

SEA WARS

ALGORITHMS FOR
NAVAL WARGAMES RULES
FOR FLEET ACTIONS IN THE AGE OF STEEL
1880 TO 1945

BY ANDREW FINCH AND ALAN BUTLER
EDITION 4.0

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GAME ALGORITHMS

1 – Ship Base Values

All ships have a number of standard values that must be created:

HIT POINTS are calculated from the standard or normal displacement on the following basis:

- 1 Hit point per 500 tons or part thereof, so 501 tons equals 2 hit points

In addition ships get an ARMOUR BONUS based on the following:

- 1 Hit Point per inch of total armour on the Belt and Deck combined (or part thereof), so a ship with 4" Belt and 1½" Deck gets 6 BONUS points.

DEFENCE VALUE (DV) is based on the same total figure above.

Note that armour is subdivided into relative grades these being Superior ('+'), Normal, and Inferior ('-'). Once again fractions are rounded up to the next higher number:

GRADE	Superior ('+')	Normal	Inferior ('-')
A	25" or more	23", 24"	21", 22"
B	19", 20"	17", 18"	15", 16"
C	14"	13"	12"
D	11"	10"	9"
E	8"	7"	6"
F	5"	4"	3"
G	2"	1"	less than 1"
H	Unarmoured		

Unarmoured vessels obviously have no grades.

SPEED is calculated on the basis of 1 knot speed giving 500 yards of movement.

2 – Gunnery Basics

Arcs of Fire

Every gun fires into an arc of fire and this calculation provides the basis of the effective number of guns that are used in a game turn, which in turn provides the SV. In the case of Secondary and Tertiary batteries these will be able to use ½ their calculated SV to fire at a target on each side of the ship, assuming that they are predominantly side mounted batteries. In some cases the secondary battery is a centreline outfit, in which case it can fire the whole value but only at a single target.

- CENTRELINE TURRETS provide coverage over 270°, unless it is located MIDSHIPS, in which case the coverage is 180°.
- WING TURRETS with no obstructions on the side of the hull that will restrict the arc of fire have coverage of 135°. No note is taken of whether this gun may be able also to fire across the deck to the other side of the ship.
- QUARTER TURRETS are those mounted to cover each quarter of the hull. They usually have restrictive superstructure forward or astern, and have coverage of 90°.
- CASEMATES typical of early warships have coverage of 45°.

The cumulative totals of the guns and their coverage in the mounts concerned is used to derive the base number of guns used to calculate the SV.

SMS Seydlitz has 10 x 11.1" guns arranged two at the bow, two on each beam, and four astern. The coverage is $6 \times 270^\circ + 4 \times 135^\circ = 2160^\circ / 360^\circ = 6$ guns.

USS Iowa has 10 x 5" guns on each side of the ship. $20 \times 135^\circ = 2700^\circ / 360^\circ = 7.5$ guns.

USS Baltimore is not quite so easy. It has 12 x 5" guns, arranged 4 on each side, plus 2 at the front and stern. However, the bow secondary is not a superfiring gun (the stern one is). $8 \times 135^\circ + 2 \times 270^\circ + 2 \times 180^\circ = 1980^\circ / 360^\circ = 5.5$ guns.

IJNS Oyodo has 4 x 3.9" guns on each side. Although it has a large hangar on the rear of the ship it is still treated as being able to fire its 3.9" guns in Wing Turret arcs. $4 \times 135^\circ = 540^\circ / 360^\circ = 1.5$ guns.

HMS Nelson has 12 x 6" guns, 6 to each side. $12 \times 135^\circ = 1620^\circ / 360^\circ = 4.5$ guns.

Dunkerque has 16 x 5.1" (3 x 4 and 2 x 2) guns, mounted with a twin and a quad on either side and one quad in a centreline mount at the stern. $12 \times 135^\circ + 4 \times 270^\circ = 2700^\circ / 360^\circ = 7.5$ guns.

Richelieu has three triple turrets at the stern, again one on each side and one centreline. $6 \times 135^\circ + 3 \times 270^\circ = 1620^\circ / 360^\circ = 4.5$ guns.

IJNS Tone has 8 x 8" guns in twin turrets, all forward. Two of these are centreline turrets and two are treated as midships turrets. $4 \times 270^\circ + 4 \times 180^\circ = 1800^\circ / 360^\circ = 5$ guns.

3 – SV values of Guns

The SV for the battery being calculated is based on the following:

- Square Root (Effective number of guns covering 360° x the game rate of fire per minute of the gun x shell weight) x 0.1)
- This value is rounded to the nearest whole number.

4 – SV values for Bombs, Rockets, Missiles and Torpedoes

The SV value of these weapons is calculated using the following formula:

- Square Root (Bomb Weight lbs or Rocket, Missile or Torpedo Warhead Weight in lbs) ÷ 4

This number is rounded to the nearest whole number. Torpedo values have already been calculated and can be found in the Torpedo section of the rules.

When calculating the SV for an aircraft type, you take the total payload of the individual aircraft, then perform the calculation, so an aircraft with 1 x 1500 lb and 2 x 250 lb bombs counts as having 2000 lb payload giving an SV of 11.

Certain Special Weapons have the following values:

Great Britain

- 1942: RP3 had a Semi-AP warhead of 25 lb. or an HE warhead of 60 lb.

United States

- 1942: 4.5" M8 (1943) rockets with a warhead of 5 lb.
- 1943: 3.5" FFAR with an AP warhead of 20 lb. or (1944) an HE warhead of 50 lb.
- 1944: 5" HVAR rockets (Holy Moses) rockets were used with a 7.2 lb.
- 1945: Tiny Tim 11.75" rockets were used with a weight of 582 kg (1280 lb) and a warhead of 68 kg (150 lb).
- 1945: ASM-N 1 "Bat" had the effect of a 1000 lb bomb.

Germany

- 1943: FX 1400 "Fritz X" Guided Bomb had a weight of 1400kg (3080 lb) and a warhead of 600 lb.
- 1943: Henschel 293 Guided Missile had a weight of 2300 lb and a warhead of 1100 lb.

5 – Barrage Weapons (AA and Quick Firers)

Barrage weapons are designated as all guns of less than 5.5" calibre.

For the purpose of these rules it is assumed that the Barrage factor is distributed to fire all round the ship. The factor is calculated as follows:

- Total the calibre of all DP/Small/AA guns in millimetres, take the square root of this, and divide the result by 6. This is the Barrage Value.

These figures are rounded to the nearest whole number once after calculation.

NOTES:

The Japanese used a 12 cm. multi-barrel rocket launcher late in the war, with up to 30 rockets. Each such mount is calculated as a 120 mm. gun (once per mount, not once per barrel).

The Yamato and most major Japanese Warships were also equipped with Type 3 sanshiki-dan AA shells for their main armament which fired 20 mm. incendiary ammunition in a huge airburst scatter covering several thousand square yards. This was used during her final sortie though with little effect other than attracting the US planes searching for her. If using this weapon, add HALF the SV of the main guns to the AA value. Once they have been used for AA work, they may not be used for normal gunnery.

The British used a 20-barrel unguided rocket launcher from 1940 to 1942 which had a 17 cm. rocket for Parachute and Cable devices. Each such mount is calculated as a 170 mm. gun (once per mount, not once per barrel).

6 – Torpedoes

The attack number for ship-borne torpedoes reflects the chances of scoring a number of hits when firing a salvo of torpedoes from a mount at a given target. It assumes a basic hit chance for ships taken from a combination of study of historical statistics and a "feel right" factor as well. This was further modified by the historical chances of the torpedoes being duds, which was about 20%. German and American World War 2 torpedoes suffered from worse chances being dud, the Germans due to the earth's magnetic field influencing the magnetic triggers, and the American due to an inherent fault in the trigger. A further aspect that is included is a comparison between the torpedo speed at "fast setting" and an average datum speed for the period concerned. This increases slightly the hit probability of faster torpedoes.

These various figures were all calculated separately in the previous editions of Sea Wars, and resulted in a series of tables which were used when creating the game data. These tables have been further refined and compared, which has resulted in the fairly simple calculation used in Sea Wars II.

Torpedo Firing Arcs

One factor that has been eliminated from Sea Wars II is the use of fixed Torpedo Tubes. Historically it was very rare for these to be used effectively. Rotating mounts as used on destroyers, most light cruisers and some larger warships are used, and the effective number of mounts is calculated in a similar manner to the effective number of guns, though using slightly different areas of coverage.

- CENTRELINE MOUNTS provide coverage over 360°.
- SIDED MOUNTS mounted on either side of the vessel (usually cruiser types, though there are some destroyers with this fit) have coverage of 180°.

Multiply the number of tubes in each mount by the arc angle covered and total these. Divide the result by 360°. This figure gives the effective number of tubes that can bear on any target in a turn.

- This figure divided by the average number of tubes in a mount tells you how many attacks can be made in a turn (= the number of mounts available to fire).
- The average number of tubes in a mount rounded to the nearest whole number is used to determine the basic attack factor (= number of tubes firing per mount).
- The number of salvos available to use in the game is one per actual mount on the ship, plus 1 per set of reloads available. (See technical references. When in doubt, assume no reloads).

A ship with centreline mounts is obviously easiest. 8 centreline tubes in quad mounts x 360° divided by 360° (=8) then divided by the average number of tubes (4) will give the original number of mounts (2), each firing with 4 tubes.

A French destroyer with one triple centreline mount and two sided twin mounts has a total of 1800° divided by 360° = 5, divided by (7/3) 2.33 gives 2.14 mounts which rounds to 2 possible attacks. Each is treated for attack purposes as having two tubes (2.33 rounded to 2).

Another ship (you can tell it is French) with two sided twin and two sided triple mounts also has a total of 1800° divided by 360° = 5, divided by (10/4) 2.5 gives exactly 2 possible attacks. Each is treated as having 3 tubes (2.5 rounded up). This is slightly better.

7 – Aircraft

As explained under the aircraft rules, all squadrons in the game are made up of flights of planes following tactical doctrine. This gives flights of aircraft a basic value in terms of hit points, which are combined to provide squadrons with durability if large numbers are combined, or provide larger numbers of attacks by making squadrons up of fewer flights (as few as 1 flight in fact).

Aircraft Speed

These are established by taking the published maximum speed in mph, dividing by 6, then rounding to the nearest whole number. This number is then the number of 1,000 yard movement units on the table. Using these numbers gives a very close approximation to the mission time for a typical carrier air strike.

Air Firepower

This is calculated similarly to the barrage values for ships. Total the calibre in mm. of all the guns on one aircraft x number of aircraft in the flight.

Then take the square root, and finally divide by 3 (by 6 for non-Fighter types), rounding to the nearest whole number at the end.

12.8 – Points values

Ship Points values

These are calculated by multiplying the Ship's Hit Points by the Speed in knots, then dividing by 5.

Add to this number:

- The Barrage Weapon factor.
- The aircraft capacity x 2 on Carriers only.
- If the Ship carries spotter planes add 25% of its Hit Points.
- If the ship is carrying radar, the cost is 10% of the ship's Hit Points per Grade of Radar.
- For each gun battery, the SV x Range in 000s yards divided by 10.
- For the torpedoes, the SV x Range in 000s yards divided by 10 x Tubes per attack (= approx. the to hit roll) x number of Salvos carried.

Aircraft Points values

These are calculated by multiplying the Flight's Hit Points by the Speed in SPEED UNITS ('000s of yards), then dividing by 2.5.

Add to this number:

- The Firepower factor.
- For Bombs and Rockets, the SV x the base To Hit Chance for that aircraft type (= the to hit roll / 10).
- For Guided Missiles, the SV x the base To Hit Chance x the number of Salvos carried.
- For Torpedoes, the SV x the base To Hit Chance (remembering that some aircraft carry 2 torpedoes which increases the hit chance).