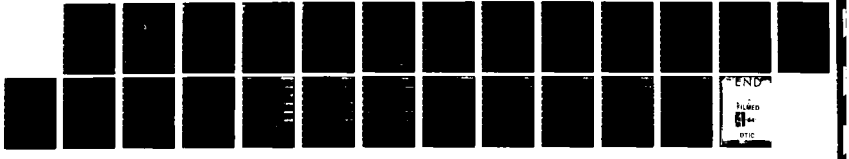
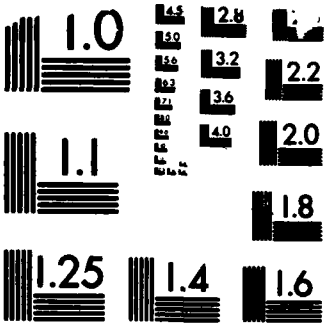
AD-A138 594 STABILITY CALCULATIONS FOR ARAPAHO FEASIBILITY DEMONSTRATION(U) HENRY (J J) CO INC ARLINGTON VA P J PIERCE 01 SEP 82 N00019-82-M-0323 1/1

UNCLASSIFIED F/G 13/10 NL





· J · J · HENRY · CO · INC ·
· NAVAL ARCHITECTS · MARINE ENGINEERS · MA

ONE CRYSTAL GATEWAY
1235 JEFFERSON DAVIS HWY.
SUITE 1305
ARLINGTON, VIRGINIA 22202
703-920-3435

File 2064 00/FYM-3.0
9/9/82

Commander
Naval Air Systems Command
Department of the Navy
Washington, D.C. 20361

N00019-82-M-0323

Attention: Mr. J. J. Mulquin
NAVAIR ADPO-15

Dear Sir:

J. J. Henry Co., Inc. (JJH) has completed a review of ARAPAHO as it would be configured for the upcoming feasibility demonstration aboard C5-S-73b (Export Leader) container ships, as requested. This review has included contact with the U.S. Coast Guard, the Maritime Administration (MARAD), the Norfolk International Terminal, and a visit to the ARAPAHO system on site at NAEC in Lakehurst, New Jersey. The Coast Guard has indicated that they will inspect the vessel at the request of MARAD, but will not issue a Certificate of Inspection. During this inspection, the requirements of Title 46 CFR, Parts 90 through 109, will be applied. They also desire a demonstration schedule, so traffic problems in the area can be avoided.

The C5-S-73b ships will be compatible with ARAPAHO for the feasibility demonstration. Visibility for the ship's officers from the navigation bridge will be adequate, as the entire ARAPAHO system will be aft of the forward house. Deck area and load capacity are sufficient for the intended application, and stability is satisfactory. Metacentric height (GM) should be approximately 8.5', compared to the minimum requirement of approximiately 4.0'. It is anticipated that the mean draft of the ship during the demonstration will be about 15'-2", with a trim of 9'-1" by the stern, which povides a trim angle of less than 1.0°. Additionally, loading of the ARAPAHO aboard this class of ship in its light condition at the Norfolk International Terminal will remain unhampered by vertical clearances at any stage of the tidal cycle. The above considerations indicate that the physical properties of the ARAPAHO/ship class combination will be acceptable for the feasibility demonstration. Seakeeping characteristics of the vessel should not be of major concern since the demonstration is going to be conducted in protected waters (the Chesapeake Bay). According to statistical meteorological data, the normal average wind speed during the month of October is on the order of 10 miles per hour. The waves associated with this wind are 1 to 2 feet high. For the size of the ship and its motion characteristics, this will not cause any significant problem. The natural period of roll was estimated at 12.0 seconds and the natural period of pitch was estimated to be on the order of 16.0 seconds. With these natural period parameters, only swells above 8 to 10 feet in height would cause significant ship's motions.

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This review has also considered supporting systems. It is advised that the plan to use two tugs for the feasibility demonstration be retained. Safety considerations dictate that both tugs remain in constant radio contact with the pilot and master on the demonstration ship's navigation bridge, and that the tug not involved in the towing operation maintain a vigilant watch on station nearby for rescue operations or emergency maneuvers. Internal communications systems and ship's radio must provide contact between the navigation bridge and the following areas, as planned: tugs, machinery spaces, anchor watch area, helicopter control station, both after and forward houses, D.C. Central, and other vessels in the area. As a minimum, the ship's radio should be operational and in compliance with Title 33 of the Code of Federal Regulations (CFR) Part 26, and Title 47 CFR, Parts 81 and 83. The proposed firefighting systems seem adequate. Review of correspondence by Cerberonics, Inc. indicates that CO_2 flooding will not be available in the machinery spaces. Particular caution must be exercised in the protection provided this area. The general alarm system should be fully operational. The fuel farm and its connections and hoses are not in compliance with Coast Guard regulations for commercial vessels, so caution must be exercised here also. The ARAPAHO system will be prone to spills of the JP-5 because no provision has been made for spill containment or periodic shut-off valves in the lines to isolate possible ruptures. It is assumed that lifesaving equipment will be provided in quantity and location as required by the Coast Guard and as detailed by Title 46 CFR, Part 94. In the area of accommodations, the Coast Guard requires that all systems be activated. This includes: ventilation, air conditioning, lighting, fresh water, sanitary water, the general alarm system and firefighting.

Some areas of potential risk to the success of the ARAPAHO feasibility demonstration are listed below. These are not considered to have a major impact on the tests to be conducted in the Chesapeake Bay, but are presented here to complete the review.

a. Safety Nets - should be used around the edge of the landing area during the feasibility demonstration.

b. Escape Routes - NAEC personnel have expressed concern that some modules have only one access.

c. Electrical Power Distribution Center - Moisture present in this module may be the cause of short circuits which have occurred. The solution may be to install dehumidification equipment.

d. Fuel Handling - no provision has been made for spill containment or isolation of leaking sections of rubber hose, as mentioned above.

e. Lashing System - the lashing arrangement was not entirely in place for JJH review. Therefore we cannot comment on the adequacy of the lashing system.

In conclusion, as far as naval architectural aspects are concerned, the ship "Export Leader" is matched to the purpose intended and the demonstration should be technically sound and effective.

Very truly yours,

J. J. HENRY CO., INC.

G. R. Jones

G. R. Jones
Manager

FYM/kc

Stability Calculations for

ARAPAHO Feasibility Demonstration

Prepared by:

J.J. Henry Co., Inc.
Suite 1305
1235 Jefferson Davis Highway
Arlington, VA 22202

Prepared: PJ Reece

Checked: J.Y. Michaud

September 1, 1982

CONDITION OF VESSEL _____ NO. _____ | DATE _____ | PAGE 1

CARGO _____ % CONSUMABLES _____ % BALLAST _____ % | BY _____ | JOU NO _____

ARAPAHO (SEAWITCH CONFIGURATION)

- No. Accomodation Modules
- Forward Fuel Farm

F.W. · S.W. · FO OR DO

OIL CARGO · BULK CARGO · DRY CARGO · FO OR DO

REF LINE FOR V.C.G. _____ REF LINE FOR L.C.G. _____

SYMBOL	COMPARTMENT	CU FT TON	WEIGHT TONS	VCG ABV. BL FT	MOMENT ABV. BL FT TONS	LCG ABT. F.P. FT	MOMENT ABT. F.P. FT TONS	VERT I OF I FT TO
	ARAPAHO Test Modules		732.7	84.47	59,946.34	275.09	253,322.53	1
	Fresh Water		60.0	39.09	2,344.8	462.50	27750.0	17
	Provisions/Stores		6.0	64.0	384.0	295.0	1,770.0	
DEADWEIGHT			988.7	63.89	62,675.14	283.63	283,342.1	1
LIGHT SHIP			10,364.0	25.45	267,702.12	313.21	3,246,108.4	
DISPLACEMENT			11,352.7	29.10	330,377.26	310.99	3,529,410.0	1

TRIM

DRAFT AT LCF	= 15.16	FT
MOMENT TO ALTER TRIM 1"	= 1792	FT-TS
LCB AFT OF FP	= 293.73	FT
LCG AFT OF FP	= 310.89	FT
TRIMMING LEVER	= 17.16	FT
TRIM	= 9.06	FT
LCF AFT OF FP	= 277.10	FT

DRAFT AT FP = 10.53' AP = 19.59'

DRAFTS AT DRAFT MARKS

FWD = 10' 7 1/4" · AFT = 18' 9 7/8" ·

midship MEAN = 15' 1 1/2" ·

STABILITY

METACENTRE ABOVE BL	$\overline{KM}$ = 37.70	
CENTRE OF GRAVITY ABV BL	$\overline{KG}$ = 29.10	
METACENTRIC HEIGHT	$\overline{GM}$ = 8.60	
ALLOWANCE FOR FREE SURFACE	= .01	
$\overline{GM}$ CORRECTED	= 8.59	
$\overline{GM}$ REQUIRED (NAV. WORST CASE)	= 3.95	
MOMENT TO HEEL 1°	= 1,702	FT

J.J. HENRY CO. INC.

NAVAL ARCHITECTS-MARINE ENGINEERS

NEW YORK PHILADELPHIA

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

NAME OF COMPANY ARAPAHO stability & trim

J. O. NO.

SHEET NO. 2 OF 19

DATE 8-31-82

SUBJECT SUMMARY OF WEIGHTS & CENTERS

COMP. BY FJC C'K'D BY

MODULE	WEIGHT IN LONG TONS	VCG	VERTICAL MOMENTS	LCG	LONGITUDINAL MOMENTS
Fuel Forward	60.13	63.15'	4,049.81	542.42'	34,795.73
Oil Level	510.05	59.90'	30,552.0	297.21'	151,591.0
02 & 03 Level	240.97	69.58'	16,759.86	193.35'	46,578.09
04 & 05 Level	107.65	79.75'	8,584.67	175.69'	18,872.71
TOTALS	922.70	64.97'	59,946.34	275.09	253,822.58

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

J. O. No. 2064-00
Sheet No. 3 of 19
Date 5-30-82
Comp. by PJP C'k'd by

Name of Company: Arapaho stability & Trim

Subject: Fuel Facil - Assumes Tanks Full

MODULE	WEIGHT IN LONG TONS	VCG	VERTICAL MOMENTS	LCG	LONGITUDINAL MOMENTS
02-QR-5	9.8	63.15	618.87	545.25	5,343.45
02-Q-3	18.11	"	1,143.65	535.25	9,693.33
02-Q-1	18.11	"	1,143.65	535.25	9,693.33
02-R-3	18.11	63.15	1,143.65	555.25	10,055.58
TOTALS			4,049.81		34,785.78
	64.13	63.15'		542.42'	

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

NAME OF COMPANY ARAPAHO Stability & Trim

J. O. NO 2064-01

SHEET NO. 4 OF 19

DATE 4-21-92

SUBJECT 01 Level Modules & Adapters

COMP. BY EJF C'K'D BY

MODULE	WEIGHT IN LONG TONS	VCG	VERTICAL MOMENTS	LCG	LONGITUDINAL MOMENTS
01-OP Modules	55.01	59.9'	3,295.1	429.0'	23,597.29
01-MN Modules	59.96		3,561.65	386.3'	22,969.4
01-KL modules	59.79		3,581.42	339.5'	20,298.11
01-IJ modules	54.8'		3,232.52	295.5'	16,193.40
01-GH Modules	62.64		3,752.14	249.00'	15,597.36
01-EF modules	59.42		3,559.26	206.08	12,245.27
01-CD modules	58.93		3,529.91	159.11'	9,379.89
"NO" Adapters	20.0		1,198.0	407.65'	8,153.0
"LM" Adapters	20.0		1,198.0	362.90'	7,258.0
"JK" Adapters	20.0		1,198.0	317.50'	6,350.0
"HI" Adapters	20.0		1,198.0	272.25'	5,445.0
"FG" Adapters	10.0		599.0	227.54'	2,275.4
"DE" Adapters	10.0	59.9'	599.0	182.63'	1,826.3
TOTALS			30552.0		151,591.0
	510.05	59.90		297.21	

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

NAME OF COMPANY [illegible] Stability & Trim

SUBJECT DE & DE (Loaded) Modules (except fuel tank) No Accommodations

J. O. NO. [illegible]

SHEET NO. 5 OF 19

DATE [illegible]

COMP. BY [illegible] C'K'D BY [illegible]

MODULE	WEIGHT IN LONG TONS	VCG	VERTICAL MOMENTS	LCG	LONGITUDINAL MOMENTS
02-FG-6					
02-FG-5	41.95	65.15'	2,733.04	227.54'	9,545.3
02-FG-7					
02-DE-6					
02-DE-5	49.53	65.15'	3,226.88	182.55'	9,045.66
02-DE-7					
02-C-6					
02-C-5	23.84	65.15'	1,553.18	149.17'	3,556.21
02-C-7					
03-FG-6					
03-FG-5	50.18	73.65'	3,695.76	[illegible]7.54'	11,417.96
03-FG-7					
03-DE-6					
03-DE-5	52.75	73.65'	3,335.04	182.63'	9,633.73
03-DE-7					
03-C-6					
03-C-5	22.62	73.65'	1,665.96	149.17'	3,374.23
03-C-7					
TOTALS			16,759.86		46,573.09
	240.87	69.58'		193.35'	

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

NAME OF COMPANY AKAPA 40 Stability & Trim

J. O. NO. 2061-02

SHEET NO. 6 OF 19

DATE 3-21-88

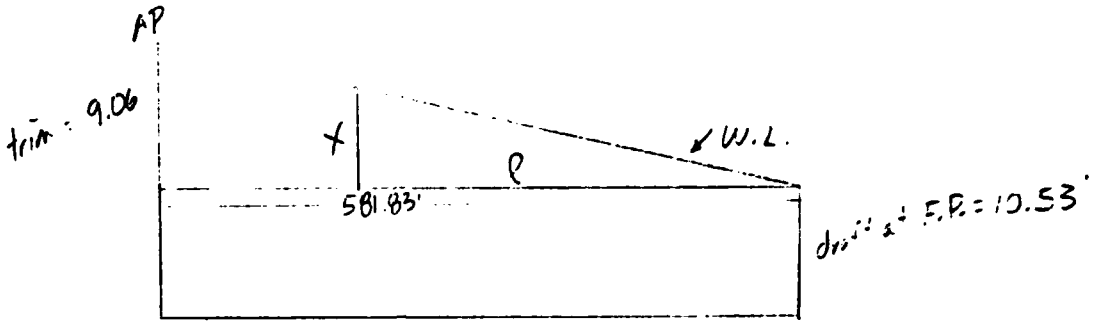
SUBJECT 04 & 05 Level Modules

COMP. BY [illegible] C'K'D BY

MODULE	WEIGHT IN LONG TONS	VCG	VERTICAL MOMENTS	LCG	LONGITUDINAL MOMENTS
04-FG modules	18.0	78.78'	1,413.04	[illegible]	4,095.0
04-DE modules	18.0	78.78'	1,413.04	182.65'	3,287.34
04-C modules	9.0	78.78'	709.02	149.17'	1,342.53
05 Level modules	62.65	80.44'	5,039.51	193.9'	12,147.31
TOTALS			8,584.67		20,872.71
	107.65	79.75		193.89	

to solve for draft at any distance "ℓ" from F.P.

(Use similar triangles)



desired draft = 10.53' + X

and $\frac{\ell}{581.83'} = \frac{X}{9.06'}$, $X = \frac{(\ell)(9.06)}{581.83'}$

so draft at any distance "ℓ" from F.P. =

$$\frac{(\ell)(9.06)}{581.83} + 10.53'$$

Angle of trim

Angle of trim = $\arctan\left(\frac{\text{trim}}{LBP}\right) = \arctan\left(\frac{9.06}{581.83'}\right) = 0.892°$

J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

NAME OF COMPANY ARAPAHO Stability & Trim

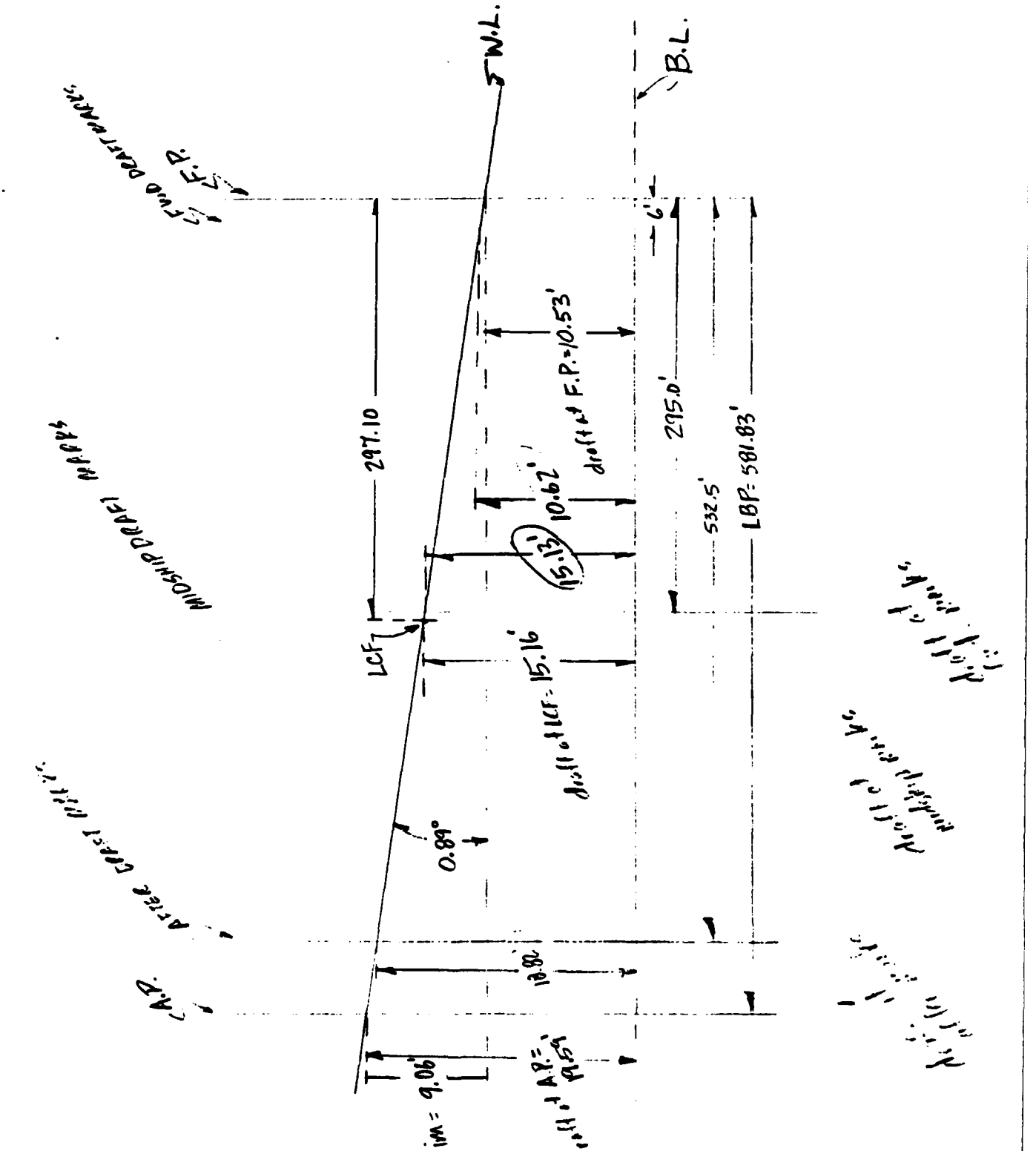
SUBJECT Trim & Trim Tables

J. O. No. [illegible]

SHEET NO. 8 OF 19

DATE 1-1-[illegible]

COMP. BY [illegible] C'K'D BY



J. J. HENRY CO., INC.

Naval Architects and Marine Engineers

J. O. No. 2964-00

NAME OF COMPANY ARAPAHO Stability & Trim

SHEET NO. 9 OF 19

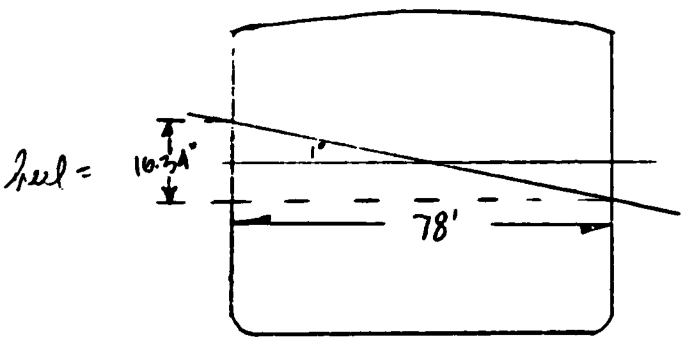
DATE 9-1-82

SUBJECT Stability Calcs

COMP. BY PJP C'K'D BY

Moment to Heel 1°

moment to heel 1" = $\frac{\Delta GM_T}{12 B} = \frac{(11,352.7 \text{ tons})(8.59 \text{ ft})}{(12)(78 \text{ ft})}$ = 104.18



Moment to heel 1° = (104.18 ft-tons)(16.34") = 1,702 ft-tons

(moment to heel 1 inch) (1° heel in inches) (approximate)

— or —

Moment to heel 1° = $(\Delta)(GM \sin 1°)$ = (11,352.7)(8.59 sin 1°) = 1,702 ft-tons

FREE SURFACE

(assume one fuel form tank slack)

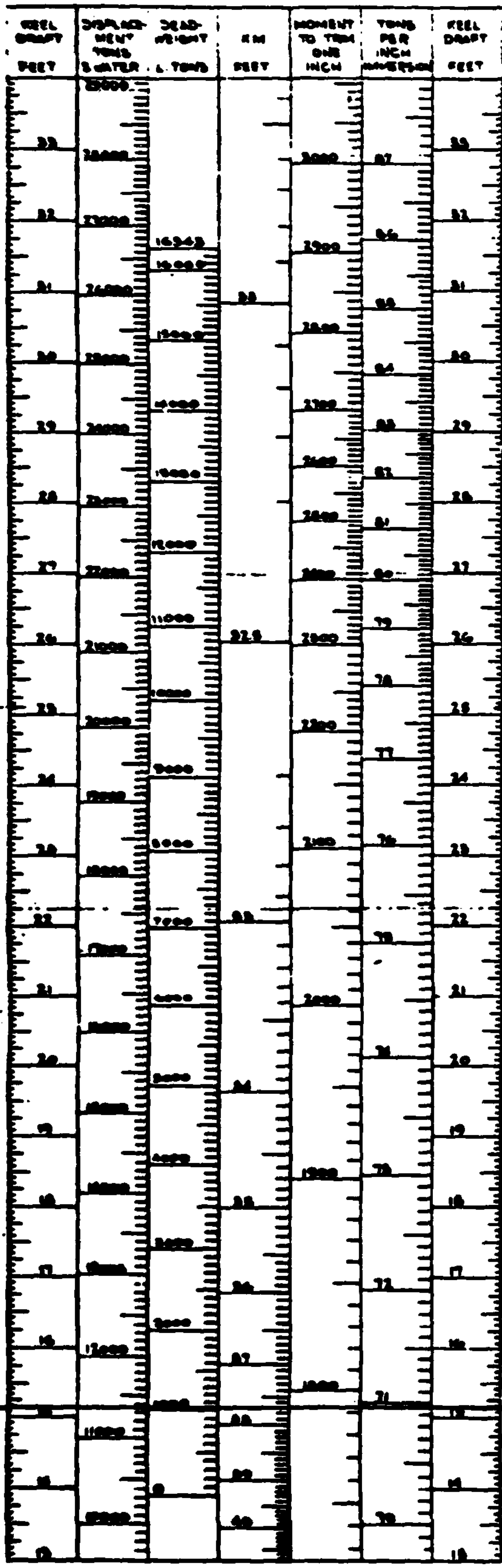
increase in vert. moments $\frac{I}{\delta} = \frac{(20)(8)^3 / 12}{44.1 \text{ ft}^3/\text{ton}}$ = 19 ft-tons

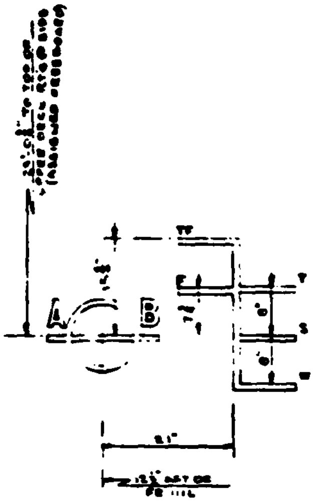
also assume ... 117 ft-tons (from stab. booklet)

free surface correction = $\frac{\text{vert. moments}}{\Delta} = \frac{(19 + 117 \text{ ft-tons})}{(11,352.7 \text{ t})}$ = .01 ft rise in KG

2054-03
sheet 10 of 19
9-1-92

4





PLIMSOLL MARK

TOTAL DISPLACEMENT (S.W.) = 26,670T @ 31'-7⅞" DRAFT
EQUIV. DEADWEIGHT = 16,343T

SEE EXAMPLE BELOW

SΔ = 11,352.7 L tons

TANK		FRAMES	CENTER OF GRAVITY VCG ABV ℄	LCG AFT FP	[illegible]
DEEP TANK NO 2	P	33-81	12.98	84.79	[illegible]
DEEP TANK NO 2	S	33-81	8.49	84.24	[illegible]
DOUBLE BOTT NO 1	P	51-79	2.57	155.95	[illegible]
DOUBLE BOTT NO 1	S	51-79	2.57	155.95	[illegible]
DOUBLE BOTT NO 2	P	79-D	2.58	235.52	[illegible]
DOUBLE BOTT NO 2	℄	79-D	2.46	230.0	[illegible]
DOUBLE BOTT NO 2	S	79-D	2.58	235.52	[illegible]
DOUBLE BOTT NO 3	P	D-133	2.56	319.61	[illegible]
DOUBLE BOTT NO 3	℄	D-133	2.46	320.0	[illegible]
DOUBLE BOTT NO 3	S	D-133	2.56	319.61	[illegible]
DOUBLE BOTT NO 4	P	133-169	2.64	400.95	[illegible]
DOUBLE BOTT NO 4	℄	133-169	2.47	409.66	[illegible]
DOUBLE BOTT NO 4	S	133-169	2.64	400.95	[illegible]
SETTLING TANK	P	194-204	29.38	529.50	[illegible]
SETTLING TANK	S	194-204	29.38	529.50	[illegible]
TOTALS			8.68	280.25	[illegible]

SALT WATER BALLAST

TANK		FRAMES	CENTER OF GRAVITY VCG ABV ℄	LCG AFT FP	GALLONS [illegible]
FOREPEAK TANK	℄	STEM-15	20.67	14.92	[illegible]
DEEP TANK NO 1	P	15-33	9.09	54.54	[illegible]
DEEP TANK NO 1	S	15-33	9.09	54.54	[illegible]
DEEP TANK NO 2	P	33-81	8.98	84.79	[illegible]
DEEP TANK NO 2	S	33-81	8.49	84.24	[illegible]
DOUBLE BOTT NO 1	P	51-79	2.57	155.95	[illegible]
DOUBLE BOTT NO 1	S	51-79	2.57	155.95	[illegible]
DOUBLE BOTT NO 2	P	79-D	2.58	235.52	[illegible]
DOUBLE BOTT NO 2	℄	79-D	2.46	230.00	[illegible]
DOUBLE BOTT NO 2	S	79-D	2.58	235.52	[illegible]
DOUBLE BOTT NO 3	P	D-133	2.56	319.61	[illegible]
DOUBLE BOTT NO 3	℄	D-133	2.46	320.00	[illegible]
DOUBLE BOTT NO 3	S	D-133	2.56	319.61	[illegible]
DOUBLE BOTT NO 4	P	133-169	2.64	400.95	[illegible]
DOUBLE BOTT NO 4	℄	133-169	2.47	409.66	[illegible]
DOUBLE BOTT NO 4	S	133-169	2.64	400.95	[illegible]
AFT PEAK TANK	P	204-220	29.93	556.63	[illegible]
AFT PEAK TANK	S	204-220	29.93	556.63	[illegible]
FLUME TANK (UPPER)	℄	118-111D	29.58	270.00	[illegible]
FLUME TANK (UPPER)	℄	131-133	29.80	362.50	[illegible]
FLUME TANK (LOWER)	℄	118-111D	18.96	270.00	[illegible]
FLUME TANK (LOWER)	℄	131-133	18.96	362.50	[illegible]
TOTALS			12.80	265.76	[illegible]

FRESH WATER

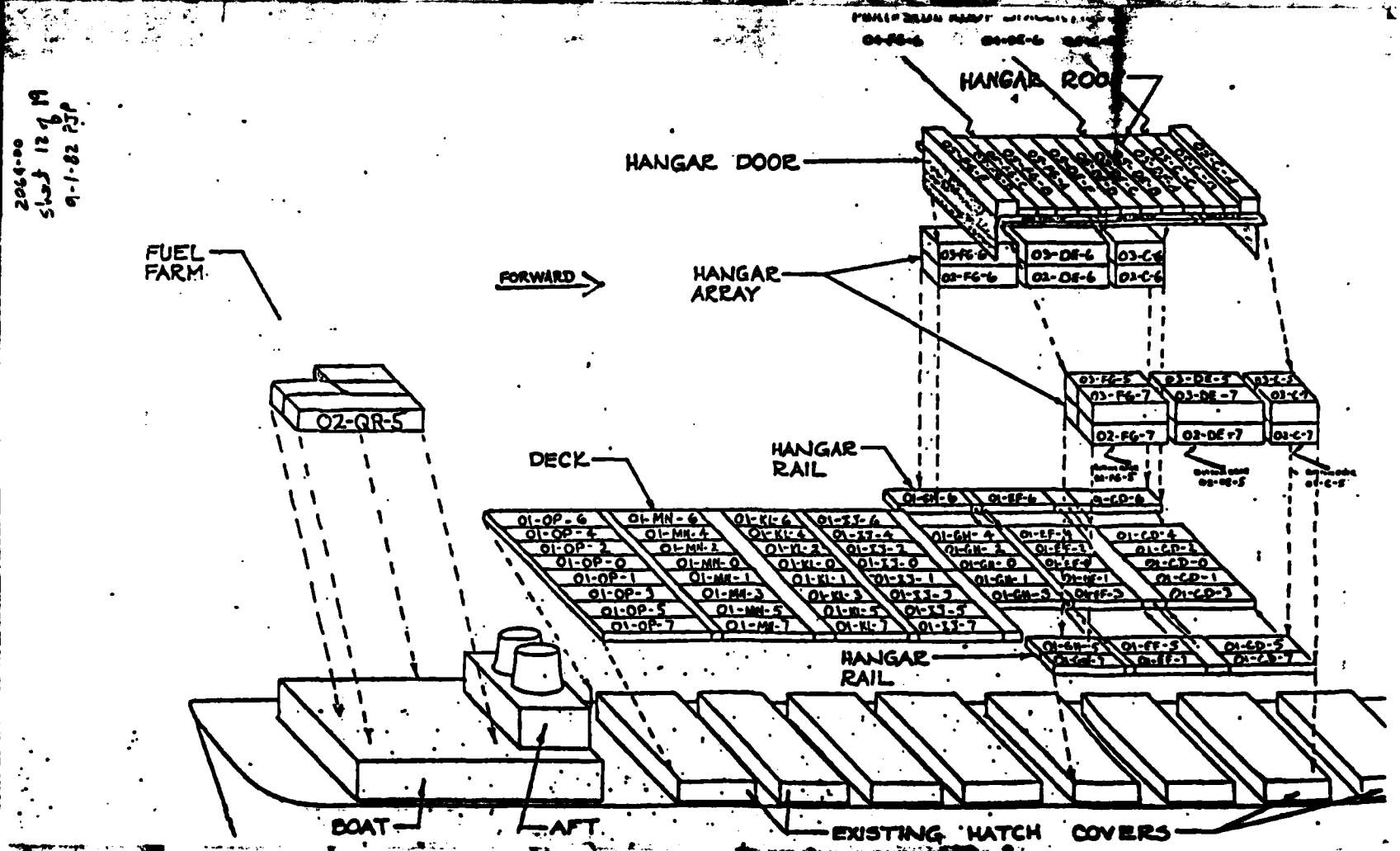
TANK		FRAMES	CENTER OF GRAVITY VCG ABV ℄	LCG AFT FP	GALLONS [illegible]
RESERVE TANK	P	170-178	2.60	467.05	[illegible]
RESERVE TANK	S	170-178	2.55	466.89	[illegible]
POTABLE WATER TK	P	169-175	30.08	462.50	[illegible]
POTABLE WATER TK	℄	169-175	39.08	462.50	[illegible]
DISTILLED WATER TK	S	169-175	39.08	462.50	[illegible]
TOTALS			26.46	464.04	[illegible]

CONVERSION TABLE

UNIT	EQUIVALENT
1 TON	2240 LBS
1 BARREL	42.0 GALS
1 BARREL	5.615 CU FT
[illegible]	

ARAPAHO FEASIBILITY DEMONSTRATION

HOST SHIP SPECIFICS


HANGAR ROOF
HANGAR DOOR
FUEL FARM
FORWARD
HANGAR ARRAY
02-QR-5
DECK
HANGAR RAIL
HANGAR RAIL
BOAT
AFT
EXISTING HATCH COVERS

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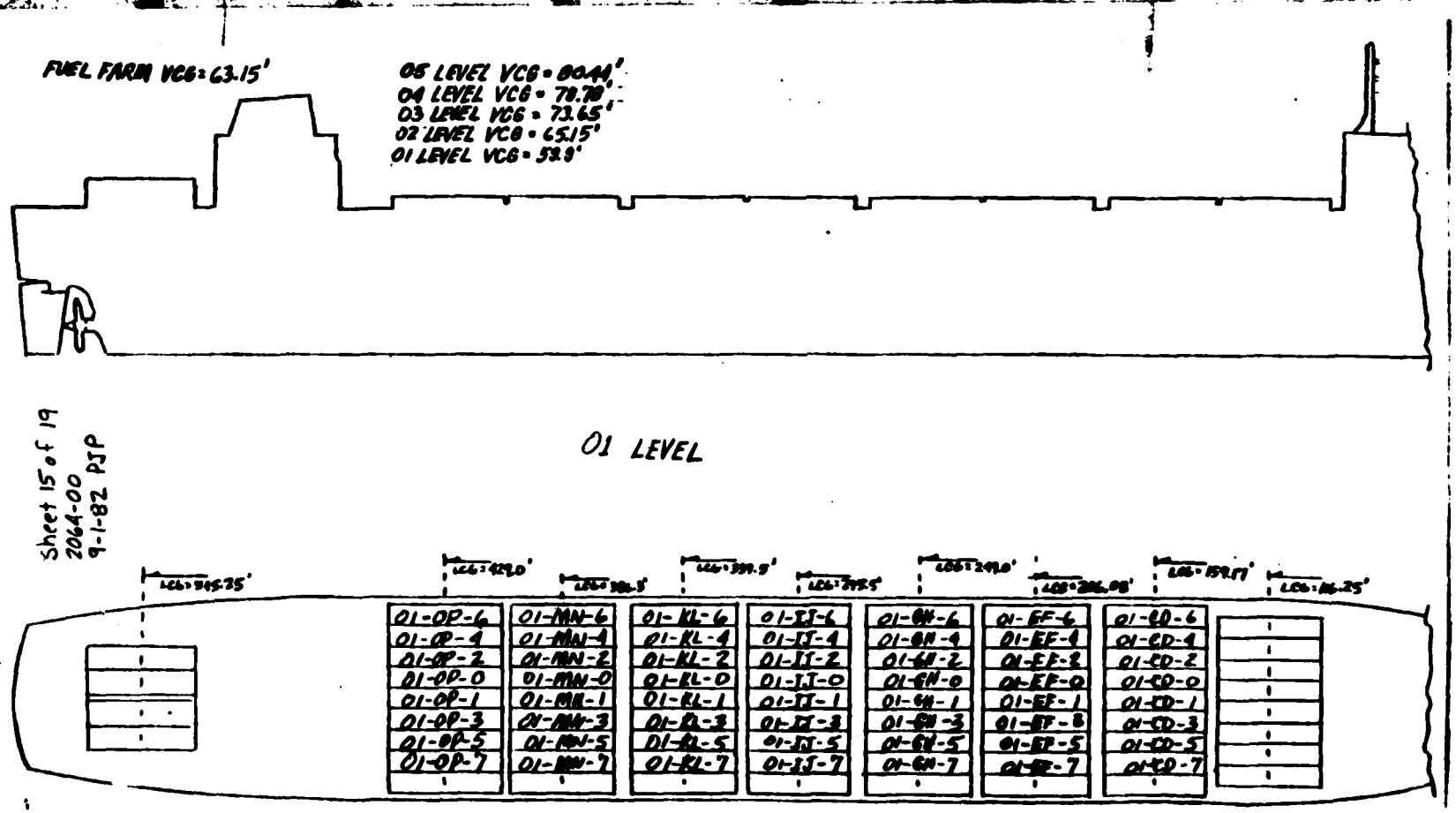
2064-00
9-1-82 PJP

LOAD	DESCRIPTION	GROSS WEIGHT LONG TONS	GROSS WEIGHT LBS
1	02-QR-5	9.8	20,196
2	01-OP-4, 01-OP-6	13.95	28,700
3	01-OP-1, 01-OP-0, 01-OP-2	20.43	44,946
4	01-OP-7, 01-OP-5, 01-OP-3	20.63	45,386
5	OUTFITTING VAN	T.B.D.	
6	01-MN-4, 01-MN-6	14.99	32,978
7	01-MN-0, 01-MN-2	14.78	32,516
8	01-MN-3, 01-MN-1	14.78	32,516
9	01-MN-7, 01-MN-5	14.91	32,802
10	SPECIAL EQUIPMENT	T.B.D.	
11	"NO" DECK ADAPTERS	20	44,000
12	01-KL-4, 01-KL-6	15.12	33,264
13	01-KL-0, 01-KL-2	14.78	32,526
14	01-KL-3, 01-KL-1	14.90	32,780
15	01-KL-7, 01-KL-5	14.99	32,978
16	"LM" DECK ADAPTERS	20	44,000
17	01-IJ-2, 01-IJ-4, 01-IJ-6	20.63	45,386
18	01-IJ-3, 01-IJ-1, 01-IJ-0	20.54	45,188
19	01-IJ-7, 01-IJ-5	13.63	29,986
20	"JK" DECK ADAPTERS	20	44,000
21	01-GH-4, 01-GH-6	16.34	35,948
22	01-GH-0, 01-GH-2	13.75	30,250
23	01-GH-3, 01-GH-1	13.76	30,272
24	01-GH-7, 01-GH-5	18.4	40,480
25	"HI" DECK ADAPTERS	20	44,000
26	01-EF-4, 01-EF-6	15.66	34,452
27	01-EF-1, 01-EF-0, 01-EF-2	20.23	44,506
28	01-EF-5, 01-EF-3	16.18	35,596
29	01-CD-7, 01-EF-7	14.69	32,318
30	01-CD-4, 01-CD-6	15.34	33,748
31	01-CD-1, 01-CD-0, 01-CD-2	20.21	44,462
32	01-CD-5, 01-CD-3	16.04	35,288
33	02-C-6, 02-C-7	15.04	33,088
34	03-C-6, 02-C-5	17.16	37,752
35	03-C-5, 03-C-7	14.26	31,372

NOTE: THIS TABLE HAS BEEN DEVELOPED ON THE INCORRECT ASSUMPTION THAT 1 LONG TON = 2200 LBS. FOR THE PURPOSE OF THIS CALCULATION, JJH HAS ASSUMED THAT THE WILLIS FOR LONG TONS ARE CORRECT, BECAUSE THEY SEEM TO COME FROM AN EARLIER STUDY.

LOAD	DESCRIPTION	GROSS WEIGHT LONG TONS	LBS
36	02-DE-6	16.47	36,234
37	"FG" and "DE" DECK ADAPTERS	20	44,000
38	02-DE-7	14.69	32,234
39	03-DE-6	20.32	44,704
40	02-DE-5	18.37	40,414
41	03-DE-5	16.25	35,750
42	03-DE-7	16.18	35,618
43	02-FG-6	14.07	30,954
44	02-FG-7	12.57	27,654
45	03-FG-6	18.37	40,414
46	02-FG-5	15.31	33,682
47	03-FG-5	14.6	32,120
48	03-FG-7	17.21	37,862
49	04-C-6, 04-C-5	9	19,980
50	04-DE-6, 04-DE-5	18	39,600
51	04-FG-6, 04-FG-5	18	39,600
52	05-C-A HANGAR DOOR	8.49	18,678
53	05-C-C, 05-DE-A, 05-DE-B, 05-C-B	17.05	37,510
54	05-DE-D, 05-DE-E, 05-FG-A, 05-DE-C	16.36	35,992
55	05-FG-C, 05-FG-D, 05-FG-B	12.1	26,972
56	05-FG-E HANGAR DOOR	8.49	18,678
57	FUEL TANK 02-Q-3, 02-Q-1	5.9	12,980 E.W.
58	02-R-3	2.95	6,490

See note on preceeding page



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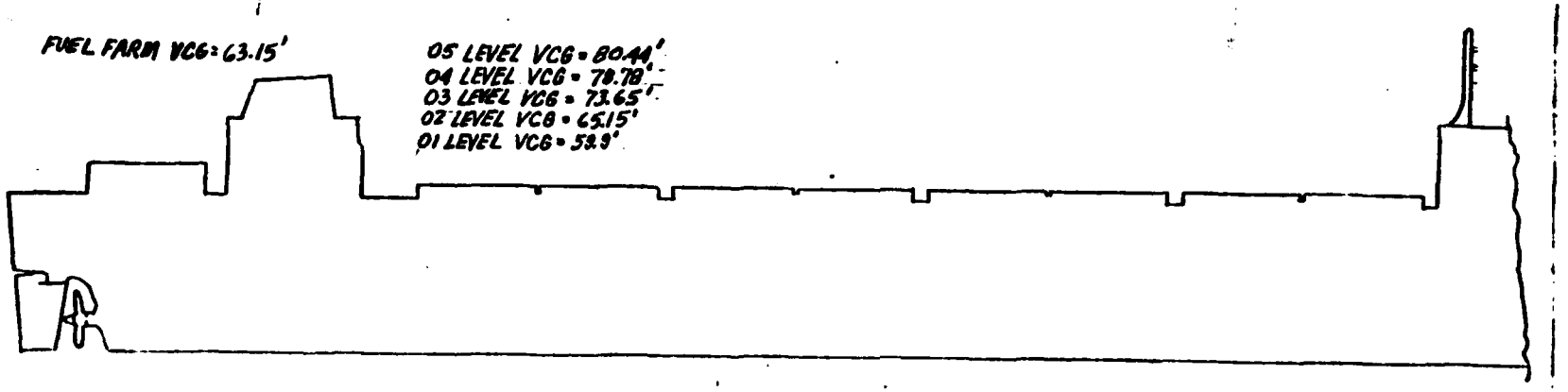

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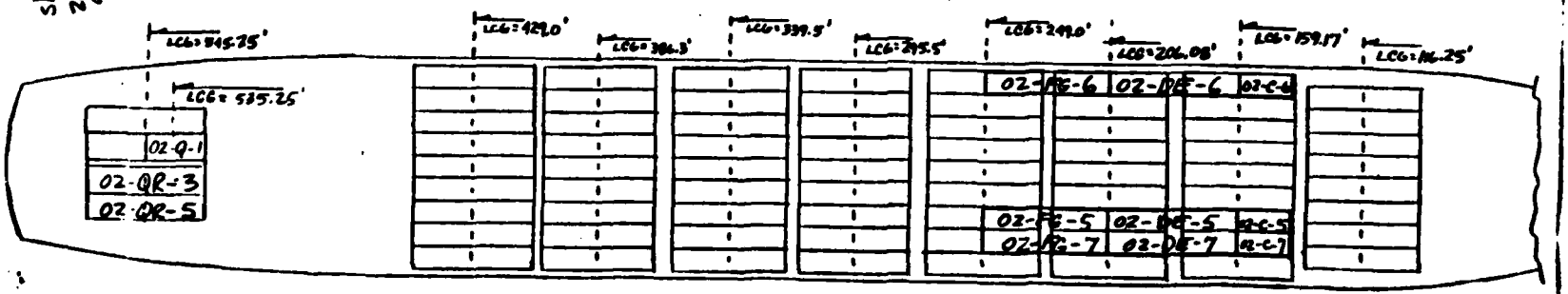
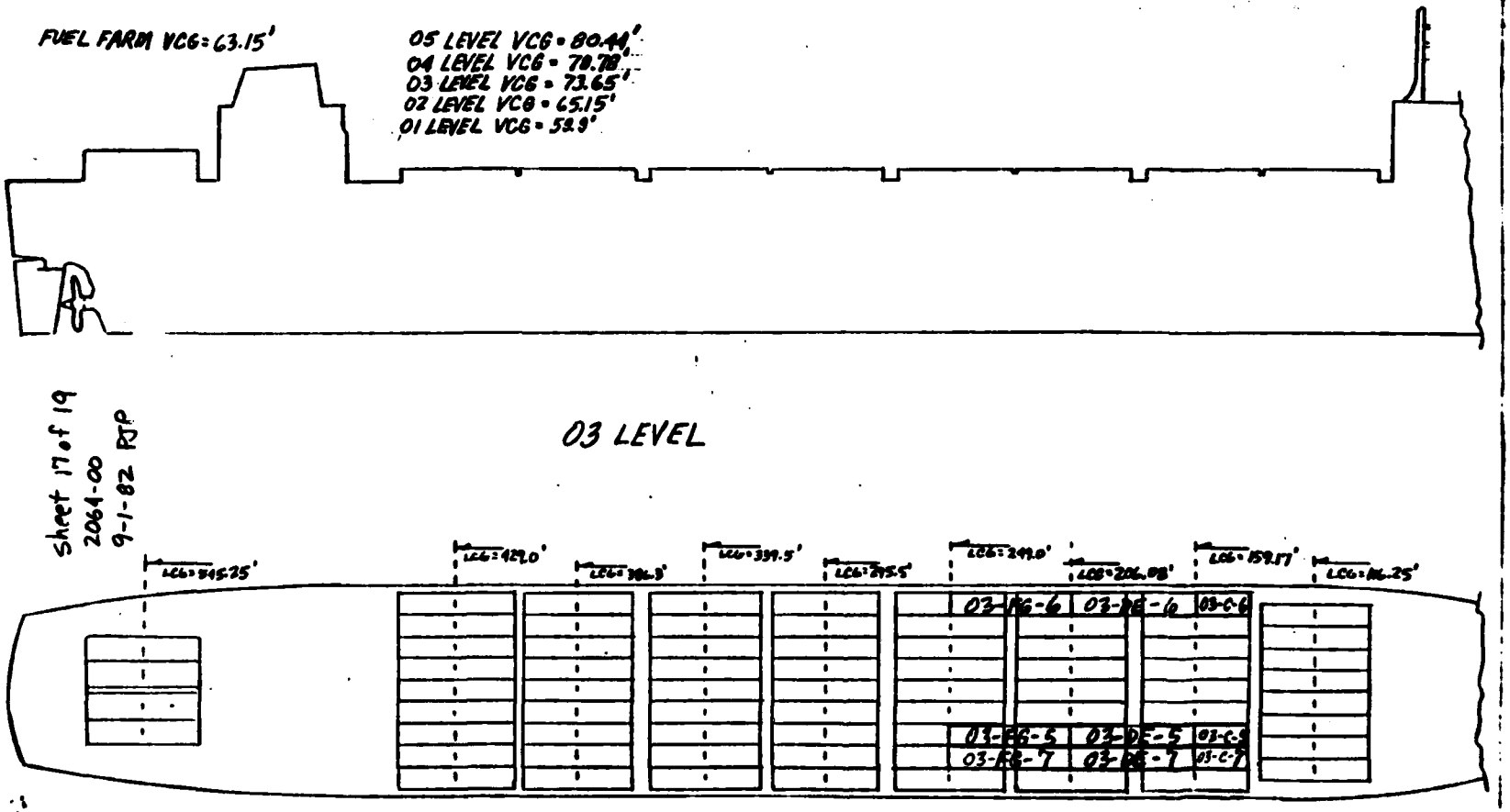
02 LEVEL




FUEL FARM VCG = 63.15'
05 LEVEL VCG = 80.44'
04 LEVEL VCG = 78.78'
03 LEVEL VCG = 73.65'
02 LEVEL VCG = 65.15'
01 LEVEL VCG = 58.9'
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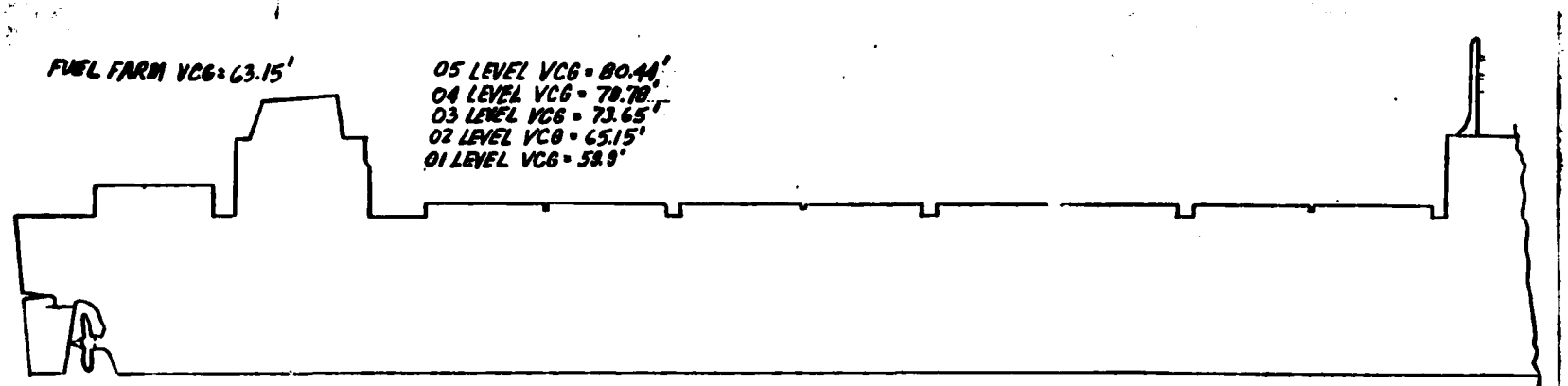
03 LEVEL
LCG = 345.25'
LCG = 429.0'
LCG = 384.5'
LCG = 339.5'
LCG = 295.5'
LCG = 249.0'
LCG = 206.98'
LCG = 159.17'
LCG = 116.25'
03-FG-6
03-FE-6
03-C-6
03-FG-5
03-FE-5
03-C-5
03-FG-7
03-FE-7
03-C-7



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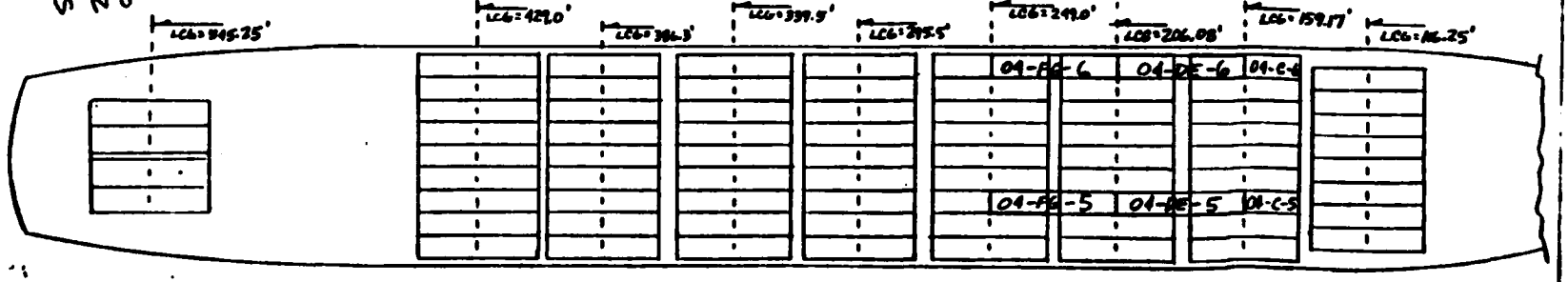
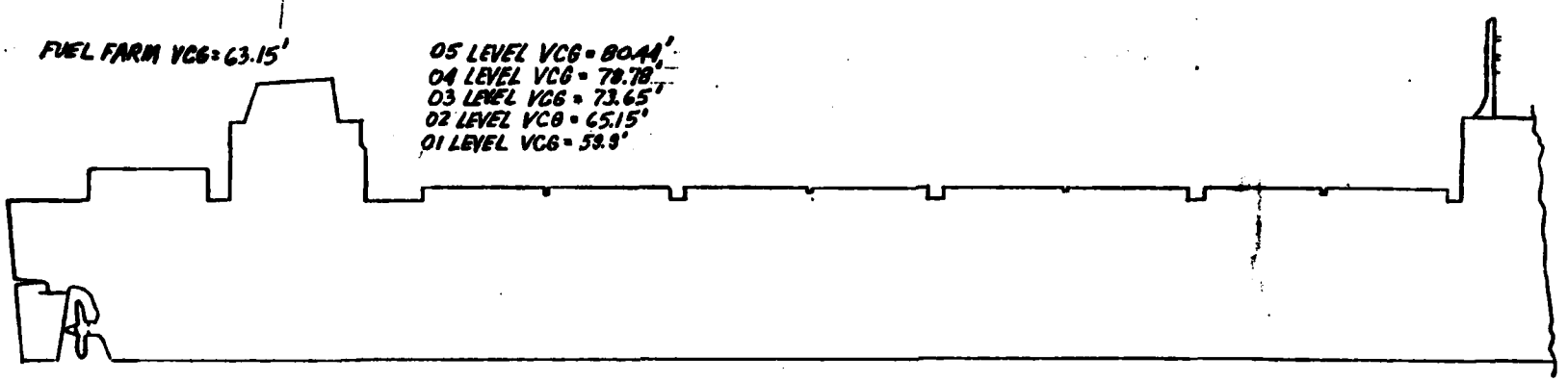
04 LEVEL





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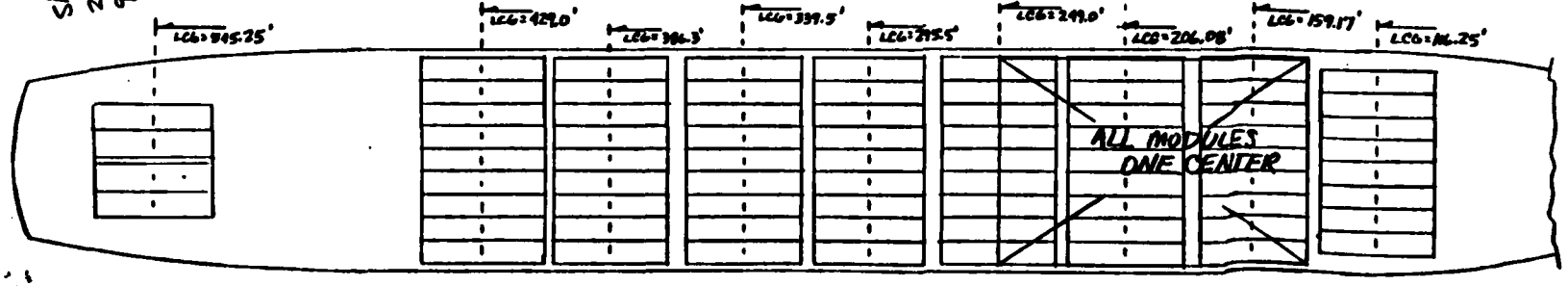
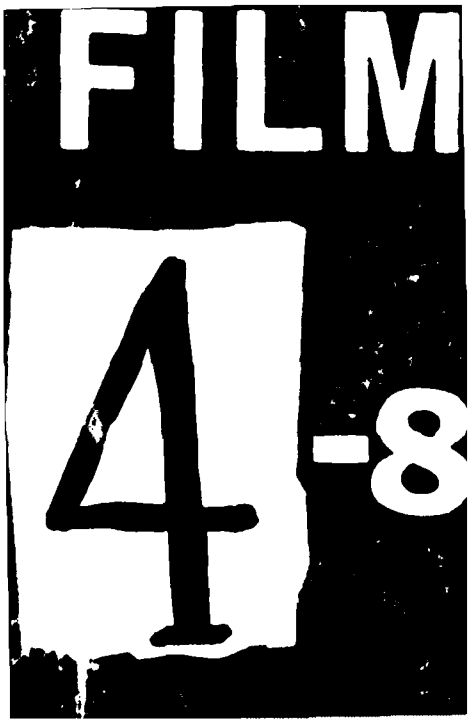
05 LEVEL




FILM
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