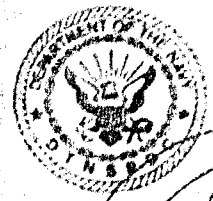


Report 77-0008

STANDARDIZATION AND PRELIMINARY FUEL ECONOMY TRIALS OF USS TARAWA (LHA 1)

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Bethesda, Md. 20084

STANDARDIZATION AND PRELIMINARY FUEL ECONOMY TRIALS OF USS TARAWA (LHA 1)

by

Donald H. Drazin

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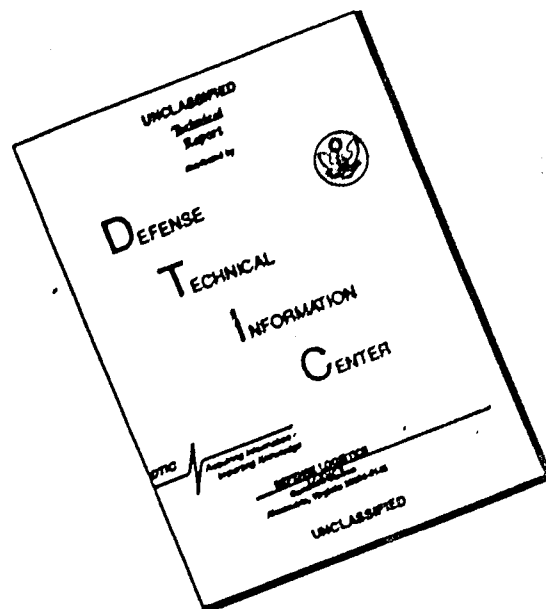
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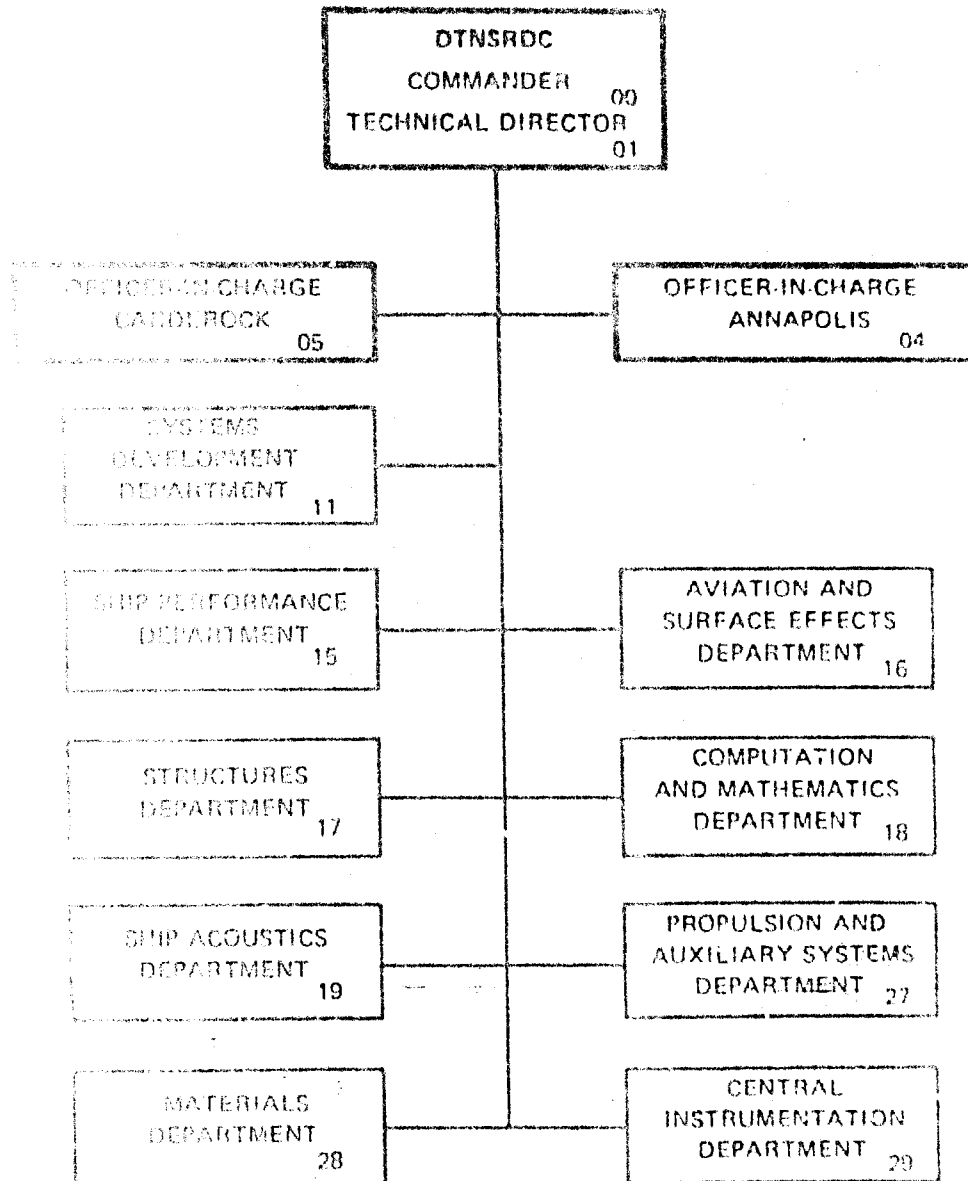
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TARAWA obtained a speed of 24.70 knots at 175.0 RPM, 2,010,000 pound feet (2,730,000 newton metres) shaft torque, and 67,050 SHP (50,000 kilowatts) at heavy displacement. A speed of 25.42 knots was obtained at 174.7 RPM, 1,925,000 pound feet (2,610,000 newton metres) shaft torque, and 64,000 SHP (47,750 kilowatts) at the light displacement. Preliminary fuel economy data indicate a Specific Fuel Rate of .647 pounds per shaft horsepower hour (.394 grams per watt hour) at 68,293 SHP (50,926 kilowatts).

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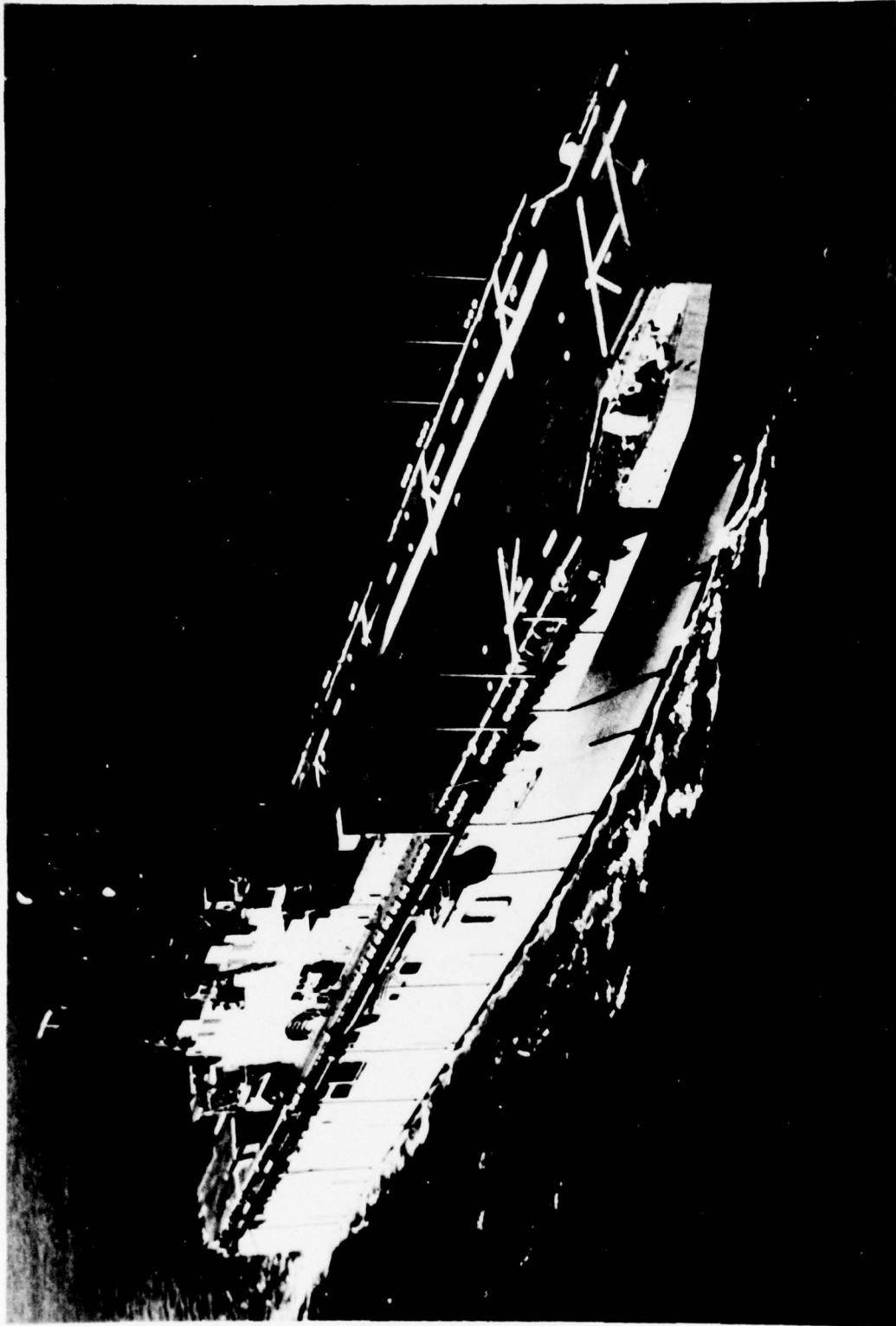
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USS TARAWA (LHA 1)

ABSTRACT

This report contains the results of standardization trials conducted on USS TARAWA (LHA 1) at a heavy displacement of 39,400 tons salt water (40,030 metric tons), and a light displacement of 35,000 tons salt water (35,560 metric tons). Measurements were made to determine powering data throughout the speed range at both displacements. In addition, fuel economy trials were conducted at the heavy displacement, and preliminary data are included in this report.

TARAWA obtained a speed of 24.70 knots at 175.0 RPM, 2,010,000 pound feet (2,730,000 newton metres) shaft torque, and 67,050 SHP (50,000 kilowatts) at heavy displacement. A speed of 25.42 knots was obtained at 174.7 RPM, 1,925,000 pound feet (2,610,000 newton metres) shaft torque, and 64,000 SHP (47,750 kilowatts) at the light displacement. Preliminary fuel economy data indicate a Specific Fuel Rate of .647 pounds per shaft horsepower hour (.394 grams per watt hour) at 68,293 SHP (50,926 kilowatts).

ADMINISTRATIVE INFORMATION

The trials of USS TARAWA (LHA 1) reported herein were authorized by and conducted in accordance with Naval Sea Systems Command Trial Agenda Letter PMS 377/DJD, LHA 1 c1/3960, Ser 728 of 21 June 1976. The work was accomplished under David W. Taylor Naval Ship Research and Development Center Work Unit Number 1-1536-143.

INTRODUCTION

USS TARAWA (LHA 1) is the first of a new class of general purpose amphibious assault ships. The ship has a highly automated steam plant permitting a reduced crew. TARAWA was constructed by the Ingalls Shipbuilding Division of Litton Systems, Inc., Pascagoula, Mississippi.

Standardization trials were conducted at the measured mile course, San Clemente Island, California on 31 August and 1 September 1976. These trials were conducted by representatives from the David W. Taylor Naval Ship Research and Development Center (DTNSRDC) with assistance from the ship's

force. The purpose of the standardization trials was to determine the relationship between ship speed, propeller shaft revolutions per minute and propeller shaft power.

The fuel economy trials were conducted in free route from 31 August through 3 September 1976 during transit to and from San Clemente Island, California and San Diego, California and while in the vicinity of San Clemente Island. These trials were conducted by Naval Ship Engineering Center personnel with assistance from the ship's force and DTNSRDC personnel.

TRIAL CONDITIONS

The principal ship and propeller characteristics are listed in Table 1. USS TARAWA was drydocked at Ingalls Shipbuilding, Pascagoula, Mississippi from 11 January to 18 January 1976 at which time the hull and propeller were cleaned. The standard Navy anticorrosive paint, with an overlay of vinyl antifouling paint, was applied to the hull.

Since the trials were not conducted until the latter part of August 1976, it was decided to have the ship's underwater hull cleaned in San Diego, California. This work was performed during the time period of 16 August through 25 August 1976. The hull was cleaned by contractor divers using the SCAMP system. The propellers and appendages were cleaned by hand. After this work was completed, DTNSRDC divers inspected and recorded the condition of the hull. This inspection indicated that the propellers had not been cleaned sufficiently, and the contractor had the propellers recleaned.

Trial conditions are listed in Table 2. The heavy standardization trials were conducted on 31 August 1976 at a displacement of 39,400 tons salt water (40,030 metric tons). Light standardization trials were conducted on 1 September 1976 at 35,000 tons salt water (35,560 metric tons) displacement. The weather conditions on both days were generally favorable.

TABLE 1 - SHIP AND PROPELLER CHARACTERISTICS

SHIP CHARACTERISTICS

Length Overall, LOA (extreme)	820 ft	(249.9 m)
Length between Perpendiculars, LBP	778 ft	(237.1 m)
Breadth, (extreme)	106.12 ft	(32.3 m)

PROPELLER CHARACTERISTICS

Number of Propellers	2	2
Propeller Diameter	16.5 ft	(5.0 m)
Propeller Pitch at 0.7 Radius	18.54 ft	(5.65 m)
Mean Width Ratio	2.49	2.49
Disc Area	214 ft ²	(19.9 m ²)
Projected Area	131 ft ²	(12.2 m ²)
Number of Blades	6	6
Material	Nickel-Aluminum-Bronze	
Manufacturer	Lips	Lips
Serial Number		
Port - S/N 28232		
Stbd - S/N 28231		
Drawing Number		
LHA1-203-4522379		

TABLE 2 - TRIAL CONDITIONS

HEAVY DISPLACEMENT

Trial Date	31 AUG 1976
Displacement	39,400 tons salt water (40,030 metric tons)
Trim	4 inches by the stern (.1 metre by the stern)
Sea State	0-1 Beaufort Scale
Water Temperature	70°F (21.1°C)
Specific Gravity	1.0255

LIGHT DISPLACEMENT

Trial Date	1 SEP 1976
Displacement	35,000 tons salt water (35,560 metric tons)
Trim	Even Keel
Sea State	0-1 Beaufort Scale
Water Temperature	70°F (21.1°C)
Specific Gravity	1.0255

Fuel economy trials were run at a heavy displacement of 39,400 tons salt water (40,030 metric tons) from 31 August through 3 September 1976. Sea conditions were favorable with low sea states and low wind velocities.

TRIAL PROCEDURES AND INSTRUMENTATION

The heavy displacement standardization trials consisted of eight spots at various approach speeds in order to define the standardization curve. Six spots were used to describe the light displacement curve. Some spots consisted of the mean of means of three passes across the measured course. When the speed across the measured course did not vary much between two successive passes, the spot at that speed consisted of the average of those two passes.

The quantities measured during the trials were propeller shaft torque, propeller shaft RPM, elapsed time over the measured course, and high pressure turbine first stage shell pressure. Propeller shaft torque was measured on each shaft with a DTNSRDC magnetic micrometer in conjunction with a clamp-on torsionmeter husk. Interrupter rings on the torsionmeter husks were electrically connected to a standardization panel for measuring propeller shaft revolutions. In addition, propeller shaft RPM was recorded by means of a clamp-on ring with magnetic inserts mounted on the ring. An electrical signal was generated by a magnetic probe in proximity to the ring. Elapsed time was read from the standardization panel with accurate electronic clocks. The elapsed time was determined by observers located on the ship at various locations. They would start and stop these clocks as the ship crossed the beginning and the end of the measured course. The high pressure turbine first stage shell pressure data were obtained from ship's electrical signals which were digitally recorded while conducting a run. These signals were calibrated prior to sea trials.

Propeller shaft torque, RPM, and fuel rate data were collected for fuel economy trials. These runs consisted of steaming on a straight course for about two hours at various steady operating conditions.

PRESENTATION AND DISCUSSION OF TRIAL RESULTS

Standardization trial results at heavy displacement are summarized in Tables 3 and 4. Light displacement results are tabulated in Tables 5 and 6. Both heavy and light displacement data are presented as curves in Figure 1. The speed data are based on the International Nautical Mile, 6076.1 feet (1852 metres). The data presented are for observed conditions and have not been corrected for wind effects or reduced to standard conditions of sea water temperature and density.

TARAWA obtained a top speed of 24.70 knots at an average RPM of 175.0; a total shaft torque of 2,010,000 pound feet (2,730,000 newton metres), and a total power of 67,050 SHP (50,000 kilowatts) at the heavy displacement. A top speed of 25.42 knots at an average RPM of 174.7 was achieved at the light displacement. A total shaft torque of 1,925,000 pound feet (2,610,000 newton metres) and a total power of 64,000 SHP (47,750 kilowatts) were developed at the light displacement.

As can be observed in Figure 1, the data spot at the light displacement condition of 20.40 knots does not fall on the curve determined by the other data spots. This problem was observed while analyzing data during the trials. Due to other ship commitments, there was no time available to make additional passes across the measured course to more closely define this area of the standardization curve.

Tables 7 and 8 are a tabulation of high pressure turbine first stage shell pressure data at heavy and light displacements, respectively, while Figure 2 presents this data graphically.

Tables 9 and 10 are preliminary fuel economy data in English and metric units, respectively. These data are to be considered preliminary as the final data will be published in a separate report by the Naval Ship Engineering Center, Philadelphia Division.

TABLE 3 - SUMMARY OF SPEED, RPM, AND POWERING DATA AT HEAVY DISPLACEMENT

AVG	SHIP'S SPEED (KNOTS)	SHAFT RPM		AVG	POWER (SHP)		POWER (KILOWATTS)		
		STBD SHAFT	PORT SHAFT		STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT
	11.81	80.1	78.6	79.4	2,990	2,800	2,220	2,090	4,310
	12.08	80.5	78.8	79.6	2,940	2,730	2,200	2,030	4,230
AVG	11.94			79.5			5,750		4,250
	14.72	99.9	99.3	99.6	5,730	5,730	4,280	4,270	8,550
	14.93	99.5	99.4	99.4	5,610	5,730	4,190	4,270	8,460
	14.54	99.6	99.4	99.5	5,830	5,810	4,340	4,340	8,680
AVG	14.78			99.5			11,450		8,550
	17.83	120.0	119.1	119.6	10,060	9,910	7,500	7,390	14,890
	17.56	119.4	119.1	119.2	9,920	10,020	7,390	7,470	14,860
AVG	17.70			119.4			19,950		14,900
	19.60	134.0	133.7	133.8	14,250	14,330	10,630	10,680	21,310
	19.86	134.8	134.6	134.7	14,250	14,540	10,630	10,840	21,470
	19.63	134.1	135.4	134.8	14,140	15,070	10,540	11,240	21,780
AVG	19.74			134.5			28,850		21,500
	21.72	149.8	149.1	149.4	20,130	20,240	15,010	15,090	30,100
	21.47	149.4	148.8	149.1	20,350	20,520	15,170	15,310	30,480
AVG	21.60			149.2			40,600		30,300
	22.64	159.7	158.9	159.3	25,000	25,030	18,640	18,670	37,310
	22.98	159.9	159.4	159.6	24,790	25,120	18,480	18,730	37,210
AVG	22.81			159.4			49,950		37,250

TABLE 3 (Continued)

AVG	SHIP'S SPEED (KNOTS)	SHAFT RPM		AVG	POWER (SHP)			POWER (KILOWATTS)		
		STBD SHAFT	PORT SHAFT		STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT	TOTAL
	23.99	169.7	170.0	169.8	30,110	30,880	60,990	22,450	23,030	45,480
	24.34	169.5	170.0	169.8	30,040	30,900	60,940	22,400	23,040	45,440
	23.83	169.4	169.8	169.6	30,050	30,860	60,910	22,410	23,010	45,420
∞	24.12			169.8			60,950			45,450
	24.92	174.9	175.1	175.0	33,220	33,700	66,920	24,770	25,130	49,900
	24.44	174.2	174.7	174.4	33,050	33,680	66,730	24,640	25,120	49,760
	25.01	176.0	176.0	176.0	33,790	34,100	67,890	25,200	25,430	50,630
AVG	24.70			175.0			67,050			50,000

The average power data are rounded off to the nearest 50 SHP and 50 kilowatts.

TABLE 4 - SUMMARY OF SPEED AND TORQUE DATA AT HEAVY DISPLACEMENT

SHIP'S SPEED (KNOTS)	SHAFT TORQUE (LB FT) x 10 ⁻⁵			SHAFT TORQUE (NEWTON METRES) x 10 ⁻⁵		
	AVG	STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT
11.81	1.96	1.87	3.83	2.65	2.54	5.19
12.08	1.92	1.82	3.74	2.60	2.46	5.06
AVG	11.94	3.80	3.80	5.10		
14.72	3.01	3.03	6.04	4.09	4.11	8.20
14.93	2.96	3.03	5.99	4.02	4.10	8.12
14.54	3.07	3.07	6.14	4.16	4.17	8.33
AVG	14.78	6.05	6.05	8.20		
17.83	4.40	4.37	8.77	5.97	5.92	11.89
17.56	4.36	4.42	8.78	5.91	5.99	11.90
AVG	17.70	8.80	8.80	11.90		
19.60	5.58	5.63	11.21	7.57	7.63	15.20
19.86	5.55	5.67	11.22	7.52	7.69	15.21
19.63	5.54	5.85	11.39	7.51	7.93	15.44
AVG	19.74	11.25	11.25	15.25		
21.72	7.06	7.13	14.19	9.57	9.67	19.24
21.47	7.15	7.24	14.39	9.70	9.82	19.52
AVG	21.60	14.30	14.30	19.40		
22.64	8.22	8.27	16.49	11.14	11.22	22.36
22.98	8.14	8.28	16.42	11.04	11.22	22.26
AVG	22.81	16.45	16.45	22.30		

TABLE 4 (Continued)

SHIP'S SPEED (KNOTS)	SHAFT TORQUE (LB FT) $\times 10^{-5}$			SHAFT TORQUE (NEWTON METRES) $\times 10^{-5}$			
	AVG	STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT	TOTAL
23.99		9.32	9.54	18.86	12.63	12.93	25.56
24.34		9.31	9.54	18.85	12.62	12.94	25.56
23.83		9.32	9.54	18.86	12.63	12.94	25.57
24.12	AVG			18.85			25.55
24.92		9.97	10.11	20.08	13.52	13.70	27.22
24.44		9.96	10.12	20.08	13.51	13.73	27.24
25.01		10.08	10.18	20.26	13.67	13.79	27.46
24.70	AVG			20.10			27.30

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The average torque data are rounded off to the nearest $5 \times 10^{+3}$ lb ft and $5 \times 10^{+3}$ newton metres.

TABLE 5 - SUMMARY OF SPEED, RPM, AND POWERING DATA AT LIGHT DISPLACEMENT

SHIP'S SPEED (KNOTS)	SHAFT RPM		POWER (SHP)			POWER (KILOWATTS)			
	STBD SHAFT	PORT SHAFT	AVG	STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT	TOTAL
12.36	80.2	79.6	79.9	2,780	2,770	5,550	2,080	2,060	4,140
12.31	79.7	79.4	79.6	2,760	2,700	5,460	2,060	2,010	4,070
AVG	12.34		79.8			5,500			4,100
15.40	100.4	100.6	100.5	5,610	5,630	11,240	4,190	4,200	8,390
15.64	99.7	101.6	100.6	5,180	5,840	11,020	3,860	4,360	8,220
AVG	15.52		100.6			11,150			8,300
18.56	119.8	119.2	119.5	9,500	9,030	18,530	7,090	6,730	13,820
18.36	120.6	120.8	120.7	9,640	9,900	19,540	7,190	7,380	14,570
AVG	18.46		120.1			19,050			14,200
20.57	135.4	136.1	135.8	14,050	14,410	28,460	10,480	10,740	21,220
20.30	135.5	135.4	135.4	14,190	14,290	28,480	10,580	10,660	21,240
20.41	134.9	135.5	135.2	13,980	14,310	28,290	10,430	10,670	21,100
AVG	20.40		135.4			28,450			21,200
23.20	154.7	155.6	155.2	21,370	22,000	43,370	15,930	16,400	32,330
23.24	156.0	155.9	156.0	21,960	21,950	43,910	16,380	16,370	32,750
AVG	23.22		155.6			43,650			32,550
25.37	174.8	173.4	174.1	32,070	31,290	63,360	23,910	23,330	47,240
25.48	176.2	174.4	175.3	33,080	31,600	64,680	24,660	23,570	48,230
AVG	25.42		174.7			64,000			47,750

The average power data are rounded off to the nearest 50 SHP and 50 kilowatts.

TABLE 6 - SUMMARY OF SPEED AND TORQUE DATA AT LIGHT DISPLACEMENT

SHIP'S SPEED (KNOTS)	SHAFT TORQUE (LB FT) x 10 ⁻⁵			SHAFT TORQUE (NEWTON METRES) x 10 ⁻⁵		
	STBD SHAFT	PORT SHAFT	TOTAL	STBD SHAFT	PORT SHAFT	TOTAL
12.36	1.82	1.83	3.65	2.47	2.48	4.95
12.31	1.82	1.78	3.60	2.47	2.42	4.89
AVG 12.34			3.60			4.90
15.40	2.94	2.94	5.88	3.98	3.99	7.97
15.64	2.73	3.02	5.75	3.70	4.09	7.79
AVG 15.52			5.80			7.90
18.56	4.16	3.98	8.14	5.65	5.39	11.04
18.36	4.20	4.30	8.50	5.69	5.83	11.52
AVG 18.46			8.30			11.30
20.57	5.45	5.56	11.01	7.39	7.54	14.93
20.30	5.50	5.54	11.04	7.46	7.51	14.97
20.41	5.44	5.55	10.99	7.38	7.52	14.90
AVG 20.40			11.00			14.95
23.20	7.25	7.43	14.68	9.84	10.06	19.90
23.24	7.39	7.40	14.79	10.03	10.02	20.05
AVG 23.22			14.75			20.00
25.37	9.63	9.48	19.11	13.06	12.85	25.91
25.48	9.86	9.51	19.37	13.37	12.90	26.27
AVG 25.42			19.25			26.10

The average shaft torque data are rounded off to the nearest 5 x 10⁺³ lb ft and 5 x 10⁺³ newton metres.

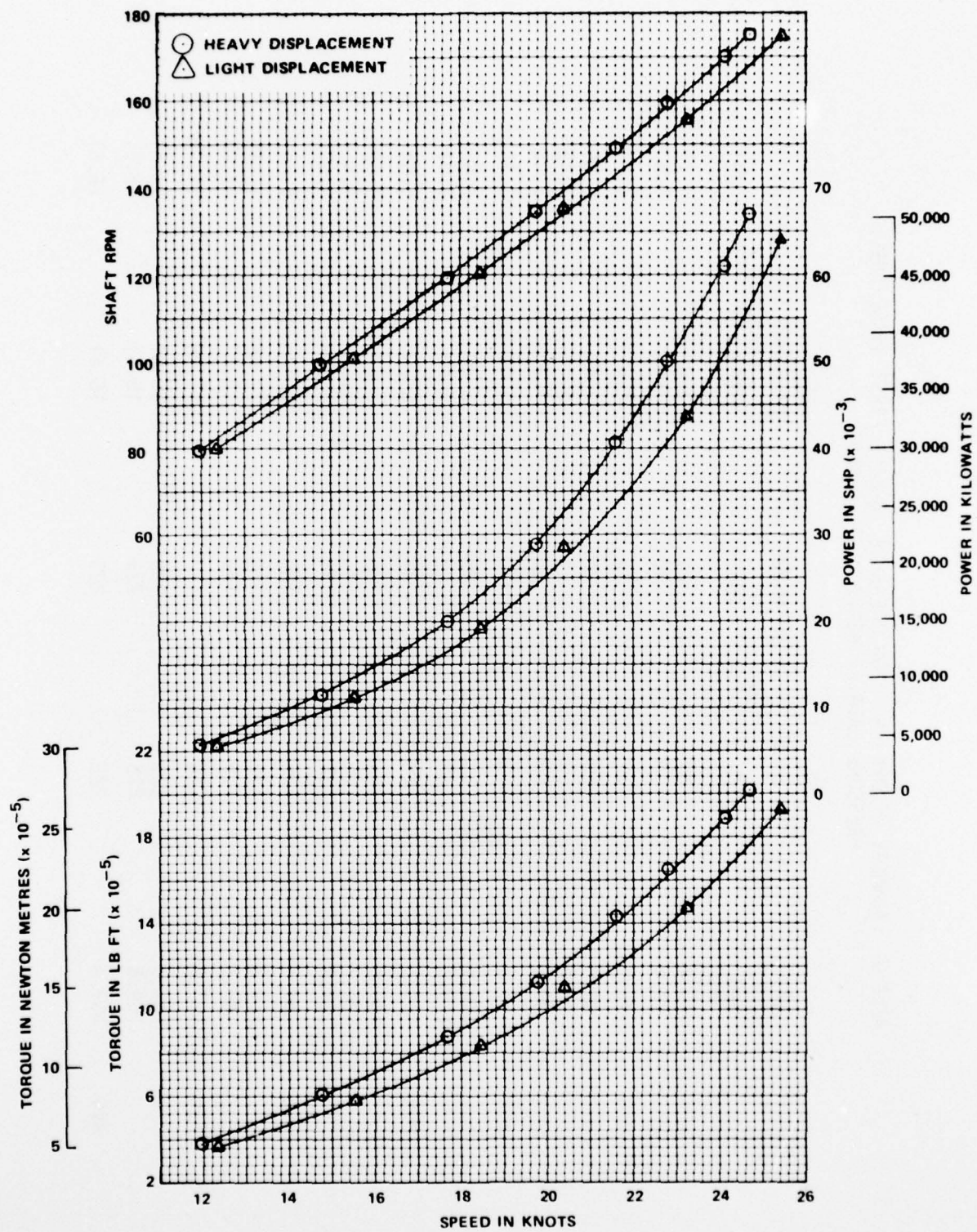


Figure 1 - Standardization Curves at Heavy and Light Displacements

TABLE 7 - SUMMARY OF RPM AND HIGH PRESSURE TURBINE FIRST STAGE SHELL PRESSURE DATA AT HEAVY DISPLACEMENT

AVG SHAFT RPM	1ST STAGE SHELL PRESSURE PSIG		1ST STAGE SHELL PRESSURE PASCALS x 10 ⁻⁵	
	STBD	PORT	STBD	PORT
	30	25	2.07	1.72
	30	25	2.07	1.72
AVG	30	25	2.07	1.72
	50	50	3.45	3.45
	50	50	3.45	3.45
	50	50	3.45	3.45
AVG	50	50	3.45	3.45
	90	85	6.20	5.86
	90	85	6.20	5.86
AVG	90	85	6.20	5.86
	125	125	8.62	8.62
	125	125	8.62	8.62
	125	130	8.62	8.90
AVG	125	126	8.62	8.70
	172	170	11.86	11.72
	175	175	12.07	12.07
AVG	174	172	11.96	11.90
	225	225	15.51	15.51
	225	225	15.51	15.51
AVG	225	225	15.51	15.51

TABLE 7 (Continued)

AVG SHAFT RPM	1ST STAGE SHELL PRESSURE PSIG		1ST STAGE SHELL PRESSURE PASCALS x 10 ⁻⁵	
	STBD	PORT	STBD	PORT
169.8	290	290	20.00	20.00
169.8	290	290	20.00	20.00
169.6	290	290	20.00	20.00
AVG 169.8	290	290	20.00	20.00
175.0	327	330	22.55	22.75
174.4	327	330	22.55	22.75
176.0	330	330	22.75	22.75
AVG 175.0	328	330	22.60	22.75

TABLE 8 - SUMMARY OF RPM AND HIGH PRESSURE TURBINE FIRST STAGE SHELL PRESSURE DATA AT LIGHT DISPLACEMENT

AVG SHAFT RPM	1ST STAGE SHELL PRESSURE PSIG		1ST STAGE SHELL PRESSURE PASCALS x 10 ⁻⁵	
	STBD	PORT	STBD	PORT
	25	20	1.72	1.38
	25	20	1.72	1.38
AVG	25	20	1.72	1.38
	50	45	3.45	3.10
	50	45	3.45	3.10
AVG	50	45	3.45	3.10
	80	75	5.52	5.17
	85	82	5.86	5.65
AVG	82	78	5.69	5.41
	120	125	8.27	8.62
	120	122	8.27	8.41
	120	125	8.27	8.62
AVG	120	124	8.27	8.52
	185	190	12.76	13.10
	192	190	13.24	13.10
AVG	188	190	13.00	13.10
	310	277	21.37	19.10
	320	300	22.06	20.68
AVG	315	288	21.72	19.89

TABLE 9 - SUMMARY OF PRELIMINARY FUEL ECONOMY DATA
(ENGLISH UNITS)

BOILER ON LINE	FUEL CONSUMPTION RATE (POUNDS PER HOUR)			POWER (SHP)			SHAFT RPM			SPECIFIC FUEL RATE LB/SHP-HR
	STBD	PORT	TOTAL	STBD	PORT	TOTAL	STBD	PORT	AVG	
SINGLE BOILER AHEAD OPERATION										
STBD	10,864	--	10,864	3,994	3,727	7,721	88.5	87.0	87.8	1.407
STBD	15,209	--	15,209	7,365	7,301	14,666	108.9	108.4	108.6	1.037
PORT	--	16,176	16,176	9,954	9,493	19,447	119.4	118.2	118.8	.832
PORT	--	20,877	20,877	14,190	14,379	28,569	134.5	134.5	134.5	.731
PORT	--	22,580	22,580	16,136	16,163	32,299	141.2	140.0	140.6	.699
TWO BOILER AHEAD OPERATION										
STBD & PORT	6,813	7,495	14,308	6,159	6,654	12,813	102.5	104.7	103.6	1.117
STBD & PORT	8,185	8,760	16,945	9,548	9,887	19,435	118.2	119.2	118.7	.872
STBD & PORT	12,183	12,001	24,184	18,126	18,371	36,497	144.9	145.2	145.0	.663
STBD & PORT	15,552	13,836	29,388	22,054	22,386	44,440	154.0	153.7	153.8	.661
STBD & PORT	19,587	16,825	36,412	27,647	27,585	55,232	165.4	164.4	164.9	.659
STBD & PORT	22,869	21,311	44,180	33,658	34,635	68,293	175.8	176.6	176.2	.647
STBD & PORT	21,422	20,422	41,844	33,298	32,094	65,392	176.6	175.1	175.8	.640
STBD & PORT	17,594	17,292	34,887	26,756	26,693	53,449	166.1	165.8	166.0	.653
TWO BOILER ASTERN OPERATION										
STBD & PORT	6,904	7,234	14,138	1,988	2,022	4,010	73.1	73.1	73.1	3.526
SINGLE BOILER ASTERN OPERATION										
PORT	--	13,766	13,766	7,456	7,408	14,864	109.2	108.8	109.0	.926

TABLE 10 - SUMMARY OF PRELIMINARY FUEL ECONOMY DATA
(METRIC UNITS)

BOILER ON LINE	FUEL CONSUMPTION RATE (MEGAGRAMS PER HOUR)			POWER (MEGAWATTS)			SHAFT RPM		SPECIFIC FUEL RATE GRAM/W-HR	
	STBD	PORT	TOTAL	STBD	PORT	TOTAL	STBD	PORT		AVG
	SINGLE BOILER AHEAD OPERATION									
STBD	4.928	--	4.928	2.978	2.779	5.758	88.5	87.0	87.5	.856
STBD	6.899	--	6.899	5.492	5.444	10.936	108.9	108.4	108.6	.631
PORT	--	7.337	7.337	7.423	7.079	14.502	119.4	118.2	118.8	.506
PORT	--	9.470	9.470	10.581	10.722	21.304	134.5	134.5	134.5	.444
PORT	--	10.242	10.242	12.033	12.053	24.085	141.2	140.0	140.6	.425
	TWO BOILER AHEAD OPERATION									
STBD & PORT	3.090	3.400	6.490	4.593	4.962	9.555	102.5	104.7	103.6	.679
STBD & PORT	3.713	3.973	7.686	7.120	7.373	14.493	118.2	119.2	118.7	.530
STBD & PORT	5.526	5.444	10.970	13.516	13.699	27.216	144.9	145.2	145.0	.403
STBD & PORT	7.054	6.276	13.330	16.446	16.693	33.139	154.0	153.7	153.8	.402
STBD & PORT	8.884	7.632	16.516	20.616	20.570	41.186	165.4	164.4	164.9	.401
STBD & PORT	10.373	9.666	20.040	25.099	25.827	50.926	175.8	176.6	176.2	.394
STBD & PORT	9.717	9.263	18.980	24.830	23.932	48.763	176.6	175.1	175.8	.389
STBD & PORT	7.981	7.844	15.824	19.952	19.905	39.857	166.1	165.8	166.0	.397
	TWO BOILER ASTERN OPERATION									
STBD & PORT	3.131	3.282	6.413	1.482	1.508	2.990	73.1	73.1	73.1	.214
	SINGLE BOILER ASTERN OPERATION									
PORT	--	6.244	6.244	5.560	5.524	11.084	109.2	108.8	109.0	.563

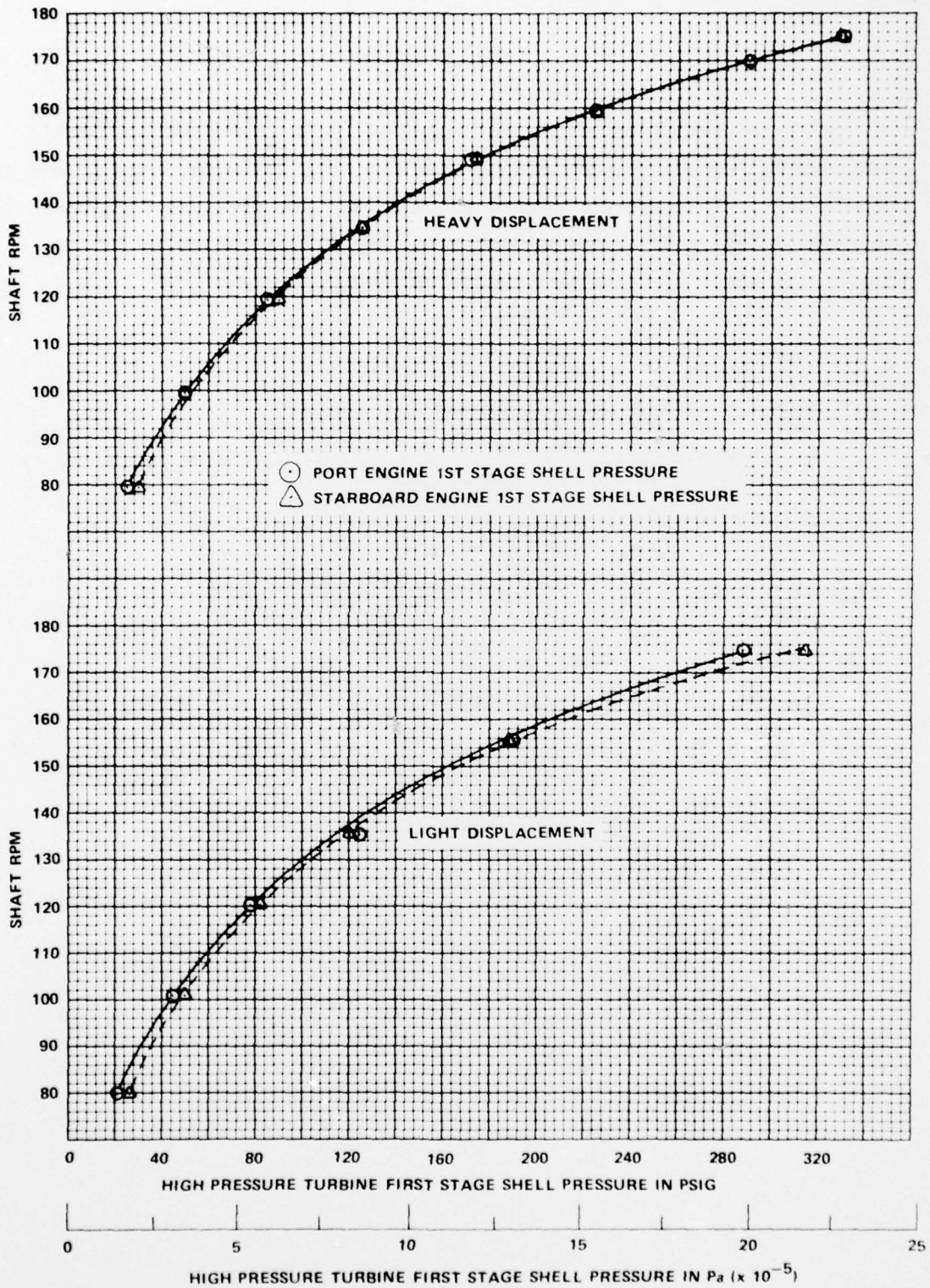


Figure 2 - High Pressure Turbine First Stage Shell Pressure Curves at Heavy and Light Displacements

CONCLUSIONS

With the exception of the data spot at 20.40 knots for the light displacement condition, the standardization data collected from trials on USS TARAWA (LHA 1) are considered to be good. The data are considered to be representative of, and applicable to, LHA 1 Class ships.

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