SEGA™

GENESIS™

16-BIT CARTRIDGE

688 ATTACK SUB™

SIMULATOR SERIES

INSTRUCTION MANUAL

Contents

Starting Up 3

Welcome Aboard, Captain 4

Take Control! 5

- Control Pad Buttons 5
- Mission Selection Screen 7
- Configuration Panel 7
- Moving Around Your Sub 8

Quick Start 10

- Starting Up 10
- Receiving Your Orders 11
- Using the Periscope 12
- Setting a Waypoint 13
- Setting Your Depth 14
- Loading Torpedoes 15
- Deploying the Towed Array 15
- Compressing Time 16
- Target and Launch 16
- Continuing the Attack 17
- End of Mission 17

Captain's Controls 18

- Reading Your Displays 18
- Top-Down Map 18
- Contour Imaging 20
- HUD (Heads-Up Display) 21
- Map Controls: 688/700 22
- Map Controls: *Alfa* 23
- Target Information 23
- Crew Messages, Location and Time 24

Battle Stations 25

- Radio Room 25
- Navigation Board 26
- Sub Control Panel 28
- Sonar Room 30
- Periscope Station 33
- Weapons Control Panel 34
- Status Panel 37

Missions 38
Mission Objectives 38
Torpex '89 39
Shake 'Em 40
Sub Ops 41
Mumar Cadaver 42
Escape 43
Goulash 44
Cat Walk 45
Surprise Party 47
Homecoming 48
Hit and Run 50

Submarine Warfare 51
Submarine Systems 51
Submarine Classifications 53
The Ocean Environment 54
Evading Pursuers 56
Evading Torpedoes 57
Responses to Torpedo Attacks 58
The Baffles 59

Submarine Specifications 60

Weapons 63
Torpedo Specifications 64
Missile Specifications 66

Surface Ship Specifications 67

Aircraft Specifications 72

Designers' Notes 74

Glossary 76

Handling Your Cartridge 79

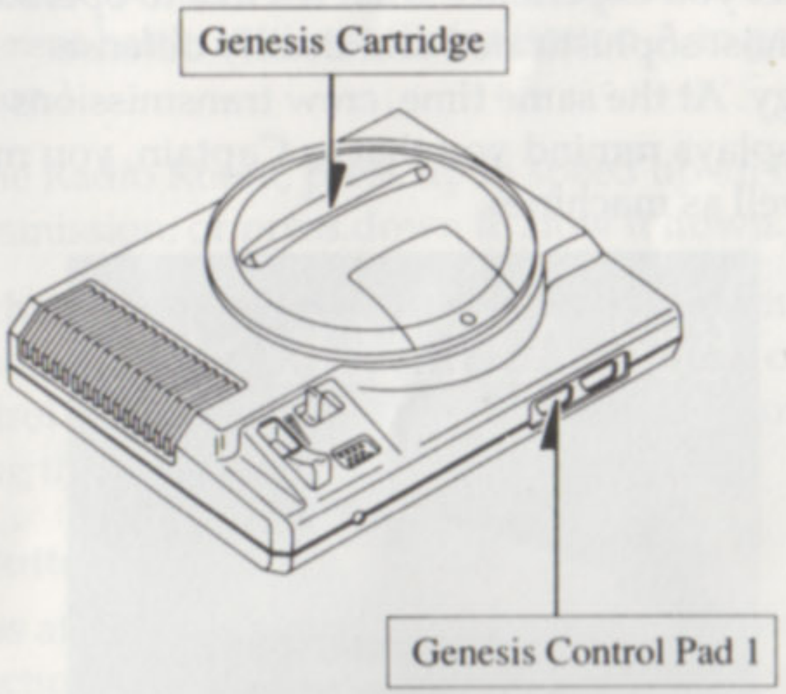
Limited Warranty 79

Starting Up

1. Set up your Genesis System as described in its instruction manual. Plug in Control Pad 1.
2. Make sure the power switch is OFF. Then insert the *688 Attack Sub* cartridge into the console.
3. Turn the power switch ON. In a few moments, the *688 Attack Sub* Title screen appears.
4. If the Title screen doesn't appear, turn the power switch OFF. Make sure your system is set up correctly and the cartridge is properly inserted. Then turn the power switch ON again.

Important: Always make sure the power switch is turned OFF before inserting or removing the cartridge.

Note: *688 Attack Sub* is for one player only.

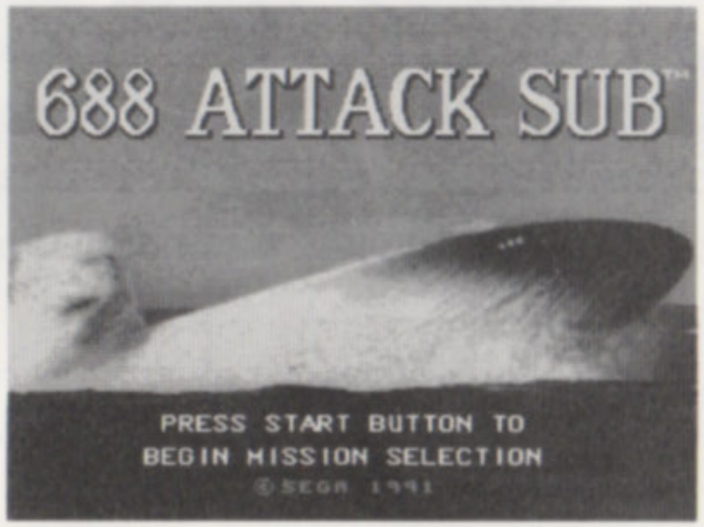


Welcome Aboard, Captain

You are now in command of the world's most powerful and versatile ocean-going defense weapon, a nuclear-powered attack submarine. You are a hunter/killer, a predator of the deep. You play a silent, sometimes lethal game of hide and seek. Every minute you make countless decisions that may have grave consequences for you, your crew . . . and your country.

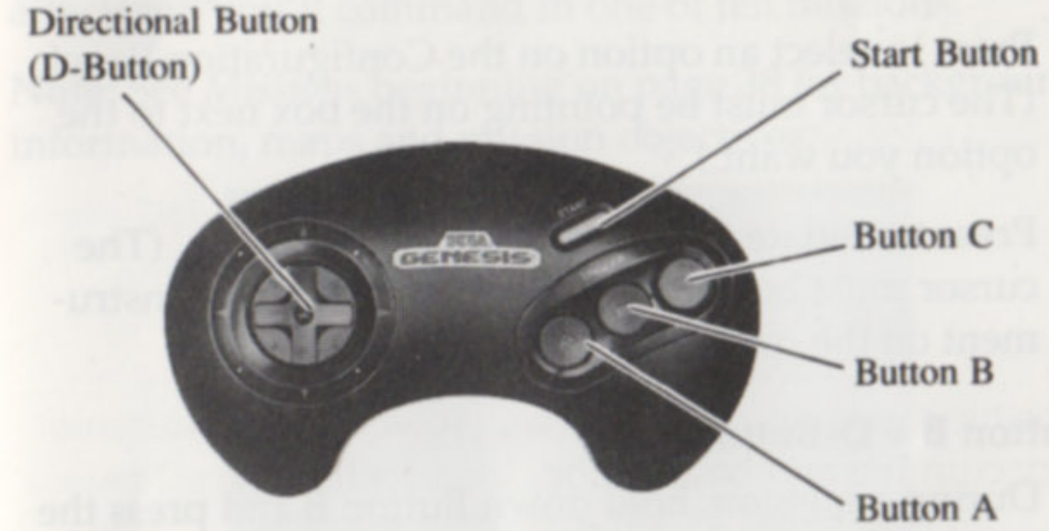
You command an American *Los Angeles* or Soviet *Alfa* class submarine. You prowl through dark undersea worlds, carrying out deadly missions that require predatory cunning and bold action. In peacetime, you track and hunt potential enemies. In war, you ambush enemy convoys or defend your warships, stalk ballistic missile subs and duel with other hunter/killers, and strike at inland targets from enemy waters. If you're lucky, you'll survive to write your memoirs.

All the major systems of modern attack submarines — sonar, weapons, navigation, helm, radio and periscope — are yours to command. Over 40 separate controls let you experience what it's like to operate the world's most sophisticated and deadly defense technology. At the same time, crew transmissions and visual displays remind you that as Captain, you manage men as well as machines.



Take Control!

Control Pad Buttons



D (Directional) Button

- On the Mission Selection screen and Configuration Panel, press in any direction to move the cursor to the box next to your choice. (Press Button A to select that choice.)
- In the Conn (the central control room), press in any direction to move the cursor to the positions for different battle stations. (Press Button A to go to a station.)
- In the Radio Room, press up to speed up an incoming transmission, or press down to slow it down.
- In a battle station, press in any direction to move the cursor onto a map symbol or an instrument on the control panel. (Press Button A to initiate an order using that map symbol or instrument.)

Start Button

- Press at the Title screen to go on to the Mission Selection screen. "Start" also pauses the game on any screen.

Button A

- Press to select a mission and submarine on the Mission Selection screen. (The cursor must be pointing on the box next to the mission and sub you want.)
- Press to select an option on the Configuration Panel. (The cursor must be pointing on the box next to the option you want.)
- Press to initiate an order in any battle station. (The cursor must be pointing on a map symbol or instrument on the control panel.)

Button B + D-Button

- During a mission, hold down Button B and press the D-Button in any direction to cycle through the symbols for the battle stations. Release Button B to go to the station for the symbol that's displayed.

Button C

- Press to stop an incoming transmission in the Radio Room.

Button C + D-Button

- In a battle station, hold down Button C and press the D-Button to move from instrument to instrument on the control panel.
- In the Conn, or central control room, hold down Button C and press the D-Button to jump from station to station.

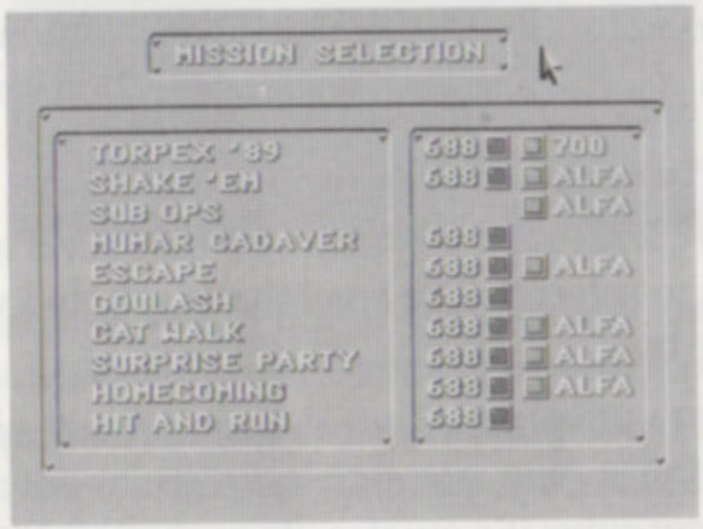
Reset Button (on console)

- Restarts the game from the Sega screen.

Mission Selection Screen

Press Start at the Title screen to go to the Mission Selection screen. From here you can choose the nuclear attack sub you'll command in one of ten missions.

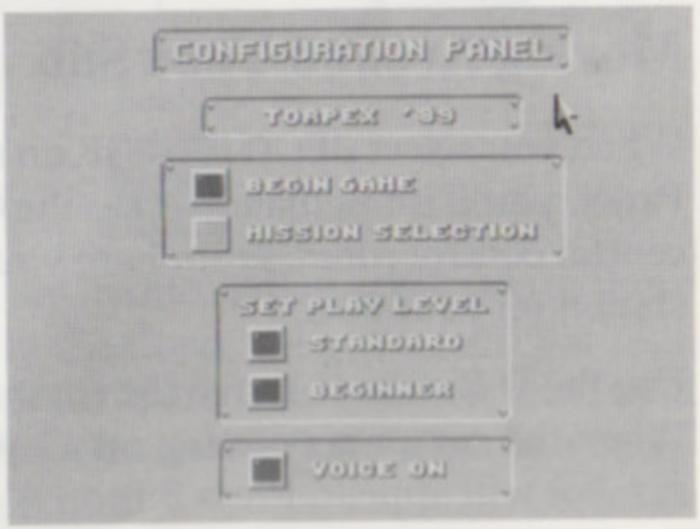
Note: See *Missions* beginning on page 38 for background information, maps and mission objectives.



Use the D-Button to place the cursor on a submarine box (blue for *Los Angeles* 688; red for *Dallas* 700 or *Alfa*) in the same line as the mission you want to undertake. Then press Button A. You'll go on to the Configuration Panel.

Configuration Panel

Use the Configuration Panel to begin the game, return to the Mission Selection screen, set your play level, and turn your crew's voice messages on or off.



Current Mission

Near the top of the panel you'll see the name of the mission you're about to begin.

Begin Game

Point the cursor on the box next to this option and press Button A to begin your mission.

Note: If you return to the Configuration Panel during a mission, this option will change to CONTINUE GAME.

Mission Selection

Point the cursor on the box next to this option and press Button A to return to the Mission Selection screen.

Set Play Level

Point the cursor on a box next to a play level and press Button A to select it. The level that's selected will have a light blue box.

In STANDARD play, your sub has normal capabilities. In BEGINNER play, your sub has certain advantages over enemy subs: it's quieter, its sonar is more powerful, it can take more damage, and its raised periscope isn't as noticeable to surface radar.

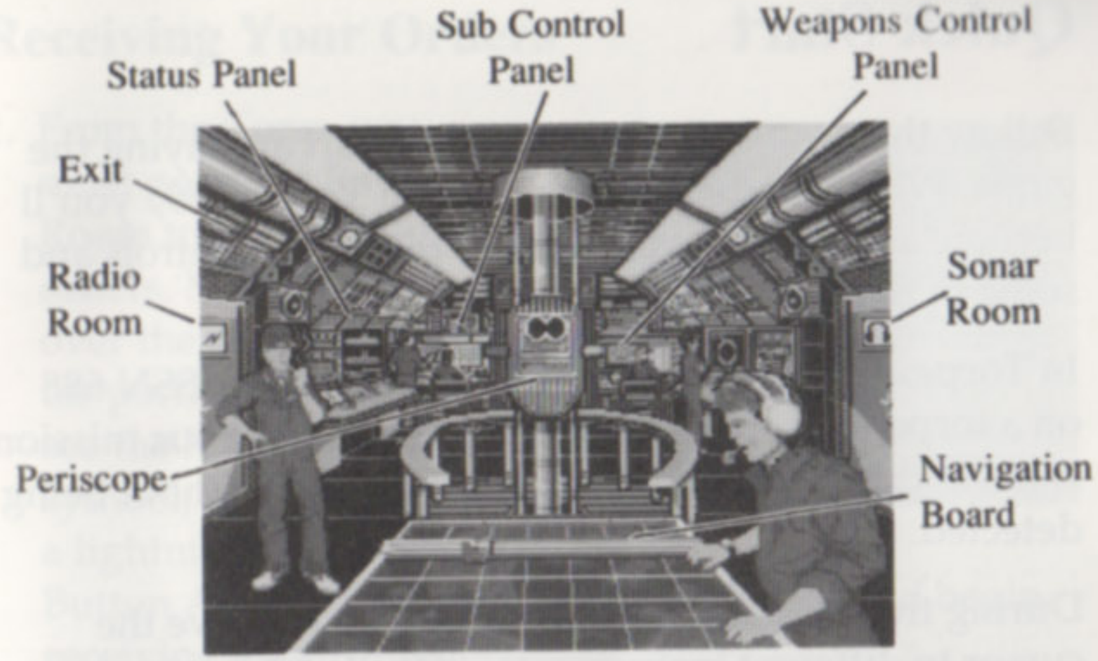
Voice

Point the cursor on the box next to this option and press Button A to turn voice messages on or off. With Voice On (light blue box), you'll hear responses from your crew as well as see them on screen. With Voice Off (dark blue box), you'll only see them.

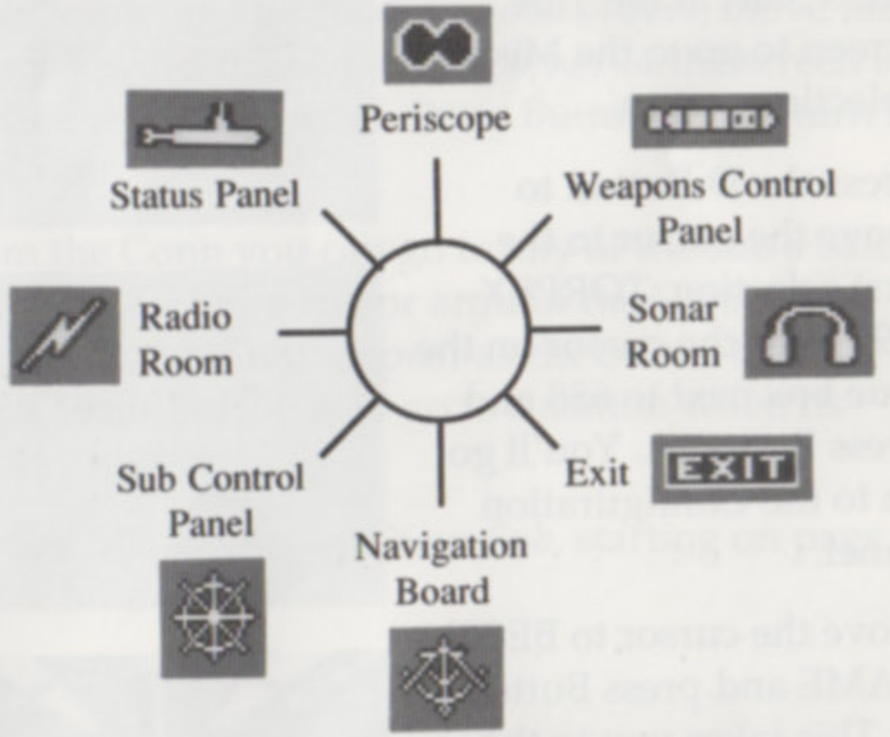
Moving Around Your Sub

When you select BEGIN GAME on the Configuration Panel, you'll immediately go to the Conn, your sub's central control room. From here you can go to any battle station on your boat.

Use the D-Button to move the cursor around the Conn. When the cursor is pointing on a battle station, its symbol will appear. Press Button A to go to that station.



You can also use Button B plus the D-Button to go to the battle stations. Hold down Button B and then press the D-Button in the direction of the battle station you want. When the station's symbol appears, release Button B to go on to that station.



Selecting EXIT from any battle station takes you to the Conn. While you're in the Conn, the game (and the game time) is paused. Go to any battle station to resume the game. Selecting EXIT from the Conn takes you back to the Configuration Panel.

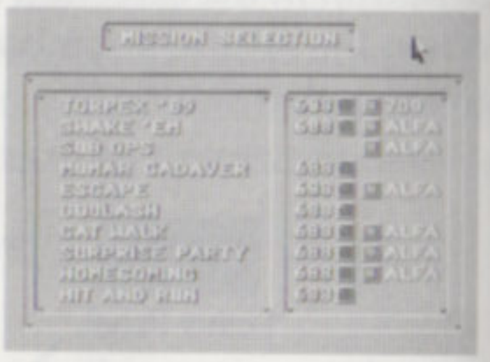
Quick Start

Follow this section to get a running start at playing the game. While conducting the mission Torpex '89, you'll become acquainted with most of the game controls and some of the strategies.

In Torpex '89 you'll command the *Los Angeles* SSN 688 on a torpedo exercise in the Faeroe Islands. Your mission is to sink three decommissioned warships without being detected.

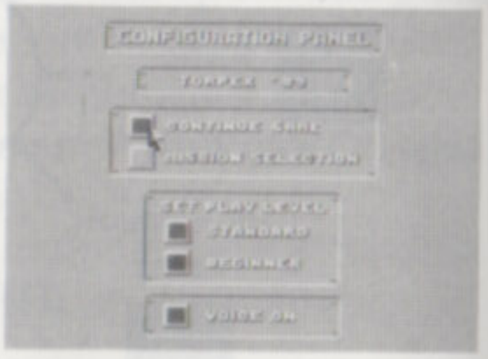
During the mission, press the D-Button to move the cursor to different instruments on the battle station control panels. Then initiate an order by pressing Button A.

Starting Up

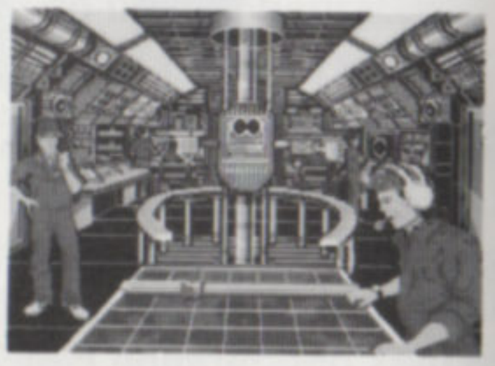


1. Press Start at the Title screen to go to the Mission Selection screen.

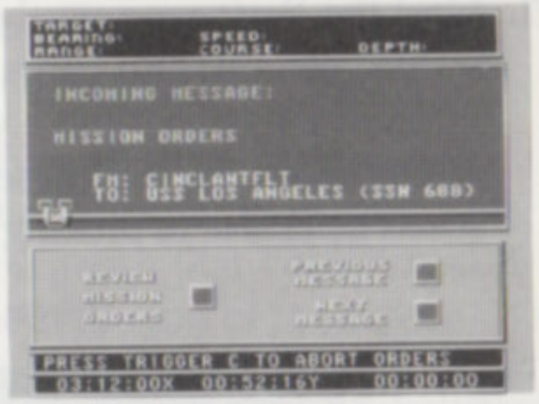
2. Press the D-Button to move the cursor to the first selection, TORPEX '89. Point the cursor on the blue box next to 688 and press Button A. You'll go on to the Configuration Panel.



3. Move the cursor to BEGIN GAME and press Button A. This takes you to the Conn, or central control room of your submarine.



Receiving Your Orders



1. From the Conn, you must go to the Radio Room to receive your orders. Move the cursor over the door on the left (or port) side. When you see the Radio Room symbol, which looks like a lightning bolt, press Button A. You'll go on to the Radio Room and begin receiving a transmission.

Note: Press the D-Button up or down to speed up or slow down the incoming message. To read the transmission again, point the cursor at the box next to REVIEW MISSION ORDERS and press Button A.

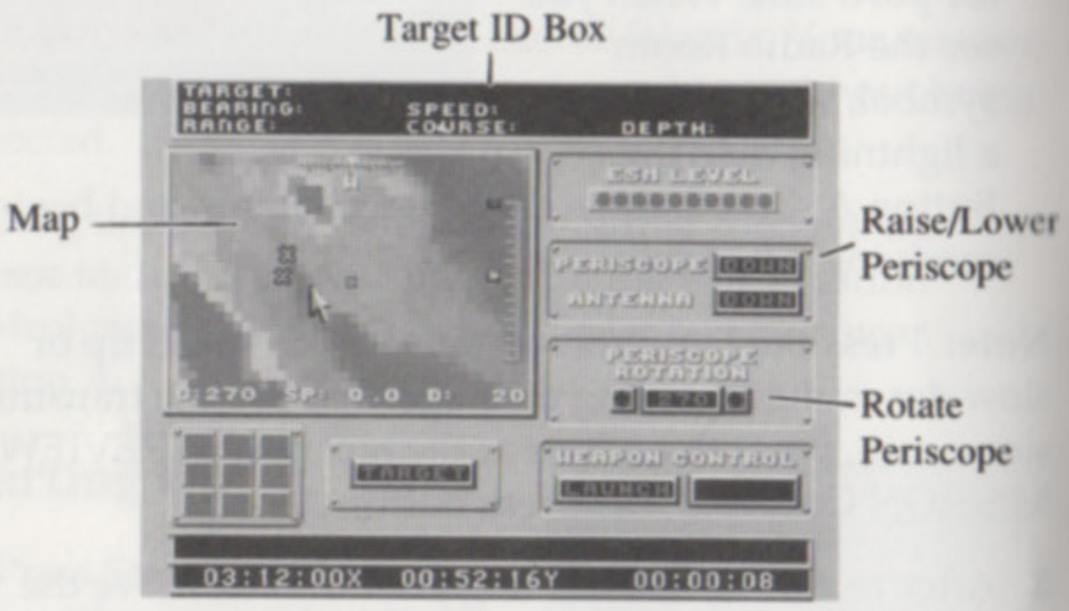
2. After receiving and reading your orders, move the cursor toward the upper left corner of the screen until you see the Exit symbol. Press Button A to return to the Conn.

3. From the Conn you can go to any of the sub's battle stations. Move the cursor around the Conn. The station symbols will appear as the cursor touches them. Press Button A to go to a station when its symbol appears.

Note: See *Moving Around Your Sub*, starting on page 8, for more information.

Using the Periscope

1. Find the Periscope symbol (in the center of the periscope column) and press Button A to go to Periscope. Look at the map, where you should see one or more X's or other letters. These are sonar contacts that your sonar operator is picking up.



   At this point, your sonarman doesn't know what the contacts are, or their range, depth or speed.

Note: The ocean is filled with sounds, which could mean anything from enemy subs to schools of fish. In combat, never take a sound for granted. Get a positive ID from sonar ASAP.

2. Sonar is not the only way to get a fix on a target. If the contact is a surface ship, you can view it on your periscope. Right now you are at periscope depth (20 ft), so you can raise the periscope. Move the cursor onto the box next to PERISCOPE and press Button A. The map will be replaced by a view of the ocean's surface.



3. Rotate the periscope until you see the destroyers. Move the cursor to a box on the left or right of the number under PERISCOPE ROTATION and press Button A.

4. Move the cursor to TARGET and press Button A. Now place the cursor on the closest ship in view and press Button A. Information about that vessel should appear in the target ID box at the top of the screen.

5. Look at the top-down map again by selecting T (use the cursor and Button A) on the nine-button map control in the lower left corner. The letters (except for X) show that you have a fix on these targets. (X indicates a contact with no targeting information as yet.)

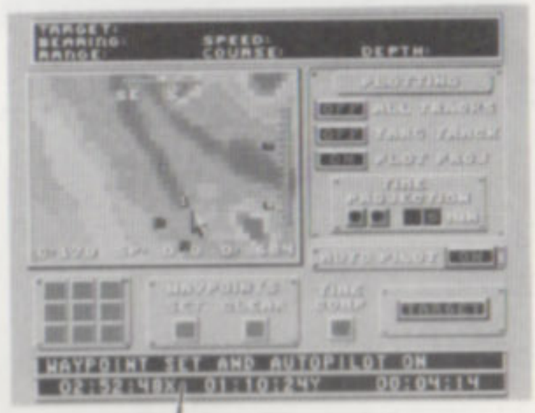
6. If you can't see the letter, the target may be outside the map area. Select O (zoom out) on the map control until you get a bigger view of the map.

7. With your periscope still up, return to the Conn by moving the cursor to the upper left corner. When the EXIT symbol appears, press button A.

Setting a Waypoint

1. While you're still getting a firm fix on your targets, go to the Navigation Board. (Its symbol looks like a sextant, and appears over the chart table in the Conn.) Here you can set auto pilot to steer your submarine toward the targets.

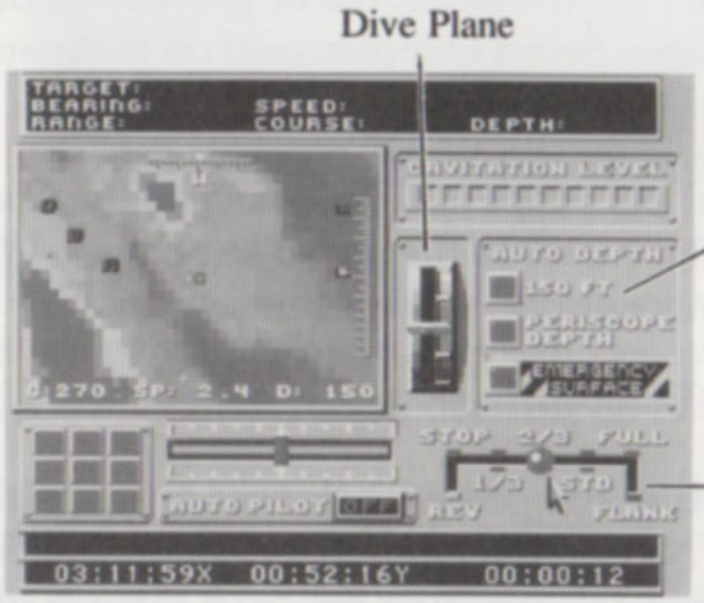
2. Select SET from the waypoint controls. Then move the cursor close to one of the targets on the map and press Button A. A number will appear to mark the waypoint.



3. Now that you know your general direction, return to the Periscope Station. Lower the periscope to avoid being detected by surface radar. You may lose the target information at the top of the screen. Don't worry about it. After your sonarman has listened for a few minutes, he'll get another fix on the target with his passive sonar.

Setting Your Depth

1. Even with auto pilot active, you're still in control of your sub's speed and depth. From the Navigation Board, go on to the Sub Control Panel. (Its symbol looks like a tiller and appears in the Conn over the two crewmen at center left.)

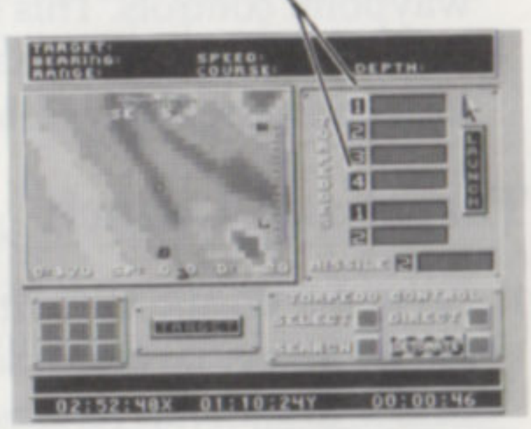


2. Set the throttle on 2/3 by moving the cursor to the 2/3 mark and pressing Button A.

3. Select 150 FT auto depth. Your crew will automatically take the sub to that depth.

Loading Torpedoes

1. Torpedoes are not stored armed and ready in the sub's torpedo tubes. They're too dangerous for that. To ready them, go to the Weapons Control Panel. (Its symbol looks like a torpedo and appears in the Conn over the two crewmen at center right.)



2. Torpedo tube 1 should already be selected (the box around the number is highlighted). Move the cursor to the box and press Button A to load the torpedo.

3. Move to the next tube and press Button A once to select it and again to load the torpedo. Do this to all four torpedo tubes. The weapons officer will inform you when each torpedo is armed. The torpedo icons will also turn red, indicating that they are armed.

Note: The two auxiliary tubes hold noisemakers, which are not needed on this mission.

Deploying the Towed Array

1. Go to the Sonar Room (its symbol, headphones, appears in the Conn on the door to the right).

2. Select DEPLOY to feed out your towed array (a long cable with microphones along its length). When towed behind a sub, it improves sonar's listening capabilities, although it limits the sub's top speed.



Compressing Time

1. If your sonarman doesn't have a positive ID, bearing, course, and range on the destroyers, you'll have to wait while he gathers that information. This can take a few minutes. If you're impatient, go to the Navigation Board and select TIME COMP, to the right of the waypoint controls. This speeds up the game time. When your sonarman has a fix on a target, deactivate time compression by selecting TIME COMP again.

Target and Launch

1. Go to the Weapons Control Panel. If the destroyers are no longer targeted, select TARGET, move the cursor to the ship on the map you want to attack, and press Button A to acquire the target.

2. If the range is under ten nautical miles (the maximum range of a 688 attack torpedo) you can fire a torpedo. Check that the box around torpedo number 1 is highlighted. If it is not, select it at once, and then select LAUNCH.

3. It takes more than one torpedo to sink a destroyer, so wait about ten seconds and launch again.

Note: If you're out of range (ten miles or more) you'll have to close in on the targets. This may require going to the Sub Control Panel and setting your throttle to a higher speed.

4. Sonar will confirm if and when the torpedoes reach their target. If you think it's worth the risk of detection (and in the beginner stage it probably is), you can go to periscope depth and raise your periscope to confirm the hit.

5. Fire torpedoes until the ship sinks (the letter will disappear from the map).

Continuing the Attack

1. Set up your attack on the next ship. If you're lucky, you're already in range to strike your next target. If you're unlucky, you'll have to set new waypoints to attack the other two ships.

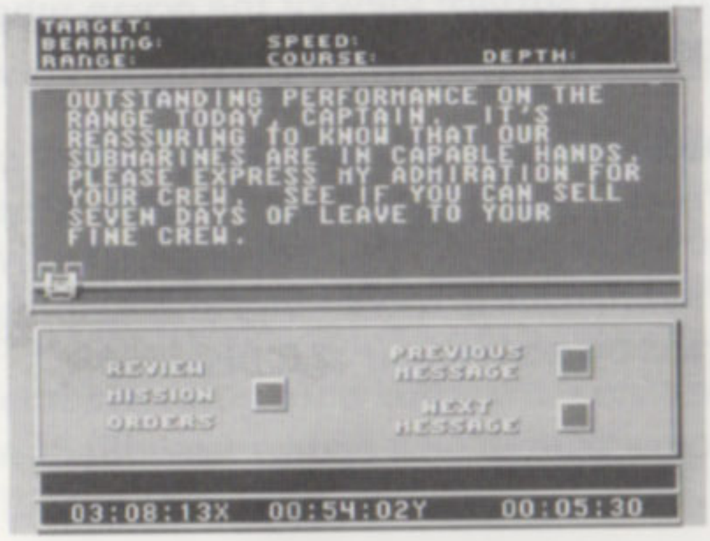
Note: You can set up to nine different waypoints. Your sub will go to each of them in numerical order.

End of Mission

Torpex '89 ends when you sink all three ships, or 15 minutes have elapsed. Now you'll receive either warm praise or a sound tongue-lashing from your superiors.

Don't be dejected if you didn't do too well the first time. Play through the exercise again. The controls will start becoming habits and you'll begin thinking and planning ahead like an ace sub commander.

Note: In the Torpex '89 mission you can also command a *Dallas* 700 and attempt to sink three of five decommissioned destroyers in a contest against the computer-controlled 688 .



Captain's Controls

In *688 Attack Sub*, most of the submarine controls are the same for the American *Los Angeles* and *Dallas* and the Soviet *Alfa*. Although the controls look different for American and Russian subs, and may be in different locations of the screen, they do the same things.

The older Soviet *Alfa* is missing some high-tech equipment. Notes in the text point out any exceptions in the *Alfa*'s controls.

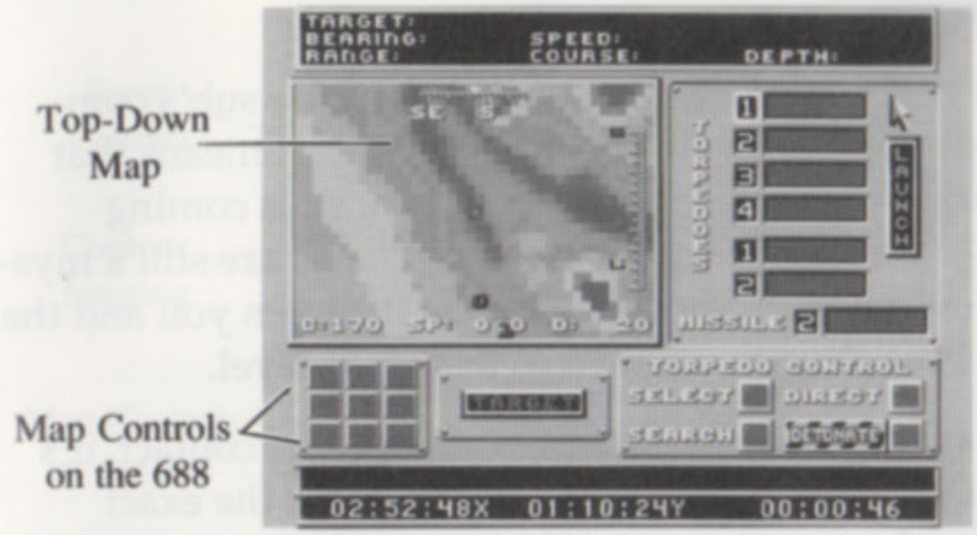
Reading Your Displays

As an attack sub, your primary role is to stalk enemy vessels. To successfully do this, you must constantly be aware of your position and course relative to those of your target(s). In a submarine, you can't actually see anything outside the sub. Instead, you must orientate yourself by reading the top-down maps and contour imaging displays.

The top-down map and contour imaging are available at all stations except the Radio Room and the Status Panel. At the Periscope Station, the map or contour imaging view becomes a surface view of the ocean when you raise the periscope.

Top-Down Map

The top-down map gives you aerial perspectives of the area your submarine is traversing, and displays information collected by your sonar and periscope.



Zoom

The area you're crossing can be viewed from many ranges on the top-down map. On the 688, select I (IN) and O (OUT) from the map controls to zoom in and out. On the *Alfa*, select the left and right buttons under KAPTY. Selecting the zoom buttons repeatedly moves you quickly through the magnifications. Your submarine is the fixed point in the center of the screen (except at the highest zoom levels).

Ocean Depths

Different color shades on the map designate different depths. The darker the shade, the deeper the water. Depth can vary from 0 to greater than 2,000 feet.

Note: Since very few submarines can dive below 2,000 feet, the exact depth of really deep ocean doesn't matter.

Stay aware of the average depth of the water you're traveling through. It's possible to run aground, which is somewhat embarrassing for a submarine commander. To cross the shallowest waters (the lightest color on the map), you'll have to surface.

Note: For depth information, see *HUD (Heads-Up Display)*, beginning on page 21.

Sonar Contacts (Letters)

When you first receive a sonar contact, the sub's computer displays it as an **X** on the map. An **X** means that you only know what direction the sound is coming from. Its identity, range, speed and depth are still a mystery. An **X** always appears halfway between you and the edge of the map, regardless of the zoom level.

When your sonar operator gets a fix on the contact, it's assigned a letter on the map. Letters mark the exact location of a target — even if it's something as mundane as a school of fish — so you can keep track of it.

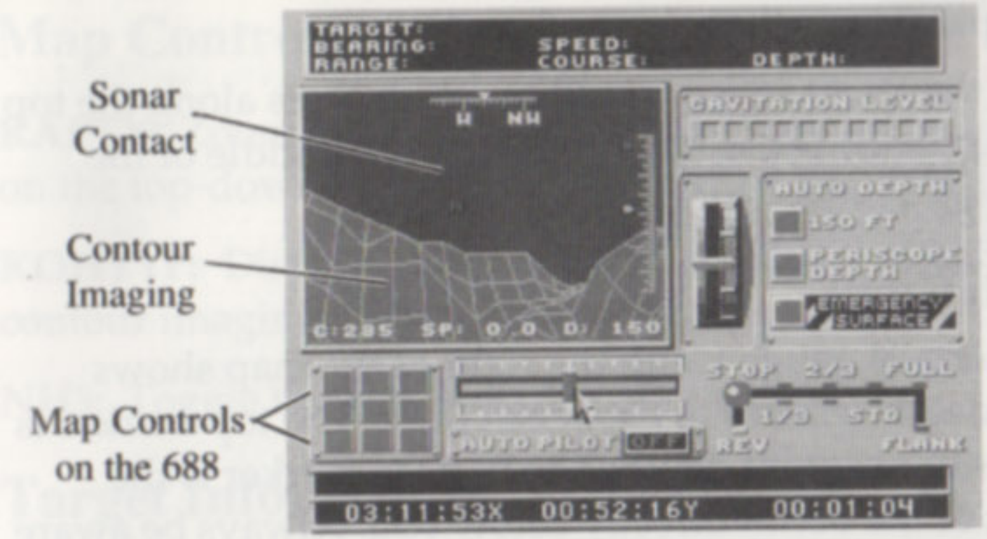
However, the sonarman still may not know exactly what the target is. If he doesn't, "Unknown Surface Contact" or "Unknown Submerged Contact" will appear in the target ID box and the target's letter will appear dark. When the sonar operator positively ID's the target, the letter will turn a lighter shade. If a contact is lost and regained, it may be assigned a new letter.

Waypoints (Numbers)

Waypoints (automatic destinations) that you've set are displayed on the map as numbers. See *Setting and Clearing Waypoints* on page 27 for more information.

Contour Imaging

The *Los Angeles*, the *Dallas*, and the *Alfa* are equipped with side-scanning sonar, a device that produces a contour image of the ocean floor. A sophisticated, high-frequency sonar beam scans the ocean terrain around the bow, port and starboard of the sub. The onboard computer uses the sonar information to generate an image of the ocean terrain around the sub.

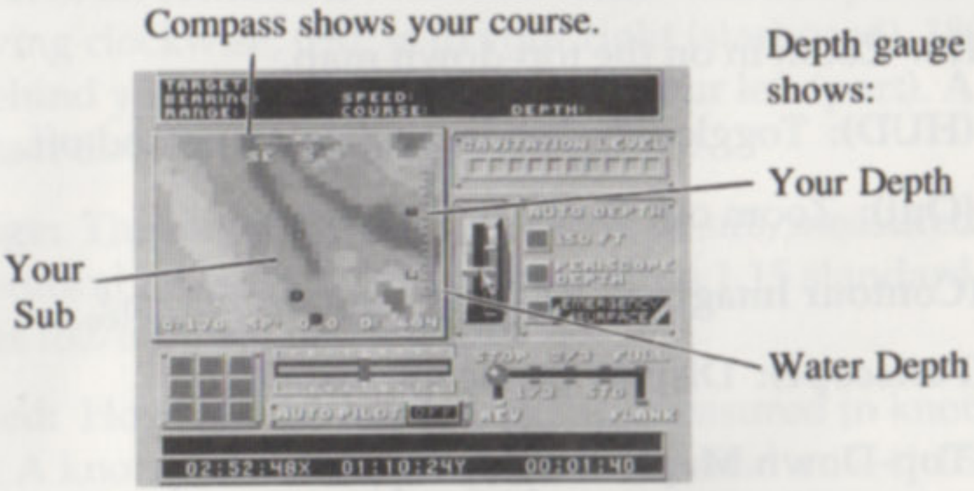


To turn on contour imaging in the 688 or 700, select C from the map controls. In the *Alfa*, select the KOHTYP switch.

You can safely use contour imaging at any time, since the sonar beam's high frequency and short range make it virtually undetectable by other ships' arrays.

HUD (Heads-Up Display)

The HUD (Heads-Up Display) is an overlay on the map that shows your sub's course and depth. On the 688 and 700, select H on the map controls to toggle the HUD on and off. On the *Alfa*, select the NH3 switch.



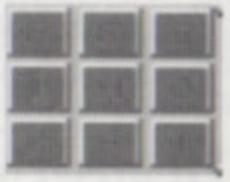
Compass

With the HUD active, you'll see a compass along the top of your map. The white triangle in the middle of the compass is your sub's current course.

Depth Gauge

The vertical gauge along the right of the map shows your depth relative to the ocean floor. The top marker is your sub's current depth. The bottom marker is the depth of the ocean directly below you. Always be aware of how close you are to the ocean floor. Keep a safe distance between you and the bottom marker or you may end up with a ruptured hull.

Map Controls: 688/700



P (Port): In contour imaging, rotate the view counterclockwise in 45 degree increments. Look to port (left) in periscope view.

F (Forward): Look forward in contour imaging or periscope view.

S (Starboard): In contour imaging, rotate view clockwise in 45 degree increments. Look to starboard (right) in periscope view.

I (In): Zoom in on the top-down map.

H (HUD): Toggles the heads-up display on and off.

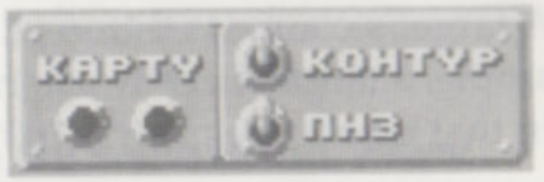
O (Out): Zoom out on the top-down map.

C (Contour Imaging): Display contour imaging.

P (Periscope): Display periscope view.

T (Top-Down Map): Display top-down map.

Map Controls: *Alfa*



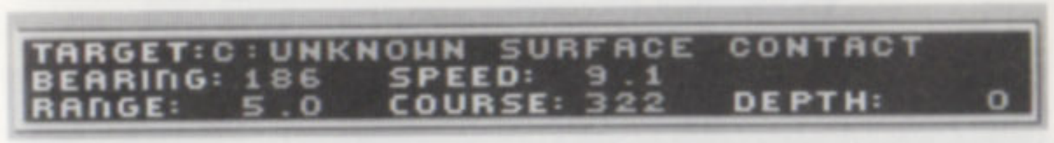
KAPTY: Zoom in or out on the top-down map.

KOHTYP: Display contour imaging.

NH3: Toggle the heads-up display on and off.

Target Information

Select TARGET and then move the cursor to a contact on the map. In the target ID box at the top of the screen, you'll see what sonar has determined (if anything) about that target.



Target: The target's ID. If the target is still unidentified, "Unknown Contact," "Unknown Surface Contact" or "Unknown Submerged Contact" will appear.

Bearing: Where the target is in relation to your submarine. Your bow (the front of the sub) is 000°, and the location of all contacts is reckoned relative to this point. Moving clockwise, 090° is to your right (starboard), 180° is behind you (astern), and 270° is to your left (port). A contact directly astern is at bearing 180°.

Range: The target's distance from your sub, measured in nautical miles (nm). A nautical mile is 1.15 standard miles (6076.12 feet or 1,852 meters).

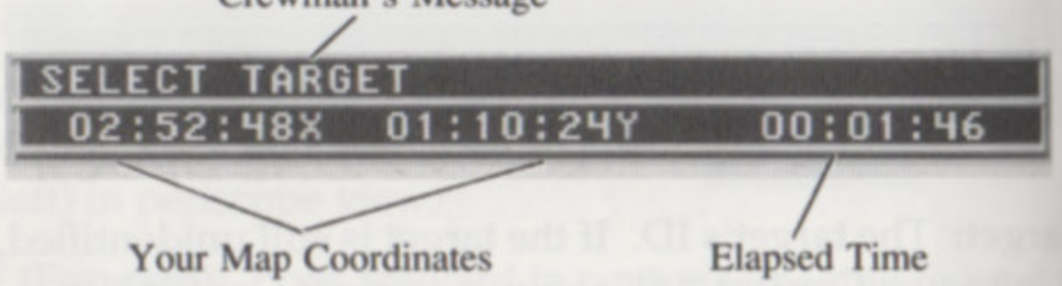
Speed: How fast the target is going, measured in knots (kt). A knot is a unit of speed of one nautical mile (1.15 standard miles) per hour.

Course: Where the target is headed on the compass. In reckoning course, north is 000°, south is 180°, and so on. A target's course is different from its bearing. For example, a target directly astern may be heading northeast. In that case its bearing is 180°, while its course is 45°.

Depth: How deep the target is, measured in feet (ft) in the 688 and 700, and measured in meters (m) in the *Alfa*.

Crew Messages, Location and Time

Two bars at the bottom of the screen give you important information. The upper bar shows you messages from your crew (some of which you will also hear if you selected Voice On at the Configuration Panel).



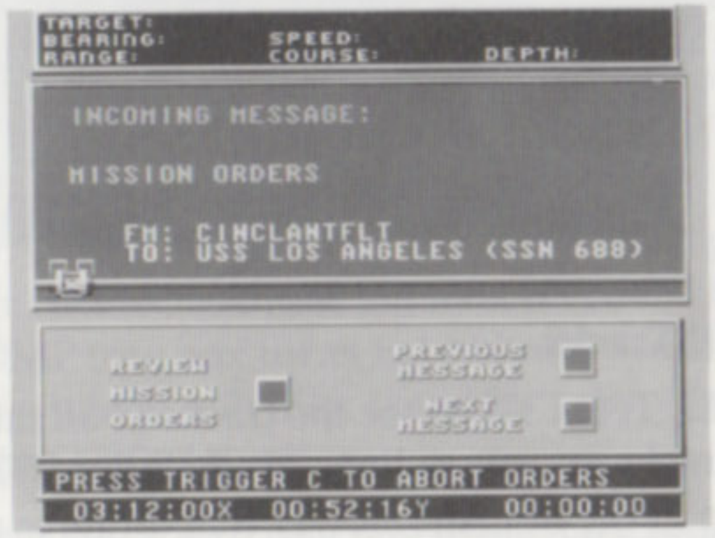
The lower bar shows your sub's current position as map coordinates. To the right of these is the number of minutes that have elapsed during your current mission. When time compression is active, mission time runs approximately twice as fast as real time.

Battle Stations

Radio Room

All missions begin and end in the Radio Room, where you receive your CINC's instructions, warm praise or cold shoulder.

Note: You can't use any controls in the Radio Room during an incoming transmission.



Reviewing Mission Orders

Select the box next to this order to review the last transmission you received.

Note: Press the D-Button up or down to speed up or slow down an incoming transmission. Press Button C to stop it.

Reviewing Messages

If messages from the crew roll by too quickly and you think you missed something critical, select PREVIOUS MESSAGE. Your ten previous messages will appear in the message bar.

Select NEXT MESSAGE to scroll forward through the previous messages until you come to the latest message you received.

Navigation Board

From the Navigation Board you can set your sub's course and track your targets.



Waypoint Controls

Plotting All Tracks

Turn on ALL TRACKS to see the tracks of all targets on the map. Tracks appear as lines of small dots. The closer the dots are in the line, the slower that target is moving.

Plotting the Target Track

Turn on TARG TRACK to see your selected target's track only.

Plot and Time Projection

Use these to see where you and a target will be in a given amount of time, if you both maintain the present course and speed. Move the cursor to one of the arrows on the left side of the TIME PROJECTION box. Press Button A to change the number of minutes for your projection. Then turn on PLOT PROJ. A yellow marker will show you what your position will be in the selected time at your present speed and course. A dark red marker will show your target's position under the same conditions. You can now direct torpedoes to the projected point. (See *Controlling Torpedoes* on page 36.)

Setting and Clearing Waypoints

A waypoint is a destination for your sub. Selecting waypoints activates the auto pilot, which will steer your sub to each waypoint in the order you set them.

To set waypoints, display the top-down map. Select SET, move the cursor to where you want your sub to go on the map and press Button A. You'll see a number on the map marking that waypoint. You can have up to nine waypoints set at any one time. The auto pilot will guide the sub to each waypoint in the order you set them.

Select CLEAR to erase the highest-numbered waypoint.

Time Compression

Use TIME COMP to speed up the game during long transits or while waiting to get a fix on contact. Turn on TIME COMP (the box turns light blue) to compress game time, which will then speed by approximately twice as fast as real time.

Turn off TIME COMP (the box turns dark blue) to return to normal time.

Setting the Auto Pilot

AUTO PILOT turns on automatically when you set a waypoint. When on, the auto pilot directs your sub to waypoints in the order you set them. The auto pilot will function only if you have at least one waypoint set.

The auto pilot doesn't control your depth, so make sure you're not too close to the ocean floor. Neither does it set the sub's speed, but it does adjust it to make turns efficiently and quietly. After making a turn, the auto pilot resumes the previously set speed.

Note: The auto pilot will not return to FLANK speed. If you were at FLANK speed before turning, the auto pilot will return you to FULL speed.

Changing your speed or depth will not affect the auto pilot. (The auto pilot is oblivious to depth. It won't take you higher if you're about to smash into the ocean floor.)

Changing the rudder setting (from the Sub Control Panel) will automatically turn off the auto pilot. Usually this happens during an emergency, when you have to change course quickly. You can head back to a waypoint (as long as it's still set) by turning AUTO PILOT back on.

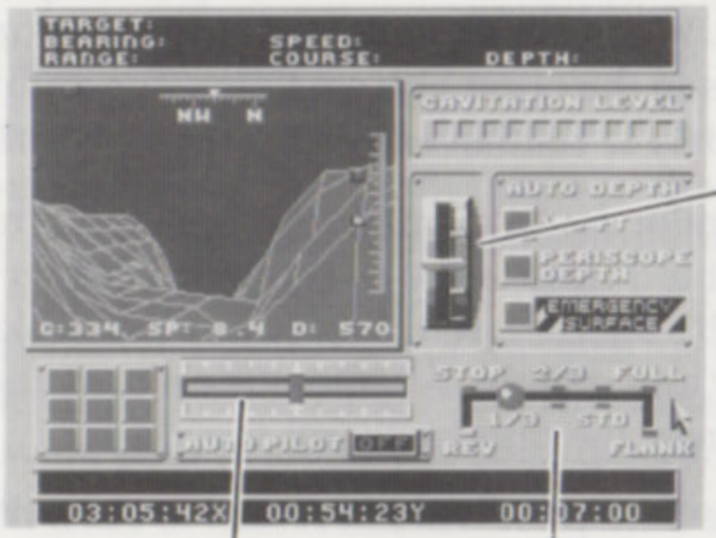
Targeting

Select TARGET, and then move the cursor over the contacts on the map. As the cursor touches each contact, all available information on that object will appear in the target ID box at the top of the screen.

When the cursor is on a contact, you can target it by pressing Button A. Launched torpedoes will head for the currently selected target. Once a torpedo is launched, you can select any other target in the water or on land.

Sub Control Panel

From the Control Room you can set your speed, manually steer your sub, and control your dive.



Cavitation Level Gauge

This gauge monitors your cavitation, which is the sound of partial vacuums forming and filling when your propeller spins faster than the water around it can follow. Cavitation is extremely noisy and should be avoided.

Two factors affect cavitation: acceleration and depth. Quick acceleration causes the propeller to spin faster than normal, which means more noise. Since water pressure increases with depth, partial vacuums don't form as readily around your propellers the deeper you go. Avoid high cavitation levels by not setting your speed at FLANK or REV (reverse) while in shallow waters.

Using the Dive Plane

The dive plane controls the rate at which you dive and surface. Point the cursor on the position you want on the dive plane, and press Button A.

Lowering the handle releases air from the ballast tanks, filling them with seawater and causing the sub to dive. Raising the handle releases compressed air into the tanks, blowing out the water and causing the sub to rise.

How far you lower or raise the handle determines how fast you dive or ascend. Raising the handle a few degrees will lift the sub gradually, while raising the handle all the way will cause the sub to surface quickly.

Using the Auto Functions

Use the auto functions to change depth immediately:

150 FT: Brings the sub to a depth of 150 ft.

PERISCOPE DEPTH: Brings the sub to 20 ft, the depth at which you can raise your periscope.

EMERGENCY SURFACE: Brings the sub to the surface at its maximum speed. This function can be used only once during each mission.

Auto Pilot

See *Setting the Auto Pilot* on page 27.

Using the Throttle

Set your speed with the throttle or engine control. The numbers are percentages of your total power output.

Use FLANK speed to accelerate quickly. You can't go to STD (standard), FULL or FLANK speeds at depths of 100 ft or less because you'll make too much noise. REV (reverse) slows you down quickly but is extremely noisy (the propeller spins opposite its normal direction, producing high cavitation, especially between 0 and 100 ft).

Note: Remember that high speeds have their penalties. Not only do you become more audible to enemy sonar, you can't hear as much over your own engines and the water flowing over your hydrophones. (See *Sensors* on page 52.)

Rudder

The rudder changes the sub's course when you're moving forward, by turning it left or right. You can control the rate at which you change course. The further you move the handle to the left or right, the "harder" (more extreme) the turn to port or starboard.

Note: Activating the rudder turns off auto pilot, if set.

Sonar Room

Go to the Sonar Room to operate your listening devices.

Analyzing Sounds

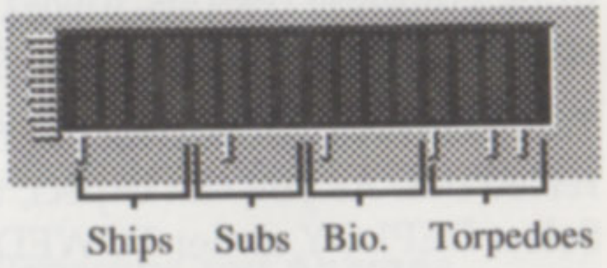
All ships, submarines, torpedoes and marine life make distinctive sounds. Each of these has a sound "signature" or frequency pattern that distinguishes it from other sounds.



Frequency Analyzer

The frequency analyzer displays the sound signature of your current target. The horizontal line represents the audible frequency spectrum. Left is low frequency; right is high frequency. The vertical line represents the degree of sound received in that part of the frequency spectrum.

Different objects will peak in different parts of the spectrum. Ships tend to make more noise in the low end; torpedoes in the higher end. Subs and marine life tend to peak nearer the middle of the spectrum.



To get positive ID, you must be able to recognize the individual sound signature of an object. This takes experience. It can be well worth your while to know the signatures of torpedoes and enemy subs when you're surrounded by unknown contacts and you need to act fast!

Filtering Sound

Sound waves travel at many frequencies through the ocean. Generally, you should set the FILTER on BND PASS (band pass) so you can monitor all of them.

Torpedo engines make noise in the high frequency range, and torpedo sonar arrays emit high frequency "pings" when actively searching for a target. Set the FILTER on HI PASS in critical situations to filter out everything except high frequency noise.

Sending Active Sonar

The targeting pulse is your active sonar. Selecting this sends a sonar "ping," which informs you of everything that's ahead of you. The problem is, it also alerts an enemy to your presence. (See *Sensors* on page 52 for more information on active sonar.)

Using Your Towed Array

The towed array is a long cable with a series of microphones along its length that heighten the sub's listening capabilities. However, towed arrays oscillate at high speeds, creating a good deal of noise and producing drag. For these reasons, towed arrays limit the sub's speed: 2/3 in the 688 or 700; 1/2 in the *Alfa*.

Towed arrays can be over 2,000 feet long and must be reeled out. As you can expect, this takes some time. Select DEPLOY under TOWED ARRAY to reel it out. Select RETRIEVE to pull it back in.

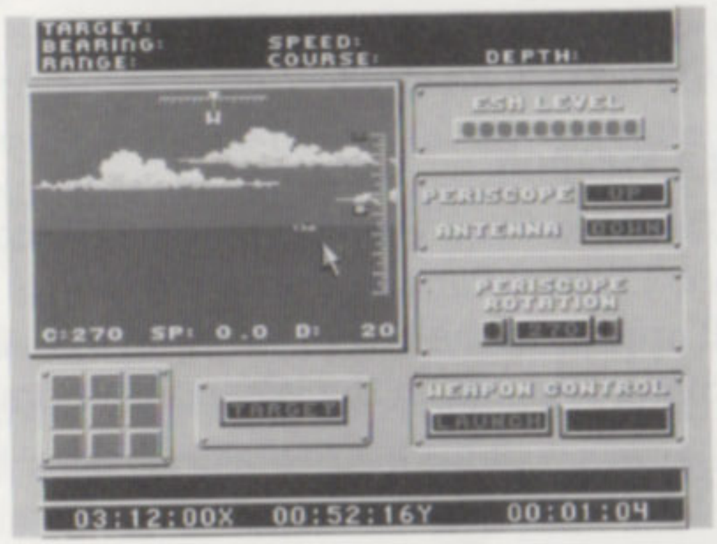
Situations may arise in which you must accelerate quickly even though your towed array is deployed. In these situations, you must decide whether or not to cut the array's cable. Once you've cut the cable, the towed array is gone for the rest of the mission.

Targeting

See *Target Information* on page 23.

Periscope Station

From the Periscope station you can look out over the surface of the ocean for reconnaissance.



Reading Your ESM Level

The ESM (Electronic Sensing Measures) gauge senses how strong an enemy's search radar is at your location. Enemy radar can detect not only your raised periscope or antenna, but also the wake they leave in the water. The stronger the ESM signal, the faster you'll be discovered. Always lower your periscope as soon as you can.

Raising and Lowering the Periscope and Antenna

You can set the PERISCOPE and ANTENNA boxes to UP or DOWN to raise and lower the equipment. You must be at 20 ft (periscope depth) or higher to raise the periscope or antenna.

Raising your periscope changes the map display to a periscope view. Select T from the map controls to switch back to the map. Select P to return to periscope view.

Raising the antenna lets you communicate with satellites to receive mission orders.

Note: While your periscope or antenna is up, watch the ESM level to keep your chances of detection low.

Rotating the Periscope

Select the arrows under PERISCOPE ROTATION to rotate the periscope relative to magnetic north (000°).

Targeting

See *Target Information* on page 23.

Launching a Weapon

Select LAUNCH to fire a weapon that you selected on the Weapons Control Panel. When a weapon is selected, its icon will appear in the box to the right of LAUNCH. The color changes just as in the Weapons Room.

Weapons Control Panel



Torpedo Tubes and Auxiliary Tubes

The 688 is outfitted with four main torpedo tubes at the bow and two auxiliary tubes amid ship for noisemakers. The *Alfa* has six torpedo tubes at the bow only, but the sixth tube launches noisemakers.

Armed weapons aren't stored in the tubes, so you must order your crew to load torpedoes. First select a torpedo tube by moving the cursor to that tube and pressing Button A. Press Button A again to start the arming cycle (an icon of the type of torpedo in the tube will appear).

When the weapon is ready to fire, the weapon icon will change colors. The weapons officer will also inform you that the torpedo is ready to launch.

The Weapons Control Panel can only monitor six torpedoes or a six-item combination of torpedoes and noisemakers at any time. It's not always a good idea to let six torpedoes loose at one time — at any moment you might need to launch a noisemaker to evade enemy torpedoes. (See *Using Noisemakers* on page 57.)

Missile Selection

Though the more recent ships of the 688 class are equipped with vertical launch tubes for missiles, the *Los Angeles* fires its missiles from its torpedo tubes.

Missiles are loaded and launched in the same way as torpedoes. Select the missile box, then select it again to initiate the arming cycle. The missile icon will appear as long as you still have missiles on board. When the icon turns a darker color, it's ready to fire. Select LAUNCH to fire the missile.

Since room aboard a submarine is limited, you'll carry only a small number of missiles. Missiles are used against surface targets only. The number and missile type are pre-selected for each mission and are listed in *Missions*, beginning on page 38.

Note: Missile specifications begin on page 66.

Targeting

See *Target Information* on page 23.

Launching a Weapon

Select LAUNCH to fire a torpedo, noisemaker or missile, depending on the weapon in the selected torpedo tube.

Controlling Torpedoes

Use the TORPEDO CONTROL functions to guide a torpedo to a target or location, or set it on an active search program. The functions will prove to be important capabilities when your torpedo loses its target, or in any situation where you don't have a firm fix on an enemy vessel that you want to destroy.

SELECT: Use this command to control a launched torpedo. After launch, select this command, and then select your torpedo. Then select one of the following commands:

SEARCH: Sets the torpedo on an active search. The torpedo will run a search pattern and begin emitting sonar pings to help it find the target.

DIRECT: Select this, then move the arrow to where you expect your target to be if it maintains its course. Press Button A to direct the torpedo there.

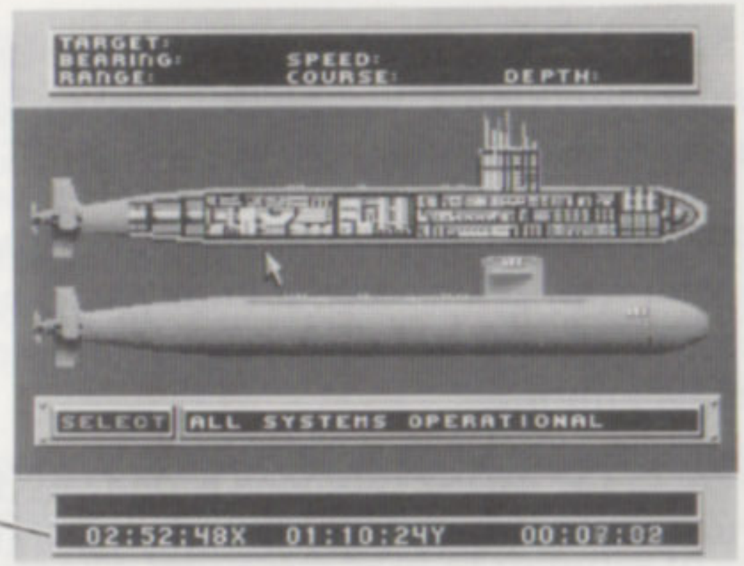
Directing a torpedo will only send it to a specific location. When the torpedo nears its destination, you have to set it on SEARCH so it will look for a target. If you don't initiate a search pattern, the torpedo will drift until it runs out of fuel.

DETONATE: Your own torpedo may lose its original target and end up locking-on to you or a friendly ship. In a situation like this you may decide it's safer to just blow it up. Make sure the torpedo is at a safe range — it doesn't have to actually hit something to do damage.

A launched torpedo has a guidance wire, 7.5 nautical miles long, connecting it to your sub. If the wire is cut, you can no longer control the torpedo. You'll be informed when a torpedo has gone off course, and the torpedo marker on the map will darken. A freed torpedo will seek a target until it detonates or runs out of fuel.

Status Panel

The Status Panel shows the condition of your sub.



Reviewing Damage

Your crew will tell you when a severe hit or scraping the bottom has damaged one of the sub's systems. Damaged systems will also be highlighted in the diagram. To review the damage your sub has taken, use SELECT to scroll through the status of each of the sub's systems.

If a system has been damaged, the status bar will tell you its operational condition. For example, a hard hit to the stern could damage the sub's engines. The status might read: "Maximum power reduced."

A damaged system remains damaged for the duration of the mission. In combat, your crew is too busy running the sub to repair anything. At any given moment, you have to make do with what you have.

Mission Objectives

688 Attack Sub's perilous missions try the true mettle of a submarine captain. You'll face ten different missions in the geographical powder kegs of the world's oceans.

The missions progress from a cold war state of mutual distrust to total war. They become more and more difficult as the war heats up and each side becomes more merciless in its hunting.

The challenge of the earlier missions is one faced daily by submarine commanders: determining if a situation is threatening while avoiding ambiguous actions that could lead to a shoot-out with a foreign sub. The later missions test your abilities as an undersea hunter/killer.

In each mission, the action unfolds within a small portion of the full mission map. This battlefield is usually an area of tactical interest to one or both sides. If you wander too far from the action, the game will end and your CINC (Commander-in-Chief) will inform you that you missed the boat. The idea is to keep from going off on wild-goose chases where nothing will challenge you.

The descriptions in this section give you necessary information that you won't get from onscreen mission orders. For most missions, you can command either an American *Los Angeles* 688 or a Soviet *Alfa*. Both subs have their advantages, but neither sub's abilities outweigh the value of a cunning commander.

Note: In the first mission, Torpex '89, you can also command a *Dallas* SSN 700.

Torpex '89

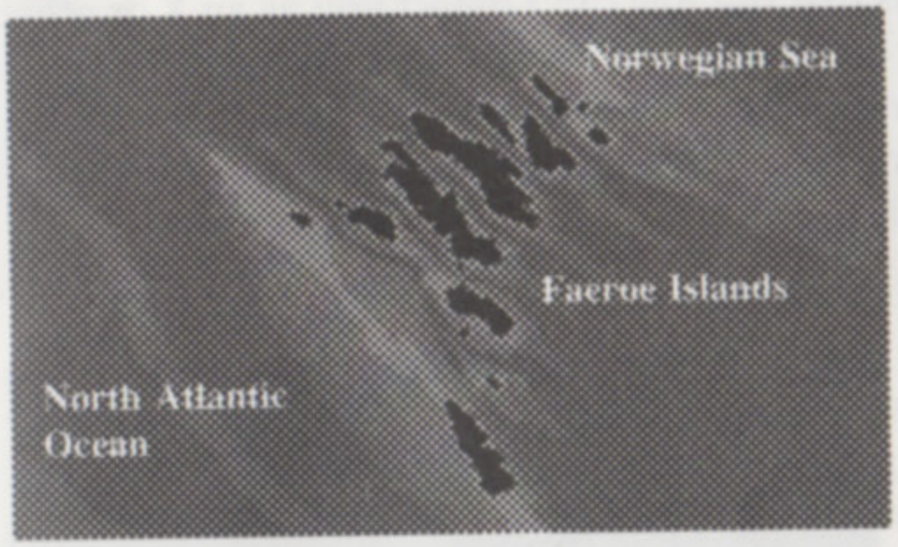


Los Angeles* or *Dallas

- 22 Mark 48 ADCAP torpedoes
- 2 Harpoon anti-ship missiles
- 6 noisemakers

Your superiors are checking you out before letting you sail off with a billion-dollar sub. As commander of the *Los Angeles* 688, you have only 15 minutes to sink three decommissioned *Forrest Sherman*-class destroyers. Your attack must be swift and silent. Navy helicopters will try to locate you, so don't advertise your position with a lot of active sonar or by leaving your periscope up.

Torpex '89



As commaner of the *Dallas* 700, you're matched against a computer-controlled *Los Angeles* 688. In this quick-draw contest you'll see who can be the first to sink three of five decomissioned warships. Both subs have the same weapons, as listed above.

Shake 'Em



Los Angeles

- 8 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

American and Soviet naval forces sometimes practice ASW (anti-submarine warfare) techniques on each other, rehearsing, as it were, for the real thing. The experience the crews gain and the information gathered on enemy tactics apparently make these high-tech games of superpower cat-and-mouse worth the risk.

In this mission, a Soviet sub is tracking you. The navy brass see their pride and budgets on the line, so the pressure's on to shake the Russian. You must lose the Soviet sub for at least three minutes in order to succeed. This means that the *Alfa* can't detect you as an **X** or other letter on its map for a period of three minutes or longer. The mission ends when you've successfully evaded your opponent for three minutes, or when the 20-minute time limit is up.

Shake 'Em





Alfa

- 8 Type 53 torpedoes
- 4 noisemakers

As in every navy, the only way up the ladder is by making your superiors notice you. Prove that American high-tech equipment is no match for Soviet training and you'll make a big impression on the top brass.

Since you're practicing for real war, you must track the 688 in such a way that you'd be able to destroy it. You may not lose contact with it (as an **X** or other letter on your map) for any longer than three minutes, or you lose. You must get within 10 nm (nautical miles), close enough to destroy the 688 if you had to. If you can, stay in its baffles to remain undetected as long as possible.

Sub Ops



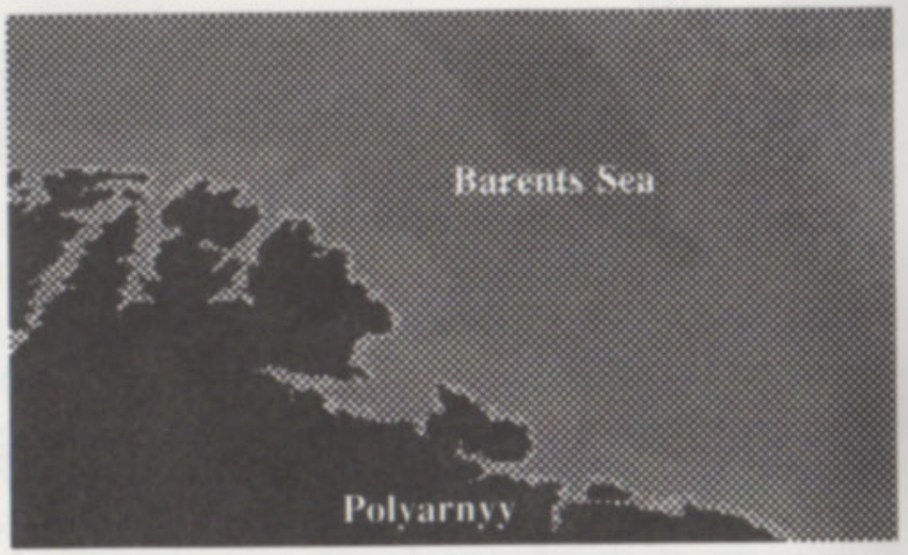
Alfa

- 18 Type 53 torpedoes
- 4 noisemakers

Following an exercise in the Barents Sea, you're ordered to execute routine ASW maneuvers before returning to your home port of Severemorsk. Since imperialist subs sometimes try to follow outbound Soviet subs as they leave home waters, you are given the job of securing the port — that is, chasing off intruders.

Using active sonar ("pinging") will show the enemy you mean business and you'll scare them off. Be careful, though. Spying subs may interpret long-distance pings as a prelude to a torpedo attack, and defend themselves.

Sub Ops



Your best bet is to get as close as you can (under one mile) before you actively ping them. At very close range, the risk of being damaged by their own torpedoes is too great, and they'll be forced to run away.

Mumar Cadaver



Los Angeles

- 20 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

Mumar Cadaver



The White House is blaming the Libyans for recent acts of terrorism. To punish these "international criminals," a *Los Angeles* is ordered to sink four Libyan oil tankers as they exit the Strait of Gibraltar. The tankers are under the protection of Libyan warships. Remember that the strait is filled with traffic, so don't put the U.S. in a bad light by sinking non-Libyan ships.

Escape



Los Angeles

- 20 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

Your crew is fatigued from month-long operations in the Mediterranean, so you're less than happy when your commander reports that Soviet subs are waiting to "accompany" you out of the Strait of Gibraltar.

The Navy wants you to make a lasting impression on the Russians. You must pass through the western edge of the strait undetected by Soviet subs. The Soviets should not have contact on you when you reach the Atlantic.

Escape



Alfa

- 18 Type 53 torpedoes
- 4 noisemakers

While returning home from tour duty, you're suddenly ordered to the Strait of Gibraltar, where you'll wait to intercept an American attack sub. Intelligence sources observed a 688 in an Italian port and expect it to exit the Mediterranean soon.

You must keep contact on the American as it enters the Atlantic. Also, you must be within a range at which you could easily destroy the 688 if you had to. Try to be sly about this. Active sonar will not only make your presence known, it could be regarded as a hostile action.

Goulash

Los Angeles

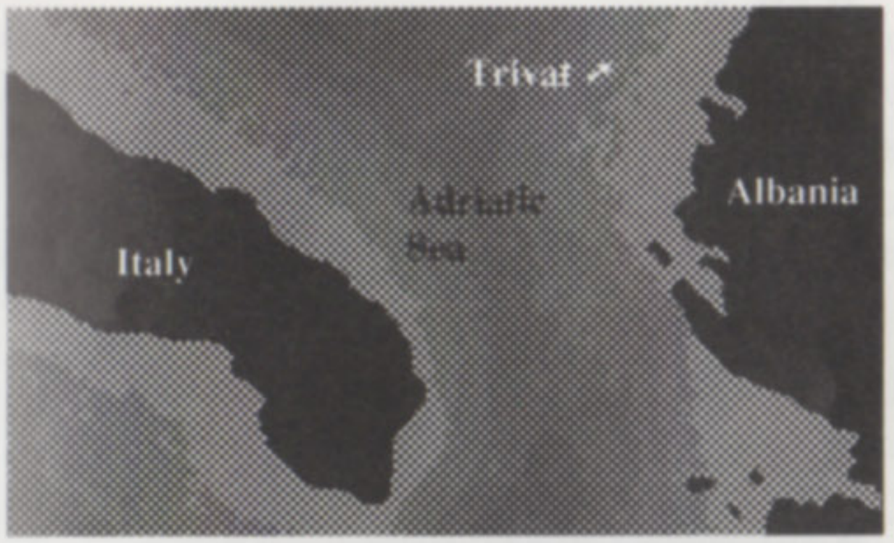
- 20 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

Under new leadership, Yugoslavia attempts to reform its economy and widen its autonomy. To do so, it has asked for NATO's support. Perceiving a Yugoslavian alliance with NATO as a threat, the Soviets invade Yugoslavia and attempt to set up a naval blockade.

The U.S. and Italy agree to provide Yugoslavia with covert military aid. A *Los Angeles*-class submarine is assigned as an escort to provide maximum protection with a minimum of exposure.

Your job is to get six cargo ships north to Trivat before the rebellion is completely crushed. The Soviets have orders to sink first, ask questions later. If they get close enough, your cargo ships are history.

Goulash



You can try to lead the warships away, or you can make the seas safe for free trade by destroying the warships before they're in range of the cargo ships. The bottom line is: the cargo ships must get northeast safely.

Cat Walk

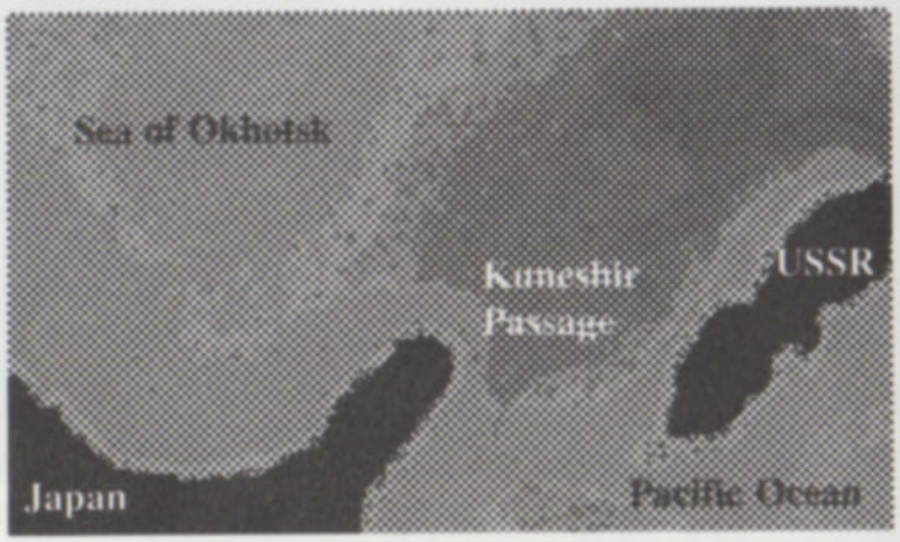
Los Angeles

- 20 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

Sparked by the Yugoslavian conflict, a limited war in Europe begins and quickly escalates into World War III. Your *Los Angeles* is assigned to patrol an area north of Japan, an important sea lane through which Soviet SSBN's (nuclear-powered ballistic missile subs) travel.

A Soviet SSBN has reportedly left Vladivostok and is entering your patrol sector. It may be under the protection of a Soviet attack submarine (SSN). Your main objective is to destroy the SSBN. Think of any SSN's you encounter as dessert.

Cat Walk



Since slow-moving SSBN's are extremely difficult to detect, a Seahawk helicopter will aid you in locating it. If the helicopter finds the boomer, it'll drop a marker buoy in its vicinity. The marker buoy floats on the ocean surface and transmits a sonar ping, informing you that it's over the general location of the SSBN.

Your sonar officer will tell you when he detects a marker buoy. When you get the message, go to a depth of 150 feet or less so that you can target the buoy. Note its bearing and distance. If you're too far away to launch torpedoes, make a course for the buoy. If the SSBN is close enough, launch torpedoes and direct them to the buoy's location, then set the torpedoes on a search program.



Alfa

- 18 Type 53 torpedoes
- 4 noisemakers

All Soviet vessels entering or leaving the main port of Vladivostok must traverse the Kunashir passage. This strategically critical "choke point" connecting the Sea of Japan with the Pacific is a likely place for an American attack on the outbound SSBN you've been ordered to protect.

If it comes to combat, don't confuse the SSBN with the 688. Make sure you know what you're firing on, because your torpedoes won't. The sonar analyzer will help you distinguish contacts and keep from firing on friendlies.

Surprise Party



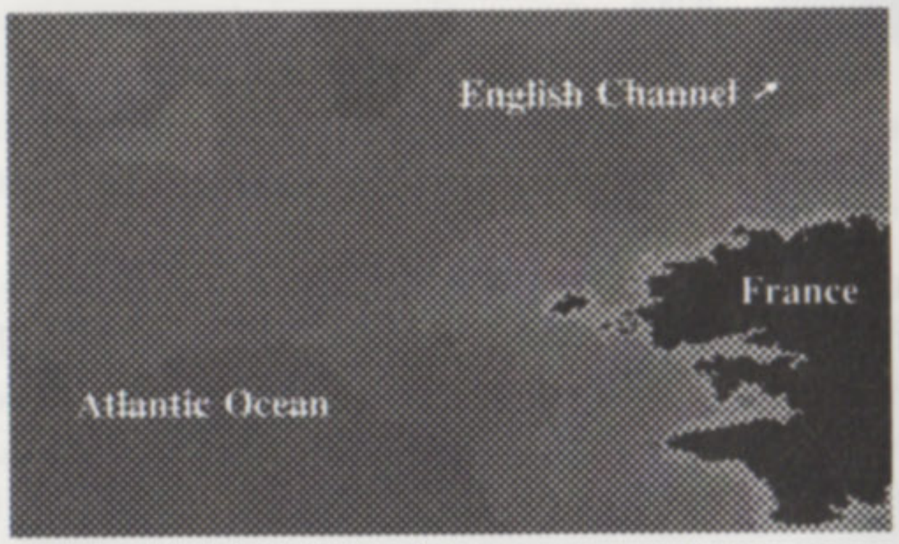
Los Angeles

- 20 Mark 48 ADCAP torpedoes
- 4 Harpoon anti-ship missiles
- 6 noisemakers

The war is heating up! NATO is sending a large battle group to the Norwegian Sea from the south in support of its current forces. The Norwegian Sea is of vital significance to both sides — it represents the only access the Soviet Northern Fleet has to the Atlantic Ocean.

If NATO can keep the Soviet fleet bottled up in its home ports, American and European shipping can deliver direly needed arms and supplies with minimum harassment. Your orders are to escort the reinforcements to the north and protect them from Soviet sub attack.

Surprise Party



Alfa

- 18 Type 53 torpedoes
- 4 noisemakers

Your orders are to patrol your sector and proceed to attack any enemy vessels you encounter. You stumble onto a large battle group and must single-handedly engage the American ships. Good luck.

Homecoming

Los Angeles

- 16 Mark 48 ADCAP torpedoes
- 8 Sea Lance missiles
- 6 noisemakers

In order to keep the war effort rolling, America must keep the sea lanes to Western Europe open. As in two previous world wars, American shipping now travels in convoys protected by warships.

Your 688 *Los Angeles* is assigned to counter any naval assaults on a convoy destined for France. In the event of attack, you must quickly determine the greatest threats to the convoy and deal with them first.

Homecoming



Alfa

- 18 Type 53 torpedoes
- 6 noisemakers

The Soviet Stavka realizes that it only has to cut off American supplies to Europe and the war will come to an effective halt, perhaps resulting in victory for the Soviets.

The massive Soviet submarine force is sent to sea to cripple the U.S. Navy. This time, your *Alfa* and an *Oscar*-class SSGN (nuclear-powered cruise-missile submarine) wait in ambush for a NATO convoy.

Hit and Run



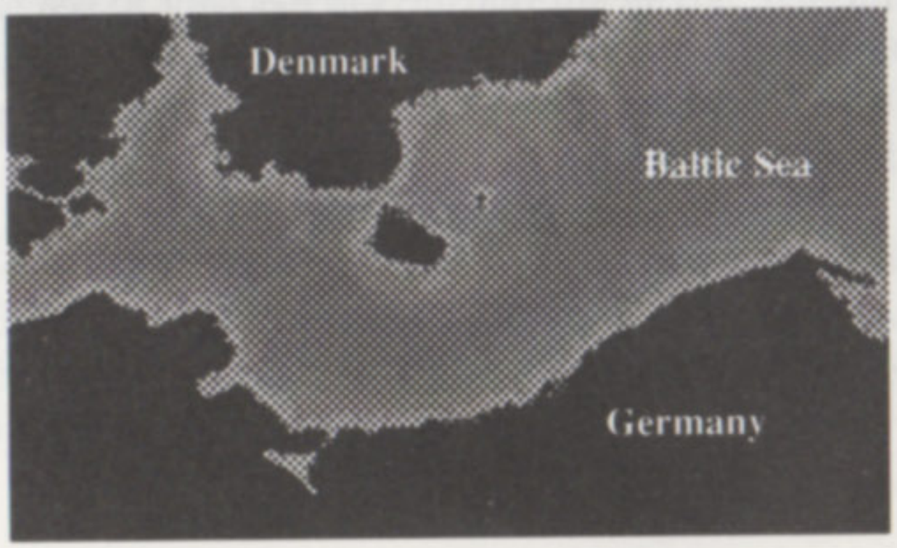
Los Angeles

- 20 Mark 48 ADCAP torpedoes
- 4 Tomahawk cruise missiles
- 6 noisemakers

As the war escalates, the Navy decides on a forward defense to intimidate the Soviets. The plan is to cripple the enemy by attacking targets behind their lines. You're sent to the Baltic Sea to deploy Tomahawk missiles, in an attempt to take out Soviet nuclear weapons facilities. You begin just off the coast of Germany. Raise your periscope to confirm your location. Then switch to the top-down map and zoom out until you see a letter. This is a preset target for your Tomahawks.

Cruise missiles get their bearings by comparing computerized maps with the local terrain. You'll provide the first landmark, which your missile will use to guide itself to its target. You have only five minutes to fire all four missiles. Don't drift too far away from the coast or you'll lose the target. After firing the missiles, you must rely on your own cunning to escape through the narrow, heavily patrolled passage to Copenhagen, on the West Coast of Denmark.

Hit and Run



Submarine Warfare

Submarine Systems

A submarine is an air bubble enclosed by one or more metal shells (hulls), designed to move underwater at great depths. All submarines do certain things: submerge, move forward, navigate, and monitor their surroundings; so all subs share certain design features.

Propulsion

Submarines need a power source to propel them forward. The power source also provides energy for subsidiary systems such as life support, lighting, navigation, weapons control, periscope, and so on.

Internal combustion engines, like automobile engines, require air to burn fuel and so are unsuitable for underwater use. Two sources of power have proven themselves effective for submarine propulsion, and both have their advantages and disadvantages.

Conventional submarines use electric batteries underwater, but these run down with use and must be recharged by diesel engines. To do this, the submarine has to return to the surface. Here it becomes fair game for anybody who wants to shoot at it (its diesel engines make it highly audible to enemy sonar, too).

Despite this, conventional submarines remain popular among many of the world's navies. They're cheap, simple to operate, and virtually silent when running on battery power.

Nuclear-powered submarines use a nuclear reactor to heat water, which in turn drives a steam generator. They don't have batteries to recharge, which neatly eliminates unsavory things like range limitations and the need to surface except for raising the periscope or antenna.

However, nuclear-powered submarines are costly and require greater expertise to operate than conventional subs. Only large navies with huge resources can maintain these submarines in their fleets. Nuclear-powered submarines have one disadvantage: the pumps they need to cool their reactors make them noisier than conventional submarines. But their ability to remain submerged for literally years makes this a suitable risk.

Submersion

Submarines submerge by flooding their *ballast tanks* with seawater. This causes the submarine to lose buoyancy and sink. To surface, compressed air is blown into the ballast tanks, forcing the seawater back out again.

Ballast tanks can be located within the inner pressure hull or between the pressure hull and the outer hull. Some submarines have *saddle tanks*: streamlined ballast tanks fitted to the outside of the hull.

Dive planes (fin-like appendages on the sides near the bow or on the sail) control the angle of the sub's dive.

Sensors

A submarine's most important sensors are its sonar and periscope. Since the periscope can only be used near the surface, modern submarines must rely almost totally on sonar for sensing. Sonar stands for Sound Navigation Ranging. It works on the principle that all objects in the water either produce or reflect sound waves, by which they can be detected and possibly identified.

Active sonar devices actively emit sound waves (the legendary sonar "ping"), which are reflected back by objects in the water. Sensitive receivers on board the sub pick up the reflected waves, which are then interpreted by sonar operators using processing devices.

Active sonar devices are usually *bow-mounted*. Some submarines, such as the 688, also have *conformal arrays* that run along the sides of the sub, giving greater all-around sensing. Active sonar, though limited by the natural features and noises of the ocean, can provide a sub with much critical information about the objects directly before it. The major drawback to active sonar is that it alerts everything in the vicinity to the sub's presence.

Passive sonar uses sensitive listening devices called *hydrophones* to pick up any sound waves that move through the water. Passive sonar has the advantage of not alerting everyone to the sub's presence. Unfortunately, it's more of an art than a science, requiring sophisticated spectrum analyzers, powerful microprocessors, intuition, and most importantly, time.

Passive sonar capabilities are greatly increased with the use of a *towed array*, a long, tapered cable with many hydrophones along its length. While a towed array is helpful, it limits a submarine's speed and maneuverability. Towed arrays are not effective in hard turns, and the fact that they oscillate at high speeds (and create noise) limits the overall speed of the submarine.

Submarine Classifications

The U.S. Navy typically classifies submarines in two ways. The first is by the role the submarine is designed to fulfill. Traditionally, the submarine's strategic purpose has been to hunt and attack enemy *surface vessels*, whether merchant or military.

While this is still a primary function, technological innovations have given the submarine new roles. Refined sensors now allow submarines to hunt and attack enemy *submarines*. In addition, those submarines outfitted with long-range cruise and ballistic missiles can strike at land-based targets.

The role a submarine performs determines what weapons it carries. Attack submarines like the *Los Angeles* generally carry mines, cruise missiles and torpedoes. A few classes of subs, such as the Soviet *Charlie* and *Oscar* classes, are primarily cruise missile platforms. Ballistic missile submarines, or *boomers*, usually carry long-range ballistic missiles and a small number of torpedoes for defense.

Submarines are also classified by their means of propulsion, usually either conventional or nuclear power. The list shows six submarine classifications:

SS	Conventional attack submarine
SSB	Conventional ballistic missile submarine
SSG	Conventional guided missile submarine
SSN	Nuclear-powered attack submarine
SSBN	Nuclear-powered ballistic missile submarine
SSGN	Nuclear-powered guided missile submarine

The Ocean Environment

Since the ocean doesn't let in much light, submarines are "blind" in the most literal sense. Because of this, subs rely on sound to identify their surroundings. Sound waves travel rapidly through water at roughly four times their speed through air. Solid objects in the water reflect sound waves. By listening to sound waves, a sonar operator with a good receiver can deduce important information about nearby objects, such as their identity, location, speed, course, and range.

Water Density

The art of sonar is by no means simple. The ocean is a dynamic environment, a fact that has direct consequences on a sonar operator's ability to pick up sound waves. Several factors affect the transmission of sound waves. The most important is water density.

Sound waves moving through water of a consistent density will travel in a straight line. But sound waves moving through areas of different density will bend. Two important factors affecting the density of water are temperature and pressure.

Cold water is denser than warm water. Sound waves traveling from warm water into cold water will bend toward the bottom of the ocean (a *negative gradient*). Sound waves traveling from cold to warm water will bend toward the surface (a *positive gradient*).

Water temperature decreases with depth, but not as gradually as might be expected. Instead, the ocean is made up of *thermal layers*. Water is normally warmest near the surface, forming a *surface duct* that can be tens to hundreds of feet deep. Below the surface duct, the temperature drops gradually with depth until it reaches a second thermal layer, the *thermocline*. The temperature falls quite rapidly below the thermocline until it reaches a thin layer near the bottom, the *permanent thermocline*.

The greater the water pressure, the denser the water. Water pressure increases the deeper you go, so sound waves bend up with depth.

Using the Ocean Environment to Your Advantage

The complexity of the ocean environment and its effects on sonar provide the submarine captain with hiding places and the sonar operator with headaches.

Sound waves are often trapped between thermal layers, forming long *sound channels*. A submarine trying to escape detection can cross a thermal layer and stand a good chance of evading enemy sonar.

Even within a sound channel, a submarine is not easily detected. Part of the effect of sound waves bending is that they tend to fall into a single, or *convergent*, path.

Convergent paths produce extensive areas where no sonar waves penetrate. These *shadow zones* can be exploited by submarine captains. A submarine lurking in a shadow zone is invisible to enemy sonar.

There's no way to know whether or not you're in a shadow zone, but your best bet is to hide just below a thermal layer. Tactically, this is a good place to be anyway: you can move quickly between thermal layers, dodging the enemy's sonar.

Evading Pursuers

There's no foolproof way to evade a submarine that's pursuing you. If your sub is faster, you can out-distance the enemy in the long run. But this tactic gives the other sub plenty of time to call in help or, in combat, to fire torpedoes and destroy you. (The noise you create at top speed makes you an easy target.) It's better to try to outmaneuver the other sub.

The first step is to make the other sub temporarily lose contact on you. Slipping across a thermal layer gives the other sub a weaker return signal, since the sound waves bouncing off you tend to stay in the thermal layer. If you're lucky, the sub will lose contact on you altogether.

Another tactic is to cut your engines and drift. Chances are that the enemy has been tracking you by listening to your engines. When you cut your engines, his sonarman will have to listen for something else: the water rushing over the hull, your reactor pumps, and so on. In any case, it will take some time for him to reestablish contact.

Once you think the other sub has lost contact on you, change course. The more unexpected the new course is, the better. You can turn to the side, turn 180° from the other sub's course and duck under it, or attempt to circle around and start tracking it. Combining maneuvers is effective, too. You can cut and drift, change course, drop

below a thermal layer, then change course again and silently speed off. The more imaginative and complex the move, the better your chances of survival.

Using Noisemakers

Noisemakers are devices you fire from your torpedo tubes that simulate the noises produced by your submarine. Enemy sonar — whether submarine or torpedo — may be temporarily deceived into thinking that the noisemaker is actually you.

In combat, noisemakers will help you survive. But in peacetime, releasing noisemakers may not be a good idea. Since noisemakers are released by compressed air through torpedo or auxiliary tubes, the other sub doesn't know whether you're launching a noisemaker to evade him or a torpedo to kill him! He might answer your noisemaker by launching several torpedoes in your direction.

Evading Torpedoes

Torpedo Limitations

There are no foolproof ways to evade torpedoes. Modern torpedoes are intelligent, capable of recognizing decoys and executing search programs. However, all torpedoes have limitations which a knowledgeable submarine captain can exploit.

Like a submarine, a torpedo relies on sonar to pinpoint its target. The torpedo's relatively small size limits the area it can sense. Its *cone of vision*, the area it "sees" or senses, is narrow (about 20° wide directly in front of it) compared to a sub's. If a submarine captain can quickly maneuver out of the torpedo's cone of vision, the torpedo will have to initiate a search program in order to find him.

Torpedoes are fairly "stupid" in the sense that their reaction to a lost target is very mechanical. A torpedo doesn't have the facility to "guess" where a target went when it escaped the torpedo's sight. It can only follow a pre-programmed search pattern, which might take it in the wrong direction, giving the submarine a chance to slip away.

Torpedoes are also limited by the amount of fuel they can carry. This gives them a maximum *range*, the point at which they run out of fuel and sink to the bottom, where they self-destruct. Torpedo ranges vary from type to type. However, in *688 Attack Sub*, all torpedoes have the same range of ten nautical miles. This makes it possible for you to outrun torpedoes in certain circumstances.

Like submarines and ships, torpedoes have a maximum *rate-of-heading change* (RHC). The RHC measures how tightly the torpedo can make a turn. A torpedo's RHC is pretty good in comparison to a ship's, but a torpedo can't turn on a dime. After all, it's swimming at speeds greater than 45 knots! A sub captain can maneuver in such a way as to force the torpedo to turn in order to keep the target in view. If the torpedo's RHC can't compensate for the change in the target's course, the torpedo may overshoot, losing the target altogether.

Responses to Torpedo Attacks

The evasive measure you undertake when attacked depends largely on the torpedo's distance, or range, from you. And your timing depends on the torpedo's bearing. For example, if a torpedo's bearing is 000°, you have to take action sooner than if the torpedo were coming from behind. Why? Because at 000°, you and the torpedo are headed for each other — the gap between you and the torpedo is closing fast.

- At long range, you should turn and out-run the torpedo. All torpedoes in the game have a range of ten nautical miles. You only need to stay ahead of the torpedo for a few miles and it will run out of fuel.
- At medium range, turn so your sub is heading 90° away from the torpedo's course (choose the shortest path to get there). If you're lucky, you'll escape the torpedo's narrow cone of vision, which will force it to initiate a search program to look for you.
- At short range, the best you can do is turn so your sub is heading 150° or 210° away from the torpedo's course (choose the shortest path to get there). Hopefully you'll escape the torpedo's cone of vision or turn so fast that the torpedo will overshoot, giving you time to make a clean getaway.

The Baffles

Both the wake a submarine leaves as it moves through the water and the rotation of the screw (propeller) disrupt the transmission of sound directly behind the sub. The "baffles" are, in effect, the submarine's blind spot.

Even a towed array, though diminishing the size of the baffles, does not completely eliminate the problem. The experienced captain stays aware of the fact that he senses virtually *nothing* to a narrow area astern.

Submarine Specifications

Although you can only command a *Los Angeles*, *Dallas*, or *Alfa*-class sub, other submarine classes make their appearances in one or more of the missions. The following specifications will help you know what you're up against when you encounter one of them.

For the sake of convenience, the Soviet subs are called by their USN designations, even when you're commanding the *Alfa*. Since probably very few players speak Russian, this shouldn't cause a problem. Note that some specifications have been altered to balance game play, particularly the maximum depth of certain Soviet submarines.

Akula (USSR)

Type: SSN
Displacement: 8,000 tons submerged
Length: 351 ft (107 m)
Beam: 42.6 ft (13 m)
Draught: 24.6 ft (7.5 m)
Maximum speed: 45 kt
Maximum depth: 1800 ft
Noise level: Above average
Weapons: Types 53 and 65 torpedoes; SS-N-16 cruise missiles

Alfa (USSR)

Type: SSN
Displacement: 2,900 tons surfaced; 3,680 tons submerged
Length: 267 ft (81.4 m)
Beam: 31 ft (9.5 m)
Draught: 23 ft (7 m)
Maximum speed: 42 kt
Maximum depth: 1800 ft
Noise level: Above average
Weapons: Type 53 torpedoes

Charlie II (USSR)

Type: SSGN
Displacement: 4,500 tons surfaced; 5,500 tons submerged
Length: 335 ft (102 m)
Beam: 33 ft (10 m)
Draught: 26 ft (8 m)
Maximum speed: 24 kt
Maximum depth: 1800 ft
Noise level: Average
Weapons: Type 53 torpedoes; SS-N-9 cruise missiles

Foxtrot (USSR, Other Nations)

Type: SS
Displacement: 1,950 tons surfaced; 2,500 tons submerged
Length: 300.1 ft (91.5 m)
Beam: 26.2 ft (8 m)
Draught: 20 ft (6.1 m)
Maximum speed: 16 kt
Maximum depth: 800 ft
Noise level: Low
Weapons: Types 40 and 53 torpedoes

Kilo (USSR)

Type: SS
Displacement: 2,500 tons surfaced; 3,000 tons submerged
Length: 230 ft (70 m)
Beam: 32 ft (9.9 m)
Draught: 21 ft (6.5 m)
Maximum speed: 16 kt
Maximum depth: 1200 ft
Noise level: Very low
Weapons: Type 53 torpedoes

Los Angeles (US)

Type: SSN
Displacement: 6,080 tons surfaced; 6,927 tons submerged
Length: 360 ft (109.8 m)
Beam: 33 ft (10.1 m)
Draught: 32 ft 4 in (9.8 m)
Maximum speed: 37 kt
Maximum depth: 1500 ft
Noise level: Low
Weapons: MK 48 ADCAP torpedoes; Harpoon and/or Tomahawk cruise missiles; Sea Lance A/S missiles

Oscar (USSR)

Type: SSGN
Displacement: 11,000 tons surfaced; 13,500 tons submerged
Length: 470 ft (143 m)
Beam: 60 ft (18 m)
Draught: 36 ft (11 m)
Maximum speed: 35 kt
Maximum depth: 1800 ft
Noise level: Average
Weapons: Types 53 and 65 torpedoes; SS-N-16 and/or SS-N-19 cruise missiles

Trafalgar (UK)

Type: SSN
Displacement: 4,800 tons surfaced; 5,300 tons submerged
Length: 280 ft (85.4 m)
Beam: 33 ft (10.1 m)
Draught: 27 ft (8.2 m)
Maximum speed: 32 kt
Maximum depth: 1500 ft
Noise level: Low
Weapons: Spearfish torpedoes; Harpoon missiles

Typhoon (USSR)

Type: SSBN
Displacement: 25-30,000 tons submerged
Length: 558 ft (170 m)
Beam: 75 ft (23 m)
Draught: 37 ft (11.5 m)
Maximum speed: 24 kt
Maximum depth: 1800 ft
Noise level: Above average
Weapons: Types 53 and 65 torpedoes; SA-N-5 missiles; SS-N-16 A/S cruise missiles

Victor III (USSR)

Type: SSN
Displacement: 6,300 tons submerged
Length: 348 ft (106 m)
Beam: 33 ft (10 m)
Draught: 23 ft (7 m)
Maximum speed: 32 kt
Maximum depth: 1800 ft
Noise level: Below average
Weapons: Types 53 and 65 torpedoes

Weapons

The following weapons are used in the game by or against submarines. Weapons used by ships against airplanes, missiles, land targets or other ships are not described since they have little impact on the submarine commander. Weapons marked with an asterisk (*) are actually used in the game by the 688, 700 or *Alfa*. All other weapons are used by ships or other subs.

Torpedo Specifications

688 Attack Sub is designed to be "hot," demanding quick responses and daring moves. Real sub combat may be intense, but there's a lot of waiting for things to happen: courses to be plotted, contacts to be identified, missiles to fly. A video game can't reproduce this aspect of naval combat and still call itself a game — the excitement has to be of the grab-you-by-the-collar variety.

With this in mind, the entire game is scaled down so that the ranges at which things happen is greatly reduced. The result is that all torpedoes, Soviet and American, have an artificially short range of 10 nm.

Mark 32 Torpedo (US, Various Nations)

Range: 10 nm
Maximum speed: 40 kt
Payload: 150 kg warhead

This obsolete acoustic anti-submarine torpedo still finds use in many of the world's navies, primarily aboard escort ships.

Mark 46 Torpedo (US)

Range: 10 nm
Maximum speed: 40 kt
Payload: 44 kg warhead

The Mk 46 is a deep-diving, high-speed ASW torpedo capable of multiple search patterns and re-attack. It can be launched from surface ships and aircraft or carried by ASROC missiles.

Mark 48 ADCAP Torpedo (US)*

Range: 10 nm
Maximum speed: 52.5 kt
Payload: 267 kg warhead

The Mk 48 ADCAP (advanced capabilities) program was initiated to counter the operational characteristics of newer Soviet subs. The result is a faster, deeper-diving torpedo with better acoustics and electronics. The Mk 48 is launched primarily from subs but can be refitted for delivery from surface ships.

Mark 50 ALW Torpedo (US)

Range: 10 nm
Maximum speed: 40 kt
Payload: 45 kg directed energy

The Mk 50 Advanced Lightweight Torpedo (ALWT) is the successor to the Mk 46 torpedo. The Mk 50 can be launched from ships, submarines and aircraft and is designed to meet the threat of faster, deeper-diving submarines. Most warheads have a large payload that blasts outward in all directions. The directed energy warhead uses a smaller, directed blast to "punch" a hole through the ship's hull. This requires even more precise delivery systems so that the directed blast won't glance off but will actually penetrate the ship's hull.

Spearfish Torpedo (UK)

Range: 10 nm
Maximum speed: 60 kt
Payload: directed energy warhead

Like the Mk 48 ADCAP, the Spearfish was developed in direct response to improved Soviet submarine technology (in particular the *Alfa*). This heavyweight torpedo is faster, more accurate, and capable of greater depths than its predecessor. The Spearfish also utilizes a directed energy warhead.

Type 40 406 mm Torpedo (USSR)

Range: 10 nm
Maximum speed: Unknown
Payload: 100 kg warhead

This relatively new, lightweight torpedo is currently in use with light destroyers and other sub killers but may also be found aboard certain Soviet nuclear submarines.

Type 53 533 mm Torpedo (USSR)*

Range: 10 nm
Maximum speed: 47.5 kt
Payload: 400 kg warhead

533 mm has been the standard caliber used by the Soviet Navy and its allies for many years.

Type 65 660 mm Torpedo (USSR)

Range: 10 nm

Maximum speed: 47.5 kt

Payload: 900 kg warhead

This heavyweight torpedo was only recently developed. Many ships are currently being refitted to accommodate its larger diameter.

Missile Specifications

ASROC Anti-Submarine System (US)

Range: 2-10 km

Maximum speed: Classified

Payload: Mk 46 torpedo

The ASROC (Anti-Submarine Rocket) is the principal ASW weapon of the U.S. Navy, and is popular with more than 10 other countries. Carried primarily by destroyers but also by cruisers and frigates, the ASROC consists of a ballistic rocket carrying an Mk 46 torpedo. The rocket drops the torpedo by parachute at a pre-determined point near the target. Once underwater, the torpedo homes in on the target. By quickly placing a torpedo in the vicinity of the target, the ASROC reduces the submarine's reaction time to the attack, increasing the likelihood of a hit.

Harpoon Submarine-Launched Cruise Missile (US)*

Range: 130 km (70 nm)

Maximum speed: 0.9 Mach

Payload: 570 lb high-energy warhead

Must be at periscope depth and have a positive ID on the target to launch this weapon.

Tomahawk Submarine-Launched Cruise Missile (US)*

Range: 460 km (anti-ship); 2600 km (land attack)

Maximum speed: 475 kt

Payload: 1000 lb high-energy warhead

Must be at periscope depth and have a positive ID on the target to launch this weapon.

SS-N-14 Anti-Submarine Weapon (USSR)

Range: 55 km

Maximum speed: 0.95 Mach at 750 m above sea level

Payload: Nuclear warhead or homing torpedo

The SS-N-14 (Silex) is a ship-launched A/S missile believed to carry a homing torpedo or low-level nuclear warhead to its target.

Sea Lance ASW Stand-Off Weapon (US)*

Range: Classified

Maximum speed: Classified

Payload: Classified

The Sea Lance was designed to replace the aging SUBROC anti-submarine missile. It gives American attack submarines an edge over Soviet subs by extending their range of attack beyond normal torpedo range. The missile is launched from a submerged submarine. As it clears the surface, a rocket motor ignites which carries the payload (a torpedo) to the target. As the missile re-enters the water, the homing device on the torpedo activates and begins searching for a target.

Surface Ship Specifications

As commander, you need to know as much about your targets as you do about your submarine. A target ship's noise level will give you an idea of how easily it can be tracked, while its type, size and maximum speed will tell you how well it can evade your attack. The weapons a ship carries are also important — they indicate what the ship can do to your torpedoes, missiles and sub.

Armed ships generally rely on a long-range and then short-range system of defense against incoming missiles and torpedoes. Surface-to-air missiles (SAM's) and anti-torpedo missiles are the first line of defense, employed against long-range targets. If missile defense is unsuccessful, Phalanx and Gatling anti-missile guns are used.

Ships will protect each other as well as themselves, firing at missiles and torpedoes destined for other ships. Keep this in mind when setting up attacks on convoys and battle groups: take out the warships first. Be wary around ships carrying depth charges, depth bombs, and anti-submarine (A/S) torpedoes or missiles. The latter are particularly dangerous because of their long range.

Cargo Ships (Various Nations)

Displacement: Varied
Length: Varied
Beam: Varied
Draught: Varied
Maximum speed: 20 kt
Noise level: Very high

Forrest Sherman Class (US)

Type: DD
Displacement: 2,800-3,000 tons average
Length: 418 ft (127.4 m)
Beam: 45 ft (13.7 m)
Draught: 23 ft (7 m)
Maximum speed: 20 kt
Noise level: High
Weapons: Not applicable in mission

Iowa Class (US)

Type: BB
Displacement: 45,000 ton average
Length: 887.2 ft (270.4 m)
Beam: 108.2 ft (33 m)
Draught: 38 ft (11.6 m)
Maximum speed: 35 kt
Noise level: High
Guns: Nine 16 in/50 guns; twelve 5 in/38 guns; four MK 15 20 mm CIWS Phalanx
SLCM's: Tomahawk cruise missiles, eight quad launchers
SSM's: Harpoon missiles

Kara Class (USSR)

Type: CG
Displacement: 9,700 tons
Length: 568 ft (173.2 m)
Beam: 61 ft (18.6 m)
Draught: 22 ft (6.7 m)
Maximum speed: 34 kt
Noise level: Above average
A/S missiles: SS-N-14 missiles, two quad launchers
Depth bombs: Anti-submarine/anti-torpedo depth bombs, two RBU 6000 12-barrelled trainable launchers
Guns: Four 76 mm/59 guns; four 30 mm Gatling guns
SAM's: SA-N-6 missiles, six launchers; SA-N-4 missiles, two twin launchers; SA-N-3 missiles, one twin launcher

Kidd Class (US)

Type: DDG
Displacement: 8,300 full load
Length: 563 ft (171.6 m)
Beam: 55 ft (16.8 m)
Draught: 30 ft (9.1 m)
Maximum speed: 33 kt
Noise level: Above average
A/S missiles: ASROC missiles
Guns: Two MK 16 20 mm CIWS 6-barrelled Phalanx
SAM's: SM-1 ER missiles
SSM's: Harpoon missiles, two quad launchers

Kirov Class (USSR)

Type: BC
Displacement: 22,000 tons average
Length: 813.6 ft (247.99 m)
Beam: 93.5 ft (28.5 m)
Draught: 29.5 ft (9.1 m)
Maximum speed: 33 kt
Noise level: High

Aircraft: Three Hormone helicopters
A/S Missiles: SS-N-14 missiles, one quad launcher
A/S Torpedoes: Type 53 torpedoes, ten torpedo tubes
Depth bombs: Anti-submarine/anti-torpedo depth bombs, one RBU 6000 12-b arrelled trainable launcher, two RBU 1000 six-barrelled trainable launchers
Guns: Two 100 mm guns; eight 30 mm Gatling guns
SAM's: SA-N-6 missiles, twelve launchers; SA-N-4 missiles, two twin launchers
SSM's: SS-N-19 missiles

Koni Class (USSR, Various Nations)

Type: FF
Displacement: 1,900 tons full load
Length: 311.6 ft (95 m)
Beam: 42 ft (12.8 m)
Draught: 13.7 ft (4.2 m)
Maximum speed: 29 kt
Noise level: Average
A/S torpedoes: Type 40 torpedoes, four torpedo tubes
Depth bombs: A/S depth bombs, two 12-barrelled RBU-6000 trainable launc hers
Depth charges: Depth charges, two DC racks
Guns: Four 76 mm twin guns; four 30 mm twin guns
SAM's: SA-N-4 missiles, one twin launcher
SSM's: SS-N-2C missiles

Merchant Ships (Various Nations)

Displacement: Varied
Length: Varied
Beam: Varied
Draught: Varied
Maximum speed: 20 kt
Noise level: High

Nimitz Class (US)

Type: CVN
Displacement: 81,600 tons average
Length: 1,092 ft (332.9 m)
Beam: 134 ft (40.8 m)
Draught: 37 ft (11.3 m)
Maximum speed: 33 kt
Noise level: High
Aircraft: 85-90
Guns: Four MK 16 20 mm CIWS six-barreled Phalanx
SAM's: Sea Sparrow missiles

Oliver Hazard Perry Class (US)

Type: FFG
Displacement: 3,585 tons
Length: 445 ft (135.6 m)
Beam: 45 ft (13.7 m)
Draught: 24.5 ft (7.5 m)
Maximum speed: 29 kt
Noise level: Above average
Aircraft: Two LAMPS III helicopters
A/S torpedoes: Mk 32 A/S torpedoes, two triple torpedo tubes
Guns: One 76 mm/62 Mk 75 gun; one 20 mm CIWS MK 17 six-barrelled Phalanx
SAM's: SM-1 ER missiles, one MK 13 dual purpose launcher
SSM's: Harpoon missiles

Sacramento Class (US)

Type: AOE
Displacement: 51,400-53,600 full load
Length: 793 ft (241.7 m)
Beam: 107 ft (32.6 m)
Draught: 39.3 ft (12 m)
Maximum speed: 26 kt
Noise level: High
Guns: Two MK 16 20 mm CIWS six-barrelled Phalanx
SAM's: Sea Sparrow missiles, one MK 29 system

Slava Class (USSR)

Type: CG
Displacement: 12,500 tons full load
Length: 613.4 ft (186.9 m)
Beam: 65.6 ft (19.99 m)
Draught: 25 ft (7.6 m)
Maximum speed: 12 kt
Noise level: Above average
Aircraft: One Hormone helicopter
A/S torpedoes: Type 53 torpedoes, eight torpedo tubes
Depth bombs: Anti-submarine/anti-torpedo depth bombs, two RBU 6000 12-b arrelled trainable launchers
Depth charges: Depth charges, two racks
Guns: Two 130 mm twin guns; 6 30 mm Gatling guns
SAM's: SA-N-6 missiles, eight launchers; SS-N-4 missiles, one twin launcher
SSM's: SS-N-12 missiles

Tankers (Various Nations)

Displacement: Varied
Length: Varied
Beam: Varied
Draught: Varied
Maximum speed: 16 kt
Noise level: Very high
Weapons: None

Aircraft Specifications

Lockheed P3C Orion Airplane (US)

Maximum speed: 415 kt
Mission endurance: 16 hr
This four-engined, land-based plane has served the US Navy well as an ASW patrol aircraft. With its onboard radar, forward-looking infra-red, MAD equipment and sonobuoys, the PC3 Orion is used to detect, track and, if necessary, destroy enemy submarines.

Sikorsky SH-60B Seahawk Helicopter (US)

Maximum speed: 126 kt
Mission endurance: 3 1/2 hr
Carried by a variety of cruisers, destroyers, frigates and special helicopter-carriers, the Seahawk acts as the forward sensors of the ship-based LAMPS III ASW system. With its search radar, towed MAD system, sonobuoys and dipping sonar, the helicopter provides raw data which is then processed onboard the parent ship. The Seahawk also carries two Mk 46 lightweight torpedoes, making it a serious threat to enemy submarines.

Designers' Notes

When the designers started *688 Attack Sub*, they wanted to design a game where the strategic and tactical decisions that confront the player occur at a reasonably exciting pace.

An attack sub isn't a jet fighter, of course, but the designers felt that a submarine game's potential for excitement and serious challenge was at least equal to that of an air combat simulator. (Given the things that today's billion-dollar subs can do, the potential might even be greater!)

However, creating a submarine game that's both reasonably accurate as a simulation yet exciting enough to play as a game presents certain problems. For example, a long-range (two-speed) torpedo can travel up to 40 miles at speeds between 20 and 50 knots. Its run time could easily end up being more than 30 minutes long.

If the designers changed the game scale so that this run time is compressed to a reasonable time frame for a game (say one or two minutes real time), then the speed of a helicopter (or worse, a missile) would be so great that it couldn't even be represented!

To overcome this difficulty, the designers threw out conventional game design theories (as might be published in trade journals) and invented something truly radical. By selecting a "combat range" of about 15 miles, they brought real excitement to an otherwise slow process.

The game scale is such that ships move at a reasonable rate, and torpedo run times are short enough to provide a fast feedback loop without the need for too much time compression. (In fact, by using this technique, time compression runs the entire game, not a simplified statistical model.) The bad news is: many weapons have incorrect maximum ranges.

The designers also had to simplify several features present in modern submarine warfare. Some of these modifications were trivial (modern SONAR sounds more like a "warble" than a "ping").

Other modifications had real game impact — for example, the designers decided to place the appropriate weapons on board the subs at the start of each mission, which tremendously improved the play balance of the missions.

The U.S. enjoys some strong advantages in weapons, and the designers wanted to focus on specific problems facing hunter-killer commanders, not the intricacies of weapons selection. For similar reasons, the designers left out nuclear "superweapons" that would rob you of long-term satisfaction. You'll have to pretend you've used them all up and you're stuck with what you have.

Regarding the top speeds of the various submarines modelled in the game: the published data in *Jane's Defense Weekly* seems ludicrously low, while other sources would have you towing water-skiers behind your *Los Angeles*. The designers picked what they felt were reasonable speeds, and then balanced the game around those speeds.

Good hunting!

Glossary

AOE Fast combat support ship

A/S Anti-submarine weapon

ASROC Anti-submarine rocket

ASW Anti-Submarine Warfare

BB Battleship

BC Battle cruiser

beam The extreme width of a ship's hull

bearing The direction of a target in relation to your sub (the nose of your sub = 000°)

BF *Baltijskij Flot* (Russian for Baltic Fleet)

boomer Slang term for an SSBN

bow Forward end of the ship

cavitation Partial vacuums forming around the blades of the propellor due to fast acceleration and/or shallow waters. Cavitation is extremely noisy.

CG Guided missile cruiser

chaff Strips of metal foil shot into the air to distract incoming missiles. Used by surface ships as a last-ditch defense.

CHG Light aircraft carrier

CINC Commander-in-Chief

CMF *Chernoe Mokoj Flot* (Russian for Black Sea Fleet)

Conn Conning tower; the elevated platform above the deck used on early submarines for attack direction and navigation. Today it refers to the control room where these functions are now performed.

course The direction you're pointing in relation to the compass (north = 000°)

CVN Multi-purpose aircraft carrier (nuclear-powered)

DD Destroyer

DDG Guided-missile destroyer

ESM Electronic Sensing Measures

FF Frigate

FFG Guided missile frigate

Glavnyi Short for *Glavnokomanduyushchij* (Russian for Commander-in-Chief)

HUD Heads-Up-Display; a monitoring system that projects compass and depth readings on the map display

hydrophones Microphones along the hull of a submarine that transmit sound waves to a sonar operator

knot A unit of speed of one nautical mile (1.15 standard miles) per hour

LANTFLT Atlantic Fleet

MAD Magnetic Anomaly Detector

MEDFLT Mediterranean Fleet

NATO North Atlantic Treaty Organization

nautical mile (nm) 6,076.12 feet (1.15 standard miles or 1,852 meters)

PACFLT Pacific Fleet

PLA *Podvodnaya Lodka Atomnaya* (Soviet designation for SSN's)

PLARB *Podvodnaya Lodka Atomnaya Raketnaya Krylataya* (Soviet designation for SSBN's)

port Left

RBOC Rapid Bloom Off-board Countermeasures; a countermeasure system for surface ships used against incoming missiles. The RBOC system consists of a number of mortars firing chaff cartridges.

SAM Surface-to-Air Missile

screw Propeller

SF *Severnyj Flot* (Russian for Northern Fleet)

SLBM Submarine-Launched Ballistic Missile

SLCM Submarine-Launched Cruise Missile

sonar Sound Navigation Ranging; a device that detects the presence and location of underwater objects by sending out sound waves and monitoring their echo.

SOSUS Underwater Sonar Surveillance System

SS Conventional attack submarine

SSB Conventional ballistic missile submarine

SSBN Nuclear-powered ballistic missile submarine

SSG Conventional guided missile submarine

SSGN Nuclear-powered guided-missile submarine

SSN Nuclear-powered attack submarine

starboard Right

stern Back end of a ship

TOF *Tikhij Okeanskij Flot* (Russian for Pacific Fleet)

towed array A long cable with microphones that enhances a surface ship or submarine's passive sonar capabilities.

waypoint A destination for your sub that your auto pilot will head for when active.

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- The Sega Genesis Cartridge is intended exclusively for the Sega Genesis System™.
- Do not bend, crush or submerge it in liquids.
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- Be sure to take an occasional recess during extended play.

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