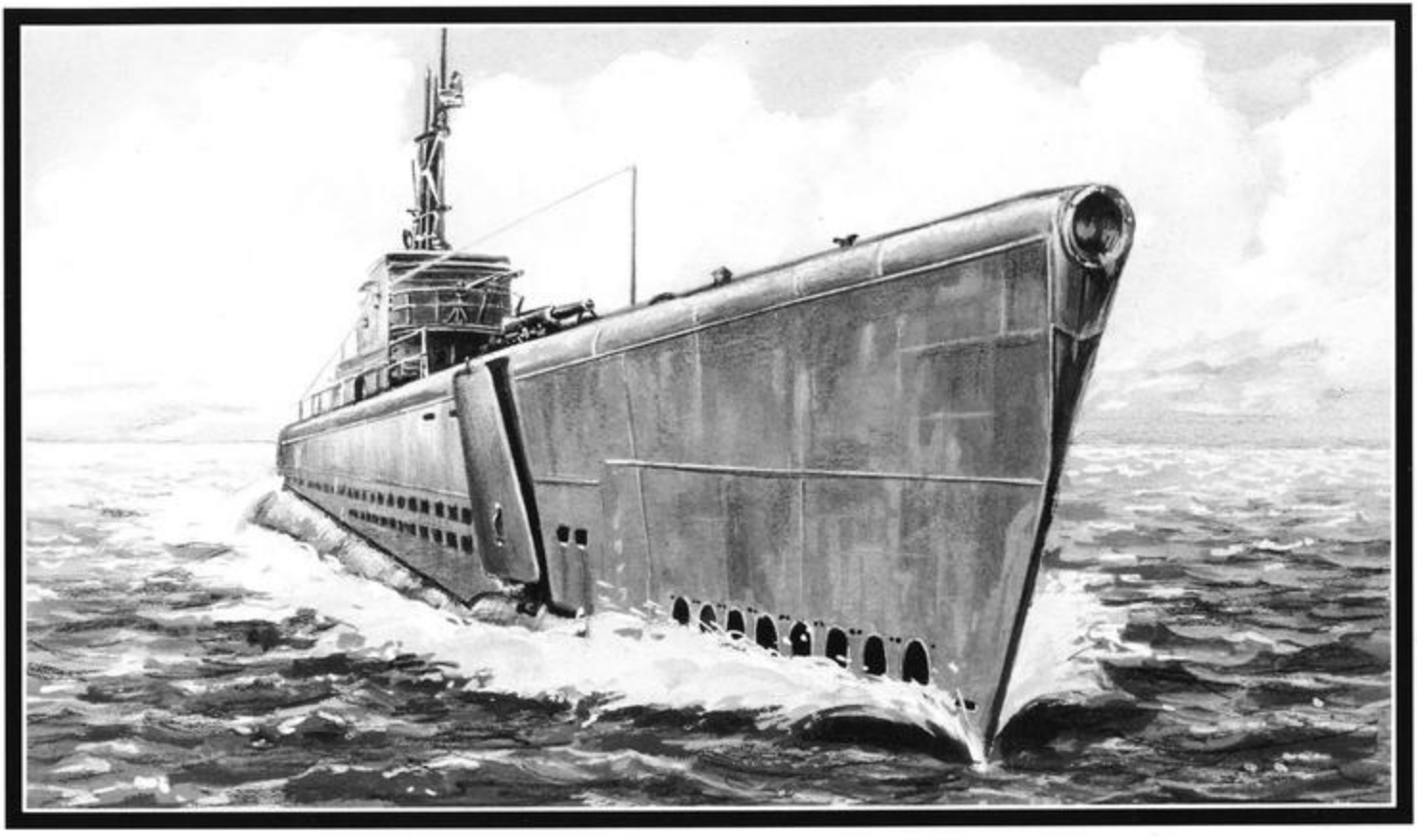
SILENT SERVICE II™

ACTUAL SCREEN SHOWN

MICROPROSE™

SILENT SERVICE II™



MICROPROSE™
SIMULATION • SOFTWARE

Silent Service II
WWII American Submarine Simulation

MicroProse Software
180 Lakefront Drive, Hunt Valley, MD 21030
(301) 771-1151

Printing: 9 8 7 6 5 4 3 2 1

TM

Introduction

World War II was the largest and most destructive war in history. Most Americans remember it as the last "good" war, fought for freedom and justice against evil tyrannies seeking to conquer the world. There is some truth in this: few defend Adolf Hitler's Nazi fascism, the way violent military men literally assassinated their way to power in Japan, or the insensitive, repressive and often bloody governments that crassly exploited whomever they "liberated" in Europe, Africa, China or Southeast Asia.

Japan was America's mortal enemy from the Pearl Harbor raid in 1941 to the atomic bombings of 1945. The struggle with Japan was a vast and bloody war that sprawled across the western half of the Pacific. America found numerous heroes in that war: sailors, soldiers and aviators. Among them were submariners from the "silent service", men like "Mush" Morton, Dick O'Kane, Sam Dealey, and Red Ramage.

American submarines pursued a dangerous calling. They sailed alone far into enemy territory, sometimes right to the Japanese coastline, thousands of miles from a friendly base. They challenged the world's most successful navy, the power that had captured all of Southeast Asia in four months. A submarine captain was in a lonely and exposed position.

Yet by war's end these same lonely submariners virtually wiped out the Japanese merchant marine single-handedly. They accomplished what the German U-Boats attempted and failed: total strangulation of a maritime economy.

The exploits of American submariners are still legendary. How Sam Dealey looked "down the throat" at destroyers charging to ram and expertly torpedoed them. How Red Ramage stormed through enemy convoys at night, on the surface, guns and torpedoes blazing, leaving burning and sinking ships in his wake. How Mush Morton bravely crept into uncharted, shallow harbors, fought his way out again, and then chased down and sank every ship he encountered. How Dick O'Kane, in patrol after patrol, showed unbelievable skill in stalking and attacking well-guarded convoys, and then in escaping the inevitable counterattacks.

Submarining was a dangerous profession. Casualties were high: six times greater than the WWII navy as a whole. Boats were cracked and crushed by depth charging, taking dying men to a watery grave. Of the famous skippers mentioned, Sam Dealey and "Mush" Morton were killed in action,

while Dick O'Kane was taken prisoner. Only Red Ramage and his boat survived the war intact.

All this action, heroism and glory makes for a great simulation. Many people over the years have attempted such products, and most feel the finest was MicroProse's 1985 *Silent Service*.

Today computer power and graphics are far better than 1985. The new *Silent Service II* takes full advantage of the best in microcomputer technology to give you greater realism and a better simulation experience. Every aspect of the original best-seller has been enhanced and redesigned. You have options and situations never before available, including a "war career" that covers the entire Pacific War. Best of all, like all MicroProse products, the game is infinitely playable and replayable, giving you fresh challenges and new situations to master.

Do you have the stuff to be a submarine hero? We let you take command in America's wartime "silent service" and find out!

Table of Contents

Quick Start

The Materials

This Manual provides a tutorial, detailed operating instructions, technical data and tactical tips. It applies to all computer systems.

The Technical Supplement gives specific instructions for your computer system.

The Keyboard Overlay(s) present all the main controls and orders for your sub in battle. For strategic "war patrol" movements, refer to the Technical Supplement and this Manual, not the keyboard overlay.

The Map of the Western Pacific exactly matches the internal "computer data" used in this simulation (hence the "jagged" coastlines, etc.).

Installation

The Technical Supplement has complete information about installing *Silent Service II* on either floppy or hard disks.

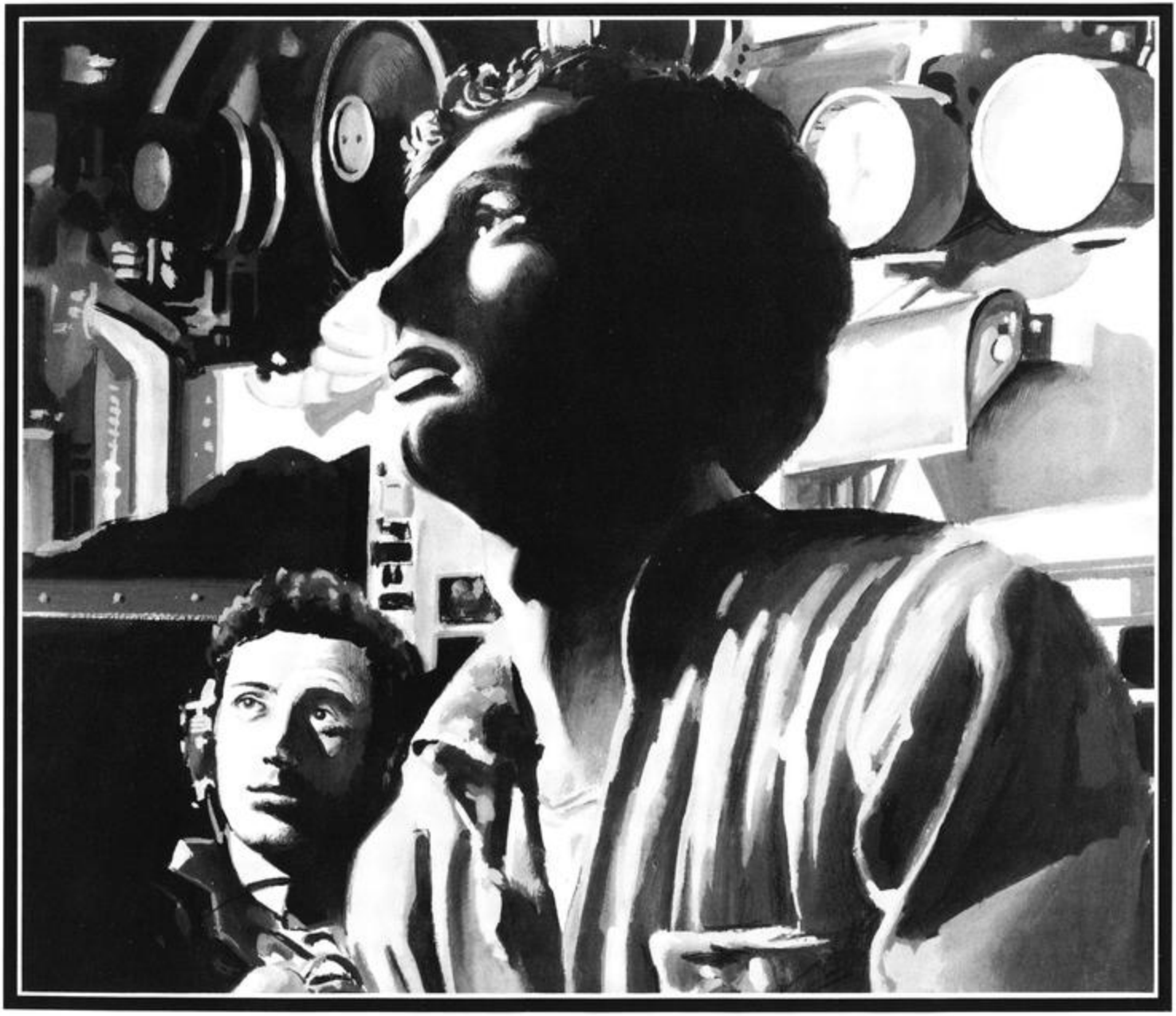
Learning *Silent Service II*

There are three basic approaches to learning this simulation. Pick the method that suits you best:

(1) Play & Skim: You can dive in and try the game, skimming what you need from this manual. Be sure to look at the descriptions of the views (pages 25-38) and the controls (pages 42-53). For your first games, pick training and then the first two historical battles ("Whales & Duds" and "Mush on the Loose"). When you're ready for more, try the third and fourth historical battles ("Flasher's Tankers").

(2) Tutorial: Here you follow the tutorial (pages 9-17) step by step. As you follow along, you'll want to skim "Commanding a Submarine" (pages 18-59) for more explanation.

(3) Study: In real life most naval officers first learn "from the book", then try to survive in real life. To duplicate this, first read "Commanding a Submarine" (pages 18-59). Skim through "Battle Tactics" and "Patrol Strategy" (pages 61-86) as well. If you still want to be "in character", start a war career. However, for easier learning we recommend a few historical battles or a single war patrol first.



1 TUTORIAL

Combat Tutorial

Start by following the installation instructions in the Technical Supplement. You should "install" (copy) the game onto floppy disks or a hard disk, and play from those. Also punch out the appropriate keyboard overlay and place it on your keyboard. All controls are refered to by the name on the overlay, which appears here in *italics*.

This tutorial acquaints you with the controls and commands needed to operate your submarine. This first tutorial occurs on a practice "range" near Pearl Harbor. Your targets are old hulks unable to move or shoot. There are no "enemies" to distract you and no time limit.

Initial Options

After the title screens, you're shown a Japanese ship. To correctly identify it, compare the picture with those in this manual (pages 116-121), then select the name using the cursor keys.

Next a series of options appears. Please make these choices:

- "Training" is the appropriate type of game.
- "Introductory" is the appropriate difficulty level.
- Type your name where requested.
- "January 1, 1944" is a good date, although any date will do.
- "Gato" is the recommended submarine class.

You'll be assigned a submarine from the Gato class. Press any key to continue and see your first logbook entry, which notes the upcoming training exercise.

Finally, check the Keyboard Overlay or Technical Supplement to find the keyboard controls that pause the game. This allows you to read a few paragraphs of this tutorial, do it, then pause so you can read the next few paragraphs, etc.

At the Start

At the start of the exercise, you're viewing a chart of the general area. Take a moment and examine your keyboard overlay. During battle you can find every control here. On some machines a joystick and/or mouse may duplicate some of these controls (see the Technical Supplement for details).

On the chart you're a dot in the middle of a box. There are four small dots north of you. These are four target hulks, anchored here for target practice. You can use the *Zoom* and *Unzoom* keys to enlarge or reduce the chart's scale. For more information about charts and scales, see pages 26-28.

Below this chart is the "info panel" that shows the status of your boat. At the start your speed is 0, your depth is 000 (i.e., you're on the surface), and your heading (HDG) is 000 (due north). Your view bearing (Bearing) is also 000 (north), you have 6 torpedoes loaded in the bow tubes and 4 torpedoes loaded in the stern tubes. The target information to the right is blank because you've not "marked" a target.

To the right of the chart is a panel of ten torpedo timers. These show how long before a torpedo reaches its target (if the TDC light beside the timer is on), or how long before the torpedo runs out of gas (if the TDC light is off). Right now all the timers read 0:00 because no torpedoes are running.

For a larger chart screen, tap the *Info Panel On/Off* key. This gives you a full-screen chart. Tap the key again to restore the Info Panel.

Heading vs. Bearing: Tap the *Bridge Lookout* key. You're now in the lookout position on top of the sub's conning tower. You see the ocean straight ahead. There are ships (the target hulks) on the horizon. Do not start up the sub's engines. Instead, try out *View Left* and *View Right*. Notice how your field of vision moves left and right. When your view moves, your view bearing (BEARING on the info panel) moves with it. However, heading (HDG on the info panel) has not moved because the sub's hull hasn't turned.

You must understand the difference between heading and bearing in order to command effectively. Heading is the direction your boat points, and in which it travels. Bearing is the direction of your view. The lookout, your periscope, TBT (Target Bearing Transmitter) binoculars, torpedoes and deck gun are all pointed and fired along the *bearing*, not the boat's heading.

This can be confusing. There are two keys to assist you. Tap *Set View To Course* to swing your bearing around so it points "straight ahead" (in the direction the sub points). Tap *Set Course to View* to turn the sub so it's headed in the same direction as your view bearing.

Find Your Targets: Select *Bridge TBT*. This is a pair of binoculars in a special mounting. They have a dark scale across the lower center. Turn your view left and right over the target hulks. The scale brightens when it is over a ship. This means that ship is "marked". The target information on the info panel comes to life, showing the enemy's range (in yards), speed (in knots), and course (heading).

For a better view of a target, tap *Zoom* one or more times. To return to a normal view, tap *Unzoom*.

Move the center of the scale to the center of the leftmost enemy ship and tap *TDC On/Off*. The TDC Light (on the info panel) turns on and a small black pointer appears on the scale. This means your Torpedo Data Computer (TDC) is "locked" on the target. While the TDC is running, your view automatically rotates to keep the current target point centered in your view. You can turn the TDC off by tapping *TDC On/Off* again. You can only turn on the TDC when a target is "marked", but you can turn it off anytime.

Make sure your heading (HDG) is 000 and the TDC is on. Tap *Ahead Full (3)*. This starts your sub moving north. Your speed will increase to 15 knots but the heading won't change (because you're not turning). However, as the TDC tracks the target, you'll see the view bearing rotate and the target range get smaller.

Note that when the TDC is "off" (not running) the *View Left* and *View Right* keys swing your view left and right. When the TDC is "on" (running), your view is locked on target. The keys now adjust the torpedo aim left or right. You'll see the torpedo aiming pointer move on the scale as you tap *View Left* and *View Right*.

The Attack

Sinking the Enemy: Tap *Set Course to View*. This swings your sub around and heads it toward the target ship. When the range to target decreases to 1,000 yards, tap *All Stop (0)*. It's time to give your deck gun crew a little practice.

Tap *Fire Deck Gun* once. You'll hear the gun fire and see either an explosion or shell splash near the target. This is because the gun crew does their best to aim the gun at the "marked" target that you're tracking with the TDC. If the target wasn't "marked", the crew refuses to shoot (they don't have a target!).

If the splash is in front of the target, you're firing too "short". You need to elevate the gun slightly to lengthen the firing range. Tap *Gun Up (+)1°* once. You'll see the elevation indicator at the top of the TBT change.

If the splash is behind the target, you're firing too "long". You need to depress the gun slightly. Tap *Gun Down (-)1°* once.

Adjust your gun elevation up or down until you're scoring hits. Some hits may set the hulk afire, or cause secondary explosions. Eventually the target will sink. You've scored your first kill!

Torpedoes Away: Obviously, the deck gun is rarely the best way to sink a ship — it takes many shells and a long time, and all the while you're on the surface, vulnerable to return fire. It's time to try the traditional submarine weapon: the torpedo. Torpedoes can be fired surfaced or submerged. Here we'll make a submerged attack.

Tap the *Dive* key once. Almost immediately you'll be removed from the Bridge TBT and go to the charts. After all, when a sub dives, all topside personnel must go below. On the chart, watch the depth carefully. When you reach 050 feet, tap *Rise* once. This levels out the submarine. If you tap *Rise* again, your sub starts back up. To level out at a depth, you can also tap *Straight & Level*. However, this would also straighten out any turns.

You can also dive or rise your sub to periscope depth (50 to 55 feet) by tapping the *Periscope Depth* key. Your crew will automatically take you to the proper depth, diving as necessary.

When you're steady at 055 feet, try tapping *Periscope*. Your crew will say that the scope is down. You need to raise it before you can use it. Therefore tap *Persicope Up/Down* once to raise the scope, then tap *Periscope* to look through it.

You can move the periscope view left or right, just like the bridge TBT. Since the last ship is sunk, your TDC is off and no target is marked. Swing the scope around to mark a new target, then turn on the TDC to track it.

In real battle, the TDC is extremely useful because it computes the enemy's course and speed. It then automatically sets the torpedo's course so it will intersect with the enemy. The TDC continually updates this setting so you can fire the torpedo at any time. With the TDC running, torpedoes should always hit unless either (a) the enemy changes speed or course (or both) after you fire, or (b) the torpedo malfunctions. Here the enemy is anchored and you have flawless torpedoes, so every "fish" fired is a hit.

Tap *Fire Torpedo* once and you'll see what happens. A "tin fish" is launched, you see the wake running toward the target, and blammo! A hit. The amount of damage is somewhat random, so one hit may or may not sink the target. If it doesn't, keep firing until you sink the hulk.

Note that when the TDC is running your view is "locked" onto the marked target. The *View Left* and *View Right* keys adjust torpedo aim, not the view. You must turn off the TDC to change your view.

Firing Stern Tubes: Swing your periscope onto the third target hulk to "mark" it, then turn on your TDC once more.

Now Tap *Ahead Full (3)*. Notice that your sub is moving at a much slower speed than on the surface. In real battles, your slower submerged speed can be important. Now press *Turn Starbd (Right)* or *Turn Port (Left)*. You'll notice your sub's heading swings away from your bearing. Shift to the Charts (tap *Charts*) and watch your sub moving there. When your sub is travelling almost exactly away from the enemy, tap *Straight & Level* and then *All Stop (0)*. During all this, because you left your periscope up, the crew and TDC continued watching the target. The current target range, speed and course should still be visible on the info panel.

Now tap *Fire Torpedo* once. You'll see a torpedo leave your boat and head to the target. Notice that on the info panel you only have three stern tubes loaded now, instead of the original four. Meanwhile the "S1" timer is counting down the seconds before the torpedo hits.

Your crew automatically selects either bow or stern tubes to fire, whichever is closer to the target. Since your stern was facing toward the target, they fired a stern tube.

If you're quick you can get back to the periscope and watch the torpedo explode.

At some point in all this, you probably received a message that one of your bow tubes has been reloaded. As you fire your torpedoes, your crew reloads them as fast as possible. However, your torpedo supply is limited. Tap *Gauges* and look in the upper right corner. The lighted torpedo graphics show the number of tubes currently loaded. The numbers below show the number of additional torpedoes available, but not yet loaded into a tube.

Ending the Training Cruise

You can end training by sinking the last hulk with gunfire and/or torpedoes. When the last enemy ship is sunk, the battle ends shortly thereafter. Battles also end if all surviving enemy ships have escaped (are beyond 30,000 yards).

In addition, you can tap *End This Battle*. You aren't allowed to quit if you're too close to the enemy, or they detected you (impossible in this case!).

Further Battle Training

To get more experience in battle, play some of the historical battle scenarios. For additional information on the views refer to pages 25-38, for the controls refer to pages 42-55.

The first two scenarios, "Whales & Duds" and "Mush on the Loose" only have merchant ships. Three other scenarios feature battles against convoys: "Flasher's Tankers (I)", "Flasher's Tankers (II)", and "Killer O'Kane".

The most difficult scenarios are those against warships, since they move so quickly. These include "Sink the Yamato!", "Death of the Shinano", and "An Embarassment of Riches".

A good final practice — and a fine, quick game in its own right — is the "Random Encounter". This scenario generates an infinite variety of encounters appropriate for the time period you select, including single ships, merchant convoys and warship groups.

Patrol Tutorial

Now it's time to try out a war patrol. In a war patrol you leave port, cruise to your patrol zone, search out enemies, and sink them. When you're out of torpedoes or low on fuel, you return to port.

Initial Options

After the title screens, you're shown a Japanese ship. To correctly identify it, compare the picture with those in this manual (pages 116-121), then select the name using the cursor keys.

Next a series of options appears. Please make these choices:

- "A Single War Patrol" is the appropriate type of game.
- "Introductory" is the appropriate difficulty level.
- Type your name where requested.
- "January 1, 1944" is a good date, although any date will do.
- "Imp. Gato" is the appropriate submarine class.

Now you'll see a map of the Western Pacific. Use the cursor to select an appropriate starting base. Keep tapping the cursor until "Midway - SubPac" appears. This will be your starting base. Press the return key to finish your selection.

Now a black box appears. This is a possible patrol zone. Again, use the cursor to move through the appropriate selections. Stop when you reach the "East China Sea". This will be your patrol area. Again, press the return key to finish your selection.

You'll be assigned a submarine from the Improved Gato class. Press any key to continue and see your first logbook entry, which shows your official sailing orders. Press any key to begin your war patrol.

Patrolling

The war patrol begins with a map view of the entire Western Pacific Ocean. Your boat is a bright dot surrounded by a bright box. Your war patrol zone is a dark box off the coast of China, southern Korea and southern Japan.

Controls: The Keyboard Overlay is *not* used during a war patrol. Only a very limited number of controls are used while patrolling.

The cursor keys or numeric keypad move your boat across the Pacific toward the patrol area (for joystick or mouse controls, see your Technical Supplement). Land and reef areas are impassable; you'll have to move around those. A larger scale navigation map is included to help you navigate through these obstacles.

Try each of the following keys, which are available during a war patrol (as well as in battle):

Captain's Log provides sailing orders, information about your boat, and your boat's past history.

Damage Report allows you to monitor damage repairs.

Gauges allows you to monitor the boat's current status in detail, especially the number of torpedo tubes and torpedoes available.

Ports is a special key only available during the patrol. It toggles symbols on and off for all friendly and enemy ports/bases. Note that these vary with time.

The computer controls (*Pause, Boss, Save Game, Exit to DOS, Joystick Adjust, Volume Adjust, Restart Game*, etc.) are all available while patrolling.

Time & Fuel: As you move, you'll see the info panel in the upper left change. The panel shows the current date and time. Time is kept using a military clock. This means 0100 is 1 AM, 1200 is noon, 1300 is 1 PM, 2100 is 9 PM, and 2400 is midnight. Below the time is the number of days cruising you have left. Most sub types (including the Gato class) have 60 days of fuel.

Move your sub across the Pacific and into the patrol zone. As soon as you enter the zone, note how many days of fuel remain. The difference is the amount of fuel it took you to reach your zone. A wise captain ends his patrol when his fuel is down to about 1 1/2 times (150%) of this amount.

For example, your patrol from Midway starts with 60 days of fuel available. When you reach the East China Sea, you're down to 45 days of fuel. Therefore, it took you 15 days to reach your patrol area. To be safe, you should end your patrol when you have about 22-23 days of fuel remaining (15 * 1.5 = 22.5). If you remain on patrol so long that you have less than 15 days of fuel left, you won't have enough to get back to Midway. However, you can look for nearer ports by tapping the *Ports* key.

Time: Continue cruising and you'll notice that every time your sub moves, time flips past. Also notice that even if you don't move, time continues to pass. You boat cruises around at its current location if you don't move it. To freeze the patrol, you must press the *Pause* key.

Contacts: Eventually your boat encounters the enemy. Most contacts occur in your patrol zone, but an encounter is possible almost anywhere. Some contacts occur when the enemy spots you. Other times you spot them with radar or visually.

Be sure to note the time of the contact. A night contact means a night battle, where you'll probably want to fight on the surface. A day contact means you'll probably want to fight submerged. A radar contact means you will start further away from the enemy with more time to maneuver. A visual contact gives you less time. A visual contact at night results in a battle that starts at point-blank range, perhaps with your boat inside the convoy's formation!

Battle Tactics

If you encounter speedy warships, just getting into firing position is hard enough. With slower merchant ships or convoys you can circle around and attack them from whatever direction seems most favorable.

As soon as you have time, it's wise to check the gauges for the current water temperature and depth under keel. There's nothing more embarrassing than making a crash dive straight into the ocean bottom!

In daylight you normally attack submerged. At night your sub is so hard to see that you can make surface attacks. However, at night deck gun flashes give away your position. Avoid using the deck gun at night if return gunfire is a threat.

If enemy destroyers pursue you, don't rely on weapons to save yourself. Destroyers are hard to hit with torpedoes. Their guns are more powerful than yours. Your best bet is to crash dive, if possible below the temperature layer (to colder water), then move away. The faster you move, the better the enemy can hear you. When evading attack, it's best to sneak away at slow speed.

More Information

For detailed information about controls available during a patrol, see pages 39-41. For more information about strategy and tactics, see pages 77-86.

2 COMMANDING A SUBMARINE

Initial Options

At the start *Silent Service II* presents you with various options. Using these you can select anything from an individual battle to refighting all of World War II. You also select the type of submarine you wish to command and an appropriate level of realism and difficulty.

Ship Identification

Here you see a page from your boat's Ship ID book. Compare the picture shown with the various ship pictures in this manual (pages 116-121). Then use the cursor keys select the correct name. If you fail to make a correct identification, you're limited to the training scenario.

Game Type

Training: This is a single learning "battle" against four motionless, unarmed freighter hulks. You're free to cruise around and attack them with torpedoes and/or guns. Training takes an hour or two, mainly because you'll constantly refer to this manual and the Technical Supplement.

A Single Battle: Here you to select one of eight actual submarine engagements, or a ninth random engagement against an unpredictable force of Japanese ships. Individual battles take a half hour to two hours, depending on the number of ships involved and your command style.

For a summary of each historical engagement, see pages 98-105.

A Single War Patrol: Here you take a submarine on a complete war patrol into the western pacific, searching for enemies, engaging them, and (hopefully) returning back to a friendly base alive. A war patrol can take a few hours to an evening or two, depending on how many contacts you make, and the size of the resulting battles.

A War Career: Here you join the US Navy as a submarine skipper any time during World War II. You sail on a series of war patrols in one or more

types of subs until either you're killed or the war ends. This is the longest and most elaborate version of Silent Service II. It may take hundreds of hours if you start at the beginning of the war (December 7, 1941).

Resume a Saved Game: This allows you to continue a game previously saved to disk.

See the Hall of Fame: This shows the submariner's "Hall of Fame".

Quit Game: This exits the game, returning you to the computer's operating system.

Recommended Choices: Try "Training" for your first game. Then advance to one of the first two single battles ("Whales & Duds" or "Mush on the Loose"). After that try more single battles or a single war patrol. Select dates in 1943 or 1944 for good gaming variety. Finally you'll be ready for the ultimate test: a war career starting December 7th, 1941!

Difficulty Level

Introductory: This difficulty level is designed purely for beginners. Japanese convoys do not zig-zag, your deck gun and torpedoes do large amounts of damage and your submarine always has radar (even before it was really introduced!). Japanese warship commanders are slow to react, and if they do your submarine can withstand a remarkable amount of punishment. Finally, whenever you use the Ship ID Book, your crew will automatically show you the correct page.

This version is considered "easy" by experienced players. Consequently, point scoring is greatly reduced.

Normal: This level introduces you to the dangers of real combat. Japanese warships are a bit more alert and all Japanese ships may zig-zag. You only have radar if it's historically appropriate. Your submarine is a bit more vulnerable to damage. You have a choice between "flawless" and "historical" torpedoes.

This version is suggested for "normal" players familiar with the game. It's a bit easier than the reality faced by skippers during the war (a lot easier if you select flawless torpedoes).

Advanced: This level is similar to "normal", but the Japanese are yet more skillful and frequently zig-zag, while your submarine's ability to withstand damage is fairly realistic. You can still pick between "flawless" and "historical" torpedoes.

This version is suggested for "experienced" players who routinely do very well in the "normal" version. With historical torpedoes, this version is a close approximation of WWII reality.

Ultimate: This is the most difficult setting for the game. The Japanese are sharp-eyed scoundrels who can smell you coming at long ranges. Your submarine was built slap-dash, so it's a bit weaker than normal. You're forced to use historical torpedoes.

This version is designed for players who have exhausted the challenge of "advanced" play. It's probably a bit harder than real life. On the other hand, the point scoring awards are the highest.

Enter Your Name

Typing your name here means that all orders and records reflect your name. Typical military form is a first initial and a full last name, but many submariner skippers were known by a nickname and a last name (such as "Mush" Morton or "Dick" O'Kane).

Select Starting Date

This option does not appear in single historical battles, since the date is fixed historically.

Otherwise, this determines the date you take command of your new boat. Use the cursor keys to select the month, day and year. The date affects submarines available, whether you have radar (at "normal" difficulty and higher), and what's happening in the war. In a war patrol or war career, it determines your choice of starting base. Finally, in a war career it determines how long the war will last — the later the date, the sooner the war will end.

Recommended Choice: All American submarines had radar by the start of 1943, and had fixed all torpedo defects by the start of 1944. New players are advised to select a date in early 1944 — the "happy hunting time" for American submarines. War patrols from November 1944 onward can be frustrating because most Japanese shipping was already sunk!

Select Submarine Class

Submarines are listed in ascending order. That is, the further down the list, the better the boat. Naturally, point scoring is improved if you have a poorer boat. See pages 107-113 for complete data on all classes. A copy of these "technical specs" also appears in your logbook for easy reference.

Old 'S' Class: This is the worst possible boat, with a very slow surfaced speed, few torpedo tubes, and very few torpedoes. It also has exceptionally short range (35 days). Only experienced player should choose this class, and

then be careful to stay within the operational limits of this type.

Barracuda Class: This is a modest improvement over the "S" class. The biggest gain is a longer range (50 days), making war patrols easier. It's also a large, strong submarine. Aside from the Narwhals, not until the Gato class did the US Navy produce a submarine of equivalent strength.

Narwhal Class: This class is very slow submerged, and not very maneuverable. Its only redeeming features are extremely powerful deck guns and a large capacity to withstand damage (because of its great size). It is the first of the full-ranged (60-day) submarine classes.

'P' Class: This class is the first of the "fleet boats". It has good speed, full-ranged endurance, but fewer torpedoes and torpedo tubes than you might desire. Aside from the old 'S', this class is the smallest and most vulnerable to damage.

New 'S' Class: This class is faster than the P's and has better stern torpedo armament. It is also slightly stronger.

'T' Class: This class is very similar to the "Gato". The main difference is a slightly slower speed submerged, and somewhat less strength (the 'T's were no stronger than the 'S's).

Gato Class: This is the "standard" class of US submarines. It was used throughout the war in great numbers. During 1942 and early 43 many older types were retired, with their captains and crews going to the newer Gatos.

Improved Gato Class: The main improvements are a slightly deeper diving depth and a more powerful deck gun. These began in 1943.

Tench Class: This class is virtually identical to the Improved Gato in operating characteristics. It is slightly harder to sink.

Recommended Choice: New players are *strongly* urged to select the *Gato class* or *Improved Gato class*. One or the other is available throughout the war, and gives you a strong, well-armed submarine

Select Torpedo Type

The specific type of torpedo carried (Mark 10, 14, 18-1 or 18-2) depends on your boat and the time period. Old 'S' boats automatically get Mark 10s. Later subs automatically get Mark 14s until the Mark 18s arrive. Then you have your choice of 14s or 18s. See pages 114-115 for detailed torpedo specifications.

Flawless Torpedoes: These torpedoes have no faults. They always explode when they hit a target. However, they are still governed by realistic

values for maximum range and speed. The amount of damage caused is realistically variable as well.

In addition, at the "introductory" difficulty level the torpedo has a more powerful warhead which does extra damage.

Historical Torpedoes: These torpedoes have realistic faults. All torpedoes may be duds occasionally, even the late-war Model 18s. This is realistic, but sometimes frustrating to game players.

In addition the Mark 14s have all their historical faults in appropriate historical periods. This means an increased chance of premature explosions until the magnetic exploder is discarded or disabled, and an increased chance of duds (depending on contact angle) until the contact exploder is fixed.

Warning: The Mark 14 torpedo faults are very realistic, and are corrected piecemeal (as they were in real life). Historical gamers will undoubtedly enjoy this challenge. However, remember that these faults can be frustrating. Nobody likes to see a big target escape just because the silly torpedoes malfunctioned. If the prospect of this bothers you, choose flawless torpedoes.

Select Your Starting Base

This option is available if you're starting a war patrol or a war career. Your starting base affects which submarine command directs your operations (SubPac or SubSoWesPac), which in turn affects the war patrol zones available to you. Equipment upgrades and solutions to Mark 14 torpedo problems are also affected.

On most computers you use the cursor keys to toggle through the base possibilities. Press the "Enter" key to select the base of your choice.

Select War Patrol Zone

This option appears whenever you start a war patrol (including each patrol in a war career). Your starting port and high command (SubPac or SubSoWesPac) affect the war patrol zones available. If you're using an old 'S' boat, be sure to select a zone close to your base — otherwise your limited fuel may make a successful patrol impossible.

On most computers you use the cursor keys to toggle through the zone possibilities. Press the "Enter" key to select the zone.

Your Command Assignment

This is the name of a real US Navy submarine of the appropriate class. After the old 'S' class (which used numbers), American submarines were named after fish.

Sailing Orders

This is a summary of your orders for the upcoming war patrol. It includes the patrol zone you selected, sailing date, and other pertinent data. It's placed in your logbook for easy reference.

Touring The Boat

The following section is a guided tour to all the stations on your boat. Like a real submarine skipper, you should be familiar with all the details of your command!

The Info Panel

This readout panel appears over the bottom of your charts, bridge, and persicope views. On the charts it can be switched on and off by pressing the *Info Panel On/Off* key.

Depth: Your current depth, in feet. A depth of "000" means you're on the surface. "Radar Depth" is 025 or less — at these depths your radar is above water and functional. "Periscope Depth" is 055 or less — at these depths your periscope can be raised above water.

Speed: Your current speed, in knots. One knot is 2002 yards per hour, or 33.3 yards per minute. Therefore, a boat at 10 knots travels 333 yards per minute, at 20 knots 666 yards per minute, etc.

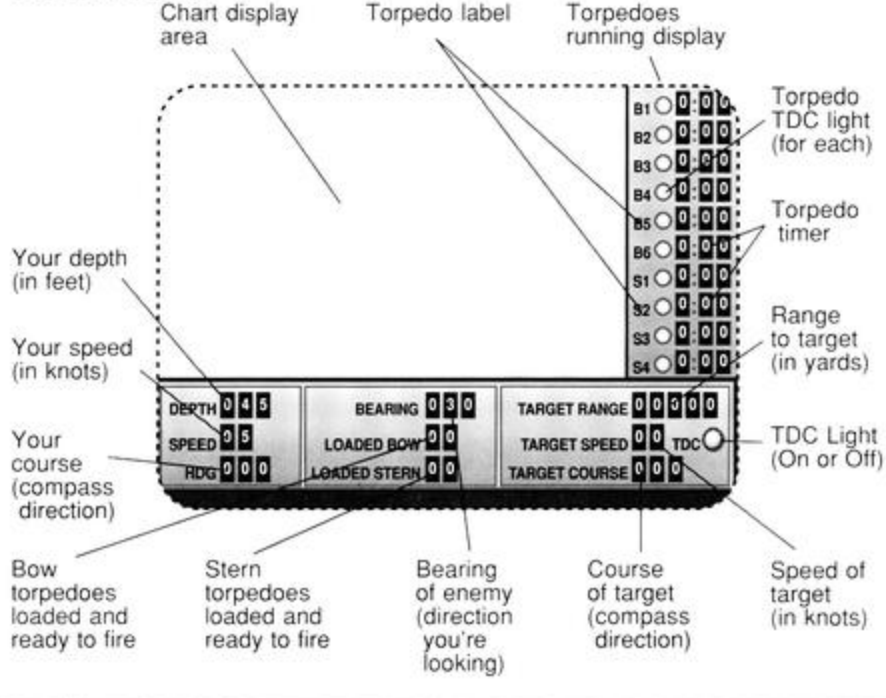
HDG (Heading): Your current course as a compass direction. On a compass, North is 000, East 090, South 180, and West 270.

Bearing: The current bearing to the enemy. Effectively, it is the direction you're looking (as a lookout, with the TBT, or with the periscope). Note that your bearing and heading can be quite different, leading to peculiar optical illusions.

Loaded Bow: The number of bow torpedo tubes loaded and ready for action. The maximum varies with the type of sub you command.

Loaded Stern: The number of stern torpedo tubes loaded and ready for action. The maximum varies with the type of sub you command.

The Info Panel



Target Course: The course, in compass degrees, of the target last "marked" by a lookout, in your periscope, or in your TBT.

TDC Light: This light is "on" when the TDC (Torpedo Data Computer) is running. It is "off" when the computer is turned off. The TDC computes torpedo courses and automatically "programs" your torpedoes.

Torpedoes Running: This secondary panel only appears on your charts (see below). It shows which torpedoes (if any) are running, and their predicted "hit" or "out of fuel" time.

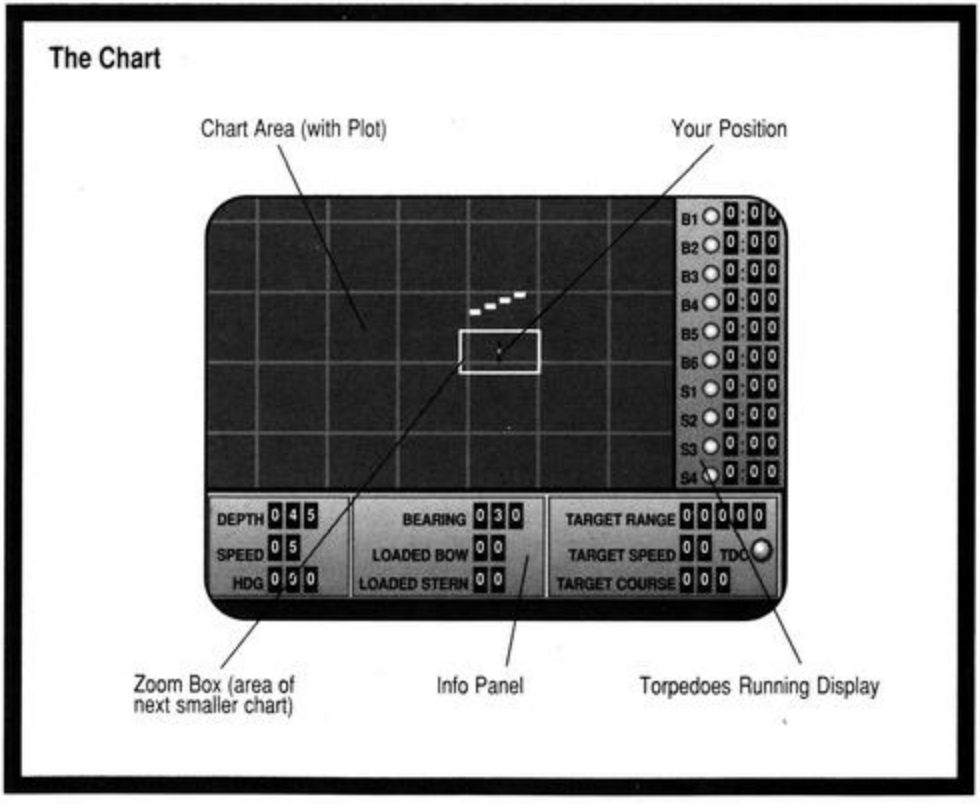
Torpedo ID: Torpedoes fired from the bow tubes are labelled B1 through B6. Those fired from the stern tubes are labelled S1 through S4.

Torpedo TDC Light: This light is on if the torpedo was fired using the TDC. It is off if the torpedo was fired manually.

Torpedo Timer: When this reads 0:00, no torpedo is running. Otherwise, it shows the minutes and seconds of the torpedo run.

If the TDC light is *on* for that torpedo, the timer is counting toward the predicted interception point.

If the TDC light is *off* for that torpedo, the timer counts down the torpedo's fuel (i.e., when it reaches zero, the torpedo runs out of fuel).



The Chart

Your submarine has a complete set of charts for the entire Western Pacific ocean at four different scales. The largest scale shows the entire ocean on one chart. Smaller scales show a large, medium or small amount of area. You change chart scale by tapping the *Zoom* and *Unzoom* keys.

All charts show areas of land and sea. Lighter-colored sea areas

are shallow water. The depth varies from 50 to 200 feet except close to land or reefs, where it may be even shallower.

Your Position on the Pacific Ocean (largest scale) chart is a single dot. On all smaller scale charts your position is represented by a small line and a wake showing your speed and direction of travel.

The Zoom Box appears around your position on all charts except the smallest. It represents the area in the next smaller chart. However, the box on the Pacific Ocean chart is oversized, since an accurately sized box would be a single dot!

Chart Scales: The amount of area covered by each chart varies, depending on whether the information panel is present across the bottom.

Chart Scales

Chart	*Overall Size without Info Panel*	*Overall Size with Info Panel*	*Size of One Grid Square*
Pacific Ocean	7000x4500 nm	(not applicable)	(none)
Battle: Large	164,000x102,000 yds	131,000x67,000 yds	10,250x10,250 yds
Battle: Medium	15,000x8,400 yds	20,500x12,800 yds	2,500x2,500 yds
Battle: Small	2,050x1,050 yds	2,550x1,600 yds	500x500 yds

nm = nautical miles (each 2,002 yards)
yds = yards

Chart Plots

Your crew automatically updates ("plots") each chart with the position of your boat, all enemy ships, and all torpedoes. Each of these appears as a short colored line. The color varies with the type of contact (radar, sonar or visual, in ascending priority). Each has a "tail", or wake. The size of the wake roughly represents the speed of the ship or torpedo. The direction of the ship and wake together approximate the direction of travel. See the Technical Supplement for symbols and colors.

Normally the chart begins centered on your submarine. However, if the TDC (Torpedo Data Computer, see pages 47-50) is running, the chart is centered halfway between your sub and the "marked" target (but only if both can fit on the chart at that scale).

Your crew constantly updates the position of your boat and all your torpedoes.They also update all enemy ships with the best available information. If your boat can see the enemy, or is using radar, enemy positions are very accurate. If your boat is using sonar only, enemy positions are fairly good, but not perfect.

If the crew has no new information an a ship, they remove it from the plot. Of course, the enemy is probably still be there, just outside of detection range!

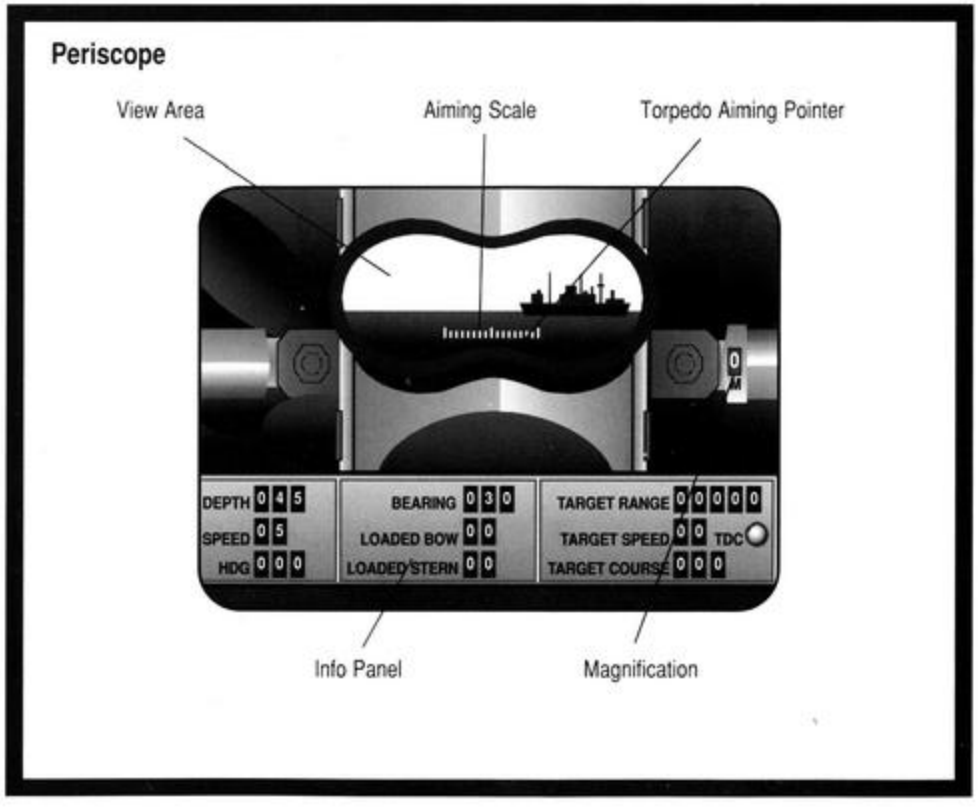
This is especially important if you're surfacing after running deep. It pays to raise the periscope and look around first!

The crew also plots sinking ships for a while after they disappear beneath the surface. This helps remind you that a slowly sinking hulk can be a navigation hazard.

Periscope

The periscope must be raised ("up") before you can use this view. Your depth must be 55' or less to use the periscope. You cannot use the periscope if it's lowered. If you press *Periscope* and nothing happens the periscope is probably down. Try tapping *Periscope Up/Down* once to raise the 'scope.

The direction your view faces appears in BEARING on the Info Panel. The periscope can be rotated to look in any direction. The *View Left, View Left Fast, View Right,* and *View Right Fast* keys control rotation.



View Area: This is the seascape visible through the periscope lens. The view can be rotated left or right. The *View Left, View Left Fast, View Right,* and *View Right Fast* keys control rotation. However, these only work if the TDC is off. If the TDC is running these keys control the torpedo aiming pointer.

Aiming Scale: This scale in the bottom of the view area is used to "mark" targets and aim torpedoes. Whenever the scale brightens you have "marked" a target. Your crew automatically updates all torpedo firing data to the last "mark" given. This data also appears on the info panel.

Your crew can only track one target at a time. Whenever you give a new "mark" (by moving the scale onto a target until it brightens) you erase all earlier information.

Torpedo Aiming Pointer: This appears on the brightened scale only when the TDC is on (running). It aims torpedoes left, right or directly at the target. The *View Left* and *View Right* keys adjust the aiming pointer, *not* your view area.

Magnification: Your periscope has four magnification levels: "1" (normal vision) to "4" (maximum magnification). These are controlled by the *Zoom* and *Unzoom* keys.

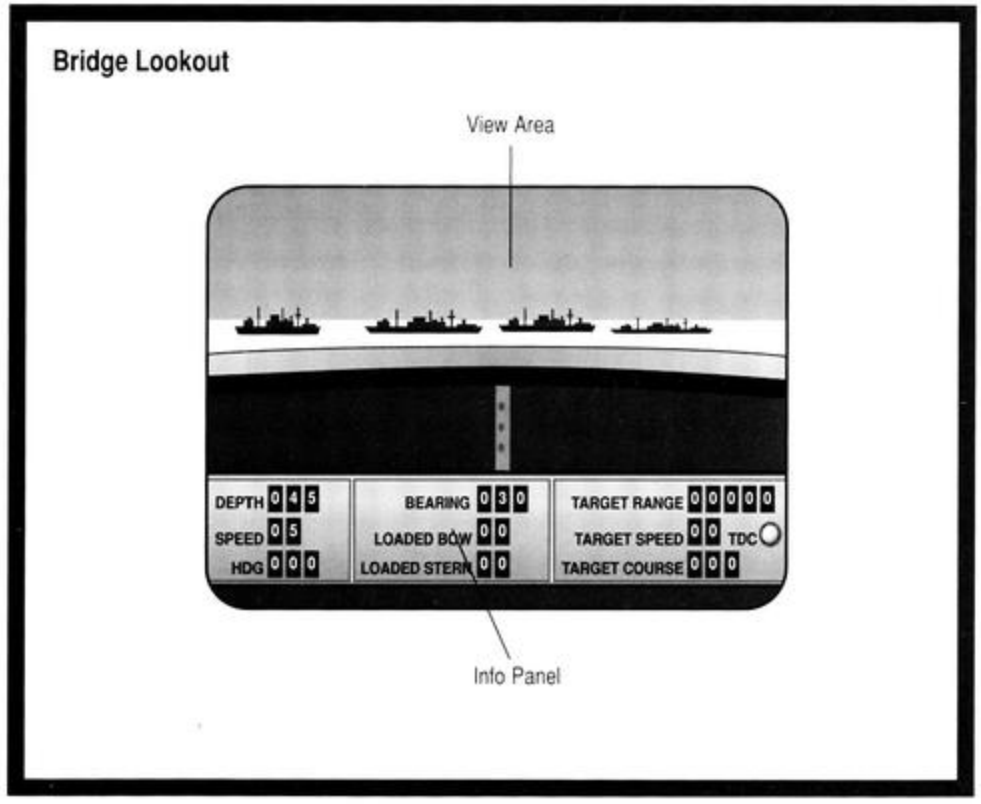
Info Panel: See above.

Bridge Lookout

The Bridge Lookout is available only if you're on the surface (at depth 000). It shows the view from the top of the conning tower ("bridge"), as seen by a lookout. It shows one quarter (about 90°) of the horizon around your boat. The direction you're facing appears in BEARING on the Info Panel.

The view can be rotated left or right. The *View Left, View Left Fast, View Right,* and *View Right Fast* keys control rotation.

Bridge Lookout



Bridge TBT

This is available only if you're on the surface (at depth 000). It shows the view from the top of the conning tower ("bridge") as you look through binoculars mounted in the TBT (Target Bearing Transmitter).

The TBT (Target Bearing Transmitter) is used to aim your torpedoes and deck gun while you're on the surface. The direction you're looking appears in BEARING on the Info Panel.

View Area: This is the seascape visible through the binocular lenses. The view can be rotated left or right. The *View Left, View Left Fast, View Right,* and *View Right Fast* keys control rotation. These keys work while the TDC is off. If the TDC is running, these keys control the torpedo aiming pointer instead.

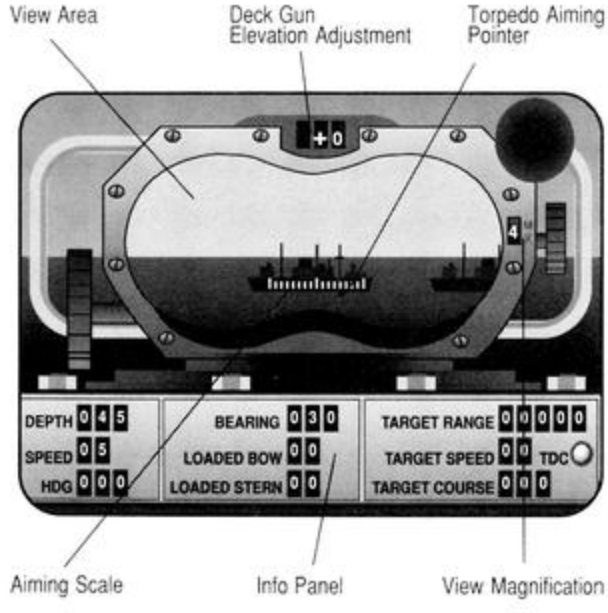
Deck Gun Elevation Adjustment: This indicates how much extra elevation or depression you're ordering to the deck gun crew. A "0" means the gun is elevated correctly for the target's current range. A "+1" or more means the gun is elevated especially high (useful if the target is opening the range to you), while "-1" or less means the gun is depressed more than normal (useful if the target is closing the range). Note: "0" does *not* mean the deck gun is shooting at "0" range.

Deck gun elevation is controlled by adding or subtracting degrees using the *Gun Down (-)1°* and the *Gun Up (+)1°* keys.

Important Note: You cannot use the deck gun unless your TDC is already tracking a target. See TDC On/Off (page 51) for details.

Aiming Scale: This scale in the bottom of the view area "marks" targets and aims the deck gun and torpedoes. Whenever the scale brightens you have "marked" a target.

Bridge TBT



Your crew automatically updates all firing data to the last "mark" given. This data also appears on the info panel.

Your crew tracks only one target at a time. Whenever you give a new "mark" (by moving the scale onto a target until it brightens) you drop the previous target.

Torpedo Aiming Pointer: This appears on the brightened scale when the TDC is on (running). It aims torpedoes left, right or directly at the target. *View Left* and *View Right* keys adjust the aiming pointer, *not* your view area.

Magnification: The TBT Binoculars have four magnification levels: "1" (normal vision) to "4" (maximum magnification). These are controlled by the *Zoom* and *Unzoom* keys.

Info Panel: See above.

Gauges

By tapping the *Gauges* key, you can see all the important gauges that report on the conditions of your boat and the surrounding environment.

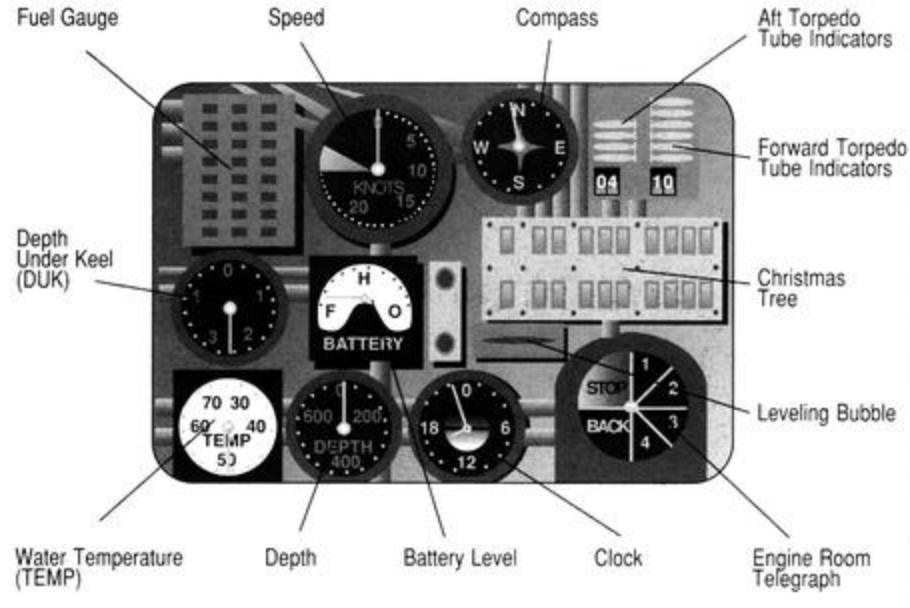
Critical Gauges

These gauges provide information useful in battle and unavailable elsewhere. You should consult the gauges periodically.

Depth Under Keel (DUK): This indicates the depth of the water (in feet) between the keel (bottom) of your sub and the sea bottom. Keep a close eye on the DUK if you're in shallow water or undertaking a deep dive. Hitting bottom can seriously damage your sub.

Water Temperature (TEMP): This indicates the temperature of the water outside the hull. This is very important if you're trying to evade

Gauges



detection by enemy sonar. At a middle depth (usually between 100' and 200') the water temperature suddenly drops. The boundary between the warm surface water and the cold deeper water is "the layer". This boundary line deflects sonar, which helps hide you from surface ships.

Battery Level: When submerged your sub is powered by batteries, which discharge slowly. Moving submerged increases the amount of discharge. The faster you go, the faster your batteries discharge. While sitting stationary, your battery can last about 24 hours, at quarter speed about 12 hours, half speed about 5 hours, at full speed about 2 1/4 hours, and at flank speed about 1 1/4 hours.

Your batteries can only be recharged while on the surface. Whenever you're surfaced, any diesel engines not used for movement are used instead to recharge the batteries. It takes all four diesel engines a couple of hours to completely recharge the batteries. However, you must be at "all stop" to use four diesels for recharging. If you have some engines moving the boat, it takes proportionately longer to recharge the batteries (with two engines moving the boat and two recharging, it takes twice as long, with three moving the boat and one recharging, four times a long). No recharging occurs if you're moving at flank (maximum) speed.

Clock: This is a 24-hour military clock. As on all clocks, the small hand shows the hours, the large hand the minutes. On a military clock time runs from 0000 to 2400. For example 8 AM is 0800; noon is 1200, 3 PM is 1500, 10 PM is 2200, and midnight is 2400.

Useful Gauges

These gauges either repeat information on the info panel or are less critical in battle.

Speed: This shows your current speed in knots (nautical miles per hour).

Engine Room Telegraph: This shows which of the four engines are moving the sub. If "4" is lit, all engines are running for maximum speed. When "2" is lit, two are running for half speed, etc. "STOP" means none are running, "BACK" means all engines are moving the boat slowly in reverse.

If you're on the surface, any engine not currently driving the sub is recharging the batteries — if they need recharging.

Depth: This indicates the current depth (in feet) of your submarine. Once you begin to submerge (go to a depth of 1' or more) all hatches are closed and locked. This prevents you from getting to the Bridge Lookout and Bridge TBT. However, at depths up to 25' your radar can still operate. At depths up to 55' your periscope can still reach the surface.

Leveling Bubble: This is much like a carpenter's level. It indicates whether the sub is diving, rising, or running steady. When the bubble floats to the right, you're diving; when to the left, you're climbing. When the bubble is in the middle, your sub is level.

Compass: This indicating the direction you're traveling. North is 000, East is 090, South is 180, and West is 270.

Forward Torpedo Tube Indicators show the number of forward torpedo tubes currently loaded. A tube that's loaded and ready is illuminated, a tube that's empty or reloading is dark.

Aft Torpedo Tube Indicators show the number of aft torpedo tubes currently loaded. A tube that's loaded and ready is illuminated, a tube that's empty or reloading is dark.

Forward Torpedo Reloads indicates the number of torpedos available for reloading in forward tubes. Therefore, the total number of forward-firing torpedos on your boat is the number of loaded tubes plus these reloads.

Aft Torpedo Reloads indicates the number of torpedos available for reloading in aft tubes. Therefore, the total number of aft-firing torpedos on your boat is the number of loaded tubes plus these reloads.

Fuel Gauge: This "column" gauge shows your remaining fuel oil. It has three columns, with each divided into a number of sections. Since oil is black, the dark areas show fuel remaining, while lighter sections show water. Note that oil floats on water, and is therefore always at the top part of the gauge.

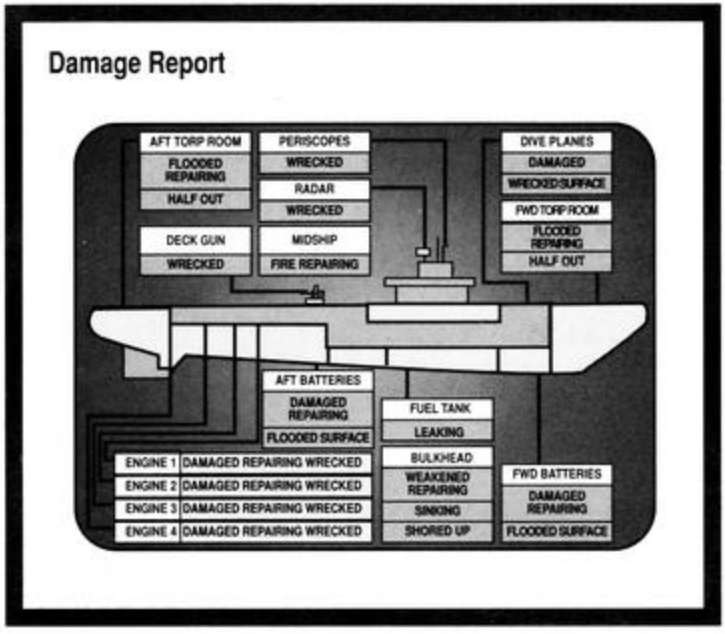
Christmas Tree: This area shows which hatches and other openings are open (red) or closed (green). The "tree" is green when you dive.

Damage Report

This display shows the major systems on your submarine, and their damage status. Whenever a system is damaged, its current condition is lighted. If a system is undamaged or completely repaired, it's dark.

Some damage is temporary. If so, "repairing" may be lighted also. Repairs can take a few minutes to a few days, depending on the system.

Some damage is permanent. It cannot be repaired until you return to base. Once at a friendly base, all damage is automatically repaired.



Damage Percentage: Your sub cannot take damage forever. Eventually the accumulated damage will weaken your hull so much that the submarine sinks. In fact, a quick series of very bad hits could do this almost instantly. The damage percentage is an estimate from your crew of how close you've come to a catatrophic collapse and sinking. Sometimes you may find the percentage becomes less. This occurs as the crew repairs damage. If damage does not threaten the watertight integrity of the boat the crew may ignore it for percentage purposes. As a result, you may have a piece of equipment malfunctioning while the damage reads 00%.

Some damage is unrepairable except at a base. As captain you must judge when you should break off the battle or the patrol and return for repairs.

Periscope

You cannot look through a damaged periscope — usually because the tube is bent and/or jammed. This makes underwater attacks so difficult and inaccurate that you're advised to attack only from the surface.

Periscope damage can be repaired only at a base.

Radar

Wrecked radar does not function at all. As a result, your contacts are at closer ranges. You'll have to rely on eyesight, periscope observations and sonar, which are usually shorter ranged than radar.

In 1944 and 1945 wrecked radar is especially disadvantageous at night, since the Japanese may have their own radars, and therefore could spot you (on their radar) before you spot them (with your lookouts).

Wrecked radar can be repaired only at a base.

Deck Gun

A wrecked deck gun cannot fire. Now your only weapon is torpedoes. Once wrecked, a deck gun can be repaired only at a base.

Torpedo Rooms

These are the crew areas that reload and control the torpedo tubes. Most spare torpedoes are also stored here.

Flooding/Repairing: When a torpedo room is damaged it begins to flood. The crew immediately begins repairs. While repairs are in progress the tubes cannot be fired. Once the crew has completed repairs, the efficiency of the torpedo room returns to normal.

Half Out: If a flooding torpedo room suffers further damage, half or all of the tubes may be permanently out of action.

Engines

Your sub has four diesel engines. These provide power for moving on the surface and for recharging batteries. Whenever an engine is wrecked your maximum speed is reduced (and battery recharging is made more difficult).

Damaged/Repairing: A damaged engine is out of action until the crew repairs it. Once repaired, it functions normally again. Engine repairs are often lengthy — don't expect results in just a few minutes.

Wrecked: A wrecked engine is beyond repair by your crew. It cannot be used for the rest of the voyage. It can be repaired only at a base.

Fuel Tank

The fuel tanks carry oil for your diesel engines. If a fuel tank is damaged, you immediately lose a large amount of oil. This loss can seriously affect your cruising range.

The crew automatically shuts off valves to isolate the damage. However, small leaks continue. The leakage may reveal your position to a nearby enemy, but isn't large enough to cause any further reductions in your cruising range.

You can suffer multiple hits in your fuel tanks, with a one-time loss in cruising range with each hit. Leaking fuel tanks can be repaired only at a base.

Batteries

Your sub uses two large banks of batteries, one forward, one aft, to power its electric engines for underwater travel. If one battery is damaged, you're reduced to half speed submerged. If both are damaged you're immobilized until at least one is repaired, or until you surface. You can still surface and dive, regardless of battery damage

Damaged/Repairing: The battery is out of action until the crew repairs it. Once repaired, it functions normally again.

Flooded, Surface: If a damaged battery suffers further damage, flooding reaches leaking battery acids, generating deadly chlorine gas. You must surface *immediately*, before the gas kills you and your crew. In this situation you should hit the *Blow All Tanks* key and surface as fast as possible.

Once surfaced your crew immediately vents the gas fumes. You can dive again if you wish. Meanwhile, repairs continue on the damaged battery.

Dive Planes

The dive planes allow your boat to dive and surface quickly: they act as "wings," guiding the ship smoothly up or down. If the dive planes are damaged your ability to control the ship when diving or climbing is reduced. As a result, it takes longer to dive and longer to surface.

Additional damage to the dive planes can wreck them. If the planes are wrecked you cannot dive at all, and can rise only by "blowing all tanks" to reach the surface. Repairing wrecked planes is virtually impossible at sea. Expect to be stuck on the surface until you reach a base for repairs.

Fire Midships

Sometimes damage causes fires. The most likely area is the midships, where many electrical connections meet in the control panels. When a fire occurs the crew works quickly to extinguish it. However, until it's out the crew reacts slowly to all your commands. In fact, don't be surprised if the crew seems to ignore your commands (you may need to press a key multiple times to "get through" to your distracted crew).

A continuing fire causes damage to your structural strength and the submarine's overall survivability.

Bulkheads

Your submarine's structural strength largely depends on its bulkheads. These are the basic skeletal structure of the vessel. If a bulkhead buckles or cracks, the entire hull is weakened. This produces permanent damage.

Weakened/Repairing: When a bulkhead is damaged, the crew immediately starts repairs. These repairs are mainly "shoring up" the weakened member with beams carried especially for this purpose.

Once a bulkhead is weakened and under repair, your maximum safe diving depth is reduced to *half* (50%) of the normal value. Furthermore, your boat cannot turn as fast.

Shored up: If repairs are successful, the bulkhead is "shored up". Turning ability becomes somewhat better, but the safe diving depth is still half (50%) of normal. Furthermore, the overall strength of the submarine remains less than before.

Multiple bulkhead hits greatly weaken the hull of your submarine, until eventually it crumples. This is true even if the bulkheads are shored up. If two or more bulkheads have been weakened, head for base immediately — even

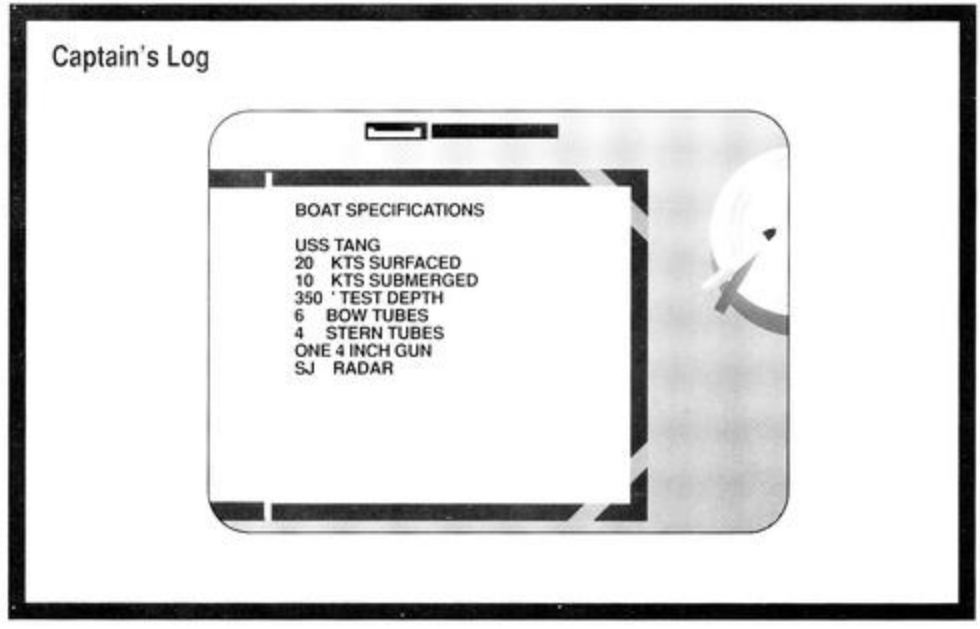
if they're shored up you're still in great danger.

Sinking: Multiple bulkhead damage can crack your hull. The sub begins to break up and sink. If you're very quick and very lucky, sometimes blowing all tanks will relieve the pressure on the hull and stop this. But this is a last and often forlorn hope. Usually you're doomed.

Captain's Log

Tap the *Captain's Log key.* At any time during play, you can consult the captain's log book. It contains current data about your boat, your sailing orders and other records.

Use the cursor keys to page back and forth in the log book.

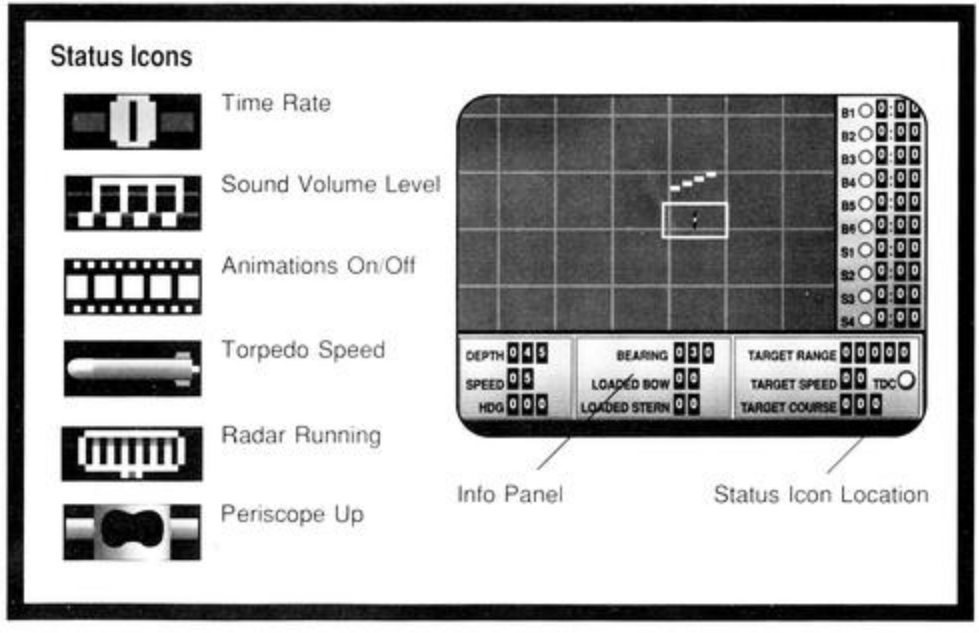


Status Icons

The icons appear at the bottom right corner of most views. They remind you of various options currently selected.

Time Rate: Default setting is "1", which means time passes at "real life" speeds. However, time can be set as high as "8", where time passes much faster.

Sound Volume: This indicates whether all, some or none of the sounds are heard. See the Technical Supplement for the different settings available.



Animations On/Off: This indicates whether the game shows special animations or not.

Torpedo Speed: This indicates whether your torpedoes are set to run at high speed (short range) or low speed (longer range). This only applies to Mark 14 torpedoes. If you have Mark 10 or Mark 18 the speed is always high.

Radar Running: This indicates that your radar set is above water and functioning

Periscope: This indicates whether the periscope is up or down. You cannot look through the "scope" unless it's up.

War Patrol Controls

War Patrols allow you to sail your submarine around the Pacific Ocean. The Battle Controls (see pages 42-53) are inactive until you make contact with enemy ships.

War Patrol controls apply only if you select a "War Patrol" or "War Career" option, and only during navigation between battles. War Patrol controls do *not* apply in "Training" or "Single Battles". (See Initial Options, pages 19-24, for more information).

Views

Only a limited number of views, often with special controls, are available during War Patrol operations. (For a more complete description of each view, see Touring The Boat pages 23-38).

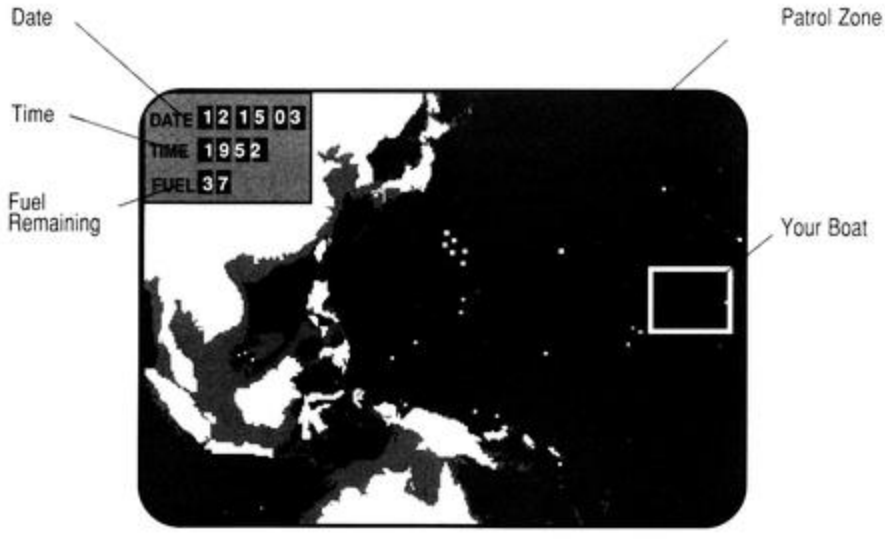
Views Available

Charts: Only the largest scale chart is available, showing the entire Western Pacific. Instead of the usual info panel, a special panel appears in the upper left showing crucial patrol information.

Gauges: The main value of these during patrol is to see the number of torpedoes available (in the upper right).

Damage Report: This is available so you can view the status of your boat.

War Patrol Chart



Captain's Log: This is available, with your sailing orders, recently received radio messages, and records of your accomplishments.

Unavailable Views: Bridge Lookout, Periscope, and Bridge TBT.

View Controls-Chart

In War Patrols, the normal zoom and unzoom functions are unavailable. Instead, you have one special option.

Ports: Tap the *Ports* key to see all Japanese and American ports/bases on the map. Japanese bases are areas of large naval activity, and are protected by wide-ranging enemy patrols. The base symbols automatically disappear whenever you resume navigation.

Entering an American base ends a war patrol. In a single war patrol this also ends the game. In a War Career the game continues with various options for refueling, repair, or even getting a new sub fresh from the construction yards.

View Controls-Damage Report

As in battles, there are no special controls on the damage report screen. Select another view to exit.

View Controls-Captain's Log

The controls in the Captain's log are the same as in battle. Use the cursor keys to page through the logbook, examining your sailing orders, current data, recent radio messages and records.

Navigation Controls

During a War Patrol, simplified controls are used to "con" (maneuver) your submarine across the Pacific Ocean. You must use the Chart view for navigation.

Keyboard: Use the cursor keys to move your sub north (up), south (down), east (right) or west (left) on the map.

Each tap of the key moves your sub many miles and causes the clock to advance a number of hours.

On many machines with a numeric keypad, all the keys are the con. This allows diagonal movement (using the 1, 3, 7 and 9 keys) as well as left-right and up-down movement. See the Technical Supplement for details.

Joystick or Mouse: If your machine has a joystick or mouse attached, in some versions this can move your sub. See the Technical Supplement for details.

Time: During a war patrol, a few hours advance every few seconds. If you sit in place and watch the clock, you'll see the hours advance. Therefore, to pause the game you must tap the *Pause* key(s).

Enemy Contact: When your sub encounters an enemy force, the war patrol temporarily halts. If the enemy sighted you first, you're forced into battle. If you sight the enemy first, you're given the choice to engage or avoid the enemy.

Note that if your sub has SJ radar (normal after the middle of 1942), many contacts (especially at night) are radar contacts. When you go to battle, these enemies are visible on your charts, but nowhere else. This is because radar "sees" further than eyesight, allowing you to detect the enemy before you can see him visually from the Bridge Lookout, Periscope, or Bridge TBT.

Before radar was installed (and sometimes afterward!), submarines could blunder into the enemy. Don't be shocked if sometimes you find enemy ships all around you.

Battle Controls

View Controls

Viewpoint Controls

Each key or control has a name in *italics*. This name is used on the keyboard overlay. A master list of all names and keys also appears in the Technical Supplement (in case your overlay is damaged or lost).

These controls determine which view is on your screen.

Charts: Tap this key to view your battle charts. This view is explained on pages 26-28.

Bridge Lookout: Tap this key to go to the bridge lookout position. This is possible only if you're on the surface (at 000' depth). This view is explained on page 29.

Bridge TBT: Tap this key to go to the bridge and look out through binoculars mounted in the TBT (Target Bearing Transmitter). As in Bridge Lookout, this is possible only if you're on the surface (at 000' depth). This view is explained on page 30.

Periscope: Tap this key to look through the periscope. This is possible only if you're at periscope depth (55' or less) and the periscope is up. This view is explained on page 28.

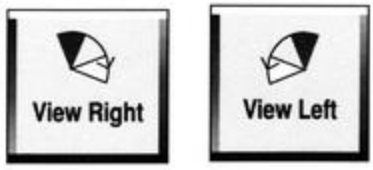
Sometimes this view suddenly disappears and you'll find yourself looking at your charts. This occurs if your periscope drops beneath the water —because your depth drops below 55', or because you've lowered the scope.

Gauges: Tap this key to view the various dials and gauges in the sub. This view is explained on pages 31-33.

Damage Report: Tap this key to see a graphic damage report about your sub. This view is explained on page 33-36.

Captain's Log: Tap this key to see your logbook.

View Scanning Controls



These controls adjust the direction in which you are looking. They only apply to the Bridge Lookout, Periscope, and Bridge TBT views.

View Right: This moves your viewpoint to the right on the Bridge Lookout, Bridge TBT or Periscope view.

If the TDC is on (running), this key adjusts your torpedo aim to the right instead of shifting your view. To change your view, you must turn off the TDC.

View Left: This moves your viewpoint to the left on the Bridge Lookout, Bridge TBT or Periscope view.

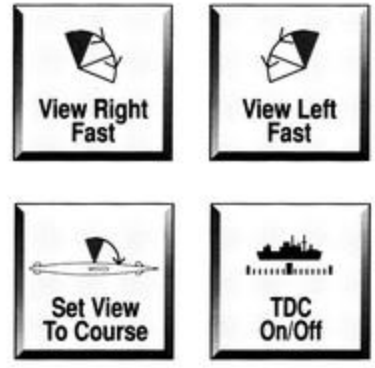
If the TDC is on (running), this key aims the torpedo to the left instead of shifting your view. To change your view, you must turn off the TDC.

View Right Fast: This quickly moves your viewpoint to the right on the Bridge Lookout, Bridge TBT or Periscope view. Your viewpoint "skips" in large 10° "jumps", so just a few taps are needed to scan the entire horizon.

View Left Fast: This quickly moves your viewpoint to the left on the Bridge Lookout, Bridge TBT or Periscope view. You viewpoint "skips" in large 10° "jumps", so just a few taps are needed to scan the entire horizon.

Set View to Course: This immediately moves your viewpoint to straight ahead: the bearing changes to match your heading. Your view is now over the bow of your boat, looking in whatever direction you're travelling.

TDC On/Off: This causes your periscope or Bridge TBT to "track" a target. It also communicates correct firing information to your torpedoes. For a detailed explaination of how to use this feature, see Torpedo Firing Controls, page 49 below.



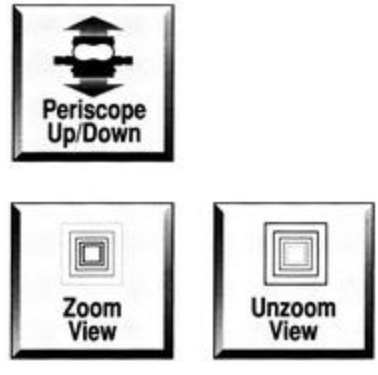
Other Viewing Controls

These controls are available on a variety of screens, as appropriate.

Periscope Up/Down: This key raises and lowers your periscope. You can toggle your periscope up and down by tapping the *Periscope Up/Down key*. The periscope is only functional when "up" and your depth is 55' or less. You can even use the periscope on the surface

Zoom View: This magnifies (enlarges) your view. At the Bridge TBT or Periscope, it shows less area but with greater detail. The TBT or Periscope magnification ranges from "1" (normal eyesight) to "4" (maximum zoom). On the charts, it sends you to a smaller scale (more detail but less area).

Unzoom View: This reduces your view. At the Bridge TBT or Periscope, it shows more but with less detail. The TBT or Periscope magnification ranges from "1" (normal eyesight) to "4" (maximum zoom). On the charts, it sends you to a larger scale (less detail but more area).



Ship ID Book

The Ship ID Book is available while you're examing charts, on the bridge (either at the lookout or the TBT), or at the periscope. The book shows pictures of enemy naval vessels, whichs helps you to identify targets.

If you select "introductory" difficulty, your crew will point out which page of the book is correct. That is, they identify the target for you!

Ship ID Book On/Off: This key toggles the book on and off. When present, the book overlays the Info Panel on the lower part of your view.

Cursor Keys: The up/down cursor keys page through the book. The left/right keys page through different views of a ship.

Important: When you have the book open, the Con (movement) controls may be inactive. This is because in some versions (depending on your hardware) the cursor keys are also the Con keys. See the Technical Supplement for details.

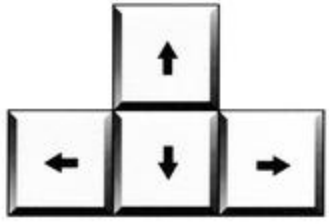


Chart Controls

The following viewing keys are available while examining the Charts. See pages 26-48 for a complete description of the charts.

Initially the chart view is centered on your boat. However, if the TDC (Torpedo Data Computer) is "on", instead the view is centered halfway between your boat and the TDC target if both fit on the chart.

Re-Center Chart: Tap this key to re-center your boat in the middle of the chart. However, if the TDC is running the view is centered halfway between your boat and the TDC target if both fit.

Zoom: Each tap enlarges the chart, showing a smaller area, but in more detail. The chart also re-centers automatically.

Unzoom: Each tap reduces the chart, showing a larger area, but in less detail. The chart also re-centers automatically.

Info Panel On/Off: This key shows or removes the Info Panel from the chart.

Ship ID Book On/Off: This key shows or removes the Ship ID Book from the chart.

Con & Engine Controls

Your submarine automatically uses diesel engines when surfaced and slower electric engines when submerged. Maneuvering and speed (engines) controls are the same in both situations.

The Con - Depth Controls

The "Con" are those controls used to steer your submarine. The depth controls regulate your operating depth – from surfaced (0' depth) on down to the maximum depth.

Dive: Tap this key to send your sub downward. This will submerge a surfaced sub, or cause a submerged sub to go deeper. To level off, tap either the *Straight & Level* key, or the *Rise* key.

Warning: If you don't level off the sub eventually either hits bottom or is crushed by the ocean.

Crash Dive: Tap this key to send your sub downward quickly. To level off tap either *Straight & Level* or *Rise*.

Rise: Tap this key to send your sub upward. This causes a submerged submarine to move upward. To level off, tap either the *Straight & Level* key or the *Dive* key.

Warning: If you don't level off the sub eventually surfaces.

Blow All Tanks: Tap this key to surface at maximum speed. However, you can only do this once in a battle. That's because this command pumps all your pressurized air into the ballast tanks (pushing out the water that keeps you submerged). After giving this command you cannot stop your rise. You *will* surface, regardless of subsequent commands.

Useful Note: This is the *only* way to surface if your diving planes are completely wrecked.

Straight & Level: Tap this key to "level off" your submarine at its current depth. It also stops any starboard or port turns at the same time.

Periscope Depth: Tap this key to send your boat to periscope depth. If you're surfaced, the boat will dive to 55', then level out. If you're underwater, the boat will rise or dive until it reaches periscope depth of 55', then level out.

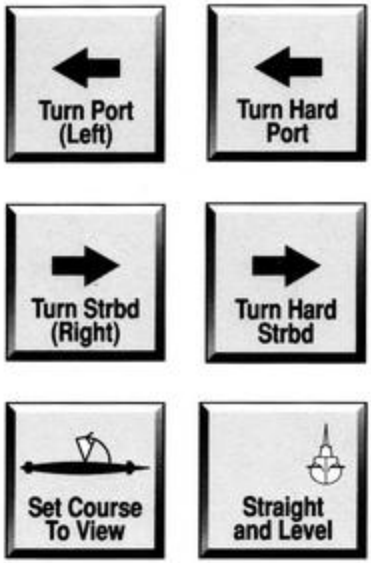
Note that unlike all other depth controls, this one automatically levels you once you reach the desired depth.

Maximum Depth: The "test depth" of your submarine is the maximum safe operating depth. This is the depth to which your submarine was tested.

In reality, many submarines went deeper than their test depth — sometimes as much as 50% deeper. However, the deeper you go below test depth, the greater the chance of damage. If you're going below test, watch your damage control carefully. You can suffer bulkhead damage if you go too deep, or even discover the entire boat collapsing inward, killing both you and your crew.

Once your bulkheads are damaged (by going too deep, or by enemy depth charges) your test depth is *cut in half.* If your test depth was normally 300', with damaged bulkheads your new test depth is 150'. If you go below that, you may suffer further damage, or be sunk.

The Con - Heading (Course) Controls



The "Con" also allows you to control the heading (course) of your submarine.

Turn Port (Left): Tap this key to start your sub turning left. The boat continues turning until you issue the order to stop. To stop turning tap either *Turn Starboard (Right), Turn Hard Starboard,* or *Straight & Level.*

Turn Hard Port (Left Fast): Tap this key to turn your sub hard left. This puts the sub into the tightest possible turn. To stop turning you can tap either *Turn Starboard (Right), Turn Hard Starboard,* or *Straight & Level.*

Turn Starboard (RIght): Tap this key to start your sub turning right. The boat continues turning until you issue the order to stop. To stop turning tap either *Turn Port (Left), Turn Hard Port,* or *Straight & Level.*

Turn Hard Starboard (Right Fast): Tap this key to turn your sub hard right. This puts the sub into the tightest possible turn. To stop turning you can tap either *Turn Port (Left), Turn Hard Port,* or *Straight & Level.*

Set Course to View: This key turns your boat until its course matches your current view (bearing). It's a fast and convenient way to order the boat to turn onto a heading.

Straight & Level: This key stops all turns and "straightens out" your course. It also stops any diving or rising, so your submarine will cruise at the current depth.

The Engines - Speed Control

These control the speed of your submarine. You have four engines. The number of engines "on line" determines your current speed. You select this with the engine keys. The exact speed, in knots, depends on the type (class) of submarine.

Diesel & Electric Power: On the surface your submarine uses diesel engines, powered by oil from the oil tanks. You sub has enough oil for 35, 50 or 60 days of cruising, depending on class. You consume oil about four times faster in battle, since the engines are not run as economically.

In war patrols you should keep a careful eye on your oil consumption and remaining fuel (see pages 39 and 86).

Submerged, your submarine uses batteries to power electric engines. This is because diesels running in a submerged sub exhaust all the air within a few minutes, which kills the crew by asphyxiation.

The electric engines use batteries that gradually run down. The batteries last a couple of hours at top speed, and over a day if you're stationary. The batteries are recharged by running the diesel engines when you're back on the surface. Diesels not used to move the sub are used instead to recharge the batteries.

Ahead Flank (4 engines): This is your maximum forward speed. Submerged it uses up your battery power very quickly. On the surface, all engines are used to drive the submarine, so the batteries cannot be recharged.

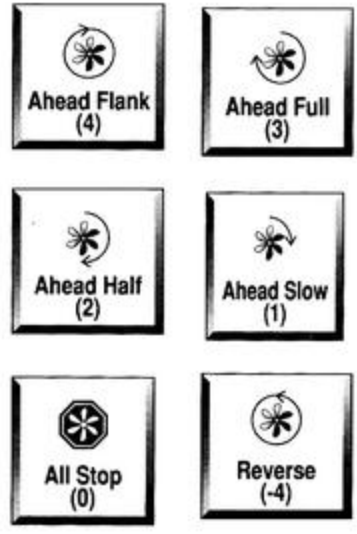
Ahead Full (3 engines): This is a fast forward speed. Submerged, it uses up batteries rather quickly. On the surface, three engines drive the submarine, while only one recharges the batteries.

Ahead Half (2 engines): This is a moderate forward speed. Submerged, it uses up batteries at a moderate rate. On the surface, two engines drive the submarine and two recharge the batteries.

Ahead Slow (1 engine): This is your slowest forward speed. Submerged, it uses up batteries very slowly. On the surface, one engine drives the boat while three recharge batteries.

All Stop (0 engines): Your submarine stops in place. Submerged your batteries are hardly reduced at all (only minor electrical systems draw current). On the surface, all diesel engines are used to recharge the batteries.

Reverse (-4 engines): Your submarine moves backwards at a slow speed. Unfortunately, due to gearing limitations all engines must be used. Therefore, your batteries are reduced quickly, and on the surface all diesel engines are used for reverse movement. However, submarines rarely move in reverse except for short periods.



Firing Torpedoes

Torpedo Firing Techniques

Torpedoes are your main weapon. They can be fired either at a "marked" target, or using a "manual plot". Most captains prefer to use the easier "marked" technique.

"Marked" Target Firing Procedure: This technique is the easiest and most straightforward method of firing. It uses your boat's TDC (Torpedo Data Computer) to correctly set your torpedoes. You just line up a target in your

periscope or TBT, turn on the TDC, and fire.

First you go to the Periscope or Bridge TBT view and rotate (using *View Left* and *View Right*) until you find a target. When the vessel is centered in your view, the aiming scale brightens and the Info Panel displays target information (range, course and speed). This means the target is "marked".

Quickly, while the target is still "marked", tap the *TDC On/Off* key to turn on your TDC. This causes the periscope or TBT to follow the target automatically while the Info Panel updates the target data and torpedo firing solution continually. The Info Panel TDC Light shows that the TDC is running. In addition, the torpedo aiming pointer appears on the periscope or TBT crosshairs.

When the range and firing position seem good to you (as Captain), tap *Fire Torpedo*.

To fire a "spread" of torpedoes, use the *View Left* and *View Right* keys to move the torpedo aiming pointer left and right of center. This sets the torpedo path slightly left or right of center, creating a "spread." You must do this while the TDC is on. This technique doesn't work if the TDC is off.

To switch targets, turn off the TDC by pressing *TDC On/Off* again. Rotate your view, "mark" another target, and turn on the TDC once more.

After firing, you'll see on the Charts view the torpedo timer counting down. The TDC light beside the timer will be on if the torpedo was fired under TDC control. The timer is counting down to the anticipated contact with the target.

"Manual Plot" Firing Procedure: In this technique you compute firing angles yourself. This technique does not use the TDC. Make sure the TDC is *not* running (the TDC Light is off on the Info Panel) before using manual firing.

This method is easiest to plan from the Charts. You decide what angle to fire a torpedo so it intercepts the enemy ship's course. To do this, you'll need to estimate how quickly the torpedo travels in relation to how fast the target is moving, and then fire at the appropriate instant. For a detailed description of how to plan a manual shot, see pages 69-72.

In manual plotting, the torpedo fires in your view direction (bearing). The crew selects bow or stern tubes, whichever is closer to your view bearing. If the tubes are empty, the crew reports this fact and doesn't shoot. You must either change your heading or bearing to use the other tubes.

Firing Ranges: Minimum torpedo range is 300 yards. A good firing range is 600 to 1,200 yards, depending on torpedo model and situation. At ranges over 2,000 yards torpedoes are unlikely to hit a moving target. Maximum range is 3,500 to 9,000 yards, depending on the torpedo model. See pages 114-115 for detailed information on all torpedoes.

Firing Position: Normally the ideal firing position is straight into the side of a ship. Firing at an angle toward the broadside is the next best (and gives early Mark 14s a better chance of exploding). Shooting at the bow of an oncoming ship is tricky because the target area is quite narrow. Shooting at the stern of a ship is the worst possible shot, since the torpedo must overtake its target.

Early versions of the Mark 14 sometimes exploded prematurely. This was generally caused by the defective magnetic exploder. Depending on the submarine command, this defect is identified and fixed sometime in 1943.

Torpedo Firing Controls

Marking a Target: You do this by centering the target in your Periscope or TBT. The target is "marked" when the aiming scale is lighted and target data appears in the Info Panel.

TDC On/Off: This toggles the TDC (Torpedo Data Computer) on and off. The TDC can be "turned on" only from the Periscope or Bridge TBT view. Furthermore, you must have a target "marked" or else the TDC won't start. A target is "marked" when the aiming scale brightens and the info panel begins displaying target data.

You can adjust your view while the TDC is running. This moves the torpedo aiming pointer left or right, causing the TDC to aim the torpedo left or right of the target. If you move the view so far that the target is no longer visible the TDC automatically turns off.

You can manually turn off the TDC by tapping *TDC On/Off* again.

To switch to a new target, turn off the TDC, "mark" a new target, then turn on the TDC once more.

Change Torpedo Speed: Normally your torpedoes are set for the fastest possible speed. In all normal firing circumstances this is the correct choice. However, the Mark 14 torpedo has a slower speed that gives it much more range than the 4,500 yards at high speed. If you think the torpedo needs to travel further, tap this key to set the torpedoes to low speed (31.5 kts) and 9,000 yards range.

This key has no effect on Mark 10 and Mark 18 torpedoes, which only have one speed.

Aim Torpedoes: You must have the TDC On (see above) to aim torpedoes. Use the *View Left* and *View Right* keys to move torpedo aiming pointer left or right of the target.

Fire Torpedo: This fires a loaded torpedo tube. Bow tubes are used for firing at targets in the 180° arc ahead of the boat, stern tubes for targets in the 180° arc behind the boat. If all tubes in the appropriate direction are empty and/or reloading, you cannot fire in that direction.

If you fire while the TDC is running (Info Panel TDC Light is "on"), the TDC (Torpedo Data Computer) automatically computes the correct course for the torpedo. After the torpedo leaves the tube it turns onto course and heads for a pre-calculated interception point with the target.

On the Charts view you'll see a timer for that torpedo counting down to the predicted interception time. The TDC light beside the timer will be on, indicating the torpedo was fired under TDC control.

If you fire when the TDC is off (Info Panel TDC Light is "off"), the torpedo fires straight out of the bow or stern. It continues straight ahead until it runs out of fuel or hits a target. The bow tubes fire if your current view bearing is closer to the bow than the stern. The stern tubes fire if your current view bearing is closer to the stern than the bow.

On the Charts view you'll see a timer for the torpedo counting down to the predicted time when the torpedo's fuel is exhausted. The TDC light beside the timer will be off, indicating the torpedo was fired under manual control.

Deck Gun Controls

Your deck gun is secondary armament. Its shells are nowhere near as powerful as your torpedoes. More importantly, you must surface to use the deck gun, which exposes your sub to hostile gunfire. Any warship larger than a patrol boat (PC) has better gun armament. Therefore, most submariners only use their deck gun to "polish off" damaged merchantmen, or if they're extremely desperate.

Deck Gun Firing Techniques

You can fire your deck gun whenever the submarine is on the surface. You should use the TBT view when firing, since the gun controls are visible there. To fire the deck gun, aim at the target until it is "marked", turn on the

TDC, adjust the gun elevation, then fire. On subsequent shots you simply adjust the elevation if necessary and fire again.

Maximum Range of your deck gun is 4,000 yards. This limit is due to the submarine's gun-mounting and sights; the size of the gun has no effect on maximum range.

Unmarked Targets cannot be hit by your deck gun. The target must be marked and tracked by the TDC before you can fire. This represents the gun crew ranging and following the target.

Marked Targets: A target is "marked" when the aiming scale is highlighted and target data appears in the Info Panel.

TDC & Gunfire: You must use your TDC to continually track a "marked" target. When the target is "marked", tap *TDC On/Off*. This automatically keeps you aimed at the target. Your gun crew elevates the gun to the current range of the target (as shown in "Target Range" on the Info Panel). To stop tracking, just turn off the TDC by tapping *TDC On/Off* again.

Adjusting Fire: Your gun crew aims at the target's location, taking into account whether it's moving left or right across your view. However, the crew does *not* adjust for the target's motion toward or away from you.

If you feel the enemy is moving toward you, depress the gun one or more degrees (-1° or more). If the enemy is moving away, elevate the gun one or more degrees more (+1° or more). The faster the enemy is closing or opening the range, the more depression or elevation you need.

Note that if a target is closing fast, even though you depress the gun a large amount, you may find shots still landing behind the target (because of his high speed). Conversely, if a target is fleeing fast, your shots frequently land behind him until you apply sufficient elevation.

Marking a Target: Center the target in your TBT. The target is "marked" when the crosshairs are lighted and target data appears in the Info Panel.

TDC On/Off: This toggles the TDC on and off. You must have a target "marked" in the TBT view to turn on the TDC.

While the TDC is running your view and the deck gun crew's aim rotates to follow the target. Furthermore, the gun crew automatically elevates the gun to hit at the current range (shown on the Info Panel). The crew does not take into account range changes. You must estimate how fast the range is

Deck Gun Firing Controls

changing, and make the appropriate adjustment to elevation/depression. Although the torpedo aiming pointer is present to adjust left/right aim, you don't need it with the deck gun (the gun crew automatically rotates to track the target).

You can manually turn off the TDC by tapping *TDC On/Off* a second time.

To switch to a new target, turn off the TDC, "mark" a new target, then turn on the TDC once more.

Gun Down (-)1°: Each tap of this key depresses (lowers) the gun barrel by 1°. This decreases the distance travelled by the shell.

When firing at a marked target, the barrel is lowered in relation to the crew's normal firing angle. You lower the gun only if you're firing at a "marked" target that's moving toward you.

Gun Up (+)1°: Each tap of this key elevates (raises) the gun barrel by 1°. This increases the distance travelled by the shell.

When firing at a marked target, the barrel is raised in relation to the crew's normal firing angle. You raise the gun only if you're firing at a "marked" target that's moving away from you.

Fire Deck Gun: This fires one shell at the enemy (on Narwhal class subs it fires a broadside of both guns in close succession). The gun only fires if a target is "marked" and/or the TDC is on and following a target.

The shell fires at the marked target's current position, plus or minus a certain distance depending on the amount of elevation or depression currently set.

If the shell hits, you'll see an explosion on the target ship. If it misses, you'll see a water-spout.

Enemy Gunfire

While you're on the surface, enemy warships or armed merchantmen may fire back at your sub. If water-spouts appear, enemy shells are landing near your boat. Eventually he'll find the range and begin scoring hits, causing damage and eventually sinking you. The only defenses are to (a) damage the enemy so badly his aim or guns are destroyed, or (b) submerge. Once you reach periscope depth (50-55') you're invulnerable to enemy gunfire.

Beware of enemy cruisers and battleships. Their guns are so powerful that one hit could blow your boat right out of the water!

Launching Debris

When you're submerged and under depth charge attack, you may want to deceive enemy into thinking you're dead. One trick is to load your torpedo tubes with various extra items (debris), and launch it. When this floats to the surface, the enemy may think you're sunk.

To attempt this deception, tap the *Launch Debris* key.

You can do this only once per battle, and it may not work.

End This Battle

Tap this key to end a battle. You cannot use this to escape possible attacks — if enemies are still in reasonable proximity, you cannot end the battle. In this case, sail away from the enemy as quickly as you feel prudent, then try again.

Computer Controls

This special set of controls adjusts the operation of your computer. These controls may vary with specific systems; see your Technical Supplement for details.

Pause

This pauses (freezes) the action. Press any key again to resume the game action.

Animation On/Off

This toggles on and off the graphic animations of torpedo firing and depth charge attacks. Turning off the animation helps speed up the game on smaller or slower computers. It also reduces the amount of RAM needed to run the game.

"Boss" Hide Game

This temporarily hides the game behind the blank screen. The computer is inoperative until you hit the *"Boss" Hide Game* key again. Use this feature when your work or home boss approaches, then complain that you're trying to figure out why the computer isn't working!

Save Game

This saves the current game to disk, including both the current situation and any war career or war patrol information. You can select which "save game" file to use. If you reuse a file, you'll overwrite the game previously saved there. On floppy disk systems you may need a formatted disk for the saved game files.

Restart Game

This ends the current game and sends you back to the very start, but without reloading lots of files from disk.

Warning: The game is NOT saved when you do this. If you want to save the game, make sure you do that before hitting *Restart Game*.

Joystick Adjust

This readjusts your joystick. Use it if the boat or view seems to "wander" left or right, as if the joystick was in use (even though it isn't).

Volume Adjust

This adjusts the sound effects in your game. It's a multi-position switch. Each tap of the key changes you to the next lower level. After the lowest you cycle to the highest again.

Most systems have four positions: all sounds, all sounds except a few very common ones, critical (only) sounds, and no sound. However, the exact number can vary. See the Technical Supplement for details.

Quit Game (to DOS)

This immediately quits the game and returns you to the operating system (DOS on IBM-compatible systems).

Warning: The game is NOT saved when you do this. If you want to save the game, make sure you do that before hitting *Quit Game*.

Aftermath of Battle

Replay

At the end of each battle, you have the option to view a "replay". This is an exact reproduction of what happened, instant by instant, view by view.

The exact features and capabilities of the replay vary from one computer system to another, and may vary depending on how you have (or have not) installed the game. See the Technical Supplement for details.

After a Single Battle

After the battle you see a logbook entry listing the ships you engaged and the results. An enemy ship may have escaped your attack, been damaged (and escaped), or been sunk. You receive a point score for damaged as well as sunken ships. You receive tonnage credit only for ships you sank.

Press any key to exit this and see what awards or commendations you received (if any). Press any key again to see the Submariner's Hall of Fame.

After a War Patrol

A war patrol ends whenever you sail into a friendly base. Your performance during the patrol determines your reception at the pier. Then press any key to see what praise (or complaints) you earned on the patrol. Press again to see the Submariner's Hall of Fame.

After a War Career

A war career ends only when Japan surrenders (ending the Pacific war) or if you're killed in action. Japan always surrenders on the historical date in August, 1945. Your career then ends with a final return to port. As in a normal war patrol, press any key to see what you earned for the patrol. Press again to see the Submariner's Hall of Fame.

Scoring

Tonnage: During WWII, the US Navy used tonnage sunk as a method of measuring success in the submarine force. The most successful captain was the one who sank the most tonnage. Merchant and military tonnage are rated equally. Note that this rating does *not* take into account enemies damaged but not sunk, or the difficulty of achieving those sinkings.

Point Score: As in most MicroProse simulations, *Silent Service II* has a complex formula for scoring your performance. You receive a "point value" for each enemy ship damaged or sunk.

The value of ASW(anti-submarine warfare) vessels is based on their capabilities. The more powerful the ship, the more it is worth. Therefore DDs and DDAAs are worth more than DEs, who in turn are worth more than PCs.

The value of *damaging* other ships depends on their intrinsic strength (a strong battleship is worth more than a small cargo ship). In addition, if you sink the ship, you get a bonus based on the target's value. Target value is determined by the strength of the ships guarding it. A well-guarded target is obviously important, and therefore is quite valuable if sunk. A poorly guarded target is less important, and therefore earns a smaller bonus if sunk. A large, well-protected troop transport could be worth as much as a cruiser, or even an old, unguarded battleship!

Your point score is adjusted based on the difficulty level selected, the class of boat you command, and if you have historical or flawless torpedoes.

Point scores are most useful for evaluating war patrols or a war career. A higher total score for either indicates better abilities as a submarine captain. Scores are also given for individual battles, but these are small compared to what's possible in a war patrol or war career.

The Submariner's Hall of Fame

The Hall of Fame lists your top scores. The Hall of Fame also lists various real captains and their tonnage score for historical interest. See the instructions on the screen for how to clear the Hall of Fame.

Promotions, Medals and Citations

Promotion: It was US Navy policy to assign command of a submarine to either a Lieutenant Commander (Lt.Cmdr) or a Commander (Cmdr). Officers of lower rank served in junior (non-skipper) positions on a submarine. Officers of a higher rank (Captain or above) no longer commanded a boat in combat; instead they received a staff, command or similar job ashore.

You begin the game as a Lieutenant Commander. If your record after a series of patrols is good, whenever you finish an especially successful patrol you may be promoted to Commander. This is the only promotion you can earn during the war. However, if you selected a high difficulty level and survive an entire war career (starting December 7, 1941), you are promoted to Captain (at advanced difficulty) or Rear Admiral (at ultimate difficulty) at the war's end.

Medals for Valor: You receive these based on your score for a single war patrol. Each war patrol is a new opportunity to gain medals, regardless of your past record (just as it was in the real war). The most difficult to achieve is the Medal of Honor, the least difficult the Bronze Star for Valor.

In reality, many of these medals (especially the Navy Cross and Silver Star) were awarded for tonnage sunk in a single patrol. However, the Navy

Submariner Ranks

- Lieutenant Commander
- Commander
- Captain*
- Rear Admiral*

*cannot skipper a boat

Combat Medals

- Medal of Honor (MH)
- Navy Cross (NC)
- Silver Star (SS)
- Bronze Star for Valor (BSV)

Other Awards

- Presidential Unit Citation (PUC)
- Navy Unit Commendation (NUC)
- Asiatic-Pacific Campaign Medal (AP)

made exceptions, based on various extenuating circumstances. Therefore, the fairest method is to use scores rather than tonnage.

Unit Citations: These are awarded to especially deserving vessels. To achieve a unit citation, your submarine must have an outstanding overall record, and in addition must have just finished an oustanding war patrol. As a result, unit citations are more difficult to get than any medal (except perhaps the Medal of Honor).

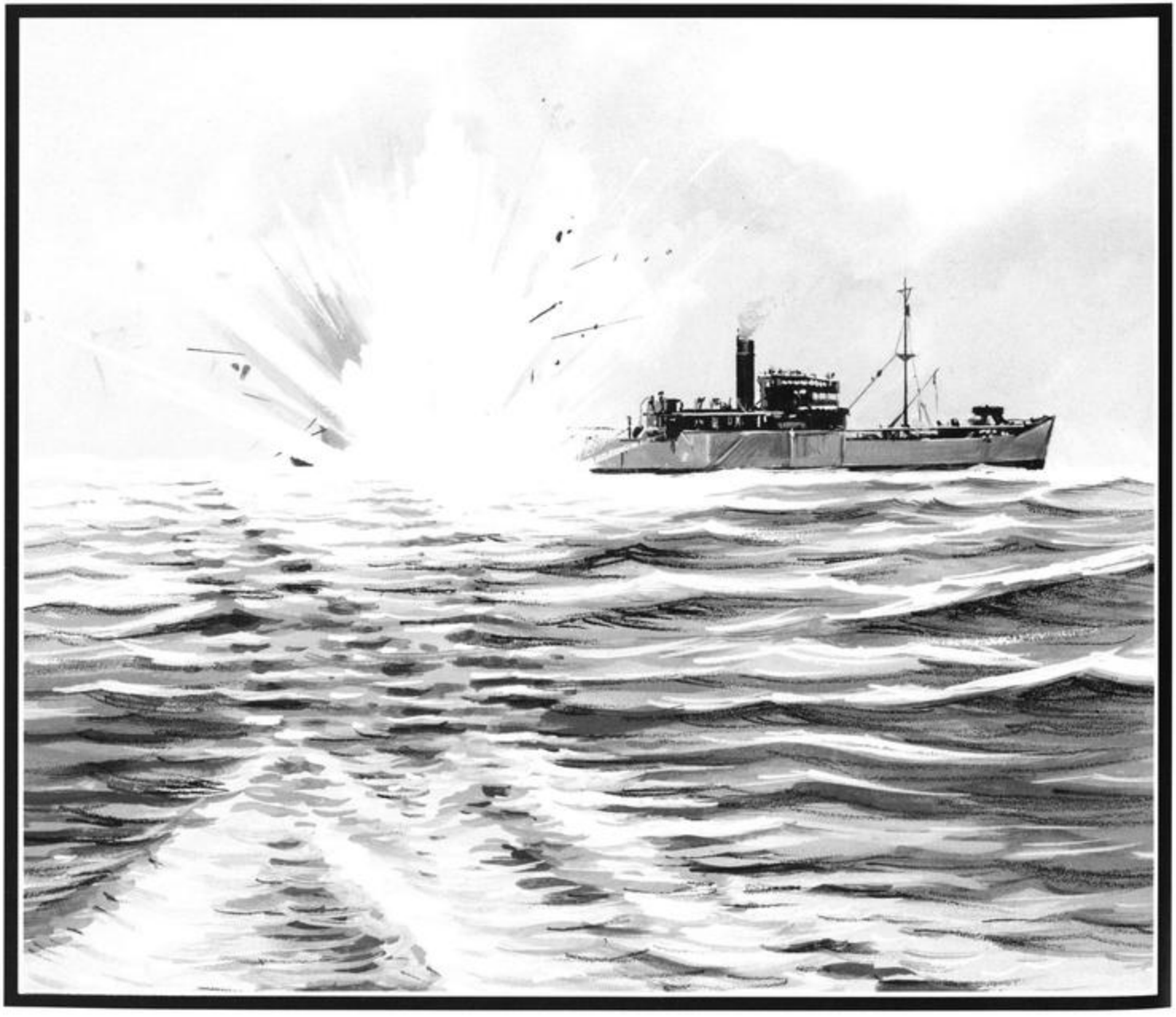
The *Presidential Unit Citation (PU`C)* is the most difficult to achieve. It means the President of the United States is personally aware of your accomplishments.

The *Navy Unit Commendation (NUC)* is slightly less difficult to achieve. It means that even if the President didn't notice your efforts, the Navy certainly did!

Asiatic-Pacific Campaign Medal (AP): This is awarded to skippers who survive a war career that began on December 7th, 1941 — in other words, survive the entire war.

In reality this medal was awarded to those who survived the war, regardless of starting date. The 12-7-41 start requirement lends special value to this medal in *Silent Service II.*

Also note that those skippers who selected "advanced" or "ultimate" difficulty will receive a final promotion to Captain or Rear Admiral after receiving this medal.



3 TACTICS AND STRATEGY

Battle Tactics

Basic Concepts

A submarine's main weapon is the torpedo. Torpedoes deliver powerful explosives into the enemy's hull below the waterline. The explosion occurs beneath the armor, often in the vitals of the ship, and is followed by massive flooding. Torpedoes can sink the largest warships, including battleships and aircraft carriers. It's the great equalizer that makes submarines so effective.

The other strength of a WWII submarine is stealth. It can sneak into enemy waters and strike from hiding. Submarines can travel into areas too dangerous for any surface warship. Unlike surface ships, submerged submarines can escape air and surface attack. Even enemy sonar cannot detect them except at very close range. Almost always, the first warning of a submarine's presence is a torpedo wake or torpedo explosion.

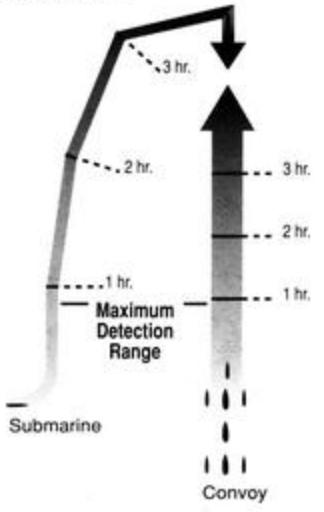
A submarine's invisibility isn't restricted to submerged operations. Even on the surface a submarine is hard to see. The nearly-awash hull is nothing more than a shadow to distant ships. The conning tower is small; when seen bow- or stern-on, it looks like a dark line. Submarines invariably see their targets before they're spotted. This allows the sub to "stalk" the targets, especially if they are slower merchantmen.

A submarine's invisibility is especially powerful at night. Often merchant ships can't spot surfaced subs until they're inside torpedo range. This allows subs to cruise in, attack, and escape on the surface, all without being spotted.

The Contact

Evaluating the Contact: Most contacts are at long range, with either radar (if available) or eyesight. As skipper your first task is to "develop" the situation. First, determine the enemy's course and range. If you're within visual range, use the TBT or Periscope to "mark" targets and note their course, speed and range. If you have radar and the enemy is distant, make

End Around



Initially the submarine spots a northbound convoy. To make an "end around", the sub turns parallel to the convoy and moves northward on the surface.

As the submarine pulls ahead of the convoy, it begins to curve inward, keeping the enemy in sight. Eventually the sub moves far enough ahead that it turns east and moves to a position in front of the oncoming convoy. As the enemy approaches, the sub submerges and prepares a torpedo attack.

Throughout the sub keeps the convoy at the edge of visibility, and/or makes periodic radar sweeps. Since subs are harder to see, this is possible without detection

sure you're at radar depth (25') or less, since radar "sees" further than human eyesight.

Don't be surprised if your contacts seem to appear and disappear. If the enemy turns his bow or stern toward your boat, he's much harder to see both on radar and with eyesight. By knowing this you can guess what direction he's turned toward.

Sometimes you'll be surprised by a very close encounter. This is especially common at night if you're without radar. As in real life, you could find yourself *inside* an enemy convoy or task force!

Situations: The best possible situation is when you're already within the enemy's formation, or directly in their path. In either case, you need only position yourself for good torpedo shots and open fire.

Unfortunately, often you're thousands of yards away from the enemy's course! Here you must plan an intercept that places you ahead of them.

Sometimes all you see is enemy anti-submarine ships (destroyers and patrol boats). They could be guardians of a larger, more distant target. Alternatively, they could be just an ASW patrol. Only a very brave (or very foolhardy) captain tangles with ASW patrols. Unless you spot a good target soon, you're advised to avoid them.

Interceptions & Chases: When pursuing an enemy, remember that he's moving too. Heading toward his current position only results in your sub arriving at where he *was*, not where he's *going*. Unless he's already headed away from you at high speed, avoid a "stern chase". You're more likely to be spotted and need to get much closer for a good torpedo shot.

The standard maneuver to achieve a good firing position is the "End Around" (see box). The sub swings around the convoy on the surface at maximum speed, positions itself ahead of the target, submerges, and lies in wait. This allows the sub to maneuver into a perfect firing position as the enemy ships sail past it. If the sub doesn't sink everyone, it can sneak away, do another end around, and attack again.

Intercepting enemy warships is a greater challenge. Task forces with cruisers, battleships, and/or aircraft carriers travel faster (21-27 knots) than a sub. The sub has one chance to intercept these targets, and one chance to fire. Afterward escorting destroyers "work over" the sub, allowing the warships to escape (assuming they're not too heavily damaged).

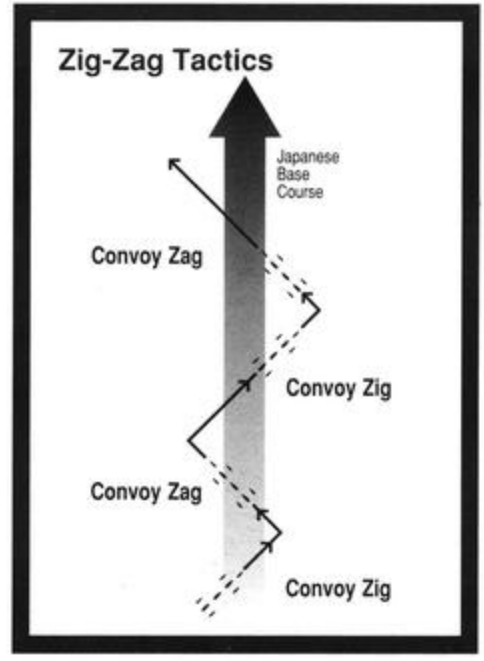
Coping with Zig-Zags: The Japanese often use zig-zag tactics. The probability of zig-zags increases with difficulty level.

A ship or group that zig-zags almost never sails along its "real" course (the "base course"). Instead it sails somewhat to the right, then somewhat to the left. The right and left turns are at irregular times to further confuse the enemy.

The best way to guess whether the enemy is zig-zagging is to consider where he might be going. If his current course isn't aimed at any port, base, or common shipping lane, then he may be on a "zig" or a "zag". If he makes a sudden, large turn then he's almost certainly zig-zagging.

If you suspect zig-zag tactics, try to determine the enemy's base course. A zig-zagging enemy must cross and recross the base course. You can be sure of intercepting them at those points.

Surviving an Ambush: Sometimes a contact begins as an ambush. The enemy has already spotted your sub: destroyers, destroyer escorts, and/or patrol craft are headed straight at you! The standard tactic is to evade and escape, normally by going deep and moving away slowly. A few brave skippers fired torpedoes "down the throat" at the approaching enemy. However, these shots are difficult. Furthermore, failure means the enemy is quite likely to score a damaging ram or depth charge attack.



Visibility and Tactics

Concealment is a submarine's best tactical tool. It's important to know what tends to hide your boat and what tends to reveal it.

Speed: On the surface, the faster you travel, the bigger your foaming wake. The wake often gives away your position first. When maneuvering to attack the enemy, travel at the minimum possible speed to accomplish your purpose. If you must make a dash, do it at the last moment, to avoid giving yourself away early.

Submerged, the faster you travel, the more noise you make and the greater the effective range of enemy listening equipment. When lying in ambush you may find it effective to stop all engines. When trying to escape depth charge attacks, sneaking away at low speed is often more effective than trying to dash away.

Silhouette: A submarine is easier to spot if you present your broadside to the enemy. If just the bow or stern is facing the enemy (end-on), the sub is much harder to see: the hull and conning tower are long, but not wide. This

is true of radar and sonar as well as eyesight. A good skipper tries to face toward or away from the enemy as much as possible.

Depth & Visibility: A submarine is most visible when surfaced.

A submarine at "radar depth" (25') has the hull and conning tower submerged but the mass of masts (including the radar set) are above water. The sub is harder to spot than a surfaced boat, and yet has both radar and periscope available for use. The main drawback is that the boat must use its slower electric engines.

A submarine at periscope depth (50-55') is even less visible. With the periscope down it's invisible to all detection except sonar. If the scope is up, the sea state and sub speed determine visibility. The calmer the sea and the faster the sub, the more visible the periscope.

As a submarine dives deeper, it eventually drops below a temperature "layer" into colder water. Sonar waves don't penetrate the "layer" very well, reducing detection range even more.

Radar: If your sub has radar, you have a significant tactical advantage. A submarine using radar can track the enemy beyond normal eyesight. This is especially true in 1942 and 1943, before the Japanese developed radar receivers and their own radar sets.

Radar is most useful at night or in bad weather. While these conditions greatly reduce human eyesight, they don't affect radar. As a result, the sub can see *much* further.

Radar spots different ships at different ranges. The larger the ship, the further away radar "sees" it. Submarines are very small. They don't register on radar until fairly short ranges (4,000 to 5,000 yards).

Eyesight: If your sub lacks radar, tactics are more complex. Since your sub is less visible than a ship, you'll probably see the enemy before he sees you. However, you must remain at the "edge" of visibility. If you venture too close, he'll spot you.

The usual technique is an "end around" while remaining at the visibility limit, then submerge and attack.

Night visibility range is usually quite short. A submarine can "stalk" a convoy on the surface, looking for gaps in the escort screen where it can streak in unobserved, fire torpedoes into the merchantmen, and streak out. Again, unless you have radar, it's best to stay at the edge of visibility to minimize the chance of the enemy spotting your sub.

In both cases roving enemy escorts cause problems. They often make sweeps around their charges, forcing you to submerge briefly, then surface when they move away.

Another problem is facing. Remember that if the enemy turns their bow or stern toward your boat, your ability to see them is reduced, both with eyesight and radar. If you keep your broadside toward them, they may just see you before you see them! This is mostly a problem in ambush situations. In an "end around" you are usually either running parallel to their course, or showing the enemy your bow or stern.

Sonar: If your sub is submerged, unless you're at radar depth or using a periscope, you must use listening hydrophones and sonar to detect enemy ships. Maximum range is a few thousand yards. Therefore, don't be surprised when all but the closest targets are likely to disappear. However, your sonar detection range is better than the enemy's in most all situations.The sole exception again is when your broadside faces the enemy bow or stern.

One special limitation of sonar is "the baffles". If your sub is moving quickly, the disturbed water astern blinds your sonar. Enemies directly behind your sub may "disappear" from your charts.

Japanese Capabilities: Japanese warships are invariably better at spotting submarines than merchant ships. Warships have a larger and better disciplined crew, including lookouts in all directions. Merchant ships have fewer lookouts, and often forget to look astern.

In 1943 the Japanese began using radar, and by 1944 it was fairly common. However, their radar sets were much inferior to the US model, with a much shorter range.

The Japanese also had radar receivers, which detected American radar emissions. However, they were extremely unreliable. After chasing innumerable "bad contacts" the Japanese lost faith in this device, especially since American subs tended to switch their radar on and off. The most successful sub skippers used their radar fully despite radar receivers.Therefore, it is always available in *Silent Service II*.

See Evading ASW Attacks (below, page 75) for information about Japanese sonar.

The Setup

The biggest problem for a submarine skipper is achieving a good firing position, or "setup".

Ideal torpedo firing range is 800 to 1200 yards for Mark 14 and 18-2 torpedoes, about 600 to 1000 for Mark 10 or 18-1 (because they're slower).

Maximum effective torpedo range is about 2000 yards against a ship moving 10 knots or faster. If the target is stationary, you can fire up to the maximum range of the torpedo (3500 to 9000 yards, depending on the torpedo model).

The Mark 14 has two range settings. However, the shorter range is 4,500 yards - more than enough for any decent shot. The long range setting gives you 9,000 yards range, but the torpedo travels much too slowly (31.5 knots). The long range setting is used primarily for desperate shots.

The Mark 10s and 14s are steam torpedoes. Their bubbling wake is easy to spot. This gives the target time to maneuver before the torpedo hits. Most ships can outmaneuver a single torpedo. However, a "spread" of torpedoes running side by side is much harder to avoid.

Mark 18 torpedoes are electric. Their wake isn't as obvious, giving the target much less time to maneuver. Unfortunately, the Mark 18-1 is so slow (27 knots) that the advantage is moot. The Mark 18-2 is fast enough (40 knots) to be a potent weapon.

Arming Distance: Torpedoes are set to "arm" their warheads after 300 yards. Unarmed torpedoes are harmless. Some dent a hull and bounce off, others penetrate the hull and jam themselves into their own hole, causing trivial leaks.

In addition, the torpedo arming device is only generally reliable. The safe distance could be a little more or a little less. Wise skippers added a bit of "Kentucky windage" and didn't fire unless the torpedo would travel at least 400 yards to target.

Broadside Shots: The ideal torpedo shot is into the side of a ship moving perpendicular to the torpedo's path (see illustration). Note that the sub must fire a bit before the ship is right in front of him. Also note that the sub is better off facing in the direction of fire. Otherwise the torpedoes must curve around before running toward the target. This makes the torpedo run longer, increasing the chance they'll be seen, as well as making it easier for the target ship to evade.

Until late in 1943 Mark 14s had contact exploder faults that caused many broadside hits to "dud" (not explode). The early Mark 14s were more likely to explode on a glancing hit. In *Silent Service II* this problem occurs only if you select "historical torpedoes".

Bow Shots: Shooting at a ship's bow ("down the throat") is more difficult. Ships are narrow, so the chance of a miss is much greater. Furthermore, the firer must shoot faster. Remember that the torpedo and target will move toward each other, so the torpedo might not arm itself before it hits the target.

The "down the throat" shot commonly occurs when an escorting warship spots the submarine and heads straight for it. The submarine is now looking at the warship's oncoming bow. Do you dive and try to hide, or wait and shoot torpedoes? The problem is that after shooting a sub is still at a fairly shallow depth, which increases your chance of suffering damage.

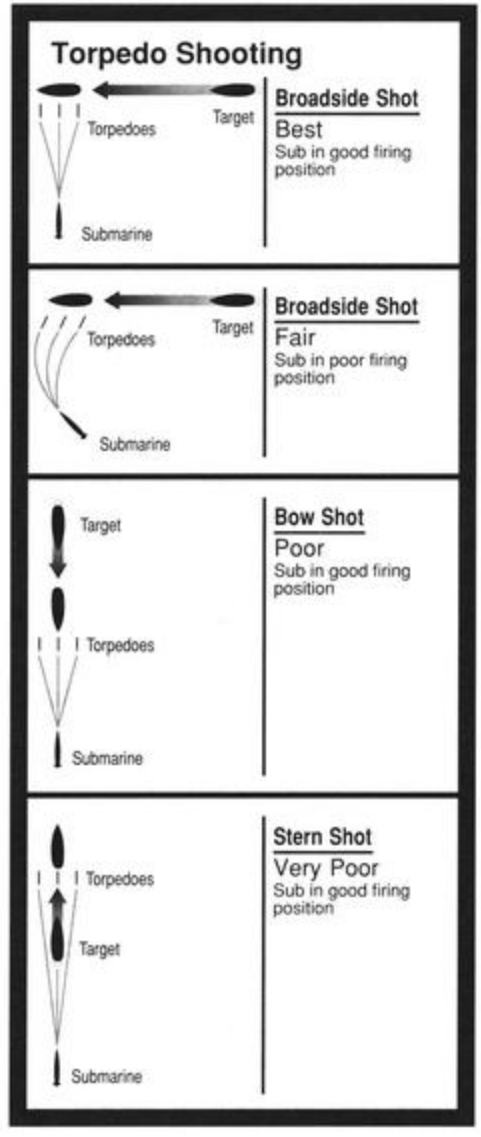
Stern Shots: Shooting at a ship's stern is the worst possible setup. The target is just as narrow as in a bow shot. Worse, the target is moving away, so the torpedo must catch up. As a result the torpedo "closes" on the target more slowly. This gives the target more time to see and react to the torpedo.

One small, mitigating factor is that merchant ships usually keep very poor lookout astern. A torpedo attack from the rear is less likely to be noticed. Furthermore, if the merchantman is moving slowly (10 knots or less), a fast torpedo (a Mark 14 or 18-2) approaches fairly quickly.

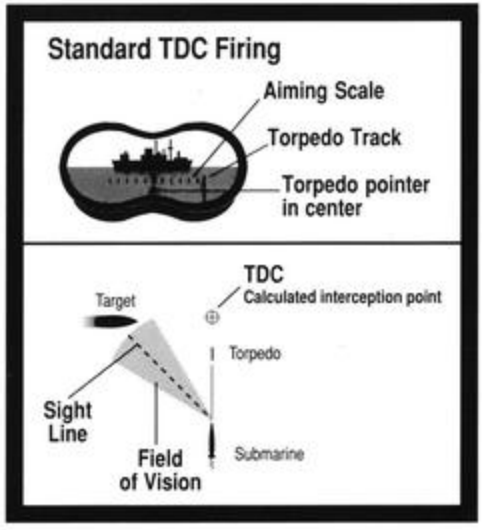
Prematures & Duds: No munition is perfect. All torpedoes sometimes blew up prematurely, or were duds (failed to go off). This occurs in Silent Service II for all "historical" torpedoes.

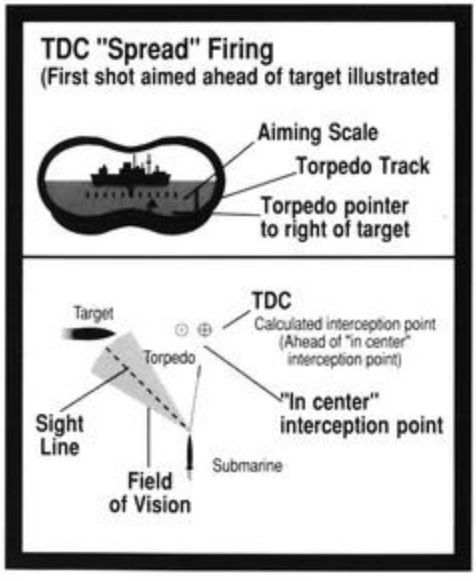
Mark 14 torpedoes had a number of special flaws that made them much less reliable than most. Their contact exploder was faulty. Straight-on broadside hits tended to dud, while torpedoes that hit at glancing angles were more likely to explode correctly. In late 1943 the exploder was redesigned, making it much more reliable.

The Mark 14 torpedoes also had a magnetic exploder. When armed, this device tended to cause torpedoes to explode prematurely, or to ignore the target and run harmlessly past it. At various points in 1943 the US sub commands finally realized this problem and ordered the magnetic exploders deactivated (which meant the torpedo relied exclusively on the contact exploder).



TDC Torpedo Firing





The TDC: American submarines had an analog "Torpedo Data Computer" (TDC) that calculated a torpedo's correct course. The crew had to input the target's course, speed and range.

When you "turn on" the TDC the crew constantly updates the firing solutions to the computer, so your torpedo is always ready to fire.

The TDC firing solution assumes the target will neither turn nor change speed. Unfortunately, once the enemy spots the torpedo, he usually turns, and frequently increases speed as well.

Spreads: Good captains compensated for target maneuvers by firing a "spread" of three or four torpedoes. When firing at a ship's broadside, the rule of thumb was to space out the "spread" along the length of the ship, with the first torpedo "marked" at the bow and the last torpedo "marked" at the stern. More enterprising commanders visualized in their mind the path of a perfect torpedo, imagined possible enemy maneuvers, then imagined aiming adjustments that would hit those maneuvers.

Aiming TDC Spreads: To aim a TDC spread you first "mark" a target. While still tracking (i.e., the TDC light is still on) use the *View Left* and *View Right* keys to move the torpedo aiming pointer left or right. The TDC uses the current course, speed and range data to set the torpedo, but it fires toward a spot slightly to the right or left of the real target position, depending on the position of the aiming pointer when the torpedo is fired.

Aiming at the bow of a ship helps if the enemy increases speed and/or turns toward you. The tighter the turn and/or higher the speed, the more you must lead the target.

Aiming at the stern of a ship helps if the enemy decreases speed and/or turns away from you. Again, the slower the speed and/or the tighter the turn, the more you must aim behind the target.

When aiming at the bow or stern of a ship, you must fire the spread to either side. The harder the enemy could turn, the wider you should "open out" the spread. Enemy destroyers and patrol boats are the most maneuverable, while large transports and battleships are the least maneuverable.

Remember that when the TDC is on, the *View Left* and *View Right* keys control the aiming pointer only, not the view. You must turn off the TDC to move your view.

Manual Torpedo Fire

In real life some captains fired torpedoes without using the TDC. Instead they used the charts, plotted the prospective course of the enemy ship, and set up the appropriate torpedo intercept course. You can do this too. A ruler, protractor (to measure angles), and scratch paper were the traditional tools used by the "plot crew" in real submarines. With a ruler you'll find that 1" = 1000 yds is a useful scale (that is, 1/2" = 500 yds, 1/4" = 250 yds, 1/8" = 125 yds, and 1/16" = 67.5 yds).

As you'll see, manual computation takes time and work, and is somewhat inaccurate. The TDC solves most of these problems for you. Furthermore, the method below is designed for good setups — firing straight into the broadside of a ship. However, you can use variants of this method to calculate shots at any angle.

Plot: You start by marking your position, a bearing line to the enemy's initial position, and by measuring the range. This gives you the enemy's starting location. Now draw a line from there along the enemy's course.

Firing Range: Next plot a line from your sub to the enemy's course. If you have a triangle, slide it along the enemy's course until the right-angle side intersects with your sub. The line along that side is the torpedo's path from your ship to the target. Measure this line to determine the firing range.

Also measure with a protractor the direction of fire. Turn your sub until it's heading in this direction. This means the torpedoes don't have to turn left or right after they leave your boat.

If the firing range seems too long, move your sub along the line of fire, closing the range.

Firing Bearing: Once you have your firing range and heading, you need to calculate when to fire. You start by computing how long the torpedo takes to run from your sub to the interception point. One knot of speed means movement of 0.555 yards per second. (See the box to the right for speeds of all torpedoes.)

Now calculate how long (in seconds) the torpedo takes to arrive at the interception point. (Divide the total distance by the yds/sec value above.)

Next calculate how far the enemy ship will travel during that same period in time. Do this by multiplying together the enemy's speed in knots *times* the torpedo time in seconds *times* 0.555.

Finally, measure from the interception point *back* along the enemy's course the appropriate distance. When the enemy ship reaches this point, you

US Torpedo Speeds

Mark 10:
- 20 yds/sec @ 36 kts

Mark 14:
- 25.5 yds/sec @ 46 kts; or
- 17.5 yds/sec @ 31.5 kts

Mark 18-1:
- 15 yds/sec @ 27 kts

Mark 18-2:
- 22.2 yds/sec @ 40 kts

should fire your torpedo — so that the enemy ship and the torpedo arrive at the same point at the same time.

Draw a line to this point and use the protractor to determine its bearing. This is the "firing bearing". Rotate your TBT or periscope to this bearing. When the enemy moves close to the center of the view, spin your scope or TBT to the course you pre-calculated for the torpedo and shoot (the torpedo fires along your view bearing).

Mathematical Solutions: If you're familiar with trigonometry, you'll realize that firing range and bearing can be calculated mathematically. Solving the problem with math yields more accurate firing headings and bearings, but unless you're thoroughly familiar with the mathematical principles, you'll probably make a fatal error that invalidates the whole effort. Errors with a ruler and protractor are usually caused by imprecise measurements, and are fairly small.

During WWII the fire control crew on a sub always calculated manual solutions as a "back up" in case of problems with the TDC. They used the ruler and protractor method, rather than pure mathematics.

Example: (See pages 71-72 for illustrations) Your submarine spots an enemy merchantman at bearing 243, 5,000 yards away moving northeast on course 050 at 9 knots. Your submarine has made an end-around and gotten close to his projected course.

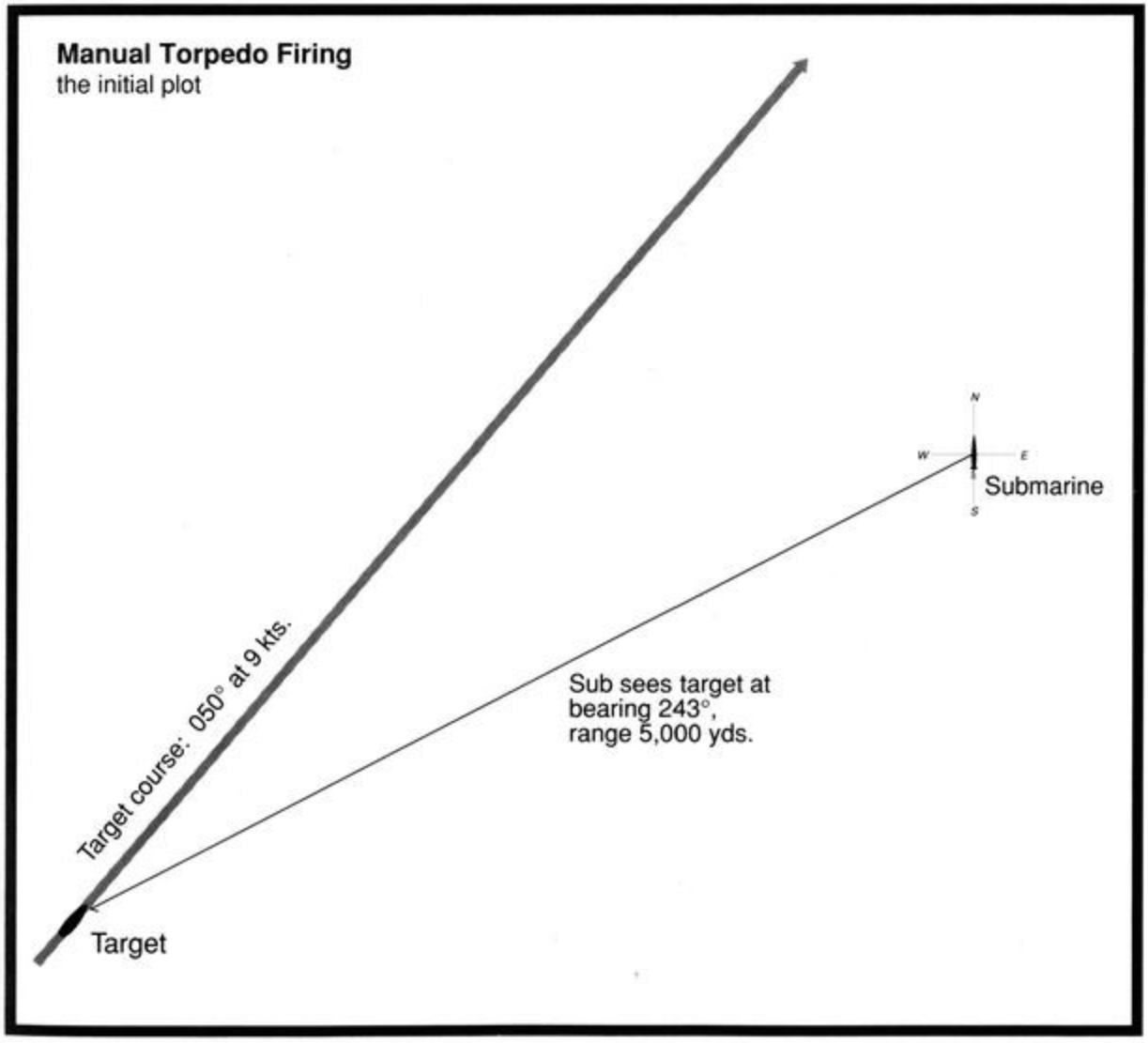
You plot his course and an appropriate torpedo intercept for a broadside hit (see illustration). You discover the torpedo needs to travel about 1,125 yards, which your 46-knot Mark 14 will cover at 25.5 yards per second. Therefore, the torpedo needs 44 seconds to reach the interception point (1125 / 25.5 = 44.1, rounded off to 44 seconds).

Meanwhile, the 9 knot freighter will cover about 220 yds (9 x 44 x 0.555 = 220). Therefore, you back up 220 yards along the freighter's course from the interception point. When he reaches this position, you must shoot.

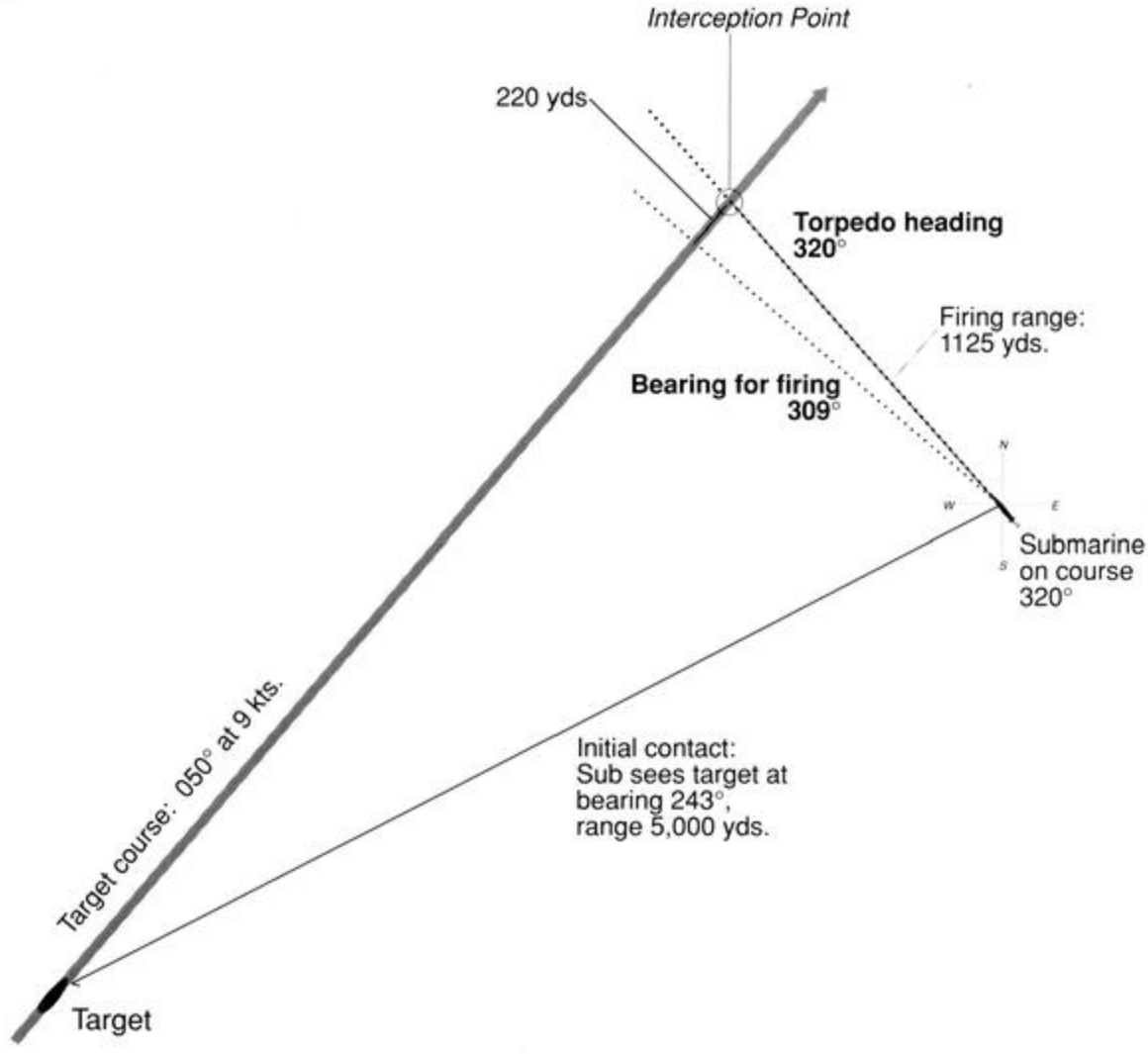
Using your protractor,you'll find that the firing bearing is 309° and the actual torpedo path is 320°.

You rotate the TBT or scope to 309° and wait for the freighter to appear. A second or two before his midships cross the middle of the scope you swing your view to 320° and fire.

To fire a spread, you might shoot at 319°, 320° and 321°. A one-or two-degree spread between torpedoes is fine for a slow ship like this. A faster ship, like a destroyer, might require a wider spread with more torpedoes.



Manual Torpedo Firing
the solution



Whom to Engage: The original purpose of deck guns was to threaten peaceful merchantmen, forcing them to surrender. However, America's "unrestricted" submarine war against Japan dispensed with such niceties. Deck guns are used to finish off targets unworthy of another torpedo. They are also used on targets too small for a torpedo, and as a weapon of last resort by a submarine forced to the surface or without torpedoes.

Most Japanese merchantmen started the war unarmed. Deck guns were added gradually. By 1944 the majority of ships carried them. Those which didn't often built "dummy" guns to discourage surface attacks by submarines and other small craft.

Merchant ships typically have two to four 3" to 5" guns, while most submarines have just one. However, merchant guns are manned by less skillful crews, which means slower and less accurate shooting. If the sub torpedoes the merchant first, the crew is further distracted. However, some merchantmen have exceptional captains and crews. On the surface these ships can fight a submarine to a draw, or possibly win.

Patrol boats normally have one or two 3" to 5" guns. They are very small and lightly built, and thus easily put out of action. Their crews are better than merchantmen, but inferior to major warships. Overall, a patrol boat is at best a match for a submarine, but again, even winning a gun duel can cause serious damage to the sub.

Japanese warships (destroyers and larger) are more powerful than a submarine. Not only is the ship larger, stronger and faster, but the gun turrets are far more stable, with high quality fire control equipment. Destroyer guns have a maximum range of 14,000 to 20,000 yards, although effective range is under 10,000.

Cruisers and battleships grossly outgun a submarine. One shell from their primary batteries can cripple or sink a sub. The secondary or tertiary batteries are as powerful as an entire destroyer's broadside! Heavy cruisers and battleships can fire to the visual horizon.

How to Score Hits: The only sensible way to use a deck gun is from the Bridge TBT, with the TDC tracking your target. In this situation the gun crew automatically rotates and elevates the gun for the target's current position. You need only adjust the elevation for the target's motion. Since shells travel quickly, the adjustments are fairly small.

If the target is stationary, scoring hits is easy. No adjustments are needed and most shells hit. Minuscule imperfections in your gun, ammunition, or crew can cause a few duds or misses.

If the enemy is moving, compare the enemy's course to your view bearing. If he's moving toward or away from you, depress or elevate the gun slightly.

The exact amount of depression/elevation depends on the enemy's speed. Expect your first few shots to miss. Observe whether the shells fall short or long and correct accordingly. Remember, if a fast enemy (such as a destroyer) is charging toward you, your shells will probably fall behind him. Conversely, if he's fleeing rapidly, your shots frequently land short.

Evading ASW Detection & Search

Japanese ships can spot a submarine various ways: visually, with radar, or with sonar. A torpedo wake or torpedo explosion can also alert them. Once one ship spots a sub, he radios all ships in the force, calling in available help and warning away potential targets.

When Japanese ships pursue a contact, they expect the submarine to submerge (which it usually does). The situation is now a duel between the ASW (anti-submarine warfare) ship's ability to find and track a target with sonar versus the submarine's ability to escape.

Japanese Sonar has short range. The best defense is avoiding ASW ships: light cruisers, destroyers, destroyer-escorts and patrol boats.

The single most useful tactic is diving below the thermal layer. At a certain depth (usually between 150' and 250') ocean water gets much colder. The area where the change occurs is the "thermal layer". Sonar signals "bend" or "bounce" on this layer. Therefore, if you're beneath the layer, in cold water, enemy sonar is less likely to detect you. Of course, in shallow water there is rarely enough depth to create a thermal layer.

The other standard tactic is to move quietly. The slower your sub moves, the quieter it is. Of course, no movement at all is quietest, but this gets you literally nowhere. The standard technique is to creep away at your slowest.

A small factor in sonar detection is the facing of your sub. Enemy sonar is more effective when it bounces off your broadside, less effective if it bounces off your bow or stern (i.e., when your sub faces toward or away from that enemy).

One factor unknown to you is the quality of the sonar operator on the Japanese ship. Interpreting sonar signals is a fine art. A skillful, experienced

operator can find and track targets at much greater ranges than greenhorns. All sonar operators started the war with little experience. Warship crews developed good skills over the years. Patrol boats were less well trained, and many new ones were added in 1943, 1944 and 1945. Therefore some PCs are very good, while others are very poor.

Baffles: As a ship moves it creates a wake of disturbed water. Sonar signals cannot travel clearly through this wake. As a result, the ship is "blind" in an arc across its stern. This blind spot is called "the baffles". A submarine in "the baffles" of a ship is completely invisible to the sonar of that ship.

ASW ships minimize baffles problems by constantly turning. This rotates the baffles arc, making it difficult for a submarine to remain hidden. ASW ships also operate in pairs: each can watch the other's baffles.

Evading ASW Attacks

Once a Japanese ASW ship has sonar contact, it begins making depth charge attacks. The ASW ship drives directly over the submarine's last position (or close to it) and drops a "pattern" of depth charges to either side and behind it. The depth charges are fused to explode at a certain depth.

However, the ASW ship loses sonar contact just before it drops the depth charges (sonar has a minimum range). The ship doesn't regain contact until some seconds after the charges explode. Furthermore, Japanese sonar provides inaccurate depth data. The ship's captain usually guesses what depth to set the charges, while the sub skipper tries to outguess him.

Evading Depth Charges: A good submarine captain exploits these weakness to evade attack. Just before the ASW ship passes overhead a submarine should quickly turn onto a new course. Bold captains may even ring up higher speeds for a short time, knowing the enemy won't hear their engines. In any case, unless the enemy makes the right guess, the depth charge attack will be off target. If your boat is taking damage from a depth charge attack, make a radical change in depth. This too may throw off the enemy's aim.

Ultimately the sub seeks to escape attacks entirely. The best way is to dive below the layer and sneak away at 3-5 knots. With a few good guesses you can slip outside the enemy's sonar range.

Torpedo Counterattacks: Attempting to torpedo an ASW warship is rarely worthwhile. Coming to periscope depth to aim is a very bad idea. The periscope not only gives away your position, it also means the enemy has

better information about your depth. Firing from a deeper depth, using just your charts, is much safer.

Determining a good firing solution is difficult because the enemy is constantly turning at high speed. Even if you line up a shot, you must insure that the torpedo will run over 300 yards. Otherwise its unarmed warhead will "dud" into the enemy's side. Needless to say, achieving all this in a few seconds is very difficult.

Being Rammed: Enemy warships and even brave merchantmen are perfectly willing to ram your sub. The thing most captains forget is that submerging does not eliminate this danger. At periscope depth (55' or less), the conning tower and periscope sheers are tall enough that ram contact is still possible. To make sure you're safe from ramming, dive to 60' or moreand lower your periscope.

Beware that even if the enemy misses ramming your boat, if they have depth charges they'll toss a few onto you with a very good chance of causing serious damage.

Ramming attacks often cause massive amounts of damage — more than a depth charge hit. Therefore it's worthwhile to avoid getting rammed, even that means you'll suffer depth charge damage.

Patrol Strategy

The first step to good strategy is knowing the enemy. Then evaluate your own capabilities, examine the combinations, and create a plan for sinking the most enemy ships at the least risk. Brave captains sought to sink without regard for risk. Many were successful, but few survived the war.

Japanese Naval Traffic

Japanese warships anchored in protected harbors until a major military operation began. Every few years, or after major battle damage a ship would return to the naval yards in Japan for overhaul. In Japan the large fleet anchorages were Tokyo Bay and the Kure navy yard. During 1942 and early 1943 Truk and Rabaul were the front-line bases. Later in 1943 through middle 1944 the fleet fell back to Yap and Palau. Later in 1944 it fell back again to Brunei and Balikpapan. After Leyte Gulf the fleet was largely destroyed, with the remnants fleeing either to Japan, or south to Singapore and Cam Ranh Bay on the Indochina coast.

At various times in the war the Japanese fleet left port to give battle. It was especially active in early 1942, securing the conquest of the southwestern Pacific from Burma to New Guinea, then in later 1942 supporting the fighting in the Solomons. There were no major naval battles in 1943. In 1944 both the fleet and naval air forces were wiped out in two major battles (The Philippine Sea and Leyte Gulf).

The Solomons campaign from August to November 1942 was an additional exception to the normal pattern of Japanese movements. Here the "Tokyo Express", composed of destroyers and sometimes a light cruiser, raced at high speed from Rabaul or the Shortlands to Guadalcanal, then back again. At its peak the Tokyo Express ran two or three times a week.

Japanese Merchant Shipping and ASW Forces

The Imperial Japanese Navy approached the problem of submarine warfare quite differently from the Allies. In the first year or two of war, American submarine performance was poor. This was partly due to few fleet boats on patrol and partly because of poor Mark 14 torpedo performance. As a result, the Japanese lost few ships, which inspired no more than modest ASW (anti-submarine warfare) efforts. As American subs became more effective the Japanese tried to increase their anti-submarine measures.

Port Patrols: Japan's first ASW policy was regular anti-submarine patrols around major ports. Ports are natural "congregation points" for ships.

Obviously it was important to discourage American submarines from hanging around ports, torpedoing ships that entered and left!

Escort Groups: During 1942 the Japanese Navy created the "First Convoy Escort Fleet" of coastal escorts. The fleet was divided into many small units scattered among the coastal ports of Indochina, southern China and the home islands of Japan. As one or more merchantmen arrived in or near an escort unit's port, the escorts joined the merchants and travelled with them up the coast for a day or two, until they reached another port or turn-over point. The escorts then released the merchants and traveled back again, hopefully escorting merchants going the other direction. In other words, merchant ships were "handed along" from one escort group to another as they moved.

Unfortunately for Japan, these coastal escort groups received low priority in ship allocations. A few ancient destroyers, old minesweepers, and various small craft were used, captained by overage officers with little or no experience in anti-submarine warfare. Some became quite good, but others were almost useless.

Convoys: Until late 1943 the Japanese Navy did not force merchant ships into convoys. Merchantmen were free to sail alone or in groups, as they desired. Merchant skippers preferred to sail alone. They could travel faster and retain more control over their fate. This resulted in merchantmen scattering across the seas, increasing the probability of a sub finding a target.

In areas of known danger near "front line" war zones merchantmen were grouped together and placed under the command of a Japanese naval officer. This "convoy leader" had deck guns and frequently some depth charges (but no sonar) on his ship, which helped protect the group from surface attack. Defenses increased as more merchantmen received deck guns, even if their gun crews were not especially skillful.

In late 1943 the Japanese Navy became alarmed at rising merchant losses and organized a new "Grand Escort Command" that included aircraft and hunter-killer destroyer groups. Although the coast escorts continued, most of their better ships were transferred to the new command.

More importantly, most merchant ships were required to sail in convoys. These convoys were escorted by warships, including at least one destroyer or destroyer escort wherever possible. The ratio of escorts to merchants varied widely, depending on the ships available and the importance of the cargo. By mid 1944 virtually all surviving Japanese ships sailed in convoys.

American Commands

Throughout WWII, American submarines in the Pacific were divided between two commands: SubPac at Pearl Harbor, and a second command that started in Manila, moved to Australia for most of the war, then returned to Manila just before the war ended. The second command was originally known as SubsAsiatic, but in early 1942 was reorganized as SubSoWesPac.

This division existed because the US Pacific Fleet after Pearl Harbor was controlled by Admiral Nimitz. General MacArthur, originally commanding the US Army in the Philippines, retreated to Australia and lobbied hard to be the overall commander in the Pacific. He and Nimitz disagreed completely on plans and strategy. In Washington the Joint Chiefs of Staff were also divided, mostly along "Army vs. Navy" lines. President Roosevelt resolved the conflict with a compromise. The Army (MacArthur) would control an offensive from Australia into the South Pacific and the Philippines. This would be the Southwest Pacific Command. The Navy (Nimitz) would control an offensive across the Central Pacific. This would be the Pacific command. They would race each other to the Japanese home islands!

Each command directed a major offensive, and therefore commanded air forces, naval surface forces and ground troops, as well as submarines.

Theaters and Transfers

As a submarine commander, you can choose between operational commands, as well as switching between them. In a war career, the base to which you return determines which theater commands controls your boat in the next patrol: SubPac or SubsAsiatic-SubSoWesPac. This in turn affects which patrol zones are available.

SubPac is limited to war patrols in the northern areas. In the early war this includes areas near Midway and Pearl Harbor where you guard against Japanese offensives. Later in the war SubPac concentrates heavily on patrols around the Japanese home islands and in the richest convoy areas: the Formosa & Luzon Straits, and the East China Sea.

SubPac is based at Pearl Harbor, which always gets the latest equipment first. During late 1942 this means you'll probably get the new SJ radar faster. SubPac uses Midway Island as a forward base starting in July 1942. Finally, all "new construction" boats arrive first at Pearl Harbor (in SubPac).

From January 1943 onward Admiral Lockwood commands SubPac. He solves problems with the Mark 14 torpedo faster than his counterpart in SubSoWesPac.

During 1944 SubPac sets up advance bases at Manjuro in the Marshalls (in May), then at Saipan (in August). The latter is very useful.

SubsAsiatic and SubSoWesPac are limited to war patrols in southern areas. Initially the command is "SubsAsiatic" and based at Manila in the Philippines. However, by Christmas 1941 this is abandoned in favor of Tjilatjap on the south coast of Java. However, the rapid Japanese conquests force the allies to abandon that in early March, 1942. The subs retreat to Fremantle, and shortly after SubSoWesPac takes over from SubsAsiatic.

Brisbane on Australia's other coast opens for business in April 1942. It initially operates Task Force 42 (TF 42), dedicated to submarines operating in the Solomons and New Guinea. Many of the old "S" boats from the Philippines end up in TF42, while the newer fleet boats operate from Fremantle.

During 1943 Darwin (on Australia's north coast) opens as a temporary port in September. In late October a tender moves to Milne Bay at the southeast tip of New Guinea, allowing TF42 a base in the New Guinea area. Brisbane and Milne Bay close in early 1944 because the front is moving westward. Shortly thereafter TF42 is disbanded and its boats reintegrated into SubSoWesPac. Meanwhile, Manus Harbor in the Admiralties becomes operational in April, then Mios Woendi in northwest New Guinea in September. Finally, after MacArthur reconquers Luzon and Manila, a submarine base is established there in March 1945.

Bases & Operational Areas

SubPac

Bases		*War Patrol Areas*	
Pearl Harbor	(12/41-8/45)	Central Pacific	(12/41-6/42)
Midway	(7/42-8/45)	Western Pacific	(12/41-2/45)
Manjuro	(5/44-8/45)	Mariana Islands	(12/41-6/44)
Saipan	(8/44-8/45)	Truk & Marshalls	(12/41-3/44)
		Palau Islands	(12/41-9/44)
		Northern Japan	(12/41-8/45)
		Southern Japan	(12/41-8/45)
		Sea of Japan	(6/43-10/43)
		Sea of Japan	(1/45-8/45)
		Yellow Sea	(12/41-8/45)
		East China Sea	(12/41-8/45)
		Formosa/Luzon Str	(12/41-8/45)

SubsAsiatic & SubSoWesPac

Bases		*War Patrol Areas*	
Manila	(12/41)	Philippines	(12/41-10/44)
Tjilatjap	(12/41-3/42)	South China Sea	(12/41-8/45)
Fremantle	(4/42-8/45)	Malaya	(12/41-8/45)
Darwin	(9/43-8/45)	Celebes	(1/42-8/45)
Manus Harbor	(4/44-8/45)	Java Sea	(1/42-8/45)
Mios Woendi	(9/44-8/45)		
Manila	(3/45-8/45)		

Task Force 42

Bases		*War Patrol Areas*	
Brisbane	(4/42-5/44)	Solomon Islands	(4/42-11/43)
Milne Bay	(10/43-3/44)	New Guinea	(4/42-4/44)

During 1941 and 1942 this command gives you excellent hunting against the advancing Japanese forces. During 1943 the leadership of SubSoWesPac continued to ignore the complaints about the Mark 14 torpedo's defective warhead. If you pick historical torpedoes, you'll be stuck with inferior weapons slightly longer. In 1944 and 45 merchant shipping is less prevalent here than in SubPac, but more Japanese warships operate in the SubSoWesPac zone.

Patrol Areas

Patrol areas are divided into two general groups: those patrolled by SubPac boats, and those by SubsAsiatic/SubSoWesPac boats.

SubPac Patrol Areas

The richest SubPac Patrol areas are, in order of priority, Formosa & Luzon Straits, Southern Japan, Sea of Japan, and the East China Sea. Other areas can be temporarily rich in targets in certain spots, notably Truk in 1942 and early 1943.

The Central Pacific: This area includes Midway Island and the approaches to Pearl Harbor. In the first months of the war there is a serious threat of Japanese warship raids or amphibious invasions, especially against Wake and Midway Island. After the middle of 1942 this threat disappears and subs are no longer assigned to this area.

The Western Pacific: This area includes Iwo Jima and the southern approaches to the Japanese home islands. During the early months of the war major elements of the Japanese fleet travel through the area on their way to and from the Central Pacific. Thereafter the area is very quiet, although some convoy routes exist along the southwestern border.

Northern Japan: This area covers the east coast of Northern Japan. A variety of general cargo traffic can be found along the Japanese coast. The open sea further east is very quiet, with almost no naval traffic. A wise captain will hunt close to the coast, especially the southwesern areas.

Sea of Japan: Due to narrow entrances and exits, SubPac normally prohibits operations in this area. However, between June and October 1943, and throughout most of 1945, Admiral Lockwood decides the potential gains outweigh the risks. In these short periods submarine patrols are allowed. During 1945 this is about the only zone with significant Japanese naval traffic.

This area has a large amount of traffic along the Japanese coastline, and between Shimminato and mainland Asia. Unfortunately, the entrances are heavily guarded. The Korea (Tsushima) Straits in the south are heavily

mined and patrolled, as is the Tsugaru Strait between Japanese islands of Hokkaido and Honshu. The northernmost entrance, the La Perouse Strait between Hokkaido and Sakhalin Island, is the easiest to pass. During 1943 Admiral Lockwood ordered all raids to use this strait.

Southern Japan: This area includes the heavily trafficked southern coast of Japan. Passage into the shallow and heavily defended Inland Sea is not recommended, but patrolling close into the entrances (the Kii suido to the north, the Bungo suido to the south) can be very profitable. In addition, open sea to the south has military convoys to and from Iwo Jima, the Marianas, and points beyond.

Mariana Islands: This area includes both the Marianas and the central Carolines to the south. Most supply and troop convoys to the Pacific island bases of the empire pass along the western edge of the Marianas. Fleet warships follow a similar path from Tokyo or Kure to Saipan and Guam, then to Yap or Truk. After the first few months of 1944 Truk and Rabaul cease to be useful bases. Warships are based further west, but troop and supply reinforcements continue into the Marianas until the American summer invasions.

Yellow Sea: This area is extremely shallow and dangerous. The largest concentration of Japanese shipping is along the southwest coast of Korea, travelling between Seoul and the Japanese home islands. They carry troops and supplies to and from the Japanese army in Manchuria (Manchukuo).

East China Sea: This area straddles the main shipping route between the Japanese home islands and the empire's possessions to the south. Virtually all raw material shipments to Japan travel from the Formosa and Luzon straits to the home islands. During the first months of the war, warships and troop transports move south to conquer these areas. Thereafter, large amounts of raw materials coming to Japan pass through. Military supplies and some troops went the other direction, supporting the garrisons to the south, as well as the campaigns in Burma and southern China. From late 1943 to late 1944 military traffic grows as the Japanese move reinforcements into the Philippines and China.

Formosa & Luzon Straits: Virtually all Japanese shipping traffic from its southern possessions to the home islands travelled through these two straits. The same "good hunting" possible in the East China Sea is found here, but there's much less area to search. Of course, these straits are also

patrolled by Japanese anti-submarine forces. American fleet victories in the Philippines in late 1944 close the Luzon Strait. The Formosa Strait remains in use, but by 1945 numbers are much fewer.

Palau Islands: These islands are the main fleet bases of the Imperial Japanese navy in the western Carolines. Naval traffic in and out of Yap and Ulithi is especially heavy. Merchant convoys also run to these bases. During 1942 and early '43 convoys use them as stopover points on their way to New Guinea, Rabaul and the Solomons.

Truk & Marshall Islands: Truk is the great island fortress guarding the eastern border of the Japanese empire. Truk is the origin and destination of numerous military troop and supply convoys, until air raids in early 1944 destroy its naval capacity. Throughout 1942 and 1943 warships fighting in the Solomons are based at Truk. However, it lacks major shipyard facilities. Ships in need of major repair or overhaul move from Truk to Japan (usually via Saipan), and when repaired return to Truk again.

The Marshalls are Japanese territory, but have very little shipping or military activity until the American invasions in late 1943. They are always a sideshow: more important targets are available at Truk.

SubsAsiatic and SubSoWesPac Patrol Areas

No areas here are as consistently rich in targets as the best SubPac areas. However, at specific times individual areas can provide better hunting, such as the southwestern seas in late '41 and early '42, or the Solomons in late '42. The Philippines, especially around Manila and the northwest coast of Luzon, are quite attractive in '43 and '44.

Solomon Islands: Throughout the last half of 1942 this area is the scene of intense naval combat, as the Japanese attempt to destroy the American Marines on Guadalcanal. Japanese major fleet units stationed in Truk swing down periodically in major offensives, while cruisers at Rabaul and destroyers in the Shortlands make runs down "the slot" between the islands to "Ironbottom Sound" on the northeast side of Guadalcanal.

After the Japanese evacuation of Guadalcanal in February 1943 the tempo of combat declines. Still, throughout 1943 Japanese cruisers, destroyers, and small transports continue operating in the upper Solomons.

New Guinea: In the summer of 1942 a small Japanese army marches overland from Buna to attack Port Moresby. They fail, but the Australian and American counteroffensive takes until early 1944 to recapture New Guinea.

Until the end Japanese transports and supply ships sail from the Celebes, the Palaus, the Marianas and Rabaul to various ports along the north coast.

Virtually no Japanese ships operate along the south coast. Traffic in the shallow Arafura and very deep Bandan Seas is also light.

Celebes: Throughout the war this area was a secondary source of raw materials for the Japanese empire. The great ports are Makassar and Balikpapan on the Makassar Strait. During the early months of 1942, cruisers, battleships and carriers inhabit this area, supporting invasions into the Dutch East Indies. Then in late 1944 large warship groups muster at Balikpapan, a major source of fuel oil, in preparation for the great naval battles in the Philippine Sea and Leyte Gulf.

Java Sea: This area is one of the major raw material sources for the Japanese empire. Individual ships and small convoys sail constantly from Surabaya on Java, and from Singapore to work their way along the southern coast of Borneo. All head for routes through the South China Sea toward the Formosa and Luzon Straits.

This area only sees large warships during the first months of 1942 (during the Japanese conquest), and then again in 1945, as remnants of the Japanese fleet flee to Singapore.

Philippines: Invaded by Japan in December of 1941, the Philippines are not completely recaptured until the beginning of 1945. Manila, on the large northern island of Luzon, is a major port. In addition to Philippine exports leaving here for Japan, Manila is the key arrival point for reinforcing troops and supplies. However it is never a major naval base while in Japanese hands.

The more southern areas of the Philippines lie along important shipping routes, with Brunei tankers skirting the Palawans in the southwest, while various supply convoys to the Palaus pass around Mindano.

During the 1944 naval battles for the Marianas and the Philippines, Tawitawi, just off the northeast coast of Borneo, serves briefly as a major fleet anchorage. From here warships sally eastward across the Celebes Sea, or northeast toward Leyte.

South China Sea: This area briefly sees warfleets steaming southward to Indonesia and Malaya in early 1942. Thereafter it is almost entirely occupied by merchant shipping moving along the coast of Indochina and southern China. A similar amount of merchant shipping passes through the southeast corner of this area, travelling between the Formosa and Luzon

Straits and the Indonesian sources of raw material. After the American conquest of the Philippines in late 1944 most of the open-ocean routes are eliminated by carrier strikes, but the Indochinese and Chinese coastal traffic continues.

Malaya: This area, just south of the South China Sea, has two major shipping routes. One crosses the Gulf of Siam from Singapore to Cam Ranh Bay, the other runs along the northwest coast of Borneo and up along the Palawans. Along this latter route is the oil port of Brunei, the single best source of fuel oil to Japan.

Japanese warships frequent this area only twice. The first is early in 1942, as the invasion forces pass southward to Malaya, Singapore and the Dutch East Indies. The second is in late 1944 and early 1945, when Brunei becomes a major fleet anchorage for warships unable to find fuel elsewhere.

Strategies on Patrol

Your goal when patrolling an area is to generate the maximum number of enemy contacts. More contacts means more chances to reach a good firing position. Since your job is to sink ships, you should investigate all contacts. Deciding which contacts to pursue and attack, and which to avoid, depends on whether you're in a "rich" area with plenty of "good fishing", or a relatively poor area where targets are rare.

The Patrol Zone: Your best chance of making contacts is within the patrol zone. Searching for enemies outside your zone yields a lower probability of success. However, you may still run into good targets if you stumble onto a shipping lane, a military operation, or a port area.

Shipping Lanes: Japanese supply lines and merchant traffic run along common routes. If your sub is on one of these lanes, the chances of making contact with a "juicy" target are much increased.

Japanese shipping, by and large, preferred to move along coastal waters and through narrow passages, rather than make big open-ocean voyages.

Military Operations: Japanese warships operated in various areas at various times during the war. Like shipping, military operations usually dictated travel along certain paths. Unlike shipping, warships usually preferred "sea room" and often sailed further out to sea where possible.

Port Areas: The waters around major ports and bases are obvious spots to look for all types of ships, civilian and military, as they enter and leave. Unfortunately, port areas are also protected by lots of anti-submarine patrols.

Your chance of finding targets is somewhat increased near ports, but your chance of being surprised by enemy ASW ships is much greater. Overall, hanging around ports moderately increases contacts and greatly increases your risks.

Overstaying Your Welcome: Whenever you contact Japanese ships in an area, the Japanese alert shipping about your submarine. For a short period merchant and military traffic avoids the area, while local ASW ships seek you out. Therefore, it's very dangerous to keep patrolling the spot where you recently made an attack.

Fuel Supply: When you sail from your home base to the patrol area, note how many days of fuel you used. To be safe, when your supply reaches 150% (3/2nds) of that value, head for home. This gives you a "safety cushion". Even if you suffer battle damage in your fuel tanks on the way home (which empties 1/5th of your tanks), you'll still have fuel to spare.

Be especially careful at the start of the war when sailing from Manila or Java. These bases will soon fall to the enemy, which forces you to sail further to reach home. Keep an extra 7 to 10 day fuel reserve for such emergencies.

Ignoring your fuel status is a good way to earn the wrath of your commander. Nothing is more embarrassing than being towed into port. If you do it too often, and don't have a good excuse (like a very successful war patrol otherwise), you could be kicked out of active command permanently!

The Pacific War

A Brief Chronological History of the Pacific War

Pearl Harbor — December 7, 1941: The Japanese surprise carrier strike on Pearl Harbor destroyed or damaged seven battleships and over half the planes on their airfields. Eight hours later the US Navy Department ordered "Execute Unrestricted Air and Submarine Warfare Against Japan".

Fall of the Philippines & Indonesia — December '41 to April '42: In the Philippines, MacArthur's forces were outmaneuvered by Japanese invasions in December. Manila was abandoned by Christmas. Mainland forces in the mountains of Bataan surrendered April 8, '42. Corregidor (the island fortress in Manila bay) surrendered May 6, '42.

During December and January all remaining American islands in the western Pacific fell, including Guam and Wake Island.

The Japanese quickly captured Hong Kong in December 1941, Singapore and Sumatra in February 1942. After a naval battle in the Java Sea (2/27/42) the victorious Japanese conquered Java and Borneo in March. The remaining small islands of the Dutch East Indies fell soon afterward.

Battle of Coral Sea — May 3-8, 1942: The Japanese attempt to invade Port Moresby on New Guinea, including a three-carrier covering force, was intercepted by two American carriers. The Americans lost one fleet carrier, the Japanese one light carrier. All surviving carriers suffered battle damage, preventing the invasion. America suffered a tactical defeat but won a strategic victory by saving Port Moresby.

Battle of Midway — June 4-6, 1942: The Japanese attempt to invade Midway and draw the US fleet into a decisive engagement backfired when three US carriers ambushed the four Japanese carriers, sinking all four. Japanese counterstrikes sank just one US carrier. This decisive engagement turned the tide of the Pacific War.

Guadalcanal Campaign — August '42 to February '43: The Japanese, operating from Rabaul and Truk, started an airbase on Guadalcanal. The Americans counter-invaded with a full Division of Marines (16,000 men) and finished the airfield for themselves. Both sides reinforced on land while surface and carrier groups dueled for naval supremacy. This included two carrier battles (the Eastern Solomons: 8/24/42, and the Santa Cruz Islands:10/26-27/42) and five night surface battles (Savo Island: 8/9/42; Cape Esperance: 10/11-12/42; First Battle of Guadalcanal: 11/12-13/42; Second Battle of Guadalcanal: 11/14-15/42; Tassafaronga: 11/30/42). These battles

hindered reinforcement by both sides, and were effectively a draw. On land the Japanese army grossly underestimated the American Marines and were decisively defeated. In February the Japanese evacuated the few survivors.

Later Solomon Campaigns — June to November '43: The American forces invaded their way up the Solomons Islands, gaining ground slowly and at high cost. The Japanese resisted with land troops, land-based aircraft, and local light naval forces, causing a series of cruiser/destroyer night surface battles (Kolombangara: 7/12-13/43, Vella Gulf: 8/6-7/43, and Empress Augusta Bay: 11/2/43). No large Japanese fleet units were committed.

During early 1944 the Admiralty Islands were occupied. American bases there, on New Guinea, and in the Solomons had surrounded the Japanese at Rabaul and Kavieng. Constant air strikes reduced both to wreckage, but the land fortifications were too strong to assualt. They remained surrounded and powerless for the rest of the war.

New Guinea Campaign — June '42 to May '44: In July '42 the Japanese marched from the north coast port of Buna over the rugged, jungled Owen-Stanley mountains to Port Moresby on the south coast. There they were finally halted by the Australians. With US reinforcements the Allies counter-attacked back over the mountains and captured Buna in January 1943. Throughout 1943 allied forces slowly marched up the north coast, capturing Lae in September '43. MacArthur leapfrogged around the powerful garrison at Wewak to Aitape (April 1944) and ultimately Biak island (May 1944).

The Gilberts — Tarawa — November '43: The Gilbert Islands were Japan's furthest Central Pacific outpost, and therefore the first to be assaulted by sea (on November 19, 1943). On Tarawa the victorious American Marines suffered enormous casualties from the vastly outnumbered Japanese defenders (who were eliminated by November 23rd). The losses were caused by operational errors, poor equipment and ignorant commanders. The remaining Gilbert islands were virtually ungarrisoned and easily occupied. The "victory" at Tarawa was so costly that America overhauled and reorganized its amphibious warfare doctrine.

The Marshalls — Kwajalein & Eniwetok — January & February '44: The American Marines elected to bypass the strongly held eastern islands of Maloelap, Wotje and Mili, and invade the central islands, notably Kwajalein, the world's largest coral atoll, while carrier raids destroyed the airbases on the

eastern islands. Invaded January 31, 1944, Kwajalein was secured by February 7. Eniwetok was invaded on February 17th and secured by the 21st.

Meanwhile, the covering carrier force made massive strikes against the enormously strong Japanese base at Truk. The main Japanese fleet escaped just weeks before the attack (after operating from Truk throughout '42 and '43), but many light units and merchant ships were sunk in the harbor-lagoon. However, Truk's defenses were so strong that no invasion was considered. Sinking all its ships and wrecking its air force was considered sufficient. Like Rabaul, it was bypassed for the rest of the war.

The Marianas — Saipan & The Battle of the Philippine Sea — June to August '44: Only the southern Mariana islands had military value. The Japanese regarded the Marianas as their main line of defense. When Saipan was invaded June 15, 1944, the Japanese main fleet sortied to counterattack. American carrier/battleship task forces sailed westward into the Philippine Sea to screen the invasion.

The battle was joined June 19, 1944 when Japanese carrier raids arrived over the American fleet. American veterans flying the new F6F Hellcat fighter massacred the raw, inexperienced Japanese pilots. The battle was unofficially known as "the Great Marianas Turkey Shoot". Unfortunately, the American carrier commander (Admiral Spruance) failed to pursue quickly enough the next day. This allowed the virtually planeless Japanese carriers to escape (except for those sunk by submarines).

Meanwhile, Saipan was not conquered for two weeks. The entire garrison of over 24,000 fought from mountain caves with a samurai mentality that prefered death to "dishonorable" surrender. As the Americans moved forward, Japanese women and children jumped from the cliffs rather than be captured. American casualties were huge: about one-third of the initial invasion force was wounded or killed.

Tinian and Guam, with weaker defenses, were overrun in July and August after long naval bombardments. The Japanese correctly understood that the loss of these islands meant defeat. However, in the military-dominated Japanese government, no general was willing to risk the personal dishonor of urging a negotiated surrender.

Soon American airbases on Saipan and neighboring Guam hosted B-29 bombers, who began raining death and destruction on the Japanese home islands.

The Palaus — September to November '44: These islands were major Japanese fleet bases, with excellent anchorages but weaker defenses than the Marianas. Now isolated, they were invaded on September 15. The Americans proceeded slowly and carefully, eliminating opposition on Peleliu (the main Japanese garrison) by November 25. Nearby Angaur fell more easily, while Ulithi atoll was virtually ungarrisoned.

Meanwhile, during the week of October 10-17, 1944, the American carrier fleet (TF38 under Admiral "Bull" Halsey) sailed past the Philippines to Formosa and back, launching massive air raids daily. The remaining Japanese air power in the Pacific was mustered against this raid and virtually destroyed. From that point onward the Japanese gave up fighting conventional air battles and concentrated on developing *kamikaze* suicide-tactics (where the attacking plane flew straight into the ship). The entire airforce was gradually turned into missiles guided by onboard humans.

Leyte Gulf & the Philippines — October 1944: Despite a daring plan to bypass the Philippines and invade Formosa, political considerations dictated recapture of this gigantic island chain. The first landings were in the protected waters of Leyte Gulf on October 20, 1944.

Meanwhile, the Japanese mustered their remaining naval strength to stop the invasion. A planeless carrier fleet sortied from Japan and successfully drew off the American carriers, who sank these "decoys" off Cape Engano on October 25, 1944. Meanwhile the full battleship power of Japan sortied from Singapore and Indonesia, striking from the south. One group was intercepted by American shore-bombardment battleships (including ships raised and rebuilt after Pearl Harbor) in the Surigao Strait. Their radar-controlled guns destroyed the radarless Japanese in less than one hour of night battle.

The second and stronger group suffered air raids on the 24th that sank the super-battleship Musashi (with 18 torpedo hits!). After a fake retreat just before nightfall the group rushed forward, surprising the American ships covering the invasion the next morning. In the famous battle off Samar on October 25th, a group of slow American escort carriers was overtaken by the Japanese force of 4 battleships, 6 cruisers and 11 destroyers. They virtually wiped out "Taffy 3's" escort carriers, destroyers and destroyer escorts. But the tiny American ships, supported by any plane that could fly, sank a few cruisers

and so demoralized the Japanese that they retired instead of pressing ahead. This heroic fight saved the American invasion force.

Overall the Battle of Leyte Gulf, October 24-25, 1944, was the greatest naval battle in world history. It was a decisive Japanese defeat. The remnants of the Imperial Navy scattered to protected anchorages. They never reformed as a battle fleet. MacArthur's troops secured Leyte Island in December 1944, then invaded Luzon on January 9, 1945, capturing Manila by March. However, mopping up operations on various islands lasted almost to the end of the war.

Iwo Jima & Okinawa — Spring 1945: American planners, impressed by the fanatical and unyielding resistance of Japanese soldiers and civilians, did not believe the Japanese would surrender until their homeland was invaded and conquered (like Germany). To prepare outlying assault bases, Iwo Jima was invaded on February 19, 1945. This resulted in a month of unbelievably bloody fighting. Iwo was secured on March 16th, 1945.

Okinawa was invaded on April 1st, 1945. The Japanese considered this island part of their homeland. The fighting here fully equaled that just finished in Iwo Jima, while continual *kamikaze* attacks caused heavy losses to the American fleet. The remaining Japanese super-battleship Yamato made a hopeless sortie (the last Japanese warship sortie of the war) but was sunk by massive carrier strikes on April 7th, 1945. After April the Japanese air counterattacks faded away, but the conquest of Okinawa was not finished until July 3rd, 1945.

Atomic Bombs & Surrender — August, 1945: After Iwo Jima and Okinawa, American planners began organizing the invasion of the Japanese home islands. A repeat of the fanatical resistance on Iwo Jima and Okinawa, coupled with the damaging *kamikaze* attacks, would make an invasion extremely costly to both sides. The casualties from the invasion campaign could exceed all American losses suffered in Europe for the whole war.

Throughout 1945 American carriers ranged along the Japanese and Chinese coasts, wrecking everything of military value they could find. By July American battleships were cruising off coastal cities, bombarding anything in range. Meanwhile B-29s mounted firestorm raids that destroyed Tokyo and other major cities, burning to death tens of thousands of Japanese civilians.

On August 6th, 1945, a lone B-29 dropped an atomic bomb over the city of Hiroshima. The 2000' airburst destroyed the entire city, killing over 72,000 outright and wounding another 68,000, many fatally with radiation. On August 9th a second bomb landed on Nagasaki with roughly equivalent results. Stupified by destruction of so much with just two bombs, the Japanese finally abandoned the samurai code and surrendered on August 15th, 1945.

A Brief History of Submarine Operations

1941-1942: SubsAsiatic lost only one boat and one subtender to Japanese air raids on Manila harbor. The rest escaped and attempted to attack Japanese warships and transports converging on the Philippines. However, commanders were cautious (conditioned by peacetime exercises that penalized risk-taking or individual initiative). Very few boats achieved good set-up positions. When Manila fell the command retreated to Java, then again to Australia.

SubsAsiatic was reorganized into SubSoWesPac in spring 1942, with major bases at Fremantle (near Perth in southwestern Australia) and Brisbane (in eastern Australia). The Fremantle subs operated against Japanese shipping in the raw-materials heartland of the new empire. They also rescued survivors and supported guerillas in the Philippines. The Brisbane subs operated in the Solomons and along the New Guinea coast, frequently committed to special missions and warship interception, with merchant shipping attacks a low priority. Submarine commanders deemed insufficiently aggressive were removed and replaced by other officers, usually slightly younger ones. If they weren't successful after two or three patrols, they too were replaced.

SubPac operating out of Pearl Harbor and later Midway used much of its strength in special operations, including island raids, scouting during the battle of Midway (June, 1942), or attempting to intercept Japanese warships. The remainder patrolled along the Japanese, Korea, and northern Chinese coasts. As in SubsAsiatic/SubSoWesPac, unaggressive skippers were replaced by new men.

1943: SubSoWesPac, frustrated with meager results in 1942, gave its boats more freedom by encouraging captains to seek merchant shipping lanes, rather than waiting near ports. General MacArthur still demanded a large number of special missions, so the overall number of submarines available for use against shipping remained small. Furthermore, throughout the year SubSoWesPac continued to ignore complaints about the Mark 14,

so much so that captains were specifically ordered to continue using their magnetic exploders. This is probably because key SubSoWesPac commanders were involved in the original development of the Mark 14 torpedo, and refused to admit that their earlier work was in any way flawed.

Meanwhile, SubPac under the new Lockwood administration was free to send heavy concentrations of submarines into Japanese home waters. Using radar, SubPac boats sank large amounts of raw material en route to Japan. Admiral Lockwood was also in the forefront of solving torpedo problems. First he investigated the magnetic exploders and deemed them unreliable.

After the *Tinosa's* experience (see "Whales & Duds", page 98) he discovered and fixed the flaws in the contact exploder. SubPac was also the first to get the improved Gato class boats, and these new boats were frequently skippered by newly promoted men who had made war patrols in '41 and '42. Their war experience before captainship gave them knowledge and insights quite different from those conditioned by peacetime.

SubPac attempted raids into the Sea of Japan during this year. After the loss of the famous "Mush" Morton and his boat, the *Wahoo*, Lockwood gave up these missions as too dangerous.

1944: SubSoWesPac operations continued much as they had in 1943, with no appreciable increase in results (although the Mark 14 torpedo problems were now fixed). Part of the reason was the continuing high demand for special operations in support of the ground fighting. The remainder was that the subs were attempting to intercept scattered freighters in the vast southern areas, rathern than the traffic choke-points further north.

Meanwhile, SubPac had finally figured out that the Luzon and Formosa straits were Japan's shipping bottleneck. Virtually all merchant traffic between the home islands and the southern sources of material passed through this area. SubPac submarines concentrated here, with fewer boats patrolling around Japan and more northern waters. Furthermore, the new advanced base at Saipan greatly reduced cruising time to the patrol zone, which meant more submarines were on patrol longer. Japanese merchant shipping suffered crippling losses, despite a crash building program of new merchantmen and ASW ships.

Both commands used informal wolfpacks, commanded by submariners on the spot. These patrols helped "sweep" the seas and find convoys or merchantmen. Attacks were not coordinated, since this required frequent radio messages that gave away a sub's position. Simultaneous attacks on convoys were usually accidental, rather than deliberate. Many subs were still sent on independent cruises.

1945: In the final half-year of the war submarines had few targets. The Japanese fleet was virtually eliminated. Shipping was all but gone as well. By the summer submarine skippers were reduced to sinking sampans, junks and fishing boats for lack of anything larger. By the end of the war the Japanese merchant marine had been virtually destroyed.

Results of the Submarine War

The Score: American submarines had a devastating effect on the Japanese merchant marine during World War II in the Pacific. At the start of WWII SubsAsiatic had 29 boats, SubPac had 22. In December 1941 these boats managed only 281 days of war patrols in their assigned areas. During late 1944, when the American submarine war reached its peak, there were an average of 43 boats in war patrol zones producing over 1,300 days of war patrolling per month.

Meanwhile, the Japanese merchant marine started the war with about 6.0 million tons of capacity. During the war another 3.2 million tons were built. Yet at war's end Japan had just 1.8 million tons afloat. Japanese plants were quiet for lack of raw material, Japanese civilians received starvation rations. Of the 8.1 million tons of Japanese merchantmen lost, American submarines sank about 60%. Most of the remainder were destroyed by air raids on Japanese bases and harbors in late 1944 and 1945. American submarines also sank 201 warships, but 127 of these were small patrol boats and other auxiliaries of modest military value.

US Submarines vs Japanese Warships

Type of Ship		*Japanese Fleet Strength*	*Sunk by Submarines*	*Percentage Sunk*
CV	Fleet Carrier	13	4	31%
CVL	Light Carrier	8	0	-
CVE	Escort Carrier	6	5	83%
BBH	Super-Battleship	2	0	-
BB	Battleship	6	0	-
BC	Battlecruiser	4	1	25%
CA	Heavy Cruiser	18	3	17%
CL	Light Cruiser	27	7	26%
DD	Destroyer	173	37	21%
SS	Submarine	247	22	9%

Japanese fleet strength includes all ships at the start of the war, plus ships completed before the end of the war. The "Destroyer" category includes DDAAs and large DEs, as well as all destroyers used as such during the war

Japanese merchant seamen suffered greatly in the campaign. Conservative American estimates put their losses at 69,600 (16,200 killed, 53,400 wounded). Many were badly burned when they abandoned ship into seas coated with burning oil. Others were eaten by sharks. Crews on small coastal steamers (under 500 tons) and fishermen are not included in these figures. Their losses are certainly thousands more.

The US Navy lost only 41 submarines to enemy action. A total of 374 officers and 3,131 men were killed in submarines.

Conclusions: The American submarine war against Japan was the most rapacious and deadly assault on merchant shipping in the history of mankind. By the end of 1944 submarines were doing so much damage that they would have probably destroyed the entire merchant marine single-handed, given another entire year. What the U-Boats attempted and failed in the Atlantic, the Americans achieved in the Pacific.

At the same time the American submarine service had tried its hardest to intercept and sink Japanese warships. Armed with decoded copies of all Japanese ship movements, submarines were vectored to intercept positions with unbelievable accuracy. However, the results were

US Submarines vs Japanese Merchant Ships

	*Tonnage**	*Percent*
Initial Merchant Tonnage	5,996,607	65%
Tonnage Built During War	3,231,509	35%
Total Wartime Merchant Marine	**9,228,116**	**100%**
Sunk by Submarines	4,859,634	60%
Sunk by Aircraft**	2,467,382	30%
Sunk by Mines	397,412	5%
Sunk by Surface Gunfire	77,145	1%
Other Losses	340,018	4%
Total Lost	**8,141,591**	**100%**

* Limited to ships of 500 tons or more.
**Includes US Army Air Force (subsequently renamed US Air Force) and US Navy Aircraft based on aircraft carriers and at land bases.

US Submarines vs Japanese Economy

Date	*Bulk Commodities* Arriving in Japan*
1940	24.2 million tons
1941	22.0 million tons
1942	21.3 million tons
1943	18.0 million tons
1944	11.1 million tons
1945	5.5 million tons**

*Includes coal, iron ore, iron, scrap iron, steel, bauxite, lead, tin, zinc, phosphorite, phosphate, dolomite, magnesite, rubber, salt, soybean cake, soybeans, rice, other grains and flours.
**Annualized figure based on 3.0 million.tons received by 8/15/45.

Source:
US Strategic Bombing Survey and Joint Army-Navy Assessment Committee, as quoted in US Submarine Operations in WWII. ©1949

not especially impressive. Submarines did not "turn the tide" in any major naval battle or campaign. Their achievements were very much "hit and miss", with most attacks resulting in minor damage, rather than a sinking. Traditional surface battles and the new carrier air battles proved much more decisive in winning (or losing) military campaigns.

Morality and Submarine Warfare

In 1922 the United States, Britain and Japan signed the London Naval Treaty. Among other provisions, the treaty outlawed unrestricted submarine warfare against civilian vessels. Submarines were supposed to act like surface ships. They were obliged to remove the crew to a safe place before capturing or sinking a ship.

However, from the start of World War II American submarine commanders, including the commanders of both SubsAsiatic and SubPac, ordered their boats to wage unrestricted warfare on all Japanese ships, including merchant ships. Some commanders (such as "Mush" Morton) even went so far as to surface and machine-gun boats and survivors after sinking their ship! By 1945 American subs had so much trouble finding merchant ships to sink that they took to sinking fishing boats with deck guns, machine guns, even rifles and hand grenades! This included any vessel crewed by people with oriental features operating off Japanese-controlled coasts, even though the crew might be Chinese, Vietnamese, Cambodian or Malaysian.

By comparison, Japanese submarines mounted no campaign against civilian vessels. Their submarines were used against surface warships, as scouts, and on occasional political missions (such as a token bombardment of the US west coast, or a plan to transport sea-

The London Naval Treaty of 1922

The document of international law guiding WWII Pacific submarine operations, signed by the United States, Britain, and Japan, reads as follows:

> (1) In their actions with regard to merchant ships, submarines must conform to the rules of International Law to which surface vessels are subject.
>
> (2) In particular, except in the case of persistent refusal to stop on being duly summoned, or of active resistance to visit or search, a warship, whether surface vessel or submarine, may not sink or render incapable of navigation a merchant vessel without having first placed passengers, crew and ship's papers in a place of safety. For this purpose the ship's boats are not regarded as a place of safety unless the safety of the passengers and crew is assured, in the existing sea and weather conditions, by proximity of land, or the presence of another vessel which is in a position to take them on board.

The United States did not formally abrogate this treaty at the start of the war. Instead, within eight hours of the Pearl Harbor attack, the US Navy Department ordered all Pacific submarine commands to "Execute Unrestricted Air and Submarine Warfare Against Japan." In general, American submariners agreed with this order, many of them with gusto and enthusiasm.

planes for a raid on the Panama canal). This policy can be viewed either as deliberately law-abiding, or as coincidental with Japan's military theories and plans, depending on your viewpoint.

Germany was the only other nation in WWII to wage large-scale unrestricted submarine warfare. Although Allied propagandists portrayed U-Boat skippers as crazed maniacs who gleefully machine-gunned survivors in the water, there are numerous cases of U-Boats on far patrols giving a solitary ship's crew time to escape in their boats before sinking the vessel. In some cases courteous U-Boat captains even gave the crew food, a map, and a compass to help them reach land. It is virtually impossible to find similar examples of American courtesy toward Japanese merchant seamen.

Historical Engagements

Whales & Duds

The Situation: You're Randall "Dan" Daspit, commanding the *Tinosa*, a Gato-class submarine. It's 0930 (morning), July 24th, 1943, west of Truk. You investigate a radar contact and discover a single, unescorted target — a huge whaling factory ship, now serving as an oil tanker. You have Mark 14 torpedoes with their worthless magnetic exploders deactivated.

Tactical Advice: You're in a fairly good position, but beyond good shooting range. The enemy is making 13 knots on the surface. You have three tactical options.

First, you can take a quick shot immediately. This might slow down the target, allowing you to approach submerged and finish him off.

Second, you can pull back to radar contact range (over 10,000 yards), surface, and "end around" ahead of him using your superior 20-knot speed, then submerge and attack.

Third, you can surface right now and shoot it out. You'll probably take damage, but a few hits might slow him down so you can submerge and approach for a good torpedo shot.

What Really Happened: Dan Daspit fired a single torpedo immediately. It hit the target (Tonan Maru #3) in the stern and disabled her propellers. The ship quickly coasted to a stop and Daspit sailed up, submerged, to 800 yards. He then proceeded to fire, one at a time, eleven torpedoes into the broadside of the Tonan Maru #3. The first was a dud, so before each subsequent shot the torpedo room crew completely "maintenanced" the torpedo to make sure it was in perfect operating order.

All eleven shots were duds or failures. Not one exploded against the ship. Eventually a destroyer arrived and towed the Tonan Maru #3 into Truk. The outraged Daspit saved his last torpedo and returned to Pearl Harbor. Admiral Lockwood was similarly outraged. He ordered tests that finally identified the design flaws in the Mark 14's contact exploder.

Mush on the Loose

The Situation: You're Dudley "Mush" Morton, commanding the *Wahoo*, a Gato-class submarine. It's 0845 (morning), January 26, 1943, northwest of Wewak, New Guinea. You investigate smoke on the horizon and find three Japanese merchant ships, without an escort. You approach as closely as possible on the surface.

Tactical Advice: You'll be seen if you move much closer on the surface. You can submerge and move into a good attack position slightly ahead of the enemy, or you can turn due east and run ahead of them a bit on the surface before turning north, submerging, and moving to an attack position. The latter method generally yields a better torpedo-firing solution.

If you're using historical torpedoes, bear in mind that your Mark 14s use the unreliable magnetic exploder as well as the terrible contact exploder.

What Really Happened: Morton dived and charged straight in, giving him rear quarter shots on the enemy. He hit all three targets, sinking one, immobilizing a second, and slowing a third. The immobilized ship was a transport, which he polished off with another torpedo, then surfaced and gunned down the soldiers in the water with his light AA guns. It took him about a hour to destroy all the boats and life rafts, as well as killing many of the soldiers.

Morton then sailed in pursuit of the escaping freighter, which had since joined up with a tanker. After a long, ten-hour chase he torpedoed the tanker at dusk, surfaced and closed. The surviving freighter had manned its guns, caused a heated gun duel that Morton resolved by firing his last torpedoes to sink the enemy.

This, along with earlier exploits in the patrol, made Morton a "war hero". He received the Navy Cross while the press called the *Wahoo* "The One-Boat Wolf Pack". Given the gross unreliability of his torpedoes, Mush was an extremely lucky guy.

Flasher's Tankers (I)

The Situation: You're George Grider commanding the *Flasher*, an improved Gato-class submarine. It's 0900 (morning), December 4th, 1944. You're sweeping through the Philippines with a wolfpack. You make radar contact with a three-ship convoy that's headed straight toward your current position. It's starting to rain, which lowers visibility significantly.

Tactical Advice: Submerge and let them approach. You may not see anything until they get within 4,000 to 5,000 yards, due to poor visibility. You choose whether to attack the escort first and then the tanker, or vice versa.

What Really Happened: Grider discovered that he was facing a single tanker escorted by two destroyers. He took the bold approach and decided to attack a destroyer first, then the tanker. His first salvo of four torpedoes hit one of the destroyers, wrecking it. However, he'd lined up his shots so the

tanker was behind the destroyer. Lo and behold, the other two torpedoes hit the tanker, setting it afire.

Grider evaded a depth charge counterattack from the undamaged destroyer, returned to periscope depth, and saw it stopped to rescue survivors from the burning tanker and now sunken destroyer. Grider launched another salvo of four torpedoes, three of which hit the destroyer, sinking it almost instantly. Then he polished off the still-burning tanker.

Flasher's Tankers (II)

The Situation: You're George Grider, commanding the *Flasher*, an improved Gato-class submarine. It's 0100 (an hour after midnight), December 22nd, 1944, off the Indochina Coast — 18 days after the encounter above. You've been chasing one tanker convoy or another up and down this coast for days, frustrated by seas so heavy you couldn't fire torpedoes. Just as you're about to give up, in a weather lull your radar operator finds the enemy. He's trying to "hug the coast" and discourage sub attacks by sailing in shallow water. You decide to outwit them by moving even closer to the coast for a night surface attack. The water is so shallow that you could hit bottom before reaching periscope depth!

Tactical Advice: You're in an excellent attack position. Let the convoy come up, keeping your bow toward them (to minimize your visiblity to them) and slowly approach. The leading ships are probably escorts, furthermore beware of small PCs hovering about. The central column is the tankers. If you get within 800 to 1000 yards of one, torpedo salvos in all directions could clean up plenty. Once they spot you, crank up to maximum speed and run away from the nearest escort. If they're too close, you may have to submerge. Beware of being rammed even when submerged because of the shallow water.

What Really Happened: Grider let the leading escorts go past as he closed on the tankers. Then he fired all his bow tubes, spun around, and fired all the stern tubes into the tanker column. The three ships exploded in vast flames. Grider then eased the *Flasher* away, but there was no pursuit. Apparently the escorts thought the convoy had blundered into a minefield.

Sink the Yamato

The Situation: You're Eugene McKinney, commanding the *Skate*, a Gato-class submarine. It's 0430 (just before dawn), Christmas day, 1943, outside Truk harbor. Thanks to an Ultra message, you're in the right position to find a huge blip to the northwest on the SJ radar, moving toward you at 23 knots.

Tactical Advice: As you can guess from the title, the big baby headed your way is the *Yamato*, largest battleship in the world and flagship of the Imperial Japanese Navy. Don't be surprised if additional ships appear — the *Yamato* is probably escorted by smaller ships not visible at this range.

Get right in front of the *Yamato* and submerge. At just under 1000 yards fire everything you've got from the bow, spin around, and empty the stern tubes into him as well. Your only hope is to score enough hits to slow or temporarily stop the *Yamato*. After you achieve that you must then escape the escorting destroyers' counterattack. Then you can return and hopefully polish off a crippled monster.

This is harder than it sounds because the *Yamato* is coming on like a freight train. She's big enough to shrug off a couple hits and keep on going. Above all, don't try a surface battle. Submarines aren't built to "slug it out" with super-battleships!

What Really Happened: McKinney had difficulty with the *Yamato's* zig-zags until she suddenly made a turn straight at him. He missed setting up a good shot from his bow, but did fire all four stern tubes. Two hit the battleship in the bow, causing trivial damage. The *Yamato* steamed onward at full speed into Truk, where the damage was patched.

Death of the Shinano

The Situation: You're Joseph Enright, commanding the *Archerfish*, an improved Gato-class submarine. It's 1715 (early evening), November 28th, 1944, off Tokyo Bay. After a boring day waiting to pick up any downed B-29 crews falling out of the sky (none did) you're released for hunting. About dinnertime your radar picks up a huge blip leaving Tokyo Bay.

Tactical Advice: This contact must be a super-ship (like the *Yamato*). Also like the *Yamato*, expect escorts. Get ahead of the group and make a night attack. It's useful to remain on the surface and use your top speed until the last minute. As with the *Yamato*, the key to victory is scoring enough hits in the first attack to slow or stop the target. Then you can return to sink it later.

What Really Happened: Enright spent a frustrating evening dealing with enemy zig-zags. He'd race torward to a good intercept, only to see the enemy zig away. This was complicated by the fact that the enemy didn't keep on the same base course, but was instead swinging westward toward the Inland Sea.

Finally, about 0300 Enright was ahead of the oncoming target and inside its protecting destroyers. He submerged and fired four bow tubes at 1500 yards range, then swung around and fired two stern tubes. Four of the torpedoes hit. Normally the *Shinano* would have survived, but it wasn't finished fitting out. The watertight doors leaked and the crew was totally untrained. As a result, flooding got worse and worse until seven hours later the Japanese were forced to abandon ship.

The *Shinano* was the largest aircraft carrier built during WWII. It was originally intended to be a Yamato-class super-battleship. During the war it was redesigned as an aircraft carrier and completed as such.

Killer O'Kane

The Situation: You're Richard "Dick" O'Kane commanding the *Tang*, an improved Gato-class submarine. It's 30 minutes past midnight in the shallow Formosa Strait, October 23rd, 1944. Your radar picks up ten blips of varying size. It looks like a convoy of five merchantment with five escorts.

If you're playing with historical torpedoes, the *Tang* has shipped the very slow Mark 18-1s (O'Kane requested Mark 14s, but none were available). You'll need to get within 1000 yards for accurate shooting.

Tactical Advice: The convoy is headed away from you. You can either try to overhaul them from astern, or run around their flank and lie in wait ahead. The latter is better, since your slow Mark 18-1s are worthless in stern attacks.

As in most night battles, don't open fire with your deck gun unless absolutely necessary. Firing the gun gives away your position to every ship within dozens of miles.

What Really Happened: O'Kane made an "end around" and positioned himself in front of the oncoming convoy. He throttled down to low speed and let the merchantmen come up past him, all on the same course. Now in the middle of the convoy, he opened fire with bow and stern tubes, firing nine torpedoes. The Japanese scattered in confusion, with the convoy commander (on board one of the merchantmen) accidentally ramming another ship during a ramming run on the *Tang*. Three Japanese ships went down and the *Tang* escaped untouched.

The next night the *Tang* found another convoy, sinking two ships and damaging a third. O'Kane closed on the cripple and fired, only to watch the torpedo malfunctionl and circle around. Despite emergency maneuvers, the torpedo hit the *Tang* in the stern and sank her. O'Kane and some of the bridge

officers were blown overboard and survived. A few crewmen forward also escaped because the sub sank in shallow water. O'Kane survived Japanese POW camps and eventually received the Medal of Honor for his exploits.

An Embarrassment of Riches

The Situation: You're Herman Kossler, commanding the *Cavalla*, an improved Gato-class submarine. After days of reporting and chasing various Japanese warship and oil tanker groups in the southern Philippine Sea, you've been vectored to an intercept position. On June 19th, 1944, you "up scope" at 1048 for a routine check and wow! — Japanese carriers! In fact, you can see it's the *Shokaku* flying off and landing aircraft. That requires the carrier to steam steadily into the wind — right past your sub!

Tactical Advice: Position your boat so the *Shokaku* will pass closely. When she does, let her have it with all you've got. As the situation develops, you'll discover that the *Shokaku* is accompanied by other attractive targets. How many torpedoes do you assign to each? Whatever you do, make your first salvo count. All these targets are warships with a maximum speed over 30 knots. If you don't slow them down with the first salvo, they'll certainly run.

One thing Kossler forgot was to make a radar check. If you come up to radar depth and do this, you'll find that the *Shokaku* isn't the only juicy target around. Now you've got real problems — is it possible to get them all?

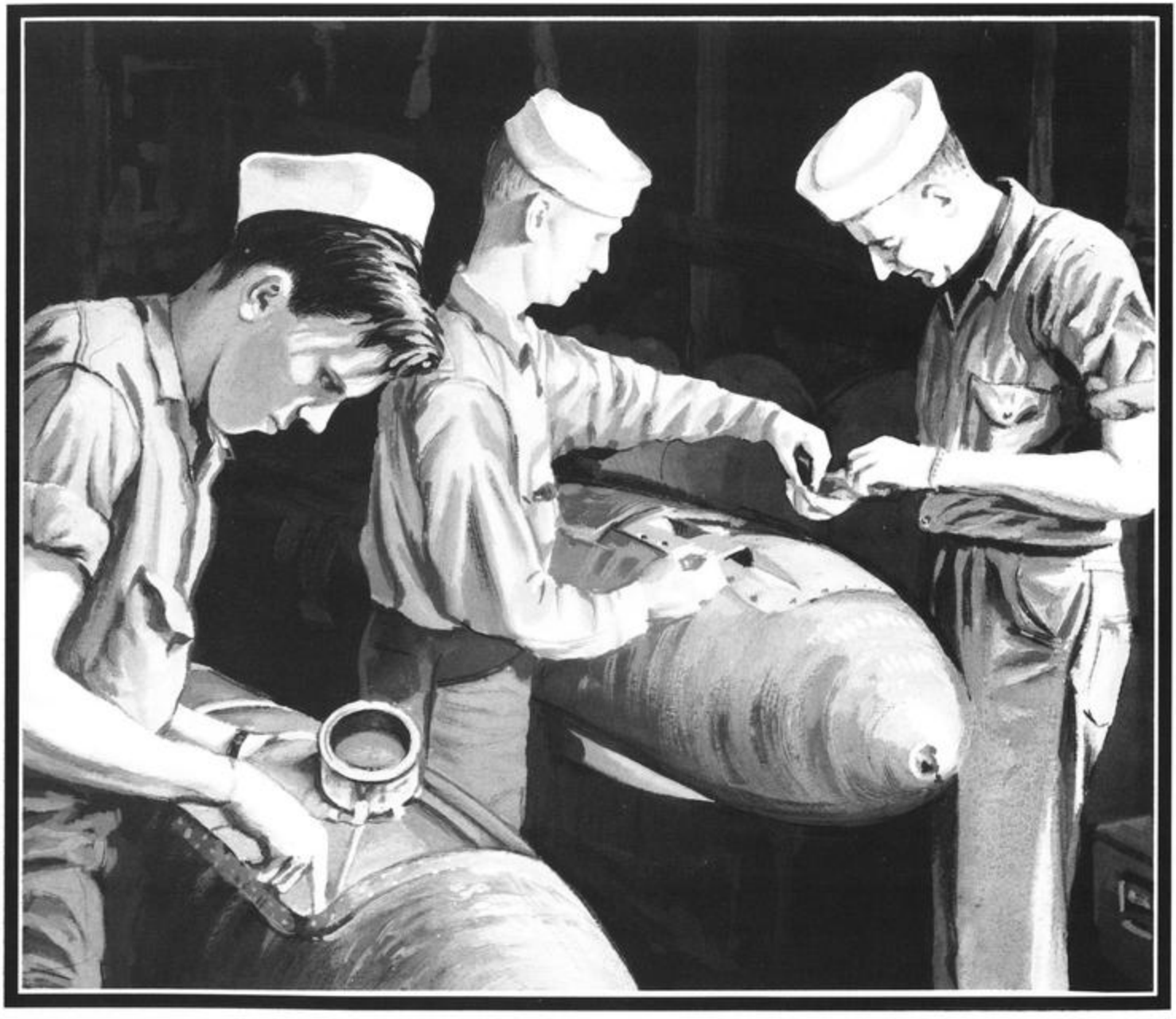
What Really Happened: Kossler got into perfect position on the *Shokaku* and fired all his bow tubes (six fish) at 1200 yards. The escorting destroyers immediately pounced on him, keeping him deep and evading for hours. Meanwhile, the *Shokaku* took four hits, setting her afire, with planes, fuel and bombs exploding everywhere. By the midafternoon the burning wreckage turned over and sank.

Meanwhile, three hours earlier, Jim Blanchard commanding the *Albacore* hit another Japanese carrier, the fleet flagship *Taiho*, with one torpedo. It jammed the forward elevator, but there was no other serious damage. However, the damage control officer made a serious error that spread gasoline fumes throughout the ship. Just after the *Shokaku* sank, the gasoline-laden air was finally ignited and the *Taiho* blew up.

The planes from these carriers, as well as others, were destroyed by fighters from seven US carriers (all this occurred during the Battle of the Philippine Sea). However, the only Japanese carriers sunk in the battle were the *Taiho* and *Shokaku*.

Random Engagement

The Situation: Here you can select the date and type of submarine you wish to command. This situation generates a random engagement based on the types of Japanese ships operating in that time period, and following their historical tactics and sailing patterns. You could encounter warships or merchantmen. These engagements are similar to those you'll experience during a war patrol or a war career.



4 TECHNICAL DATA

US Submarines of World War II

Design Theories

After World War I (1914-18) the US Navy began experimenting with new submarine designs. Before the success of German U-Boats in WWI, naval strategists regarded submarines as coastal defense vessels that could ambush enemy warships that ventured too near a coastline, port, or bay. Gradually this concept was extended to warship ambushes in any waters, including enemy waters.

Although submarines were used against merchantmen in WWI, many powers felt its morality was equivalent to using poison gas. There was considerable popular sentiment for either banning submarines entirely, or banning their use against merchantmen. American, Britain and Japan signed the London Naval Treaty of 1922, agreeing not to perform unrestricted submarine warfare on merchantmen. Although navy men knew in their heart of hearts that unrestricted submarine warfare was likely, for political reasons they felt obliged to design submarines for use against surface warships.

This caused the US Navy to evolve the "fleet boat" concept. This submarine would cruise with the surface battle fleet. For example, the American contingency plan for war against Japan assumed the main battle fleet at Pearl Harbor would sail west to rescue the Philippines from Japanese invasion. The battle fleet was composed mainly of late WWI-vintage battleships with a cruising speed of 17 knots and a maximum speed of 20-21 knots. A "fleet boat" with a top speed of 20-21 knots could travel with the battleships and be used in regular battles, as well as in ambushes.

The "P" class was the first of these designs. Experimentation continued until the middle of 1941, when the Navy finally put the Gato class into mass production.

Rating Submarines

By tradition all submarines are referred to as "boats". A submarine is *never* a "ship" in US Navy terminology.

Launched: The date of launch gives an approximate measure of a submarine's age. It normally took two to six months to "fit out" a submarine after launching. In peacetime submarines received a major overhaul every seven to fifteen years. In wartime it was every two to three years.

Tonnage & Length: The tonnage and length of a boat give an approximate idea of its size. All things being equal (which they rarely are), tonnage also measures the damage a boat can absorb before sinking.

Speed: The reported maximum speed of the submarine on the surface (using diesel power) and submerged (using electric power). The 1920s and '30s classes usually had a "designed" speed 1-2 knots higher than the figures here (which are speeds actually achieved). American propulsion technology of this era almost never achieved design specifications.

Test Depth: The maximum "safe" diving depth of the submarine, based on the design specifications. American structural technology was almost always superior to specification, allowing a boat to dive below the test depth. True maximum depth was 10% to 50% greater than the test depth, depending on the specific boat.

Torpedoes: These are the primary weapon of a submarine. Therefore, the maximum number of launching tubes and the overall maximum number of torpedoes are important statistics. Due to their bulk, torpedoes cannot be transferred between bow and stern areas while a submarine is at sea.

Deck Gun: Due to muzzle velocity, American 3" and 4" submarine deck guns were roughly equivalent in power (the 3" gun had a smaller shell, but was more accurate). The 5" deck gun, much desired but almost universally denied until late in the war, had greater power and accuracy. The 6" guns on the Narwhal class were as large as those on a light cruiser, but had less range.

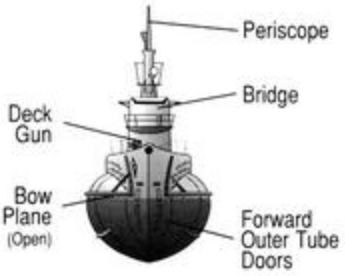
Endurance: This represents the number of days the submarine can run at economical speed (10-15 knots) using its diesels. In short, endurance represents the amount of fuel oil on board,

Crew: A submarine's crew is based on its size. Designers provided space for the maximum possible crew within the hull. As in some modern subs (including current American attack subs), the crewmen were "hot bunked": two men shared the same bunk bed, one sleeping while the other was "on watch" (working at his duties).

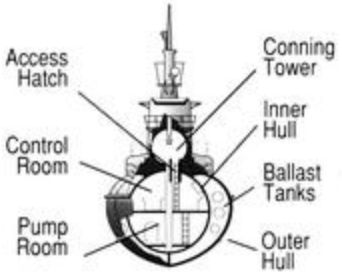
Typical US Fleet Submarine

(Gato Class)
312' long
1525 tons displacement surfaced
2415 tons displacement submerged
6 bow tubes with 16 torpedoes
4 stern tubes with 8 torpedoes
one 4" deck gun, various light AA cannons
20 knots on surface, 10 knots submerged
350' maximum safe diving depth

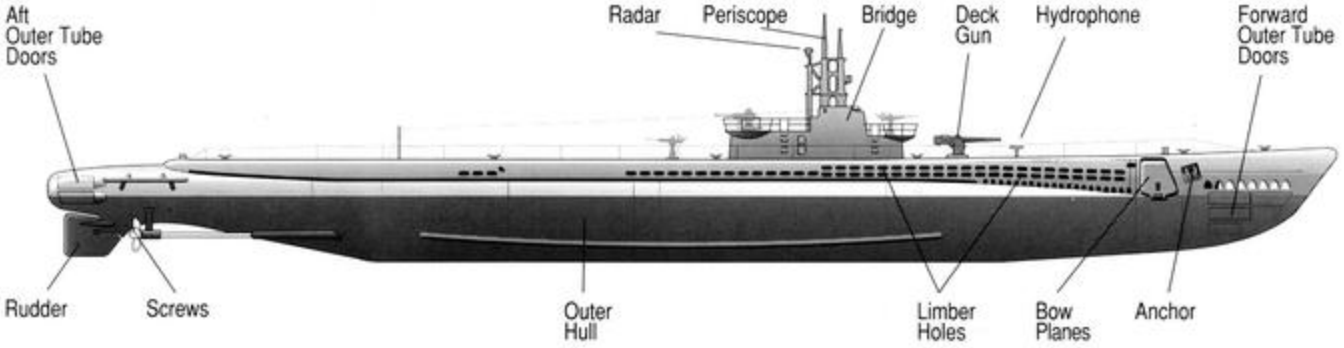
End View



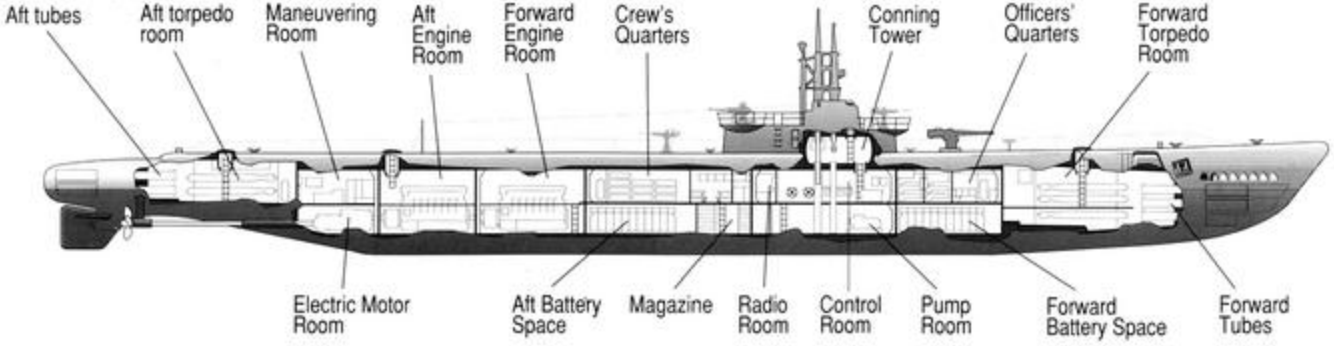
Cross Section



Exterior View



Interior View



Old "S" Class

Launched: October 1918 through November 1922
Tonnage: 840-870 tons surfaced, 1090-1135 tons submerged
Length: 219-231'
Speed: 15 kts surfaced, 11 kts submerged
Test Depth: 200'
Torpedoes: 4 bow tubes and 10 torpedoes, 1 stern tube and 2 torpedoes
Deck Gun: one 4" (or one 3" on some)
Endurance: 35 days
Crew: 42 officers and men

The "S-boats" were the first large class of submarines built for the US Navy. They were similar to or slightly better than submarines built by the European combatants during WWI. They were numbered ("S-1" through "S-48") rather than named. By 1941 these boats were ridiculously outdated. Much of their equipment was so old it broke down continually. Their low surface speed and small endurance made them useless for long-distance operations. By the end of 1942 all "S" boats had been retired from active operations in frontline areas. A few continued patrolling the Aleutians and other "minor" areas during 1943 before final retirement.

Barracuda Class

Launched: August 1924 through June 1924
Tonnage: 2000 tons surfaced, 2620 tons submerged
Length: 341.5'
Speed: 16 kts surfaced, 8 kts submerged
Test Depth: 225'
Torpedoes: 4 bow tubes and 12 torpedoes, 2 stern tubes and 4 torpedoes
Deck Gun: one 5"
Endurance: 50 days
Crew: 80 officers and men

Originally the "V" class, these boats were the first experiment with large cruising submarines with sufficient speed to keep up with WWI-style battleships and battle fleets. Completion was delayed from 1921 to 1924 by postwar Congressional cuts in military budgets. The design was over-ambitious: the diesel engines were unable to develop the expected power, the hull leaked fuel oil, diving speeds were slow, and underwater maneuverability was poor. By 1941 these boats were a mechanical nightmare to operate. All were withdrawn by the end of 1942.

Narwhal Class

Launched: December 1929 through March 1930
Tonnage: 2710 tons surfaced, 4080 tons submerged
Length: 381'
Speed: 16 kts surfaced, 6 kts submerged
Test Depth: 250'
Torpedoes: 4 bow tubes and 12 torpedoes, 2 stern tubes and 4 torpedoes
Deck Gun: two 6"

Endurance: 60 days
Crew: 90 officers and men

These boats were the largest class of submarines built for the US Navy before or during WWII. The great size was needed for a new and more powerful type of German diesel engine. Unfortunately, the engines were a failure and the boats never achieved the design speed of 17 kts surfaced and 8 kts submerged. Their huge size made them slow to dive and sluggish to maneuver. However, the boats were spacious and had powerful deck gun armament. During the 1930s one of the class (the *Argonaut*) had the rear torpedo tubes replaced by mine-laying gear. After the first few months of WWII the boats were used primarily for commando raids and similar clandestine missions behind enemy lines.

"P" Class

Launched: May 1935 through March 1937
Tonnage: 1310-1330 tons surfaced, 1960-2210 tons submerged
Length: 298-301'
Speed: 19 kts surfaced, 8 kts submerged
Test Depth: 250'
Torpedoes: 4 bow tubes and 12 torpedoes, 2 stern tubes and 4 torpedoes
Deck Gun: one 3" or 4"
Endurance: 60 days
Crew: 55 officers and men

After three unsuccessful experimental designs in the early 1930s (the *Dolphin*, *Cachalot* and *Cuttlefish*), the Navy finally settled on the new "fleet boat" concept with new, lightweight diesel engines along with a better electric battery. The resulting "P" class, the first "fleet boats", were faster, more maneuverable and quicker diving. They also had the first analog torpedo data computers (TDCs) and the first air conditioning systems. The latter not only improved crew performance in hot weather, but also greatly reduced electrical faults caused by condensation within the hull.

New "S" Class

Launched: June 1937 through August 1939
Tonnage: 1435-1475 tons surfaced, 2210-2350 tons submerged
Length: 308-310.5'
Speed: 20 kts surfaced, 9 kts submerged
Test Depth: 300'
Torpedoes: 4 bow tubes and 12 torpedoes, 4 stern tubes and 8 torpedoes
Deck Gun: one 4" (or one 3" on some)
Endurance: 60 days
Crew: 70 officers and men

The new "S" (or Salmon) class was actually a continuation of the "P" class, with a different and somewhat superior type of diesel engine. Although the hoped-for design speed was 21 kts, in reality the boats never made more than 20. The class did have a problem with the diesel

engine air intakes. These were supposed to shut automatically during a dive, but in a test dive of the *Squalus* the lids stayed open, causing the boat to flood and sink. Over one third of her crew were drowned, but the boat was raised, refurbished, and renamed the *Sailfish* (informally known as the "Squailfish").

"T" Class

Launched:	December 1939 through January 1941
Tonnage:	1475 tons surfaced, 2370 tons submerged
Length:	307'
Speed:	20 kts surfaced, 9 kts submerged
Test Depth:	325'
Torpedoes:	6 bow tubes and 16 torpedoes, 4 stern tubes and 8 torpedoes
Deck Gun:	one 5"
Endurance:	60 days
Crew:	85 officers and men

Also known as the Tambor class, these were the first fleet boats to carry the enlarged armament of 6 bow tubes and 4 stern tubes. Other internal equipment was upgraded and improved over the "P" and "S" classes. The teething problems of various diesel engine designs had finally been resolved. For the first time in over 15 years an entire class of US submarines had a good, reliable power plant.

Gato Class

Launched:	March 1941 through May 1943
Tonnage:	1525 tons surfaced, 2415 tons submerged
Length:	312'
Speed:	20 kts surfaced, 10 kts submerged
Test Depth:	350'
Torpedoes:	6 bow tubes and 16 torpedoes, 4 stern tubes and 8 torpedoes
Deck Gun:	one 4" (on some one 3" or one 5")
Endurance:	60 days
Crew:	80 officers and men

This class was the final refinement of the fleet boat concept. It incorporated all the design adjustments and improvements of the earlier types. Unlike earlier classes, this one was mass produced, with over 200 built during the war (including the improved Gatos, below). The class was probably the most formidable submarine built by any nation in the war, and superior in most respects to German U-Boat designs.

Improved Gato Class

Launched:	May 1943 through July 1945
Tonnage:	1525 tons surfaced, 2415 tons submerged
Length:	312'
Speed:	20 kts surfaced, 10 kts submerged
Test Depth:	400'
Torpedoes:	6 bow tubes and 16 torpedoes, 4 stern tubes and 8 torpedoes

Deck Gun:	one 5"
Endurance:	60 days
Crew:	80 officers and men

It was very hard to improve significantly on the magnificent Gato design. However, a new method of strengthening the hull permitted deeper diving, and 5" deck guns (long desired by submariners) were finally fitted as standard weapons. Many other pieces of equipment received slight improvement. There was no official change from "Gato" to "Improved Gato" class. Instead the improvements were added as soon as they were available at each shipyard.

Tench Class

Launched:	July 1944 through January 1946
Tonnage:	1570 tons surfaced, 2415 tons submerged
Length:	312'
Speed:	20 kts surfaced, 10 kts submerged
Test Depth:	400'
Torpedoes:	6 bow tubes and 16 torpedoes, 4 stern tubes and 8 torpedoes
Deck Gun:	one 5"
Endurance:	60 days
Crew:	80 officers and men

This was the final class of "fleet submarines" built during WWII. A number were cancelled or scrapped unfinished at the end of the war. The class was similar to the improved Gatos, but with enough refinements and adjustments to merit a new class name.

Type VII German U-Boat

Launched:	1937 through 1945
Tonnage:	626-769 tons surfaced, 745-871 tons submerged
Length:	211-220'
Speed:	16-17 kts surfaced, 7.5-8 kts submerged
Test Depth:	650'
Torpedoes:	4 bow tubes and 12 torpedoes, 1 stern tube and 2 torpedoes
Deck Gun:	one 3.5"
Endurance:	20 days (at 12 kts)
Crew:	44 officers and men

This data is provided for comparative interest. This type (VIIA, B and C) was the standard German U-Boat used in the North Atlantic throughout the war. It had only two diesel engines, but was less visible on the surface (smaller conning tower) and could "crash dive" in 30 seconds (fleet boats took 60 seconds). The larger type IX were considered too large and unmaneuverable for combat operations, while the first type XXI (a highly advanced successor to the type VII) made its 'shake down' cruise in the last month of the war.

US Torpedoes

Rating Torpedoes

Propulsion: Steam propulsion leaves a highly visible trail of bubbles, while electric propulsion leaves only a wake of disturbed water, which is less visible.

Speed/Range: At a given speed, a torpedo can travel a given distance. The Mark 14 had two speed settings. American torpedoes were about average in their speed and range capabilities.

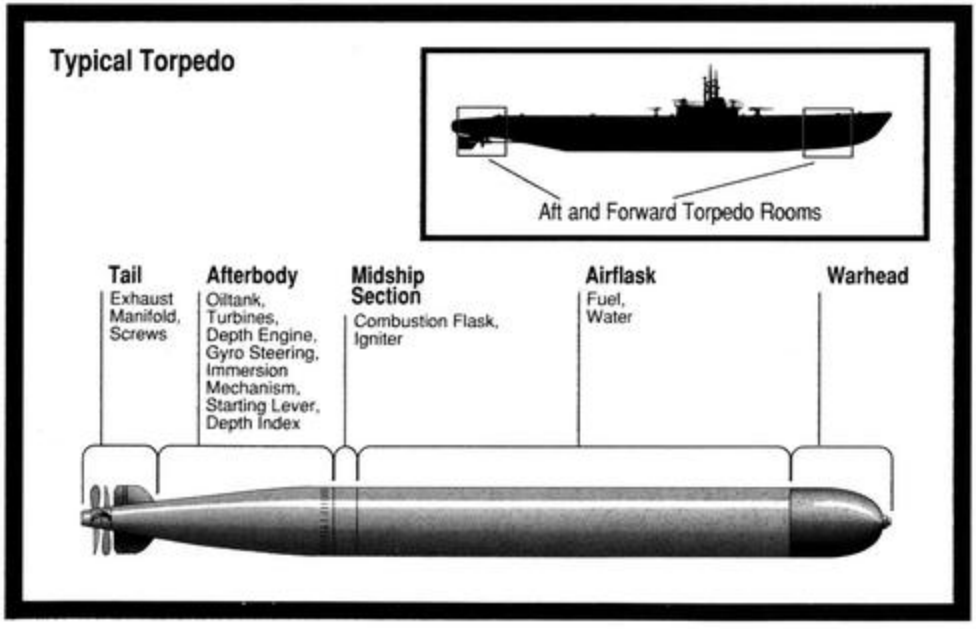
Warhead: The amount of high explosive in the warhead. American torpedoes had small warheads. Some torpedoes of similar size of other nations had 600 to 900 lb. warheads.

Available: The "in service" time period for the weapon.

Mark 10 Torpedo

Propulsion:	Steam
Speed/Range:	3500 yards at 36 knots
Warhead:	500 lbs
Available:	until the end of 1943

Designed during WWI and closely based on the original Whitehead torpedo, this weapon was standard armament for all American submarines until the late 1930s. All the old "S" boat class submarines used this model because their tubes and firing controls couldn't be adapted to the Mark 14. However, later boats could still use the Mark 10s.



Mark 14 Torpedo

Propulsion:	Steam
Speed/Range:	4500 yards at 46 knots
Speed/Range:	9000 yards at 31.5 knots
Warhead:	500 lbs
Available:	throughout war

Designed in the 1930s, this torpedo was to be the "wonder weapon" of the US Navy. It had a magnetic proximity exploder designed to explode beneath a ship and break its keel, as well as a "back-up" contact exploder. Unfortunately, the Navy Department prohibited any live-fire tests of the torpedo. As a result, it ran 10-15' too deep, and its magnetic

exploder rarely worked (it either caused premature explosions, or failed to explode at all). Its contact exploder frequently failed when the torpedo hit "straight on," but functioned somewhat better at glancing angles.

The depth problem was discovered in early 1942 by Admiral Lockwood (then commanding in Fremantle) and most skippers corrected for it. Official acknowledgment didn't occur until June 20th, 1942. Not until June 1943 did Admiral Lockwood (now at SubPac) discover that the magnetic exploder was faulty. However, the SubSoWesPac HQ staff insisted until the end of '43 that the magnetic exploder was fine. The contact exploder fault was not discovered until July-August 1943, and new exploders weren't ready until September. Again, Admiral Lockwood at SubPac discovered the problems and SubSoWesPac, after considerable bureaucratic skirmishing, grudgingly agreed that problems might exist.

Mark 18 Mod 1 Torpedo

Propulsion: Electric
Speed/Range: 4000 yards at 27 knots
Warhead: 500 lbs
Available: 1944 and 1945 only

Popularly known as the "18-1", this torpedo was originally designed by private contractors (not the US Navy). However, later development of this weapon was greatly slowed by the ineptitude of the US Navy Bureau of Ordnance. The first torpedoes delivered ran poorly, but after extensive testing the faults were found and corrected. The weapon was efficient but not especially effective due to its very low speed. For example, a submarine astern of a warship was helpless, since this torpedo could not overtake a major warship moving at high speed.

Mark 18 Mod 2 Torpedo

Propulsion: Electric
Speed/Range: 4000 yards at 40 knots
Warhead: 500 lbs
Available: later 1944 and 1945 only

Upgrades in the Mark 18 engine design, combined with new and improved maintenance procedures, increased its speed considerably. The result was popularly known as the "18-2". This torpedo was more effective than the old Mark 14. However HQ staffs, still embarrassed by forcing sub captains to use the faulty features of the Mark 14, let each skipper select his own torpedo types. Many distrusted new weapons from the Navy Bureau of Ordnance and selected Mark 14s instead.

Japanese Ships in World War II

Rating Ships

Tonnage: Warship tonnage is measured in many ways, including standard light displacement (only appropriate to international law, such as the Naval Limitation Treaty of 1922), normal displacement, and full-load displacement. Normal displacement is used here, and is generally representative of a ship's size.

Max Speed: This is the maximum speed the ship's engines can produce in calm waters. Most warships cruise at a lower speed (17 to 24 knots) to conserve fuel. Merchant ship engines are designed for a different range of speed output and capability, and therefore they cruise economically at speeds very close to their maximum speed.

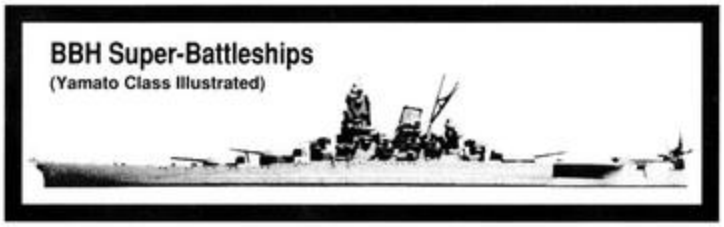
Main Guns: The number and size of the ship's main battery. Major warships invariably have secondary or even tertiary batteries, as well as light AA guns. For example, the *Yamato* class super-battleship had 6.1" secondary and 5" tertiary turrets, as well as numerous 25mm AA gun mountings.

Armor: The maximum thickness of a warship's steel armor. Belt armor is along the side of the ship, usually just above the waterline. Deck armor is the total of various armored decks, the thickest of which is usually well down inside the ship, at the top of the belt, forming an armored box over the ship's vitals.

ASW Weapons: The anti-submarine warfare armament of the ship. Most larger warships did not carry sonar or depth charges. A fully submerged submarine can only be found and attacked with ASW weaponry.

Torps to Sink: This is a rough, statistical estimate of how many torpedo explosions are needed to sink the ship. It is based on the weak 500 lb. warheads in US torpedoes (torpedoes used by other WWII navies were more powerful). It does *not* include secondary damage such as fires, exploding ammunition or fuel, etc. It *does* consider a normal, expected frequency of duds and malfunctions. However, this does not include the extraordinary defects in the Mark 14 (which were gradually corrected during 1943).

Radar Range: The maximum range at which submarine-mounted SJ radar could detect the ship, assuming ideal operating conditions. The range varies depending on whether the ship is end-on or broadside to the radar set (the broadside can be seen further away).



BBH Super-Battleships

Tonnage:	67,123 tons
Max Speed:	27 knots
Main Guns:	nine 18.1"
Armor:	16.1" belt, 9" deck
ASW Weapons:	none
Torps to Sink:	about 12
Radar Range:	25,000 to 40,000 yards

The *Yamato* class of super-battleships was begun in 1937. They were the largest, most heavily armed and armored battleships ever built in human history (larger even than the American *Iowa*class, although the *Iowas* were faster). They were ambushed more than once by American submarines, but shrugged off the one or two torpedo hits and sped away. All were eventually sunk by American air attacks in late 1944 and summer of 1945.

BB Battleships

Tonnage:	30-35,000 tons
Max Speed:	25 knots
Main Guns:	twelve 14" or eight 16"
Armor:	12" belt, 2" to 7" deck
ASW Weapons:	none
Torps to Sink:	about 9
Radar Range:	20,000 to 32,000 yards

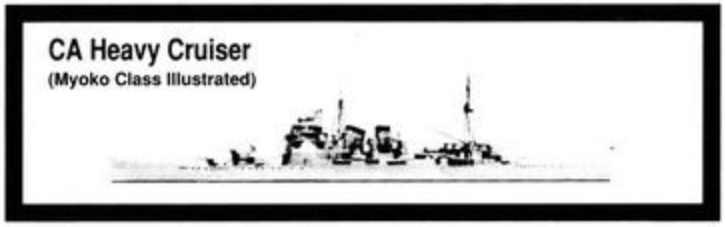
The *Fuso* class of battleships is typical of many Japanese battleship classes. Built during or immediately after WWI, they were extensively rebuilt and modified during the 1930s. The added "pagoda" superstructures were uniquely Japanese. Although these battleships never engaged in a surface battle, slightly smaller battlecruisers (*Kongo* class) with eight 14" guns saw extensive action in the Solomons during 1942. The only Japanese "battleship" sunk by a submarine was actually a *Kongo* class ship.

CV Aircraft Carrier

Tonnage	30-34,000 tons
Max Speed:	28 to 34 knots
Main Guns:	sixteen 5" guns (some had a few 8" guns also)
Armor:	varied, 8.5" belt, 6.7" deck typical
ASW Weapons:	none
Torps to Sink:	about 6 (less if vulnerable)
Radar Range:	20,000 to 31,000 yards

In 1941 the Japanese navy had six powerful "fleet" carriers, of which the *Kaga* was one. Some were built on the uncompleted hulls of battleships or battlecruisers, the others were built as carriers from the "keel up". If caught during flight operations, especially with many fueled and armed aircraft, the carriers were very vulnerable. Otherwise they proved difficult to sink. The *Shokaku*, for example, was damaged in numerous battles before being sunk late in the war.

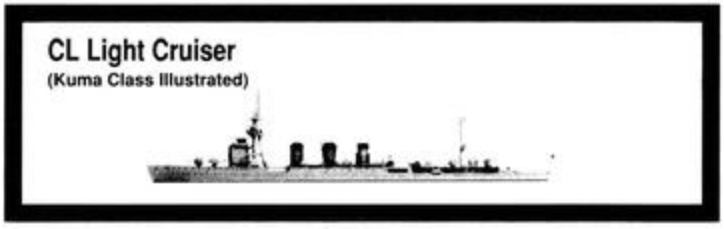
Japan also had a variety of medium and light carriers of smaller displacement and lower speed. During the war a number of additional fleet carriers were completed. The largest was the *Shinano.* Built on a *Yamato* class battleship hull, it was huge (68,059 tons). Unfortunately, the *Archerfish* found and sank her with just four lucky torpedo hits before the ship was fitted out or its crew trained.



CA Heavy Cruiser

Tonnage: 12,300-13,900 tons
Max Speed: 34-35 knots
Main Guns: ten 8"
Armor: 4" to 5" belt, 1.5" to 2" deck
ASW Weapons: none
Torps to Sink: about 4
Radar Range: 14,000 to 22,000 yards

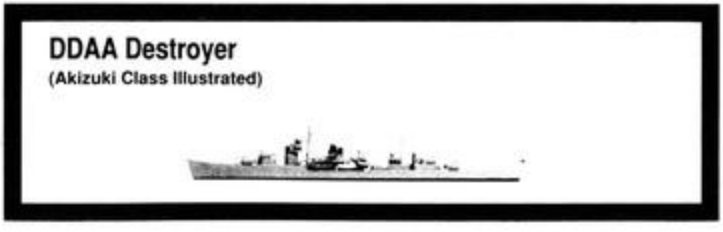
These famous ships saw heavy service throughout the war, including numerous surface battles from the Java Sea to the Aleutian Islands. They were also used extensively as escorts for fleet carriers in naval air actions. Large and powerful, Japanese heavy cruisers were sometimes mistaken for battleships because of their big superstructures.



CL Light Cruiser

Tonnage: 5,500 tons
Max Speed: 35-36 knots
Main Guns: seven 5.5"
Armor: 2" belt (waterline only), 1" to 2" deck
ASW Weapons: sonar, depth charge racks
Torps to Sink: about 2 or 3
Radar Range: 11,000 to 17,000 yards

Built between 1918 and 1925, these ships were never modernized or upgraded, probably because their small size made them unsuitable for work in a battle line. During WWII they were primarily used as destroyer squadron leaders. In the later part of the war Japan completed a few larger light cruisers with 6.1" guns, but most were finished too late to see major action.

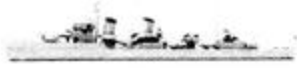


DDAA Destroyer

Tonnage: 3,500 tons
Max Speed: 33 knots
Main Guns: eight 3.9"
Armor: none
ASW Weapons: sonar, depth charge racks and throwers
Torps to Sink: about 2
Radar Range: 10,000 to 15,000 yards

Started in 1940, these ships were originally intended to be anti-aircraft cruisers. When completed they were re-rated as destroyers due to their small displacement. The 3.9" guns were formidable rapid-firing weapons whose volume of fire was superior to the normal 5" armament of a destroyer (although maximum range was somewhat less). The ships were primarily used as destroyers, rather than in their intended role as anti-aircraft ships guarding heavier surface warships (such as carriers).

DD Destroyer
(Fabuki Class Illustrated)

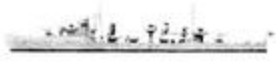


DD Destroyer

Tonnage:	2,000-2,500 tons
Max Speed:	34-38 knots
Main Guns:	four to six 5"
Armor:	none
ASW Weapons:	sonar, depth charge racks and throwers
Torps to Sink:	about 2
Radar Range:	9,000 to 14,000 yards

Japan had numerous classes of fleet destroyers, all built on similar lines. They performed a variety of functions. All major fleet task forces included a screen of destroyers. They also operated alone in small squadrons of 4 to 8 ships, sometimes with a light cruiser leading them. The "Tokyo Express" that ran almost nightly down "the Slot" during the Solomons campaign was a destroyer squadron carrying troops and supplies. Finally, these destroyers were assigned to merchant escort and protection duties, especially from 1943 onward when Japan began using convoys.

DE Destroyer Escort
(Matsu Class Illustrated)



DE Destroyer Escort

Tonnage:	1,500 tons
Max Speed:	28 knots
Main Guns:	three 5"
Armor:	none
ASW Weapons:	sonar, depth charge racks and throwers
Torps to Sink:	about 1
Radar Range:	8,000 to 13,000 yards

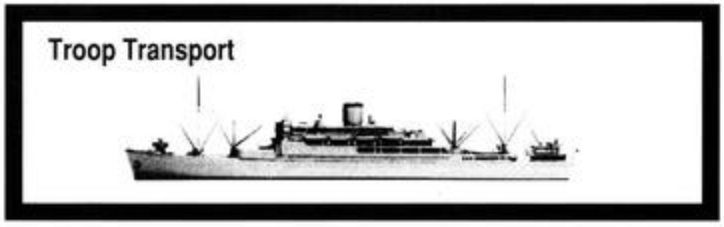
Begun in 1943, these ships were built very quickly (5 to 9 months each), and used to replace fleet destroyers in a convoy escort role. Due to American bombing and lack of raw materials, many were incomplete at the end of war. To a submarine these ships were almost as dangerous as a full fleet destroyer, the only difference being a slightly slower top speed.

PC Patrol Craft
(Type C Illustrated)

PC Patrol Craft

Tonnage:	about 800 tons
Max Speed:	16 to 19 knots
Main Guns:	two or three 3" to 4.7"
Armor:	none
ASW Weapons:	sonar, depth charge racks & throwers
Torps to Sink:	usually 1
Radar Range:	7,000 to 11,000 yards

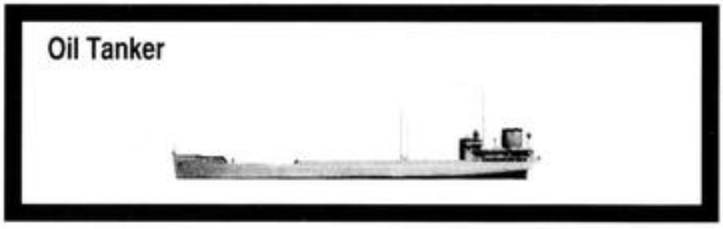
A variety of steel- and wood-hulled small craft were built by Japan as merchant escorts between 1943 and 1945. These supplemented numerous minesweepers and patrol boats already functioning as escorts. Most were used to escort coastal convoys, but the larger ones (such as the *Ukuru* class, Type Cs and Type Ds) could handle the open sea for short or moderate voyages. These ships were nowhere near as formidable as destroyers or destroyer escorts. In fact, in one famous action the submarine *Salmon*, damaged by depth charges, surfaced and defeated two such patrol craft in a gun duel.



Troop Transport

Tonnage: 4,000 to 17,000 tons
Max Speed: 8 to 17 knots
Main Guns: none to four 3" to 5" guns
Armor: none
ASW Weapons: none
Torps to Sink: 1 to 3, varies with size
Radar Range: 6,000 to 11,000 yds if small, 10,000 to 19,000 yds if large

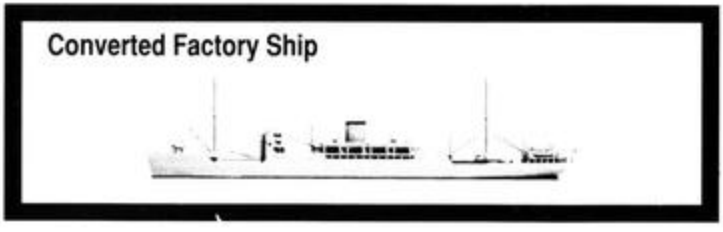
Japanese troop transports came in all types and sizes. Some were converted passenger steamers, but many were freighters with cargo space converted into bunk areas. Most carried ammunition and stores for the troops on board, making them quite vulnerable when loaded.



Oil Tanker

Tonnage: 2,000 to 16,000 tons
Max Speed: 6 to 14 knots
Main Guns: none to two 3" to 5" guns
Armor: none
ASW Weapons: none
Torps to Sink: 1 to 3, varies with size, more if empty
Radar Range: 5,000 to 10,000 yds if small, 10,000 to 19,000 yds if large

Japanese oil tankers came in all sizes. although smaller ones predominated during WWII. Tankers were very vulnerable when loaded, especially since many Japanese-controlled oil areas (such as Brunei) produced high-grade crude that could be transported and used without refining. Unfortunately, this oil contained an unusually high concentration of volatile gases, resulting in spectacular explosions if a torpedo hit ignited them. However, an empty oil tanker was very difficult to sink, since a punctured tank could be sealed off and treated like a full one (a tank filled with water is not unlike a tank filled with oil!).



Converted Factory Ship

Tonnage: 15,000 to 20,000 tons
Max Speed: 8 to 16 knots
Main Guns: usually two to six 4.7" or 5" guns
Armor: none
ASW Weapons: none
Torps to Sink: 2 to 4, more if empty
Radar Range: 10,000 to 20,000 yds

Giant Japanese whaling factory ships and similar vessels were converted during WWII to a variety of duties, but oil transport was the most common. The above data is based on an oil tanker conversion. Because of their large size, the ships were usually well armed.

Large Freighter

Large Freighters

Tonnage: 7,000 to 18,000 tons
Max Speed: 6 to 15 knots
Main Guns: none to four 3" to 5" guns
Armor: none
ASW Weapons: none
Torps to Sink: 2 or 3, more if loaded bulk carrier
Radar Range: 7,000 to 20,000 yds

Japanese freighters carried raw material in bulk, food and military stores of all types, including highly volatile ammunition or gasoline (for ground vehicles and aircraft). Bulk and stores carriers are not especially vulnerable when loaded. In fact, bulk carriers are somewhat less vulnerable when loaded. However, ammo and gasoline ships almost always sink after the first hit if loaded.

Small Freighter

Small Freighters

Tonnage: 1,000 to 8,000 tons
Max Speed: 6 to 14 knots
Main Guns: none to four 3" to 5" guns
Armor: none
ASW Weapons: none
Torps to Sink: 1 or 2, more if loaded bulk carrier
Radar Range: 4,000 to 15,000 yds

Many Japanese freighters were smaller sized. Like the larger ones, they carried bulk raw materials, stores and equipment of all types, and sometimes ammo and gasoline. It was not easy to estimate displacement based on size, since many did not appear significantly smaller than the larger ones.

5 APPENDIX

Design Notes

Silent Service II was the brainchild of Bill Stealey, MicroProse's President. Back in 1985 Sid Meier's original *Silent Service* was a smash bestseller for various 8-bit microcomputers, such as the Atari 800, Commodore C-64 and Apple II. In 1990 the common microcomputer is a 16-bit machine with more memory, computing horsepower, and disk space. We wanted to exploit this greater power to remake *Silent Service* into something bigger and better than its illustrious ancestor.

In late summer 1989 the creative team assembled in MPS Labs. Lead programmer Roy Gibson and artist Kim Biscoe were both British, which lent an air of internationalism in a game about American submarines fighting the Japanese along the Pacific Rim! Originally the game designer/project manager was Bruce Shelley, who did much of the original brainstorming and research with Roy. However, the *Railroad Tycoon* project derailed his time and Arnold Hendrick took over in midstream. Arnold finished up the historical nit-picking, wrote the manual, and gently encouraged Roy and Kim to finish the project as quickly as possible. Rumors that he carried a baseball bat to timetable meetings are completely unfounded, as are the rumors that MicroProse's higher management wished he did!

The greatest technological feat in *Silent Service II* is the highly realistic presentation of enemy ships. We originally wanted different pictures for every type of warship in the Imperial Japanese Navy (IJN). Bruce and Roy combed the US Naval Archives searching for detailed views. With the kind help of librarian Kathy Lloyd we tried actual WWII ship recognition books, but found them inferior to a magnificent resource on the outskirts of Washington D.C. This was Don Montgomery, who spent years modelling *every warship* of the

IJN in 1/700 scale. When photographed from periscope perspective, these models made superlative "raw material" for artist Kim Biscoe. After extensive artwork tied to complex scaling algorithms built by ace "tool-maker" Dave McKibbin, we achieved screen images that closely match what real submariners saw through binoculars or periscopes.

Of course, the game development had many other triumphs. We exploited the additional power of 16-bit microcomputers to completely rework all the battle logic, adding more detail and realism. We expected the playtest department to complain about the new features. Instead, they urged on us even more! The original *Silent Service* was an old favorite: everybody had ideas on how to improve it. Soon our problem was not what to include, but what we were obliged to leave out!

Silent Service II is a fine game in any 16-bit computer environment. However, we'd like to especially recommend it for IBM MCGA and VGA 256-color graphics (all PS/2s or any machine with a VGA board and monitor). It is one of the first simulations designed to take full advantage of 256-color graphics. The results are absolutely amazing. Enhancing an IBM's sound system with one of the add-on boards we support is also a good idea.

In the final stages of development, while playing *Silent Service II*, we found ourselves transported mentally to a time 50 years ago, when small bands of brave men set sail over thousands of miles to challenge the might of a seemingly invincible empire. Today America's victory is taken for granted. But it took brave men to struggle past the first disasters and defeats, then eventually emerge victorious. In *Silent Service II* you're one of that band of heroes, setting sail to victory and eternal glory.

A Note About War

War is perhaps the most unpleasant attribute of the human race. Historians can list literally thousands of wars. Causes and results are legion, the amount of death and suffering unimaginable. We Americans sometimes forget this because it's been 125 years since war has devastated our own land. Since then we've always fought overseas. On the other hand, men (and a few women) are fascinated by warfare, by the extreme risks and sometimes world-shaking results. Young men are especially entranced by tales of adventure and bravery.

Many MicroProse simulations deal with warfare. In a simulation you can vicariously experience the thrills of warfare and the responsibilities of battle-

field command without anyone getting hurt, much less killed. But always remember that the real thing is unimaginably horrible, full of pain and death. Simulations are deceiving because we "edit out" the unpleasant parts!

It is also worth mentioning that Japan learned a great deal from WWII. Japan has renounced the use of military power as an instrument of foreign policy. Its armed forces are purely to guard its own borders, and are deliberately kept small. The officer corps itself has a completely different attitude from the overconfident radical-rightists who took over the government in the 1920s and '30s. Even when provoked by Japan's most famous and popular author (Mishima), they refused to involve themselves in politics. The Japan of today is very different from the Japan of 1941.

Further Reading
General Histories

There are many excellent sources of information about American submarines in the Pacific during WWII. As with all history, remember that each writer has opinions and a viewpoint which colors what he presents.

The Pacific War 1941-1945 by John Costello. This is an excellent one-volume account that gives equal weight and considerable detail to all national perspectives, including Japanese, Chinese and British, rather than the rah-rah-America stuff usually found in the USA. While excellent for the entire war, the book doesn't include much about submarines *per se*.

Silent Victory by Clay Blair, Jr., is the single best history of American WWII submarines. It covers all the events, personalities, and individual patrols in exhaustive detail. Although a submariner himself, Blair is remarkably impartial and quite enjoyable to read. Unfortunately, as with many superlative history books, the hardcover version is now out of print.

US Submarine Operations in WWII by Theodore Roscoe is a detailed operational history with some very useful appendices. Written shortly after the war, it is an official history in all but name, and extremely laudatory to the US Navy in general, its officers, and especially the men of its submarine service. Although it's great reading, don't expect a balanced viewpoint.

History of US Naval Operations in WWII by S.E. Morison is the classic 15-volume history of the US Navy. Morison was one of America's finest historians and an excellent writer. If you don't want to tackle all 15 volumes, he has a superbly readable one-volume summary titled **The Two-Ocean War.**

Technical Sources

Finding data and statistics books takes time. Many are out of print, and most libraries don't carry them. Fortunately we had access to various large private collections. Among the best books we encountered were these:

Warships of the Imperial Japanese Navy, 1869-1945 by Jetschura, Jung and Mickel. Translated from German and published by the US Naval Institute, this is the single best volume for data on every Japanese warship, given in exhaustive detail.

US Warships of World War II by Paul Silverstone. Originally published in Britain, this handy volume provides basic data on the huge US WWII fleet, including its submarines. Similar volumes by various authors cover other WWII fleets. Unfortunately, all are now out of print.

US Subs in Action by Robert C. Stern. This Squadron/Signal book was intended for modellers, but includes a wealth of illustrations and visual detail that aided us in duplicating the "look" of US submarines.

USS Torsk. We repeatedly visited this Tench-class submarine (a real boat!) and used its equipment as a model for that shown in the game. We took into account that the Tench class has refinements not available on earlier classes.

Other Books

Clear the Bridge by Richard H. O'Kane. This is a very interesting autobiographical account of O'Kane's command of the USS Tang during her five war patrols, in which the boat earned two Presidential Unit Citations and her skipper the Medal of Honor.

Wahoo by Richard O'Kane. This is a history of the USS Wahoo's war patrols under the command of "Mush" Morton. O'Kane was executive officer (second in command) for many of these, and therefore writes from personal experience.

Take Her Deep by I.J.Galantin recounts the war patrols of the USS Halibut under his command. It provides an excellent insight into "average" war patrols under a "merely" competent skipper. Comparing Galantin to O'Kane provides interesting insights into what makes a really great sub skipper: personality, skill or luck?

Shinano! by Joseph F. Enright recounts the first and final voyage of that aircraft carrier, and how the *Archerfish* sank her. What the book doesn't reveal is that this was Enright's only big score for the entire war, despite numerous war patrols.

Bowfin by E.P.Hoyt details the war patrols of that boat. Hoyt has written tons of WWII books, including lots about submarines. However, much of his work is derivative.

Run Silent, Run Deep by Edward Beach, a WWII sub skipper, is fiction. The book is well writen, exciting and technically accurate. The novel combines in one character all the great US sub skippers of the war. It's very highly recommended.

War under the Pacific by Keith Wheeler is a Time-Life "picture book", one of a subscription series. Its many photographs helped inspire us all, especially artist Kim Biscoe. We recommend it for a "visual feel" of the period, including the era, men, the boats, and the battles.

— Arnold Hendrick, May 1990

Credits

Game Design
Arnold Hendrick and Roy Gibson
based on the original Silent Service by
Sid Meier

Programming
Roy Gibson

Graphics
Kim Biscoe

Music & Sound Effects
Ken Lagace and Jim McConkey
with theme music composed by
Dr. Jeffery L. Briggs

Quality Assurance
Chris Taormino, Alan Roireau and Russell Cooney

Manual
Written by Arnold Hendrick
Direction & Design by Iris Idokogi
Graphics by Barbara Bents, Michael Reis, Iris Idokogi and Cheri Glover
Layout by Michael Reis and Iris Idokogi
Chapter Illustrations by Ken Zaruba

Project Management
Arnold Hendrick and Bruce Shelley

Package Design
Creative Direction by Mark Ciola
with John Emory, Juanita Bussard and Jack Kammer
Photography by Frederick Sutter Photography
based on computer art by Kim Biscoe

Special Thanks to...
USS Torsk, Baltimore Maritime Museum.
Kathy Lloyd, Librarian of the Operational Archives at the Washington Navy Yard.
Don Montgomery, Master Modeller.
Options backdrop courtesy of the estate of Fred Freeman, Cmdr, USN (ret).

Copyright Notice

LIMITED WARRANTY

Neither MICROPROSE SOFTWARE, INC., nor any dealer or distributor makes any warranty, express or implied, with respect to this manual, the disk or any related item, their quality, performance, merchantability, or fitness for any purpose. It is the responsibility solely of the purchaser to determine the suitability of the products for any purpose. Some states do not allow limitations on implied warranties or how long an implied warranty lasts, so the above limitation may not apply to you.

As a condition precedent to the warranty coverage provided below and to ensure identification, the original purchaser must complete and mail to MicroProse Software, Inc., 180 Lakefront Drive, Hunt Valley, Maryland 21030, within 30 days after purchase, the Registration/Warranty card enclosed in this product. To the original purchaser only, MicroProse Software, Inc. warrants the media to be free from defects in material for 90 days. If during the first 90 days after purchase a defect in media should occur, the software may be returned to MicroProse Software, Inc., who will replace the media at no charge. If at any time after the initial 90 day period your media becomes defective, the media may be returned to MicroProse Software for replacement at a reasonable service charge.

In no case will MicroProse Software, Inc. be held liable for direct, indirect or incidental damages resulting from any defect or omission in the manual, or other related items and processes, including, but not limited to, any interruption of service, loss of business, anticipated profit, or other consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

IMPORTANT: The above warranty does not apply if the you make any unauthorized attempt to modify or duplicate the product, or if the product has been damaged by accident or abuse.

MICROPROSE
Simulation • Software
180 Lakefront Drive, Hunt Valley, Maryland, 21030 (301) 771-1151
Unit 1, Hampton Road Industrial Estate, Tetbury, Glos. GL8 8LD. Tel: 0666 504326

NOTES

NOTES

NOTES

NOTES