

SEEKRIEG 4

CHART

1. RADAR TYPES & FUNCTIONSGREAT BRITAIN

Type 271	1941	25nm	Surface warning for all minor warships
Type 272	1941	25nm	Surface warning for CA, CL, and DD
Type 273	1941	25nm	Surface warning for BB and CA
Type 274	1944	20nm	Replacement for 284
Type 275	1945	16nm	Replacement for 285
Type 276	1943	30nm	Replaced 272 in some DD
Type 277	1943	35nm	Combined air & surface warning with height-finder & PPI
Type 79	1938	60nm	Air warning only (first set aboard HMS SHEFFIELD)
Type 279	1939	100nm	Air warning only with AA barrage predictor -- widely used
Type 280	1940	60nm	Air warning and AA ranging used on old AA cruisers 1940-41
Type 281	1940	120nm	Air warning only -- widely used on large warships CL to BB
Type 282	1941	4nm	Close range AA fire control for large ships
Type 283	1942	9nm	AA barrage for CA to BB main armament
Type 284	1940	10nm	Main battery fire control for CL to BB
Type 285	1941	9nm	Surface and air warning (also long range AA) for all ships
Type 286	1940		Air and surface ASV radar for aircraft
Type 290	1941		Air warning not widely used and replaced by 271 and 272
Type 291	1941	35nm	Air warning for small ships -- widely used
Type 293	1943	13nm	Air and surface target IFF
Type 294	1944	35nm	Replacement for 277
Type 295	1945	40nm	Replacement for 271, 272, and 273

UNITED STATES

XAF	1938	40nm	Air warning for BB New York only
CXZ	1939	25nm	Air warning for BB Texas only
CXAM	1940	60nm	Air and surface warning (California, Yorktown, Chester, Chicago, Northampton & Pensacola)
CXAM-1	1940	80nm	Air and surface warning for all CV and BB
SC & SC-1	1941	80nm	Replaced CXAM models -- widely used on BB to DD
SC-2 & SK	1943	80nm	Surface and air warning -- widely used on CV, BB, CA
SK-2	1944		Air warning and fighter direction for CV, BB, CA
SP	1944		Fighter direction for CV, BB, CA and Surface search--widely used
SM	1943		Replaced by SP (only 23 sets produced)
SG	1941	20nm	Air and surface warning for all ships in wide use by 1942. By 7-43 all DD to BB had SG with PPI and CIC
SL	1942	18nm	Surface warning for DE and smaller ships--widely used
SU	1945	25nm	Surface warning replacing SL sets
SA	1943	30nm	Air warning for DD and smaller ships
SF	1943	20nm	Surface warning for CL, DD and smaller ships
SO	1943	20nm	Surface warning for PT boats
SJ	1943	20nm	Surface warning for SS -- in wide use by 1943
Mark 3	1941	12nm	Main battery fire control for BB, CA, CL
Mark 4	1942	15nm	Secondary battery fire control for BB, CA, and CV
Mark 8	1943	20nm	Replaced Mark 3
Mark 13 & 27	1944	20nm	Replaced Mark 8 (used with Mark 38 Director)
Mark 22 & 32	1944	20nm	Replaced Mark 4 (used with Mark 37 Director)
Mark 34	1942	12nm	AA Fire control for MG batteries
Mark 35	1944	15nm	Replaced Mark 34 (used with Mark 56 Director)

2. RADAR TYPES & FUNCTIONS

FRANCE

	1941	49nm	Air warning set installed aboard Strasbourg
Sadir M.E.	1942	18nm	Air warning set installed aboard Richelieu
Sadir 2M	1942	42nm	Air warning set installed aboard Jean Bart

GERMANY

FuMO 25 & 26	1938	60nm	Air and surface warning and gunnery fire control radar "Seetakt" used on all major warships BB to DD. Also called GEMA and DTG
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JAPAN

Type 21	1942	30nm	Air and surface warning aboard CV, BB, CA, CL, and DD
Type 13	1942	30nm	Air warning only for larger warships
Type 22	1944	15nm	Surface warning

ITALY

Gufo	1942	30nm	Air and surface warning aboard Vittorio Veneto, Africano, A. Regolo, Maestrale, Leone, Pancaldo, and 8 others
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SEEKRIEG 4



CHART

1. ARMOR TYPES & FACTORS

SEEKRIEG 4



CHART

ARMOR TYPE	NAME	IN USE	1	NOTES	2
Type F	SCHNEIDER MILD STEEL	1876-1889	0.62	Developed in France (Used primarily by French)	0.60
Type F	COMPOSITE and COMPOUND	1876-1880 1881-1889	0.60 0.64	Developed in Great Britain (Widely used)	0.60 0.60
Type E	SCHNEIDER NICKEL STEEL	1889-1910	0.67	Developed in France (Widely used)	0.70
Type D	HARVEY NICKEL STEEL	1893-1950	0.77	Developed in United States (Widely used)	0.80
Type C	KRUPP CEMENTED CHROME-NICKEL STEEL	1893-1915	0.90	Developed in Germany (Replaced Harvey by 1900)	0.90
Type B	KRUPP CEMENTED CHROME-NICKEL STEEL	1910-1925 1920-1935	1.00 1.20	"	1.00 1.00
Type A	HOMOGENOUS CHROME-NICKEL or CHROME-NICKEL-MOLYBDENUM STEEL	1900-1925 1915-1945 1922-1950	.75 .90 1.10		1.00 1.00 1.00

The Armor Types listed above correspond to the types listed in the SHIP DATA SHEETS. For game purposes, the factor listed in Column 2 can be used to reduce the amount of armor listed for the ship [by multiplying the amount of armor by the factor listed above]. Column 1 may be used if more detailed results are required.

RANGE IN YARDS



1. NAVAL ORDNANCE PENETRATION [AVERAGE]

	000 2,500	2,600 7,500	7,600 12,500	12,600 17,500	17,600 22,500	22,600 27,500	27,600 32,500	32,600 37,500	37,600 42,500
20.0"/45 A1 [34]	18.5	16.7	15.6	14.7	14.2	14.0	13.5	16.1	17.8
18.0"/45 B1 [30]	17.5	15.5	14.0	13.0	12.3	11.9	11.2	13.0	14.1
18.0"/40 B2 [30]	17.3	14.8	12.9	11.6	10.5	9.9	8.9	10.0	10.5
16.0"/50 C1 [26]	15.8	14.1	12.9	12.1	11.5	11.3	10.7	12.6	13.8
16.0"/45 C2 [26]	15.5	13.4	11.8	10.7	9.9	9.4	8.6	9.7	10.4
15.0"/50 D1 [24]	15.3	13.5	12.2	11.3	10.6	10.3	9.7	11.2	12.2
15.0"/45 D2 [24]	15.0	12.7	10.9	9.7	8.7	8.0	7.2	8.1	8.3
15.0"/42 D3 [24]	14.8	12.3	10.2	8.9	7.8	7.0	6.2	6.7	6.7
14.0"/50 E1 [22]	14.8	12.6	11.0	9.8	9.0	8.4	7.6	8.5	9.0
14.0"/45 E2 [22]	14.5	12.0	10.0	8.6	7.6	7.1	6.2	6.8	6.8
13.5"/45 F1 [21]	14.0	11.5	9.4	8.0	7.0	6.2	5.4	5.8	5.8
13.5"/30 F2 [21]	13.2	9.7	7.1	5.3	4.1	3.3	---	---	---
13.0"/50 G1 [20]	13.8	11.5	9.8	8.5	7.6	6.9	6.2	---	---
13.0"/35 G2 [20]	13.0	9.3	7.4	5.7	4.5	3.7	---	---	---
12.6"/44 H1 [19]	13.0	10.4	8.3	6.9	5.8	5.1	4.3	4.5	4.4
12.0"/50 H2 [18]	12.8	10.4	8.5	7.3	6.3	5.6	4.9	5.3	5.2
12.0"/45 H3 [18]	12.5	9.9	7.8	6.4	5.4	4.6	3.8	4.0	3.8
12.0"/40 H4 [18]	12.3	9.3	7.1	5.6	4.5	3.7	---	---	---
12.0"/35 H5 [18]	12.0	8.8	6.5	4.8	3.7	2.9	---	---	---
11.0"/54 J1 [16]	12.0	10.2	8.7	7.6	6.9	6.4	5.7	6.4	6.6
11.0"/50 J2 [16]	11.8	9.4	7.5	6.2	5.3	4.6	---	---	---
11.0"/45 J3 [16]	11.5	8.9	6.9	5.5	4.4	3.7	---	---	---
11.0"/40 J4 [16]	11.3	8.4	6.2	4.7	3.7	3.0	---	---	---
10.0"/45 K1 [14]	10.5	7.9	6.0	4.6	3.6	2.9	---	---	---
10.0"/40 K2 [14]	10.3	7.4	5.4	4.0	3.0	2.3	---	---	---
10.0"/35 K3 [14]	10.0	7.0	4.9	3.5	2.6	---	---	---	---
9.4"/45 L1 [13]	10.0	7.5	5.6	4.2	3.3	2.6	---	---	---
9.4"/40 L2 [13]	9.8	7.0	5.1	3.7	2.7	2.1	---	---	---
9.4"/35 L3 [13]	9.5	6.6	4.6	3.2	2.3	---	---	---	---
8.0"/60 M1 [10]	9.3	7.5	6.1	5.1	4.3	3.8	3.3	3.5	3.4
8.0"/55 M2 [10]	9.0	7.0	5.4	4.3	3.4	2.9	2.4	2.4	2.2
8.0"/50 M3 [10]	8.8	6.5	4.9	3.7	2.9	2.3	1.9	1.7	---
8.0"/45 M4 [10]	8.5	6.1	4.4	3.3	2.4	1.9	1.5	1.2	---
8.0"/40 M5 [10]	8.3	5.7	4.0	2.9	2.1	1.6	---	---	---
8.0"/35 M6 [10]	8.0	5.3	3.6	2.5	1.8	1.3	---	---	---
7.5"/50 N1 [9]	8.3	6.1	4.5	3.4	2.6	2.0	1.6	---	---
7.5"/45 N2 [9]	8.0	5.7	4.1	3.0	2.2	1.7	1.3	---	---
6.0"/55 P1 [7]	7.0	5.2	3.9	3.0	2.4	2.1	1.9	---	---
6.0"/50 P2 [7]	6.8	4.8	3.4	2.5	1.9	1.5	1.3	---	---
6.0"/45 P3 [7]	6.5	4.4	3.1	2.2	1.6	1.2	1.1	---	---
6.0"/40 P4 [7]	6.3	4.1	2.7	1.9	1.4	1.0	---	---	---
6.0"/30 P5 [7]	5.6	3.5	2.2	1.4	1.0	---	---	---	---
5.5"/50 Q1 [6]	6.3	4.3	3.1	2.2	1.6	1.3	1.1	---	---
5.25"/50 R1 [6]	5.9	4.1	2.8	2.0	1.5	1.2	---	---	---
5.0"/55 S1 [5]	6.0	4.3	3.1	2.3	1.8	1.4	1.3	---	---
5.0"/50 S2 [5]	5.8	3.9	2.7	2.0	1.5	1.1	1.0	---	---
5.0"/45 S3 [5]	5.5	3.6	2.4	1.7	1.2	1.0	---	---	---
5.0"/40 S4 [5]	5.3	3.3	2.2	1.5	1.1	1.0	---	---	---
5.0"/25 S5 [5]	4.5	2.5	1.5	1.0	1.0	1.0	---	---	---
4.0"/65 T1 [4]	5.5	4.0	2.9	2.1	1.7	1.2	---	---	---
4.0"/50 T2 [4]	4.8	3.1	2.1	1.5	1.1	---	---	---	---
4.0"/45 T3 [4]	4.5	2.8	1.9	1.3	1.0	---	---	---	---
4.0"/40 T4 [4]	4.3	2.6	1.7	1.1	1.0	---	---	---	---
3.0"/50 U1 [3]	3.8	2.4	1.6	1.1	1.0	---	---	---	---
3.0"/45 U2 [3]	3.5	2.1	1.4	1.0	---	---	---	---	---
3.0"/40 U3 [3]	3.2	1.8	1.1	1.0	---	---	---	---	---
SAMLLER X1 [1]	1.8	1.2	1.0	---	---	---	---	---	---



2. NAVAL ORDNANCE PENETRATION [VERTICAL/HORIZONTAL]

NOTE: In cases where 00.0 appears, the actual penetration is less than 1", but for game purposes this must be considered as 1"

	000 2,500	2,600 7,500	7,600 12,500	12,600 17,500	17,600 22,500	22,600 27,500	27,600 32,500	32,600 37,500	37,600 42,500
20.0"/45 A1 [34]	36.0/00.0	32.4/00.0	29.2/01.9	26.2/03.1	23.6/04.7	21.2/06.8	19.1/07.8	17.2/14.9	15.5/20.1
18.0"/45 B1 [30]	34.0/00.0	29.9/00.0	26.3/01.7	23.2/02.8	20.4/04.1	17.9/05.8	15.8/06.5	13.9/12.1	12.2/15.9
18.0"/40 B2 [30]	33.5/00.0	28.5/00.0	24.2/01.6	20.6/02.5	17.5/03.5	14.9/04.8	12.6/05.2	10.7/09.3	9.1/11.8
16.0"/50 C1 [26]	30.5/00.0	27.1/00.0	24.2/01.6	21.5/02.6	19.1/03.8	17.0/05.5	15.2/06.2	13.5/11.7	12.0/15.6
16.0"/45 C2 [26]	30.0/00.0	25.8/00.0	22.2/01.4	19.1/02.3	16.4/03.3	14.1/04.6	12.1/05.0	10.4/09.0	9.0/11.7
15.0"/50 D1 [24]	29.5/00.0	25.9/00.0	22.8/01.5	20.1/02.4	17.7/03.5	15.6/05.0	13.7/05.6	12.0/10.4	10.6/13.8
15.0"/45 D2 [24]	29.0/00.0	24.4/00.0	20.5/01.3	17.2/02.1	14.4/02.9	12.1/03.9	10.2/04.2	8.6/07.5	7.2/09.4
15.0"/42 D3 [24]	28.6/00.0	23.5/00.0	19.2/01.2	15.8/01.9	12.9/02.6	10.6/03.4	8.7/03.6	7.1/06.2	5.8/07.5
14.0"/50 E1 [22]	28.5/00.0	24.2/00.0	20.6/01.3	17.5/02.1	14.9/03.0	12.6/04.1	10.7/04.4	9.1/07.9	7.8/10.1
14.0"/45 E2 [22]	28.0/00.0	23.0/00.0	18.8/01.2	15.4/01.8	12.6/02.5	10.7/03.4	8.8/03.6	7.2/06.3	5.9/07.7
13.5"/45 F1 [21]	27.0/00.0	21.9/00.0	17.7/01.1	14.3/01.7	11.6/02.3	9.4/03.0	7.6/03.1	6.2/05.4	5.0/06.5
13.5"/30 F2 [21]	25.5/00.0	18.4/00.0	13.2/00.0	9.5/01.1	6.8/01.4	4.9/01.6	-----	-----	-----
13.0"/50 G1 [20]	26.5/00.0	22.0/00.0	18.3/01.2	15.2/01.8	12.6/02.5	10.4/03.4	8.7/03.6	-----	-----
13.0"/35 G2 [20]	25.0/00.0	18.5/00.0	13.7/00.0	10.1/01.2	7.5/01.5	5.5/01.8	-----	-----	-----
12.6"/44 H1 [19]	25.0/00.0	19.8/00.0	15.6/01.0	12.3/01.5	9.7/01.9	7.7/02.5	6.1/02.5	4.8/04.2	3.8/04.9
12.0"/50 H2 [18]	24.5/00.0	19.8/00.0	16.0/01.0	13.0/01.6	10.5/02.1	8.5/02.7	6.9/02.8	5.6/04.9	4.5/05.9
12.0"/45 H3 [18]	24.0/00.0	18.7/00.0	14.6/00.0	11.4/01.4	8.9/01.8	6.9/02.2	5.4/02.2	4.2/03.7	3.3/04.3
12.0"/40 H4 [18]	23.5/00.0	17.6/00.0	13.2/00.0	9.9/01.2	7.4/01.5	5.6/01.8	-----	-----	-----
12.0"/35 H5 [18]	23.0/00.0	16.6/00.0	11.9/00.0	8.6/01.0	6.2/01.2	4.4/01.4	-----	-----	-----
11.0"/54 J1 [16]	23.0/00.0	19.3/00.0	16.2/01.1	13.6/01.6	11.5/02.3	9.6/03.1	8.1/03.3	6.8/05.9	5.7/07.4
11.0"/50 J2 [16]	22.5/00.0	17.8/00.0	14.0/00.0	11.1/01.3	8.8/01.8	6.9/02.2	-----	-----	-----
11.0"/45 J3 [16]	22.0/00.0	16.7/00.0	12.7/00.0	9.7/01.2	7.3/01.5	5.6/01.8	-----	-----	-----
11.0"/40 J4 [16]	21.5/00.0	15.7/00.0	11.4/00.0	8.4/01.0	6.1/01.2	4.5/01.5	-----	-----	-----
10.0"/45 K1 [14]	20.0/00.0	14.8/00.0	11.0/00.0	8.1/01.0	6.0/01.2	4.4/01.4	-----	-----	-----
10.0"/40 K2 [14]	19.5/00.0	13.8/00.0	9.8/00.0	7.0/00.0	4.9/00.0	3.5/01.1	-----	-----	-----
10.0"/35 K3 [14]	19.0/00.0	12.9/00.0	8.8/00.0	6.0/00.0	4.1/00.0	-----	-----	-----	-----
9.4"/45 L1 [13]	19.0/00.0	13.9/00.0	10.1/00.0	7.4/00.0	5.4/01.1	3.9/01.3	-----	-----	-----
9.4"/40 L2 [13]	18.5/00.0	13.0/00.0	9.1/00.0	6.3/00.0	4.4/00.0	3.1/01.0	-----	-----	-----
9.4"/35 L3 [13]	18.0/00.0	12.1/00.0	8.1/00.0	5.4/00.0	3.6/00.0	-----	-----	-----	-----
8.0"/60 M1 [10]	17.5/00.0	14.0/00.0	11.2/00.0	9.0/01.1	7.2/01.4	5.7/01.8	4.6/01.9	3.7/03.2	2.9/03.8
8.0"/55 M2 [10]	17.0/00.0	12.9/00.0	9.8/00.0	7.5/00.0	5.7/01.1	4.3/01.4	3.3/01.5	2.5/02.2	1.9/02.5
8.0"/50 M3 [10]	16.5/00.0	12.0/00.0	8.8/00.0	6.4/00.0	4.7/00.0	3.4/01.1	2.5/01.2	1.8/01.6	-----
8.0"/45 M4 [10]	16.0/00.0	11.2/00.0	7.8/00.0	5.5/00.0	3.8/00.0	2.7/00.0	1.9/00.0	1.3/01.1	-----
8.0"/40 M5 [10]	15.5/00.0	10.4/00.0	6.9/00.0	4.7/00.0	3.1/00.0	2.1/00.0	-----	-----	-----
8.0"/35 M6 [10]	15.0/00.0	9.6/00.0	6.1/00.0	3.9/00.0	2.5/00.0	1.6/00.0	-----	-----	-----
7.5"/50 N1 [9]	15.5/00.0	11.2/00.0	8.0/00.0	5.8/00.0	4.2/00.0	3.0/01.0	2.2/01.0	-----	-----
7.5"/45 N2 [9]	15.0/00.0	10.4/00.0	7.1/00.0	4.9/00.0	3.4/00.0	2.3/00.0	1.6/00.0	-----	-----
6.0"/55 P1 [7]	13.0/00.0	9.4/00.0	6.7/00.0	4.8/01.1	3.5/01.3	2.5/01.6	1.8/02.0	-----	-----
6.0"/50 P2 [7]	12.5/00.0	8.5/00.0	5.8/00.0	3.9/00.0	2.7/01.0	1.8/01.2	1.2/01.3	-----	-----
6.0"/45 P3 [7]	12.0/00.0	7.8/00.0	5.1/00.0	3.3/00.0	2.1/00.0	1.4/00.0	1.0/01.1	-----	-----
6.0"/40 P4 [7]	11.5/00.0	7.1/00.0	4.4/00.0	2.7/00.0	1.7/00.0	1.0/00.0	-----	-----	-----
6.0"/30 P5 [7]	10.5/00.0	5.9/00.0	3.3/00.0	1.8/00.0	1.0/00.0	-----	-----	-----	-----
5.5"/50 Q1 [6]	11.5/00.0	7.6/00.0	5.1/00.0	3.4/00.0	2.2/00.0	1.5/01.0	1.0/01.1	-----	-----
5.25"/50 R1 [6]	10.8/00.0	7.1/00.0	4.6/00.0	3.0/00.0	2.0/00.0	1.3/00.0	-----	-----	-----
5.0"/55 S1 [5]	11.0/00.0	7.6/00.0	5.2/00.0	3.6/00.0	2.5/00.0	1.7/01.1	1.2/01.3	-----	-----
5.0"/50 S2 [5]	10.5/00.0	6.8/00.0	4.4/00.0	2.9/00.0	1.9/00.0	1.2/00.0	1.0/00.0	-----	-----
5.0"/45 S3 [5]	10.0/00.0	6.2/00.0	3.8/00.0	2.4/00.0	1.4/00.0	1.0/00.0	-----	-----	-----
5.0"/40 S4 [5]	9.5/00.0	5.6/00.0	3.3/00.0	2.0/00.0	1.2/00.0	-----	-----	-----	-----
5.0"/25 S5 [5]	8.0/00.0	4.0/00.0	2.0/00.0	1.0/00.0	1.0/00.0	-----	-----	-----	-----
4.0"/65 T1 [4]	10.0/00.0	6.9/00.0	4.8/00.0	3.3/00.0	2.3/00.0	-----	-----	-----	-----
4.0"/50 T2 [4]	8.5/00.0	5.2/00.0	3.2/00.0	1.9/00.0	1.2/00.0	-----	-----	-----	-----
4.0"/45 T3 [4]	8.0/00.0	4.6/00.0	2.7/00.0	1.6/00.0	1.0/00.0	-----	-----	-----	-----
4.0"/40 T4 [4]	7.5/00.0	4.1/00.0	2.3/00.0	1.2/00.0	1.0/00.0	-----	-----	-----	-----
3.0"/50 U1 [3]	6.5/00.0	3.7/00.0	2.1/00.0	1.2/00.0	1.0/00.0	-----	-----	-----	-----
3.0"/45 U2 [3]	6.0/00.0	3.2/00.0	1.7/00.0	1.0/00.0	-----	-----	-----	-----	-----
3.0"/40 U3 [3]	5.3/00.0	2.6/00.0	1.2/00.0	1.0/00.0	-----	-----	-----	-----	-----
SMALLER X1 [1]	2.5/00.0	1.3/00.0	1.0/00.0	-----	-----	-----	-----	-----	-----

1. TORPEDO DATA TABLES

GREAT BRITAIN

14.0" Whitehead	1880	C/A	F	1,000/24	2,000/16	
14.0" Mark X	1891	C/A	F	1,000/28	2,000/20	
18.0" Mark IV	1892	C/A	E	1,000/26	2,000/18	
18.0" Mark V	1894	C/A	E	1,000/28	2,000/24	
18.0" Mark V*	1898	C/A	E	2,000/26	4,000/18	
18.0" Fiume	1903	C/A	E	2,000/26	4,000/20	
18.0" Mark VIII*	1914	C/A	D	2,500/34	4,000/30	Std. sub and surface torpedo
18.0" Mark IX	1915	C/A	D	2,000/30	-----	Aerial torpedo
18.0" Mark X	1925	C/A	C	1,500/34	-----	Aerial torpedo
18.0" Mark XI	1936	C/A	C	1,500/40	3,000/28	Aerial torpedo
18.0" Mark XII	1939	C/A	C	1,500/40	4,000/28	Std. aerial and MTB torpedo
21.0" Mark I		C/A	E	1,000/50	7,000/30	
21.0" Mark II		C/A	D	5,000/34	12,000/24	Sub and surface torpedo
21.0" Mark IV	1917	C/A	D	4,500/44	9,000/30	Sub and surface torpedo
21.0" Mark V	1920	C/A	C	9,000/36	14,000/30	Sub and surface torpedo
21.0" Mark VIII*	1933	C/A	B	5,000/40	7,000/30	Std. sub torpedo
21.0" Mark VIII*E	1939	C/A	B	7,000/40	-----	Std. sub torpedo
21.0" Mark VIII**	1942	C/A	B	5,000/44	7,000/40	Std. sub and MTB torpedo
21.0" Mark IX	1932	C/A	B	10,500/34	13,500/30	Std. surface torpedo
24.5" Mark I	1922	C/A	B	15,000/36	20,000/30	NELSON Class torpedo

GERMANY

13.7"	1898	C/A	F	1,000/28	2,000/20	
17.7"	1900	C/A	D	1,000/30	2,000/26	
20.0"	1907	C/A	D	2,000/32	4,000/20	
22.0"	1910	C/A	D	1,000/38	4,000/34	
21.0" G7a	1930	C/A	B	8,200/40	13,700/30	Std. surface torpedo
21.0" G7e	1936	ELE	B	5,000/30	-----	Std. submarine torpedo
T5						Acoustic homing torpedo
FAT/LUT	1943		B	15,400/40	-----	Pattern running sub torpedo

ITALY

17.7" A110		C/A	D	2,000/38	6,000/26	
17.7" W200		C/A	C	3,000/44	-----	CAGNI Class sub torpedo
17.7" A110S		C/A	D	2,000/44	-----	Std. MTB torpedo
21.0" SI270-I		C/A	C	4,000/48	12,000/30	Std. surface torpedo
21.0" W250V		C/A	C	4,000/48	12,000/30	
21.0" SI250		C/A	C	3,000/40	12,000/26	

NOTE: Above models were in use 1938-43. Earlier models were primarily British Whitehead torpedoes.

2. TORPEDO DATA TABLES
UNITED STATES

14.2" Howell	1895	C/A	F	1,000/26	2,000/16	
18.0" WL II	1901	C/A	E	1,000/28	2,000/22	
18.0" BL	1905	C/A	E	1,000/36	4,000/26	
21.0" BL	1905	C/A	D	1,000/36	4,000/28	
21.0" Mark 8	1914	C/A	C	10,000/28	-----	Std. DD torpedo for WW1
21.0" Mark 9	1915	C/A	C	7,000/26	-----	
21.0" Mark 10	1917	C/A	C	3,500/36	-----	
21.0" Mark 15	19	C/A	C	6,000/44	15,000/26	Std. DD torpedo for WW2
21.0" Mark 15M3	1944	C/A	B	6,000/44	15,000/26	Surface torpedo
21.0" Mark 14		C/A	C	4,500/46	9,000/32	Std. sub torpedo
12.8" Mark 24	1943		E	8,000/15	-----	Aerial acoustic homing torpedo
22.5" Mark 13	1936		C	6,000/32	-----	Aerial torpedo for TBF Avenger
21.0" Mark 18	1944	ELE	C	4,000/28	-----	Surface torpedo-wakeless

JAPAN

17.7" Type 91M1	1934	C/A	D	24,000/42	-----	Aerial torpedo
17.7" Type 91M2	1941	C/A	C	22,000/42	-----	Aerial torpedo
17.7" Type 91M4	1944		A	22,000/44	-----	Aerial torpedo
21.0" Type 6	1918	C/A	E	8,000/34	16,000/26	Sub and surface torpedo
21.0" Type 89	1930	C/A	C	6,000/44	-----	Submarine torpedo
21.0" Type 92M1	1940	ELE	C	8,000/30	-----	Submarine torpedo
21.0" Type 95M1	1940	C/A	A	10,000/48	13,000/42	Submarine torpedo
21.0" Type 96	1943	C/A	A	5,000/48	-----	Submarine torpedo
21.0" Type 95M2	1945		A	6,000/48	9,000/44	Submarine torpedo
24.0" Type 8	1921	C/A	B	11,500/36	22,000/28	Surface torpedo
24.0" Type 90	1927	C/A	B	8,000/44	16,000/36	Surface torpedo for DD
24.0" Type 93M1	1936	C/A	A	22,000/48	44,000/36	Surface torpedo-standard
24.0" Type 95M2			A	24,000/48	43,700/36	Surface torpedo

FRANCE

15.0" Type	1887	C/A	F	1,000/28	-----	
15.7" Type V26	1926	C/A	C	1,500/44	-----	Submarine torpedo
15.7" Type DAR	1932	C/A	D	3,300/34	-----	Aerial and NTB torpedo
17.7" Type R	1909	C/A	D	1,100/38	3,300/28	Std. surface torpedo
18.0" Type	1892	C/A	E	1,000/28	-----	
18.0" Type	1904	C/A	E	1,000/32	2,000/24	
18.0" Type	1906	C/A	E	1,000/34	3,000/22	
21.6" Type DT	1923	C/A	B	11,000/40	15,300/34	Std. DD torpedo
21.6" Type V24	1924	C/A	B	4,000/42	8,000/30	Submarine torpedo
21.6" Type D	1929	C/A	B	7,000/44	13,500/36	Std. surface torpedo



2. TORPEDO RELATIVE TRACKING ERROR (RTE)

SPEED OF TARGET	RELATIVE TRACKING ERROR	MODIFIERS TO RELATIVE TRACKING ERROR
0- 4 knots	2.4	
5- 8 knots	4.0	NORMAL CONVOY ZIG-ZAG +0.5
9-12 knots	5.6	TARGET IN EVASIVE MANEUVER ... +1.0
13-18 knots	7.0	TARGET MOVES TO COMB SPREAD .. +1.5
19-24 knots	8.0	ACOUSTIC HOMING TORPEDO -3.0
25-30 knots	9.0	PATTERN RUNNING TORPEDO -1.5
31-36 knots	10.0	
37 + knots	11.6	

1. TORPEDO HIT PROBABILITY CALCULATION

$$\frac{\left(\frac{57.3 \times \text{LENGTH OF TARGET (in feet)} \times \text{SINE OF ANGLE OF BEARING FROM TARGET}}{\text{RANGE BETWEEN SHIPS (in feet)}} \right)}{\text{RELATIVE TRACKING ERROR}} = \text{PROBABILITY OF HIT WHEN COMPARED WITH CHART T4}$$

4. TORPEDO HIT PROBABILITY

0.01 = 1%	0.26 = 20%	0.51 = 39%	0.76 = 55%	1.24 = 78%
0.02 = 2%	0.27 = 21%	0.52 = 40%	0.77 = 56%	1.28 = 80%
0.03 = 2%	0.28 = 22%	0.53 = 40%	0.78 = 56%	1.32 = 81%
0.04 = 3%	0.29 = 23%	0.54 = 41%	0.79 = 57%	1.36 = 83%
0.05 = 4%	0.30 = 24%	0.55 = 42%	0.80 = 58%	1.40 = 84%
0.06 = 5%	0.31 = 24%	0.56 = 42%	0.82 = 59%	1.44 = 85%
0.07 = 6%	0.32 = 25%	0.57 = 43%	0.84 = 60%	1.48 = 86%
0.08 = 6%	0.33 = 26%	0.58 = 44%	0.86 = 61%	1.52 = 87%
0.09 = 7%	0.34 = 27%	0.59 = 44%	0.88 = 62%	1.56 = 88%
0.10 = 8%	0.35 = 27%	0.60 = 45%	0.90 = 63%	1.60 = 89%
0.11 = 9%	0.36 = 28%	0.61 = 46%	0.92 = 64%	1.64 = 90%
0.12 = 10%	0.37 = 29%	0.62 = 46%	0.94 = 65%	1.68 = 91%
0.13 = 10%	0.38 = 30%	0.63 = 47%	0.96 = 66%	1.75 = 92%
0.14 = 11%	0.39 = 30%	0.64 = 48%	0.98 = 67%	1.80 = 93%
0.15 = 12%	0.40 = 31%	0.65 = 48%	1.00 = 68%	1.85 = 94%
0.16 = 13%	0.41 = 32%	0.66 = 49%	1.02 = 69%	1.90 = 94%
0.17 = 14%	0.42 = 33%	0.67 = 50%	1.04 = 70%	2.00 = 95%
0.18 = 14%	0.43 = 33%	0.68 = 50%	1.06 = 71%	2.10 = 96%
0.19 = 15%	0.44 = 34%	0.69 = 51%	1.08 = 72%	2.20 = 97%
0.20 = 16%	0.45 = 35%	0.70 = 52%	1.10 = 73%	2.40 = 98%
0.21 = 17%	0.46 = 35%	0.71 = 52%	1.12 = 74%	2.60 = 99%
0.22 = 17%	0.47 = 36%	0.72 = 53%	1.14 = 75%	
0.23 = 18%	0.48 = 37%	0.73 = 53%	1.16 = 75%	
0.24 = 19%	0.49 = 38%	0.74 = 54%	1.18 = 76%	
0.25 = 20%	0.50 = 38%	0.75 = 55%	1.20 = 77%	

3. SINES

DEGREE OF ANGLE	SINE
1	.017
5	.087
10	.174
15	.259
20	.342
25	.423
30	.500
35	.573
40	.643
45	.707
50	.766
55	.819
60	.866
65	.906
70	.940
75	.966
80	.985
85	.996
90	1.000



6. TORPEDO DAMAGE EFFECTIVENESS RATING (DER)

TARGET SHIP BELT ARMOR	TORPEDO CLASS					
	A	B	C	D	E	F
1.0 - 1.5	384	310	230	192	154	115
1.6 - 2.5	370	296	222	185	148	111
2.6 - 3.5	357	285	214	178	143	107
3.6 - 4.5	345	275	206	172	138	103
4.6 - 5.5	333	267	200	167	133	100
5.6 - 6.5	322	258	193	161	129	97
6.6 - 7.5	312	250	188	156	125	94
7.6 - 8.5	303	242	182	151	121	91
8.6 - 9.5	294	235	176	147	118	88
9.6 - 10.5	278	222	167	139	111	83
10.6 - 11.5	263	210	158	131	105	79
11.6 - 13.0	250	200	150	125	100	75
13.1 - 14.5	238	190	143	119	95	71
14.6 - 17.0	217	174	130	109	87	65

5. TORPEDO DUD FACTORS

CONTACT PISTOLS:	
United States pre 9/43	40%
United States 9/43 on	20%
Germany	25%
Japan/France/Italy/Great Britain	20%
MAGNETIC PISTOLS:	
United States pre 9/43	60%
United States 9/43 on	20%
Great Britain pre 3/44	30%
Great Britain 3/44 on	20%
Germany pre 11/42	50%
Germany 11/42 on	30%
Italy	30%

7. TORPEDO DER MODIFIER

CONTACT PISTOLS		MAGNETIC PISTOLS	
ROLL	MULTIPLY DER BY	ROLL	MULTIPLY DER BY
01-08	0.1	01-08	0.2
09-16	0.2	09-16	0.5
17-30	0.4	17-50	1.0
31-50	0.6	51-75	1.4
51-85	1.0	76-00	1.8
86-00	1.5		



1. SHIP SPEEDS vs. SEARCH PHASE TURNS

SPEED OF SHIP	DURATION OF SEARCH PHASE TURN							
	1	2	3	4	5	6	10	12
2 knots		0.5	0.5	1.0	1.0	1.0	2.0	2.5
4 knots	0.5	1.0	1.0	1.5	2.0	2.5	4.0	5.0
6 knots	0.5	1.0	2.0	2.5	3.0	3.6	6.0	7.0
8 knots	1.0	1.5	2.5	3.0	4.0	5.0	8.0	9.5
10 knots	1.0	2.0	3.0	4.0	5.0	6.0	10.0	12.0
12 knots	1.0	2.5	3.5	5.0	6.0	7.0	12.0	14.5
14 knots	1.5	3.0	4.0	5.5	7.0	8.5	14.0	17.0
16 knots	1.5	3.0	5.0	6.5	8.0	9.5	16.0	19.0
18 knots	2.0	3.5	5.5	7.0	9.0	11.0	18.0	21.5
20 knots	2.0	4.0	6.0	8.0	10.0	12.0	20.0	24.0
22 knots	2.0	4.5	6.5	9.0	11.0	13.0	22.0	26.5
24 knots	2.5	5.0	7.0	9.5	12.0	14.5	24.0	29.0
26 knots	2.5	5.0	8.0	10.5	13.0	15.5	26.0	31.0
28 knots	3.0	5.5	8.5	11.0	14.0	17.0	28.0	33.5
30 knots	3.0	6.0	9.0	12.0	15.0	18.0	30.0	36.0
32 knots	3.0	6.5	9.5	13.0	16.0	19.0	32.0	38.5

2. MORALE

65% DAMAGE	01-05	ROLL REQUIRED FOR CREW TO ABANDON SHIP
75% DAMAGE	01-08	
85% DAMAGE	01-12	
95% DAMAGE	01-20	
100% DAMAGE	01-90	

3. TURNING RADIUS

DP OF SHIP	MAXIMUM TURN ALLOWED IN ONE GAME TURN
25 - 199	180°
200 - 899	135°
900+	90°

4. LOSS OF RADAR

DAMAGE SUSTAINED BY SHIP	PROBABILITY OF LOSS OF RADAR
10%	30%
20%	40%
30%	50%
40%	70%
50%	90%
60%	100%

5. RAMMING CD

DP CAUSED BY RAMMING	NUMBER OF CD ROLLS
1%- 5%	0
6%- 25%	1
26%- 50%	2
51%-100%	3

The above are for Target Ship only. One roll only is made for CD to ramming ship if the ramming caused 10% damage or more to the ramming ship.



1. DAMAGE CONTROL

DP OF SHIP	DAMAGE CONTROL AVAILABLE
01- 50	7
51- 100	10
101- 200	14
201- 300	15
301- 400	20
401- 500	25
501- 600	30
601- 700	35
701- 800	40
801- 900	45
901-1000	50
over 1000	58

2. DAMAGE CONTROL MODIFIERS

COUNTRY	DCO MODIFIER
Germany WW 1	x 1.0
All others WW 1	x 0.8
United States WW 2	x 1.4
Germany WW 2	x 1.1
Great Britain WW 2	x 1.0
All others WW 2	x 0.9

3. FLIGHT TIME TO TARGET

AIRCRAFT SPEED	MILES PER GAME TURN	MILES TO TARGET											
		40	50	60	70	80	90	100	120	140	160	180	200
70 kts	2.3	17	22	26	30	35	39	43	52	61	70	78	87
80 kts	2.7	15	18	22	26	30	33	37	44	52	59	67	74
90 kts	3.0	13	17	20	23	27	30	33	40	47	53	60	67
100 kts	3.3	12	15	18	21	24	27	30	36	42	48	55	61
110 kts	3.7	11	14	16	19	22	24	27	32	38	43	49	54
120 kts	4.0	10	13	15	18	20	23	25	30	35	40	45	50
130 kts	4.3	9	12	14	16	19	21	23	28	33	37	42	47
140 kts	4.7	9	11	13	15	17	19	21	26	30	34	38	43
150 kts	5.0	8	10	12	14	16	18	20	24	28	32	36	40
160 kts	5.3	8	9	11	13	15	17	19	23	26	30	34	38

[FLIGHT TIME TO TARGET IN TURNS]

4. KAMIKAZE MODIFIERS

DICE ROLL	MODIFY KAMIKAZE DV BY
01-20	x 0.8
21-40	x 1.0
41-60	x 1.5
61-80	x 2.0
81-00	x 2.5



1. A/A & S/A COMBAT RESOLUTION

RESULT OF A/D RATIO

		.02	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
NUMBER OF ATTACKING AIRCRAFT	2	1	01-04	01-10	02-19	03-28	05-36	07-44	10-51	13-58	17-64	21-70	26-75
		2	---	---	01-01	01-02	01-04	01-06	01-09	01-12	01-16	01-20	01-25
	3	1	01-06	02-14	04-27	07-39	11-49	17-58	23-66	29-73	36-78	44-83	51-88
		2	---	01-01	01-03	01-06	02-10	03-16	04-22	05-28	07-35	10-43	13-50
		3	---	---	---	---	01-01	01-02	01-03	01-04	01-06	01-09	01-12
	4	1	01-08	02-19	06-34	12-48	19-59	27-68	36-76	45-82	53-87	62-91	70-94
		2	---	01-01	01-05	02-11	04-18	06-26	09-35	14-44	19-52	25-61	32-69
		3	---	---	---	01-01	01-03	01-05	02-08	03-13	04-18	05-24	07-31
		4	---	---	---	---	---	---	01-01	01-02	01-03	01-04	01-06
	5	1	01-10	03-23	09-41	17-56	27-67	38-76	48-83	58-88	67-92	75-95	82-97
		2	---	01-02	02-08	04-16	07-26	11-37	17-47	25-57	33-66	42-74	51-81
		3	---	---	01-01	01-03	02-06	03-10	04-16	06-24	10-32	14-41	20-50
		4	---	---	---	---	01-01	01-02	01-03	02-05	02-09	03-13	04-19
		5	---	---	---	---	---	---	---	01-01	01-01	01-02	01-03
	6	1	02-11	04-26	12-47	23-62	35-74	48-82	59-88	69-92	78-95	85-97	90-98
		2	01-01	01-03	03-11	06-22	11-34	18-47	27-58	36-68	47-77	57-84	67-89
3		---	---	01-02	02-05	03-10	05-17	08-26	13-35	19-46	27-56	35-66	
4		---	---	---	01-01	01-02	01-04	02-07	03-12	05-18	08-26	12-34	
5		---	---	---	---	---	---	01-01	01-02	01-04	02-07	03-11	
6		---	---	---	---	---	---	---	---	---	01-01	01-02	
7	1	02-13	05-30	16-52	29-68	43-79	57-87	68-92	78-95	85-97	91-98	95-99	
	2	01-01	01-04	04-15	08-28	16-42	25-56	36-67	48-77	59-84	69-90	78-94	
	3	---	---	01-03	02-07	04-15	08-24	14-35	21-47	30-58	40-68	51-77	
	4	---	---	---	01-01	01-03	02-07	04-13	07-20	11-29	16-39	24-50	
	5	---	---	---	---	---	01-01	01-03	02-06	03-10	05-15	07-23	
	6	---	---	---	---	---	---	---	01-01	01-02	01-04	02-06	
	7	---	---	---	---	---	---	---	---	---	---	01-01	
8	1	02-15	07-34	20-57	35-73	51-83	64-90	75-94	84-97	90-98	95-99	97-00	
	2	01-01	02-06	05-19	12-34	21-50	33-63	46-74	58-83	69-89	79-94	87-96	
	3	---	01-01	02-04	03-11	07-20	12-32	20-45	30-57	42-68	53-78	65-86	
	4	---	---	01-01	01-02	02-06	04-11	07-19	12-29	18-41	27-52	37-64	
	5	---	---	---	---	01-01	01-03	02-06	04-11	06-17	10-26	15-36	
	6	---	---	---	---	---	---	01-01	01-03	02-05	03-09	05-14	
	7	---	---	---	---	---	---	---	---	01-01	01-02	01-04	
9	1	02-17	08-37	24-61	41-77	57-87	71-92	81-96	89-98	94-99	97-00	99-00	
	2	01-01	02-07	06-23	15-40	27-56	41-70	55-80	67-88	78-93	86-96	92-98	
	3	---	01-01	02-05	04-14	10-26	18-40	28-54	40-66	53-77	65-85	76-91	
	4	---	---	01-01	02-03	03-09	06-17	11-27	18-39	28-52	39-64	51-75	
	5	---	---	---	01-01	01-02	02-05	04-10	06-17	11-27	18-38	26-50	
	6	---	---	---	---	---	01-01	01-03	02-05	04-10	06-17	10-25	
	7	---	---	---	---	---	---	---	01-01	01-03	02-05	03-09	
	8	---	---	---	---	---	---	---	---	---	01-01	01-02	



2. A/A & S/A COMBAT RESOLUTION

RESULT OF A/D RATIO

NUMBER OF ATTACKING AIRCRAFT

		.55	.60	.65	.70	.75	.80	.85	.90	.95
2	1	31-80	37-84	43-88	50-91	57-94	65-96	73-98	82-99	91-00
	2	01-30	01-36	01-42	01-49	01-56	01-64	01-72	01-81	01-90
3	1	58-91	66-94	73-96	79-97	85-98	91-99	95-00	98-00	00-00
	2	18-57	23-65	28-72	35-78	43-84	52-90	62-94	74-97	87-99
	3	01-17	01-22	01-27	01-34	01-42	01-51	01-61	01-73	01-86
4	1	77-96	83-97	88-98	93-99	96-00	98-00	00-00	*	*
	2	40-76	49-82	57-87	66-92	75-95	83-97	90-99	96-00	00-00
	3	10-39	14-48	19-56	25-65	33-74	42-82	53-89	67-95	82-99
	4	01-09	01-13	01-18	01-24	01-32	01-41	01-52	01-66	01-81
5	1	88-98	92-99	96-99	98-00	99-00	00-00	*	*	*
	2	60-87	69-91	77-95	85-97	91-98	95-99	98-00	00-00	*
	3	27-59	35-68	44-76	54-84	64-90	75-94	85-97	93-99	99-00
	4	06-26	09-34	13-43	18-53	25-63	34-74	45-84	60-92	78-98
	5	01-05	01-08	01-12	01-17	01-24	01-33	01-44	01-59	01-77
6	1	94-99	97-00	99-00	00-00	*	*	*	*	*
	2	75-93	83-96	89-98	94-99	97-00	99-00	00-00	*	*
	3	45-74	55-82	66-88	75-93	84-96	91-98	96-99	99-00	*
	4	17-44	24-54	33-65	43-74	54-83	67-90	79-95	90-98	98-00
	5	04-16	06-23	09-32	13-42	19-53	27-66	39-78	54-89	75-97
	6	01-03	01-05	01-08	01-12	01-18	01-26	01-38	01-53	01-74
7	1	97-00	99-00	00-00	*	*	*	*	*	*
	2	86-96	91-98	95-99	98-00	00-00	*	*	*	*
	3	62-85	72-90	81-94	88-97	94-99	98-00	00-00	*	*
	4	33-61	43-71	54-80	66-87	77-93	86-97	94-99	98-00	*
	5	11-32	17-42	24-53	34-65	45-76	59-85	73-93	86-97	97-00
	6	03-10	04-16	06-23	09-33	14-44	22-58	33-72	49-85	71-96
	7	01-02	01-03	01-05	01-08	01-13	01-21	01-32	01-48	01-70
8	1	99-00	00-00	*	*	*	*	*	*	*
	2	92-98	96-99	98-00	00-00	*	*	*	*	*
	3	75-91	84-95	90-97	95-99	98-00	00-00	*	*	*
	4	49-74	60-83	72-89	82-94	90-97	95-99	99-00	00-00	*
	5	23-48	33-59	44-71	56-81	69-89	81-94	90-98	97-99	00-00
	6	07-22	12-32	18-43	27-55	38-68	51-80	67-89	82-96	95-99
	7	02-06	03-11	04-17	07-26	11-37	18-50	28-66	44-81	67-94
	8	01-01	01-02	01-03	01-06	01-10	01-17	01-27	01-43	01-66
9	1	00-00	*	*	*	*	*	*	*	*
	2	96-99	98-00	00-00	*	*	*	*	*	*
	3	84-95	91-97	96-99	98-00	00-00	*	*	*	*
	4	63-83	74-90	84-95	91-97	96-99	99-00	00-00	*	*
	5	37-62	49-73	62-83	74-90	84-95	92-98	98-99	00-00	*
	6	16-36	24-48	35-61	47-73	61-83	75-91	87-97	96-99	00-00
	7	05-15	08-23	13-34	21-46	31-60	45-74	61-86	78-95	94-99
	8	01-04	02-07	03-12	05-20	09-30	14-44	24-60	40-77	64-93
	9	---	01-01	01-02	01-04	01-08	01-13	01-23	01-39	01-63