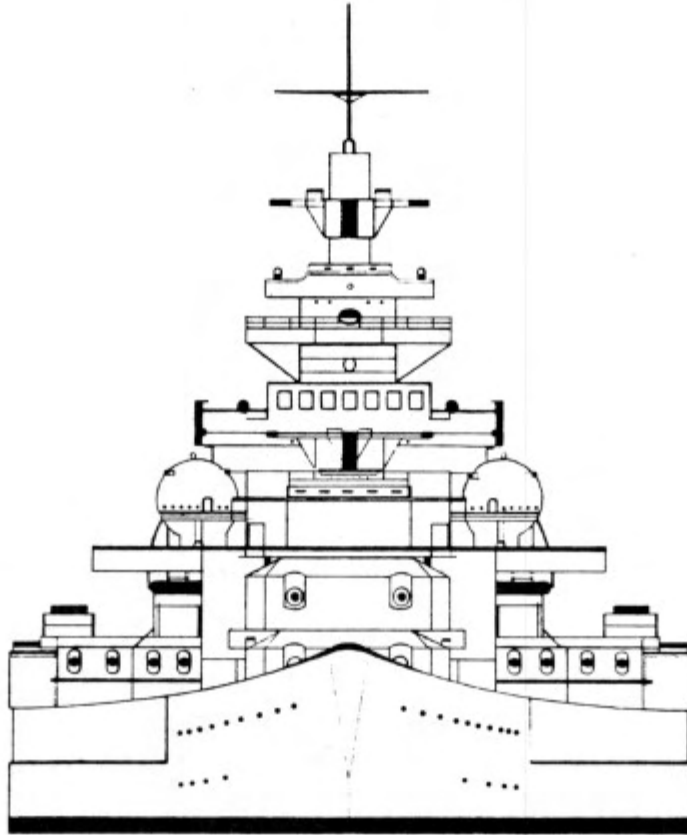


SEEKRIEG

FOURTH EDITION



CHARTS

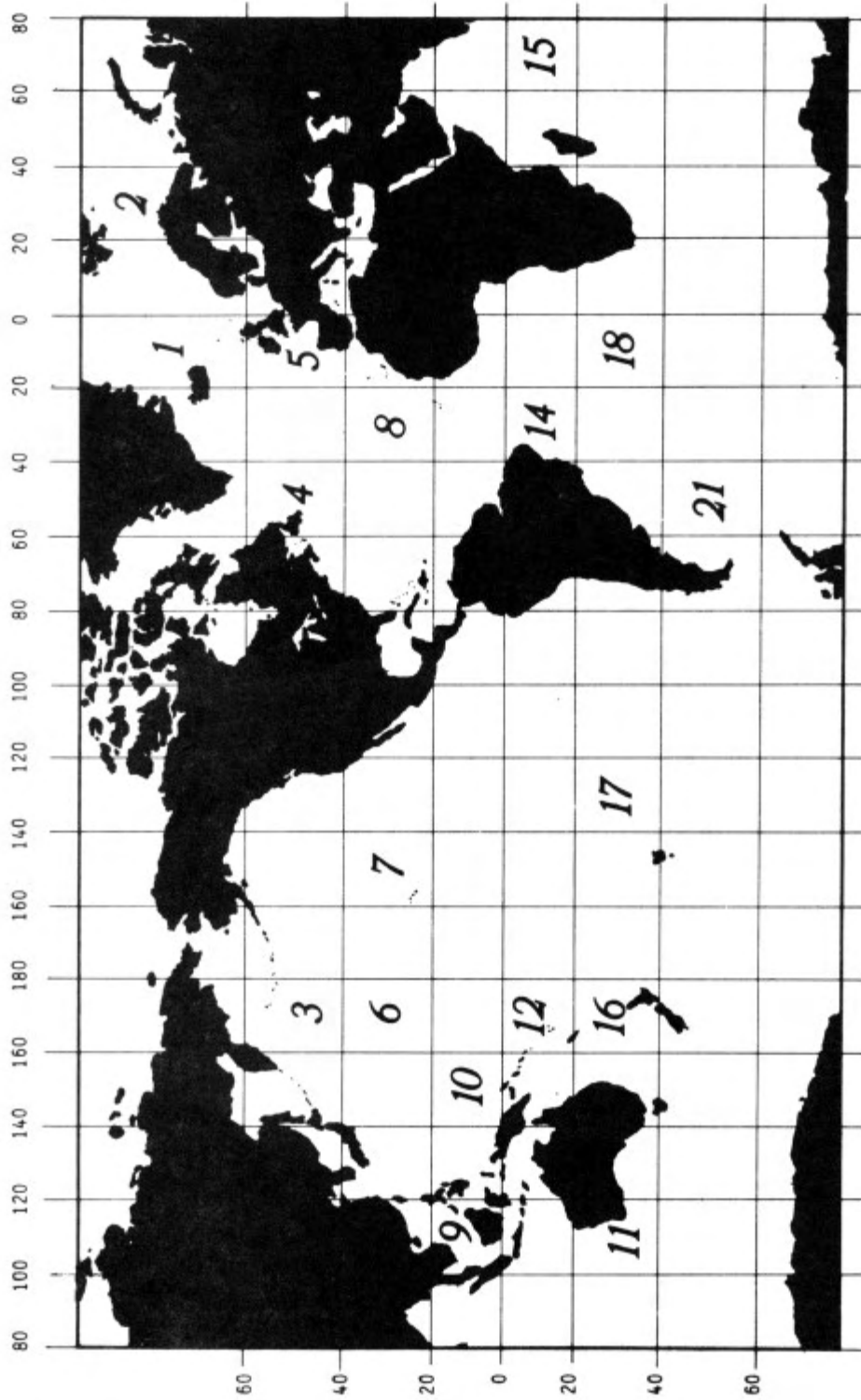
1. MOVEMENT, GUNNERY, AND GAME SCALES



SPEED OF SHIP	1:1200 SCALE		1:2400 SCALE		1:3000 SCALE		1:4000 SCALE		1:4800 SCALE	
	2 kt = 1/4" 1,000 yds = 2"	2 kt = 4" 1,000 yds = 30"	2 kt = 2" 1,000 yds = 15"	2 kt = 1.6" 1,000 yds = 12"	2 kt = 1.2" 1,000 yds = 9"	2 kt = 1.0" 1,000 yds = 7 1/2"				
2 knots	0.25"	4"	2"	1.6"	1.2"	1.0"				
4 knots	0.50"	8"	4"	3.2"	2.4"	2.0"				
6 knots	0.75"	12"	6"	4.8"	3.6"	3.0"				
8 knots	1.00"	16"	8"	6.4"	4.8"	4.0"				
10 knots	1.25"	20"	10"	8.0"	6.0"	5.0"				
12 knots	1.50"	24"	12"	9.6"	7.2"	6.0"				
14 knots	1.75"	28"	14"	11.2"	8.4"	7.0"				
16 knots	2.00"	32"	16"	12.8"	9.6"	8.0"				
18 knots	2.25"	36"	18"	14.4"	10.8"	9.0"				
20 knots	2.50"	40"	20"	16.0"	12.0"	10.0"				
22 knots	2.75"	44"	22"	17.6"	13.2"	11.0"				
24 knots	3.00"	48"	24"	19.2"	14.4"	12.0"				
26 knots	3.25"	52"	26"	20.8"	15.6"	13.0"				
28 knots	3.50"	56"	28"	22.4"	16.8"	14.0"				
30 knots	3.75"	60"	30"	24.0"	18.0"	15.0"				
32 knots	4.00"	64"	32"	25.6"	19.2"	16.0"				
34 knots	4.25"	68"	34"	27.2"	20.4"	17.0"				
36 knots	4.50"	72"	36"	28.8"	21.6"	18.0"				
38 knots	4.75"	76"	38"	30.4"	22.8"	19.0"				
40 knots	5.00"	80"	40"	32.0"	24.0"	20.0"				

NOTE: All movement amounts are based on a 2-minute turn length.

1. GENERAL WEATHER AREAS



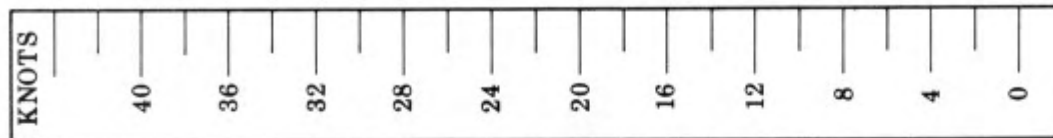
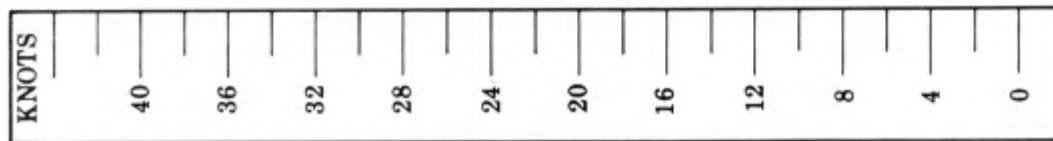


2. WEATHER PROBABILITY FOR AREAS BY QUARTERS

	2-4	5-6	7-8	9-10	11-12
AREA 1					
J-M	01-42	43-68	69-93	94-98	99-00
A-J	01-42	43-77	78-95	96-99	00
J-S	01-84	85-97	98-00	-----	-----
O-D	01-47	48-78	79-91	92-98	99-00
AREA 2					
J-M	01-49	50-76	77-90	91-99	00
A-J	01-52	53-82	83-96	97-00	-----
J-S	01-69	70-85	86-99	00	-----
O-D	01-57	58-88	89-95	96-98	99-00
AREA 3					
J-M	01-40	41-76	77-92	93-97	98-00
A-J	01-48	49-74	75-95	96-00	-----
J-S	01-69	70-95	96-99	00	-----
O-D	01-40	41-78	79-95	96-99	00
AREA 4					
J-M	01-31	32-66	67-90	91-98	99-00
A-J	01-40	41-77	78-97	98-00	-----
J-S	01-64	65-91	92-96	97-99	00
O-D	01-44	45-80	81-95	96-98	99-00
AREA 5					
J-M	01-45	46-76	77-94	95-98	99-00
A-J	01-50	51-84	85-96	97-00	-----
J-S	01-70	71-89	90-98	99-00	-----
O-D	01-54	55-85	86-96	97-99	00
AREA 6					
J-M	01-39	40-76	77-93	94-98	99-00
A-J	01-55	56-87	88-98	99-00	-----
J-S	01-73	74-92	93-96	97-98	99-00
O-D	01-53	54-89	90-96	97-99	00
AREA 7					
J-M	01-72	73-94	95-98	99-00	-----
A-J	01-72	73-96	97-98	99-00	-----
J-S	01-73	74-94	95-96	97-98	99-00
O-D	01-66	67-90	91-98	99-00	-----
AREA 8					
J-M	01-60	61-93	94-99	00	-----
A-J	01-69	70-98	99-00	-----	-----
J-S	01-64	65-92	93-98	99-00	-----
O-D	01-63	64-96	97-99	00	-----
AREA 9					
J-M	01-52	53-90	91-98	99-00	-----
A-J	01-92	93-97	98-99	00	-----
J-S	01-66	67-86	87-93	94-96	97-00
O-D	01-82	83-94	95-97	98-99	00
AREA 10					
J-M	01-57	58-90	91-96	97-00	-----
A-J	01-51	52-92	93-98	99-00	-----
J-S	01-72	73-88	89-92	93-95	96-00
O-D	01-61	62-90	91-95	96-97	98-00

	2-4	5-6	7-8	9-10	11-12
AREA 11					
J-M	01-63	64-86	87-90	91-94	95-00
A-J	01-70	71-94	95-98	99-00	-----
J-S	01-53	54-82	83-98	99-00	-----
O-D	01-67	68-90	91-96	97-98	99-00
AREA 12					
J-M	01-80	81-86	87-88	89-91	92-00
A-J	01-75	76-94	95-96	97-98	99-00
J-S	01-65	66-96	97-00	-----	-----
O-D	01-76	77-90	91-94	95-96	97-00
AREA 14					
J-M	01-70	71-98	99-00	-----	-----
A-J	01-66	67-98	99-00	-----	-----
J-S	01-42	43-90	91-99	00	-----
O-D	01-55	56-98	99-00	-----	-----
AREA 15					
J-M	01-84	85-91	92-93	94-95	96-00
A-J	01-90	91-96	97-98	99-00	-----
J-S	01-52	53-90	91-99	00	-----
O-D	01-63	64-88	89-95	96-97	98-00
AREA 16					
J-M	01-78	79-86	87-90	91-93	94-00
A-J	01-65	66-88	89-95	96-98	99-00
J-S	01-52	53-84	85-95	96-00	-----
O-D	01-69	70-88	89-93	94-95	96-00
AREA 17					
J-M	01-80	81-93	94-95	96-97	98-00
A-J	01-64	65-90	91-98	99-00	-----
J-S	01-58	59-86	87-96	97-98	99-00
O-D	01-68	69-92	93-98	99-00	-----
AREA 18					
J-M	01-63	64-95	96-99	00	-----
A-J	01-38	39-80	81-93	94-00	-----
J-S	01-36	37-78	79-96	97-00	-----
O-D	01-44	45-80	81-95	96-00	-----
AREA 21					
J-M	01-44	45-81	82-96	97-98	99-00
A-J	01-46	47-71	72-88	89-97	98-00
J-S	01-34	35-65	66-87	88-98	99-00
O-D	01-46	47-77	78-95	96-00	-----
NORTH SEA					
J-M	01-36	37-72	73-93	94-98	99-00
A-J	01-45	46-76	77-95	96-00	-----
J-S	01-62	63-88	89-97	98-00	-----
O-D	01-48	49-78	79-92	93-98	99-00
MEDITERRANEAN SEA					
J-M	01-58	59-84	85-95	96-00	-----
A-J	01-61	62-88	89-97	98-00	-----
J-S	01-79	80-96	97-00	-----	-----
O-D	01-71	72-90	91-98	99-00	-----

Listed under each area are four rows, each row representing a different calendar quarter (January to March, April to June, etc.). Each row lists the probability (01-00) of a particular set of Beaufort Numbers occurring during that quarter. The Beaufort Numbers are listed along the top row of the chart so that on a roll of 95 for AREA 1 during the month of November would result in either Beaufort Number 9 or 10 sea state.



These movement markers may be copied and pasted to a piece of cardboard or plastic.

3. BEAUFORT SEA STATE TABLE

BEAUFORT NUMBER	WIND SPEED	DESCRIPTION	REDUCE VISIBILITY	EFFECT ON SHIPBOARD OPERATIONS	
0	0- 1 knots	CALM - Sea like a mirror.	--	NONE	
1	2- 3 knots	LIGHT AIR - Ripples form.	--	NONE	
2	4- 6 knots	LIGHT BREEZE - Small wavelets form.	--	NONE	
3	7-10 knots	GENTLE BREEZE - Large wavelets with some breaking crests	--	NONE	
4	11-16 knots	MODERATE BREEZE - Small waves with breaking crests.	--	NONE	
5	17-21 knots	FRESH BREEZE - Moderate waves with many breaking crests and some spray.	--	NONE	
6	22-27 knots	STRONG BREEZE - Large waves with extensive whitecaps and spray.	--	0-30 DP SHIPS	10%
7	28-33 knots	MODERATE GALE - Sea heaps up and white foam from breaking waves begins to be blown along the direction of the wind.	5%	0- 40 DP SHIPS 41- 90 DP SHIPS	20% 10%
8	34-40 knots	FRESH GALE - Moderately high waves of greater length; edges of crests break into spindrift. Foam is blown in well-marked streaks.	10%	0- 40 DP SHIPS 41-120 DP SHIPS	30% 15%
9	41-47 knots	STRONG GALE - High waves. Dense streaks of foam. Sea begins to roll. Much spray.	20%	0- 30 DP SHIPS 31-100 DP SHIPS 101-200 DP SHIPS	40% 30% 15%
10	48-55 knots	WHOLE GALE - Very high waves with long overhanging crests. White appearance of sea. Rolling of sea becomes heavy.	40%	0- 40 DP SHIPS 41-150 DP SHIPS 151-500 DP SHIPS 501 + DP SHIPS	50% 40% 20% 10%
11	56-66 knots	STORM - Exceptionally high waves. Entire sea is white with foam and spray.	60%	0-100 DP SHIPS 101-500 DP SHIPS 501 + DP SHIPS	50% 40% 25%
12	66 + knots	CYCLONE - The air is filled with foam and spray. Extremely high seas. Ships under 100 DP in danger of being lost or severely damaged.	80%	0-200 DP SHIPS 201-500 DP SHIPS 501 + DP SHIPS	80% 50% 40%



1. VISIBILITY TABLE

VISIBILITY CODE	DESCRIPTION	EFFECT ON CURRENT VISIBILITY
0	Dense fog	nil
1	Thick fog	nil
2	Moderate fog	nil
3	Light fog	1% to 3%
4	Thin fog	3% to 5%
5	Haze	5% to 8%
6	Light haze	8% to 18%
7	Clear	18% to 37%
8	Very Clear	37% to 85%
9	Exceptionally clear	85% to 95%

NOTE: 0, 1, 2, and 3 exist only during Force 0-2
3 and 4 exist only during Force 0-3 and possibly Force 4.

2. SURFACE TO SURFACE VISIBILITY (VISUAL)

DP OF SEARCH VESSEL	DP OF TARGET SHIP						
	01- 25	26- 50	51- 75	76-150	151-300	301-600	601+
01- 25	15,600	18,400	20,600	25,200	28,600	30,400	31,400
26- 50	18,400	21,200	23,400	28,000	31,400	33,200	34,200
51- 75	20,600	23,400	25,600	30,200	33,600	35,400	36,400
76-150	25,200	28,000	30,200	34,800	38,200	40,000	41,000
151-300	28,600	31,400	33,600	38,200	41,600	43,400	44,400
301-600	30,400	33,200	35,400	40,000	43,400	45,200	46,200
601 +	31,400	34,200	36,400	41,000	44,400	46,200	47,200

NOTE: The above yard distances are the approximate distances at which the upper half of the target is visible assuming perfect visibility (such as in a vacuum!). Smoke and tall masts will, of course, be sighted at greater distances. Reduce the above ranges by the factors on CHART C1 (and those on B3 if applicable).

3. SURFACE TO SURFACE VISIBILITY (RADAR)

DP OF SEARCH VESSEL	DP OF TARGET SHIP						
	01- 25	26- 50	51- 75	76-150	151-300	301-600	601 +
01-100	25,700	28,900	31,400	36,700	40,700	42,800	44,000
101-200	29,000	32,200	34,700	40,000	44,000	46,100	47,300
201-500	31,900	35,100	37,600	42,900	46,900	49,000	50,200
501 +	35,000	38,200	40,700	46,000	50,000	52,100	53,300

NOTE: The above yard distances are the approximate distances at which shipboard surface search radar will detect a target. Radar is, for the most part unaffected by most weather conditions. However, reductions may be made for Force 10-12 or for periods of very low, heavy cloud cover.

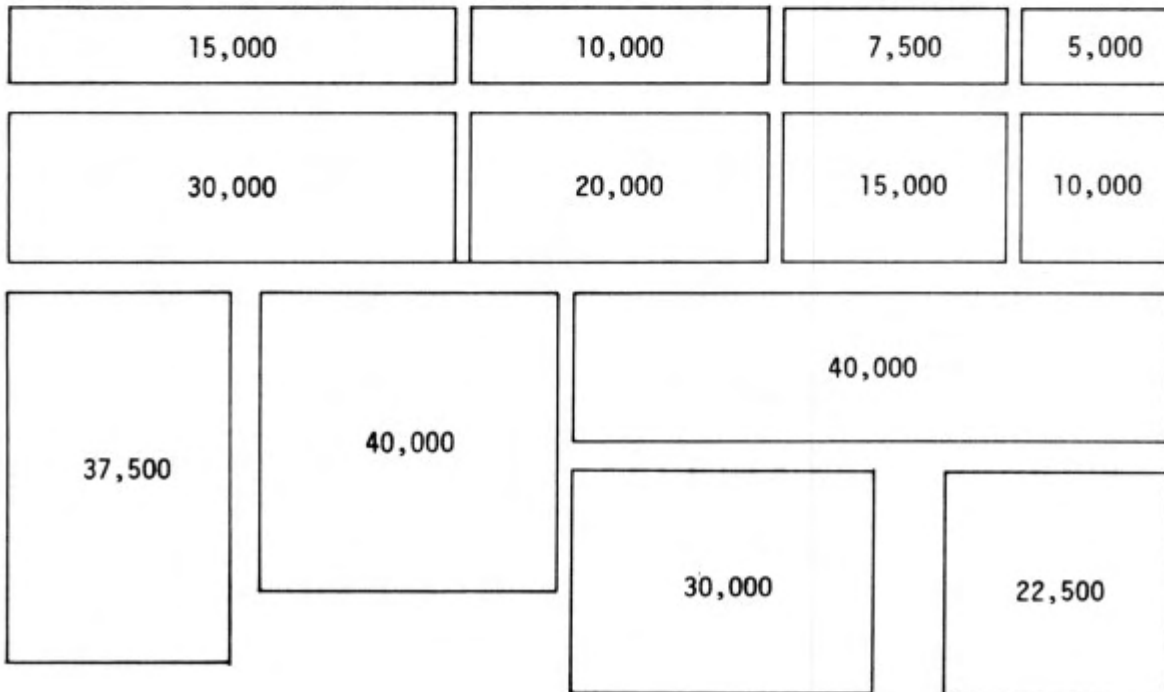


1. AIR TO SEA DETECTION PROBABILITY

VISIBILITY IN MILES	SEARCH AREA (IN SQUARE MILES)								
	5000	7500	10000	15000	20000	22500	30000	37500	40000
RADAR II	99	95	89	77	67	62	52	44	42
RADAR I	94	85	75	61	50	46	37	31	29
50	87	74	63	49	39	36	28	23	22
40	80	66	55	41	33	30	23	19	18
35	75	61	50	37	30	27	21	17	16
30	70	55	45	33	26	23	18	15	14
25	63	49	39	28	22	20	15	13	12
20	55	41	33	23	18	16	13	10	09
15	45	33	26	18	14	13	10	08	07
10	33	23	18	13	10	09	06	05	04

NOTE: Radar I is early (pre 1943) radar models.
 Radar II is late (USA from 1-43 and GB from 11-43) radar models.
 This chart gives the probability of detection (air to surface) by aircraft searching at 1,000 feet at 100 knots.

2. STANDARD AIR TO SURFACE SEARCH PATTERNS (1" = 120 n miles)



1. D.P. AND A.A. GUN FACTORS

GUN SIZE/CALIBER	MARK & MODEL	YEAR	SHELL WEIGHT	ROF	MAX ALTITUDE	RATING
------------------	--------------	------	--------------	-----	--------------	--------

FRANCE						
6.00"	/54		123.00 lbs.	8	S L M H V	3.1
5.10"	/45		64.90 lbs.	22	S L M H V	3.8
3.90"	/45		33.00 lbs.	12	S L M H	2.0
3.90"	/45		33.00 lbs.	16	S L M H V	2.3
3.90"	/45		29.36 lbs.	20	S L M H V	2.4
3.50"	/50		21.00 lbs.	14	S L M H	1.7
3.00"	/50		13.00 lbs.	16	S L M	1.4
40 mm	/56	Bofors	1.98 lbs.	240	S L M	2.2
37 mm	/60	Mark 33	1.80 lbs.	170	S L M	1.7
37 mm	/48		1.80 lbs.	300	S L M	2.2
20 mm	/70	Oerlikon	.27 lbs.	470	S L	1.1
13.2mm			.11 lbs	500	S	1.0

GREAT BRITAIN						
5.25"	/50	Mark I	80.00 lbs.	16	S L M H V	3.6
4.72"	/43	Mark VIII*	50.00 lbs.	16	S L M H	2.8
4.70"	/50		62.00 lbs.	18	S L M H	3.3
4.50"	/45	Mark III	55.00 lbs.	24	S L M H	3.6
4.00"	/45	Mark V	31.00 lbs.	22	S L M H	2.6
4.00"	/45	Mark XVI	36.00 lbs.	32	S L M H	3.4
3.00"	/45	Marks I-III (12 pdr.)	12.50 lbs.	40	S L M	2.2
2.24"	/40	Marks I-II (6 pdr.)	6.00 lbs.	40	S L	1.5
1.85"	/50	Mark II (3 pdr.)	3.40 lbs.	260	S L M	3.0
40 mm	/40	Marks I-II (2 pdr. pom-pom)	2.00 lbs.	180	S L	1.9
40 mm	/40	Marks V-VIII (2 pdr. pom-pom)	1.80 lbs.	220	S L M	2.0
40 mm	/60	Marks NI-X (Bofors)	2.00 lbs.	240	S L M	2.2
20 mm	/65	Marks I-V (Oerlikon)	0.27 lbs.	900	S L	1.6
0.50"	/52	Marks I-III (Vickers MG)	0.08 lbs.	1200	S	1.0

GERMANY						
4.10"	/65		33.30 lbs.	30	S L M H V	3.2
3.90"	/45		21.40 lbs.	20	S L M	2.1
3.5"	/76		19.80 lbs.	30	S L M H	2.4
40 mm	/56	Bofors	1.98 lbs.	320	S L M H	2.5
37 mm	/83		1.76 lbs.	60	S L M	1.0
37 mm	/69		1.32 lbs.	180	S L M	1.5
20 mm	/65		.24 lbs.	900	S L	1.5

2. D.P. AND A.A. GUN FACTORS



ITALY							
3.90"	/47		1928	33.00 lbs.	18	S L M H	2.4
3.50"	/50		1939	22.00 lbs.	24	S L M H	2.3
3.00"	/40		1917	13.20 lbs.	20	S L M	1.6
40 mm	/39		1917	1.98 lbs.	160	S L	1.8
37 mm	/54		1932	1.76 lbs.	240	S L M	2.1
20 mm	/65		1940	.31 lbs.	250	S L	0.9
13.2mm			1930	.11 lbs.	450	S	0.9

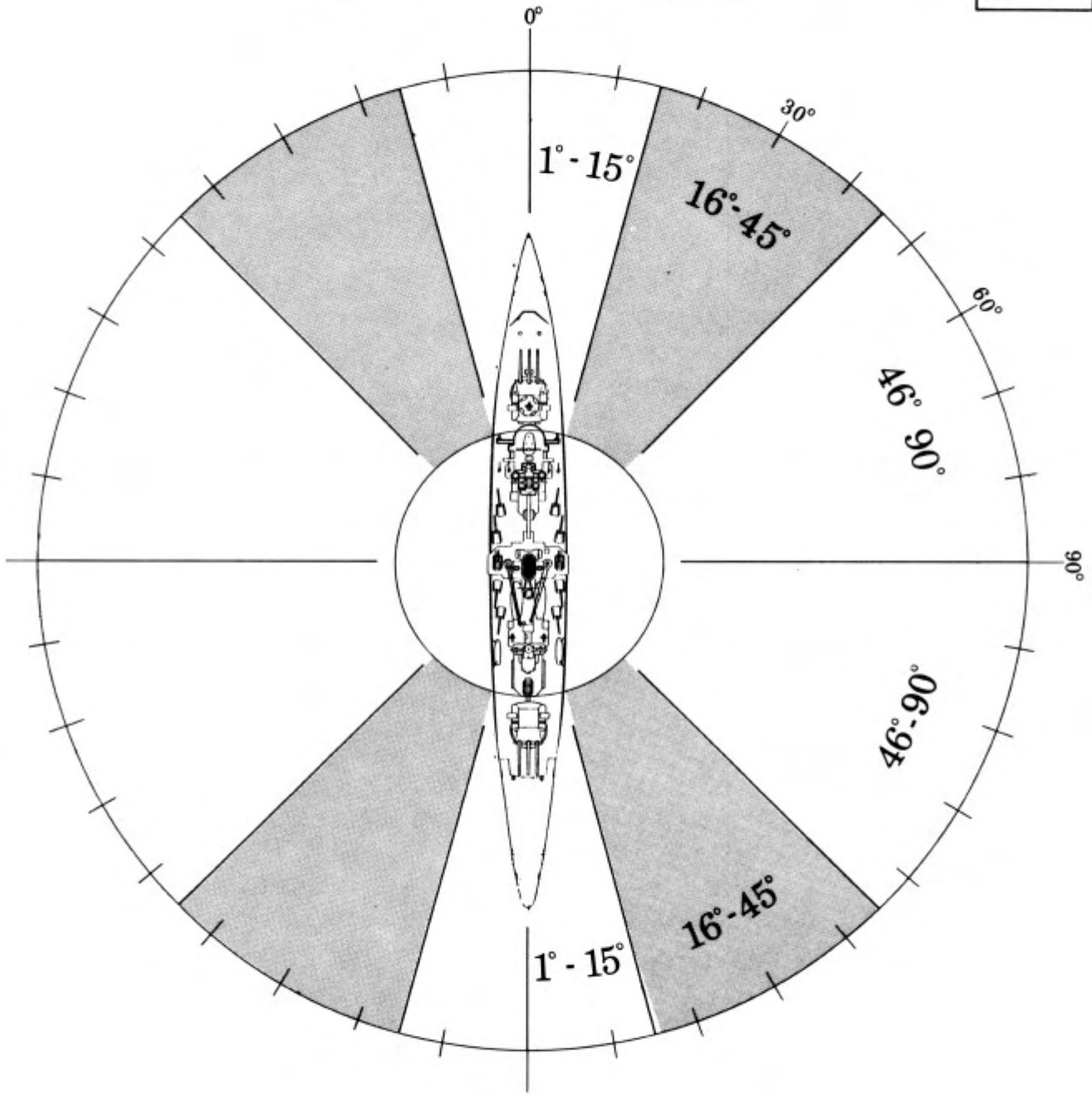
JAPAN							
6.10"	/60	Third year	1938	123.10 lbs.	10	S L M H V	3.5
5.00"	/40	Type 89	1930	50.80 lbs.	20	S L M H V	3.2
5.00"	/40	Type 89	1940	50.80 lbs.	28	S L M H V	3.8
4.72"	/45	10 Nendo Shiki	1927	45.10 lbs.	20	S L M H V	3.0
4.70"		AA Rockets	1944			S	1.0
3.90"	/65		1940	24.20 lbs.	22	S L M	2.3
3.10"	/40	3 Nendo Shiki	1916	13.20 lbs.	30	S L M	1.9
40 mm	/62	Type 92	1930	2.00 lbs.	260	S L M	2.3
25 mm	/60	Type 96	1935	0.55 lbs.	340	S L M	1.4
13.2mm		Type 93	1935	.12 lbs.	1000	S L	1.1
7.7mm		Type 92 F	1925	.03 lbs.	1800	S	0.7
8.00"	/50		1932	277.50 lbs.	5	S L M H	3.7

RUSSIA							
3.90"	/56		1934	34.83 lbs.	24	S L M H V	2.9
3.00"	/55		1934	14.60 lbs.	30	S L M H	2.1
2.95"	/31		1914	12.10 lbs.	22	S L M	1.6
37 mm	/67		1939	1.59 lbs.	200	S L M	1.8
45 mm			1926	2.20 lbs.	110	S L M H	1.5

UNITED STATES							
5.00"	/25	Mark 13	1923	59.50 lbs.	18	S L M H	3.3
5.00"	/38	Mark 12	1934	55.00 lbs.	24	S L M H V	3.6
5.00"	/38	Mark 12 (w/power ran)	1937	55.00 lbs.	36	S L M H V	4.4
5.00"	/54	Mark 16	1945	69.00 lbs.	30	S L M H V	4.5
3.00"	/50	Mark 10	1917	13.00 lbs.	20	S L M	1.6
3.00"	/50	Mark 21	1930	12.20 lbs.	40	S L M H	2.2
40 mm	/56	Marks 1-2	1941	2.00 lbs.	300	S L M	2.4
28 mm	/75	Mark 1	1936	0.90 lbs.	300	S L M	1.7
20 mm	/72	Marks 2-4	1937	0.27 lbs.	900	S L	1.6

SEEKRIEG 4 CHART
F

1. BEARINGS FROM TARGET SHIP





1. HIT LOCATION

SHORT RANGE	LONG RANGE	HIT LOCATION	
		BB-CB-CA-CL-DD	CV
01-08	01-30	[D] DECK	[D] FLIGHT DECK
09-40	31-40	[B] SIDEBELT	[H] HANGAR
41-55	41-50	[C] CON	[C] CON
56-65	51-70	[T] TURRET	[S] ISLAND
66-85	71-82	[S] SUPERSTRUCTURE	[B] SIDEBELT
86-00	83-00	[I] DUD	[I] DUD

2. SHELL DAMAGE MODIFIERS

	SHELL TYPE			
	APC	SAP	COM	HE/HC
PENETRATION FACTOR	1.0	0.7	0.4	---
DAMAGE FACTOR MODIFIER (no penetration)	1.0	1.3	1.6	2.0
DAMAGE FACTOR MODIFIER (penetration)	3.0	3.5	4.0	---
PROBABILITY OF CRITICAL DAMAGE (no penetration)	*20%	*20%	*20%	*20%
PROBABILITY OF CRITICAL DAMAGE (penetration)	*65%	*65%	*65%	---
PROBABILITY OF PASS-THROUGH	45%	40%	30%	0

All HE and HC shells have no penetration capability and have the same Damage Factor Modifier and Probability of Critical Damage when they hit any target.

[*] CHECK FOR SHIPBOARD FIRE DURING THIS ROLL

3. RATE OF FIRE BY RANGE

RANGE TO TARGET	MAXIMUM RATE OF FIRE PER GUN (IN 2 MINUTES)
2,500 yards or less	10
2,600 to 5,000 yards	8
5,100 to 10,000 yards	6
10,100 to 17,500 yards	4
17,600 to 24,000 yards	3
24,100 to 30,000 yards	2
30,100 yards or more	1

4. SHIPBOARD FIRES

A shipboard fire will occur if two of the same number are rolled during the roll to see if the hit caused Critical Damage. The severity of the fire is determined by total of the two dice (00 being counted as 20). Each turn (2 minutes) a Damage Control Roll must be made to determine the status of the fire:

- 01-20 Subtract 4 from severity
- 21-35 Subtract 2 from severity
- 36-50 Subtract 1 from severity
- 51-75 No change
- 76-85 Add 1 to severity
- 86-99 Add 2 to severity
- 00 Fire 00C (abandon ship)

1. HIT PROBABILITY [BASIC METHOD]
1. TARGET SIZE

1- 100 DP	- 8
101- 500 DP	- 4
500-1000 DP	0
Over 1000 DP	+ 5

2. BEARING FROM TARGET

Bow-on [0° - 45°]	0
Broadside [46° - 90°]	+10

3. FIRE CONTROL SYSTEM

1942-1945	+26
1925-1941	+18
1914-1924	+10
1900-1914	+ 2
1890-1900	- 8

4. RADAR ASSISTED FIRE CONTROL

1939-42 FC Radars	+14
1942-44 FC Radars	+22
1944-45 FC Radars	+30

5. CHANGE OF TARGET

Firing on new target	-10
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6. RANGE TO TARGET

less than 5,000 yards ($0-9\frac{1}{2}''$)....	+20
5,000 to 10,000 yards ($10''-20''$)..	+16
10,100 to 15,000 yards ($20\frac{1}{2}''-30''$)	+10
15,100 to 20,000 yards ($30\frac{1}{2}''-40''$)	+ 4
20,100 to 30,000 yards ($40\frac{1}{2}''-60''$)	- 4
more than 30,000 yards ($60\frac{1}{2}''$ +)..	-12

7. SPEED OF TARGET

less than 5 knots	+ 6
5 to 10 knots	0
11 to 15 knots	- 4
16 to 20 knots	- 8
21 to 25 knots	-10
26 to 30 knots	-12
31 to 36 knots	-14
more than 36 knots	-16

AP SHELL DAMAGE [BASIC METHOD]

SHELL SIZE	DP INFLICTED (penetration)	DP INFLICTED (no penetration)	SHELL SIZE	DP INFLICTED (penetration)	DP INFLICTED (no penetration)
20.00"	102	34	9.40"	36	13
18.00"	90	30	8.00"	30	10
16.00"	78	26	7.50"	27	9
15.00"	72	24	6.00"	21	7
14.00"	66	22	5.50"	18	6
13.50"	63	21	5.25"	18	6
13.00"	60	20	5.00"	15	5
12.60"	57	19	4.00"	12	4
12.00"	54	18	3.00"	9	3
11.00"	48	16	SMALLER	3	1
10.00"	42	14			



2. HIT PROBABILITY [ADVANCED METHOD]

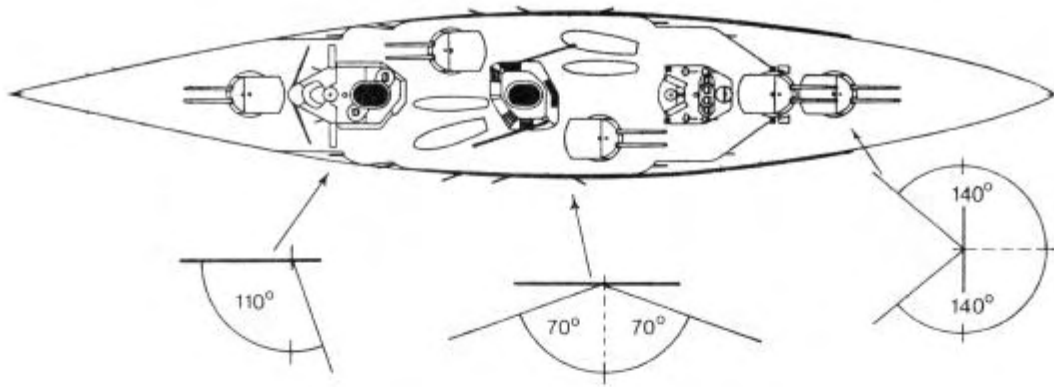
1. <u>TARGET SIZE</u>	
01- 40 DP	- 4
41- 80 DP	- 2
81- 200 DP	0
201- 500 DP	+ 2
501-1000 DP	+ 4
Over 1000 DP	+ 6
2. <u>BEARING FROM TARGET</u>	
Pos. A [0° - 15°]	0
Pos. B [16° - 45°]	+ 8
Pos. C [46° - 90°]	+15
3. <u>FIRING SHIP UNDER FIRE</u>	
Hit during last turn	- 8
4. <u>OVER CONCENTRATION</u>	
1 ship only firing at target ..	0
2-3 ships firing at target	- 5
4 or more ships firing	-10
5. <u>FIRE CONTROL SYSTEM</u>	
Post 1930 DCT System	+26
Post 1930 Local RF	+19
1914-30 DCT System	+15
1914-30 Top RF	+12
1914-30 Local RF	+ 8
1900-19 Top RF	+ 3
1900-19 Local RF	- 2
1880-99 Top spot	- 8
1880-99 Local spot	-12
6. <u>RADAR ASSISTED FIRE CONTROL</u>	
1939-42 FC Radars	+14
1942-44 FC Radars	+22
1944-45 FC Radars	+30
7. <u>RANGE TO TARGET</u>	
less than 4,000 yards	+21
4,000 to 8,000 yards	+18
8,100 to 12,000 yards	+15
12,100 to 16,000 yards	+10
16,100 to 20,000 yards	+ 4
20,100 to 24,000 yards	0
24,100 to 30,000 yards	- 5
more than 30,000 yards	-12
8. <u>CHANGE OF TARGET</u>	
Firing on new target	-14
9. <u>SPEED OF TARGET</u>	
less than 5 knots	+15
5 to 10 knots	+11
11 to 15 knots	+ 6
16 to 20 knots	0
21 to 25 knots	- 3
26 to 30 knots	- 5
31 to 36 knots	- 8
more than 36 knots	-12
10. <u>SPOTTER AIRCRAFT</u>	
Aircraft spotting shell splashes.	+10
11. <u>EVASIVE MANEUVER</u>	
Target only in E.M.	- 6
Firing ship only in E.M.	-12
Both Ships in E.M.	-18
12. <u>SEA STATE</u>	
Beaufort 0 to 6	0
Beaufort 7 (ships under 200 DP)..	- 4
Beaufort 8 (ships under 400 DP)..	- 8
Beaufort 9 (ships under 600 DP)..	-14
Beaufort 10 (all ships)	-30
13. <u>SMOKE SCREENS</u>	
Target behind chemical screen ...	-16
Target behind funnel smoke	- 6
14. <u>VISIBILITY</u>	
<u>OURING DAYLIGHT</u>	
Code 9 (Exceptionally Clear)	+ 4
Code 8 (Very Clear).....	0
Code 7 (Clear)	- 4
Code 5 or 6 (Haze)	- 8
Patchy fog	-16
<u>MORNING/EVENING TWILIGHT</u>	
Target afire or silhouetted	+ 2
Target in darkness	-10
Neither of the above	- 4
<u>NIGHT</u>	
No moonlight	-18
Moonlight	- 9
Target afire or silhouetted	+ 2
Target illuminated by searchlight	0
Target using a searchlight	- 4
Target in a starshell pattern ...	- 2



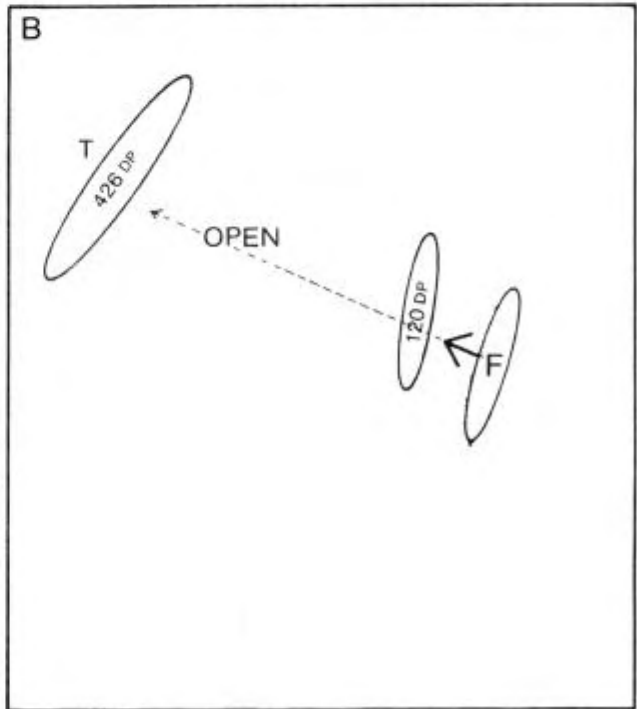
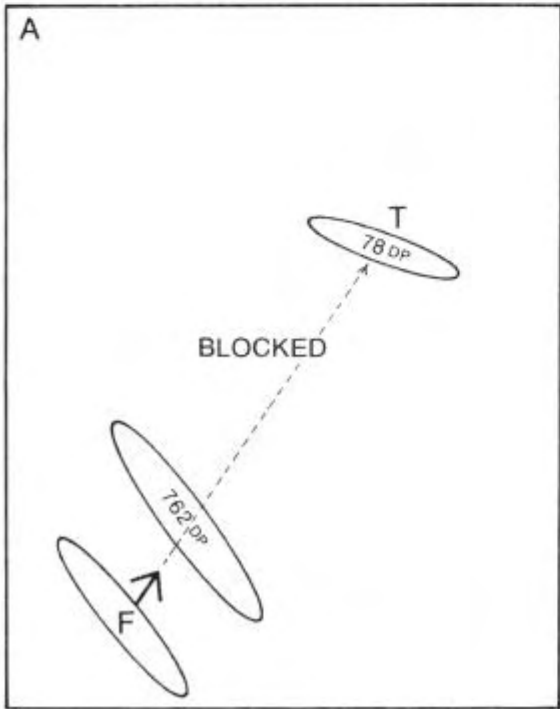
3. HIT PROBABILITY [RANGE ESTIMATION METHOD]

<p>1. <u>TARGET SIZE</u></p> <p>01- 40 DP + 2</p> <p>41- 80 DP + 4</p> <p>81- 200 DP + 6</p> <p>201- 500 DP + 8</p> <p>501-1000 DP +10</p> <p>over 1000 DP +12</p> <p>2. <u>BEARING FROM TARGET</u></p> <p>Pos. A [0° - 15°] 0</p> <p>Pos. B [16° - 45°] +12</p> <p>Pos. C [46° - 90°] +22</p> <p>3. <u>SEA STATE</u></p> <p>Beaufort 0 to 6 0</p> <p>Beaufort 7 (ships under 200 DP) - 4</p> <p>Beaufort 8 (ships under 400 DP) - 8</p> <p>Beaufort 9 (ships under 600 DP) -12</p> <p>Beaufort 10 (all ships) -20</p> <p>4. <u>FIRING SHIP UNDER FIRE</u></p> <p>Hit during last turn - 4</p> <p>5. <u>OVER CONCENTRATION</u></p> <p>1 ship only firing at target... 0</p> <p>2 or 3 ships firing at target.. - 3</p> <p>4 or more ships firing - 6</p> <p>6. <u>FIRE CONTROL SYSTEM</u></p> <p>Post 1930 DCT System +48</p> <p>Post 1930 Local RF +35</p> <p>1914-30 DCT System +28</p> <p>1914-30 Top RF +23</p> <p>1914-30 Local RF +16</p> <p>1900-19 Top RF +10</p> <p>1900-19 Local RF + 6</p> <p>1880-99 Top spot + 2</p> <p>1880-99 Local spot - 2</p>	<p>7. <u>RADAR ASSISTED FIRE CONTROL</u></p> <p>1939-42 FC Radars +25</p> <p>1942-44 FC Radars +40</p> <p>1944-45 FC Radars +54</p> <p>8. <u>SPOTTER AIRCRAFT</u></p> <p>Aircraft spotting shell splashes.. +16</p> <p>9. <u>SMOKE SCREENS</u></p> <p>Target behind chemical screen -16</p> <p>Target behind funnel smoke - 6</p> <p>10. <u>EVASIVE MANEUVER</u></p> <p>Target only in E.M. - 5</p> <p>Firing ship only in E.M. -10</p> <p>Both ships in E.M. -15</p> <p>11. <u>VISIBILITY</u></p> <p>DURING DAYLIGHT</p> <p>Code 9 (Exceptionally Clear) + 4</p> <p>Code 8 (Very Clear) 0</p> <p>Code 7 (Clear) - 4</p> <p>Code 5 or 6 (Haze) - 8</p> <p>Patchy fog -16</p> <p>MORNING/EVENING TWILIGHT</p> <p>Target afire or silhouetted + 2</p> <p>Target in darkness -10</p> <p>None of the above - 4</p> <p>NIGHT</p> <p>No moonlight -18</p> <p>Moonlight - 9</p> <p>Target afire or silhouetted + 2</p> <p>Target illuminated by searchlight. 0</p> <p>Target using a searchlight - 4</p> <p>Target in a starshell pattern - 2</p> <p>12. <u>ACQUIRED FIRE</u></p> <p>Same target hit last turn + 4</p>
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1. ARCS OF FIRE



2. LINE OF SIGHT



1. SURFACE GUNFIRE COMBAT RESOLUTION

RESULT FROM HIT PROBABILITY TABLE [CHART H]

	01-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121-130	131-140
1 1	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12	01-13	01-14
2 1	01-02	01-04	01-06	01-08	01-10	01-12	01-14	02-15	02-17	02-19	02-21	02-23	03-24	03-26
2 2	---	---	---	---	---	---	---	01-01	01-01	01-01	01-01	01-01	01-02	01-02
3 1	01-03	01-06	01-09	01-12	02-14	02-17	02-20	03-22	03-25	04-27	04-30	05-32	06-34	06-36
2 2	---	---	---	---	01-01	01-01	01-01	01-02	01-02	01-03	01-03	01-04	01-05	01-05
4 1	01-04	01-08	02-11	02-15	02-19	03-22	04-25	04-28	05-31	06-34	07-37	08-40	09-43	12-45
2 2	---	---	01-01	01-01	01-01	01-02	01-03	01-03	01-04	01-05	01-06	02-07	02-08	02-11
3 3	---	---	---	---	---	---	---	---	---	---	---	01-01	01-01	01-01
5 1	01-05	01-10	02-14	02-18	03-23	04-27	05-30	06-34	08-38	09-41	11-44	12-47	14-50	17-56
2 2	---	---	01-01	01-01	01-02	01-03	01-04	01-05	02-07	02-08	02-10	02-11	03-13	03-15
3 3	---	---	---	---	---	---	---	---	01-01	01-01	01-01	01-01	01-02	01-02
6 1	01-06	02-11	02-17	03-22	04-26	06-31	07-35	09-39	11-43	12-47	14-50	17-53	19-57	21-60
2 2	---	01-01	01-01	01-02	01-03	01-05	02-06	02-08	02-10	03-11	03-13	04-16	04-18	05-20
3 3	---	---	---	---	---	---	01-01	01-01	01-01	01-02	01-02	01-03	01-03	02-04
4 4	---	---	---	---	---	---	---	---	---	---	---	---	---	01-01
7 1	01-07	02-13	03-19	04-25	05-30	07-35	09-40	11-44	14-48	16-52	19-56	21-59	24-62	27-65
2 2	---	01-01	01-02	01-03	01-04	02-06	02-08	02-10	03-13	04-15	04-18	05-20	06-23	07-26
3 3	---	---	---	---	---	01-01	01-01	01-01	01-02	01-03	01-03	02-04	02-05	02-06
4 4	---	---	---	---	---	---	---	---	---	---	---	01-01	01-01	01-01
8 1	01-08	02-15	03-22	05-28	07-34	09-39	11-44	14-49	17-53	20-57	23-61	26-64	29-67	32-70
2 2	---	01-01	01-02	01-04	02-06	02-08	02-10	03-13	04-16	05-19	06-22	07-25	08-28	10-31
3 3	---	---	---	---	01-01	01-01	01-01	01-02	01-03	02-04	02-05	02-06	02-07	03-09
4 4	---	---	---	---	---	---	---	---	---	01-01	01-01	01-01	01-01	01-02
9 1	01-09	02-17	04-24	06-31	08-37	11-43	14-48	17-53	20-57	24-61	27-65	31-68	34-71	38-74
2 2	---	01-01	01-03	01-05	02-07	02-10	03-13	04-16	05-19	06-23	08-26	09-30	11-33	13-37
3 3	---	---	---	---	01-01	01-01	01-02	01-03	02-04	02-05	02-07	03-08	03-10	04-12
4 4	---	---	---	---	---	---	---	---	01-01	01-01	01-01	01-02	01-02	02-03
5 5	---	---	---	---	---	---	---	---	---	---	---	---	---	01-01
10 1	01-10	03-18	04-26	07-34	10-40	13-46	16-52	20-57	24-61	27-65	31-69	35-72	39-75	43-78
2 2	---	01-02	01-03	02-06	02-09	03-12	04-15	05-19	06-23	08-26	10-30	12-34	14-38	16-42
3 3	---	---	---	01-01	01-01	01-02	01-03	02-04	02-05	02-07	03-09	03-11	04-13	05-15
4 4	---	---	---	---	---	---	---	01-01	01-01	01-01	01-02	01-02	02-03	02-04
5 5	---	---	---	---	---	---	---	---	---	---	---	---	01-01	01-01

NUMBER OF SHELLS



1. TIME OF SUNRISE BY LATITUDE (L.C.T.)

		NORTH LATITUDE												
		0	10	20	30	35	40	45	50	55	60	65	70	75
APR	1	0601	0558	0555	0552	0550	0546	0544	0540	0537	0530	0528	0512	0455
	15	0557	0550	0542	0534	0529	0524	0517	0509	0500	0446	0429	0400	0310
MAY	1	0554	0544	0531	0518	0511	0502	0452	0440	0423	0402	0332	0240	L
	15	0553	0538	0523	0507	0457	0445	0432	0415	0353	0323	0237	L	L
JUN	1	0554	0537	0520	0458	0447	0433	0417	0357	0328	0251	L	L	L
	15	0557	0538	0520	0458	0444	0430	0412	0350	0320	0335	L	L	L
JUL	1	0600	0542	0523	0502	0448	0433	0416	0354	0324	0240	L	L	L
	15	0602	0546	0528	0508	0457	0443	0426	0406	0340	0301	L	L	L
AUG	1	0603	0549	0534	0517	0507	0457	0443	0427	0405	0338	0252	L	L
	15	0601	0551	0539	0527	0518	0511	0500	0448	0433	0412	0343	0353	L
SEP	1	0557	0551	0544	0536	0529	0525	0519	0512	0502	0450	0434	0405	0320
	15	0553	0550	0547	0544	0542	0540	0538	0534	0530	0526	0519	0509	0452
OCT	1	0546	0548	0550	0553	0555	0556	0557	0559	0600	0602	0605	0610	0615
	15	0543	0548	0554	0602	0605	0610	0615	0621	0628	0637	0650	0710	0741
NOV	1	0540	0550	0600	0613	0619	0628	0637	0647	0700	0718	0743	0820	D
	15	0540	0554	0609	0625	0634	0644	0652	0712	0730	0752	0835	D	D
DEC	1	0545	0600	0618	0637	0648	0701	0716	0735	0759	0833	0924	D	D
	15	0552	0608	0627	0648	0700	0714	0731	0751	0818	0857	D	D	D
JAN	1	0559	0617	0634	0656	0708	0722	0738	0759	0827	0903	D	D	D
	15	0605	0621	0638	0657	0708	0721	0736	0754	0816	0849	D	D	D
FEB	1	0610	0622	0631	0651	0700	0710	0721	0736	0754	0818	0855	D	D
	15	0611	0620	0630	0641	0647	0654	0702	0712	0725	0740	0805	0840	D
MAR	1	0609	0616	0621	0628	0632	0636	0641	0646	0654	0704	0718	0737	0807
	15	0606	0608	0609	0611	0612	0613	0615	0616	0617	0624	0624	0628	0632

2. TIME OF SUNSET BY LATITUDE (L.C.T.)

		NORTH LATITUDE												
		0	10	20	30	35	40	45	50	55	60	65	70	75
APR	1	1810	1810	1810	1810	1812	1812	1813	1814	1815	1815	1815	1815	1818
	15	1804	1810	1818	1827	1832	1838	1845	1853	1902	1916	1933	2002	2050
MAY	1	1800	1811	1823	1836	1839	1853	1903	1916	1931	1954	2020	2111	L
	15	1759	1814	1828	1846	1856	1907	1921	1938	2000	2030	2113	L	L
JUN	1	1801	1817	1835	1855	1907	1922	1938	1959	2025	2104	L	L	L
	15	1804	1821	1840	1902	1915	1931	1947	2010	2041	2124	L	L	L
JUL	1	1807	1824	1843	1905	1917	1933	1951	2013	2043	2126	L	L	L
	15	1810	1825	1843	1903	1915	1928	1944	2005	2030	2108	L	L	L
AUG	1	1810	1823	1838	1854	1904	1916	1927	1945	2005	2035	2123	L	L
	15	1808	1818	1829	1842	1849	1858	1907	1920	1935	1955	2029	2120	L
SEP	1	1803	1810	1816	1825	1829	1835	1841	1848	1856	1909	1930	1955	2045
	15	1758	1801	1803	1806	1808	1810	1813	1815	1818	1823	1832	1843	1900
OCT	1	1753	1752	1750	1748	1747	1745	1744	1743	1740	1737	1735	1730	1722
	15	1748	1743	1737	1730	1726	1722	1717	1711	1704	1654	1644	1624	1554
NOV	1	1747	1737	1726	1714	1707	1659	1651	1639	1626	1608	1545	1506	D
	15	1747	1735	1720	1704	1655	1645	1632	1617	1557	1532	1457	D	D
DEC	1	1752	1736	1719	1700	1649	1636	1621	1602	1538	1505	D	D	D
	15	1758	1741	1723	1702	1649	1635	1618	1558	1531	1453	D	D	D
JAN	1	1806	1749	1731	1710	1658	1644	1628	1607	1542	1502	D	D	D
	15	1813	1758	1741	1722	1711	1658	1644	1625	1602	1530	1536	D	D
FEB	1	1818	1805	1751	1736	1727	1718	1705	1651	1634	1611	1533	1434	D
	15	1818	1809	1759	1748	1742	1736	1727	1717	1705	1649	1619	1550	1440
MAR	1	1816	1811	1805	1758	1755	1750	1745	1739	1732	1723	1708	1648	1617
	15	1812	1811	1810	1808	1807	1806	1805	1804	1803	1801	1758	1752	1746



3. DURATION OF TWILIGHT

	NORTH LATITUDE									
	0	30	40	45	50	55	60	65	70	75
JANUARY	0113	0123	0135	0143	0155	0212	0236	D	D	D
FEBRUARY	0109	0121	0131	0139	0149	0204	0224	0256	0355	D
MARCH	0109	0121	0131	0140	0151	0206	0230	0305	0409	0500
APRIL	0110	0125	0135	0150	0207	0235	0320	T	T	T
MAY	0111	0130	0151	0205	0255	T	T	T	T	T
JUNE	0113	0135	0201	0227	T	T	T	T	T	T
JULY	0113	0134	0156	0220	0305	T	T	T	T	T
AUGUST	0111	0126	0144	0209	0222	0320	T	T	T	T
SEPTEMBER	0109	0121	0135	0144	0156	0217	0248	0330	T	T
OCTOBER	0109	0120	0132	0140	0150	0203	0222	0255	0335	0455
NOVEMBER	0113	0123	0135	0143	0155	0207	0231	0313	0440	D
DECEMBER	0115	0126	0137	0147	0159	0215	0243	0342	D	D

4. SOUTH LATITUDE ADJUSTMENTS

MONTH	USE	APPLY
APRIL	OCTOBER	+0015
MAY	NOVEMBER	+0011
JUNE	DECEMBER	+0005
JULY	JANUARY	-0003
AUGUST	FEBRUARY	-0009
SEPTEMBER	MARCH	-0014
OCTOBER	APRIL	-0015
NOVEMBER	MAY	-0011
DECEMBER	JUNE	-0005
JANUARY	JULY	+0003
FEBRUARY	AUGUST	+0010
MARCH	SEPTEMBER	+0014

L = Continuous light
 D = Continuous darkness
 T = Continuous twilight and light

CHART 5165 (Sunrise, Sunset, and Twilight Diagrams) is available from the Defense Mapping Agency (address on Page 3 of the Rulebook) and contains more detailed information.

The times listed on CHARTS K1 and K2 are for North Latitudes and are correct within the given time zones [all times are expressed as Local Civil Time]. Use CHART K4 to adjust the times for use in South Latitudes. [For April in the Southern Hemisphere, use the values for October in the Northern Hemisphere and add 15 minutes].

1. AIRCRAFT NAVIGATIONAL ERROR [NO RADAR]

	MILES OFF COURSE							
	0	10	15	20	25	30	40	50*
Beaufort 0-1	01-50	51-65	66-75	76-80	81-85	86-90	91-95	96-00
Beaufort 2-3	01-45	46-55	56-65	66-75	76-80	81-85	86-90	91-00
Beaufort 4	01-40	41-52	53-60	61-65	66-70	71-75	76-80	81-00
Beaufort 5	01-35	36-42	43-48	49-53	54-58	59-66	67-74	75-00
Beaufort 6	01-30	31-40	41-45	46-50	51-55	56-62	63-69	70-00
Beaufort 7	01-25	26-30	31-35	36-40	41-48	49-58	59-69	70-00
Beaufort 8	01-22	23-27	28-32	33-40	41-48	49-56	57-64	65-00

The above percentages are for strikes of 200 miles or less. For strikes of distances over 200 miles, read one line down [for a 300 mile strike during Beaufort 5, use the line for Beaufort 6].

* Aircraft are considered completely lost and must return to base.

2. AIRCRAFT DROP-OUT

MILES TO TARGET	% DROP-OUT AND RETURN TO BASE
Less than 100	use 11-20 on CHART I
100 - 300	use 21-30 on CHART I
301 - 500	use 31-40 on CHART I
Over 500	use 61-70 on CHART I

For each strike group of aircraft

4. AIR SEARCH ACCURACY

ROLL	REPORT ACCURACY
01-30	Position reported accurately
31-34	Reported 10 miles North of actual
35-38	Reported 10 miles West of actual
39-42	Reported 10 miles South of actual
43-46	Reported 10 miles East of actual
47-50	Reported 20 miles North of actual
51-54	Reported 20 miles West of actual
55-58	Reported 20 miles South of actual
59-62	Reported 20 miles East of actual
63-66	Reported 30 miles North of actual
67-70	Reported 30 miles West of actual
71-74	Reported 30 miles South of actual
75-78	Reported 30 miles East of actual
79-82	Reported 50 miles North of actual
83-86	Reported 50 miles West of actual
87-90	Reported 50 miles South of actual
91-94	Reported 50 miles East of actual
95	Reported 70 miles North of actual
96	Reported 70 miles West of actual
97	Reported 70 miles South of actual
98	Reported 70 miles East of actual
99-00	No report until return to base

3. CAP VECTORING

No Air Warning Radar	Use 0.50 column on CHART Y1
1940-42 Air Warning Radar	Use 0.75 column on CHART Y2
1942-43 Air Warning Radar	Use 0.85 column on CHART Y2
1944-45 Air Warning Radar	Use 0.95 column on CHART Y2

This table gives the number of groups (of 4 aircraft) of CAP that can be vectored to detected raid on the first turn of detection [using the 0.75 column on CHART Y2, if there are 5 groups (20 aircraft total), the defender may vector up to 3 of those groups if he rolls 64-90 on the first turn of detection].



1. RAID DETECTION PROBABILITY

SHIP CONDITION	ATTACK AIRCRAFT LEVEL	DIE ROLL									
		1	2	3	4	5	6	7	8	9	0
1. No radar and no CAP	(S)	2	2	3	3	3	4	4	4	4	5
2. No radar and no CAP	(L M H V)	2	3	3	3	4	4	4	5	5	6
3. No radar and CAP	(S L M H V)	4	4	5	5	5	6	6	6	7	7
4. Radar and no CAP	(S)	4	4	4	4	5	5	6	7	8	9
5. Radar and no CAP	(L M H V)	6	6	8	8	9	9	10	11	12	12
6. Radar and CAP	(S L M H V)	7	7	9	9	10	11	12	14	16	18

2. AA FIRE CALCULATION

$$\left(\frac{\text{TOTAL ADJUSTED AA FACTOR}}{\text{TOTAL NUMBER OF AIRCRAFT MAKING ATTACK}} \right) \div \left(\frac{\text{Percentage along top of CHARTS Y}}{2 \times \text{DEFENSE FACTOR OF 1 AIRCRAFT}} \right)$$

3. AA FACTOR MODIFIERS

FUZE TYPE

Mechanical Time Multiply AA by 1.2
 Variable Time (VT) Multiply AA by 1.5

FIRE CONTROL TYPE

Radar & Director Control Multiply AA by 1.3
 Director Control Only Multiply AA by 1.0
 Visual Multiply AA by 0.6

The MT fuze was used by most navies from 1935 on and available for nearly all sizes of shells. The VT fuze was available only on the U.S. 5"/38 gun from October 1942 on.

4. AERIAL ORDNANCE HIT TABLE [METHOD 1]

	SPEED OF TARGET SHIP				
	0-6 kts	8-14 kts	16-22 kts	24-30 kts	32-40 kts
[S] Sea Level less than 2,000 ft	2	3	4	5	6
[L] Low Level 2,000 - 10,000 ft	3	4	5	6	7
[M] Medium Level 10,100 - 18,000 ft	4	5	6	7	9
[H] High Level 18,100 - 27,000 ft	6	7	8	10	14

5. AERIAL ORDNANCE HIT TABLE [METHOD 2]

	SPEED OF TARGET SHIP				
	0-6 kts	8-14 kts	16-22 kts	24-30 kts	32-40 kts
[S] Sea Level less than 2,000 ft	.50	.35	.25	.20	.15
[L] Low Level 2,000 - 10,000 ft	.35	.25	.20	.15	.15
[M] Medium Level 10,100 - 18,000 ft	.25	.20	.15	.15	.10
[H] High Level 18,100 - 27,000 ft	.15	.15	.10	.10	.05



6. AERIAL ORDNANCE PENETRATION

LEVEL OF ATTACK	USE CHART R PENETRATION FOR
SEA LEVEL	17,600-22,500 yards
LOW LEVEL	17,600-22,500 yards
MEDIUM LEVEL	12,600-17,500 yards
HIGH LEVEL	12,600-17,500 yards

[For Dive-Bombers, use MEDIUM LEVEL]

7. BOMB DAMAGE FACTORS

WEIGHT OF BOMB		DF	PENETRATION CLASS
10 lb. to	20 lb.	2	CLASS U2
21 lb. to	50 lb.	4	CLASS T3
51 lb. to	90 lb.	5	CLASS S3
91 lb. to	160 lb.	7	CLASS P3
161 lb. to	350 lb.	10	CLASS M4
351 lb. to	600 lb.	13	CLASS L1
601 lb. to	900 lb.	16	CLASS J3
901 lb. to	1,200 lb.	18	CLASS H3
1,201 lb. to	1,600 lb.	21	CLASS F1
1,601 lb. to	2,400 lb.	26	CLASS C2
2,401 lb. to	2,900 lb.	29	CLASS B2
2,901 lb. to	3,600 lb.	31	CLASS B1
3,601 lb. to	4,100 lb.	35	CLASS A1
4,101 lb. to	4,900 lb.	41	CLASS A1
4,901 lb. to	6,000 lb.	48	CLASS A1

8. BOMB DAMAGE MODIFIERS

	AP	SAP	GP
PENETRATION FACTOR	1.0	0.7	0.1
DAMAGE FACTOR MODIFIER (penetration)	3.0	3.5	4.0
DAMAGE FACTOR MODIFIER (no penetration)	1.0	2.0	3.5
PROBABILITY OF CRITICAL DAMAGE (penetration)	*75%	*75%	*75%
PROBABILITY OF CRITICAL DAMAGE (no penetration)	*20%	*25%	*30%
PROBABILITY OF PASS-THROUGH	60%	50%	0

[* CHECK FOR SHIPBOARD FIRE DURING THIS ROLL]

3. SUBMARINE CD

ROLL	CD NUMBER
01-10	52
11-18	51
19-23	53
24-29	54
30-36	55
37-42	56
43-50	57
51-58	58
59-67	59
68-72	60
73-76	61
77-82	62
83-90	63
91-00	No damage

5. C.D. DURATION

ROLL	DURATION OF CRITICAL DAMAGE
01-10	2 minutes (1 turn)
11-20	4 minutes (2 turns)
21-30	6 minutes (3 turns)
31-40	10 minutes (5 turns)
41-50	16 minutes (8 turns)
51-60	24 minutes (12 turns)
61-70	30 minutes (15 turns)
71-80	60 minutes (30 turns)
81-00	PERMANENT

2. CLASS B CD DETERMINATION

CD NUMBER	D	H	C	S	B
1	01-02	01-05	01-06	---	01-04
2	03-06	---	07-10	---	05-10
3	07-12	---	11-14	---	11-14
4	13-16	06-09	15-18	---	15-17
5	17-20	---	19-22	---	18-23
6	---	---	23-25	---	24-28
7	---	---	26-30	---	29-32
8	21-25	---	---	01-03	33-34
9	26-30	---	---	04-10	---
10	---	---	31-34	11-15	35-39
11	---	---	35-40	16-20	40-44
12	---	---	---	21-26	---
13	---	---	---	27-33	---
14	---	---	---	34-37	45-47
17	31-34	---	41-43	38-40	48-50
18	35-38	---	---	41-43	51-53
19	39-42	---	---	44-47	---
20	43-46	---	---	48-50	54-56
21	47-50	---	44-50	51-60	57-59
22	51-54	---	51-54	---	60-63
23	---	---	55-57	---	---
26	55-58	---	---	61-65	---
27	59-61	---	---	66-72	---
28	62-65	---	---	73-76	---
29	66-70	---	---	77-80	---
30	---	---	58-63	81-85	---
31	---	---	63-65	86-88	---
32	---	---	66-70	89-92	---
33	---	---	---	93-95	---
36	71-74	10-15	71-76	---	64-67
37	---	---	77-84	96-98	---
38	75-77	16-22	---	---	---
39	78-80	23-30	---	---	68-70
40	---	---	---	---	71-74
41	---	31-40	---	---	75-78
42	---	---	---	---	79-80
43	---	41-48	---	---	---
44	---	49-58	---	---	---
45	---	59-69	---	---	81-84
46	81-90	70-85	---	---	85-87
47	91-95	86-00	---	---	---
48	96-00	---	85-00	99-00	---
49	---	---	---	---	88-95
50	---	---	---	---	96-00

1. CLASS A CD DETERMINATION

CD NUMBER	D	B	C	T	S
1	01-04	01-04	01-03	01-09	---
2	05-09	05-10	04-11	---	---
3	10-13	11-14	12-16	---	---
4	14-19	15-18	17-25	10-21	---
5	20-24	19-22	26-30	---	---
6	25-28	23-30	31-35	---	---
7	29-31	31-35	36-40	---	---
8	32-34	---	---	22-31	---
9	35-40	---	---	---	01-04
10	41-43	36-40	41-48	---	05-10
11	44-48	41-46	49-54	---	11-15
12	---	---	---	---	16-20
13	---	---	---	---	21-25
14	---	---	---	---	26-30
15	---	---	---	---	31-34
16	---	---	---	---	35-42
17	49-52	---	---	---	43-49
18	53-55	47-51	55-60	---	---
19	56-58	52-54	61-63	32-39	---
20	59-61	55-59	64-66	40-46	---
21	62-64	---	---	47-56	---
22	---	---	67-72	---	50-54
23	65-68	---	73-75	---	55-59
24	---	60-65	76-80	---	---
25	---	---	---	---	60-63
26	---	---	---	---	64-67
27	---	---	---	57-64	68-73
28	---	---	---	---	74-78
29	69-72	---	---	65-71	79-85
30	73-75	---	---	---	86-88
31	76-78	---	---	---	89-91
32	---	---	---	---	92-95
33	79-81	---	---	---	96-97
34	---	---	---	72-74	98-99
35	82-83	---	---	00	---
36	84-86	---	---	---	---
37	87-90	66-75	81-86	75-88	---
38	91-93	---	---	89-94	---
39	94-98	76-80	87-91	---	---
40	99-00	81-85	92-95	95-96	---
41	---	86-92	---	---	---
42	---	---	96-00	97-00	---
43	---	93-96	---	---	---
44	---	97-00	---	---	---



4. CRITICAL DAMAGE EFFECTS

1. Magazine explosion - ship destroyed and removed from playing area at end of game turn.
2. Engine room damaged - reduce maximum speed by $\frac{1}{2}$ of original maximum speed for the next \bar{N} turns.
3. Engine room destroyed - reduce maximum speed by $\frac{1}{2}$ of original maximum speed permanently.
4. Magazine fire (roll to determine PRIMARY or SECONDARY battery and roll again to determine location of battery magazine affected - FORWARD/CENTER/AFT or PORT/STARBOARD). Multiply DP caused by this hit by 3 and add this to total. For the next 3 game turns roll dice to determine progress of firefighting; 01-59 FLOODING SUCCESSFUL / 60-79 ADDITIONAL DAMAGE - ADD DP CAUSED BY ORIGINAL HIT AGAIN / 80-00 FIRE GOES OOC AND SHIP DESTROYED BY MAGAZINE EXPLOSION. Regardless of the rolls (made at the end of the next 3 turns), all guns being serviced by this magazine may not fire for the remainder of the battle.
5. Fire in engine room - reduce maximum speed by 2 knots each turn for the next \bar{N} turns and remain at the final reduced speed an equal number of turns before increasing speed.
6. Magazine flooded - Guns serviced by this magazine may fire for the next 3 turns and may not fire again for the remainder of the battle (roll to determine battery affected and location of flooding as in #4).
7. Flooding in fireroom - multiply DP caused by this hit by 2 and add this to total. Reduce maximum speed by $\frac{1}{2}$ of original maximum speed permanently.
8. One turret of gunmount OOA for \bar{N} turns (roll to determine which battery PRIMARY/SECONDARY, and roll again to determine location of turret or gunmount affected).
9. One TI mount, DC mount, or AA mount OOA for \bar{N} turns (roll to determine type of mount and roll again to determine location of mount affected).
10. Steerage OOA for \bar{N} turns - maximum turn reduced to half of normal per game turn. No EM possible.
11. Steerage jammed for \bar{N} turns - ship must continue on same course as this game turn and reduce speed to no more than 16 knots. No EM possible.
12. Searchlight destroyed (roll to determine location of destroyed light).
13. Signal bridge OOA for \bar{N} turns - no visual communications with other ships in company.
14. Radio room OOA for \bar{N} turns - no radio communications possible.
15. Funnel damage - when firing guns abaft of forward-most funnel without radar assist, reduce the total from CHART H by 4 for each gun. Reduce speed by 4 knots permanently.
16. Aircraft stowage hit - multiply DP caused by this hit by 2 and add this to total. Automatic SF of severity 10. Catapult and all aircraft aboard destroyed. If ship not carrying catapult, use CD #9.
17. Aux. Steering destroyed - if ship affected by CD #10 or #11 during battle then it has no steerage and must reduce speed to no more than 10 knots and retreat from action. Maximum turning capability is then $\frac{1}{4}$ that of the normal capability of the ship per game turn. Until affected by 10 or 11, this has no effect.
18. Ammo hoist in one turret or gunmount OOA for \bar{N} turns - reduce MAXIMUM ROF by 50% in the affected turret (roll to determine which battery PRIMARY/SECONDARY and roll again to determine location of mount).
19. Handling room OOA for \bar{N} turns - reduce MAXIMUM ROF by 50% for all mounts serviced by this magazine (roll to determine which battery PRIMARY/SECONDARY and roll again to determine location of affected magazine FORWARD/CENTER/AFT or PORT/STARBOARD).
20. One turret or gunmount destroyed (roll to determine which battery PRIMARY/SECONDARY and roll again to determine location of mount destroyed).
21. Service to 25% of AA battery OOA for \bar{N} turns - reduce AA Factor by 25% for affected battery. If ship has no AA battery, then use CD #15.



4. CRITICAL DAMAGE EFFECTS

22. Service to 10% of AA battery OOA for \bar{N} turns - reduce AA Factor by 10% in affected battery. If ship has no AA battery, then use CD #12.
23. Fuel bunker hit - double fuel consumption (half the remaining cruising radius) during search. If oil fuel, ship will leave trail each remaining game turn which will be visible for 24 hours. Automatic shipboard fire, severity 8 for both coal and oil fuel ships.
24. Sonar/Asdic destroyed - no underwater detection capabilities. If ship has no Sonar or Asdic, then use CD #14.
25. Sonar/Asdic OOA for \bar{N} turns - as CD #24.
26. Fire control radar OOA for \bar{N} turns (roll to determine which battery PRIMARY/SECONDARY/AA). If no radar, then use CD #28.
27. Fire control radar destroyed - as #26 except permanent. If no radar, then use CD #29.
28. Fire control director OOA for \bar{N} turns (roll to determine which battery PRIMARY/SECONDARY/AA is affected and roll again to determine location of guns being serviced by director). No DCT bonus for all guns serviced by director for duration of CD. If no DCT, then reduce total from CHART H by 6.
29. Fire control director destroyed - as #28 except permanent.
30. Surface search radar OOA for \bar{N} turns - use visual sighting during search. If no radar, then reduce visual sighting range by 20% during search.
31. Surface search radar destroyed - as #30 except permanent.
32. Air search radar OOA for \bar{N} turns - use visual detection on CHART M1. If no radar, then reduce visual sighting range by 20% during search.
33. Air search radar destroyed - as #32 except permanent.
34. Rangefinder destroyed - if using visual fire control, reduce total from CHART H by 6 for battery being serviced by this RF.
35. Barbette of one mount jammed for \bar{N} turns - cannot traverse or fire (determine location as in CD #18).
36. Powerplant OOA for \bar{N} turns - all radar out, no radio communications, reduce ROF by 50% for all batteries and reduce AA (if any) by 25% for duration of effect.
37. Bridge hit - ship must continue on same course at same speed as this game turn for the next 4 game turns.
38. Structural damage - double the DP caused by this hit.
39. Severe structural damage - triple DP caused by this hit.
40. Prop/shaft damage - reduce maximum speed by 10 knots permanently.



4. CRITICAL DAMAGE EFFECTS

41. Damage control party trapped for \bar{N} turns - no damage control reduction available during turns of effect. If ship currently under the effects of a shipboard fire, then add 25 to die roll when determining fire damage control.
42. Excessive flooding - ships over 75% damaged capsize. Ships with 75% damage or under must reduce speed by 10 knots and may not commence evasive maneuver. If affected by this CD again, ship capsizes regardless of current damage.
43. Avgas storage hit - multiply damage points caused by this hit by 5 and add this to total. Automatic shipboard fire severity 16. No further launch or recovery operations possible until fire is out.
44. Ready-use ammo hit - multiply damage points caused by this hit by 4 and add this to total. Reduce AA by 25% for the next \bar{N} turns. Automatic shipboard fire severity 10.
45. Hangar fire - roll dice to determine percentage of aircraft remaining aboard destroyed by fire. Automatic shipboard fire severity 8. No further launch or recovery operations possible until fire is out.
46. Elevator OOA for \bar{N} turns - reduce launch and recovery operations by 50% for duration of effect.
47. Elevator destroyed - as above except permanent.
48. Launch control OOA for \bar{N} turns - no launch or recovery operation for duration of effect.
49. Excess flooding causes severe list - as above except permanent.
50. Severe flooding - ships moving faster than 18 knots multiply damage caused by this hit by 4 and add to total. Ships moving 18 knots or slower multiply damage caused by this hit by 2 and add to total.
51. Flooding in compartments - sub must surface during any of next 3 turns.
52. Hull crushed - sub is destroyed.
53. Conning tower hit - no further offensive operations possible
54. Damage to bow TT - 50% of bow TT OOA permanently.
55. Severe damage to bow TT - all bow TT OOA permanently.
56. Damage to stern TT - as CD #54 except for stern TT.
57. Sea water in battery compartments - sub must surface next turn (regardless of depth). No offensive operations possible for next 4 turns on surface. No submerged operations for next 30 turns.
58. Diving planes jammed - sub must dive 100 feet per turn for the next 4 turns.
59. Diving planes jammed - sub must surface 100 feet per turn for the next 4 turns.
60. Diving planes jammed - sub must remain at current depth for the next 2 turns.
61. Sub leaking oil - sub must reveal location (not depth) to all ships within 6,000 yards as well as all aircraft for each turn.
62. Leaks in hull - sub may dive to $\frac{1}{2}$ of its maximum depth.
63. Prop damage - sub must reduce speed to $\frac{1}{2}$ of its maximum in order to remain undetected.

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

SEEKRIEG 4



CHART

1. ARMOR TYPES & FACTORS

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]	7.5/00.0	4.6/00.0	2.7/00.0	1.6/00.0	1.0/00.0	-----	-----	-----	-----
4.0"/40 T4 [4]	7.0/00.0	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 MTB 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

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

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