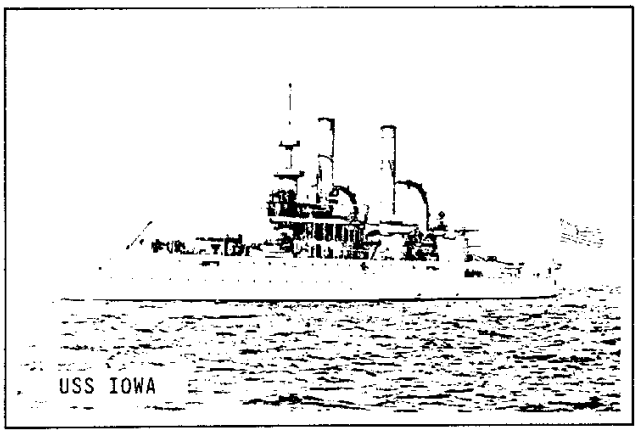


There are three different classes of CD; CLASS A (Any BB, CB, CA, CL, DD, etc.), CLASS B (Any Aircraft Carrier), and CLASS C (Any Submarine). If the roll to determine the probability of CD on CHART G2 was successful, then the dice are rolled again and the result is compared with the appropriate table on CHART N (N1 for CLASS A, N2 for CLASS B, and N3 for CLASS C). The location of the hit must also be used when determining the extent of the CD on CHART N1 and N2. Thus, if the shell causing the CD had hit the Turret (T) of the ship and the dice roll on CHART N1 was 33, then the CD Number would be 18 (from the far right column of N1). This number is then compared with the matching number on CHARTS N4 which reveal the actual extent of the Critical Damage (in the above case, the air search radar was destroyed).

Some of the CD Effects listed on CHARTS N4 use a Ñ symbol which means that a dice roll must be made in order to determine the length of time or duration of the effect. CHART N5 lists the results of the dice rolls in terms of duration. Thus, a roll of 24 would mean that the CD as explained on CHARTS N4 would be in effect for a total of six minutes (3 game turns). In cases where no Ñ symbol appears, the damage is considered permanent for the remainder of the game.



The effects of Critical Damage are cumulative which means that a ship may receive the same CD more than once during a game turn (including permanent CD). Thus, a ship that has its aft main battery firing at ½ its normal rate due to a previous CD would have to reduce its rate of fire to ¼ (½ of ½) if it received that same CD again while still under the effect of the previous CD.

As with regular damage, all CD takes effect at the end of the game turn during which it was inflicted. All damage caused by CD is in addition to regular damage and loss of guns and speed due to CD is in addition to loss of speed and guns from regular damage.

Duds and Pass-throughs do not cause any CD.

SHIPBOARD FIRES

One very common aspect of the damage caused by shell hits was their chance of causing a fire aboard the ship. Any shell hit capable of causing Critical Damage is also capable of causing a shipboard fire. For this reason, when rolling to determine the probability of CD on CHART G2, a roll of doubles on the percentile dice (i.e. 11, 22, 33, etc.) indicates that a shipboard fire has started (regardless of whether or not there is CD). The severity of the fire is expressed in DP and is the total of the numbers rolled when added together. Thus, a roll of 77 would indicate the presence of a shipboard fire, the severity of which is 14 DP (7+7 = 14). This amount of DP is added to the total DP already inflicted on the ship at the end of the turn in which it was caused [the roll would also indicate that no CD had been scored--see CRITICAL DAMAGE on Page 13].

The severity of the fire will be added to the ships damage in DP at the end of each turn. Thus, a fire of severity 14 DP will cause 14 DP to be added to a ship's damage at the end of each game turn. However, it is likely that the ship's damage control will have a chance of putting out the fire or at least reducing its severity. At the end of the game turn after the fire had started, the percentile dice are rolled once for each fire aboard a ship and the result compared with CHART G4. The result can range from 4 being subtracted from the severity of the fire to the fire going out of control (OOC) and forcing the crew to abandon ship. This same procedure is followed each turn until the fire is put out (or goes OOC). Thus, in the above case, the fire would cause 14 DP at the end of the turn in which the fire started, only 10 DP at the end of the following turn (if the commander rolled from 01 to 20 for the fire fighting party of the Damage Control). All DP caused by shipboard fires is in addition to damage caused by regular or Critical Damage.

Additional shipboard fires may be caused as the result of Critical Damage effects if listed on CHARTS N4.

FIRE CONTROL SYSTEMS

In order to be completely accurate, each ship's fire control system should be considered separately and rated based on the individual merits of the system. However, this is beyond the original scope of these rules so only some generalizations will be included.

Prior to the turn of the century (and a few years after) many ships relied entirely on straight visual sighting of shell splashes. Of course, the higher the location of the spotter, the more accurate would be the ranging. If the higher position was destroyed, ranging would have to be accomplished from a lower spot or the gunmount itself. Ranging in both cases was, at best, poor (even in consideration of the comparatively short maximum ranges of the guns).

Circa 1895, optical rangefinders were installed aboard warships and this proved greatly superior to the straight visual system. Optical rangefinders were improved over the years (better optics and increased base lengths allowing more accurate ranging) and remained the standard installation for all warships built through 1945. However, during the First World War, the Director Control Tower (DCT) system was introduced. Basically, a DCT was an enclosed rangefinder with gunnery fire control calculators to solve ballistics problems for each battery. This provided a more accurate and better controlled means for ranging than the plain rangefinder (RF) which still remained the only means of fire control aboard some warships of this period.

Over the years improvements were made on the optics and the DCT system so that by World War Two, an extremely accurate and efficient system had been developed, some of which used the newly developed electronics called radar. Thus, a typical battleship of that period had two main battery DCTs (one for each battery - fore and aft), two or four secondary battery DCTs (one for port and one for starboard or one for starboard forward and one for starboard aft and a like installation on the port side) and a like number of DCTs or directors for the DP and smaller AA batteries.

Radar was probably the single most important development for assistance in fire control made during the 1890 to 1945 period. However, although most countries had radar in the form of search or warning models, only the United States, Great Britain, and Germany used radar as a form of fire control during the Second World War. In most cases, the radar set was mounted atop the DCT and improvements to radar during the course of the war allowed the United States and Great Britain a fire control system unmatched by any other powers. Should the DCTs be destroyed, of course, the ship would be forced to use the rangefinders located in the individual turrets (local RF).

Perhaps the single exception to all this is the Japanese Type 98 Firing Device which was installed on all Japanese Battleships and Cruisers during the Second World War. Although the device actually had nothing to do with gunnery ranging and calculations, it affected the firing circuits so that the salvoes fell in a much tighter pattern than would normally be expected. Optionally, when using CHARTS H for computing hit probability for a Japanese warship of this period, a +11 bonus may be given (if using CHART H2) or a +20 may be given (if using CHART H3).

A complete listing of the major types of radar in use by all countries can be found on CHARTS P.

EVASIVE MANEUVER

Any ship capable of moving faster than 13 knots can commence Evasive Maneuver (EM). In order to be considered in EM, the commander of the ship must announce that the ship is commencing EM at the beginning of the game turn before any movement takes place. Ships in EM move ahead at the rate of 75% of the normal movement(in inches)for their current speed. Thus, a ship moving at 28 knots that goes into EM may move ahead at only 2.6" (0.75 x 3.5" = 2.6") instead of the full 3.5" allowed for 28 knots speed. Ships that are not capable of at least 13 knots cannot commence EM due to the fact that their speed is too slow to allow the maneuverability needed to be considered in EM.

SMOKE SCREENS

Any ship is capable of laying a screen of funnel smoke, however, only ships fitted with screen project-

ors (such as Destroyers and some cruisers) can lay a screen of chemical smoke. Chemical screens, of course, are much more dense and provide better protection for those ships behind the screen. For game purposes, a ship at least 50% concealed (half of its length) by a screen is considered behind the screen.

To lay a screen, a marker (such as a penny or tack) is placed behind the model of the ship that is to lay the screen before ship movement takes place for that game turn. Another marker is placed behind the ship at the end of each movement for as long as the ship is laying the screen. These markers represent the extent of the smoke screen and when this screen lies in the line of sight, the reductions on CHARTS H are used. All ships may fire through the screen but have their fire reduced by the factors listed on CHARTS H under SMOKE SCREENS. Even ships with radar assisted fire control must reduce their running total by the factors listed.

NOTE: Due to the fact that radar assisted fire control was much more effective if the target was also in visual contact, all reductions found on CHARTS H for SMOKE SCREENS, BEARING FROM TARGET, SEA STATE, VISIBILITY, etc. must be deducted from the running total even when using radar assisted fire control.

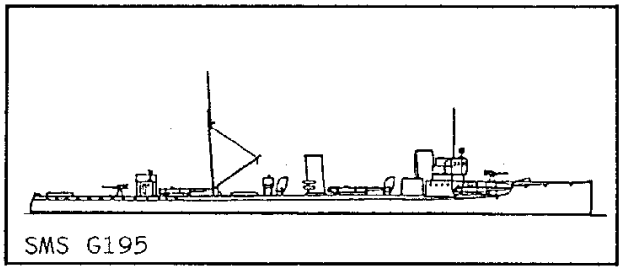
Smoke shells may be fired by any ship in lieu of regular shells (APC, SAP, etc.) fired during a game turn for a particular battery. The total screen area provided by smoke shells fired during a game turn is an area 2,000 yards by 2,000 yards (4" by 4") and their effect is the same as chemical smoke.

The duration any marker for a screen may remain on the playing area is 10 minutes (5 game turns). Optionally, screens may drift in the direction of the wind at a rate equal to $\frac{1}{2}$ the speed of the wind in knots. Thus, an 8 knot wind from the West will cause a screen to drift 4 knots ($\frac{1}{2}$") to the East each game turn. All screens are considered ineffective when the wind speed reaches 20 knots or more.

OVERS AND UNDERS

Optionally, the chance that the shells intended for one target ship may also hit another ship close-by may be considered. When using the Basic or Advanced Methods of Hit Determination, any ship within $1\frac{1}{2}$" of the target ship risks being hit by overs or unders (or rights or lefts!). This is determined by multiplying the final resulting hit probability from the top of CHART I1 by .25 (or 25%) and rolling for the number of shells that did not hit the target ship. Thus, if the target ship has been hit by two shells out of a total of 10 shells falling around her, then any ship within $1\frac{1}{2}$" of her may be hit by some of the remaining eight shells. If the hit probability as determined from CHARTS H was 44, then any of those ships would roll on the 11-20 column on CHART I1 (.25 x 44 = 11) using 8 as the number of shells. In this case, the $1\frac{1}{2}$" is measured from the closest portion of the actual target to the closest portion of the surrounding ships.

This same method may be used for the Range Estimation Method.[OPTION 2]Only parts of ships that actually intersect the range at which shells are falling should be considered. Hit determination should be calculated in the same manner as if that ship had been the intended target, however, reduce the number of actual hits scored by $\frac{1}{2}$.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MORALE

Optionally, crew morale may be considered. When the damage inflicted on a ship reaches 65% of the total original DP (the percentage being calculated by dividing the total amount of DP sustained by the total DP listed for the ship in the SHIP DATA SHEETS), then there is a 5% chance that the crew will abandon ship (without orders, that is). CHART U2 shows the different probabilities according to the amount of damage the ship has sustained. Morale is checked only once each time the percentages on CHART U2 have been reached. The 100% morale check is just for grins (to see if your ship's crew will go down fighting). Of course, when the crew abandons ship, all fire and movement ceases for the following turn (and all remaining turns!).

TORPEDOES [SURFACE SHIPS]

Surface ships that have torpedo tubes may fire any or all of these during a game turn. The commander of the firing ship must note the number of torpedoes fired (only one per tube) and the intended target immediately after ship movement has taken place and before any gunfire combat is resolved.

Fixed or submerged torpedo tubes (denoted by * in the SHIP DATA SHEETS) are not trainable and must be fired while the target ship is within a 30° arc (15° on either side of the mount) of the tube mounting. Most fixed mounts were located at the bow, stern, or on either side (some ships had tubes in all four locations). Trainable, or deck mounted tubes may be fired when the target is with a 45° arc forward of the mount position (45° from the perpendicular) or up to 15° aft of the mount position (15° behind the perpendicular.

Information on the various torpedo models used by the major powers is shown on CHARTS S1 and S2. The designation, year introduced, propulsion (Compressed Air types or Electric types), damage class (either A, B, C, D, E, or F), high speed run (yards/knots) and maximum range run (yards/knots), and notes regarding its its use may be found for most models listed.

A torpedo may not reach its intended target during the first turn of its run. For this reason, the time of arrival (expresses as game turns) must be figured based upon the distance to the target and the speed of the torpedo. Thus, a torpedo traveling at 30 knots may not reach a target ship that is 5" away on the same turn in which it was fired, but it will reach the ship next turn. It is not necessary to take the speed of the target into account when figuring the arrival time of the torpedo because the limitations on firing angles have been designed to take this into account.

During the turn in which torpedoes have been fired (usually right after gunfire resolution), certain information must be recorded before any ships are moved. Length of the target ship, the angle of bearing measured FROM the center of THE TARGET SHIP, and the range between the ships must be recorded for use in the calculation listed on CHART T1. Of course, name of the target ship, its speed, and the number of torpedoes fired should also be recorded. During the turn in which the torpedoes have been calculated to arrive, the formula on CHART T1 is calculated, plugging in the appropriate information. Thus, if the firing ship bears 40° from the center of the target ship, and the length of the target ship is 525 feet, then the result of the top line of the calculation would be 19343.047 [57.3 x 525 x .643 = 19343.047]. If your calculator does not have a sine function or you do not have a complete table of sines, the sines listed (by 5° increments) on CHART T3 may be used. This result must then be divided by the range between the ships IN FEET. Thus, if the two ships in our example were 6,000 yards apart (18,000 feet), then we would divide the 19343.047 by 18,000 and get 1.0746137. The 1.0746137 must now be divided by the RELATIVE TRACKING ERROR (or RTE). The RTE is basically determined by the speed of the target ship at the time the torpedoes were fired and may be found on CHART T2. The RTE can be modified by the addition or subtraction of the factors listed on CHART T2 before plugging it into the calculation. If the target speed was 28 knots, and the commander of the ship moved to comb the spread of torpedoes (by turning toward or away from the torpedoes so that he is on a parallel course with the torpedoes), then the total RTE would be 10.5 and the result of the calculation would be .1023441 (For game purposes, this should be rounded to .10).

This result, however, is not the actual percentage probability of a hit and must be adjusted by using CHART T4 to get the actual probability. Thus, our result of .10 would actually be an 8% probability of a hit. The percentile dice can be rolled a number of times equal to the number of torpedoes fired at the target (since the percentage is the chance that each torpedo fired will hit) or CHARTS Y can be used to reduce the number of rolls as explained on Page 2 (UNDERSTANDING THE PROBABILITY SYSTEM).

It will be noted that, when firing at targets at low angles (1° to 35°), very fast targets, or at long ranges, the probability of a hit will be low. Due to the workings of the formula, no angle of bearing of less than 1° may be used.

In many cases, torpedoes proved to be more of a problem than an effective weapon (especially the U.S. pre 9-43 models!). Torpedoes frequently ran wild, too deep, or failed to explode when they hit the target. In SEEKRIEG, this is termed the DUD FACTOR and ratings of the torpedoes by country can be found on CHART T5. One of the biggest problems causing torpedoes to be duds was the type of firing mechanism with which they were fitted. Early war developments of the Magnetic Pistol (designed to detonate the torpedo when passing beneath the ship) were, for the most part, poor and not until refinements had been made were these as

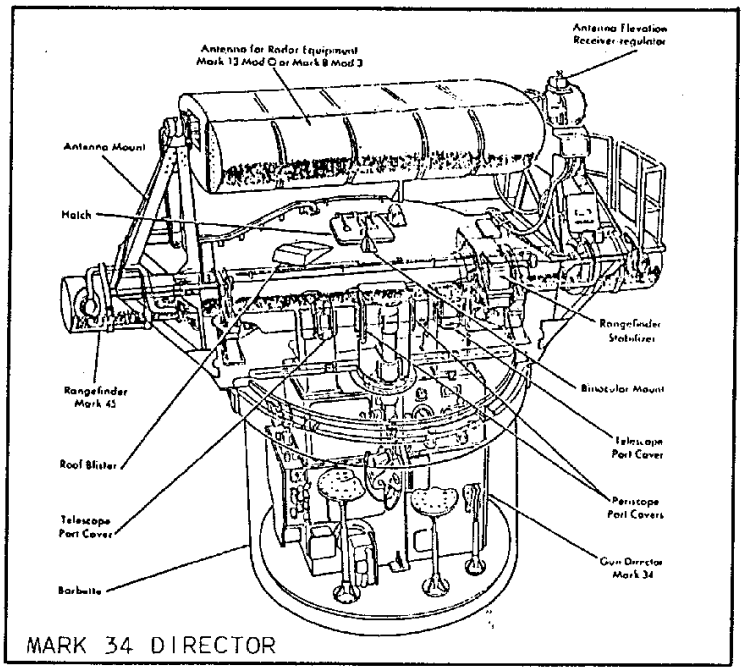
reliable as the Contact Pistol. Thus, it is important that the commander of the firing ship specify which type of pistol he wishes to use on the torpedoes before actually firing them at the target. Any torpedo that hits a target must be checked for the dud factor on CHART T5. Any torpedo that fails this roll (rolls equal to or less than the percentage listed on CHART T5) is considered a dud and will cause no damage.

However, torpedoes that are not duds will cause damage to the target ship as a factor of the amount of belt armor on the ship and the amount of explosive contained in the torpedo warhead. The amount of damage caused by a torpedo hitting a ship is called the DAMAGE EFFECTIVENESS RATING (DER) and this may be found on CHART T6. The Torpedo Class is a rating given to each torpedo on CHARTS S based upon the amount and type of explosive contained in the warhead. Thus, the DER for a Class C torpedo hitting a ship with 6.1" of sidebelt armor would be 193 DP. Of course, the amount of belt armor should be adjusted by the Armor Type (see CHART Q1) before using CHART T6.

Due to the fact that a torpedo could hit a wide variety of places along the side of a ship (such as on the thickest part of the sidebelt, on a thinner portion of the sidebelt, or even underneath where there is little or no armor at all!), the DER must be modified according to the type of pistol installed on the particular torpedo. CHART T7 shows the various modifiers according to the types of pistols and the roll of the percentile dice. Using the above example, the torpedo fitted with a contact pistol would cause 116 DP to the target ship if 42 was rolled on the percentile dice. That same torpedo, if fitted with a magnetic pistol would cause 193 DP to the ship if the same number were rolled (193 x 0.6 = 116 for the contact pistol and 193 x 1.0 = 193 for the magnetic pistol). Torpedoes fitted with magnetic pistols will, as a general rule, cause greater damage per hit than one fitted with a contact pistol due to the fact that the magnetic pistol was designed to explode beneath a ship's hull (where the armor was weakest).

Critical Damage is determined in the same manner as explained on Page 14 except that the location is always considered to be the sidebelt. Every torpedo hit has a 100% probability of causing CD (as long as it is not a dud, of course).

Any ship that crosses the track of the torpedoes (either before or after they have reached the actual target ship) risk being hit by the torpedoes. Ships crossing the track before they reach the target have a probability of being hit equal to ½ the calculated probability for the actual target ship. Thus, a ship crossing the track before the torpedoes reach the target risks an 11% chance of being hit if the probability calculated for the actual target ship was 22%. A ship crossing the tracks after the torpedoes have hit the target (assuming the torpedoes have not run to their full range) has a probability of being hit equal to ¼ that of the probability calculated for the actual target. However, if six torpedoes were fired and one of them hit a ship before reaching the actual target, then only 5 would be calculated for the actual target. The same holds true for any ships crossing the track after the target ship had been hit. This same method may be used to determine hits on ships in convoy.

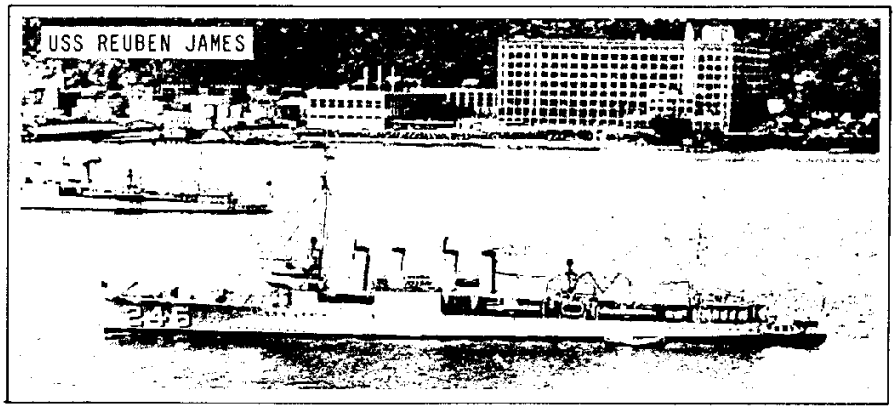


MARK 34 DIRECTOR

Torpedoes may be reloaded at the rate of one tube (NOT the entire mount) per 4 minutes (2 game turns). Like gunfire damage, DP caused by torpedoes will take effect at the end of the game turn and ships that are considered sunk due to torpedo damage do not "sink" until the end of the game turn.

LOSS OF RADAR

Radar was an extremely delicate piece of electronics and when subjected to the severe shocks that accompany battle damage or rough seas could easily malfunction (or just plain cease to function). CHART U4 shows the probability of loss of radar (either search or fire control) due to damage sustained. Thus, a ship that has received DP equal to 30% of the total DP as listed in the SHIP DATA SHEETS, will have a 50% chance that it will lose its search or fire control radar (or both). Each time a ship's damage reaches one of the percentages listed on CHART U4, a roll of the percentile dice must be made.



For loss of radar due to weather conditions, use CHART B3 and the percentages listed for EFFECT ON SHIPBOARD OPERATIONS. Rolls of the percentile dice must be made for each 2-hour period. Thus, a 200 DP ship during Force 9 weather will lose radar capabilities on a roll of 01 to 15.

RAMMING

Ramming, as a naval tactic, was on its way out by the end of the 19th Century. Its occasional use during both World Wars was primarily in cases of desperation or completely accidental rather than intentional. However, to compute the amount of damage done by intentional or accidental rams, the following calculations may be used:

1. Compute Momentum Factor (MF):

$$\frac{\text{DP OF TARGET SHIP}}{\text{DP OF TARGET SHIP + DP OF RAMMING SHIP}} = \text{MF}$$

2. Compute Base Damage (BD):

$$\sqrt{\frac{\text{DP OF RAMMING SHIP} \times \text{MF}}{\text{TARGET SHIP BELT ARMOR (in inches)}}} \times \text{SPEED OF RAMMING SHIP (in knots)} = \text{BASE DAMAGE (DP) DONE TO TARGET SHIP}$$

$$\tfrac{1}{2}\sqrt{\text{DP OF RAMMING SHIP}} \times \text{MF} \times \text{SPEED OF RAMMING SHIP (in knots)} = \text{BASE DAMAGE (DP) DONE TO RAMMING SHIP}$$

3. Modify BD by sine of impact angle (impact angle being measured from target ship as on CHART F1):

$$\text{BD} \times \text{SINE OF IMPACT ANGLE} = \text{DAMAGE DONE TO SHIP (in DP)}$$

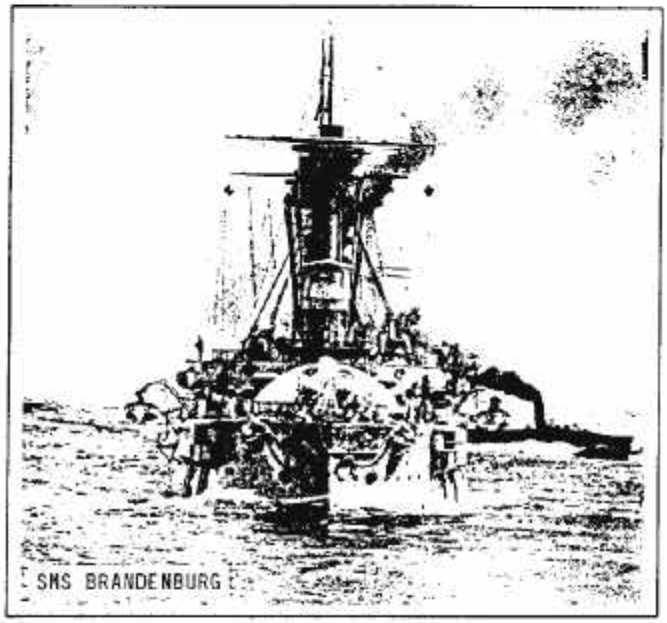
For game purposes, impact angles of less than 20° are not considered collisions and cause no damage. When using the above formulas, all ships are considered to have <u>at least</u> 1.0" of sidebelt armor.

Collisions which impact within the forward or aft 25% of the ship's length are likely to hit an area of comparatively thinner armor than would be found amidships. In these cases, the target belt armor may be considered as $\frac{1}{2}$ of that listed in the SHIP DATA SHEETS (but not less than 1.0") when using the above calculations. Belt armor thickness should also be modified by the Armor Type as listed on CHART Q1 before being used in the ramming calculations.

Ramming will also cause Critical Damage. CHART U5 shows the probability of CD being caused as a factor of the amount of damage (in percentage) caused by the ramming. Thus, if the target ship received from 26% to 50% damage [DP CAUSED divided by ORIGINAL DP = % DAMAGE], two dice rolls would be made using the side-belt as the location using CHART N1 (or N2 if the target was a CV). If 10% damage (or more) is caused on the ramming ship as a result of the ram, then one dice roll would be made to determine the effects of CD for the ramming ship.

OPTIONAL DAMAGE CONTROL

The game system as designed takes into account that average Damage Control is taking place. However, if one wishes to take into account the superior American Damage Control during the Second World War (and that of Germany during World War I), then CHARTS V may be used. Each ship is assigned Damage Control (DCO will be used for Damage Control because DC is being used for Depth-Charge) based on its total DP as listed in the SHIP DATA SHEETS (see CHART V1). This amount must be modified by the factors listed on CHART V2. Thus, a U.S. ship of 350 DP during World War Two has DCO of 28 (20 x 1.4 = 28).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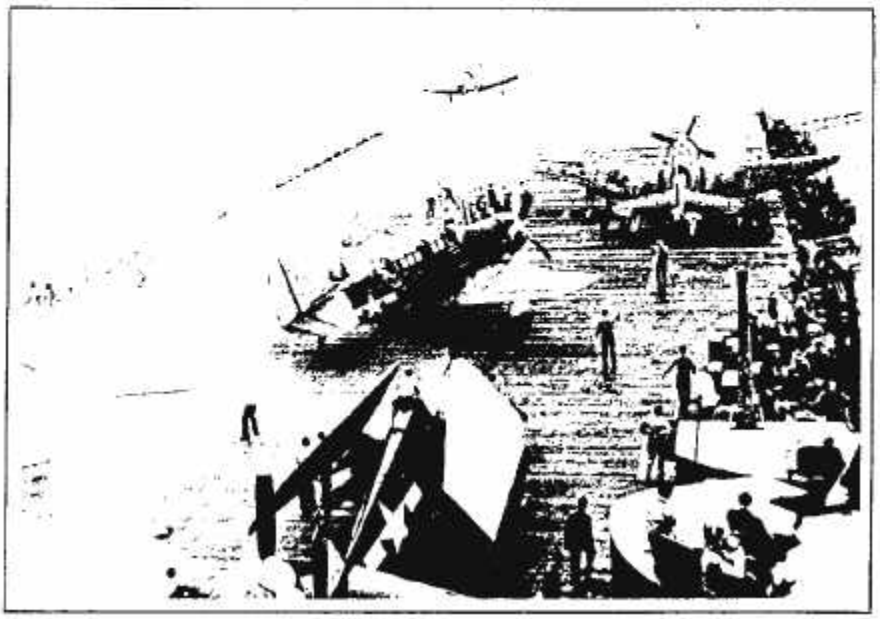
This amount is the TOTAL DCO available to the ship while at sea and once used, cannot be replaced until the ship puts into port. Up to 50% of this amount may be used during a single game turn. Thus, our U.S. ship above could deduct up to 14 DP from damage that the ship had received in battle. Note that DCO is expressed in DP and is deducted from DP the ship has received due to damage. When using DCO as explained above, it may also be used as an additional reduction to shipboard fires and applied in the same manner. This may be done in addition to any rolls made for shipboard fires.

Damage Control may be deducted only at the end of a game turn when all gunfire has been resolved and Loss Factors are being figured. Any ships that are considered sunk (reached their maximum DP in damage during that game turn) may not apply DCO and be "refloated". Likewise, a ship may not apply DCO in greater amounts than the DP that has already been sustained (i.e. a ship that has received only 9 DP may not deduct more than 9 DP in DCO even if available).

AIR OPERATIONS



In order to portray air operations with the proper degree of importance, a fair amount of detail is required in the rules simulating such operations. Almost any simpler game system can be plugged-in to SEEKRIEG in order to allow a more fast-paced air combat simulation, however, this will usually be a sacrifice to the realism intended by the rules presented herein.

Beginning on Page 63 of the SHIP DATA SHEETS can be found information for most aircraft produced by the major powers during the period covered by these rules. The majority of the listings are for naval aircraft although several of the more prominent army aircraft are listed as well. This data will be all the information you need to stage air to air and air to surface combat using SEEKRIEG.

ENVIRONMENTAL FACTORS

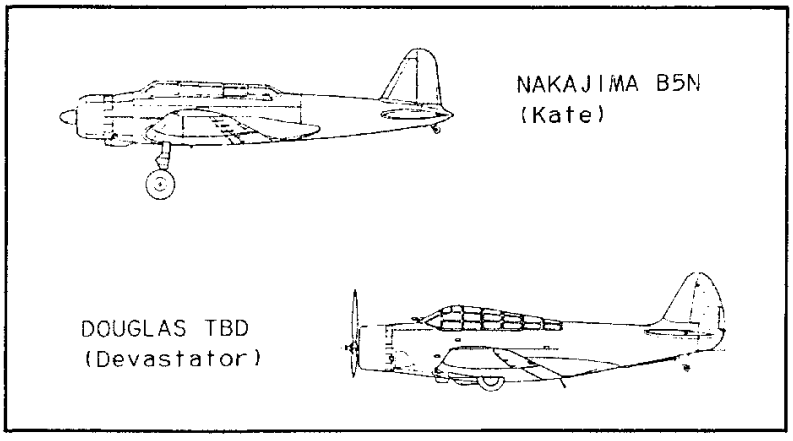
Before any air operations may take place, the environmental conditions must be taken into account. No aircraft may operate during Force 8 weather (or worse), and any aircraft accidentally "caught" in such weather risks a 60% probability of being lost. Only land based or carrier-based aircraft with radar may operate at night or during periods of visibility Code 5 or less. Carrier-based aircraft without radar that are "caught" by these conditions must use CHART L1 in order to determine the number of miles off course : (this chart will be explained later).

For game purposes, carriers may launch aircraft at the rate of 4 per game turn (2 minutes) during normal weather. Weather conditions of Force 6 will reduce this to 3 per game turn and that of Force 7 will reduce launch rate to 2 per game turn. In order to launch aircraft, the carrier must turn into the direction of the wind (or to within 10^{0} of the direction of the wind) and the total of the speed of the carrier and the velocity of the wind must equal at least 25 knots before any aircraft may be launched. Thus, a carrier moving at 20 knots into a wind of 10 knots has 30 knots of Wind Over Deck (WOD). The 25 knots of WOD is a requirement for most World War Two aircraft, especially important when flying off of short flight decks (such as the decks of escort carriers). Land bases may launch aircraft at the rate of 12 per game turn during normal weather and 8 per game turn during Force 7 weather conditions. Shipboard floatplanes may be launched at the rate of 1 per 4 game turns (8 minutes total) per available catapult during weather conditions of Force 0 thru 6 only.

PREPARING A STRIKE

Before launching a strike all aircraft must be armed and fueled. For game purposes, all carriers may arm and fuel aircraft at the rate of 2 per game turn. Rearming only may be done at the rate of 3 aircraft per game turn. Land bases may arm and fuel aircraft at the rate of 4 per game turn and rearm only at the rate of 6 per game turn. Any DP received by a carrier or base while engaged in these operations receive twice the normal damage in DP (multiply all DP received by 2). Ordnance may be selected according to the type of aircraft and its load capacity as listed in the SHIP DATA SHEETS. The number and types of aircraft aboard each carrier (or land base) should be designated before the game begins.

The number of aircraft per squadron aboard a carrier varied a great deal, but during World War Two, the typical squadron comprised 18 aircraft (of the same type). In certain circumstances, "half-squadrons" of 9 aircraft were embarked due to the limits imposed by the particular carrier's capacity. For game purposes, aircraft should operate in multiples of three or four when conducting strike operations. The original carrier complement should be decided with this in mind.



For game purposes, all aircraft are considered to be armed and fueled while on deck. Thus, a carrier may either be launching, recovering, or arming & fueling.

FLIGHT TIME

In order to make air operations easier, the flight time (or total amount of time in the air allowed for the particular aircraft) for each type of aircraft should be calculated. This is accomplished by dividing the normal range of the aircraft (in nautical miles) by the cruising speed and multiplying the result by 30 to get total flight time in game turns. Thus, a DOUGLAS TBD-1 Devastator has a total flight time of 143 game turns [535/112 = 4.777 and 4.777 x 30 = 143]. Deductions will be made from this time due to combat, navigational error, form up time, etc.

An estimated time of arrival (ETA) over the target should be calculated in game turns depending upon the distance to the target and the cruising speed of the aircraft. CHART V3 shows the approximate number of turns of flight time used in reaching a target a certain distance away at a given cruising speed. This may be calculated to a finer degree by dividing the distance to the target (in nautical miles) by the miles travelled by the aircraft per 2 minutes (listed to the immediate right of the cruising speed on CHART V3). Remember that this is only the time TO the target and that equal time will be used on the return flight. It should be noted here that since total flight time was calculated using the cruising speed, that speed must also be used when figuring time to target. Cruising speeds slower than those listed may be used at the discretion of the commander (especially when escorting attack aircraft with fighters that have a much higher cruising speed), however, faster speeds and the maximum speed should NOT be used. Thus, our TBD-1 above, if launched on Game Turn 10 would reach her target 140 miles away on Game Turn 48 (assuming everything else went as planned).

However, it will be desirable to send more than 4 aircraft in a single strike and when this is the case, some aircraft will lose flight time due to the time spent waiting for other aircraft to be launched and form up before proceeding to the target. One turn of flight time must be deducted from the total for each group of four aircraft launched after the first group if all are to form a single strike group. Thus, a strike group composed of 16 aircraft must deduct 3 turns of flight time from their total before deducting the time for the flight to the target. Our TBD-1 above, if part of that group, would not be over the target until Game Turn 51.

NAVIGATIONAL ERROR AND DROP-OUTS

There is a chance that, when unassisted by a radar equipped aircraft in the group, a strike group may not navigate perfectly to the target. There are several factors that might cause this, but two of the most important are the prevailing weather(and visibility) and the distance to the target (assuming, of course, that correct positions of the targets were given to the pilots). CHART L1 may be used to determine the number of miles a strike group of aircraft is off course (for strikes of 200 miles or less) as a function of the weather conditions. Thus, during Force 5 weather our strike group of 16 TBD-1s would be 40 miles off course (if there was no radar-equipped leader) on a dice roll of 71. This will have to be deducted from their total flight time and added to their ETA over target. Now, they will not be over the target until Game Turn 62 (since an additional 40 miles is another 11 turns) and will have to deduct 11 turns from their total flight time (their time remaining now is 91 turns[or 143 minus 52]). It is adviseable, therefore, to leave some extra flight time for the aircraft (either by reducing the cruising speed or waiting until the target gets closer). However, at this point, the mission may be aborted by the commander if he feels that his aircraft may not have enough flight time remaining to attack the target AND return safely.

It is also possible for some aircraft to be forced to drop out of the strike group and return to the base due to mechanical difficulties. CHART L2 shows the probability of drop outs as a function of the range (in nautical miles) to the target. Rolls may be made using the appropriate columns on CHART I1. Thus, for our TBD-1s, rolls of 12 and 83 (rolling twice using the 8 row since there are 16 aircraft total) would mean that 1 aircraft had to drop out and return to base--remember that our target is 140 miles away). This aircraft may be used again in a later strike since it is assumed to have been repaired by then.

Strike groups equipped with a radar-equipped leader (most U.S. and British aircraft from late 1942 on) are assumed to reach their target without any navigational error. Aircraft that are 50 miles off course are assumed to be completely lost and MUST return to base. Both navigational error and drop out should be figured for EACH STRIKE GROUP. Since the number of aircraft in a single strike group is up to the commander, this may affect any number of aircraft. For game purposes, a strike group is any number and types

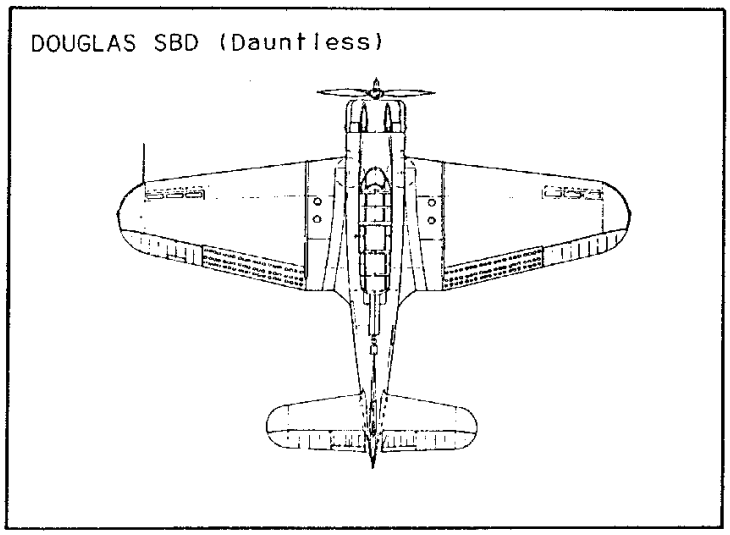
of aircraft that are proceeding to the target together (at the same speed, and same altitude level) and will arrive at the same time.

RAID DETECTION AND CAP VECTORING

One of the most important factors of naval air operations is the Combat Air Patrol (CAP). This is nothing more than a number of fighters assigned to protect a group of ships from attack by enemy aircraft. Launch of CAP is handled in the same manner described earlier. Total flight time should also be calculated but instead of a time to target, the time at which the aircraft should return (land) to base should be noted (allowing sufficient time for air to air combat). For game purposes, all CAP must operate in sections of four aircraft each and are assumed to be operating in the general area of the ship or ships it has been assigned to protect.

Each strike group is termed a "raid" and the probability that a raid will be detected depends upon several factors, the most important of which are the approach altitude of the raid, the presence of CAP above the target, and the presence of air search radar on ships of the target group. There are six general conditions as listed on CHART M1, one of which (and only one) will apply to the particular target. One of the percentile dice is rolled and compared with this chart. Thus, on a roll of 5, a ship (or ships) with air search radar and a CAP (number 6) will detect a raid when the raid is 10 game turns from reaching the ship. If, however, there was air search radar aboard the ship but no CAP above it, on the same roll the raid would only be detected 5 game turn away if the raid approached at Sea Level, and 9 game turns away if the raid was approaching at any level above Sea Level.

Only if the raid is detected can CAP groups be vectored to intercept. The major factor affecting the probability of intercept in this case is the quality of the air search radar aboard the target ships. CHART L3 shows the probability of successful CAP group vectoring as a function of the air search radar by the use of CHARTS Y. Thus, if the raid was detected by ships with 1940-42 air search radar, the base probability of CAP groups intercepting is 75% (.75). If there are 6 groups of CAP (24 aircraft total), and the dice roll was 43, then up to five of those groups may be considered to successfully have intercepted the raid on the first turn of detection. The CAP commander may not wish to vector all 5 groups to this one raid and may decide to hold some groups in reserve. If, however, on a later turn the CAP commander wishes to vector additional CAP groups, then he must roll as explained above, using the total number of CAP groups remaining as the left column number on CHARTS Y. Thus, if the commander in the situation above had decided to vector only 2 groups on the first turn, then his remaining number of CAP groups would be 4 (yes, he does have to roll again for those 3 he chose not to vector the first turn).



Successfully vectored CAP groups may attempt to engage the raid on the first turn of detection. It is not necessary to deduct flight time from the CAP aircraft for vectoring since, if successfully vectored, the group is considered to have arrived on the game turn of the CAP vector roll.

Remember that each strike group is considered a raid and must be rolled for seperately on CHART M1.

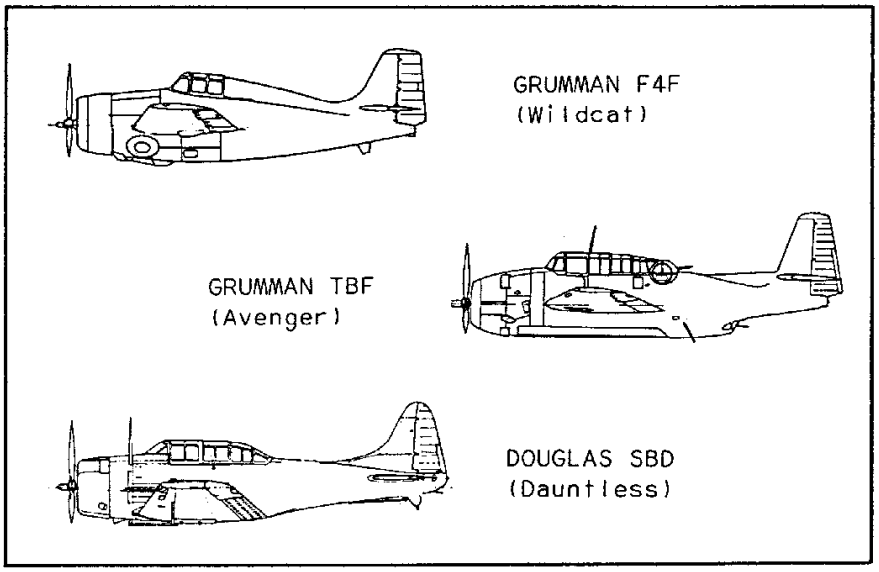
AIR TO AIR COMBAT

Each aircraft has been assigned an Attack Value and a Defense Value (see AIRCRAFT A/D FORMULA) based upon its performance and specifications. However, before any combat may take place, an "initiative roll" must be made based on the number of fighter aircraft present in each of the opposing groups. This roll will

determine which aircraft commander has the advantage and it will be his decision as to how the attacking and defending aircraft will be allocated for air to air combat. Each commander rolls the percentile dice and adds the total of the two dice (i.e. 46 being counted as 10 and 70 being counted as 17) to the number of fighter aircraft in his group. The commander with the higher total has the initiative and may decide to use his fighters to engage the enemy fighters (regardless of the number of fighters in the opposing forces, if a commander has won the initiative roll, he may keep all of the enemy fighters from his attack aircraft by allocating a number of fighters equal to at least 50% of the number of enemy fighters) or, if a CAP group, the enemy attack aircraft. Thus, if a CAP of 8 fighters intercepts a raid of 6 fighters escorting 12 attack aircraft, and the raid commander has the initiative, he may allocate only 4 of his fighters to attack the CAP fighters and the CAP commander may not attack the attack aircraft during this turn of air combat. As a general rule, any commander with the initiative may attack with a given number of fighters, an enemy group of fighters equal to twice his strength, thus preventing the enemy fighters from any other combat during that turn. If the raid commander in the above situation had only 2 fighters and still won the initiative roll (talk about lucky!), then only 4 of the enemy fighters would be prevented from attacking the attack aircraft during that turn.

The initiative roll is still made, even when one of the opposing forces has no fighter aircraft.

Initiative rolls are made at the beginning of each turn of air combat and take into account the number of fighter aircraft remaining at that time.



After the initiative roll and allocation of aircraft, actual combat may begin. This is accomplished by dividing the attack value of one of the type of aircraft that are attacking by the defense value of one of the defending aircraft. This will result in a percentage to be used on CHARTS Y. Thus, if 12 A6M-2 Zekes are attacking 8 F4F-3 Wildcats the percent probability for the Zekes is 42% (22/52 = .423). Since all air combat during a game turn is considered simultaneous, then the attack for the Wildcats must also be considered, the actual probability for which is 23% (10/44 = .227). Since the difference of two or three percent makes little difference on CHARTS Y, the increments are by 5%, and the closest percent column should be used. Results with .025 or higher and .075 or higher should be rounded to the higher column. Thus, the Zekes would roll on the 40% column and the Wildcats on the 25% column. The number of aircraft (for use on the left column on CHARTS Y) must always be the NUMBER OF AIRCRAFT COMPRISING THE SMALLEST OF THE TWO OPPOSING FORCES. Thus, in the above situation the number used will be 8 for both sides when computing the number of aircraft shot down. On a roll of 62 on the dice for the Zekes, 3 Wildcats would be shot down in that game turn. Likewise, a roll of 08 for the Wildcats would mean that 4 Zekes had been shot down. It will be noted that even though the Zekes have a better probability in this case, through the use of CHARTS Y it is still possible for an "inferior" group to do better.

Combat resolution when fighters are attacking attack aircraft is done in the same manner. Fighters can never be considered to be engaging more than twice their number in attack aircraft during any one game turn. Thus, 12 fighters may attack up to 24 attack aircraft in one game turn. The number of aircraft is still considered the number of aircraft comprising the smaller of the two forces when using CHARTS Y. However, on the initial run (first turn of attack) for fighters against attack aircraft, the fighters may increase their percentage column on CHARTS Y by 10% (two columns) when figuring the number of attack aircraft shot down. Thus, a fighter group using the .35 column may use the .45 column when attacking attack aircraft for the first time.

Of course, when different types of aircraft are in the same group, their attacks must be calculated

separately because of their different attack/defense values. Like fighters, attack aircraft are never considered to be engaging more than twice their number in opposing aircraft.

Air combat will continue until the game turn in which the attack aircraft reach the target. At that time they are considered to have broken free of any fighters and may attack their targets. Air combat may be terminated after ANY turn ONLY by aircraft with the faster maximum speed. All aircraft engaged in air combat use 3 turns of flight time for each game turn of combat. Thus our TBD-1s from Page 22 (remember them?), if engaged in air combat for two game turns would have only 85 turns of flight time remaining (91 minus 6 = 85). This is to simulate the higher fuel consumption due to high-speed maneuvering, etc. They will still be over the target on Game Turn 62, however.

Aircraft do not, of course, have an unlimited supply of ammunition. Fighters are considered to have sufficient ammunition with which to fight 6 game turns of air combat (12 minutes). Attack aircraft have sufficient ammunition with which to fight 10 game turns of air combat (20 minutes). Any aircraft that is out of ammunition may not return fire if engaged in an air combat situation.

ALTITUDES

It may be desireable to include the current operating altitude of the aircraft during each game turn. There are five basic altitude levels and these are as follows:

[S] 1. SEA LEVEL -- less than 2,000 feet
[L] 2. LOW LEVEL -- 2,000 feet to 10,000 feet
[M] 3. MEDIUM LEVEL -- 10,100 feet to 18,000 feet
[H] 4. HIGH LEVEL -- 18,100 feet to 27,000 feet
[V] 5. VERY HIGH LEVEL -- above 27,000 feet

All aircraft operating as a strike group (or raid) must be at the same LEVEL, however, they may be at different altitudes within that level. It will take some time for aircraft to change from one level to the next. All fighters may change up to 3 levels when in a dive and only one level when in a climb. These are per game turn, so that a fighter may dive from H to S in one turn and climb from M to H in one turn. All attack aircraft may dive up to 2 levels per turn and climb one level per 2 game turns. Of course, each type of aircraft has its own rate of climb and dive. If actually known, this may be used, however, for game purposes the above limitations can be used.

Thus, a CAP at H that is successfully vectored to the raid 5 game turns away from the target may not engage the raid until the raid is 4 game turns away if the raid is at S because it will take one game turn for the fighters to dive to that level. Any level changes less than the limitations above do not delay intercept and combat may take place immediately.

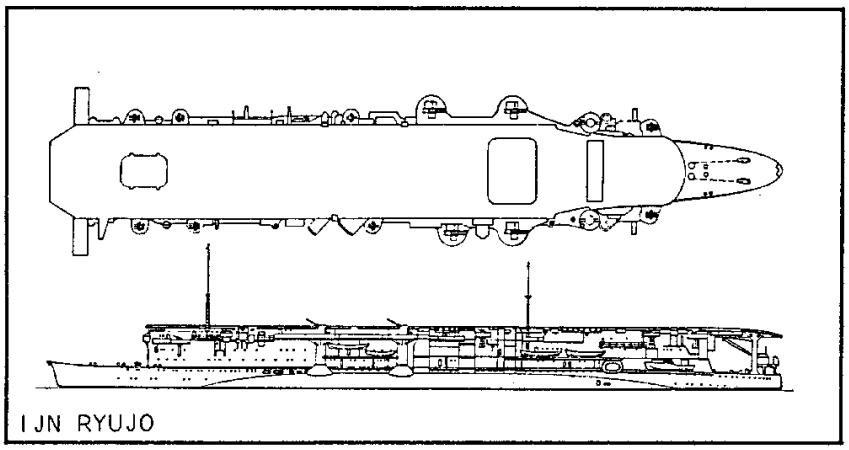
AA FIRE AND ATTACKS ON SHIPS

On the game turn during which the attack aircraft arrive at the target and resolve their attack on the ships, AA fire from the actual target and any screening AA fire from the ships around it must be resolved. Each battery of like guns aboard a ship has an AA Factor which is calculated by multiplying the number of guns in that battery by the factor for the type of gun as listed on CHARTS E. Thus, a U.S. ship with a battery of 8 5"/38 Mark 12 guns (without power ramming) has an AA Factor of 29 for that battery (8 x 3.6 = 28.8 which is rounded to 29). Of course, not all types of guns could fire effectively at the higher altitude levels so each is given a limitation in altitude levels. The 5"/38 Mark 12 could fire effectively at all 5 levels, but the U.S. 3"/50 Mark 10 could fire effectively only at the lower three levels. Thus, a ship armed with both of these weapons could only use the AA Factor for the 5"/38 guns when attacked by aircraft flying at level H or above. However, if attacked at level M or lower, the ship could use both of the AA Factors. All ships within 4,000 yards (foremast to foremast) of the actual target ship may elect to provide screening fire IN LIEU OF AA FIRE FOR THEMSELVES IF ATTACKED DURING THAT SAME TURN. Only AA Factors for guns capable of firing at level M or above may be used by the screening ships and the total resulting number is halved before adding it to the target ship's AA Factor. Thus, a ship armed with only 8 of the 5"/38 guns above would have an AA Factor of 15 to add to the target ships AA fire if it is screening for the target (29 x $\frac{1}{2}$ = 14.5 which is rounded to 15). If desired, only the number of AA guns that can be

brought to bear in the direction of the attacking aircraft can be considered, however this may prove much too time consuming.

Aircraft may attack in various ways, so the type of attack must also be considered when determining the total AA Factor. LEVEL BOMBING will expose the aircraft to AA fire from all guns capable of firing at that altitude level or above. TORPEDO BOMBING and SKIP BOMBING must be done at level S and so expose the aircraft to AA fire from all guns capable of firing at level S or above. DIVE BOMBING will expose the aircraft to AA fire from all guns capable of firing at level L or above (since most of the attack time is spent at that level while diving).

AA Factors may be adjusted according to the factors listed on CHART M3. Thus, our ship with the eight 5"/38 guns, if using VT fuse and radar and director fire control systems would have the original AA Factor of 29 increased to 60 (29 x 1.6 x 1.3 = 60.3 which is rounded to 60). This must be done for the target ship and all screening ships individually BEFORE adding the totals together.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The total AA Factors for the target ship and all screening ships are then added together and divided by the total number of aircraft making the attack that during that turn. No more than 9 aircraft are permitted to attack a single ship during one game turn. The result is then divided by the Defense Value of one of that type of aircraft multiplied by 2. This calculation may be seen on CHART M2. The result of the completed calculation should match with the percentages along the top row of CHARTS Y or be rounded until it matches one of the percentages. A roll of the percentile dice is then made using the total number of aircraft (never more than 9) for the far left column on CHARTS Y. The result is the number of attacking aircraft shot down by AA fire before releasing their ordnance (actually, this is the number of aircraft shot down during the entire attack and if desired this may be split 60/40 to show the number shot down before releasing their ordnance and after releasing their ordnance).

Aircraft not downed by AA fire may release their ordnance according to the type of attack. LEVEL BOMBERS release their ordnance at their level of attack. TORPEDO and SKIP BOMBERS release their ordnance always at Level S. DIVE BOMBERS release their ordnance always at Level S (even though they only expose themselves to AA fire at Level L). Attack aircraft must always be (and remain) at their attack level from the time they have been detected up to the time (and including the time) of their attack.

Actual hits on ships are determined by the speed of the target ship and the level at which the aircraft released their ordnance. One of two different methods may be used. In METHOD 1 (shown on CHART M4), the target ship commander and the aircraft commander each draw a number of boxes on a piece of paper equal to the number indicated by CHART M4 (i.e. an attack at level L on a ship moving at 28 knots would mean that each draw a row of six boxes). The commander of the ship may then locate his ship by placing an X in any one of the boxes (or squares). At the same time, the commander of the aircraft may place any of his aircraft(that remain after AA fire) in any of the boxes by writing the number of aircraft dropping their ordnance in a particular box. The two sheets are then compared and any aircraft releasing their ordnance in the same box in which the ship was placed have scored hits. METHOD 2 (shown on CHART M5) is simply a percent probability system, the number from CHART M5 being matched with the appropriate number on CHARTS Y (top row) and the number of attacking aircraft (after AA fire) being listed along the far left column of CHARTS Y. Thus, in the above situation, the probability would be .15 (15%) and with 4 aircraft making the attack would mean that two of them scored hits if 02 thru 11 were rolled on the percentile dice. All of the ordnance carried by the aircraft is assumed to have hit the target if successful. It should be noted that the hit probabilities resulting from either CHART M4 or M5 take into account the fact that the target ship will be attempting to avoid bombs or torpedoes as much as possible.

The amount of armor penetration for a bomb and the amount of damage it will cause are both a function of the weight. CHART M7 lists the Damage Factors and the Penetration Class for bombs according to their weight. CHART M6 shows the range column to use on CHARTS R in determining the penetration of the bomb as a function of the height at which it was released. Hit Location should be determined using the Long Range column on CHART G1. Penetration and damage can be calculated using the same systems explained on Pages 11, 12, and 13, but using CHART M8 in place of CHART G2. Critical Damage is calculated in the same manner, as are shipboard fires, however, the probability for CD is greater as noted on CHART M8. Damage caused by torpedo hits are calculated in the same manner as explained on Pages 17 and 18.

Skip bombing, even though performed at the same altitude level as torpedo bombing, was more accurate. When used, a skip bomber will have twice the probability of scoring a hit as that of any level S attack. Thus, when using CHART M4 for skip bombers, the first row should read 1, 2, 2, 3, 3, and when using CHART M5 for skip bombers, the first row should read 1.00, .70, .50, .40, .30. Skip bombers should use the Short Range column for Hit Location on CHART G1.

KAMIKAZE ATTACKS

The standard Kamikaze tactic was to operate in groups of three aircraft. Any aircraft so designated must expose themselves to AA fire from all guns capable of firing at level S or above. If not downed by AA fire, then the aircraft uses the method described for skip bombers above to determine its probability of hitting the target ship (CHART M4 or M5 may be used). In addition to damage caused by the bombs carried by the Kamikaze aircraft, the aircraft itself will do Damage Points equal to a percentage of its Defense Value. CHART V4 shows the modifiers to the aircraft Defense Value according to a roll on the percentile dice. Thus, a Kamikaze aircraft with a Defense Value of 45 would cause 68 DP to a ship if 52 were rolled. Remember that this amount is only for the aircraft itself. Any bombs carried by the aircraft will also cause damage that is calculated in the usual manner using the penetration for LOW LEVEL on CHART M6. Any Kamikaze hit on a ship (with or without bombs) will cause automatic Critical Damage (use Short Range column on CHART G1 for hit location) and a shipboard fire, the severity of which is the total rolled on two dice.

AIRCRAFT RETURN AND RECOVERY

Any aircraft that survive air combat and AA fire may return to their base. Since most World War Two carriers were equipped with homing beacons, there is no need to determine navigational error on the return flight. However, CHART L1 should be used for aircraft returning to carriers that are not equipped with homing beacons. Carriers may recover aircraft at the rate of 3 per game turn during normal conditions and 2 per turn during Force 6 weather or worse. Land bases may recover aircraft at the rate of 8 per game turn regardless of conditions. Shipboard floatplanes may be recovered at the rate of 1 per 5 game turns (per catapult) and only during Force 5 conditions or better. Ships recovering aircraft in this manner must come to a complete stop before hauling the aircraft aboard.

It should be mentioned that for each turn in the air, an aircraft will use one turn of flight time while waiting to be recovered. Thus, any aircraft that run out of flight time before they can be recovered are assumed to have landed in the water and although the crew may be safe, the aircraft is a total loss.

ATTACKS AT NIGHT

Radar equipped aircraft operating at night will score hits equal to about 70% of those operating under normal daylight conditions. Likewise, radar-directed AA fire should be reduced by 70% (accuracy) and non radar directed AA fire reduced by 50%.

DAMAGE TO CARRIERS AND LAND BASES

Any carriers or land bases that have received damage risk the loss of launch and recovery operations. For game purposes, CHART U4 may be used, substituting the column at the right to read PROBABILITY OF LOSS OF LAUNCH/RECOVERY OPERATIONS. Thus, on a roll of 40 or less a carrier or air base with 20% damage would lose launch and recovery capability. This may be considered temporary damage and a roll on CHART N5 can be made to determine duration of loss.

AIRCRAFT A/D FORMULA

The Attack/Defense values for aircraft have been computed from a involved formula. To be perfectly accurate, one must take into account many more factors than are readily (if at all) available. In addition to to that, most of the sources consulted provided data that conflicted one another (especially where normal and maximum ranges are concerned) for the same model aircraft. This is understandable when one takes into account the variety of conditions that may be encountered by an aircraft in flight as well as whether the aircraft is factory fresh, or a seasoned veteran.

Thanks must here be expressed to Mr. Lou Zocchi for his invaluable assistance in both providing data and the maneuverability calculation. His cooperation made much of this possible.

The Defense Factor is perhaps the easiest calculation and this is as follows:

$$(\text{EMPTY WEIGHT OF AIRCRAFT})^{.46} = \text{Defense Factor}$$

The Attack Factor takes into account the firepower and maneuverability of the aircraft. There is a difference between the calculation for fighter aircraft and for bomber types. For fighters, a firepower rating was calculated by multiplying the number of forward firing guns by the factor listed below for each type of gun:

.303", 30 cal., 7.7 mm, 7.9 mm, 7.5 mm	1.25
50 cal., 12.7 mm, 13 mm, 15 mm	2.50
20 mm	8.50

This result is then divided by the result of a maneuverability calculation, which is a calculation resulting in the maximum speed at which an aircraft can make a 2G turn.

$$\sqrt{\frac{\frac{\text{WEIGHT (EMPTY)}}{\text{WING AREA (sq. ft.)}}}{1.56}} \times 19.66 \times 1.414 = \text{Maximum speed in MPH to complete a 2G turn}$$

$$\frac{\text{FIREPOWER FACTOR}}{\text{MAX SPEED FROM ABOVE} \times 0.01} = \text{Attack Factor}$$

For bombers, since their attack is considered to be defensive area fire, the firepower factor of ALL guns is added together and the result is square-rooted. This number is then the total Attack Factor for a bomber.

SUBMARINES AND ASW

Submarines are a unique type of naval weapon and must be considered apart from other warships. They also, however, deserve more detailed rules than can be presented in this rulebook. For this reason, only basic rules for conducting submarine operations will be given.

During search, submarines may be sighted by aircraft and other ships only when the sub is surfaced. During battle, submerged subs are not placed on the playing area until detected by sonar or asdic. Hidden movement may be accomplished by the use of a 360° protractor or compass rose (the larger the better) fastened to the playing area. Range and distance bearings may be taken from the center of the protractor at the end of each submarine's movement so that its position can be plotted by the commander of the sub. When recording positions of subs, the direction of movement and the current depth should be noted also.

In a controlled ascent or descent, a sub may change a maximum of 250 feet of depth per game turn. Depth changes are always in increments of 50 feet and subs may dive to a maximum of 600 feet without being affected by pressure extremes. However, each turn a sub remains at depths below 600 feet, it risks a 30% probability of being crushed by pressure. Thus, if the commander rolls 01 to 30 on the percentile dice when the sub is below 600 feet, then the sub is lost and removed from the playing area. Subs may turn up to 360° during any game turn.

Firing torpedoes from subs in done in the same manner as described for surface ships, however, since periscope depth is considered to be 50 feet, no torpedoes may be fired at depths below 50 feet.

Sonar or asdic contact will be made by any ship so equipped (most Destroyers and some Cruisers) if the ship passes within 5,000 yards of the position of the submarine during a game turn. No ship moving faster than 18 knots may receive sonar or asdic contact regardless of the range of the sub and all ships damaged may lose their sonar/asdic capabilities according to CHART U4. When a contact is made, the sub is placed on the playing area in the position when contact was made and will remain on the playing area until out of range of any effective sonar/asdic sweeps.

Depth Charge attacks (DC) may be made by any ship so equipped that passes within 500 yards of the position of the submarine (measured from the foremast to the conning tower). The ship may drop a maximum of 6 DC per game turn. Each DC may be set to explode at any depth (in 50' increments) or all at the same depth. If the current depth of the submarine matches that of any DC depth, then the sub has been hit. Only DC at the correct depth setting are considered hits.

Unlike other ships, submarines do not receive DP as a calculation of its damage, but rather receive only Critical Damage. Both DC, shell, and bomb hits are all scored in this manner, using CHART N3 to determine the extent of the damage. One dice roll on CHART N3 is made for each hit from a DC, shell, or bomb. Regardless of depth, no sub may make a torpedo attack while under fire.

Ahead Throwing Weapons (ATW) such as hedgehogs and squids can also be used if carried aboard the attacking ship. 6 depths may be chosen by the commander of the ship for each salvo fired (one per game turn), as explained for DC, except that the attacking ship need only be within 1,000 yards of the position of the sub in order to fire ATW.

NIGHT ACTIONS

Night battles may be fought using the same rules as for daylight actions with a few exceptions. The maximum visibility as listed on CHART C2 should be reduced by about 60%, assuming bright moonlight, and somewhat less for poorer light conditions. This visibility should be further reduced by atmospheric conditions as shown on CHART C1. Of course, the proper reductions listed on CHARTS H should also be employed according to the conditions. Ships using searchlights to assist in scanning for other ships increase their visibility by 20% under good visibility conditions and somewhat less during periods of low visibility.

Searchlights, when used to assist fire control, have a maximum range during good visibility conditions of 6,000 yards. Two searchlights may be combined on the same target to increase the range to a maximum of 10,000 yards. Loss of searchlights may be determined by using CHART U4.

Star shells may be fired by any gunmount or turret mounting guns of 3" to 6" caliber. This turret or gunmount must be on the engaged side and is assumed to be firing starshells during the entire turn (and, thus may not fire offensively). Each turret or gunmount so designated will illuminate an area 3,500 yards by 3,500 yards for the entire game turn and any ship in this area is considered in the pattern. However, at least 50% of the ship's length must be within this area in order to be considered illuminated. For game purposes, the maximum range at which a starshell may be fired is 75% of the normal maximum range for the type of gun. All starshell patterns should be designated before the movement of ships during a game turn and any ship that spends the majority of its movement allowance in the pattern, or ends its movement in the pattern is considered illuminated.

Ships equipped with radar are assumed to have IFF (Identify Friend or Foe) electronics so there is no danger of firing on a friendly ship. However, there is a possibility that when two friendly forces approaching from different bearings without IFF meet, they may fire upon one another. The referee should keep this in mind and no ship, until identified, should be placed on the playing area but rather represented by a marker (or covered with a piece of cotton).

BARRAGE FIRE OPTION

Any ship mounting guns capable of firing at a higher rate than allowed by CHART G3 may elect to com-

mence Barrage Fire (BF). In the BF mode, a ship may fire up to twice the rate allowed by CHART G3 (if its maximum rate of fire as listed in the SHIP DATA SHEETS will allow it to do so). However, the final total resulting from the use of CHARTS H should be reduced by 40% (multiply the result by 0.6) before using CHART I1 to determine hits. If using the 01-10 column because the result from CHARTS H was less than 0, then use the 01-10 column and reduce the final number of hits scored by 40% instead.

The BF option should only be used during extreme circumstances and not be available as a general rule.

SELECTED BIBLIOGRAPHY

It would be impossible to list every source consulted during the design and writing of SEEKRIEG 4, so only a list of those works which provided the majority of information are listed below. Much of the detailed information came from various issues of WARSHIP INTERNATIONAL published between 1966 and 1981 and sources consulted at the Naval History Division, Washington Navy Yard, Washington D.C. Several volumes of WARSHIP magazine published by Conway Maritime Press have also been consulted. Assistance provided by the U.S. Naval Institute, both in the publication of their excellent books and in providing reprints of articles from the PROCEEDINGS has been invaluable. Those readers requiring more information on a particular aspect of naval warfare are encouraged to write us for a more detailed bibliography of suggested reading.

Richard R. Sartore

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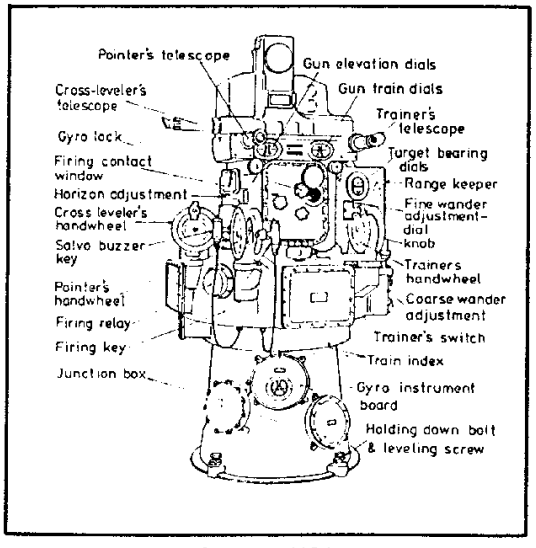
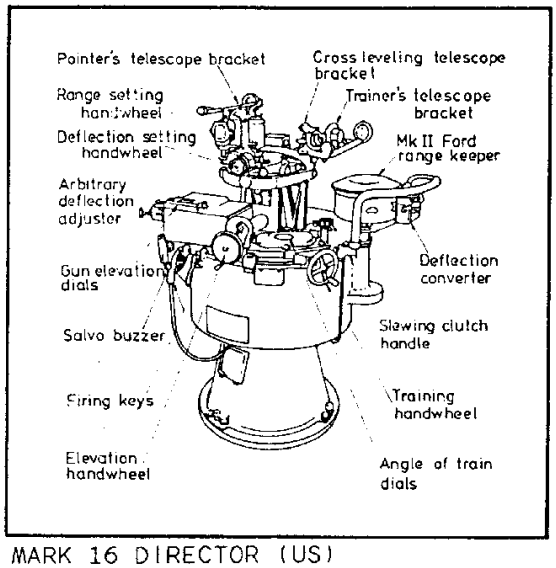
TURN SEQUENCE CHART

1. If not the result of a prior map search in which environmental factors had already been stated, the current visibility, sea state, wind speed and direction, and cloud ceiling should all be decided.
2. Decide which side moves ships first by either alternating each turn or rolling for initiative (high roll moves last).
3. Move ships according to their current speed [PAGES 6-7 / CHARTS A B3]
4. Plot gunfire and torpedo fire by all ships. This is done by noting the name of the target ship and the estimate of the range (if using Range Estimation Method) as well as which guns are firing at the target (or number of torpedoes fired). Also, note type of shell or torpedo used (AP, COM, HE etc. or Contact/Magnetic).
5. Check the line of sight and arcs of fire for all guns in a questionable aspect [PAGES 7-8 / CHARTS J1 J2].
6. Measure all ranges for ships that have fired.
7. Calculate probability of hits for each ship [PAGES 9-10 / CHARTS H1 or H2 or H3]
8. Check the rate of fire for each battery to determine number of shells on target [PAGE 8 / CHART G3].
9. Determine number of hits (if any) on target ship [PAGES 8-10 / CHART I1].
10. Determine location of each hit [PAGE 11 / CHART G1].
11. Determine penetration of shell according to the shell type and armor type (it may be helpful to adjust each ship's armor amount listed by the Armor Type Factors on CHART Q1 before the game begins). If required, check for pass-throughs [PAGES 11-12 / CHARTS R1 or R2 G2].
12. Calculate damage done by each hit in DP using the damage factors on CHARTS R [PAGES 12-13 / CHART G2].
13. Check for any Critical Damage from each hit AND Shipboard Fires during the same roll (doubles) [PAGES 13-14 / CHART G2 N].
14. Measure and note all information required for the Torpedo Calculation if any torpedoes have been fired during Step 4 of this turn [PAGES 17-18 / CHARTS S T]. If their speed allows them to reach the target this turn, then check for hits and calculate damage at this time.
15. Adjust any DP received by using Optional Damage Control [PAGE 20 / CHARTS V1 V2].
16. Check status of any shipboard fires caused during the PREVIOUS turn [PAGE 14 / CHART G4].
17. Adjust for any speed or guns lost from DP received this turn by using the Loss Factors [PAGE 13].
18. Check for loss of radar and check morale for each ship when applicable [PAGES 16 19 / CHARTS U2 U4].
19. Note any evasive maneuver or smoke screens for next turn [PAGES 15-16].
20. Begin sequence again at Step 2 above.

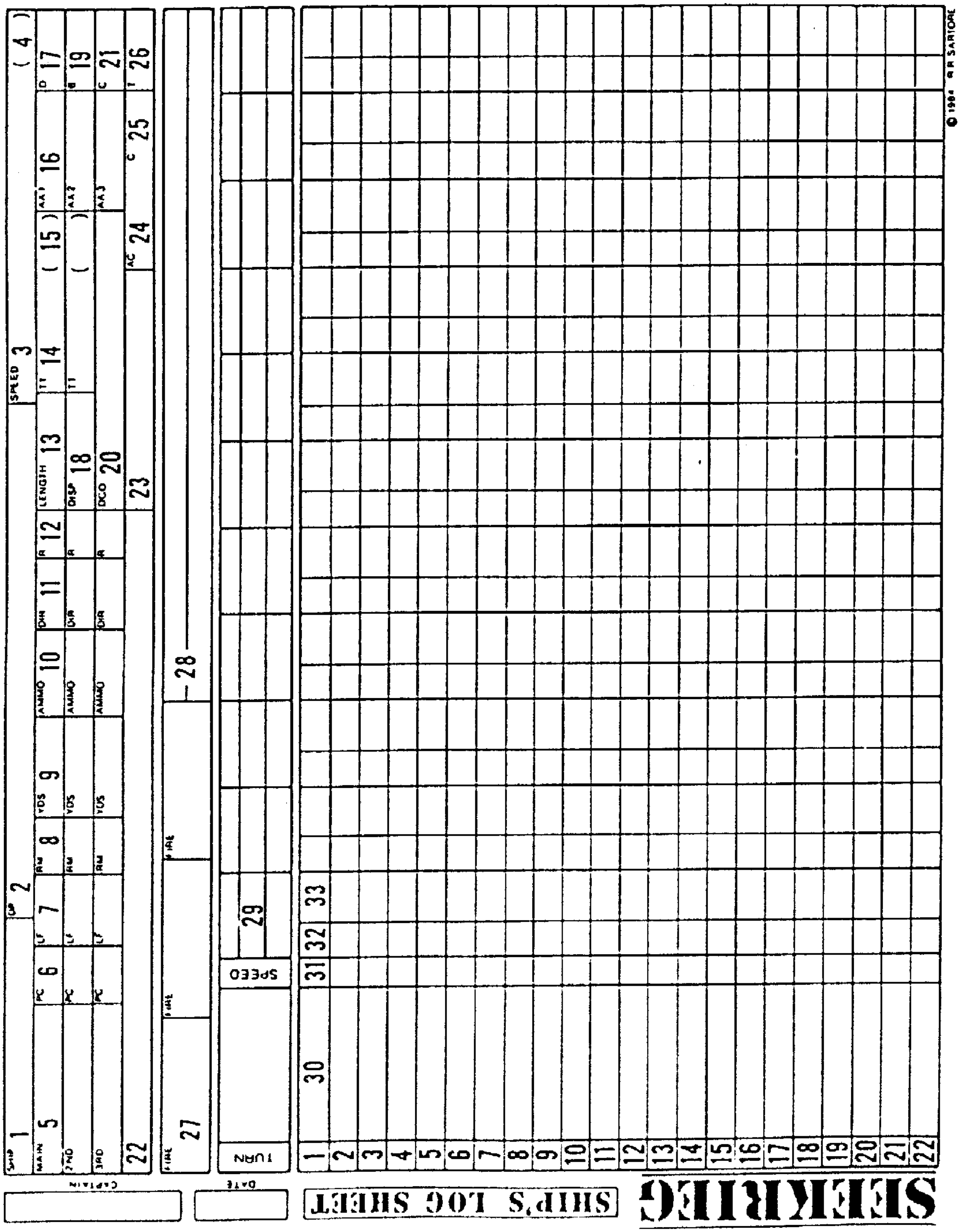
NOTE: Attacks by aircraft on ships and the resulting AA fire can be resolved immediately after Step 6 [PAGES 25-27].

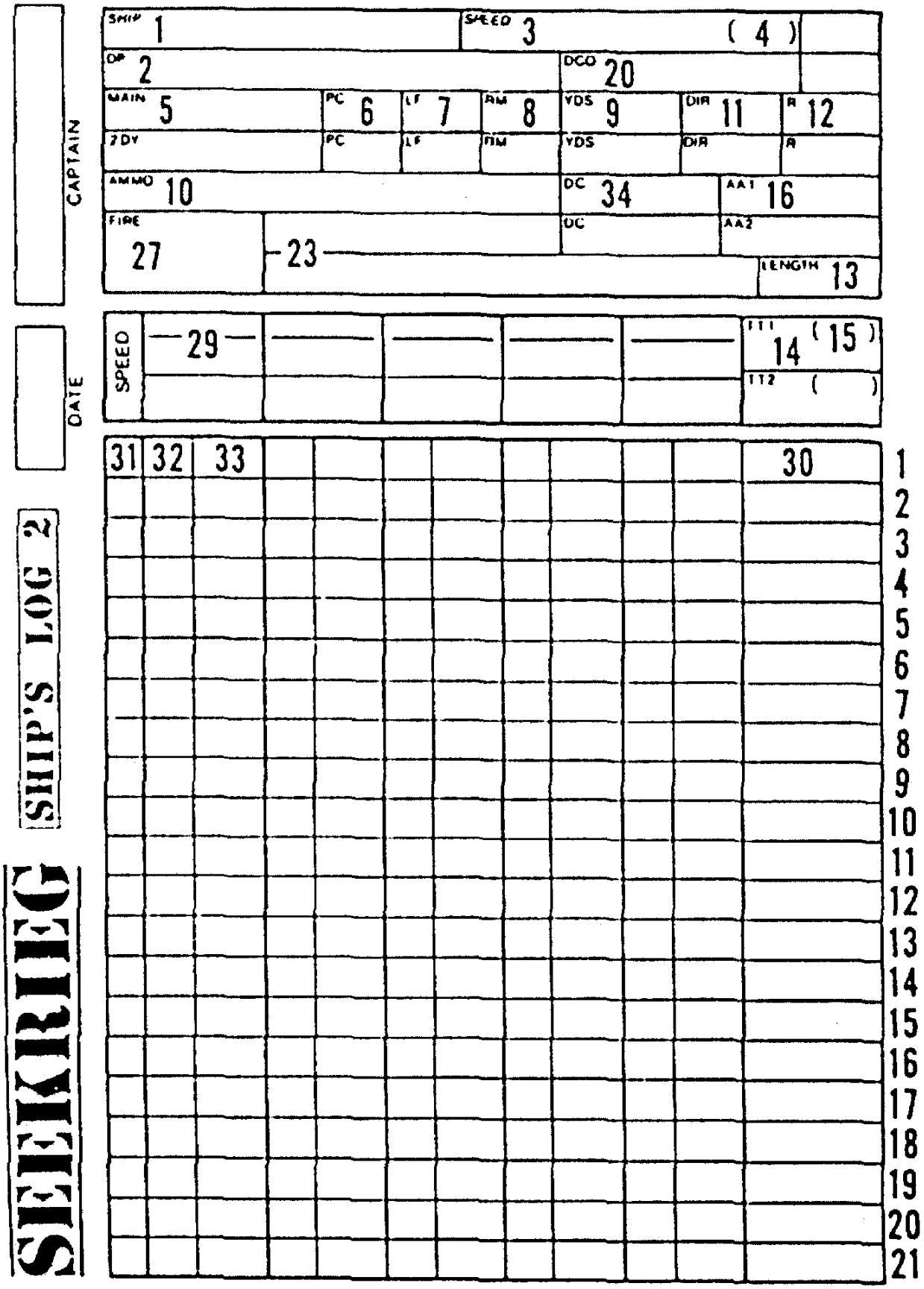


MARK 18 DIRECTOR (US)



MARK 16 DIRECTOR (US)





1. Name of ship.
2. DP of ship and space to keep track of DP taken.
3. Maximum speed of ship and space to keep track of losses to max. speed.
4. Loss Factor for speed.
5. Number, size and caliber of guns (i.e. 8x15.0"/42).
6. Penetration class of guns.
7. Loss factor for guns.
8. Rate of fire for guns.
9. Maximum range of guns.
10. Ammunition allowance (number of shells).
11. Type of gun director (number from CHARTS H).
12. Radar fire control (number from CHARTS H).
13. Length of ship in feet.
14. Number and size of torpedo tubes (i.e. 4x21.0").
15. Loss factor for torpedo tubes.
16. AA factor for each battery of AA guns.
17. Deck armor in inches.
18. Displacement of ship in tons.
19. Belt armor in inches.
20. Damage control points available.
21. Con armor in inches.
22. Space for notes or to provide space for a fourth battery of guns.
23. Space for notes.
24. Number of aircraft available.
25. Number of catapults aboard.
26. Turret armor in inches.
27. Space for keeping track of shipboard fires.
28. Space for notes.
29. Columns for keeping track of each turret. First line should contain turret number (i.e. A, B, X, or Y OR 1, 2, 3, etc.) and second line the number of guns in the turret. Secondary and other batteries may be listed in the same manner if space permits or may be grouped each battery to a column (i.e. PORT 8x5.0").
30. Notes for each turn (i.e. launch torpedoes, lay smoke, evasive maneuver).
31. Current speed for each turn.
32. Designated target ship for that turret or battery for each turn.
33. Range estimate for that turret or battery for each turn (or type of shell being fired if not using range estimation method).
34. Depth charges available (for port & starboard sides).