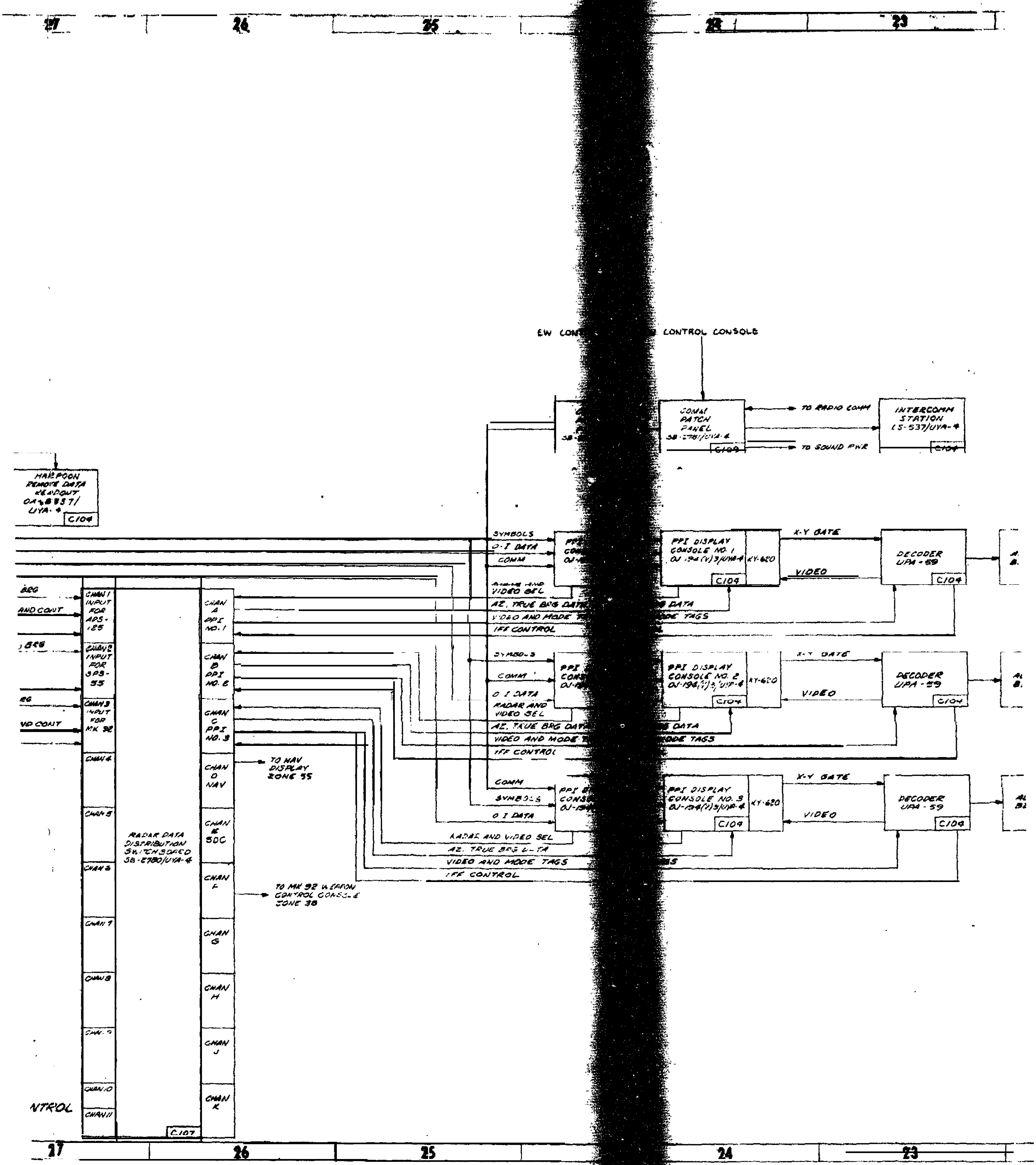


ONTROL SYSTEM (FCS)

4

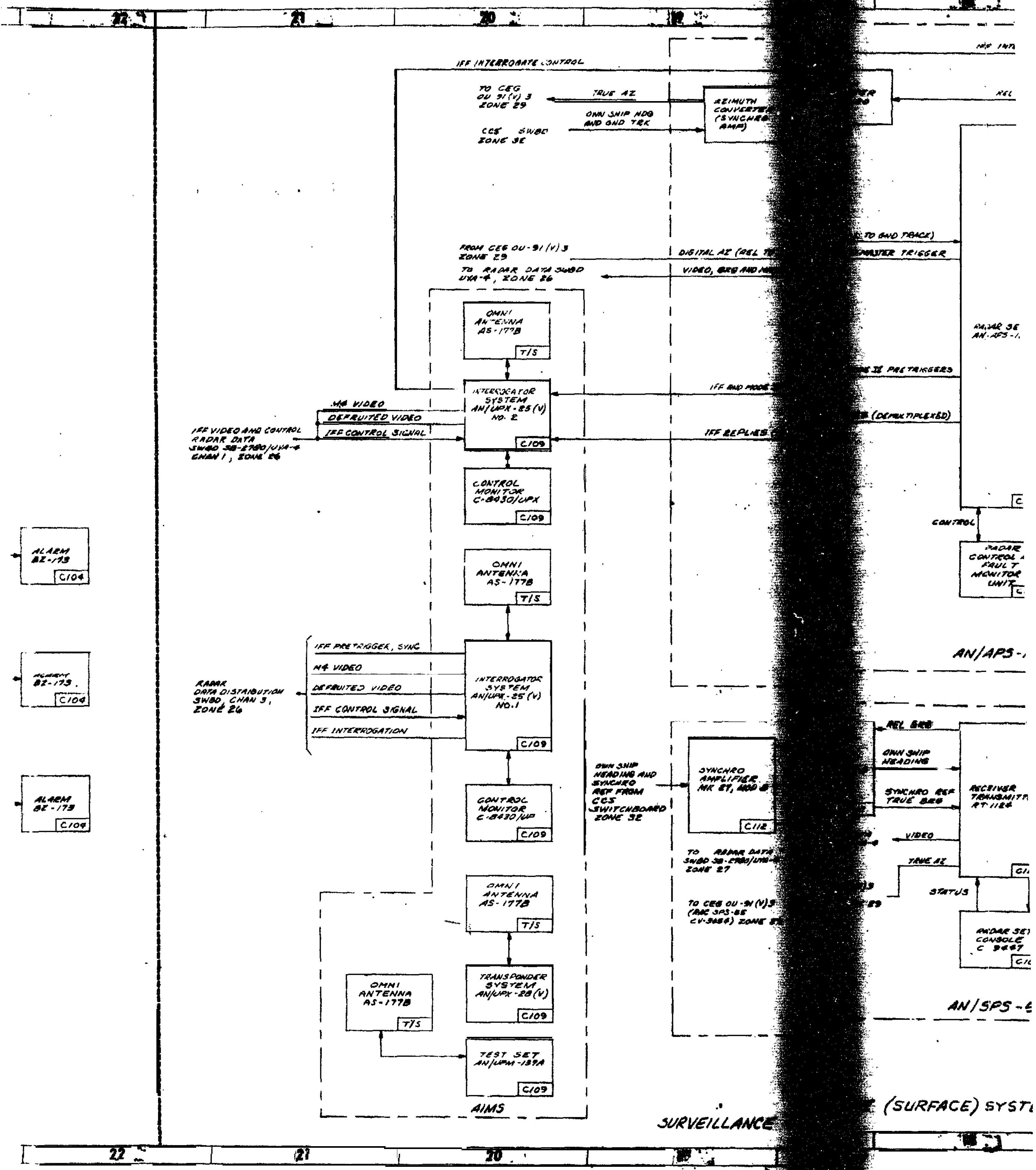

32
31
29
28
I/O DATA
SYSTEM CONTROL CONSOLE OJ-200/UYA-4
C104
I/O DATA
STATUS AND CONTROL
C107
CHAN 0
CHAN 6
CHAN 3
CHAN 7
CHAN 17
CHAN 13
CHAN 5 ESA
CHAN 10
CHAN 14
CHAN 16
CHAN 1
CHAN 15
CHAN 2
CHAN 12
CHAN 4
CHAN 11
CCS
I/O DATA
DEAC I/O DATA
TACTAS ACOUSTIC PROCESSOR AN/UYK-20 ZONE 47
NAV SYSTEM COMPUTER
MK 309 CONTROL PANEL ZONE 40
I/O EQUIP SWITCHING
NAV SYSTEM COMPUTER ZONE 55
DATA COLLECTION SWITCHING
O/S NAV DATA (SYNCHRO) ANEMOMETER, PITCH, ROLL, HEADING
O/S NAV DATA SYNCHRO
APS-125 AZ CONV ZONE 19
MK 309 CONTROL PANEL ZONE 40
SYNCHRO AMP MK 27 MOD 8 ZONE 19
SERVO CONT CABINET ZONE 40
HARPOON WEAPON CONT ZONE 34
NAV DATA SWITCHING
CCS SWITCHBOARD
TACTAS ACOUSTIC PROCESSOR AN/UYK-20 ZONE 47
LINK 11 (SEE DRAWING 162001-320)
HARPOON WEAPON CONTROL CONSOLE ZONE 34
I/O DATA
UQR-1 ZONE 47
TO NAV CAS PROCESSOR ZONE 55
TRUE AZ
AZ DATA (DIG Ø)
AZ DATA (DIG Ø)
PA / SS CV-3057
RAC APS-125 CV-XXXX
RAC SPS-55 CV-3054
RAC MK 92 CV-3054
RAC CV-XXXX
TMG
CEG OU-91(V)3/UYA-4
C107
SM-1 REMOTE DATA READOUT OA-8337/ UYA-4
FROM RADAR SET AN/APS-125, ZONE 18
FROM RECEIVER TRANSMITTER RT 1124 SPS-55, ZONE 18
FROM WEAPON CONTROL CONSOLE ZONE 37
COMMAND AND
SYSTEM (C

5



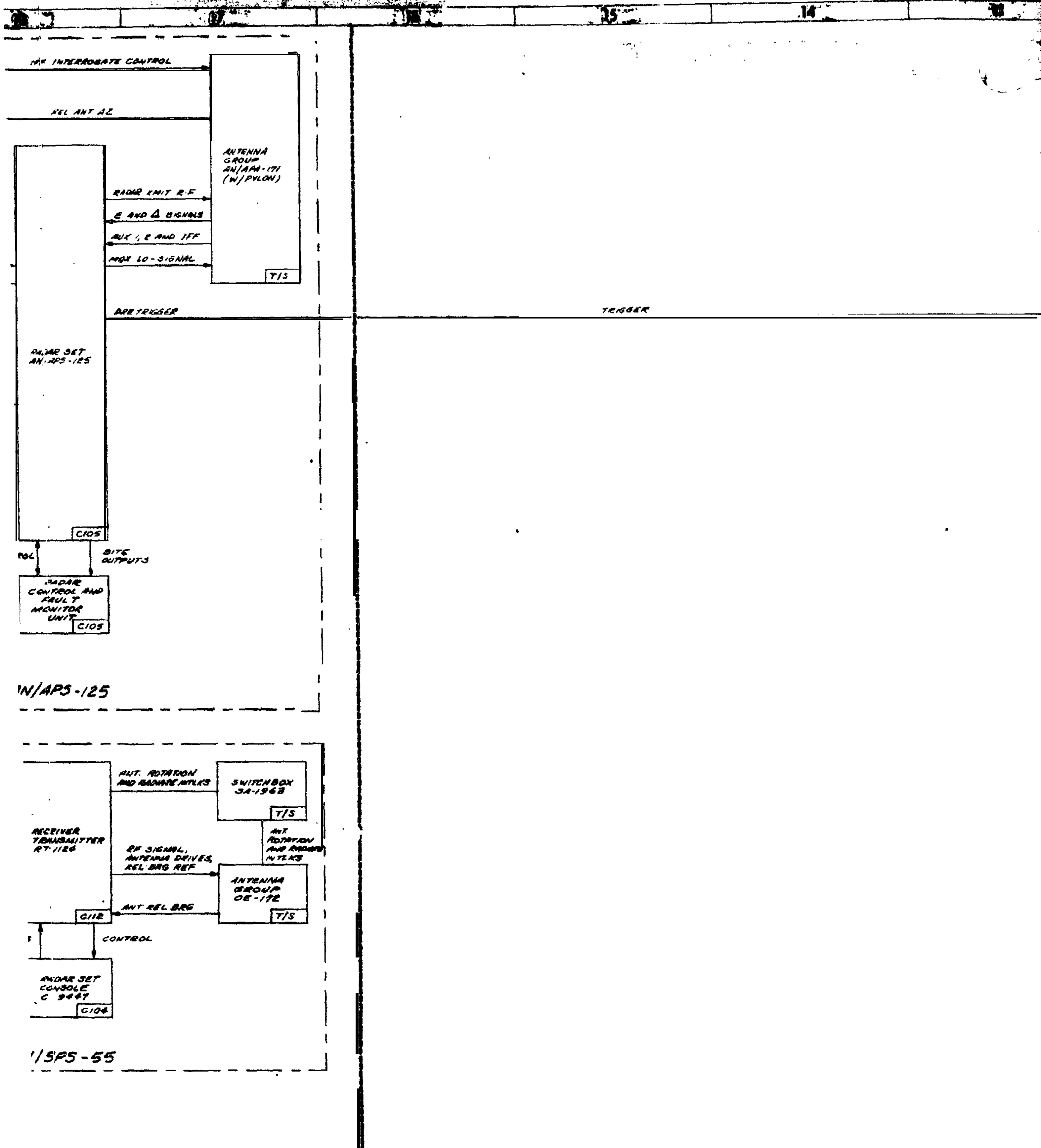
27
26
25
23
EW CON
CONTROL CONSOLE
COMM PATCH PANEL SB-2781/UYA-4
C109
TO RADIO COMM
TO SOUND PWR
INTERCOMM STATION LS-537/UYA-4
C104
HARPOON REMOTE DATA READOUT OA-8937/UYA-4
C104
SYMBOLS
O-I DATA
COMM
RADAR AND VIDEO SEL
AZ. TRUE BRG DATA
VIDEO AND MODE TAGS
IFF CONTROL
PPI DISPLAY CONSOLE NO. 1 OJ-194(V)3/UYA-4
KY-620
X-Y GATE
VIDEO
DECODER UPA-59
C104
PPI DISPLAY CONSOLE NO. 2 OJ-194(V)3/UYA-4
PPI DISPLAY CONSOLE NO. 3 OJ-194(V)3/UYA-4
CHAN 1 INPUT FOR APS-125
CHAN 2 INPUT FOR SPS-55
CHAN 3 INPUT FOR MK 92
CHAN 4
CHAN 5
CHAN 6
CHAN 7
CHAN 8
CHAN 10
CHAN 11
RADAR DATA DISTRIBUTION SWITCHBOARD SB-2780/UYA-4
C107
CHAN A PPI NO. 1
CHAN B PPI NO. 2
CHAN C PPI NO. 3
CHAN D NAV
CHAN E SDC
CHAN F
CHAN G
CHAN H
CHAN J
CHAN K
TO NAV DISPLAY ZONE 35
TO MK 92 WEAPON CONTROL CONSOLE ZONE 38
BRG
AND CONT
NTROL
27
26
25
24
23

6

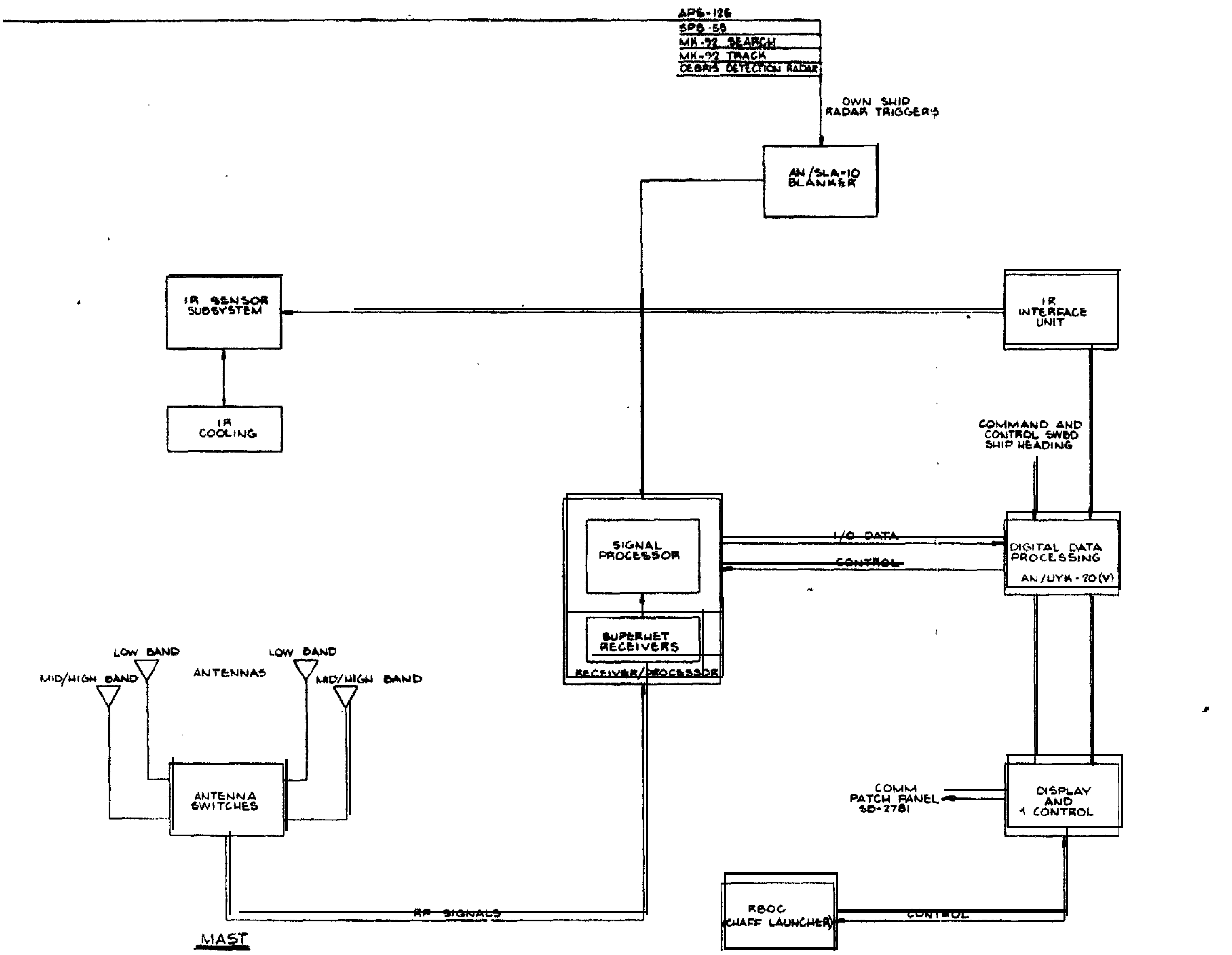


22
21
20
IFF INTERROGATE CONTROL
TO CEG OU-91(V)3 ZONE 29
TRUE AZ
OWN SHIP HDG AND GND TRK
CCS SWBD ZONE 32
AZIMUTH CONVERTER (SYNCHRO AMP)
FROM CEG OU-91(V)3 ZONE 29
TO RADAR DATA SWBD UYA-4, ZONE 26
DIGITAL AZ
VIDEO
MASTER TRIGGER
TO GND TRACK)
PRETRIGGERS
(DEMULTIPLEXED)
IFF REPLIES
CONTROL
OMNI ANTENNA AS-177B
T/S
INTERROGATOR SYSTEM AN/UPX-25(V) NO. 2
C109
M4 VIDEO
DEFRUITED VIDEO
IFF CONTROL SIGNAL
IFF VIDEO AND CONTROL RADAR DATA SWBD SB-2780/UYA-4 CHAN 1, ZONE 26
CONTROL MONITOR C-8430/UPX
ALARM BZ-173
C104
IFF PRETRIGGER, SYNC
RADAR DATA DISTRIBUTION SWBD, CHAN 3, ZONE 26
IFF INTERROGATION
INTERROGATOR SYSTEM AN/UPX-25(V) NO.1
OWN SHIP HEADING AND SYNCHRO REF FROM CCS SWITCHBOARD ZONE 32
SYNCHRO AMPLIFIER MK 27
C112
REL BRG
OWN SHIP HEADING
SYNCHRO REF TRUE BRG
RECEIVER TRANSMITTER RT-1124
TRUE AZ
STATUS
TO RADAR DATA SWBD ZONE 27
TO CEG OU-91(V)3
CONTROL MONITOR C-8430/UP
OMNI ANTENNA AS-177B
TRANSPONDER SYSTEM AN/UPX-28(V)
TEST SET AN/UPM-137A
AIMS
AN/APS-
AN/SPS-
SURVEILLANCE
(SURFACE) SYSTE

7


17
16
15
14
13
INTERROGATE CONTROL
REL ANT AZ
ANTENNA GROUP AN/APA-171 (W/PYLON)
T/S
RADAR XMIT R-F
Σ AND Δ SIGNALS
AUX 1, Σ AND IFF
MOX LO-SIGNAL
PRETRIGGER
TRIGGER
RADAR SET AN/APS-125
C105
BITE OUTPUTS
RADAR CONTROL AND FAULT MONITOR UNIT
C105
N/APS-125
ANT. ROTATION AND RADIATE INTLKS
SWITCHBOX SA-1968
T/S
RECEIVER TRANSMITTER RT-1124
ANT ROTATION AND RADIATE INTLKS
RF SIGNAL, ANTENNA DRIVES, REL BRG REF
ANTENNA GROUP OE-172
ANT REL BRG
C112
T/S
CONTROL
RADAR SET CONSOLE C 9447
C104
/SPS-55

) SYSTEM



DESIGN-TO-PRICE ELECTRONIC
WARFARE SYSTEM AN/SLQ-32(V)

UNCLAS

6	5	4	3	2

A REVISED

BLOCK DIAGRAM GROUP LOCATION	
COMMAND AND SURVEILLANCE GROUPS	ZONES
PASSIVE ECM	1 THRU 16
SURVEILLANCE (SURFACE) SYSTEM	17 THRU 21
COMMAND AND CONTROL SYSTEM (CCS)	22 THRU 32
FIRE CONTROL SYSTEM (FCS)	33 THRU 42
SURVEILLANCE (UNDERWATER) SYSTEM	43 THRU 49
SPECIAL PURPOSE SYSTEM	50 THRU 51
NAV SYSTEM	52 THRU 58

DSD

COMMAN

6	5	4	3	2

UNCL

10

ED

OO S | 7/6/70

ES
URVEILLANCE
AGRAM

00001 | A

11

FUNCTIONAL REQUIREMENTS FOR INTERIOR COMMUNICATIONS	BASED ON GENERAL SPECIFICATION CIRCUIT	GEN SPEC REF PARA	PILOT HOUSE								CHART ROOM		CENTRAL CONTROL					CIC															SEA CAB	COMM CTR			HELO	
			GENERAL RM	CO CHAIR	TEST DIR CHAIR	[illegible] CONT OFFCER	ASST CONT OFFCER	LOOKOUT (P)	LOOKOUT (S)	VISUAL SIG	GENERAL RM	NAV CENTER	GENERAL RM		PROP/ELECT		DC/AUX	GENERAL RM	CO CHAIR	SWC/ASAC	SURF DET	AIR DET TRKR		VOICE PAD OPR	ASW SUPV			DIR SONAR OPR	WCC-1/HARPOON	WCC-2		ESM	GENERAL RM	GENERAL RM	RADIO SUPV	RADIO OPR	HELO CONT STA	LSO PLTFM
[illegible]	CIRCUIT J	[illegible]	1	1	1	1	1				1		1		1		1		1	1					1								1	1	1		1	
[illegible] COMMAND COORD	JA, JC	4026		1	1	1	1								1		1		1	1													1					

PC NO	DESCRIPTION	QTY
10	MONITOR CONTROL CONSOLE OJ-200/UYA-4(V)	1
9	COMM PATCH PANEL SB-2781/UYA-4(V)	1
8	TEST SET TS-2460/UYA-4	1
7	WORK BENCH	1
6	RADAR DATA DISTRIBUTION SWITCHBOARD SB-2780/UYA-4(V)	1
5	CENTRAL EQUIPMENT GROUP OU-91(V)3/UYA-4(V)	1
4	SIGNAL DATA CONVERTER CV-2953/UYK-7(V)	1
3	INPUT/OUTPUT CONSOLE OJ-172/UYK-7(V)	2
2	COMPUTER AN/UYK-7(V) (INCLUDING GROWTH)	3
1	COMMAND AND SURVEILLANCE SYSTEM SWITCHBOARDS	3

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
M Wallace CONFIG MGT DATE 5/18/76

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO	NEXT	FINAL
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±.1 .XX ±.03 .XXX ±.010 ANGLES ±2°
GENERAL SPECIFICATION
CAL WT LBS
LAYOUT NO

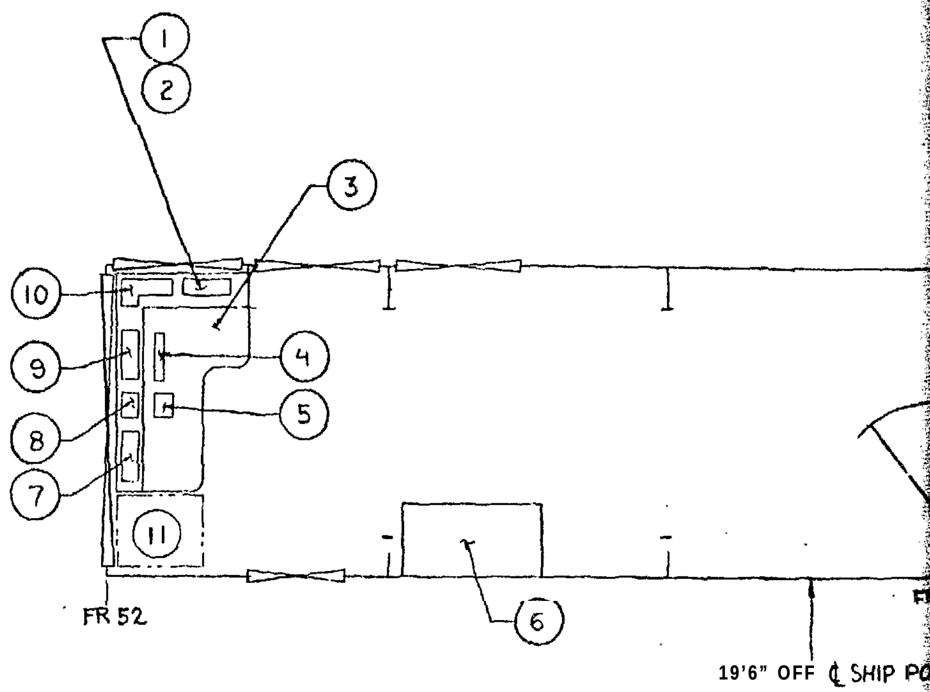
DRAWN S. RHODES 4/2/76
APPROVED [signature] 5/1/76
CHECKED [signature] 5-6-76
[signature] 5-12-76
WEIGHT [signature] 5-13-76
STRESS
MAPL
PROD ENGRG
[signature] 5/13/76
[signature]
[signature] 5/13/76

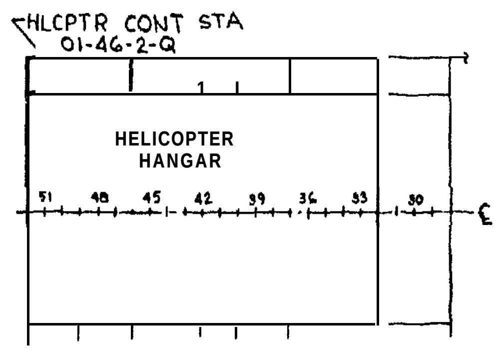
CHULA VISTA, CALIF.
ROHR INDUSTRIES, INC.

DATA PROCESSING ROOM ARRANGEMENT MAIN DECK

SIZE D | CODE IDENT 51563 | DWG NO LL412001 | REV A
SCALE 1/2"=1' | SHEET 1 OF 1

Figure B.5-4 (U)





KEY PLAN
HELICOPTER CONTROL STA
01 LEVEL
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

UNCLASSIFIED

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-29-76 / 6-30-76 / 6-30-76	

PARTS AND MATERIAL LIST

PC NO	DESCRIPTION	QTY
11	CONTROL CONSOLE, RPV (SPACE ONLY)	1
10	VISUAL LANDING AIDS CONTROL PANEL	1
9	IC ALARM AND WARNING PANEL	1
8	ANEMOMETER AND COURSE INDICATOR	1
7	UHF TRANSCEIVER CONTROL C-9059/URC	1
6	EQUIPMENT RACK	1
5	SECURING AND TRAVERSING CONTROL	1
4	ALARM PANEL (WAVEOFF/CRASH/FIRE ALARMS)	1
3	CONSOLE	1
2	LIGHT PANEL	1
1	HEATING/VENTILATION/AIR CONDITIONING CONTROL PANEL	1

DOCUMENT RELEASE
CONFIG MGT DATE 5/13/76

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±.1 .XX ±.03 .XXX ±.010 ANGLES ±2°
GENERAL SPECIFICATION
CAL WT LBS
LAYOUT NO

DRAWN S. RHODES 5/11/76
APPROVED 5/11/76; 5-11-76; 5-12-76; 5-13-76
5/14/76; 5-11-76; 5/13/76

CHULA VISTA, CALIF.
ROHR INDUSTRIES, INC.

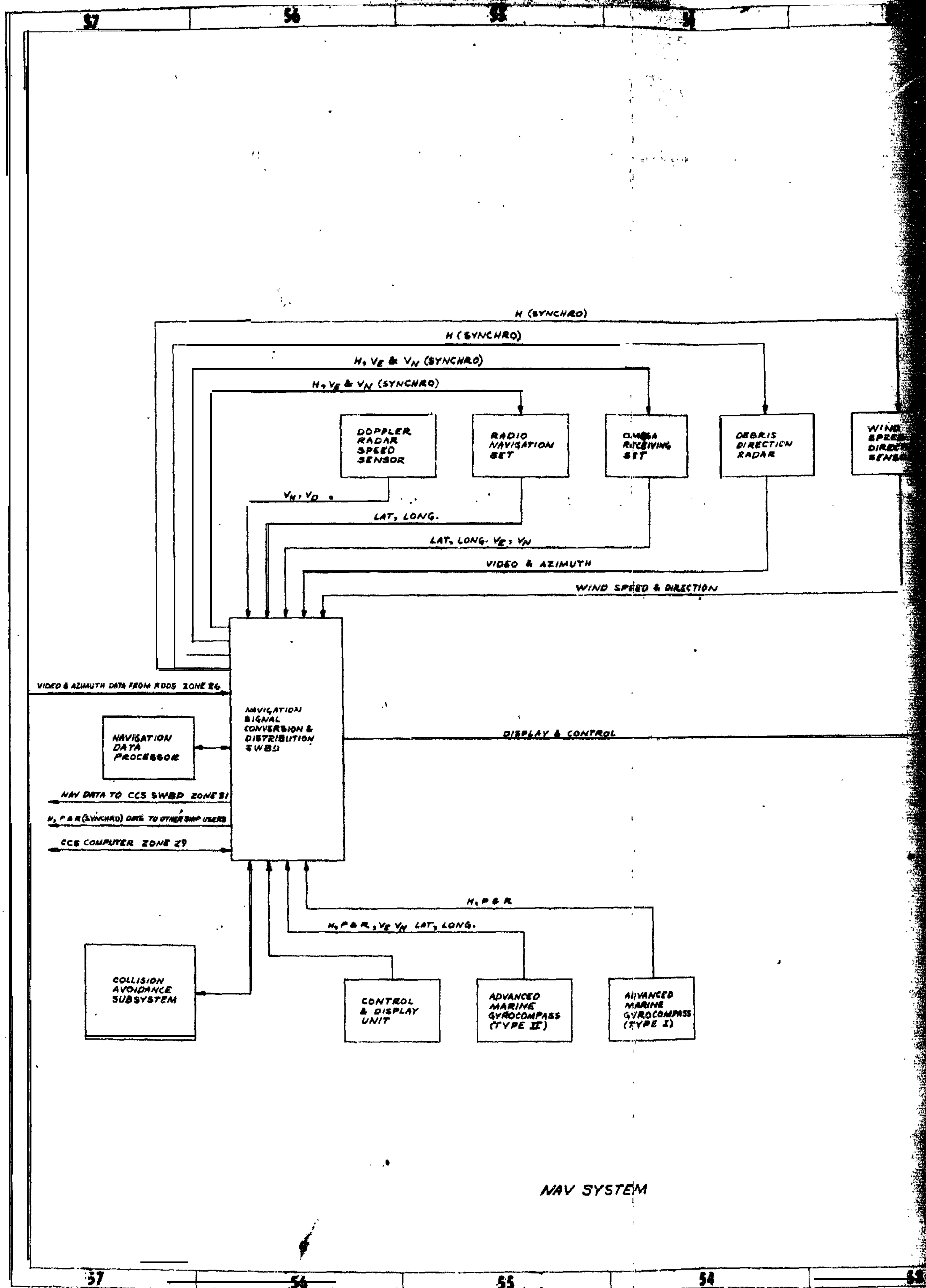
HELICOPTER CONTROL STA
ARRANGEMENT
01 LEVEL

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL440002	A

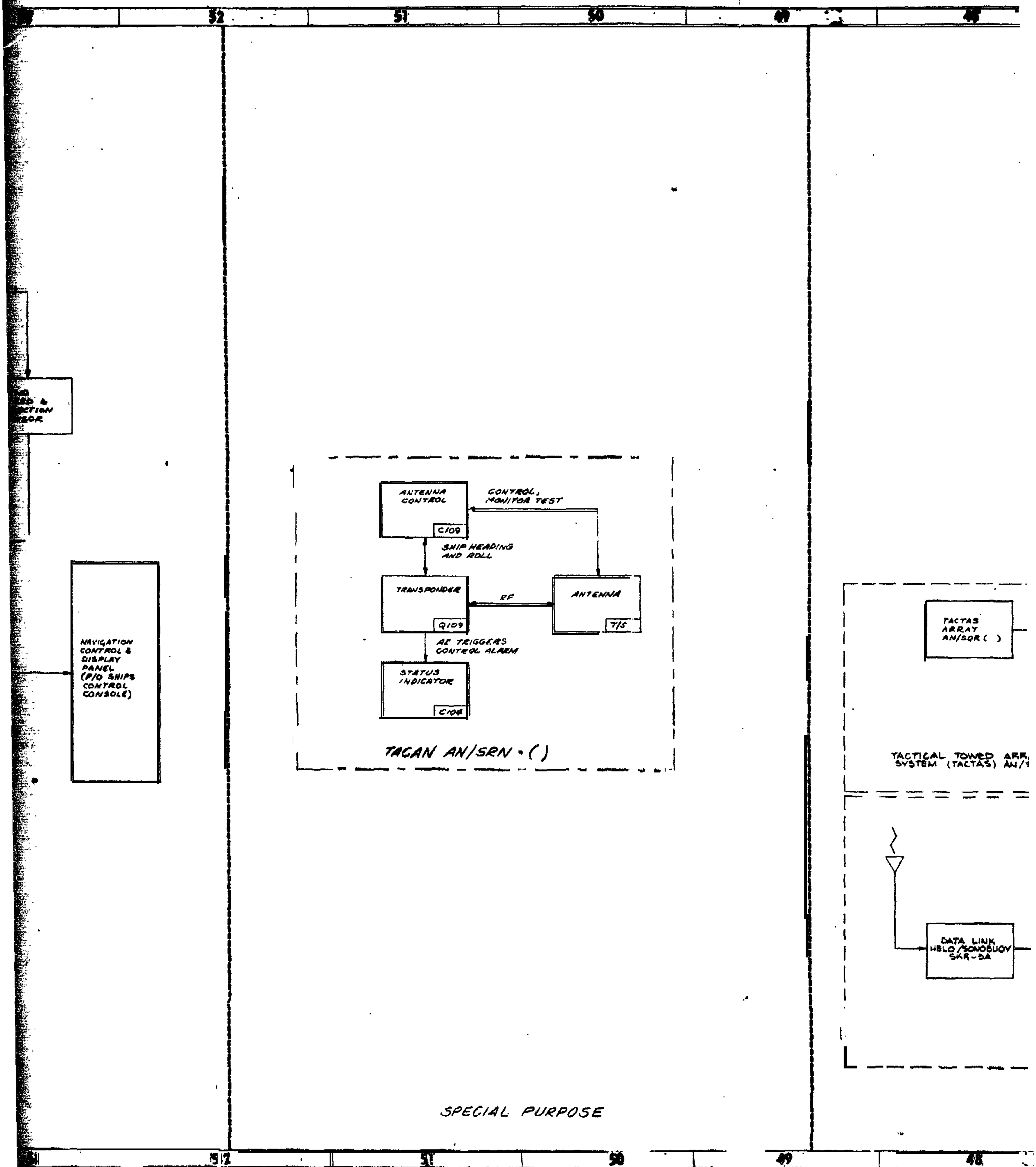
SCALE 1/2"=1'0" SHEET 1 OF 1

Figure B (U)

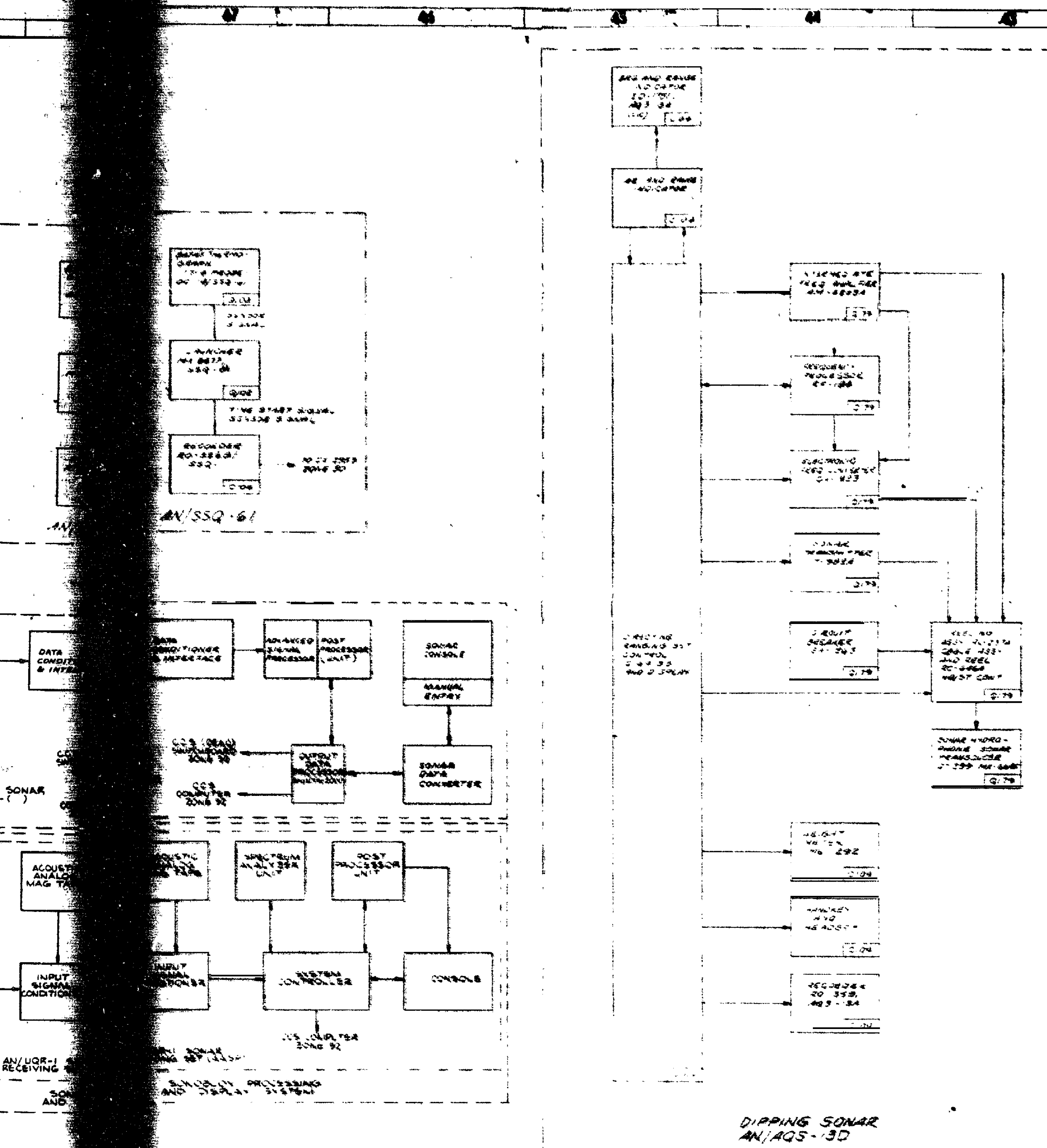
UNCLASSIFIED


57
56
55
54
H (SYNCHRO)
H (SYNCHRO)
H, VE & VN (SYNCHRO)
H, VE & VN (SYNCHRO)
DOPPLER RADAR SPEED SENSOR
RADIO NAVIGATION SET
OMEGA RECEIVING SET
DEBRIS DIRECTION RADAR
VH, VD
LAT, LONG.
LAT, LONG. VE, VN
VIDEO & AZIMUTH
WIND SPEED & DIRECTION
VIDEO & AZIMUTH DATA FROM RDDS ZONE 26
NAVIGATION SIGNAL CONVERSION & DISTRIBUTION SWBD
NAVIGATION DATA PROCESSOR
DISPLAY & CONTROL
NAV DATA TO CCS SWBD ZONE 31
H, P & R (SYNCHRO) DATA TO OTHER SHIP USERS
CCS COMPUTER ZONE 29
H, P & R
H, P & R, VE VN LAT, LONG.
COLLISION AVOIDANCE SUBSYSTEM
CONTROL & DISPLAY UNIT
ADVANCED MARINE GYROCOMPASS (TYPE II)
ADVANCED MARINE GYROCOMPASS (TYPE I)
57
56
55
54
53

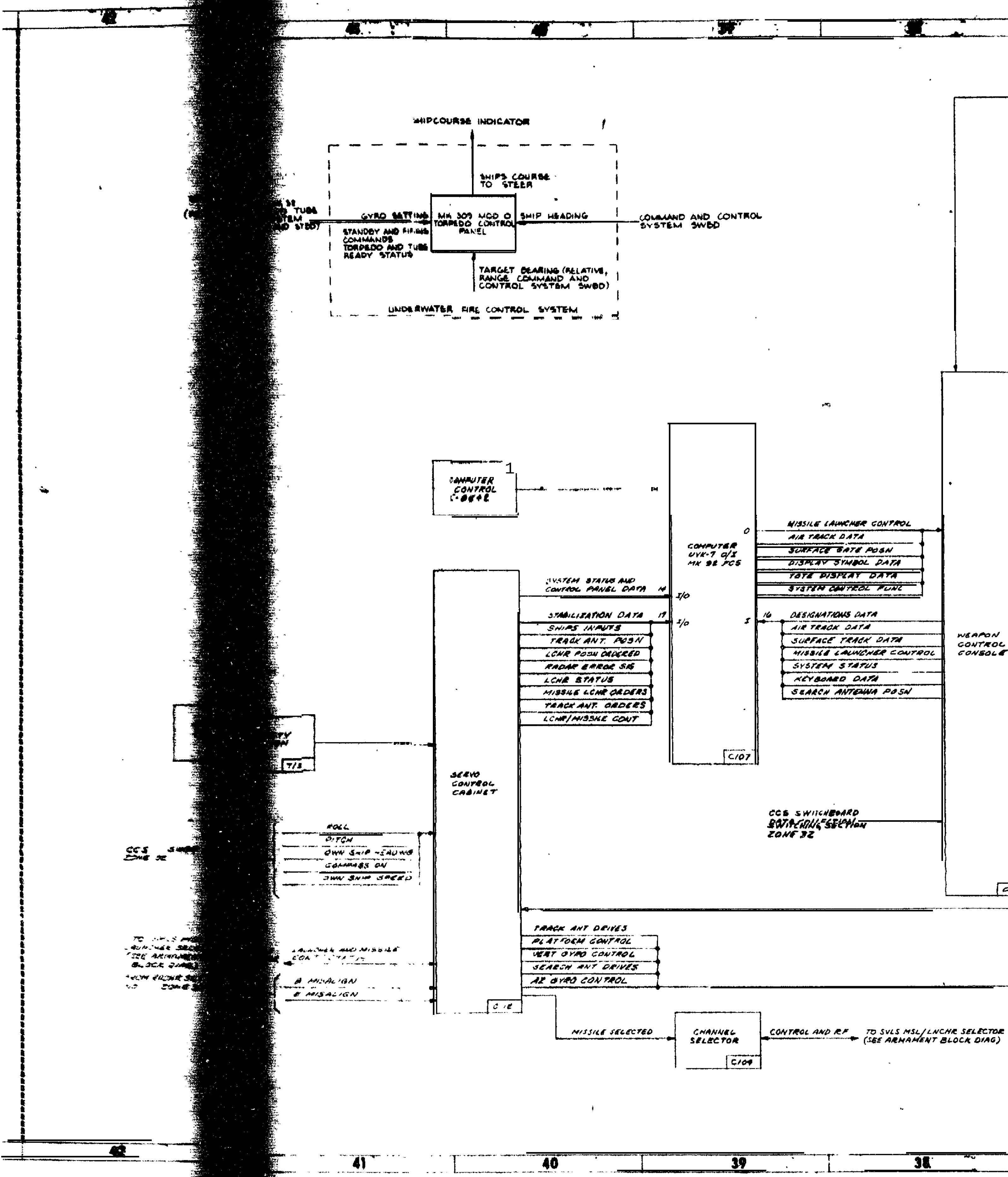
NAV SYSTEM

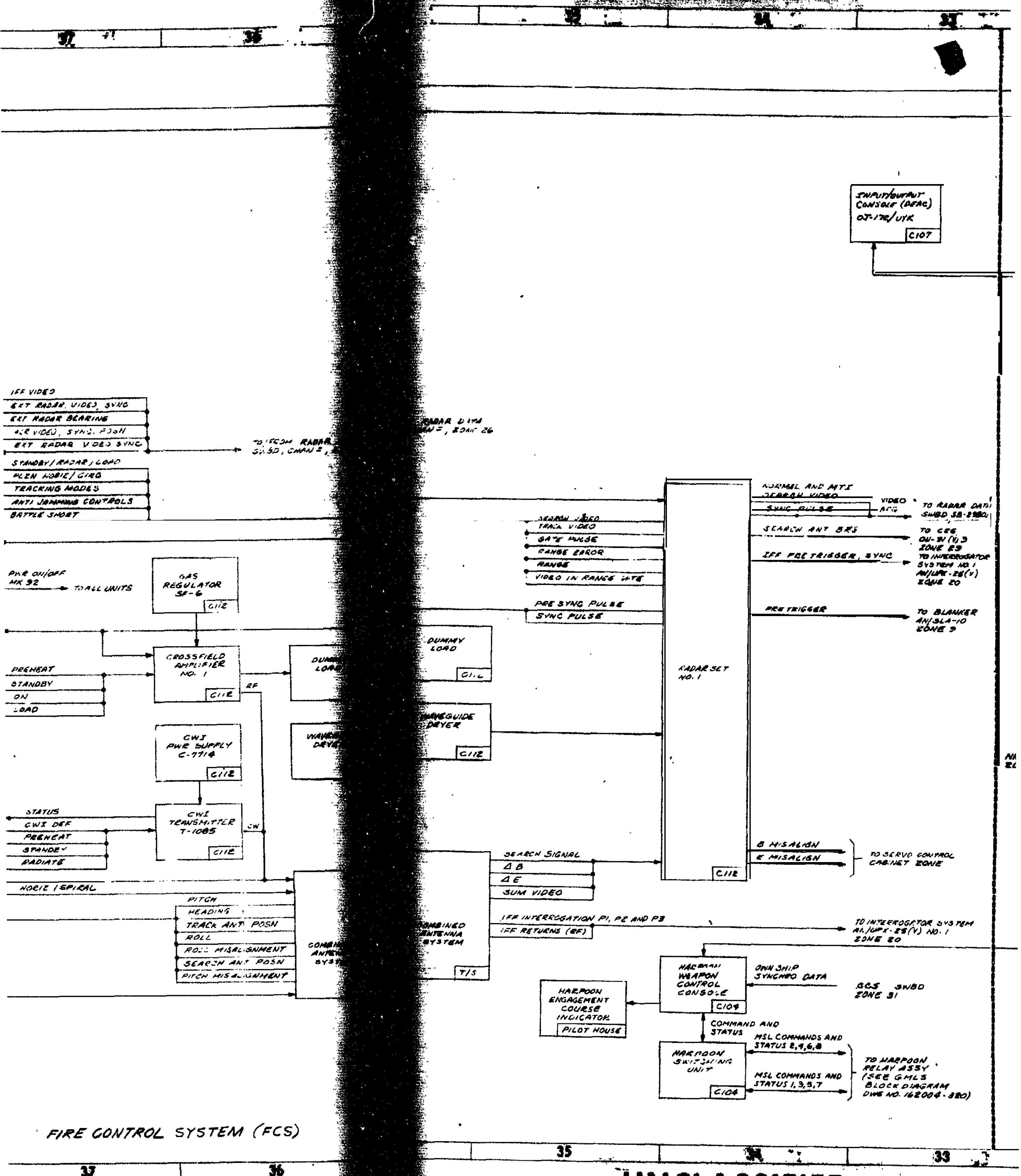


52
51
50
49
48
NAVIGATION CONTROL & DISPLAY PANEL (P/O SHIPS CONTROL CONSOLE)
ANTENNA CONTROL
C109
CONTROL, MONITOR TEST
SHIP HEADING AND ROLL
TRANSPONDER
Q109
RF
ANTENNA
7/5
AZ TRIGGERS CONTROL ALARM
STATUS INDICATOR
C104
TACAN AN/SRN-( )
TACTAS ARRAY AN/SQR ( )
DATA LINK HELO/SONOBUOY SKR-5A
SPECIAL PURPOSE



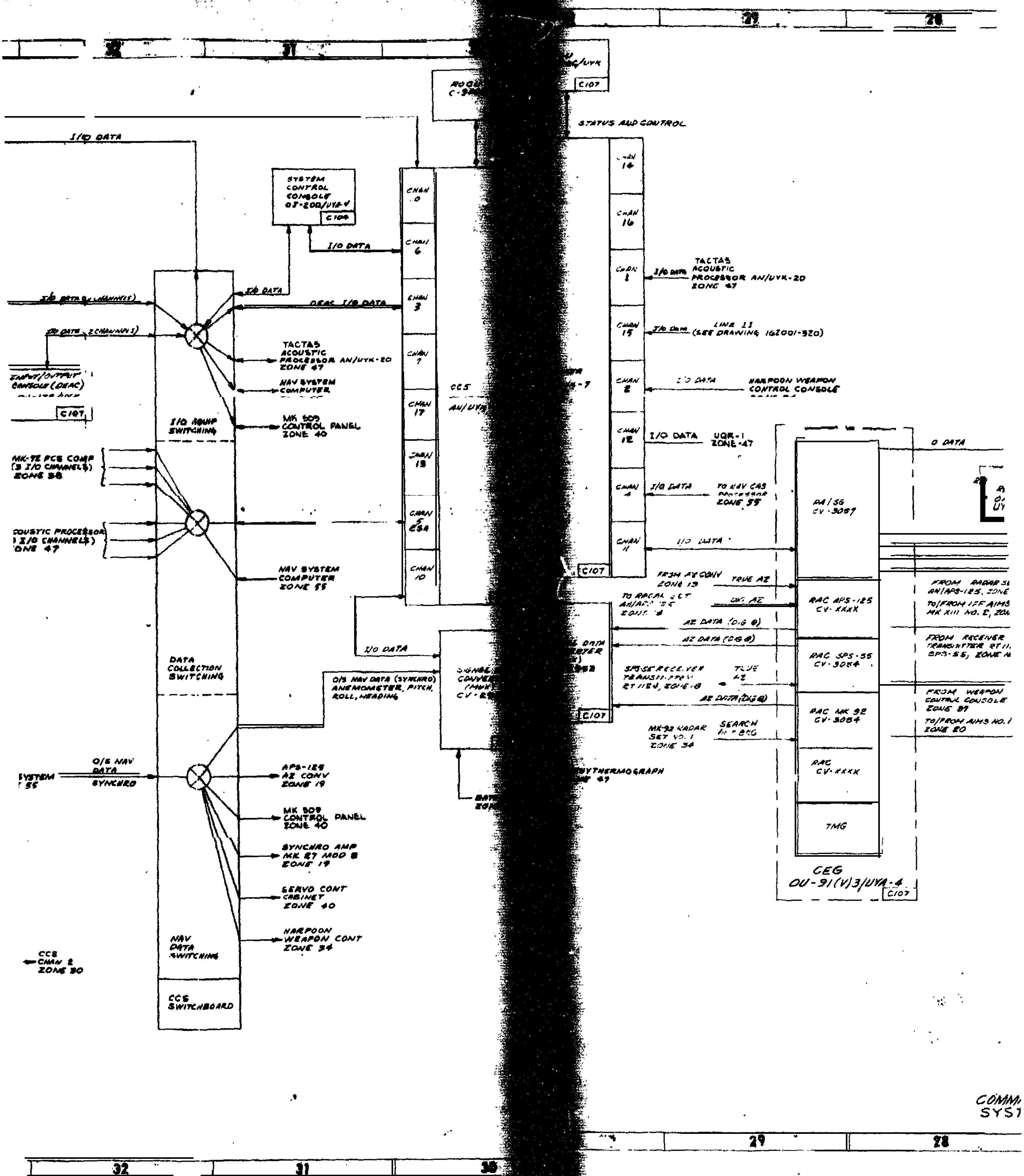
SURVEILLANCE (UNDER WATER) SYSTEM


SHIPCOURSE INDICATOR
SHIPS COURSE TO STEER
GYRO SETTING
STANDBY AND FIRING COMMANDS
TORPEDO AND TUBE READY STATUS
MK 309 MOD 0 TORPEDO CONTROL PANEL
SHIP HEADING
COMMAND AND CONTROL SYSTEM SWBD
TARGET BEARING (RELATIVE, RANGE COMMAND AND CONTROL SYSTEM SWBD)
UNDERWATER FIRE CONTROL SYSTEM
COMPUTER CONTROL
COMPUTER UYK-7 O/I MK 92 FCS
MISSILE LAUNCHER CONTROL
AIR TRACK DATA
SURFACE GATE POSN
DISPLAY SYMBOL DATA
TOTE DISPLAY DATA
SYSTEM CONTROL FUNC
SYSTEM STATUS AND CONTROL PANEL DATA
STABILIZATION DATA
SHIPS INPUTS
TRACK ANT. POSN
LCHR POSN ORDERED
RADAR ERROR SIG
LCHR STATUS
MISSILE LCHR ORDERS
TRACK ANT. ORDERS
LCHR/MISSILE CONT
DESIGNATIONS DATA
AIR TRACK DATA
SURFACE TRACK DATA
MISSILE LAUNCHER CONTROL
SYSTEM STATUS
KEYBOARD DATA
SEARCH ANTENNA POSN
C107
WEAPON CONTROL CONSOLE
SERVO CONTROL CABINET
CCS SWITCHBOARD DATA COLLECTION SWITCHING SECTION ZONE 32
ROLL
PITCH
OWN SHIP HEADING
COMPASS ON
OWN SHIP SPEED
TRACK ANT DRIVES
PLATFORM CONTROL
VERT GYRO CONTROL
SEARCH ANT DRIVES
AZ GYRO CONTROL
B MISALIGN
E MISALIGN
MISSILE SELECTED
CHANNEL SELECTOR
C104
CONTROL AND RF
TO SVLS MSL/LNCHR SELECTOR (SEE ARMAMENT BLOCK DIAG)
41
40
39
38



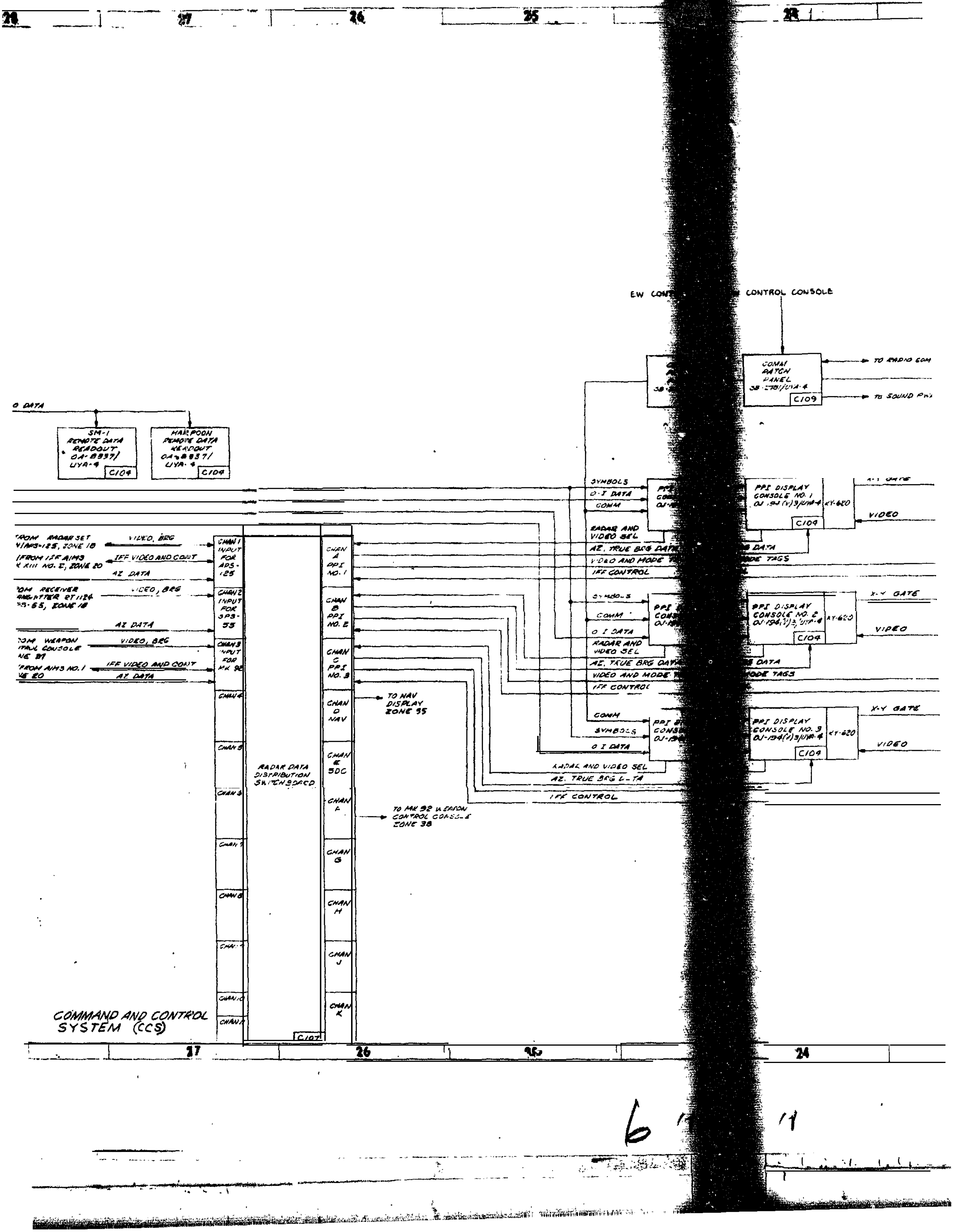
FIRE CONTROL SYSTEM (FCS)

4

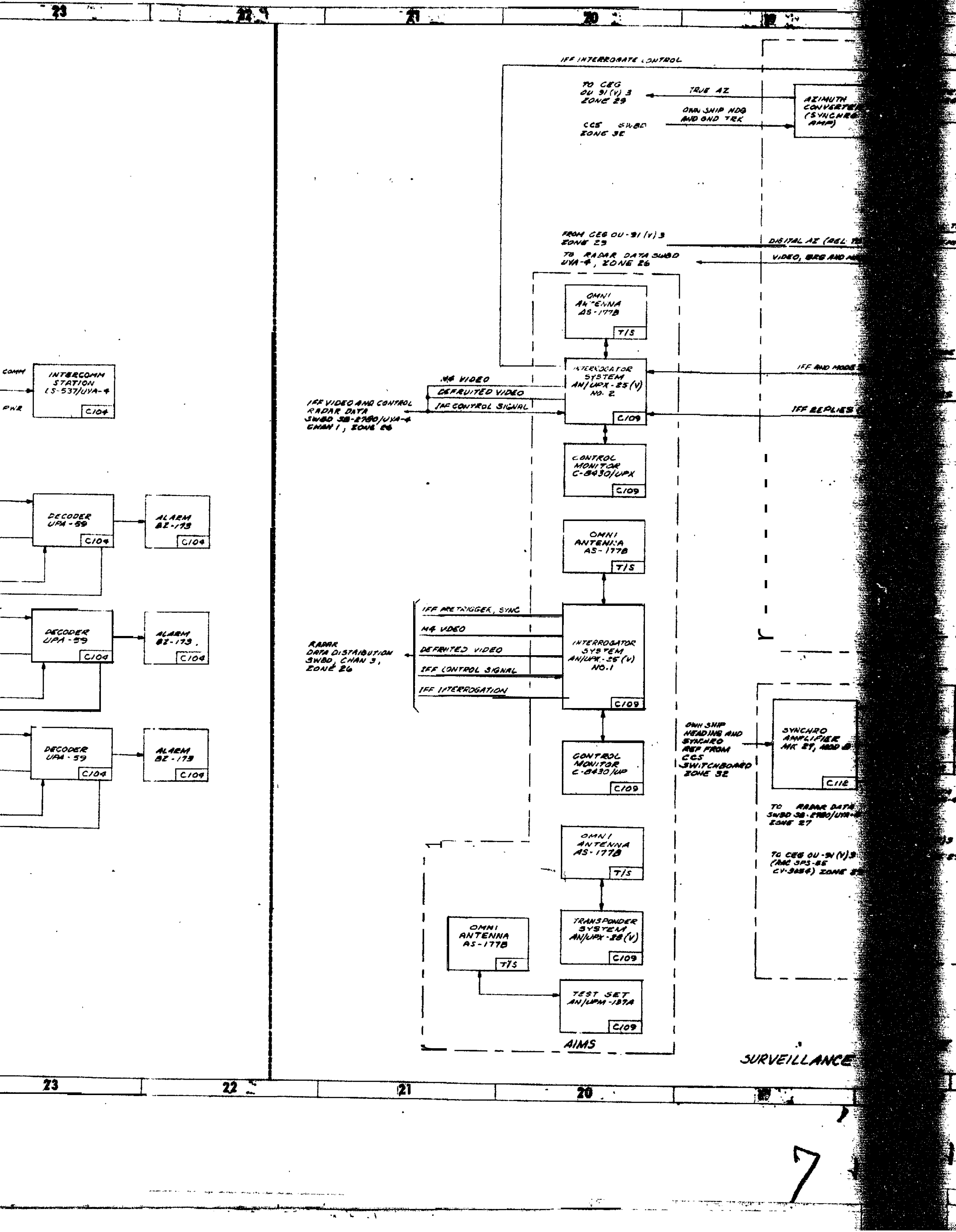


32
31
29
28
SYSTEM CONTROL CONSOLE OJ-200/UYA-4
C104
I/O DATA
STATUS AND CONTROL
C107
CHAN 0
CHAN 6
CHAN 3
CHAN 7
CHAN 17
CHAN 13
CHAN 5 ESA
CHAN 10
CHAN 14
CHAN 16
CHAN 1
CHAN 15
CHAN 2
CHAN 12
CHAN 4
CHAN 11
CCS AN/UYK-7
DEAC I/O DATA
TACTAS ACOUSTIC PROCESSOR AN/UYK-20 ZONE 47
NAV SYSTEM COMPUTER
MK 509 CONTROL PANEL ZONE 40
I/O GROUP SWITCHING
INPUT/OUTPUT CONSOLE (DEAC)
MK-72 FCS COMP (3 I/O CHANNELS) ZONE 58
ACOUSTIC PROCESSOR (I/O CHANNELS) ZONE 47
NAV SYSTEM COMPUTER ZONE 55
DATA COLLECTION SWITCHING
O/S NAV DATA (SYNCHRO) ANEMOMETER, PITCH, ROLL, HEADING
O/S NAV DATA SYNCHRO
SYSTEM 55
APS-125 AZ CONV ZONE 19
MK 509 CONTROL PANEL ZONE 40
SYNCHRO AMP MK 27 MOD 8 ZONE 19
SERVO CONT CABINET ZONE 40
HARPOON WEAPON CONT ZONE 34
NAV DATA SWITCHING
CCS CHAN 2 ZONE 30
CCS SWITCHBOARD
TACTAS ACOUSTIC PROCESSOR AN/UYK-20 ZONE 47
LINK 11 (SEE DRAWING 16Z001-320)
HARPOON WEAPON CONTROL CONSOLE
I/O DATA UQR-1 ZONE 47
TO NAV CAS ZONE 55
FROM AZ CONV ZONE 19
TRUE AZ
AZ DATA (DIG 8)
SPS-55 RECEIVER TRANSMITTER RT 1184, ZONE 8
MK-92 RADAR SET NO. 1 ZONE 34
SEARCH
THERMOGRAPH
RA/SG CV-3087
RAC APS-125 CV-XXXX
RAC SPS-55 CV-3054
RAC MK 92 CV-3054
RAC CV-XXXX
TMG
CEG OU-91(V)3/UYA-4
O DATA
FROM RADAR SET AN/APS-125, ZONE
TO/FROM IFF AIMS MK XIII NO. 2, ZONE
FROM RECEIVER TRANSMITTER RT, SPS-55, ZONE
FROM WEAPON CONTROL CONSOLE ZONE 37
TO/FROM AIMS NO. 1 ZONE 20
COMM
SYST

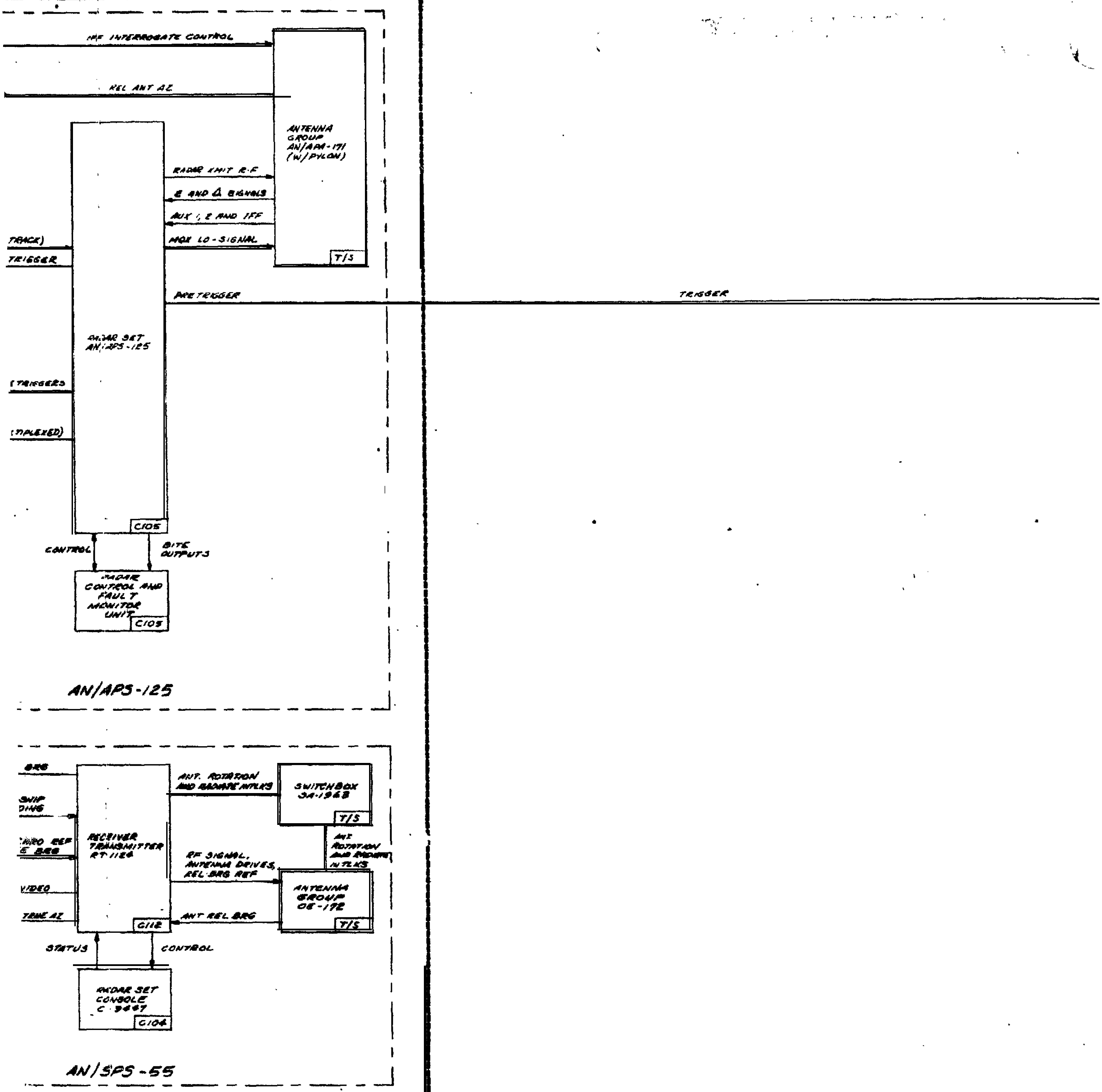
5



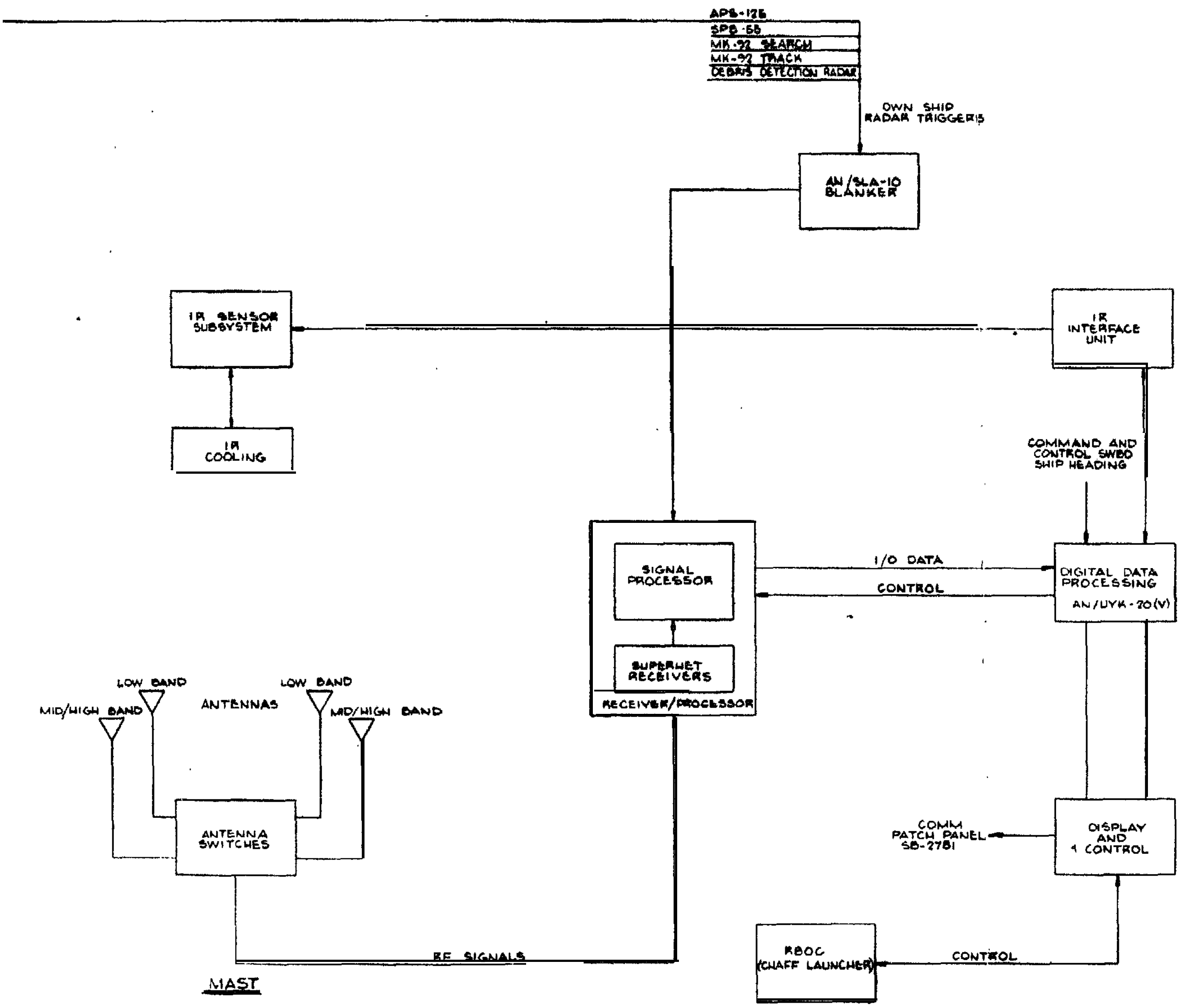
28
27
26
25
24
EW CONT
CONTROL CONSOLE
COMM PATCH PANEL SB-2781/UYA-4
C109
TO RADIO COM
TO SOUND PWR
O DATA
SM-1 REMOTE DATA READOUT OA-8937/UYA-4
C104
HARPOON REMOTE DATA READOUT OA-8937/UYA-4
C104
SYMBOLS
O-I DATA
COMM
RADAR AND VIDEO SEL
AZ. TRUE BRG DATA
VIDEO AND MODE TAGS
IFF CONTROL
PPI DISPLAY CONSOLE NO. 1 OJ-194(V)3/UYA-4
KY-620
X-Y GATE
VIDEO
C104
PPI DISPLAY CONSOLE NO. 2 OJ-194(V)3/UYA-4
PPI DISPLAY CONSOLE NO. 3 OJ-194(V)3/UYA-4
FROM RADAR SET AN/APS-125, ZONE 18
VIDEO, BRG
FROM IFF AIMS MK XIII NO. 2, ZONE 20
IFF VIDEO AND CONT
AZ DATA
FROM RECEIVER TRANSMITTER RT 1124 SPS-55, ZONE 18
FROM WEAPON CONTROL CONSOLE ZONE 37
FROM AIMS NO. 1 ZONE 20
CHAN 1 INPUT FOR APS-125
CHAN 2 INPUT FOR SPS-55
CHAN 3 INPUT FOR MK 92
CHAN 4
CHAN 5
CHAN 6
CHAN 7
CHAN 8
CHAN 9
CHAN 10
CHAN 11
RADAR DATA DISTRIBUTION SWITCHBOARD
C107
CHAN A PPI NO. 1
CHAN B PPI NO. 2
CHAN C PPI NO. 3
CHAN D NAV
CHAN E SDC
CHAN F
CHAN G
CHAN H
CHAN J
CHAN K
TO NAV DISPLAY ZONE 35
TO MK 92 WEAPON CONTROL CONSOLE ZONE 38
COMMAND AND CONTROL SYSTEM (CCS)



IFF INTERROGATE CONTROL
TO CEG OU 91(V) 3 ZONE 29
TRUE AZ
AZIMUTH CONVERTER (SYNCHRO AMP)
OWN SHIP HDG AND GND TRK
CCS SWBD ZONE 3E
FROM CEG OU-91 (V) 3 ZONE 29
DIGITAL AZ
TO RADAR DATA SWBD UYA-4, ZONE 26
VIDEO, BRG AND
OMNI ANTENNA AS-177B
T/S
INTERROGATOR SYSTEM AN/UPX-25(V) NO. 2
C/09
IFF AND MODE
M4 VIDEO
DEFRUITED VIDEO
IFF CONTROL SIGNAL
IFF VIDEO AND CONTROL RADAR DATA SWBD SB-2780/UYA-4 CHAN 1, ZONE 26
IFF REPLIES
INTERCOMM STATION LS-537/UYA-4
C/04
COMM
PWR
CONTROL MONITOR C-8430/UPX
DECODER UPA-59
ALARM BZ-173
IFF PRETRIGGER, SYNC
M4 VIDEO
DEFRUITED VIDEO
IFF CONTROL SIGNAL
IFF INTERROGATION
RADAR DATA DISTRIBUTION SWBD, CHAN 3, ZONE 26
INTERROGATOR SYSTEM AN/UPX-25 (V) NO.1
OWN SHIP HEADING AND SYNCHRO REF FROM CCS SWITCHBOARD ZONE 32
SYNCHRO AMPLIFIER MK 27
C/16
CONTROL MONITOR C-8430/UP
TO RADAR DATA SWBD SB-2780/UYA-4 ZONE 27
TO CEG OU-91 (V)3 (RAC SPS-85 CV-3654) ZONE
TRANSPONDER SYSTEM AN/UPX-28(V)
TEST SET AN/UPM-137A
AIMS
SURVEILLANCE
19
20
21
22
23
7



IRFACE) SYSTEM



DESIGN-TO-PRICE ELECTRONIC WARFARE. SYSTEM AN/SLQ-31 (V)

UNCLAS

6	5	4	3	2

A REVISED

BLOCK DIAGRAM GROUP LOCATION	
COMMAND AND SURVEILLANCE GROUPS	ZONES
PASSIVE ECM	1 THRU 16
SURVEILLANCE (SURFACE) SYSTEM	17 THRU 21
COMMAND AND CONTROL SYSTEM (CCS)	22 THRU 32
FIRE CONTROL SYSTEM (FCS)	33 THRU 42
SURVEILLANCE (UNDERWATER) SYSTEM	43 THRU 49
SPECIAL PURPOSE SYSTEM	50 THRU 51
NAV SYSTEM	52 THRU 58

COMMAN

UNCL

10

ES
URVEILLANCE
IAGRAM

00001

A

11

FUNCTIONAL REQUIREMENTS FOR INTERIOR COMMUNICATIONS	BASED ON GENERAL SPECIFICATION CIRCUIT	GEN SPEC REF PARA	PILOT HOUSE								CHART ROOM		CENTRAL CONTROL					CIC															SEA CAB	COMM CTR			HELO STATIONS				
			GENERAL RM	CO CHAIR	TEST DIR CHAIR	SCONT OFCER	ASST SCONT OFCER	LKOUT (P)	LKOUT (S)	VISUAL SIG	GENERAL RM	NAVIGATOR	GENERAL RM		PROP/LIFT		SC/AUX	GENERAL RM	CO CHAIR	SWC/ASAC	SURF D/T	AIR DET TRKR		VOICE RAD OPR	ASW SUPV			DIR SONAR OPR	WCC-1/HARPOON	WCC-2		ESM	GENERAL RM	GENERAL RM	RADIO SUPV	RADIO OPR	HELO CONT STA	LSO PLTFM	CRASH & RESC	HANGAR	HELO SECRG WHDLS
[illegible]	CIRCUIT J	[illegible]	1	1	1	1	1		1		1		1		1		1		1	1					1								1	1	1		1		1	1	1
ROUT RE COMMAND COORD	3A, 3C	432a		1	1	1	1								1		1		1	1													1	1			1				
ROUTINE OPS COORD	3S, 3L, 3W, 3X	432a				1	1	1	1	1		1									1			1	1								1		1						
ROUT RE REPAIR COORD	2-11, 3Z	432b													1		1																								
ROUTINE ENGR MCH COORD	1, 2, 4, 5 JV	432c				1	1								1		1																				1		1		1
ROUTINE MAINT. COORD	X62, X25J, X43J	[illegible]													1		1								1				1	1		1									
ROUTINE AV OPS COORD	1 JG	[illegible]																		1																	1	2	1	1	1
[illegible] SEA COORD	X8J	[illegible]				1		1	1																																
[illegible]	1/5 MC	[illegible]	1/2								1/2		1/2					1/2															1/2	1/2			1/2	2/1	1/3	1/1	1/4
[illegible]	1 3 MC	[illegible]		1	1	1	1								1		1		1																		1				
[illegible]	21 MC	[illegible]	1															1							1			1							1						
[illegible] COMMAND COORD	18/21 MC	433c		1	1	1	1	1	1	1	1				1		1		1	1					1										1		1				
[illegible] SURF COORD	27/23/32 MC	433c																		1					1										1						
AIRCRAFT [illegible] COORD	4/24 54 MC	[illegible]													1		1																								
[illegible]	17 MC	433c				1	1																														1		1		
[illegible]	CIRCUIT CA	433d																		1	1	1							1	1		1									
[illegible]	CIRCUIT C[illegible]	433d		1	1	1	1												1						1																
[illegible]	——	433f																4																							
[illegible] RECORDING	——	[illegible]																4																							
[illegible]	1 VR	[illegible]																							1			1													
ENT & TRG TV MONITOR	14 TV	433g																																							
ENT - AUDIO	5Z	433h																																							
REMOTE RADIO MONITORS	RPS		3			2													2					1													1				
REMOTE RADIO RCVR	RRS		1																1					1													1				
REMOTE SECURE RADIO	QHRS					1													1	1					1									1			1				

STATIONS			CASUALTY CONTROL					OFFICES					LIVING SPACES												UNMANNED ENGR EQMT RM							ELEX EQMT RMS										DECK STATIONS				TOP SIDE LOCATIONS							TEST DATA ACQ						IC TERMINATION POINTS PER SYSTEM
WASH & RESC	HANGAR	HELO SPCNG WHDLS	FPD REPAIR	AFT REPAIR	ELEY MAINT	MEDICAL	AV & GEN W.S.	SUPPLY	AVIATION	EXECUTIVE	DEPT OFC	DATA TECH LIB	CREW - 8 RM	CPO - 2 RM	WRKR - 9 RM	CREW'S REC	CPO LNGE	OFCR LNGE	CREW'S MESS	CPO MESS	OFCR MESS	GALLEY	LAUNDRY	SHIPS STORE	AUX MCHY RM - 3	WTR JET PUMP - 2	PROP ENG - 2	LIFT FAN - 4	ELECT GEN - 3	LIFT FAN ENG - 2	VERT CNVR TRK	RAD XMTR RM	CDR PROC	ROP EQ RM	DP	ELEX EQ RM	SHIPS ENT CTR	SONAR	TACTASS GA		HOOR STA - 4	ACMR WELS	ODD - 2	RAS - 2	MAST 03 LVL	MAST 78 FT	MAST 80 FT	02 LVL AFT	01 LVL FWD	LPG PLTFMAFT	GENERAL	GENERAL RM	POU RM 13	CCTV CONT	DET CONT	ANALOG CONT	MASTER CONT	
1	1	1	1	1	1	1	1	1	1	1	2	1	8	2	9	1	1	1	1	1	1	1	1	1	3	2	2	4	3	2		1	1	1	1	1	1	1	1	1	4	1	4	2								2				1	1	26
																																																				1						12
			1	1	1	1	1																																													1						12
		1																							3	2	2	4	3	2																												23
			1	1	1		1	1	1		1																														4	1	2	2														16
[illegible]																															1	1	1	1	1	1	1	1	1						1	1	1	1	1	1		1	1	1	1	1	1	32
[illegible]																																																										5
[illegible]																																												2														5
[illegible]																																																										10
[illegible]																																																										6
[illegible]																																																										15
[illegible]																																																										9
[illegible]																																																										5
[illegible]																																																										6
[illegible]																																																										5
[illegible]																																																										6
[illegible]																																																										5
[illegible]																																																										4
[illegible]																																																										2
[illegible]																																																										8
								1	1	1	1		8	2	9	1	1	1	1	1	1	1	1																																			29
[illegible]																																																										10
[illegible]																																																										4
[illegible]																																																										6

DOCUMENT RELEASE
M. Wallace DATE 5/25/76
CONFIG MGT

DIMENSIONS ARE IN INCHES TOLERANCES ON:					DRAWN			INDUSTRIES, INC. SEE DIVISION			
FRACTIONS ±1/16	.X ±.1	.XX ±.03	.XXX ±.010	ANGLE ±2°	CHK	R S Rhodes	5/24/76	LSES INTERIOR COMMUNICATION VOICE SYSTEM MATRIX			
					[illegible]		5/24/76				
					WEIGHTS						
					DESG SUPV	[illegible]	5/24/76				
					GRP MGR			SIZE	CODE IDENT NO 51563	DWG NO LB430001	REV
					MFG ENG	[illegible]	[illegible]				
					QA	T. [illegible]	5/25/76			NAVSEA NO	REV
					DRB/CCB	[illegible]	[illegible]				
NEXT ASSY		USED ON				[illegible]	5/24/76				
APPLICATION					LAYOUT NO			SCALE —		SHEET 1 OF 1	

Figure B.5-7 (U)

(U) B.6 HULL INSULATION, SHEATHING, AND DECK COVERING SYSTEMS

(U) This section of Appendix B consists of 29 Sheets of Rohr Drawing No. LL635001, "Hull Insulation, Sheathing and Deck Covering Systems". This drawing describes the cited systems covered in the text in Section 2.3.6.

GENERAL NOTES

1. INSULATION

A. ALL INSULATION MATERIALS INSTALLED SHALL COMPLY WITH APPLICABLE GOVERNMENT SPECIFICATIONS OR SHALL BE EQUIVALENT TO PRODUCTS IDENTIFIED.

B. IN ADDITION TO THE ABOVE, ALL FIRE, THERMAL AND ACOUSTICAL INSULATION INSTALLED SHALL SATISFY THE REQUIREMENTS OF USCG INCOMBUSTIBILITY TEST 164.009.

C. FIRE PROTECTIVE INSULATION SHALL BE ALUMINA/SILICA FELT OF FOUR-POUND DENSITY PER CUBIC FOOT (FIBRAFRAX OR EQUAL).

D. THERMAL INSULATION SHALL BE FACED FIBROUS GLASS CONFORMING TO MIL-I-742. ALTERNATELY, UNFACED FIBROUS GLASS MIL-I-742 SHEATHED WITH.032 INCH THICK ALUMINUM SHALL BE USED.,

E. ACOUSTICAL INSULATION SHALL BE ONE-INCH THICK PERFORATED HARD SURFACE FIBROUS GLASS ACOUSTIC BOARD CONFORMING TO MIL-A-2364 AND SHALL SATISFY THE REQUIREMENTS OF THE USCG INCOMBUSTIBILITY TEST. ALTERNATELY ONE-INCH THICK, SOUND-ABSORBING, FIBROUS GLASS FELT MIL-I-22023, TYPE II AND SHEATHED WITH .032 INCH PERFORATED ALUMINUM, MINIMUM 10% FREE AREA SHALL BE USED.

F. CLIPS, ANGLE SUPPORTS & STAND-OFFS SHALL BE BONDED TO STRUCTURE TO ACCOMMODATE STANDARD PANEL FASTENER PATTERN (SEE SHEETS 26,27 8.28).

G. PANEL BUTT & CORNER JOINTS SHALL BE SEALED BY COMPRESSING 6 LB/FT^3 REFRACTORY FIBROUS FELT STRIPS INTO GAPS & COVERING WITH CRES FLASHINGS

H. DECKS REQUIRING FIRE PROTECTION (GROUP I & GROUP II) SHALL HAVE .25 INCH THICK CERAMIC FIBER MOIST FELT INSULATION BONDED TO THEM, USING A CERAMIC CEMENT. THICKNESS DEFENDS ON FIRE LOADING.

I. WHERE REQUIRED AS SHOWN ON INSULATION ARRANGEMENT PLANS, FIRE, THERMAL AND ACOUSTICAL INSULATION SHALL BE COMBINED IN VARIOUS THICKNESSES AND FABRICATED INTO S-FOOT WIDE PANELS

J. THE INSULATION PANELS SHALL BE OF A SANDWICH TYPE CONSTRUCTION CONSISTING OF AN ALUMINUM BACKING SHEET.516 INCH THICK, COMBINATIONS OF FIRE, THERMAL AND ACOUSTICAL INSULATION IN THICKNESSES INDICATED IN LEGEND AND A FACE SHEET AND EDGE CLOSURES AS FOLLOWS:

- IN MACHINERY SPACES (GROUP I FIRE HAZARD), THE FACE SHEET SHALL BE .012 INCH THICK CRES WITH CRES CHANNEL TYPE EDGE CLOSURES.
- IN AREAS OTHER THAN MACHINERY SPACES REQUIRING THERMAL INSULATION OVER FIRE INSULATION. OR ONLY THERMAL INSULATION, THE FACE SHEET SHALL BE .032 INCH THICK ALUMINUM. ALTERNATELY, THERMAL INSULATION SHALL BE HARD FACED INSULATION BOARD CONFORMING TO MIL-I-742.
- IN AREAS REQUIRING ACOUSTICAL INSULATION OVER FIRE INSULATION, THE INSULATION SHALL BE HARD SURFACE FIBROUS GLASS ACOUSTICAL BOARD CONFORMING TO MIL-A-23054. ALTERNATELY, THE INSULATION AND FACE SHEET SHALL BE MIL-I-22023, TYPE II, SHEATHED .032 INCH PERFORATED ALUMINUM.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

RESERVATIONS

1. DECK INSULATION *IN WAY OF* LANDING PLATFORM *AND* HANGAR PENDING DEVELOPMENT.

REV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

REV	—	—	—	—	—	—	—	—	—	—
SHEET	20	21	22	23	24	25	26	27	28	29

DOCUMENT RELEASE
M. Wallace 7/10/76

DRAWN	G. BARTON	7-9-76
CHK	R. HOWARD	7-10-76
SYS ENG	[signature]	7-10-76
WEIGHTS	[signature]	7-10-76
DESG SUPV	[signature]	7-10-76
GRP MGR	[signature]	7-10-76
MFG ENG	[signature]	7-10-76
QA	[signature]	7-10-76
DRS/CCB	[signature]	7-10-76

INDUSTRIES, INC. SES DIVISION

HULL INSULATION, SHEATHING AND DECK COVERING SYSTEMS (INCLUDES ACTIVE AND PASSIVE FIRE PROTECTION SYSTEMS)

SIZE	CODE IDENT NO	DWG NO	REV
C	51563	LL635001	—
		NAVSEA NO	REV

LAYOUT NO | SCALE NONE | SHEET 1 OF 29

Figure B.6-1 (Sheet 1 of 29) (U) UNCLASSIFIED

GENERAL NOTES (CONTD)

- PANEL LENGTHS 'SHALL BE AS FOLLOWS:

DECK	BULKHEADS	OVERHEAD
01 LEVEL	8'-7" LG	6'-0" LG
MAIN DK	7'-7" LG	6'-0" LG
2ND D K	7'-7" LG	6'-0" LG
3RD DK	7'-7" LG	6'-0" LG

2. EXTENT OF INSULATION

A INSULATION SHALL BE FITTED TO UNDERSIDE OF DECKS, BULKHEADS AND STRUCTURAL MEMBERS AS INDICATED ON INSULATION ARRANGEMENT PLANS AND THE FOLLOWING NOTES.

B. INSULATION ON THE WARM SIDE OF THE VERTICAL SURFACES BOUNDING UPTAKE ENCLOSURES, MAGAZINES, AND FIRE INSULATION SHALL EXTEND FROM THE DECK TO THE OVERHEAD. IN ALL OTHER AREAS, THERMAL INSULATION ON VERTICAL SURFACES SHALL EXTEND FROM SIX INCHES ABOVE THE DECK TO THE OVERHEAD.

C. INSULATION SHALL NOT BE INSTALLED IN WAY OF SHOWER STALLS OR BUILT-IN FURNITURE, EXCEPT DOWN TO THE DECK AND ALONG THE DECK FOR A WIDTH OF NINE INCHES FROM THE WEATHER BOUNDARY OR TO THE BACK OF SUB-EASE, WHICHEVER IS LESS.

D. WHERE ONLY A PARTIAL AREA OF A BOUNDARY REQUIRES INSULATION, THE INSULATION SHALL BE INSTALLED SUCH AS TO EXTEND 12 INCHES BEYOND THE AREA REQUIRING INSULATION.

E. BOUNDARIES ABUTTING INSULATED BOUNDARIES WHERE INSULATION IS NOT OTHERWISE REQUIRED, SHALL BE INSULATED FOR A DISTANCE OF 12 INCHES FROM SUCH INSULATED BOUNDARIES.

F. DOORT
INSULAT

G. ACOUSTI
TIVE TRE
DOORS T
DITIONA
REDUCTI

H. THE SUR
SHALL BE

I. WHERE
VERTICA
STATUS
BULKHEA

J. WHERE A
BE FOF
THROUGH

K. UNLESS
REQUIRE
SPECIFIE
PLIED TO
REQUIRE

L. WHERE A
AN OVER
STALLED

(a.) PERF
AT TH
GLAS
UPON

(b.) PERF
ABSO
HEIG

METHODS
REQUIRE

M. EXPOSED
GORY I S
INSULATIO
TRUSSES
1-1/2 INCH

NO	TITLE	CODE	MFR OR CONTR NO
10	LSES PRESERVATIVE & COVERINGS SPEC	51563	L24630001
9	ACTIVE FIRE PROTECTION SYSTEM	51563	LB555001
8	LSES SYSTEM SPECIFICATION	51563	L01000001
7	AIR CONDITIONING, VENTILATION AND HEATING DESIGN CRITERIA MANUAL		0938-018-0010
6	INLET INSTL-LIFT SYSTEM	51563	LS567020
5	ARR-INTAKE SYS, COMBUSTION AIR P/S	51563	LL251001
4	LSES GENERAL ARRGMT - 3RD DECK	51563	LL802006
3	LSES GENERAL ARRGMT - 2ND DECK	51563	LL802005
2	LSES GENERAL ARRGMT - MAIN DECK	51563	LL802004
1	LSES GENERAL ARRGMT - 01 LVL & ABOVE	51563	LL802003

REFERENCES

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

DOORS TO MAGAZINE AND MISSILE STORAGE SPACES SHALL BE INSULATED WITH ONE-INCH BOARD.

ACOUSTICAL TREATMENT. WHEREVER ACOUSTICAL ABSORPTIVE TREATMENT IS REQUIRED FOR NOISE REDUCTION IN ROOMS, DOORS TO THESE SPACES SHALL BE COVERED ONLY IF THE ADDITIONAL AREA IS NECESSARY TO OBTAIN THE DESIRED REDUCTION.

ME SURFACE OF THE ACOUSTICAL ABSORPTIVE TREATMENT #ALL BE PAINTED AS SHOWN IN PAINTING SCHEDULE.

WHERE ACOUSTICAL ABSORPTIVE TREATMENT IS REQUIRED ON VERTICAL SURFACES, TREATMENT SHALL BE ELIMINATED BEHIND STATUS BOARDS AND LARGE EQUIPMENT WHICH HIDES THE BULKHEADS AND WHERE SOLID SHEATHING IS REQUIRED.

MERE ALUMINUM SHEATHING IS USED, THE SHEATHING MAY BE FORMED INTO PANS AND SECURED TO THE STRUCTURE WITH THROUGH CONNECTIONS.

UNLESS OTHERWISE SPECIFIED, IF ACOUSTICAL TREATMENT IS REQUIRED FOR ANY AREA IN WHICH THERMAL INSULATION is SPECIFIED, ONLY THE ACOUSTICAL TREATMENT SHALL BE APPLIED TO THE PLAIN SURFACES, AND THERMAL INSULATION, IF REQUIRED, SHALL BE APPLIED TO BEAMS AND STIFFENERS.

WHERE ACOUSTICAL ABSORPTIVE TREATMENT IS REQUIRED FOR AN OVERHEAD IN WHICH A DROPPED CEILING MUST BE INSTALLED, ONE OF THE FOLLOWING METHODS SHALL BE USED:

a) PERFORATED ALUMINUM SHEATHING SHALL BE INSTALLED AT THE DESIRED HEIGHT AND SOUND-ABSORBING FIBROUS GLASS FELT SHALL BE INSTALLED DIRECTLY ABOVE AND UPON IT.

b) PERFORATED HARD-SURFACE FIBROUS GLASS ACOUSTICAL ABSORPTIVE BOARD SHALL BE INSTALLED AT THE DESIRED HEIGHT WITH NO SHEATHING REQUIRED.

METHODS a & b ABOVE DO NOT ELIMINATE THERMAL INSULATION REQUIREMENTS FOR THE OVERHEAD.

EXPOSED STANCHIONS AND TRUSSES SHALL BE INSULATED IN ALL CATEGORY I SPACES WITH A 3/4-INCH THICKNESS OF MOLDABLE FIBER MOIST FELT INSULATION. THE MOIST FELT WILL BE BONDED TO THE STANCHIONS AND TRUSSES WITH CERAMIC CEMENT. THE MOIST FELT SHALL BE OVERLAPPED 1/2 INCHES TO PREVENT A DIRECT PATH TO THE PROTECTED MEMBER.

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	–
SCALE NONE		SHEET 2 OF 29	

Figure B.6-1 (Sheet 2 of 29) (U)

GENERAL NOTES (CONT'D)

3. INSULATION PROTECTION

A INSULATION ON BULKHEADS OF COMMISSARY IN WAY OF HEAT-PRODUCING COMMISSARY EQUIPMENT AND VEGETABLE-PEELING MACHINES SHALL BE SHEATHED. INSULATION ON THE OTHER AREAS ADJACENT TO THESE FIXTURES WHICH MAY BECOME WET OR COATED WITH GREASE OR IN ANY AREA WHERE INSULATION IS SUBJECT TO DAMAGE OR EXPOSED TO HEAVY TRAFFIC. SHALL ALSO BE SHEATHED.

INSULATION BEHIND LAVATORIES, SERVICE SINKS. WATER CLOSETS, AND FOOD PREPARATION TABLES SHALL BE SHEATHED FROM THE DECK TO AT LEAST TWO FEET ABOVE THE WORKING SURFACE OF THE FIXTURES

B. EXPOSED EDGES AROUND AIRPORTS, DOORS AND EXPOSED EDGES IN OTHER LOCATIONS WHERE SUCH EDGES ARE SUBJECT TO DAMAGE SHALL EE PROTECTED BY LIGHT Z OR FLAT BARS.

C. EXPOSED EDGES OF INSULATION NOT SUBJECT TO DAMAGE SHALL BE PROTECTED WITH FIBROUS GLASS TAPE.

D. INSULATION IN PASSAGEWAYS AND OTHER AREAS SUBJECT TO HEAVY TRAFFIC, SHALL BE SHEATHED FROM THE DECK TO AT LEAST 36" ABOVE THE DECK. SHEATHING SHALL BE CRES .019 AISI TY-304, FIN 4

E. WHEN ATTACHING CRES SHEATHING IN WAY OF ALUMINUM STRUCTURE, ALL SUPPORT ANGLES AND COAMINGS TO BE INSULATED WITH DIELECTRIC TAPE.

4 INSTALLATION

A. INSTALLATION PROCEDURE SHALL BE IN ACCORDANCE WITH THIS PLAN.

5. REPAIR

A WHERE PRACTICABLE, DAMAGED FACED FIBROUS GLASS BOARD SHALL BE COVERED WITH GLASS CLOTH AND CEMENT.

6. ANTISWEAT TREATMENT

A. ANTISWEAT TREATMENT TO BE APPLIED IN ACCORDANCE WITH PAINT SCHEDULE.

7. VAPOR BARRIER

A A VAPOR BARRIER COATING CONFORMING TO MIL-C-19993 OR EQUIV SHALL BE APPLIED TO THE EXPOSED SURFACE OF ALL INSULATION WITHIN LAUNDRIES, SCULLERIES, AND GALLEYS. ONE HUNDRED PERCENT COVERAGE SHALL BE PROVIDED BY ANY SINGLE COAT OF VAPOR BARRIER COATING SEE PAINT SCHEDULE FOR APPLICATION.

8. PAINTING

A STRUCTURE BEHIND HULL INSULATION SHALL NOT BE PAINTED UNLESS IT IS A WEATHER BOUNDARY OR BETWEEN AIR CONDITIONED AND NON-AIR CONDITIONED SPACES. SEE PAINT SCHEDULE FOR FINISH PAINTING OF INSULATION.

B. FORWARD SIDE OF FIRE ZONE BULKHEADS SHALL RECEIVE TWO COATS OF THERMAL INSULATING (INTUMESCENT) PAINT, MIL SPEC MIL-C-46081.

9. DECK COVERING

A. DECK COVERING AN
RANGEMENT DRAWI
TRATE THE INTEGR
WITH THE DECK CO
ING SPECIFICATION
REGARDING DE'CK C

a UNDERLAY PC 20 8
DECK COVERING IS
AND UNDERLAY PC
DECK SEAMS ARE T

C. DECK COVERING SHA
ELECTRONIC EQUIPM
PANELS SEE DWG L
MOUNTED EQUIPMEN

10. ACTIVE FIRE PROTECTIO

THE ACTIVE FIRE PR
ARRANGEMENT DRA
TRATE THE INTEGRA
PROTECTION SYSTE
PLETE INFORMATION
SYSTEM.

Figure B.6-1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NG AND DECK INSULATION IS SHOWN ON THE AR-
DRAWINGS. (SEE SHEETS 17 THROUGH 25) TO ILLUS-
NTEGRATION OF THE PASSIVE FIRE PROTECTION
CK COVERING, WHERE REQUIRED. SEE DECK COVER-
ATION NO L2463001 FOR COMPLETE INFORMATION
DECK COVERING.

20 SHALL BE USED ONLY WHERE
NG IS TO BE SLOPED FOR DRAINAGE
AY PC 21 SHALL BE USED ONLY WHERE
ARE TO BE FAIRED.

NG SHALL NOT BE INSTALLED UNDER FURNITURE SUB-BASES,
EQUIPMENT, MECHANICAL EQUIPMENT, OR BEHIND BULKHEAD
DWG LL802004 THRU LL802007 FOR EXTENT OF DECK
UIPMENT, ETC.

TECTION SYSTEM

IRE PROTECTION SYSTEM IS INDICATED ON THE
DRAWINGS (SEE SHEETS 8 THROUGH 11) TO ILLUS-
TEGRATION OF THE ACTIVE AND PASSIVE FIRE
YSTEM. SEE DRAWING NO LL555001 & 2 FOR COM-
IATION REGARDING THE ACTIVE FIRE PROTECTION

SIZE	CODE IDENT NUMBER	DWG no	RE
C	51563	LL635001	-
SCALE NONE		SHEET 3 OF 29	

.6-1 (Sheet 3 of 29) (U) UNCLASSIFIED

MATERIAL IDENTIFICATION LIST

ITEM NO	DESCRIPTION	QTY	WEIGHT-LBS UNIT	WEIGHT-LBS TOTAL	MATERIAL	REF TO	SPECIFICATION
1	1/2" FIRE INSUL 4 LBS/CU FT	47,906 SQ FT	.166 SQ FT	7952	CERAMIC FBRS FELT		CARBORUNDUM FIBER-FRAX OR EQUIV
2	1" FIRE INSUL 4 LBS/CU FT	15,836 SQ FT	.33 SQ FT	5,226	CERAMIC FBRS FELT		CARBORUNDUM FIBER-FRAX OR EQUIV
3	1" ACOUSTIC INSUL 2 LBS/CU FT	37,467 SQ FT	.17 SQ FT	6,369	FIBROUS GLASS FELT		MIL-I-22023 TYPE II CL 5 OR MIL-A-23054
4	1" THERMAL INSUL	5,169 SQ FT	.39 SQ FT	2,016	FACED FIBROUS GLASS BOARD		MIL-I-742
5	2" THERMAL INSUL	2,062 SQ FT	.61 SQ FT	1,258	FACED FIBROUS GLASS BOARD		MIL-I-742
6	.012" FACE SHEET	48,196 SQ FT	.48 SQ FT	23,134	CRES SH		QQ-A-766 TYPE 304 FINISH 2B
7	.016" BACK SHEET	89,967 SQ FT	.23 SQ FT	20,692	AL SH		QQ-A-250/8 5052-H32
8	.012" PANEL CLOSURE	82,535 LIN FT	.18 LIN FT	14,856	CRES SH		QQ-A-766 TYPE 304 FINISH 2B
9	54 MIL ACOUSTICAL SHEATHING	3,307 SQ FT	.87 SQ FT	2,877	LEAD VINYL		SOUND FAB OR EQUIV
10	1/2" THERMAL INSUL	2,144 SQ FT	.195 SQ FT	418	FACED FIBROUS GLASS BOARD		MIL-I-742
11	1/4" FIRE INSUL - DK 15 LBS/CU FT	17,302 SQ FT	.31 SQ FT	5,364	CERAMIC FIBER MOIST FELT		REFRACTORY PROD CO WRP X AQ OR EQUIV *
12	ADHESIVE	17,302 SQ FT	.10 SQ FT	1,730	CERAMIC		CABORUNDUM QF-180 OR EQUIV
13	CLOTH	17,302 SQ FT	.08 SQ FT	1,384	FIBROUS GLASS		MIL-C-9084 TYPE II CLASS 2
14	RESIN	17,302 SQ FT	.10 SQ FT	1,730	EPOXY RM TEMP CURE		SHELL EPON 934 OR EQUIV *
15	DECK TILE	8,815 SQ FT	1.10 SQ FT	9,701	VINYL ASBESTOS		MIL-T-18830
16	RUG	3,732 SQ FT	.50 SQ FT	1,866	BETA FIBROUS GLASS		CAROLINA NARROW FABRIC CO OR EQUIV
17							
18	SLIP RESISTANT COVERING	22,624 SQ FT	.25 SQ FT	5,706	EPOXY PLUS AGGREGATE		MIL-D-23003 TYPE II
19	EPOXY COVERING	1,504 SQ FT	2.88 SQ FT	4,332	SOLVENT FREE POLY-AMIDE PLUS AGGREGATE		
20	UNDERLAY 1/8" TO 1" THK	608 SQ FT	1.75 * SQ FT	1,064	LATEX MASTIC *MEAN THICKNESS 1/4"	NOTE 11	MIL-D-3135 TYPE I
21	UNDERLAY FEATHEREDGE TO 1/8" THK	7,795 SQ FT	1.0 * SQ FT	7,795	LATEX MASTIC *MEAN THICKNESS 1/10"	NOTE 11	MIL-D-3135 TYPE II
22	BOTTOM CHANNEL	6,922 LN FT	.463 LN FT	3,205	ALUMINUM 1 1/8 x 2 1/4 x .090		QQ-A-200/8 6061-T6
23	SUPPORT CHANNEL	41,440 LN FT	.180 LN FT	7,459	ALUM 1"x2 1/2"x1" C .062 COMPCOR TYPE C-1 THK		QQ-A-200/8 6061-T6
24	SUPPORT CLIP	LN FT	1.06 LN FT	1,287	ALUMINUM 1" x .090		QQ-A-200/5 5086-H111
25	INSULATOR PAD	20,238	.017	344	1/2" FIRE INSULATION 4 LBS/CU FT 2 1/2" X 6" LG		CARBORUNDUM FIBER-FRAX OR EQUIV
26	ANGLE 2" x 3" x .062	6,922 LN FT	.20 LN FT	1,384	ALUMINUM COMPCOR TYPE C-1		QQ-A-200/8 6061-T6
27	1" x 1" x .0235	10,443 LN FT	.165 LN FT	1,723	.0235 CRES		QQ-A-766 TYPE 304 FINISH 2B

CONTINUED Off SHEET NO 5

UNCLASSIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

BER-
BER-
PE II
5054
304
304
D CO
UIV *
F-180
PE II
34
OW
QUIV
PE II
E I
E II
FIBER-
IV
E 304

*MODIFIED WITH FIRE RETARDENT

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	–
SCALE NONE		SHEET 4 OF 29	

e B.6-1 (Sheet 4 of 29) (U)

UNCLASSIFIED

MATERIAL IDENTIFICATION LIST

ITEM NO	DESCRIPTION	QTY	WEIGHT LBS UNIT	WEIGHT LBS TOTAL	MATERIAL	REF TO	SPECIFICATION
28	SEALING STRIP 2½"W	43,351 LN FT	.205 LN FT	8,887	.0235" CRES		QQ-A-766 TYPE 3(FINISH 2B
29	RIVET, BLIND	20,238	.0625	1,265	1/8" DIA CRES LG TO SUIT		
30	ANGLE 4"x 4" x .062THK	6,992 LN FT	.32 LN FT	2,215	ALUMINUM COMPCOR TYPE C-1		QQ-A-200/8 6061-T6
31							
32	SPACER 3/8" DIA x 2" LG	20,238	.125	2,530	CERAMIC		
33							
34	CHANNEL 1' x 2' x 1'	6,922 LN FT	.329 LN FT	2,277	.0235" THK CRES		QQ-A-766 TYPE 3 FINISH 2B
35	COAMING	6,922 LN FT	.588 LN FT	4,070	4" x 1/8" AL FLAT BAR		QQ-A-200/5 5086-H111
36							
37	RIVET BLIND	13,834	.0625	865	1/8' DIA CRES LG TO SUIT		
38							
39	DECK INSULATION	6,922 LN FT	.31 LN FT	2,146	CERAMIC FIBER MOIST FELT 1/4" THK x 3-1/4" W		REFRACTORY PROD WRP-X-AQ OR EQU
40							
41	ADHESIVE (RUG)	3,732 SQ FT	.10 SQ FT	373			3-M CO BLUEGLUE OR EQU
42	ADHESIVE (TILE)	9,701 SQ FT	.10 SQ FT	882			MIL-A-21016
43	.032' FACE SHEET (PERFORATED)	29,518 SQ FT	.384 SQ FT	11,335	ALUMINUM SHEET		QQ-A-250/8 5052-H32
44	ISOLATION STRIP	28,900	.016	462	RUBBER 1/8' THK		1' x 2½'
45	↓ ↓	6,922 LN FT	.132 LN FT	914	↓ 1/16 THK		3¼' WIDE
46	1/2' FIRE INSULATION 4 LBS/CU FT	43,351 SQ FT	.034 SQ FT	1,474	CERAMIC FIBROUS FELT		CARBORUNDUM FIB FRAX OR EQUAL
47	.032' FACE SHEET	12,254 SQ FT	.452 SQ FT	5,539	ALUMINUM SHEET		QQ-A-250/8 5052-H32
48							
49							
50							

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

ON
E 304

E 304

ROD CO
EQUIV

EQUIV

FIBER-
L

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	–
SCALE NONE		SHEET 5 OF 29	

B.6-1 (Sheet 5 of 29) (U)

LEGEND

FIRE HAZARD CATEGORIZATION

SPACES ARE CATEGORIZED [1] THRU [4] ACCORDING TO THE ANTICIPATED FIRE LOADING AND POTENTIAL FIRE HAZARD OF THE SPACE

FIRE LOADING IS DEFINED BY THE WEIGHT OF COMBUSTIBLES PER SQUARE FOOT (LBS/ SQ FT), SEE TABLE BELOW,

GROUP	DEGREE OF HAZARD	FIRE LOADING
[1]	HIGH (MCHRY SPACES)	10 LBS/SQ FT
[2]	MODERATE TO HIGH	5-10 LBS/SQ FT
[3]	MODERATE	3-5 LBS/SQ FT'
[4]	LOW	0-3 LBS/SQ FT

A = ACOUSTICAL CATEGORY - SEE SHEET 7

T = THERMAL CATEGORY - SEE REF NO 7

ITEM NO	DECK COVERINGS
15	DECK TILE
16	RUG
18	SLIP RESISTANT COVERING
19	EPOXY

* INCLUDING ACOUSTICAL AN0 T…

** F=FIRE, A=ACOUSTICAL, T-1…

ITEM NO	PASSIVE FIRE P… THICKNESS	MATERI…
1	1/2"	FIRE … INSULA…
2	1"	
3	1"	ACOUST… INSULA…
4	1" BHD	THERM… INSULA…
5	2" OVHD	
10	1 1/2" BHD	THERM… INSULA…
4	1" OVHD	
		SHEATHI…
1 & 3	** 1/2" F + 1"A	FIRE A… ACOUS…
2 & 3	** 1"F+1"A(MACH SP)	
10 & 3	** 1 1/2" T+1"A (BHD)	THERMAL… ACOUST…
4 & 3	** 1"T+1"A (OVHD)	
3 & 4	** 1"T+1"A (BHD)	THERMAL… ACOUST…
3 & 5	** 2"T+1"A (OVHD)	
9&3	1/16" LV+ 1"A	LEAD VIN… & ACOUST…
1, 3 & 9	** 1/2"F+1/16"LV+1"A	FIRE… LEAD VI… AND ACOUST…
2, 3 & 9	** 1"F+1/16"LV+1"A	
		SUSPEN… CEILING…
11	1/4"	FIRE… INSULAT…

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

AND THERMAL INSULATION
T=THERMAL, LV=LEAD VINYL

E PROTECTION"		
ERIAL	BHD	OVHD
RE ULATION		
USTICAL ULATION		
ERMAL ULATION		
ERMAL ULATION		
THING		
E AND USTICAL		
MAL AND USTICAL		
MAL AND USTICAL		
VINYL USTICAL		LV
FIRE VINYL AND USTICAL		LV
ENDED ING		C
IRE LATION	DECK	

ACTIVE FIRE PROTECTION	
SYSTEM	SYMBOL
HALON	✚
HI-EX FOAM	●
FE 1211 EXTINGUISHER	■
18* DRY CHEM EXTINGUISHER	●
AFFF FOAM	◆
S W SPRINKLING	▲

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE NONE		SHEET 6 OF 29	

SPACE/COMPARTMENT AIRBORNE NOISE CATEGORI[ES]

02 LEVEL

SPACE/COMP	CATEGORY
PILOT HOUSE	A_{12}

01 LEVEL

SPACE/COMP	CATEGORY
CHART ROOM	A_3
HANGAR	E
HEAD	B
PASSAGE WAYS	D
FAN ROOM	H
SEA CABIN	A_3
CENTRAL CONTROL STA	A_{12}
RADAR EQUIP RM	D
HELO LANG CONTROL STA	E
FUEL AT SEA STA	E
MACHINE ROOM	H

MAIN DECK

SPACE/COMP	CATEGORY
COMM. CENTER	A_3
CIC	A_{12}
RADAR PRCS ROOM	A_3
AVIATION OFFICE	B
DATA PROC. CENTER	A_3
AVIATION WORKSHOP	B
HANGAR	E
PASSAGEWAYS	D
FAN ROOMS	H
MK 46 TORPEDO MAGAZINE	D
SONOBUOY MAGAZINE	D
AVIATION STORE-ROOMS	D
AFFF STATION	D
RADIO XMTR ROOM	D
SUPPLY OFFICE	B
SD ISSUE ROOM	B
ELEK MAINT RM	D
BOSUN STOREROOMS	D
ELECTRONIC SPARE PARTS STRM	D
SD GENL STRM	D
TDAS CONTROL CTR	B
AVIATION & GEN WORKSHOP	B
ELEK GEN ROOMS	D
LX. HAN. RMS	H

2ND DECK

SPACE/COMP	CATEGORY
DEPT OFFICE	B
DATA & TECH LIBRARY	B
EXEC OFFICE	B
EXEC OFF. SR	B
OFF WR, WC & SH	B
CPO BERTH	B
CPO WR, WC & SH	B
WR LOUNGE	B
WR MESS ROOM	B
PANTRY	B
CPO LOUNGE	B
CREW REC. RM	B
CREW MESS RM	B
SCULLERY	B
GALLEY	B
CREW WR, WC & SH	B
MED TRT ROOM	B
FAN ROOMS	H
OFF BAG RM	D
CPO BAG RM	D
DRY PROV. STRM	D
PASSAGEWAYS	D
CREW LIVING SPCS	B
CHILL STOREROOM	D
FREEZE STOREROOM	D
REFR MCHRY RM	D
TRASH DISPSL RM	D
CPO MESS RM	B
OFFICERS SRS	B
CO BATH	B
CO SR	B
DIVING CR STRM	D
ACY REPAIR	D
TACTAS	D
HF LD SECRG RM	D
ROU STAS	D
SHIP CNTER EQP. RM	D
ATHLETIC GEAR RM	D
SEAL RPR FR STRM	D
UNASSIGNED	H*
SHIP STORE	D
CREW BAG.	D
FLAY. LIQ. STRM	D
ARMORY	D
FWD REPAIR	D

3RD DECK

SPACE/COMP	CATEGORY
SONAR ROOM	[illegible]
PASSAGEWAYS	[illegible]
ANCHOR WINDLASS RM	[illegible]
AUX. MACH. ROOMS	[illegible]
ELEK GEN RMS	[illegible]
PROP. FNG. RMS	[illegible]
WATERJET PUMP RMS	[illegible]
LIFT FAN ROOMS	[illegible]
ROU STATIONS	[illegible]
BOW SEAL MACH. RM	[illegible]
LAUNDRY ROOM	[illegible]

AIRBORNE NOISE LEVELS (DECIBELS RE $20 \mu N/M^2$).

NOISE CATEGORY	SIL VALUE	32	63	125	250	500	1000	2000	4000	8000
		CENTER FREQUENCIES OF STANDARD OCTAVE BANDS (HZ)								
A_3	64	90	84	79	76	SEE NOTE 2			69	68
A_{12}	54	90	84	79	76	SEE NOTE 2			69	68
B	NONE	90	84	79	76	73	71	70	69	68
C	NONE	85	78	72	68	65	62	60	58	57
D	NONE	105	100	95	90	90	85	85	85	85
E	72	105	100	95	90	SEE NOTE 2			86	86
H	SEE NOTE 1									

NOTE 1. THIS CATEGORY APPLIES TO SPACES WHERE A HEARING HAZARD EXISTS, SUCH AS GAS TURBINE ENCLOSURES, WHICH MUST BE ENTERED ON AN INTERMITTENT BASIS FOR MAINTENANCE PURPOSES.

2. THE SIL VALUE APPLIES IN THE 500, 1000, AND 2000 HZ OCTAVE BANDS. THE SIL VALUE IS THE ARITHMETIC AVERAGE OF THE SOUND PRESSURE LEVEL IN THE ABOVE THREE OCTAVE BANDS.

3. THE NOISE LEVEL IN ANY ONE OCTAVE BAND MAY BE EXCEEDED BY TWO DECIBELS FOR EACH NOISE CATEGORY. IN THE OCTAVE BANDS WHERE THE SIL VALUE APPLIES, THE NOISE LEVEL MAY EXCEED THE SIL VALUE IN ANY OF THE THREE OCTAVE BANDS PROVIDED THE ARITHMETIC AVERAGE OF THE LEVELS IN THE THREE BANDS DOES NOT EXCEED THE SPECIFIED SIL VALUE.

AIRBORNE NOISE CATEGOR[IES]

A. CATEGORY A. SPACES [...] TION MUST BE UNDER[...] WITHOUT NEED FOR R[...] ARE BASED ON APPRO[...] EITHER 3 FEET OR 12 [...] WHEN THE EXTREME T[...] THAN 6 FEET. CATEGO[...] EXTREME TALKER-LIS[...] GREATER.

B. CATEGORY B. SPACES [...] THEIR QUARTERS IS T[...] COMMUNICATION CON[...]

C. CATEGORY C. SPACES [...] ESPECIALLY QUIET CO[...]

D. CATEGORY D. HIGH N[...] MUNICATION IS NOT I[...] IS NOT PROVIDED, AN[...] PRIMARY CONSIDERAT[...]

E. CATEGORY E. AREAS [...] HIGH VOCAL EFFORT [...] AND WHERE AMPLIFIE[...] NORMALLY AVAI[...]

H. CATEGORY H. NOISE [...] LEVELS EXCEED THE [...] SPACES. THE REQUIRE[...]

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

IES

	CATE-GORY	WET DECK SPACE/COMP	CATE GORY
	D	NO REQUIREMENTS	
	D		
	D		
	D		
	D		
	H		
	H		
	H		
	D		
	D		
	D		

TEGORIES

SPACES WHERE DIRECT SPEECH COMMUNICA- UNDERSTOOD WITH MINIMAL ERROR AND FOR REPETITION. ACCEPTABLE NOISE LEVELS APPROXIMATE TALKER-LISTENER DISTANCES, OR 12 FEET. CATEGORY A-3 IS ASSIGNED REME TALKER-LISTENER DISTANCE IS LESS CATEGORY A-12 IS ASSIGNED WHEN THE ER-LISTENER DISTANCE IS 6 FEET OR

SPACES WHERE COMFORT OF PERSONNEL IN RS IS THE PRIMARY CONSIDERATION; WHERE ON CONSIDERATIONS ARE SECONDARY.

SPACES WHERE IT IS ESSENTIAL TO MAINTAIN IET CONDITIONS.

HIGH NOISE LEVEL AREAS WHERE VOICE COM- S NOT IMPORTANT; WHERE EAR PROTECTION ED, AND PREVENTION OF HEARING LOSS IS THE DERATION.

AREAS WHERE VOICE COMMUNICATION AT FFORT OVER SHORT DISTANCES IS ACCEPTABLE PLIFIED SPEECH EQUIPMENT OR TELEPHONES Y AVAILABLE.

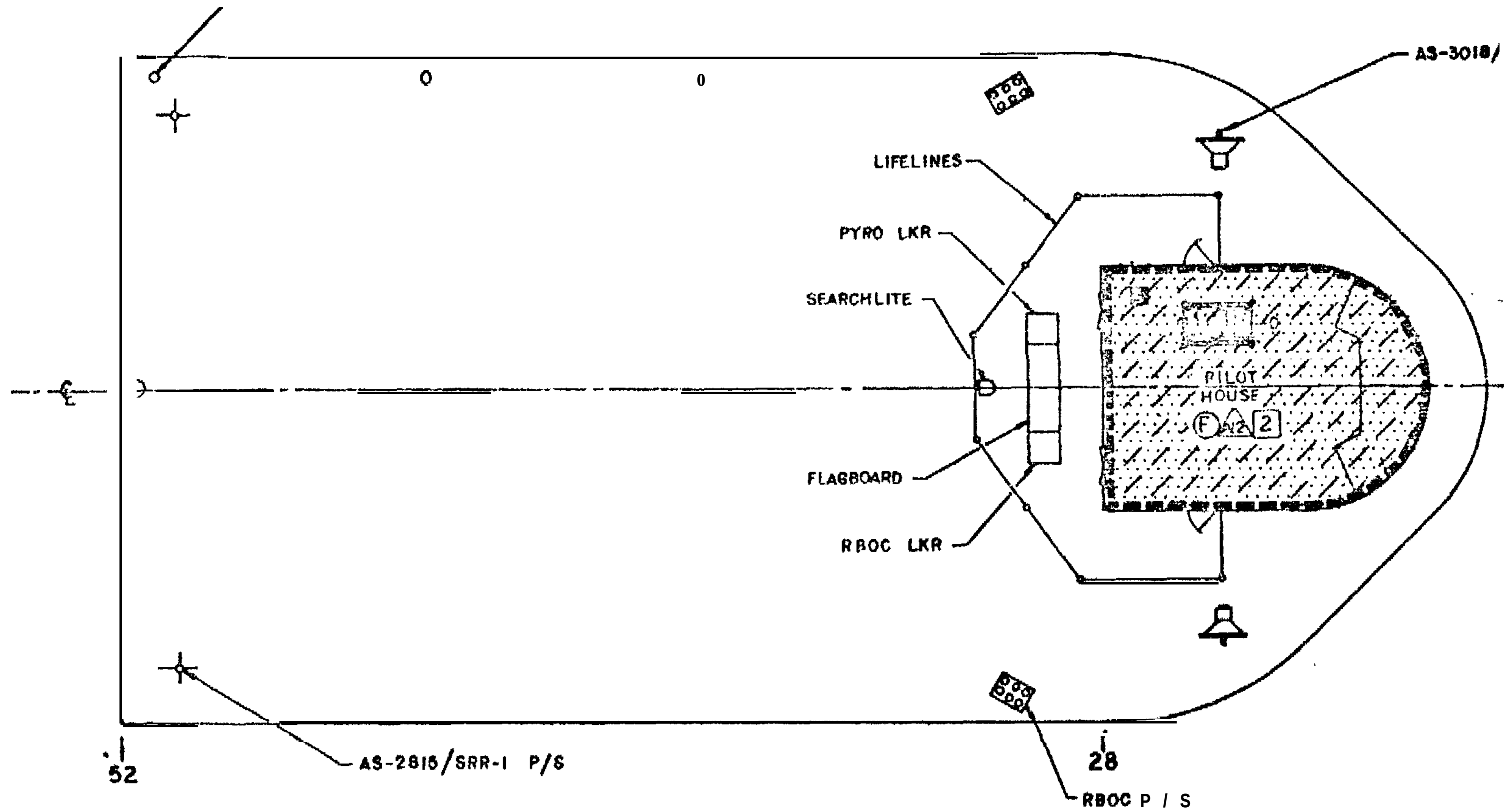
NOISE HAZARDOUS AREAS WHERE NOISE D THE LEVELS SPECIFIED FOR CATEGORY D EQUIREMENTS OF BUMED INSTR 6260.6B APPLY.

** Prospective Category Change Upon Space Assignment*

SIZE	CODE IDENT NUMBER	DWG NO	REV
	51563	LL635001	
SCALE NONE		SHEET 7 OF 29	

L (Sheet 7 of 29) (U) UNCLASSIFIED

2



02 LEVEL
BHD & OVHD INSULATI

Figure B.6-1

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED

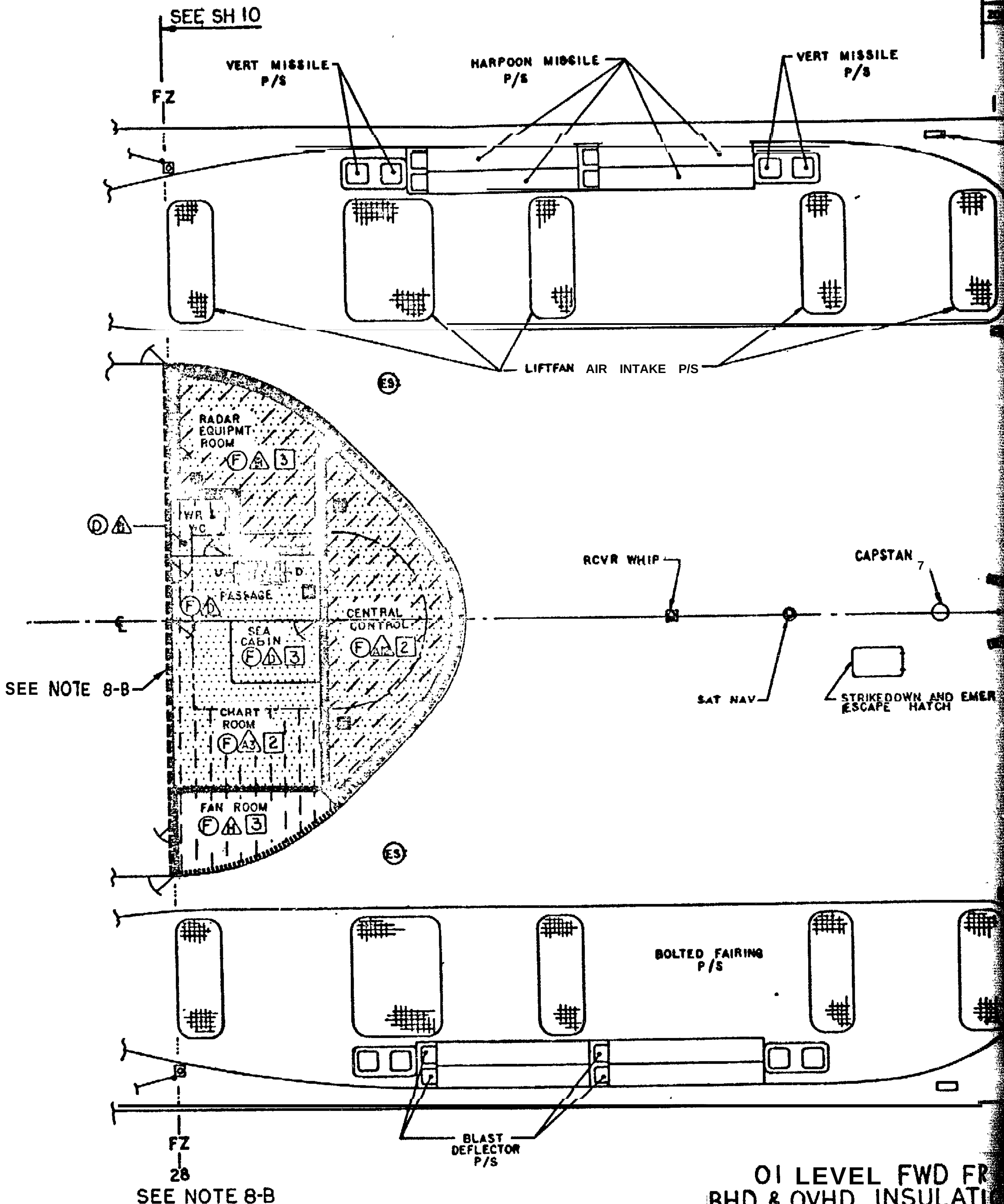
-I P/S

℄

ON

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"			

(Sheet 8 of 29) (U)

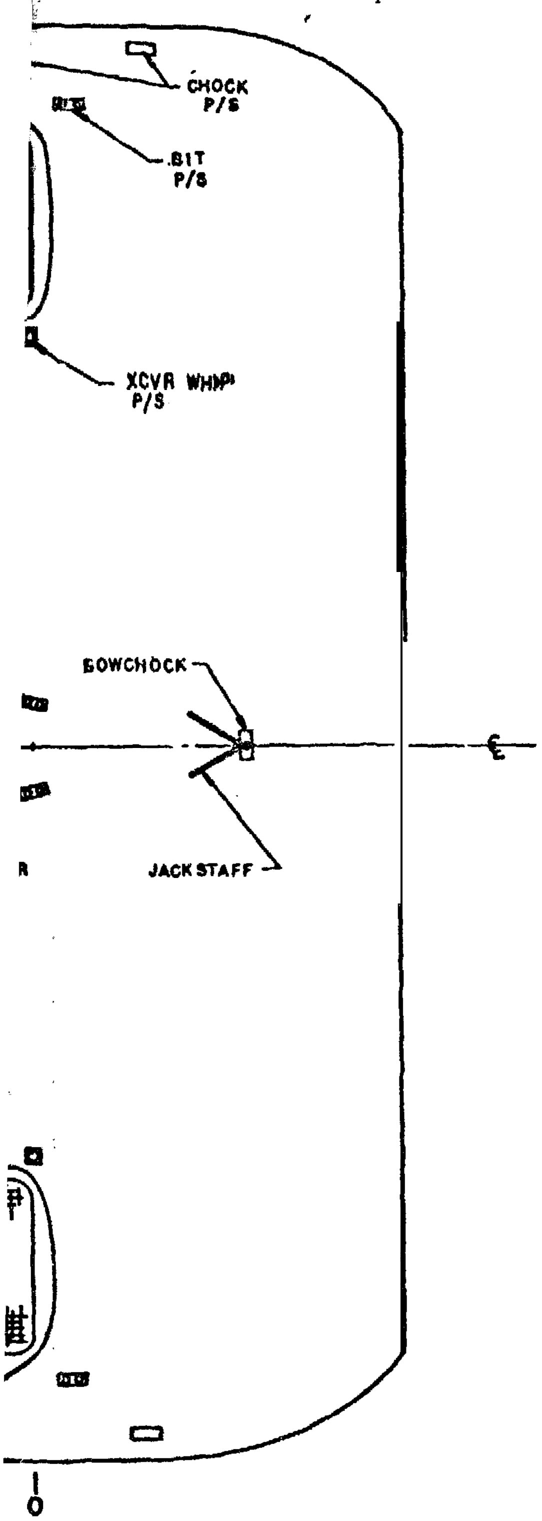


01 LEVEL FWD FR
BHD & OVHD INSULATI

Figure B.6-1 (S

REVISIONS

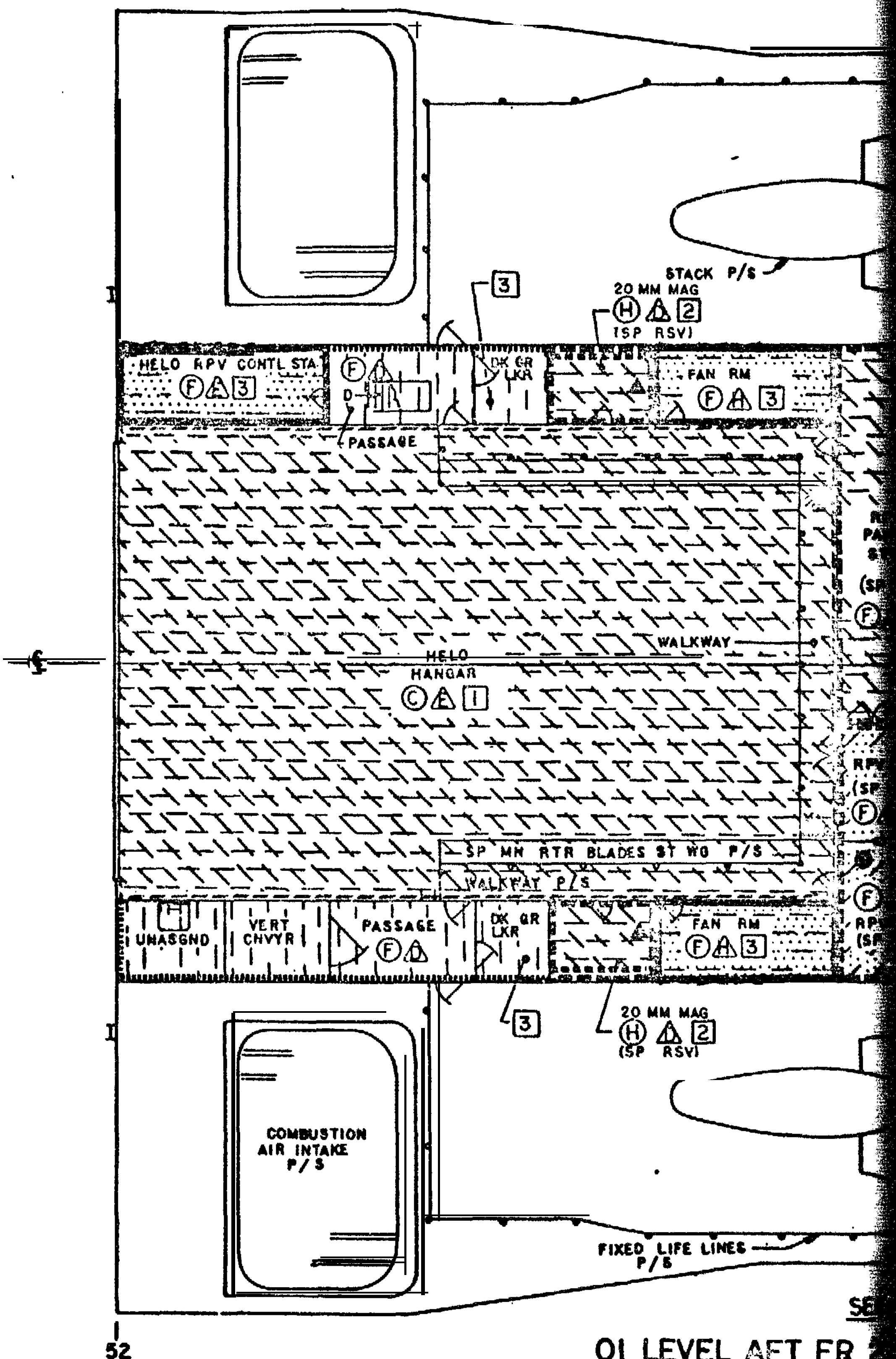
NE	LTR	DESCRIPTION	DATE	APPROVED



R 28
ION

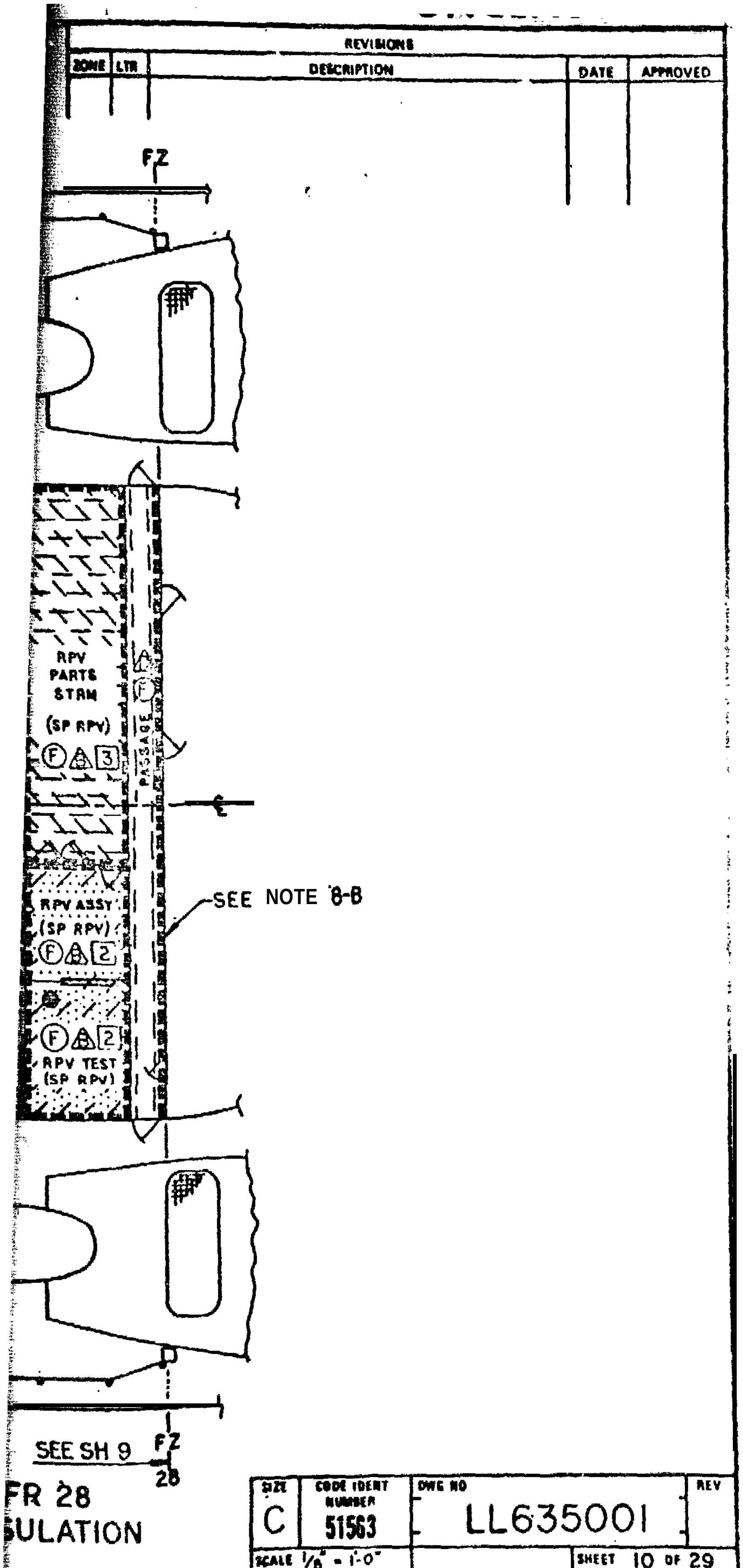
SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 9 OF 29	

(Sheet 9 of 29) (U)



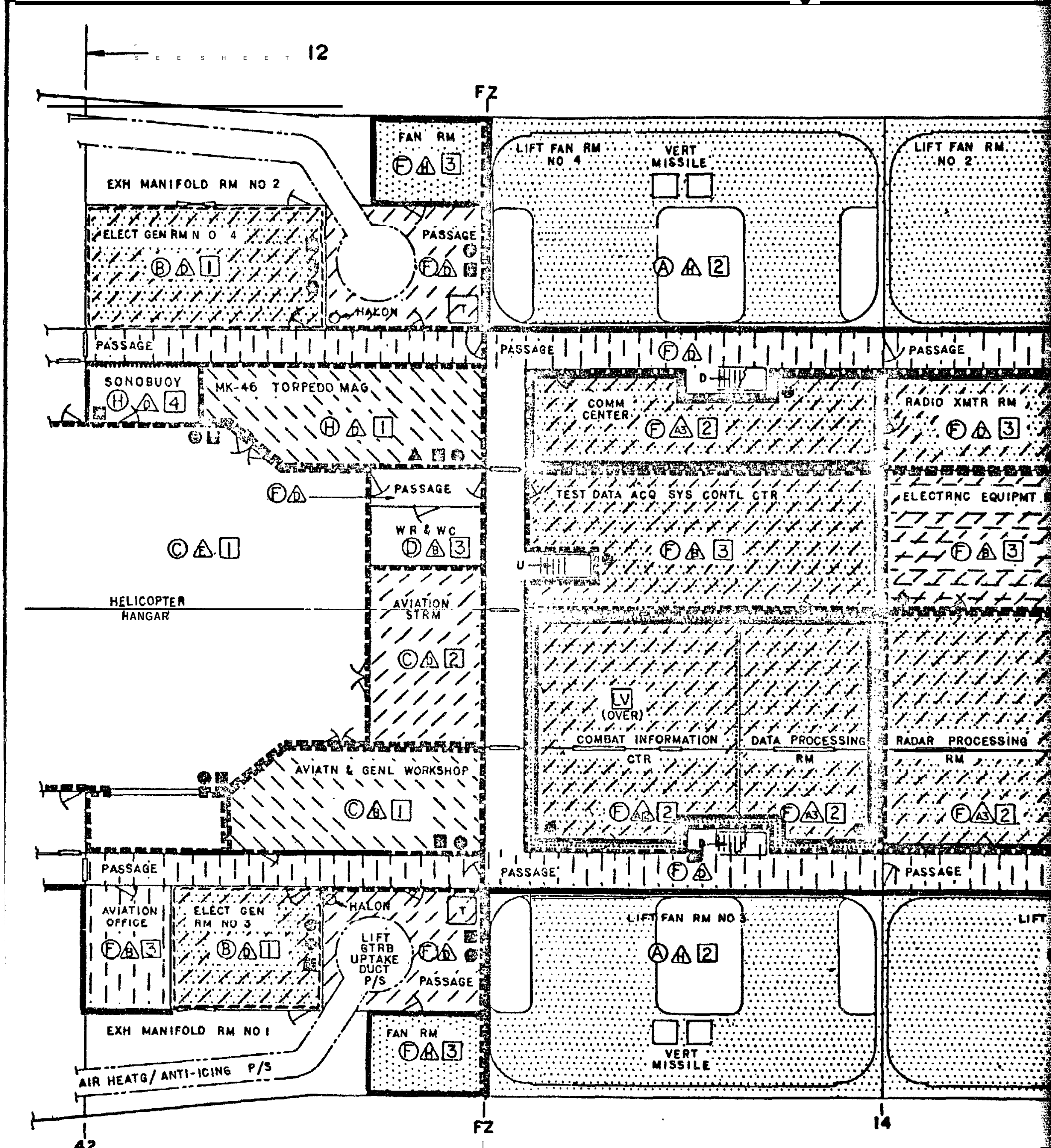
OI LEVEL AFT FR
BHD & OVHD INSUL

Figure B.6.



B.6-1 (Sheet 10 of 29) (U)

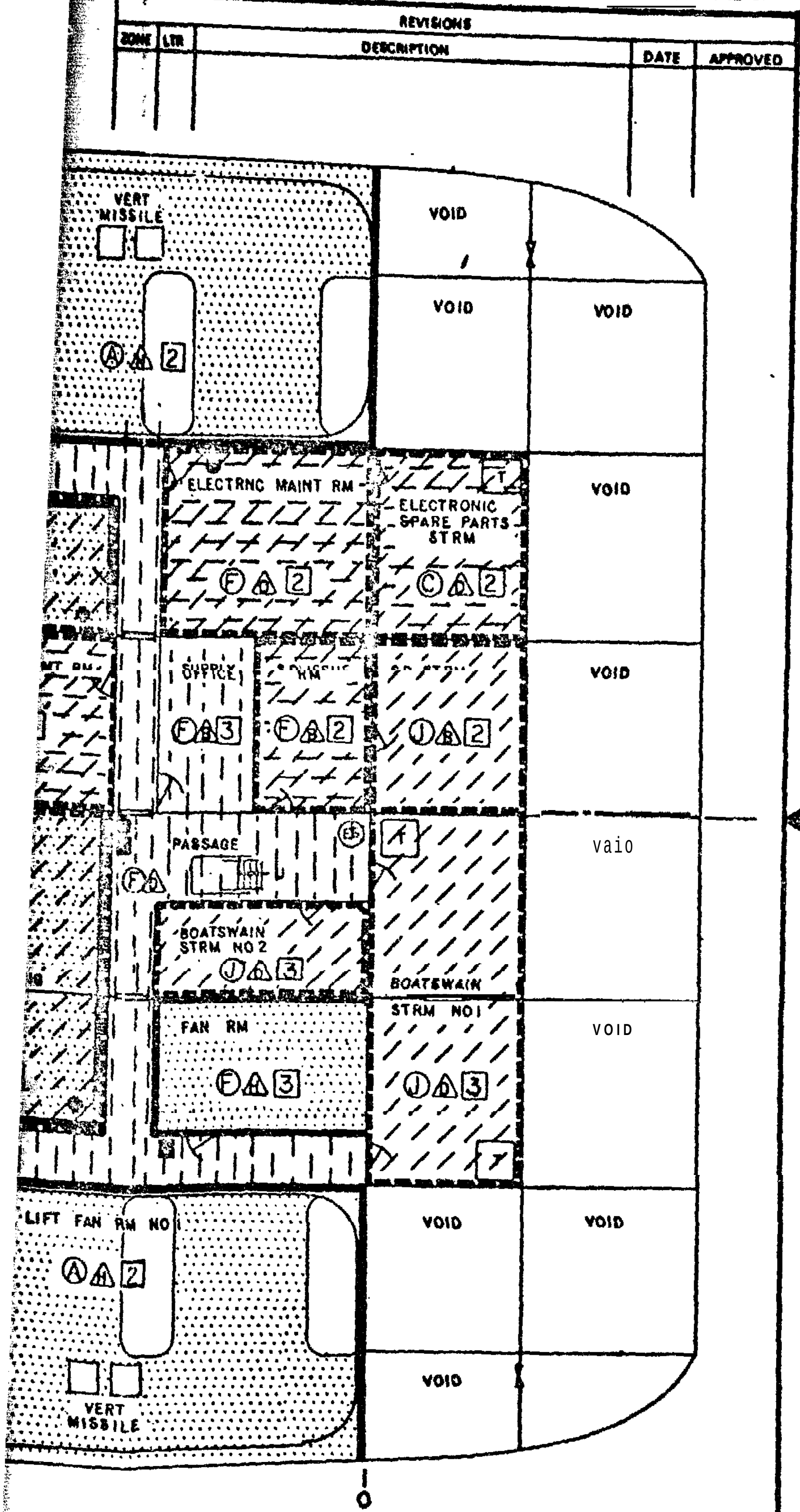
UNCLASSIFIED



SEE NOTE 8-B

MAIN DECK F
BHD & OVHD

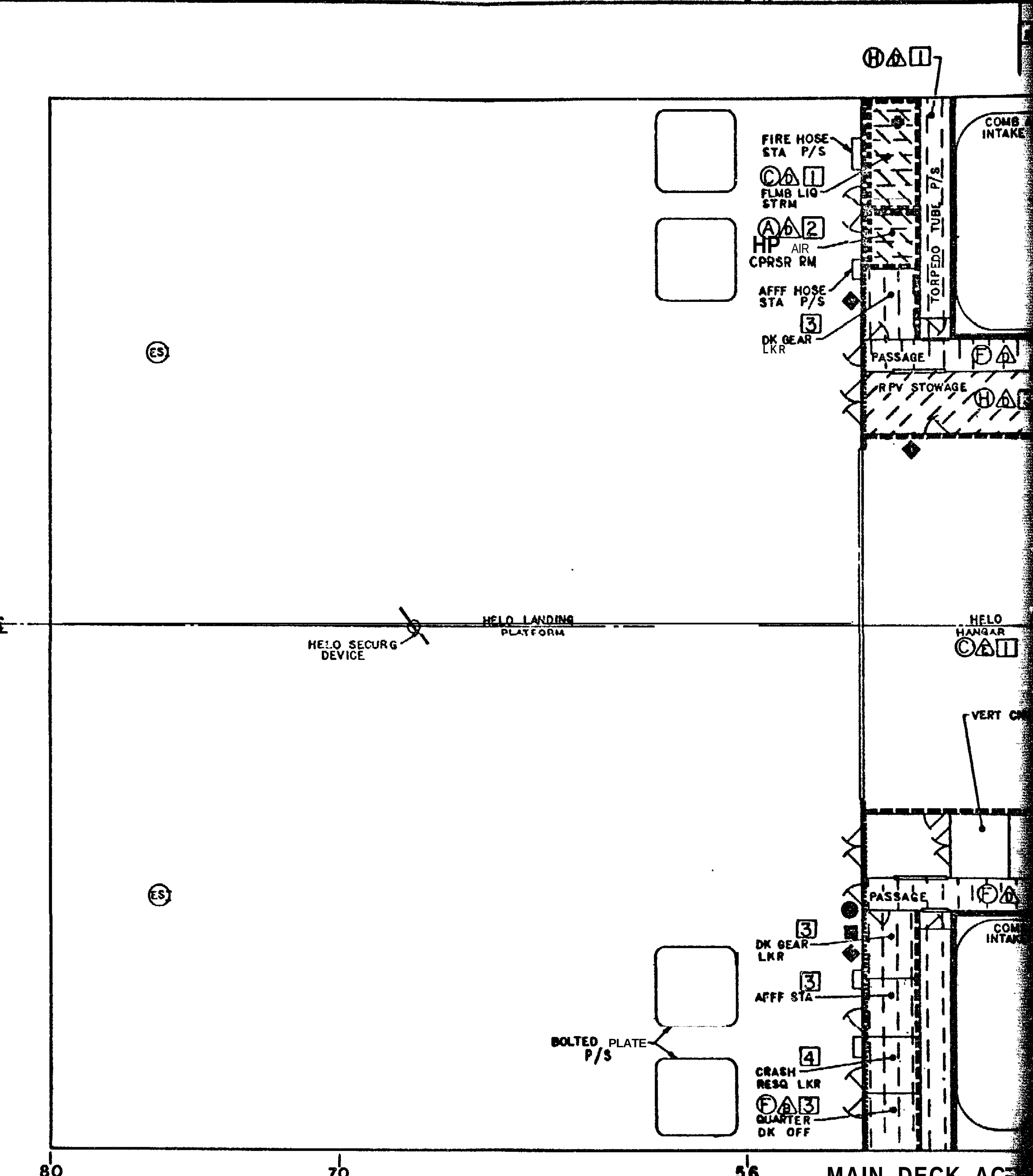
Figure B.



K FWD FR 42
D INSULATION

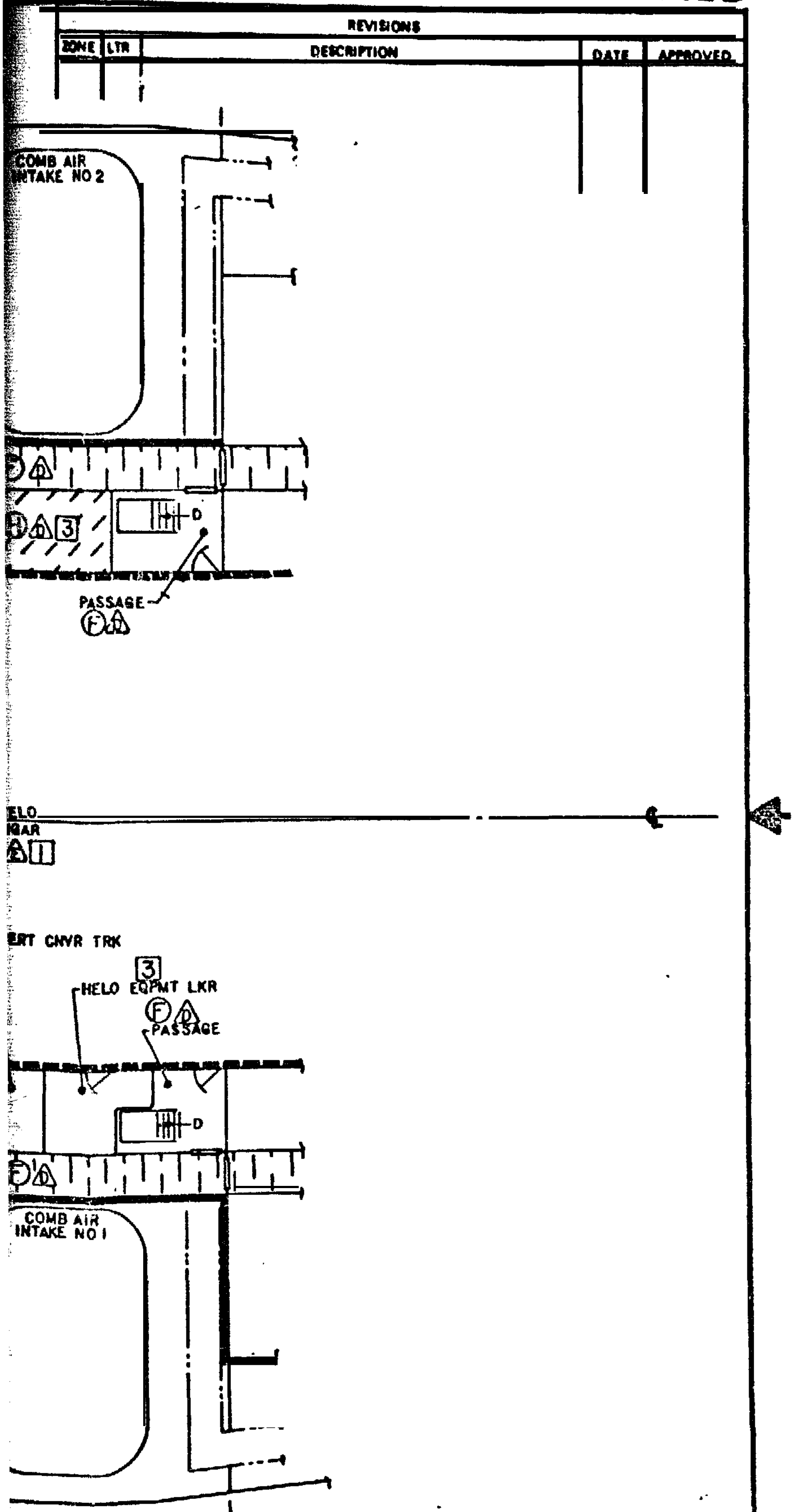
SIZE	CODE IDENT NUMBER	DWG NO	REV
	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 11 OF 29	

B.6-1 (Sheet 11 Of 29) (U)



MAIN DECK AC
BHD & OVHD INS
SEE SH

Figure B.6-1



AFT FR 42
INSULATION
SHEET 11

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 12 OF 29	

B-1 (Sheet 12 of 29) (U)

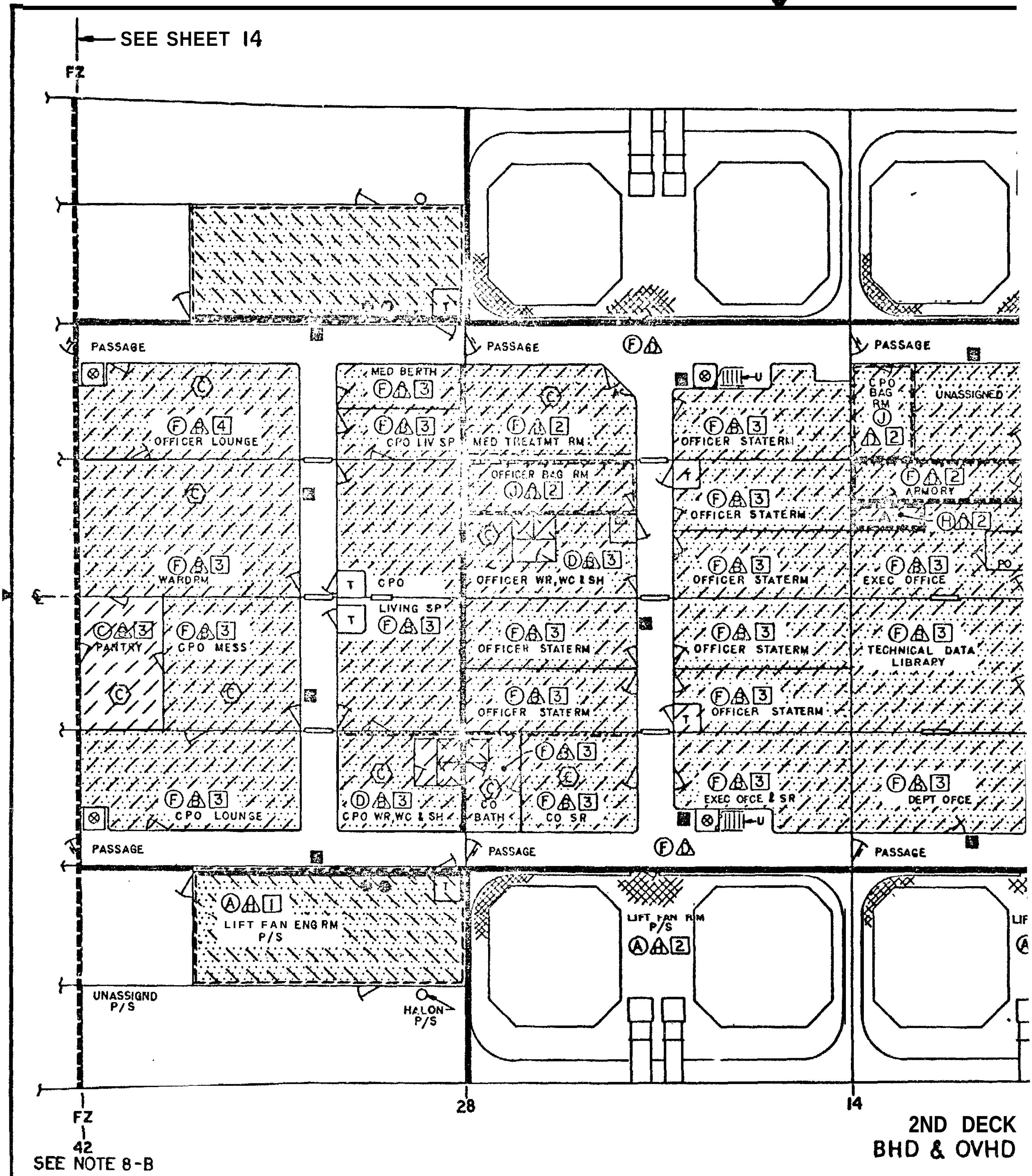
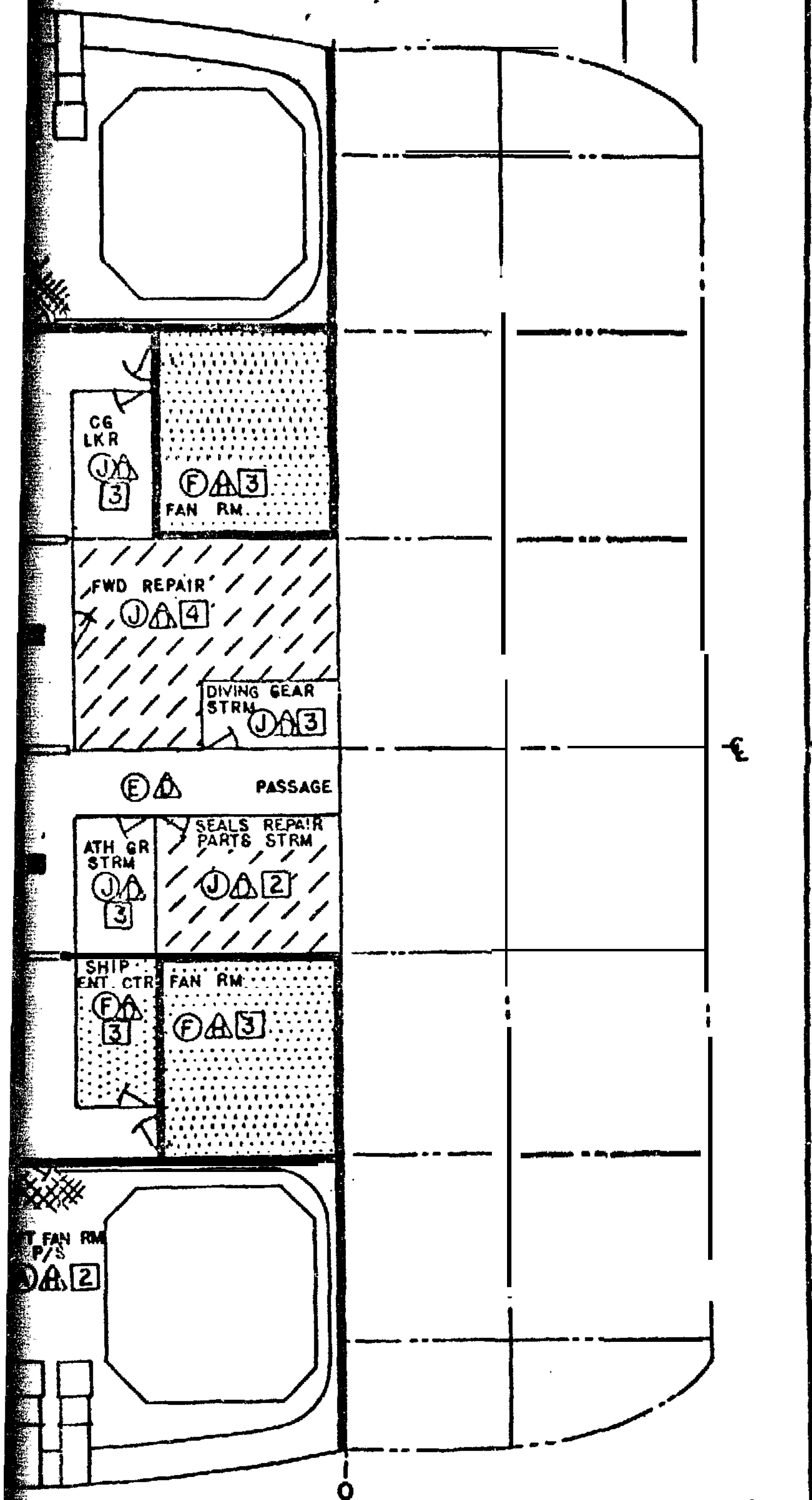

SEE SHEET 14
FZ
PASSAGE
OFFICER LOUNGE
WARDRM
PANTRY
CPO MESS
CPO LOUNGE
MED BERTH
CPO LIV SP
CPO
LIVING SP
CPO WR,WC & SH
MED TREATMT RM
OFFICER BAG RM
OFFICER WR,WC & SH
OFFICER STATERM
CO BATH
CO SR
OFFICER STATERM
EXEC OFCE & SR
CPO BAG RM
UNASSIGNED
ARMORY
EXEC OFFICE
TECHNICAL DATA LIBRARY
DEPT OFCE
LIFT FAN ENG RM P/S
LIFT FAN RM P/S
UNASSIGND P/S
HALON P/S
28
14
FZ
42
SEE NOTE 8-B
2ND DECK
BHD & OVHD

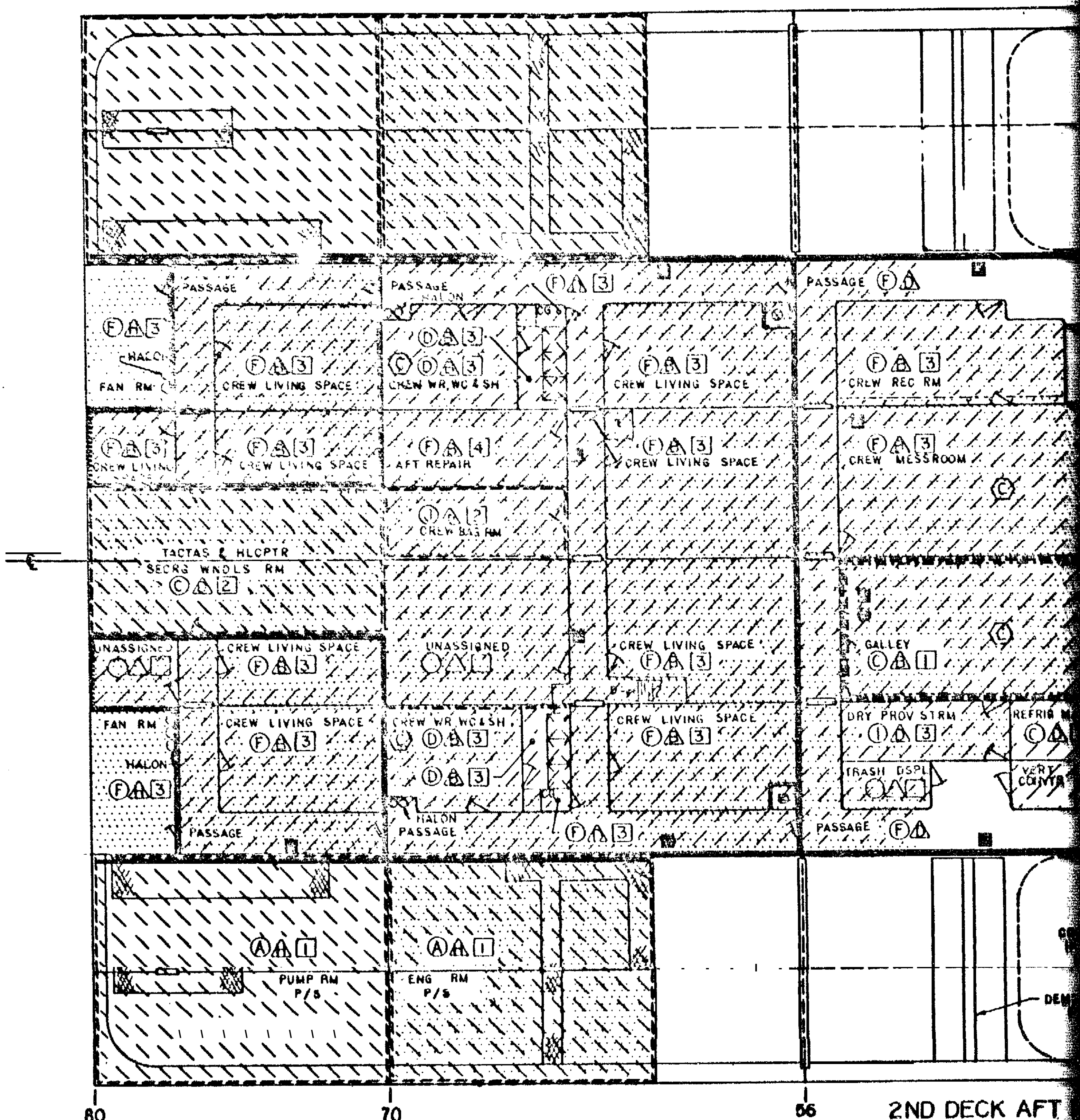
Figure B.6-1

ZONE	LTR	DESCRIPTION	DATE	APPROVED



FWD FR 42 INSULATION	SIZE C	CODE IDENT NUMBER 51563	DWG NO LL635001	REV
	SCALE 1/8" = 1'-0"		SHEET 13 OF 29	

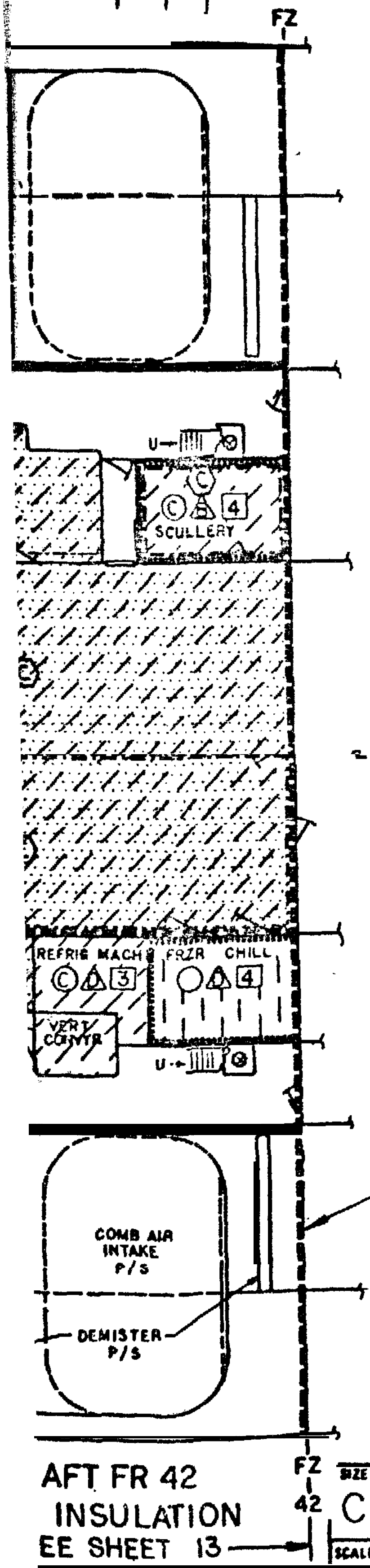
(Sheet 13 of 29) (U)



2ND DECK AFT
BHD & OVHD INS
SEE S

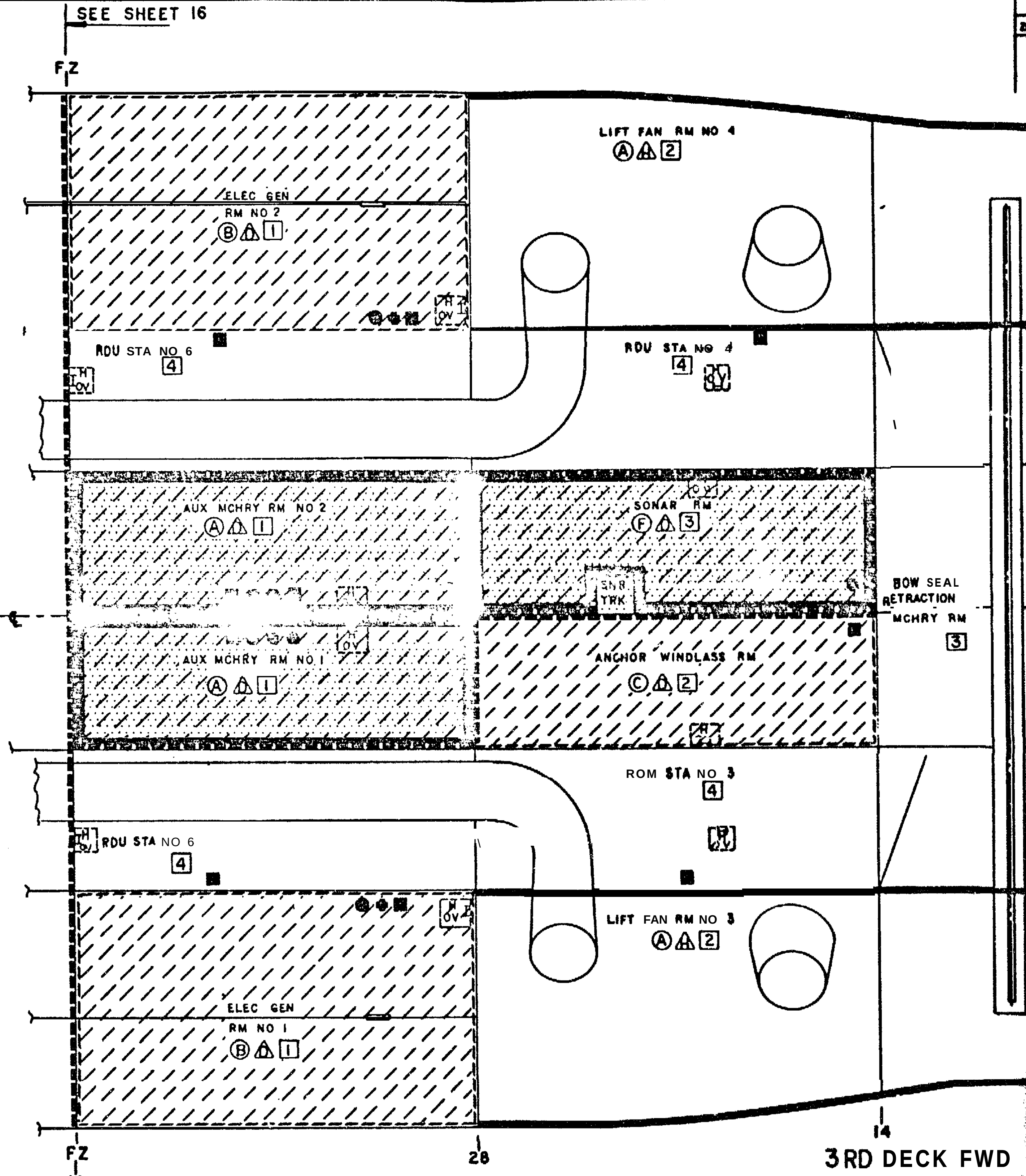
Figure B

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 14 OF 29	

Figure B.6-1 (Sheet 14 of 29) (U)

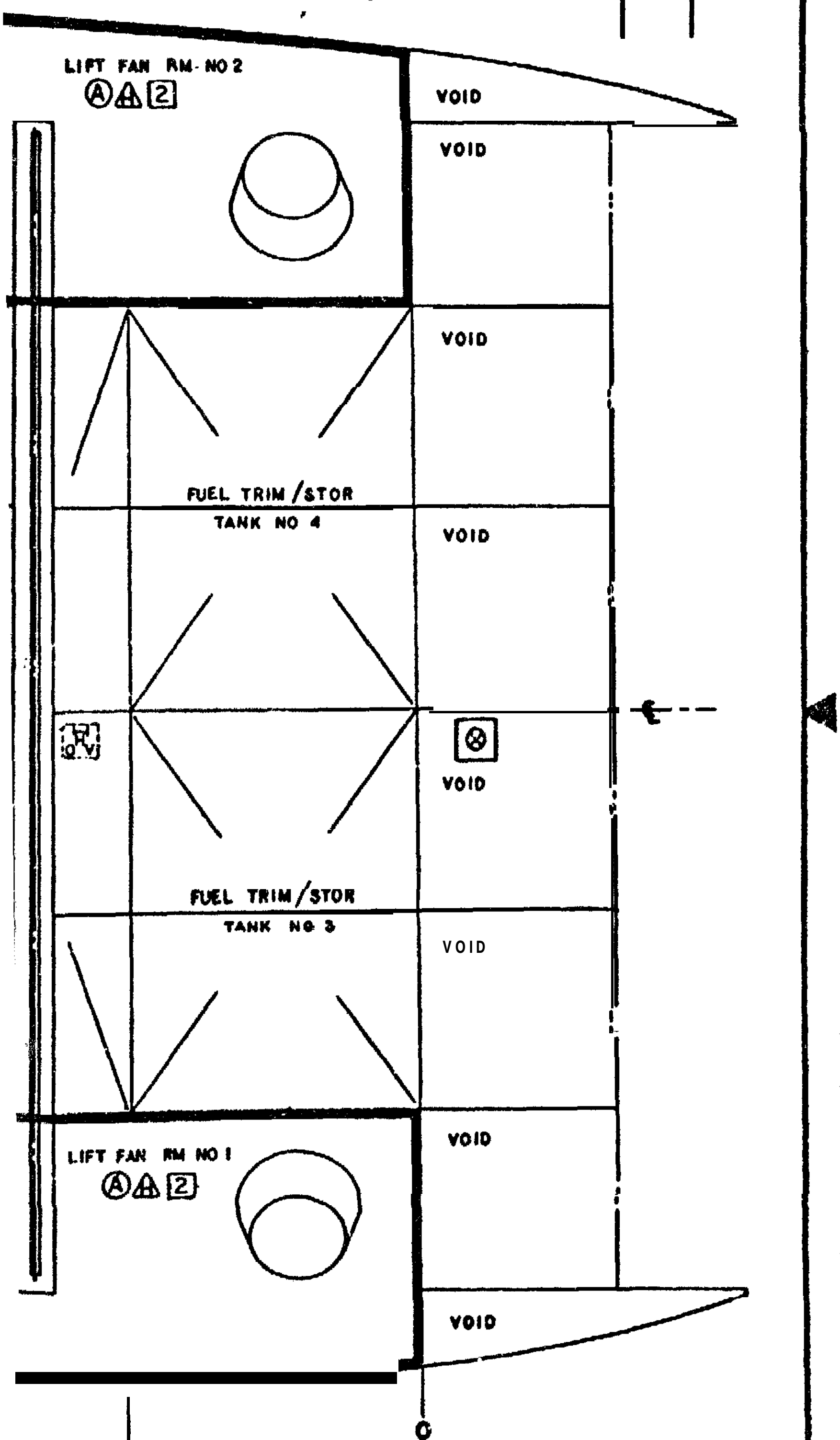


3RD DECK FWD
BHD & OVHD I N !S

SEE NOTE B-B

Figure B.6-1 (

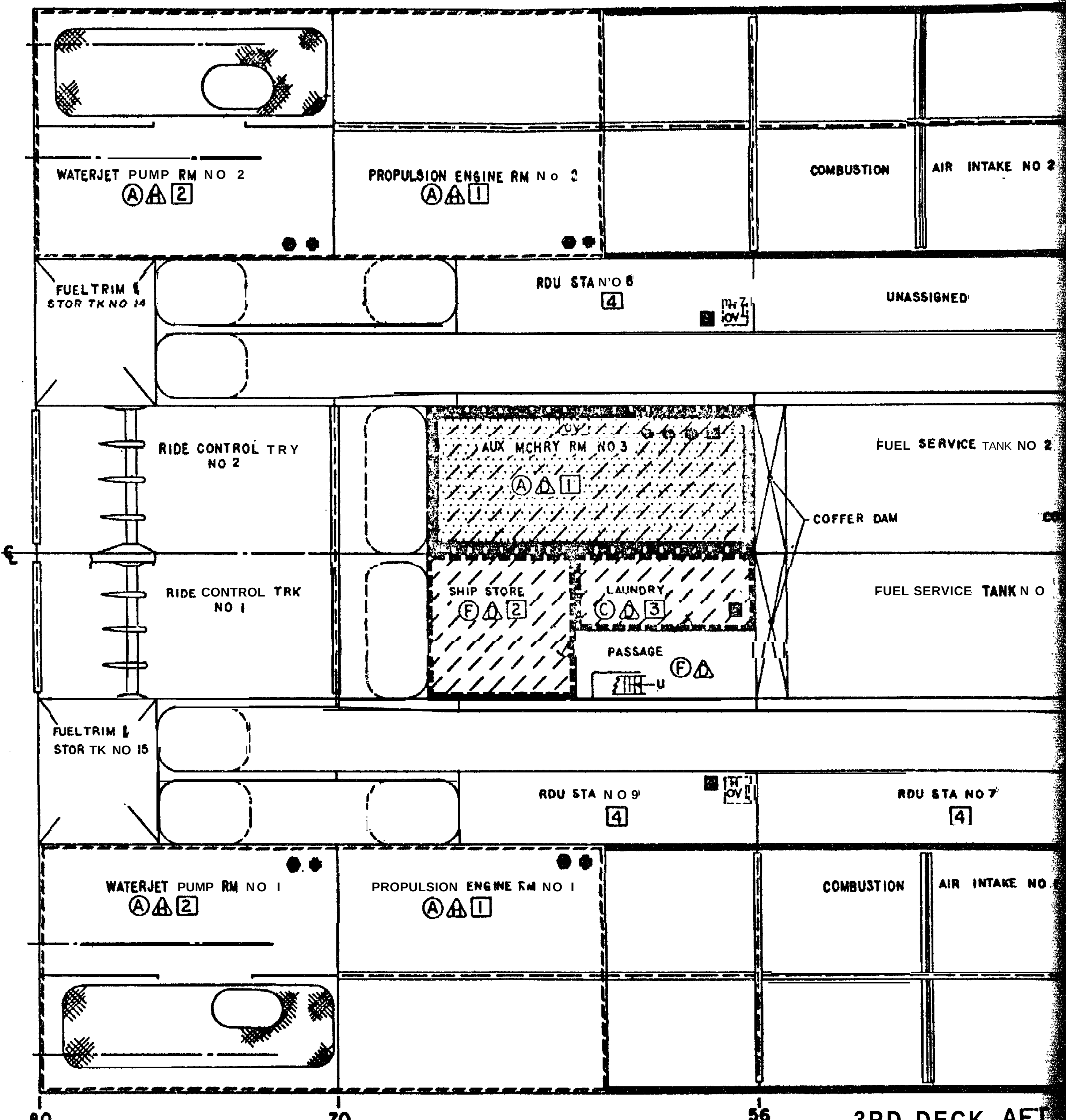
ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED



D FR 42
SULATION

SIZE	CODE IDENT NUMBER	DWG NO	REV
	51563	LL635001	
SCALE 1/8"=1'0"		SHEET 15 OF 29	

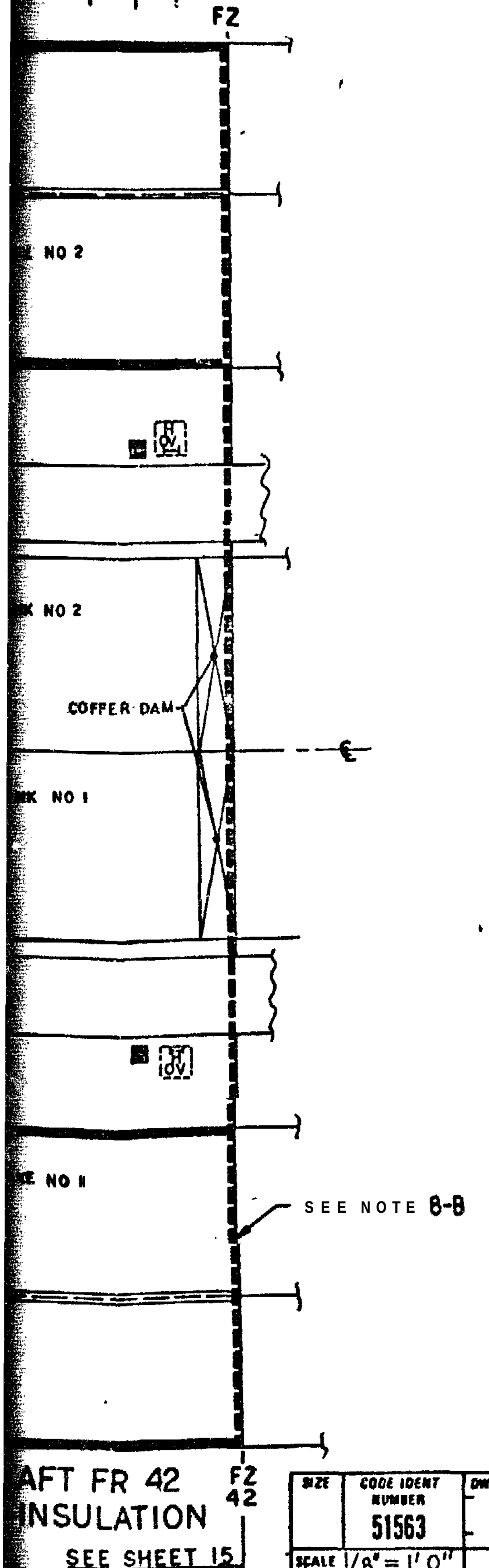
. (Sheet 15 of 29) (U) UNCLASSIFIED



3RD DECK AFT
BHD & OVHD INS

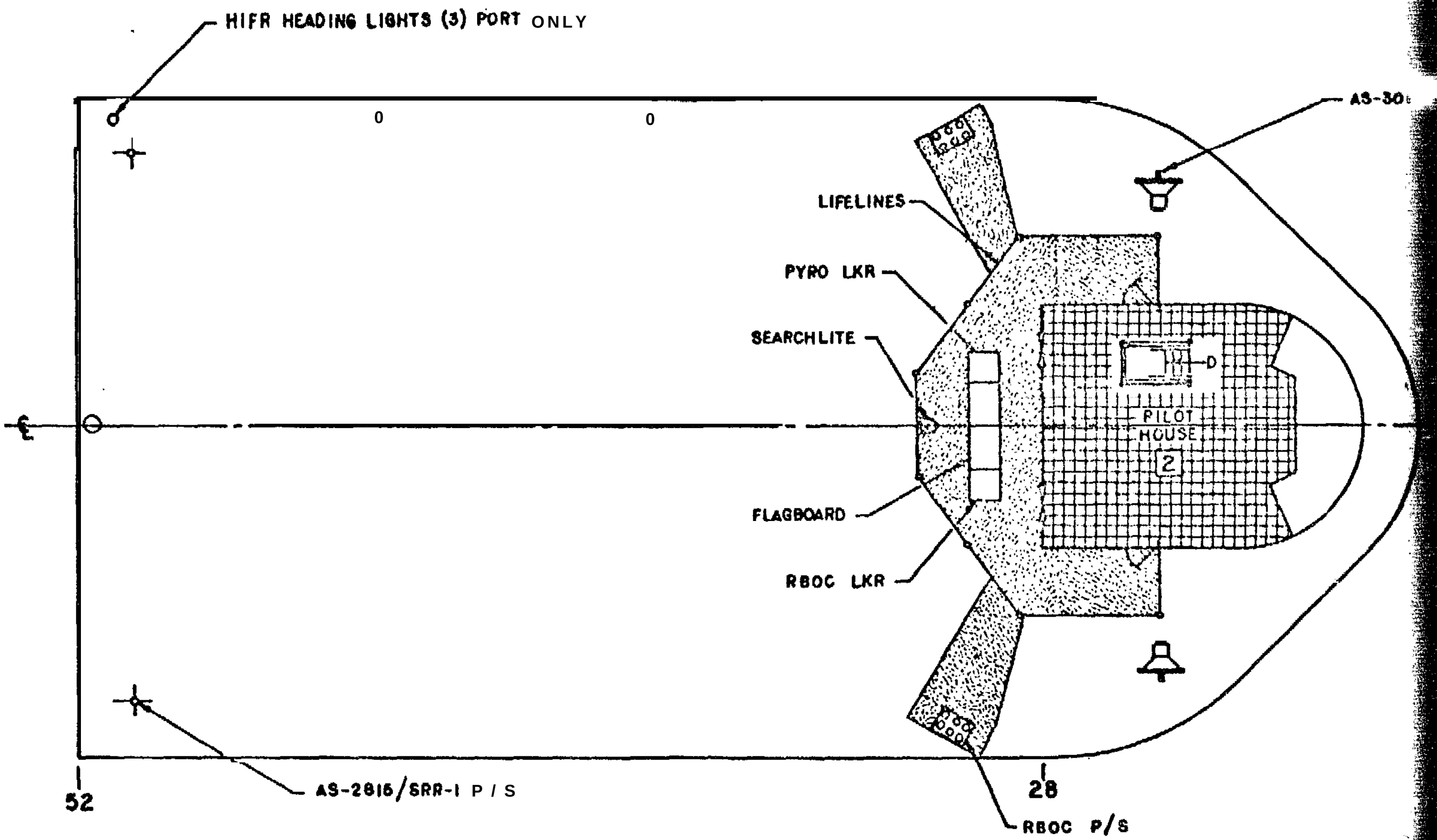
Figure B.6-

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIZE	CODE IDENT NUMBER	DWG NO	REV
	51563	LL635001	
SCALE 1/8" = 1' 0"		SHEET 16 OF 29	

.6-1 (Sheet 16 of 29) (U)

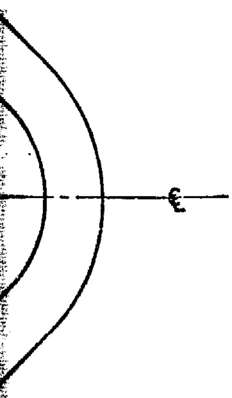


02 LEVEL
DK COVERING

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

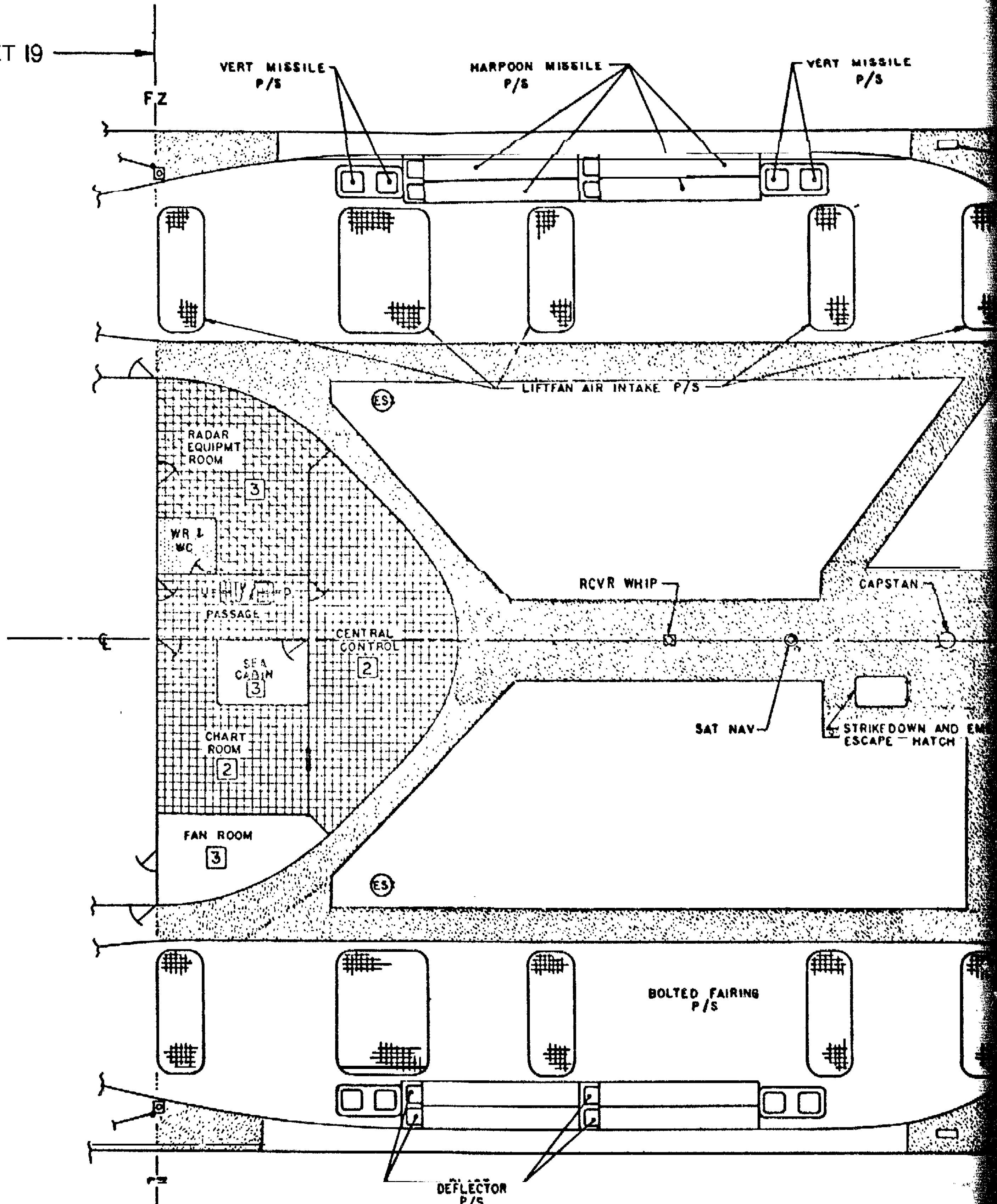
— AS-3018/WSC-1 P/S



SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 17 OF 29	

G

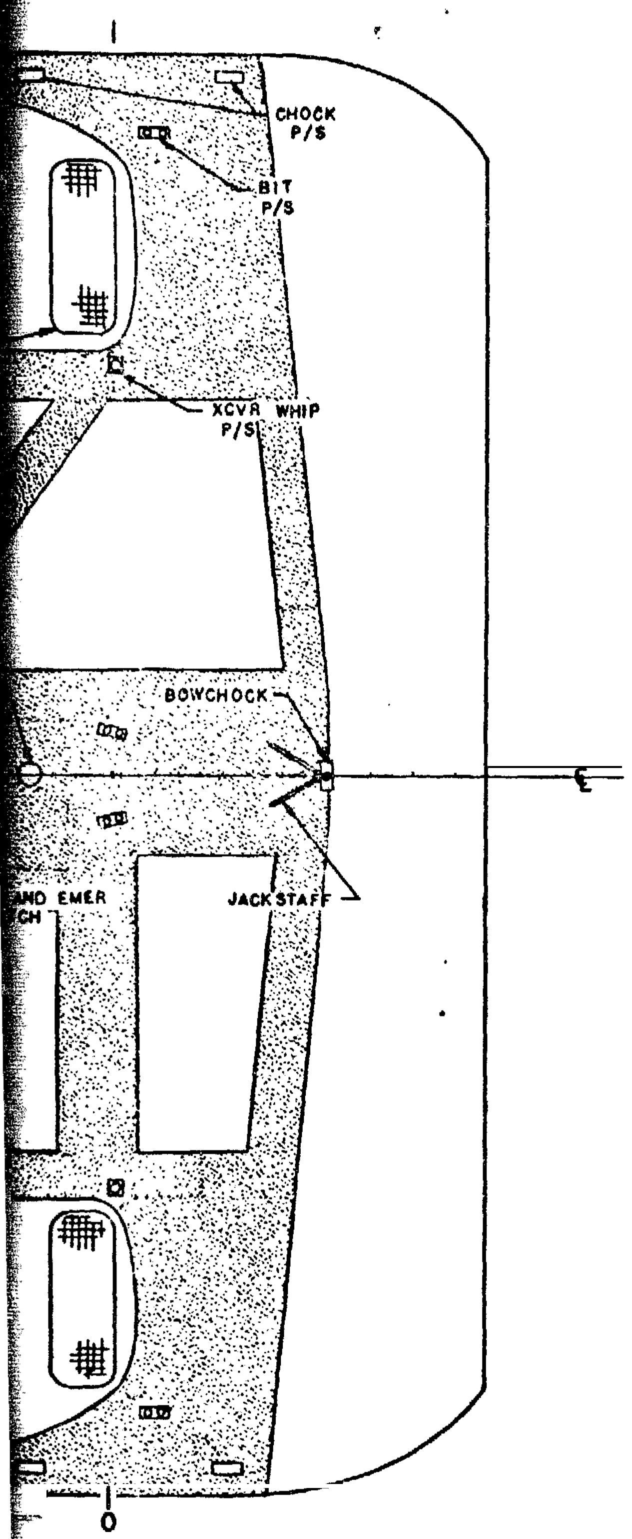
re B.6-1 (sheet 17 of 29) (U)



OI LEVEL FWD F
DK COVERING

ZONE	LTR	DESCRIPTION	DATE	APPROVED

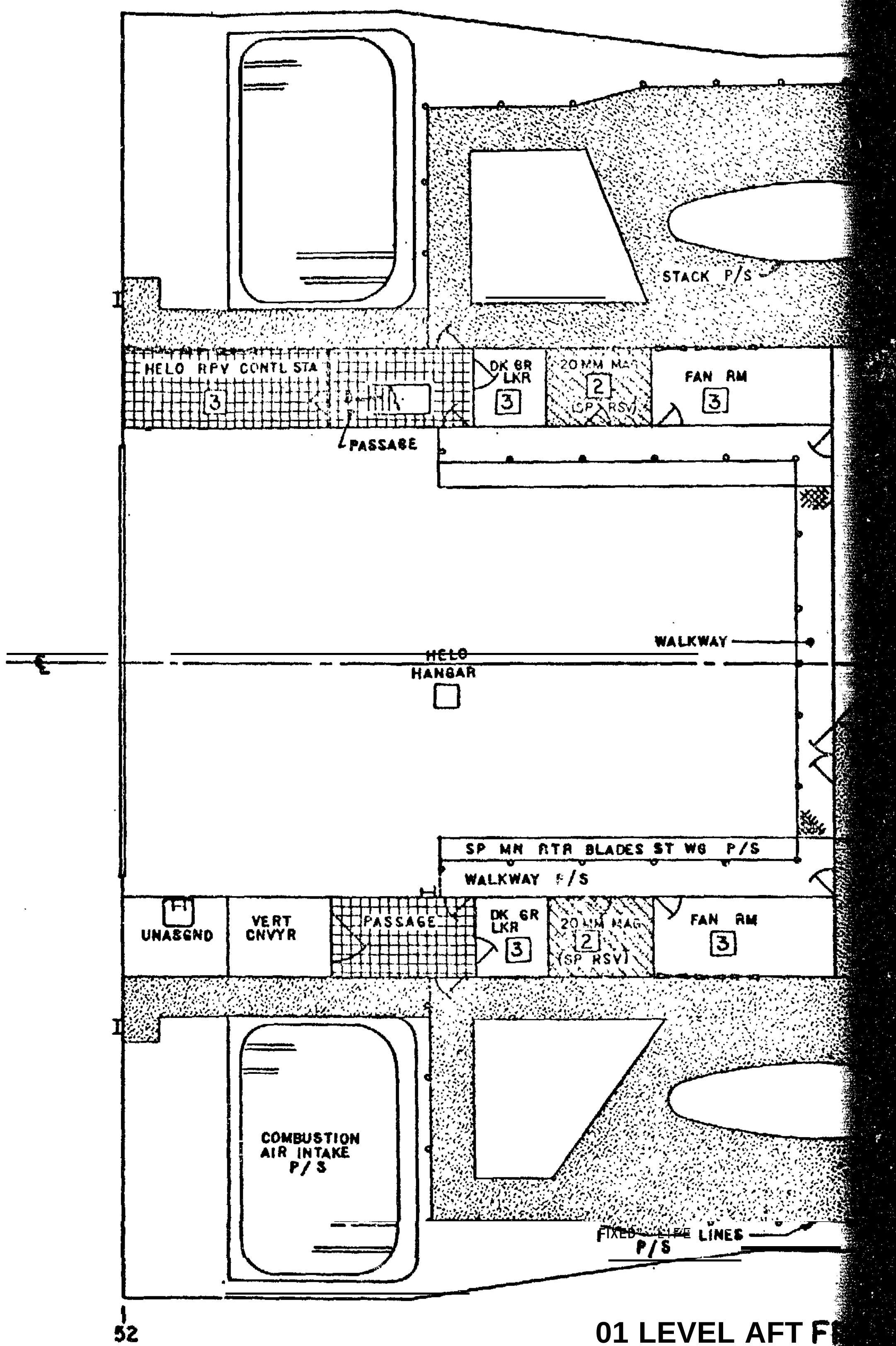
REVISIONS



FR 28
G

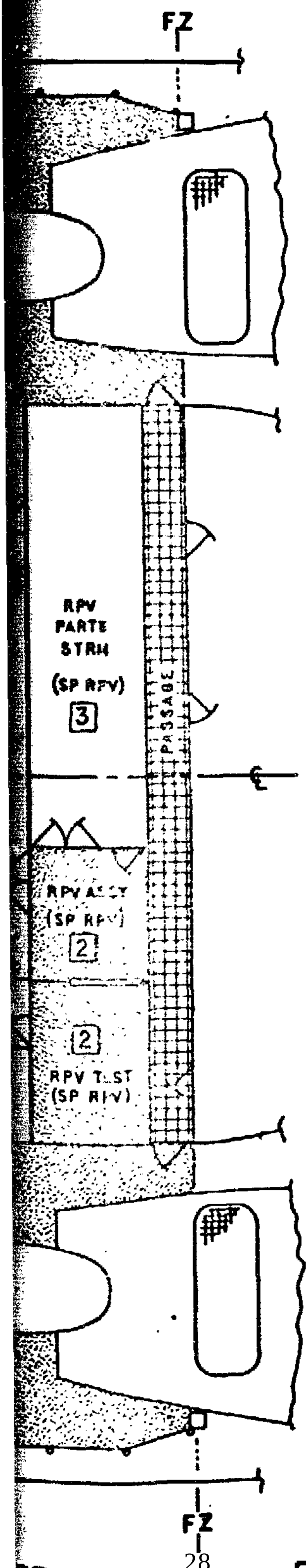
SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL63500 I	
SCALE		SHEET 18 of 29	

(Sheet 18 of 29) (U)



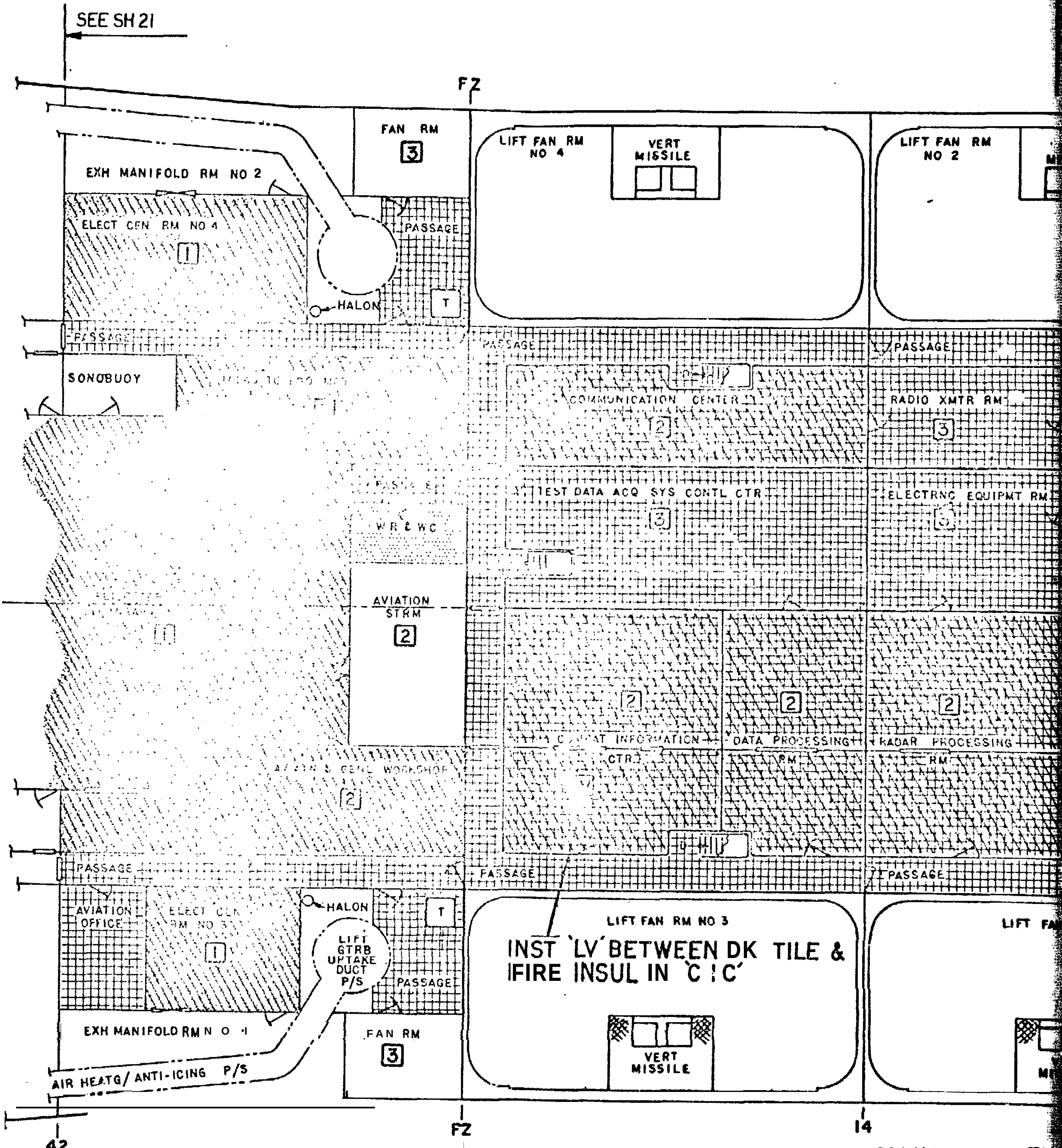
01 LEVEL AFT F
DK COVERING
SEE SH

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8 = 1'-0"		SHEET 19 of 29	

e B.6-1 (Sheet 19 Of 29) (U)

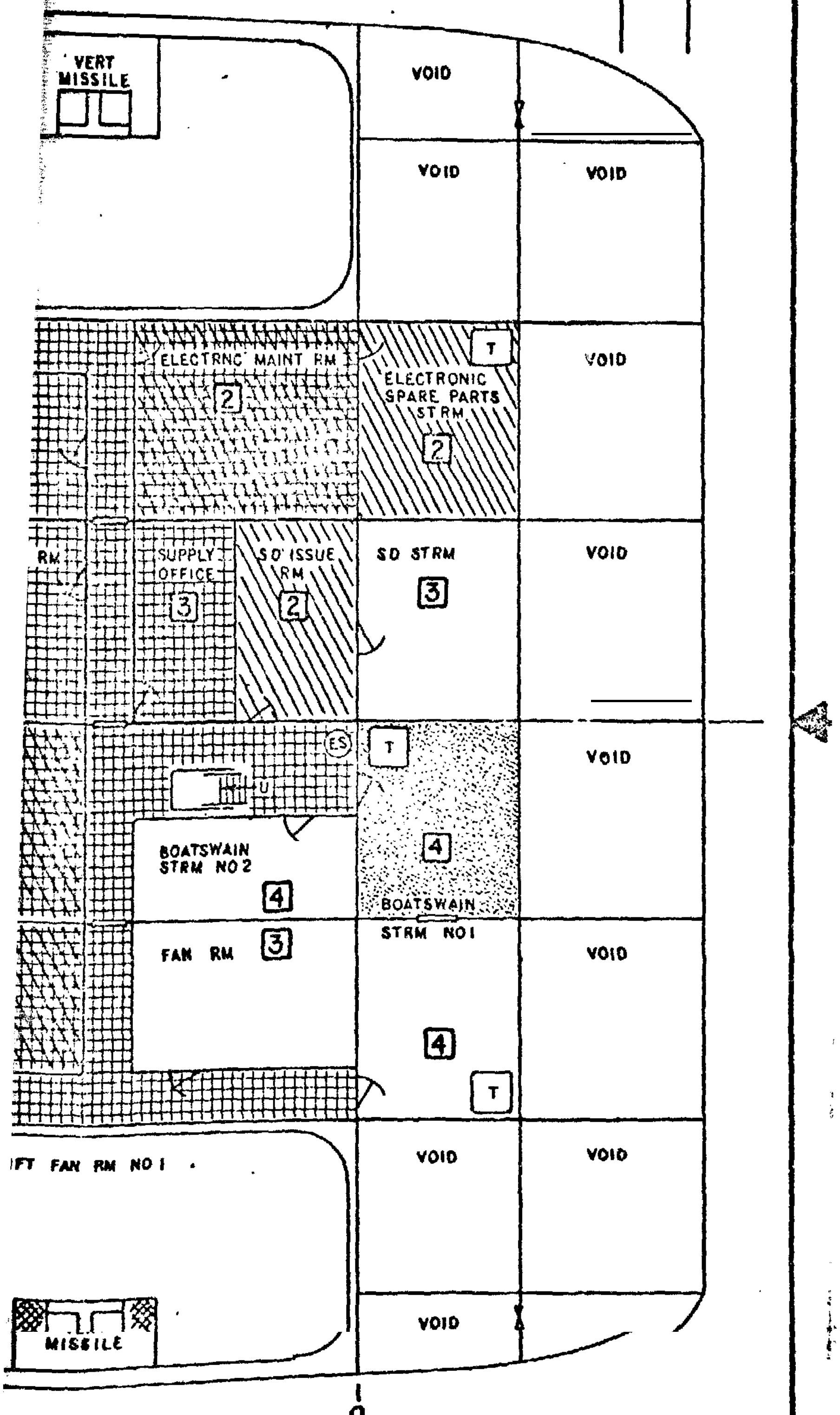


SEE NOTE a-8

MAIN DECK FV
DK COVERI

Figure B.(

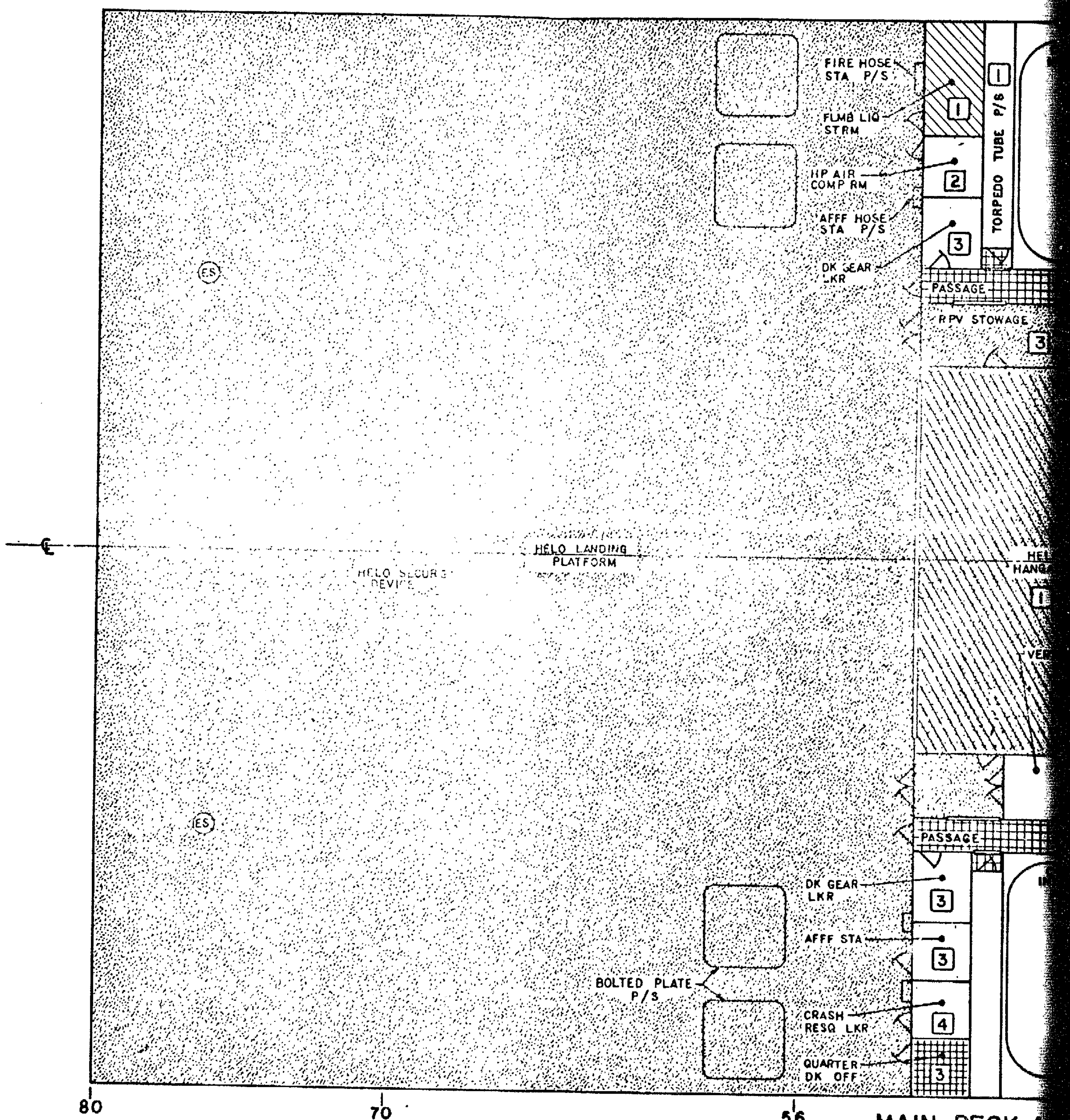
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



FWD_FR 4 2
ERING

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 20 OF 29	

B.6-1 (Sheet 20 of 29) (U) UNCLASSIFIED



MAIN DECK A
DK COVERI
SEE

Figure

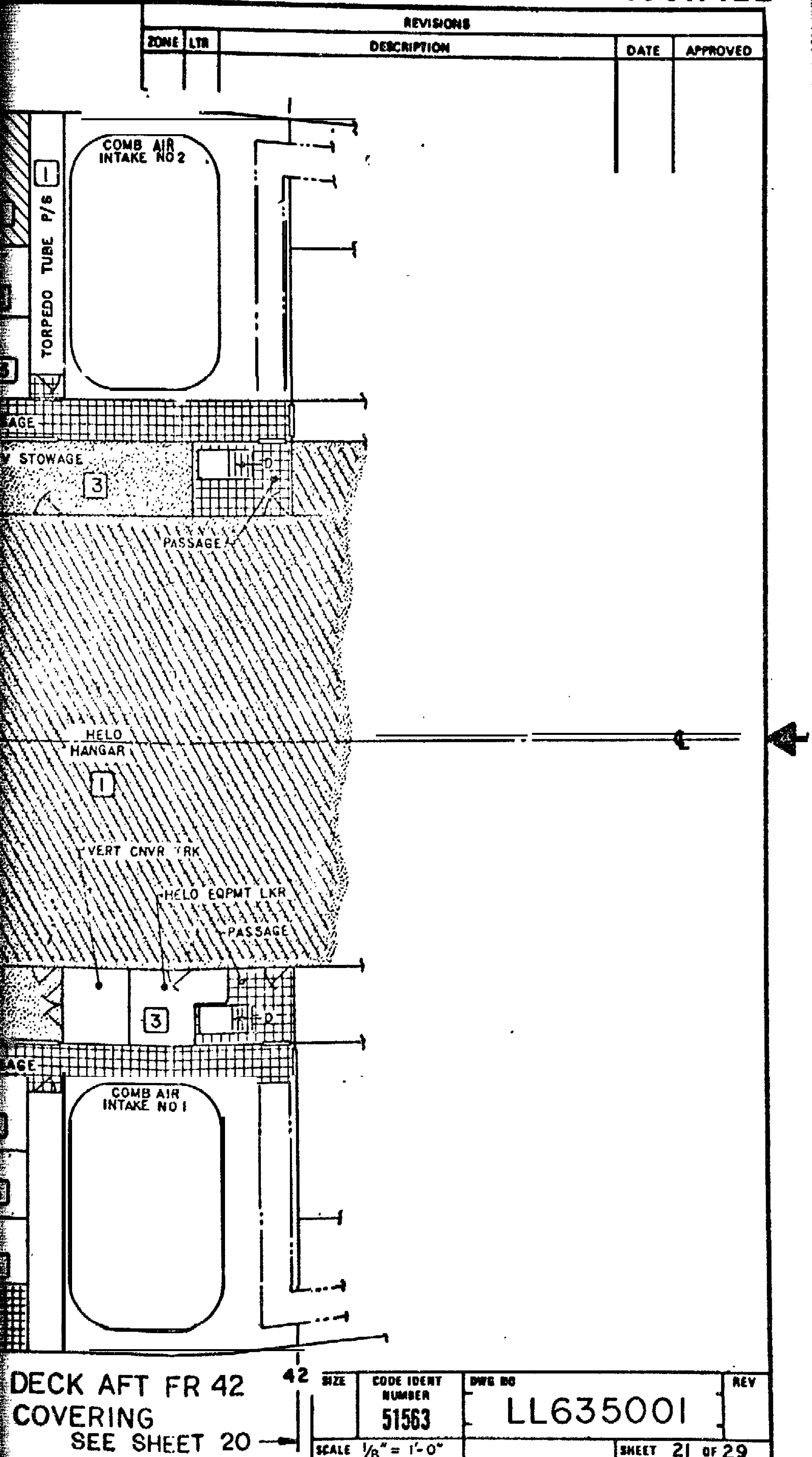
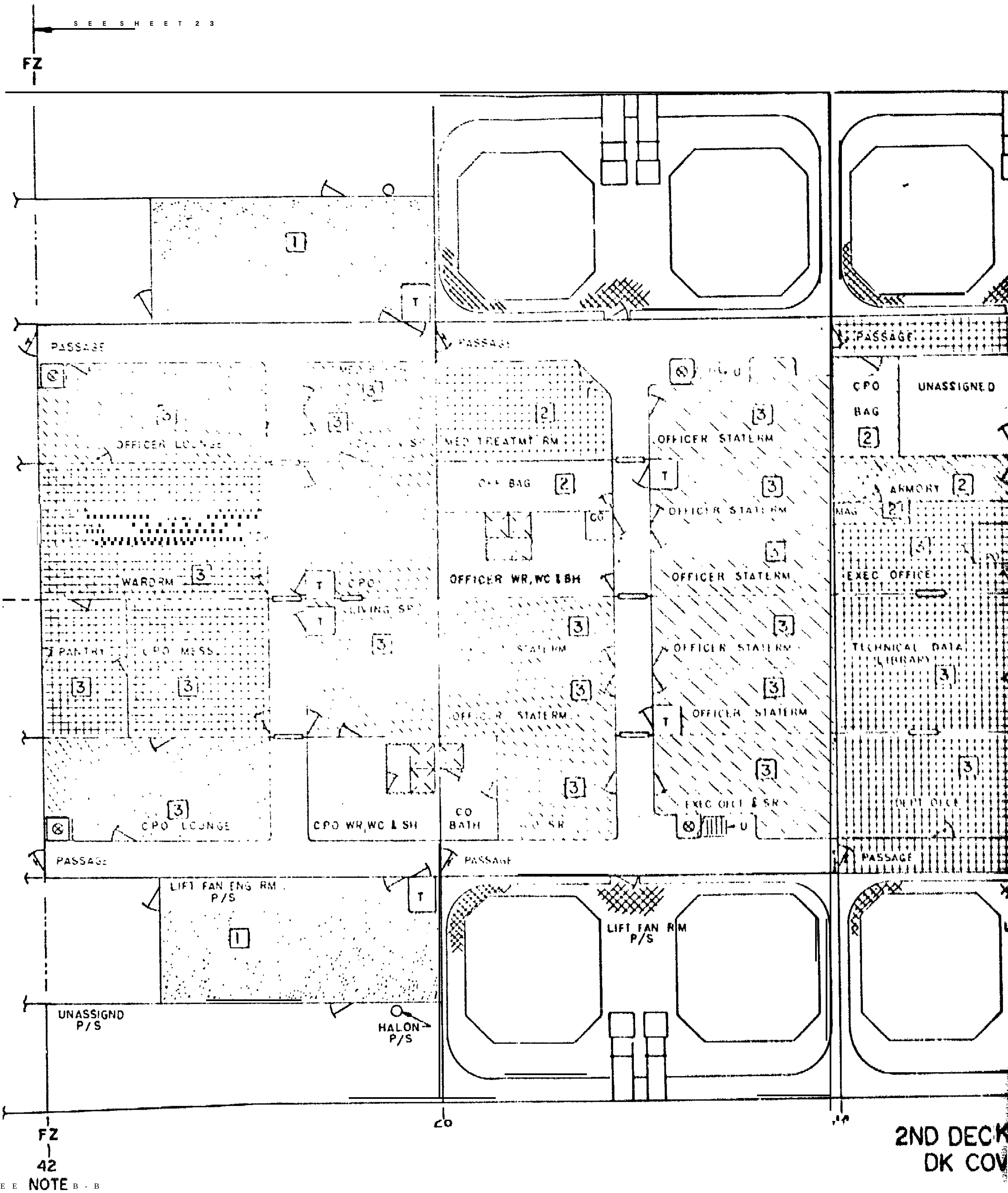
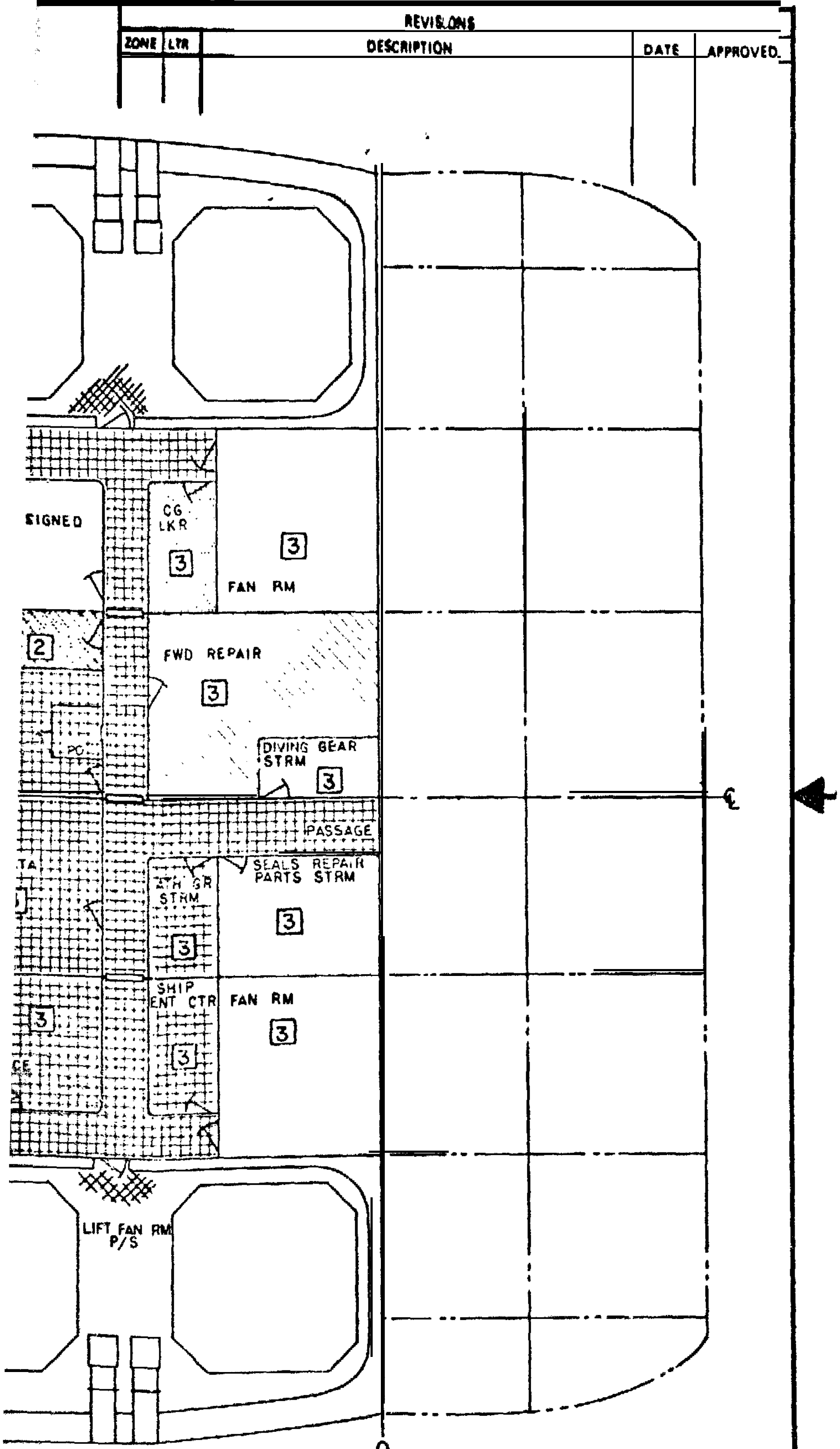


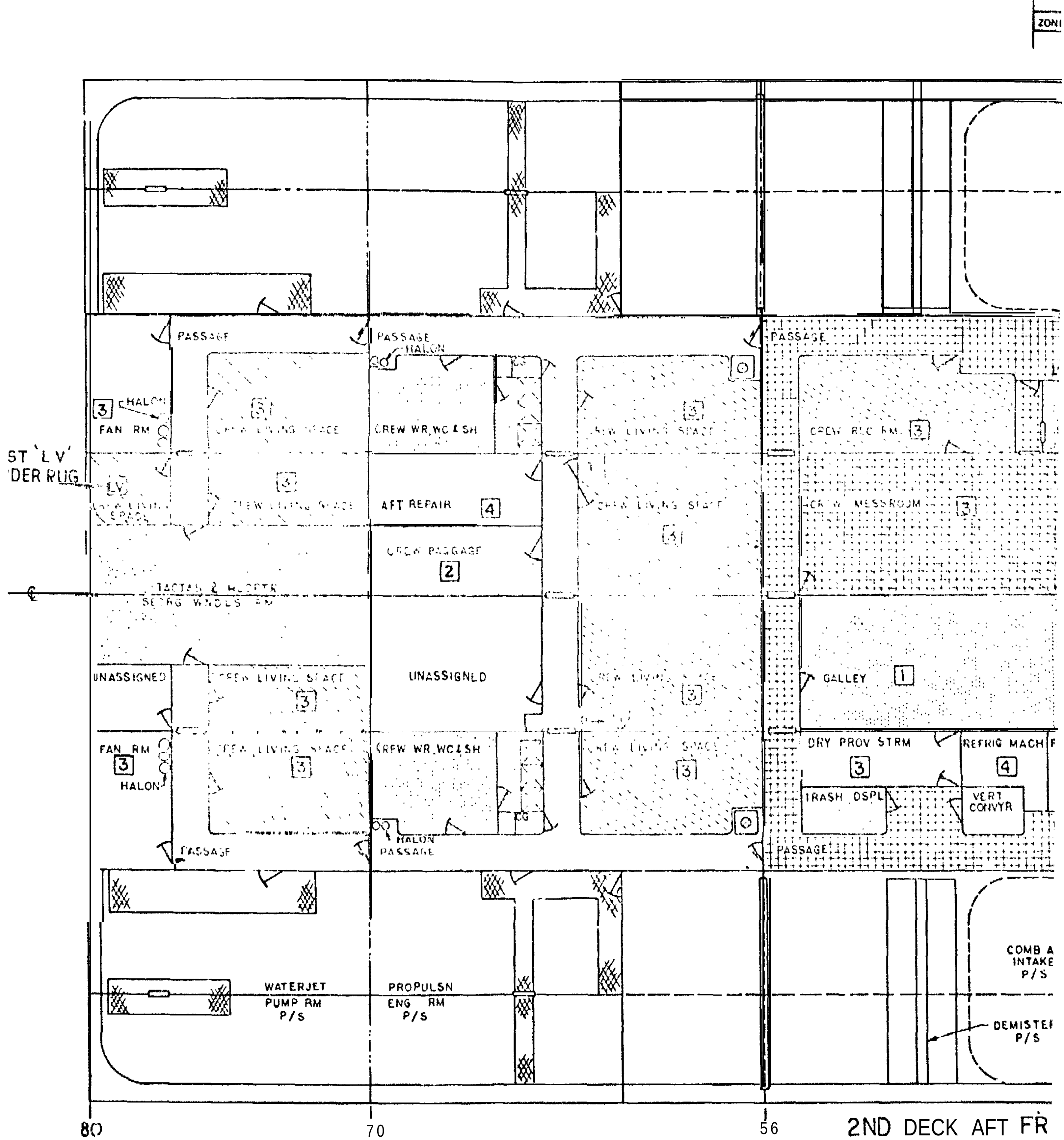
Figure B.6-1 (Sheet 21 of 29) (U)


SEE SHEET 23
FZ
PASSAGE
OFFICER LOUNGE
MED TREATMT RM
OFFICER STATERM
CPO
BAG
UNASSIGNED
OFF BAG
ARMORY
OFFICER WR, WC & SH
WARDRM
CPO
LIVING SP
EXEC OFFICE
PANTRY
CPO MESS
STATERM
TECHNICAL DATA LIBRARY
OFFICER STATERM
CPO LOUNGE
CPO WR, WC & SH
CO BATH
EXEC OFCE & SR
DEPT OFCE
LIFT FAN ENG RM P/S
LIFT FAN RM P/S
UNASSIGND P/S
HALON P/S
FZ
42
NOTE
2ND DECK
DK COV



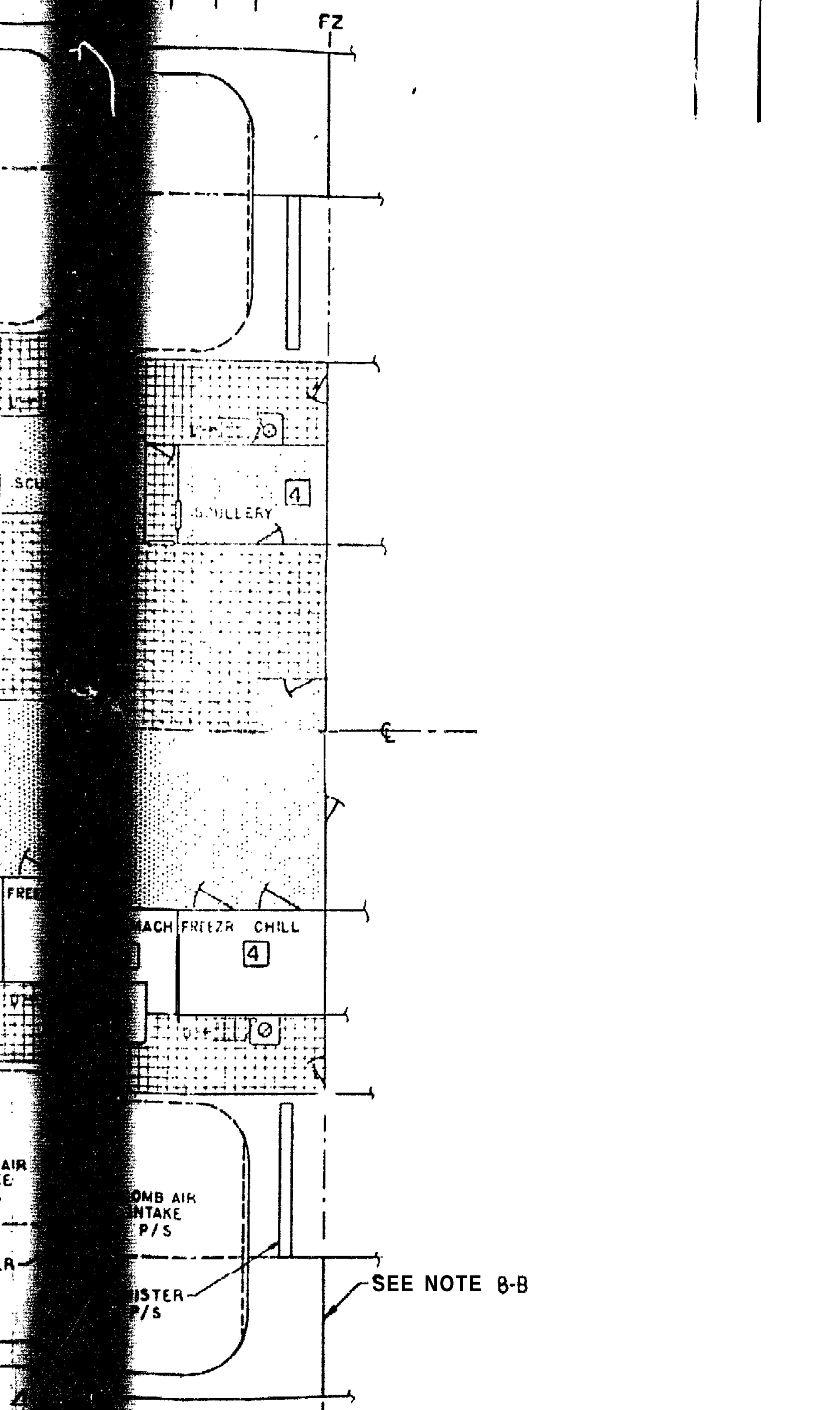
DECK FWD FR 42 K COVERING	SIZE C	CODE IDENT NUMBER 51563	DWG NO LL635001	REV
	SCALE 1/8"=1'-0"		SHEET 22 OF 29	

igure B.6-1 (Sheet 22 of 29) (U)



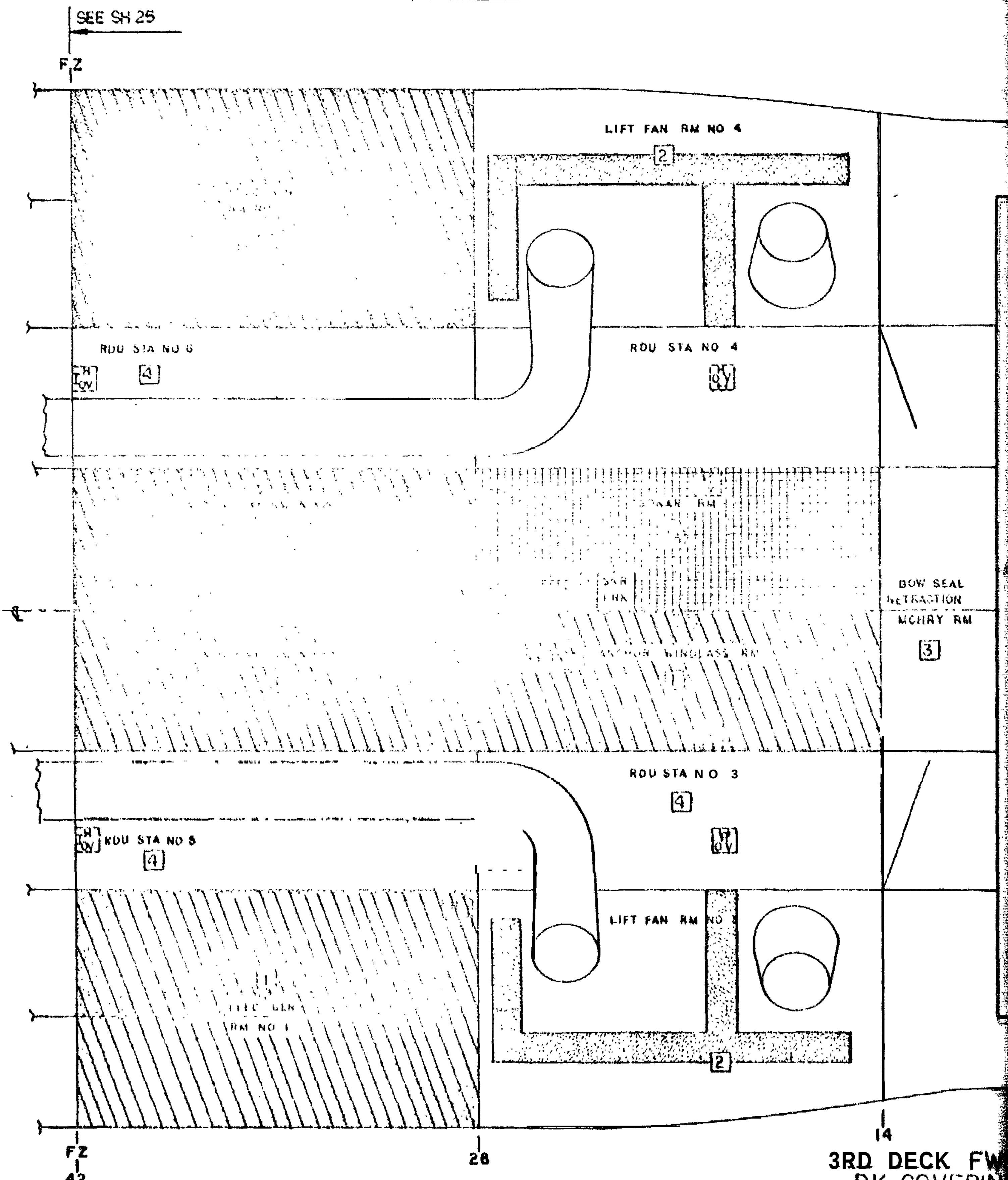
2ND DECK AFT FR
DK COVERING
SEE S

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

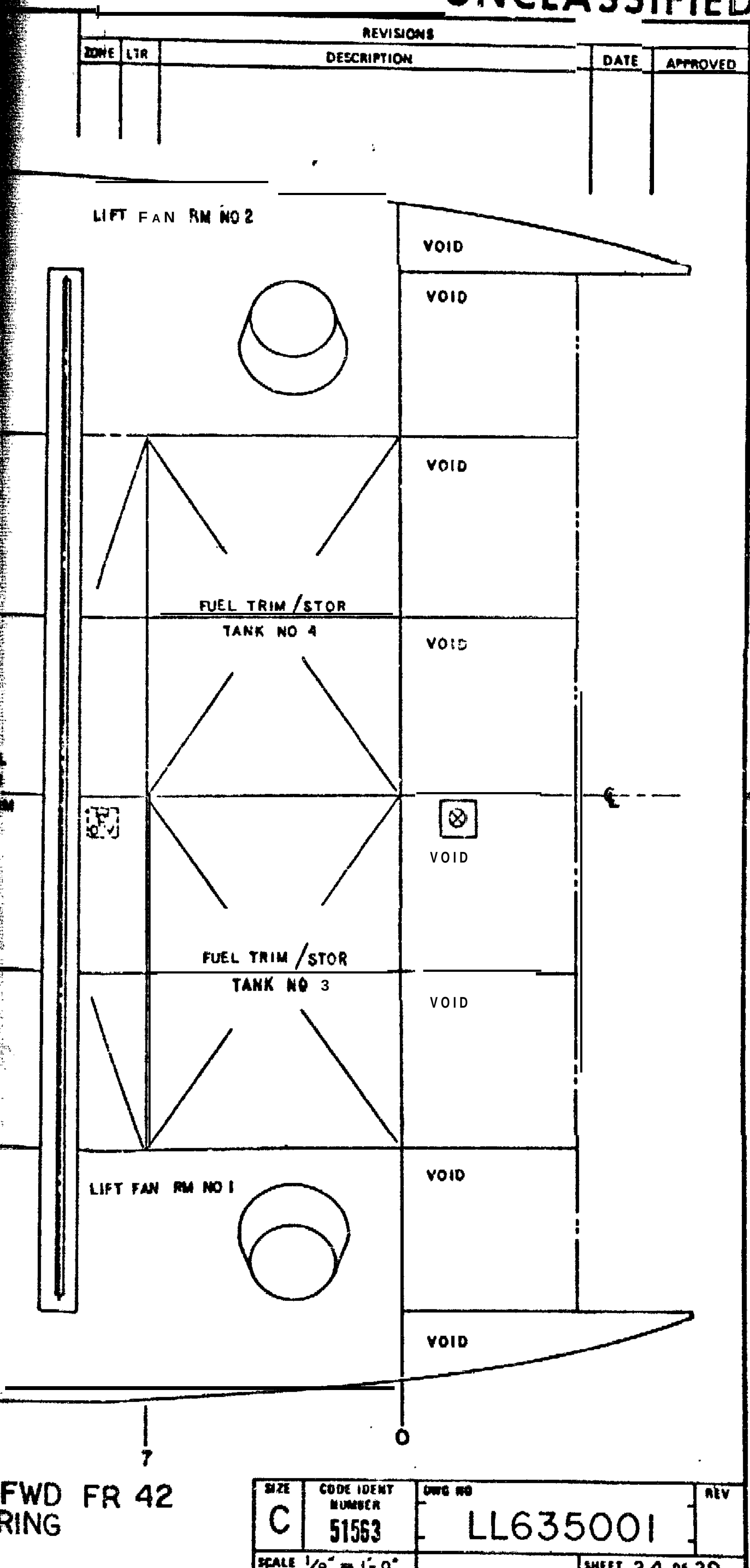


SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	
SCALE 1/8" = 1'-0"		SHEET 23 OF 29	

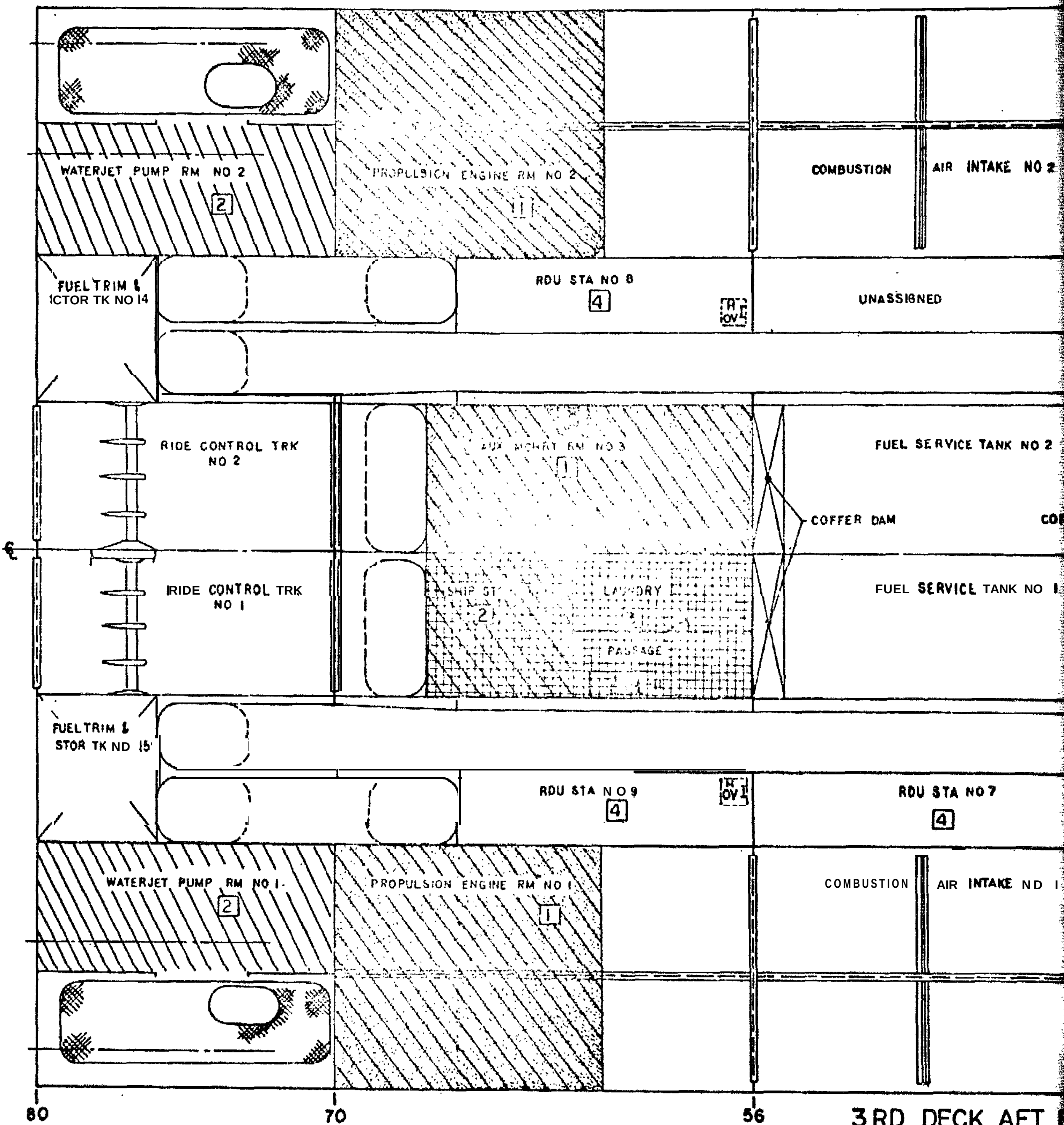
-1 (Sheet 23 of 29) (U)



3RD DECK FW
DK COVERIN

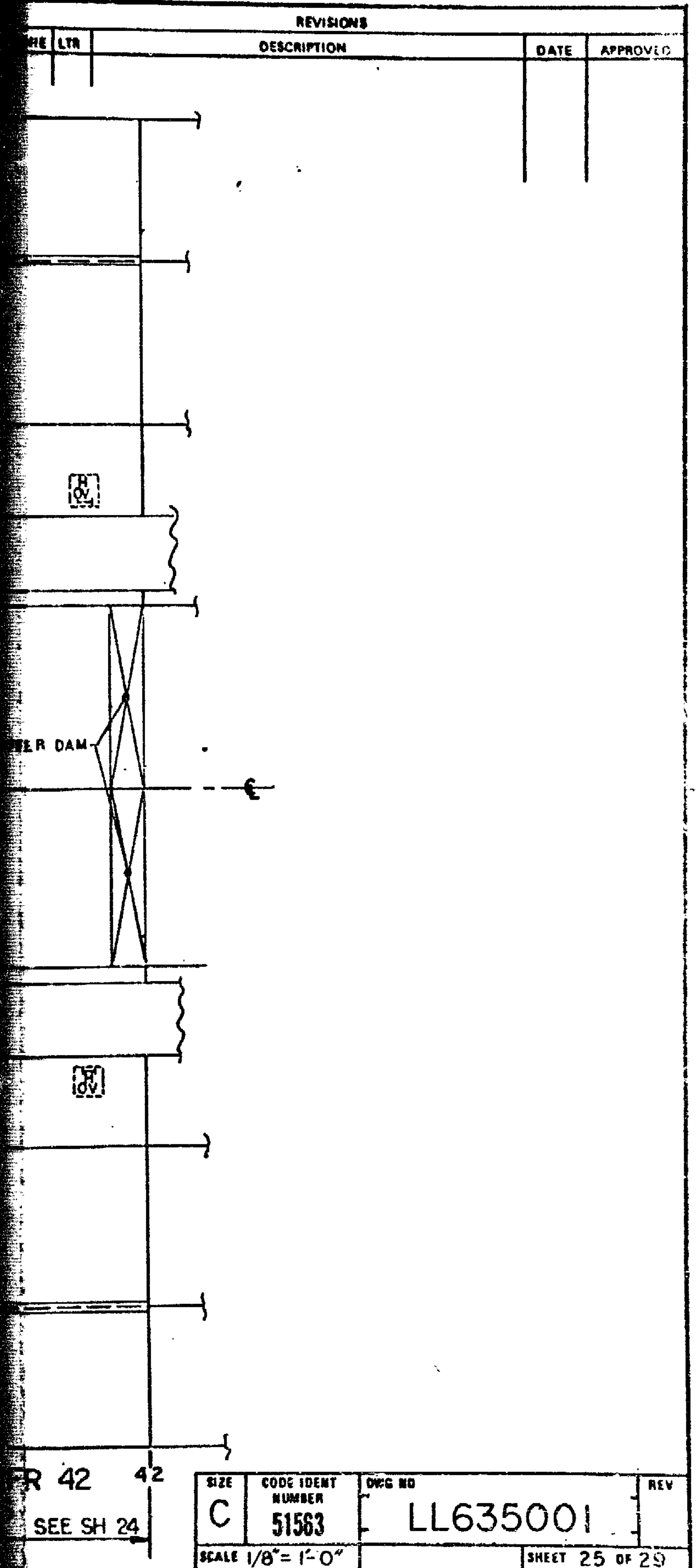


B.6-1 (Sheet 24 of 29) (U)



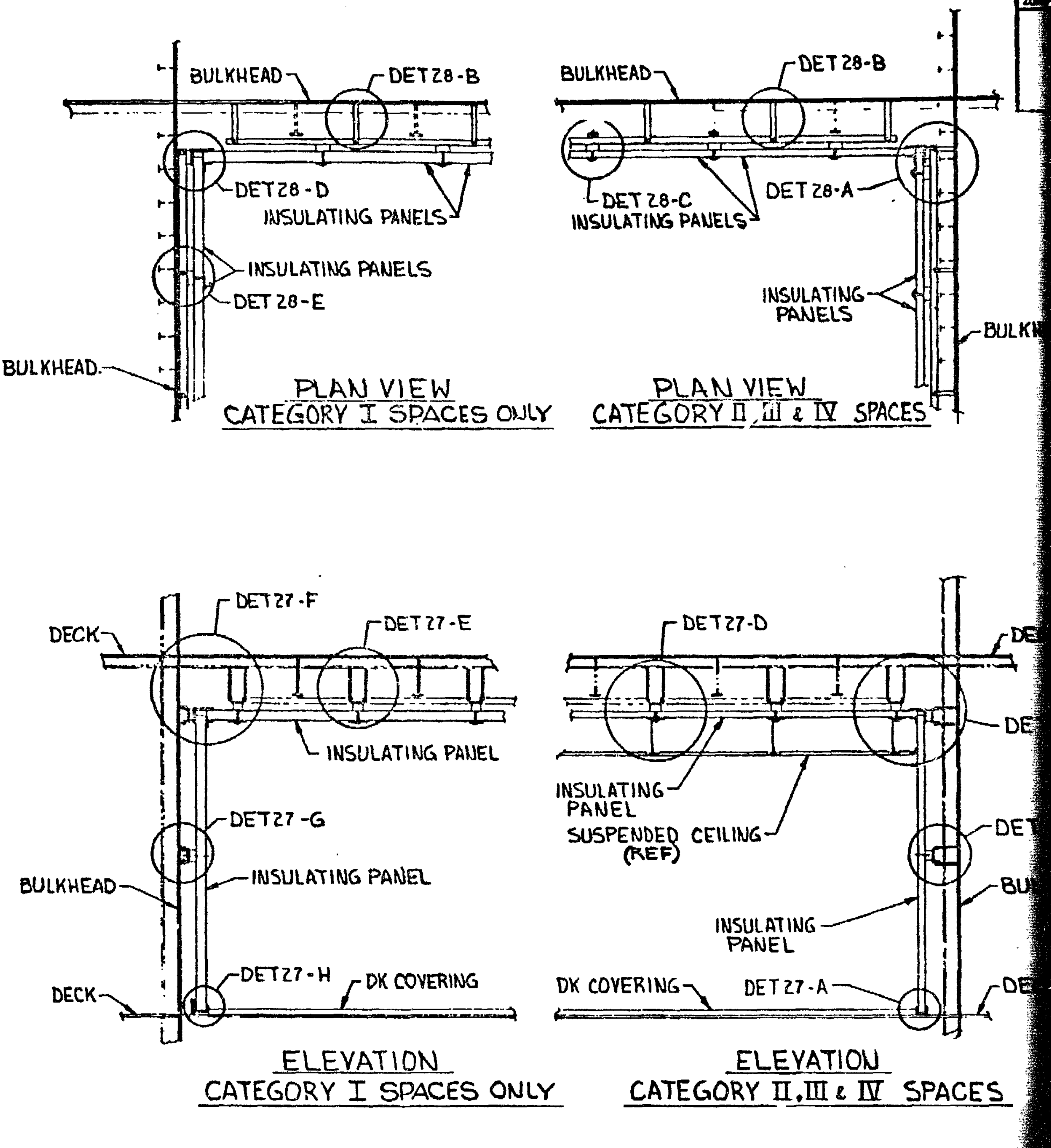
3RD DECK AFT
DK COVERING

Figure B.6-

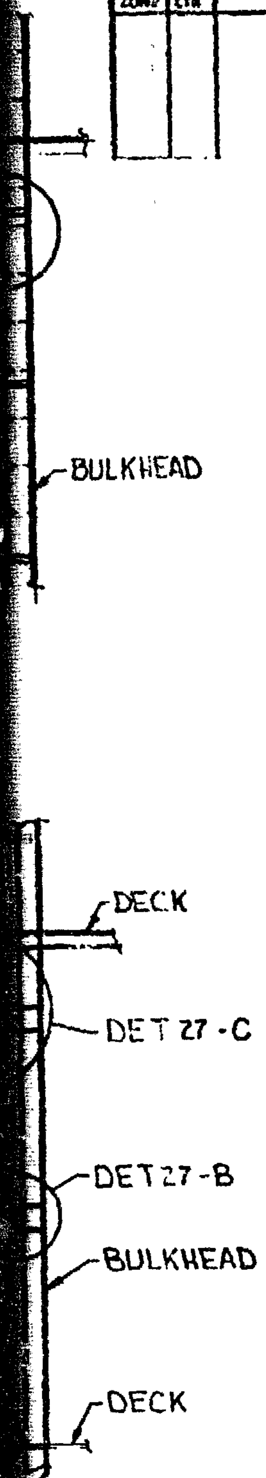


1 (Sheet 25 of 29) (U)

UNCLASSIFIED


BULKHEAD
DET 28-B
DET 28-D
INSULATING PANELS
INSULATING PANELS
DET 28-E
BULKHEAD
PLAN VIEW
CATEGORY I SPACES ONLY
BULKHEAD
DET 28-B
DET 28-C
INSULATING PANELS
DET 28-A
INSULATING PANELS
PLAN VIEW
CATEGORY II, III & IV SPACES
DET 27-F
DECK
DET 27-E
INSULATING PANEL
DET 27-G
BULKHEAD
INSULATING PANEL
DET 27-H
DK COVERING
DECK
ELEVATION
CATEGORY I SPACES ONLY
DET 27-D
INSULATING PANEL
SUSPENDED CEILING (REF)
INSULATING PANEL
DK COVERING
DET 27-A
ELEVATION
CATEGORY II, III & IV SPACES

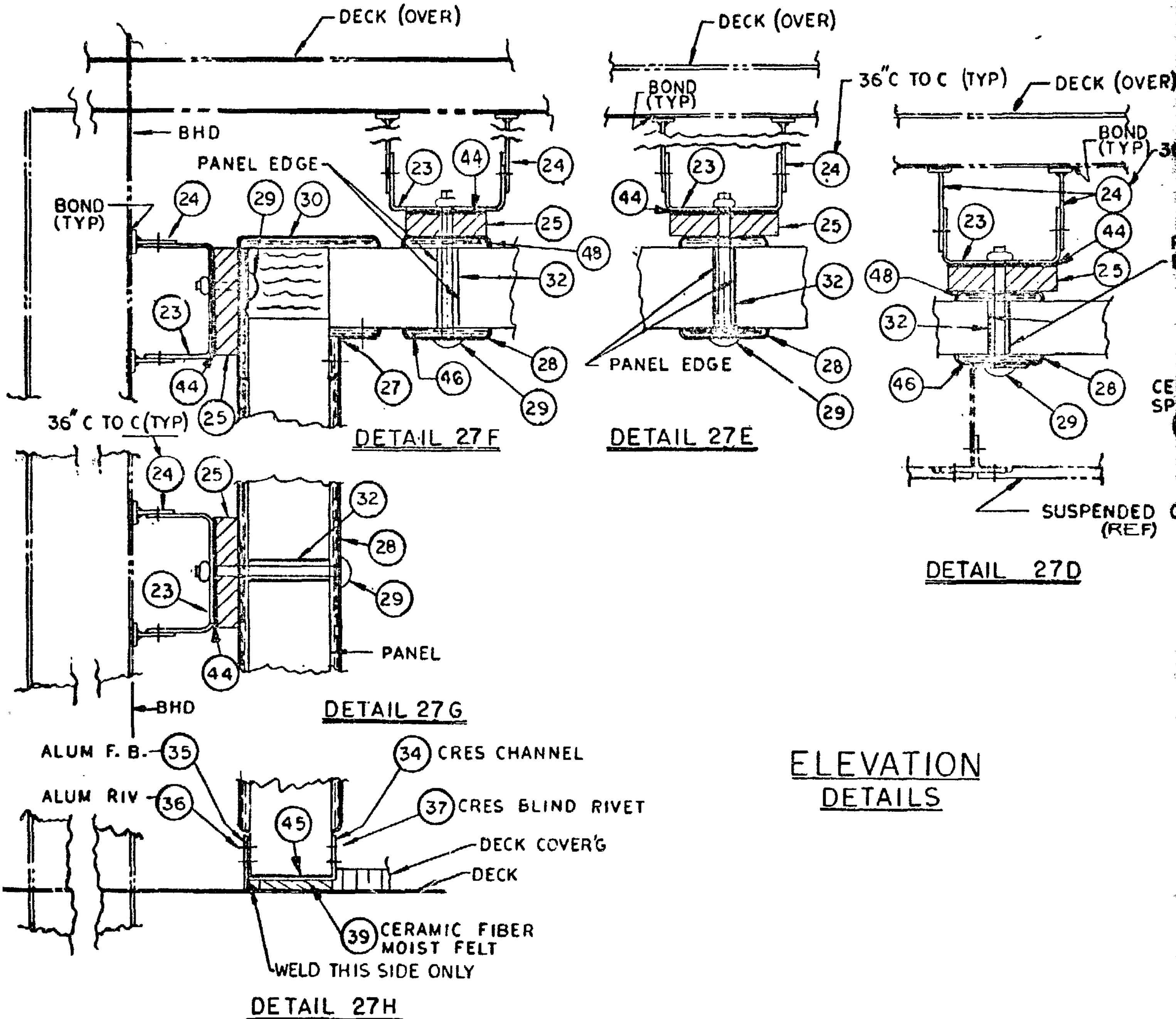
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



CES

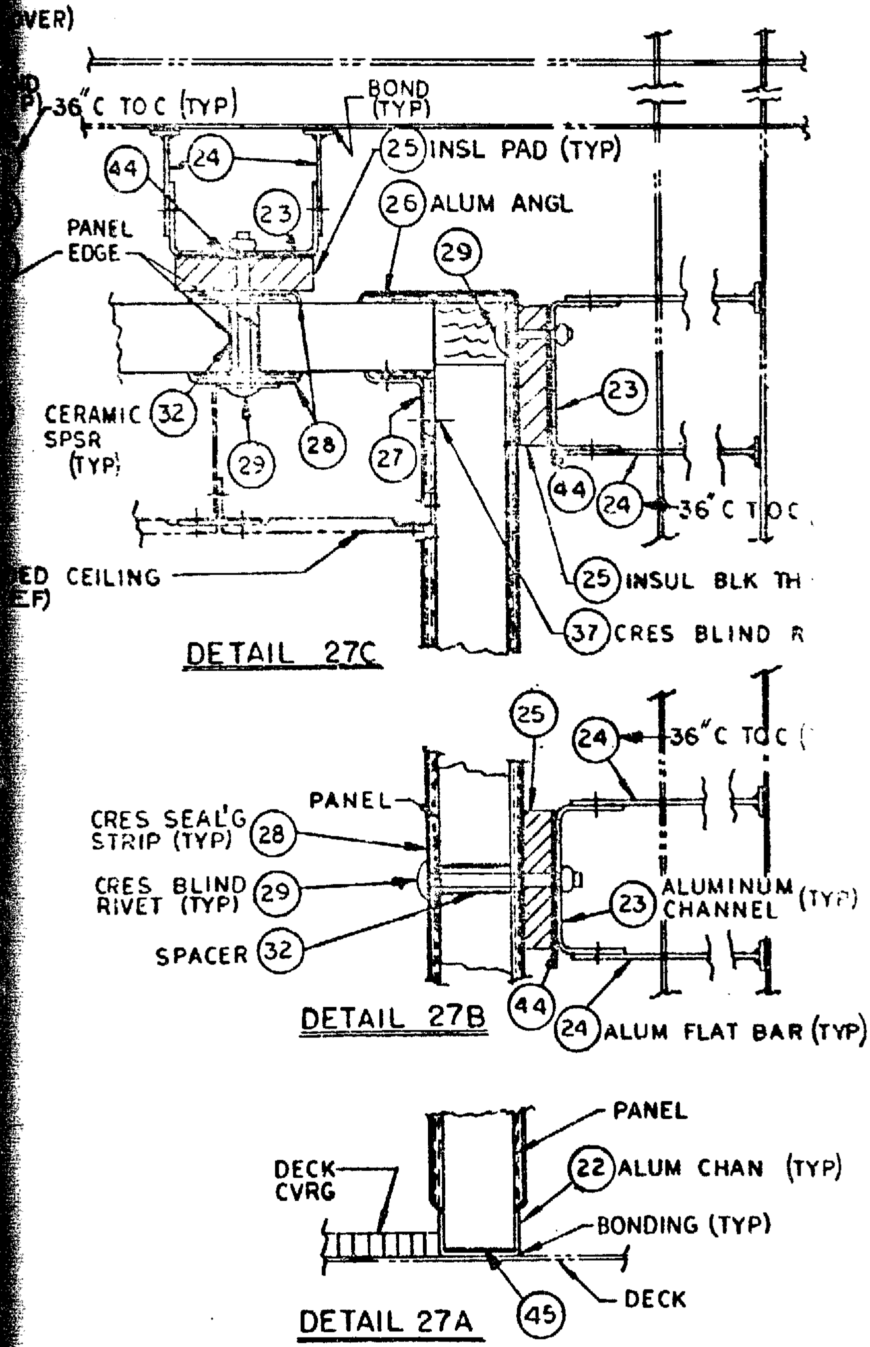
SIZE	CODE IDENT NUMBER	DWG NO.	REV
C	51563	LL635001	–
SCALE 1/2"-1'0"		SHEET 26 OF 29	

igure B.6-1 (Sheet 26 of 29) (U)



ELEVATION DETAILS

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	-
SCALE NONE		SHEET 27 OF 29	

re B.6-1 (Sheet 27 of 29) (U)

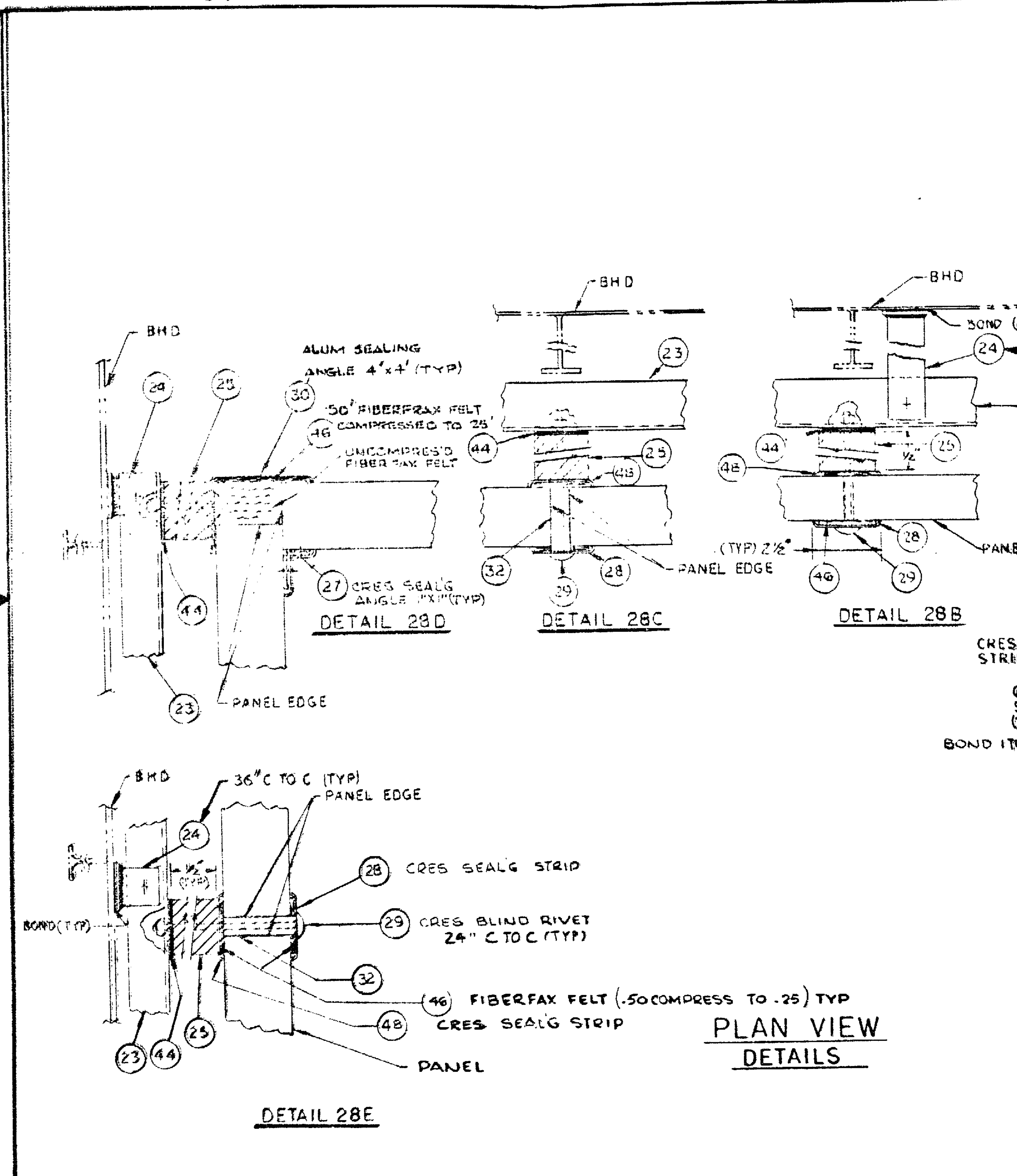
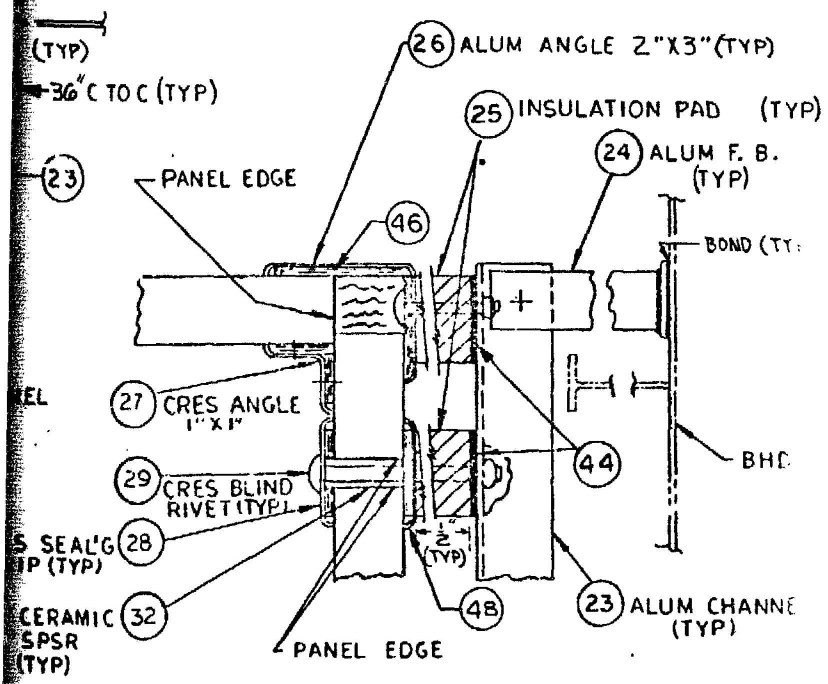

BHD
ALUM SEALING ANGLE 4'x4' (TYP)
.50' FIBERFRAX FELT COMPRESSED TO .25'
UNCOMPRES'D FIBER FAX FELT
CRES SEAL'G ANGLE (TYP)
PANEL EDGE
DETAIL 28D
DETAIL 28C
DETAIL 28B
(TYP) 2½"
PANEL
36" C TO C (TYP)
CRES SEAL'G STRIP
CRES BLIND RIVET 24" C TO C (TYP)
FIBERFAX FELT (.50 COMPRESS TO .25) TYP
CRES SEAL'G STRIP
BOND (TYP)
DETAIL 28E
PLAN VIEW DETAILS

Figure B.6

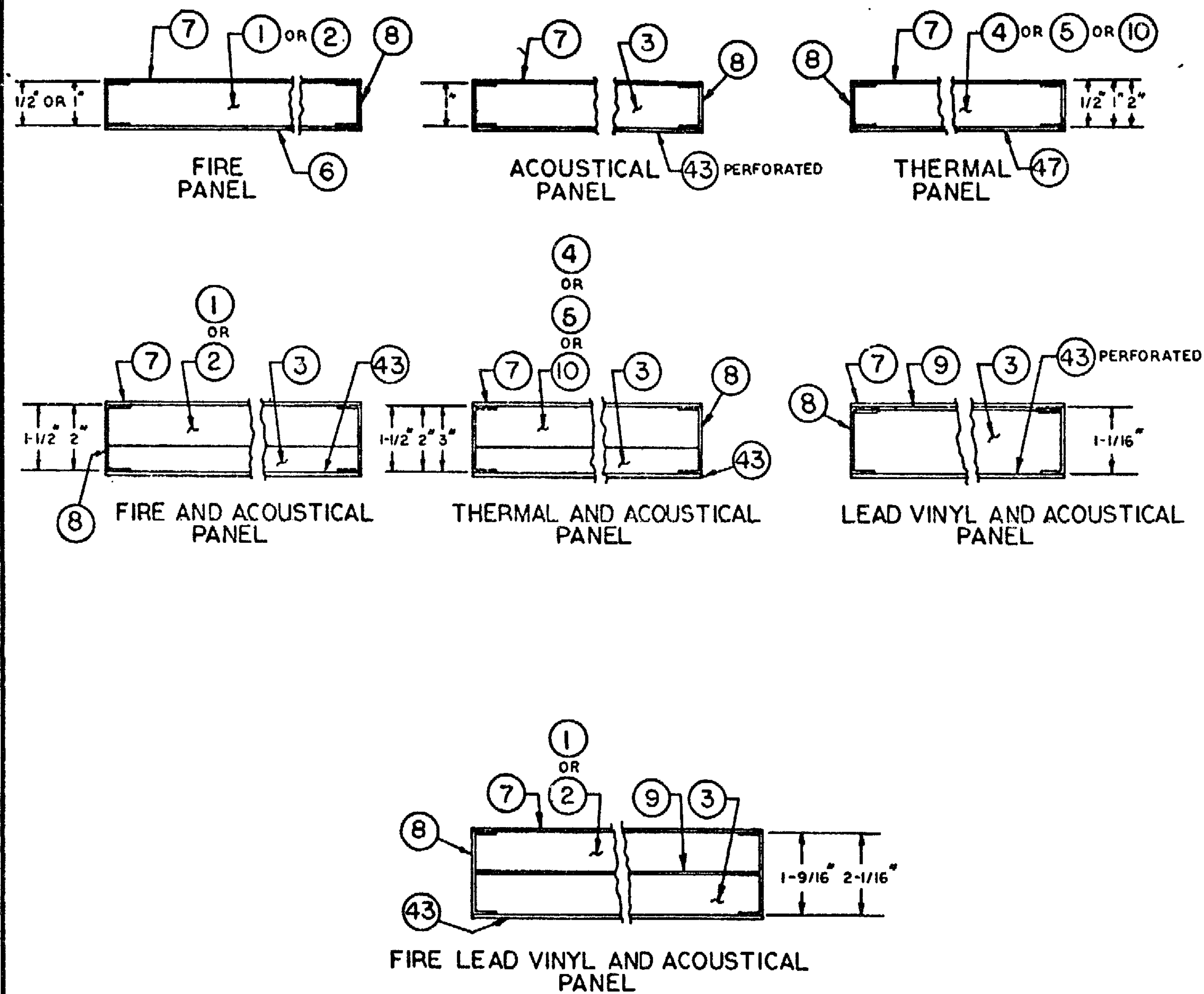
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



DETAIL 28A

SIZE	CODE IDENT NUMBER	DWG NO	REV
C	51563	LL635001	-
SCALE NONE		SHEET 28 OF 29	

-1 (Sheet 28 of 29) (U)



7
1 OR 2
8
1/2" OR 1"
6
FIRE PANEL
7
3
8
1"
43 PERFORATED
ACOUSTICAL PANEL
8
7
4 OR 5 OR 10
1/2" 1" 2"
47
THERMAL PANEL
1 OR 2
7
3
43
1-1/2" 2"
8
FIRE AND ACOUSTICAL PANEL
4 OR 5 OR 10
7
3
8
1-1/2" 2" 3"
43
THERMAL AND ACOUSTICAL PANEL
8
7
9
3
43 PERFORATED
1-1/16"
LEAD VINYL AND ACOUSTICAL PANEL
1 OR 2
7
9
3
8
43
1-9/16" 2-1/16"
FIRE LEAD VINYL AND ACOUSTICAL PANEL

Figure B.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

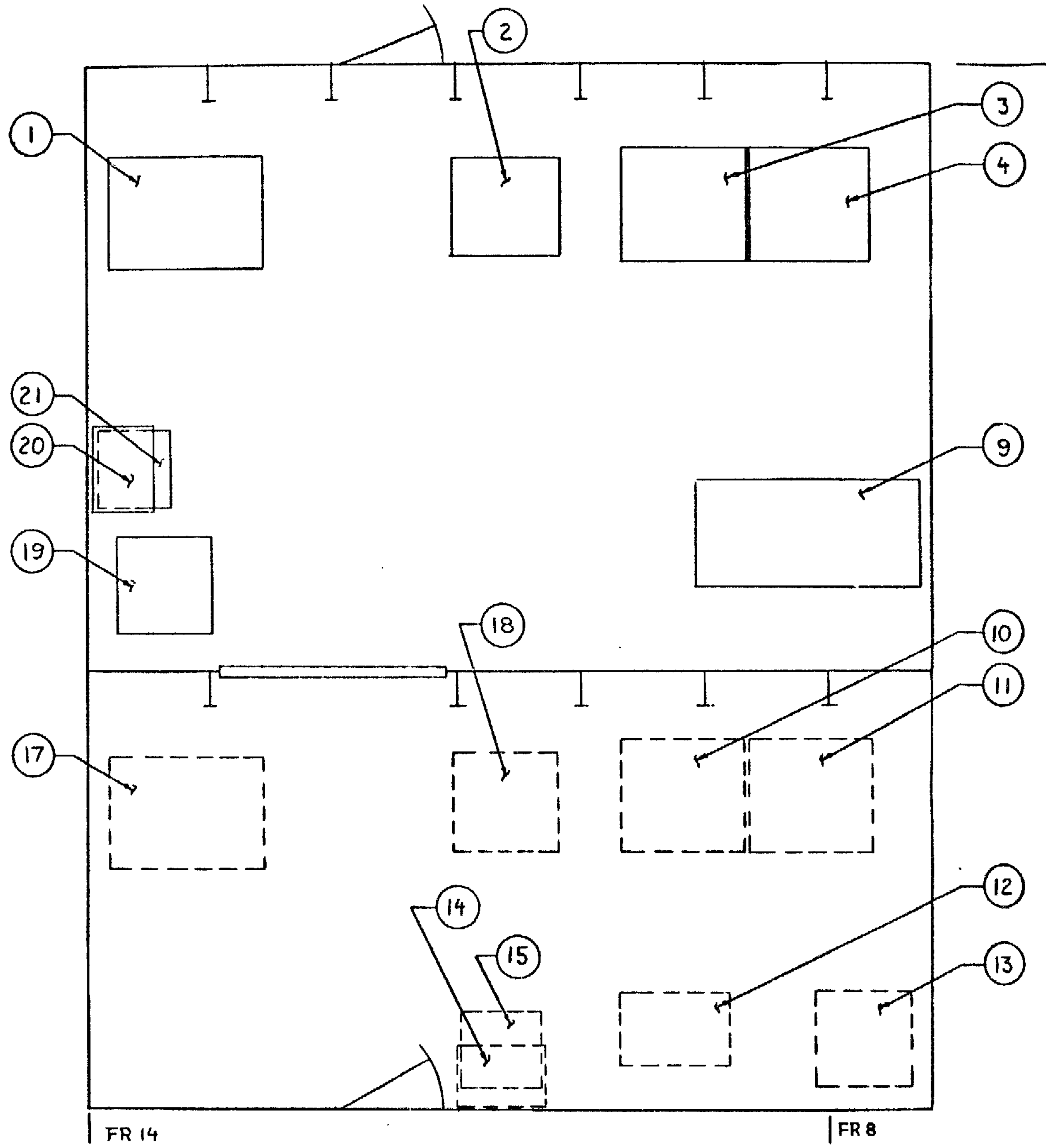
INSULATING PANEL DETAILS

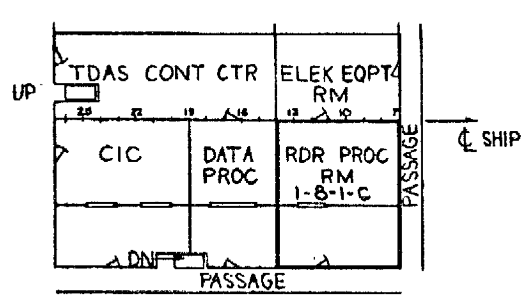
SIZE	CODE IDENT NUMBER	DWG NO		REV
C	51563	LL635001		–
SCALE NONE			SHEET 29 OF 29	

B.6-1 (Sheet 29 of 29) (U)

(U) B.7 COMBAT SYSTEMS ARRANGEMENT DRAWINGS AND BLOCK DIAGRAMS

(U) This section of Appendix B contains the combat systems arrangement drawings and block diagrams for the near term ANVCE SES. These arrangements are:





KEY PLAN
RADAR PROCESSING ROOM
MAIN DECK
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

UNCLASSIFIED

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-23-76 6-30-76 6-30-76	[illegible]

℄ SHIP —— FWD

(3)

(4)

(9)

(10)

(11)

(12)

(13)

PC NO	DESCRIPTION	QTY
21	RADAR TEST SET MK 574/0	1
20	GAS REGULATOR MK 21/0	1
19	WAVEGUIDE DRYER MK 13/0	1
18	POWER SUPPLY CONTROL (STIR) C-7714/SPG-51D (SPACE & WEIGHT)	1
17	RADAR TRANSMITTER (STIR) T-1085/SPG-51D (SPACE & WEIGHT)	1
16		
15	RADAR TEST SET (STIR) MK 574/0 (SPACE & WEIGHT)	1
14	GAS REGULATOR (STIR) MK 21/0 (SPACE & WEIGHT)	1
13	WAVEGUIDE DRYER (STIR) MK 13/0 (SPACE & WEIGHT)	1
12	ANTENNA CONTROL UNIT (STIR) MK 161/0 (SPACE & WEIGHT	1
11	RADIO FREQUENCY AMPLIFIER (STIR) MK 168/0 (SPACE & WEIGHT)	1
10	RADAR TRANSMITTER (STIR) MK 86/0 (SPACE & WEIGHT)	1
9	SERVO CONTROL MK 160	1
8		
7		
6		
5		
4	RADIO FREQUENCY AMPLIFIER MK 167/0	1
3	RADAR RECEIVER-TRANSMITTER MK 69/1	1
2	POWER SUPPLY CONTROL C-7714/SPG-51D	1
1	RADAR TRANSMITTER T-1085/SPG-51D	1

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
M. Wallace 5/18/76
CONFIG MGT

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.0	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

DRAWN	S. RHODES	4/9/76
APPROVED	[signature]	5/7/76
	[signature]	5/6/76
	[signature]	5-12-76
	[signature]	5-13-76
STRESS		
MFG		
NO ENGRG		
	[signature]	5/10/76
	[signature]	5-7-76
	[signature]	5/13/76

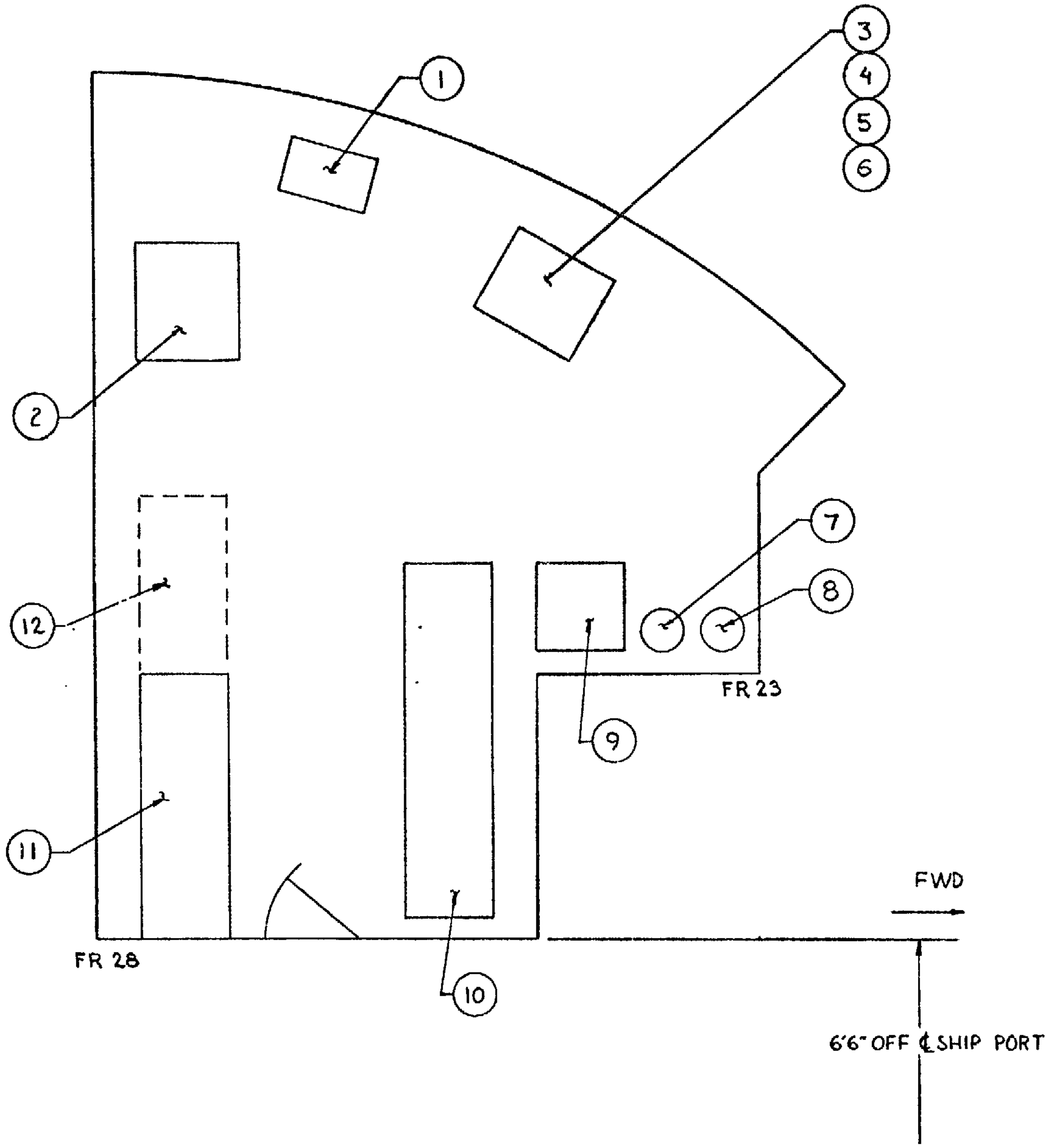
CHULA VISTA, CALIF.

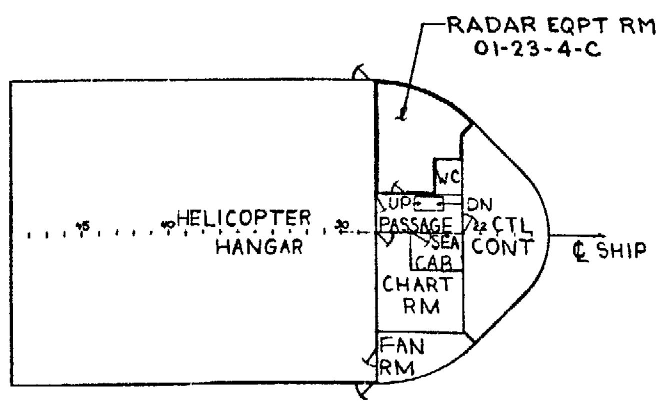
ROHR INDUSTRIES, INC.

RADAR PROCESSING ROOM ARRANGEMENT MAIN DECK

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL450001	A

SCALE 1/2"=1' SHEET 1 OF 1





KEY PLAN
RADAR EQUIPMENT ROOM
01 LEVEL
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

MICROFILM SYMBOL	ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-13-76 6-30-76 6-30-76	

PC NO	DESCRIPTION	QTY
12	AN/SLQ-31 (GROWTH)	
11	COMPUTER/SIGNAL PROCESSOR (AN/SLQ-31 V-2)	1
10	RADAR RACK (AN/APS-125)	1
9	DETECTOR PROCESSOR / DIGITAL SIGNAL ANALYZER (AN/APS-125)	1
8	HEAT EXCHANGER (AN/APS-125)	1
7	NITROGEN TANK (AN/APS-125)	1
6	SYNCHRONIZER-EXCITER SN-460/APS-116	1
5	RECEIVER-PULSE COMPRESSOR R-1747/APS-116	1
4	POWER SUPPLY PP-6633/APS-116	1
3	RADAR TRANSMITTER T-1203/APS-116	1
2	RADAR RECEIVER TRANSMITTER RT-1124/SPS-55	1
1	SYNCHRO AMPLIFIER MK-27	1

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT 5/13/76

NOTE THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X	.XX	.XXX	ANGLES
±.1	±.03	±.010	±2°

GENERAL SPECIFICATION

CAL WT LBS

LAYOUT NO

DRAWN S RHODES 4/27/76
APPROVED 5/7/76
CHECKED 6-6-76
5-12-76
WEIGHT 5-13-76
STRESS
MAPL
MO ENGRG
MFG 5/12/76
5-7-76
5/13/76

CHULA VISTA, CALIF.

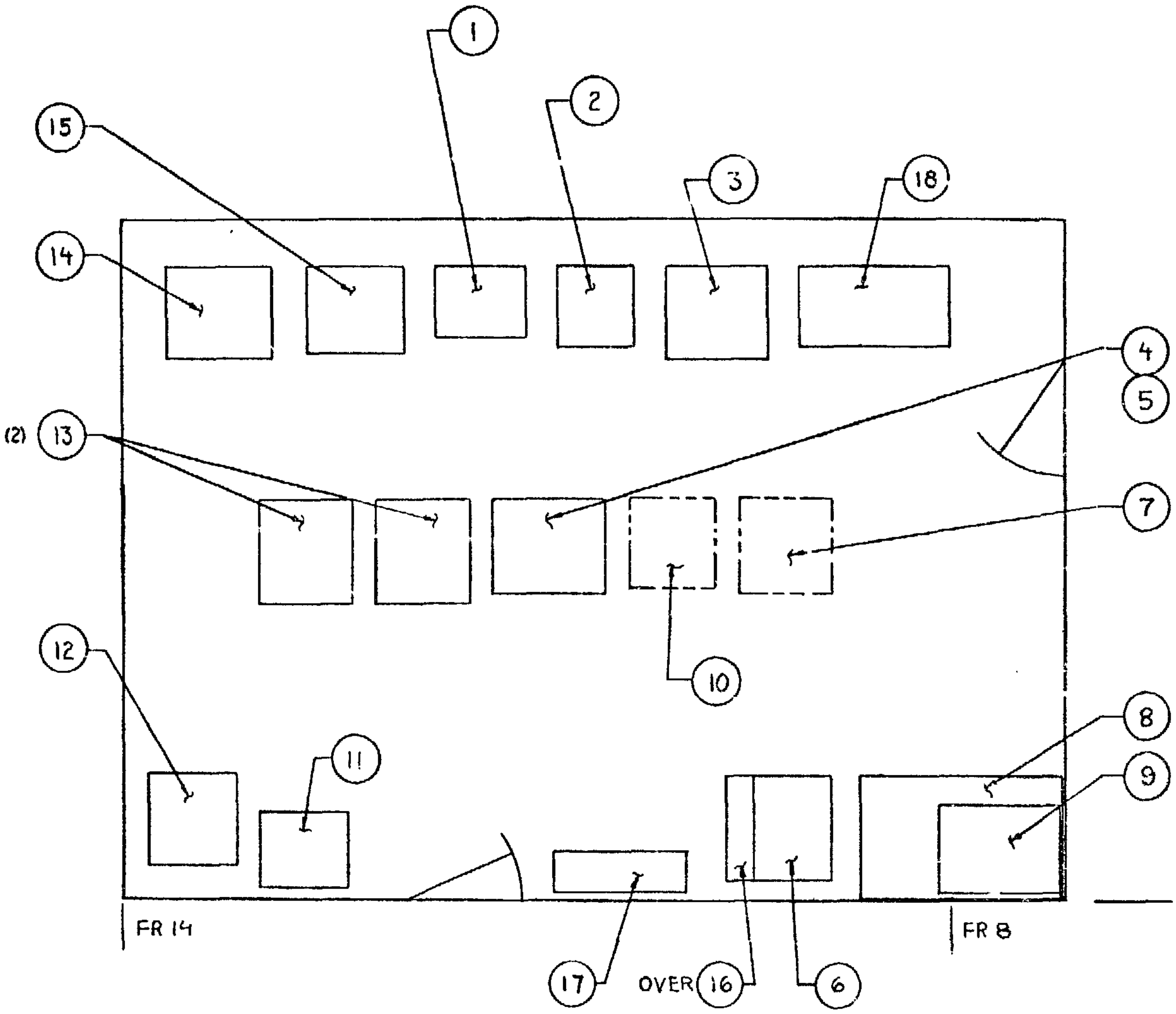
ROHR INDUSTRIES, INC.

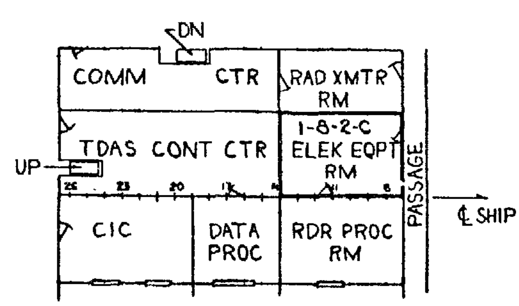
RADAR EQUIPMENT ROOM ARRANGEMENT 01 LEVEL

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL452001	A

SCALE 1/2"=1' SHEET 1 OF 1

Figure B.7-2 (U)





KEY PLAN
ELECTRONIC EQPT ROOM
MAIN DECK
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER ECR L00003	6-23-76 / 6-30-76 / 6-30-76	

— ℄ SHIP FWD ——

PC NO	DESCRIPTION	QTY
18	SONAR RECEIVING SET-REMOTE UNIT	1
17	MK 4 CHANNEL SELECTOR SWITCH	1
16	HARPOON LAUNCHING SWITCHING UNIT	1
15	ACOUSTIC COMPUTER AN/UYK-20	1
14	SONAR DATA CONVERTER AN/UYQ-( )	1
13	IFF INTERROGATOR AN/UPX-25(V)	2
12	TACAN TRANSPONDER	1
11	TACAN ANTENNA CONTROL UNIT	1
10	MK 140 CONSOLE (SPACE & WEIGHT)	1
9	IFF TEST SET AN/UPM-137A	1
8	WORK BENCH	1
7	MK 82 CONSOLE (SPACE & WEIGHT)	1
6	VERTICAL MISSILE LAUNCHER/SELECTOR	1
5	IFF TRANSPONDER AN/UPX-28(V)	1
4	CONTROL MONITOR C-8430/UPX	1
3	INPUT SIGNAL CONDITIONER	1
2	ACOUSTIC SENSOR DATA DISTRIBUTION SWITCHBOARD	1
1	ADVANCED SIGNAL PROCESSOR	1

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT DATE 5/13/76

NOTE: THIS BLOCK IS NOT MAINTAINED

PART NUMBER	NEXT ASSY	MODEL NO.	NEXT ASSY	FINAL ASSY
APPLICATION			QTY REQD	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±.1 .XX ±.03 .XXX ±.010 ANGLES ±2°
GENERAL SPECIFICATION
CAL WT LBS
LAYOUT NO

S. RHODES 4/9/76
5/12/76
5-6-76
5-12-76
5-13-76
5/10/76
5-7-76
5/13/76

CHULA VISTA, CALIF.

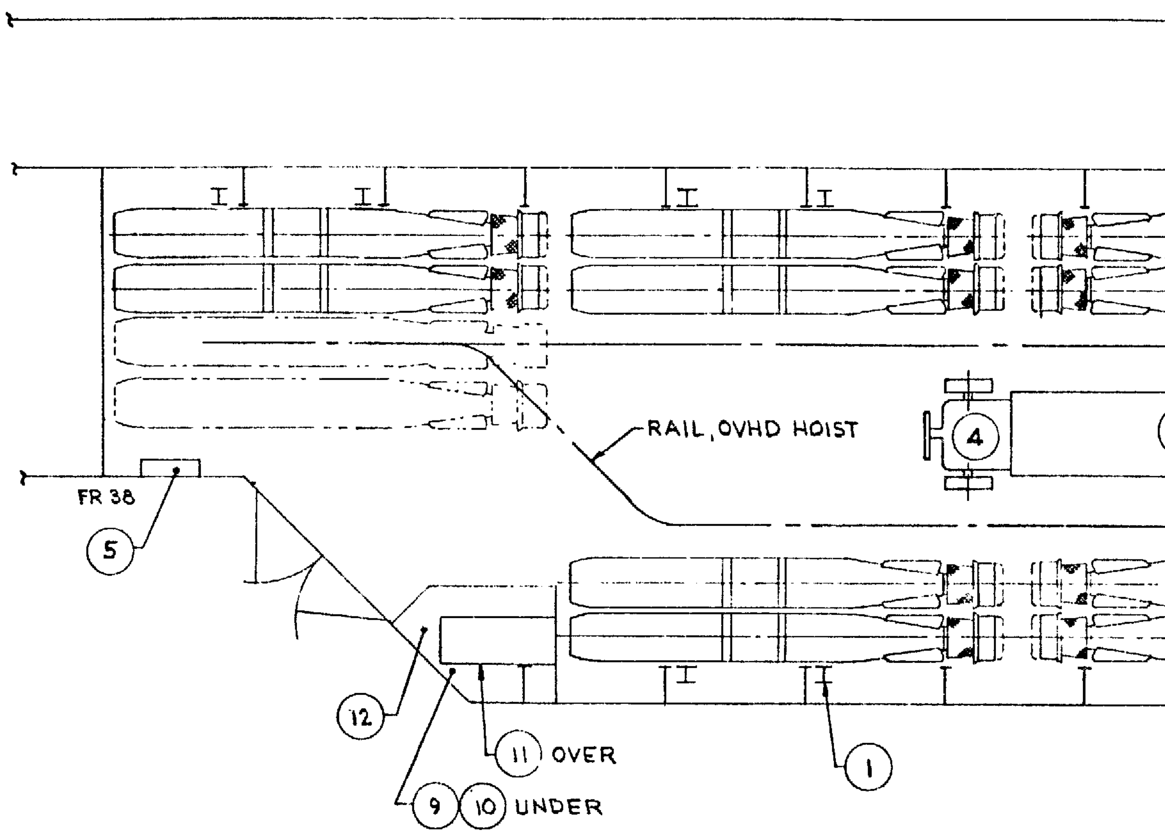
ROHR INDUSTRIES, INC.

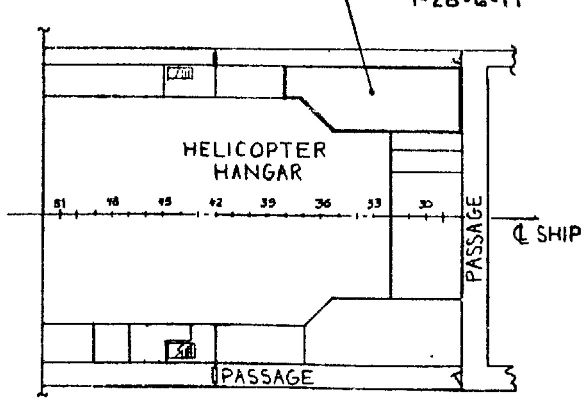
ELECTRONIC EQUIPMENT RM
ARRANGEMENT
MAIN DECK

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL440001	A

SCALE 1/2" = 1' SHEET 1 OF 1

Figure B.7-3 (U) **UNCLASSIFIED**





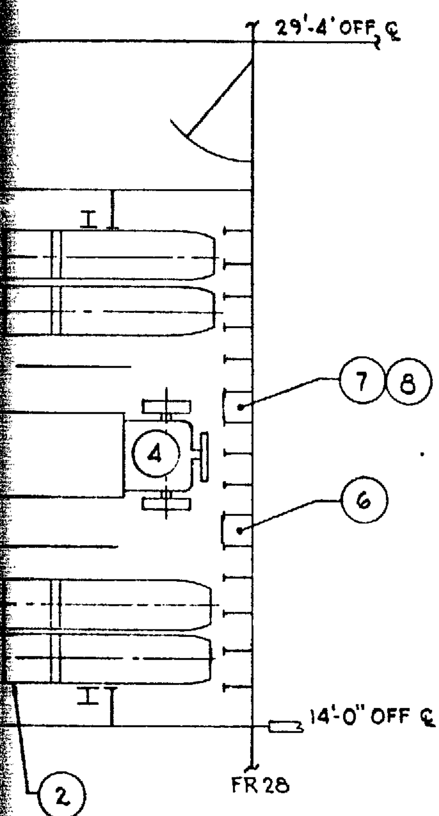
KEY PLAN
MK 46 TORPEDO MAGAZINE
MAIN DECK
SCALE 1/16"=1'0"

SYM	EFFECTIVITY

ROHR 3282-1

UNCLASSIFIED

MICROFILM SYMBOL	ZONE	LTR	DESCRIPTION	DATE	APPROVED
		A	REVISED PER ECR L00003	6-22-76	



PC NO	DESCRIPTION	QTY
12	CABINET	1
11	LOCKER, EXPLODER STOWAGE	1
10	TEST SET MK 432 MOD 2	1
9	PRESETTER MK 437 MOD 0	1
8	SLING, TORPEDO 106/0	2
7	SLING, TORPEDO 102/0	2
6	SLING, WEAPONS HANDLING	1
5	ADAPTER, HANDLIFT TRUCK	2
4	TRUCK, HANDLIFT	2
3	DOLLY, HANDLIFT	1
2	TORPEDO MK 46/1	40
1	STOWAGE RACK	5

PARTS AND MATERIAL LIST

DOCUMENT RELEASE
CONFIG MGT 5/13/76

NOTE. THIS BLOCK IS NOT MAINTAINED

PART NUMBER | NEXT ASSY | MODEL NO. | NEXT ASSY | FINAL ASSY
APPLICATION | QTY REQD

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±.1 .XX ±.03 .XXX ±.010
ANGLES ±2°
GENERAL SPECIFICATION
CAL WT LBS
LAYOUT NO

DR S. RHODES 5/7/76

CHULA VISTA, CALIF.

ROHR INDUSTRIES, INC.

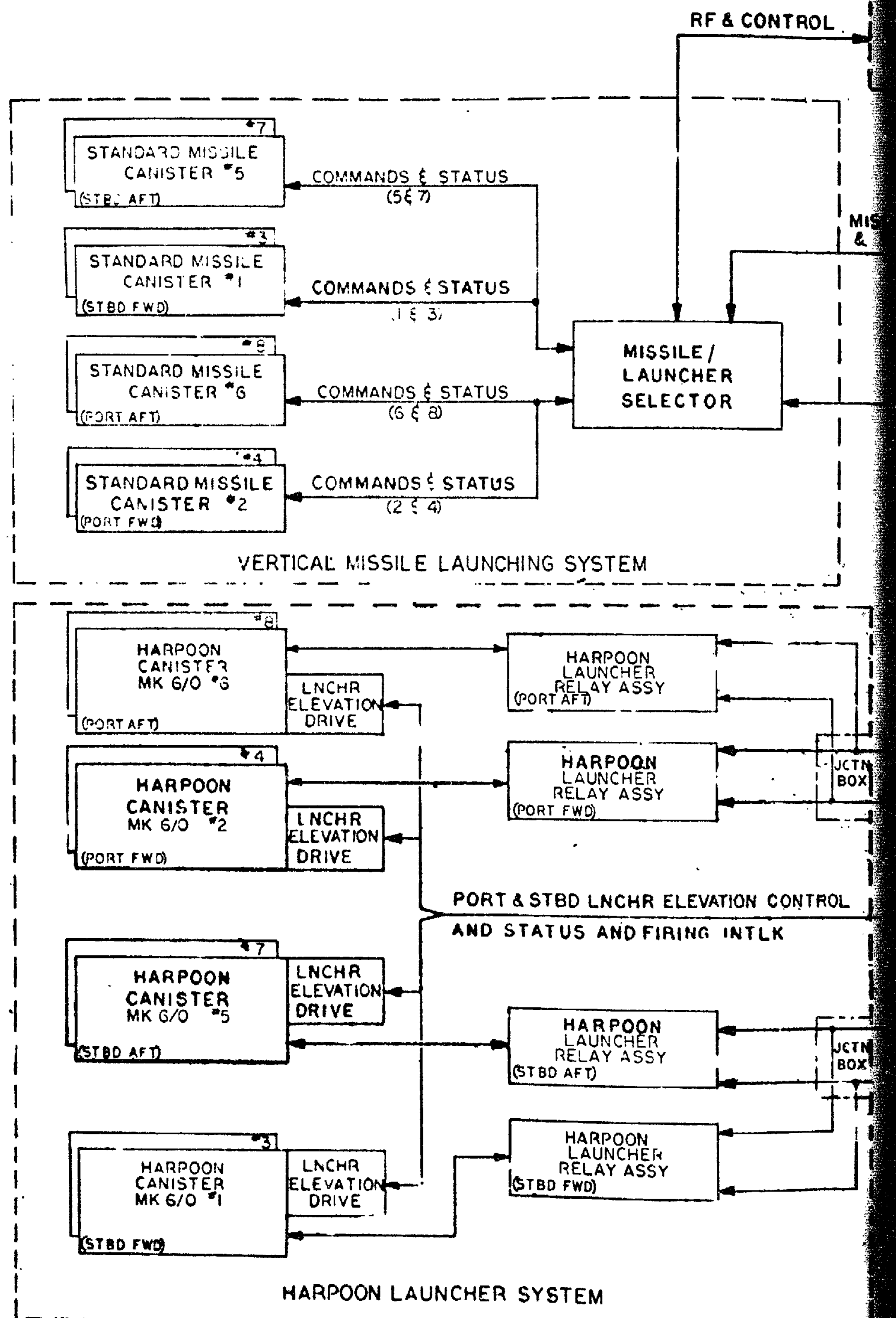
MK 46 TORPEDO MAGAZINE ARRANGEMENT MAIN DECK

SIZE	CODE IDENT	DWG NO	REV
D	51563	LL783001	A

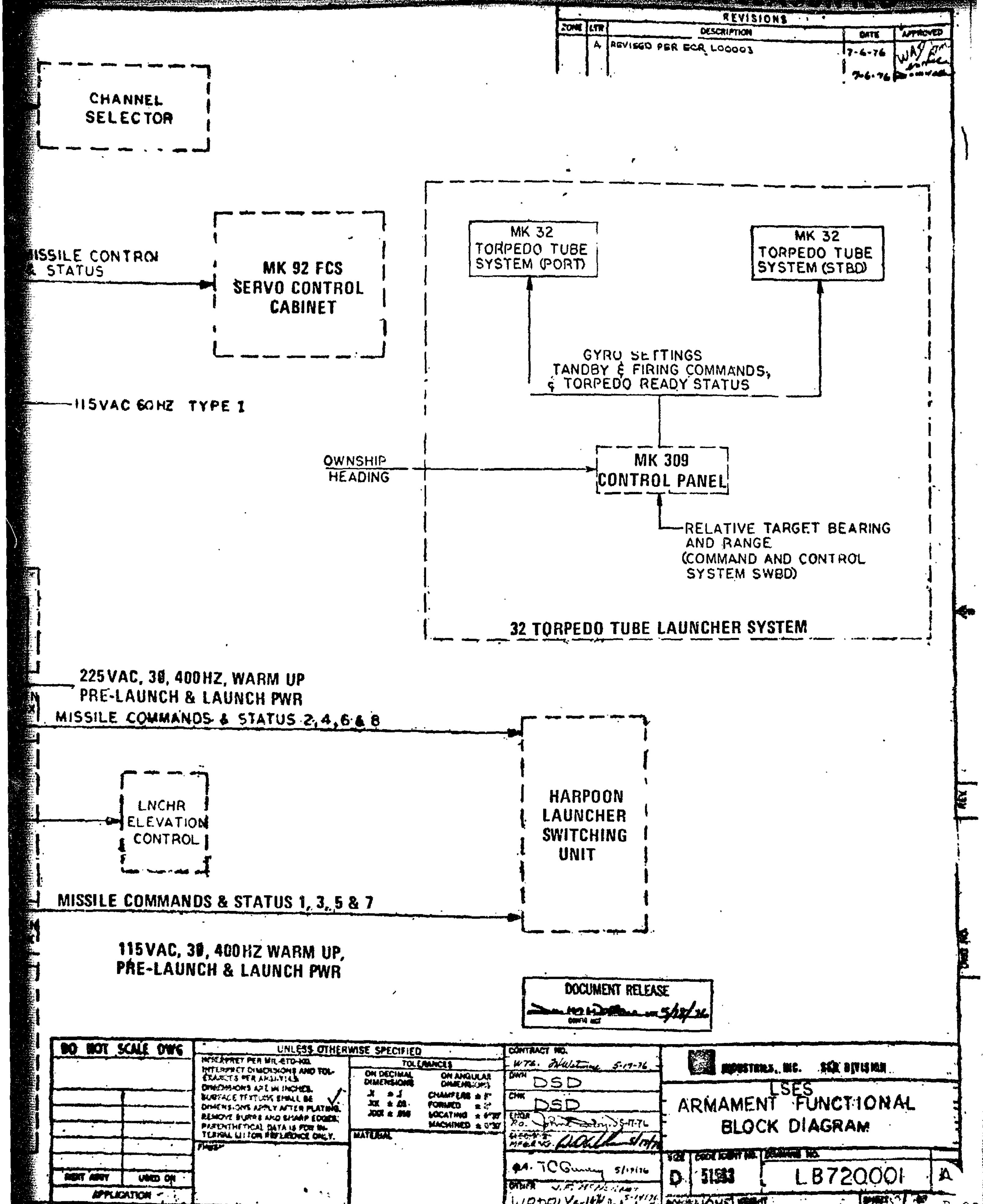
SCALE 1/2"=1'0" SHEET 1 OF 1

Figure B.7-4 (U)

UNCLASSIFIED



NOTES: UNLESS OTHERWISE SPECIFIED



REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A REVISED PER ECR L00003 7-6-76
CHANNEL SELECTOR
MISSILE CONTROL & STATUS
MK 92 FCS SERVO CONTROL CABINET
115VAC 60HZ TYPE I
MK 32 TORPEDO TUBE SYSTEM (PORT)
MK 32 TORPEDO TUBE SYSTEM (STBD)
GYRO SETTINGS TANDBY & FIRING COMMANDS, & TORPEDO READY STATUS
OWNSHIP HEADING
MK 309 CONTROL PANEL
RELATIVE TARGET BEARING AND RANGE (COMMAND AND CONTROL SYSTEM SWBD)
32 TORPEDO TUBE LAUNCHER SYSTEM
225VAC, 3Ø, 400HZ, WARM UP PRE-LAUNCH & LAUNCH PWR
MISSILE COMMANDS & STATUS 2, 4, 6 & 8
LNCHR ELEVATION CONTROL
HARPOON LAUNCHER SWITCHING UNIT
MISSILE COMMANDS & STATUS 1, 3, 5 & 7
115VAC, 3Ø, 400HZ WARM UP, PRE-LAUNCH & LAUNCH PWR
DOCUMENT RELEASE
DO NOT SCALE DWG
UNLESS OTHERWISE SPECIFIED
TOLERANCES
CONTRACT NO.
DWN DSD
CHK DSD
LSES ARMAMENT FUNCTIONAL BLOCK DIAGRAM
SIZE D
CODE IDENT NO. 51993
DRAWING NO. LB720001
A
APPLICATION
MATERIAL
FINISH

Figure B.7-5 (U)

APPENDIX C

This appendix contains equipment data sheets for the near term SES C^3 system and combat system elements.

Items marked with a ◇ are part of the C^3 system and those marked with a ◈ have navigation and IC related functions. All other elements not marked are part of the combat system.

Weights, size and service requirements are shown for unit elements. The tables show the quantity required for the near term SES.

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED
Display System AN/UYA-4(V)	411 A	1													
PPI Display Cons. OJ-194(U)3/UYA-41(V)	A1	3					950			CIC	676 3007	50 1270	32 813	45 1143	[illegible]
Radar Data Dist. Swbd SB-2780/UYA-41(V)	A2	1					1600			DPC	640 2847	72 1829	37 940	23 584	[illegible]
Central Eqt Grp OV-91(V)3/UYA-41(V)	A3	1					1350			DPC	709 3154	72 1829	37 940	23 584	[illegible]
Signal Gen SG-10S1/UYA-4(V)	A4	1								DPC	25 111				
Remote Data R/O OA-8337(V)2/UYA-4(V)	A5	2					156			CIC	125 556	11 279	33 838	23 584	[illegible]
Intercom Station LS 537A/UYA-4(V)	A6	3								CIC DPC PH	27 120	9 229	19 483	15 381	
Comm P.P. SB-2781/UYA-4(V)	A7	1								DPC	328 1459	72 1829	37 940	19 483	
Monitor Control Cons OJ-200/UYA-4(V)	A8	1					500			DPC	440 1957	50 1270	24 610	47 1194	
OPS Summary Cons OJ-197/UYA-41(V)							1730			CIC		49 1245	52 1321	41 1041	[illegible]

HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
		TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
320	630	DW	1.7 107.3	150 1034	40.5	5.0 34.5					18" (457 mm) Rear Clearance Two Additional Consoles are Growth Item DW Deminwater
310	610	DW	1.5 94.6	150 1034	40.5	4.9 33.8					18" (457 mm) Rear Clearance
320	430	DW	1.4 88.3	150 1034	40.5	1.4 9.7					18" (457 mm) Rear Clearance
150											
19											
											18" (457 mm) Rear Clearance
											18" (457 mm) Rear Clearance
490	1240	DW	3.2 201.9	150 1034	40.5	8.0 55.2					*Growth Item Only

EQUIPMENT / INSTALLATION DATA	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Computer System AN/UYK-7(V)	412 A	1												
Computer AN/UYK-7(V)	A1	1					2760			DPC	535 2380	41 1041	20 508	23 584
Computer Cont C-8542/UYK-7(V)	A2	1					3			DPC	5 22	6 152	7 179	7 179
Test Set TS-2942/UYK-7(V)	A3	1					16			DPC	35 156	19 483	19 483	6 152
Digital/Analog SWBDS	413 A													
Combat Syst SWBD	A1	3								DPC	1000 4448			

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
23 (584)	2290											One additional comp is growth item
7 (179)	3											
6 (152)	16											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Interface Equipment	414 A													
I/O Cons Deac OJ-172/UYK-7(V)	A1	1	486				1900			DPC	970 4315	63 1600	30 762	34 864
Signal Data Comv CV-2953/UYK	A2	1	500				2000			DPC	625 2780	72 1829	37 940	23 584
Data Terminal Set AN/USQ-63	415 A													
Electrical Equipment Dwr	A1	1				160				EER	11 50	9 229	19 483	21 441
Digital-Anal Conv CV-2969A(P)/U	A2	1									32 142	8 203	7 178	19 483
Comp Adapter MX-9222/U	A3	1									12 53	8 203	3 76	20 508
Fault Isol Cont C-9061/U	A4	1									3 13	4 102	6 152	4 102
Address Cont. Ind C-9062/U	A5	1								CIC	30 139	11 279	19 483	12 305
Data Term Set Cont C-9063/USQ-59	A6	1				230				CIC	40 178	11 279	19 483	12 305
Equipment Rack	A7	1								CIC	40 178	25 635	23 584	14 356
Cont SWBD SB-3372	A8	1								EER	160 712			

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	NOTES
34 864	2386											
23 584	2000											18" (457 mm) Rear Clearance
21 441												Holis A2, A3, & A4 and fits into std 19" (482 mm) rack
19 483												
20 508												
4 102												
12 305												
12 305												
14 356												Holds A5 & A6

EQUIPMENT / INSTALLATION DATA	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED
Test Set TS-2460/UYA-4	416 A1	1	183				600			DPC	300 1334	24 610	32 813	19 483	5
Non-elect NAV aids	421 A														
Binoculars	A1	6								PH	5 22				
Barometer	A2	1								PH	5 22				
Clinometer	A3	1								PH	5 22				

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
19 483	520											

EQUIPMENT \ INSTALLATION DATA	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)
Electrical NAV aids	422 A												
Masthead Light	A1	1	50							MAST	9 40		
Side Lights	A2	2	50							PILOT HOUSE	9 40		
Stern Light	A3	1	50							AFT	10 44		
Towing Lights	A4	2	50							MAST	12 53		
Task Lights	A5	6	450							MAST	13 58		
Wake Lights	A6	2	50							MAST	20 89		
Anchor Lights	A7	2	50							MAST	8 36		
Speed Light	A8	1	135							MAST	20 89		
Blinking Light	A9	2	180							AFT	26 116		
Search Lights	A10	2	1,000							02 LVL	115 512		
Supply Control & Telltale Panel	A11	1								PILOT HOUSE	56 249		
Supply & Control Panel	A12	1								PILOT HOUSE	34 151		
Dimmer Panels	A13	2								PILOT HOUSE	33 147		
Range Light	A14	1	50							MAST	9/40		

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	NOTES
												20 DT Light-White No range it unless 2nd mast installed
												10 pt. lights - green - s red - port
												12 pt light - white
												portable
												Red - white - red - 32 pt Two sets for full coverage
												Gred Bulbs Includes A/C warning lt 3 White
												12/305
												20 pt light - white

UNCLASSIFIED

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (m…
Helo Landing Lights	422 B													
Edge Lights (Red) 256.1 256.7	B1	17	38							LANDING PLATF	18 80			
Lineup Lights (white) 260.1 356.9	B2	20	45							↓	16 71			
Touchdown Lt (Green) 256.1 256.7	B3	1	38							↓	18 80			
Vertrep Lineup Lights (White) 262.1 257.3	B4	15	90							↓	14 62	9 229	6 152	3 7
Vertical Dicopline Lights (Red) 243.1	B5	12	100							↓	3 13			
Extended lineup Lights (White)	B6	12	45							↓	3 13			
Deck Surface Flooding Lights (Red or White)	B7	8	150							↓	15 67			
Maint Flood Light (Red)	B8	1	300							↓	15 67			
Hier Headine Lights (Red)	B9	3	50							02 LVL	5 22			
Signal Wands	B10	2									1 4			
Wave off Lights (Red)	B11	2	100							02 LVL	5 22			
Overhead Flood Lights (Red)	B12	8	300								15 67			
Landing Signal Light Kit	B13	1									5 22			
Homing Beacon (White) 258	B14	3	150								12 53			
Rotary Beacon Signal System (Red Green Amber)	B15	3	150								12 53			
DECK STATUS LIGHT (Red, Green, Amber)	B16	1	150								12 53			

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
													At least 4 per edge 120/12 XFMR 38W ea. 12V
													Turn on only 6 at a time
													120/6.5 XFMR 6.5V 45W
6 152	3 76												120/12 XFMR 38W ea. 12V
													120/6.5 XFMR 6.5V 45W ea.
													115/12 XFMR 100W 13V
													120/6.5 XFMR 6.5V 45W
													28V 120/30 XFMR
													Battery Powered
													Battery Powered
													115/32 XFMR 150W 32V

EQUIPMENT / INSTALLATION DATA	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Stabilized Glide Slope Ind.	422 C	1									500 2224			
Hydraulic Pump Assembly	C1	1			2100					HANGAR		28 711	26 660	17 432
Remote Panel Assembly	C2	1								HELO CONTROL STATION		15 381	12 305	6 152
Stable Platform Assembly	C3	1								02 LVL		25 635	25 635	28 711
Glide Slope Indic Assembly	C4	1								02 LVL		13 330	13 330	26 660
Transformer Assembly	C5	1								HANGAR		14 356	11 279	7 178
Electronics Encl Assembly	C6	1	960							HANGAR		30 762	24 610	10 254

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER TYPE	COOLING WATER FLOW	COOLING WATER PRESSURE	COOLING WATER TEMP IN	COOLING WATER HXDP	HYDR PRESSURE	HYDR FLOW	AIR PRESSURE	AIR VOLUME/FLOW	NOTES
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
7 32												Close to Glide Scope Indic & Platform Self Contained Hydraulics 2.7A
[illegible] 52												
28 11												
26 60												
7 78												W/in 8' of Platform Base (914 mm)
0 54												10760 W total Helo Hq pwr 60 hz

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED W
Receiver R-1843/WRN-5	423 A1	1	400								150 667	13 330	19 482	30 762	40
Pre Amp AM-6603/WRN-5	A2	1									13 58	13 330	10 254	5 127	
Remote Display IP-1154/U	A3	1	20								5 22	5 127	5 127	11 279	2
Headset H3/ARR-3	A4	1									1 4				
Antenna CA-3086	A5	1								02 LVL	20 89	46 1168	6.5 165	DIA DIA	
Omega AN/SPN-17	B														
Receiver/Computer OR-133 (V)/URN	B1	1								CHART ROOM	68 302	12 305	14 356	24 607	
Antenna AS-2960/SRN-17	B2	1									9 40	126 3200	6 152	6 152	
Control Indicator C-9462/SRN-17	B3	1									17 76	14 356	10 254	9 229	
Interconnecting GP ON-128/WRN	B4	1				415					33 147	10 254	9 229	11 279	3
Test Set TS-3389/URN	B5	1									40 178	14 356	19 483	11 279	8
Echo Sounding System AN/UQN-4	424 A														
Indicator Display ID-1566/UQN-4	A1	3	100								21 93	7 179	10 254	17 432	2
Transmitter/Receiver RT-888/UQN-4	A2	1	230								195 867	29 737	24 610	20 508	
Transducer	A3	1									131 583	8 203	15 381	DIA DIA	

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
30 762	400											
5 127												
11 279	20											
DIA DIA												Studs out to 13" (330 mm) diameter 38.25 (972 mm) max base dia
24 607												Powered via ON-128
6 152												
9 229												Powered via ON-128
11 279	330											
11 279	85											Powered via ON-128 420W 60Hz 415W 400Hz Total
17 432	20											
20 508	75											
DIA DIA												530 W 60Hz

INSTALLATION DATA / EQUIPMENT	SUBSYS NO	QUANTITY	ELECTRICAL POWER (W)							LOCATION	WEIGHT lb (kg)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible] Nav System	[illegible]													
[illegible]	1	2								93' 6" (28.5 m) FL[illegible]	5 / [illegible]	3.5 / [illegible]	15 / 391	15 / 391
Anemometer	2	2	[illegible]			[illegible]				93' 6" (28.5 m) FL[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3	1					[illegible]			[illegible]	[illegible] / [illegible]			
Air Compressor AN/[illegible]	4	1	[illegible]							[illegible]	220 / [illegible]	20 / 508	[illegible] / 159	24 / 610
CAS Compressor AN/[illegible]	5	1	[illegible]							[illegible]	220 / [illegible]	20 / 229	15 / 4[illegible]	24 / 610
CA Radar AN/APS-116	6						[illegible]							
Transmitter T-1300 APS-116	6.1	1								RFR	68 / 747	13 / 229	22 / 559	21 / 533
Power Supply PP-6833	6.2	1								RFR	44 / 19[illegible]	9 / 2[illegible]	12 / 3[illegible]	19 / 483
RCVR [illegible] R-1700	6.3	1								RFR	45 / [illegible]	11 / [illegible]	13 / 330	[illegible]
Sync [illegible]	6.4	1								RFR	32 / 1[illegible]	[illegible] / 2[illegible]	10 / 224	17 / 132
Digital Video Proc	6.5	1								RFR	150 / [illegible]			
Antenna AS-2719	6.6	1								93' 6" (28.5 m) FL[illegible]	52 / 249	49 / 1245	49 / 1245	37 / 148
Control Set	6.7	1								[illegible] / [illegible]	75 / 341			
NAV Signal Conv SWBD	7	1								[illegible]	150 / [illegible]			
EM Log (Space & Wt)	8	1								[illegible]	221 / 983			
LLL TS (Space & Wt)	9	1								[illegible] / TOPSIDE	4[illegible] / 1779			
Syn Map Storage Unit	10	1								[illegible]	30 / 133			

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
5 81												1 Radar (W 3 Probes) 28 VDC 50 Watts ea.
4 56	217											2 Sensors on 95 PCT
	300											
24 610	1000											
4 10	1000											
1 33	3495											
9 83	365											
6 06	149											
7 37	155											
												To be Developed
7 40												To be Developed

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Integrated C/D Unit	426 11									CR	30 133			
Radar Beacon (Space & Weight)	12									CR	40 178			
NAV/CAS Control/Display Panel D/p Ship Cont Console	13										100 445			
Ship Water Speed Sensor SR301(M)	14													

				COOLING WATER					HYDR		AIR		
WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	^oC	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED (AIR) W
Inertial Nav System Gyro Type II (Space & Wt.)	427 A1	1					500			CHART RM	280 1245				300
Telephone Systems	432 A														
System Center Equipment	A1	1								SHIP ENTERTAINMENT ROOM	558 2482	[illegible] 1778	24 610	27 686	
Dial Terminal Non W/T	A2	129								DIST	15 67	13 330	13 330	7 178	
Loud Speaker Ext	A3	29	25							DIST	10 45	12 305	10 254	8 203	
Handset	A4	90								DIST	1 4.5	11 279	4 102	5 127	
Headset	A5	80								DIST					
Speaker Phone (2-way)	A6	10								DIST					
Loudspeaker (1-way)	A7	10								DIST					
Extensions	A8	10								DIST					

HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
		TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES
00											
											With Holder

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Announcing Systems	433 A													
Ampl OSC AN/S1A-123	A1	1	860							SHIP ENTERTAINMENT ROOM	270 1201	51 1295	20 508	13 330
Microphone Cont	A2	2									15 67	12 305	10 254	6 152
Loudspeaker LS-305/SIC	A3	90									7 31			
Loudspeaker LS-387/STC	A4	24									30 133			
Entertainment and Training Systems	434 A													
T.V. Entertainment	A1													
Control Site 1-1	A1.1	1	2000							SHIP ENTERTAINMENT ROOM	1300 5782	70 1778	44 1118	23 584
Uniplexor Site 1 - 3	A1.2	1									600 2669	60 1524	59 1499	22 559
Color TV Rcvr	A1.3	5									90 400	22 559	25 635	21 533
VHF Dist Net	A1.4	1									50 222			
Audio Ent.	A2													
AM Rcvr	A2.1	1								SHIP ENTERTAINMENT ROOM	50 222			
System AN/SIN-7	A2.2	1	1100								415 1846	66 1676	21 533	14 356
Loudspeaker LS-444/WIH	A2.3	25									15 67	14 356	14 356	8 203

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
n m)	W	W		gpm (cm^3/s)	psi (kPa)	^{o}C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES
3 30												
6 ?2												
3 34												
2 59												
1 33												
4 56												
3 33												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	…
Alarm, Safety & Warning System	436 A													
Indic, Order & Metering System	437 A													
Integ Cont System	438 A													
Recording & TV System	439 A													
An/UNQ-8 Recorder	A1										400 1779			

...	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
n)	W	W		gpm (cm3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm3/s	psi (kPa)	ft3/min m3/s	NOTES
												Ship Control System
												↓

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)
Radio Systems HF XCVR GP	441 A									RADIO XMTR RM			
HF Radio Set AN/URC-81	A1	5				300	3000			RADIO XMTR RM	140 623		
HF Radio Set Cont C-9058/URC	A2	8								2 RADIO XMTR RM 4 COMM	75 334		
RF SW Unit SA-1070/UR	A3	1								RADIO XMTR RM	130 578		
XMTR Matrix Cont C-4787/SRA-34	A4	1								RADIO XMTR RM	60 267		
XMTR Temp Alarm	A5	1								COMM	2 9		
Dummy Load DA-242A/U	A6	1								RADIO XMTR RM	35 156	11 279	7 178
Coupler Adapter MX-4845/SR	A7	1								RADIO XMTR RM	75 334		
Broad Band Antenna 2-4MH$_2$	A8	1								01 LVL	120 534	35 10.7	ft m
Broadband Ant 4-10MHZ	A9	1								01 LVL	120 534	35 10.7	ft m
Broadband Ant 10-30MHZ	A10	1								01 LVL	120 534	35 10.7	ft m
Cabinet CY-( )	A11	2								RADIO XMTR RM	275 1223		
Multicoupler 2-6MH$_2$ CU-1179	A12	1									75 334		
Multicoupler 4-12MH$_2$ CU-1180	A13	1								RADIO XMTR RM	75 334		
Multicoupler 10-30MHz CU-1181	A14	1									75 334		

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	^{o}C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
	2300											
	19											2 Local 4 Remote
	400											
25 635	2500											
	35											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W							LOCATION	WEIGHT	HEIGHT	WIDTH	DEPTH
			115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE		lbs (N)	in (mm)	in (mm)	in (mm)
HF Radio KCVR GP	B						2400			RADIO XMTR RM				
HF RCVR AN/URR-67	B1	4								↓	75 334			
RCVR Multiplxr Collins 512J2	B2	1								↓	39 175			
Term Box J-3152/SRC	B3	1								↓	50 222			
Ant Whip AS-2537A/SR	B4	2								↓	120 534			
Local Cont Unit C-9058/URC	B5	5								1 RADIO XMTR RM 4 COMM	4 18			
Filter LP-101C	B6	4								RADIO XMTR RM	275 1223			
Eqpt CAB CY-( ) 651-S	B7	1								↓				
651-5	B8	1								↓				
UHF Radio XCVR GP	C													
UHF XCVR AN/URC-82	C1	6					600			RADIO XMTR RM	50 222			
Local Cont Unit C-9059/URC	C2	9								1 R XMTR RM 4 COMM 4 CIC 1 PH	75 334			
Remote XFR SWBD SB-1039/SRI	C3	1								RADIO XMTR RM	19 85			
Bandpass Filter F-1332/UR	C4	6				150				↓	24 107	18 457	4 102	21 533
UHF Multicplr TD-1046/URC	C5	2								↓	150 667			
UHF Antenna AS-1735/SRC	C6	2								BELOW 108.5 ft 33.1 m PLATF	25 111	28 711	30 762	30 762
Eqpt CAB CY-11	C7	3								RADIO XMTR RM	275 1223			

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
		1000	1000	FW	1.5 94.6								
													1 Local 4 Remote
		600											
		28											Helo Comt Sta - 1
4 02	21 533	150											
30 762	30 762												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)
UHF LOS/SATCOM XCVR Group	D												
UHF LOS/SATCOM XCVR RT-1107/WSC-3	D1	1	1500							RADIO XMTR RM	148 658		
Control Indic. C-9351/WSC-3	D2	1								COMM	3 13	6 152	8 203
XCVR SW SA-1712/UR	D3	1								RADIO XMTR RM	4 18		
RF SW Unit SA-2000/WSC	D4	1			396					RADIO XMTR RM	130 578		
Ant Control C-3597/WSC-1	D5	1				3				RADIO XMTR RM	18 80		
Ampl Filter AS-6691/WSC-1	D6	2								02 LVL	125 556	23 584	15 381
Antenna AS-1018/URC (Mod)	D7	1								93'-6" PLTF 208.5 m	50 222	73 1854	14 356
Antenna AS-3018/WSC-1	D8	2	250							02 LVL	325 1445	54 1372	50 1270
Interconnect Group ON-143(V)/USQ	D9	1	265							COMM	60 267		
Recorder - Repro RD-396/U	D10	1	265							COMM	41 182		
Recorder - Repro RD-397/U	D11	1								COMM	41 182		
Control Panel	D12	1								COMM	75 334		
Equipment Cabinet	D13	1								RTR	275 1223		
Computer AN/UYK-20	D14	1	1000							COMM	220 979		

HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
		TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
1100											
40											
396											
3											
250											
265											
265											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
UHF SATCOM BCST RCVRGP	E													
Comb - Modulator MD - 900/SSR-1	E1	1	65							COMM	84 373			
RF AMP AM-6334-SSR-1	E2	4								02 LVL	12 53	8 203	12 305	9 229
Antenna AS-2815/SSR-1	E3	4								02 LVL	13 58	36 914	31 787	31 787
Demultiplexer TD-1063/SSR-1	E4	1	24							COMM	72 320			
Fault Alarm IC/BSIA	E5	1									8 36			
UHF Tel Data Gp (Helo)	F													
Telem Rcvr R-1893/SKR-3A	F1	1	1100							RADIO XMTR RM	465 2068	36 914	24 610	27 686
Ampl AM-6663/SKR-3A	F2	1								COMM	2 9	2 51	5 127	3 76
Monitor Panel ID-1949/SKR-3A	F3	1								COMM	6 27	8 203	6 152	22 559
Demod MD-912/SKR-3A	F4	1								RADIO XMTR RM	350 1557	36 914	24 610	27 686
Test Set TS-3335/SKR-3A	F5	1	100							RADIO XMTR RM	15 67	19 483	12 305	12 305
RF AMPL AM 64 93/SKR3	F6	1								MAST	14 62			
Antenna AS-2743/SKR-3A	F7	1									3 13	19 483	3 DIA 76	
Test Antenna AS-2893/SKR-3A	F8	1									3 13	19 483	3 DIA 76	
Patch Panel Matrix SB-3721/SKR-3A	F9	1	1050							RTR	450 2002	79 2007	48 1219	8 203
Patch Panel Matrix SB-3720/SKR-3A	F10	1								RTR	20 89	11 279	10 254	10 254

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER TYPE	COOLING WATER FLOW	COOLING WATER PRESSURE	COOLING WATER TEMP IN	COOLING WATER HXDP	HYDR PRESSURE	HYDR FLOW	AIR PRESSURE	AIR VOLUME/FLOW	NOTES
in (mm)	W	W		gpm (cm3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm3/s	psi (kPa)	ft3/min m3/s	
	65											
9 29												
1 87												
	24											
27 186	1100											
3 6												
2 59												
27 86												
12 05												
3 03	1050											
0 54												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
VHF Bridge-to-Bridge Group	G													
Transceiver, VHF AN/URC-80	G1	1				50				PILOT HOUSE	30 133	6 152	9 229	18 457
Control C-8980/URC	G2	1								PILOT HOUSE	3 13			
Antenna AS-2809/SRC	G3	2									7 31			
Transceiver, VHF AN/URC-86	G4	1				50				PILOT HOUSE	40 178			
Wideband Secure Voice Group	H													
Secure Voice SW SA-2112(V)/STQ	H1	1								COMM	60 267	12 305	19 483	12 30[illegible]
Ampl Speaker AN-4453/U	H2	6								1 COMM 3 CIC 1 PH 1 HCS	21 93	8 203	13 330	9 22[illegible]
Sec Tel Set TA-840/U	H3	6								1 COMM 3 CIC 1 PH 1 HCS	4 18			
Plain Cipher SW SA-1711/UR	H4	2								COMM	4 18			
Interconnect Box J-2910/UR	H5	2								COMM	2 9			
RCS Remote Channel Sel	H6	10								COMM				
Analog - Digital Model CV-3333	H7	1												
Signal Conditioning	J													
Telegraph Signal Converter CV-2460/SGC	J1	2	20 40							COMM	25 111			
Telegraph Conv/Comparator AN/URA-170	J2	1	70							COMM	65 289			
Telegraph Mux Terminal AN/UCC-1D(V)	J3	1	154							COMM	144 641			
Telegraph MUX Terminal AN/UCC-1D T/R	J4	1	154							COMM	144 641			

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	^oC	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES
18 457	50											
12 305												
9 229												
	60											
	70											
	154											
	154											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Miscellaneous	K													
XMTR XFR SWBD SB-2744/SRT(Mod)	K1	3								COMM	74 329			
Rcvr XFR SWBD SB-2727/SRR	K2	3								COMM	44 196			
Low Level DC XFR SWBD SB-2727/SRR/Mod)	K3	3								COMM	44 196			
Low Level Power Supply (±6VDC) OP-94S	K4	3								COMM	75 334			
Low Level Power Dist PNI	K5	3								COMM	50 222			
XFR SWBD SB-3195/U	K6	1								COMM	11 49			
XFR SWBD SB-1039	K7	1								COMM	19 85			
Freq Std Amecon, CTFS	K8	1				15				COMM	23 102			
RF Dist Amp 1 AM-2123A/U	K9	1				100				COMM	16 71			
Alarm, Freq Std	K10	1								COMM	3 13			
Guard Rcvr	K11	1								COMM	100 445			
Antenna CA-1128-1	K12	1									120 534			
Audio Ampl/Spkr AM-4453/U	K13	3								COMM	21 93			
Time Stamp NA-18BG	K14	1								COMM	2 9			
Duplicator E-141U	K15	1								COMM	60 267			
AM Ampl AM-6694/SR	K16	1								COMM	30 133			

			COOLING WATER					HYDR		AIR		
DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	NOTES
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
												KG-14
												KWX-11
	15											
	30											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Eqpt Cabinet	K17	10								COMM	275 1223			
CW Keyer SB-315/U	K18	1								COMM				
Radio Relay Cont C-4621/SR	K19	1								COMM	6 27			
Switch SA-734/SG	K20	3								COMM	4 18			
Indicator ID-866/SG	K21	3												
Antenna AS-3025/SRG	K22	1												
MF RCVR GP	L													
LF/MF RCVR AN/WRR-3B	L1	1	60							RADIO XMTR RM	70 311			
Antenna Group AN/SQA-17D	L2	1									50 222			
Filter AN/SRA-12B	L3	1												

	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
m)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	$^\circ$C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
		55											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Underwater Systems	442													
UW Tel GP AN/WQL-2	A													
Rcvr - XMTR RT-876/WQC-2	A1	1	3450							SONAR	345 1535	59 1499	19 483	21 533
Comm Set C-7440/WQC-2	A2	1								CIC	10 45	8 203	14 356	10 254
Comm Set C-7441/WQC-2	A3	1								PILOT HSE	6 27	8 203	9 229	8 203
XDCR TR-232/WQC-2	A4	1								SIDE WALL	440 1957	13 330	22 559	DIA DIA
XDCR TR-233/WQC-2	A5	1								SIDE WALL	100 445	18 457	12 305	DIA DIA
Visual & Audible Gp	443													
Signal Flags	A	1								02 LVL	150 667			
Whistle	B	1								PILOT HSE	50 222			
Signal Search Lights (12")	C	2								02 LVL	25 111			
Teletype Eqt	445 A													
Teleprinter TT-624/UG	A1	1	350							COMM	265 1179			
Teletype Set AN/UGC-48A	A2	3	240								267 1188	39 991	36 914	24 610
Teletype Set AN/UGC-77	A3	1	80								52 231			
PAGE PRINTER AN/UGR-9	A4	2	120								40 178	10 254	17 432	12 305
PAGEPRINTER SET AN/UGR-10	A5	1	375								576 2562	72 1829	22 559	28 711
PERFORATOR TI-605/UG	A6	1	27								46 205	11 279	17 432	12 305

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER TYPE	COOLING WATER FLOW	COOLING WATER PRESSURE	COOLING WATER TEMP IN	COOLING WATER HXDP	HYDR PRESSURE	HYDR FLOW	AIR PRESSURE	AIR VOLUME/FLOW	NOTES
in (mm)	in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
9 33	21 533												
4 56	10 254												Powered FM RT-876
 29	8 203												Powered FM RT-876
2 59	DIA DIA												
2 35	DIA DIA												
		350											
 4	24 610	240											
		80											
 2	12 305	80											
 9	28 711	264											
 2	12 305	80											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W							LOCATION	WEIGHT	HEIGHT	WIDTH	DEPTH
			115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE		lbs (N)	in (mm)	in (mm)	in (mm)
Security Equipment TSEC/KG-36-4	446 A1	1								COMM	27 120			
TSEC/KY-8										COMM	73 352			
KYB-G/TSEC	A2	2								COMM	36 160			
HYP-2/TSEC P.S.	A3	2	130							COMM	37 165			
TSEC/KWR-37	A4	2	320							COMM	149 663			
TSEC/KG-14	A5	4	100							COMM	130 578			
TSEC/KW-7	A6	4	85							COMM	74 329			
Plant Adapter KWX-11/TSEC	A7	4								COMM	20 89			
Remote Fltn KWX-8/TSEC	A8	3								COMM	3 13	5 127	7 178	6 152
TSEC/KL-47	A9	1	200							COMM	30 133			
TSEC/HL-1B	A10	1	350							COMM	50 222			
Security Equipment TSEC/KG-40	A11	1				60				CIC	37 165	10 254	9 229	22 559
Remote Control KGX-40/TSEC	A12	1								CIC	4 18	5 127	6 152	8 203
Security Equipment OK-313(V)SC CSS	A13	1								COMM				
Type 8 Safe	A14	1								COMM	175 778			
Int Comp KIR-1A/TSEC	A15	2												
Trans Comp KIT-1A/TSEC	A16	1												
Crypto Key KIK-18/TSEC	A17	1												

WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED (AIR) W	HEAT DISSIPATED (WATER) W	COOLING WATER TYPE	COOLING WATER FLOW gpm (cm^3/s)	COOLING WATER PRESSURE psi (kPa)	COOLING WATER TEMP IN °C	COOLING WATER HXDP psig (kPa)	HYDR PRESSURE psi (kPa)	HYDR FLOW gpm cm^3/s	AIR PRESSURE psi (kPa)	AIR VOLUME/FLOW ft^3/min m^3/s	NOTES
		36											
		400											26.5 VDC FM HYP-2 80 Watts Ea.
		320											
		100											
		85											
7 178	6 152												
		150											
		350											
9 229	22 559												
6 152	8 203	60											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH In (mm)	DEPTH in (mm)	HEAT DISSIPATED W
Surveillance System (Surface)	450														
Surf Search Radar AN/SPS-55	451														
Antenna Assembly OE-172/SPS-55	1	1								83'-6"(25.5m) PLTF	195 867	27 686	78 1981	18 457	
Antenna AS-2953/SPS-55	1.1	1								83'-6"(25.5m) PLTF	195 867				
Antenna Pedestal AB-124/SPS-55	1.2	1								83'-6"(25.5m PLTF	195 867				
RADAR SET CONTROL C-9447/SPS-55	2	1								CIC	25 111	16 406	19 483	7 178	3
Rcvr - Transmitter 1124/SPS-55	3	1	1150							RADAR EQPT RM	560 5491	73 1854	29 737	26 660	51
Safety SW SA-1963/SPS-55	4	1								83'-6'(25.5m) PLTF	5 22	7 178	7 178	5 127	
Sync. Amp MK 27-8	5	1								RADAR EQPT RM	65 289	15 381	20 508	10 254	3
Air Search Radar AN/APA-171	452						28Kw				6000 26.7	TOTAL kN	WT		6
Antenna Group AN/APA-171	1	1								POLE MAST	3800 16.9kN	10.7 3.3m	24.5 7.5m	DIA	
Radar Set AN/APA-125	2	1								RADAR EQPT Rm					
Radar Control Panel	3	1								CIC	7.5 33	11 279	6 152	6 152	
Perf Monit AN/ASM-440	4	1								RADAR EQPT Rm					
Liquid Cooling Hx	5	1								RADAR EQPT Rm					
Electric Cooling Subsystem	6	1								RADAR EQPT Rm					

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES
8 57												
7 18	30											
6 60	513											VA. 95 p.f. 10A. Radiate 5A. Stby 2A. Off
5 27												
0 54	35											
	6197	20 K										
4												
2												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	
Ident Syst (IFF)	455														
Interrogator AN/UPX-25(V)	1	2	850							EER	500 2224	63 1600	23 584	27 686	s
Transponder AN/UPX-28(V)	2	1	300							EER	99 440	15 381	15 381	19 483	2
Antenna AS-177B/UPX	3	4								93'-6" (28.5m) PLTF	7 31	20 508	7 179	7 179	
Test Set AN/UPM-137A	4	1	285							EER	190 845	23 584	32 813	22 559	2
Control Monitor C-8430/UPX	5	2	17 34							EER	12 53	8 203	10 254	8 203	1
Decoder Group AN/UPA-59A (V)	6	3	75							CIC	32 142				
Video Decoder KY-761(P)/UPA-59A(V)	6.1	3	75							CIC	32 142	12 305	6 152	17 432	
Intra-Target Data Ind. ID-1844/UPA-59A(V)	6.2	3	75							CIC	32 142				
Alarm Monitor BZ-173/UPA-59A(V)	6.3	3	75							CIC	32 142	7 178	5 127	3 76	
Cabinet CY-6816/APX-72	7	1								EER		10 254	8 203	7 178	
XMTR Set Cont C-6280/APX	7.1	1								EER	8 36				

HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
		TYPE	FLOW	PRESSURE	[illegible]	[illegible]	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W	W		gpm (cm³/s)	psi (kPa)	[illegible]	[illegible]	[illegible]	[illegible]	psi (kPa)	ft³/min m³/s	
[illegible]											VA 60 or 400
[illegible]											500 VA Start 300 VA SS 60 or 400 Hz
											No Power
[illegible]											VA
[illegible]											
											P/O KY 761
											No Power
											P/O CY-6816 2544W60 or 400 Hz

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Passive Sonar	462													
Tactical Towed Array Sonar	Δ													
Winch, Array, Cable	Δ1	1								ETAS RM	15570 69.3kN	86 2184	96 2438	80 2032
Levelwind, Fairlead, Bellows	Δ2	1								ETAS RM	1300 5782	12 305	96 2438	24 610
Winch, Hydraulic Power	Δ3	1			22K					ETAS RM	1700 7562	36 914	24 610	60 1524
Winch Control	Δ4	1								ETAS CONTROL RM	1000 4448	48 1219	24 610	24 610
Module Fill Station	Δ5	1								ETAS RM	300 1334	30 762	24 610	18 457
Storage Trough	Δ6	1								ETAS RM	600 2669		7 178	480 12192
Transformer 60Hz	Δ7	3	50							ETAS RM	110 489	17 432	9 229	8 203
Power Dist Cab	Δ8	1	270							ETAS RM	175 778	36 914	24 610	6 152
Input Signal Conditioner (ISC)	Δ9	1								EER	600 2669		26 660	23 584
Advanced Signal Processor (ASP)	Δ10	1								EER	214 952	57 1448	21 533	18 457
Acoustic Computer AN/UYQ-L	Δ11	1								EER	220 979	20 508	19 483	31 787
Display Console AN/UYQ-L	Δ12	1				4300				CIC	950 4226	61 1549	29 737	40 1016
Data Convecter AN/UYQ-L	Δ13	1				4300				EER	950 4226	72 1829	26 660	23 584
Transformer 400 Hz	Δ14	3				218 654				TACTASS RM	30 130	6 152	8 203	7 178
Acoustic Sensor Data Dist SWBD	Δ15	1												

HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
		TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
											208V3Ø WYE Type I 60 Hz 3500 W

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Active Passive Sonar	463													
Active Dipping Sonar 13-D-AN/AQS-12D	Δ													
Rcvr Indic Assy Rcvr R-1695/AQS-13B ndic IP-1045/AQS-13B	Δ1	1				25				CIC	79 351	25 635	14 356	23 584
Multiplex Processor Assembly	Δ2	1								SONAR	43 191	8 203	9 227	23 584
Bearing & Rge Indic Assembly ID-1751/AWS-13	Δ3	1								CIC	2 9			
Recorder Assembly RO-358/AQS-13A	Δ4	1								CIC	33 147	17 432	9 227	13 330
Dome Control Assembly	Δ5	1								SONAR	5 22	5 127	5 127	7 178
Launch, Reel & Cable Assembly	Δ6	1					4500			SONAR	213 947	36 914	44 1118	26 660
Transducer Assembly	Δ7	1					1000			SONAR	201 894	48 1219	15 381	DIA
XDCR HSG & Funnel Assembly	Δ8	1								SONAR	41 182			
XDCR Cable Attitude Ind.	Δ9	1												
APRAPS (Space & Weight)	B	1								SONAR/ CIC	9375 41.7 kN			

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER TYPE	COOLING WATER FLOW	COOLING WATER PRESSURE	COOLING WATER TEMP IN	COOLING WATER HXDP	HYDR PRESSURE	HYDR FLOW	AIR PRESSURE	AIR VOLUME/FLOW	NOTES
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
23 584	135											
23 584												28vdc 10a
	9								-			Contains RS & Beam Forming Network
13 330	108											
7 178												
26 660	4500											B/U dc Motor for Winch 80a, 28vdc 12 757cm$^{3/5}$ gpm 2550 19.6MPa psig motor for winch
DIA												
												5525W 400 Hz

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-1Ø-60Hz	115V-3Ø-60Hz	450V-3Ø-60Hz	115V-1Ø-400Hz	115V-3Ø-400Hz	DC	TYPE	LOCATION	WEIGHT lb (kg)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
Classification Sonar	4-4													
AASF Sonar [illegible] AN/[illegible] [illegible]	A	1	[illegible]											
Remote Unit	A 1	1								[illegible]	254 (112)	[illegible]	[illegible]	[illegible]
Display Unit	[illegible]	1								[illegible]	254 (112)	[illegible]	[illegible]	[illegible]
Bathythermograph (BT)	466													
BT AN/[illegible]	A													
Launcher MK [illegible]	A 1	1								[illegible]	[illegible]	[illegible]	[illegible]	
Recorder [illegible]	A 2	1	[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DEPTH in (mm)	HEAT DISSIPATED (AIR) W	HEAT DISSIPATED (WATER) W	COOLING WATER TYPE	COOLING WATER FLOW gpm (cm^3/s)	COOLING WATER PRESSURE psi (kPa)	COOLING WATER TEMP IN °C	COOLING WATER HXDP psig (kPa)	HYDR PRESSURE psi (kPa)	HYDR FLOW gpm cm^3/s	AIR PRESSURE psi (kPa)	AIR VOLUME/FLOW ft^3/min m^3/s	NOTES
21 (533)	1280											
36 (914)	1280											
15 (381)	35											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
PASSIVE ECM DESIGN-TO-PRICE WARFARE SYSTEM AN/SLQ-31V(2)	472 A													
RF ANTENNA/RECEIVER SUBSYSTEM (MID/HIGH BAND)	A1	1	1200				8600			DIST	3045 13.5*			
RF ANTENNA/RECEIVER SUBSYSTEM (LOW BAND)	A2	1												
IR SENSOR SUBSYSTEM	A3	1												
AUTO SIGNAL PROCESSOR	A4	1								RER				
COMPUTER AN/UYK-20	A5	1								RER				
GRAPHIC DISPLAY UNIT WITH OPERATOR CONTROL	A6	1								CIC				
OFF BOARD DECOY LAUNCHER	A7	2												
BLANKER AN/SLA-10	B	1	170							RER				
BLANKER - VIDEO MIXER MX-7544	B1	1												
BLANKING DISABLE CONTROL C-7132	B2	1												
RADIO FREQUENCY SWITCH SA-1512 (60 MC)	B3	1												
RADIO FREQUENCY SWITCH SA-1513 (160 MC)	B4	1												

* kN

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	^oC	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
	6700		DW	0.8 50.7								

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED W
FIRE CONTROL SYSTEM (NON-SONAR DATA BASE)	482														
FCS MK92-3	A														
COMBINED ANTENNA SYSTEM MK53/I	A1	1	300		4000						1650 7339	131 3327	96 2438	DIA DIA	
MAN ALOFT SWITCH MK142/0	A2	1									5 22	–	7 178	8 203	
WAVE GUIDE DRYER MK13 MOD 0	A3	1	1350							RPR	175 778	25 635	28 711	28 711	13
RADAR XMTR T-1085/SPG-51D	A4	1	600					50V 30V	DC AC	RPR	1150 5115	78 1981	45 1143	33 838	12
POWER SUPPLY CONTROL C-7714/SPG-51D	A5	1	800					50V 130V	DC AC	RPR	925 4114	78 1981	31 787	28 711	4
RADIO FREQUENCY AMPLIFIER (CAS) MK167/0	A6	1	250				4200			RPR	940 4181	66 1676	36 914	32 813	
RADAR RECEIVER - XMTR (CAS) MK69/I	A7	1	300				5000			RPR	1100 4893	66 1676	36 914	32 813	
RADAR TEST SET MK574/0	A8	1	400							RPR	100 445	18 457	22 559	12 305	14
SERVO CONT' CAB' MK160/I	A9	1	700				1800			RPR	2000 8896	77 1956	66 1676	29 737	3
WEAPON CONTROL CONSOLE (CAS) MK106/I	A10	1	900				1800			CIC	1200 5338	20 508	46 1168	45 1143	17
GAS REGULATOR MK21/0	A11	1								RPR	77 342	22 559	21 533	16 406	
WAVE GUIDE SW NAVIGATION SWITCH AND DUMMY LOAD MK143/0	A12	1								RPR	75 334	9 229	7 178	15 381	
CHANNEL SET SWITCH MK4/I	A13	1	800							EER	85 378	36 914	26 660	14 356	[illegible]
COMPUTER AN/UYK-7(V)	A14	1					2700			DPC	535 2380	41 1041	20 508	23 584	[illegible]
COMPUTER CONTROL C-8542/UYK-7(V)	A15	1					3			DPC	5 22	6 152	7 178	7 178	
TEST SET TS-2940/UYK-7(V)	A16	1					16			DPC	35 156	19 483	19 483	6 152	
I/O COMS (DEAC) OJ-172/UYK-7(V)	A17	1	486				1900			DPC	470 4315	63 1600	30 762	34 864	[illegible]

	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
m)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
A A										3.0 20.7	.510	
6 03												
28 11	1350											
33 38	1200	23500	DW	5.5 347.0	115 793	30						
28 11	4400											CROSS FIELD AMPLIFIER
32 13		4000	CW	3.1 195.6	150 1034	10				3.0 20.7	.015	
32 13		3200	CW	2.5 157.7	150 1034	10				3.0 20.7	.015	RADAR CABINET
12 05	140											
29 37	3600											
45 143	1700											
16 06												
15 381		1000	CW	1.0 63.1	150 1034	10						
14 356	640											
23 384	2290											
7 78	3											
6 52	16											
34 364	2386											

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
STIR (SPACE & WEIGHT)	B													
RADAR ANTENNA MK54/0	B1	1					360				4060 18100			
SAFETY SWITCH MK142/0	B2	1									5 22			
WAVEGUIDE DRYER MK13/0	B3	1	1000								165 734			
WAVEGUIDE SWITCH ASSEMBLY MK143/0	B4	1									25 111			
RADIO FREQUENCY AMPL. MK168/0	B5	1	900				4200				1100 4893			
RADAR XMTR T-1085/SPG-51D	B6	1	600					50vdc 130			1150 5115			
POWER SUPPLY CONTROL C-7714/SPG-51D	B7	1	800					50vdc 130	II		925 4114			
RADAR XMTR MK86/0	B8	1	300				3200				1100 4893			
RADAR TEST SET MK574/0	B9	1	400								100 445			
ANTENNA CONTROL MK161/0	B10	1					1140		I		500 2224			
STIR WCC MK107	B11	1	900				1800				1250 5560			
GAS REG MK21/0	B12	1									100 445			
HARPOON FCS	C													
HARPOON WCC	C1	1					2900	28vdc 115		CIC	600 2669	54 1372	20 508	39 99
LAUNCHER SWU	C2	1	150							EER	220 979	15 381	30 762	18 45
MISSILE SIM AN/DSM-13(XN-1)	C3	1								EER	66 294	16 406	22 559	1 4
HARPOON ENGAGEMENT COURSE INDICATOR	C4	1								PH	20 89			

WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED (AIR) W	HEAT DISSIPATED (WATER) W	COOLING WATER TYPE	COOLING WATER FLOW gpm (cm³/s)	COOLING WATER PRESSURE psi (kPa)	COOLING WATER TEMP IN °C	COOLING WATER HXDP psig (kPa)	HYDR PRESSURE psi (kPa)	HYDR FLOW gpm cm³/s	AIR PRESSURE psi (kPa)	AIR VOLUME/FLOW ft³/min m³/s	NOTES
											5.5 38.4	.060	
		500											
			1000	CW	1.0 63.1	100 689							
			4000	CW	3.1 195.6	100 689					3.0 20.7	.015	
		1200	25000	DW	5.5 347.0	115 793							
		4400											
			3200	CW	2.5 157.7	100 689					3.0 20.7	.015	
		140											
		2300											
		1700											
20 508	39 991	2900											
30 762	18 457	150											
22 559	16 406												

1.

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W							LOCATION	WEIGHT	HEIGHT	WIDTH	DEPTH	HEAT DISSIPATED
			115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE		lbs (N)	in (mm)	in (mm)	in (mm)	
FCS (SONAR DATA BASE)	483														
TORPEDO FC PANEL MK309	△	1	1760								300 1334				17
MK48 WFCS (SPACE & WEIGHT)	B	1													
MK81 CONSOLE	B1	1													
FIRING PANEL	B2	1													
MK82 CONSOLE	B3	1													
MK140 CONSOLE	B4	1													
MK22 WEAPON SIM.	B5	1													

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
		1700											
													SPACE & WEIGHT

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W							LOCATION	WEIGHT	HEIGHT	WIDTH	DEPTH
			115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE		lbs (N)	in (mm)	in (mm)	in (mm)
ELECTRONIC TEST MONITORING & CHECKOUT EQUIPMENT	491										200 891			
FLIGHT CONTROL & INSTALLATION LANDING SYSTEM	492													
AN/SRN-( ) TACAN	Δ	1												
ANTENNA	Δ1	1									100 445	10 254	52 1320	ø14
TRANSPONDER	Δ2	1	2000								500 2224	66 1676	22 559	26 66
ANTENNA CONTROL	Δ3	1									100 445	21 534	19 483	12 30
STATUS INDICATOR	Δ4	1									10 46	8 203	10 254	8 20
COMMAN[illegible] & SURVEILLANCE OPERATING FLUIDS	498										25 111			
COMMAND & SURVEILLANCE REPAIR PARTS & TOOLS	499										1000 4448			

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
2 20	014												
2 9	26 660	2000											
9 3	12 305												
0 4	8 203												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
LAUNCHING DEVICES	721													
VERTICAL MISSILE LAUNCHER	A													
LAUNCHER CANISTER	A1	8								VERT MISL TRUNK	1150 5115	200 5080	31 787	30 762
BLAST DEFLECTOR	A2	8								VERT MISL ROOM	850 3781			
MISSILE/LAUNCHER SEL.	A3	1	250							ELEV EQPT ROOM	200 890	38 965	18 457	30 762
HARPOON CANISTER LAUNCHER	B						11,220							
CANISTER MK6/0	B1	8								01 LVL	443 1970			
HARNESS ASSEMBLY	B2	8								01 LVL	100 445			
LAUNCHER RELAY ASSEMBLY	B3	4								01 LVL	48 214			
SUPPORT ASSEMBLY MK140/0	B4	4								01 LVL	625 2780			
HOIST/ROTATION BEAM ASSEMBLY	B5	1												
TOOL KIT	B6	1												

DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	W	W		gpm (cm³/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm³/s	psi (kPa)	ft³/min m³/s	
30 767												
30 762	235											
												MISSILE WARMUP - 910 WATTS PER MISSILE MISSILE ELECTRIC POWER 985 WATTS PER MISSILE
												8000 WATTS 60 Hz 11,220 WATTS 400 Hz

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED W
GUNS	711														
CLOSE-IN-WEAPON SYSTEM	Δ	2													
LAUNCHING DEVICES	721														
HARPOON CANISTER LAUNCHER	Δ						11220								
LAUNCHER CANISTER MK6/0	Δ1	8								01 LVL	443 1970				
MISSILE CANISTER LAUNCHER MK140/0	Δ2	4								01 LVL	673 2993				
HOIST ROTATION BEAM ASSEMBLY	Δ3	1									25 111				
TOOL KIT	Δ4	1									25 111				
HARNESS ASSEMBLY	Δ5	8								01 LVL	100 445				
VERTICAL MISSILE LAUNCHER	B														
LAUNCH CANISTER	B1	8								LIFT FAN ROOM	1150 5115	200 5080	31 787	30 762	
BLAST DEFLECTOR	B2	8								LIFT FAN ROOM	850 3781				
MISSILE/LAUNCHER SET	B3	1	250							EER	200 890	38 965	18 457	30 762	235

HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
	TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
										MISSILE WARMUP 910 WATTS PER MISSILE
										MISSILE ELECTRIC POWER 785 WATTS PER MISSILE
										HEATER POWER 60 Ω 400 Hz
										INCLUDE 4 LAUNCHER RELAY ASSEMBLIES

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W: 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH
TORPEDO TUBES	751													
TORPEDO TUBE MK32	A	2		5700 11400						TOPSIDE	2300 10.2 kN			
TORPEDO TUBE MK25 (SPACE & WEIGHT)	B	2												

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)
TORPEDO ACCESSORIES	761 13											
PRESETTER MK437/0 TEST SET	13.1	1								HELO HANGAR	25 111	
TORPEDO STARBOARD IN CONTAINER MK31/0	13.2	2									30 133	
SUSPENSION BAND IN CARTON (SET)	13.3	2									14 62	
EXHAUST VALVE ASSEMBLY LD620105 TW88	13.4	2									1 4	
ARMING WIRING MK2/1	13.5	1									17 76	
NOSE GUARD	13.6	2									9 40	
PROP GUARD	13.7	2									2 9	
MK46 RECORD BOOK	13.8	20									1 4	
700/S AND ACCEL. SET MK46	13.9	1									25 111	
SMALL ARMS & PYRO STOWAGE	763											
PYRO MAGAZINES	1	3										

				COOLING WATER					HYDR		AIR		
	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
n)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	^{o}C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	NOTES
													I BOX - 100 PER BOX

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
AIRCRAFT WEAPONS HANDLING	782													
OVERHEAD ELECTRIC HOIST/TRACK	1	1								MK 46 TORP RM	400 1779			
MK45/I HANDLIFT TRUCK	2	2								MK 46 TORP RM	128 569	45 1143	29 737	22 559
MK24/0 HANDLING DOLLY	3	1								MK 46 TORP MAG	200 890	24 610	22 559	94 2388
MK28/I HANDLIFT TRUCK ADAPTOR	4	2								MK 46 TORP MAG	22 98	10 254	16 406	4 102
MK99/0 WEAPONS HANDLING SLING	5	1								MK 46 TORP MAG	27 120			
TORPEDO SLING MKI02/0	6	2								MK 46 TORP MAG	4 18			
TORPEDO SLING MKI06/0	7	2								MK 46 TORP MAG	1 4			
AIRCRAFT WEAPONS STOWAGE	783													
STOWAGE CHOCKS	1	40 SETS								TORP MAG	120 534			

WIDTH in (mm)	DEPTH in (mm)	HEAT DISSIPATED (AIR) W	HEAT DISSIPATED (WATER) W	COOLING WATER TYPE	COOLING WATER FLOW gpm (cm³/s)	COOLING WATER PRESSURE psi (kPa)	COOLING WATER TEMP IN °C	COOLING WATER HXDP psig (kPa)	HYDR PRESSURE psi (kPa)	HYDR FLOW gpm cm³/s	AIR PRESSURE psi (kPa)	AIR VOLUME/FLOW ft³/min m³/s	NOTES
9 37	22 559												
22 59	94 2388												
6 06	4 102												

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W 115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE	LOCATION	WEIGHT lbs (N)	HEIGHT in (mm)	WIDTH in (mm)	DEPTH in (mm)
SHIP AMMUNITION	F21													
HARPOON MISSILE RGM-84-I	A	8								01 LVL	1530 / 6800			
STANDARD MISSILE RIM-66B	B	8									1373 / 6100			
SMALL ARMS AMMUNITION	C	-								AMMO LCKR	935 / 4200			
BT PROBES DC-14/SSQ-56	D	300								TACTAS EQPT RM	2 / 10			
TORPEDO MK46-I	E	6									530 / 2357			
TORPEDO MK48	F	2									3600 / 16000			
CLOSE-IN-WEAPONS SYSTEM AMMUNITION	G										4000 / 17800			
ORDNANCE DELIVERY SYSTEM AMMUNITION	F22													
TORPEDO MK46-I	A	34									530 / 2357			
DICASS AN/SSQ-62	B	50									39 / 174			
DIFAR AN/SSQ-53	C	80									29 / 129			
ORDNANCE DELIVERY SYSTEM	F23													
HELO SH-3H	A	2									15000 / 66720			

	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
			TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
m)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	
												(SPACE & WEIGHT)
												(SPACE & WEIGHT)

INSTALLATION DATA / EQUIPMENT	SWBS NO.	QUANTITY	ELECTRICAL POWER, W							LOCATION	WEIGHT	HEIGHT	WIDTH
			115V-10-60Hz	115V-30-60Hz	450V-30-60Hz	115V-10-400Hz	115V-30-400Hz	DC	TYPE		lbs (N)	in (mm)	in (mm)
ORDNANCE DELIVERY SYSTEM SUPPORT EQUIPMENT	F26												
MISCELLANEOUS ORDNANCE & PYROS	F27												
PYROS	1										3441 15300		

WIDTH	DEPTH	HEAT DISSIPATED (AIR)	HEAT DISSIPATED (WATER)	COOLING WATER					HYDR		AIR		NOTES
				TYPE	FLOW	PRESSURE	TEMP IN	HXDP	PRESSURE	FLOW	PRESSURE	VOLUME/FLOW	
in (mm)	in (mm)	W	W		gpm (cm^3/s)	psi (kPa)	°C	psig (kPa)	psi (kPa)	gpm cm^3/s	psi (kPa)	ft^3/min m^3/s	

END