

SHIP CHARACTERISTICS

Red = 9/07/83

9/26/83

mtg

Green = maximum

9/23/83  
 SES  
 CGV  
 08/17/83 09/23/83  
 02 0753 11.08.08

525

LOA-	688	689	700
BOA	129	135	
LCUSH	616	615.4	
BCUSH	30.8	30.4	
HT TO LN DK	77.4	77.7	
DRAFT OFF CUSH.	18.0	20.2	27.0
DRAFT ON CUSH.	10.7	9.96	13.4
-1/B	20.0	20.3	
PCUE	692	641.7	865.7
HTWD	47.4	45.7	
FLD	16759	19125	20240
VOL X10 <sup>6</sup>	4.061	4.022	3.916
STHZ		15.2	
LBP	6.22		
VOL XROSS STRUC	2.589	2.716	2.707
VOL SH	1.271	1.305	1.208

V DESIGD	30	30
V CR	20	20
PROP OD	16.3	16.7
KPH	186	163
PC design	.62	.62
PC CVISE	.62	.62

BHP PROPUL 30KT	160872	209672	150000
BHP LIFT	9872	12,005	
TOTAL BHP W/D MARGIN	170744	221677	
TOTAL BHP W/ MARGIN	199,156	251,000	147,000

BHP @ 20KT HB	35,832	34,536	
FUEL RANGE	2404	3878	2645
N FANS	4	4	3250
ACCOMMODATIONS W/10% MARG	1272	1271	
SHTK	15.4		

MACHN	4 LM5000	2 LM5000	6 LM2500
	4 MSWESSEL	2 LM2500	
		2 RIZER	

K&S PROFILES	15,000	15000	15000
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SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PMS 304

SES SES

MH

SUATH

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
GROUP 1 BULL STRUCTURE:	08/14/13 13.74.59	08/14/13 020753	09/23			
100 BULL STRUCTURE, GENERAL						
110 SHELL AND SUPPORTING STRUCTURE		4549	5458	5207	2991	9870
111 Shell Pltng., Surf. Ship & Sub. Press. Bull					1700	
112 Shell Pltng., Sub. Non-Pressure Bull						
113 Inner Bottom					322	
114 Shell Appendages						
115 Stanchions						
116 Longit. Framing, Surf. Ship & Sub. Press. Bull					969	
117 Transv. Framing, Surf. Ship & Sub. Press. Bull						
118 Longit. & Transv. Sub. Non-Press. Bull Framing						
119 Lift System Flexible Skirts and Seals 02224 JWB/FT2		42		60		
120 BULL STRUCTURAL BULKHEADS		202	200	194	1891	
121 Longitudinal Structural Bulkheads					276	
122 Transverse Structural Bulkheads					1067	
123 Trunks and Enclosures					173	
124 Bulkheads in Torpedo Protection System					375	
125 Submarine Hard Tanks						
Submarine Soft Tanks						
130 BULL DECKS					3022	
131 Main Deck					729	
132 2nd Deck					327	
133 3rd Deck						
134 4th Deck						
135 5th Deck and Decks Below						
136 01 Bull Deck (Forecastle and Poop Decks)					234	
137 02 Bull Deck					486	
138 03 Bull Deck					1245	
139 04 Bull Deck and Bull Decks Above						
140 BULL PLATFORMS AND PLATS					470	
141 1st Platform					237	
142 2nd Platform					149	
143 3rd Platform						
144 4th Platform						
145 5th Platform					84	
149 Plats						



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PMS 304

91

SES

SES  
9/23/13

MH

SWATH

		60K QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS <sup>240K</sup>	Vol 126k REFERENCE
150	DECKHOUSE STRUCTURE	<del>60K</del>	(125)	125	125	500	297 20
151	Deckhouse Structure to First Level						
152	1st Deckhouse Level						
153	2nd Deckhouse Level						
154	3rd Deckhouse Level						
155	4th Deckhouse Level						
156	5th Deckhouse Level						
157	6th Deckhouse Level						
158	7th Deckhouse Level						
159	8th Deckhouse Level						(160)
							76 kts per
160	SPECIAL STRUCTURES W/O 164		476	474	471	598	1244 7
161	Struct. Castings, Forgings, & Equip. Weldments		100	99	98	237	253
162	Stacks and Macks (Combined Stack and Mast)						
163	Sea Chests		13	14	14	54	13
164	Ballistic Plating ?		187	187	187	1971	979 7
165	Sonar Domes						
166	Sponsons					190	(VLS) 123
167	Bull Structural Closures		77	75	74	77	80
	Deckhouse Structural Closures						
169	Special Purpose Closures and Structures		41	99	99	41	190
170	MASTS, KINGPOSTS, AND SERVICE PLATFORMS		32	32	32	32	32
171	Masts, Towers, Tetrapods		(32)				
172	Kingposts and Support Frames						
179	Service Platforms						
180	FOUNDATIONS		249	305	361	468	553
181	Bull Structure Foundations						
182	Propulsion Plant Foundations					135	129
183	Electric Plant Foundations					68	79
184	Command and Surveillance Foundations					46	46
185	Auxiliary Systems Foundations					263	245
186	Outfit and Furnishings Foundations						
187	Armament Foundations					56	52

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SES UNIT ANALYSIS - SUMMARY  
 (By Ship's Work Breakdown Structure)

PMS 304

		SES	SES	MH	GWATH
	QTY	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
190	SPECIAL PURPOSE SYSTEMS	SEALS	1110	1600	297
191	Ballast, Fixed or Fluid, and Buoyancy Units				
192	Compartment Testing				
195	Erection of Sub Sections (Progress Rpt. Only)				
198	Free Flooding Liquids	?	?	20.	21
199	Hull Repair Parts and Special Tools				
197	WELDING & MIL TOL 2.5%	(240)	?	160	276
	GROUP 100 TOTAL	5570	6568	<del>1118</del> 12303	12195
				6578	

Signature \_\_\_\_\_

1.5 weld  
 4 mill  


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 5.5 %

~~1118~~  
 DD08 2570

∴ use 2.5% of (GP 1 - 190)



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES SES 111 SUBATH

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 2 PROPULSION PLANT:</b>						
200	PROPULSION PLANT, GENERAL					
210	ENERGY GENERATING SYSTEM (NUCLEAR)					
211	(Reserved)					
212	Nuclear Steam Generator					
213	Reactors					
214	Reactor Coolant System					
215	Reactor Coolant Service System					
216	Reactor Plant Auxiliary Systems					
217	Nuclear Power Control and Instrumentation					
218	Radiation Shielding (Primary)					
219	Radiation Shielding (Secondary)					
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)					
221	Propulsion Boilers					
222	Gas Generators					
223	Main Propulsion Batteries					
224	Main Propulsion Fuel Cells					
	PROPULSION UNITS					
231	Propulsion Steam Turbines					
232	Propulsion Steam Engines					
233	Propulsion Internal Combustion Engines <i>PERFORM</i>					
234	Propulsion Gas Turbines <i>WITH STD MOD</i>					
235	Electric Propulsion					
236	Self-Contained Propulsion Systems					
237	Auxiliary Propulsion Devices					
238	Secondary Propulsion (Submarines)					
239	Emergency Propulsion (Submarines)					
240	TRANSMISSION AND PROPULSOR SYSTEMS					
241	Propulsion Reduction Gears					
242	Propulsion Clutches and Couplings					
243	Propulsion Shafting					
244	Propulsion Shaft Bearings					
245	Propulsors					
246	Propulsors Shrouds and Ducts					
247	Water Jet Propulsors					
248	Lift System Fans and Ducting					
250	PROPULSION SUPPT SYS (EXC. FUEL AND LUBE OIL)					
251	Combustion Air System					
252	Pump <i>central &amp; 2 local</i>					

09/23/83

35

374

136  
136 29

650.6

250

C-172

280

210

107

120.6

510

20

457

639

381.5

C

299

1165

265

184

181

C

51

1140

183

30 295

474 196

C

10

160Y

78

72

101 101

C

76

113

51.5

108 92

16

16

316

31

40

109

35

11

13

22

25

11

9

11

11

*central & 2 local*  
*high*

*asset*  
*algorithm*

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PPS 304

SES 117 53172

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE	
253					5 R		
254							
255					18 R		
256				5	35 R	50	
259	C		15 ?	34	127	22 18.5 DD451 64C .15 ton/ft	
260			23	32	86 65	84	
261	C		11 21	26	36 15	42	
262	C		9 ?	17	30	27 30	
263							
264			2	4	20	6	
290					76		
298	C	chit 40	6	(40)	44	66 P	33 55
299	C		20	(10)	13	10	10
			932		1418	1225.5	1472
					<del>1246</del>		
					1246		

$L = 24.5$

Signature \_\_\_\_\_

262 Lube oil Bob Lamp inverse relation to efficiency of reduct.

298 Asset says epicyclic

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

9/23/83

DATE PMS 304

		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 3 ELECTRIC PLANT:</b>							
300	ELECTRIC PLANT, GENERAL						
310	ELECTRIC POWER GENERATION						
311	C	170 GT	135	150	2.88	288	288
312		150 MED DIES			2.76	295	150 276 D
313	C	1	112	6	12		12
314	C						
315							
<b>POWER DISTRIBUTION SYSTEMS</b>							
321	C	Ship Service Power Cable Tom Green X-85 chg	85	192	2.78	309	309
322		Emergency Power Cable System	206		2.22	247	247
323		Casualty Power Cable System	3	7			
324	C	Switchgear and Panels Tom Green C use .8 chg	57	66	8.5	66	8.5 66 chg
<b>LIGHTING SYSTEM</b>							
331	C	Lighting Distribution Tom Green chg	9	2.9	76		81
332		Lighting Fixtures	34	34			
333		Switches, Receptacles, and Outlets					
<b>POWER GENERATION SUPPORT SYSTEMS</b>							
341		SSTG Lube Oil			59		21
342	C	Diesel Support Systems 74.10 GP3	31.5	34	59		27 = 31
343	C	Turbine Support Systems	10				
<b>SPECIAL PURPOSE SYSTEMS</b>							
398	C	Electric Plant Operating Fluids	2	2	12		18
399	C	Electric Plant Repair Parts and Special Tools	16	16	2		2
<b>GROUP 300 TOTAL</b>			286	510	803	738	603

(553)  
change to diesel +15  
526  
536  
↑  
748  
603

Signature \_\_\_\_\_

Right to Med Speed  
Fairbanks Morse

2500 KW = \$1.6 MIL  
2500 KW = \$1 MIL

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PMS 304



SES SES H:H SUBTOTAL

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE	
<b>GROUP 5 AUXILIARY SYSTEMS:</b>							
500	<b>AUXILIARY SYSTEMS, GENERAL</b>						
510	<b>CLIMATE CONTROL</b>						
511	C			30	35	42	
512	C			81	248	296 245	
513	C			29	15	}	
514	C			92	195		209
515		0.720					
516	C			57	8	8	
517	Auxiliary Boilers and Other Heat Sources						
<b>520 SEA WATER SYSTEMS</b>							
521	C			104	210	210 109	
522					555	555	
523					141		
524				11	11		
526				1	1		
527					75	157	
528	C			36	24		
					35		
<b>530 FRESH WATER SYSTEMS</b>							
531	C			519	19	21	
532	C			27	27	27	
533	C			19	19	19	
534	Auxiliary Steam and Drains Within Machinery Box						
535	Auxiliary Steam and Drains Outside Machinery Box						
536				122	122	22 = 1	
<b>540 FUELS AND LUBRICANTS, HANDLING AND STORAGE</b>							
541	C			54	64	75 65	
542	C			17	17	18	
543				1	1		
544	Liquid Cargo						
545	Tank Heating						
549				PL	4	4	
<b>550 AIR, GAS, AND MISC. FLUID SYSTEMS</b>							
				24	46	52	
553				8	8	8	
554							
555					28		

		QTY	SES WT (LT)	WT (LT)	SES WT (LT)	HH SCALE FACTORS	SWATH REFERENCE
5	<b>C</b> Hydraulic Fluid System		20		2	0	0
558	Liquid Gases, Cargo						
	Special Piping Systems						
560	SHIP CONTROL SYSTEMS						
561	Steering and Diving Control Systems		34		35	46	77
562	Rudder					73	160
563	Hovering and Depth Control (Submarine)						
564	Trim System (Submarines)						
565	Trim and Reel Systems (Surface Ships)		NA			160	160
566	Diving Planes & Stabilizing Fins (Submarines)					Belge Keel	
567	Strut and Poil Systems					For Stabilizer	
568	Maneuvering Systems						
570	UNDERWAY REPLENISHMENT SYSTEMS						
571	<b>C</b> Replenishment-At-Sea Systems -15 <b>C</b>	59	9		59	59	59
572	<b>C</b> Ship Stores and Equipment Handling Systems <b>C</b>	34	5		34	34	34
573	Cargo Handling Systems						
574	Vertical Replenishment Systems						
	MECHANICAL HANDLING SYSTEM						
581	<b>C</b> Anchor Handling and Stowage Systems	115	6	115	63	227	227
582	<b>C</b> Mooring and Towing Systems		118		118		
583	<b>C</b> Boats, Boat Handling and Stowage Systems <b>C</b>	32	15		32	32	32
584	Mechan. Oper. Door, Gate, Ramp, Turntab. Sys.				56	56	56
585	Elevating and Retracting Gear						
586	Aircraft Recovery Support Systems		45		45	45	45
587	Aircraft Launch Support Systems						
588	Aircraft Handling, Servicing and Stowage		581		581	581	522
589	Miscellaneous Mechanical Handling Systems						
590	SPECIAL PURPOSE SYSTEMS						
591	Scientific and Ocean Engineering Systems						
592	Swimmer and Diver Support and Protection Sys.						
593	Environmental Pollution Control Systems		33		33	28	28
594	Submarine Rescue, Salvage, & Survival Sys.						
595	Towing, Launch. & Handl. for Underwater Sys.						
596	Handling Sys. for Diver & Submers. Vehicles						
597	Salvage Support Systems						
598	<b>C</b> Auxiliary Systems Operating Fluids <b>N</b>	160	71		199	227	208
599	Auxiliary Systems Repair Parts and Tools <b>C</b>	14	28		28	35	33
	90 1.84						
	GROUP 500 TOTAL		1541		2086	2522	

583 Boats  
 4 RIB 10 10 2049  
 2 UTIL 40' 16 -10% 14 2092  
 LR PAP 23 30FT-0018  
 DAVITS 20 -302AL14  
 56

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PMS 304



		SES	SES	M/H	SUJATH	
		QTY	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
GROUP 6 OUTFIT AND FURNISHINGS:						
600	OUTFIT AND FURNISHINGS, GENERAL					
610	SHIP FITTINGS		11	17	37	35
611	C Hull Fittings		<del>4</del> 8	7	13.16	15
612	C Rails, Stanchions, and Lifelines		<del>6</del> 9	9	18.18	16
613	Rigging and Canvas		<del>4</del> 1	1	3	4
620	HULL COMPARTMENTATION		142	142	213	220
621	Non-Structural Bulkheads		70	68	119	<del>120</del> 72
622	C Floor Plates and Gratings		46	51	72	49.6 65
623	C Ladders		14	20	20	22 20
624	C Non-Structural Closures P		<del>12</del>	1		
625	Airports, Fixed Portlights, and Windows		01	2	2	2
630	PRESERVATIVES AND COVERINGS		454	380	458	511
631	Painting		75	72	127	138 150
632	Zinc Coating					138 WIPOM
633	Cathodic Protection		3	3	3	7
6'	C Deck Covering f (VOL)		4	52 88	85	109
	C Hull Insulation		165	271 165	172	205
636	Hull Damping		20	20	20	20
637	Sheathing					
638	C Refrigerated Spaces		<del>28</del> 28	28	32	28 32
639	Radiation Shielding					
640	LIVING SPACES		236	236	225	225
641	Officer Berthing and Messing Spaces		36	38	34	34
642	Noncomm. Officer Berthing & Missing Spaces		14	14		
643	Enlisted Personnel Berthing & Missing Spaces		154	154	176	176
644	Sanitary Spaces and Fixtures		30	30	15	15
645	Leisure and Community Spaces					
650	SERVICE SPACES		105	75	72	72
651	C Commissary Spaces		<del>23</del> 43	43	39	40
652	Medical Spaces		10	10	14	14
653	Dental Spaces		5			
654	Utility Spaces			5		
655	Laundry Spaces		13	13	19	19
6'	Trash Disposal Spaces		4	4		



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES SES 124 50000

		QTY	WT (LT)	WT (LT)	9/23/13 WT (LT)	SCALE FACTORS	REFERENCE
660	WORKING SPACES		148		147	164	172
661	Offices		15		15	39	39
662	Machinery Control Centers Furnishings		1		1		
663	Electronics Control Centers Furnishings		10		10		
664	Damage Control Stations		12		12		
665	Worsshops, Labs, Test Areas	-	110		106	125	133
670	STOWAGE SPACES		163		156	187	206
671	Lockers and Special Stowage	-	41		39		
672	Storerooms and Issue Rooms		122		117	187	206
673	Cargo Stowage						
690	SPECIAL PURPOSE SYSTEMS		46		12	8	10
698	C Outfit and Furnishings Operating Fluids		5	0		0	
699	C Outfit and Furnish. Repair Parts and Special Tools		10	10	12	8	10
	GROUP 600 TOTAL		1276		1162	1364	

Signature \_\_\_\_\_

Red = 9/07/83

SHIP CHARACTERISTICS

SEC  
CGV  
08/12/83  
02 0753

	SEC	KVA	SWTH
LOA-	688	700	525
BOA	129		
LCUSH	616		
BCUSH	30.8		
HT TO MN DK	79.4		
DRAFT OFF CUSH.	18.0		
DRAFT ON CUSH.	10.7		
L/B	20		
PCUE	692		
HTWD	47.4		
FLD	16759		
VOL X10 <sup>6</sup>	4.061		
LBP	642		
VOL XROSS STRUC	2,589		
VOL SH	1.471		
V DESIGN KT	30		
V CR KT	20		
D <sup>2</sup> @ 30 KTS @ 10 <sup>6</sup>	1.091		
PROP OD	16.3		
KPH	186		
PC design	.62		
PC CRUISE	.62		
BHP PROPUL 30KT	160872		
BHP LIFT	9872		
TOTAL BHP W/D MARGIN	170744		
TOTAL BHP W/ MARGIN	199,156	151,000	147,000
BHP @ 20KT HB	35,832		
FUEL RANGE	2404	2685	3250
N FANS	4		
ACCOMMODATIONS	1272		
SHTR	15.4		
MACHY	4 LH5000 4 HSDIESEL	2 LH2000 2 LH2500 2 RCKER	6 LH2500
KW INSTALLED	15,000	15000	15000



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 1 HULL STRUCTURE:</b>		08/09/83 13.24.59	08/14/83 020753				
100	HULL STRUCTURE, GENERAL						
110	SHELL AND SUPPORTING STRUCTURE		4549			2991	9870
111	Shell Pltng., Surf. Ship & Sub. Press. Hull					1760	
112	Shell Pltng., Sub. Non-Pressure Hull						
113	Inner Bottom					322	
114	Shell Appendages						
115	Stanchions						
116	Longit. Framing, Surf. Ship & Sub. Press. Hull					969	
117	Transv. Framing, Surf. Ship & Sub. Press. Hull						
118	Longit. & Transv. Sub. Non-Press. Hull Framing						
119	Lift System Flexible Skirts and Seals		42				
<b>HULL STRUCTURAL BULKHEADS</b>							
120	HULL STRUCTURAL BULKHEADS		202			1891	
121	Longitudinal Structural Bulkheads					276	
122	Transverse Structural Bulkheads					1067	
123	Trunks and Enclosures					173	
124	Bulkheads in Torpedo Protection System					375	
125	Submarine Hard Tanks						
	Submarine Soft Tanks						
<b>HULL DECKS</b>							
130	HULL DECKS					3022	
131	Main Deck					729	
132	2nd Deck					327	
133	3rd Deck						
134	4th Deck						
135	5th Deck and Decks Below						
136	01 Hull Deck (Forecastle and Poop Decks)					234	
137	02 Hull Deck					486	
138	03 Hull Deck					1245	
139	04 Hull Deck and Hull Decks Above						
<b>HULL PLATFORMS AND FLATS</b>							
140	HULL PLATFORMS AND FLATS					470	
141	1st Platform					237	
142	2nd Platform					149	
143	3rd Platform						
144	4th Platform						
145	5th Platform					84	
149	Flats						

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

91

		SES			MH	SWATH	
		GOR QTY	WT (LT)	WT (LT)	WT (LT)	SCALE <sup>240K</sup> FACTORS	Vol 126K REFERENCE
150	DECKHOUSE STRUCTURE	<del>60K</del>	125			500	297 203
151	Deckhouse Structure to First Level						
152	1st Deckhouse Level						
153	2nd Deckhouse Level						
154	3rd Deckhouse Level						
155	4th Deckhouse Level						
156	5th Deckhouse Level						
157	6th Deckhouse Level						
158	7th Deckhouse Level						
159	8th Deckhouse Level						(160)
							76 shh parm
160	SPECIAL STRUCTURES w/o 164		476			599	1244 70
161	Struct. Castings, Forgings, & Equiv. Weldmnts.		100			237	253
162	Stacks and Macks (Combined Stack and Mast)						
163	Sea Chests		13			54	13
164	Ballistic Plating	23	187			1971	979 79
165	Sonar Domes						
166	Sponsons					190	(VLS) (123)
167	Hull Structural Closures		77			77	80
	Deckhouse Structural Closures						
169	Special Purpose Closures and Structures		41			41	190
170	MASTS, KINGPOSTS, AND SERVICE PLATFORMS		52			32	32
171	Masts, Towers, Tetrapods		32				
172	Kingposts and Support Frames						
179	Service Platforms						
180	FOUNDATIONS		209			468	553
181	Hull Structure Foundations						
182	Propulsion Plant Foundations					135	129
183	Electric Plant Foundations					68	79
184	Command and Surveillance Foundations		8			46	46
185	Auxiliary Systems Foundations					263	205
186	Outfit and Furnishings Foundations						
187	Armament Foundations		55			56	54

		SES			MH	GWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
190	SPECIAL PURPOSE SYSTEMS					260	297
191	Ballast, Fixed or Fluid, and Buoyancy Units						
192	Compartment Testing						
195	Erection of Sub Sections (Progress Rpt. Only)						
198	Free Flooding Liquids	?	?			20.	21
199	Hull Repair Parts and Special Tools						
197	WELDING & MIL TOL		(240)			240	276
	GROUP 100 TOTAL		5570			12303	12195

Signature \_\_\_\_\_

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES

124

SUJATH

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE	
<b>GROUP 2 PROPULSION PLANT:</b>							
200	PROPULSION PLANT, GENERAL						
210	ENERGY GENERATING SYSTEM (NUCLEAR)						
211	(Reserved)						
212	Nuclear Steam Generator						
213	Reactors						
214	Reactor Coolant System						
215	Reactor Coolant Service System						
216	Reactor Plant Auxiliary Systems						
217	Nuclear Power Control and Instrumentation						
218	Radiation Shielding (Primary)						
219	Radiation Shielding (Secondary)						
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)						
221	Propulsion Boilers						
222	Gas Generators						
223	Main Propulsion Batteries						
224	Main Propulsion Fuel Cells						
230	PROPULSION UNITS						
231	Propulsion Steam Turbines						
232	Propulsion Steam Engines						
233	Propulsion Internal Combustion Engines <small>WED STATE PRES</small>						
234	Propulsion Gas Turbines <small>WITH STD MOD</small>						
235	Electric Propulsion						
236	Self-Contained Propulsion Systems						
237	Auxiliary Propulsion Devices						
238	Secondary Propulsion (Submarines)						
239	Emergency Propulsion (Submarines)						
240	TRANSMISSION AND PROPULSOR SYSTEMS						
241	C	Propulsion Reduction Gears	chg	299	1165	2 184	181
242		Propulsion Clutches and Couplings		5	connect		1
243	C	Propulsion Shafting	chg	51	(140)✓	30 295	474 196
244	C	Propulsion Shaft Bearings	chg	10	160Y	72	108 101
245		Propulsors		76		51.5	108 92
246		Propulsors Shrouds and Ducts					
247		Water Jet Propulsors					
248		Lift System Fans and Ducting		16			
250	PROPULSION SUPPT SYS (EXC. FUEL AND LUBE OIL)						
251	Combustion Air System						
252	C	Prop coal		4		22	25.7
		high		11	asset	11	28 3.5
		central & 2 local			algebra		11

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

072 144 50172

		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
253	Main Steam Piping System					5 R	
254	Condensers and Air Ejectors						
255	Feed and Condensate System					18 R	
256	Circulating and Cooling Sea Water System					35 R	50
259	C Dptakes (Inner Casing) <b>.18 x 57' #4</b>			<b>15 ? 34</b>		127	22 <del>18.5</del> DDG51 G9C <b>.15 ton/ft</b>
260	PROPULSION SUPPT SYS (FUEL & LUBE OIL)						
261	C Fuel Service System		23'			86	84
262	C Main Propulsion Lube Oil System		11 21'			36 15	42
263	Shaft Lube Oil System (Submarines)		9 ?	17		30	37
264	Lube Oil Fill, Transfer, and Purification		3'			20	6
290	SPECIAL PURPOSE SYSTEMS					76	
298	C Propulsion Plant Operating Fluids	<i>ch 40</i>	6	(40)'		66 P	<del>33</del> 55
299	C Propulsion Plant Repair Parts & Special Tools	<i>1/2"</i>	20	(110)'		10	10
	GROUP 200 TOTAL		932				

L = 24.5

Signature \_\_\_\_\_

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES				MH	QUALITY
QTY		WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS		REFERENCE
<b>GROUP 3 ELECTRIC PLANT:</b>							
300	ELECTRIC PLANT, GENERAL						
310	ELECTRIC POWER GENERATION						
311	C	Ship Service Power Generation	150 GT	135 GT	276 D	150	276 D
312	Emergency Generators						
313	C	Batteries and Service Facilities	1	112 <sup>v</sup>	12		12
314	C	Power Conversion Equipment	39				
315	Shore Power Receptacles						
320	POWER DISTRIBUTION SYSTEMS						
321	C	Ship Service Power Cable Tom Cannon X-85	chg 85	1298	278		309
322	Emergency Power Cable System						
323	Casualty Power Cable System						
324	C	Switchgear and Panels Tom Cannon	57	66 <sup>v</sup>	8/66	8/31	chg 66
330	LIGHTING SYSTEM						
331	C	Lighting Distribution Tom Cannon	chg 9	130	76		81
332	Lighting Fixtures						
333	Switches, Receptacles, and Outlets						
340	POWER GENERATION SUPPORT SYSTEMS						
341	SSTG Lube Oil						
342	C	Diesel Support Systems 27 + .10 GP3	31.5		59		27 59 315
343	C	Turbine Support Systems	10				
390	SPECIAL PURPOSE SYSTEMS						
398	C	Electric Plant Operating Fluids	11	2	2		2
399	C	Electric Plant Repair Parts and Special Tools	4	9	16		16
		GROUP 300 TOTAL		286		803	738

(553)

change  
to diesel

Signature \_\_\_\_\_

SES UNIT ANALYSIS - SUMMARY (By Ship's Work Breakdown Structure)

SES HH SUDATH

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 5 AUXILIARY SYSTEMS:</b>						
<b>500 AUXILIARY SYSTEMS, GENERAL</b>						
510					486	
511	C	382			30	42
512	C	81	40203		35	42
513	C	29			248	296 245
514	C	92	1402		5	209
515		0+20			195	209
516	C	57			8	8
517						
<b>520 SEA WATER SYSTEMS</b>						
521	C	104			210	210 149
522			485		100 555	100 555
523			141			
524		11				
526		1				
527			62		75	157
528	C	1125				
		36				
<b>530 FRESH WATER SYSTEMS</b>						
531	C	519			19	21
532	C	27			27	27
533	C	19			19	19
534						
535						
536		12			12A	22 EM 1
<b>540 FUELS AND LUBRICANTS, HANDLING AND STORAGE</b>						
541	C	5A			77 64	75 65
542	C	17			17	18
543		1				
544						
545						
549		PL			4	4
<b>550 AIR, GAS, AND MISC. FLUID SYSTEMS</b>						
		24	bleed air		46	54
			air			
553		8			8	8
554						
555		56			56	57 1

		QTY	SES WT (LT)	WT (LT)	WT (LT)	MH SCALE FACTORS	SMATH REFERENCE
	<b>C</b> Hydraulic Fluid System		20			0	0
5	Liquid Gases, Cargo						
558	Special Piping Systems						
560	<b>SHIP CONTROL SYSTEMS</b>						
561	Steering and Diving Control Systems		34			46	77
562	Rudder					73	160
563	Hovering and Depth Control (Submarine)						
564	Trim System (Submarines)						
565	Trim and Heel Systems (Surface Ships)		NA			160	160
566	Diving Planes & Stabilizing Fins (Submarines)					Ballast Keel Fin Stabilizer	
567	Strut and Foil Systems						
568	Maneuvering Systems						
570	<b>UNDERWAY REPLENISHMENT SYSTEMS</b>						
571	<b>C</b> Replenishment-At-Sea Systems	59	9			59	59
572	<b>C</b> Ship Stores and Equipment Handling Systems	34	5			34	34
573	Cargo Handling Systems						
574	Vertical Replenishment Systems						
	<b>MECHANICAL HANDLING SYSTEM</b>						
581	<b>C</b> Anchor Handling and Stowage Systems	165	65	165		227	227
582	<b>C</b> Mooring and Towing Systems		ATD				
583	<b>C</b> Boats, Boat Handling and Stowage Systems	32	15			32	32
584	Mechan. Oper. Door, Gate, Ramp, Turntab. Sys.						
585	Elevating and Retracting Gear						
586	Aircraft Recovery Support Systems		45			45	45
587	Aircraft Launch Support Systems						
588	Aircraft Handling, Servicing and Stowage		581			581	522
589	Miscellaneous Mechanical Handling Systems						
590	<b>SPECIAL PURPOSE SYSTEMS</b>						
591	Scientific and Ocean Engineering Systems						
592	Swimmer and Diver Support and Protection Sys.						
593	Environmental Pollution Control Systems		33			28	28
594	Submarine Rescue, Salvage, & Survival Sys.						
595	Towing, Launch. & Handl. for Underwater Sys.						
596	Handling Sys. for Diver & Submers. Vehicles						
597	Salvage Support Systems						
598	<b>C</b> Auxiliary Systems Operating Fluids	N 160	71			227	208
599	Auxiliary Systems Repair Parts and Tools	N	14			35	33
	<b>GROUP 500 TOTAL</b>		1541				



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 6 OUTFIT AND FURNISHINGS:</b>						
600	<b>OUTFIT AND FURNISHINGS, GENERAL</b>					
610	SHIP FITTINGS					
611	C	<del>11</del> 4	8		31	35
612	C	<del>6</del>	9		<del>13</del> 16	15
613		<del>4</del>	<del>7</del>		3	4
620	<b>HULL COMPARTMENTATION</b>					
621	Non-Structural Bulkheads					
622	C	142			213	220
623	C	70			119	<del>140</del> 72
624	C	46	5A		72	} <del>49</del> 65
625	C	14	20		<del>20</del>	
625		<del>12</del>				
625	Airports, Fixed Portlights, and Windows					
		01			2	2
630	<b>PRESERVATIVES AND COVERINGS</b>					
631	Painting					
632	Zinc Coating					
633	Cathodic Protection					
634	C	454			462	511
635	C	75			127	<del>138</del> <del>150</del>
636						138 W.P.M.
637		3			3	7
638	C	49	<del>57</del> 98		109	109
639	C	165	<del>271</del> 165		171	205
640	Hull Damping					
641			20		20	20
642	Sheathing					
643	C		<del>292</del> 28		<del>32</del> 28	<del>32</del> 28
644	Radiation Shielding					
640	<b>LIVING SPACES</b>					
641	Officer Berthing and Messing Spaces					
642	Noncomm. Officer Berthing & Missing Spaces					
643	Enlisted Personnel Berthing & Missing Spaces					
644	Sanitary Spaces and Fixtures					
645	Leisure and Community Spaces					
640	<b>SERVICE SPACES</b>					
641	C	236	75		225	225
642		38			34	34
643		14				
644		154			176	176
645		30			15	15
650	<b>SERVICE SPACES</b>					
651	C	105	75		72	72
652		<del>73</del>	43		39	40
653		10			14	14
654		5				
655		13			19	19
656		1				
657	Trash Disposal Spaces					

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES 124 522712

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
660	WORKING SPACES	148			164	172
661	Offices	15			39	39
662	Machinery Control Centers Furnishings	1				
663	Electronics Control Centers Furnishings	10				
664	Damage Control Stations	12				
665	Worshhips, Labs, Test Areas	110			125	133
670	STOWAGE SPACES	163			187	206
671	Lockers and Special Stowage	41				
672	Storerooms and Issue Rooms	122			187	206
673	Cargo Stowage					
690	SPECIAL PURPOSE SYSTEMS	<del>16</del>			9	10
698	C Outfit and Furnishings Operating Fluids	5	0		0	
699	C Outfit and Furnish. Repair Parts and Special Tools	10	10		8	10
	GROUP 600 TOTAL	1276				

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9/07/83

311

~~High Speed~~

European Med Speed Diesel

weighs half wt of American MED. S

SFS = .51  $\frac{lb}{KW}$  PA 6 280 with encl & MTG  
HR

~~6~~ X 2500 = 150

EMD diesel 6 X 2500 = 295

342 use

27 LT + .10 GP3

311

High 2 speed diesels. Still feel uncomfortable with reliability.

check GT wts. they are high

324

Done 20% copper clad cable.

10% 311 ~~340~~

10% (311, 324, 342)

47

~~WTD~~ WTD

\* 241 check

\* 259 check

22 ~~70~~<sub>57</sub> ft x 4 = <sup>228</sup> ~~250~~ ft 88 out sides.  
@ 15 LT = 7 ~~18~~<sup>18</sup> LT/FT

~~give~~ give details to Dick

3 KSES @ 22 x 4 = 88 ft long @ 15.5 LT

=> 0.18 => 46.04 for 228 ft out Transom

261 21 LT ok

SWATH is higher due to Engines high & non structural settling tank <sup>extra</sup> & fuel pump

\* 262 flow meter "check"

SES change to CVOZ algorithm.

\* 514 .40 (ACCOH)  
+ .60

$$AC\ LOAD = 1.25 (1. + .3) \left[ \frac{2315 \times ACCOH + 850K \times \frac{Vol}{106}}{12000} \right]$$

+ 60.98  
GALLEY

$$WT\ 514 = 50 + .155 (AC\ LOAD) -$$

GP ~~6~~

511, 612 aluminum

621 use romex at half  
wt of Aluminum.

622 okay

623 20 LT scaled DDG51  
all steel.

624 assume in 621

635 change to middle curve  
of conventional

638 base on DDG51 @ 339 over  
scaled linearly  
7.44

651 Compressor  
use  $T_{om}$  curve

DK HSE VOL

150

80 x 30 x 25

160 MH  
ARMOUR magazines

VLS MODULES

SWATH  
+ cheap kill GT & CIC

AL Ballistic PLATING  
Gene Eroni

steel / Al /  $\frac{1}{2}$ " steel = 1.25 Al

1" steel = 2.25 Al

NEED 3" steel including  
3" steel include

level 4 cheap kill =  $\frac{1}{2}$ " steel dk Hse

level 3 CIC 1" steel

160

161 add to list ~ 1/2 of Marshall  
164 add to list

169

SWATH.

81 Hanger Door (1)  
73 2 Dr Edge eleva door  
33 elevator Weap Ammo Doors

170

change to CV02

198

190 of (GP1-190)

DD08

197

Welding & P. Tol  
1.5% MIL TOL  
Try to check.

Ron Smith feedback on life boat



150  
199

0830 FRI

1

241 Propulsion use Cente Epicycle  
 243 high speed shaft okay  
 252 USE Asset algorithm. 11

(DDO8A)

(251)

259 SWATH

L = 24.5 x 86 x 147 HP => 22 LT

.15 T/FT

SES review + give disk length

261 Asset

10.5T DDG51 CURRENT 100 HP.

BW 262 = DDG51 25 LT  
check SES EPICYCLIC

298 DDG51 => 52 LT  
7 LT/Rover x 2

311 DDG51 => 93  
for 3 x 2500  
use 180 LT for 6 GT.  
include subbase + enclosure

321 Disk will get lightweight  
number Delta percentage

374 CVOZ for MH + SWATH  
also -20% for light wt panels.  
66 LT SES

Disk M to check

512/513 high Vol detecting

DDG51 { 512 22  
          { 513 14  
                  36

1 MIL ft<sup>3</sup>  
for 1M ft<sup>3</sup>

\*

60 LT/M ft<sup>3</sup>

512 } 83 LT @ 647      1.1 MIL  
513 }

scale DDG51 to SES  
4 x Vol  
2 x H

SES use ~~20~~ 50. LT/MIL ft<sup>3</sup>

Dick MILLIGAN TO CHECK DDG51.

514 Checking Annapolis for Heat Pump  
      & imp

514-516      130 LT for DDG51  
              133

521-24 USE CVOZ algorithm  
      27      40.2 x L x D / 10,000

526, 28, 29      CVOZ

60 LT @ 47  
35 LT      DDG51

528      24 DDG51  
          39

528      SES use 25

531 SES go to 19

532 Elect cooling add 27

541 ok

542 use CVOZ .025 X WT AV FUEL

551 compressed Air OK

553  
a add 8 LT balled for A/C

556 zero out.

581/82 use CVOZ

$$65 + (L B D) 34 \times 10^{-6}$$

let D = Box HT

581	51	DG 51
582	<u>19</u>	"

83 CG#7

598	BDG 51	$\left( \frac{64}{800} \right)$	8
599			
$CVOZ = \frac{107 (GP 5)}{1000} - 50$			

SES change to CVOZ  
.013 (GP 5)

$$W_{150} = w_i \frac{9 \left[ V_{OD} - .4166 V_{hang} \right]}{2240}$$

$$w_i = 4.492 \text{ lb/ft}^3 \text{ steel}$$

$$w_i = 1.960 \text{ lb/ft}^3 \text{ Aluminum with fire protection}$$

Relation from ASSET - 3-7-22+23

$$W_{164} = 187 \text{ lb constant for CGV.}$$

$$W_{161} = .21 \text{ of } 160$$

$$W_{163} = .03 \text{ of } 160$$

$$W_{167} = .16 \text{ of } 160$$

$$W_{169} = .21 \text{ of } 160$$

$$W_{170} = .62 W_{170x} \quad \begin{array}{l} \text{growth factor} \\ \text{column 73} \end{array}$$

$$W_{182} = .24 \text{ of } 180$$

$$W_{183} = .12 \text{ of } 180$$

$$W_{184} = .08 \text{ of } 180$$

$$W_{185} = .46 \text{ of } 180$$

~~$$W_{186} = .10 \text{ of } 180$$~~

$$W_{187} = .10 \text{ of } 180$$

based on Marshall  
Breakdown.

$$W_{119} = K_{190} \cdot \text{BELLE} \cdot \text{CIDS} \cdot \text{HTWB}$$

(Now is VARN 190, should be VARN 119  
Make change)

VARN 197 should be

$$W_{197} = .04 W_{100}$$

$$\text{VARN}_{190} + \text{~~190~~} = W_{197}$$

~~$W_{241} \Rightarrow$  growth factor of .55~~

~~$W_{243} \Rightarrow$  growth factor of 2.75~~

~~$W_{244} \Rightarrow$  growth factor of 6.0~~

~~$K_{244} = .429$~~

$$W_{241} = C_0 + Q_{241} * \text{TRANS}$$

$$+ Q_{241} * \text{NPEC} * \text{WTRC} \text{ Hoif}$$

$$Q_{241} = .55$$

$$W_{243} = C_0 + Q_{243} * \text{WSHF}$$

$$+ Q_{243} * C_1 * \text{WSHP} + C_0$$

~~$W_{244} =$~~

$$Q_{243} = 2.75$$

$$K_{244} = .429$$

$$W_{252} = \left( \text{HPT} * \frac{.358}{x_0} \right) * \frac{.2}{x_1} \frac{1}{x_2} \quad (\text{Eq. 5THZ})$$

~~K259~~

$$W259 = CO + CO * K259 + K259 * \overset{.15}{\parallel} \overset{LOUT}{\cancel{HPT}} * NPFC + CO \text{ etc}$$

$$K259 = .15$$

$$LOUT = 57.0$$

$$K261 = .000115$$

$$K262 = .000 \cancel{115}$$

$$W262 = CO + K262 * HPT + CO \text{ etc}$$

$$K298 = \cancel{.000115} .0002$$

$$K299 = .0000 \cancel{B}$$

$$N311 = 6$$

$$W/31 = 25.0$$

$$K313 = 2.0$$

~~W314~~ delete items

$$K314 = .00001$$

42.381 50 SHEETS 5 SQUARE  
42.382 100 SHEETS 5 SQUARE  
42.386 200 SHEETS 5 SQUARE



change

$$L 321 = 4.23$$

NEW Constant

$$KWI = 15000 \text{ or}$$

$$KWI = KW * 1.4 / .9$$

Installed Power elect total.

$$K 324 = 0.007$$

$$K 331 = 0.00739$$

$$K 343 = 0.0$$

$$K 342 = \frac{1.0021}{.0035}$$

$$W 342 = \frac{.K 342}{K 342} * KWI$$

$$K 398 = .015$$

$$K 399 = .001$$

$$W 399 = .001 * KWI$$

From Asset

DUM 1 ~~100~~

$$W_{S12} = 7.083 \times (V_{CS} \times 10^{-5})$$

$$W_{S13} = 1.266 \times (V_{SH} \times 10^{-5})$$

---

42-381 50 SHEETS 5 SQUARE  
42-382 100 SHEETS 5 SQUARE  
42-389 200 SHEETS 5 SQUARE  
NATIONAL





$$W_{S14} = \overset{KS14}{50.00} + \overset{LS14}{17.84} \times \frac{V_T}{106} + C1 \times \overset{MS14}{10459} \times \text{COMP}$$

$$W_{S16} = KS16 \quad KS16 = \del{5.00} ,00015$$

$$KS28 = \del{.16} .16$$

K

$$W_{S31} = \overset{.007}{\cancel{0.1911}} + \overset{.007}{\cancel{.007}} \times (COMP \times \overset{1.1045}{MS31})$$

$$LS31 = .007$$

~~W533 =~~

$$\del{WS33 = .015}$$

$$KS33 = .015$$

$$KS42 = ,00000123$$

$$W553 = C0 + LCUE \times KSS3 + C0 \text{ etc}$$

$$KSS3 = ,013$$

$$L556 = 0.0$$

$$KS71 = ,012$$

$$KS72 = .0072$$

42,381 50 SHEETS 3 SQUARE  
42,382 100 SHEETS 3 SQUARE  
42,383 200 SHEETS 3 SQUARE  
NATIONAL

K 582 = .030

K 583 = .030

K 598 = ~~9.23~~ .11

~~K 599~~

K 611 = 8.82

K 612 = 11.25

~~K~~

K 622 = .134 .0134

~~K 623 = .47~~

L 623 = .47

L 624 = 0.0

K 625 = 2

K 634 = 2.18

Change in List 635

both C1 to C59 = .59

K 638 = .0223

K 651 = .0336

K 698 = 0.0

~~K 699~~

09/08/83

CGU WT DELTAS

GP 1 365 SUPERSTRUCT + ARMOR

GP 2 73 MISC

GP 3 159 DIESEL

GP 5 408 HVAC, HILINE, ANCHOR

GP 6 -134 MISC

Σ 871 LT

FUEL SAVINGS - 150

HOTEL LOAD DIESEL

$$\begin{array}{r}
 \text{FLD} = 16759 \\
 + 871 \\
 \hline
 17630 \text{ LT}
 \end{array}$$

$$\text{GPI} = 5570 + 365 = 5935$$

$$\text{WT FRACT} = 33.7\%$$

Red = 9/07/83

# SHIP CHARACTERISTICS

	SES	KH	SWATH
	CGV		
	08/17/83		
	02 0753		
LOA-	688	700	525
BOA	129		
LCUSH	616		
BCUSH	30.8		
HT TO MN DK	79.4		
DRAFT OFF CUSH.	18.0		
DRAFT ON CUSH.	10.7		
L/B	20		
PCUE	692		
HTWD	47.4		
FLP	16759		
VOL X10 <sup>6</sup>	4.061		
LBP	642		
VOL XROSS STRUC	2,589		
VOL SH	1271		
V DESIGN K <sub>T</sub>	30		
V CV K <sub>T</sub>	20		
Z <sub>T</sub> @ 30 KTS @ 10 <sup>6</sup>	1.091		
PROP OD	16.3		
RPM	186		
PC design	162		
PC CRUISE	162		
BHP PROPUL 30KT	160872		
BHP LIFT	9872		
TOTAL BHP W/D MARGIN	170744		
TOTAL BHP W MARGIN	199,156	151,000	147,500
BHP @ 20KT HB	35,832		
FUEL RANGE	2404	2685	3250
N FANS	4		
ACCOMMODATIONS	1272		
SHTR	15.4		
MACHN	4 LH5000 4 LH5150	2 LH3000 2 LH2500 2 RFLER	6 LH2500
KW INSTALLED	15,000	15,000	15,000

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 1 HULL STRUCTURE:</b>		05.2483	02/17/13				
100	HULL STRUCTURE, GENERAL	13.24.59	020753				
110	SHELL AND SUPPORTING STRUCTURE		4549			2991	9870
111	Shell Pltng., Surf. Ship & Sub. Press. Hull					1760	
112	Shell Pltng., Sub. Non-Pressure Hull						
113	Inner Bottom					322	
114	Shell Appendages						
115	Stanchions						
116	Longit. Framing, Surf. Ship & Sub. Press. Hull					969	
117	Transv. Framing, Surf. Ship & Sub. Press. Hull						
118	Longit. & Transv. Sub. Non-Press. Hull Framing						
119	Lift System Flexible Skirts and Seals		42				
120	HULL STRUCTURAL BULKHEADS		202			1891	
121	Longitudinal Structural Bulkheads					276	
122	Transverse Structural Bulkheads					1067	
123	Trunks and Enclosures					173	
124	Bulkheads in Torpedo Protection System					375	
125	Submarine Hard Tanks						
	Submarine Soft Tanks						
130	HULL DECKS					3022	
131	Main Deck					729	
132	2nd Deck					327	
133	3rd Deck						
134	4th Deck						
135	5th Deck and Decks Below						
136	01 Hull Deck (Forecastle and Poop Decks)					234	
137	02 Hull Deck					486	
138	03 Hull Deck					1245	
139	04 Hull Deck and Hull Decks Above						
140	HULL PLATFORMS AND FLATS					470	
141	1st Platform					237	
142	2nd Platform					149	
143	3rd Platform						
144	4th Platform						
145	5th Platform					84	
149	Flats						

SES UNIT ANALYSIS - SUMMARY  
 (By Ship's Work Breakdown Structure)

		SES			MH	SWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE <sup>240K</sup> FACTORS	Vol 126K REFERENCE
150	DECKHOUSE STRUCTURE	60K				500	297 263
151	Deckhouse Structure to First Level						
152	1st Deckhouse Level						
153	2nd Deckhouse Level						
154	3rd Deckhouse Level						
155	4th Deckhouse Level						
156	5th Deckhouse Level						
157	6th Deckhouse Level						
158	7th Deckhouse Level						
159	8th Deckhouse Level						(160)
							76 Ahl pump
160	SPECIAL STRUCTURES W/O 164		476			598	1244 705
161	Struct. Castings, Forgings, & Equiv. Weldmnts.					237	253
162	Stacks and Macks (Combined Stack and Mast)						
163	Sea Chests					54	13
164	Ballistic Plating					1971	979 798
165	Sonar Domes						
166	Sponsons					190	(VLS) (123)
167	Hull Structural Closures					77	81)
	Deckhouse Structural Closures						
168	Special Purpose Closures and Structures					41	190
170	MASTS, KINGPOSTS, AND SERVICE PLATFORMS		52			32	32
171	Masts, Towers, Tetrapods		(32				
172	Kingposts and Support Frames						
179	Service Platforms						
180	FOUNDATIONS		249			568	553
181	Hull Structure Foundations						
182	Propulsion Plant Foundations					135	129
183	Electric Plant Foundations					68	79
184	Command and Surveillance Foundations					46	46
185	Auxiliary Systems Foundations					263	245
186	Outfit and Furnishings Foundations						
187	Armament Foundations					56	54

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	GWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
190	SPECIAL PURPOSE SYSTEMS					260	297
191	Ballast, Fixed or Fluid, and Buoyancy Units						
192	Compartment Testing						
195	Erection of Sub Sections (Progress Rpt. Only)						
198	Free Flooding Liquids					20.	21
199	Hull Repair Parts and Special Tools						
197	WELDING & MIL TOL					240	276
	GROUP 100 TOTAL		5570			12303	12195

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SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES 114 SUJATH

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 2 PROPULSION PLANT:</b>						
200	PROPULSION PLANT, GENERAL					
210	ENERGY GENERATING SYSTEM (NUCLEAR)					
211	(Reserved)					
212	Nuclear Steam Generator					
213	Reactors					
214	Reactor Coolant System					
215	Reactor Coolant Service System					
216	Reactor Plant Auxiliary Systems					
217	Nuclear Power Control and Instrumentation					
218	Radiation Shielding (Primary)					
219	Radiation Shielding (Secondary)					
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)					
221	Propulsion Boilers					
222	Gas Generators					
223	Main Propulsion Batteries					
224	Main Propulsion Fuel Cells					
230	PROPULSION UNITS					
231	Propulsion Steam Turbines					
232	Propulsion Steam Engines					
233	Propulsion Internal Combustion Engines <small>HED SPPT DIESEL</small>					
234	Propulsion Gas Turbines WITH STD MOD					
235	Electric Propulsion					
236	Self-Contained Propulsion Systems					
237	Auxiliary Propulsion Devices					
238	Secondary Propulsion (Submarines)					
239	Emergency Propulsion (Submarines)					
240	TRANSMISSION AND PROPULSOR SYSTEMS					
241	C	299	1165		184	181
242		5	invariant			1
243	C	51	1140		295	474 196
244	C	10	160		72	103 101
245		76			51.5	108 92
246						
247						
248		16				
250	PROPULSION SUPPT SYS (EXC. FUEL AND LUBE OIL)					
251	Combustion Air System					
252	C	2			22	25.7
		11	asset		11	35
			alginate			11

252 C pump cont. central & 2 local high



SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

332

144

50A-2

		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
253	Main Steam Piping System					5 R	
254	Condensors and Air Ejectors						
255	Feed and Condensate System					18 R	
256	Circulating and Cooling Sea Water System					35 R	50
259	C Uptakes (Inner Casing) .13 X 57' X 4		15	34		127	22 18.5 DDG51 69C .15 ton/ft
260	PROPULSION SUPPT SYS (FUEL & LUBE OIL)		23			86	84
261	C Fuel Service System		11	21		36 15	42
262	C Main Propulsion Lube Oil System		9	17		30	37
263	Shaft Lube Oil System (Submarines)						
264	Lube Oil Fill, Transfer, and Purification		2			20	6
290	SPECIAL PURPOSE SYSTEMS					76	
298	C Propulsion Plant Operating Fluids	chr 40	6	(40)		66 P	33 55
299	C Propulsion Plant Repair Parts & Special Tools		20	(110)		10	10
	GROUP 200 TOTAL		932				

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PMS 304

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES MH SIGNATURE

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 3 ELECTRIC PLANT:</b>						
300	ELECTRIC PLANT, GENERAL					
310	ELECTRIC POWER GENERATION					
311	C	Ship Service Power Generation	<del>170</del> 135	GT	288	288
312		Emergency Generators	150	MED DIES	276	150 276 D
313	C	Batteries and Service Facilities	1	(12)	12	12
314	C	Power Conversion Equipment	1			
315	Shore Power Receptacles					
320	POWER DISTRIBUTION SYSTEMS					
321	C	Ship Service Power Cable Tomlinson X-85	85	(128)	362	330
322		Emergency Power Cable System		206	278	309
323		Casualty Power Cable System	3		222	247
324	C	Switchgear and Panels Tomlinson	57	66	866	866 chip
330	LIGHTING SYSTEM					
331	C	Lighting Distribution Tomlinson	9	(30)	76	81
332		Lighting Fixtures	34	60		
333		Switches, Receptacles, and Outlets				
340	POWER GENERATION SUPPORT SYSTEMS					
341		SSTG Lube Oil			59	21
342	C	Diesel Support Systems 27+10 GP3	31.5		59	59 315
343	C	Turbine Support Systems	10			
390	SPECIAL PURPOSE SYSTEMS					
398	C	Electric Plant Operating Fluids	1	2	18	18
399	C	Electric Plant Repair Parts and Special Tools	1	(9) 16	2	2
				(GT)	16	16
		GROUP 300 TOTAL			286	803
						738

(553)  
change  
to diesel

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SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

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	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 5 AUXILIARY SYSTEMS:</b>						
500	<b>AUXILIARY SYSTEMS, GENERAL</b>					
510			380		486	
511	C		30		35	42
512	C		81	40203	248	296 245
513	E		29			
514	E		92	4002	195	209
515						
516	C		57		8	8
517						
<b>SEA WATER SYSTEMS</b>						
521	C		104		210	210 199
522				445	555	555
523				141		
524			11			
526			1			
527				62	75	157
528	C		1125			
			36			
<b>FRESH WATER SYSTEMS</b>						
531	C		519		19	21
532	C		27		27	27
533	C	19	25		19	19
534						
535						
536			NA		NA	22 EH
<b>FUELS AND LUBRICANTS, HANDLING AND STORAGE</b>						
541	C		5A		64	75 65
542	C	17	7		17	18
543			1			
544						
545						
549			PL		4	4
<b>AIR, GAS, AND MISC. FLUID SYSTEMS</b>						
550			24	bleed air	46	54
551						
553			8		8	8
554						
555			26		51	51

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SES UNIT PRICE ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

DATE  
PMS 304

	QTY	SES WT (LT)	WT (LT)	WT (LT)	MH SCALE FACTORS	SMATH REFERENCE
<b>C</b> Hydraulic Fluid System		20			0	0
557 Liquid Gases, Cargo						
558 Special Piping Systems						
<b>SHIP CONTROL SYSTEMS</b>						
560						
561 Steering and Diving Control Systems		74			46	77
562 Rudder					73	160
563 Hovering and Depth Control (Submarine)						
564 Trim System (Submarines)						
565 Trim and Heel Systems (Surface Ships)		NA			160	160
566 Diving Planes & Stabilizing Fins (Submarines)					Belge Keel	
567 Strut and Foil Systems					Fin Stabilizer	
568 Maneuvering Systems						
<b>UNDERWAY REPLENISHMENT SYSTEMS</b>						
570						
<b>C</b> 571 Replenishment-At-Sea Systems	59	9			59	59
<b>C</b> 572 Ship Stores and Equipment Handling Systems	34	5			34	34
573 Cargo Handling Systems						
574 Vertical Replenishment Systems						
<b>MECHANICAL HANDLING SYSTEM</b>						
500						
<b>C</b> 581 Anchor Handling and Stowage Systems	115	65	115		2 227	2 227
<b>C</b> 582 Mooring and Towing Systems		AT				
<b>C</b> 583 Boats, Boat Handling and Stowage Systems	32	15			32	32
584 Mechan. Oper. Door, Gate, Ramp, Turntab. Sys.						
585 Elevating and Retracting Gear						
586 Aircraft Recovery Support Systems		45			45	45
587 Aircraft Launch Support Systems						
588 Aircraft Handling, Servicing and Stowage		581			581	522
589 Miscellaneous Mechanical Handling Systems						
<b>SPECIAL PURPOSE SYSTEMS</b>						
590						
591 Scientific and Ocean Engineering Systems						
592 Swimmer and Diver Support and Protection Sys.						
593 Environmental Pollution Control Systems		33			28	28
594 Submarine Rescue, Salvage, & Survival Sys.						
595 Towing, Launch, & Handl. for Underwater Sys.						
596 Handling Sys. for Diver & Submers. Vehicles						
597 Salvage Support Systems						
<b>C</b> 598 Auxiliary Systems Operating Fluids	N 160	71			227	208
599 Auxiliary Systems Repair Parts and Tools	2	12			35	33
<b>GROUP 500 TOTAL</b>			1541			

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PMS 304

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SES

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	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 6 OUTFIT AND FURNISHINGS:</b>						
500	OUTFIT AND FURNISHINGS, GENERAL					
610	SHIP FITTINGS					
611	C	<del>4</del>	8		31	35
612	C	<del>6</del>	9		<del>16</del> 18	15
613		<del>4</del>	<del>1</del>		3	4
620	HULL COMPARTMENTATION					
621		142			213	220
622	C	70			119	<del>140</del> 72
623	C	46	5A		72	3 } <del>49.6</del> 65
624	C	14	20		<del>20</del>	28 } 20
625	C	<del>12</del>				
625		01			2	2
630	PRESERVATIVES AND COVERINGS					
631		454			462	511
632		75			127	<del>138</del> 152
633						<del>138</del> WIPING
633		3			3	7
634	C	4	<del>57</del> 88		109	109
635	C	165	<del>277</del> 165		171	205
636			20		20	20
637						
638	C		<del>258</del> 28		<del>32</del> 28	32
639						
640	LIVING SPACES					
641		236			225	225
642		38			34	34
643		14				
643		154			176	176
644		30			15	15
645						
650	SERVICE SPACES					
651	C	105	75		72	72
652		<del>73</del>	43		39	40
653		10			14	14
654		5				
655		13			19	19
656		4				

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PMS 304SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

SFS

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5003-12

	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
660	WORKING SPACES		148		164	172
661	Offices		15		39	39
662	Machinery Control Centers Furnishings		1			
663	Electronics Control Centers Furnishings		10			
664	Damage Control Stations		12			
665	Worsships, Labs, Test Areas		110		125	133
670	STOWAGE SPACES		163		187	206
671	Lockers and Special Stowage		41			
672	Storerooms and Issue Rooms		122		187	206
673	Cargo Stowage					
690	SPECIAL PURPOSE SYSTEMS		<del>5</del>		9	10
698	C Outfit and Furnishings Operating Fluids		5	0	0	
699	C Outfit and Furnish. Repair Parts and Special Tools		10	10	8	10
	GROUP 600 TOTAL		1276			

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8/19/83

## SHIP CHARACTERISTICS

	SES CGV 08/12/83 02 0753	MH	SWATH
LOA	688		
BOA	129		
LCUSH	616		
BCUSH	30.8		
HT TO MN DK	79.4		
DRAFT OFF CUSH.	18.0		
DRAFT ON CUSH	10.7		
L/B	2.0		
PCUE	692		
HTWD	47.4		
FLD	16759		
VOL X10 <sup>6</sup>	4.061		
LBP	642		
VOL XROSS STRUC	2,589		
VOL SH	1,471		
V DESIGN KT	30		
V CR KT	20		
DT @ 30 KTS @ 10 <sup>6</sup>	1,091		
PROP OD	16.3		
KPH	186		
PC design	.62		
PC CRUISE	.62		
BHP PROPUL 30KT	160872		
BHP LIFT	9872		
TOTAL BHP W/MARGIN	170744		
TOTAL BHP W MARGIN	199,156	151,000	147,000
BHP @ 20KT HB	35,832		
FUEL RANGE	2404		
N FANS	4		
ACCOMODATIONS	1272		
SHTK	15.4		
MACHN	4 LH5000 4 HS DIESEL	2 LH5000 2 LH2500 2 RACER	6 LH2500
KW INSTALLED	15,000	15000	15000

AGEH-1 = H1  
PCH-1 = H2  
PHM-1 = H3  
JEFF A = H4  
ROHR 10/76 = H5  
BELL 5/75 = H6  
BELL 3/76 = H7  
MXSES = H8  
SES 100A = H9  
LSES = H10  
LOCK 2K = H11  
PGH 2 = H12

DLG 26 = D1  
DLGN 35 = D2  
DE 1057 = D3  
DLGN 38 = D4

PF 105 = P1  
PGM 94 = P2  
PCG 612 = P3  
PGG 511 = P4

FFG 7 = F1

CVN 67 = C1  
CVN 68/69 = C2

LPH 12 = L1  
LHA 4 = L2  
LST 1179 = L3  
LSD 37 = L4  
LPD 13 = L5  
LCU 1646 = L6  
LKA 117 = L7

TAGOR 16 = A1  
AE 35 = A2  
AS 40 = A3  
AD 37 = A4

VOLUME X10<sup>-6</sup>



SUBROUTINE

WGTS

## SUBROUTINE WGTS

### INTRODUCTION

Subroutine WGTS performs a 3 digit SWBS weight estimate based primarily on parametric equations. The empirical data used to derive these equations is presented here in the subroutine documentation.

### DISCUSSION

For any ship type, SWBS (Ship Work Breakdown Structure) breaks down ship gross weight into the following broad categories:

- o 1. Hull Structure
- o 2. Propulsion Plant
- o 3. Electric Plant
- o 4. Command & Surveillance
- o 5. Auxiliary Systems
- o 6. Outfit & Furnishings
- o 7. Armament
- o Margins
- o Variable Loads (including ship's fuel)

The philosophy which governed the use of WGTS in the design program (SESDS) was to first assume a gross weight and size, then estimate the system weights necessary to support the gross weight which is initially assumed. Once the system weights have been calculated, they are summed and subtracted from the gross weight to get fuel weight.

Not all ship system weights are calculated in subroutine WGTS. Other subroutines which are used by WGTS to supply weight information are:

- o Subroutines GROUP4 & GROUP7
- o Group 1 weight calculated in STRUCT
- o Fan weight calculated in FANS
- o Pump weight calculated in JETPMP

- o Gear weights calculated in GEAR
- o Gas turbine weight supplied by ENGID

The reason that these other subroutines are used to calculate weights is that in some cases system designs must be performed before they can be weighed out, and in other cases weight information is stored in vectors.

The plots used to develop empirical 3-digit SWBS weight equations for WGTS appear in Figure 1-74. The list of figures is broken into sections of 1-digit SWBS groups. Also, at the beginning of each section are tables which summarize the figures for that group. The SWBS groups for which weight equations are provided are Group 2 (Figure 1-11), Group 3 (Figure 12-19), Group 5 (Figure 20-44), and Group 6 (Figure 45-74).

The weight of ships fuel is defined as the difference between total lift and the weights of all systems, loads, and margins in the ship. This calculation is complicated by the fact that certain weight groups (Groups 541, 571, 572) are related directly to fuel weight while others (Groups 185, 578, 599) are indirectly related. This situation is rectified by writing an algebraic equation, containing fuel weight as an unknown, relating total static lift capacity to the summation of all weights. The relationship of fuel weight to the above weight groups should appear explicitly in this equation. The equation can then be solved for fuel weight. It should be kept in mind that changes to the weight algorithms for groups 185, 541, 571, 572, 598, and 599 must be reflected in this fuel weight equation.

**SES UNIT ANALYSIS - SUMMARY**  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 1 HULL STRUCTURE:</b>		05.11.13	28.73				
100	<b>HULL STRUCTURE, GENERAL</b>	13.11.13	28.73				
110	<b>SHELL AND SUPPORTING STRUCTURE</b>		4549			2991	9870
111	Shell Pltng., Surf. Ship & Sub. Press. Hull					1760	
112	Shell Pltng., Sub. Non-Pressure Hull						
113	Inner Bottom					322	
114	Shell Appendages						
115	Stanchions						
116	Longit. Framing, Surf. Ship & Sub. Press. Hull					969	
117	Transv. Framing, Surf. Ship & Sub. Press. Hull						
118	Longit. & Transv. Sub. Non-Press. Hull Framing						
119	Lift System Flexible Skirts and Seals		42				
120	<b>HULL STRUCTURAL BULKHEADS</b>		202			1891	
121	Longitudinal Structural Bulkheads					276	
122	Transverse Structural Bulkheads					1067	
123	Trunks and Enclosures					173	
124	Bulkheads in Torpedo Protection System					375	
125	Submarine Hard Tanks						
	Submarine Soft Tanks						
130	<b>HULL DECKS</b>					3022	
131	Main Deck					729	
132	2nd Deck					327	
133	3rd Deck						
134	4th Deck						
135	5th Deck and Decks Below						
136	01 Hull Deck (Forecastle and Poop Decks)					234	
137	02 Hull Deck					486	
138	03 Hull Deck					1245	
139	04 Hull Deck and Hull Decks Above						
140	<b>HULL PLATFORMS AND FLATS</b>					470	
141	1st Platform					237	
142	2nd Platform					149	
143	3rd Platform						
144	4th Platform						
145	5th Platform					84	
149	Flats						

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

FIG 304

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		SES			MH	SWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS <sup>240K</sup>	10 <sup>3</sup> 126 k REFERENCE
150	DECKHOUSE STRUCTURE	60K				500	297 263
151	Deckhouse Structure to First Level						
152	1st Deckhouse Level						
153	2nd Deckhouse Level						
154	3rd Deckhouse Level						
155	4th Deckhouse Level						
156	5th Deckhouse Level						
157	6th Deckhouse Level						
158	7th Deckhouse Level						
159	8th Deckhouse Level						
							160
							76 LHS ramp
160	SPECIAL STRUCTURES W/D 164		476			598	1244 745
161	Struct. Castings, Forgings, & Equiv. Weldmnts.					237	253
162	Stacks and Macks (Combined Stack and Mast)						
163	Sea Chests					54	13
164	Ballistic Plating					1971	979 700
165	Sonar Domes						
166	Sponsons					190	VLS (133)
167	Hull Structural Closures					77	80
	Deckhouse Structural Closures						
169	Special Purpose Closures and Structures					41	190
170	MASTS, KINGPOSTS, AND SERVICE PLATFORMS		52			32	32
171	Masts, Towers, Tetrapods		32				
172	Kingposts and Support Frames						
179	Service Platforms						
180	FOUNDATIONS		249			568	553
181	Hull Structure Foundations						
182	Propulsion Plant Foundations					135	129
183	Electric Plant Foundations					68	79
184	Command and Surveillance Foundations					46	46
185	Auxiliary Systems Foundations					263	225
186	Outfit and Furnishings Foundations						
187	Armament Foundations					56	72

SES UNIT ANALYSIS - SUMMARY  
 (By Ship's Work Breakdown Structure)

		SES			MH	GWATH	
		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
190	SPECIAL PURPOSE SYSTEMS					260	297
191	Ballast, Fixed or Fluid, and Buoyancy Units						
192	Compartment Testing						
195	Erection of Sub Sections (Progress Rpt. Only)						
198	Free Flooding Liquids					20.	21
199	Hull Repair Parts and Special Tools						
197	WELDING & MIL TOL					240	276
	GROUP 100 TOTAL		5570			12303	12195

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ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	SWATH CENTER OF GRAVITY									
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.			REFERRED TO				
					FWD	MOMENTS	AFT	SEDES				
							MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
110	SHELL AND SUPPORTING STRUCTURE	2991.15	19.44						4931.92			
111	SHELL PLATING, SURF. SHIP AND SUB. PRESS. HULL	1700.01	27.46									
112	SHELL PLATING, SUBMARINE NON-PRESSURE HULL											
113	INNER BOTTOM	322.39	4.10									
114	SHELL APPENDAGES											
115	STANCHIONS											
116	LONGIT. FRAMING, SURF. SHIP AND SUB. PRESS. HULL	968.75	10.47									
117	TRANSV. FRAMING, SURF. SHIP AND SUB. PRESS. HULL											
118	LONGIT. AND TRANSV. FRAMING, SUB. NON-PRESS. HULL											
119	LIFT SYSTEM FLEXIBLE SKIRTS AND SEALS											
120	HULL STRUCTURAL BULKHEADS	1891.31	36.08						197.89			
121	LONGITUDINAL STRUCTURAL BULKHEADS	275.62	41.95									
122	TRANSVERSE STRUCTURAL BULKHEADS	1067.45	41.95									
123	TRUNKS AND ENCLOSURES	172.79	35.99									
124	BULKHEADS IN TORPEDO PROTECTION SYSTEM	375.45	15.15									
125	SUBMARINE HARD TANKS											
126	SUBMARINE SOFT TANKS											
130	HULL DECKS	3021.96	59.34									
131	MAIN DECK	729.44	43.46									
132	2ND DECK	326.73	33.96									
133	3RD DECK											
134	4TH DECK											
135	5TH DECK AND DECKS BELOW											
136	01 HULL DECK (FORECASTLE AND POOP DECKS)	234.46	53.96									
137	02 HULL DECK	486.25	64.96									
138	03 HULL DECK											
139	04 HULL DECK AND HULL DECKS ABOVE	- 1245.08	74.13									
Sub Total Group 1 — Sheet 1, POUNDS												
TONS									9870			

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO. $\emptyset$			REFERRED TO $\downarrow$						
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
140	HULL PLATFORMS AND FLATS	469.83	21.33											
141	1ST PLATFORM	236.69	24.98											
142	2ND PLATFORM	148.97	14.99											
143	3RD PLATFORM													
144	4TH PLATFORM													
145	5TH PLATFORM													
149	FLATS	84.18	22.29											
150	DECKHOUSE STRUCTURE	500.09	94.50		296.8									
151	DECKHOUSE STRUCTURE TO FIRST LEVEL													
152	1ST DECKHOUSE LEVEL													
153	2ND DECKHOUSE LEVEL													
154	3RD DECKHOUSE LEVEL													
155	4TH DECKHOUSE LEVEL													
156	5TH DECKHOUSE LEVEL													
157	6TH DECKHOUSE LEVEL													
158	7TH DECKHOUSE LEVEL													
159	8TH DECKHOUSE LEVEL AND ABOVE													
160	SPECIAL STRUCTURES w/o 164	597.67	37.10		1244.45		463.55							
161	STRUCTURAL CASTINGS, FORGINGS, AND EQUIV. WELDMENTS	236.81	21.76		252.6									
162	STACKS AND MACKS (COMBINED STACK AND MAST)													
163	SEA CHESTS	53.96	5.80		12.85									
164	BALLISTIC PLATING	1971.00	24.80		979									
165	SONAR DOMES													
166	SPONSONS	189.62	60.82											
167	HULL STRUCTURAL CLOSURES	76.55	41.87											
168	DECKHOUSE STRUCTURAL CLOSURES													
169	SPECIAL PURPOSE CLOSURES AND STRUCTURES	40.73	48.42											
Sub Total Group 1 — Sheet 2, POUNDS														
TONS					1541.3									

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE



ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
170	MASTS, KINGPOSTS, AND SERVICE PLATFORMS	32.20	137.50				32.2			52.21				
171	MASTS, TOWERS, TETRAPODS													
172	KINGPOSTS AND SUPPORT FRAMES													
179	SERVICE PLATFORMS													
180	FOUNDATIONS	568.30	37.12				553.48			243.15				
181	HULL STRUCTURE FOUNDATIONS													
182	PROPULSION PLANT FOUNDATIONS	135.41	8.19				128.8							
183	ELECTRIC PLANT FOUNDATIONS	67.94	46.17				77.74							
184	COMMAND AND SURVEILLANCE FOUNDATIONS	46.48	46.17				46							
185	AUXILIARY SYSTEMS FOUNDATIONS	262.87	46.17				214.24							
186	OUTFIT AND FURNISHINGS FOUNDATIONS													
187	ARMAMENT FOUNDATIONS	55.60	46.17				54.2							
190	SPECIAL PURPOSE SYSTEMS	259.89	36.04				296.6			1112.55				
191	BALLAST, FIXED OR FLUID, AND BUOYANCY UNITS									212/03				
192	COMPARTMENT TESTING													
195	ERECTION OF SUBSECTIONS (PROGRESS REPORT ONLY)													
198	FREE FLOODING LIQUIDS	20.25	5.50				21							
199	HULL REPAIR PARTS AND SPECIAL TOOLS													
197	WELDING & MILL TOLERANCE	239.64	38.62				275.6							
	ALL EXCEPT 164	10332.40	40.66											
	164	1971.00	24.80	48881										
	Sub Total Group 1 — Sheet 3						984							
	Sub Total Group 1 — Sheet 1						9870							
	Sub Total Group 1 — Sheet 2						1341							
	<b>TOTAL — GROUP 1, POUNDS</b>													
	<b>TONS</b>	12203.40	38.11				12195			5888.72				

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 2 PROPULSION PLANT:</b>						
200	PROPULSION PLANT, GENERAL					
210	ENERGY GENERATING SYSTEM (NUCLEAR)					
211	(Reserved)					
212	Nuclear Steam Generator					
213	Reactors					
214	Reactor Coolant System					
215	Reactor Coolant Service System					
216	Reactor Plant Auxiliary Systems					
217	Nuclear Power Control and Instrumentation					
218	Radiation Shielding (Primary)					
219	Radiation Shielding (Secondary)					
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)					
221	Propulsion Boilers					
222	Gas Generators					
223	Main Propulsion Batteries					
224	Main Propulsion Fuel Cells					
230	PROPULSION UNITS					
231	Propulsion Steam Turbines					
232	Propulsion Steam Engines					
233	Propulsion Internal Combustion Engines <small>HEAVY DIESEL</small>					
234	Propulsion Gas Turbines					
235	Electric Propulsion					
236	Self-Contained Propulsion Systems					
237	Auxiliary Propulsion Devices					
238	Secondary Propulsion (Submarines)					
239	Emergency Propulsion (Submarines)					
240	TRANSMISSION AND PROPULSOR SYSTEMS					
241	Propulsion Reduction Gears					
242	Propulsion Clutches and Couplings					
243	Propulsion Shafting					
244	Propulsion Shaft Bearings					
245	Propulsors					
246	Propulsors Shrouds and Ducts					
247	Water Jet Propulsors					
248	Lift System Fans and Ducting					
250	PROPULSION SUPPT SYS (EXC. FUEL AND LUBE OIL)					
251	Combustion Air System					
252	Propulsion Control System					

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
253	Main Steam Piping System				5 F	
254	Condensers and Air Ejectors					
255	Feed and Condensate System				13 F	
256	Circulating and Cooling Sea Water System				35 F	50
259	Uptakes (Inner Casing)		15		127	18.5
260	PROPULSION SUPPT SYS (FUEL & LUBE OIL)		23		86	84
261	Fuel Service System		11		36	42
262	Main Propulsion Lube Oil System		9		30	37
263	Shaft Lube Oil System (Submarines)					
264	Lube Oil Fill, Transfer, and Purification		3		20	6
290	SPECIAL PURPOSE SYSTEMS				76	
298	Propulsion Plant Operating Fluids	40	6	40	66 F	33
299	Propulsion Plant Repair Parts & Special Tools	40	20		10	10
	GROUP 200 TOTAL		932			

Signature \_\_\_\_\_

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
210	ENERGY GENERATING SYSTEM (NUCLEAR)												
211	(RESERVED)												
212	NUCLEAR STEAM GENERATOR												
213	REACTORS												
214	REACTOR COOLANT SYSTEM												
215	REACTOR COOLANT SERVICE SYSTEM												
216	REACTOR PLANT AUXILIARY SYSTEMS												
217	NUCLEAR POWER CONTROL AND INSTRUMENTATION												
218	RADIATION SHIELDING (PRIMARY)												
219	RADIATION SHIELDING (SECONDARY)												
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	800.00	20.77	35.6									
221	PROPULSION BOILERS												
222	GAS GENERATORS	800.00	20.77										
223	MAIN PROPULSION BATTERIES												
224	MAIN PROPULSION FUEL CELLS												
230	PROPULSION UNITS			136		454.5		194.84		394.23			
231	PROPULSION STEAM TURBINES									(incl 230-242)			
232	PROPULSION STEAM ENGINES												
233	PROPULSION INTERNAL COMBUSTION ENGINES												
234	PROPULSION GAS TURBINES					120.5		194.84					
235	ELECTRIC PROPULSION					334							
236	SELF-CONTAINED PROPULSION SYSTEMS												
237	AUXILIARY PROPULSION DEVICES												
238	SECONDARY PROPULSION (SUBMARINES)												
239	EMERGENCY PROPULSION (SUBMARINES)												
Sub Total Group 2 — Sheet 1, POUNDS													
TONS						454.5							

REPRODUCED AT GOVERNMENT EXPENSE

COMPUTING BY

COMPUTING CHECKED

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
240	TRANSMISSION AND PROPULSOR SYSTEMS	455.46	11.44	639.5		563.5		241.47						
241	PROPULSION REDUCTION GEARS					181		138.45						
242	PROPULSION CLUTCHES AND COUPLINGS					1		6.98						
243	PROPULSION SHAFTING	294.57	11.44			170.5		58.11				661.48	(inc 243-248)	
244	PROPULSION SHAFT BEARINGS	70.78	11.44			103		10.81						
245	PROPULSORS	90.11	11.44			152		19.95						
246	PROPULSOR SHROUDS AND DUCTS													
247	WATER JET PROPULSORS													
248	LIFT SYSTEM FANS AND DUCTING							7.17						
250	PROPULSION SUPPORT SYS. (EXCEPT FUEL AND LUBE OIL)	46.52	68.26	331		92.0		432.29				882.5		
251	COMBUSTION AIR SYSTEM	16.00	94.50			20		296.07				24.94		
252	PROPULSION CONTROL SYSTEM					3.5		6.25				18.27		
253	MAIN STEAM PIPING SYSTEM											182.10		
254	CONDENSERS AND AIR EJECTORS											165.52		
255	FEED AND CONDENSATE SYSTEM											212.61		
256	CIRCULATING AND COOLING SEA WATER SYSTEM					50		6.53				205.59		
258	H.P. STEAM DRAIN SYSTEM													
259	UPTAKES (INNER CASING)	30.52	54.50			18.5		123.44				73.47		
260	PROPULSION SUPPORT SYSTEMS (FUEL AND LUBE OIL)			69		85		29.62				97.77		
261	FUEL SERVICE SYSTEM					42		13.21				62.94		
262	MAIN PROPULSION LUBE OIL SYSTEM					37		12.04				35.03	(incl 262, 263)	
263	SHAFT LUBE OIL SYSTEM (SUBMARINES)													
264	LUBE OIL FILL, TRANSFER, AND PURIFICATION					6		3.71						
290	SPECIAL PURPOSE SYSTEMS			76		43.5		136.73				559.22		
298	PROPULSION PLANT OPERATING FLUIDS					33.5		110.92				405.80		
299	PROPULSION PLANT REPAIR PARTS AND SPECIAL TOOLS					10		25.25				153.42		
	Sub Total Group 2 — Sheet 2							784						
	Sub Total Group 2 — Sheet 1							454.5						
	TOTAL — GROUP 2, POUNDS													
	TONS	1301.98	19.20	1286.5		1238.5		1034.96				2595.40		

COMPUTING BY \_\_\_\_\_ COMPUTING CHECKED \_\_\_\_\_

REPRODUCED AT GOVERNMENT EXPENSE

## GROUP 2 - PROPULSION PLANT

SWBS

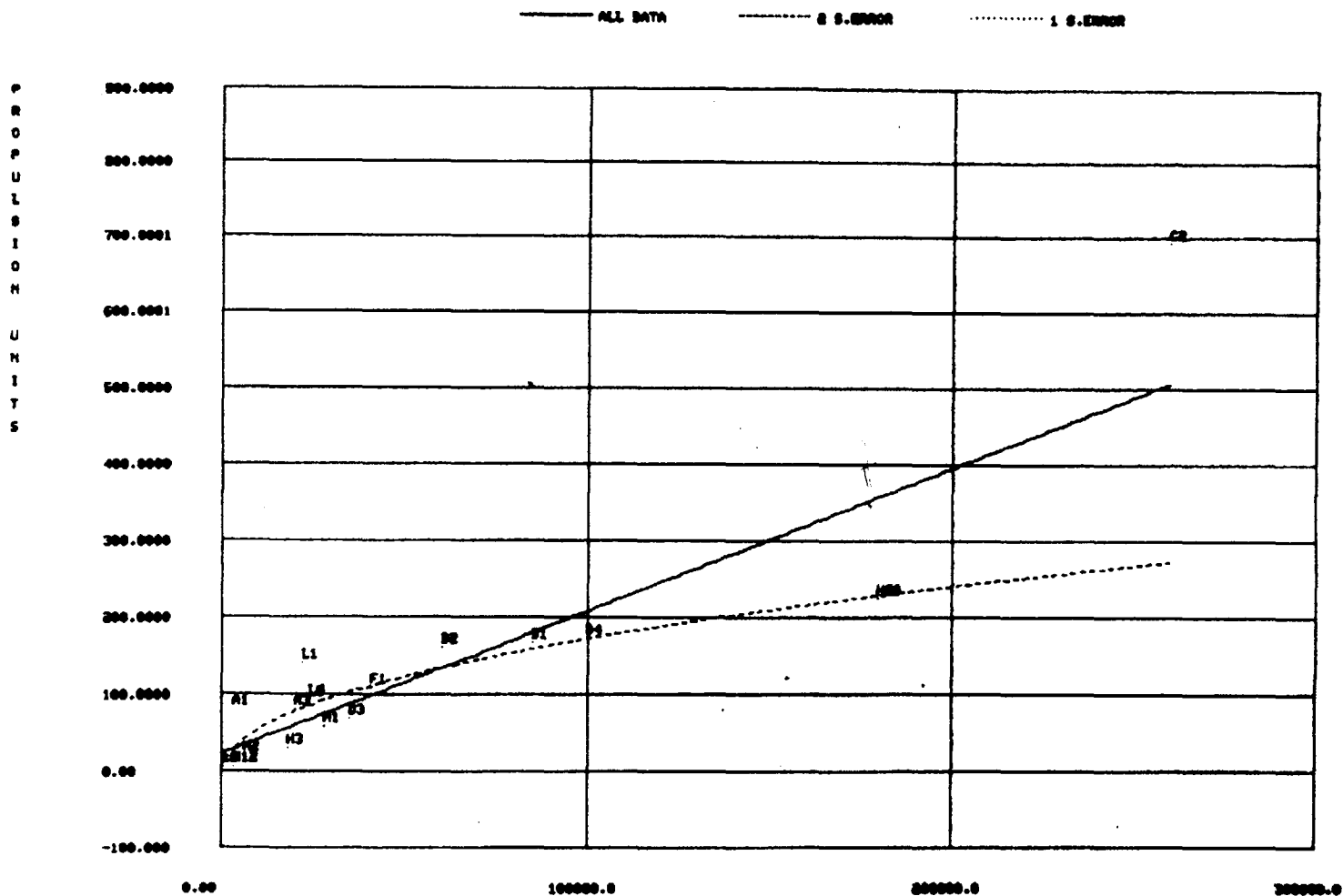
- \* 234 - Propulsion Gas Turbines
- \*\* 241 - Propulsion Reduction Gears
- 242 - Propulsion Couplings (No Clutches)
- 243 - Propulsion Shafting
- 244 - Propulsion Shaft Bearings
- \*\*\* 247 - Propulsors (Waterjet)
  
- 251 - Combustion Air System
- 252 - Propulsion Control Systems
- 256 - Circulating and Cooling Water
- 259 - Uptakes
  
- 261 - Fuel Service System
- 262 - Main Propulsion Lube Oil Systems
- 264 - Lube Oil Fill and Transfer
  
- \*\*\* 298 - Operating Fluids
- 299 - Repair Parts and Tools
  
- \* Wt. from Engid
- \*\* Wt. from Gears
- \*\*\* Wt. from Jetpmp

TABLE 1 - GROUP 2

<u>SWBS GROUP</u>	<u>FIG. NO</u>	<u>WEIGHT EQUATION</u>
234 Propulsion Gas Turbines	-	Weights of turbines are listed in ENGID
241 Propulsion Reduction Gears	-	Weight from GEAR
242 Propulsion Clutches & Couplings	1	$W_{242} = 126 * X_{NPE} * ((HP1MI/RPMP)**.6666)/2240.$
243 Propulsion Shafting	2	$W_{243} = (33. + ((HP1MI/RPMP)**.6666)) * X_{LSHFP} / 2240.$
244 Propulsion Shaft Bearings	3	$W_{244} = .2143 * (W_{242} + W_{243})$
247 Water Jet Propulsors	-	$W_{247} = W_{PUMP} * X_{NPE}$
251 Combustion Air System	4	$W_{251} = .0001357 * HP1MI * X_{NPE}$
252 Propulsion Control Systems	5	$W_{252} = .00425 * X_{NPE} * SQRT(HP1MI)$
256 Circulating & Cool Sea Water Systems	6	$W_{256} = .00444 * X_{NPE} * SQRT(HP1MI)$
259 Uptakes	7	$W_{259} = 6.2832 * (.5 + SQRT(.00085 * HP1MI / 3.14159)) * 9.2 * X_{NPE} * UPTAKL * 1.05 / 2240.$
261 Fuel Service Systems	8	$W_{261} = .0000625 * X_{NPE} * HP1MI$
262 Main Propulsion Lube Oil System	9	$W_{262} = .5 + .000052 * (X_{NPE} * HP1MI)$
264 Lube Oil Filling, Transfer & Purification System	10	$W_{264} = .0000167 * X_{NPE} * HP1MI$
298 Propulsion Plant Operating Fluids	-	$W_{298} = W_{H2O} * X_{NPE} + FLOW * X_{NPE} * .015$
299 Propulsion Plant Repair Parts	11	$W_{299} = .01 * (W_{230} + W_{240} + W_{250} + W_{260})$

TO CONTINUE, TYPE CONTINUE  
6 CONTINUE

PROPULSION UNITS (230-242) VS SHP



$$W 230 = 23.691 + 0.00164 \text{ SHP}^{1.010}$$
$$= -6.610 + 0.833 \text{ SHP}^{0.426}$$



Fig. 1

W242 - COUPLINGS (NO CLUTCHES)

2000

WT/ENGINE FOR COUPLINGS (LB)

1000

$$W_{242} = 126 \cdot X_{NPE} \cdot \left( \frac{HP_{21ME}}{RPM} \right) \cdot X_{GLOGLO}$$

X HI 4B - COUPLINGS ONLY

X ROHR BKSES  
 10/12/76

X LOCKHEED - COUPLINGS ONLY  
 (EKSES PROPOSAL)

X ROHR - COUPLINGS ONLY  
 (BASELINE)

X PHM - COUPLINGS + CLUTCHES  
 X PHM - COUPLINGS ONLY

$$\left( \frac{BHP \text{ PER SHFT}}{RPM} \right)^{2/3}$$

0 1 2 3 4 5 6 7 8 9

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Fig. 2

W243 - PROPULSION SHAFTING

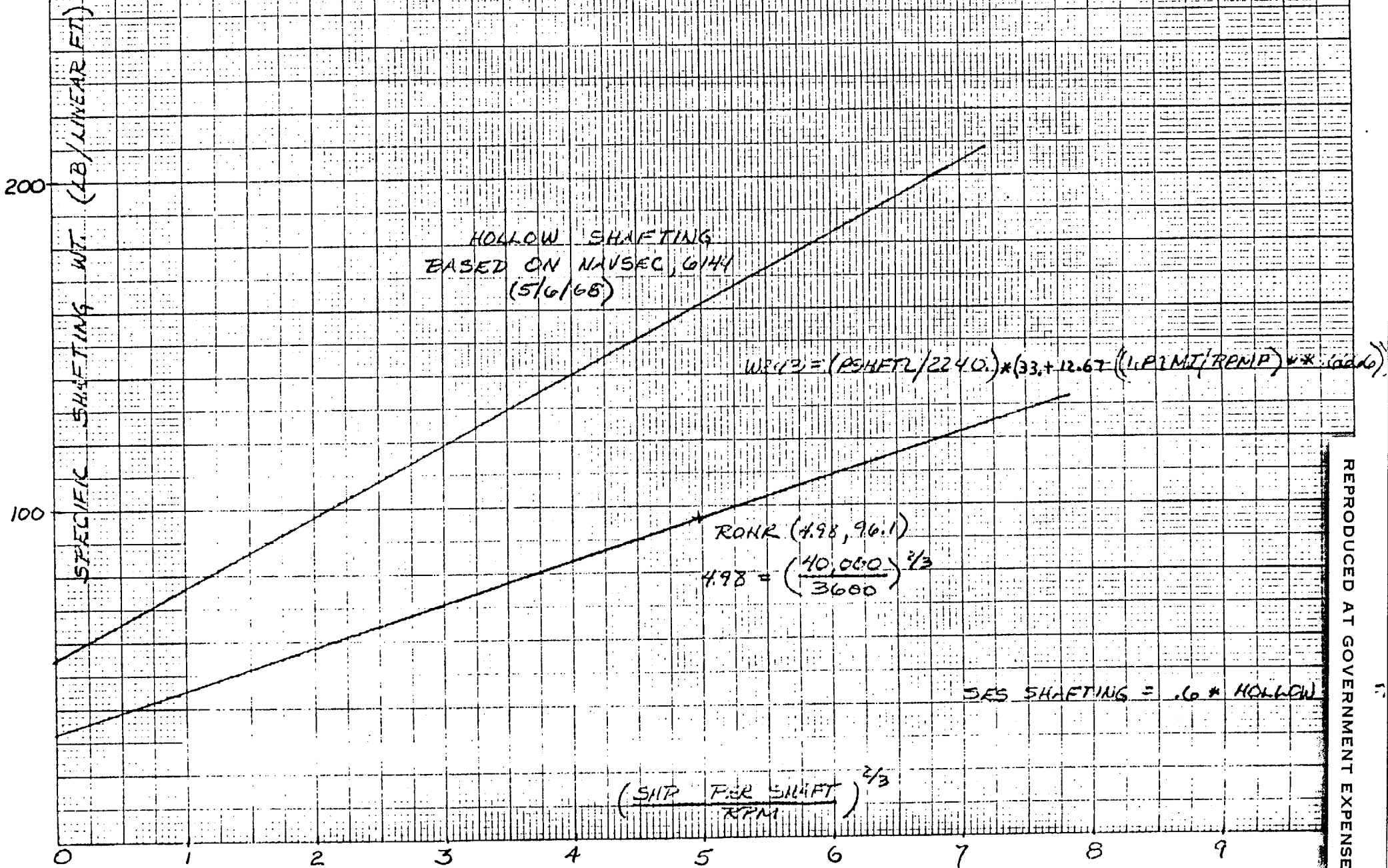
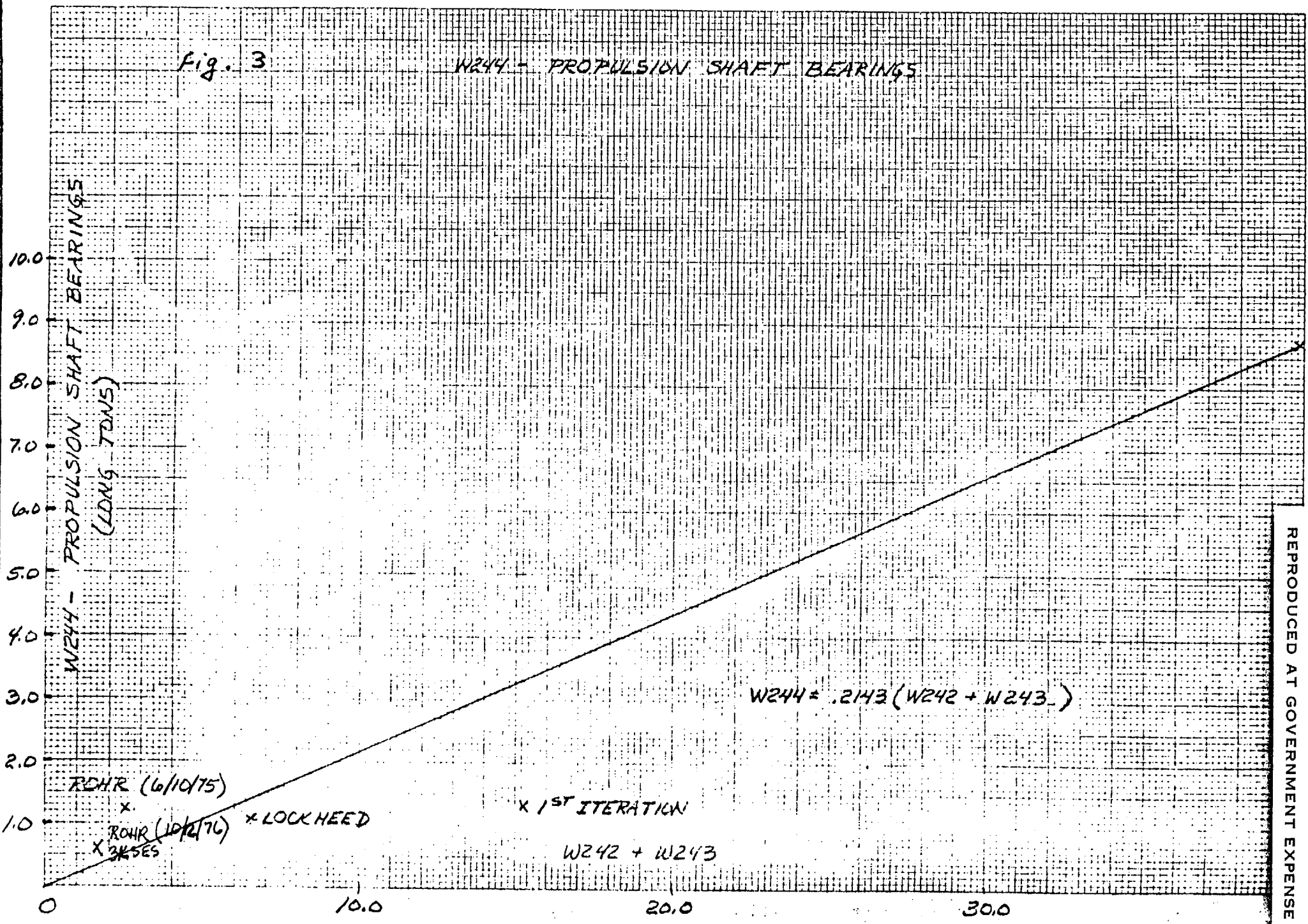


Fig. 3

W244 - PROPULSION SHAFT BEARINGS

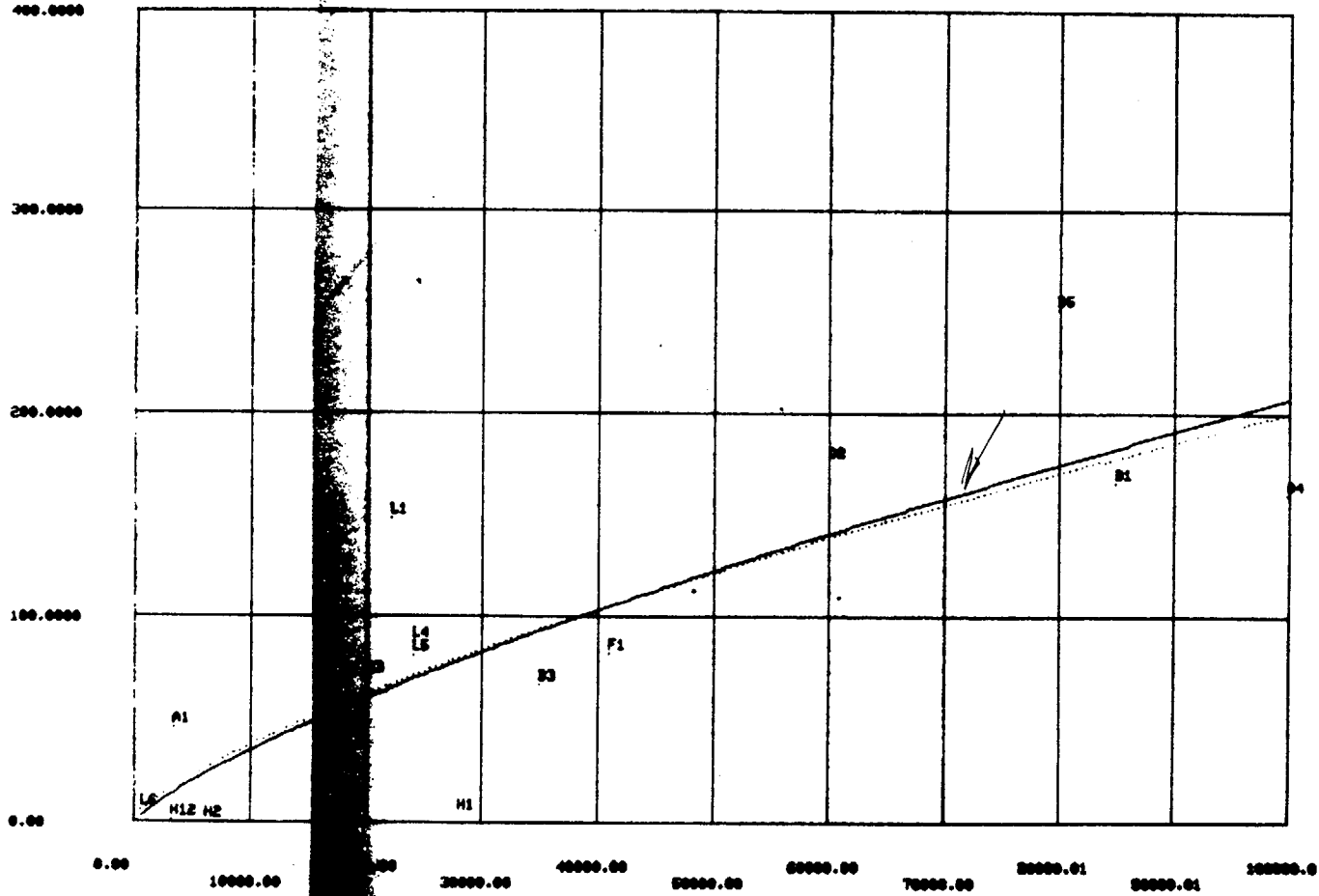


8 CONTINUE

TRANSMISSION AND PROP SYS (243-248) US SHP

—— ALL DATA      - - - - 2 S.ERROR      ..... 1 S.ERROR

T  
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P  
R  
O  
P  
S  
Y  
S

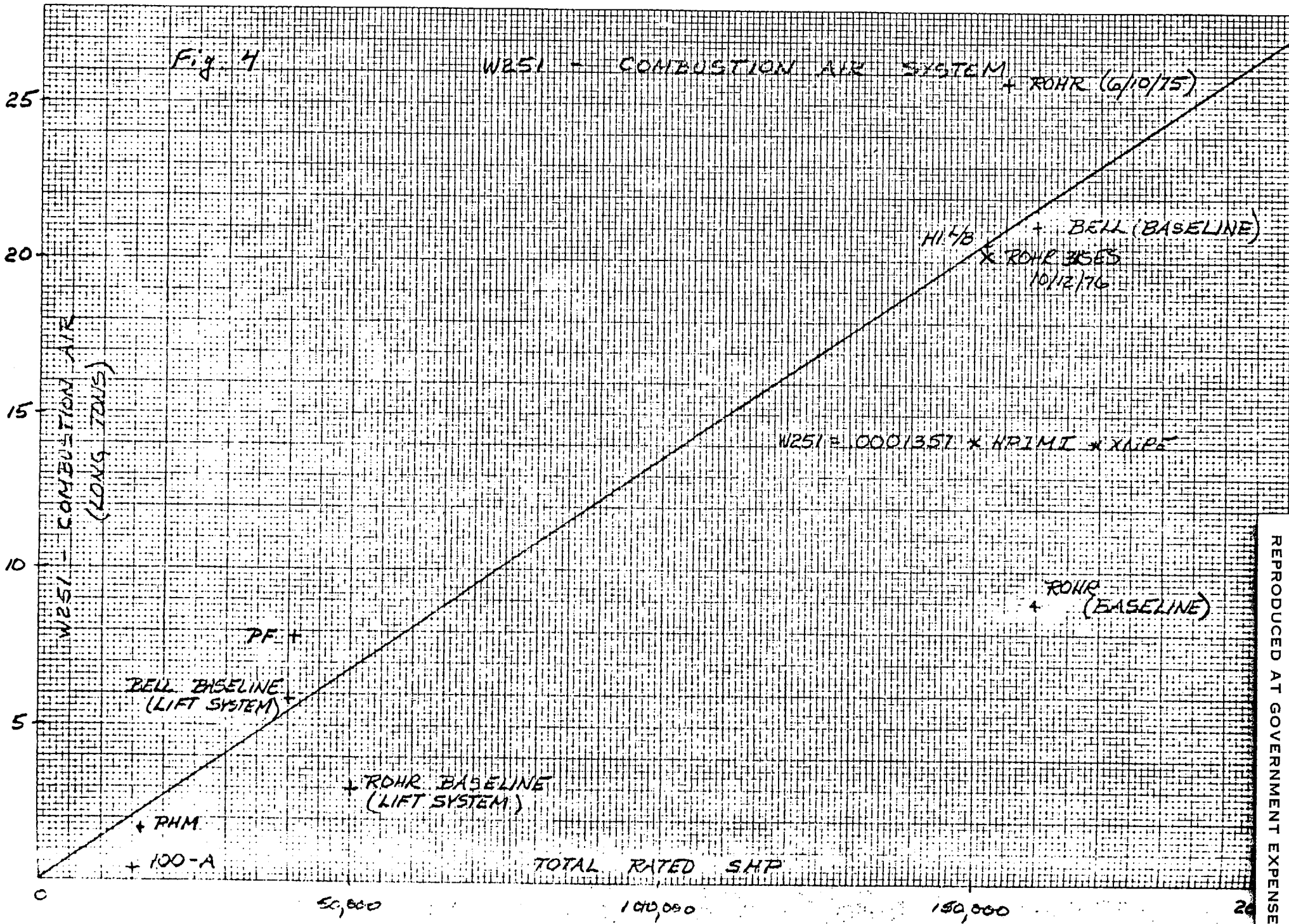


$W 243 = -2.167 + 0.0362 \text{ SHP}$

$= -0.404 + 0.0482 \text{ SHP}$

Fig. 4

W251 - COMBUSTION AIR SYSTEM + ROHR (6/10/75)



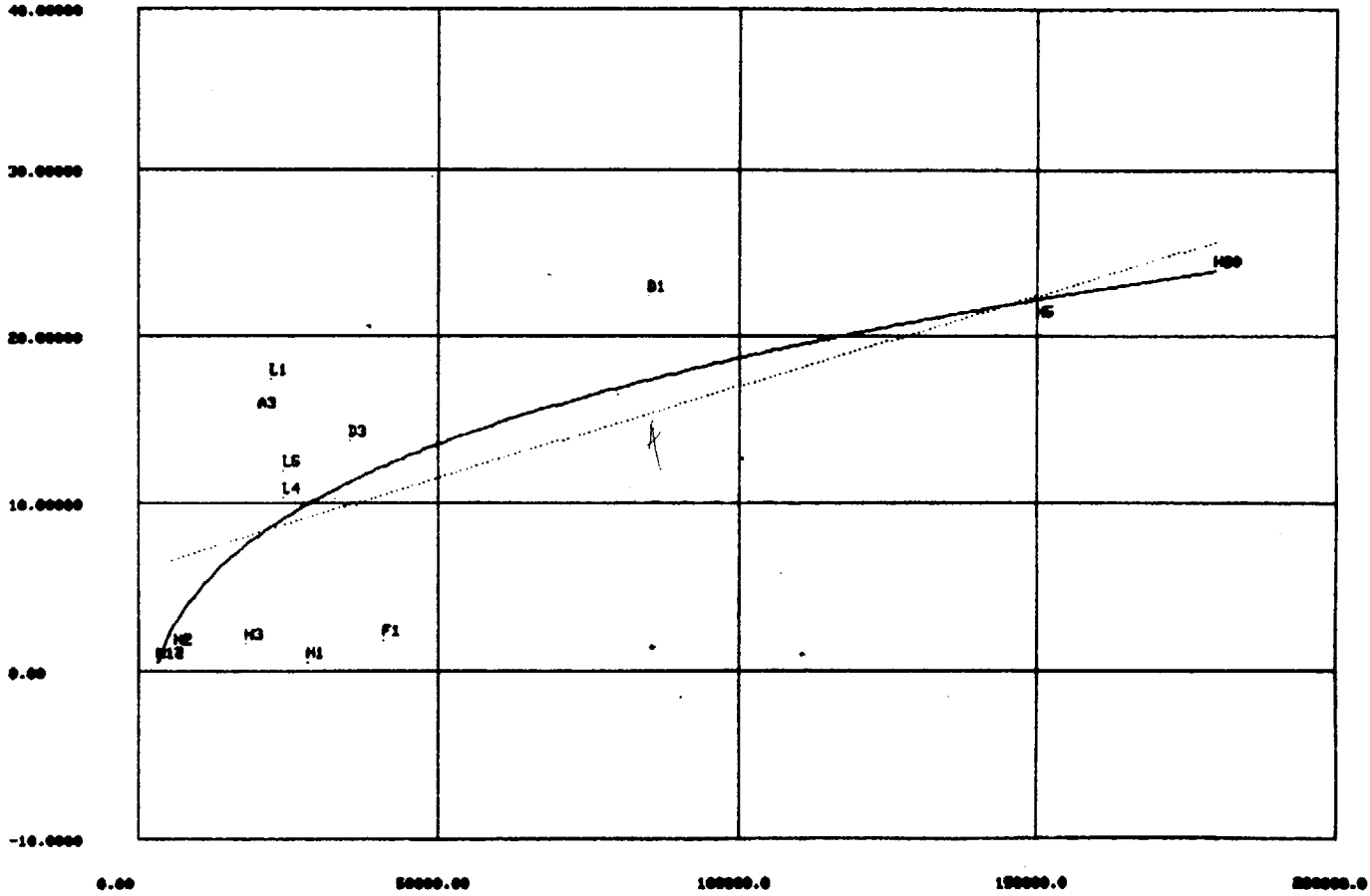
TO CONTINUE, TYPE CONTINUE

6 CONTINUE

COMBUSTION AIR SYSTEM (251)

—— ALL DATA    - - - - 2 S.ERROR    ..... 1 S.ERROR

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$$W251 = -10.277 + 1.233 \text{ SHP}^{0.277}$$

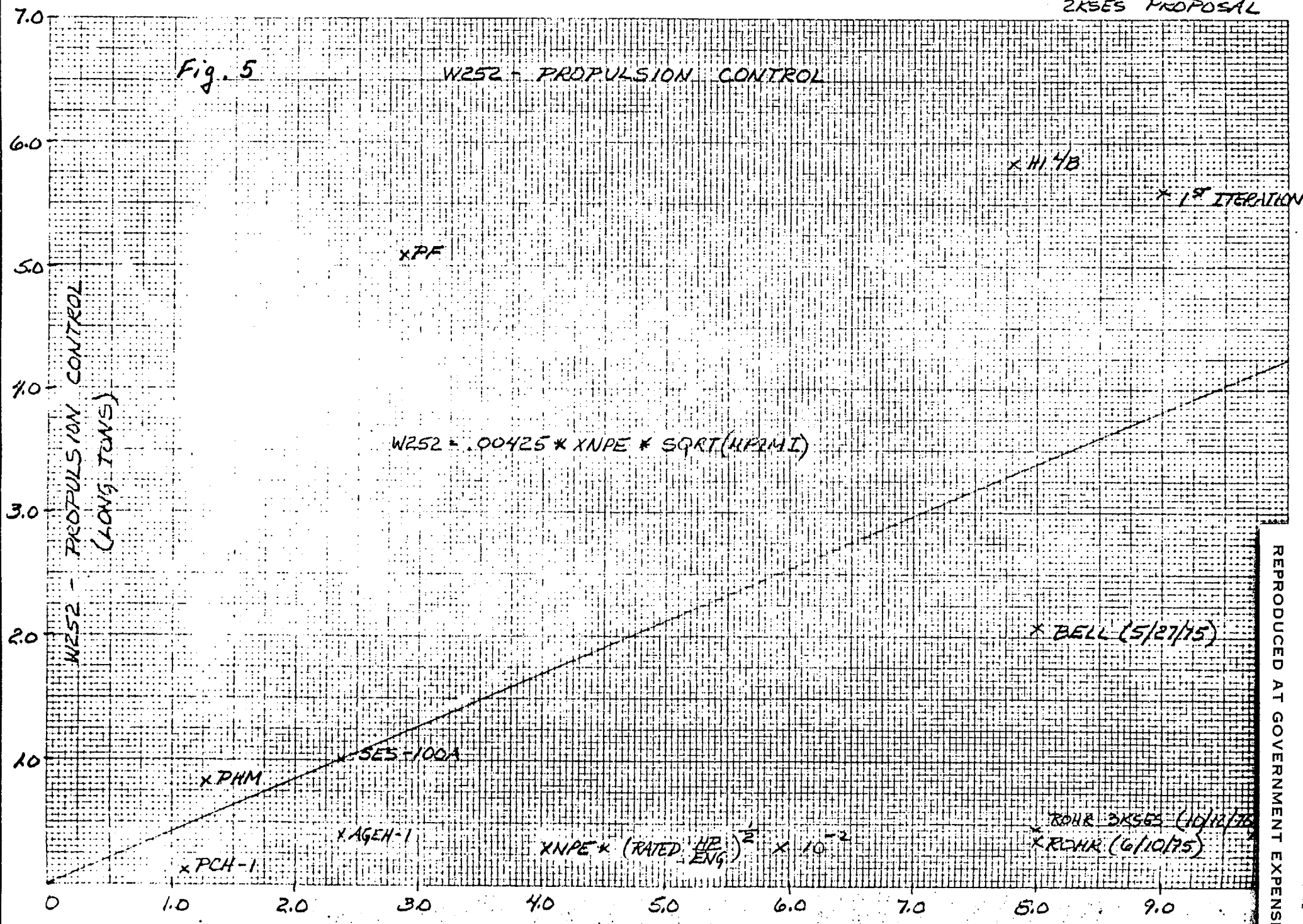
$$= 5.972 + 0.000125 \text{ SHP}^{0.989}$$



X LOCKHEED  
 2KSES PROPOSAL

Fig. 5

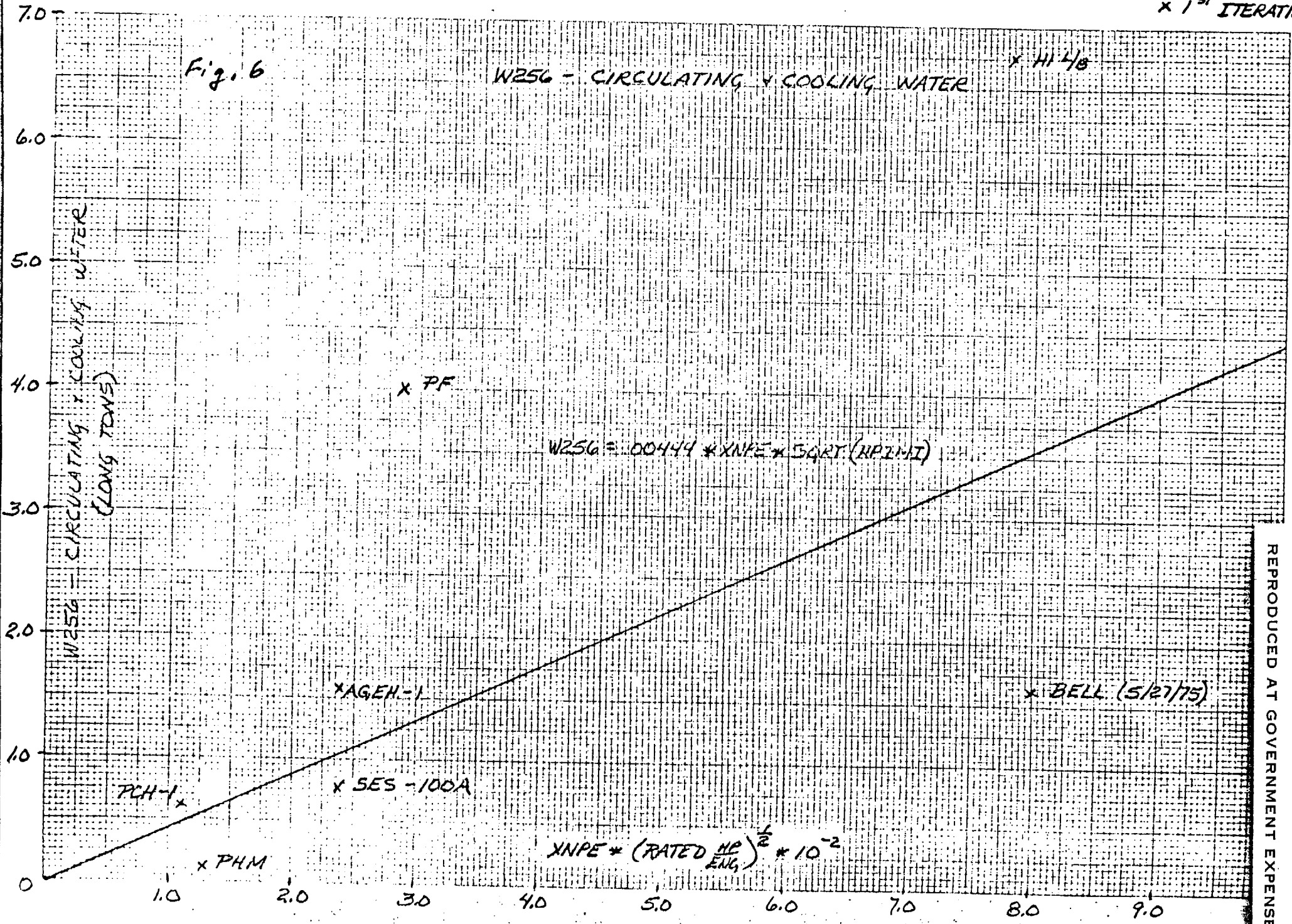
W252 - PROPULSION CONTROL



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x 1<sup>ST</sup> ITERATION

Fig. 6

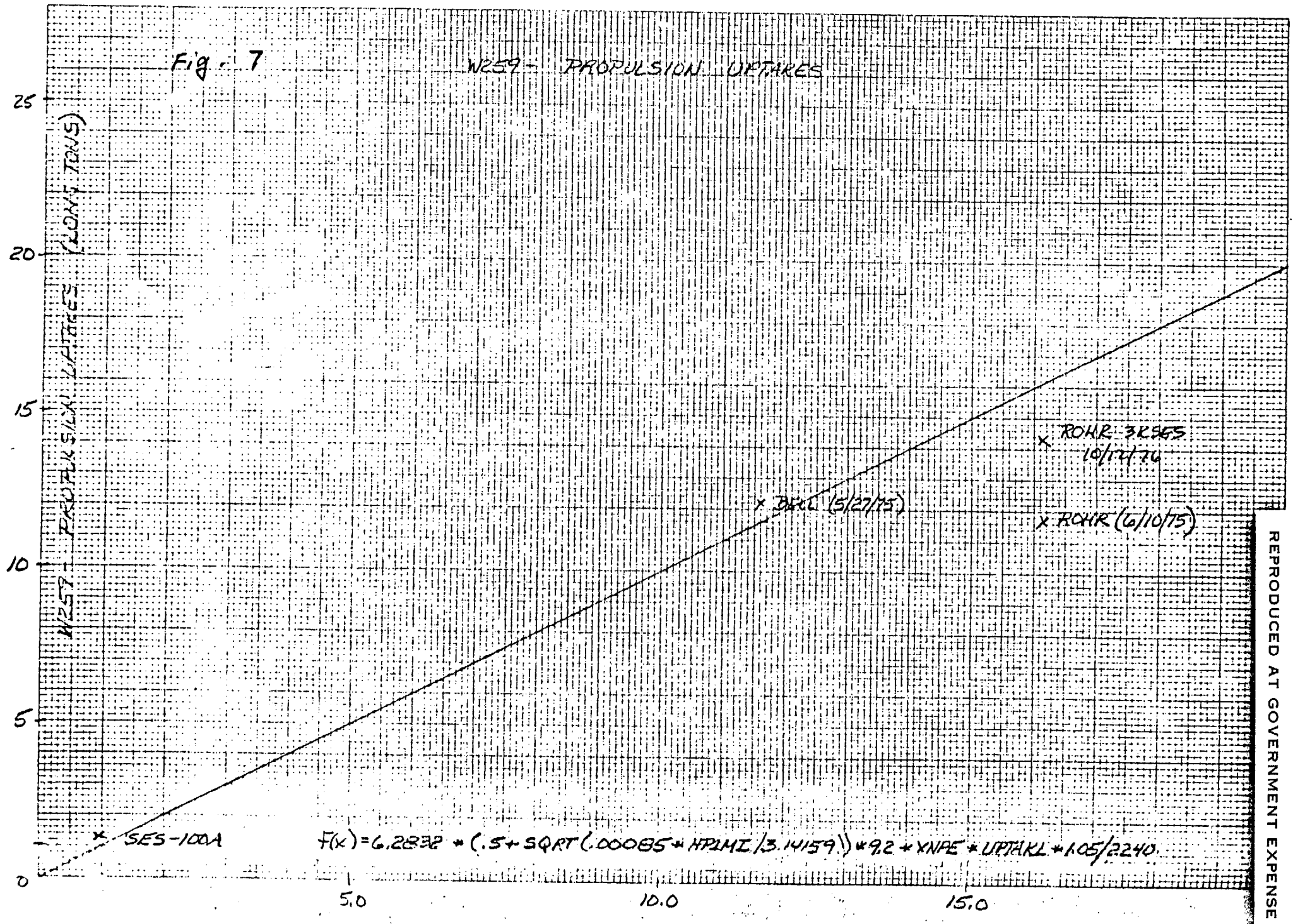


REPRODUCED AT GOVERNMENT EXPENSE



Fig. 7

W259 - PROPULSION UPTAKES



TO CONTINUE, TYPE CONTINUE

8 CONTINUE

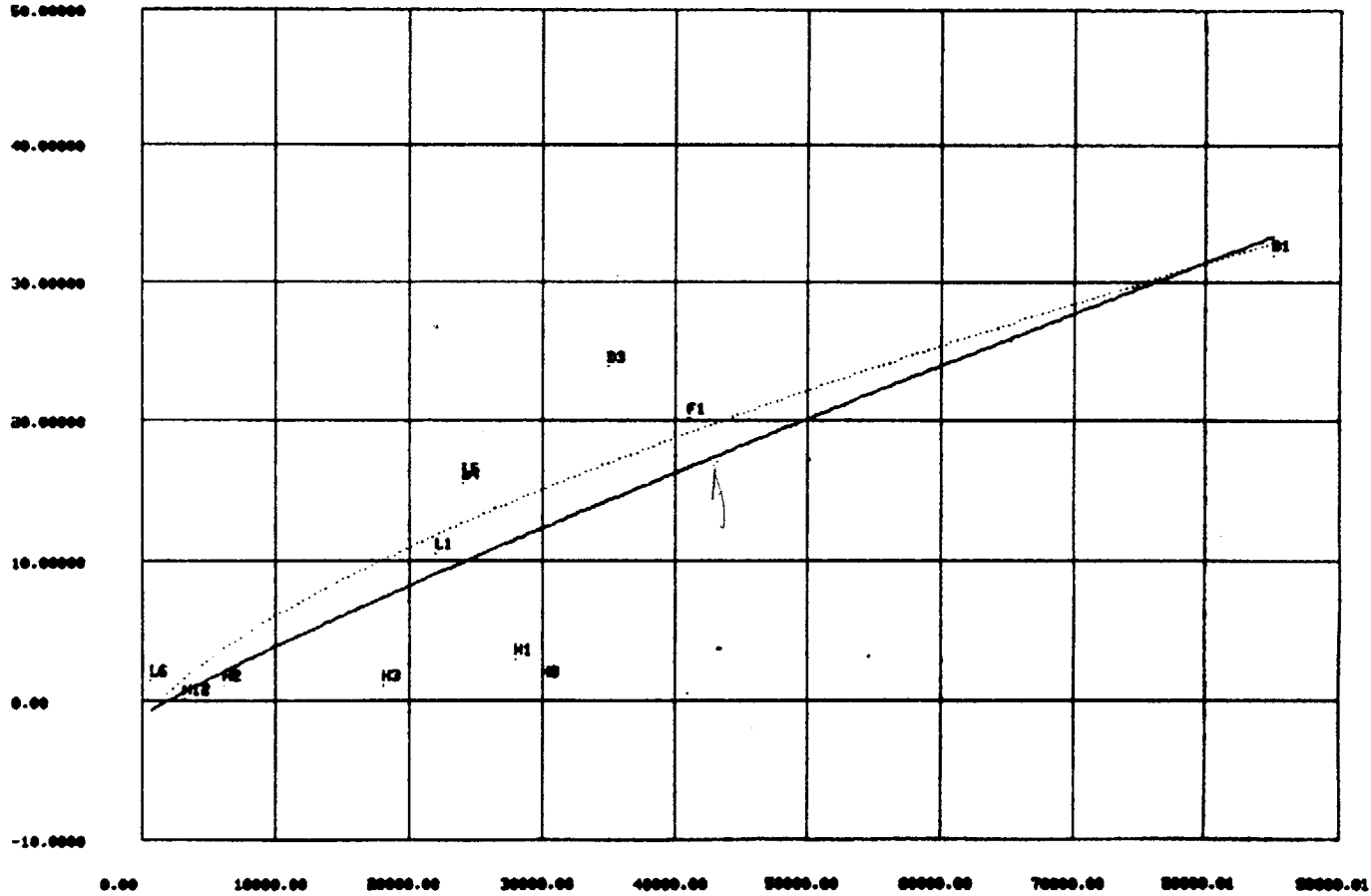
UPTAKES (259)

—— ALL DATA

- - - - - 2 S.ERROR

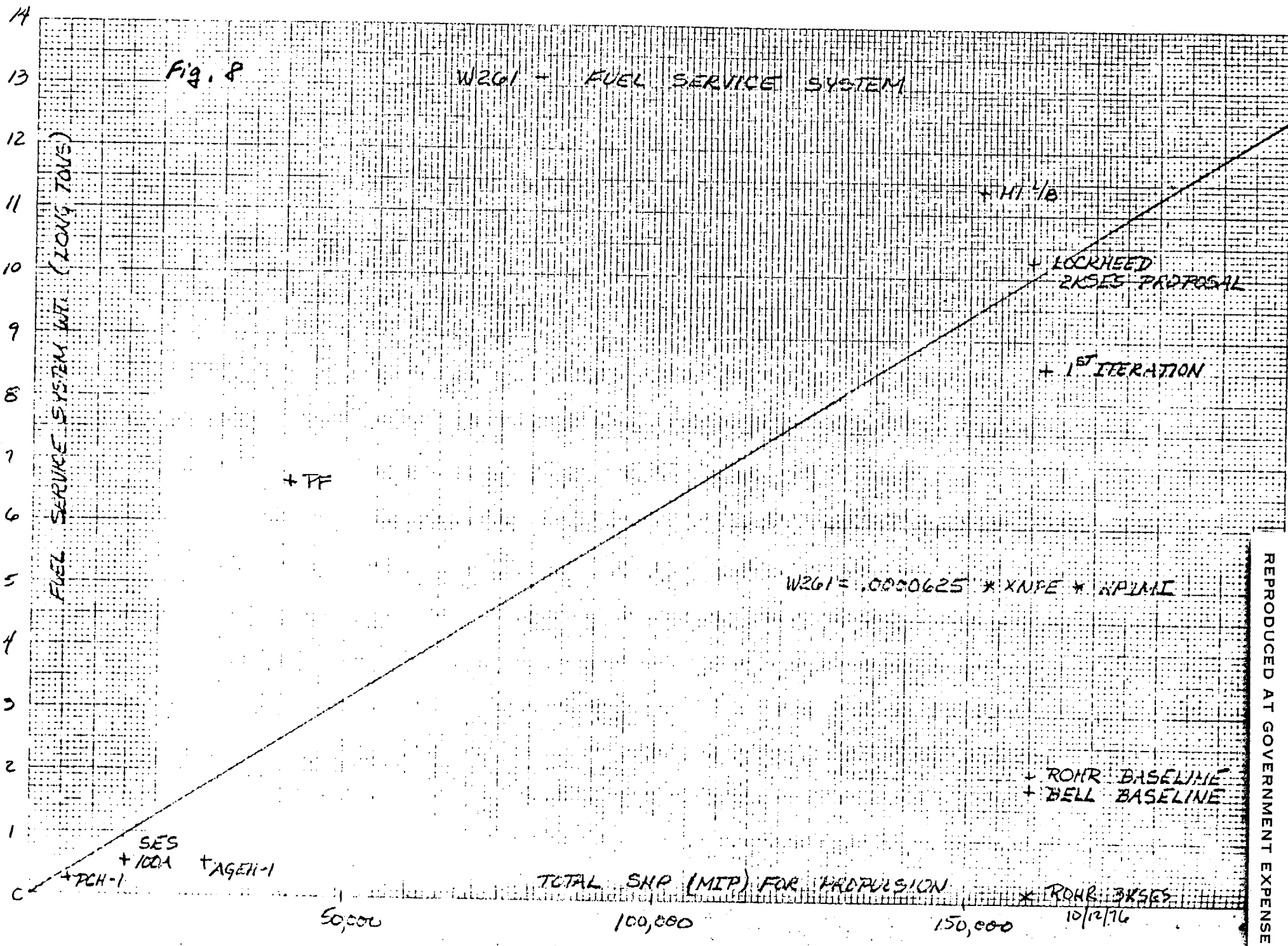
..... 1 S.ERROR

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$W259 = -1.126 + 0.00118 \text{ SHP}$   $0.904$

$-2.126 + 0.0159 \text{ SHP}$   $0.678$



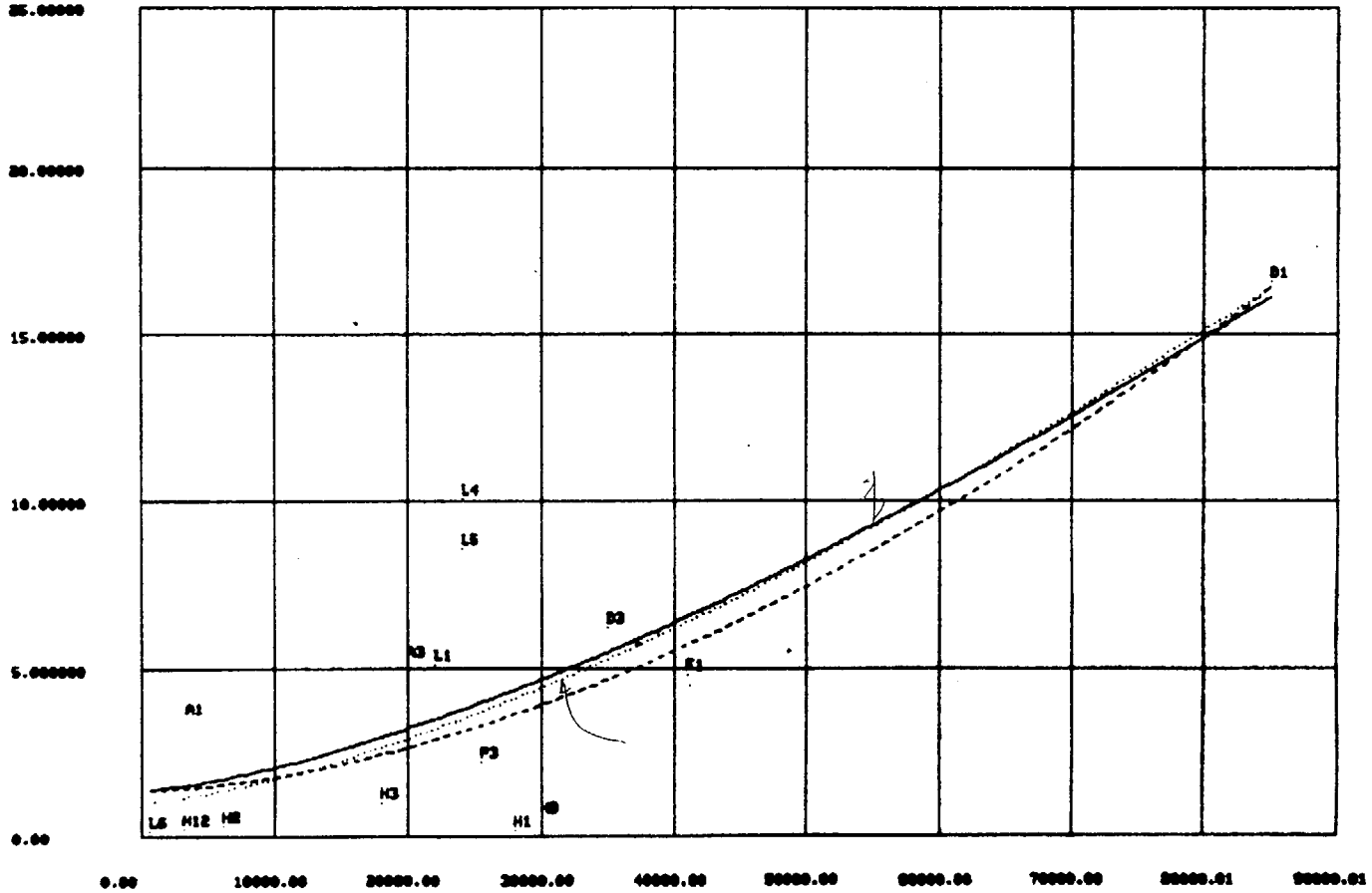
REPRODUCED AT GOVERNMENT EXPENSE

8 CONTINUE

FUEL SERVICE SYSTEM (881)

— ALL DATA    - - - - 2 S. ERROR    ······ 1 S. ERROR

F  
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V  
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M



$$W261 = 1.420 + 0.00000108 \text{ WHP} \quad 1.447$$

$$= 1.418 + 0.000000507 \text{ WHP} \quad 1.514$$

$$= 1.055 + 0.00000106 \text{ WHP} \quad 1.453$$

Fig. 9

W262 - MAIN PROPULSION LUBE OIL SYSTEM

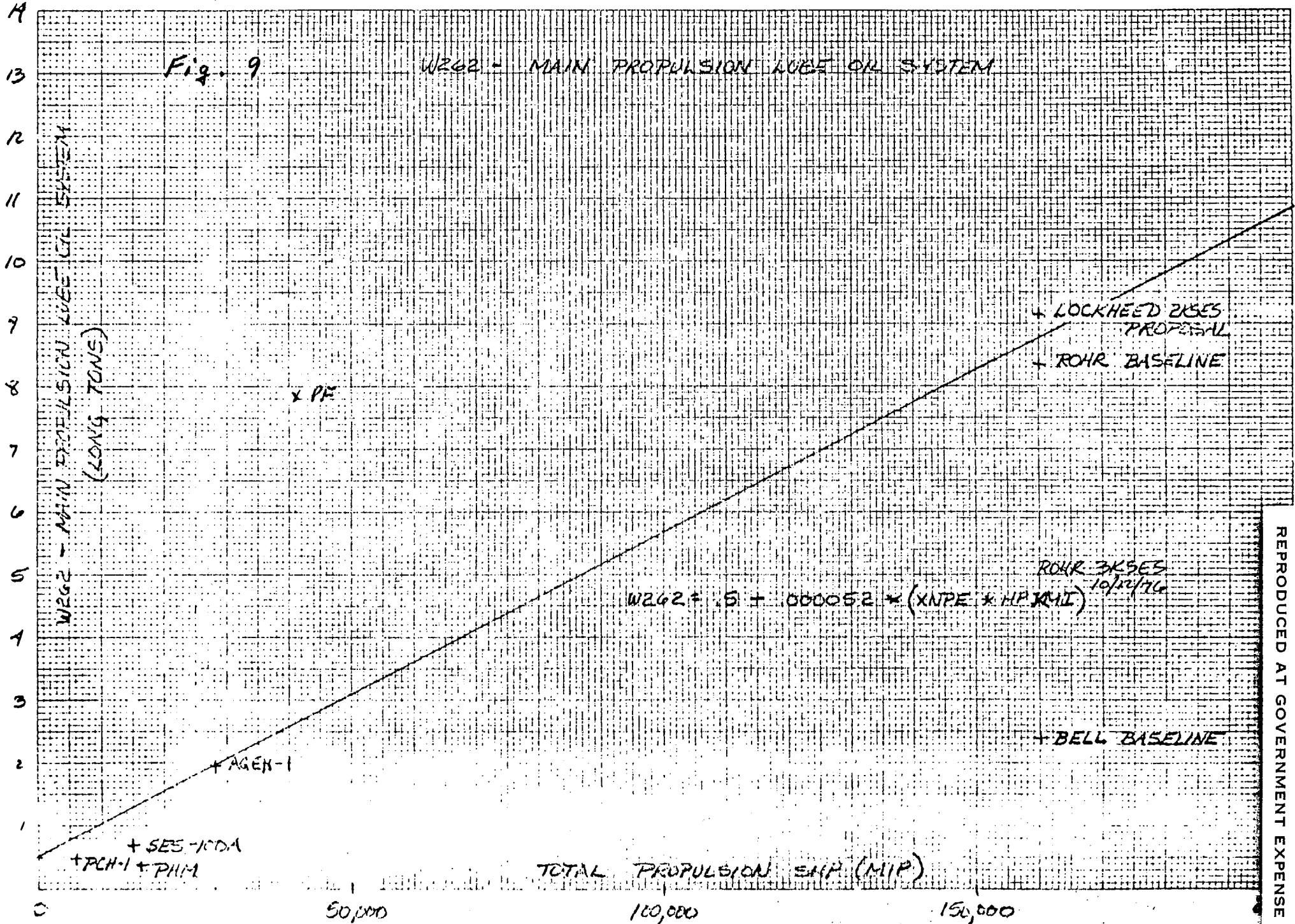
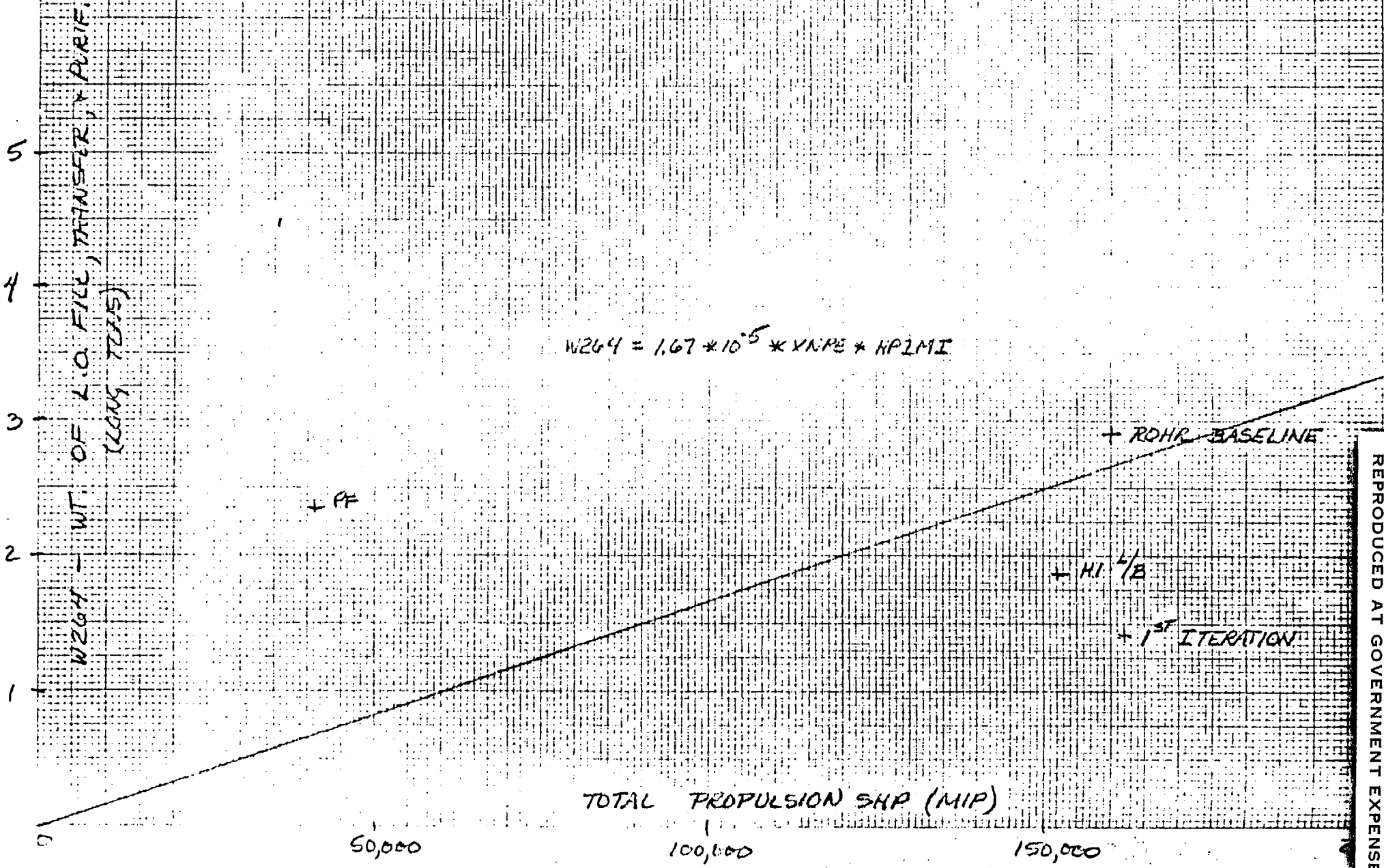


Fig. 10

WZ64 - L.O. FILL, TRANSFER, & PURIF. SYSTEM



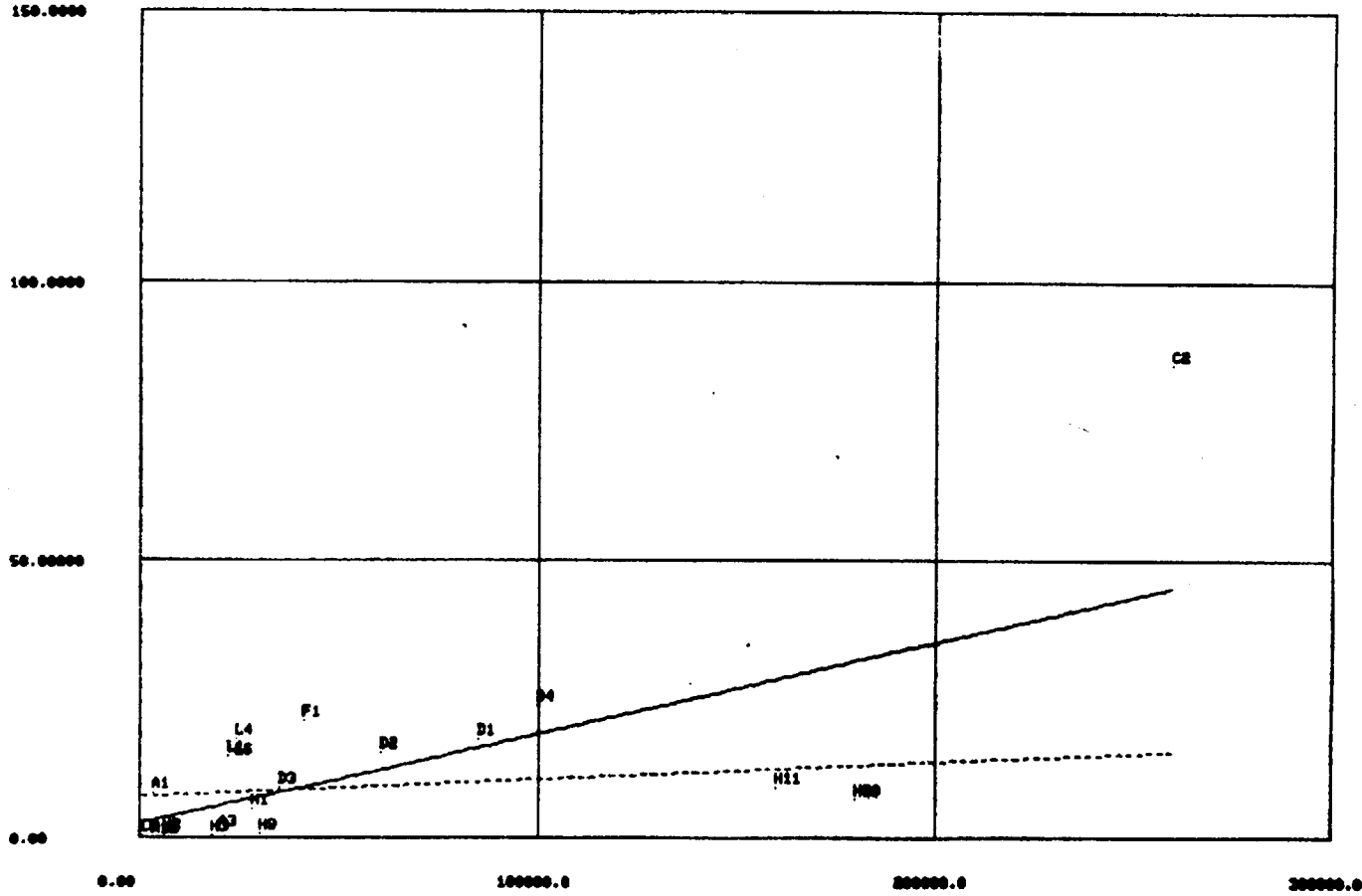
TO CONTINUE, TYPE CONTINUE

@ CONTINUE

MAIN PROPULSION LUBE OIL SYSTEM (262-264)

— ALL DATA      - - - - - 2 S.ERROR      ..... 1 S.ERROR

M  
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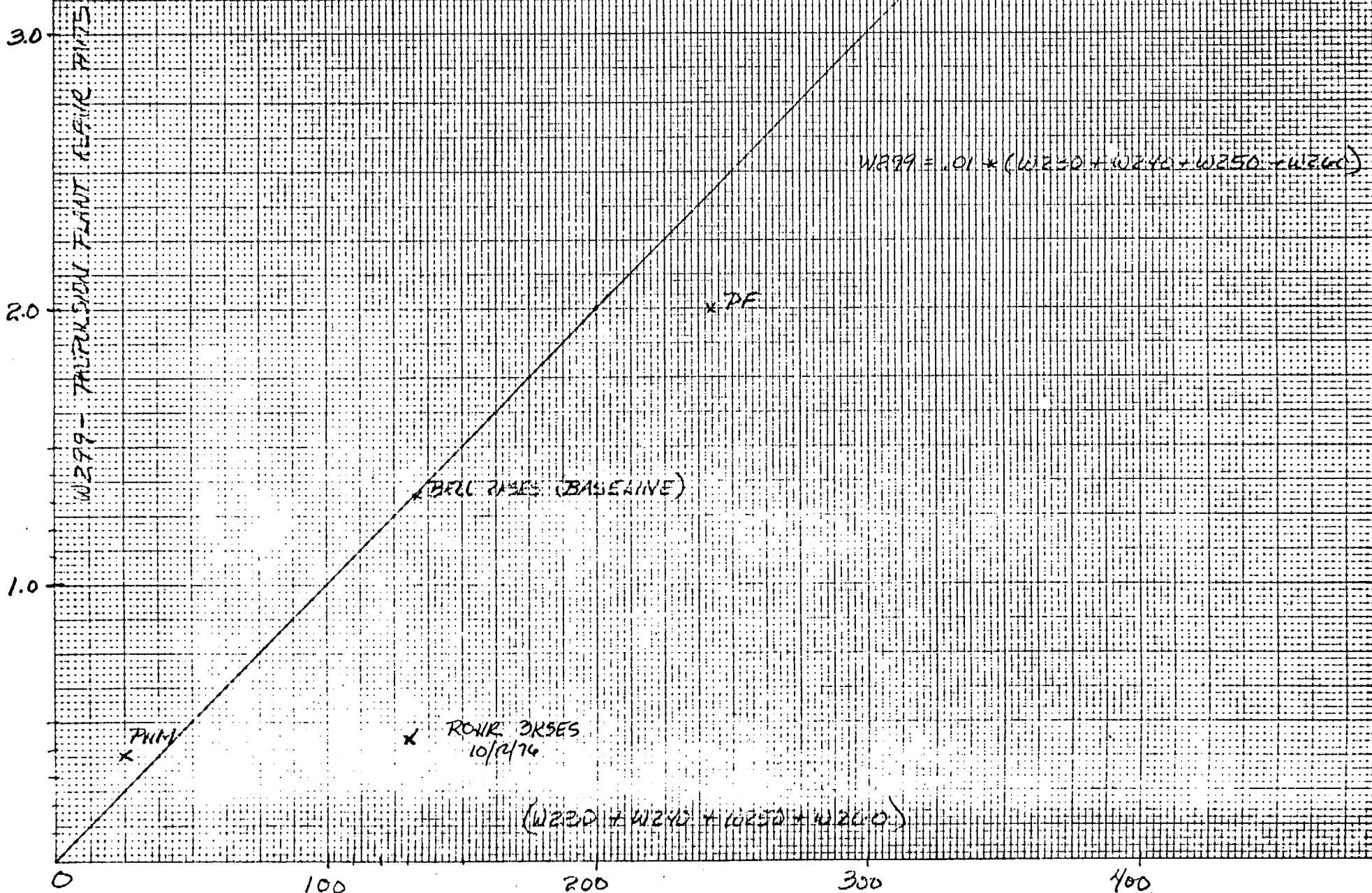
W 262 = 2.712 + 0.000143 SHP <sup>1.010</sup>  
 = 7.032 + 0.000353 SHP <sup>0.110</sup>

H1 1/8

Fig 11

W299 - PROPULSION FRONT REPAIR PARTS

Fig 11





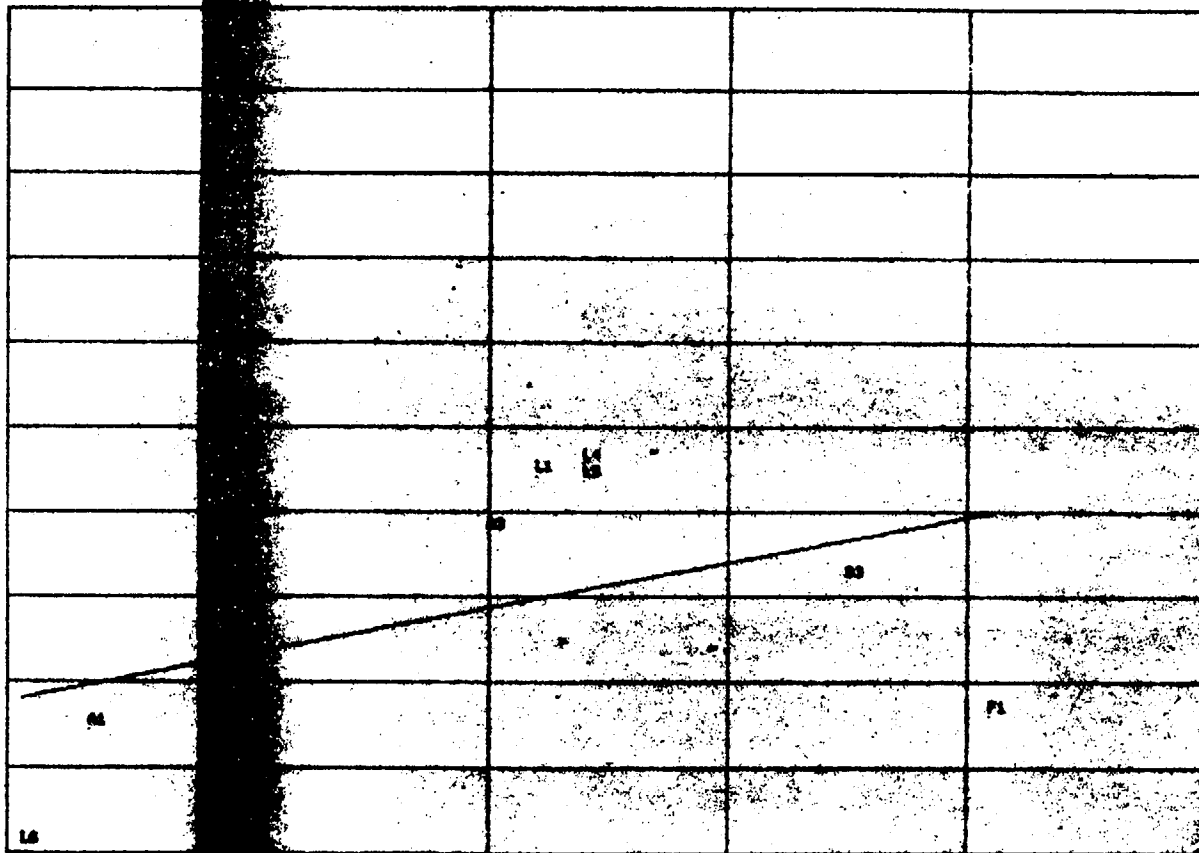
TO CONTINUE. TYPE CONTINUE  
S CONTINUE

PROPULSION PLANT OPERATING FLUIDS (288)

—— ALL DATA      - - - - - 2 C. 28888      ..... 1 C. 28888

P  
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0.00



0.00

2000.00

4000.00

6000.00

8000.00

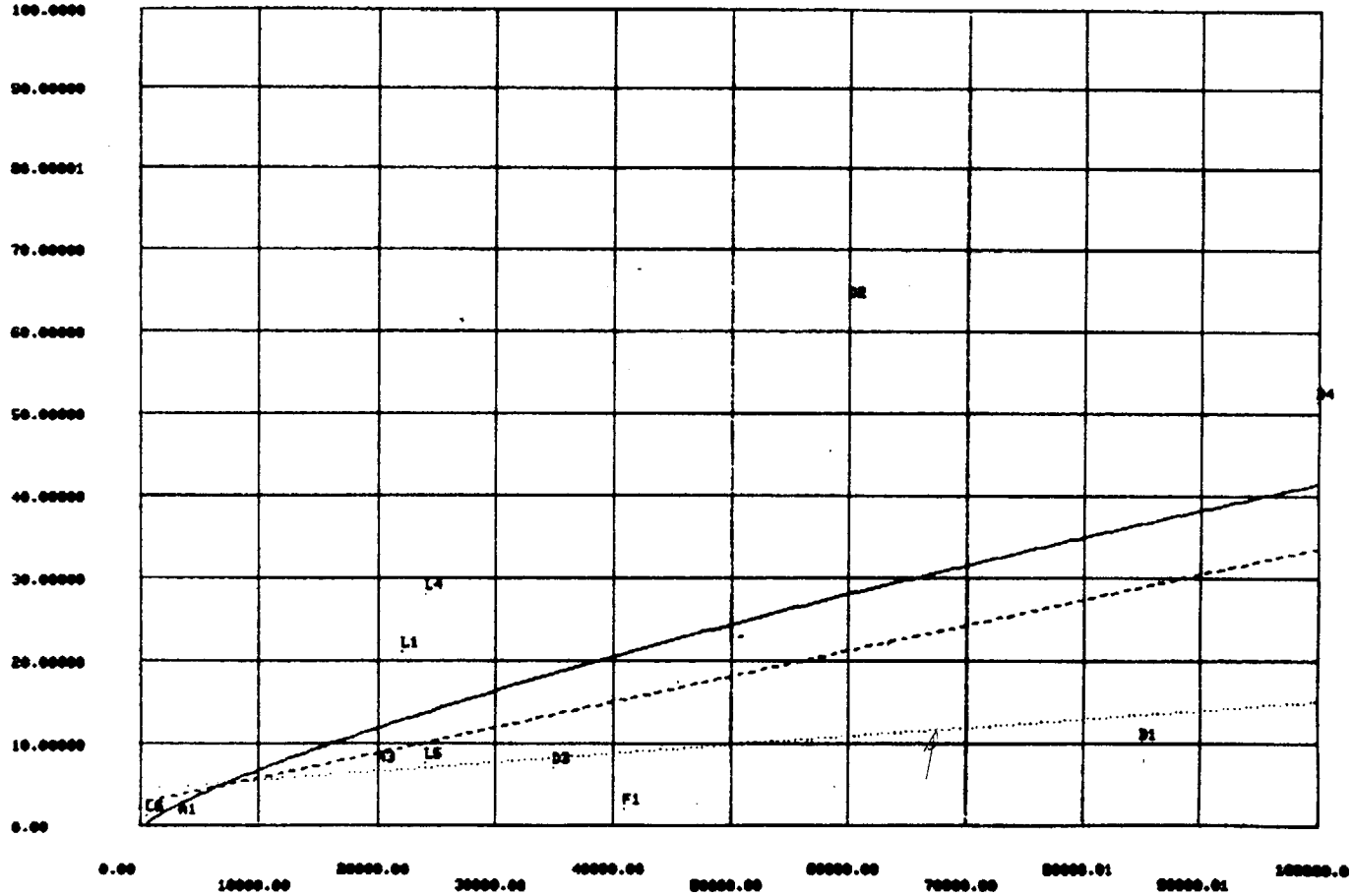
W288 = 17.803 + 0.000000 x 288 0.789

TO CONTINUE, TYPE CONTINUE  
 6 CONTINUE

PROPULSION PLANT REPAIR PARTS (899)

—— ALL DATA      - - - - - 2 S.ERROR      ..... 1 S.ERROR

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S



$$W299 = -0.614 + 0.000712 \text{ SHP} \quad 0.754$$

$$= 2.922 + 0.000271 \text{ SHP} \quad 1.010$$

$$= 4.517 + 0.000110 \text{ SHP} \quad 0.781$$

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

PAGE 304

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 3 ELECTRIC PLANT:</b>						
300	<b>ELECTRIC PLANT, GENERAL</b>					
310	<b>ELECTRIC POWER GENERATION</b>					
311	Ship Service Power Generation		135	GT	288 276.2	288 276.2
312	Emergency Generators					
313	Batteries and Service Facilities	2000	1	(12)	12	12
314	Power Conversion Equipment	1000	39			
315	Shore Power Receptacles					
<b>POWER DISTRIBUTION SYSTEMS</b>						
320	Ship Service Power Cable		14		362	330
321	Emergency Power Cable System	1000	85		278	300
322	Casualty Power Cable System		3			
323	Switchgear and Panels		57		83	21
<b>LIGHTING SYSTEM</b>						
330	Lighting Distribution	1000	9	(12)	76	81
331	Lighting Fixtures		34			
332	Switches, Receptacles, and Outlets					
<b>POWER GENERATION SUPPORT SYSTEMS</b>						
340	SSTG Lube Oil		10		59	21
341	Diesel Support Systems	27-10-6-3			59	21
342	Turbine Support Systems		10			
<b>SPECIAL PURPOSE SYSTEMS</b>						
390	Electric Plant Operating Fluids		15		12	18
398	Electric Plant Repair Parts and Special Tools		11		2	2
399			4		16	16
<b>GROUP 300 TOTAL</b>			<b>286</b>		<b>903</b>	<b>738</b>

Signature \_\_\_\_\_

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.			REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
310	ELECTRIC POWER GENERATION	312.00	26.05										
311	SHIP SERVICE POWER GENERATION	300.00	25.59										
312	EMERGENCY GENERATORS												
313	BATTERIES AND SERVICE FACILITIES	12.00	37.50										
314	POWER CONVERSION EQUIPMENT												
320	POWER DISTRIBUTION SYSTEMS	362.02	36.22										
321	SHIP SERVICE POWER CABLE	278.77	37.25										
322	EMERGENCY POWER CABLE SYSTEM												
323	CASUALTY POWER CABLE SYSTEM												
324	SWITCHGEAR AND PANELS	83.25	32.78										
330	LIGHTING SYSTEM	76.09	54.39										
331	LIGHTING DISTRIBUTION	76.09	54.39										
332	LIGHTING FIXTURES												
340	POWER GENERATION SUPPORT SYSTEMS												
341	SSTG LUBE OIL												
342	DIESEL SUPPORT SYSTEMS												
343	TURBINE SUPPORT SYSTEMS												
390	SPECIAL PURPOSE SYSTEMS	18.45	25.83										
398	ELECTRIC PLANT OPERATING FLUIDS	2.32	13.80										
399	ELECTRIC PLANT REPAIR PARTS AND SPECIAL TOOLS	16.13	27.57										
	TOTAL — GROUP 3, POUNDS												
	TONS	768.56	33.64										

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

SUBROUTINE WATTSINTRODUCTION

SUBROUTINE WATTS estimates the electrical Kilowatt requirement for the ship.

DISCUSSION

The routine begins by converting the integer numbers of turbines installed for propulsion and lift into real numbers.

The total 400 Hz electrical Kilowatt requirement for electronic equipment (SWBS group 4) is then initialized at zero. The types of electronic equipment are then selected and the total 400 Hz electrical requirement for all types calculated.

The total 400 Hz electrical Kilowatt requirement for armament (SWBS group 7) is then initialized at zero. The types of weapons are then selected and the total 400 Hz electrical requirement for all types calculated.

The 60 Hz electrical power requirement for electronic equipment is then initialized at zero. Once again, the types of electronic equipment are selected; but, this time, it is the total 60 Hz requirement for all types that is calculated.

The 60 Hz electrical power requirement for armament is then initialized at zero. After, again, selecting the types of weapons, the total 60 Hz power requirement for all types is calculated.

Once the KW requirements for the electronics and weapons have been summed, the KW requirements for the remainder of the ship functions are calculated. Figures 1 - 5 show graphs for calculating, machinery, HVAC, lighting, hotel, and auxiliary KW requirements.

Group 3 KW is set equal to the total 400 Hz KW requirement, since it is assumed that it will be converted from 60 Hz, and the converter weight is in

Fig 1

LIFT & PROPULSION MACHINERY RWL WITH STEERING  
 FOR WINTER CRUISE CONDITION

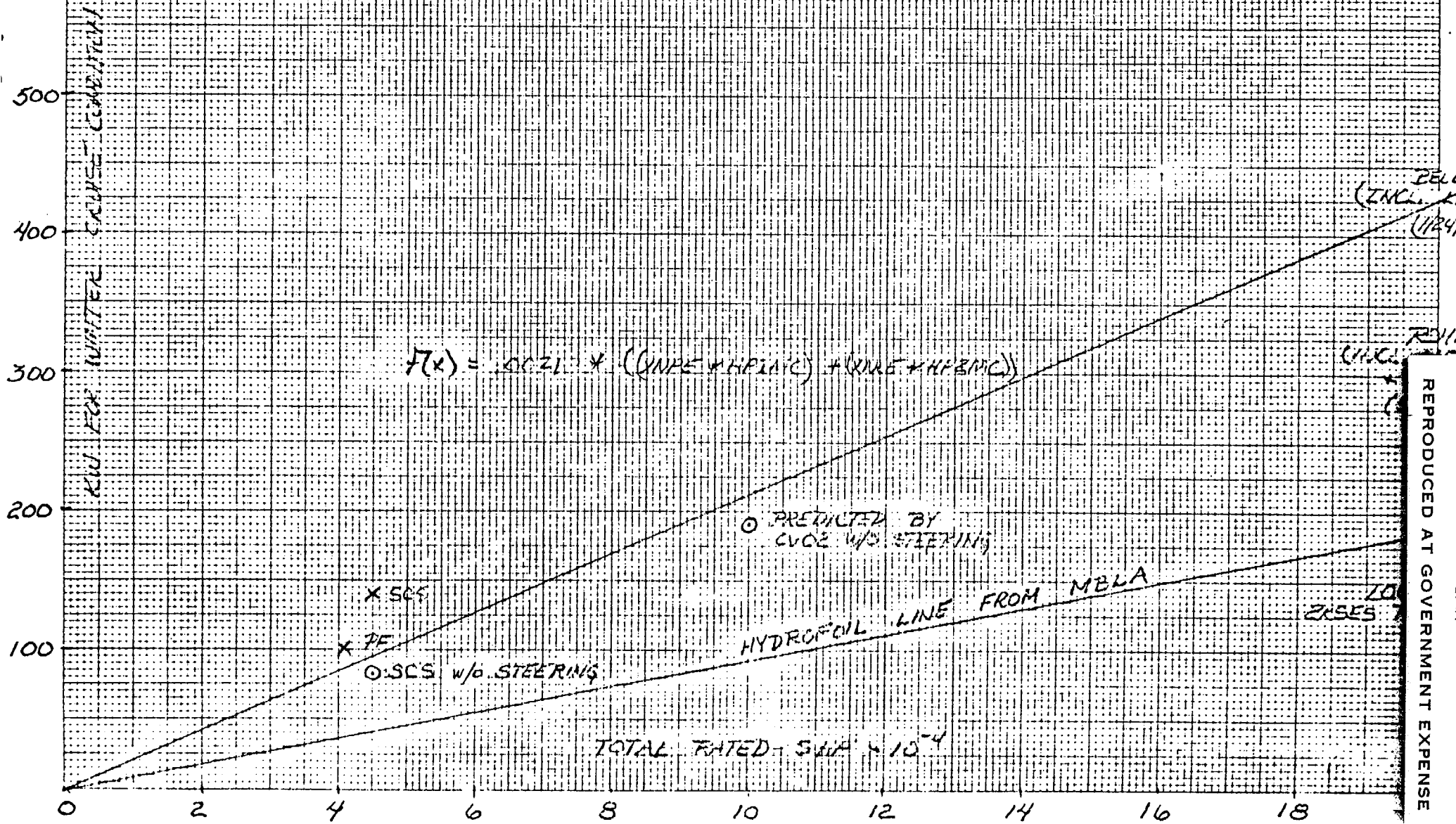
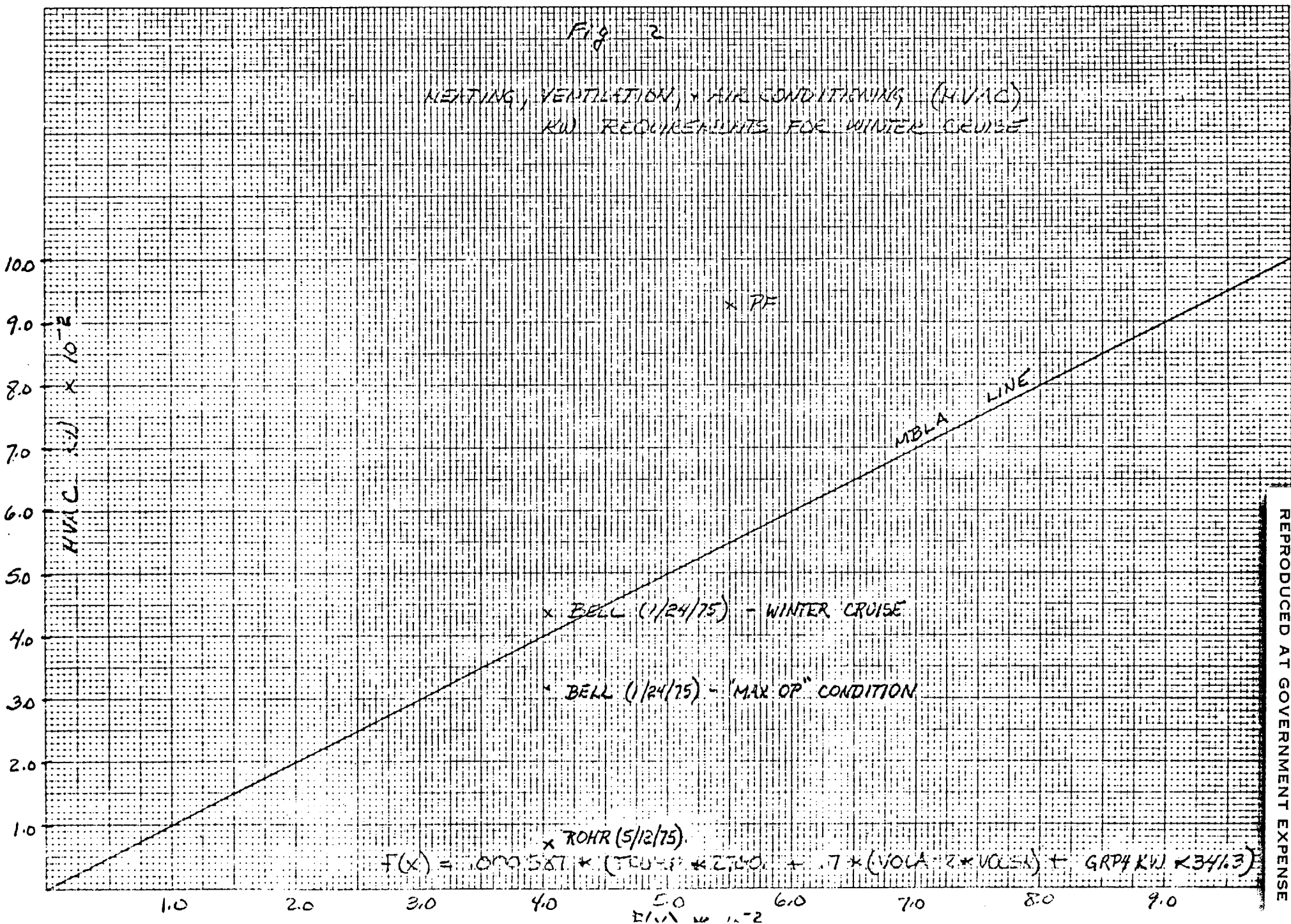
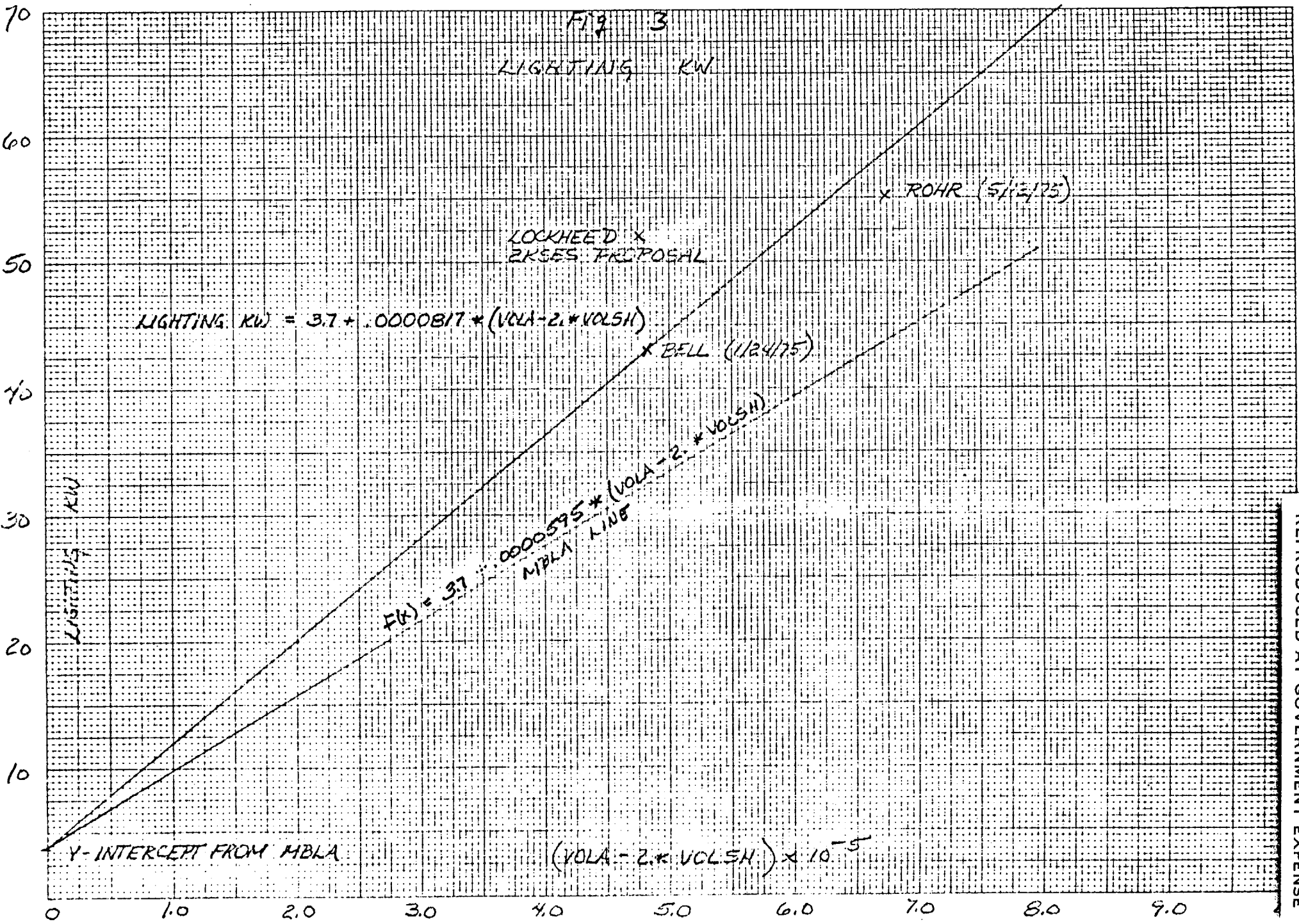


Fig 2

HEATING, VENTILATION, & AIR CONDITIONING (HVAC)  
 KW REQUIREMENTS FOR WINTER CRUISE







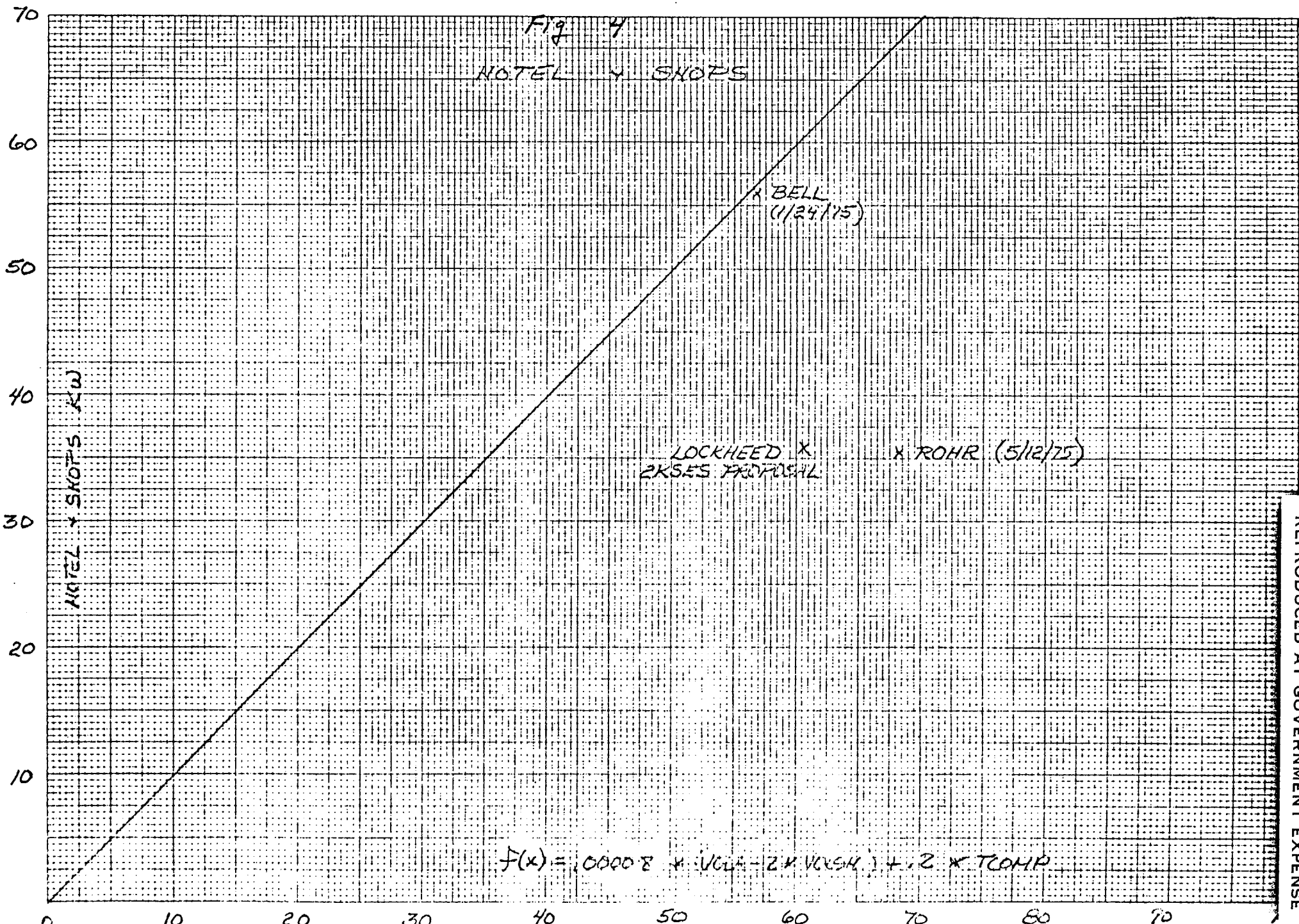


Fig 5

AUXILIARY & DECK MACHINERY

x PF

ROHR x  
(5/12/75)

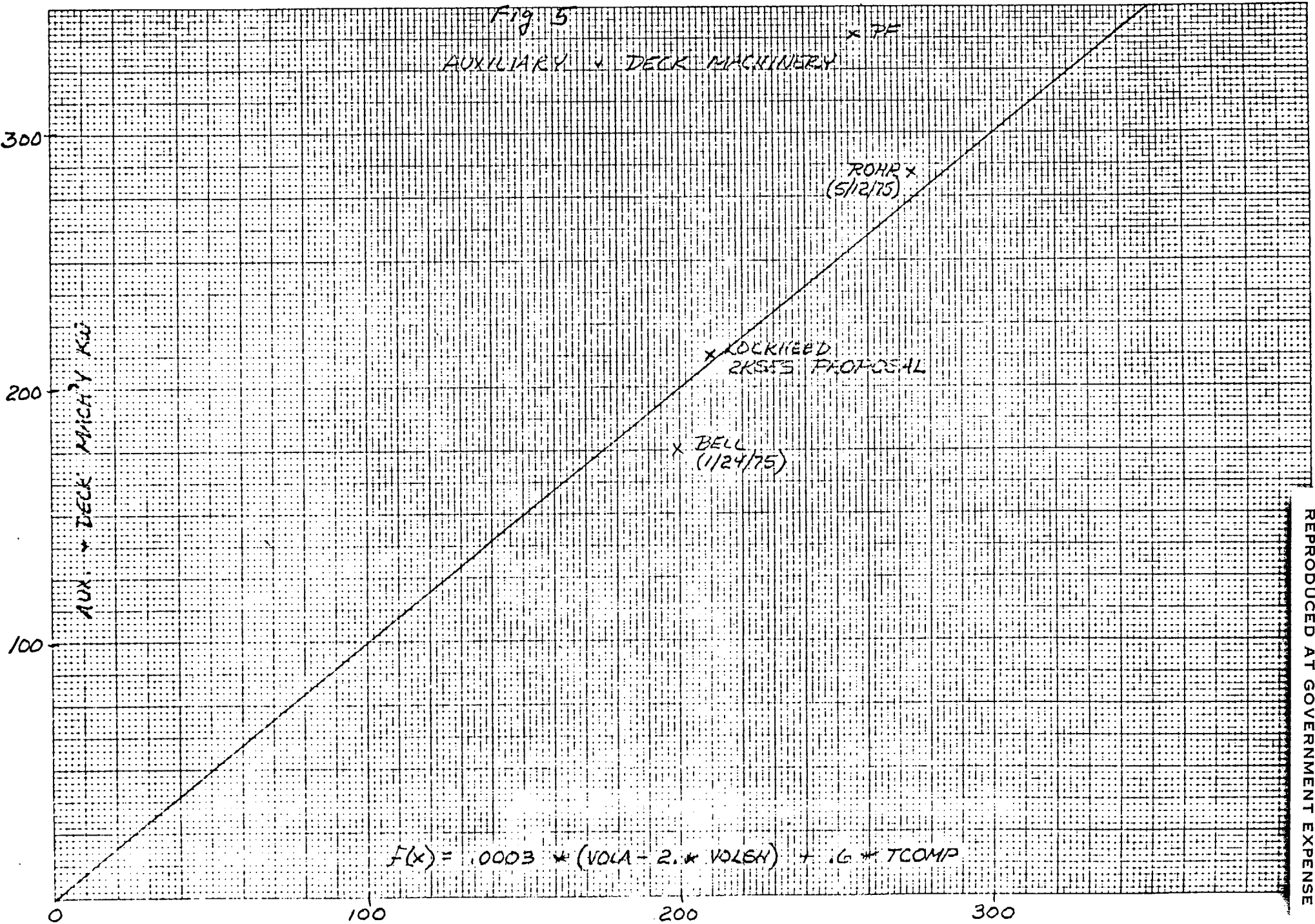
x ROCKWELL  
2KSES PROPOSAL

x BELL  
(1/24/75)

AUX. & DECK MACH'Y KW

$$F(x) = .0003 * (VOLA - 2 * VOLSH) + .6 * TCOMP$$

REPRODUCED AT GOVERNMENT EXPENSE



Group 3.

A 30% growth margin is allowed in calculating total KW requirement. It should be noted here that this total KW corresponds to a "maximum operating" condition which more or less combines winter cruise requirements with the maximum KW requirements of the electronics and weapons.

Average 24 hr. KW is taken to be 87% of the total KW requirement. Both total and average KW requirement calculations are considered to be fairly conservative.

## GROUP 3 - ELECTRIC PLANT

## SWBS

- 311 - Ship Service Power Generation
- 313 - Batteries and Service Facilities
- 314 - Power Conversion Equipment
  
- 321 - Ship Service Power Cable
- 323 - Casualty Power Cable System
- 324 - Switchgear and Panels
  
- 331 - Lighting Distribution
- 332 - Lighting Fixtures
  
- 341 - SSTG Lube Oil
- 342 - Diesel Support System
- 343 - Turbine Support System
  
- 398 - Operating Fluids
- 399 - Repair Parts and Tools

## W311 - Ship Service Generators

## 60 Hz Generator Sets

<u>No.</u>	<u>Type</u>	<u>WT</u>
1	100 KW Diesel	
2	500 KW Diesel CAT D-348	1.765
3	650 KW Diesel CAT D-349	8.82
4	700 KW G.T. Solar Saturn	9.33
5	800 KW G.T. TF 14B	5.36
6	1250 KW G.T. Ruston TA-1750	6.25
7	2000 KW G.T. Allison 501	15.18
		22.64

## 400 Hz Generator Sets

1	120 KW Diesel	
2	500 KW Diesel CAT D-348	1.196
3	650 KW Diesel CAT D-349	8.01
4	60 KW G.T. Solar Titan	8.56
5	90 KW G.T. Garrett 85	.424
6	108 KW G.T. Sunstrand Allison C20B	.45
7	950 KW G.T. Westinghouse Solid State	.43
		2.33

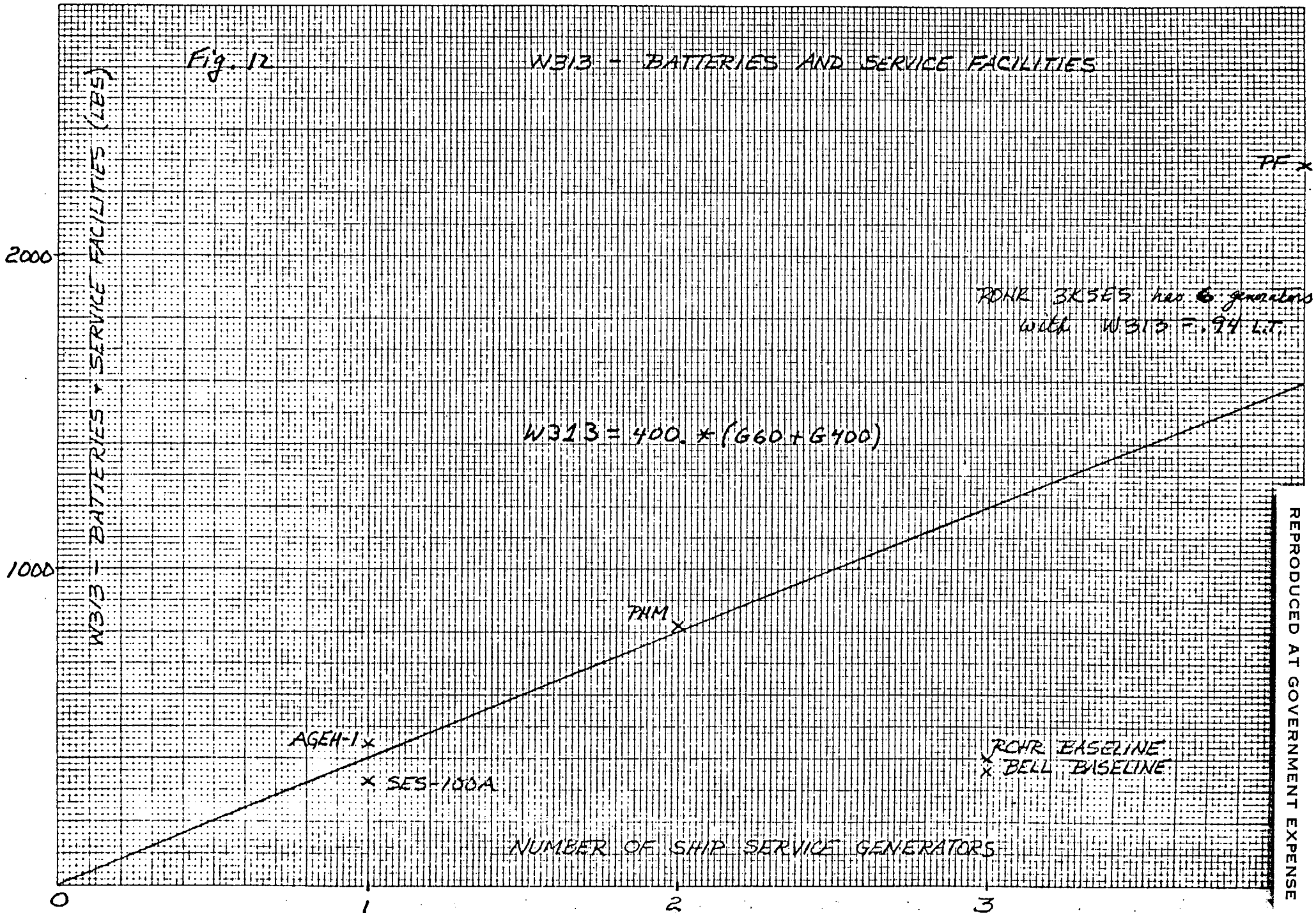
NOTE: #7 is Bell's Configuration with 2-400 KW 400 Hz generators geared together with 1-150 KW 60 Hz generator to form one generator set.

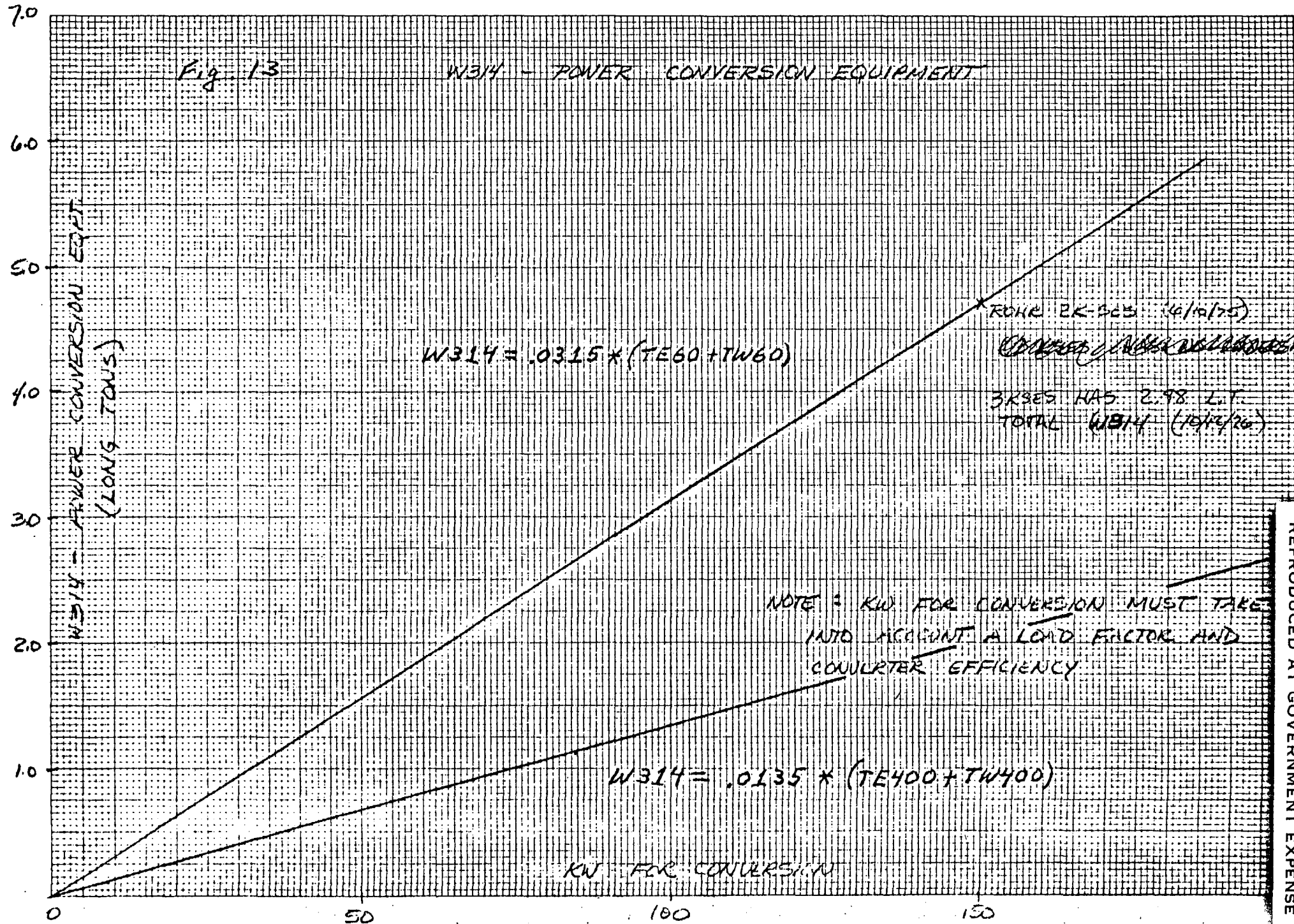
TABLE 2 - GROUP 3

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
311 Ship Service Power Generation Equipment	-	$W311 = (G60WT * G60) + (G400WT * G400)$
313 Batteries & Service Facility	12	$W313 = 400. * (G60 + G400) / 2240.$
314 Power Conversion Equipment	13	$W314 = (TE60 + TW60) * .0315$ and $W314 = (TE400 + TW400) * .0135$
321 Non-elect/elex Navigation Aids	14	$W321 = .0028 * ((G60KW * G60) + (G400KW * G400)) + .000006 * (VOLA - 2. * VOLSH)$
323 Elex Navigation (Radio)	15	$W323 = .0346 * W321$
324 Elex Navigation (Acoustical)	16	$W324 = .0032 * ((G60KW * G60) + (G60KW * G400))$
330 Lighting System	17	$W330 = ((60. * TCOMP) + (.005 * VOLA)) / 2240.$
3413 Turbine L.O. & Support System	18	$W3413 = .033 * (G60 + G400) * (G60 * G60KW + G400 * G400KW)$
342 Diesel Support Systems	19	$W342 = .45 * G60WT * G60$ and $W342 = .45 * G400WT * G400$
398 Electric Plant Operating Fluids		$W398 = .08 * W311$
399 Electric Plant Repair Parts		$W399 = .01 * (W310 + W320 + W330 + W340)$

Fig. 12

W313 - BATTERIES AND SERVICE FACILITIES



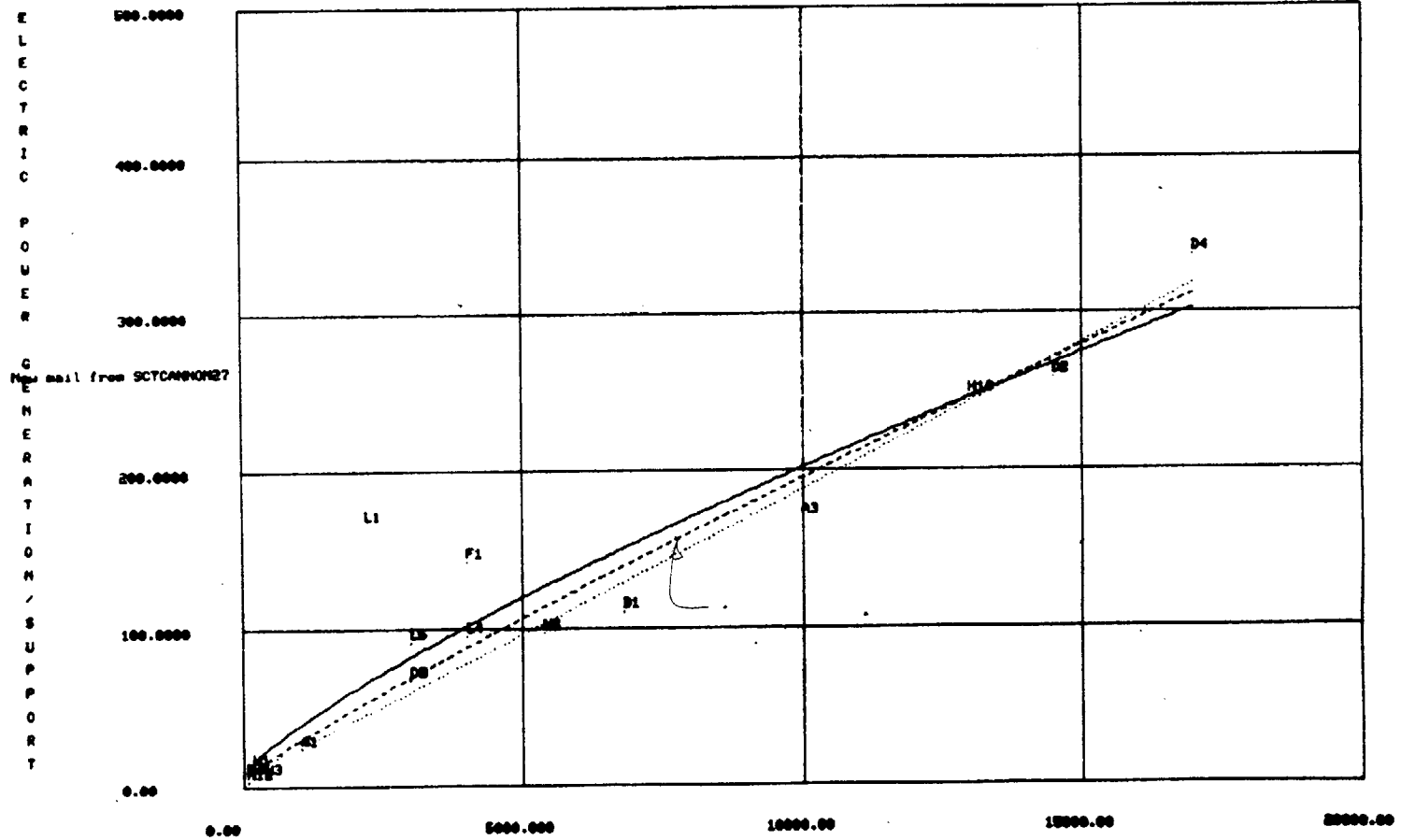




TO CONTINUE, TYPE CONTINUE  
 & CONTINUE

ELECTRIC POWER GENERATION/SUPPORT (310-318,314,340-343)

———— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR



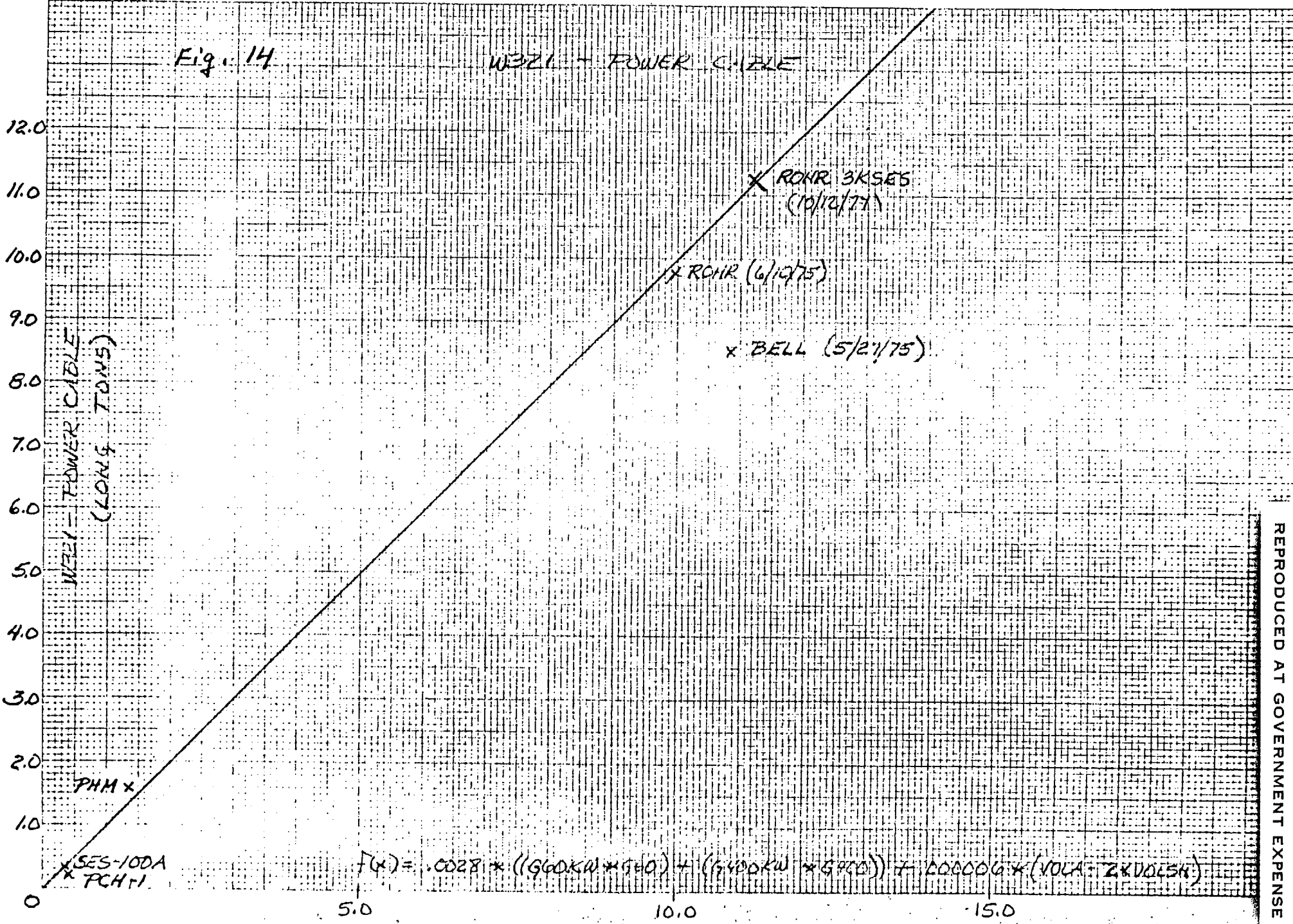
$$W(10) = 7.267 + 0.110 \text{ kW}^{0.807}$$

$$= 7.047 + 0.12419 \text{ kW}^{0.711}$$

$$= 2.769 + 0.052 \text{ kW}^{0.271}$$

Fig. 14

W321 - POWER CABLE

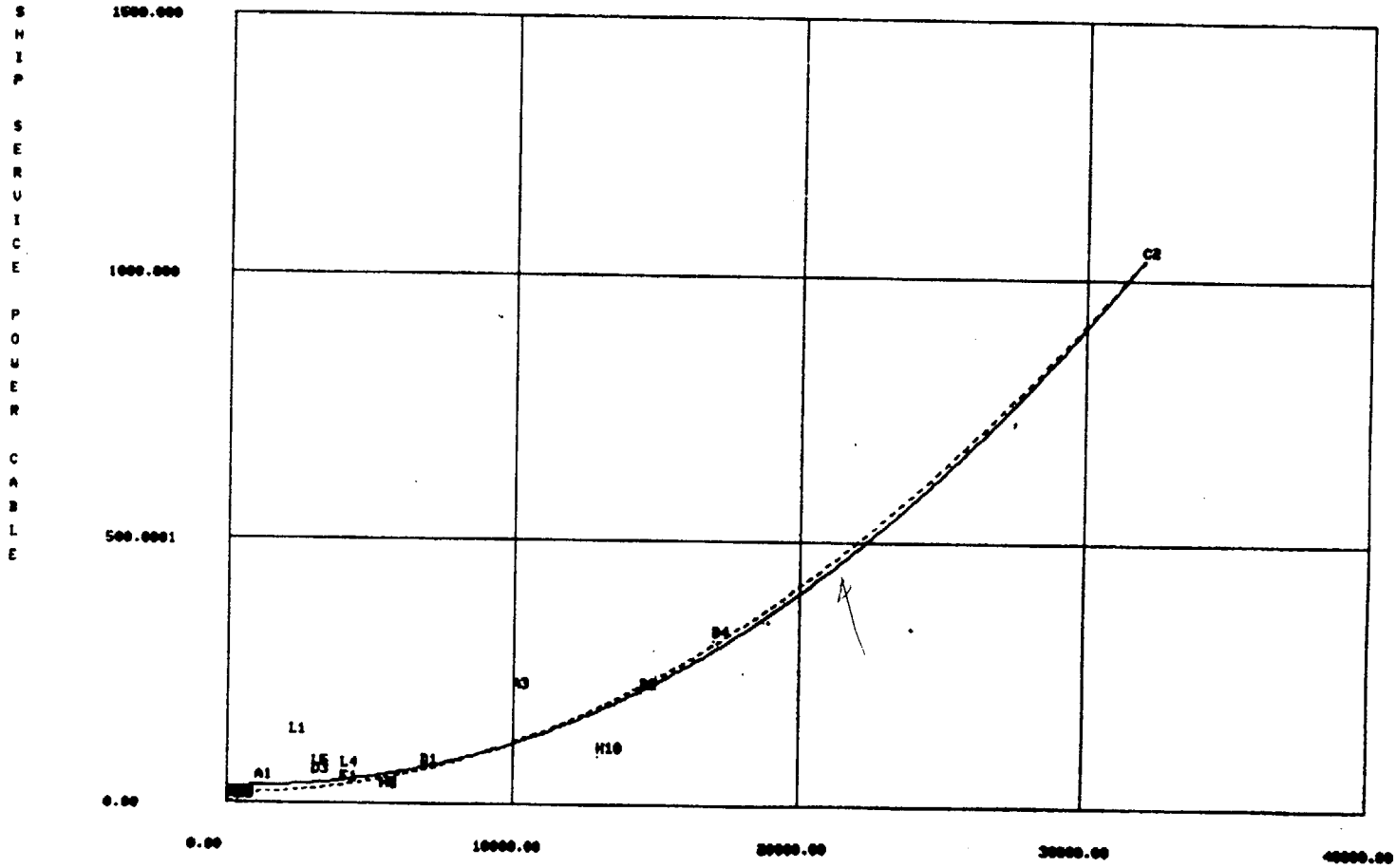


$$f(x) = .0028 * ((960KW * 940) + (5400KW * 940)) + .00006 * (VOLA - 2KVOLSH)$$

TO CONTINUE, TYPE CONTINUE  
6 CONTINUE

SHIP SERVICE POWER CABLE (320-323)

— ALL DATA      - - - - - 2 S.ERROR      ..... 1 S.ERROR



K2

$W 320 = 32.61x + 0.00000022x^2$       2.00  
 $W 320 = 32.61x + 0.00000022x^2$       1.00

Fig 15

W323 - CASUALTY TOWER CABLE

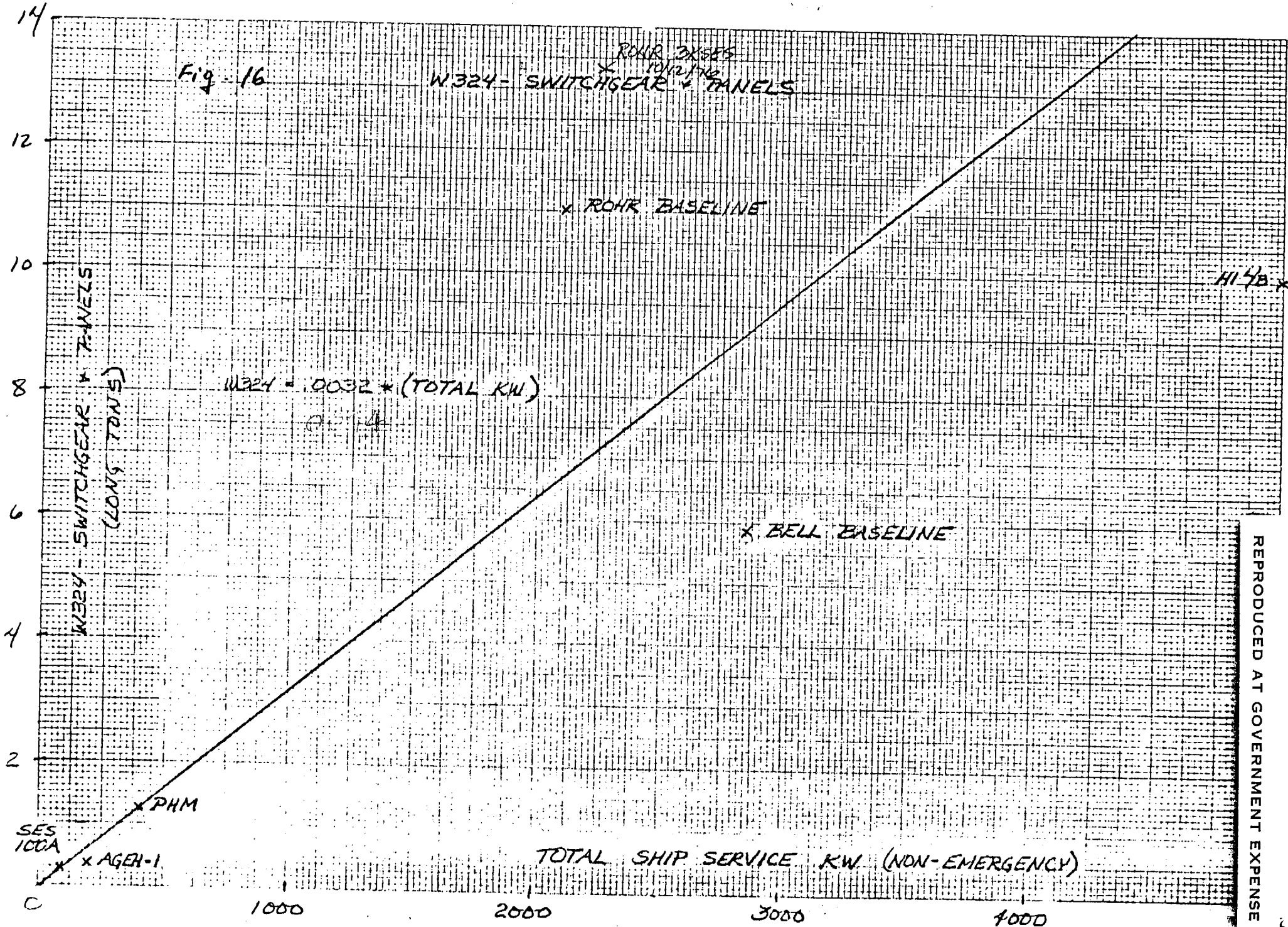
W323 - CASUALTY TOWER CABLE  
(LONG TONS)

X. REVE (6/10/75)

$$W323 = .0346 * W321$$

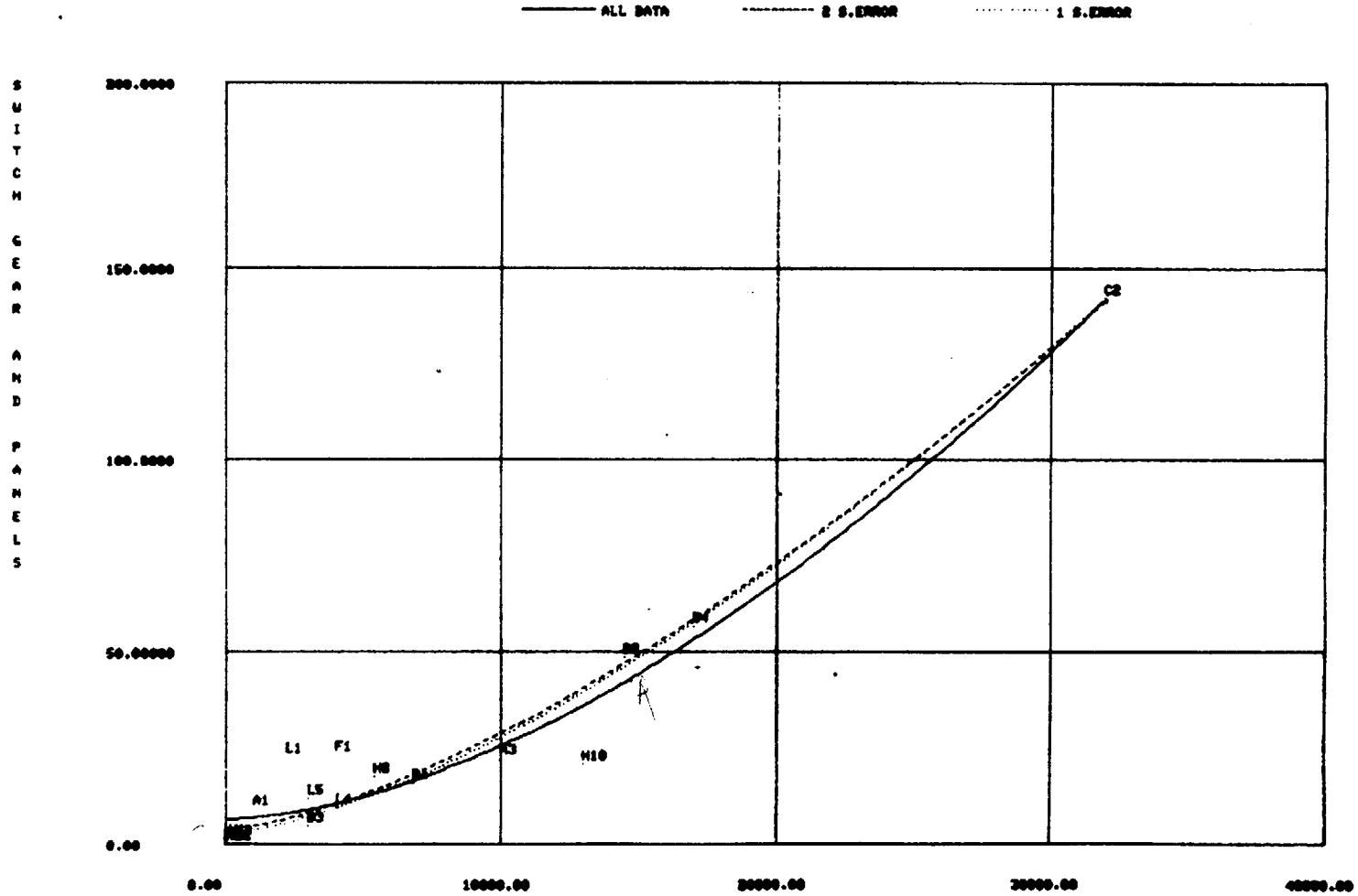
X. PE

W321 - SHIP SERVICE TOWER CABLE



TO CONTINUE, TYPE CONTINUE  
 S CONTINUE

**SWITCH GEAR AND PANELS (324)**



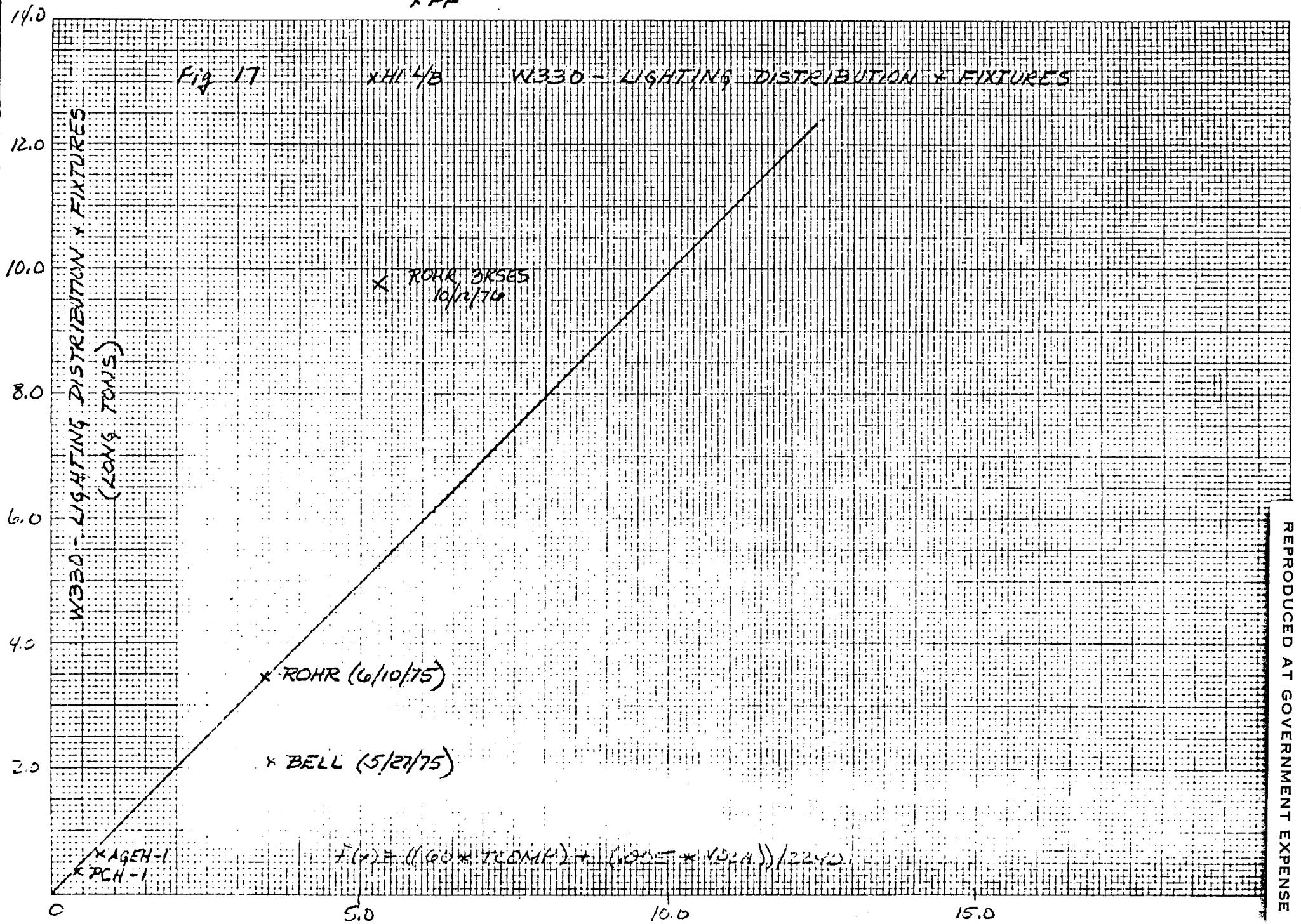
$11224 = 6.642 + 0.00000009 \text{ kW}$  1.1224  
 $6.000 + 0.000000349 \text{ kW}$  1.1224  
 $2.999 + 0.000000214 \text{ kW}$  1.1224

x PF

Fig 17

x HI 4/8

W330 - LIGHTING DISTRIBUTION & FIXTURES



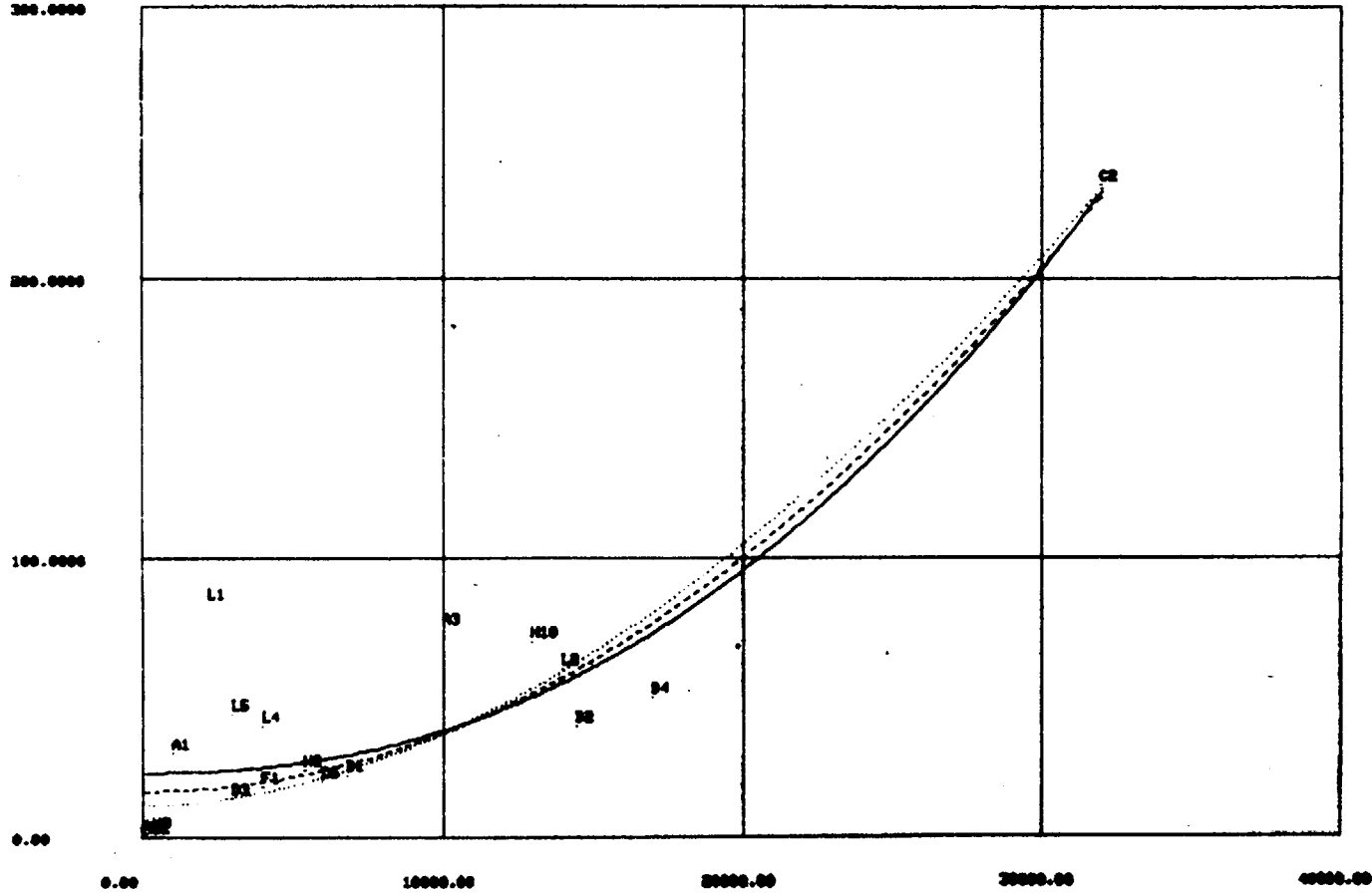
$$F(x) = ((60 * 7COMP) + (600 * 1024)) / 2240$$

TO CONTINUE, TYPE CONTINUE  
 @ CONTINUE

LIGHTING SYSTEM (330-332)

———— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR

L  
I  
G  
H  
T  
I  
N  
G  
  
S  
Y  
S  
T  
E  
M



M2

$$M3 = 23.260 + 0.000000130 \text{ kW} \quad 0.000130$$

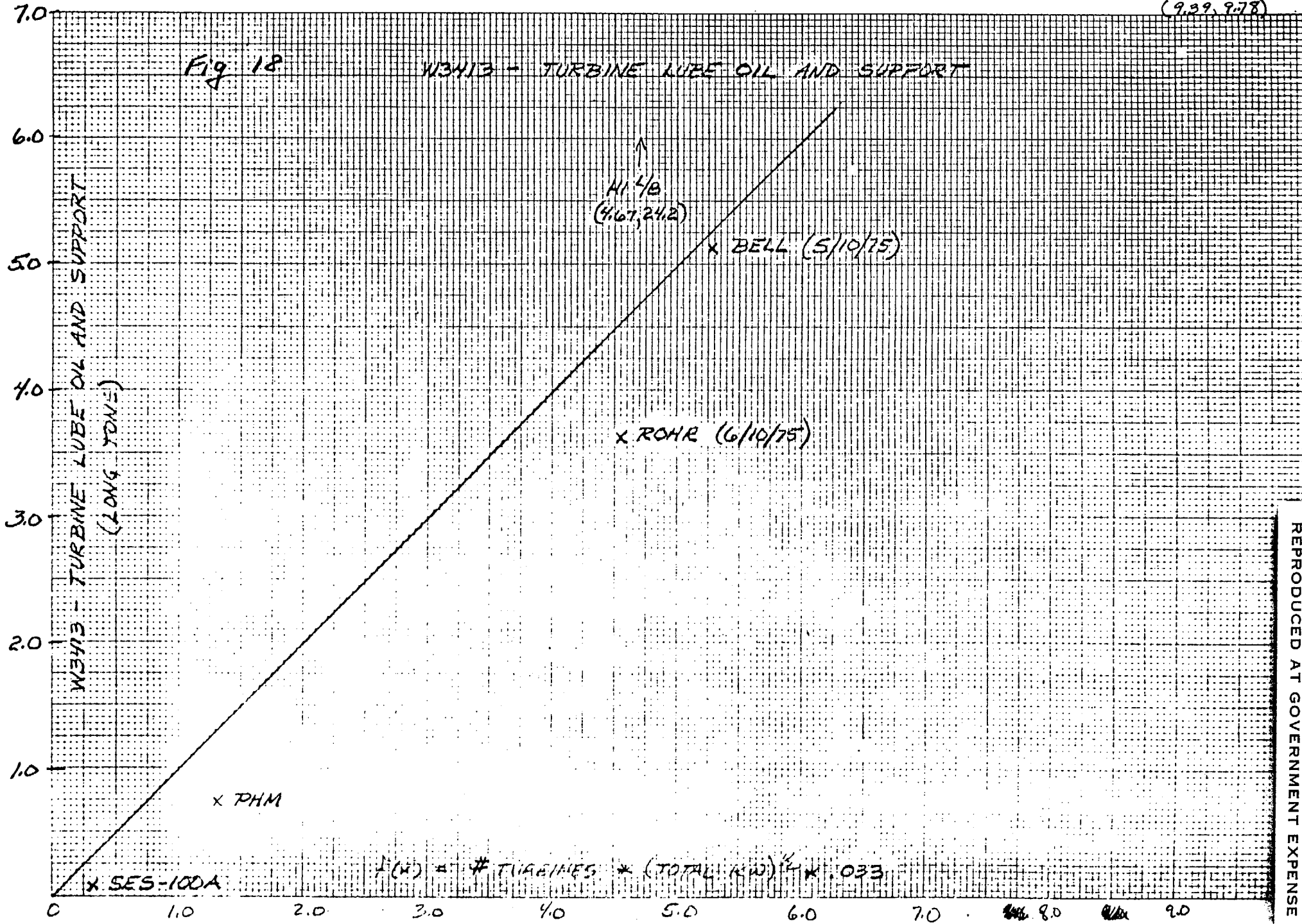
$$= 16.723 + 0.000000171 \text{ kW} \quad 2.00\%$$

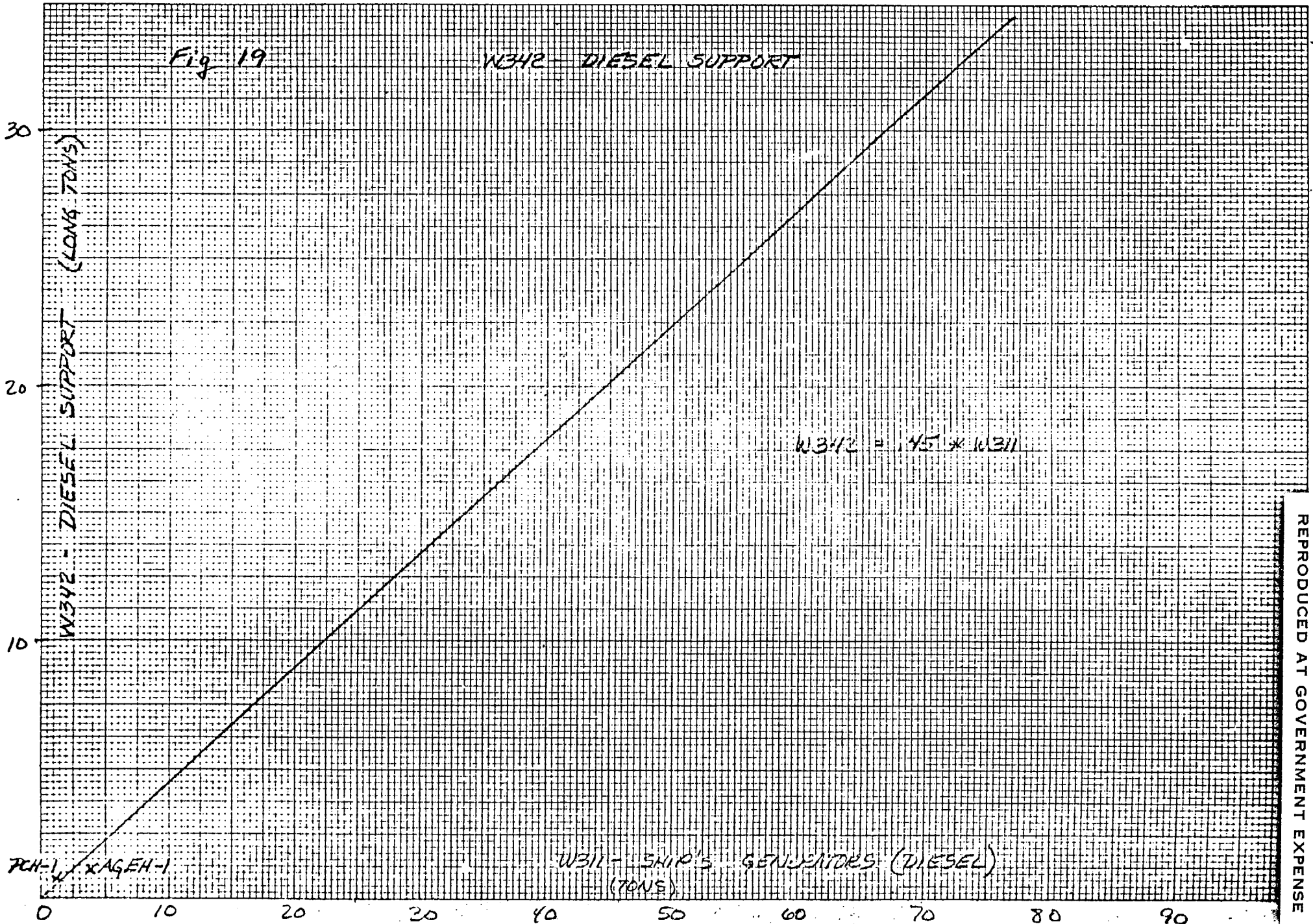
$$= 11.277 + 0.000000111 \text{ kW} \quad 1.843$$



ROHR 3KSES  
 (9.39, 9.78)

Fig 18 W3413 - TURBINE LUBE OIL AND SUPPORT

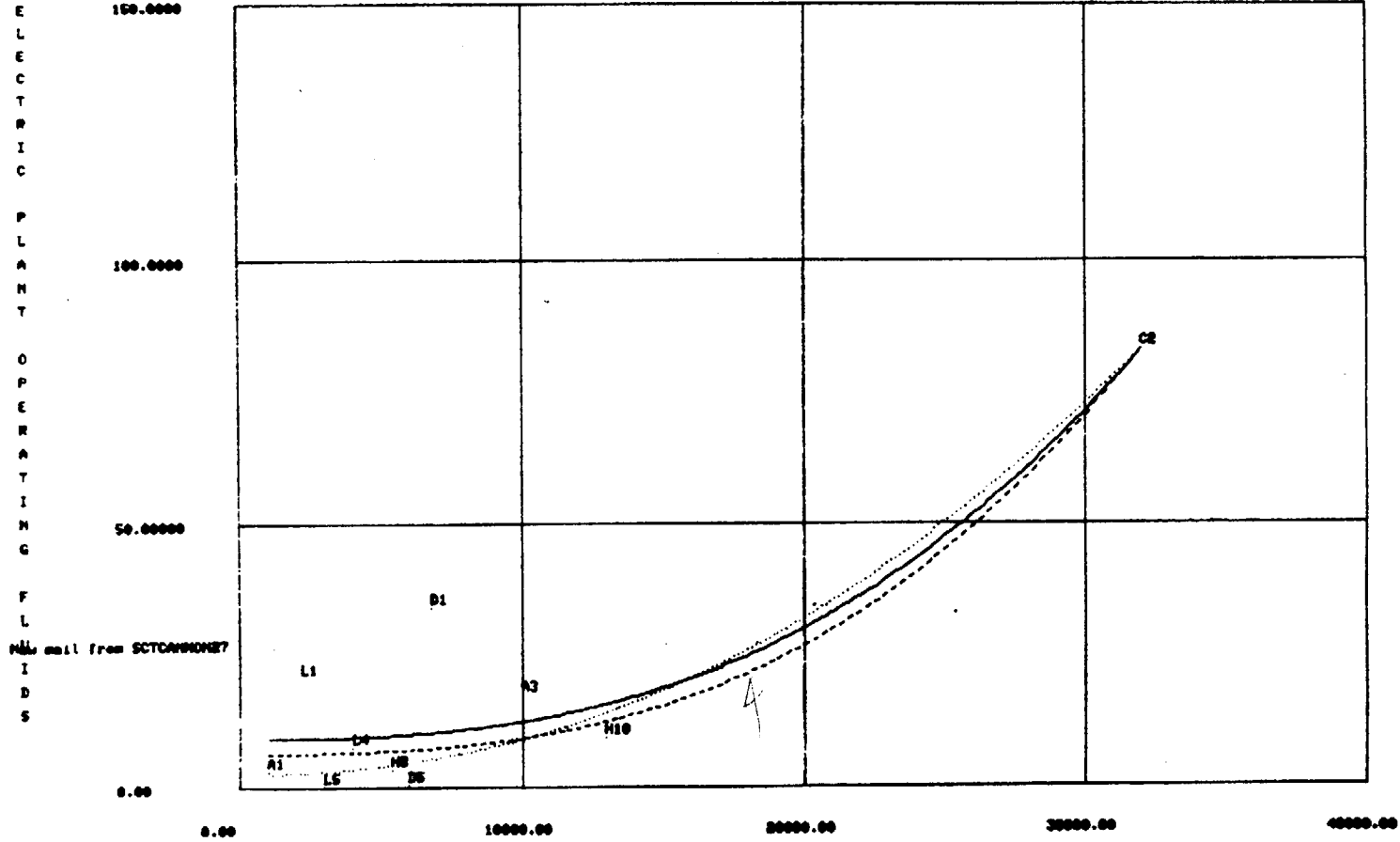




TO CONTINUE, TYPE CONTINUE  
 8 CONTINUE

ELECTRIC PLANT OPERATING FLUIDS (398)

———— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR

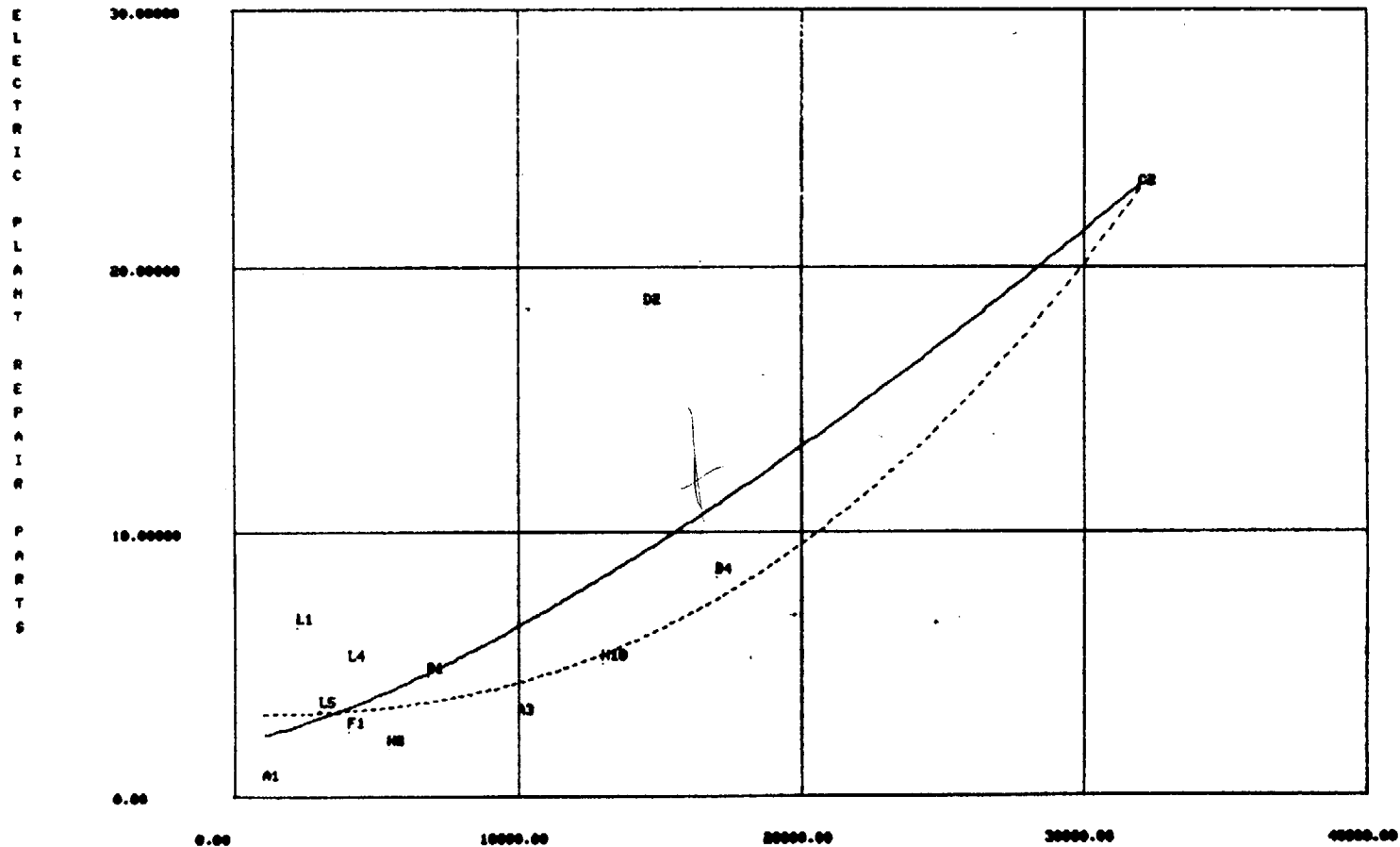


$$\begin{aligned}
 W392 &= 9.341 + 0.425 \times 10^{-10} \text{ KW}^{2.704} \\
 &= 2.517 + 0.1 \times 10^{-10} \text{ KW}^{2.832} \\
 &= 2.507 + 0.102 \times 10^{-10} \text{ KW}^{2.150}
 \end{aligned}$$

TO CONTINUE, TYPE CONTINUE  
 9 CONTINUE

ELECTRIC PLANT REPAIR PARTS (399)

———— ALL DATA      - - - - - 2 S. ERROR      ······ 1 S. ERROR



$$W10 = 7.132 + 0.001128 KW \quad 1.372$$

$$= 3.123 + 0.00174 KW \quad 2.421$$

KW

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY									
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO			
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS
410	COMMAND AND CONTROL SYSTEMS	27.64	38.00				41.92					
411	DATA DISPLAY GROUP	14.14					27.64					
412	DATA PROCESSING GROUP	13.36					14.14					
413	DIGITAL DATA SWITCHBOARDS											
414	INTERFACE EQUIPMENT											
415	DIGITAL DATA COMMUNICATIONS	0.14					0.14					
417	COMMAND AND CONTROL ANALOG SWITCHBOARDS											
420	NAVIGATION SYSTEMS	9.54	73.01				9.54					
421	NON-ELECTRICAL/ELECTRONIC NAVIGATION AIDS	0.57					0.57					
422	ELECTRICAL NAVIGATION AIDS (INCL NAVIG. LIGHTS)	2.59					2.59					
423	ELECTRONIC NAVIGATION SYSTEMS, RADIO	1.16					1.16					
424	ELECTRONIC NAVIGATION SYSTEMS, ACOUSTICAL	0.22					0.22					
425	PERISCOPES											
426	ELECTRICAL NAVIGATION SYSTEMS	1.18					1.18					
427	INERTIAL NAVIGATION SYSTEMS	3.82					3.82					
428	NAVIGATION CONTROL MONITORING											
430	INTERIOR COMMUNICATIONS	81.10	53.64				88.45					
431	SWITCHBOARDS FOR I.C. SYSTEMS	1.83					2.06					
432	TELEPHONE SYSTEMS	24.97					28.06					
433	ANNOUNCING SYSTEMS	14.04					24.72					
434	ENTERTAINMENT AND TRAINING SYSTEMS	8.55					9.61					
435	VOICE TUBES AND MESSAGE PASSING SYSTEMS	0.15					0.19					
436	ALARM, SAFETY, AND WARNING SYSTEMS	8.39					13.22					
437	INDICATING, ORDER, AND METERING SYSTEMS	21.30					5.55					
438	INTEGRATED CONTROL SYSTEMS						2.58					
439	RECORDING AND TELEVISION SYSTEMS	1.87					2.10					
Sub Total Group 4 — Sheet 1, POUNDS												
		TONS										

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

ACCT. NO.	DESCRIPTION	WEIGHT <del>Pounds</del> (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
440	EXTERIOR COMMUNICATIONS	31.95	65.00						31.95					
441	RADIO SYSTEMS	29.25							29.25					
442	UNDERWATER SYSTEMS	0.55							0.55					
443	VISUAL AND AUDIBLE SYSTEMS	0.45							0.45					
444	TELEMETRY SYSTEMS													
445	TTY AND FACSIMILE SYSTEMS	0.69							0.69					
446	SECURITY EQUIPMENT SYSTEMS	1.01							1.01					
450	SURVEILLANCE SYSTEMS (SURFACE)	59.41	84.50						81.13					
451	SURFACE SEARCH RADAR	1.35							11.35					
452	AIR SEARCH RADAR (2D)								11.72					
453	AIR SEARCH RADAR (3D)													
454	AIRCRAFT CONTROL APPROACH RADAR	10.76							10.76					
455	IDENTIFICATION SYSTEMS (IFF)	2.52							2.52					
456	MULTIPLE MODE/FUNCTION RADAR	44.78							44.78					
459	SPACE VEHICLE ELECTRONIC TRACKING													
460	SURVEILLANCE SYSTEMS (UNDERWATER)	157.59	18.63						152.54					
461	ACTIVE SONAR	19.02							15.04					
462	PASSIVE SONAR	136.40							137.40					
463	MULTIPLE MODE SONAR													
464	CLASSIFICATION SONAR													
465	BATHYTHERMOGRAPH	0.10							0.10					
466	LAMPS III ELECTRONICS	2.07												
Sub Total Group 4 — Sheet 2, POUNDS														
TONS														

REPRODUCED AT GOVERNMENT EXPENSE

COMPUTING BY

COMPUTING CHECKED

ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 COMMUNICATION AND CONTROL — GROUP 4, Sheet 3 of 3  
 NAVSEA 9096/3 (7-82) (Previously NAVSHIPS 9291/14)

U.S.S. FY 83 CGV MONOHULL

COMMUNICATION AND  
 CONTROL — GROUP 4

PAGE

DATE 5-31-83

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
470	COUNTERMEASURES	63.51	55.62						14.74				
471	ACTIVE ECM (INCL COMB. ACTIVE/PASSIVE)	6.20							6.20				
472	PASSIVE ECM	5.23							5.23				
473	TORPEDO DECOYS												
474	DECOYS (OTHER)	3.31							3.31				
475	DEGAUSSING	48.77	49.92										
476	MINE COUNTERMEASURES												
485	SPECIAL WEAPON SYS FIRE CNTRL	1.99											
480	FIRE CONTROL SYSTEMS	41.46	82.00						39.47				
481	GUN FIRE CONTROL SYSTEMS												
482	MISSILE FIRE CONTROL SYSTEMS	32.85							32.85				
483	UNDERWATER FIRE CONTROL SYSTEMS	5.24							5.24				
484	INTEGRATED FIRE CONTROL SYSTEMS												
489	WEAPON SYSTEMS SWITCHBOARDS	1.38							1.38				
490	SPECIAL PURPOSE SYSTEMS	31.93	37.25						24.93				
491	ELECTRONIC TEST, CHECKOUT, AND MONITORING EQUIPMENT	6.58							6.58				
492	FLIGHT CONTROL AND INSTRUMENT LANDING SYSTEMS	1.74							1.74				
493	NON COMBAT DATA PROCESSING SYSTEMS	2.26							2.26				
494	METEOROLOGICAL SYSTEMS												
495	SPECIAL PURPOSE INTELLIGENCE SYSTEMS	3.64							3.64				
498	COMMAND AND SURVEILLANCE OPERATING FLUIDS	7.00											
499	COMMAND SURV. REPAIR PARTS AND SPEC. TOOLS	10.71							10.71				
	Sub Total Group 4 -- Sheet 3												
	Sub Total Group 4 -- Sheet 1												
	Sub Total Group 4 -- Sheet 2												
	<b>TOTAL — GROUP 4, POUNDS</b>												
	<b>TONS</b>	504.13	48.11	24251.38					484.67				

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES	MH	SWATH	
QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 5 AUXILIARY SYSTEMS:</b>					
500	<b>AUXILIARY SYSTEMS, GENERAL</b>				
510	<b>CLIMATE CONTROL</b>				
511	C	Compartment Heating System	30	35	42
512		Ventilation System	51	248	296
513		Machinery Space Ventilation System	29		
514		Air Conditioning System	92	195	209
515		Air Revitalization Systems (Submarines)			
516		Refrigeration System	57	8	8
517		Auxiliary Boilers and Other Heat Sources			
<b>SEA WATER SYSTEMS</b>					
521	C	Firemain and Flushing (Sea Water) System	104	210	210
522		Sprinkler System			
523		Washdown System		see 555	see 555
524		Auxiliary Sea Water System	11		
526		Scuppers and Deck Drains	1	75	157
527		Firemain Actuated Services - Other	48		
528		Plumbing Drainage	11		
		Drainage and Ballasting System	36		
<b>FRESH WATER SYSTEMS</b>					
531	C	Distilling Plant	51	19	21
532	C	Cooling Water			
533	C	Potable Water	24	19	19
534		Auxiliary Steam and Drains Within Machinery Box			
535		Auxiliary Steam and Drains Outside Machinery Box			
536		Auxiliary Fresh Water Cooling	NA	NA	22
<b>FUELS AND LUBRICANTS, HANDLING AND STORAGE</b>					
541	C	Ship Fuel and Fuel Compensating System	50	77	75
542		Aviation and General Purpose Fuels	7	17	18
543		Aviation and General Purpose Lubricating Oil	1		
544		Liquid Cargo			
545		Tank Heating			
549		Special Fuel & Lubricants, Handling & Stowage	PL	4	4
<b>AIR, GAS, AND MISC. FLUID SYSTEMS</b>					
		Compressed Air Systems	24	46	54
		Compressed Gases			
553		O2 N2 System		8	8
554		LP Blow			
555		Fire Extinguishing Systems	26	in 521	in 521



8/19/83

		QTY	SES WT (LT)	WT (LT)	WT (LT)	MH SCALE FACTORS	SWATH REFERENCE
	Hydraulic Fluid System		20			0	0
557	Liquid Gases, Cargo						
558	Special Piping Systems						
560	SHIP CONTROL SYSTEMS						
561	Steering and Diving Control Systems		34			46	77
562	Rudder					73	160
563	Hovering and Depth Control (Submarine)						
564	Trim System (Submarines)						
565	Trim and Heel Systems (Surface Ships)		NA			160	160
566	Diving Planes & Stabilizing Fins (Submarines)						
567	Strut and Foil Systems						
568	Maneuvering Systems						
570	UNDERWAY REPLENISHMENT SYSTEMS						
571	Replenishment-At-Sea Systems		9			59	59
572	Ship Stores and Equipment Handling Systems		5			34	34
573	Cargo Handling Systems						
574	Vertical Replenishment Systems						
580	MECHANICAL HANDLING SYSTEM						
581	Anchor Handling and Stowage Systems		65	105		227	227
582	Mooring and Towing Systems		41				
583	Boats, Boat Handling and Stowage Systems		15			32	32
584	Mechan. Oper. Door, Gate, Ramp, Turntab. Sys.						
585	Elevating and Retracting Gear						
586	Aircraft Recovery Support Systems		45			45	45
587	Aircraft Launch Support Systems						
588	Aircraft Handling, Servicing and Stowage		581			581	522
589	Miscellaneous Mechanical Handling Systems						
590	SPECIAL PURPOSE SYSTEMS						
591	Scientific and Ocean Engineering Systems						
592	Swimmer and Diver Support and Protection Sys.						
593	Environmental Pollution Control Systems		33			28	28
594	Submarine Rescue, Salvage, & Survival Sys.						
595	Towing, Launch, & Handl. for Underwater Sys.						
596	Handling Sys. for Diver & Submers. Vehicles						
597	Salvage Support Systems						
598	Auxiliary Systems Operating Fluids		71			227	208
	Auxiliary Systems Repair Parts and Tools		14			35	33
	GROUP 500 TOTAL		1541				

SESDES Design  
changes  
Tuesday Aug 83

530 group  
540

$$586 = 95.0$$

$$622 = .01144 * VOLA = 0.01144 * VOLA$$

$$\text{where } K622 = .01144$$

$$637 = 0.0, \therefore K637 = 0.0$$

511 use conventional

$$512 \quad K512 = 0.9$$

521 use conventional

528 DUM3 not DUM1

529 DUM3 not DUM1

531, 532, 533 use conventional

541 use conventional

REV 2 - 8/4/83

PAGE

DATE 5-31-83

ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 AUXILIARY SYSTEMS - GROUP 5, Sheet 1 of 3  
 NAVSEA 9096/3 (7-82) (Previously NAVSHIPS 9291/14)

U.S.S. FY 83 CGV MONOHULL AUXILIARY SYSTEMS - GROUP 5

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.			REFERRED TO						
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
510	CLIMATE CONTROL	486.54	41.44			554.91			178.64			306.43		
511	COMPARTMENT HEATING SYSTEM	35.35	47.42			41.85		TC	5.53			24.37		
512	VENTILATION SYSTEM	248.32	51.15			296.1			21.60			192.33		
513	MACHINERY SPACE VENTILATION SYSTEM								27.09					
514	AIR CONDITIONING SYSTEM	194.81	29.55			208.9			78.14			63.56		
515	AIR REVITALIZATION SYSTEMS (SUBMARINES)													
516	REFRIGERATION SYSTEM	8.06	24.33			8.06			46.28			26.17		
517	AUXILIARY BOILERS AND OTHER HEAT SOURCES					0								
520	SEA WATER SYSTEMS	284.44	38.88			356.2			81.36			216.62		
521	FIREMAIN AND FLUSHING (SEA WATER) SYSTEM	209.64	42.21			199.4		TC	39.95			102.14	+1690	555
522	SPRINKLER SYSTEM													
523	WASHDOWN SYSTEM													
524	AUXILIARY SEA WATER SYSTEM								10.16					
526	SCUPPERS AND DECK DRAINS	74.80	29.55						1.0			22.16		
527	FIREMAIN ACTUATED SERVICES - OTHER													
528	PLUMBING DRAINAGE							Top Deck	7.20			42.89		
529	DRAINAGE AND BALLASTING SYSTEM					156.8			24.05			49.43		
530	FRESH WATER SYSTEMS	65.27	28.00			40.2			91.85			55.57		
531	DISTILLING PLANT	19.12	20.77			21			33.94			36.12	26.00	
532	COOLING WATER	27.00	22.35						26.26			<del>19.45</del>		
533	POTABLE WATER	19.15	43.21			19.2			31.65			19.45	24	
534	AUX. STEAM AND DRAINS WITHIN MACHINERY BOX													
535	AUX. STEAM AND DRAINS OUTSIDE MACHINERY BOX								1100 TC					
536	AUXILIARY FRESH WATER COOLING													
Sub Total Group 5 - Sheet 1, POUNDS														
TONS						958.25								

COMPUTING BY

COMPUTING CHECKED

REV 2 - 8/4/83

U.S.S. FY 83 CGV MONOHULL AUXILIARY SYSTEMS — GROUP 5

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.			REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
540	FUELS AND LUBRICANTS, HANDLING AND STORAGE	102.46	17.44		96.25			27.13			63.10		
541	SHIP FUEL AND FUEL COMPENSATING SYSTEM	77.20	15.27		75			19.81			58.0X		
542	AVIATION AND GENERAL PURPOSE FUELS	17.15	30.55		17.5			6.78			5.10		
543	AVIATION AND GENERAL PURPOSE LUBRICATING OIL							.54					
544	LIQUID CARGO												
545	TANK HEATING	3.86	5.40		3.75								
549	SPECIAL FUEL AND LUBRICANTS, HANDLING, AND STOWAGE	4.25	15.00										
550	AIR, GAS, AND MISC. FLUID SYSTEMS	53.65	40.23		62.42			61.48			97.29		
551	COMPRESSED AIR SYSTEMS	45.66	40.23		54.44			22.45			43.04		
552	COMPRESSED GASES												
553	O2 N2 SYSTEM	7.98	40.23		7.98								
554	LP BLOW												
555	FIRE EXTINGUISHING SYSTEM							25.16			43.44		
556	HYDRAULIC FLUID SYSTEM							13.87			10.81		
557	LIQUID GASES, CARGO												
558	SPECIAL PIPING SYSTEMS												
560	SHIP CONTROL SYSTEMS	279.02	17.05		390			31.95			85.91		
561	STEERING AND DIVING CONTROL SYSTEMS	46.33	31.75		80			31.95			33.57		
562	RUDDER	72.69	18.52		150						52.34		
563	HOVERING AND DEPTH CONTROL (SUBMARINES)												
564	TRIM SYSTEM (SUBMARINES)												
565	TRIM AND HEEL SYSTEMS (SURFACE SHIPS)	160.00	12.13		160								
566	DIVING PLANES AND STABILIZING FINS (SUBMARINES)												
567	STRUT AND FOIL SYSTEMS												
568	MANEUVERING SYSTEMS												
Sub Total Group 5 — Sheet 2, POUNDS													
		TONS						548.67					

COMPUTING BY

COMPUTING CHECKED

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY									
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO			
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS
570	REPLENISHMENT SYSTEMS	93.42	62.15		82.96		13.02		188.92			
571	REPLENISHMENT-AT-SEA SYSTEMS	59.29	66.19		48.83		8.23		130.65		change eqpt	
572	SHIP STORES AND EQUIP. HANDLING SYSTEMS	34.13	55.13		34.13		4.79		58.27		change eqpt	
573	CARGO HANDLING SYSTEMS											
574	VERTICAL REPLENISHMENT SYSTEMS											
575	VEHICLE HANDLING AND STOWAGE SYSTEMS											
580	MECHANICAL HANDLING SYSTEM	888.17	47.86		910.17		760.83		1122.58			
581	ANCHOR HANDLING AND STOWAGE SYSTEMS	227.41	45.95		307.9		63.27		366.20		change to 105	
582	MOORING AND TOWING SYSTEMS						39.54				(105)	
583	BOATS, BOAT HANDLING AND STOWAGE SYSTEMS	31.82	42.00		31.82		11.31		130.07		match MH	
584	LANDING CRAFT HANDLING AND STOWAGE SYSTEMS											
585	ELEVATING AND RETRACTING GEAR	2.63	64.00		3.1							
586	AIRCRAFT RECOVERY SUPPORT SYSTEMS	45.00	68.50		45		65.40 ?		45.0			
587	AIRCRAFT LAUNCH SUPPORT SYSTEMS						change 45					
588	AIRCRAFT HANDLING, SERVICING AND STOWAGE	581.31	48.04		522.35		581.31		581.31			
589	MISCELLANEOUS MECHANICAL HANDLING SYSTEMS											
590	SPECIAL PURPOSE SYSTEMS	289.48	29.14		268.31		88.85		157.40			
591	SCIENTIFIC AND OCEAN ENGINEERING SYSTEMS											
592	SWIMMER AND DIVER SUPPORT AND PROTECT. SYSTMS.											
593	ENVIRONMENTAL POLLUTION CONTROL SYSTEMS	27.61	29.05		27.61		26.54		49.60		change 202 DM	
594	SUB. RESCUE, SALVAGE, AND SURVIVAL SYSTEMS											
595	TOWING, LAUNCHING AND HANDLING FOR UNDERWATER SYS.											
596	HANDLING SYS. FOR DIVER AND SUBMERSIBLE VEHS.											
597	SALVAGE SUPPORT SYSTEMS											
598	AUXILIARY SYSTEMS OPERATING FLUIDS	226.61	29.29		207.8		62.31		97.38		change 5(A)	
599	AUXILIARY SYSTEMS REPAIR PARTS AND TOOLS	35.25	28.31		32.9		12.46		10.42			
	Sub Total Group 5 - Sheet 3						1261.44					
	Sub Total Group 5 - Sheet 1						958.25					
	Sub Total Group 5 - Sheet 2						548.67					
	<b>TOTAL - GROUP 5, POUNDS</b>											
	<b>TONS</b>	<b>2542.45</b>	<b>38.74</b>				<b>2768.4</b>		<b>1347.57</b>		<b>2293.82</b>	

COMPUTING BY

COMPUTING CHECKED

Volume. Mono. SWATH SES  
 4.1 mil 4.9 4.0

6/18

Group 1 - Compression

511 - Comp. Htg  
 - all assume all electric  
 ship hty.

Mono SWATH SES  
 35 42 10 lt. wt.

8/12/87  
~~8/10/87~~  
 SES

512 - Ventilation

} 248 (CV02) } 296 (CV02) } 49 ? 192 (51  
 80 } 29

513 - Mach. Spans

514 - Air Conditioning

195 (CV02) 209 (CV02) 88 (include 524) (92  
 (145) 57

516 - Refrig. System

8 8 46

521 - Fuel tank

210 199 210 40 <sup>incl. 523, 522, 527</sup>  
 - some GRP 115 { 104  
 11

524 - SW

526

528

529 - Drawings, Ballasting

} 75 } 157 } 48 { 1  
 int. ballast tank 24 } 11  
 36

531 - Distillery

19 536 - 21 34 change 51

532, 536  
 533 - Potable Water

19 19 <sup>also  
 motor  
 cooling</sup> 54 24

541 - Ship Fuel + Comp

77 75 20 54

542 - Aviation Fuel

17 18 7 7

543  
 545 - Tanks

3 4 0 1

549 - Special Fuels (LASER)

4 4 in PL.

551 - Comp Air

46 54 23 { 24

553 O<sub>2</sub>/N<sub>2</sub>  
 555 - Fire Ext

8 (in 521) 8 25 44 { 20

556 - Hyd. Fluid

- - 19 - { 20

561 - Ship

46 80 77 } 32 { 34

562 - Rudder

73 180 160 } 32 { 34

565 - Truss Mast bidge heads, fms.

160 160 0 (in group 2) NA

571 - ref. at sea

59 59 8 9

572 - ship stores handling

34 34 5 5

581/582 water beddy

221 308 252 103 lt. wt. Danforth 565  
 227 106 { 41

582 - Tanks

32 32 11 15

583 - ship stores handling

3 3 0 25

584

45 MK7

	Mono	SWATH	SES	
588 - Aircraft Halls	581	522	501	581
593 - Pollen Cert.	28	28	27	33
✓ 598 - Aux. Sept. Op.	227	208	62 - don't carry at all	71
599 -	35	33	12 much	14
			<u>1348</u>	15-41
			+193	

OFF  
2112

A = 935  
V = 4000 x 10<sup>3</sup>      2925

	NAV	SES	DES	
* 512/513	192.3	48.70		- 143.60
* 516	26.2	46.28		+ 20.08
* 511/517	24.4	5.53		- 18.87
* 514/524	63.7	88.30		+ 24.60
* 521/22/23/27	102.1	39.95		- 62.15
526	22.2	0.0		- 22.2
528	42.9	7.20		- 35.70
* 529	49.4	24.05		- 25.35
* 531	36.1	33.94		- 2.16
* 532/33/26	19.5	53.91		+ 34.41
* 551	43.0	22.45		- 20.55
* 555	43.4	25.16		- 18.24
* 556	10.8	13.87		+ 3.07
* 561	85.9	31.95		- 53.95
* 571/522/577	130.6	8.23		- 122.37
* 572	58.3	4.79		- 53.51
* 583	130.1	11.31		- 118.79
581/82	366.2	102.81		- 263.39
<b>Σ</b>	<b>1447.1</b>	<b>568.42</b>		
541		19.81		
542		6.78		
543		0.54		
586		65.40		
588		581.31		
593		26.54		
598		62.31		
599		12.46		
<b>Σ</b>	<b>2222.25</b>	<b>1343.57</b>		

NON-CONFIRMED  
- 105 CT

4212  
- 25  
27 210/210



SWBS

- 511 Compartment Heating System
- 512 Ventilation System
- 513 Machinery Space Ventilation System
- 514 Air Conditioning System
- 516 Refrigeration System
  
- 521 Firemain and Flushing System
- 522 Sprinkler System
- 523 Washdown System
- 524 Auxiliary Seawater Systems
- 526 Scuppers and Deck Drains
- 528 Plumbing Drainage
- 529 Drainage and Ballasting System
  
- 531 Distilling Plants
- 532 Cooling Water
- 533 Potable Water
- 536 Auxiliary Fresh Water Cooling
  
- 541 Ship Fuel and Fuel Compensating System
- 542 Aviation and General Purpose Fuels
- 543 Aviation and General Purpose Lube Oil
  
- 551 Compressed Air Systems
- 555 Fire Extinguishing System
- 556 Hydraulic Fluid System
  
- 561 Steering System
- 562 Rudder
- 567 Lift System
  - A. Lift Engines
  - B. Gears
  - C. Clutches & Couplings
  - D. Shafting
  - E. Bearings
  - F. Combustion Air
  - G. Lift Engine Control
  - H. Circulating & Cooling Sea Water
  - I. Uptakes
  - J. Fuel Service
  - K. Lube Oil
  - L. L.O. Fill, Transfer, Purification
  - M. Bow Seal & Bleed System
  - N. Stern Seal , Seal Bleed, & Seal Control
  - O. Vent Valves/Ride Control
  - P. Fans
  - Q. Fan Ducting & Installation
- 568 Maneuvering Systems
- 571 Replenishment-at-Sea
- 572 Ship Stores & Personnel

SWBS

- 581 Anchor Handling & Stowage Systems
- 582 Mooring and Towing System
- 583 Boat Handling and Stowage
- 584 Mechanically Operated Door Systems
- 586 Aircraft Recovery Support System
- 588 Aircraft Handling, Servicing and Stowage
  
- 593 Environmental Pollution Control
- 598 Operating Fluids
- 599 Repair Parts

TABLE 3 - GROUP 5

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
511 Compartment Heating Systems	20	$W511 = .204 * DUM1$
512 Ventilation System	21	$W512 = .021 * TCOMP$
513 Machinery Space Ventilation System	22	$W513 = DUM1 = (VOLA - 2.0 * VOLSH) * .00001$
514 Air Conditioning System	23	$W514 = .4 + .68 * (.03 * (VOLA - 2.0 * VOLSH) + (170. * TCOMP)) / 2240.$
516 Refrigeration System	24	$W516 = .00075 * DSTRS * TCOMP$
521 Fire Main & Sea Water Flush	25	$W521 = W52123 = 1.475 * DUM1$ and $DUM1 = (VOLA - 2.0 * VOLSH) * .00001$
522 Sprinkler System		
523 Washdown System		
524 Auxiliary Sea Water System	26	$W524 = .375 * DUM1$
526 Scupper & Deck Drains	27	$W526 = 1.15 * DUM2$ and $DUM2 = .00001 * XL1CE * B1T$
528 Plumbing Drainage	28	$W528 = .266 * DUM1$
529 Drainage & Ballasting System	29	$W529 = .888 * DUM1$
531 Distilling Plant	30	$W531 = .033 * TCOMP + .3$
532 Cooling Water System	-	$W532 = .054 * W400$
533 Portable Water System	31	$W533 = .03077 * TCOMP$
541 Ship Fuel & Comp Systems	-	$W541 = .0000017 * XL1CE * D * W1FT$
551 Compressed Air Systems	32	$W551 = .829 * DUM1$
555 Fire Extinguishing Systems	33	$W555 = .929 * DUM1$

TABLE 3 - GROUP 5 (Continued)

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
556 Hydraulic Fluid System	34	$W556 = 1.6 + .453 * DUM1$
561 Steering System	35	$W561 = W56128 = .8 + 1.15 * DUM3$ and $DUM3 = VOLA * .00001$
562 Rudder		
568 Maneuvering System		
567A Lift Engines	-	$W567A = XNLE * EWTS (ILIFT)$
567B Gear Boxes, Lift	-	$W567B = GEARWL * XNLE$
567C Clutches & Couplings, Lift	-	$W567C = 126. * XNLE * ((HP2MI / RPMP) ** .6666) / 2240.$
567D Shafting in Lift System	-	$W567D = (33. + ((HP2MI / XND) ** .6666)) * XLSHFL / 2240.$
567E Bearings in Lift System	-	$W567E = .2143 * (W567C + W567D)$
567F Combustion Air System for Lift	-	$W567F = .0001357 + HP2MI * XNLE$
567G Lift Engine Control	-	$W567G = .00425 * XNLE * SQRT(HP2MI)$
567H Circulating & Cooling Sea Water for Lift System	-	$W567H = .00444 * XNLE * SQRT(HP2MI)$
567I Uptakes & Insulation for Lift System	-	$W567I + 6.2832 * (.5 + SQRT(.00085 * HP2MI / 3.14159)) * 9.2$ $* XNLE * UPTLL *$
567J Fuel Service for Lift System	-	$W567J = .0000625 * XNLE * HP2MI$
567K Lube Oil for Lift System	-	$W567K = .5 + .000052 * (XNLE * HP2MI)$
567L Lube Oil Fill, Transfer, Purification for Lift System	-	$W567L = .0000167 * XNLE * HP2MI$

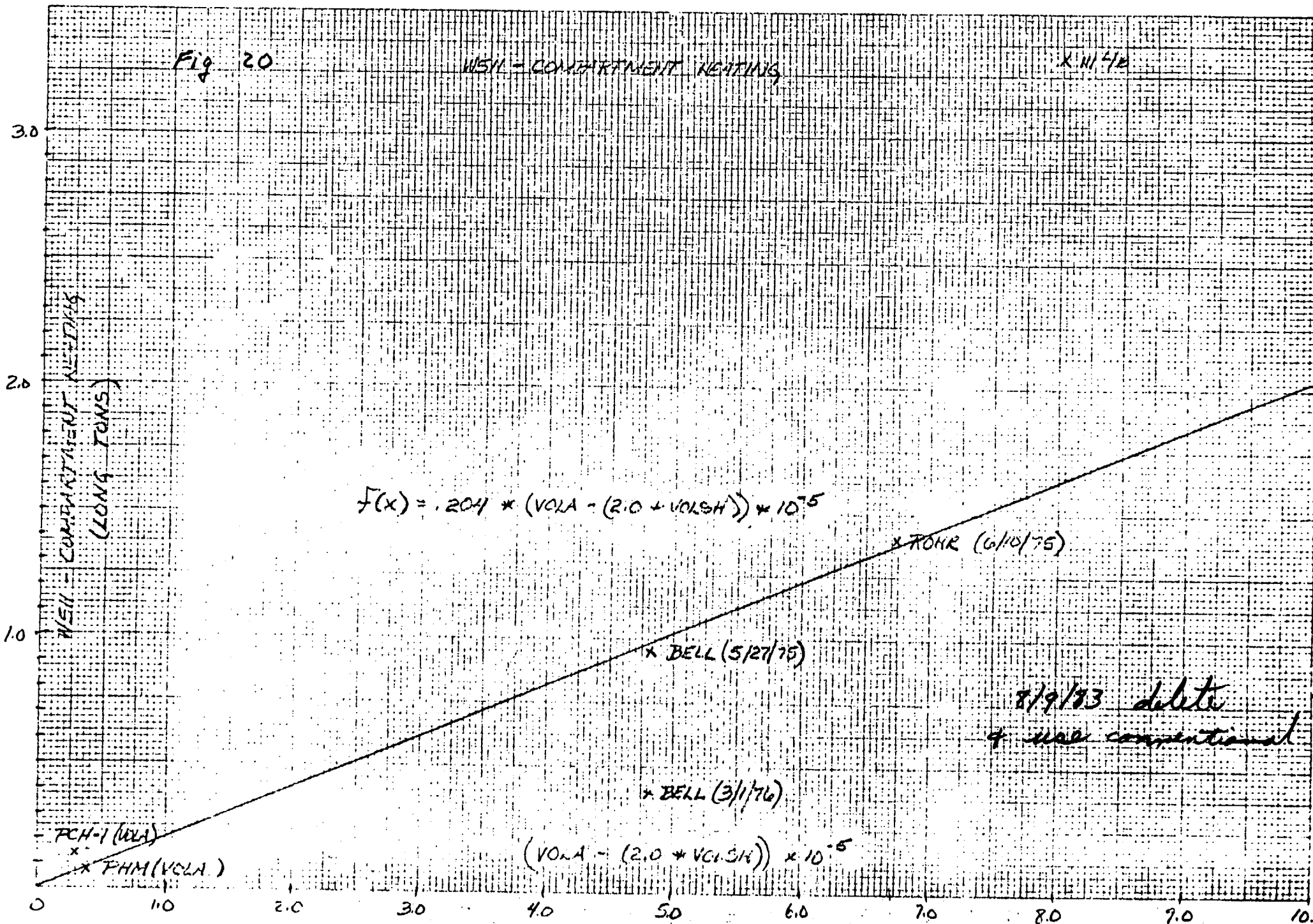
TABLE 3 - GROUP 5 (Continued)

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
567M Bow Seal & Bleed System	36	$W567M = .004545*(H1CB+H1S)*(XL1SK-B1C)$
567N Stern Seal, Seal Bleed, Seal Cont	37	$W567N = .0097*H1S*B1C$
567O Vent Valves, Ride Control	38	$W567O = .000342*XL1CE*B1C$
567P Fans	-	$W567P = FANWT*FLOAT(NFACT)$
567Q Fan Ducting & Installation	-	$W567Q = FDUCTL*.00055*(HP2MC**.5)$
571 Replenishment-at-sea Systems	39	$W571 = .00058*WFOO$
572 Ship Stores Handling Equipment	40	$W572 = .0011*WFOO$
581 Anchor Handling System	41	$W581 = .000016*VOLA$
582 Mooring & Towing Systems	42	$W582 = .00001*VOLA$
583 Boat-handling & Stowage	43	$W583 = .0114*TCOMP$
584 Mechanically-operated Doors & Ramps	-	$W584 = W58468 = THELOS*5$
586 Aircraft Recovery System	-	
588 Aircraft Handling, Storage & Service Systems	-	
593 Pollution Control Systems	44	$W593 = .0258*TCOMP$
598 Auxiliary System Operating Fluids	-	$W598 = .05*(W510+W520+W530+W540+W550+W560+W570+W580)$
599 Auxiliary System Repair Parts	-	$W599 = .01*(W510+W520+W530+W540+W550+W560+W570+W580)$

Fig 20

W511 - COMPARTMENT HEATING

X 1/11/72



W512 VS DUM1 AS OF 10/27/83

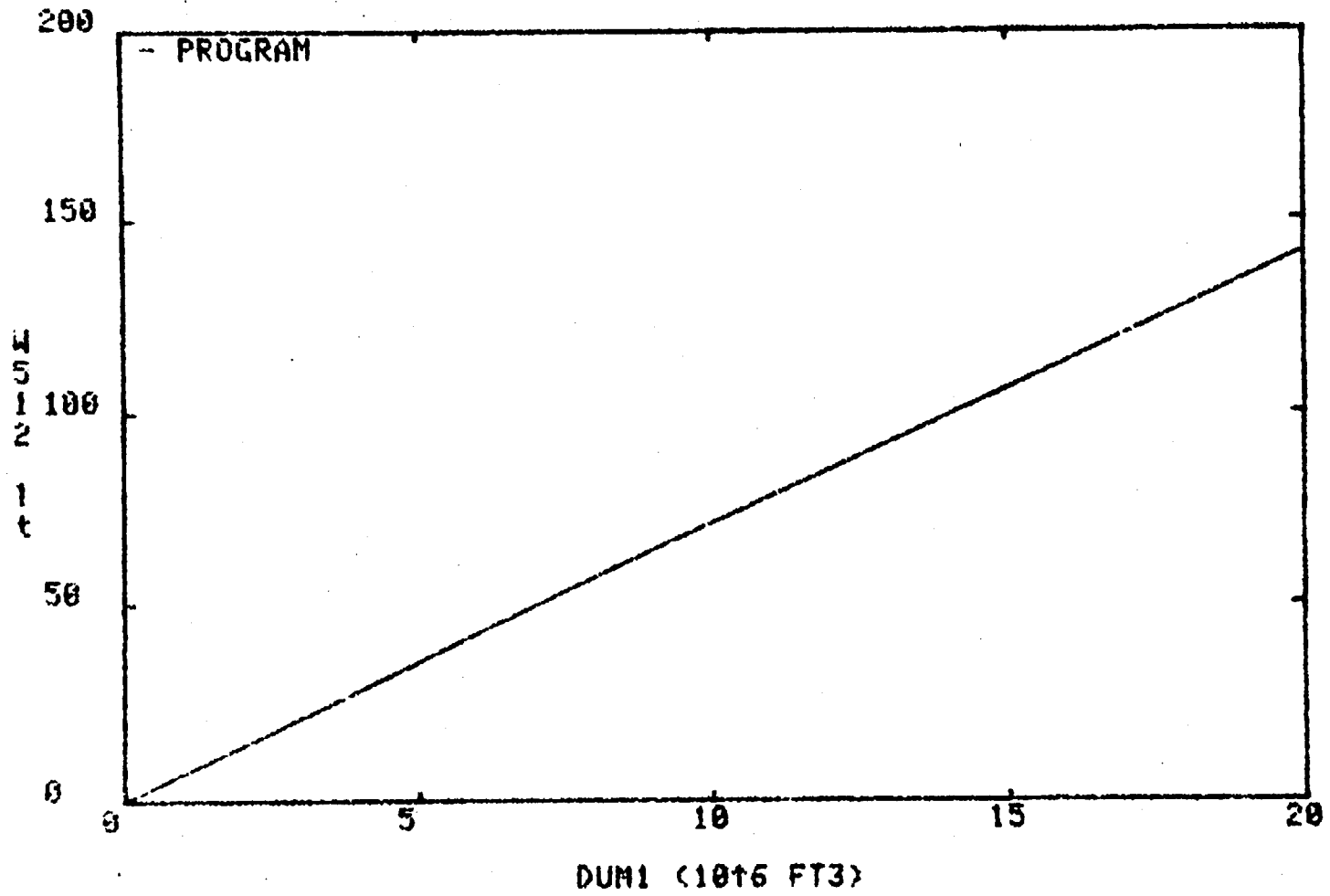
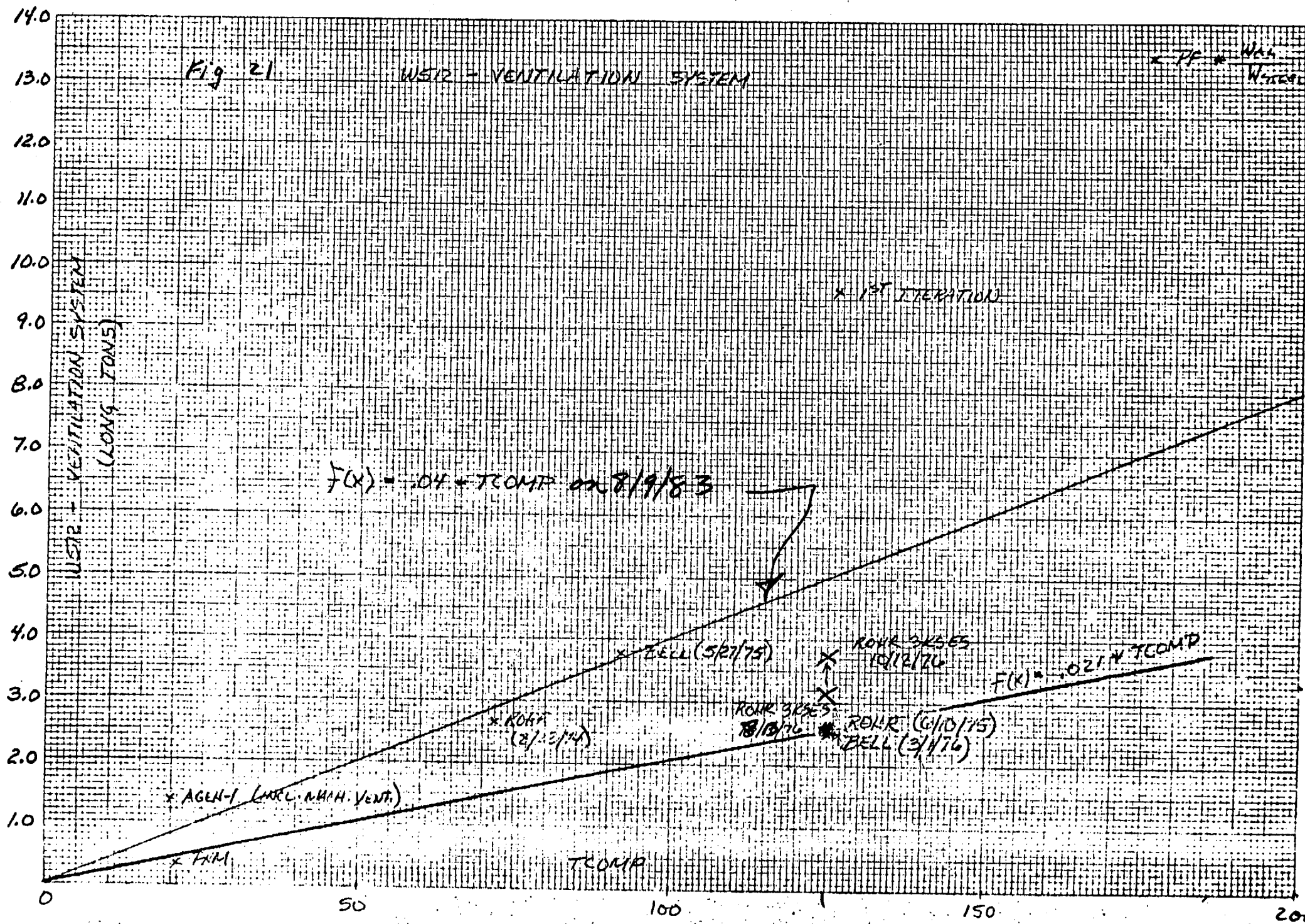


Fig 21

WEIR - VENTILATION SYSTEM

← TF → Max  
 ← TF → Min





W513 VS USH AS OF 10/31/83

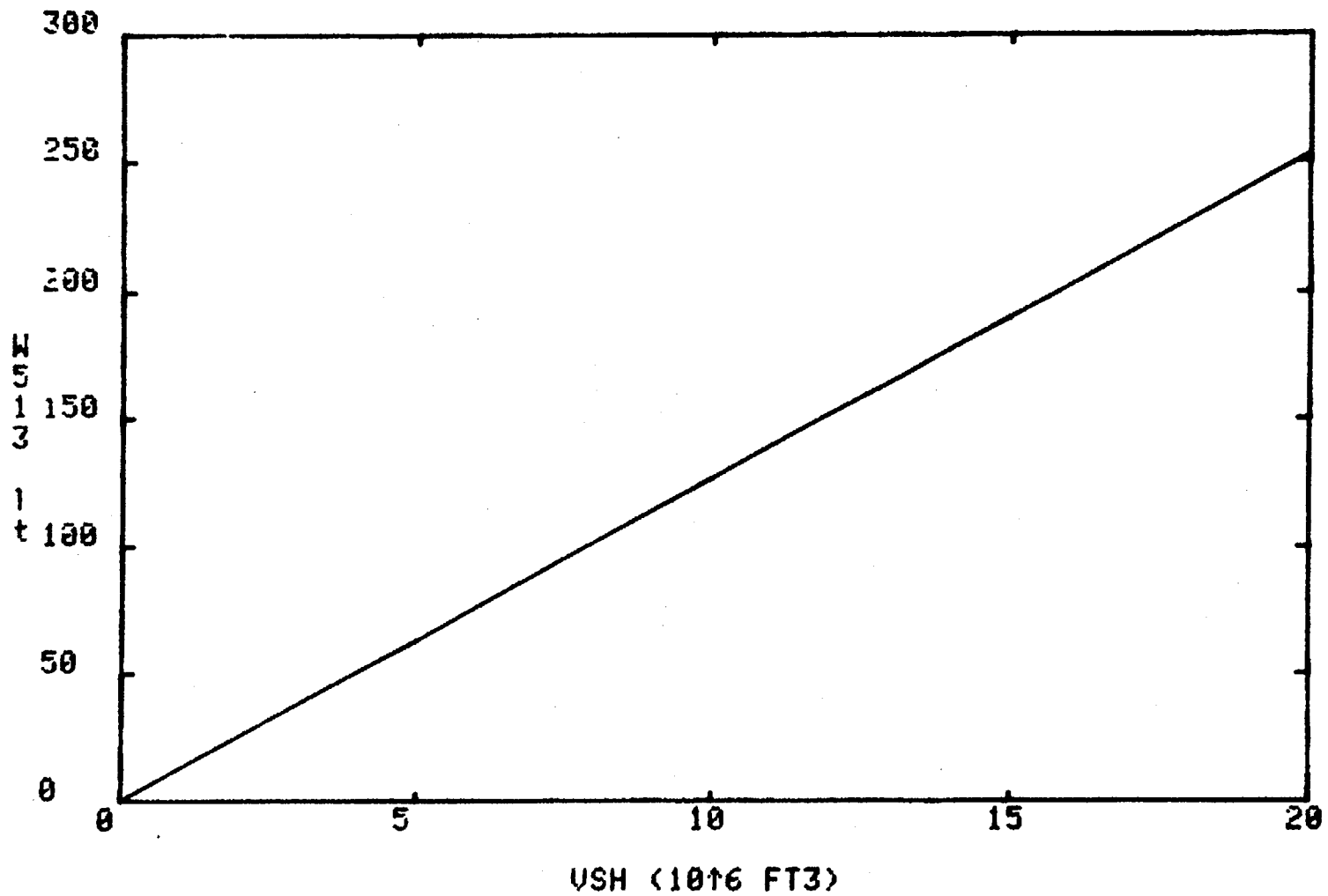


Fig 22

WS13 - MACHINERY SPACE VENTILATION

WS13 - MACHINERY SPACE VENTILATION  
(LONG TONS)

10.0  
9.0  
8.0  
7.0  
6.0  
5.0  
4.0  
3.0  
2.0  
1.0  
0

0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

$$f(x) = (VOL_A + (2.0 * VOL_{SH})) * 10^{-5}$$

$$g(x) = (VOL_A - (2.0 * VOL_{SH})) * 10^{-5}$$

PHM

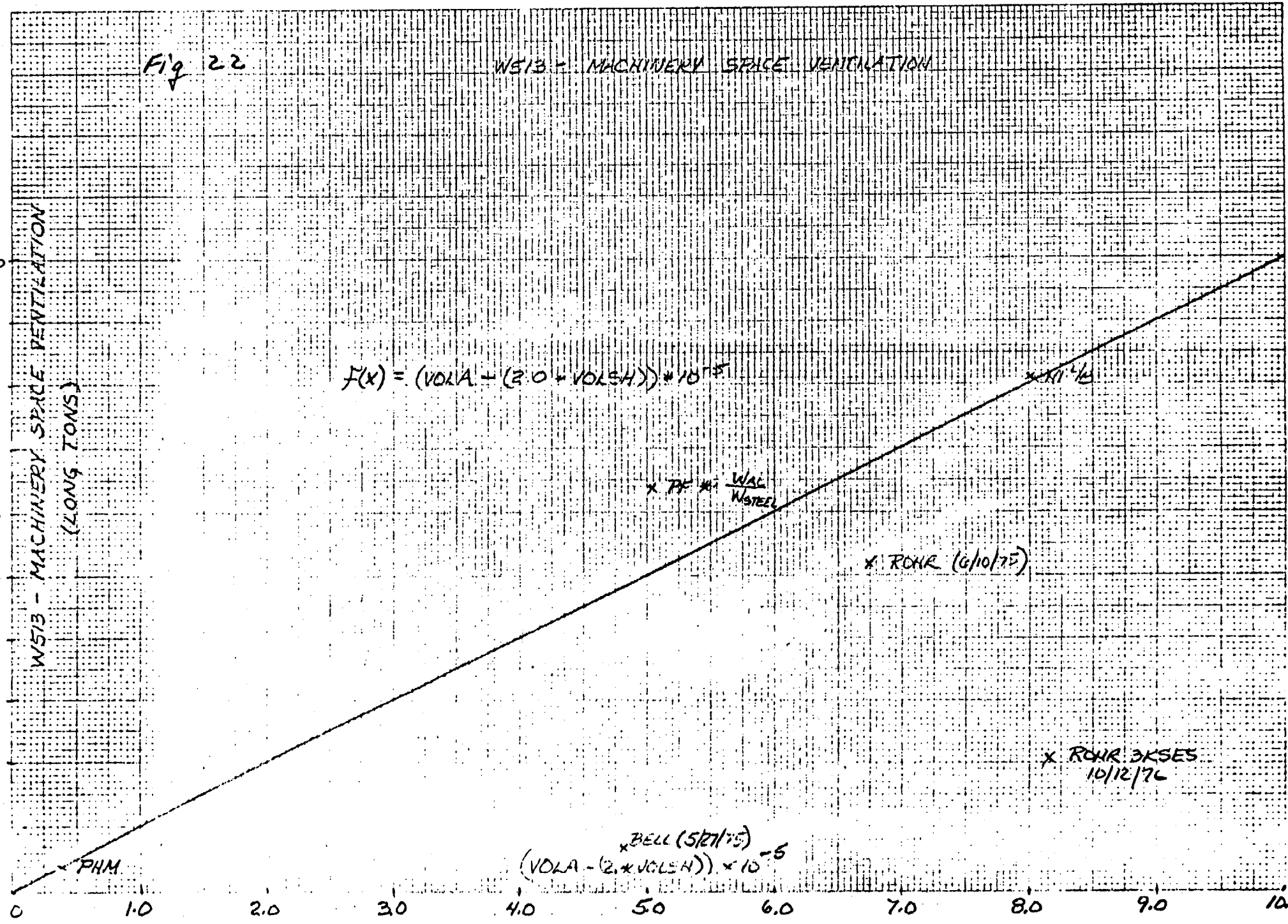
BELL (5/11/75)

x PF x W/AC  
W/STEEL

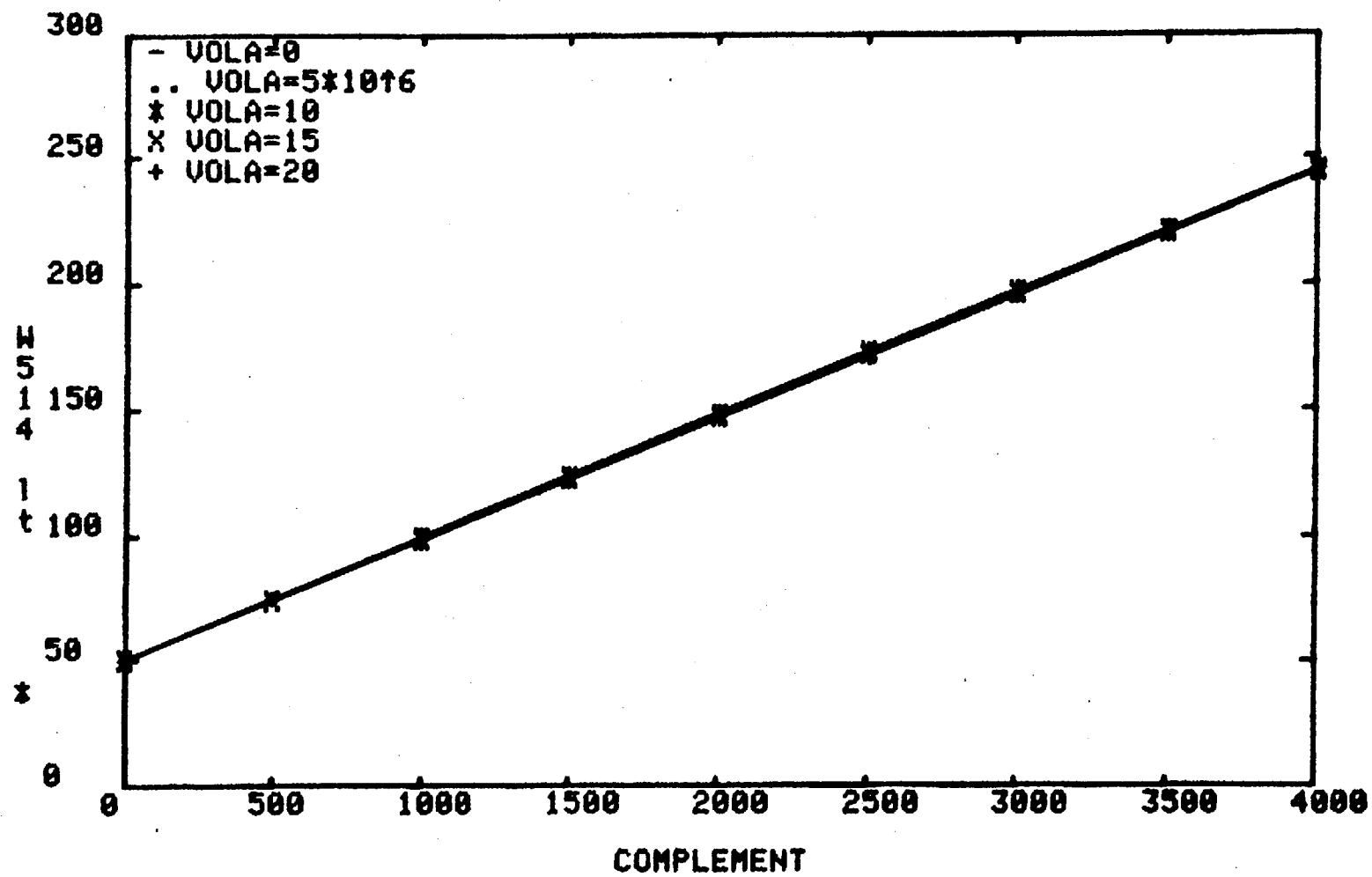
x ROHR (6/10/75)

x 11/1/75

x ROHR BKSES  
10/12/76



CONSTANT VOLA ON W514 VS COMPLEMENT AS OF 10/27/83



CONSTANT COMPLEMENT ON W514 VS VOLA AS OF 10/27/83

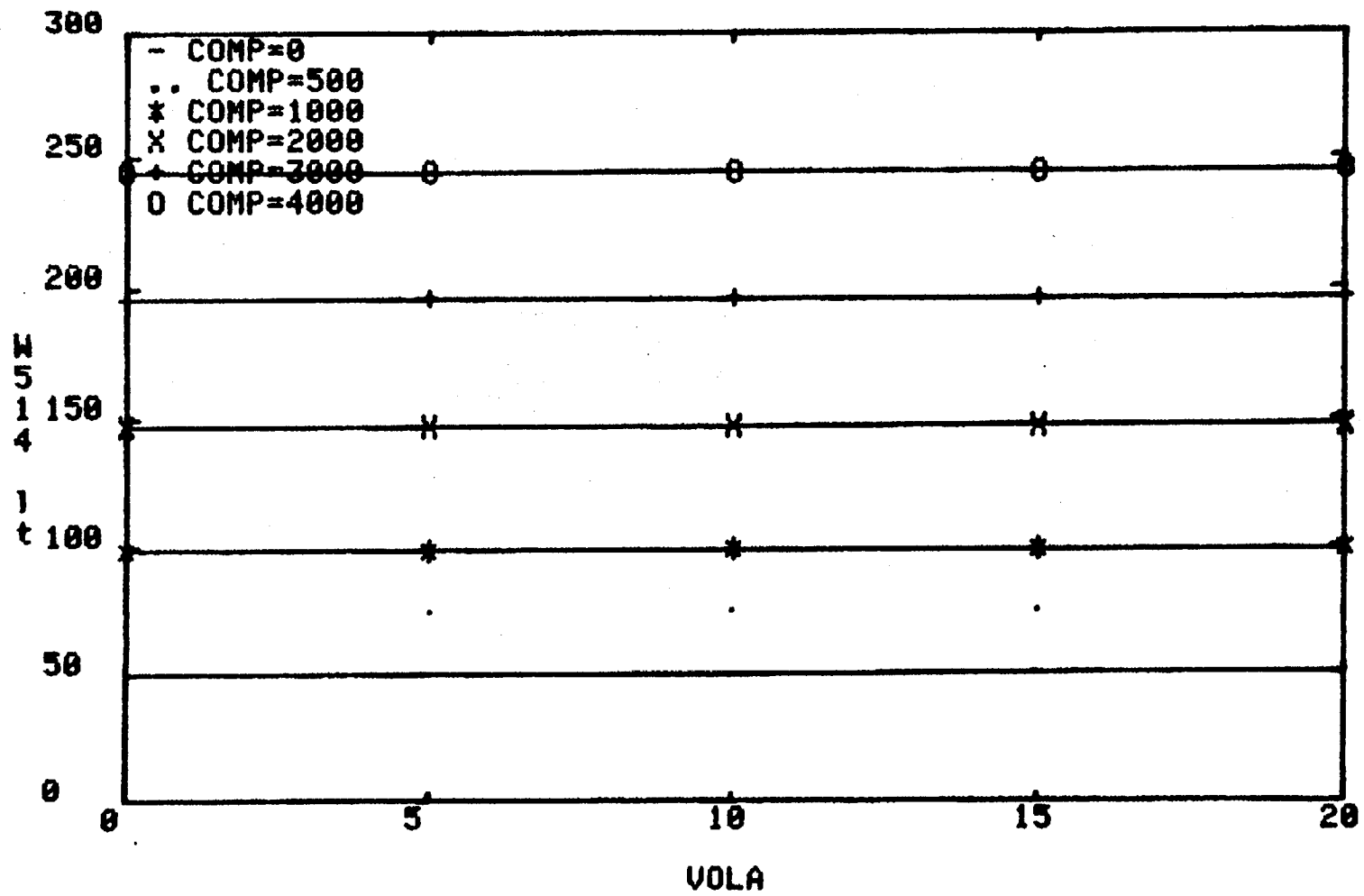
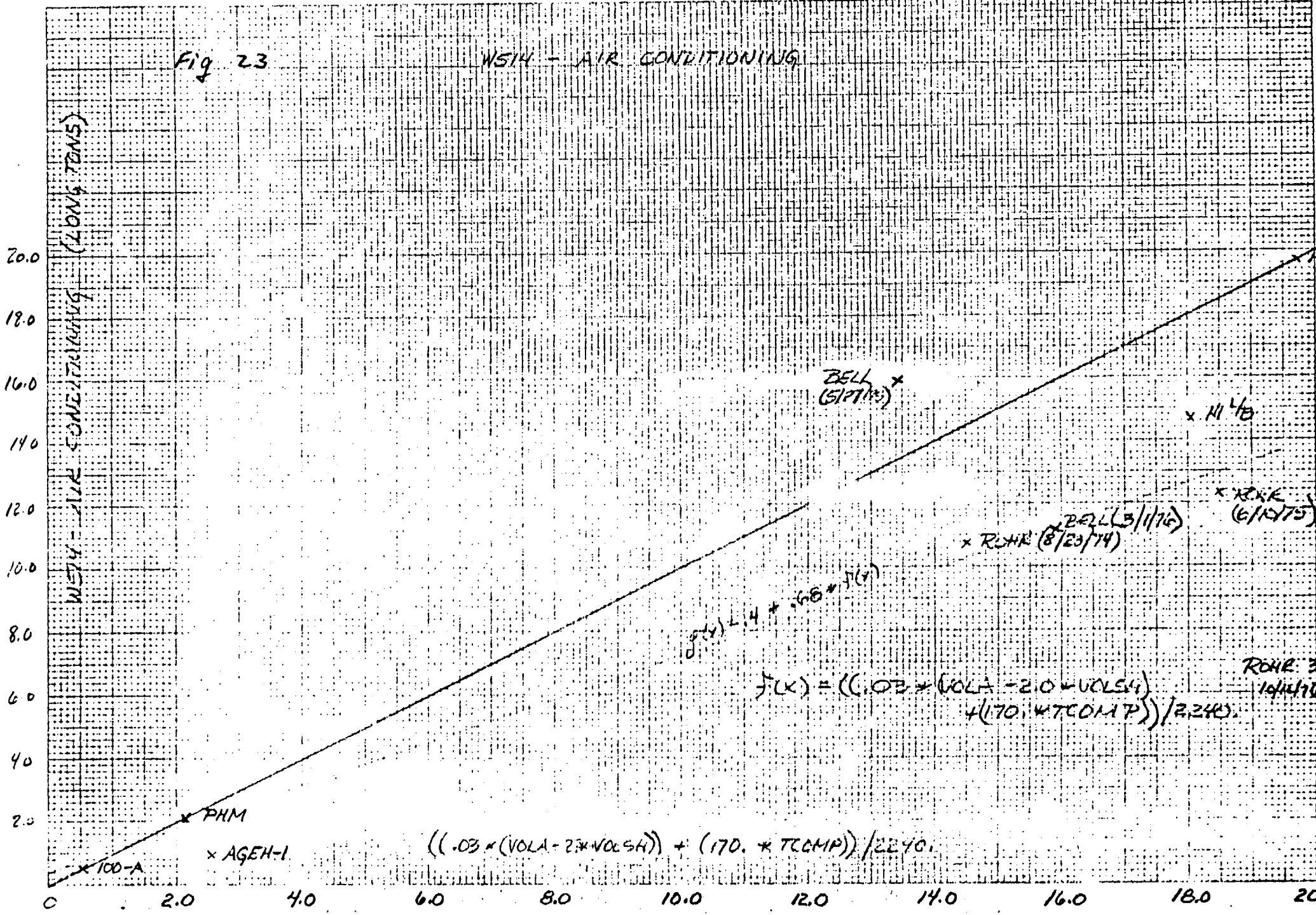
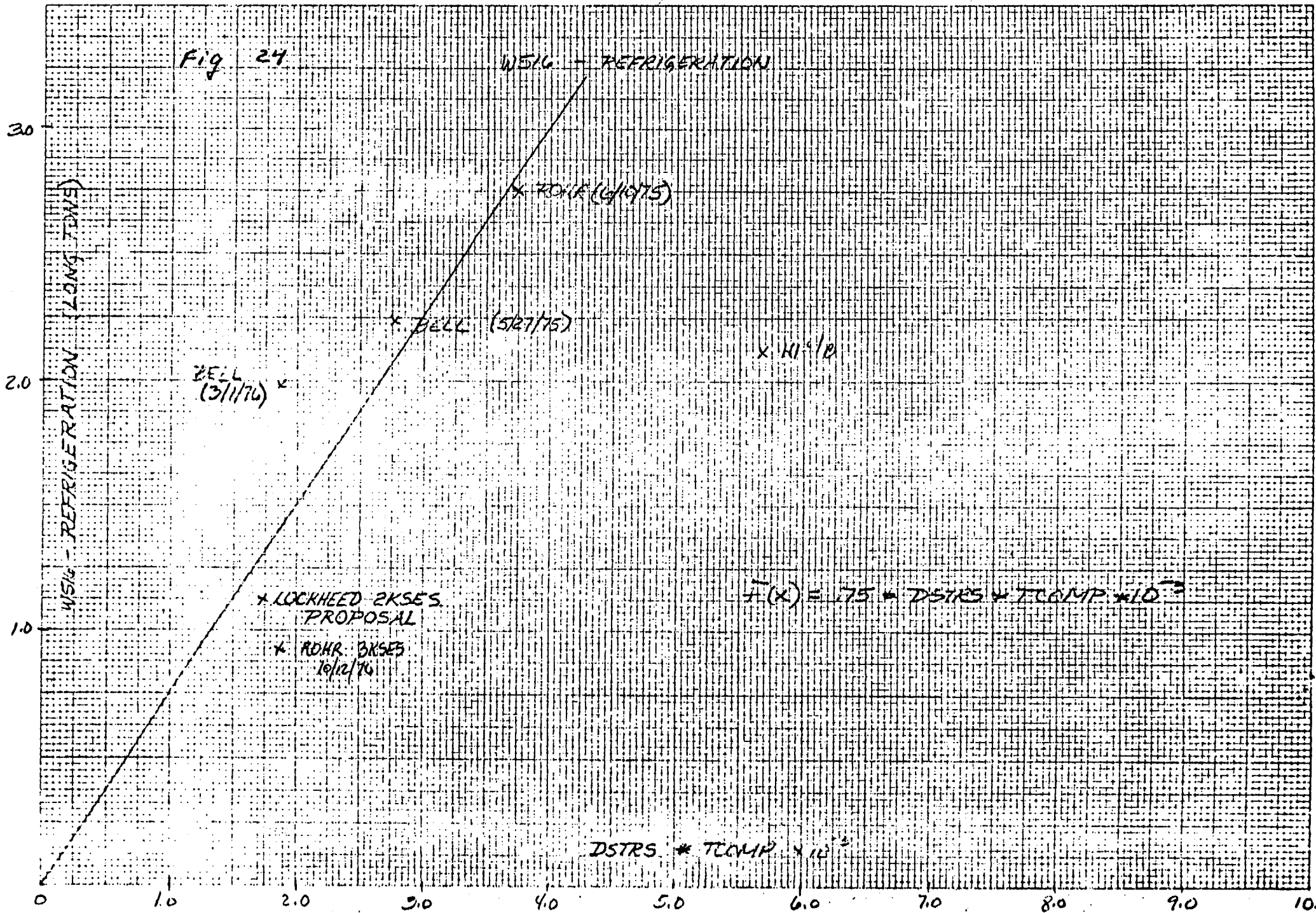


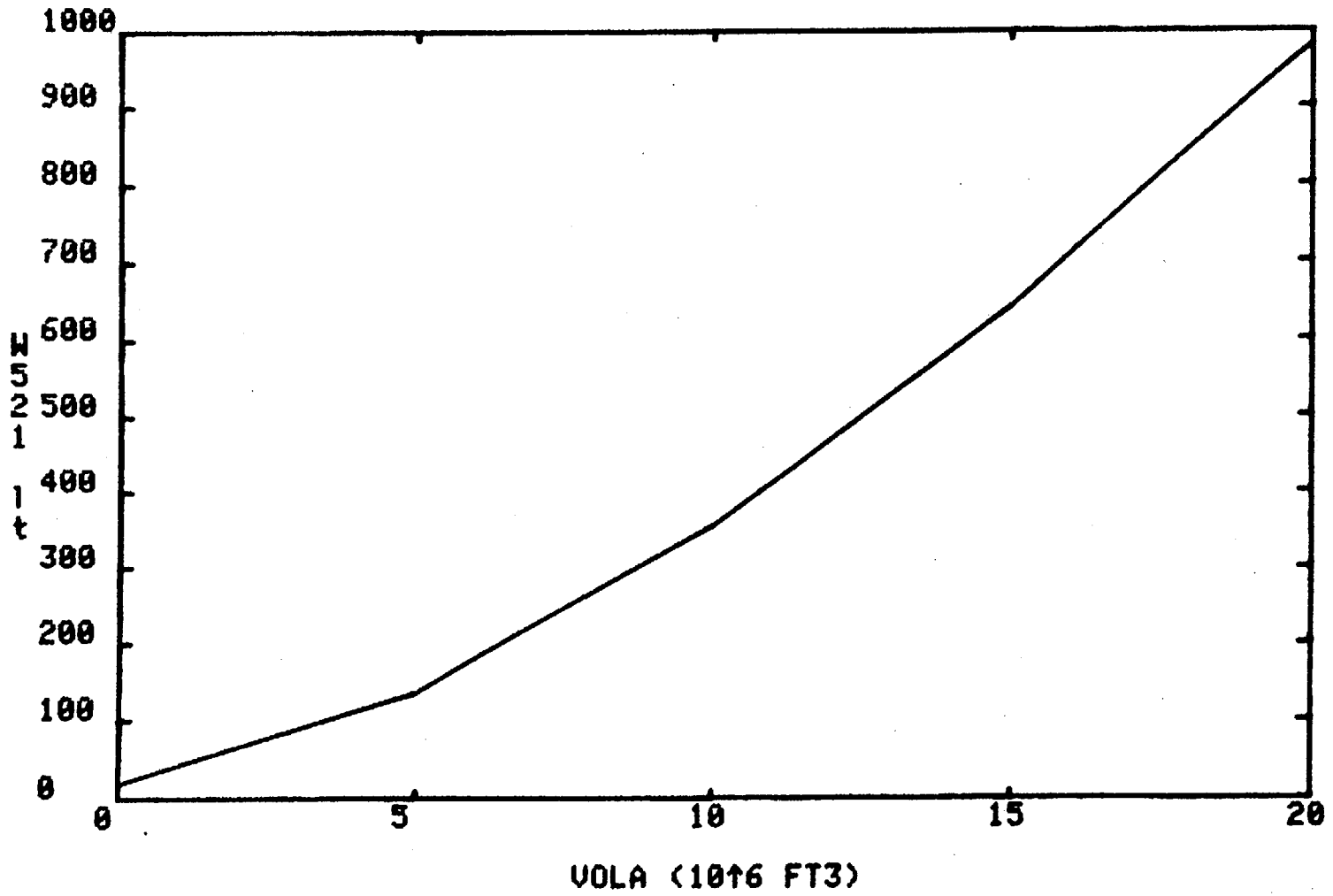
Fig 23

WS14 - AIR CONDITIONING





W521 VS VOLA AS OF 10/31/83



PF

Fig 25

W52123 FIREMAIN + FLUSHING, SPRINKLERS, WASHDOWN

W521 - FIREMAIN + FLUSHING, SPRINKLERS, WASHDOWN  
(LONG TONS)

$$F(x) = 1.475 * (VOLA - 2 * VOLSH) * 10^{-5}$$

$$(VOLA - 2 * VOLSH) * 10^{-5}$$

x 100-A

x AGEH-1

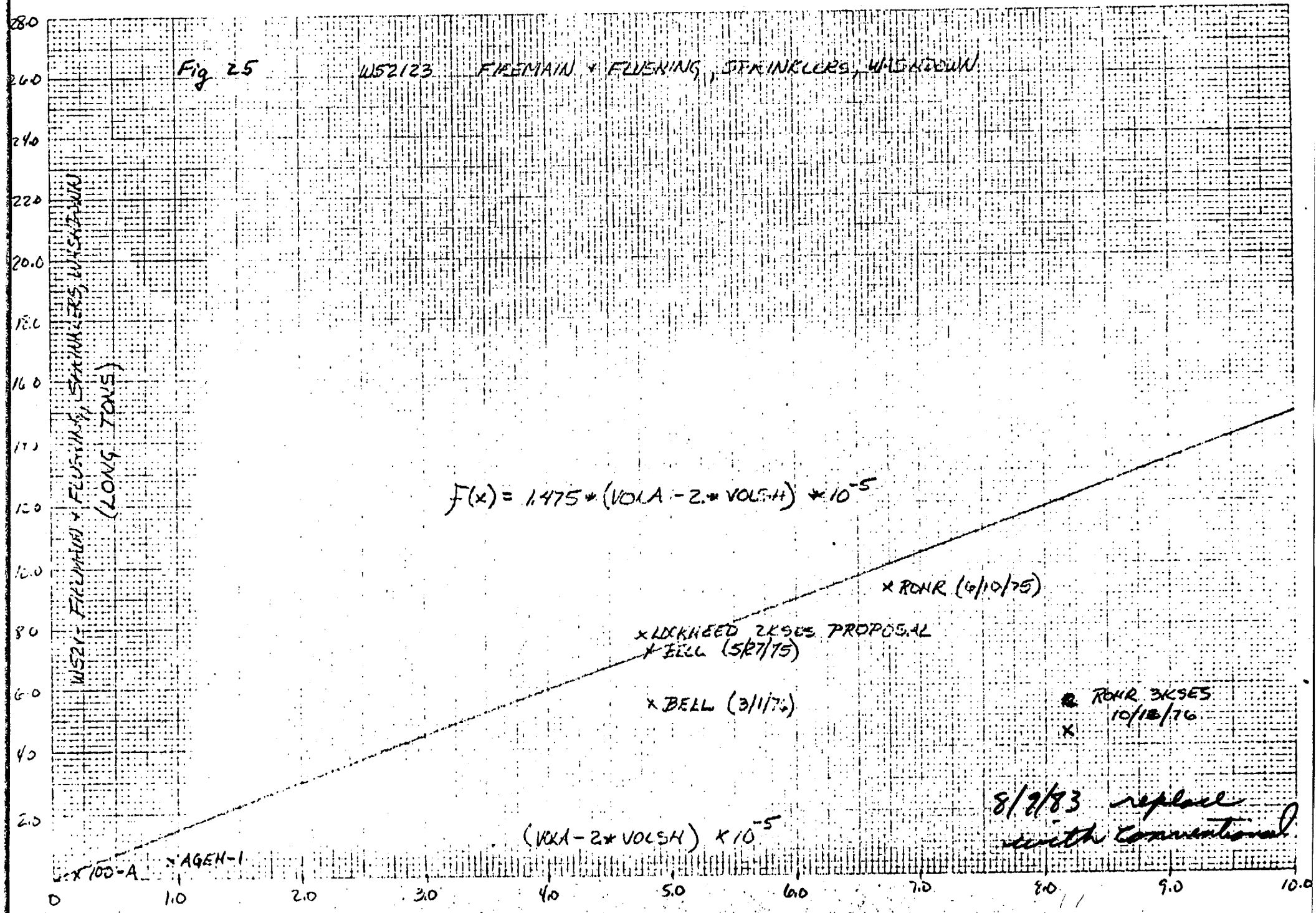
x ROAR (4/10/75)

x LOCKHEED 2KSES PROPOSAL  
x BELL (5/7/75)

x BELL (3/1/74)

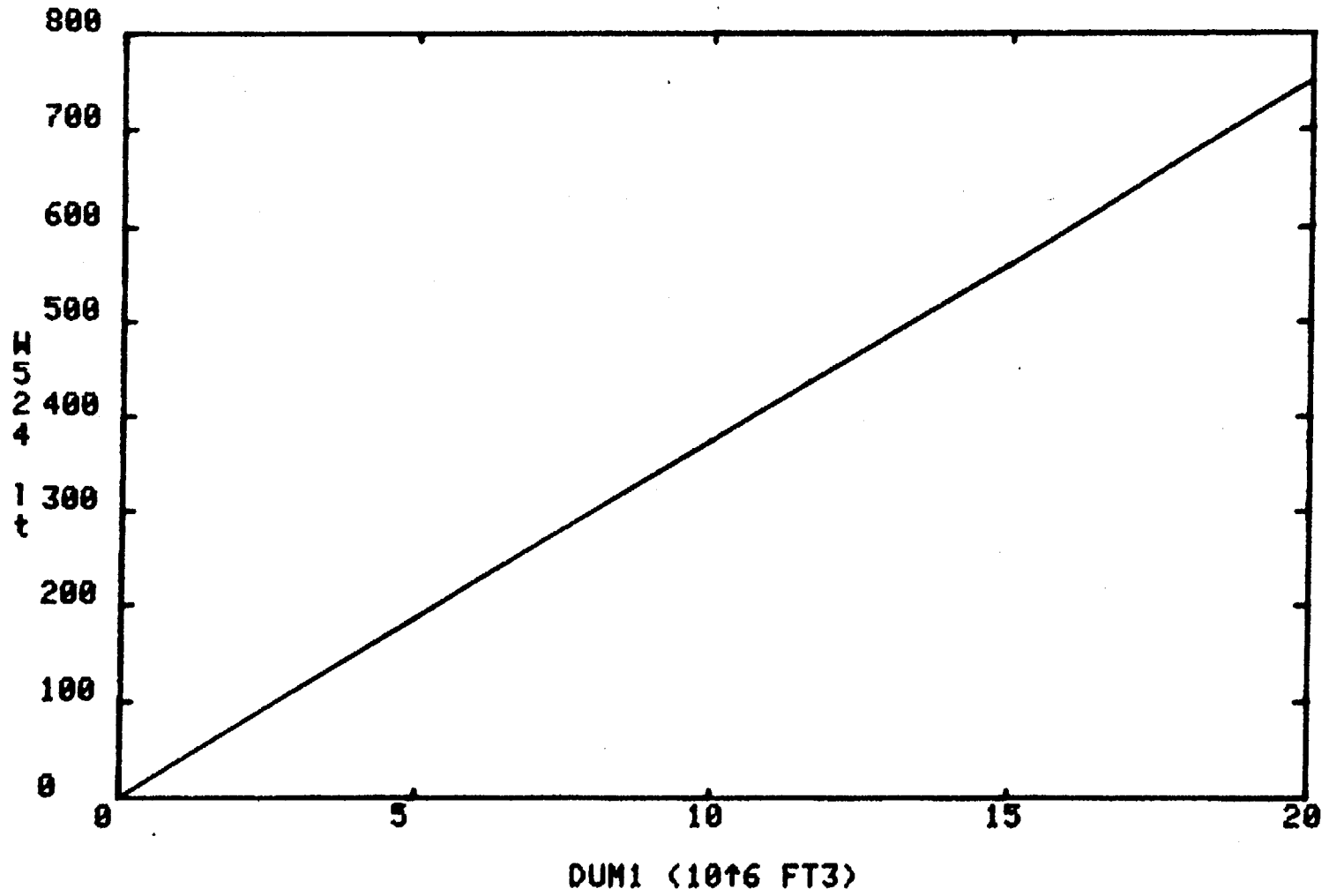
x ROAR 3KSES  
10/12/76

8/2/83 replace  
with conventional





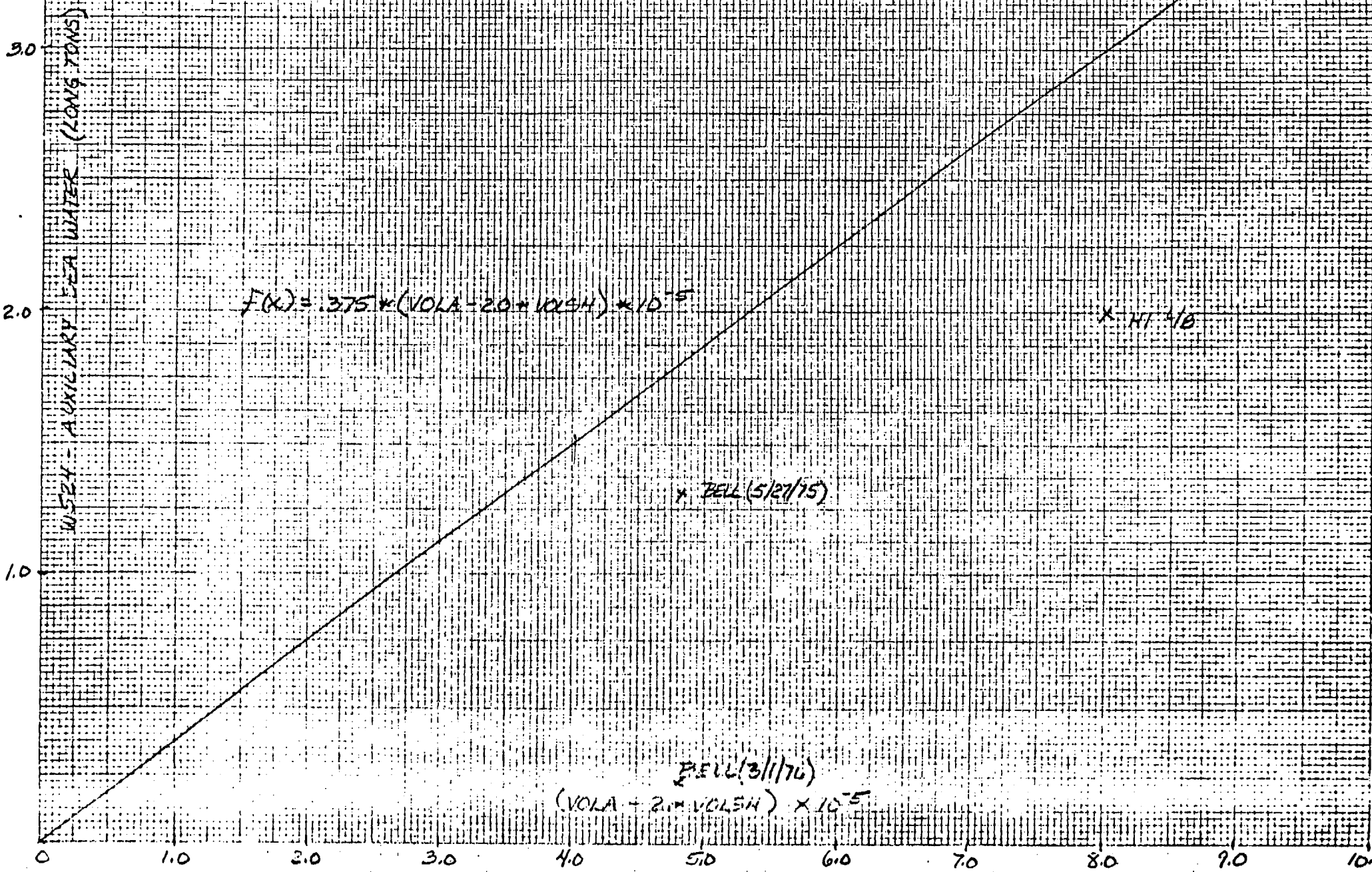
W524 VS DUM1 AS OF 10/31/83



↑ ROHR 3XSES = 3.78 Z.T.  
1912/76

Fig 26

W524 - AUXILIARY SEA WATER X ROHR (6/10/75)



W526 VS DUM2 AS OF 10/31/83

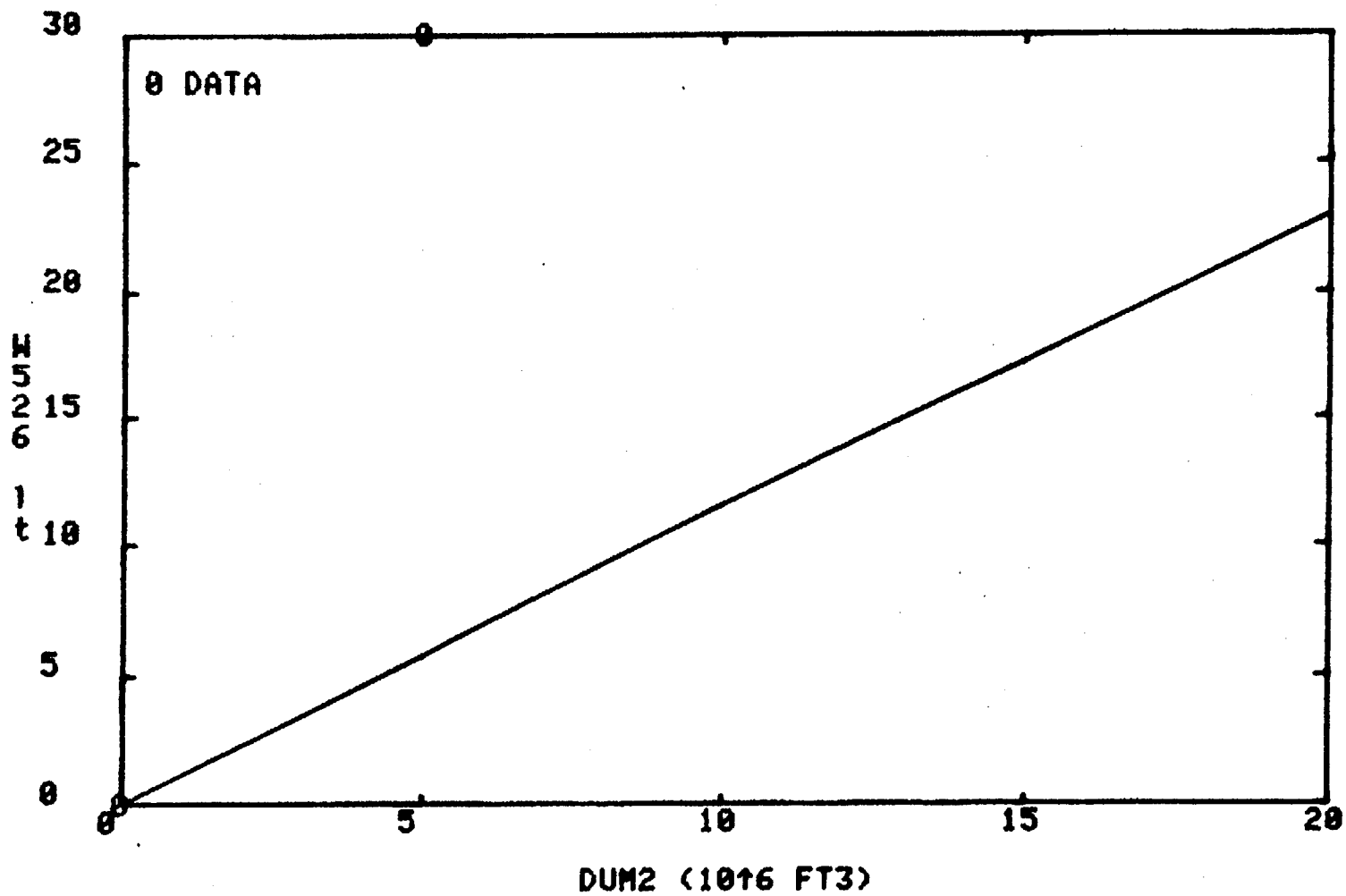
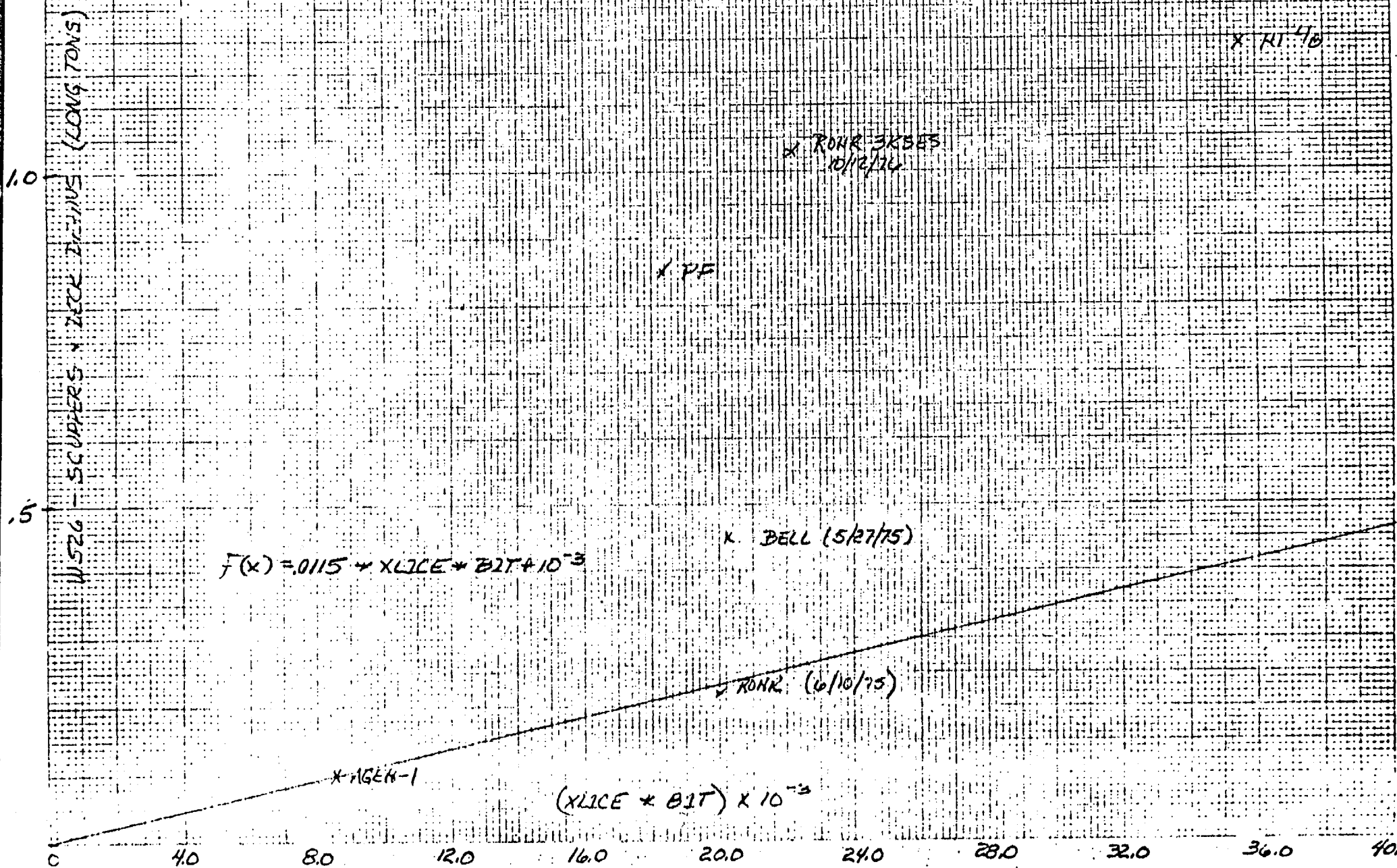


Fig 27

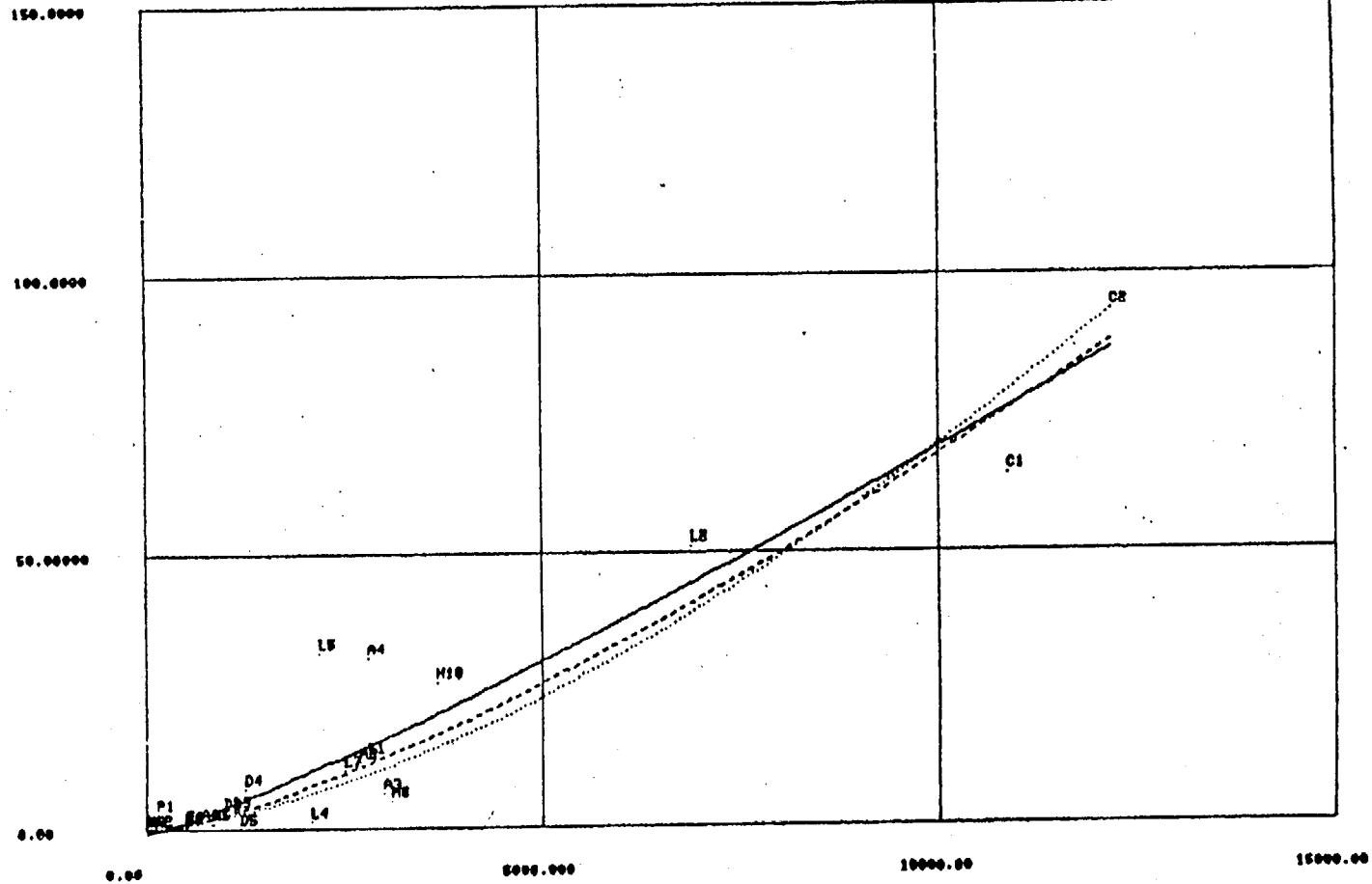
W526 - SCUPPERS & DECK DRAINS



SUBS 586 SCUPPERS & DECK DRAINS (BSCI 510)

S  
C  
U  
P  
P  
E  
R  
S  
  
A  
N  
D  
  
D  
E  
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K  
  
D  
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S  
)

—— ALL DATA      - - - - - 2 S.ERROR      ..... 1 S.ERROR



TOTAL VOLUME

W528 US VOLA AS OF 10/31/83

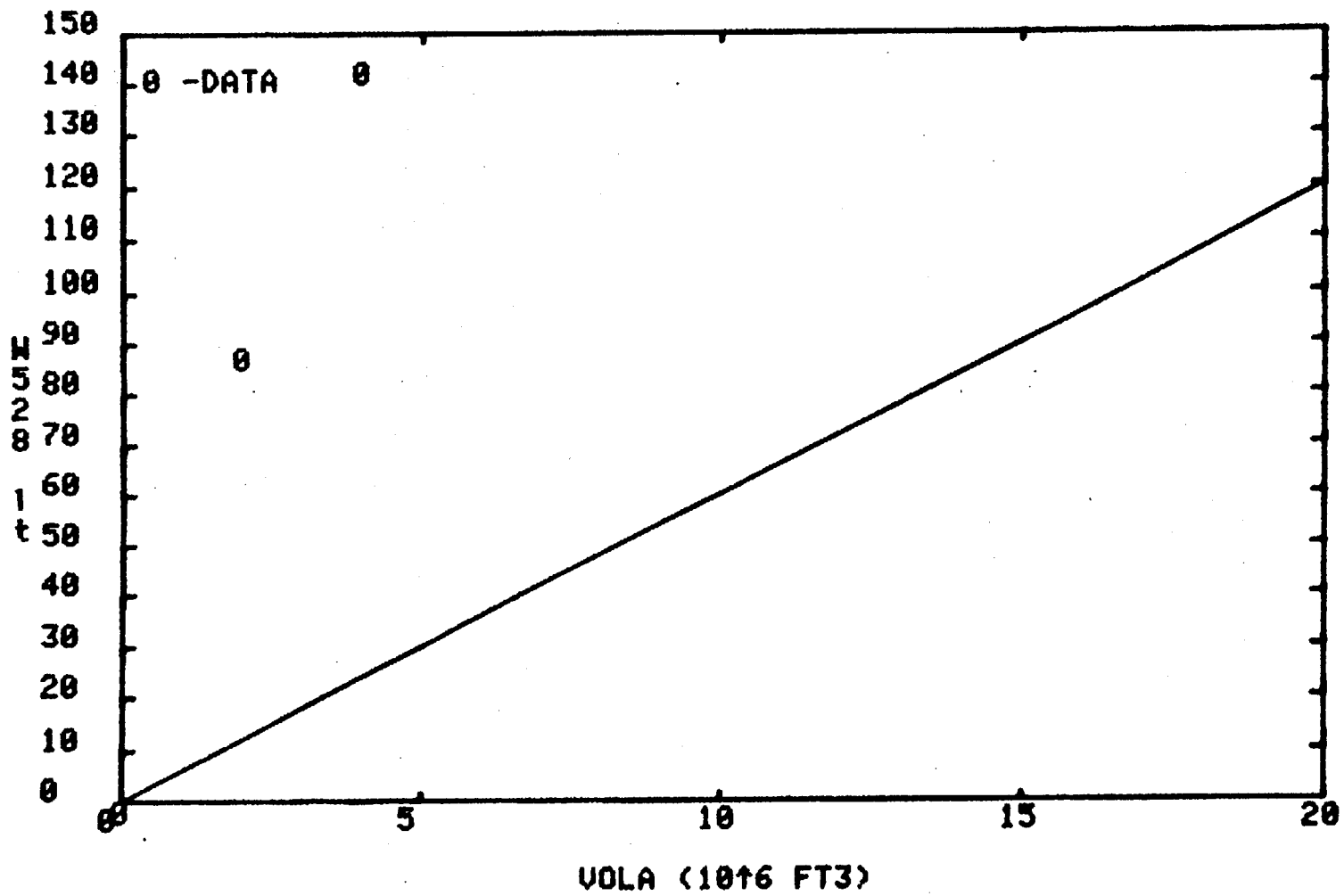
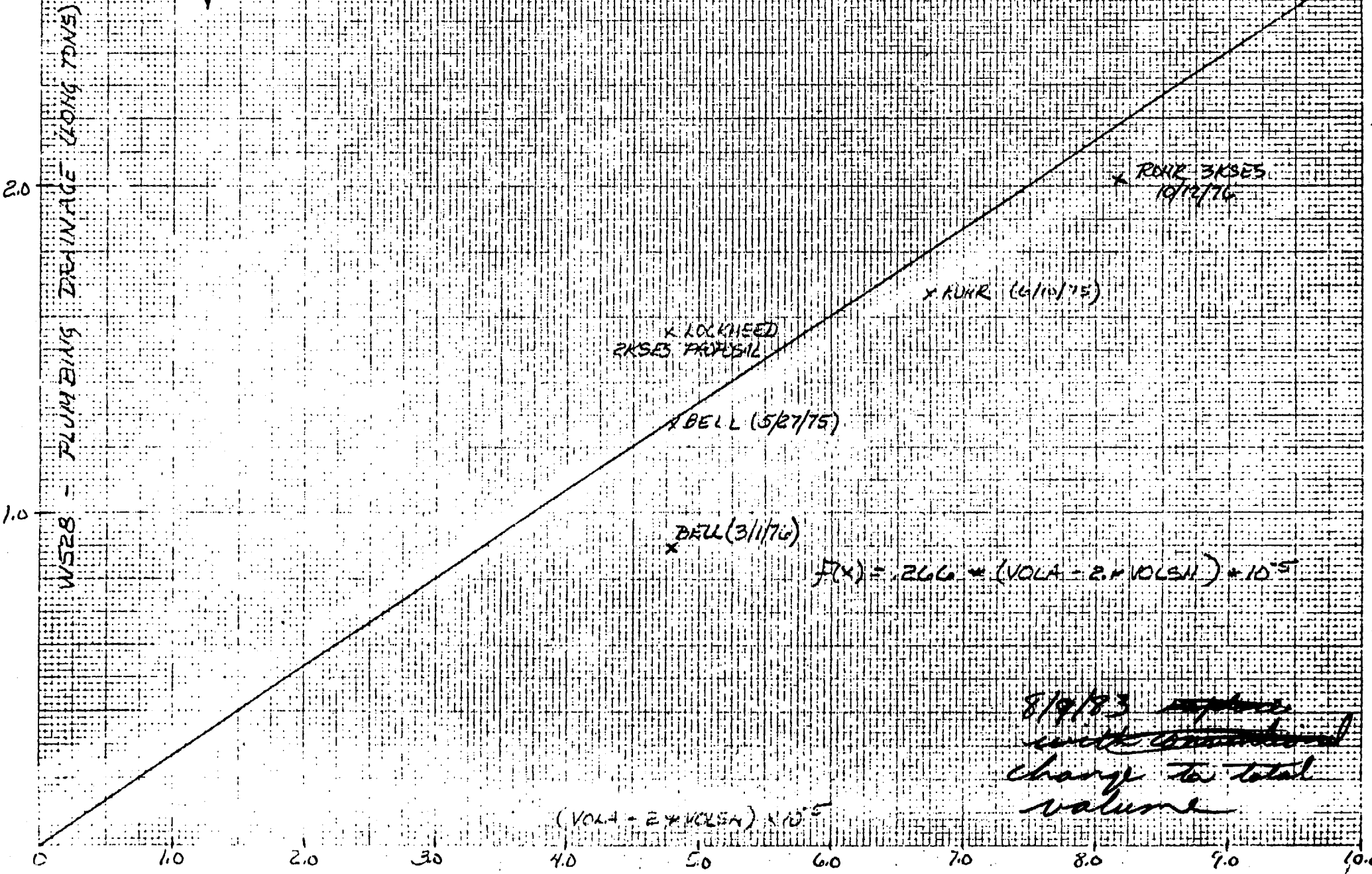


Fig 2A

W528 - PLUMBING DRAINAGE



$F(x) = .266 * (VOLA - 2 * VOLSH) * 10^5$

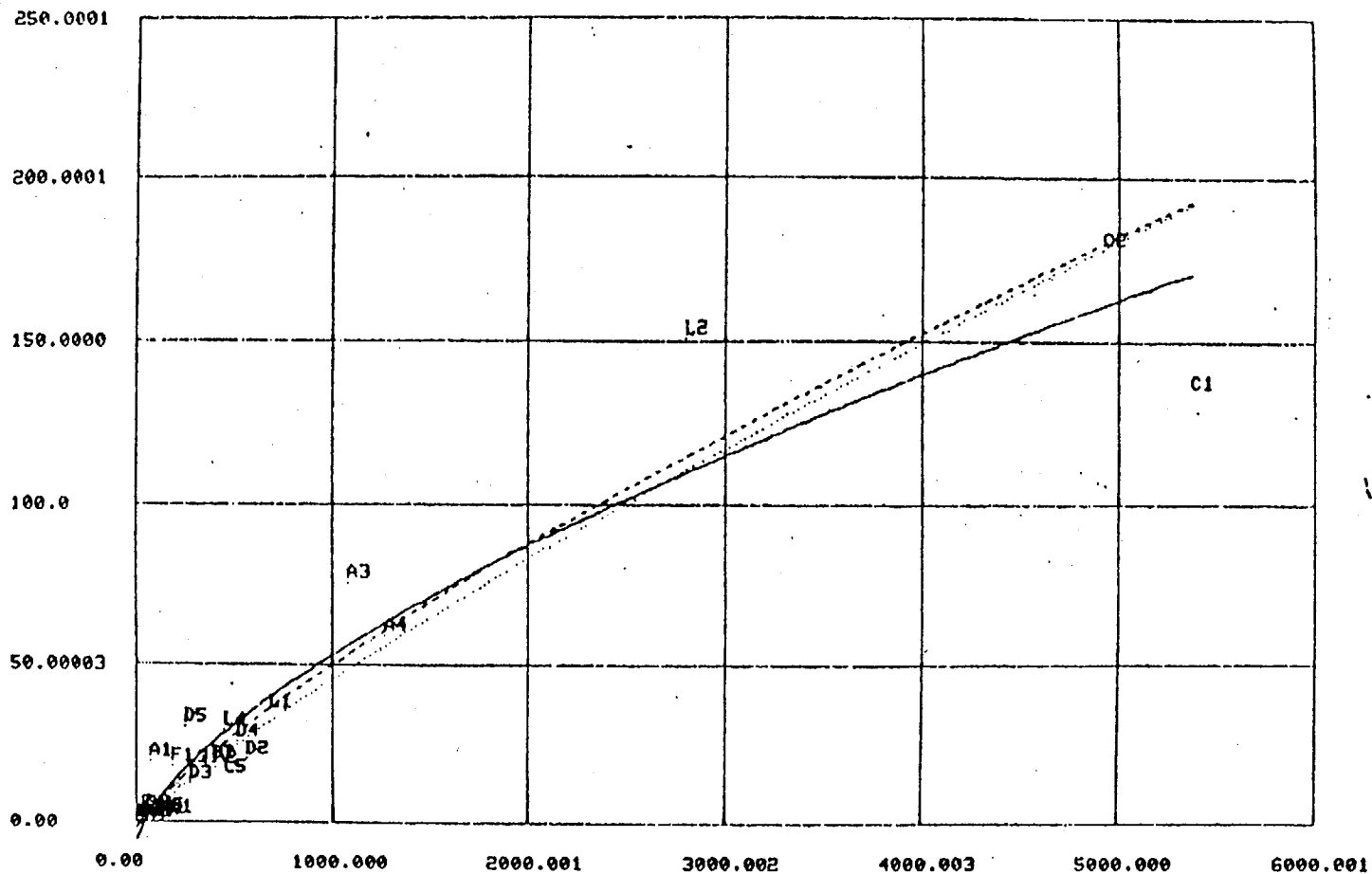
$(VOLA - 2 * VOLSH) * 10^5$

8/9/83 replace  
 with ~~original~~  
 change to total  
 volume

PAUSE (PRESS (RETURN) TO  
 SUBS 528 PLUMBING DRAINAGE (BSOI 505)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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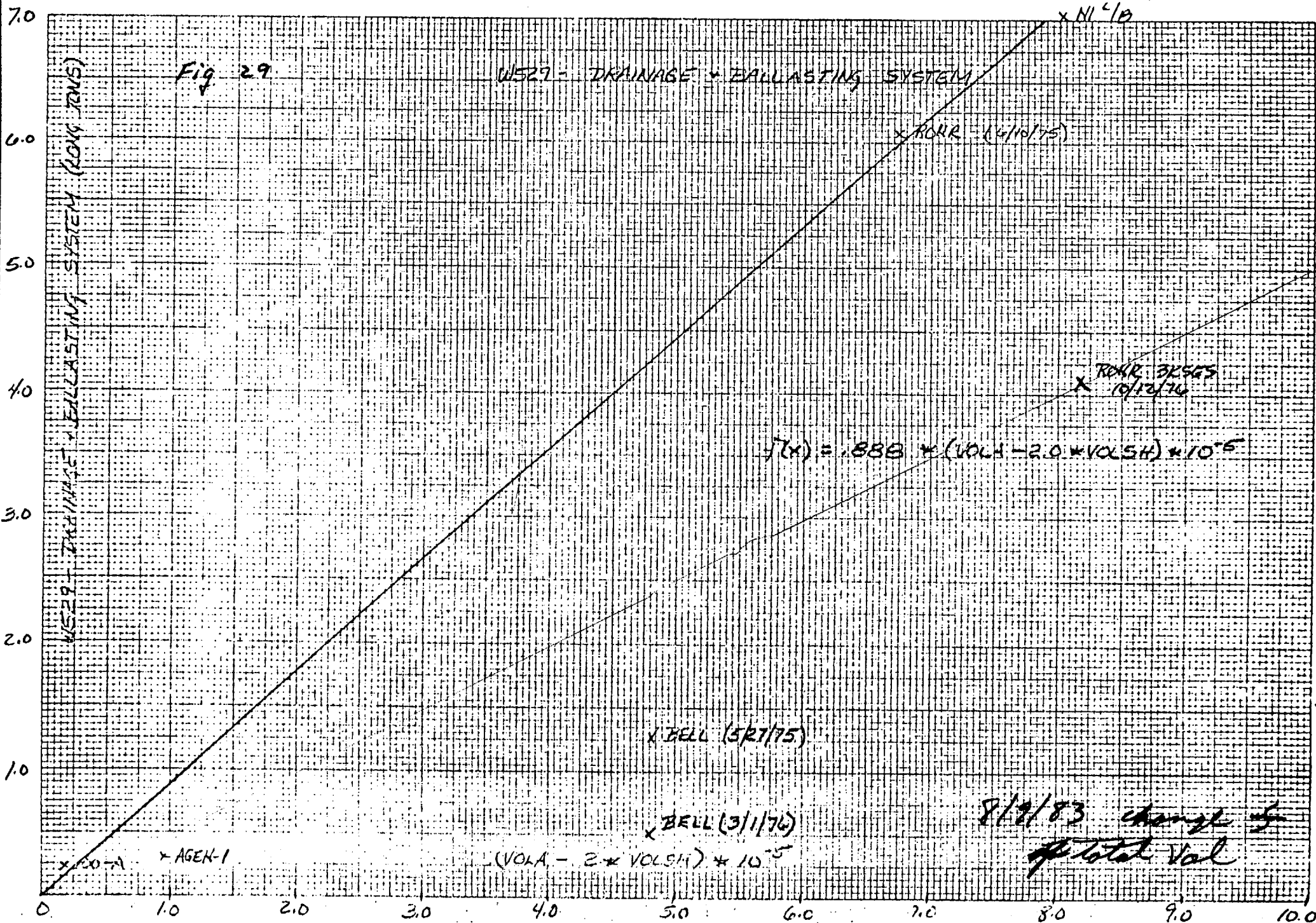


TOTAL ACCOMADATIONS

.01911 + 0.19

1.1045



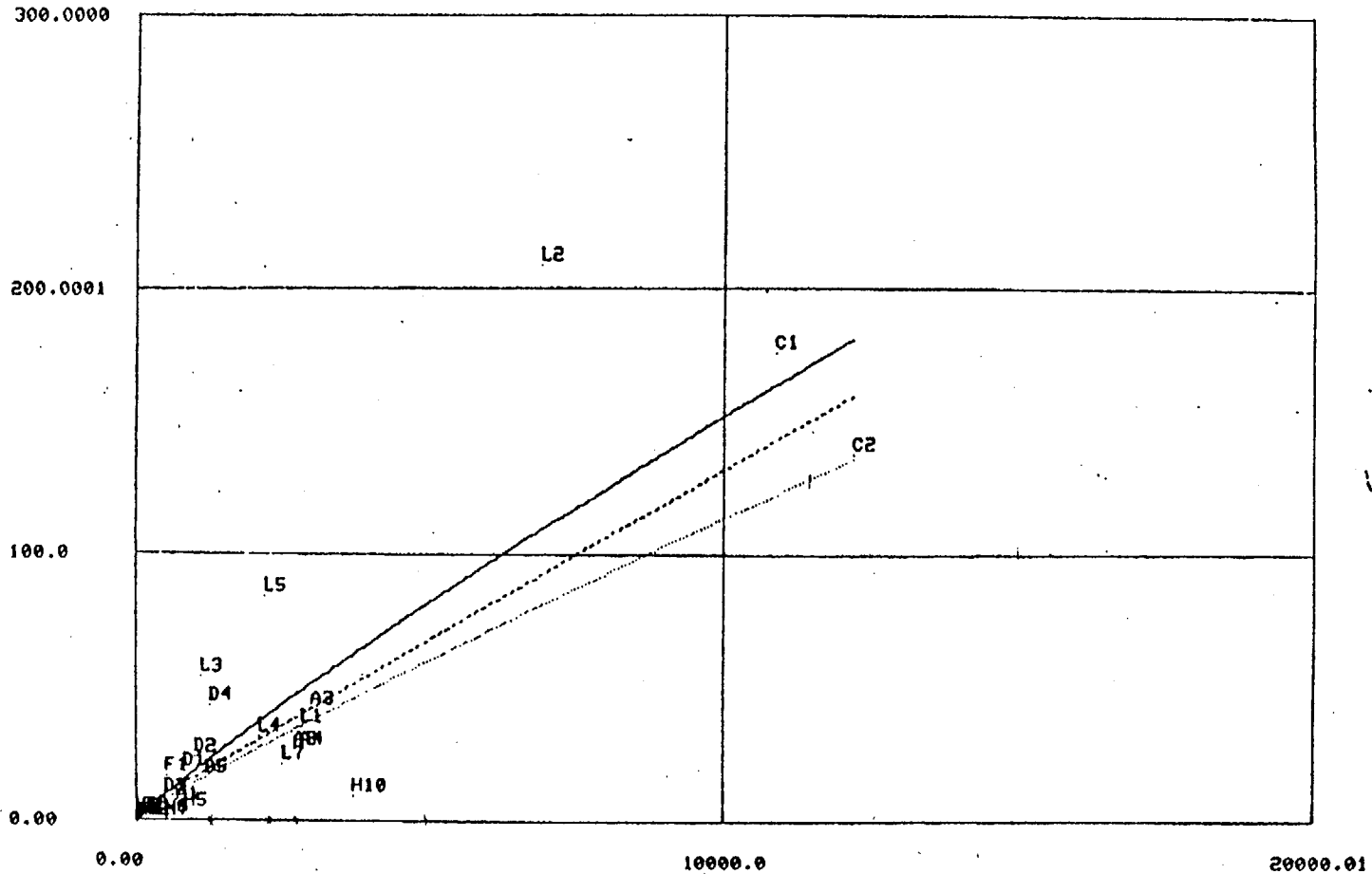


PA

SUBS 529 DRAINAGE AND BALLASTING SYSTEM (BSCI 508)

— ALL DATA    - - - 2 S.ERROR    ····· 1 S.ERROR

D  
R  
A  
I  
N  
A  
G  
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&  
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L  
L  
A  
S  
T  
I  
N  
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)



TOTAL VOLUME  
 ST<sup>3</sup> / 10<sup>3</sup>

3KSES TOTAL VOLUME is 800000

W531 US COMPLEMENT AS OF 10/31/83

0

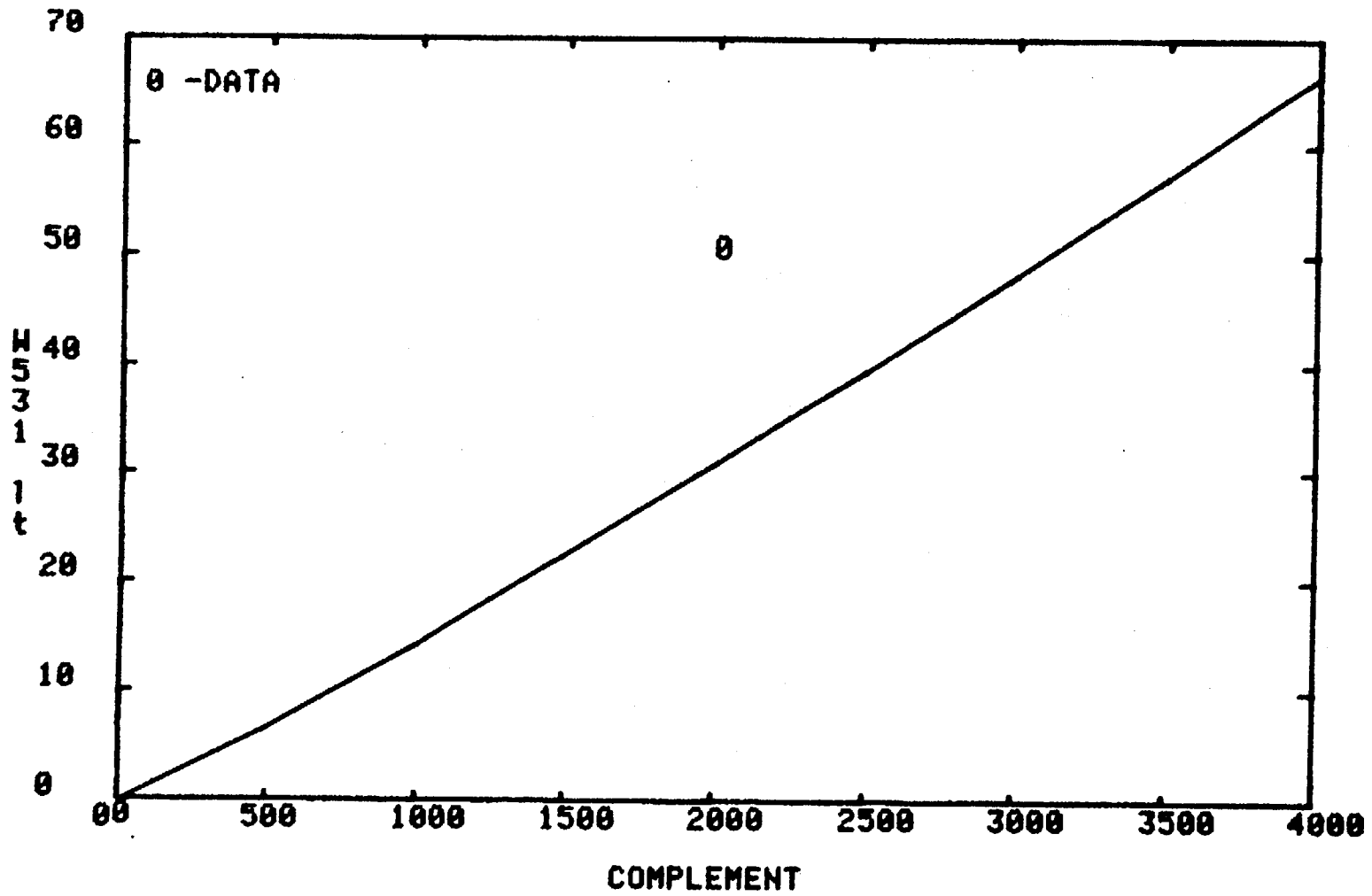
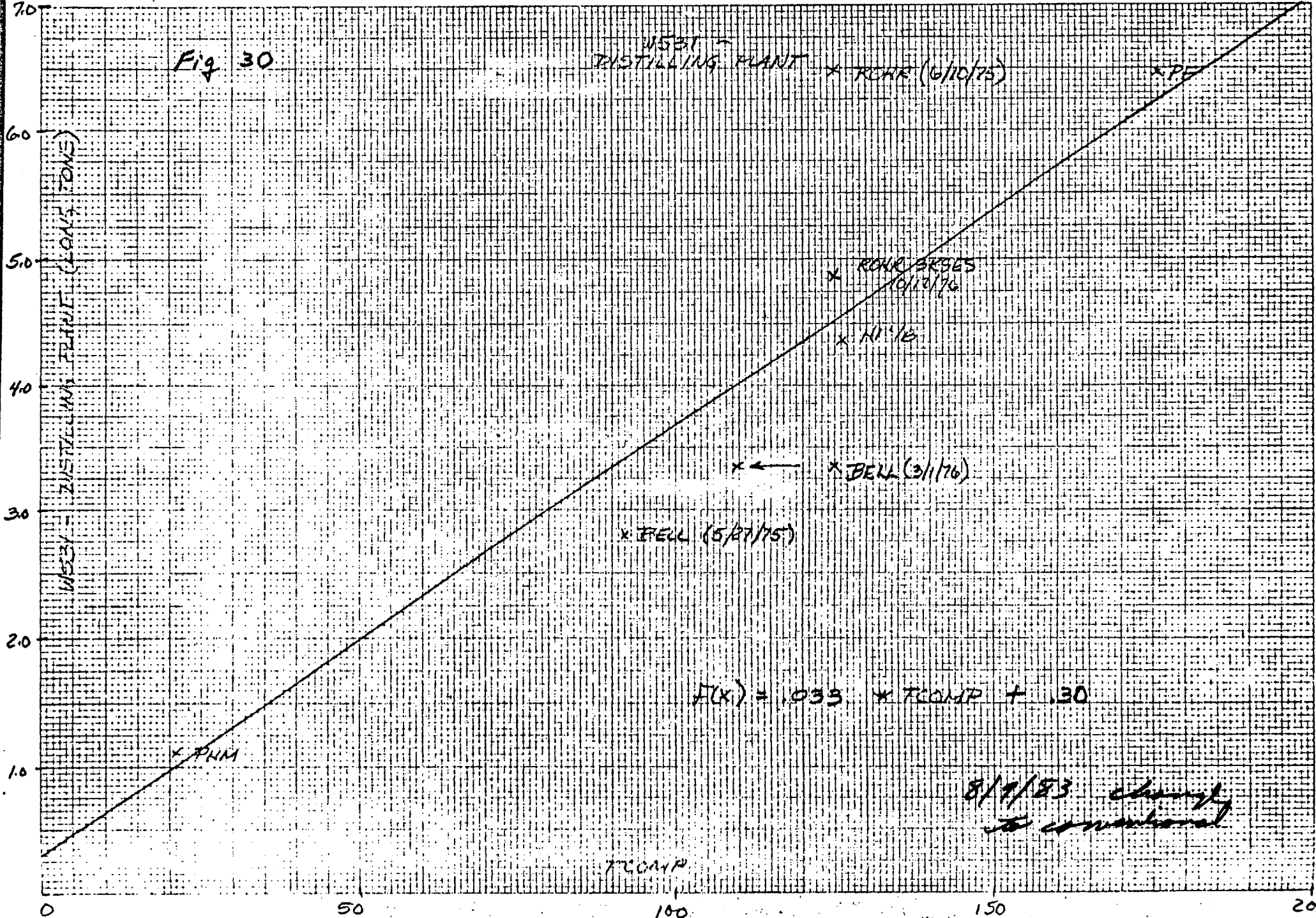


Fig 30

WSEB -  
DISTILLING PLANT \* ROWE (6/10/75)

\* PE



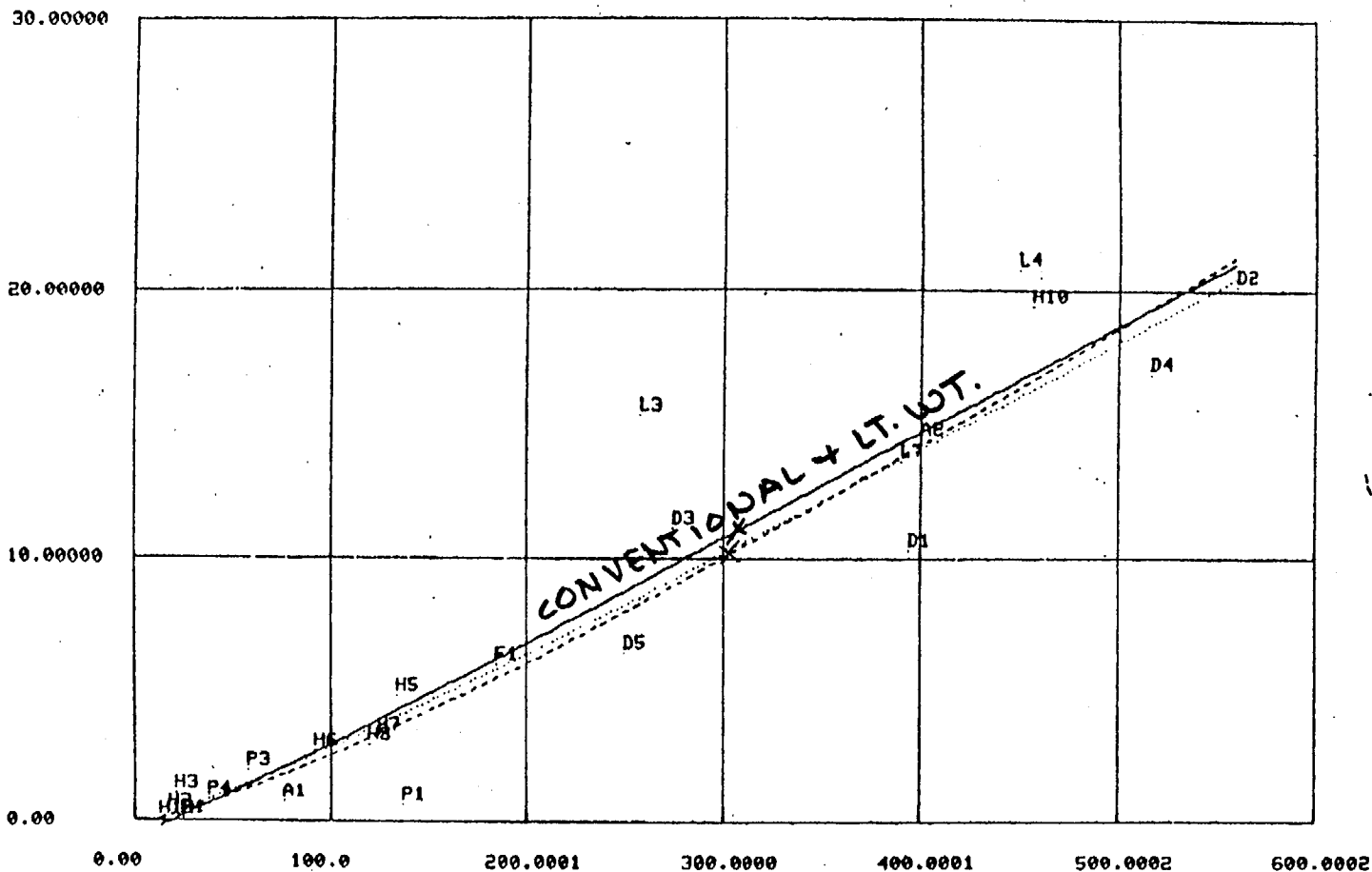
PA

SWRS 531 DISTILLING PLANT (BSCI 517)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR ✓

EXCLUDES:  
C1, C2, L1, L2, A3, A4

D  
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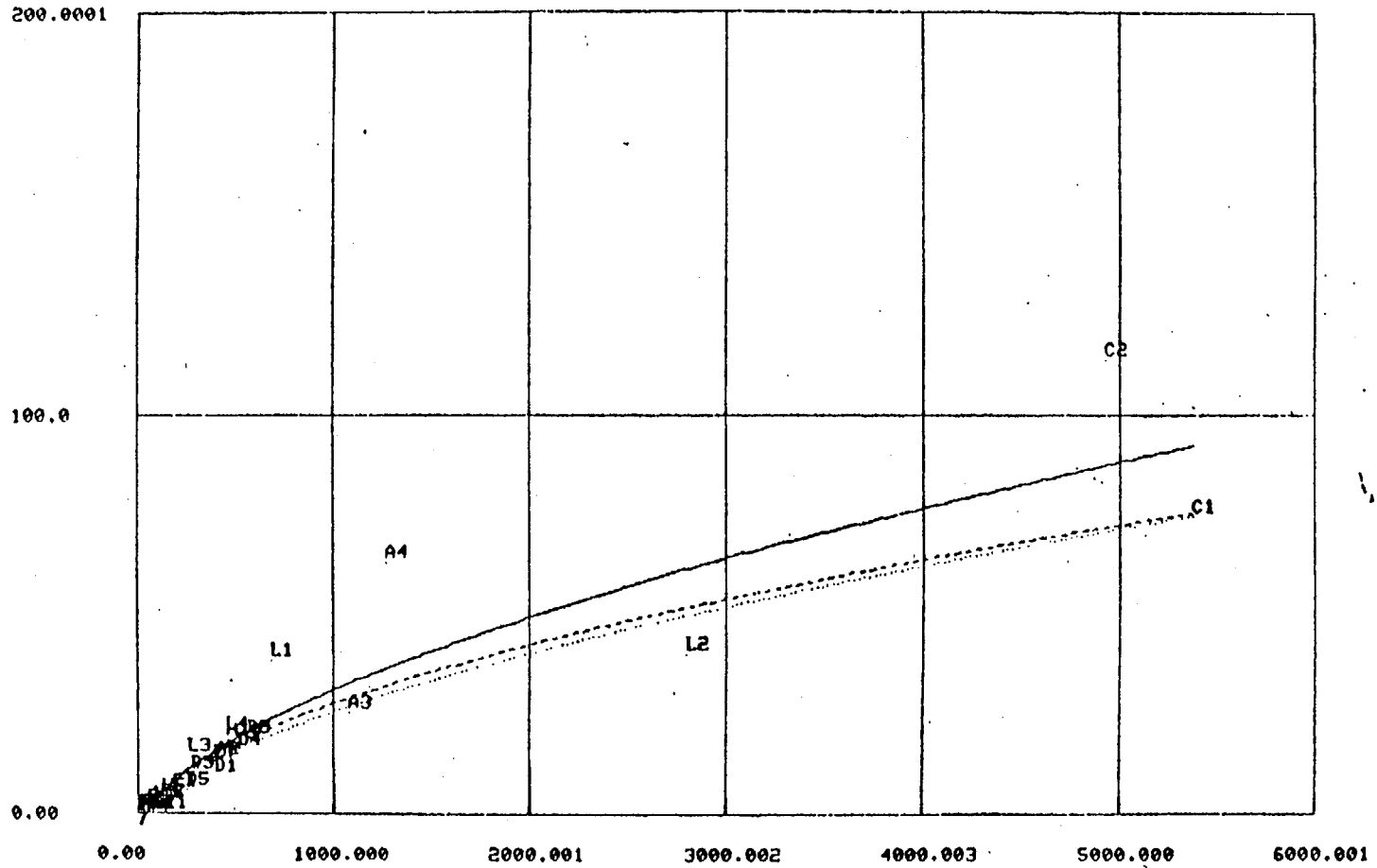


TOTAL ACCOMADATIONS

PAUSE 'PRESS (RETURN) TO CONTINUE'  
SWSR 531 DISTILLING PLANT (BSCI 517),

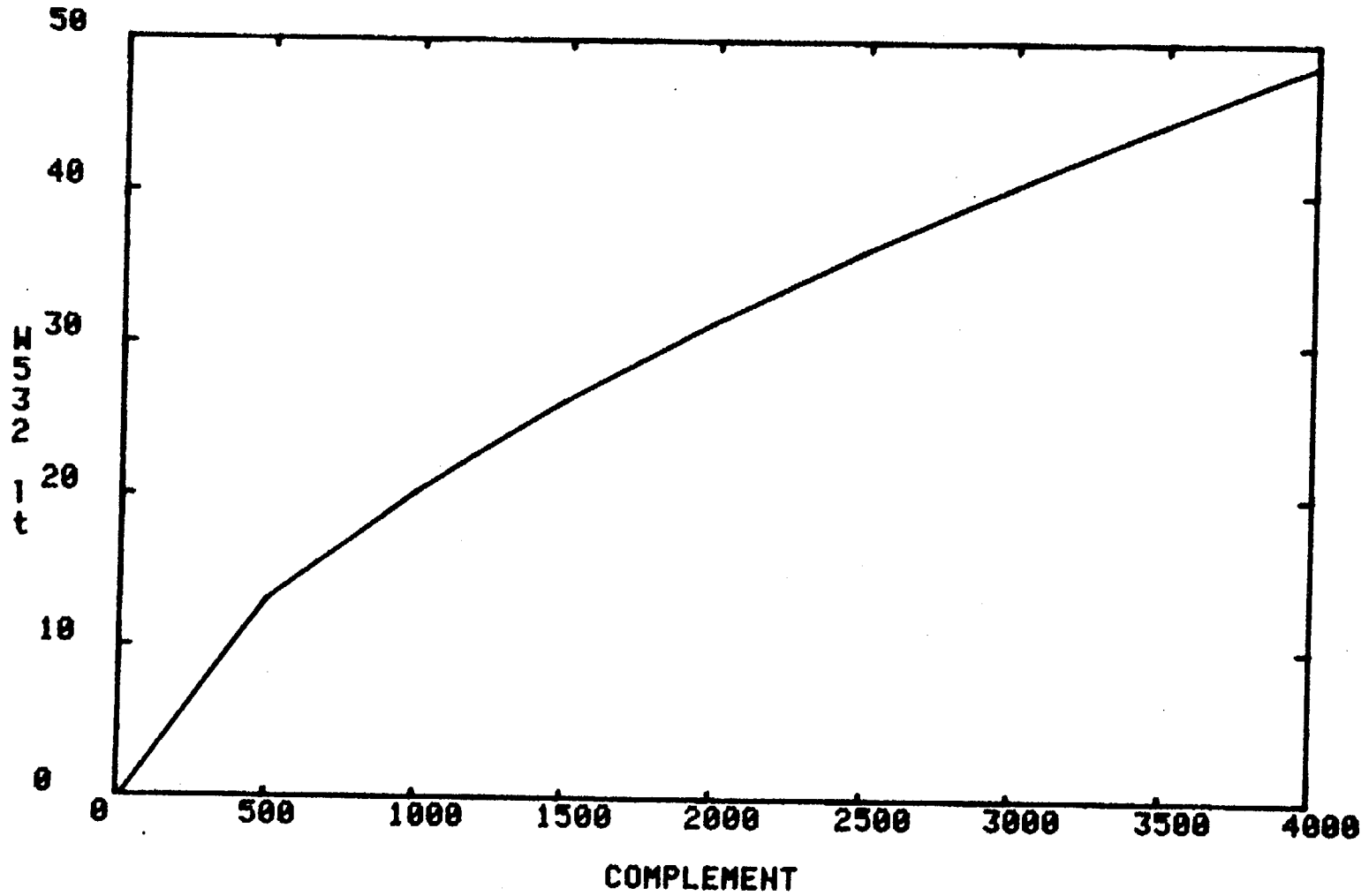
—— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR

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S  
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TOTAL ACCOMADATIONS

W532 US COMPLEMENT AS OF 10/31/83



W533 US COMPLEMENT AS OF 10/31/83

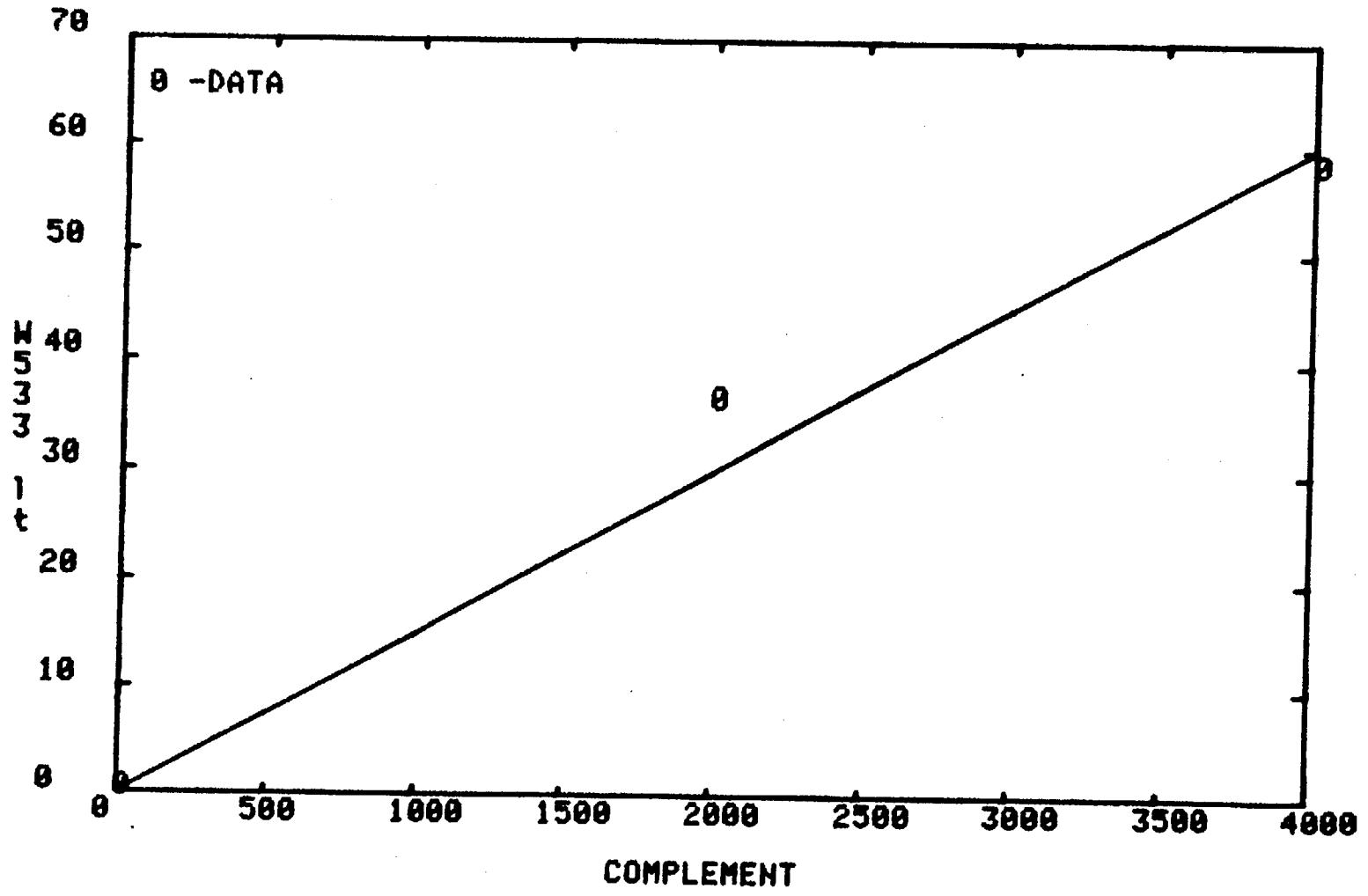
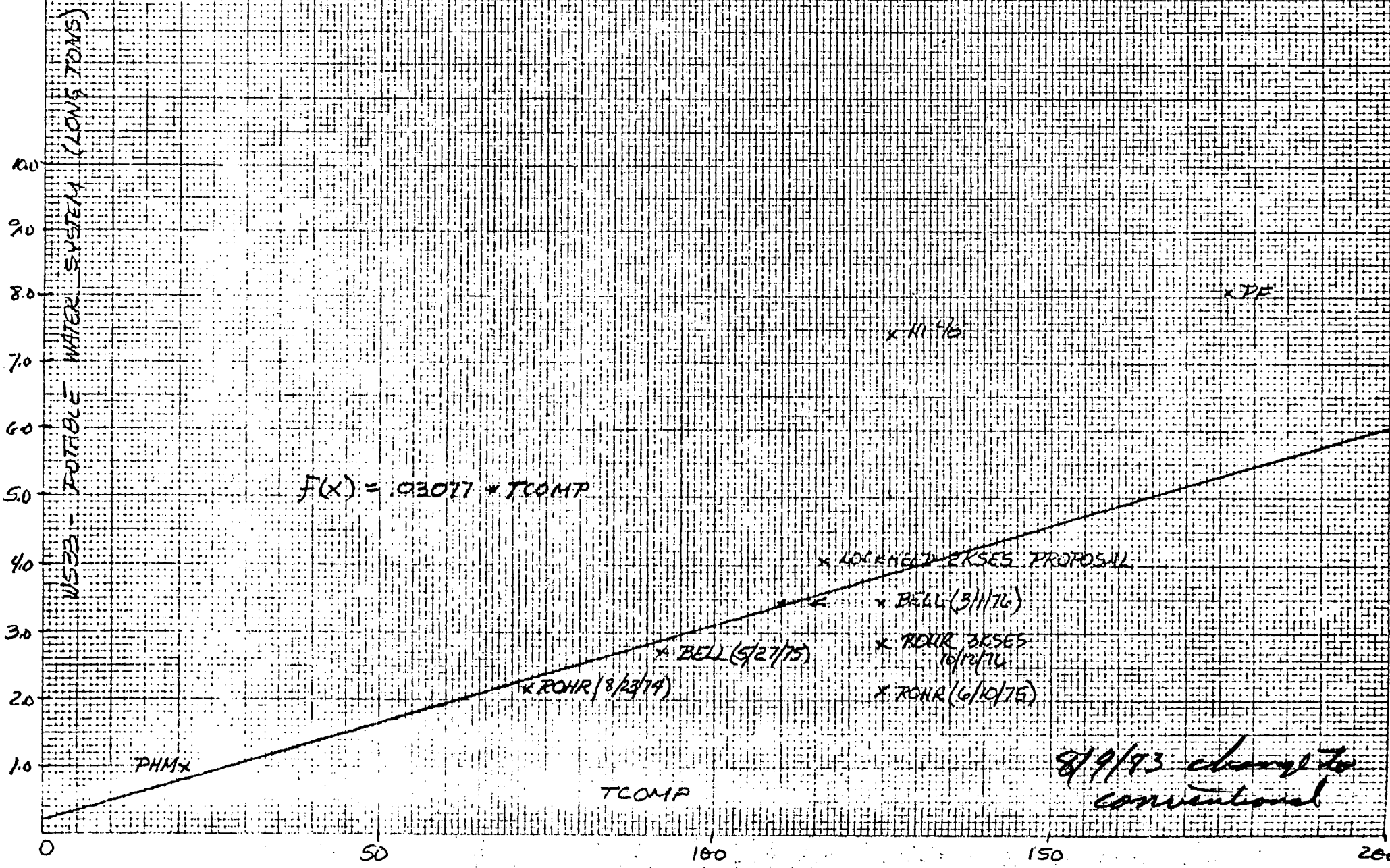




Fig 31

US33 - POTABLE WATER SYSTEM

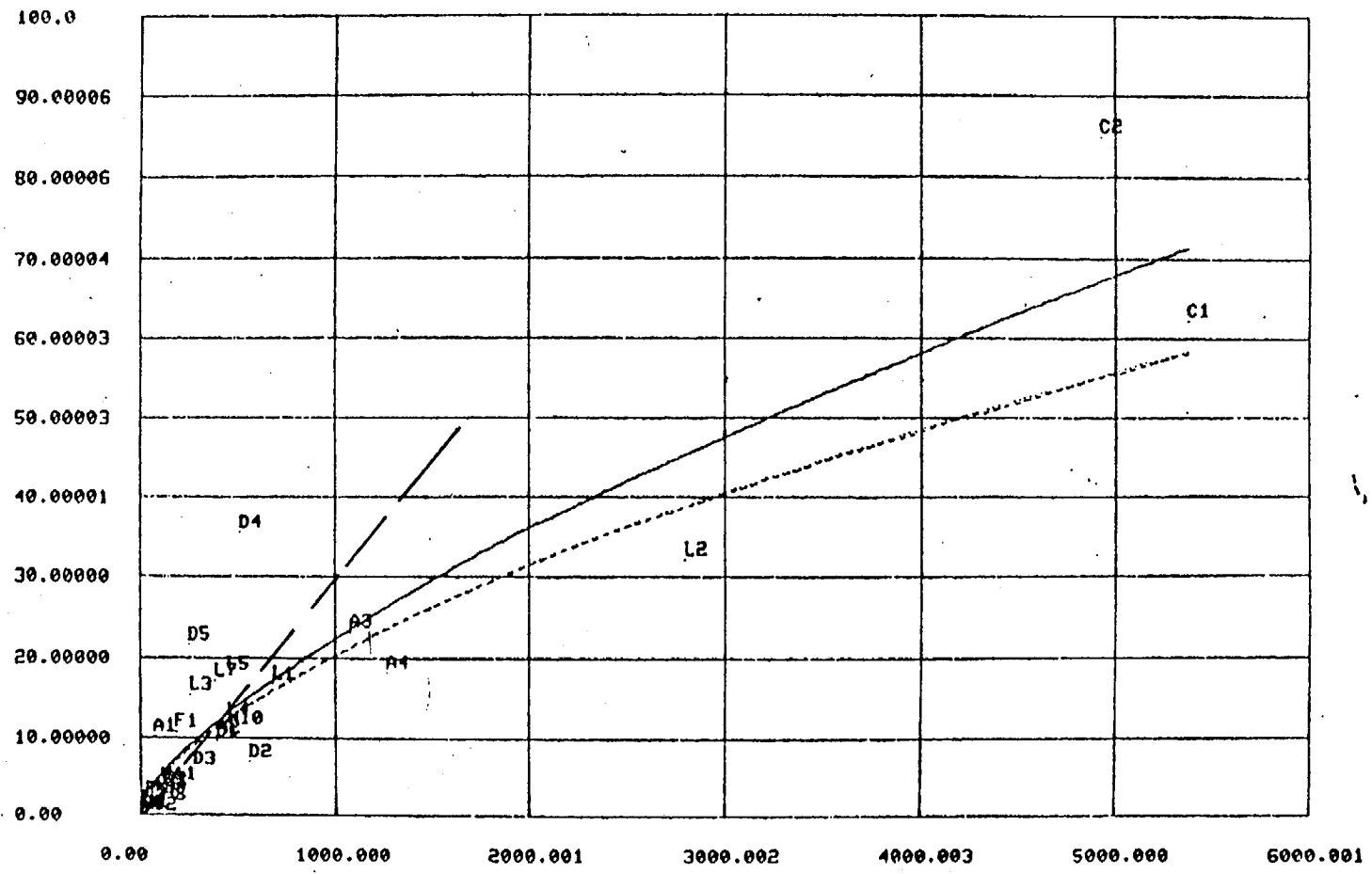


PAUSE 'PRESS (RETURN) TO CONTINUE'  
 SWBS 533 POTABLE WATER SYSTEM (BSC1 509)

—— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

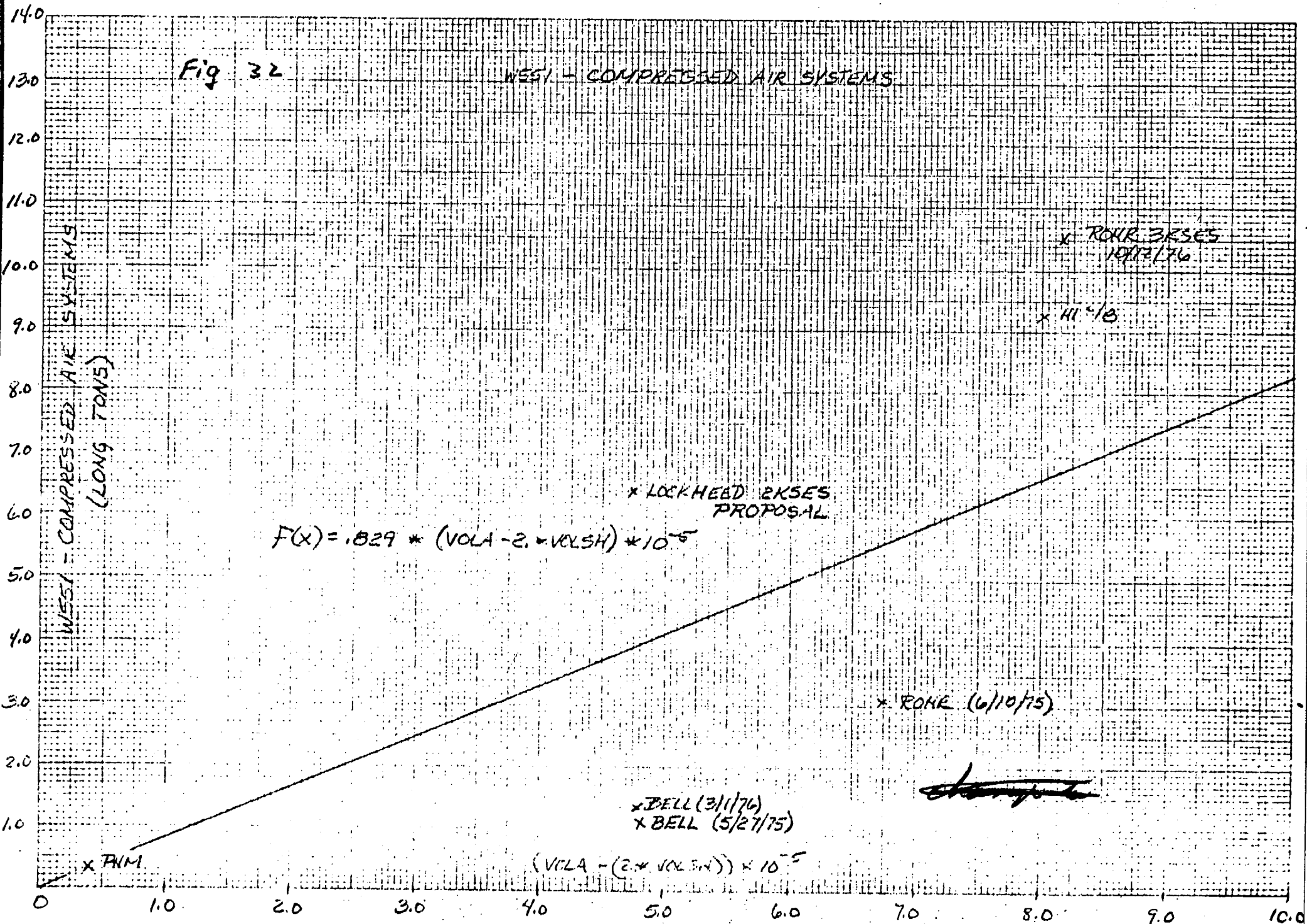
↑

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TOTAL ACCOMADATIONS

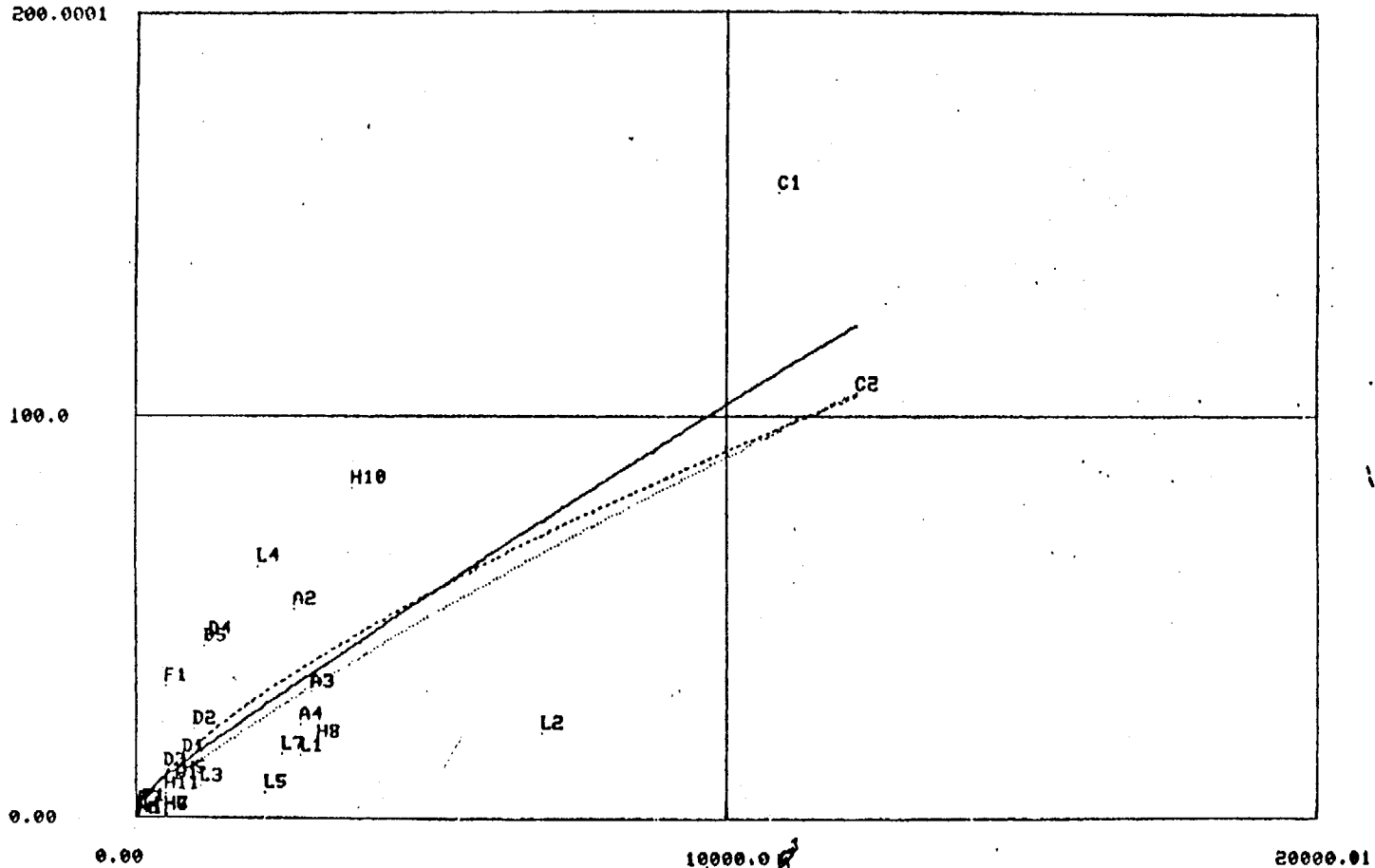
PF



SWBS 551 COMPRESSED AIR SYSTEMS (BSCI 513)

— ALL DATA    - - - - 2 S.ERROR    ······ 1 S.ERROR  
 φ

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S  
)



TOTAL VOLUME  $10^3$

10000.0

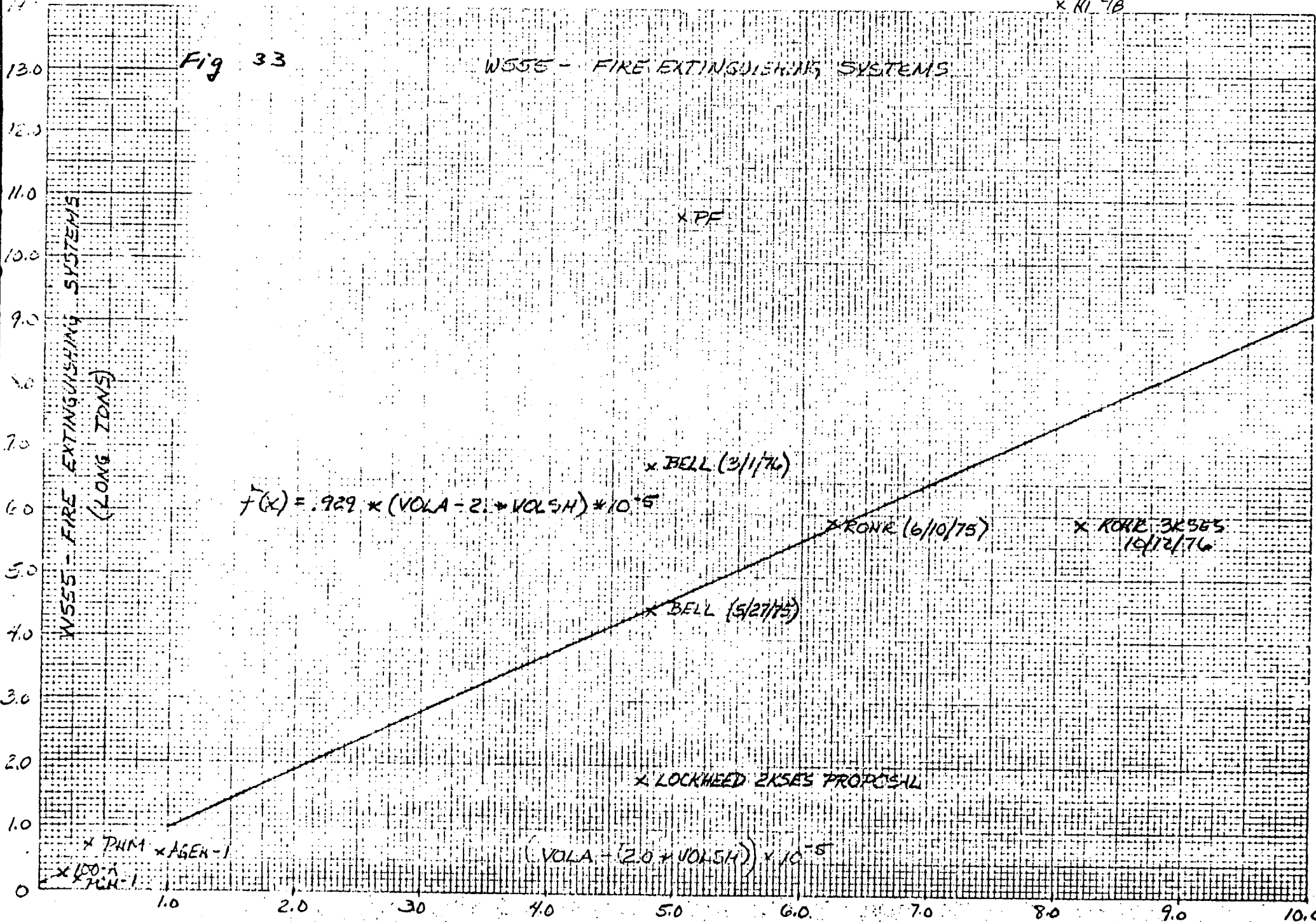
20000.01

~~2.2~~

Fig 33

WSS5 - FIRE EXTINGUISHING SYSTEMS

x KI 4B



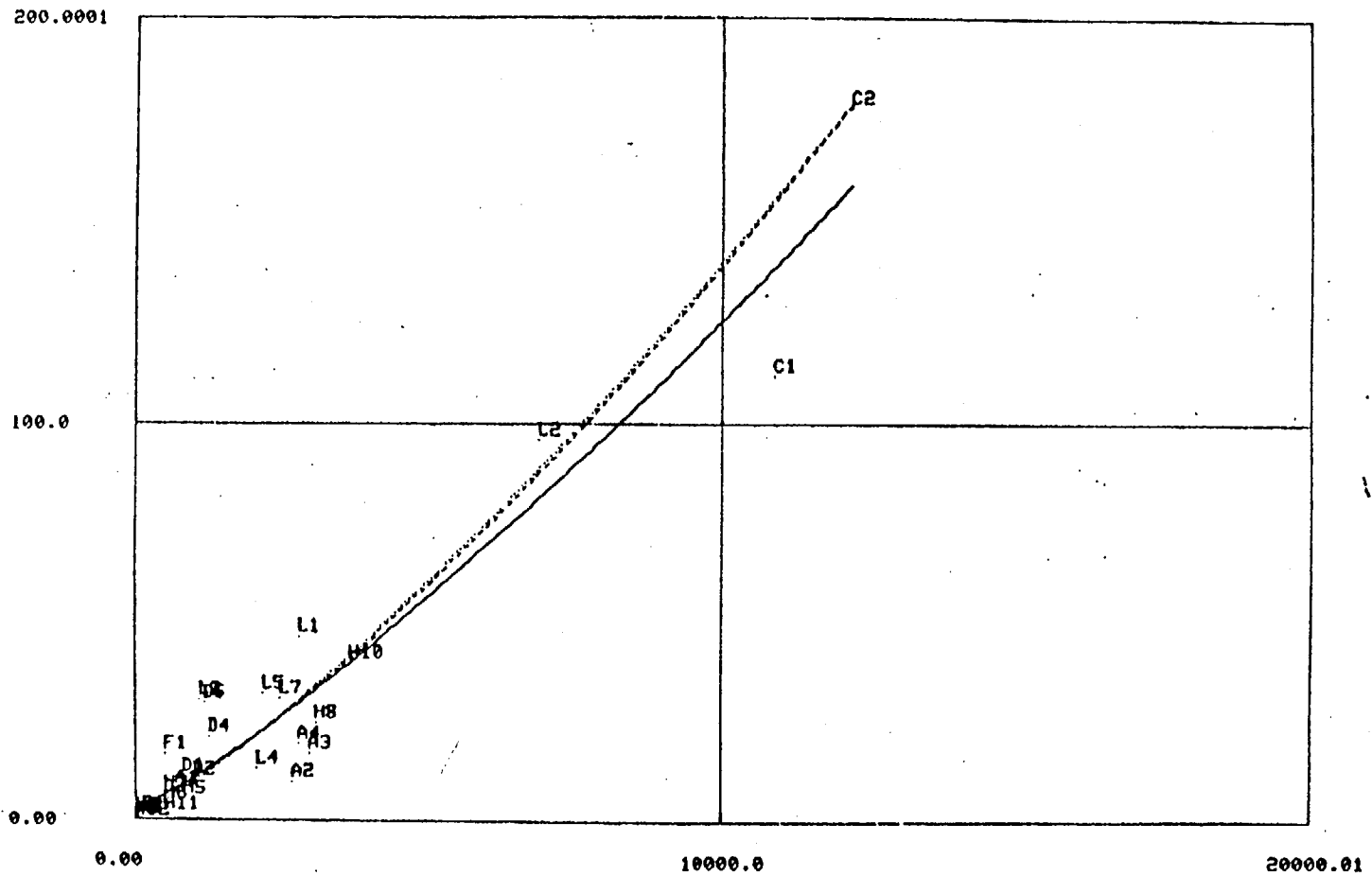
$(VOLA - (2.0 + VOLSH)) * 10^5$

PAUSE 'PRESS (RETURN) TO CONTINUE'  
SURS 555 FIRE EXTINGUISHING SYSTEMS (BSCI 507)

—— ALL DATA    - - - - - 2 S.ERROR    ..... 1 S.ERROR

4

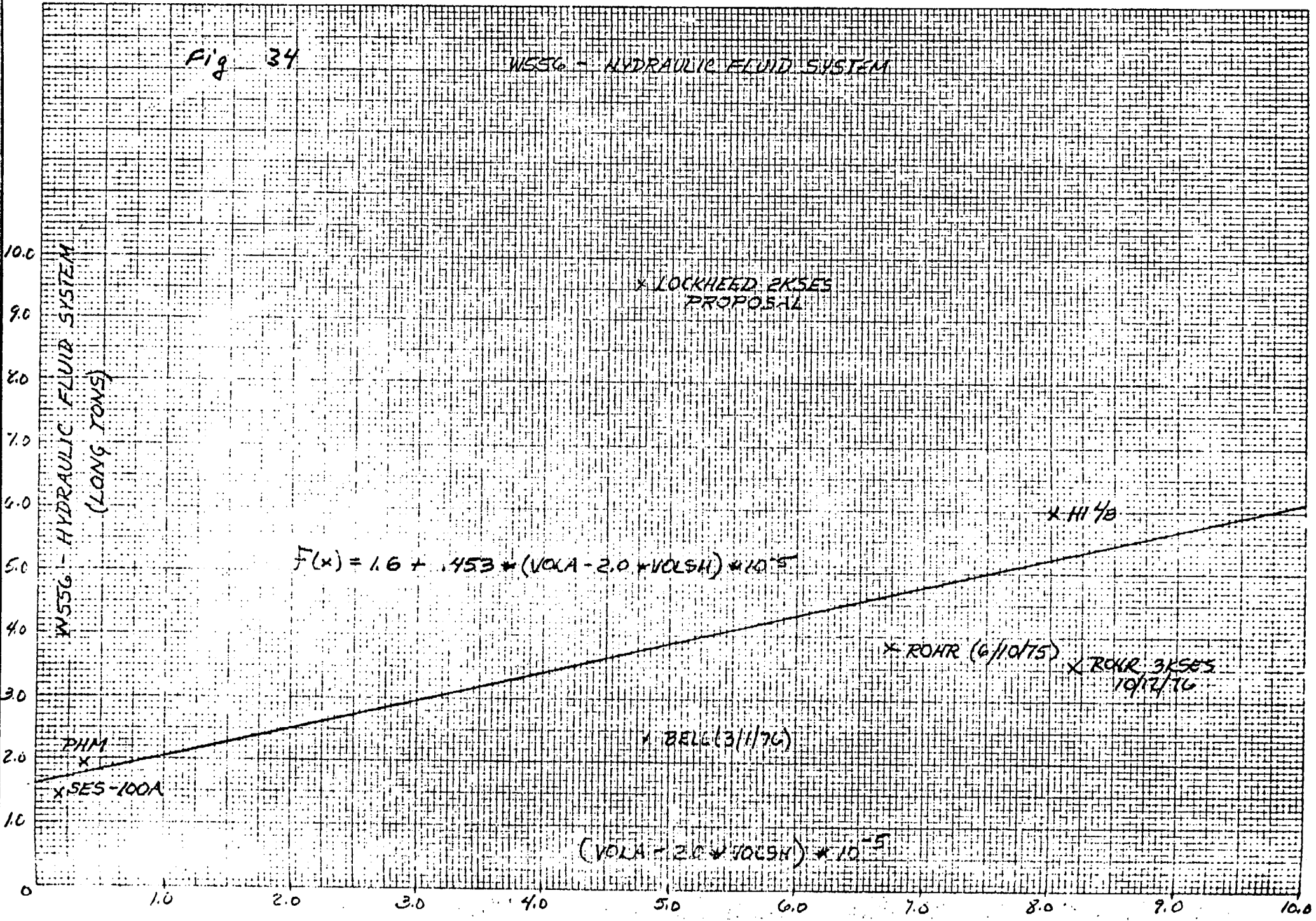
F  
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)



TOTAL VOLUME

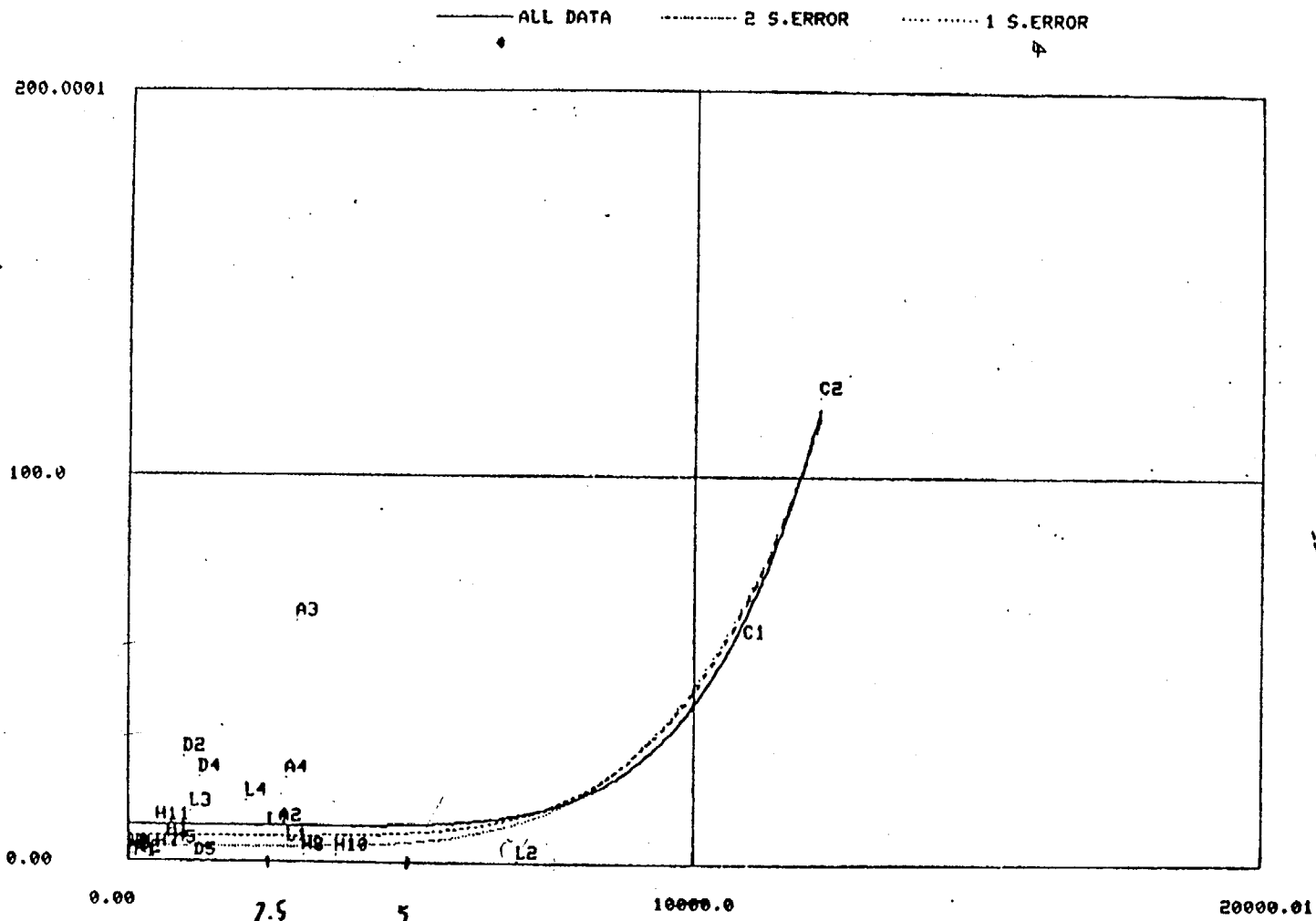
Fig 34

W556 - HYDRAULIC FLUID SYSTEM



SUBS 556 HYDRAULIC FLUID SYSTEM (BSCI 916)

HYDRAULIC FLUID (LONG TONS)



-6  
x 10



W561 VS DUM1 AS OF 10/31/83

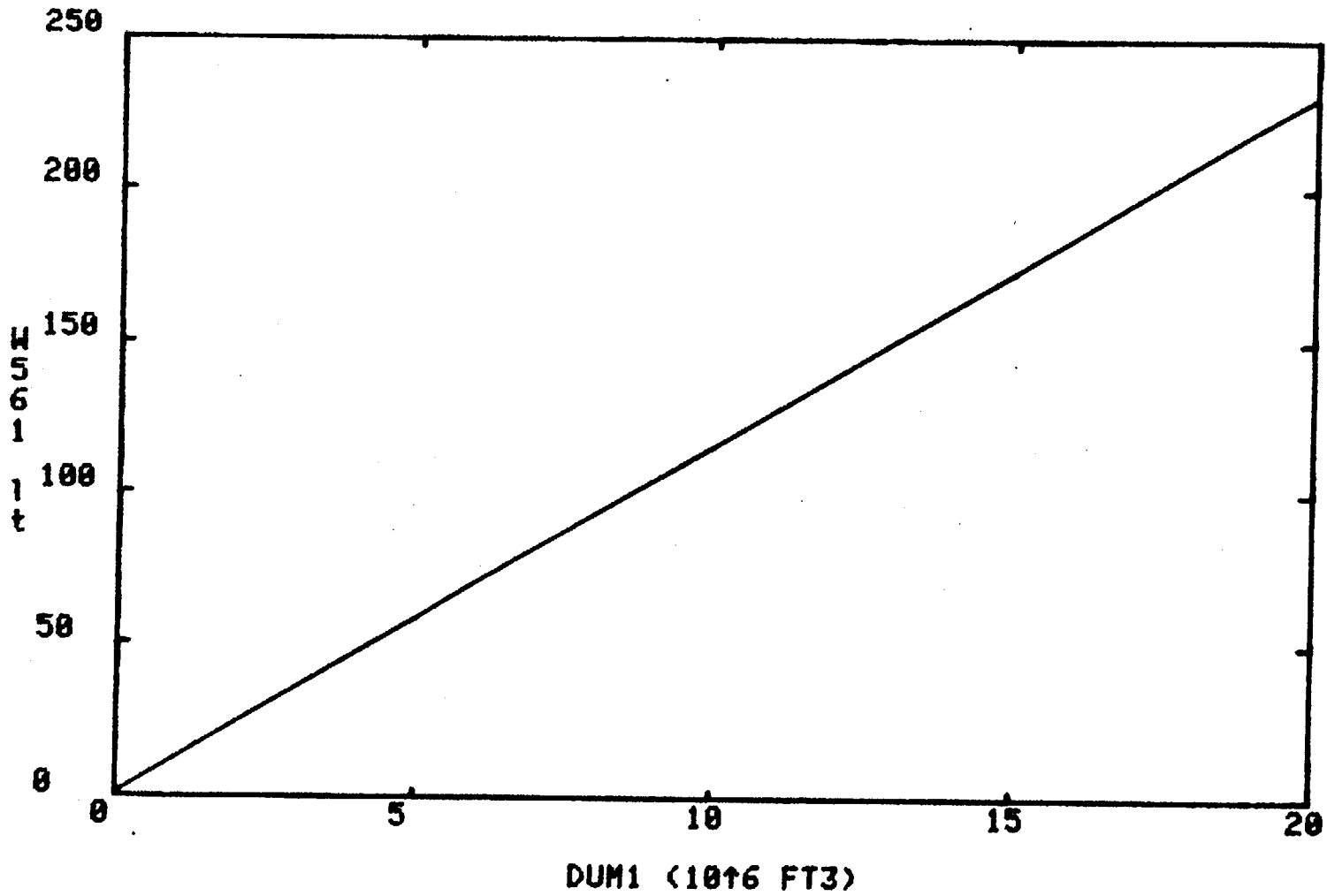
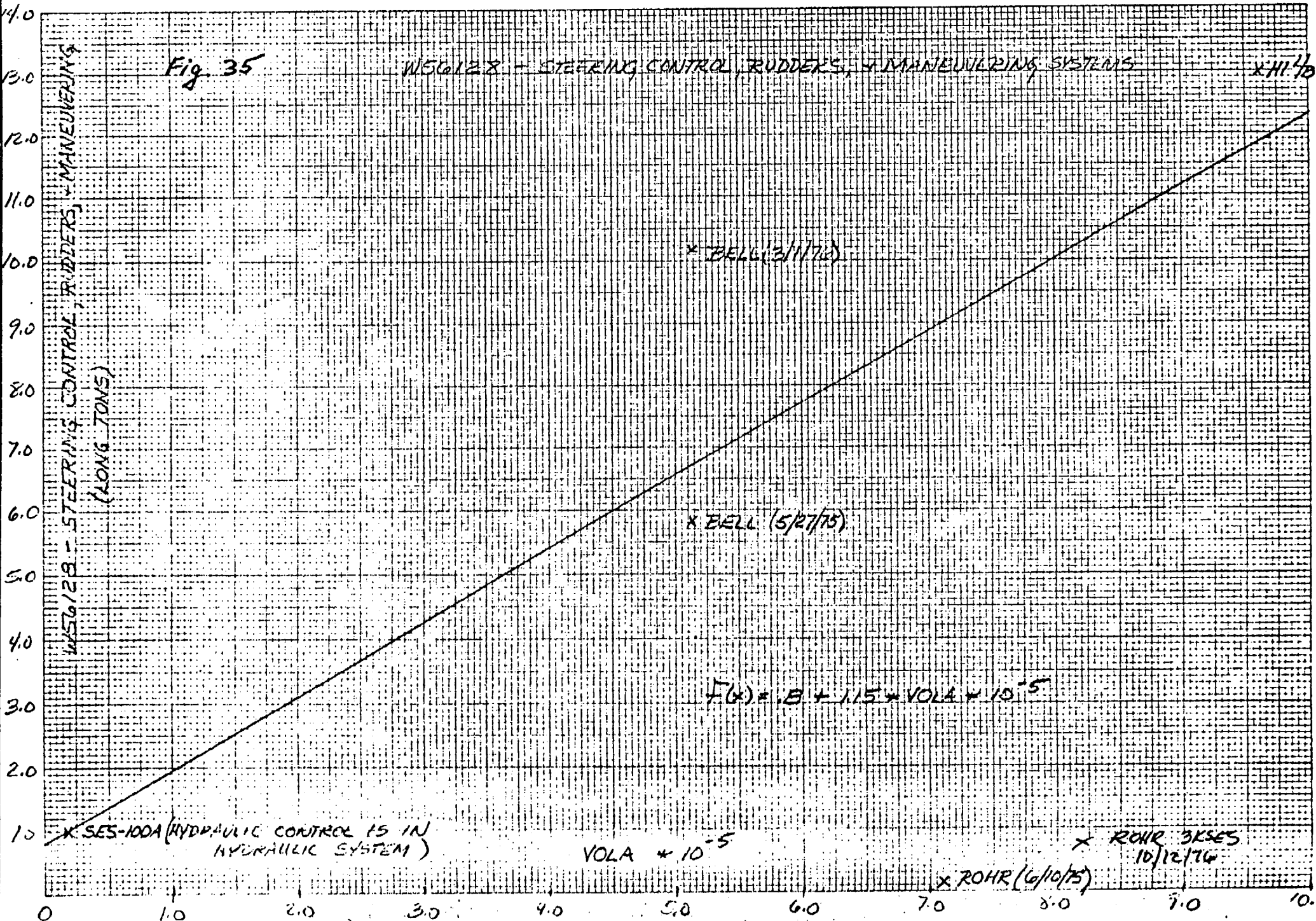


Fig. 35

W56128 - STEERING CONTROL, RUDDERS, & MANEUVERING SYSTEMS

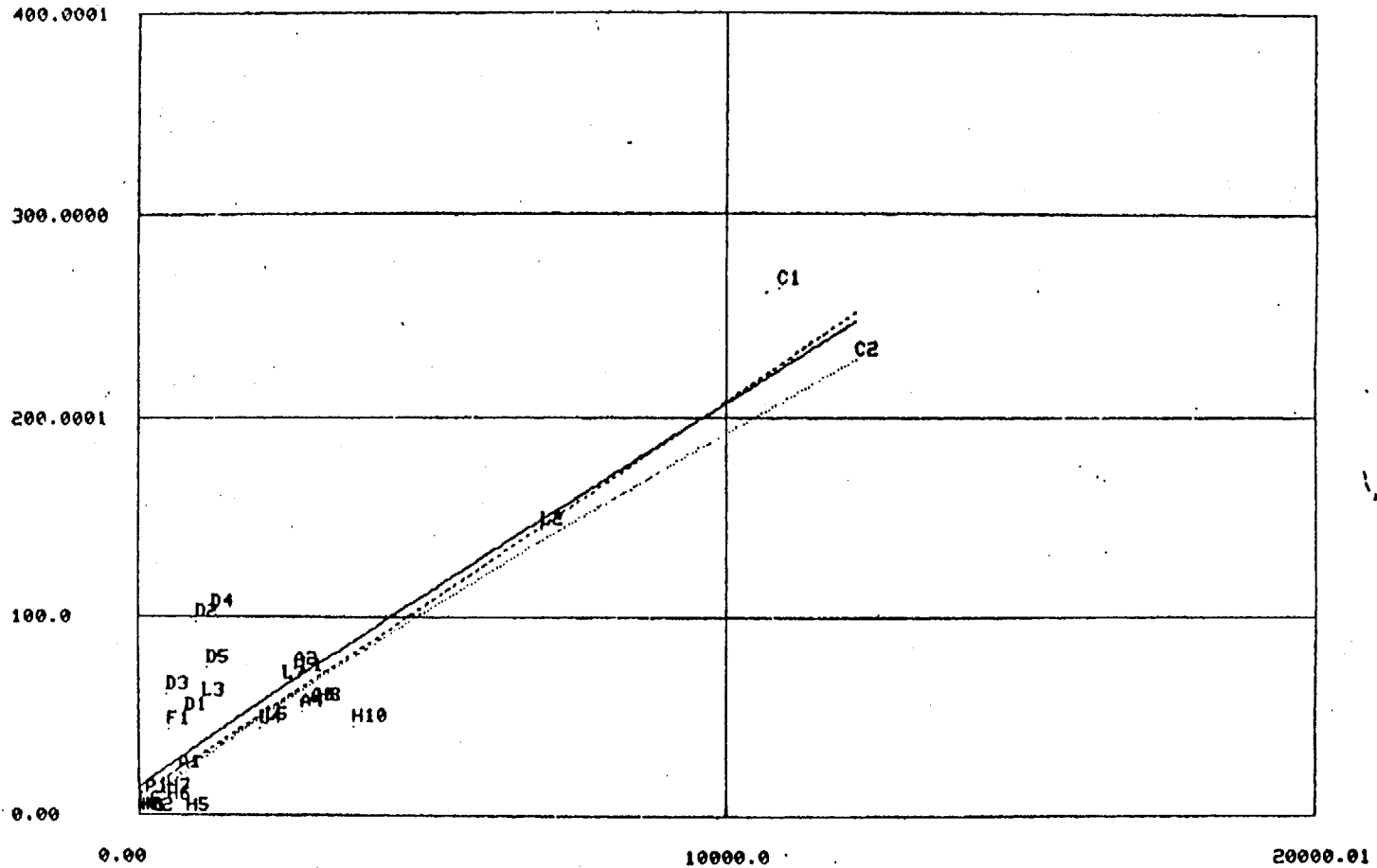
XHI 4/70



SWBS 561/2/8 STEERING MANEUVERING (BSCI 518/9)

—— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR

S  
T  
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TOTAL VOLUME

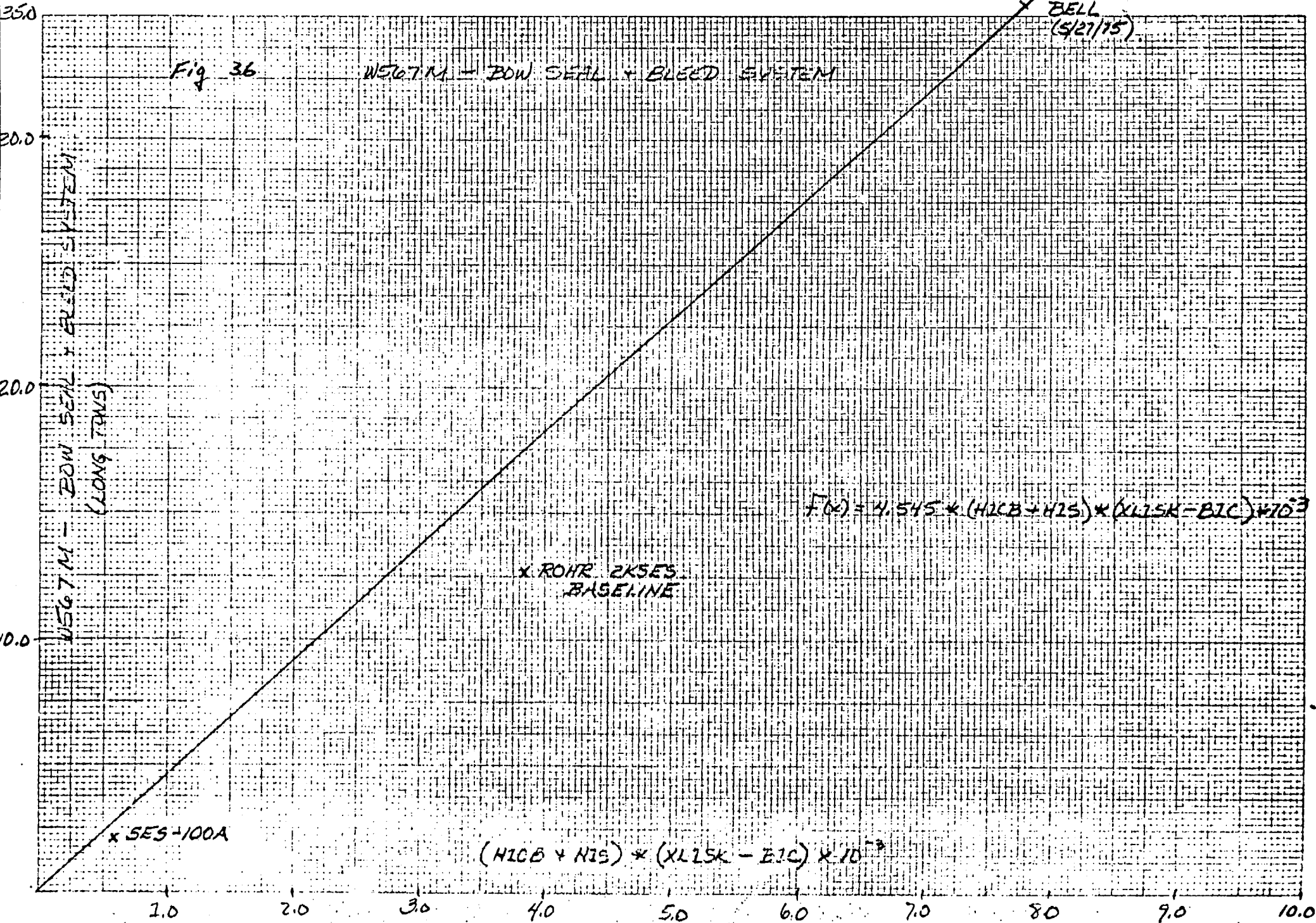


Fig 37

W567N - STERN SEAL, SEAL BLEED, + SEAL LIFT

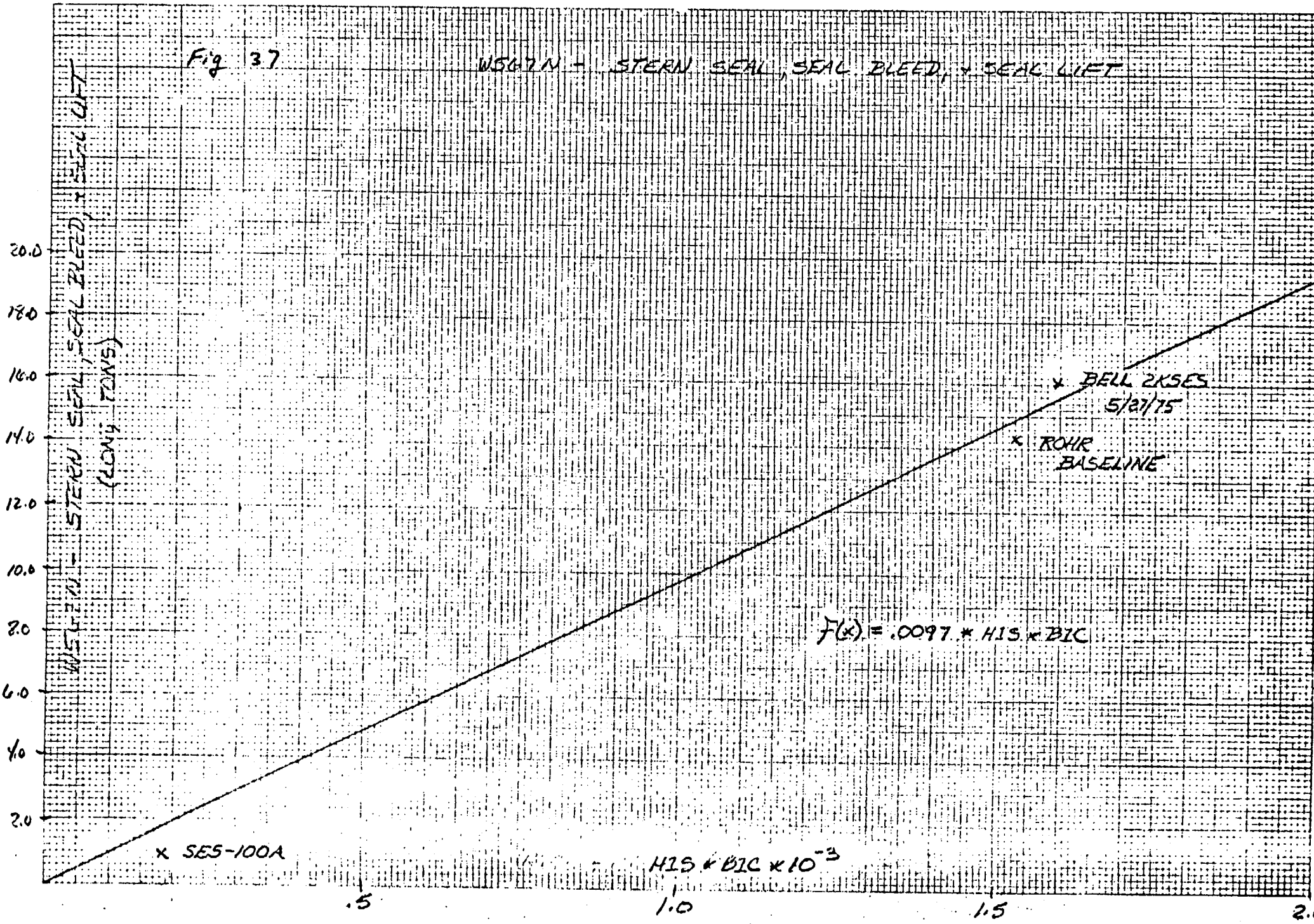


Fig 38

WSG70 - VENT VALVES / RIDE CONTROL SYSTEM

VENT VALVES / RIDE CONTROL  
(LONG TONS)  
WSG70

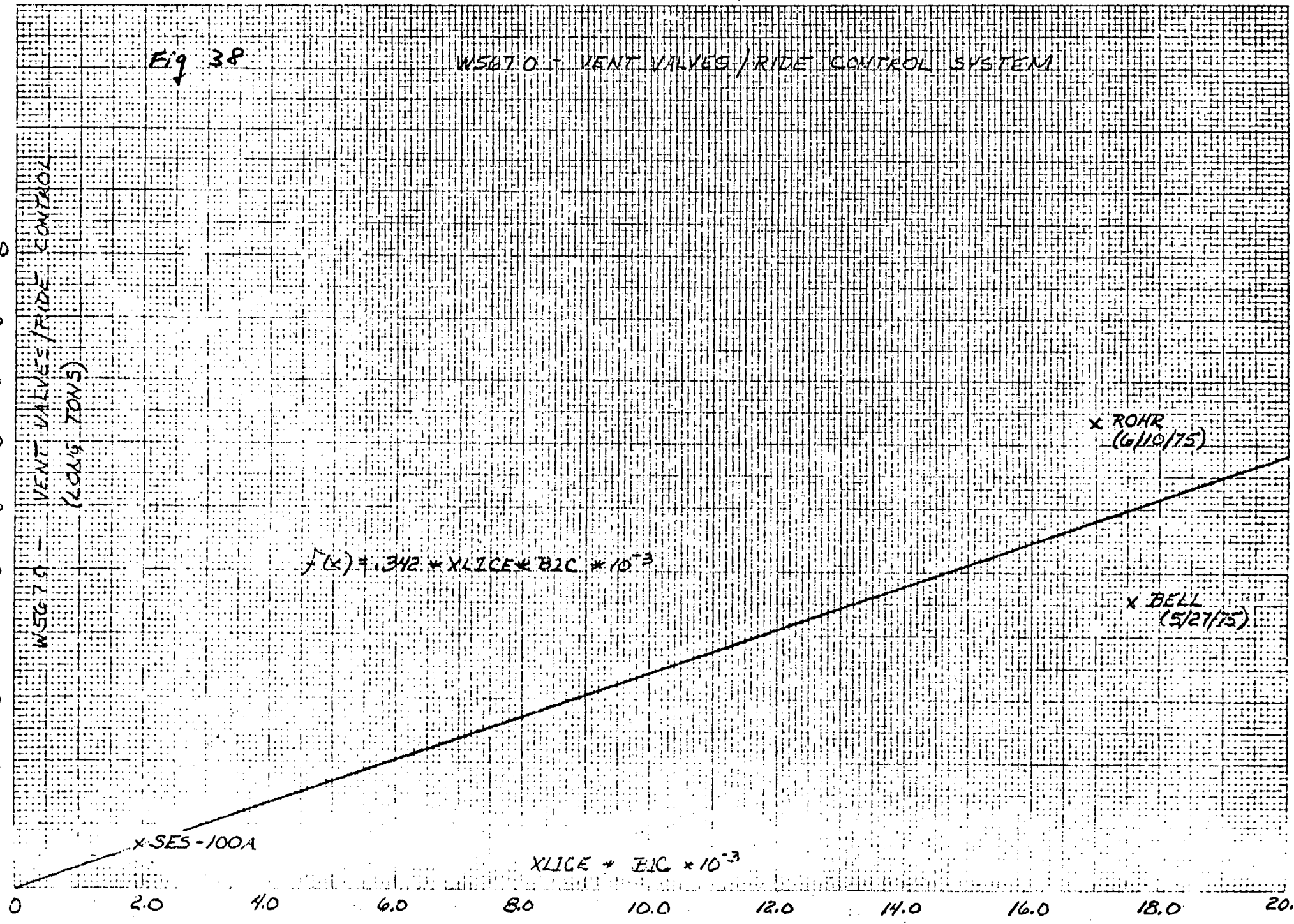
$$f(x) = .342 * XLICE * BIC * 10^{-3}$$

x SES-100A

XLICE + BIC \* 10<sup>-3</sup>

x ROHR  
(6/10/75)

x BELL  
(5/27/75)





X BELL 5/27/75

Fig 39

WSTI - REPLENISHMENT WT SET

ROHR 31585  
V.L = 1339  
WSTI = 2.94  
(10/27/76)

10

WSTI - REPLENISHMENT WT SET (LONG TONS)

$$f(x) = .00058 * WFOO$$

5

X RT 5/8

X ROHR (6/10/75)

VARIABLE LOADS (LONG TONS)

0 100 200 300 400 500 600 700 800 900 1000

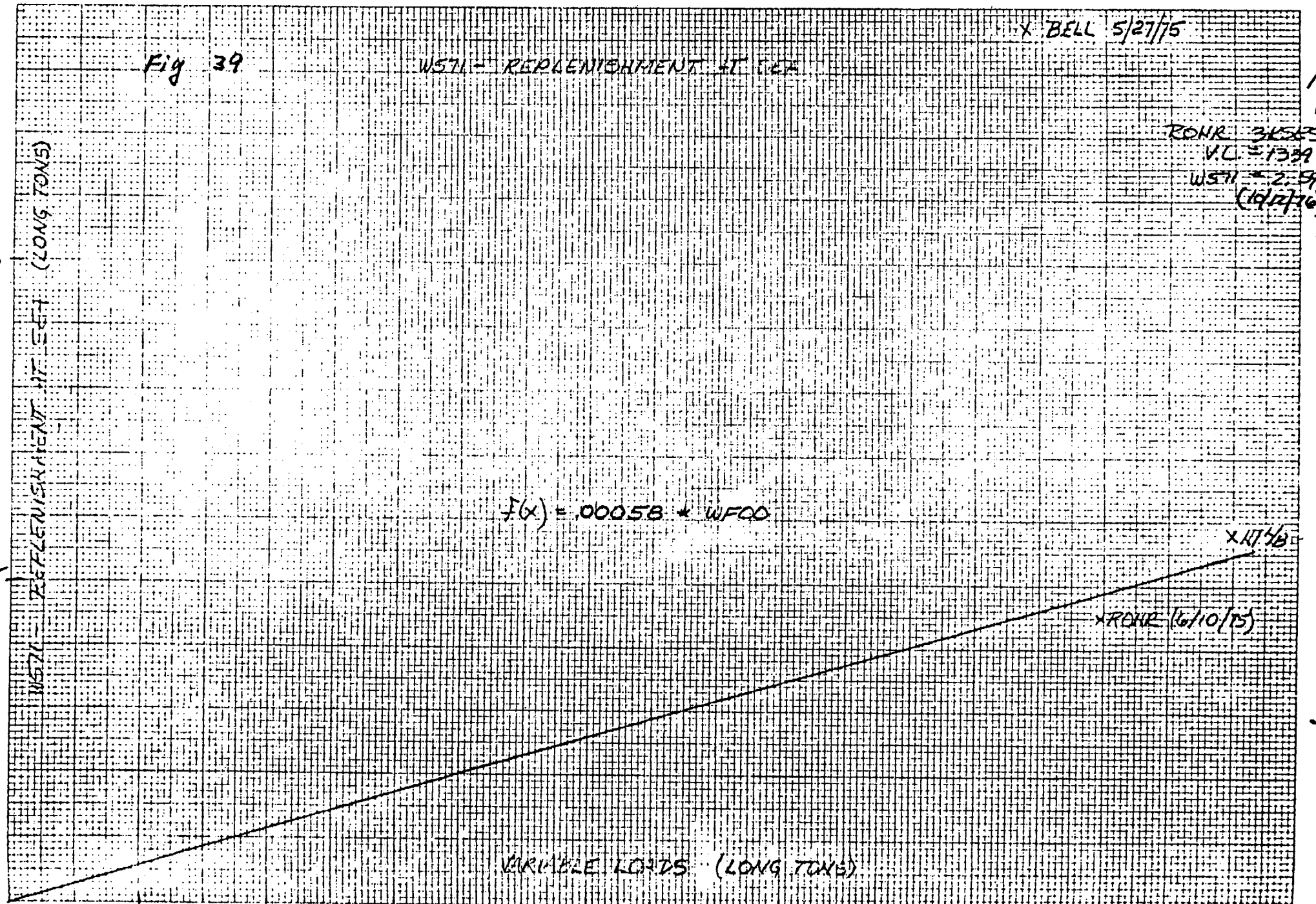
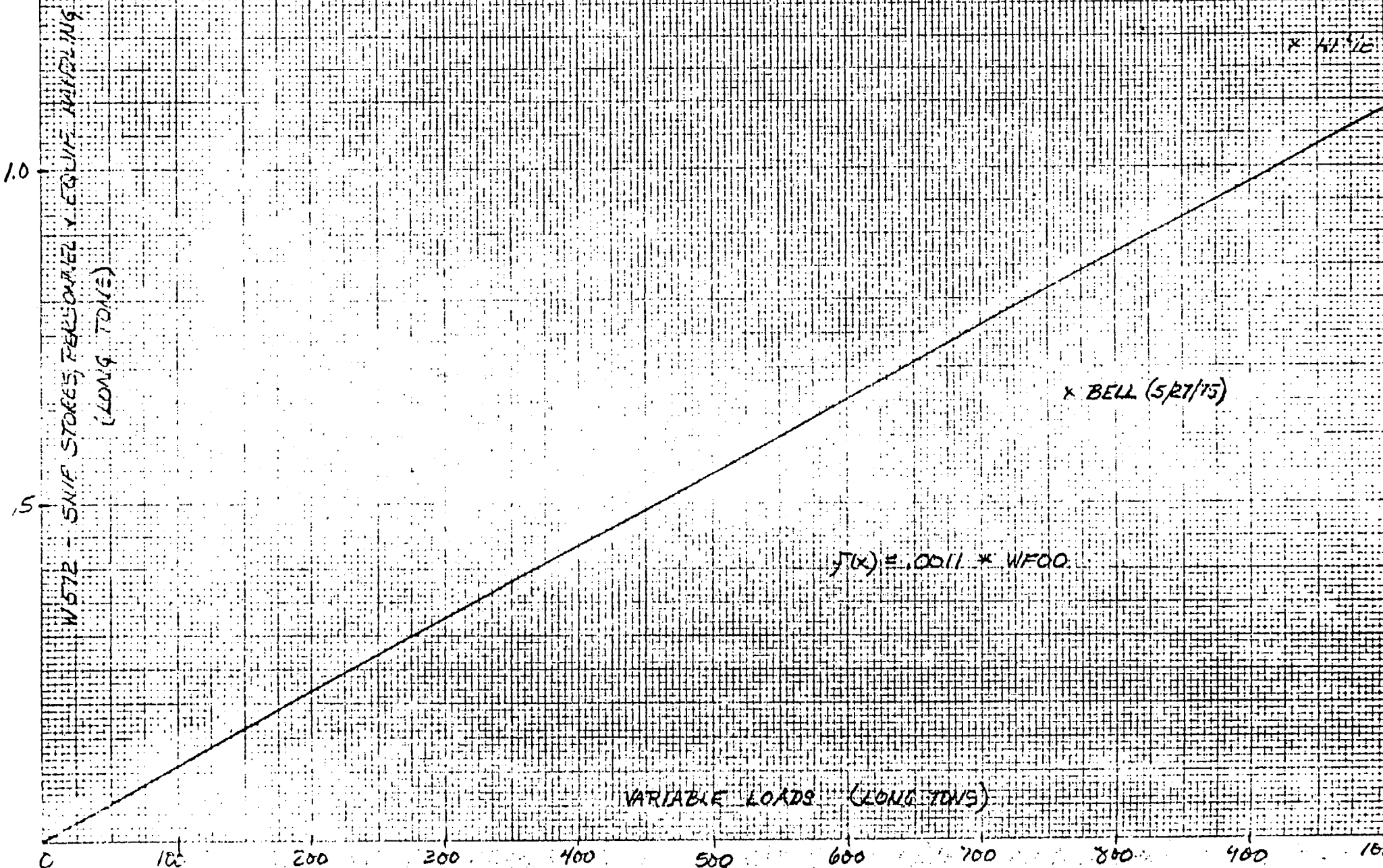


Fig 40

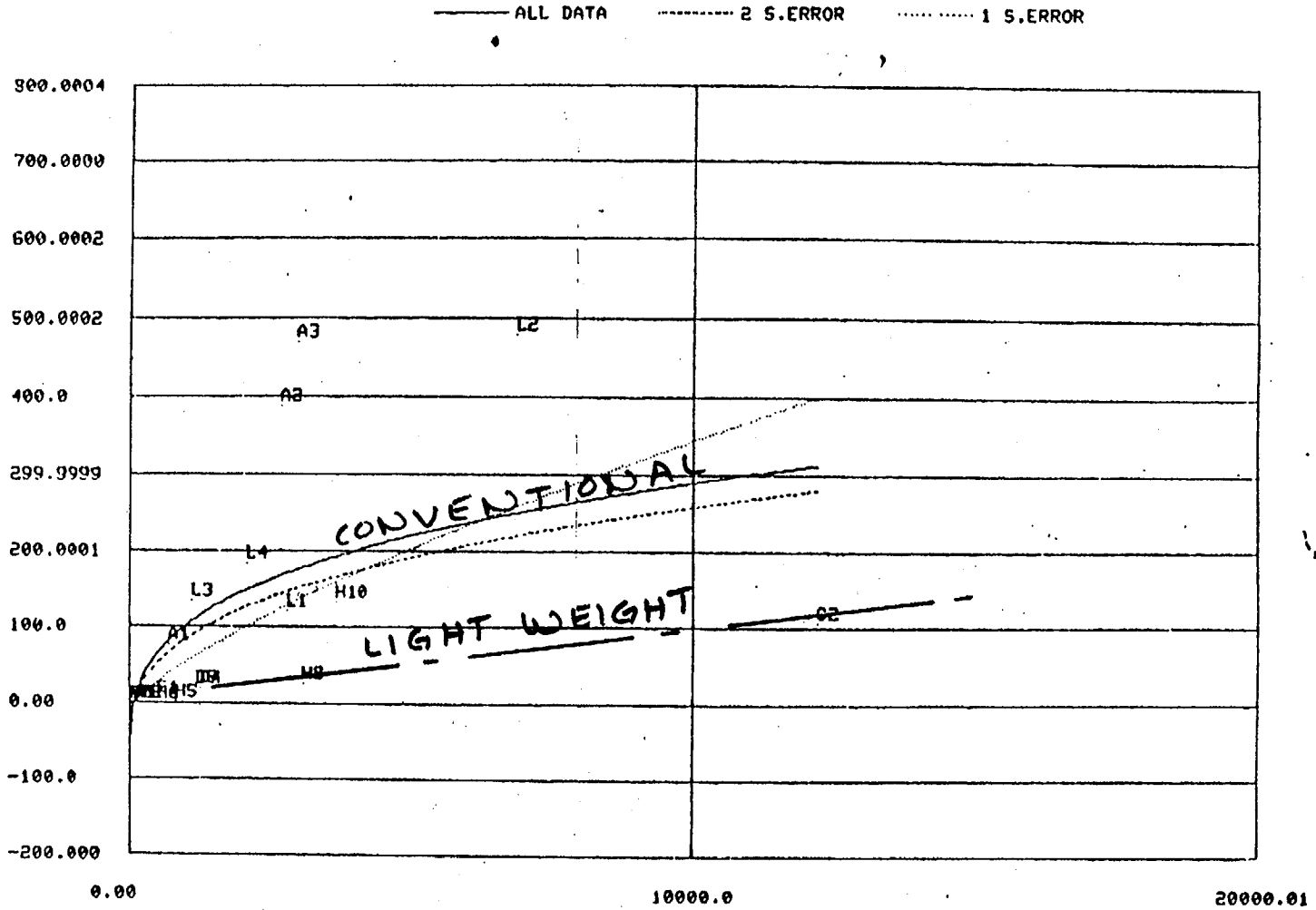
W572 - SNIP STORES, PERSONNEL & EQUIP HANDLING





SUBS 571/3/4 RAS & CARGO HANDLING (BSCI 528)

R  
A  
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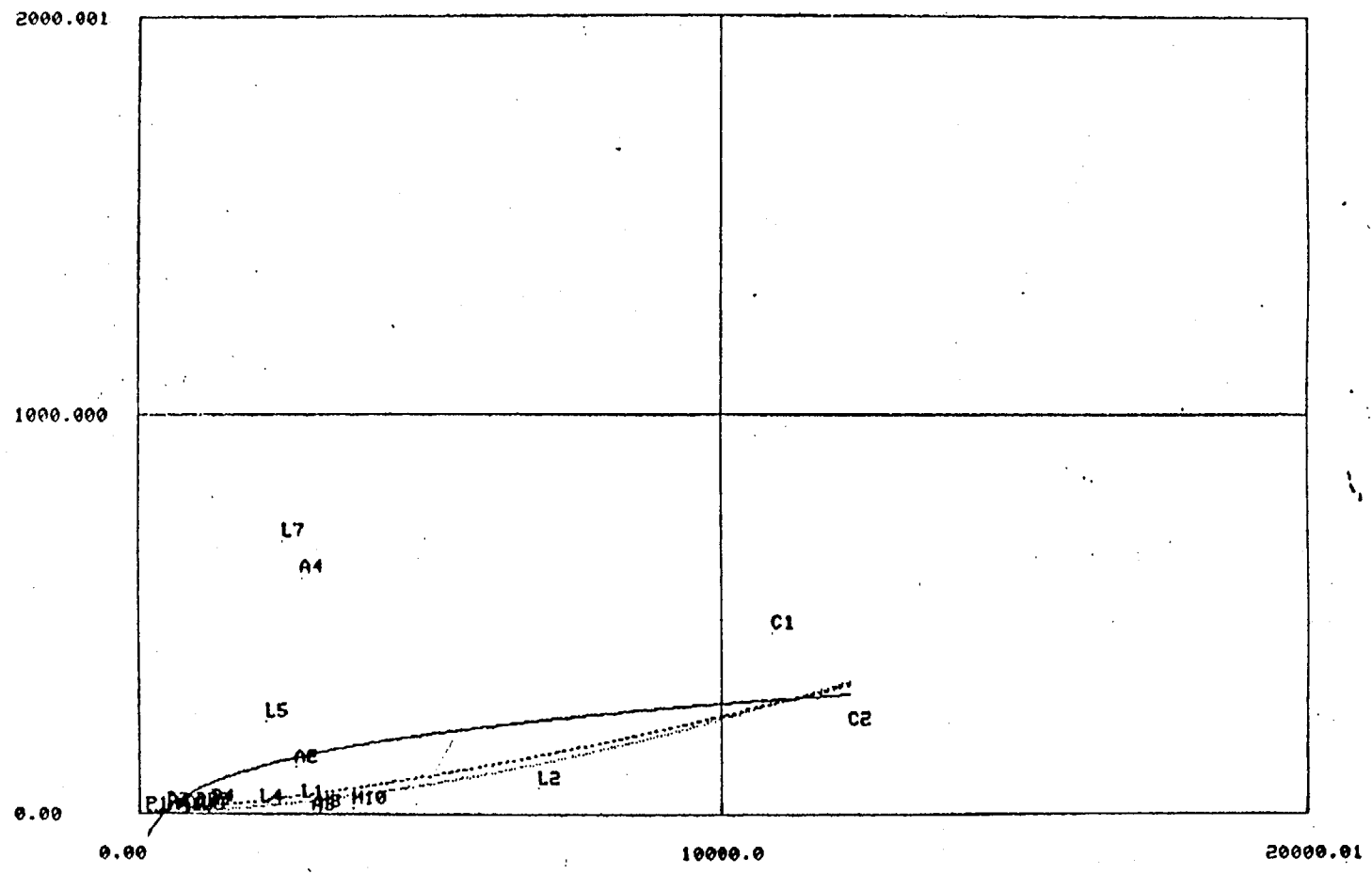


TOTAL VOLUME

SUBS 572 SHIPS STORES & EOPT HANDLING (BSCI(521))

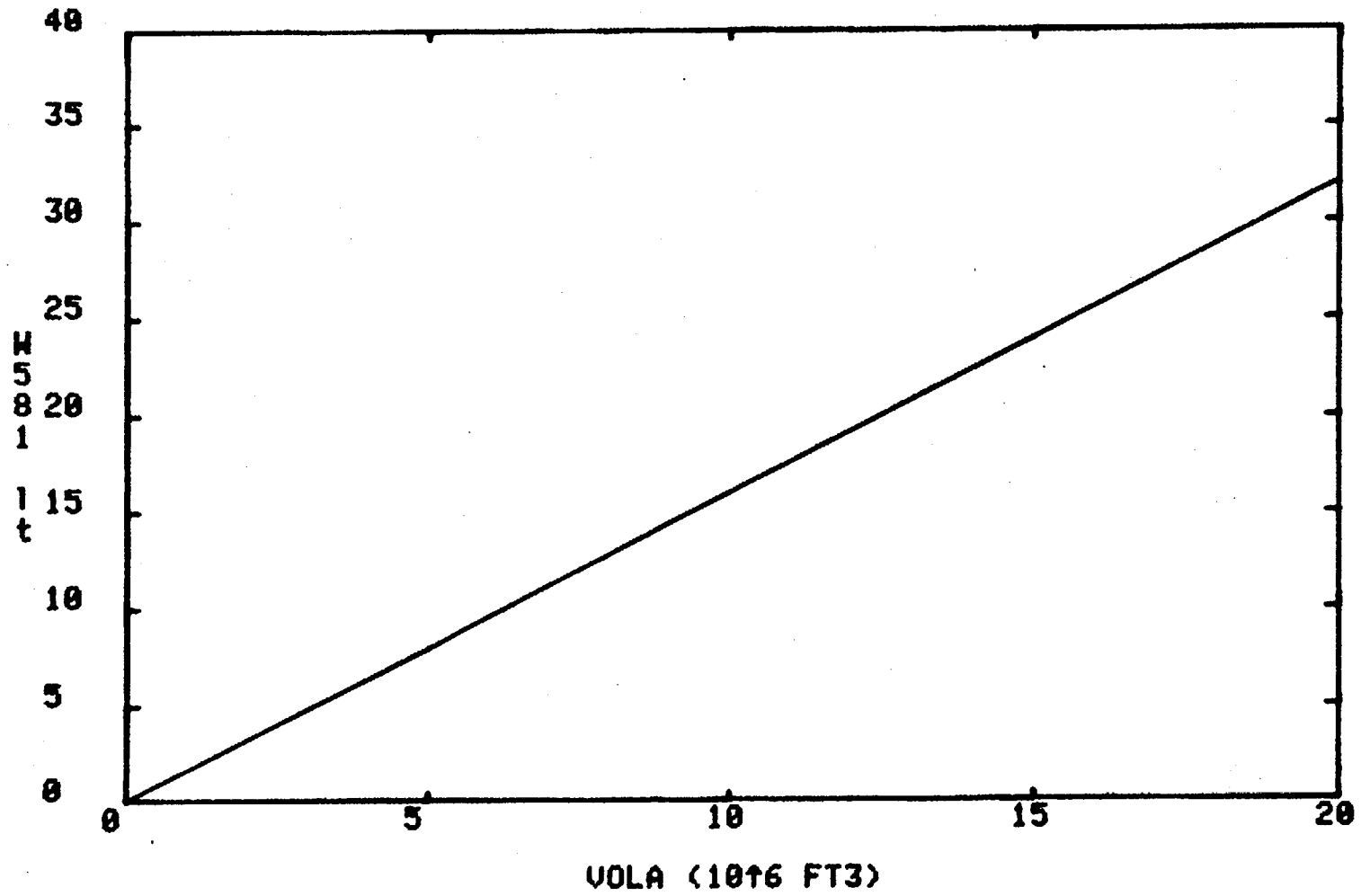
— ALL DATA      - - - - - 2 S.ERROR      ······ 1 S.ERROR

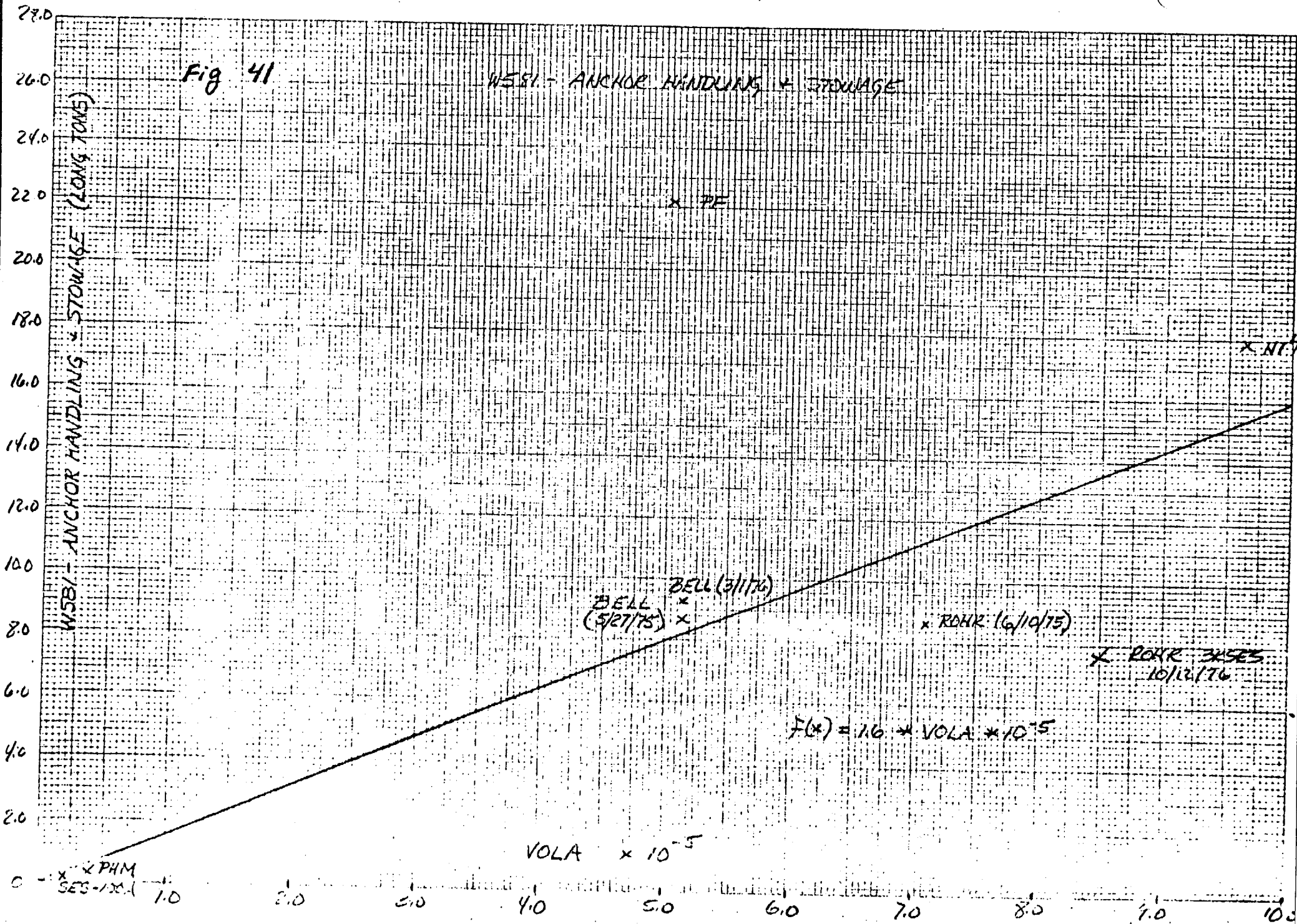
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TOTAL VOLUME

H581 US VOLA AS OF 10/31/83

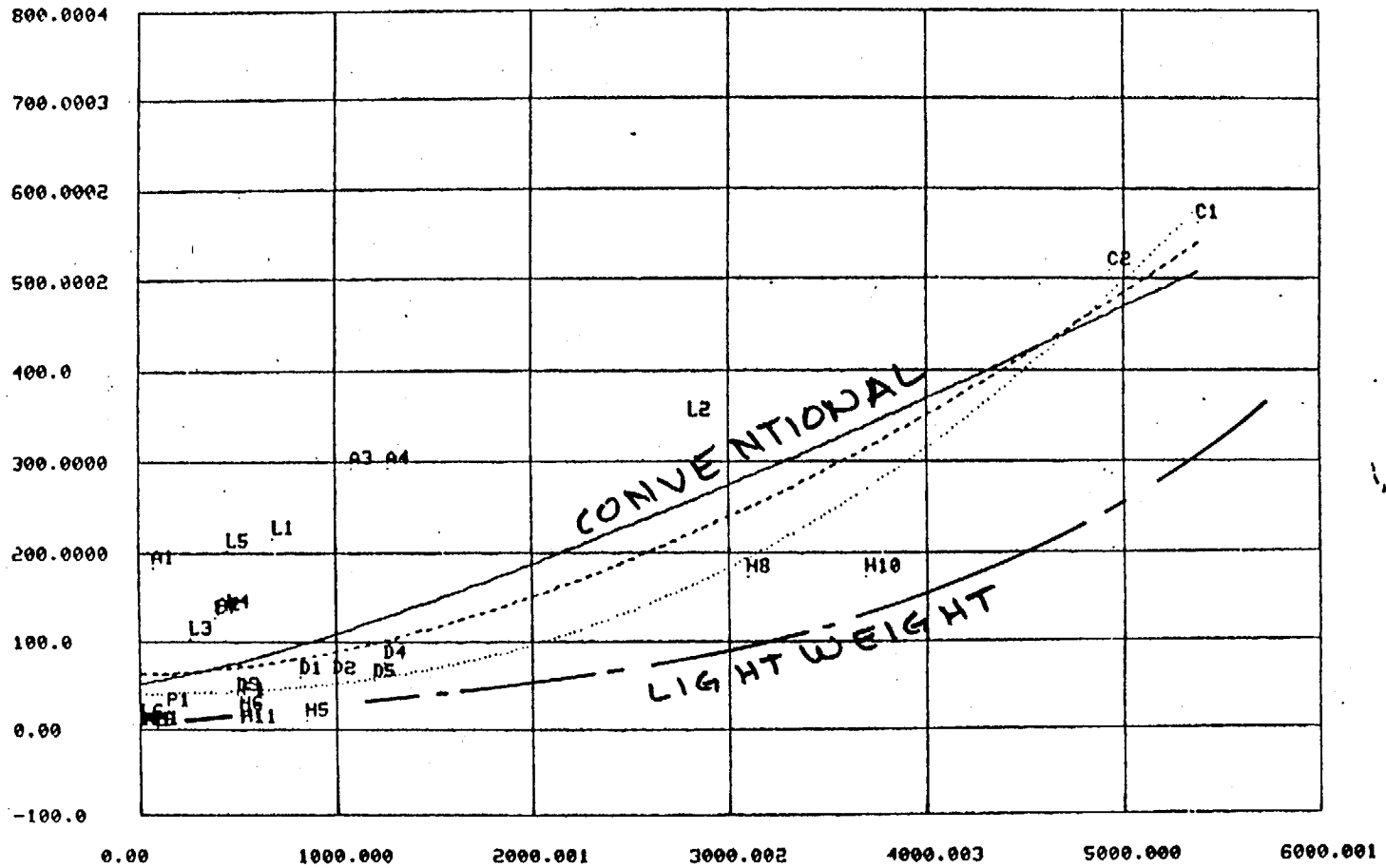




SWBS 581/2 ANCHOR HANDLING, MOORING & TOWING (BSCI 520)

— ALL DATA    - - - - - 2 S.ERROR    ..... 1 S.ERROR

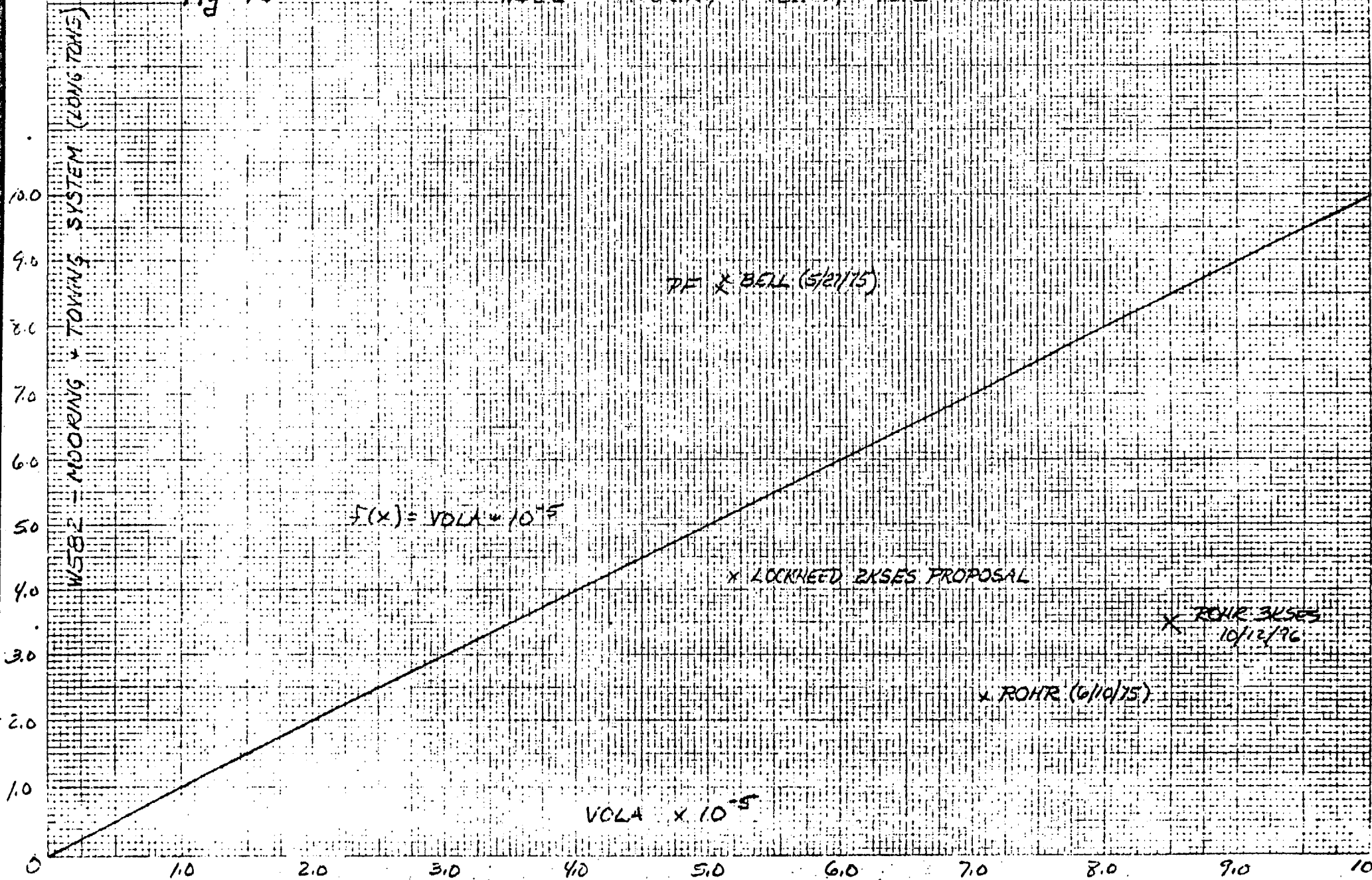
ANCHOR HANDLING, MOORING & TOWING (L TONS)

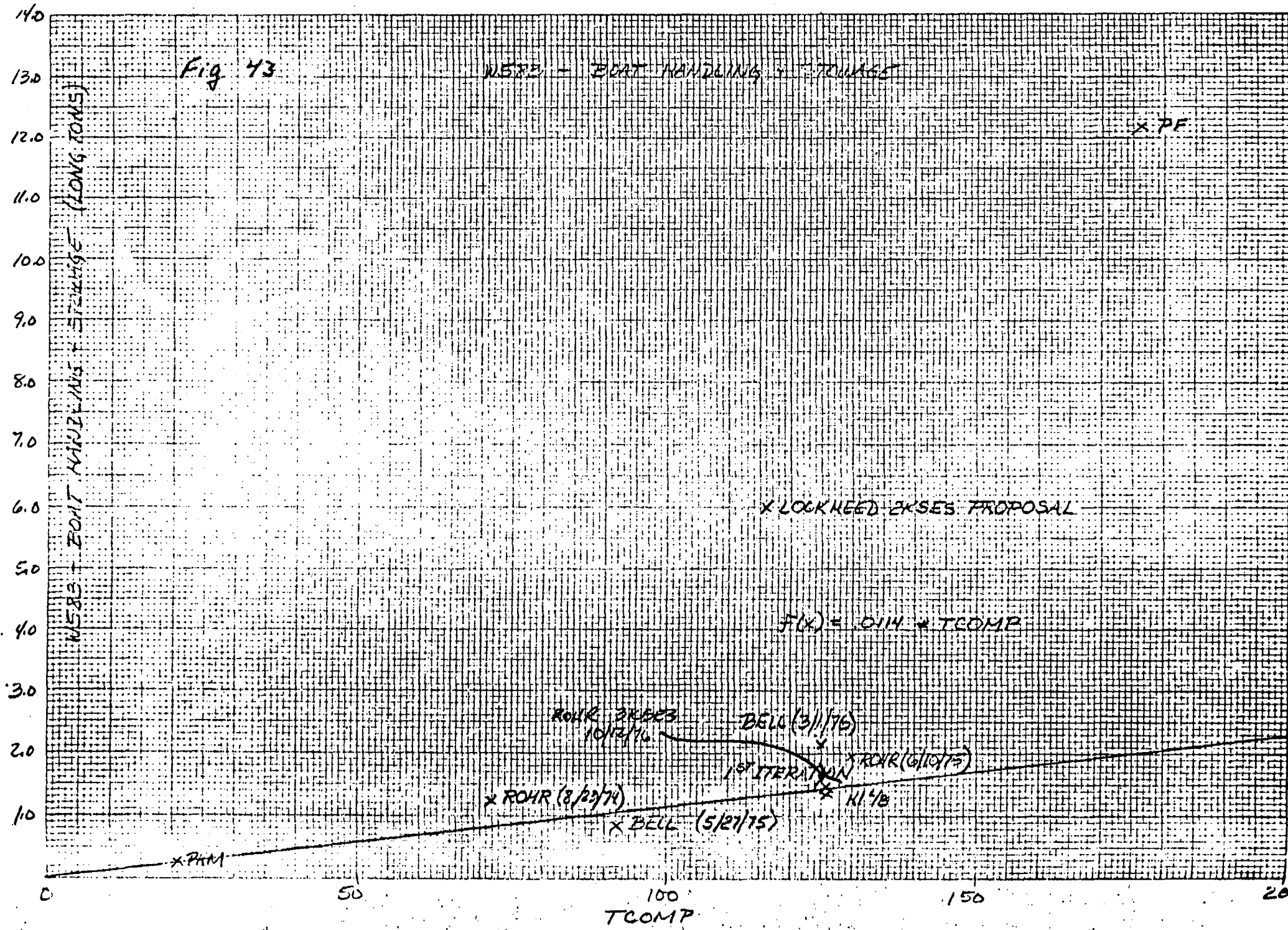


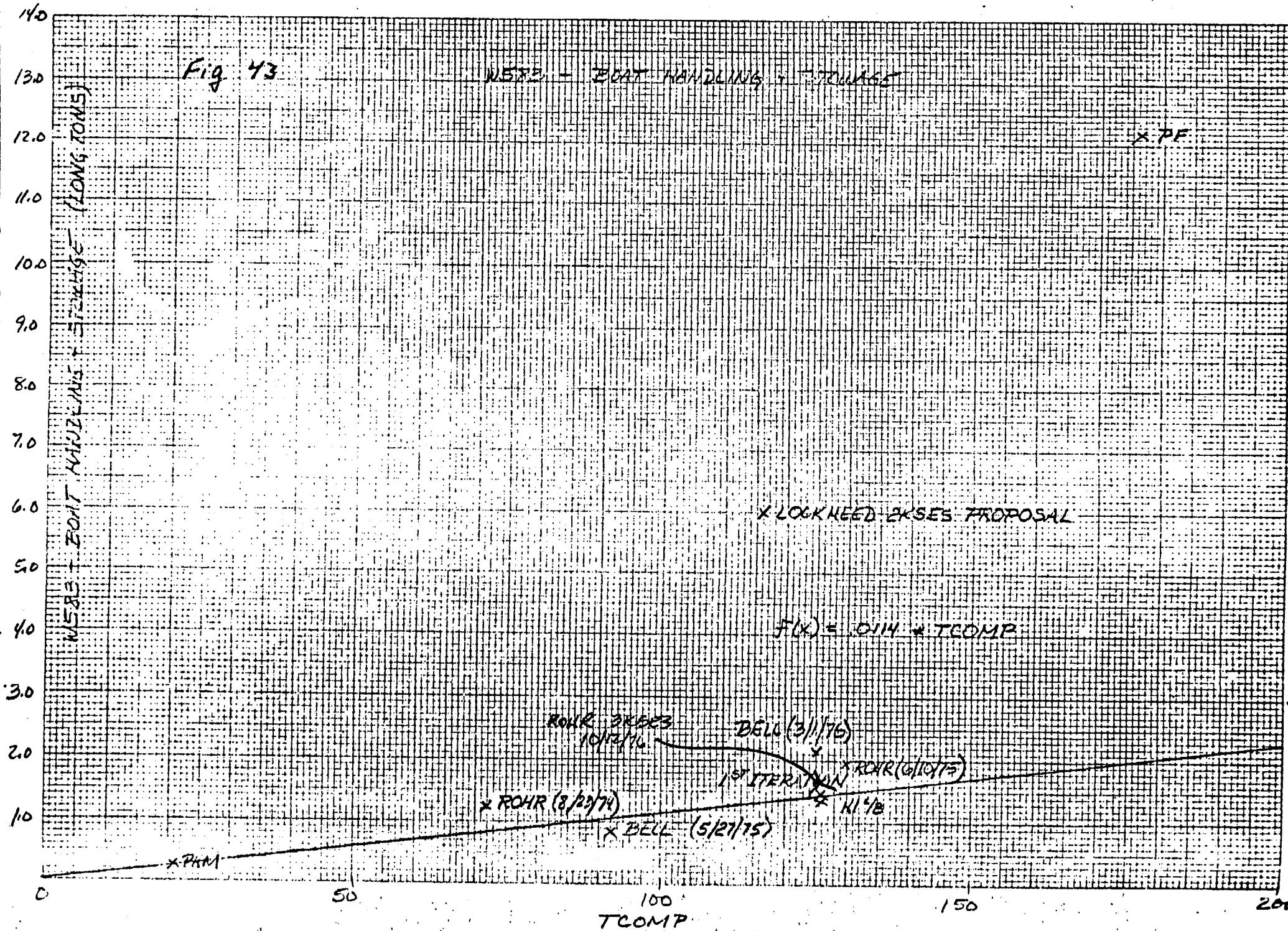
TOTAL VOLUME

Fig 42

WSB2 - MOORING & TOWING SYSTEM





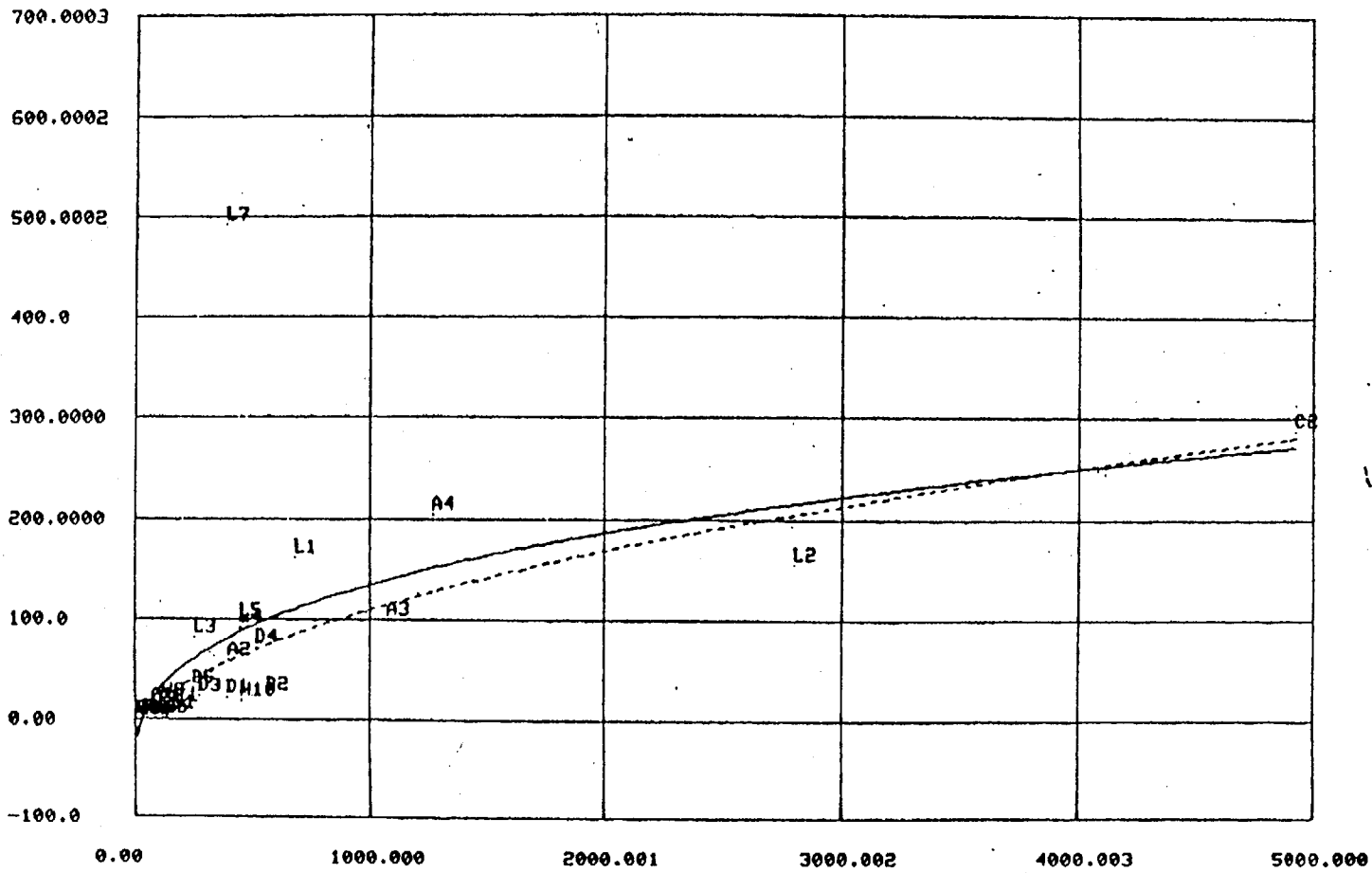




PAUSE 'PRESS <RETURN> TO CONTINUE'  
 SWBS 583 BOATS, BOAT HANDLING AND STOWAGE (BSCI 601)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

B  
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S  
)



TOTAL ACCOMADATIONS

W593 US COMPLEMENT AS OF 10/31/83

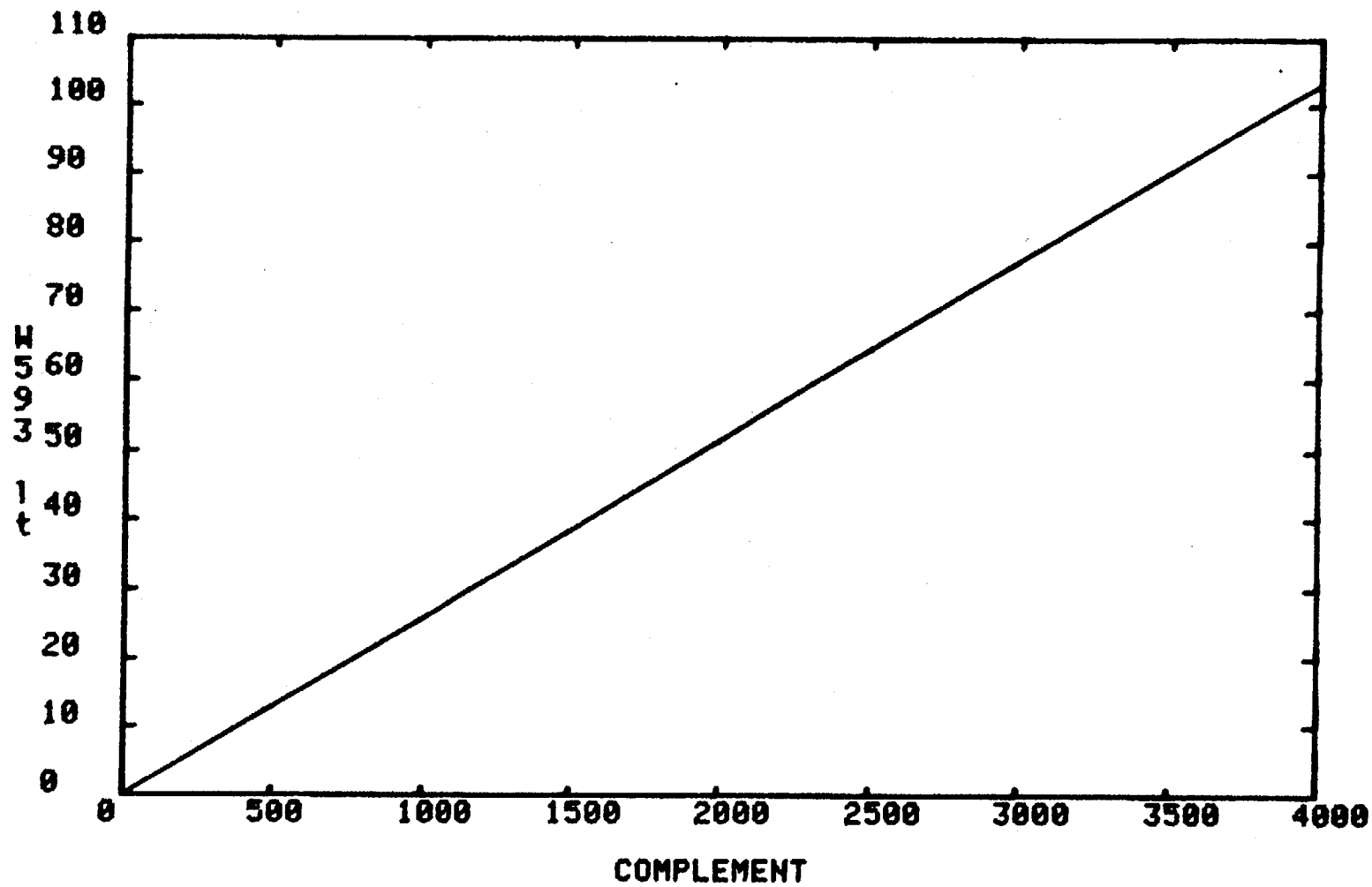
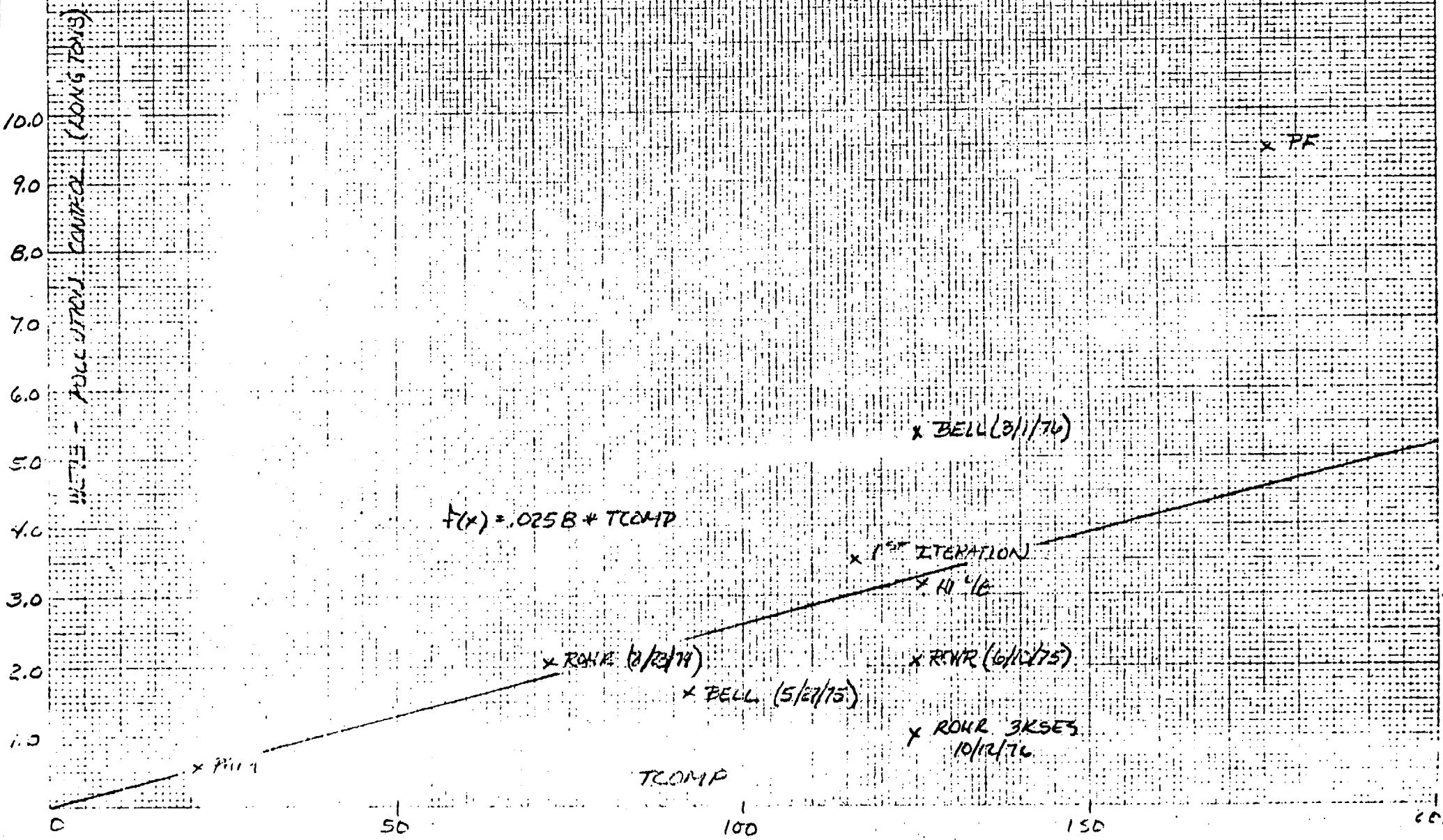


Fig 44

W593 - POLLUTION CONTROL



09/07/83

## Current Practice Regarding Grating & Joiner Bulkheads

### 1. Gratings

Current U. S. Navy practice for the use of gratings in machinery spaces has been to specify steel construction. Steel has also been chosen for the DDG 51 based on material compatibility with surrounding structure and required material toughness. Ship Work Breakdown Structure (SWBS) element number 622, Floor Plates and Grating lists a total of 43.29 long tons for the DDG 51 (May 1, 1983 weight report). Typical weight per square foot values for grating are from 3 to 8.45 with cost estimates running about \$4.95/ft<sup>2</sup>. This type of grating is specified by MIL-G-18014B and has a minimum design loading of 175 lbs. Glass reinforced plastic (GRP) is available in grating pattern and type similar to the steel grating; however, its maximum design load is approximately 80 lbs/ft<sup>2</sup>, which does not satisfy the minimum design load for MIL-G-18014B.

### 2. Joiner Bulkheads

During the last ten years, much effort has been spent to develop a light-weight joiner bulkhead system. Traditional U. S. Navy practice has been to use extruded steel or aluminum panels; however, the weight associated with this type of system was excessive, and a lighter weight aluminum honeycomb system was developed. These panels consisted of aluminum skins over an aluminum honeycomb core and were approximately .625 inches thick. The weight of the panels was 2.25 lbs/ft<sup>2</sup> using .05 inch high pressure laminate decorative finishes. The approximate cost was \$3.10/ft<sup>2</sup>. The aluminum honeycomb system is being replaced for the DDG 51 and CG 49 follow ships by a GRP-NOMEX system. These panels consist of GRP skins covering NOMEX (aramid fiber) honeycomb cores and are also .625 inches thick. The weight of the GRP-NOMEX panels is about half that of the aluminum honeycomb panels. Using .03 inch HPL, the panels weight in at 1.1 lbs/ft<sup>2</sup> with an approximate cost of \$8.00/ft<sup>2</sup>.

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
<b>GROUP 6 OUTFIT AND FURNISHINGS:</b>						
600	<b>OUTFIT AND FURNISHINGS, GENERAL</b>					
610	<b>SHIP FITTINGS</b>					
611	Hull Fittings	4			13	15
612	Rails, Stanchions, and Lifelines	6			14	16
613	Rigging and Canvas	1			3	4
620	<b>HULL COMPARTMENTATION</b>					
621	Non-Structural Bulkheads	70			119	140
622	Floor Plates and Gratings	46			46	
623	Ladders	14			46	78
624	Non-Structural Closures	12				
625	Airports, Fixed Portlights, and Windows	01			2	2
630	<b>PRESERVATIVES AND COVERINGS</b>					
631	Painting	75			127	138
632	Zinc Coating					
633	Cathodic Protection	3			3	7
634	Deck Covering	57			109	109
	Hull Insulation	279			171	205
636	Hull Damping	20			20	20
637	Sheathing					
638	Refrigerated Spaces	20			32	32
639	Radiation Shielding					
640	<b>LIVING SPACES</b>					
641	Officer Berthing and Messing Spaces	38			34	34
642	Noncomm. Officer Berthing & Missing Spaces	14				
643	Enlisted Personnel Berthing & Missing Spaces	154			176	176
644	Sanitary Spaces and Fixtures	30			15	15
645	Leisure and Community Spaces					
650	<b>SERVICE SPACES</b>					
651	Commissary Spaces	73			39	40
652	Medical Spaces	10			14	14
653	Dental Spaces	5				
654	Utility Spaces					
655	Laundry Spaces	13			19	19
656	Trash Disposal Spaces	4				

SES DES  
change  
9 Aug 83

530 group  
540

$$586 = 95.0$$

$$622 = .01149 * VOLA = 0.01149 * VOLA$$

where  $K622 = .01149$

$$637 = 0.0, \therefore K637 = 0.0$$

511 use conventional

$$512 \quad K512 = 0.9$$

521 use conventional

528 DUM 3 not DUM 1  
529 DUM 3 not DUM 1

531, 532, 533 use conventional

541 use conventional

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		SES			MH	SWATH
	QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
660	WORKING SPACES	148			164	172
661	Offices	15			39	39
662	Machinery Control Centers Furnishings	1				
663	Electronics Control Centers Furnishings	10				
664	Damage Control Stations	12				
665	Workshops, Labs, Test Areas	110			125	133
670	STOWAGE SPACES	163			187	206
671	Lockers and Special Stowage	41				
672	Storerooms and Issue Rooms	122			187	206
673	Cargo Stowage					
690	SPECIAL PURPOSE SYSTEMS	18			9	10
698	Outfit and Furnishings Operating Fluids	5			0	
699	Outfit and Furnish. Repair Parts and Special Tools	13			8	10
	GROUP 600 TOTAL	1276				

Signature \_\_\_\_\_

REV 2 - 8/4/83

U.S.S. FY 83 CGV MONOHULL

OUTFIT AND FURNISHINGS --  
 GROUP 6

PAGE

DATE 5-31-82

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	SWATH CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO. <u>Hi Tech</u>				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
610	SHIP FITTINGS	30.58	59.70			35.25					67.48		
611	HULL FITTINGS	12.74	52.64			15.2			3.5		64.93		
612	RAILS, STANCHIONS, AND LIFELINES	14.47	65.31			16.25			5.9				
613	RIGGING AND CANVAS	3.37	62.33			3.8			0.9		2.55		
620	HULL COMPARTMENTATION	212.98	44.60			219.45			96.61		184.24		
621	NON-STRUCTURAL BULKHEADS	119.13	58.60			139.5			68.41		90.27		
622	FLOOR PLATES AND GRATINGS	45.85	25.39						3.26		79.76		
623	LADDERS	46.03	25.39			77.6			13.35				
624	NON-STRUCTURAL CLOSURES								11.47		14.70		
625	AIRPORTS, FIXED PORTLIGHTS, AND WINDOWS	1.97	94.06			2.35			0.12				
630	PRESERVATIVES AND COVERINGS	517.90	43.97			612.79			471.65		365.6		
631	PAINTING	127 127 88.92	44.47			138.85			73.15		119.68		
632	ZINC COATING												
633	CATHODIC PROTECTION	3.10	19.12			7							
634	DECK COVERING	108.91	52.64			109 130			55.83		126.27		
635	HULL INSULATION	176 38 264.73	46.36			209 284.7			265.44		119.65		151.72
636	HULL DAMPING	20.00	12.00			20			20.00				
637	SHEATHING								40.88				
638	REFRIGERATED SPACES	32.24	24.33			32.24			216.35				
639	RADIATION SHIELDING								ALL 516				
640	LIVING SPACES	225.52	53.72			225.5			190.92		135.40		156.91
641	OFFICER BERTHING AND MESSING SPACES	34.10	68.50			34.1			31.76		135.40		
642	NONCOM. OFFICER BERTHING AND MESSING SPACES								10.56				
643	ENLISTED PERSONNEL BERTHING AND MESSING SPACES	176.10	51.15			176.1			124.43				
644	SANITARY SPACES AND FIXTURES	15.32	50.40			15.3			24.17				
645	LEISURE AND COMMUNITY SPACES												
Sub Total Group 6 - Sheet 1, POUNDS													
TONS						1093							

COMPUTING BY

COMPUTING CHECKED



ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 OUTFIT AND FURNISHINGS — GROUP 6, Sheet 2 of 2  
 NAVSEA 9096/3 (7-82) (Previously NAVSHIPS 9291/14)

U.S.S. FY83 CGV MONOHULL

OUTFIT AND FURNISHINGS —  
 GROUP 6

PAGE

DATE 5-31-82

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY									
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.			REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	ST'BD	MOMENTS
650	SERVICE SPACES	72.37	41.92		72.4		62.01		79.13			
651	COMMISSARY SPACES	39.49	44.44		39.5		36.51		38.91			
652	MEDICAL SPACES	14.36	37.50		14.4		7.71		14.22			
653	DENTAL SPACES						4.11		26.00			
654	UTILITY SPACES											
655	LAUNDRY SPACES	18.52	39.98		18.5		10.29					
656	TRASH DISPOSAL SPACES						3.39					
660	WORKING SPACES	183.14	47.73		191.77		143.92		70.97			
661	OFFICES	39.37	58.60		39.4		14.94		21.58			
662	MACHINERY CONTROL CENTERS FURNISHINGS						0.67					
663	ELECTRONICS CONTROL CENTERS FURNISHINGS						9.68					
664	DAMAGE CONTROL STATIONS						11.86					
665	WORKSHOPS, LABS, TEST AREAS (INCL. PORTABLE TOOLS EQUIPMENT)	143.77 <i>175.712</i>	44.76		152.37 <i>(133)</i>		106.77		49.39		148.95	
670	STOWAGE SPACES	208.08	41.47		241.4		158.17		186.43			
671	LOCKERS AND SPECIAL STOWAGE						39.54		186.43			
672	STOREROOMS AND ISSUE ROOMS	208.08 <i>187</i>	41.47				118.63					
673	CARGO STOWAGE											
690	SPECIAL PURPOSE SYSTEMS	8.63	49.77		10.21		14.33		8.00			
698	OUTFIT AND FURNISHINGS OPERATING FLUIDS	0.41	51.89		0.41		3.10					
699	OUTFIT AND FURNISH. REPAIR PARTS AND SPECIAL TOOLS	8.22	49.66		9.8		11.23		8.00			
	Sub Total Group 6 — Sheet 2				515.78							
	Sub Total Group 6 — Sheet 1				1093							
	TOTAL — GROUP 6, POUNDS											
	TONS -	1459.22	45.95		1608.8		1137.63		1097.74			

COMPUTING BY

COMPUTING CHECKED

$$y = a + bx$$

611/12/25

LI  
check  
wet sources don't agree.

DDO8 check

622/623

check SESTECH<sup>CH</sup> wets

631

S1 (Vol)

152 US 120

tons

635

use middle curve.

638

refrig spaces check 1000

641-44

~~SEE~~ SES TELH is high  
& monohull is low.

665

normal is bad use

SESTECH

check NAEC John Christ.

Group 6 Components	Mass	SWATH	SES		0/9/82	
			Hi Tech	Conv		
611 Hull fittings	13	15	} (611/612/625) ✓ no lifebuoys		date	
612 Rails, stanchions, lifelines	15	16		65		
613 Rigging	3	4	0	3		
621/624 Non-struct Blk/bds	119	140	80	105	incl. bonnet norms, etc very small mac spaces; fiberglass gratings; lub. acc	
622/623 Ladders, floor plates, gratings	92	78	17	80		
625 Amps + windows	2	2	0			
631 Painting	89 <sup>+17</sup> fctn grp 1	139	73	120	interior pv frnt (not painted)	
633 Cathodic protection	3	7	3-4			
634 Deck covering	109 fctn vol	131	56	126	limited use of deck cov. low, manual	
635/637 Hull Encl/Structuring	265 <sup>71</sup> high	285 <sup>205</sup>	306	220	pv finished equiv.	
636 Hull damping	20	20	20			
638 Refug space	32	32	16	?	✓	
641 Office Living	34	34	} 194 ✓ 149 ✓ ✓			
642/643 Ent. "	176 <sup>225</sup>	176 <sup>225</sup>				
644 Sanitary	15	15				
651 Commensal	40	40	37	39		
652/653 Med/Dental	14	14	8	14		
654/655/656 Util/Laundry/Trash	19	19	18	26		
661/662/663 Office, Control Centers	39 fctn accom	39	25	35	light not office eqpt 8+	
665 Workshops	144 <sup>✓</sup> fctn all not assumes I level	152 <sup>✓</sup>	107	49 <sup>✓</sup>	✓ - optm.	
664/671/672 DC/Lockers/Stowroom	208 <sup>✓</sup> fctn (Vol, Acc) → 187	241 <sup>✓</sup> → 230	170	186	8+ same altum rule	
698 Op fluids	4	4	3			
699 Repair Parts	8	10	11			

	NAV	SESOES	
* 611/12/25	64.9	0.12	- 64.78
* 613	2.6	0.0	- 2.6
* 621/24	105.0	79.84	- 25.12
* 622/623	79.8	16.61	- 63.19
* 631	119.7	73.15	- 46.55
634	126.3	55.83	- 70.47
635/637	119.7	306.32	+ 186.62
641/43/44	135.4	180.36	+ 44.96
* 651	38.9	36.51	- 2.39
* 652	14.2	7.71	- 6.49
* 654/55/56	26.0	17.79	- 8.21
* 661/62/63	<del>21.6</del> 35.6	25.29	+ 3.69
665	49.4	106.77	+ 57.37
* 671/72/64	186.4	170.03	- 16.37

Σ

1089.9

1076.37

636

20.0

638

16.35

642

10.56

698

3.10

699

11.23

1151.14

1137.61

SWBS

611 Hull Fittings  
612 Rails, Stanchions, Lifelines  
613 Rigging and Canvas

621 Non-Structural Bulkheads  
622 Floor Plates and Gratings  
623 Ladders  
624 Non-Structural Enclosures  
625 Airports and Windows

631 Painting  
633 Cathodic Protection  
634 Deck Covering  
635 Hull Insulation  
637 Sheathing  
638 Refrigerated Spaces

641 Officers Living Spaces  
642 Non-Commissioned Officers  
643 Enlisted Personnel  
644 Sanitary Spaces and Fixtures

651 Commissary Spaces  
652 Medical Spaces  
654 Utility Spaces  
655 Laundry Spaces  
656 Trash Disposal Spaces

661 Offices  
662 Machinery Control Centers Furnishings  
663 Electronics Control Centers Furnishings  
664 Damage Control Stations  
665 Workshops, Labs, Test Areas

671 Lockers and Special Stowage  
672 Storerooms and Issue Rooms

698 Operating Fluids  
699 Repair Parts

TABLE 4 - GROUP 6

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
611 Hull Fittings	45	{ W611 = 4.42*DUM2 and DUM2 = .00001*XL1CE*B1T
612 Rails, Stanchion & Lifelines	46	W612 = 7.5*DUM2
613 Rigging & Canvas	47	W613 = 1.15*DUM2
621 Non-structural Bulkheads	48	{ W621 = 1.73*DUM3 and DUM3 = VOLA*.00001
622 Floor Plates & Gratings	49	W622 = .37+.073*DUM3
623 Ladders	50	W623 = .3+.33*DUM3
624 Non-structural Closures	51	W624 = .16+.286*DUM3
625 Air Ports & Windows	52	W625 = .12+.0000147*VOLSS
631 Painting	53	W631 = 1.85*DUM3
633 Cathodic Protection	54	W633 = 3.57*DUM2
634 Deck Covering	55	W634 = 1.412* DUM3
635 Hull Insulation	56	W635 = .000098*(VOLA-(2.*VOLSH)-VOLIB)
637 Sheathing	57	W637 = .0000151*(VOLA-(2.*VOLSH)-VOLIB)
638 Refrigerated Spaces	58	W638 = .0159*TCOMP
641 Officer Berthing & Messing	59	W641 = .375*TOFF
642 CPO Berthing & Messing	60	W642 = .192*TCPO

TABLE 4 - GROUP 6 (Continued)

<u>SWBS GROUP</u>	<u>FIG. NO.</u>	<u>WEIGHT EQUATION</u>
643 Enlisted Berthing & Messing	61	W643 = 14*TENL
644 Sanitary Spaces & Fixtures	62	W644 = .0235*TCOMP
651 Commissary Spaces	63	W651 = .0355*TCOMP
652 Medical Spaces	64	W652 = .0075*TCOMP
654 Utility Spaces	65	W654 = .004*TCOMP
655 Laundry Spaces	66	W655 = .01*TCOMP
656 Trash Disposal Spaces	67	W656 = .0033*TCOMP
661 Offices	68	W661 = .0355*TCOMP
662 Machinery Control Center Furn	69	W662 = .0016*TCOMP
663 Electronic Control Center Furn	70	W663 = .023*TCOMP
664 Damage Control Stations	71	W664 = .35+.051*TCOMP*VOLA*.000001
665 Workshops, Labs & Test Areas	72	W665 = .055*TCOMP*VOLA*.000001
671 Lockers & Special Stowage	73	W671 = .0285*TCOMP
672 Storerooms & Issue Rooms	74	W672 = .0028*DSTRS*TCOMP
698 Outfit & Furn Operating Fluids	-	W698 = .05*W650
699 Outfit & Furn Repair Parts	-	W699 = .01*(W610+W620+W630+W640+W650+W660+W670)

W611 VS DUM2 AS OF 10/31/83

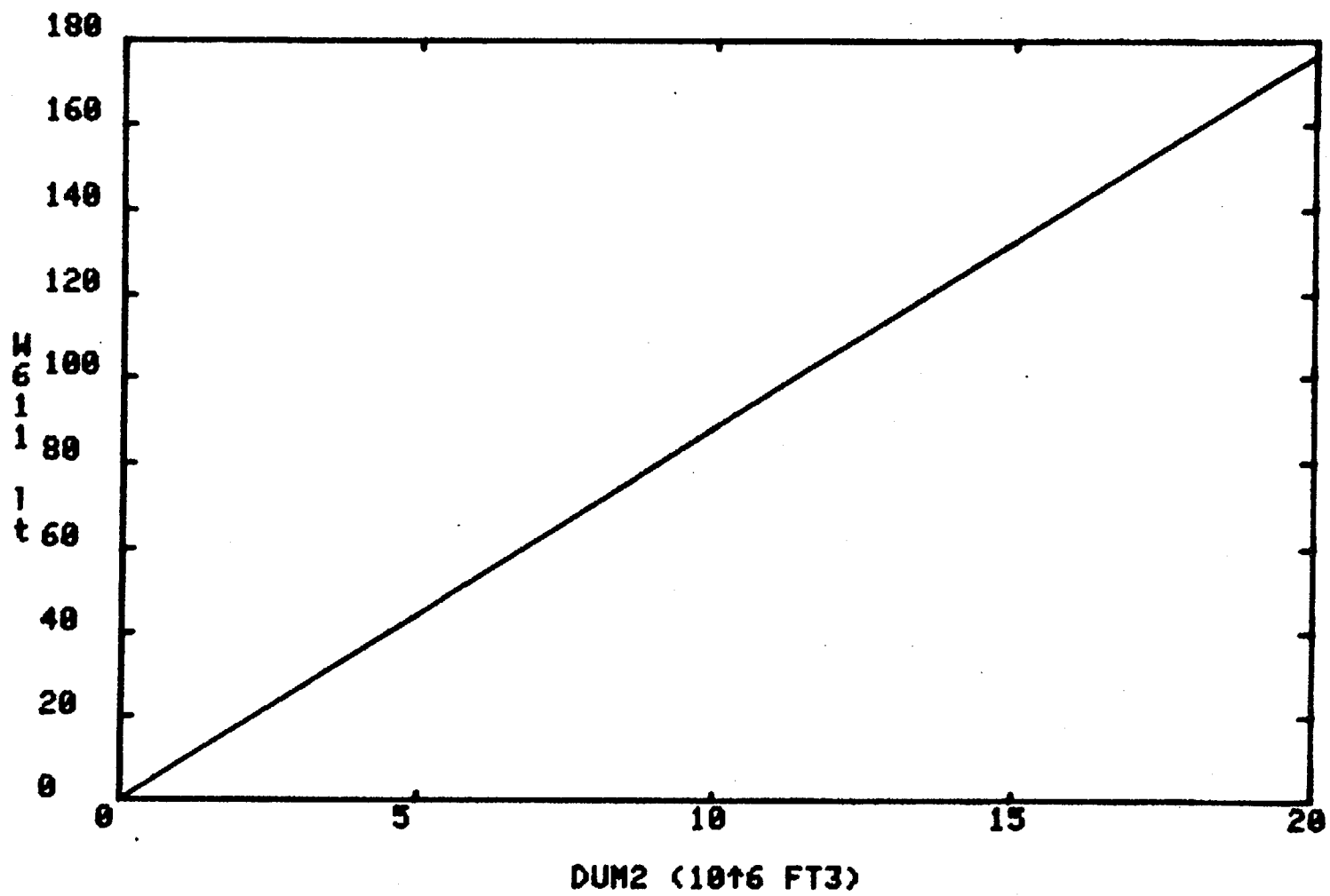




Fig 45

WGII - HULL FITTINGS

6.0  
5.0  
4.0  
3.0  
2.0  
1.0  
0

WGII - HULL FITTINGS (L.T.)  
(LONG TONG)

SES-100A

x x PHM

AGEH-1

FRONT 2KSES  
(6/10/75)

FRONT 2KSES  
(10/12/74)  
BELL 2KSES  
(5/27/75)

XLICE \* BIT \* 10<sup>-3</sup>

WGII = 442 \* XLICE \* BIT \* 10<sup>-3</sup>

W 1/8 \*

FE X

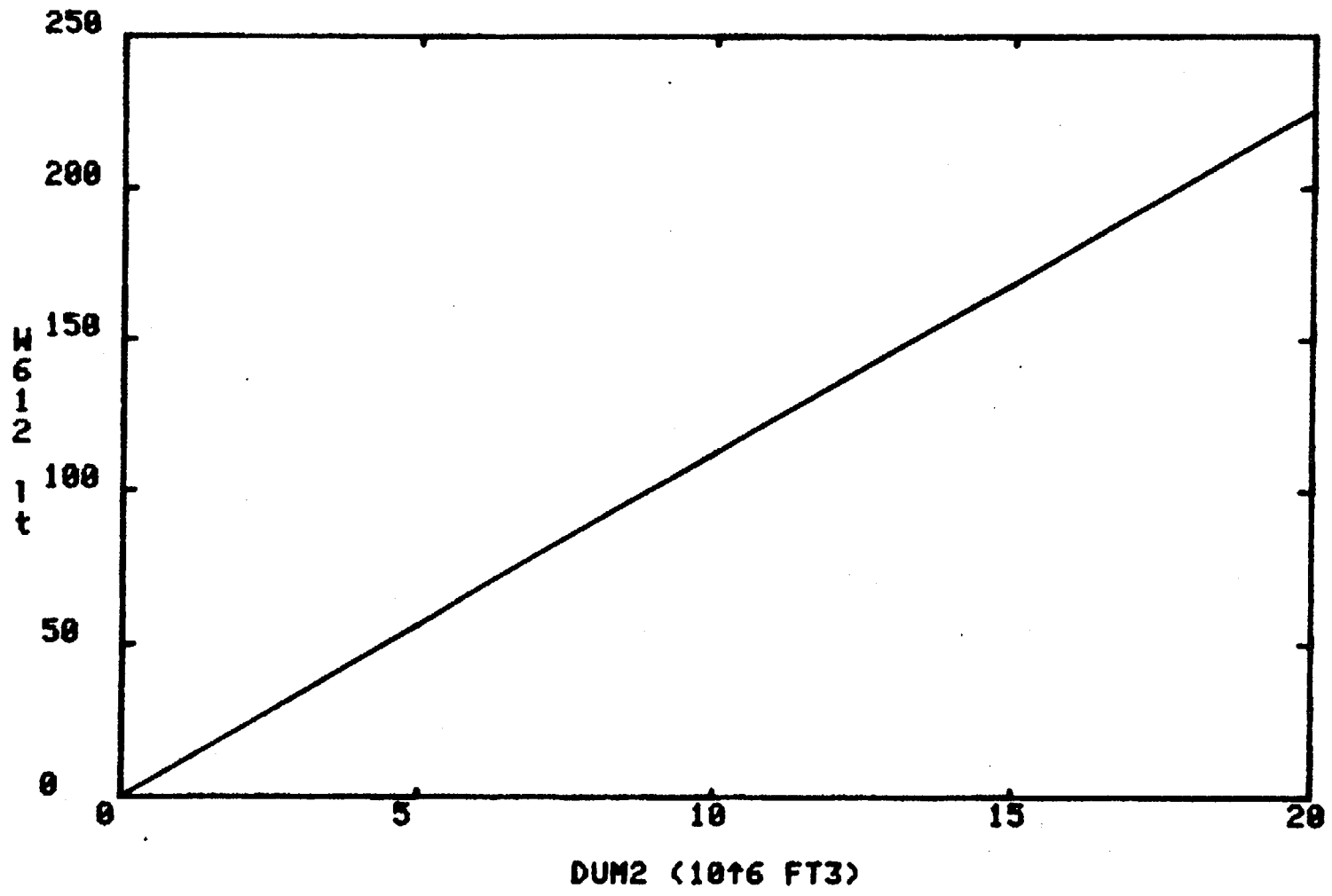
10

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30

40

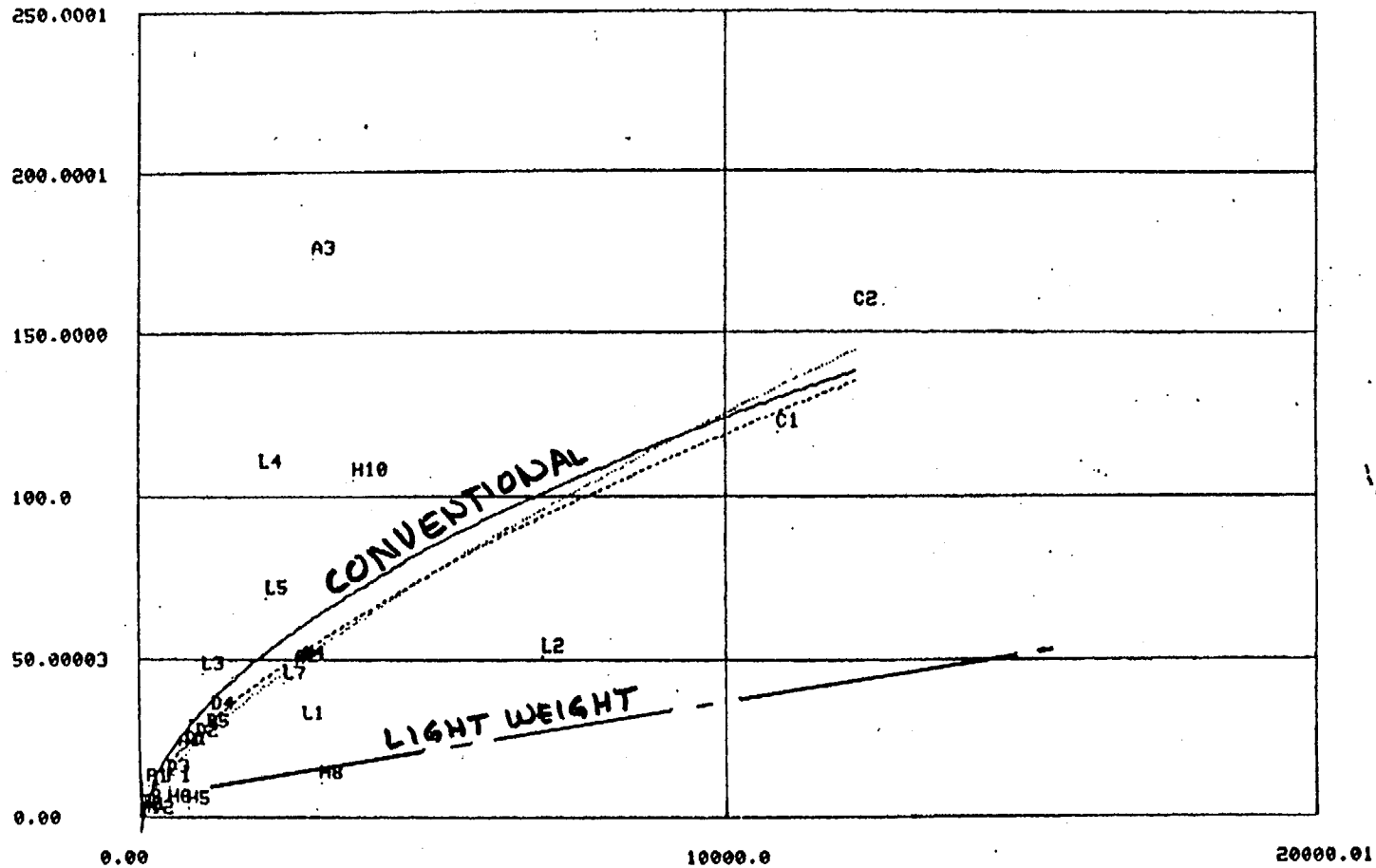
N612 US DUM2 AS OF 10/31/83



SJBS 611/12/25 HULL FITTINGS (BSCI 600)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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TOTAL VOLUME

*b*  
*X10*

Fig 46

WG12 - RAILS, STANCHIONS, LIFELINES

WG12 - RAILS, STANCHIONS, LIFELINES  
(LONG TONS)

6.0  
5.0  
4.0  
3.0  
2.0  
1.0  
0

X PC

X ROHR 3KSES  
10/10/76

WG12 = 75 \* XLICE \* BIT \* 10<sup>3</sup>

X BEL 2KSES (5/21/75)

X ROHR 2KSES (6/10/75)

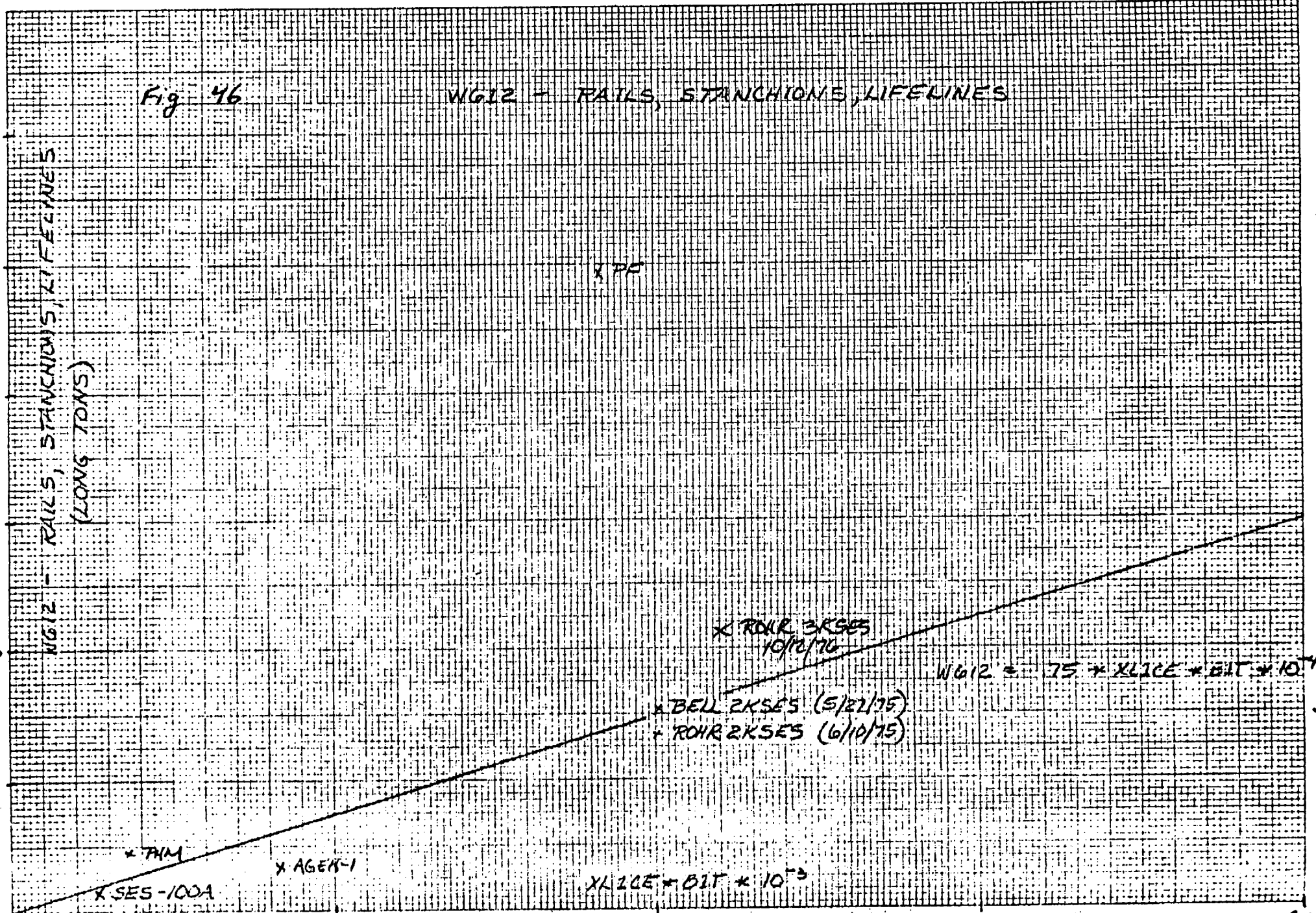
X THM

X AGER-1

X SES-100A

XLICE \* BIT \* 10<sup>3</sup>

0 10 20 30 40



H613 VS DUM2 AS OF 10/31/83

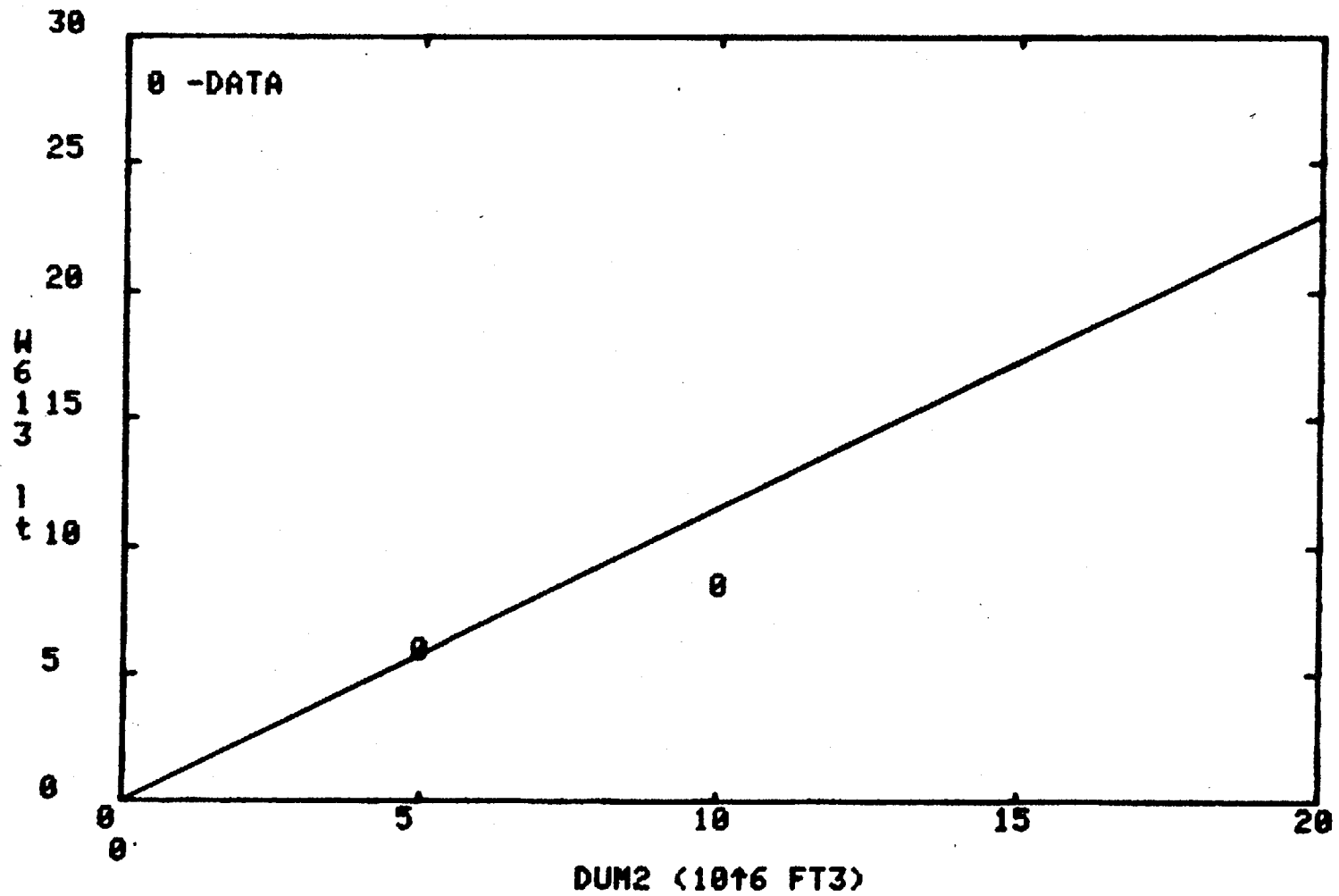
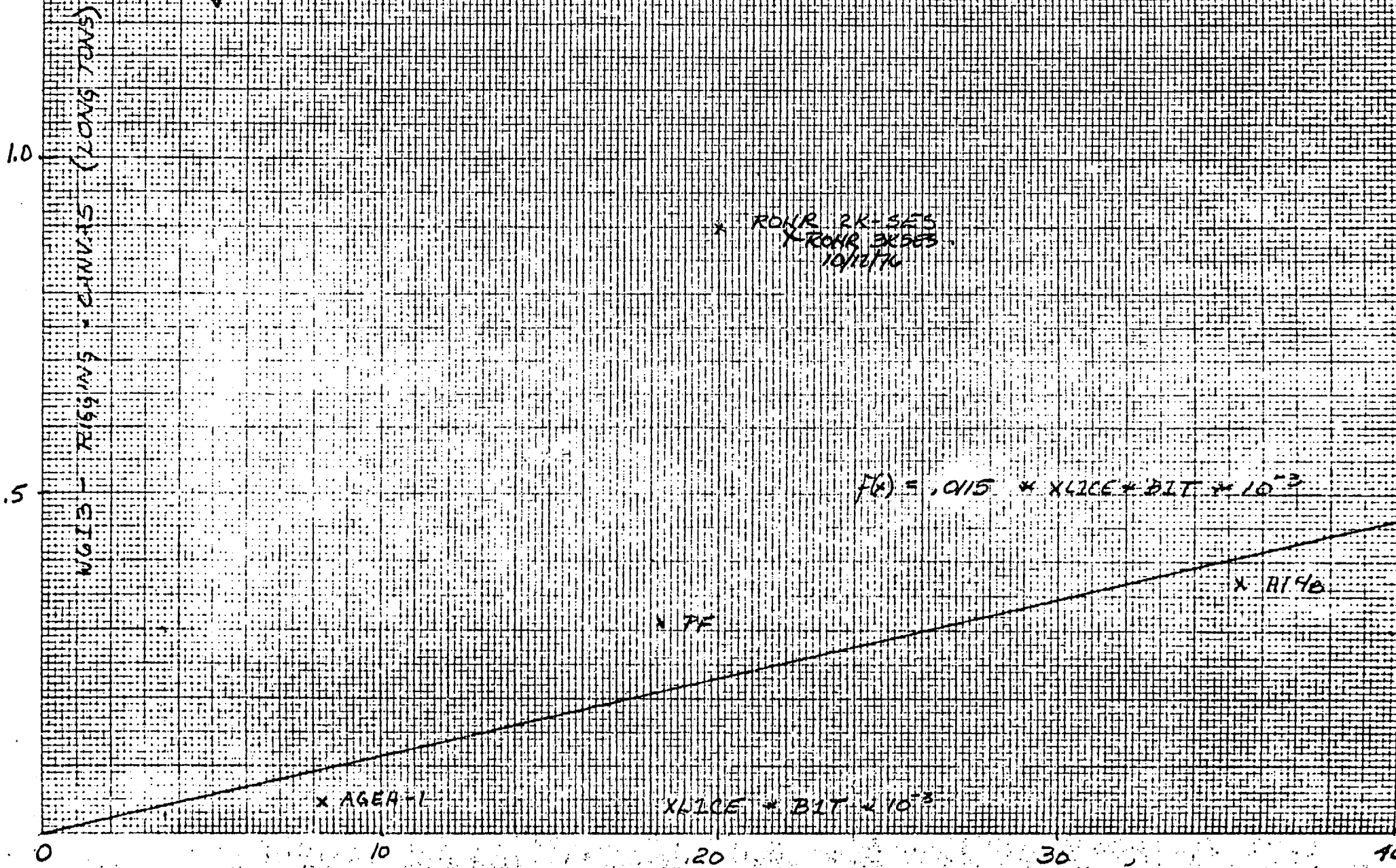


Fig 47

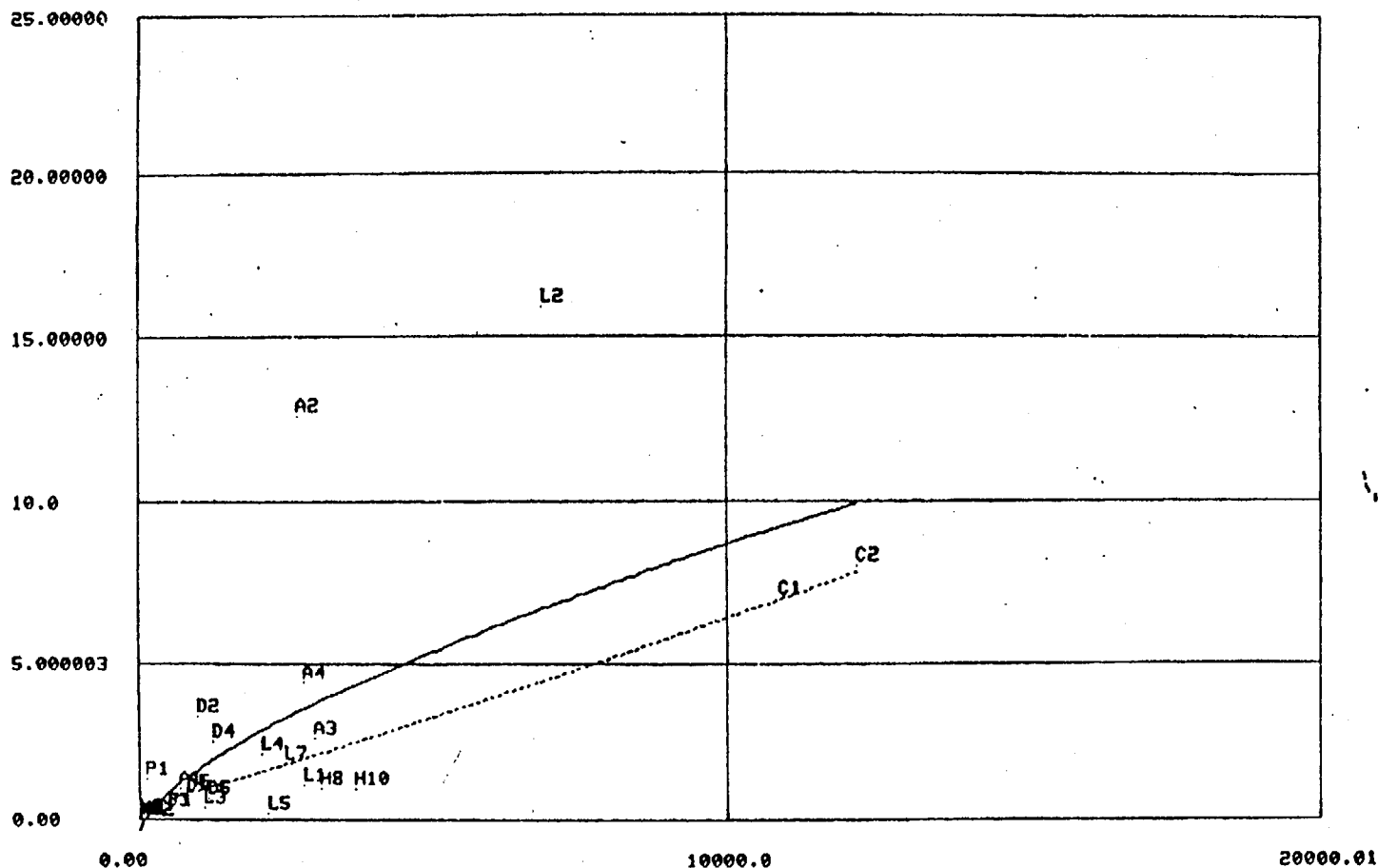
W013 - RIGGING & CANNAS



PAUSE 'PRESS (RETURN) TO CONTINUE'  
SUBS 613 RIGGING AND CANVAS (BSCI 602)

—— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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TOTAL VOLUME

H621 VS VOLA AS OF 10/31/83

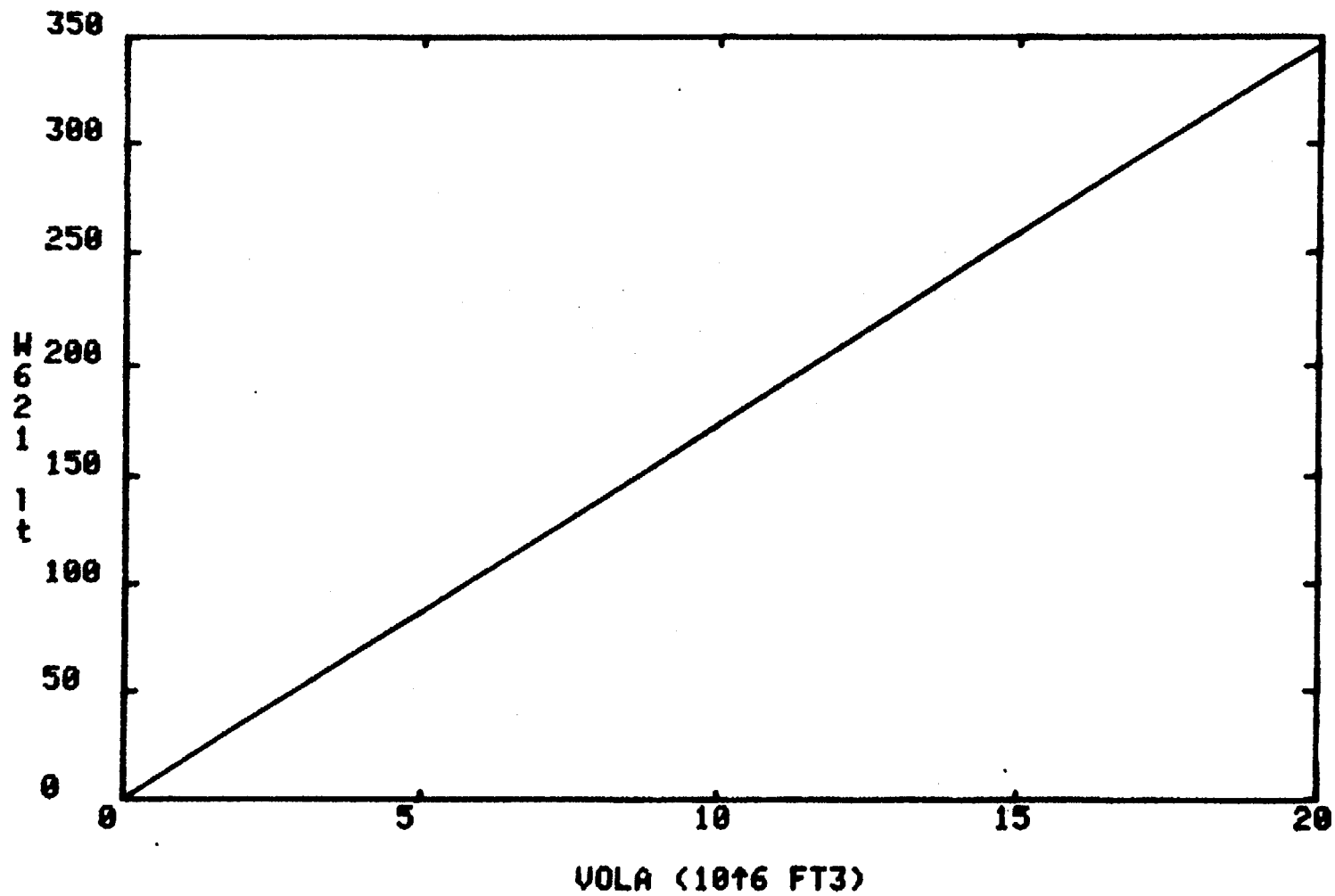
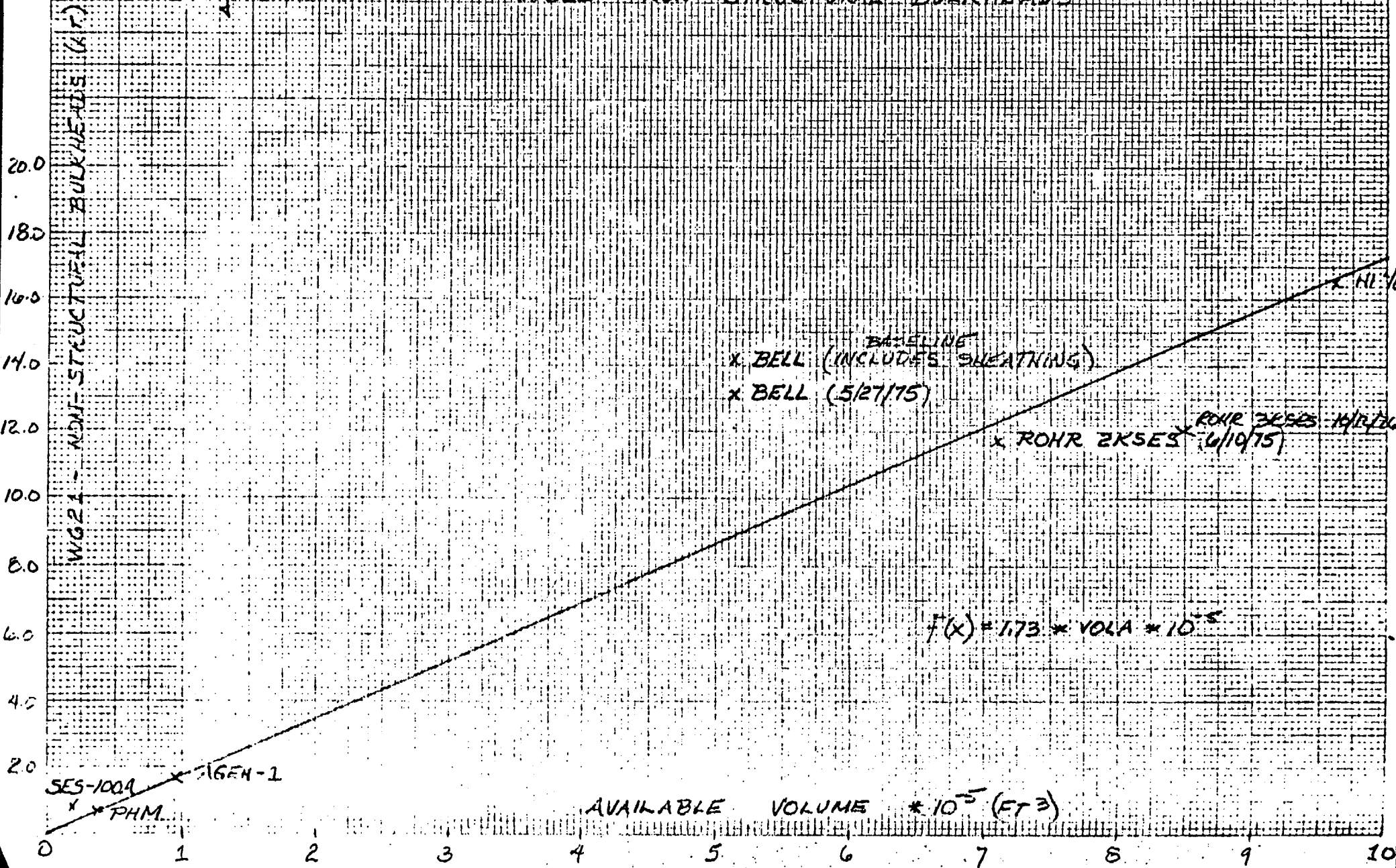




Fig 48

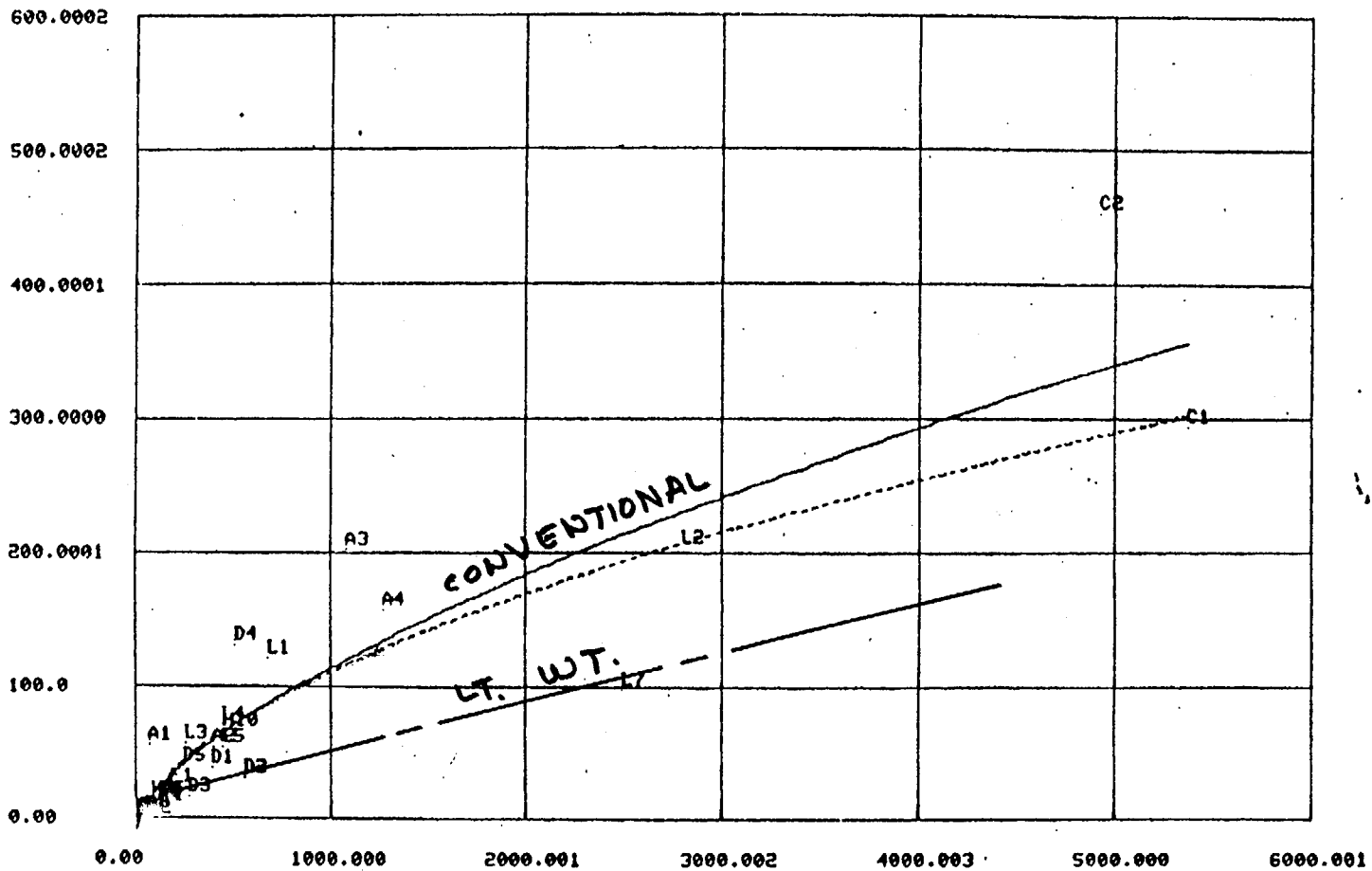
WG21 - NON-STRUCTURAL BULKHEADS



SUBS 621/24 NON-STRUC TURAL BULKHEADS AND CLOSURES (BSCI 604)

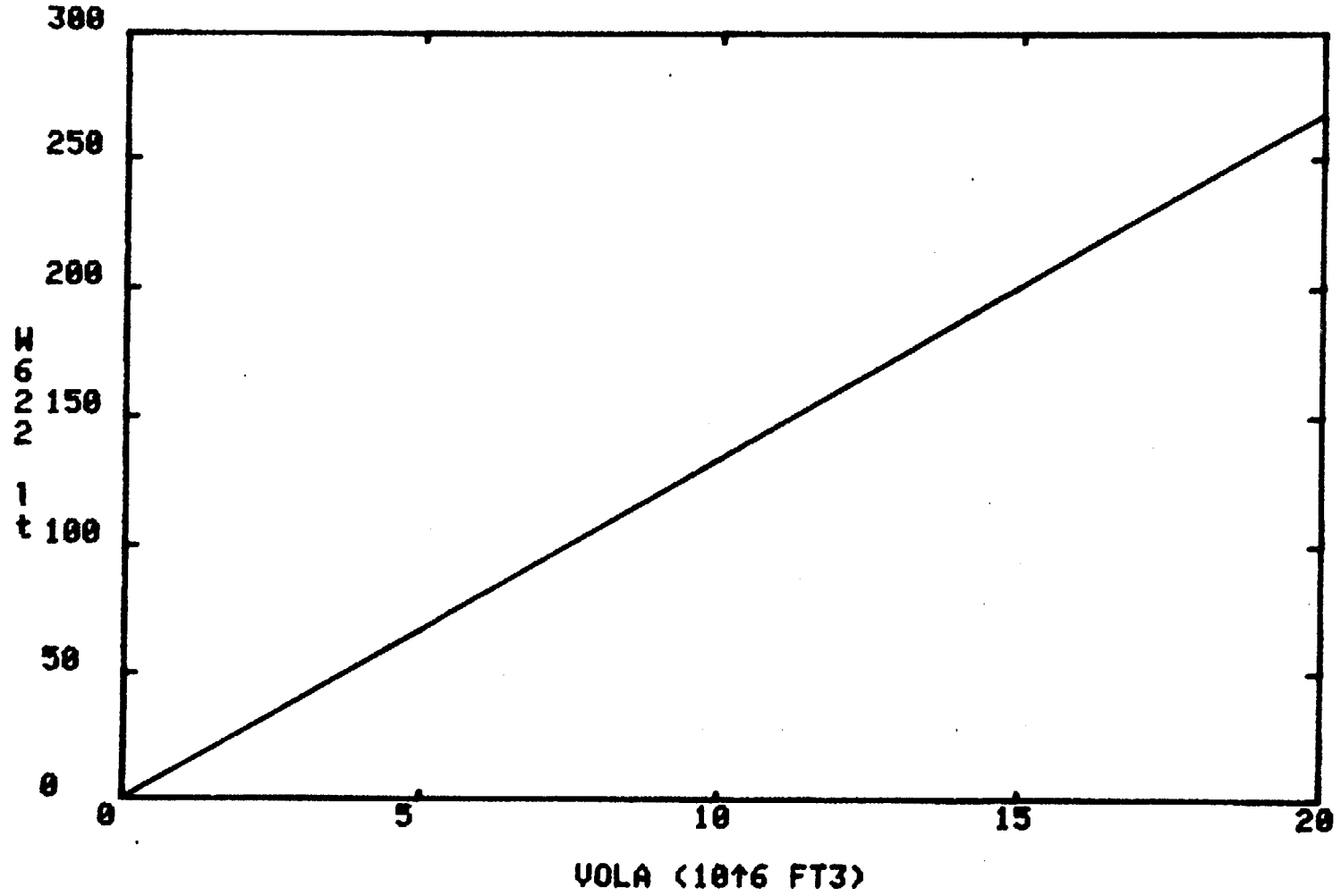
— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

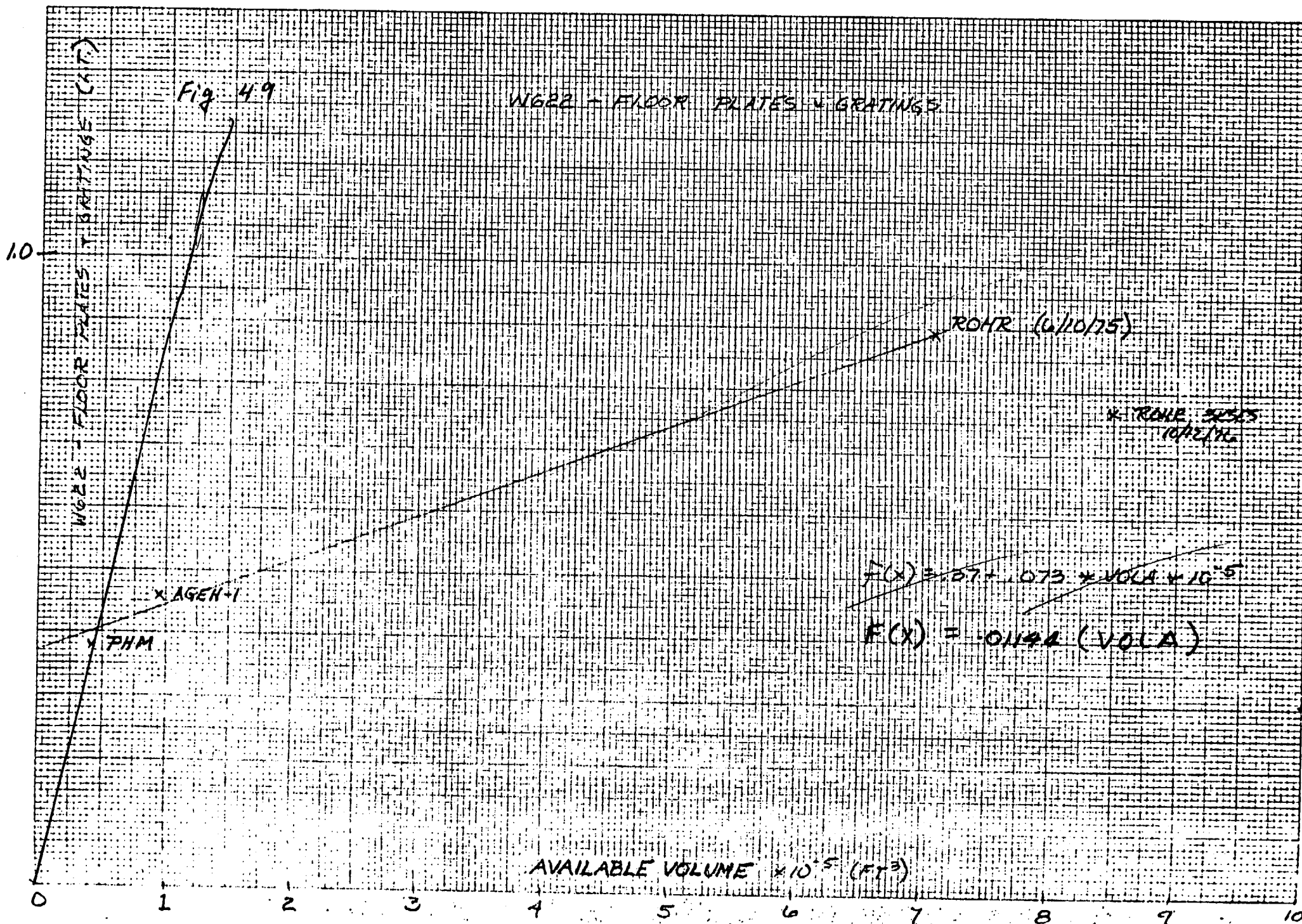
NON-STRUC TURAL BULKHEADS & CLOSURES (L.TONS)



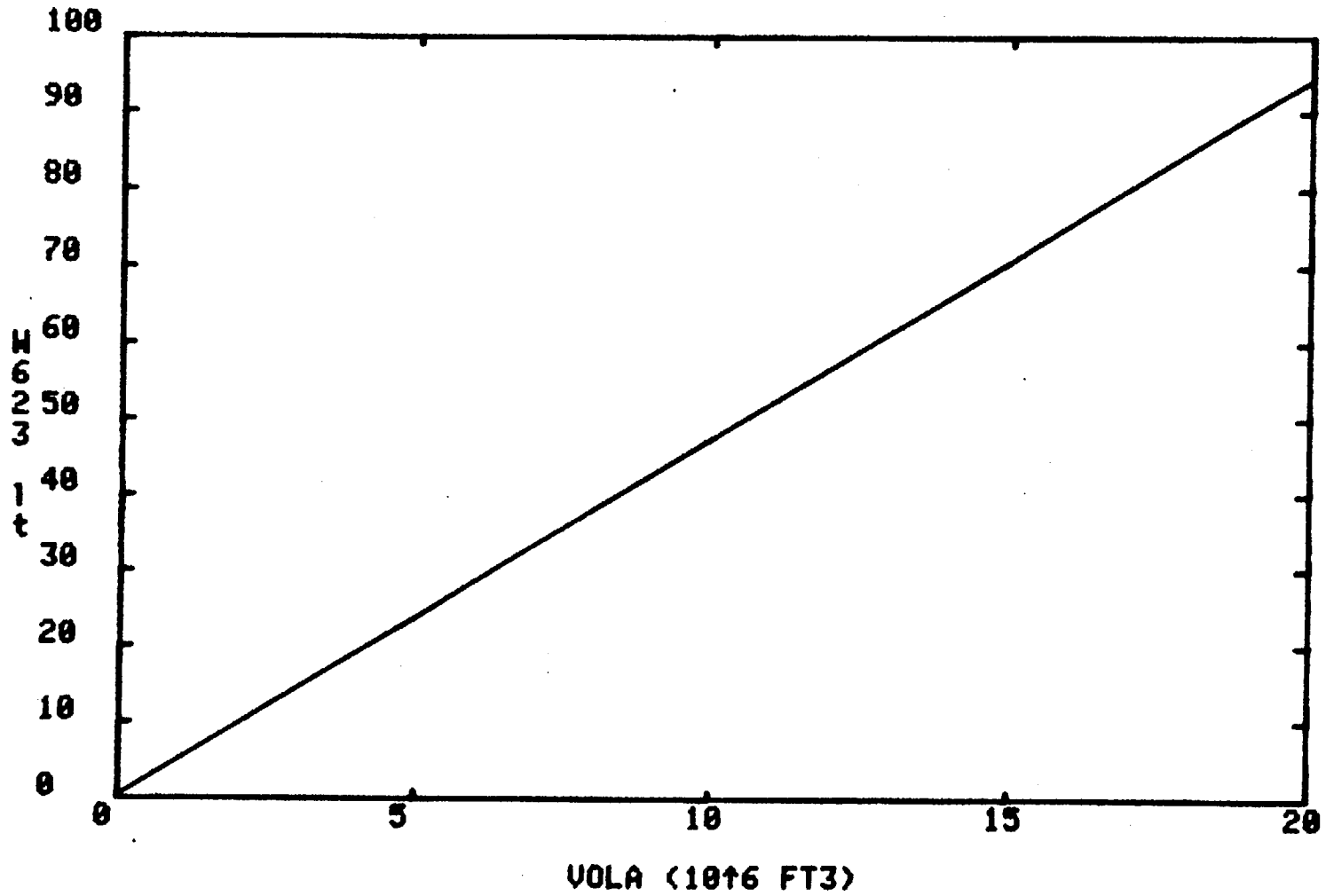
TOTAL ACCOMADATIONS

W622 VS VOLA AS OF 10/31/83





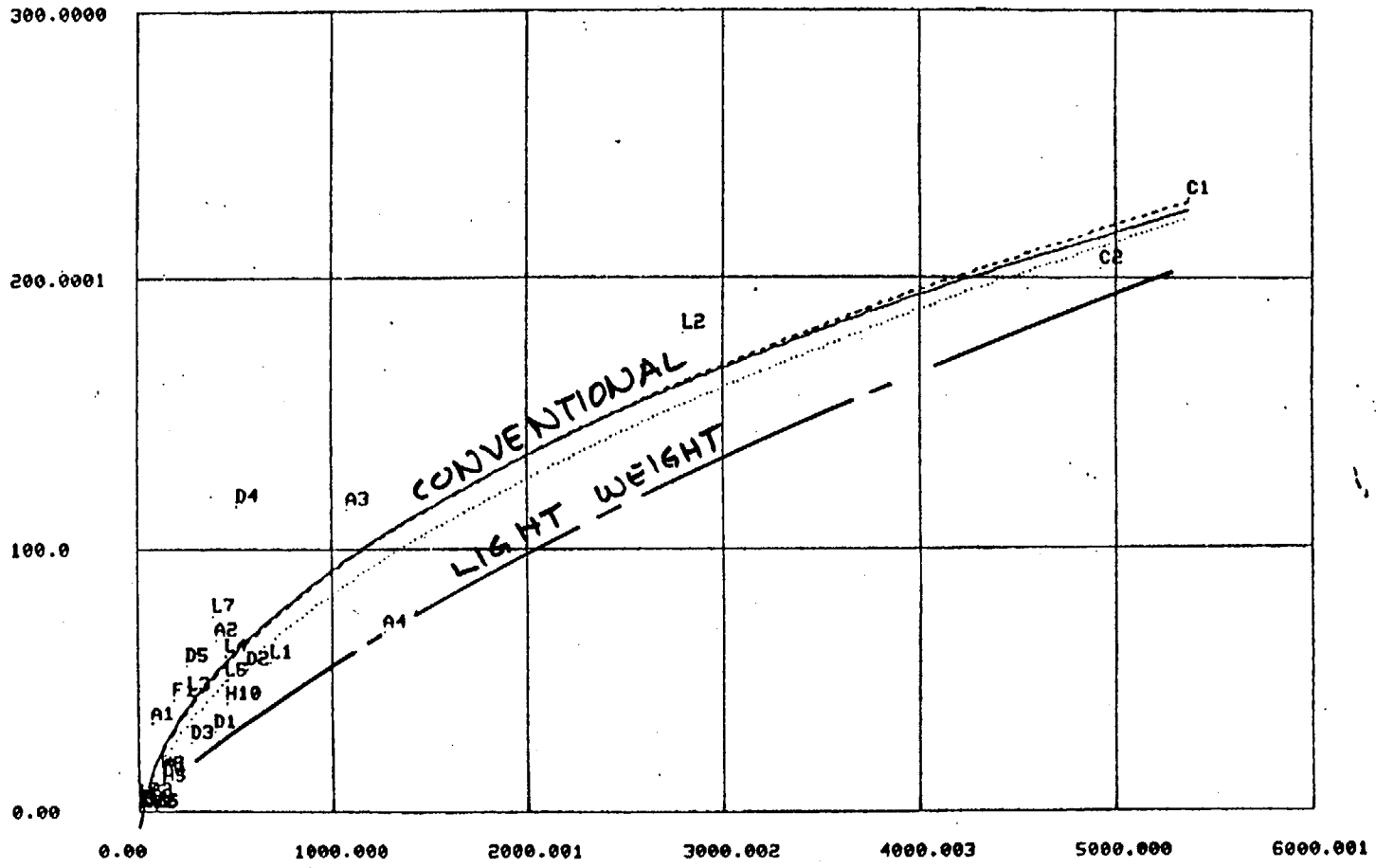
M623 VS VOLA AS OF 10/31/83



SUBS 622/23 FLOOR PLATES, GRATINGS AND LADDERS (BSCI 603)

— ALL DATA    - - - - 2 S.ERROR    ····· 1 S.ERROR

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TOTAL ACCOMADATIONS

Fig 50

WGB3 - LADDERS

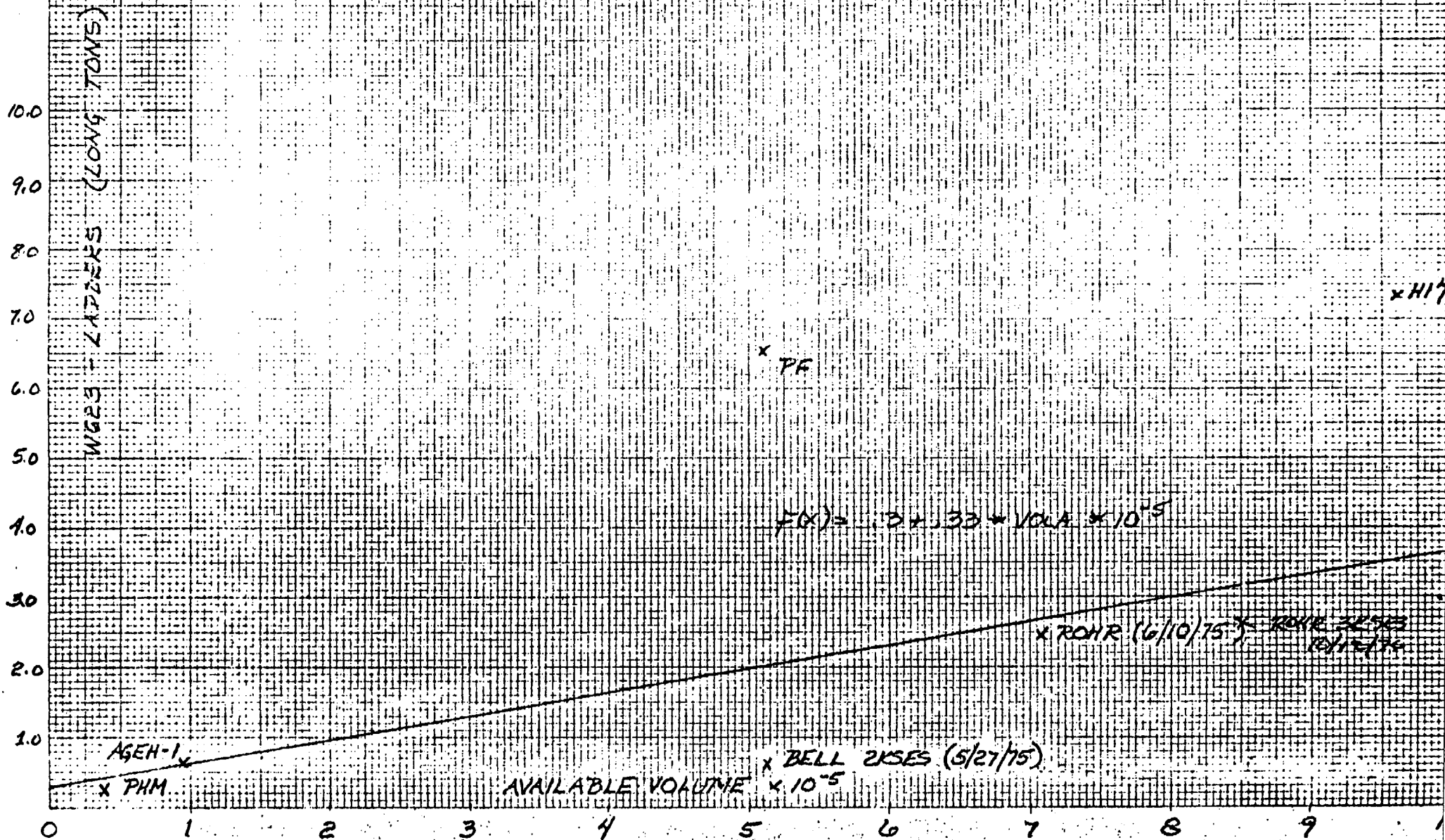


Fig 51

WGBH - NON-STRUCTURAL ENCLOSURES

ROHR  
(6/10/75) x

x TANK RESES  
10/17/76

x H<sup>2</sup>

x BELL (5/27/75)

$$F(x) = .16 + .286 * VOLA * 10^{-5}$$

WGBH - NON-STRUCTURAL BULKHEADS  
(LONG TONS)

PHM  
x

x AGEH-1

AVAILABLE VOLUME  $\times 10^{-5}$

2.0

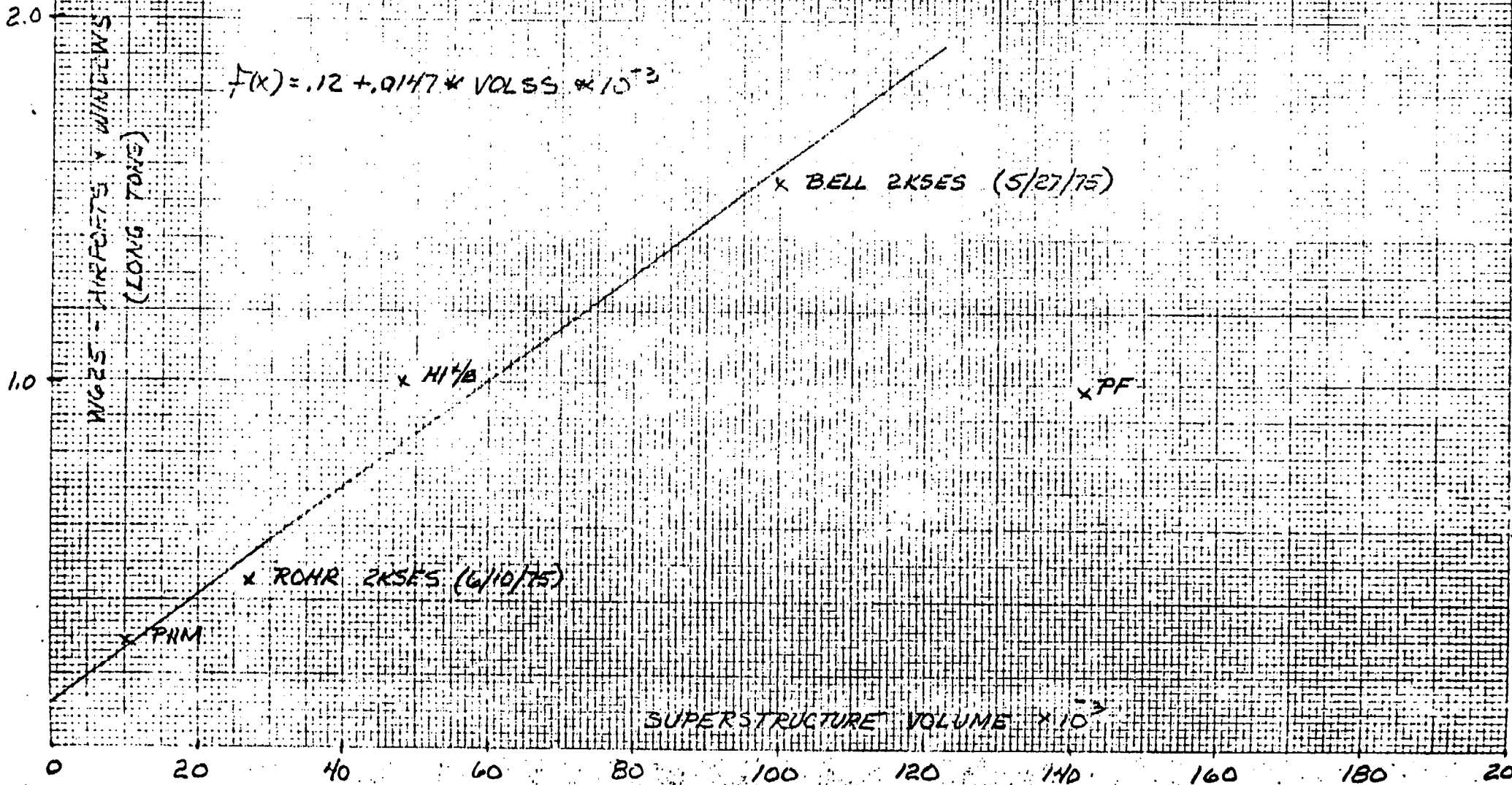
1.0

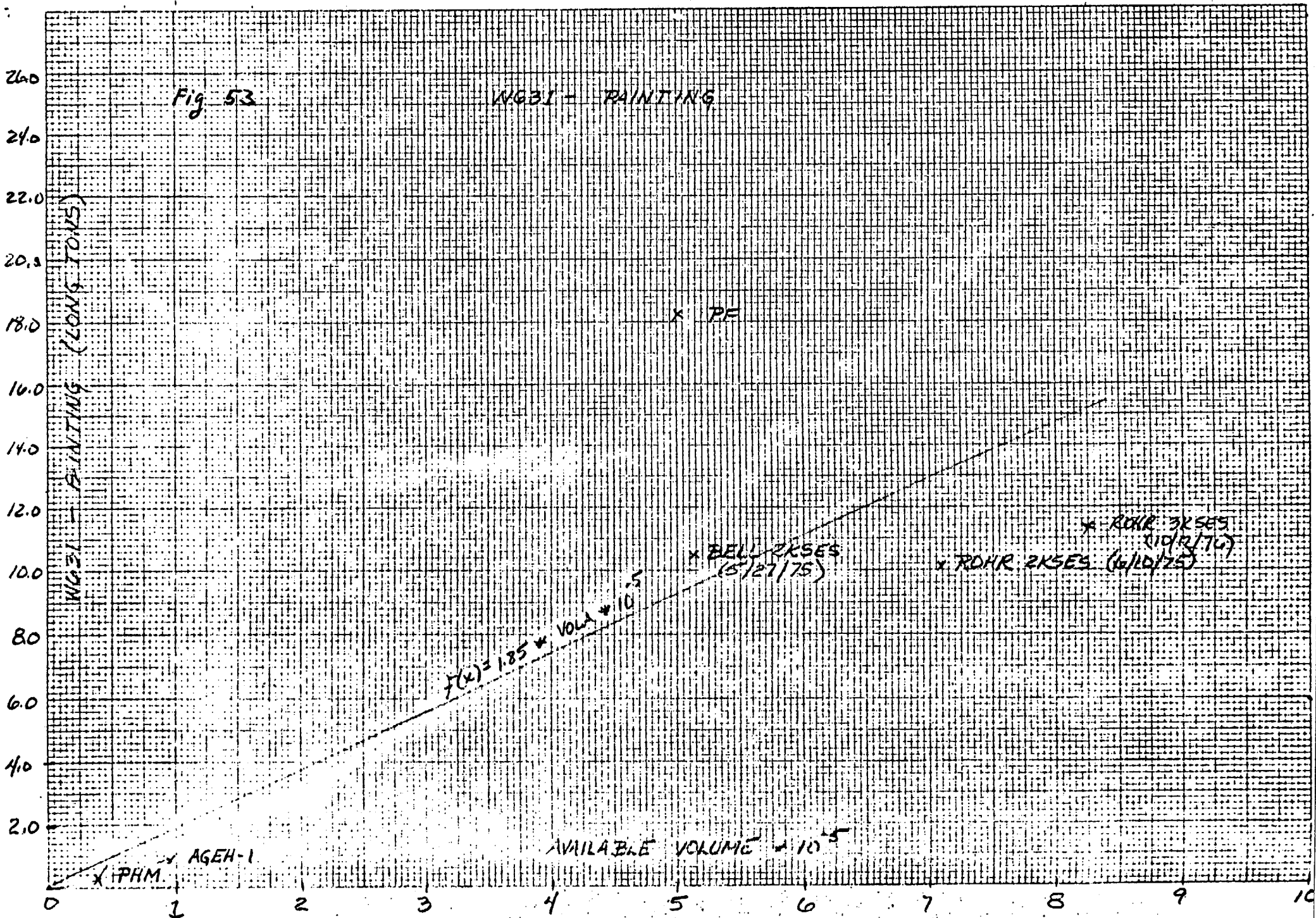
0 1 2 3 4 5 6 7 8 9



Fig 52

WIGES - AIRPORTS + WINDOWS

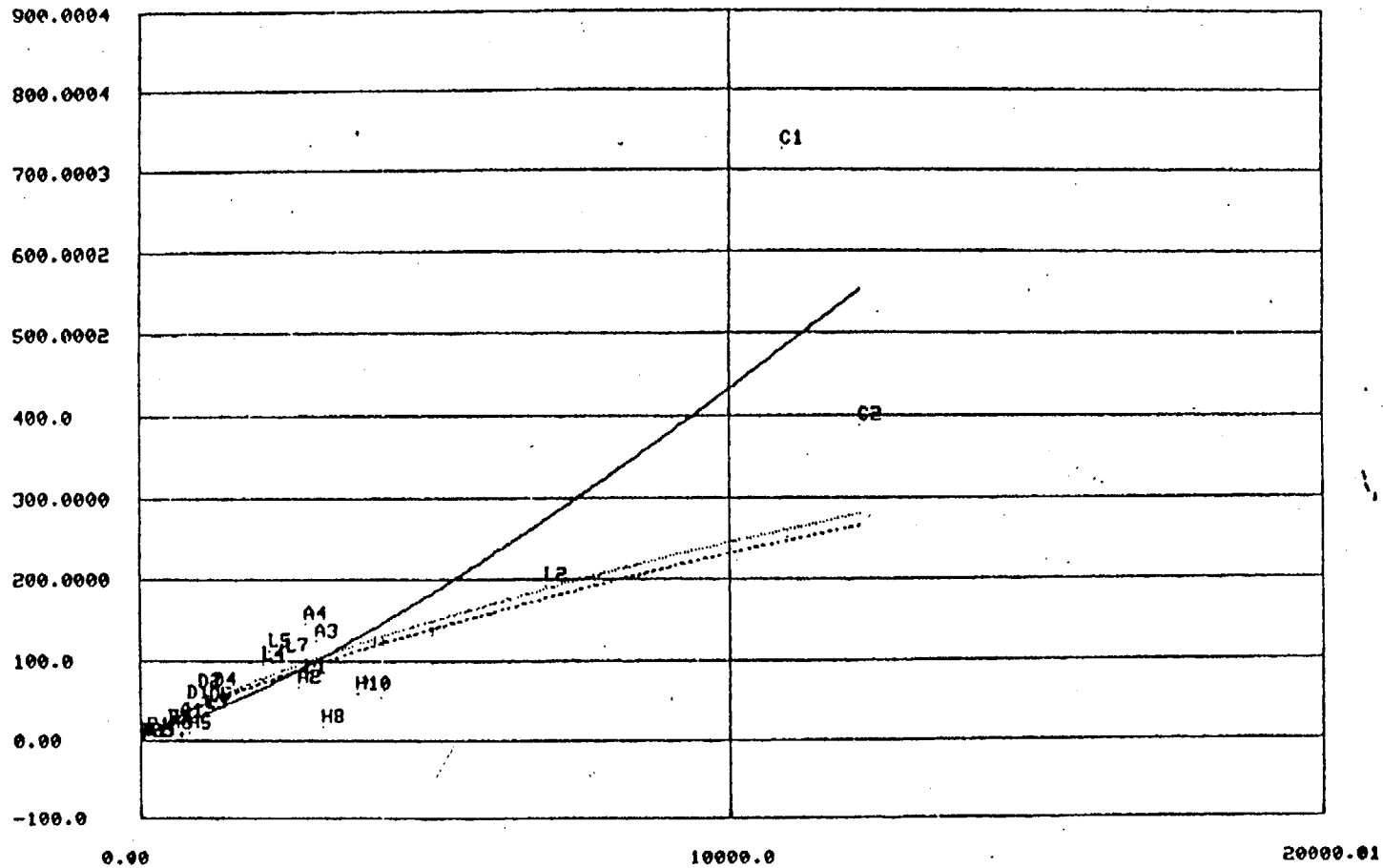




SWBS 631 PAINTING (BSCI 605)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

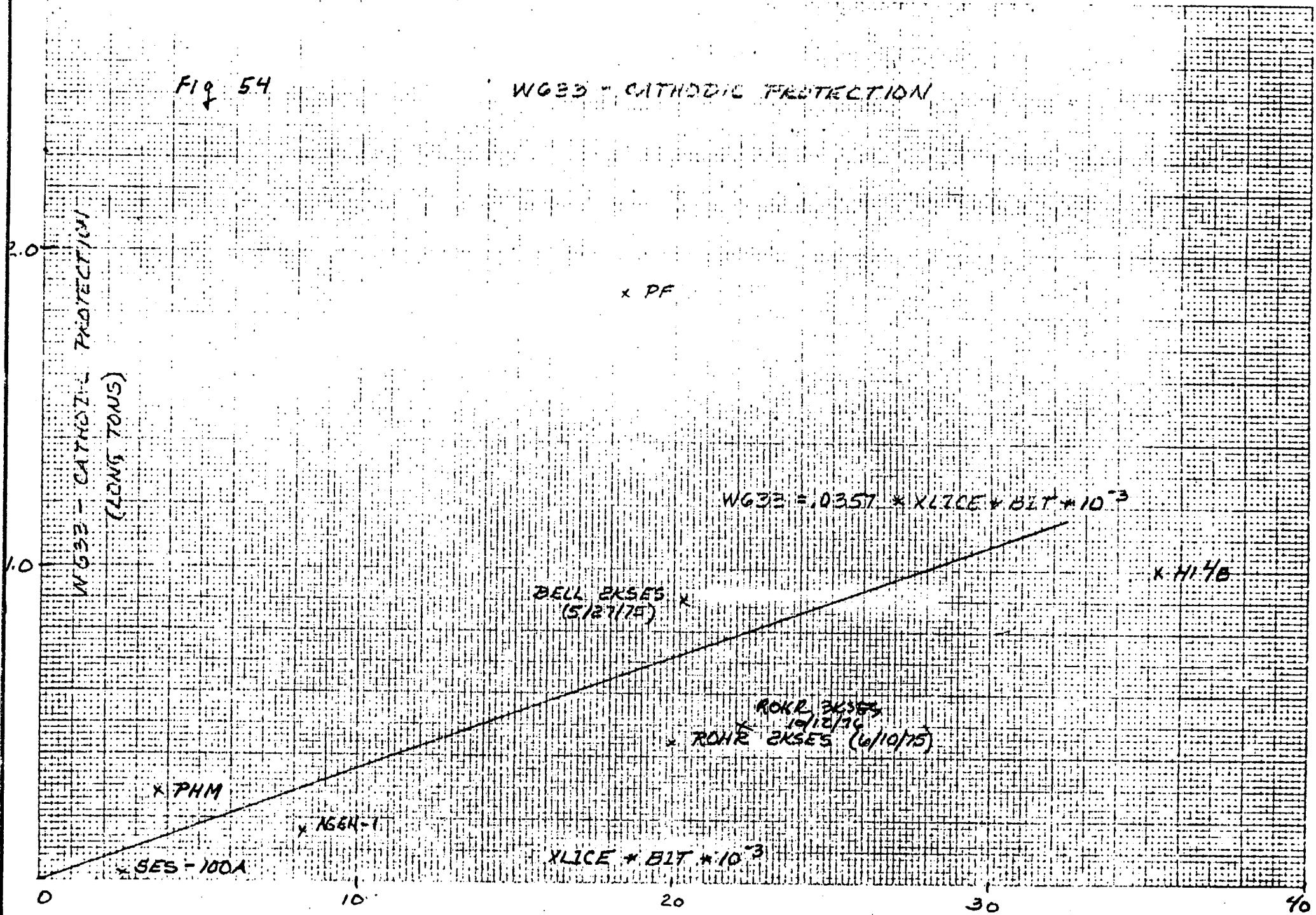
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TOTAL VOLUME

Fig 54

WG33 - CATHODIC PROTECTION



\* ROHR 3KSE  
10/2/76

Fig 55

DF - 15.3 T

WG34 - DECK COVERING

\* ROHR (6/10/75)

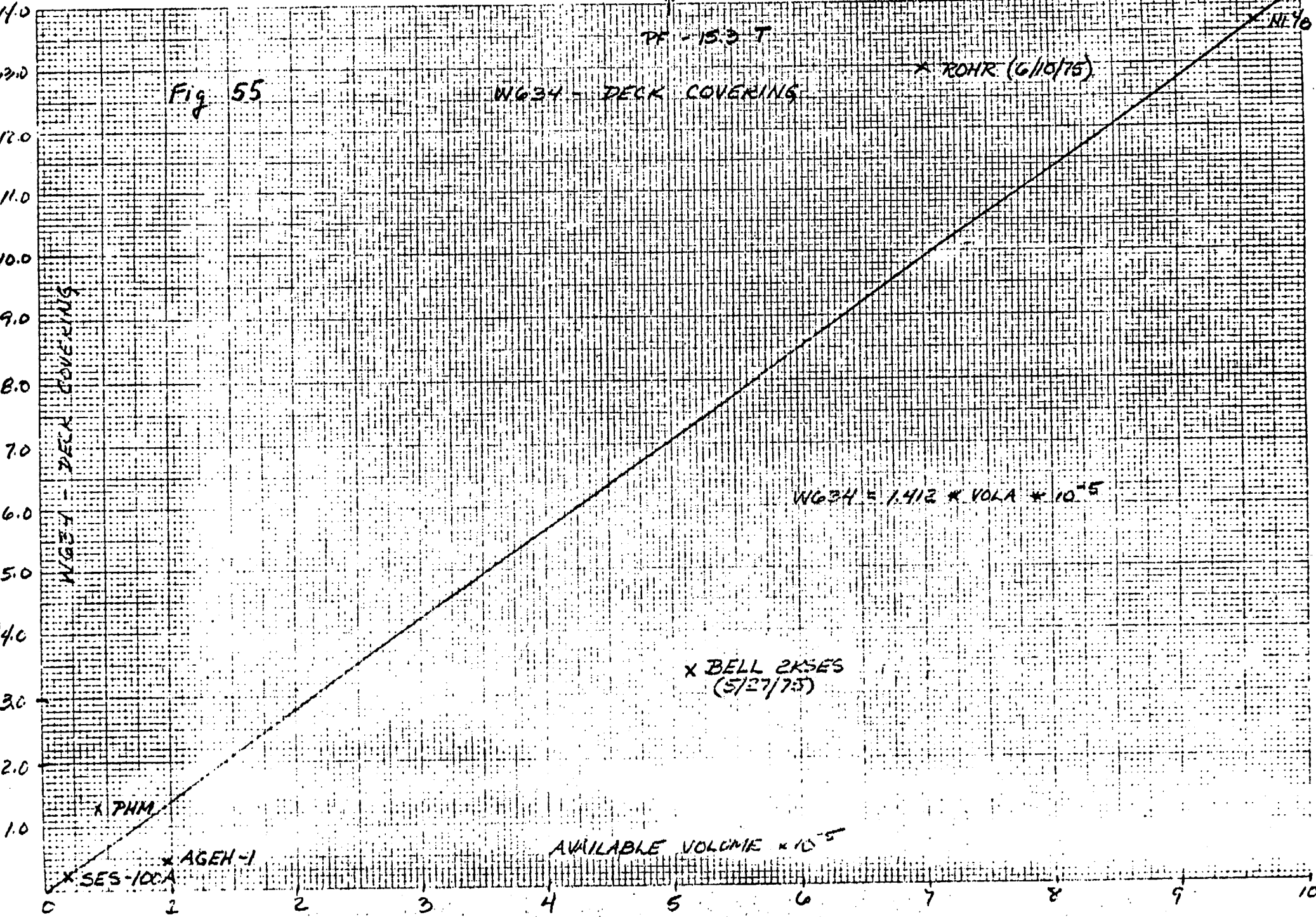
NI 40

WG34 - DECK COVERING

$$WG34 = 1.412 * VOLA * 10^{-5}$$

\* BELL 2KSES  
(5/27/75)

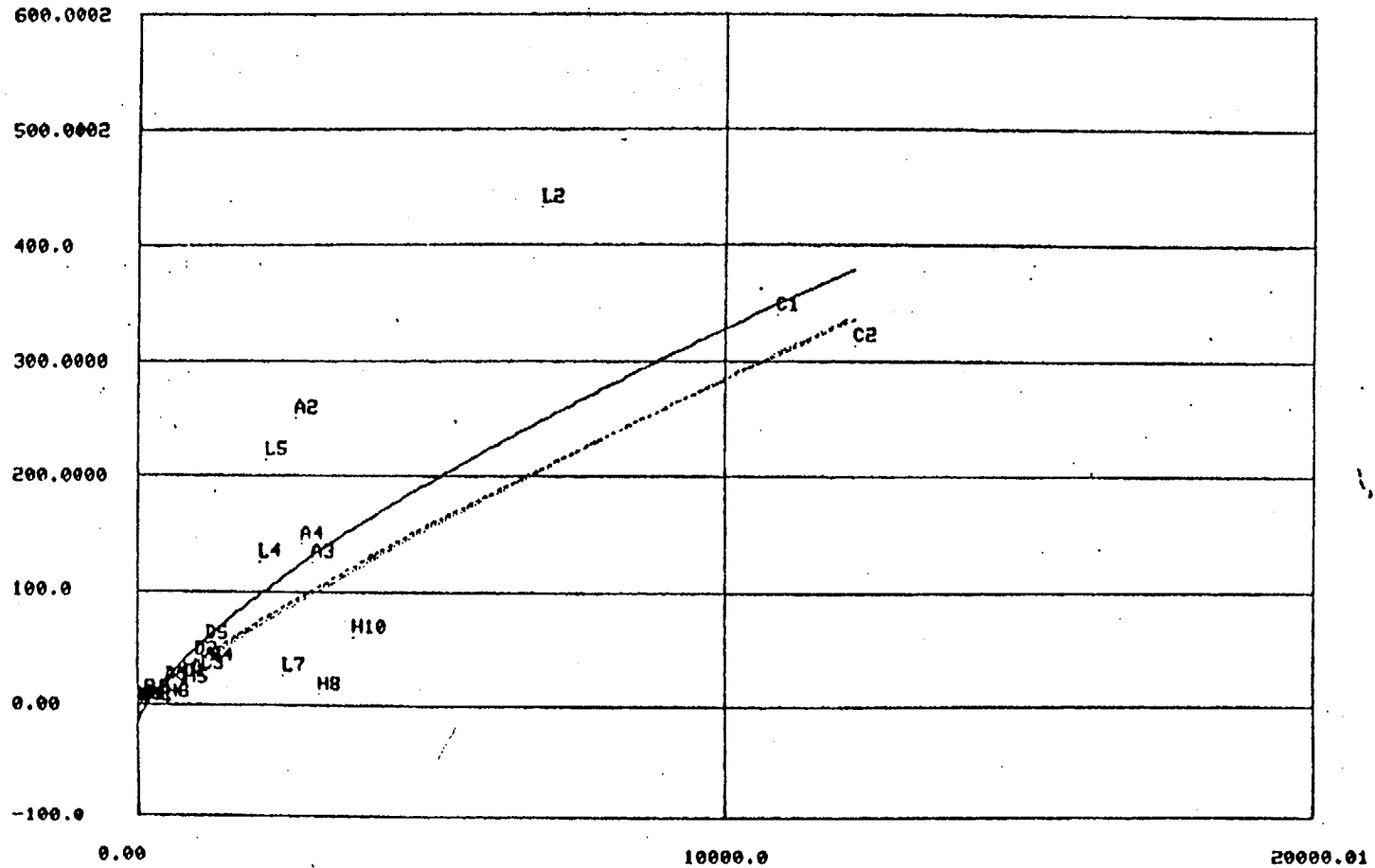
AVAILABLE VOLUME \* 10<sup>-5</sup>



SUBS 634 DECK COVERING (BSCI 606)

—— ALL DATA      - - - - - 2 S.ERROR      ..... 1 S.ERROR

DECK COVERING (LONG TONS)



TOTAL VOLUME



Fig 56

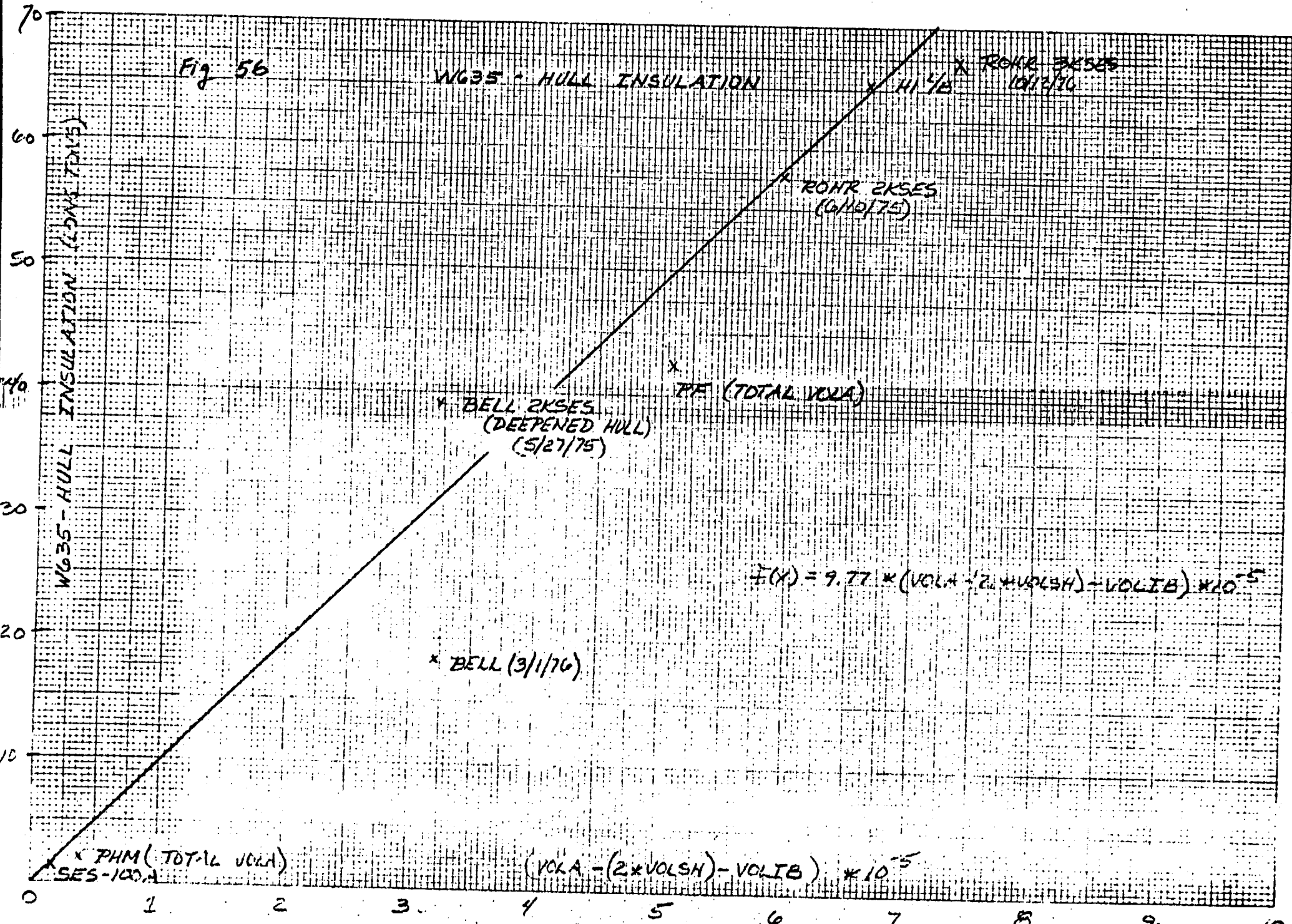
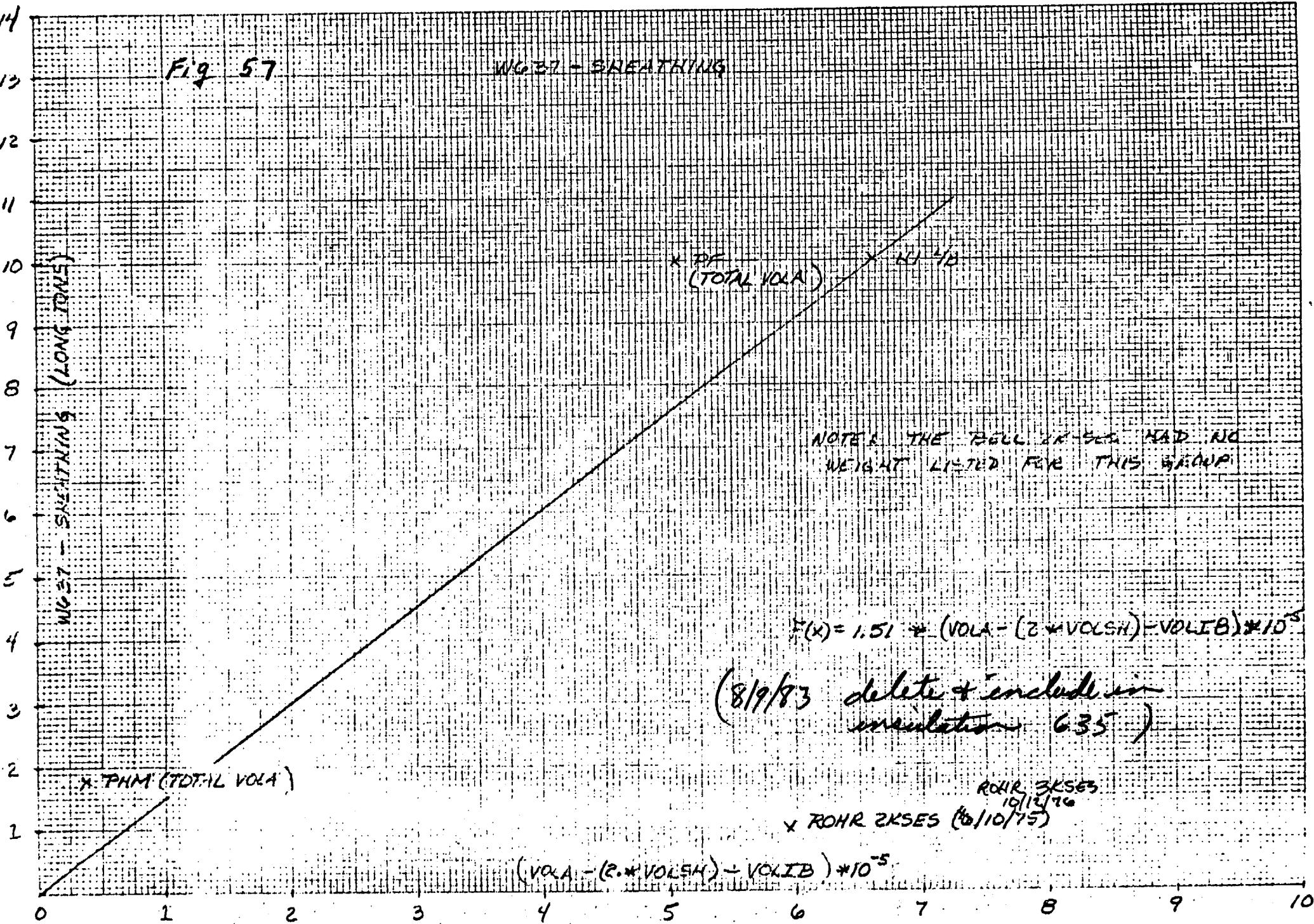


Fig 57

WG 37 - BREATHING



(LONG TONS)

WG 37 - BREATHING

X PHM (TOTAL VOLA)

WG 4B

NOTE: THE BELL 2KSES HAD NO WEIGHT LISTED FOR THIS GROUP

$$F(x) = 1.51 * (VOLA - (2 * VOLSH) - VOLIB) * 10^{-5}$$

(8/19/83 delete & include in circulation 6.35)

ROHR 3KSES  
10/14/76

X ROHR 2KSES (6/10/75)

$$(VOLA - (2 * VOLSH) - VOLIB) * 10^{-5}$$

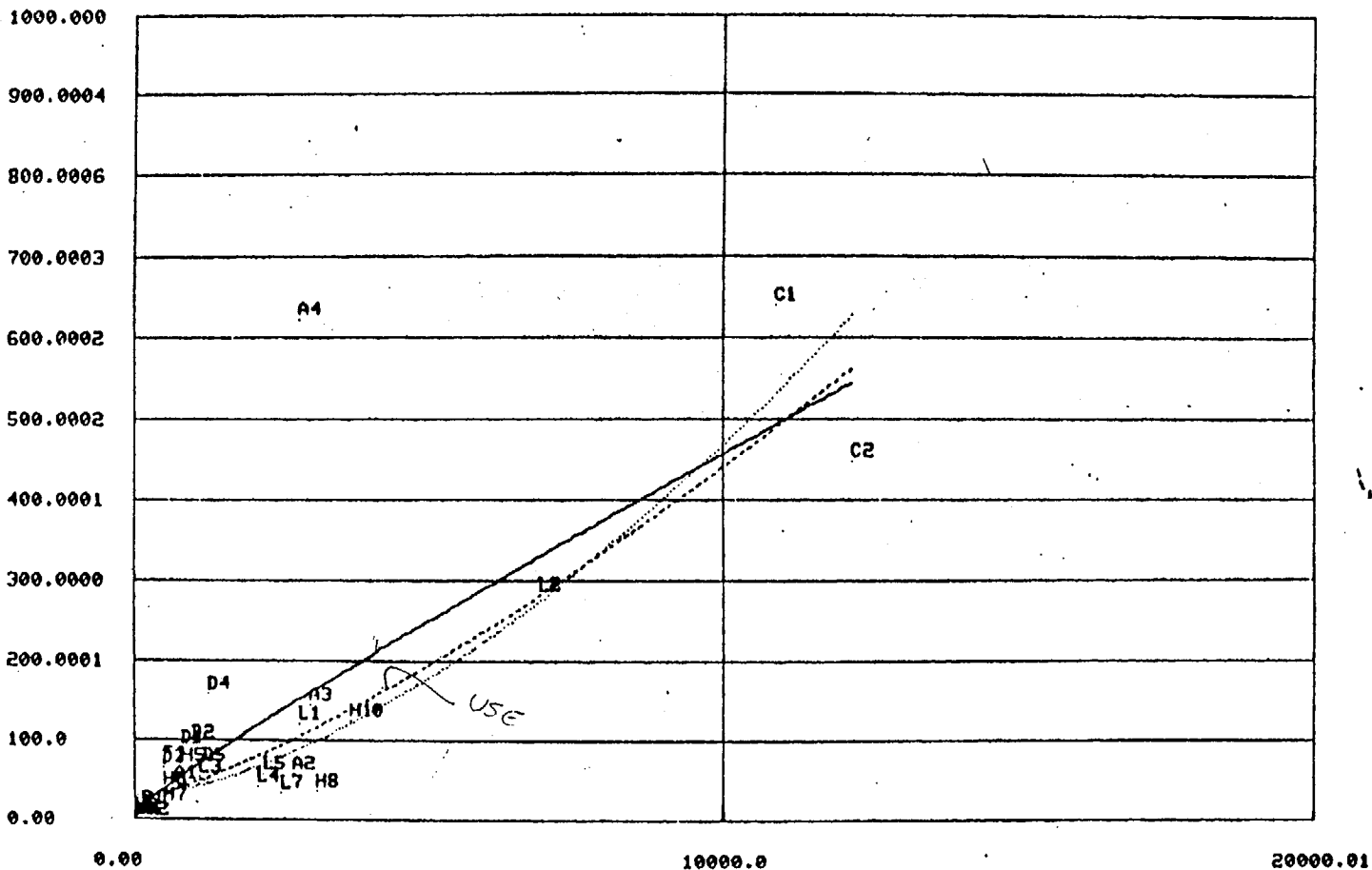


P

SUBS 635/37 HULL INSULATION AND SHEATHING (BSCI 607)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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TOTAL VOLUME

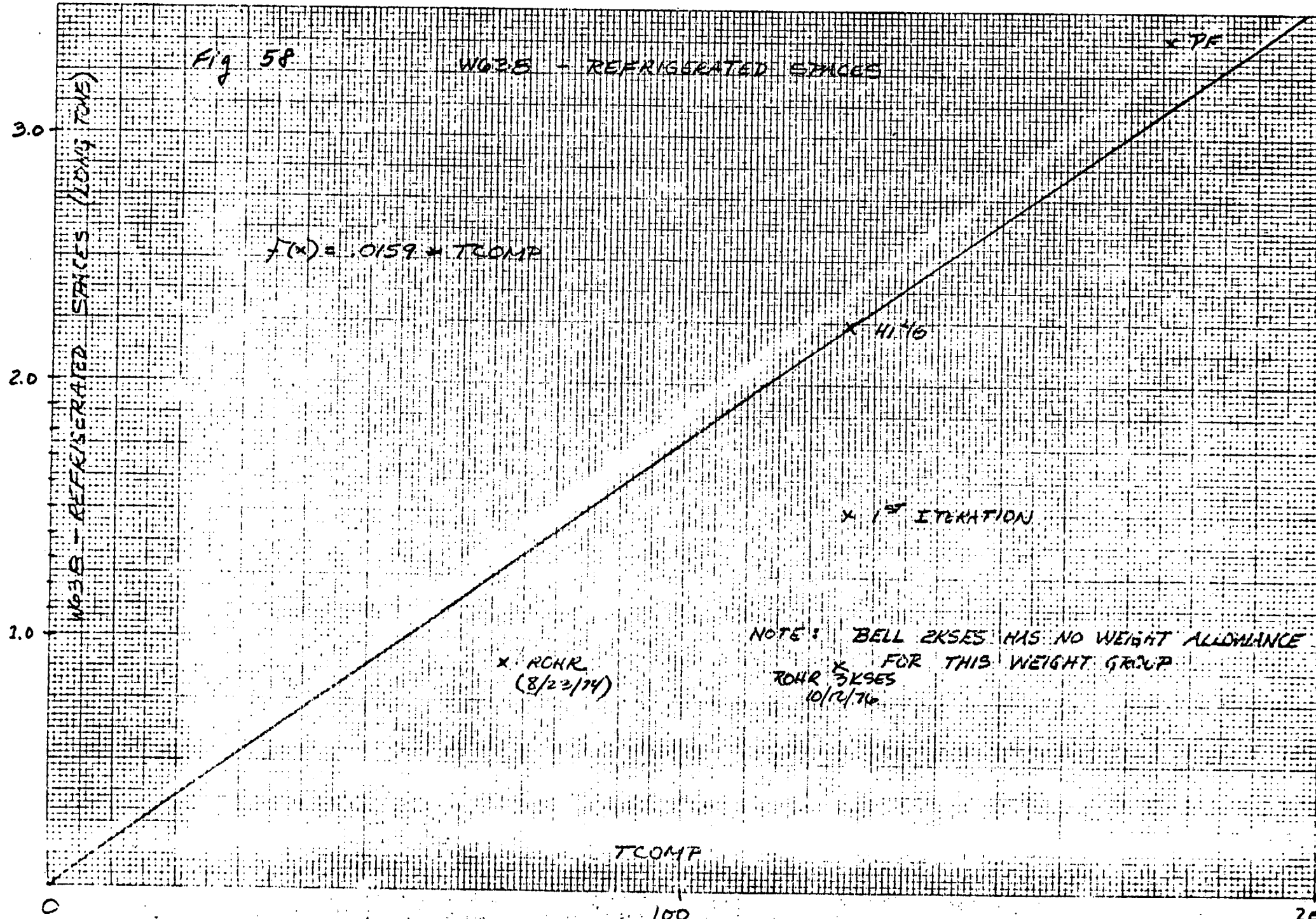


Fig 58

WGRS - REFRIGERATED SPACES

WGRS - REFRIGERATED SPACES (LONG TONS)

3.0

2.0

1.0

0

TCOMP

100

$$f(x) = .0159 * TCOMP$$

x ROHR  
(8/23/74)

x 1st ITERATION

x 41.15

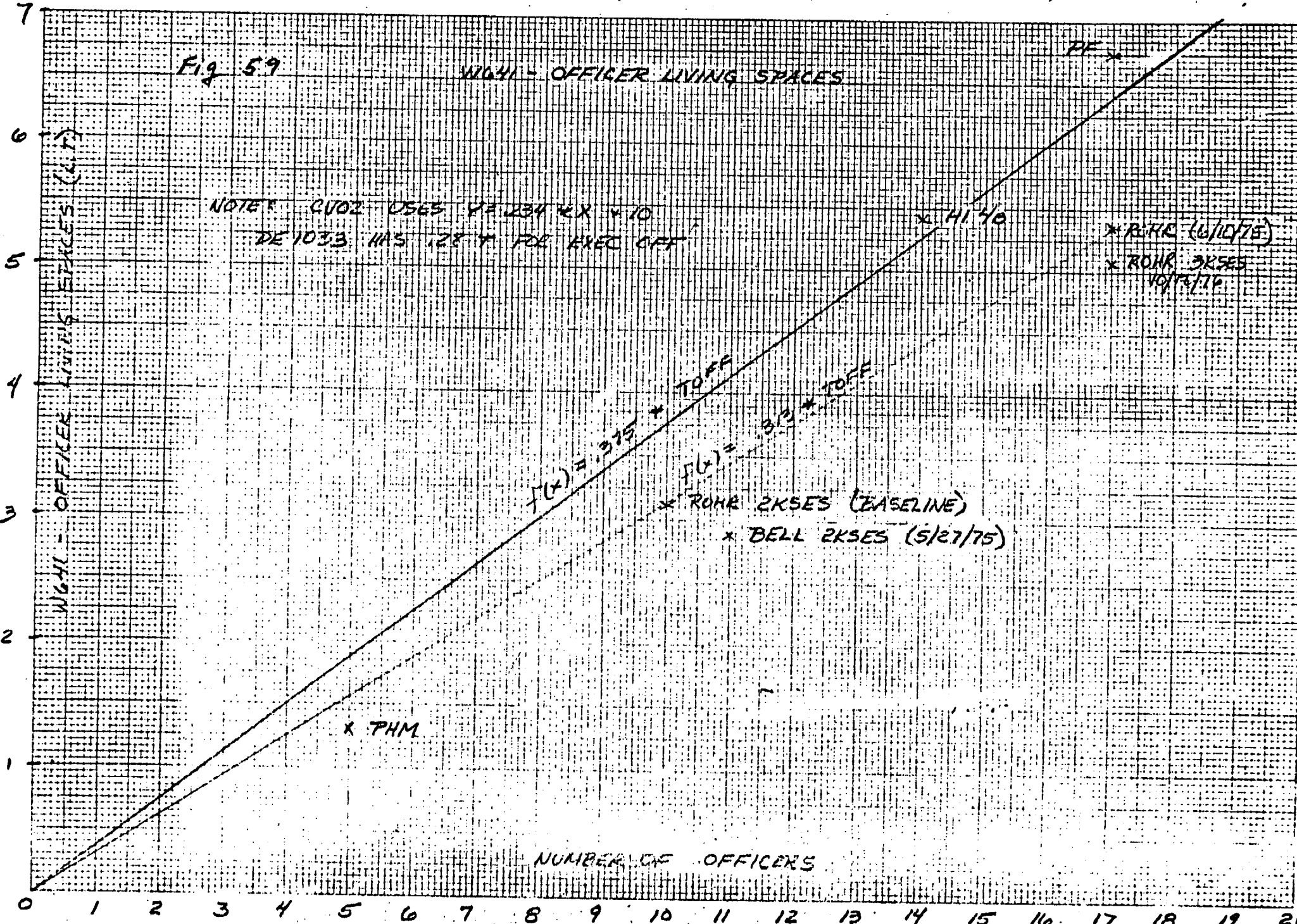
NOTE: BELL 2KSES HAS NO WEIGHT ALLOWANCE  
FOR THIS WEIGHT GROUP  
ROHR 3KSES  
10/12/74

x 75

Fig 59

WG41 - OFFICER LIVING SPACES

NOTE: CV02 USES 42.234 SQ FT  
DE 1033 HAS 28 FT FOR EXEC OFF



NUMBER OF OFFICERS

WG41 - OFFICER LIVING SPACES (SQ FT)

$F(x) = .375 * TOFF$

$F(x) = .33 * TOFF$

x PHM

x ROHR 2KSES (BASELINE)

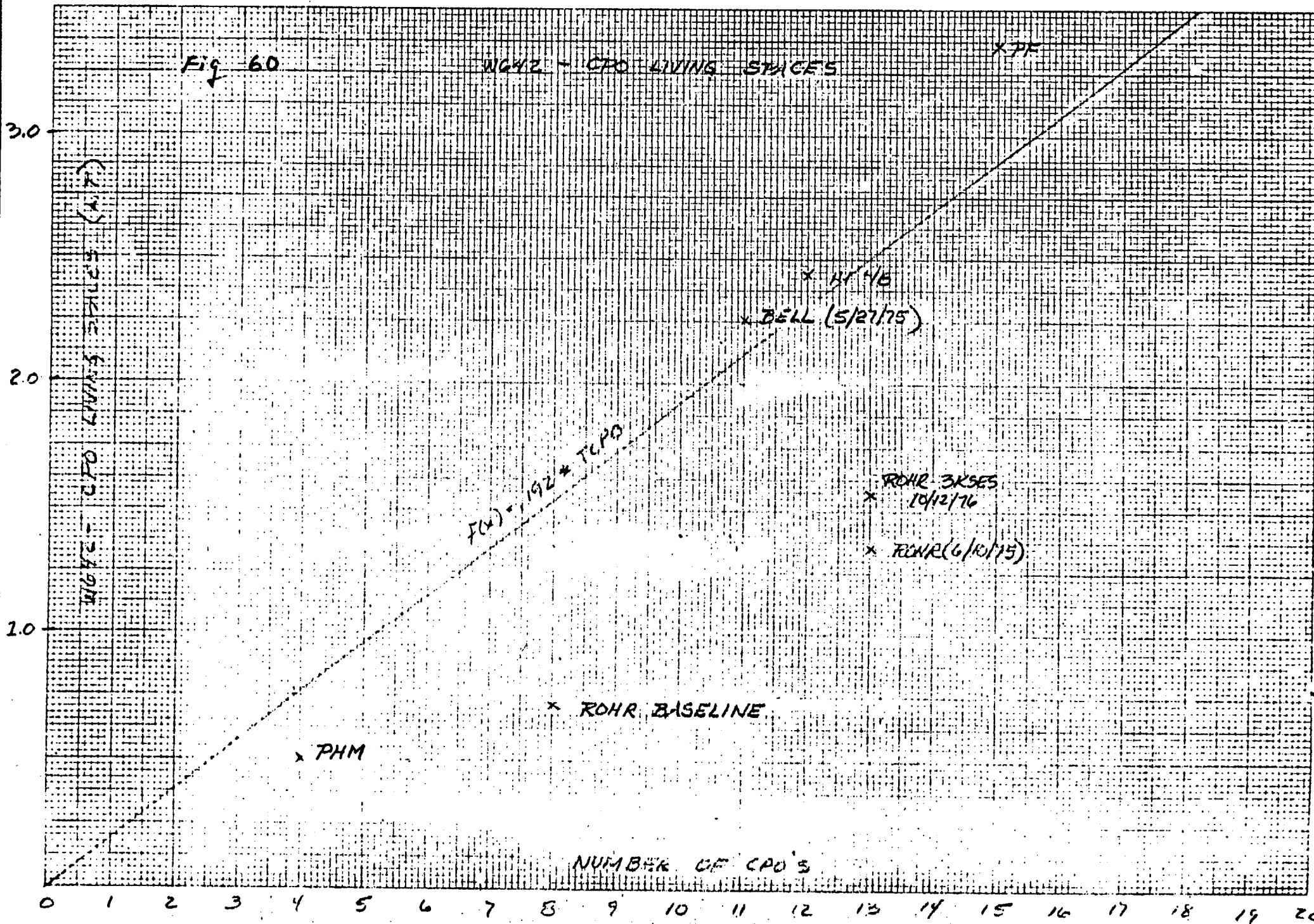
x BELL 2KSES (5/27/75)

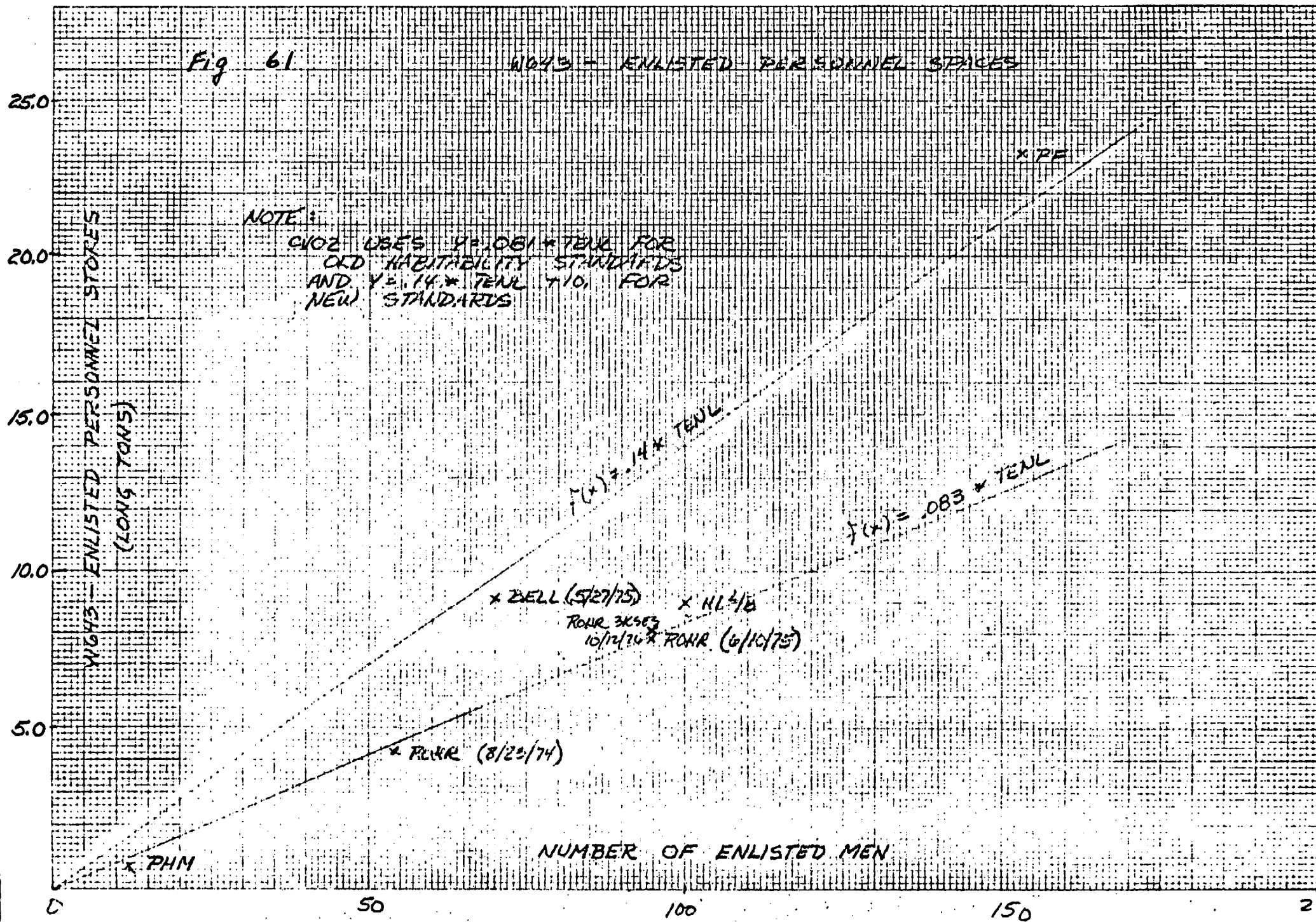
x HI 40

x ROHR (6/10/75)

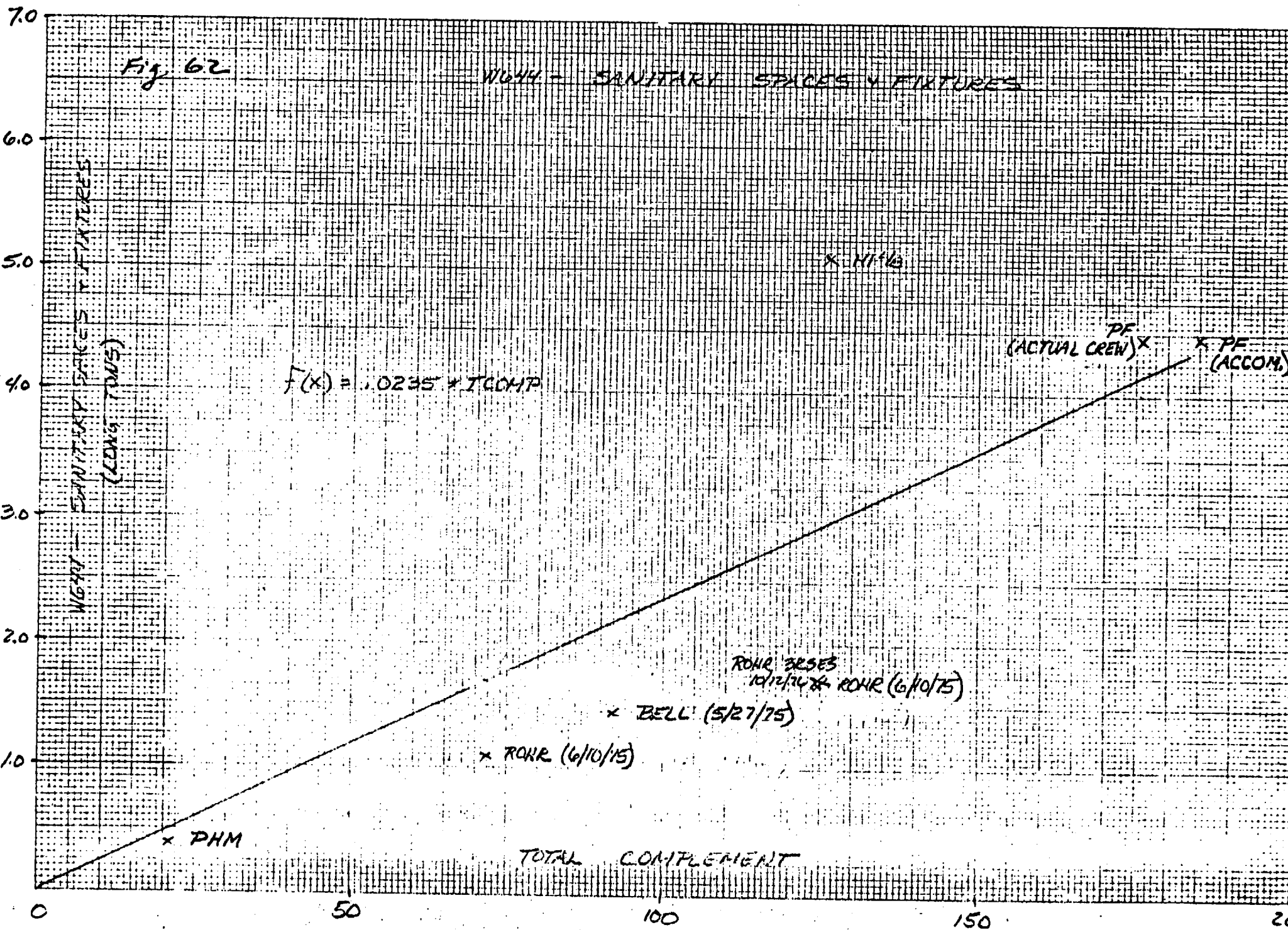
x ROHR 3KSES  
10/14/75

DE 1033







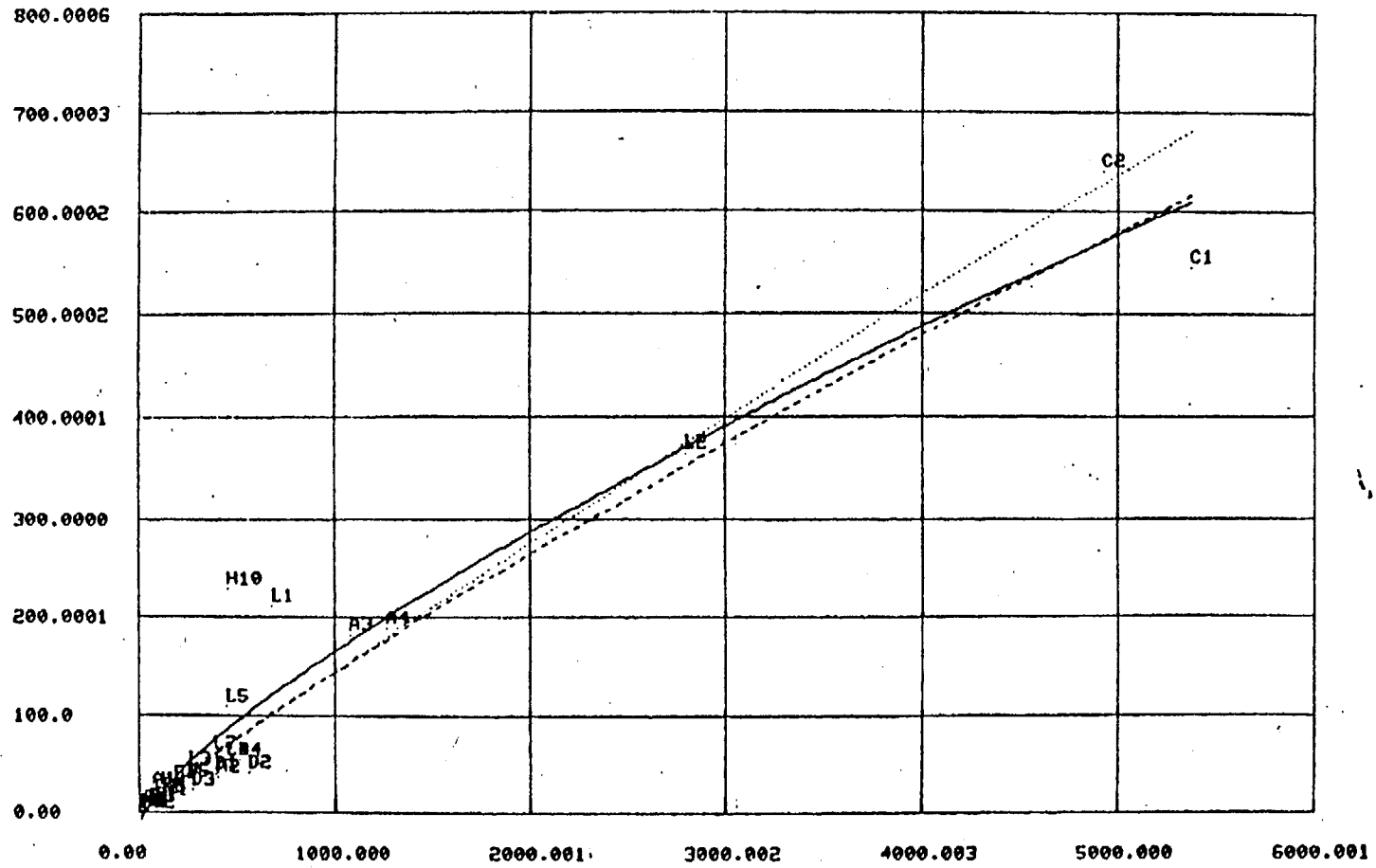


PAU

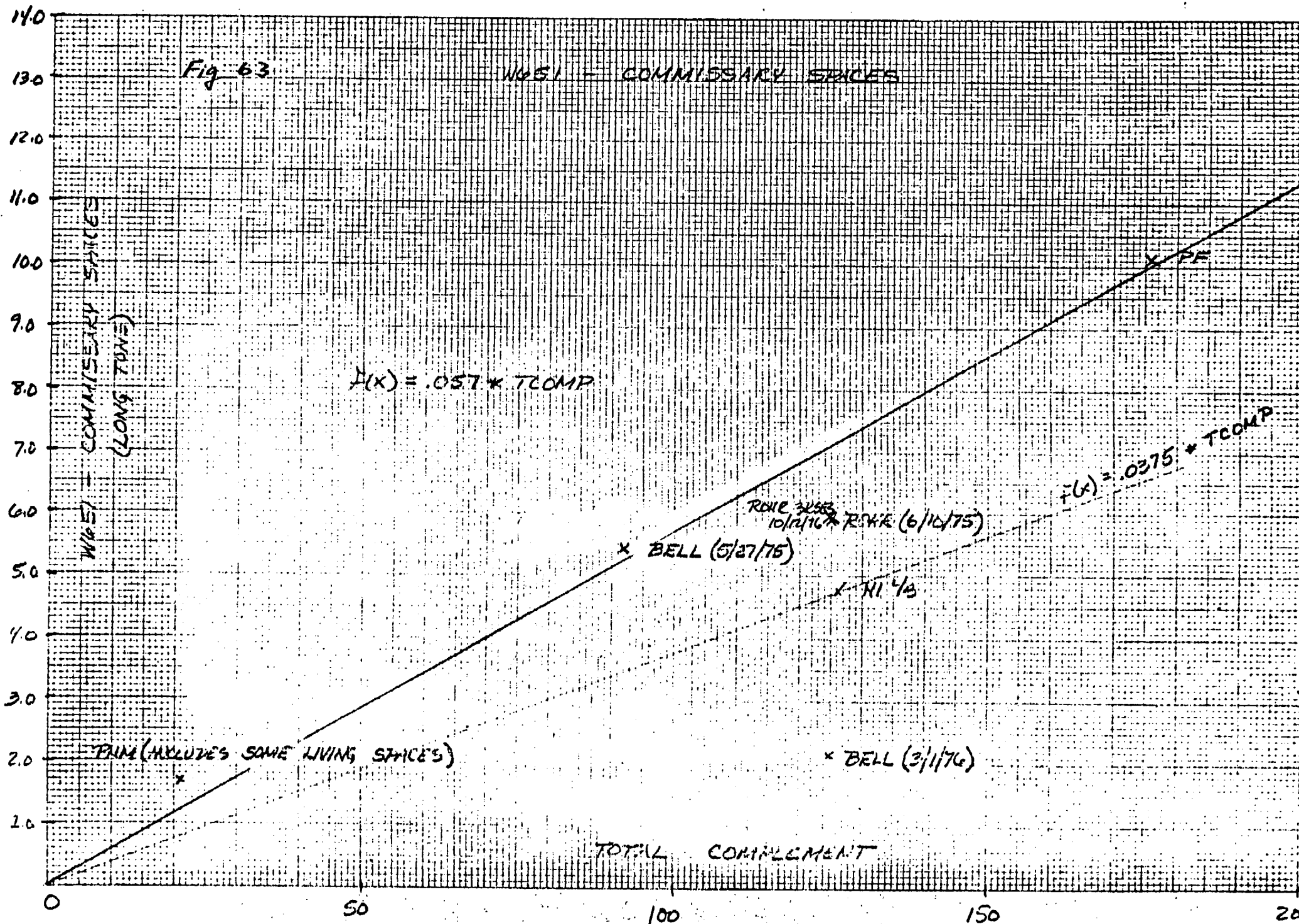
SWBS 641/41/43/44 LIVING SPACES (BSCI 612)

—— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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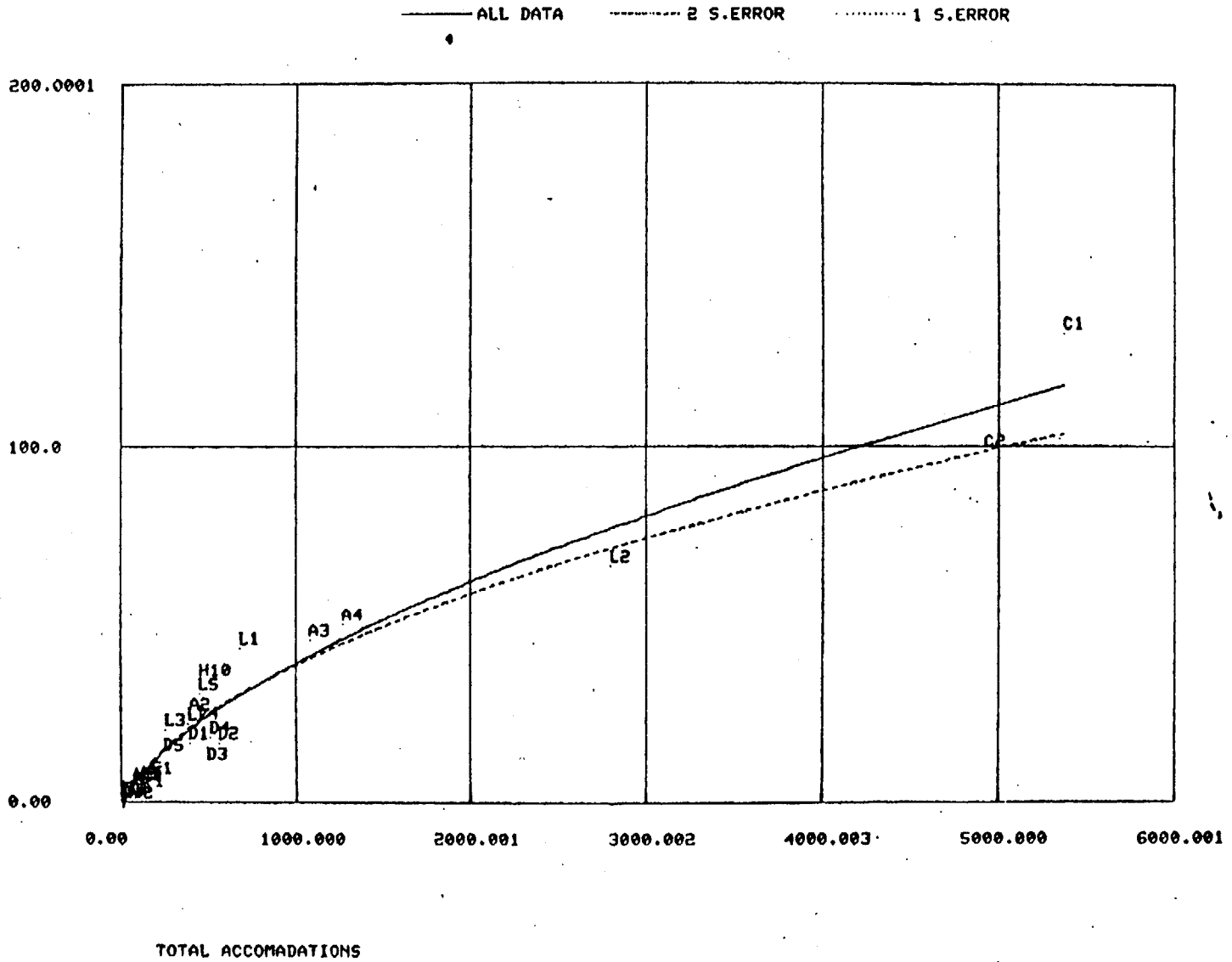
TOTAL ACCOMADATTIONS

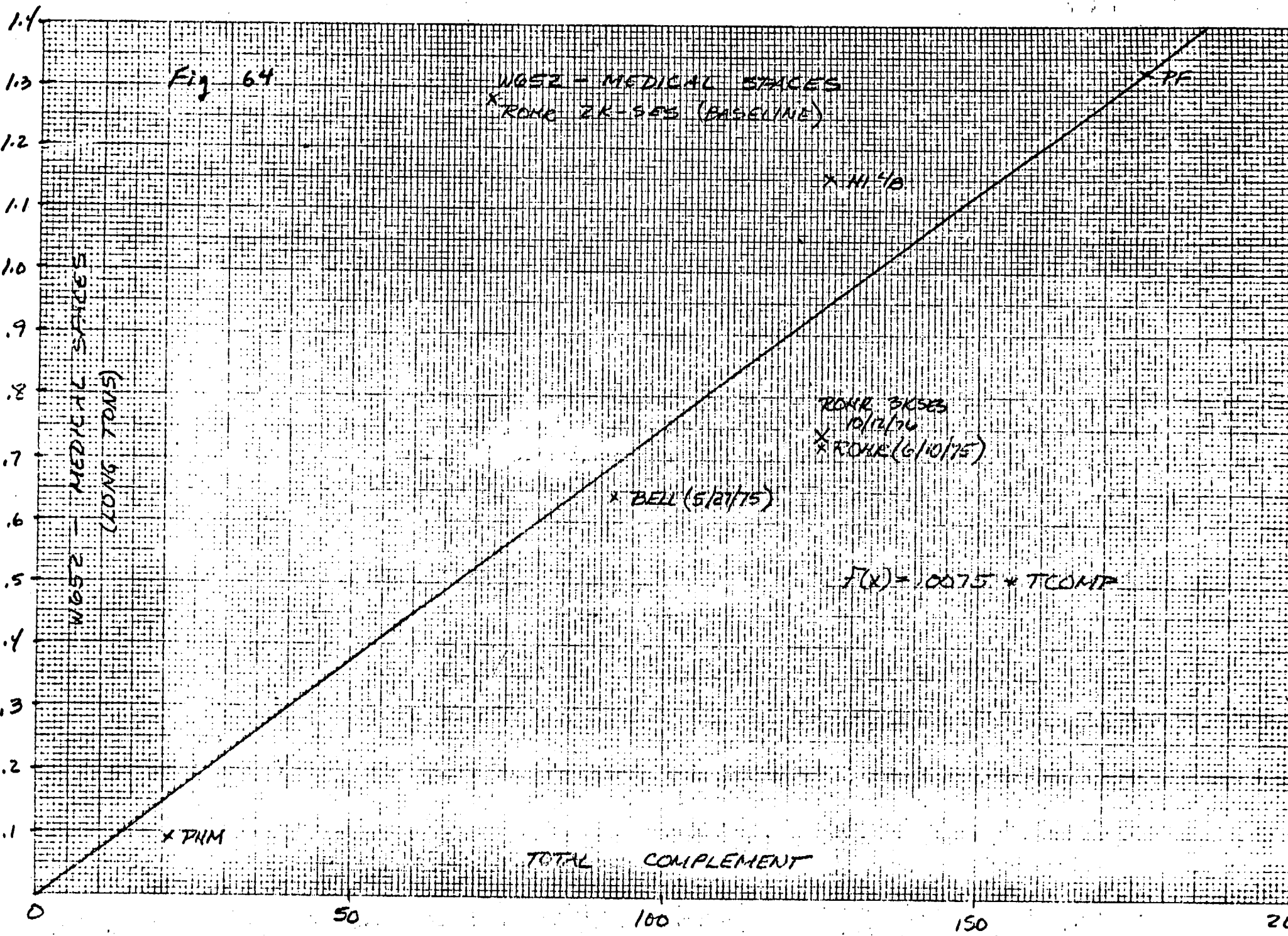




SWBS 651 COMMISSARY SPACES (BSCI 611)

COMMISSARY SPACES (LONG TONS)

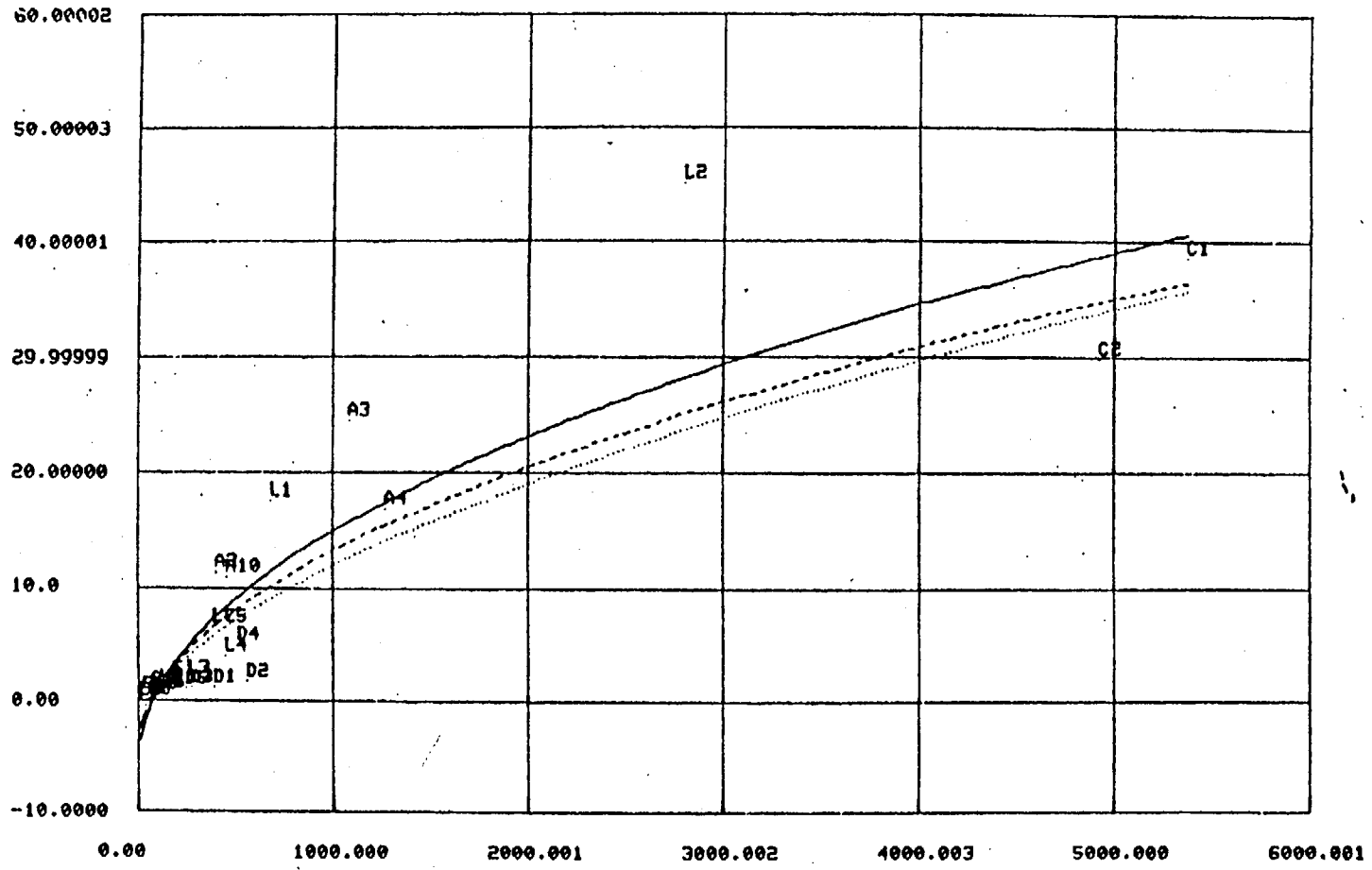




SUBS 652 MEDICAL SPACES (BSCI 614)

—— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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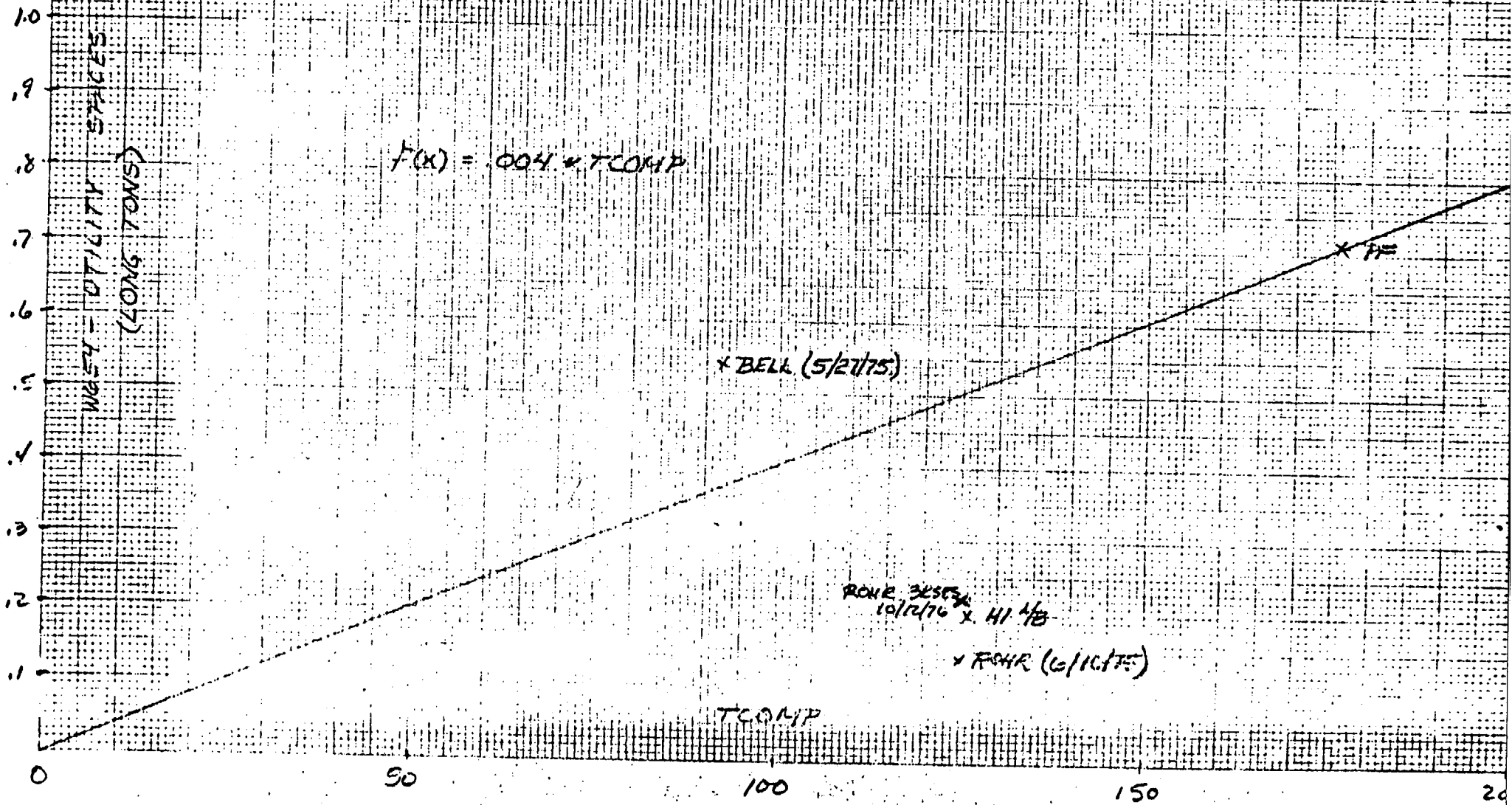
TOTAL ACCOMADATIONS

Fig 65

W654 - UTILITY SPACES

W654 - UTILITY SPACES  
(LONG TONS)

$$F(x) = 0.04 \times TCOMP$$



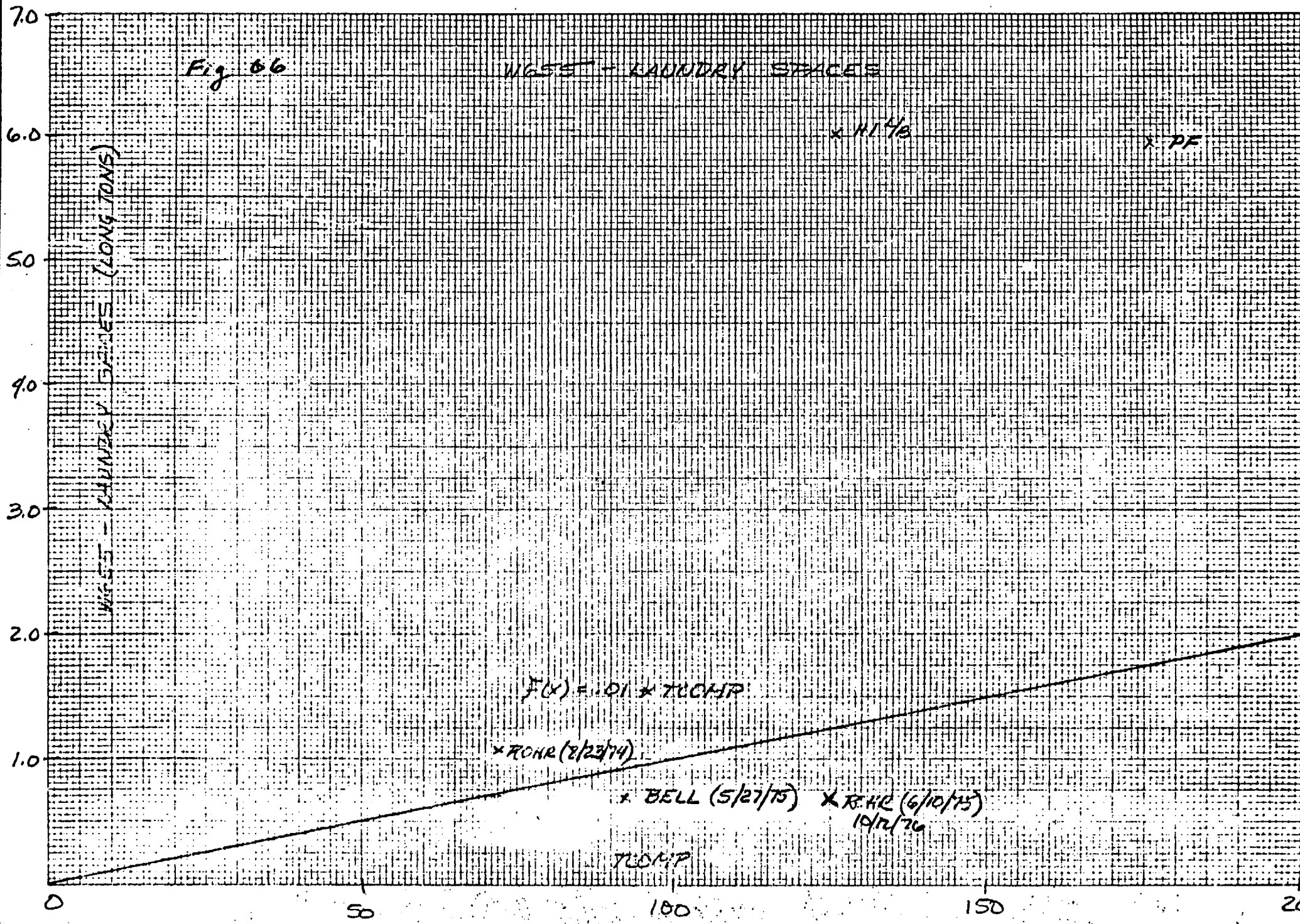


Fig 67

W656 - TRASH DISPOSAL SPACES

1.0

.9

.8

.7

.6

.5

.4

.3

.2

.1

NOTE: BOTH BELL & HOWA HAVE  
INCORPORATED THIS WT. GROUP  
INTO "COMMERCIAL SPACES"

$$F(x) = .0033 * TCOMP$$

\* H1 1/2

\* PF

TOTAL COMPLEMENT

0

50

100

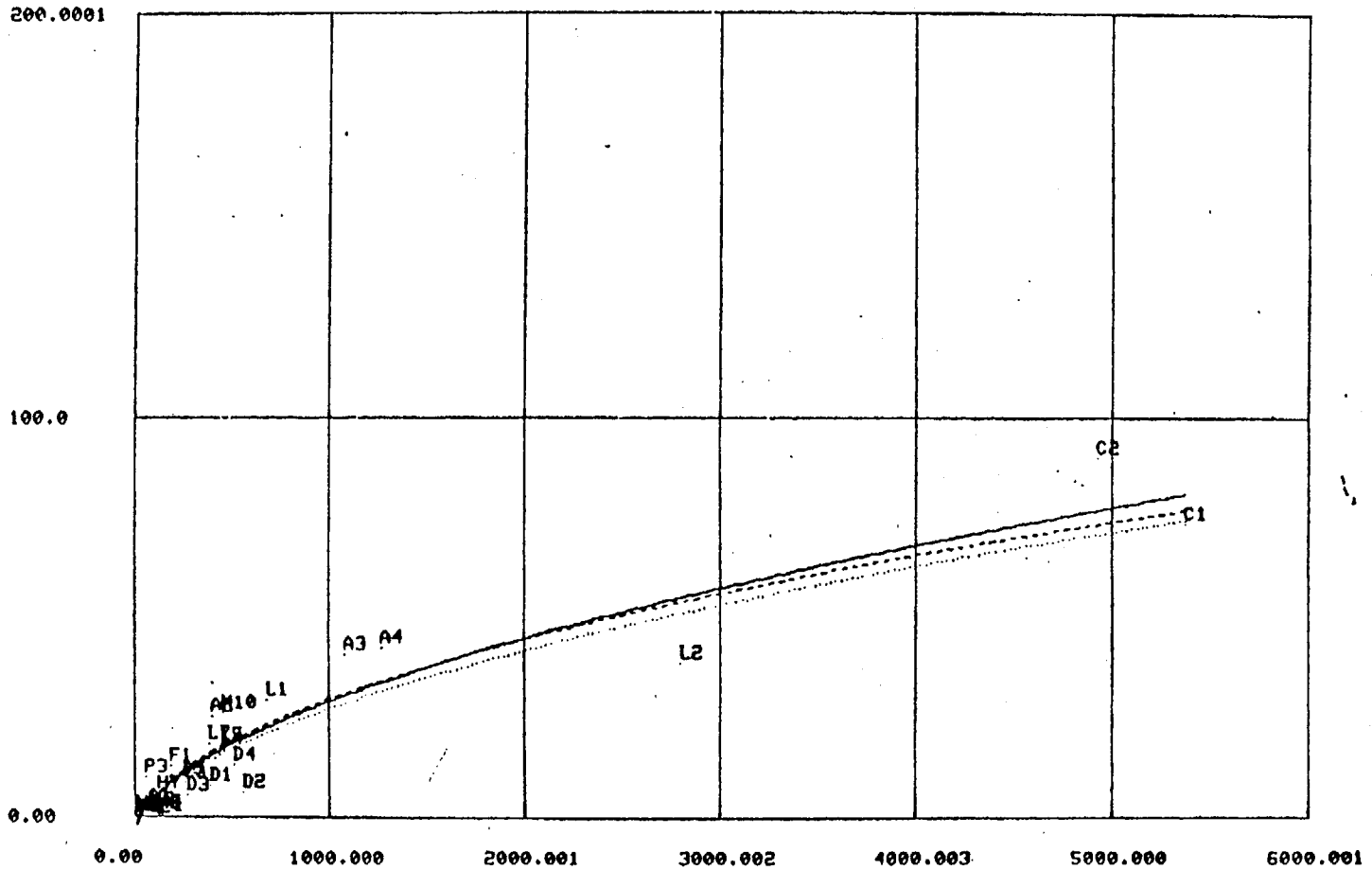
150

200

SUBS 654/55/56/93 UTILITY SPACES EQUIPMENT (BSCI 609)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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TOTAL ACCOMADATIONS



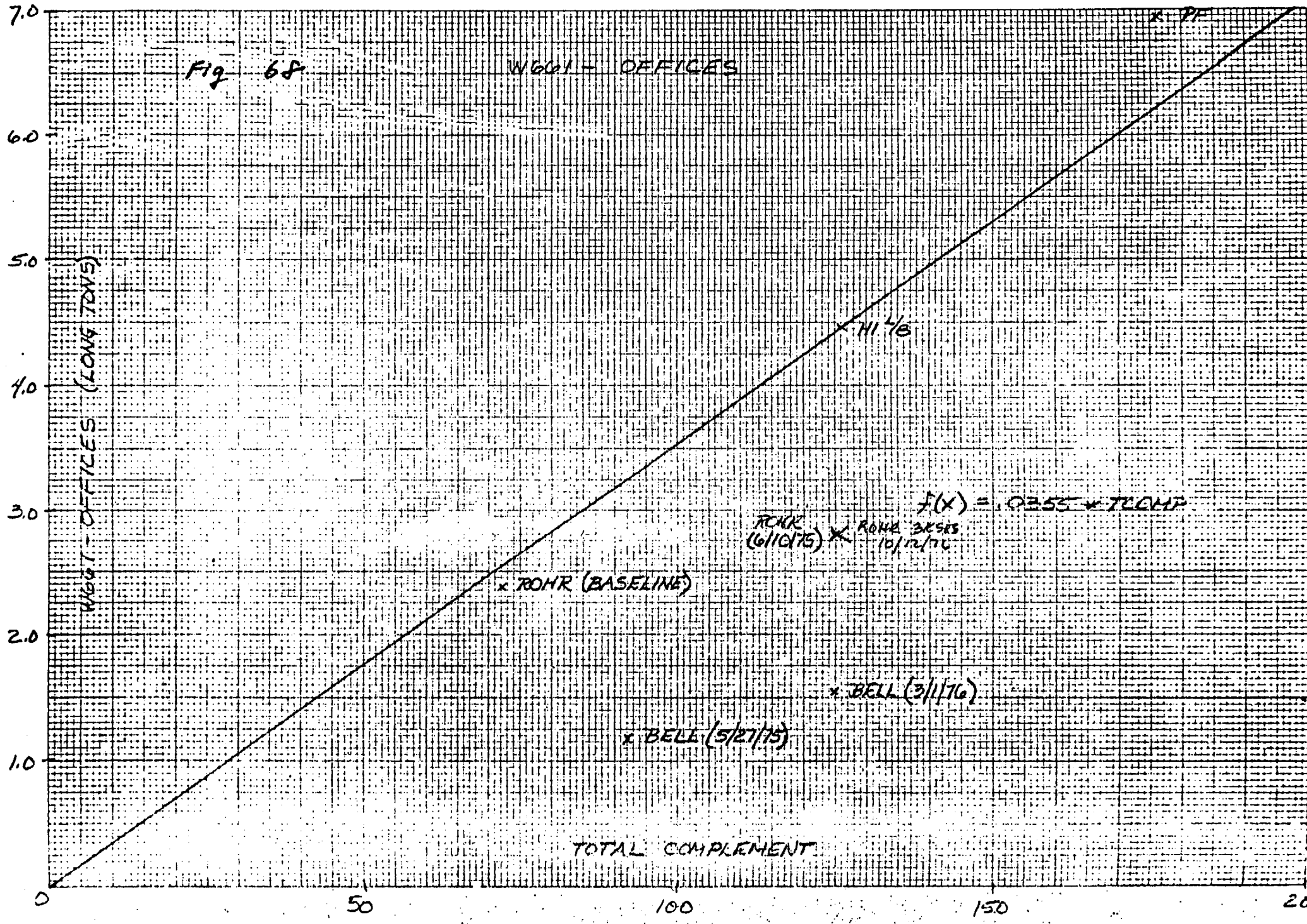


Fig 68

W601 - OFFICES



Fig 69

W662 - MACHINERY CONTROL CENTERS FURNISHINGS

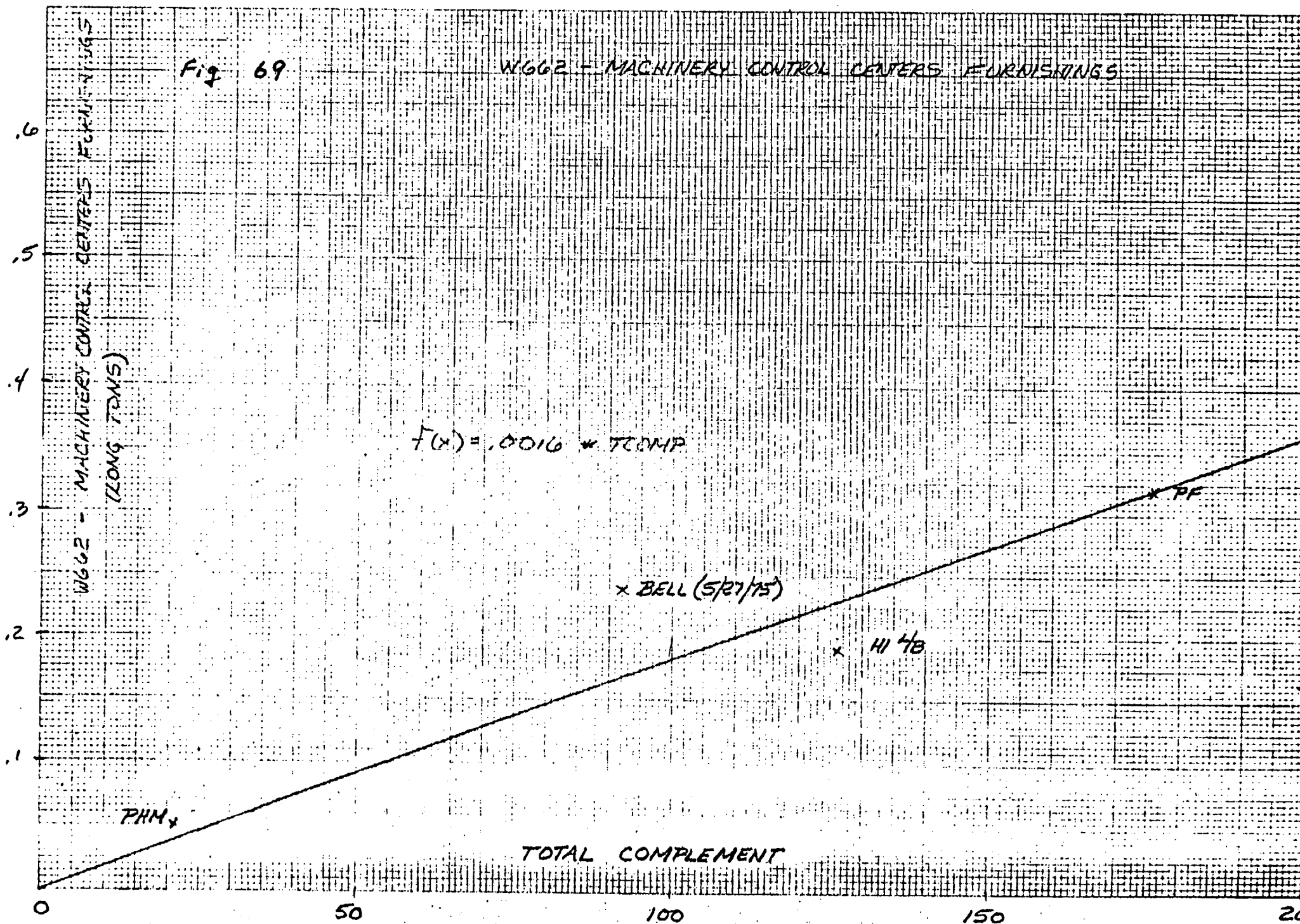
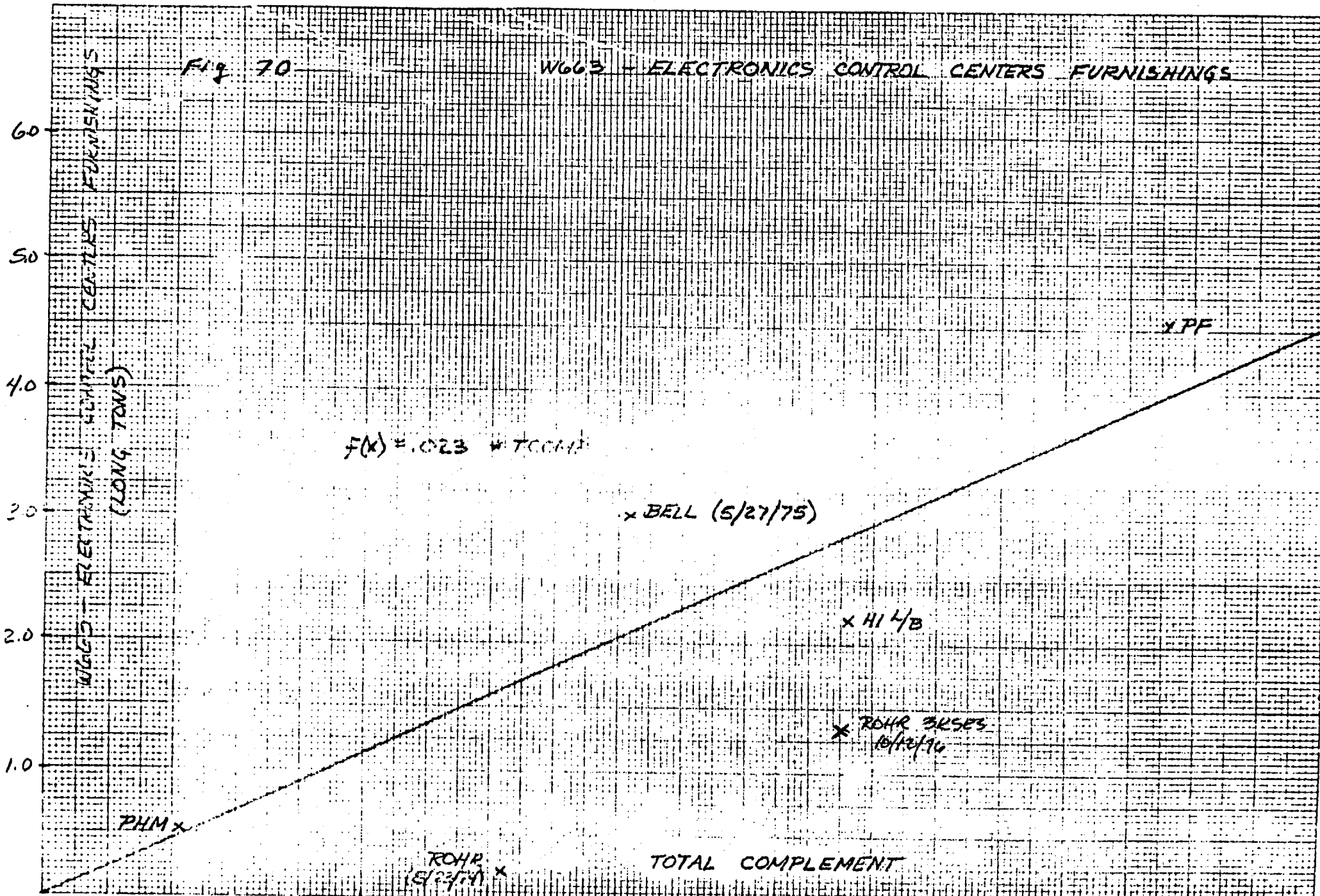


FIG 70

W663 - ELECTRONICS CONTROL CENTERS FURNISHINGS



PAUSE 'PRESS <RETURN> TO CONTINUE'  
 SUBS 661/62/63 WORKING SPACES (BSOI 613)

—— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

WORKING SPACES (LITONS)

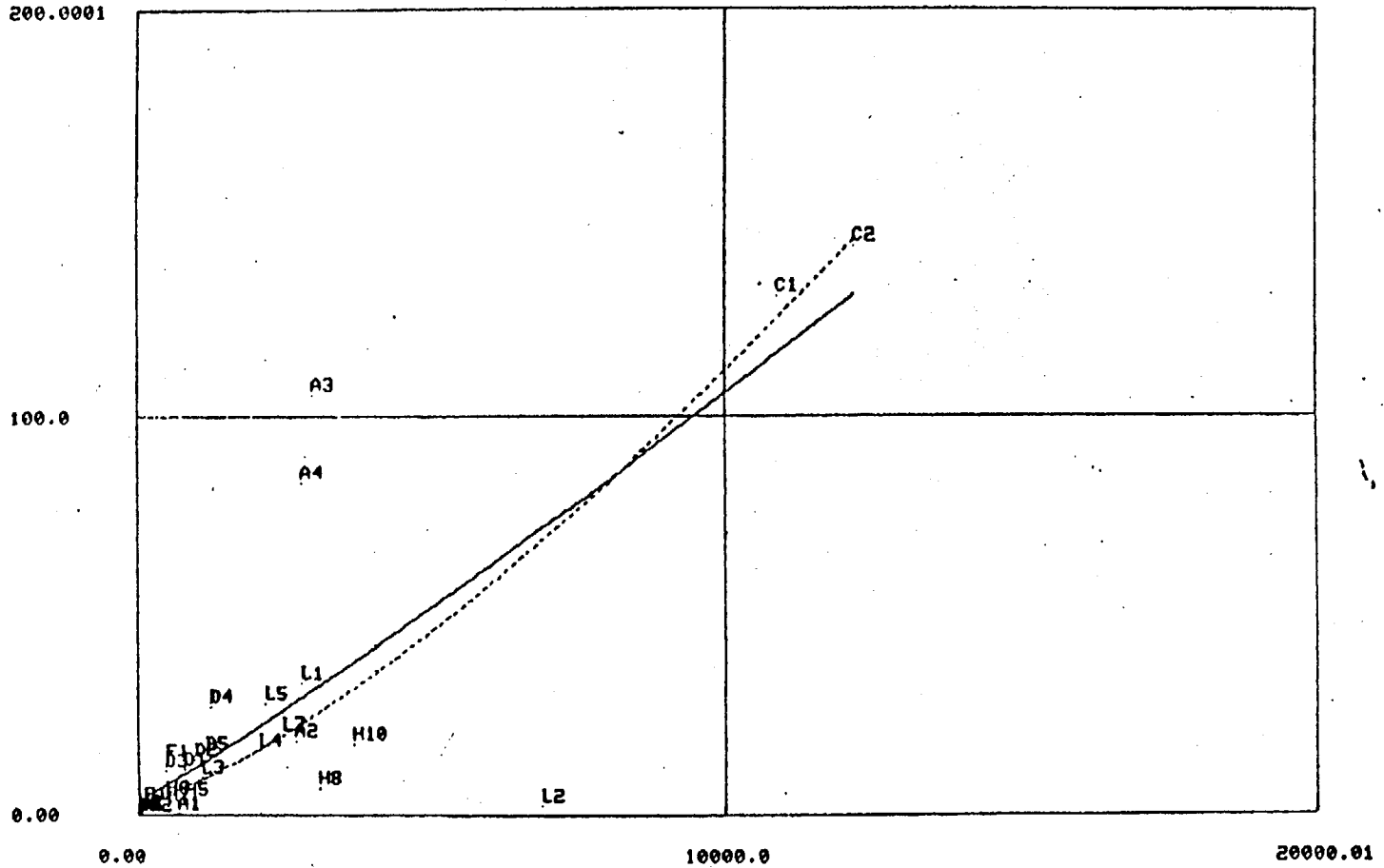


Fig 7.1

WGG4 - DAMAGE CONTROL STATIONS

10.0  
7.0  
8.0  
7.0  
6.0  
5.0  
4.0  
3.0  
2.0  
1.0

STATIONS  
DAMAGE CONTROL  
WGG4 - (LONG TONS)

\* AGEN-1  
\* PHM

BELL (3/1/76)

TCOMP \* VOA \* 10<sup>6</sup>  
\* RAMP BRSES  
10/10/74

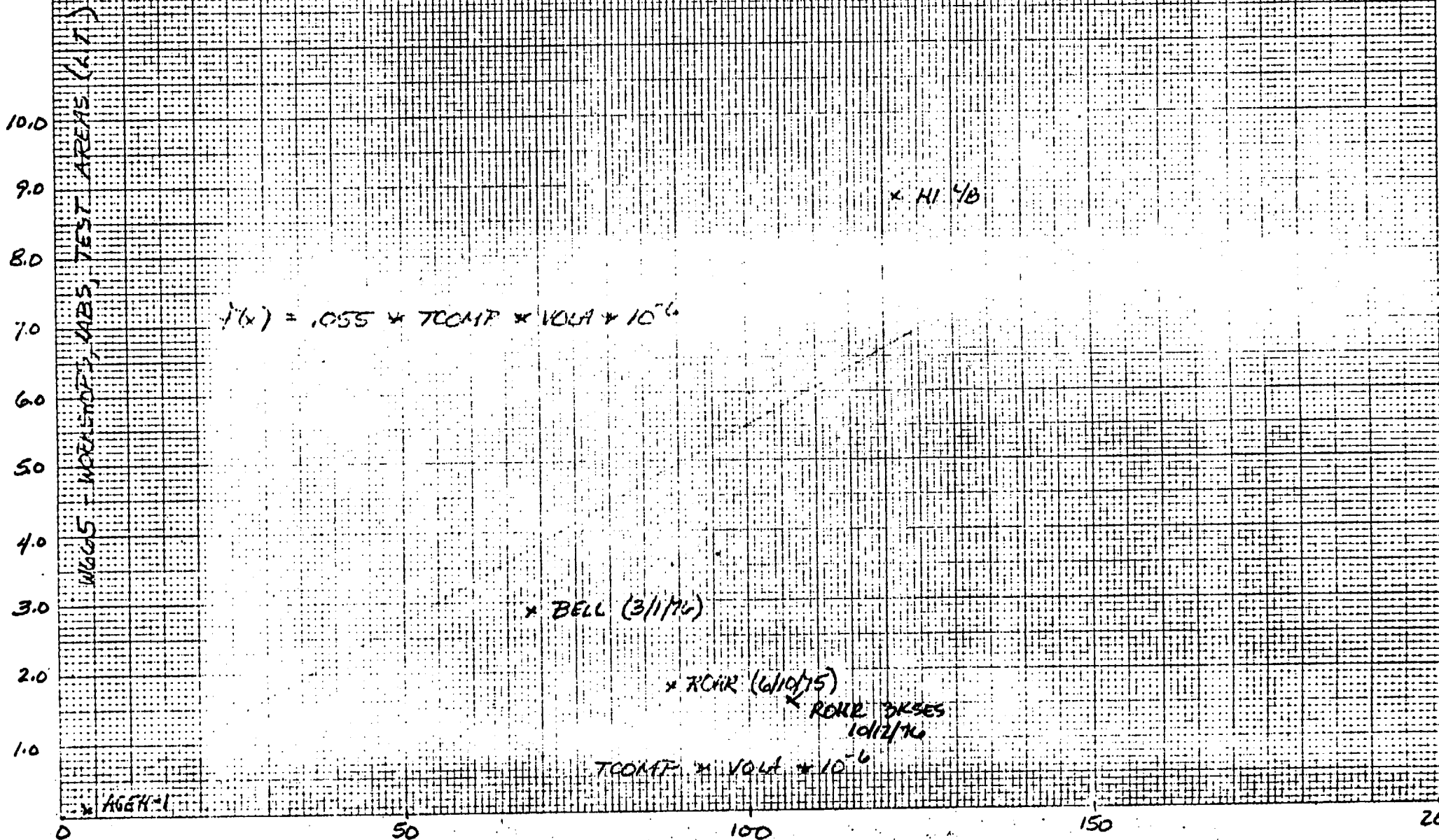
f(x) \* .35 \* 051 \* TCOMP \* 10LA \* 10<sup>4</sup>

\* NIT/10

0 50 100 150 200

Fig 72

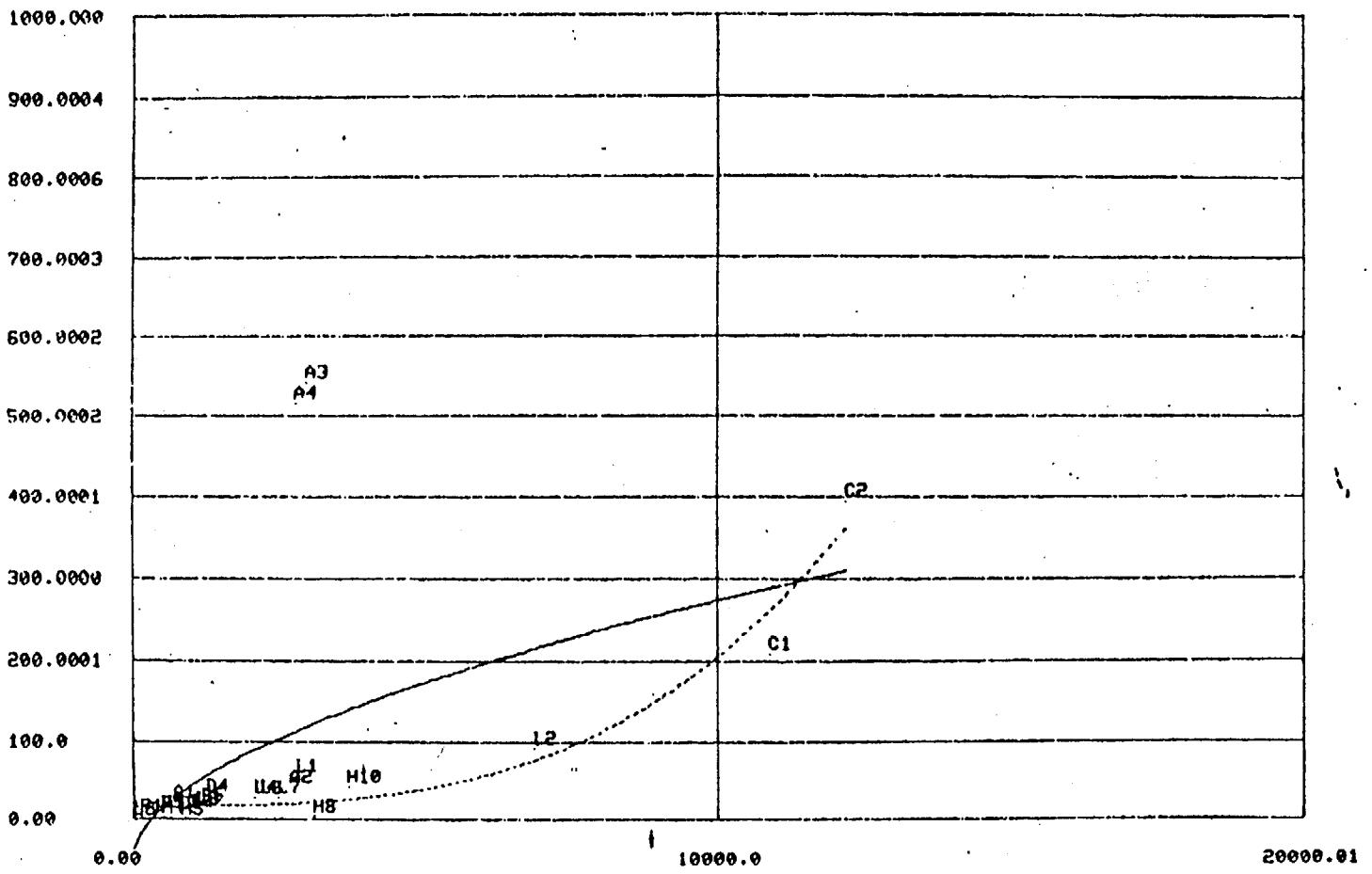
WGS - WORKSHOPS, LABS, TEST AREAS



PAUSE 'PRESS <RETURN> TO CONTINUE'  
 SUBS 665 WORKSHOPS AND LABS (BSCI 610)

—— ALL DATA    - - - - 2 S.ERROR    ····· 1 S.ERROR

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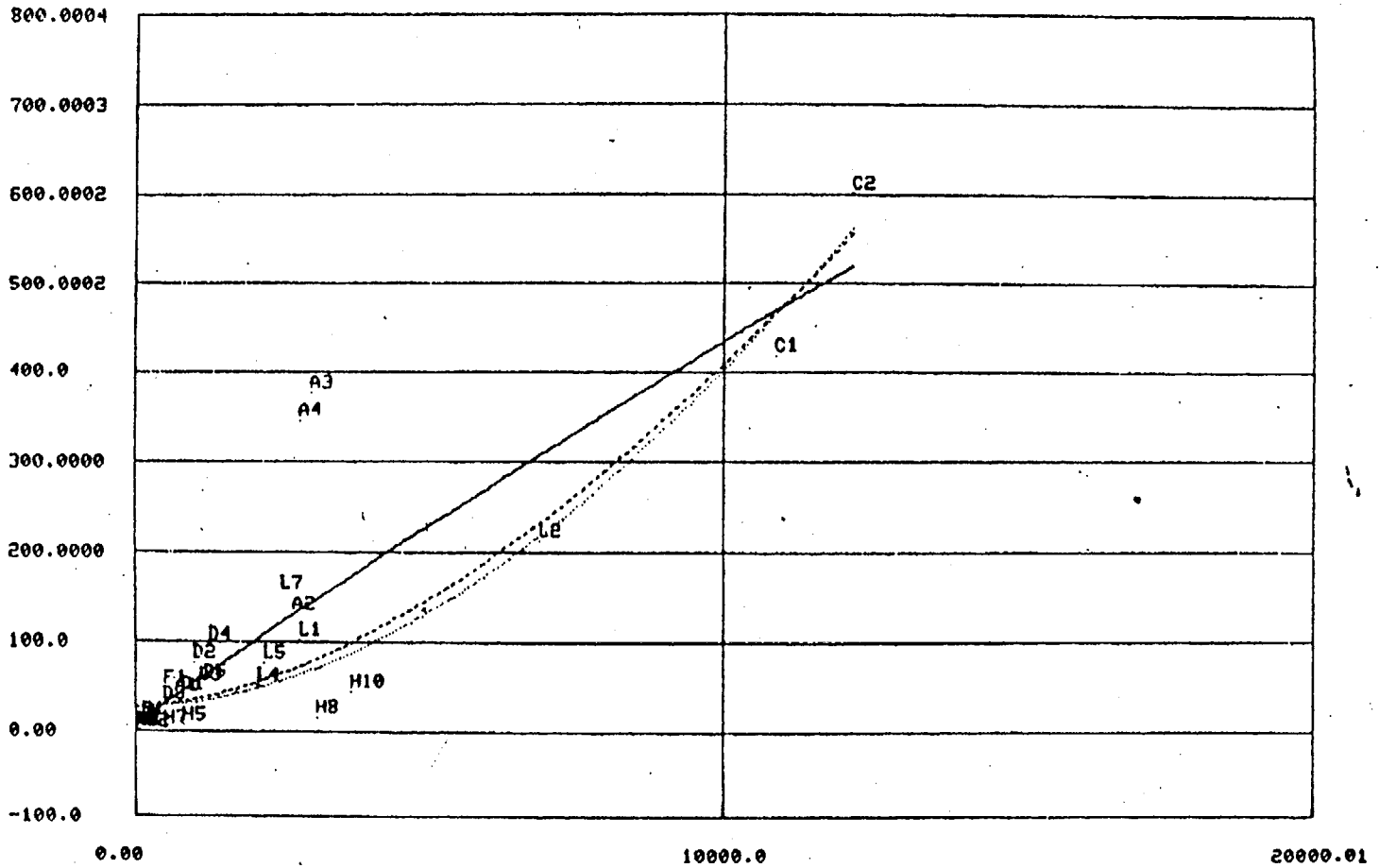


TOTAL VOLUME

SUBS 671/72/64 STOREROOMS AND LOCKERS (B5C1 608)

— ALL DATA    - - - - - 2 S.ERROR    ······ 1 S.ERROR

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TOTAL VOLUME



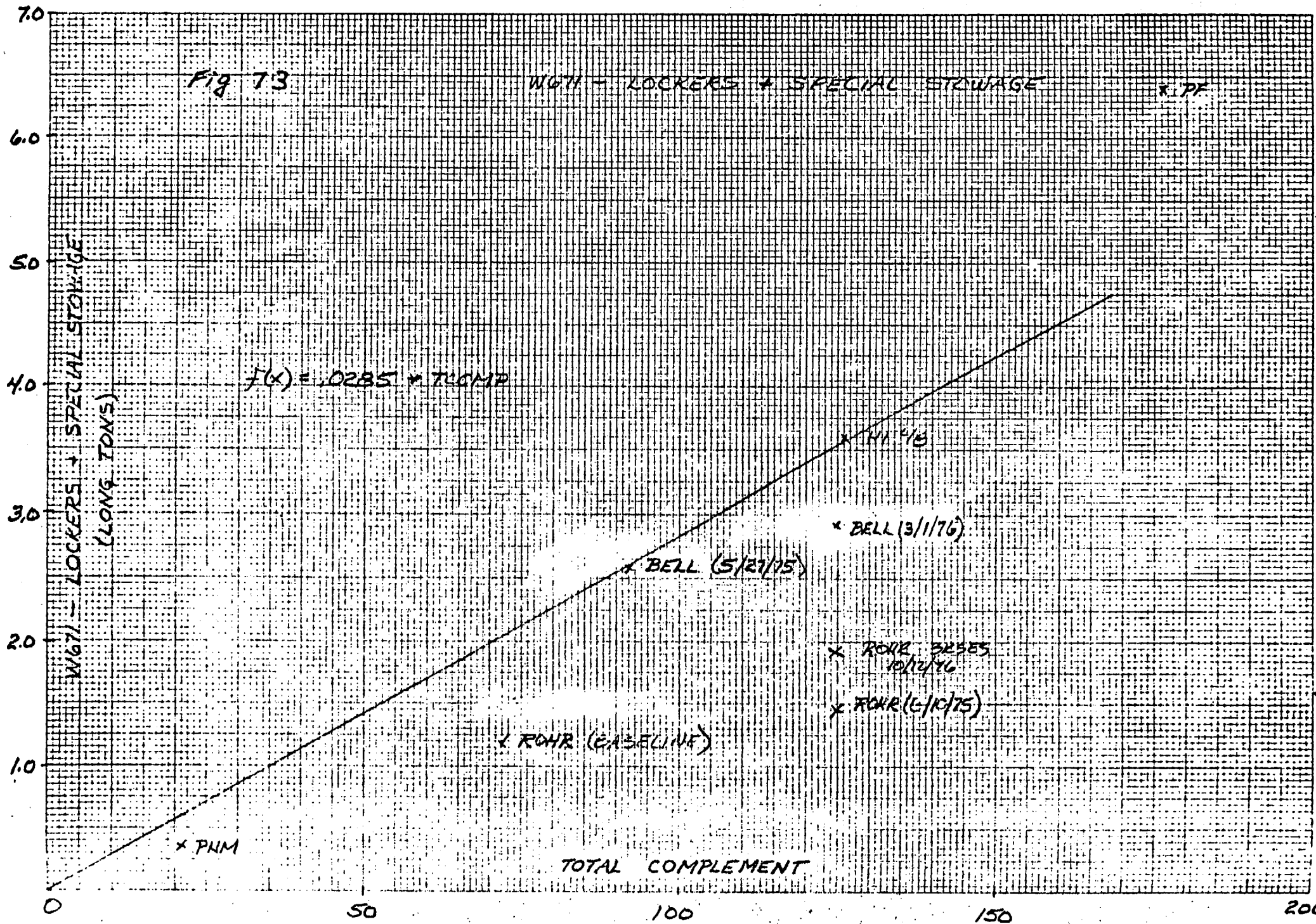




Fig. 74

WG7Z - STOREROOMS + ISSUE ROOMS

WG7Z - STOREROOMS + ISSUE ROOMS  
(LONG TONS)

20.0  
18.0  
16.0  
14.0  
12.0  
10.0  
8.0  
6.0  
4.0  
2.0

0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

ADHR 3465  
10/24/74 x  
REAR  
(8/23/74)

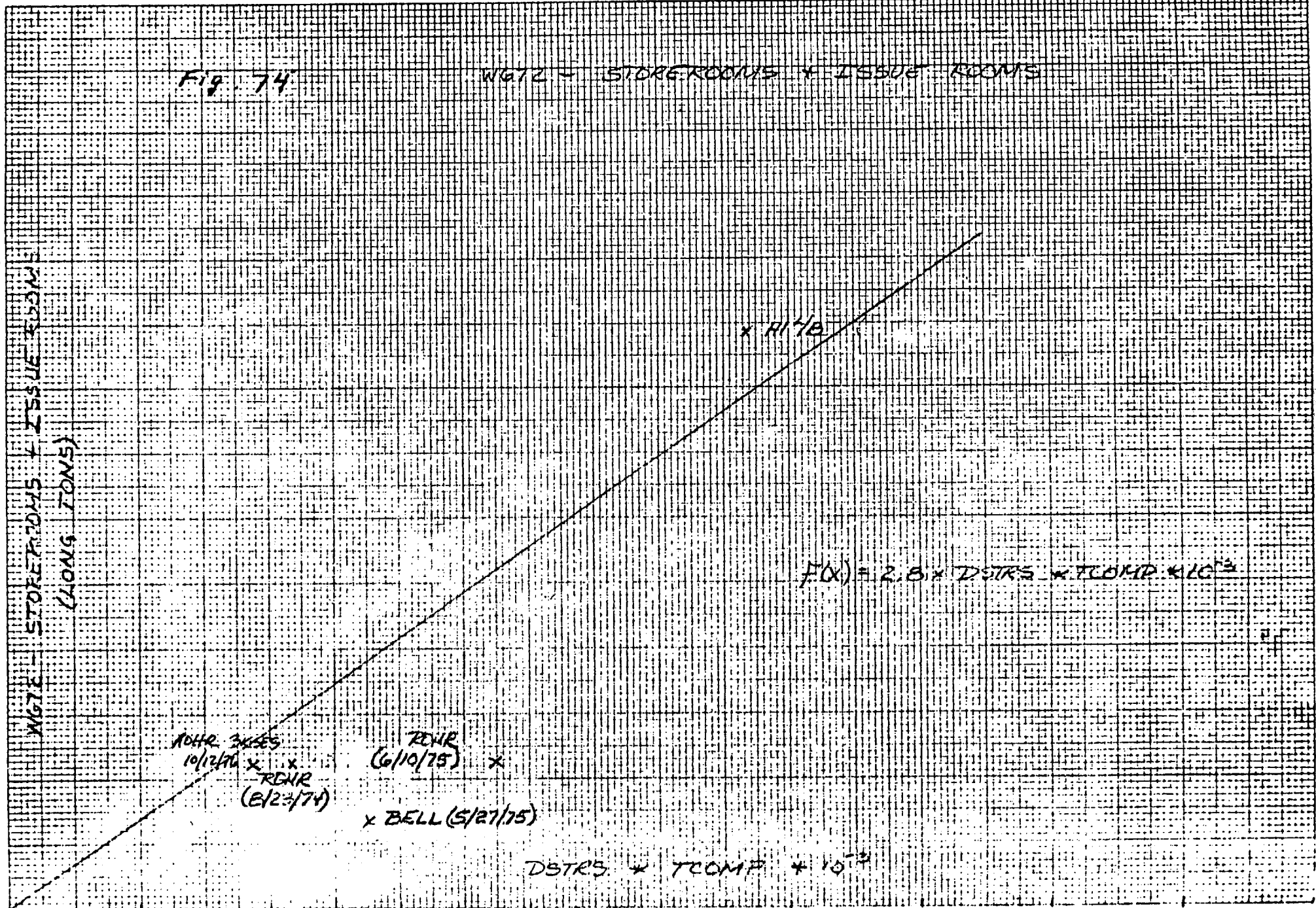
REAR  
(6/10/75) x

x BELL (5/27/75)

x RI 1/10

$$F(x) = 2.8 \times \text{DSTRS} \times \text{TCOMP} \times 10^3$$

$$\text{DSTRS} \times \text{TCOMP} \times 10^3$$



ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 ARMAMENT — GROUP 7, Sheet 1 of 2  
 NAVSEA 9096/3 (7-82) (Previously NAVSHIPS 9291/14)

REV 2-8/4/63

U.S.S. FY 83 CGV MONOHULL ARMAMENT — GROUP 7

PAGE

DATE 5-31-83

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
710	GUNS AND AMMUNITION	20.12	67.00						20.12				
711	GUNS 3 GOALKEEPER 30mm	19.82	67.00						19.82				
712	AMMUNITION HANDLING	0.30	67.00						0.30				
713	AMMUNITION STOWAGE												
720	MISSILES AND ROCKETS	354.96	63.00						354.96				
721	LAUNCHING DEVICES (MISSILES AND ROCKETS)	354.96	63.00						354.96				
722	MISSILE, ROCKET, AND GUIDANCE CAPSULE HANDLING SYS.												
723	MISSILE AND ROCKET STOWAGE												
724	MISSILE HYDRAULICS												
725	MISSILE GAS												
726	MISSILE COMPENSATING												
727	MISSILE LAUNCHER CONTROL												
728	MISSILE HEATING, COOLING, TEMPERATURE CONTROL												
729	MISSILE MONITORING, TEST AND ALINEMENT												
730	MINES												
731	MINE LAUNCHING DEVICES												
732	MINE HANDLING												
733	MINE STOWAGE												
740	DEPTH CHARGES												
741	DEPTH CHARGE LAUNCHING DEVICES												
742	DEPTH CHARGE HANDLING												
743	DEPTH CHARGE STOWAGE												
750	TORPEDOES	2.00	44.00						2.00				
751	TORPEDO TUBES	2.00	44.00						2.00				
752	TORPEDO HANDLING												
753	TORPEDO STOWAGE												
754	SUBMARINE TORPEDO EJECTION												
Sub Total Group 7 — Sheet 1, POUNDS													
TONS													

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 ARMAMENT — GROUP 7, Sheet 2 of 2  
 NAVSEA 9096/3 (7-82) (Previously NAVSHIPS 9291/14)

U.S.S. FY 83 CGV MONOHULL ARMAMENT — GROUP 7

PAGE

DATE 5-31-83

ACCT. NO.	DESCRIPTION	WEIGHT (Pounds) (Tons)	CENTER OF GRAVITY										
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	ST'BD	MOMENTS	
760	SMALL ARMS AND PYROTECHNICS	5.00	40.23					5.00					
761	SMALL ARMS AND PYROTECHNIC LAUNCHING DEVICES	5.00	40.23					5.00					
762	SMALL ARMS AND PYROTECHNIC HANDLING							5.00					
763	SMALL ARMS AND PYROTECHNIC STOWAGE												
770	CARGO MUNITIONS												
772	CARGO MUNITIONS HANDLING												
773	CARGO MUNITIONS STOWAGE												
780	AIRCRAFT RELATED WEAPONS	103.24	26.94					135.57					
782	AIRCRAFT RELATED WEAPONS HANDLING	52.73	35.76					42.61					
783	AIRCRAFT RELATED WEAPONS STOWAGE	50.51	17.75					26.76					
790	SPECIAL PURPOSE SYSTEMS	71.85	43.05					15.79					
792	SPECIAL WEAPONS HANDLING												
793	SPECIAL WEAPONS STOWAGE LASER	12.60	15.00										
797	MISC. ORDNANCE SPACES												
798	ARMAMENT OPERATING FLUIDS	1.29	38.74					1.29					
799	ARMAMENT REPAIR PARTS AND SPECIAL TOOLS	14.50	95.01					14.50					
791	SPECIAL WEAPONS LASER	43.46	54.00										
	Sub Total Group 7 — Sheet 2												
	Sub Total Group 7 — Sheet 1												
	TOTAL — GROUP 7, POUNDS												
	TONS	557.17	53.62					533.00					

REPRODUCED AT GOVERNMENT EXPENSE

COMPUTING BY

COMPUTING CHECKED

HELWS - Consumable Weights for 100

POUNDS\*

<u>Consumable</u>		<u>Baseline</u>	<u>Near-term</u>	<u>Advanced</u>
Nitrogen Tri-flouride	NF <sub>3</sub>	4,044	3,173	4,101
Ethylene	C <sub>2</sub> H <sub>4</sub>	405	291	464
Helium	He	3,485	2,914	3,769
Deuterium	D <sub>2</sub>	309	212	274
LOX	O <sub>2</sub>	7,784	5,304	6,851
Nitrogen**	(stowed) N <sub>2</sub>	2,000	2,000	2,000
	(used) N <sub>2</sub>	1,200	1,200	1,200
Water, fresh	H <sub>2</sub> O	<u>5,738</u>	<u>3,750</u>	<u>4,839</u>
<b>Total</b>		<b>23,765</b>	<b>17,649</b>	<b>22,298</b>

\* Does not include tanks, valves, feedlines, etc.

\*\* Nitrogen: 2.0K lbs. stowed and included in total;  
1.2K lbs used for 100 seconds of firing.

22-80-0000

<u>Subsystem</u>		<u>Baseline</u>	<u>Near Term</u>	<u>Advanced</u>
Gain Generator		2,779	2,007	2,591
Optical Resonator		1,000	1,000	1,000
Optical Bench		1,504	910	1,274
Diffuser		930	532	738
Ejector		5,096	3,628	4,452
Consumables: *				
Nitrogen Tri-flouride	NF <sub>3</sub>	5,266	4,371	5,411
Ethylene	C <sub>2</sub> H <sub>4</sub>	1,367	788	1,429
Helium	He	9,781	9,196	11,040
Deuterium	D <sub>2</sub>	862	657	726
LOX	O <sub>2</sub>	9,412	6,400	8,211
Water, fresh	H <sub>2</sub> O	5,929	4,864	5,004
Sub-total	(A)	<u>43,926</u>	<u>34,353</u>	<u>41,876</u>
Distillate fuel required	JP-5	4,723	3,579	4,625

\*Includes tanks, valves, feedlines and heaters

Beam Duct		2,425	About 10% less than baseline	About same as Baseline
Control Console		1,500		
Beam Shaping Telescope		2,500		
Turning Mirror and Enclosure		900		
Alignment System		450		
Cryostat		1,800		
Isolation Valves (4)		1,400		
Air Liquefier (O <sub>2</sub> /N <sub>2</sub> )		18,500		
Aerodynamic Window		1,375		
Sub-total	(B)	<u>30,850</u>		
Beam Director		59,000	48,000	57,000
Sub-total	(B)+BD=(C)	<u>89,850</u>	<u>76,765</u>	<u>87,850</u>
Sub-total	(A)	43,926	34,353	41,876
Total (A)+(C)		133,776	110,418	129,726

Approx. 61,000 Kg      50,000 Kg      59,000 Kg

SES UNIT ANALYSIS - SUMMARY  
(By Ship's Work Breakdown Structure)

		QTY	WT (LT)	WT (LT)	WT (LT)	SCALE FACTORS	REFERENCE
770	CARGO MUNITIONS						
772	Cargo Munitions Handling						
773	Cargo Munitions Stowage						
780	AIRCRAFT RELATED WEAPONS						
782	Aircraft Related Weapons Handling						
783	Aircraft Related Weapons Stowage						
790	SPECIAL PURPOSE SYSTEMS						
792	Special Weapons Handling						
793	Special Weapons Stowage						
797	Misc. Ordnance Spaces						
798	Armament Operating Fluids						
799	Armament Repair Parts and Special Tools						
	GROUP 700 TOTAL		557				

GP 4

487

Signature \_\_\_\_\_

MARGINS

1338

LIGHT SHIP

12087

F10 CREW

129

F20 MISSILE EXPEND

1120

F30 STORES

117

F40 FUELS

3159

F50 LIQUIDS

218

Σ VAR LOAD

4743

FLD

16830

ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
 LOADS - Sheet 1 of 2  
 NAVSEA 9096/5 (7-82) (Formerly NAVSEC 9291/15)

PAGE

U.S.S. FY 83 CGV MONOHULL LOADS

DATE 5-31-82

ACCT. NO.	DESCRIPTION	WEIGHT (Tons)	CENTER OF GRAVITY											
			ABOVE BASE	MOMENTS	REFERRED TO FRAME NO.				REFERRED TO					
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS		
10	SHIPS FORCE, AMPHIBIOUS FORCE, TROOPS AND PASSENGERS	129.61	51.40		142.3									
11	SHIPS OFFICERS	16.76	51.40		18.4			74.87						
12	SHIPS NONCOMMISSIONED OFFICERS	9.76	51.40		10.8									
13	SHIPS ENLISTED MEN	103.09	51.40		113.1									
14	MARINES													
15	TROOPS													
16	AIR WING PERSONNEL													
19	OTHER PERSONNEL													
20	MISSION RELATED EXPENDABLES AND SYSTEMS	1200.36	43.80		1053.5			1120.00						
21	SHIP AMMUNITION (FOR USE BY SHIP ON WHICH STOWED)	523.91	55.99		523									
22	ORDNANCE DELIVERY SYSTEMS AMMUNITION	400.00	16.25		320									
23	ORDNANCE DELIVERY SYSTEMS	173.20	69.50		173									
24	ORDNANCE REPAIR PARTS (SHIP AMMO)													
25	ORDNANCE REPAIR PARTS (ORDNANCE DELIVERY SYSTEMS AMMO)													
26	ORDNANCE DELIVERY SYSTEMS SUPPORT EQUIPMENT	103.25	45.57		37.5									
29	SPECIAL MISSION RELATED SYSTEMS AND EXPENDABLES													
30	STORES	248.11	28.64		270			129.35						
31	PROVISIONS & PERSONNEL STORES	200.22	26.40		~205									
32	GENERAL STORES	47.89	37.99		~65									
33	MARINES STORES (FOR SHIP'S COMPLEMENT)													
39	SPECIAL STORES													
40	FUEL AND LUBRICANTS	3431.43	15.07		3958			2800.15						
41	DIESEL FUEL	2685.08	14.85		700									
42	JP-5	700.00	14.85											
43	GASOLINE													
44	DISTILLATE FUEL													
45	NAVY STANDARD FUEL OIL (NSFO)				3258									
46	LUBRICATING OIL	33.75	36.67											
49	SPECIAL FUELS AND LUBRICANTS (LASER)	12.60	15.00											
Sub Total LOADS - Sheet 1, TONS					5424									

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE

REV 1 - 7/2/83

ESTIMATE OF WEIGHT FOR SHIPS, SUMMARY SHEET  
LOADS - Sheet 2 of 2  
NAVSEA 9096/5 (7-82) (Formerly NAVSEC 9291/15)

U.S.S. FY 83 CGV MONOHULL LOADS

PAGE

DATE 5-31-83

ACCT. NO.	DESCRIPTION	WEIGHT (Tons)	ABOVE BASE	MOMENTS	CENTER OF GRAVITY								
					REFERRED TO FRAME NO.				REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD	MOMENTS	
50	LIQUID AND GASES (NON FUEL TYPE)	224.87	14.85			190			208.32				
51	SEA WATER												
52	FRESH WATER	189.51	14.85			190							
53	RESERVE FEED WATER	16.20	14.85										
54	HYDRAULIC FLUID												
55	SANITARY TANK LIQUID	19.16	14.85										
56	GAS (NON FUEL TYPE)												
59	MISCELLANEOUS LIQUIDS (NON FUEL TYPE)												
60	CARGO												
61	CARGO, ORDNANCE AND ORDNANCE DELIVERY SYSTEM												
62	CARGO, STORES												
63	CARGO, FUEL AND LUBRICANTS												
64	CARGO LIQUIDS (NON FUEL TYPE)												
65	CARGO, CRYOGENIC AND LIQUEFIED GAS												
66	CARGO, AMPHIBIOUS ASSAULT SYSTEMS												
67	CARGO, GASES												
69	CARGO, MISCELLANEOUS												
70	SEA WATER BALLAST (SUBMARINES)												
71	MAIN BALLAST WATER (SUB)												
72	VARIABLE BALLAST WATER (SUB)												
73	RESIDUAL WATER (SUB)												
	Sub Total LOADS - Sheet 2, TONS					190							
	Sub Total LOADS - Sheet 1, TONS					5424							
	<b>TOTAL - LOADS, TONS</b>	<b>5234.38</b>	<b>23.19</b>			<b>5614</b>			<b>4352.70</b>				

REPRODUCED AT GOVERNMENT EXPENSE

COMPUTING BY

COMPUTING CHECKED



ESTIMATE OF WEIGHT FOR SHIPS  
SHIP IN LIGHT CONDITION

NAVSHIPS 9291/6 (REV. 3-67) (Formerly NAVSHIPS 4616A-4) SHEET 1 U.S.S.

PAGE

DATE

SESDES

NAVSEA

GROUP	DESCRIPTION	WEIGHT (Tons)	ABOVE BASE	MOMENTS	SWATH CENTER OF GRAVITY						
					REFERRED TO FRAME NO.		REFERRED TO				
					FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	STBD
1	HULL STRUCTURE	12303.40	38.11			12195		5888.72			
2	PROPULSION	1301.98	19.20			1240		1034.76			
3	ELECTRIC PLANT	768.56	33.64			902		352.07			
4	COMMUNICATION AND CONTROL	504.13	48.11			520		484.67			
5	AUXILIARY SYSTEMS	2542.45	38.74			2768.5		1347.57		2293.82	
6	OUTFIT AND FURNISHINGS	1459.22	45.95			1609		1137.63		1097.74	
7	ARMAMENT	557.17	53.62			613		533.44			
<b>MARGIN</b>											
TOTAL 1-7		19436.89	38.04			19917.5		10779.06			
MARGIN 12.5% wt / 12.5% KG		+ 2429.61	+4.76			2480.9		1347.38			
<b>SHIP IN LIGHT CONDITION</b>		<b>21866.50</b>	<b>42.80</b>			<b>22329</b>		<b>12126.44</b>			
BASE ABOVE/BELOW BOTTOM OF KEEL - FEET											
CENTER OF GRAVITY ABOVE BOTTOM OF KEEL - FEET											

CONDITION A - LIGHT CONDITION

Ship complete, ready for service in every respect, including permanent ballast (solid and liquid), and liquids in machinery at operating levels, without any items of variable load, and without airplanes. This condition shall represent the ship under wartime conditions, with ultimate armament and boat allowance aboard.

DRAFT CORRESPONDING TO ABOVE DISPLACEMENT AT CENTER OF FLOTATION	
TRANSVERSE METACENTER ABOVE BOTTOM OF KEEL AT ABOVE MEAN DRAFT	
C.G. ABOVE BOTTOM OF KEEL	FEET GM
MOMENT TO ALTER TRIM 1 INCH	
C.B. OF SHIP ON EVEN KEEL AT ABOVE DRAFT FORWARD/AFT OF REFERENCE FRAME	
C.G. FORWARD/AFT OF REFERENCE FRAME	
TRIMMING LEVER FORWARD/AFT	
$\text{TRIM} = \frac{\text{DISP'T (tons)} \times \text{TRIMMING LEVER (ft.)}}{\text{MOMENT TO ALTER TRIM 1 IN. (ft. tons)} \times 12}$	
$\text{DIFF. IN DRAFT BETWEEN L.C.F. AND MIDSHIPS} = \frac{\text{TRIM} \times \text{CG OF WP AFT OF WP (ft.)}}{\text{L.B.P. (ft.)}}$	
$\text{LIST} = \frac{\text{HEELING MOMENT (ft. tons)}}{.01745 \times \text{DISP'T (tons)} \times \text{GM}}$	

REPRODUCED AT GOVERNMENT EXPENSE

REV 1 - 7/20/83

REV 2 - 8/4/83

ESTIMATE OF WEIGHT FOR SHIPS  
SHIP IN FULL LOAD CONDITION  
NAVSIPS 929170 (REV. 3-67) SHEET 4

U.S.S. CGV MONOHULL

PAGE  
DATE 7-19-83

DESCRIPTION	WEIGHT (Tons)	ABOVE BASE	MOMENTS	CENTER OF GRAVITY								
				REFERRED TO FRAME NO.				REFERRED TO				
				FWD	MOMENTS	AFT	MOMENTS	PORT	MOMENTS	ST'BD	MOMENTS	
SHIP IN LIGHT CONDITION	21866.50	42.80			22329			12126.44				
LOADS (FROM PAGE _____)	5234.38	23.19			5614			4352.70				
SHIP IN FULL LOAD CONDITION	27100.88	39.01			27943			16479.14				
BASE ABOVE/BELOW BOTTOM OF KEEL - FEET												
CENTER OF GRAVITY ABOVE BOTTOM OF KEEL - FEET												

CONDITION D-FULL LOAD CONDITION. -Ship complete, ready for service in every respect, with liquids in machinery at operating levels; authorized complement of officers, men, and their effects; full allowances of ammunition; full complement of airplanes (fully loaded); full supply of provisions and stores for the period specified in the design characteristics; fuel oil in amount necessary to meet endurance requirements; all other liquids in tanks, to full capacity.

For cargo and tender type vessels, the ammunition, stores, fresh water, and fuel, referred to above, are for the ship's own use; cargo, and supplies other than for ship's own use, shall be included in the amounts normally carried, or to the full capacity of the spaces assigned. Cargo shall be limited, if necessary, to avoid exceeding the limiting draft.

DRAFT CORRESPONDING TO ABOVE DISPLACEMENT AT CENTER OF FLOTATION

TRANSVERSE METACENTER ABOVE BOTTOM OF KEEL AT ABOVE MEAN DRAFT

C.G. ABOVE BOTTOM OF KEEL

GM, NO CORRECTION FOR FREE SURFACE. FEET (CORRECTION = feet), GM, CORRECTED FOR FREE SURFACE.

MOMENT TO ALTER TRIM 1 INCH

C.B. OF SHIP ON EVEN KEEL AT ABOVE DRAFT FORWARD/AFT OF REFERENCE FRAME

C.G. FORWARD/AFT OF REFERENCE FRAME

TRIMMING LEVER FORWARD/AFT

TRIM =  $\frac{\text{DISP'T (tons)} \times \text{TRIMMING LEVER (ft.)}}{\text{MOMENT TO ALTER TRIM 1 IN. (ft. tons)} \times 12}$  = \_\_\_\_\_ FEET

DIFF. IN DRAFT BETWEEN L.C.F. AND MIDSHIPS =  $\frac{\text{TRIM} \times \text{CG OF WP AFT OF MP (ft.)}}{\text{L.B.P. (ft.)}}$  = \_\_\_\_\_ FEET INCRE

LIST =  $\frac{\text{HEELING MOMENT (ft. tons)}}{.01745 \times \text{DISP'T (tons)} \times \text{GM}}$  = \_\_\_\_\_ DEGREES PO

DRAFTS ABOVE BOTTOM OF KEEL AT PERPENDICULARS: FORWARD FEET, AFT FEET, MEAN

COMPUTING BY

COMPUTING CHECKED

REPRODUCED AT GOVERNMENT EXPENSE