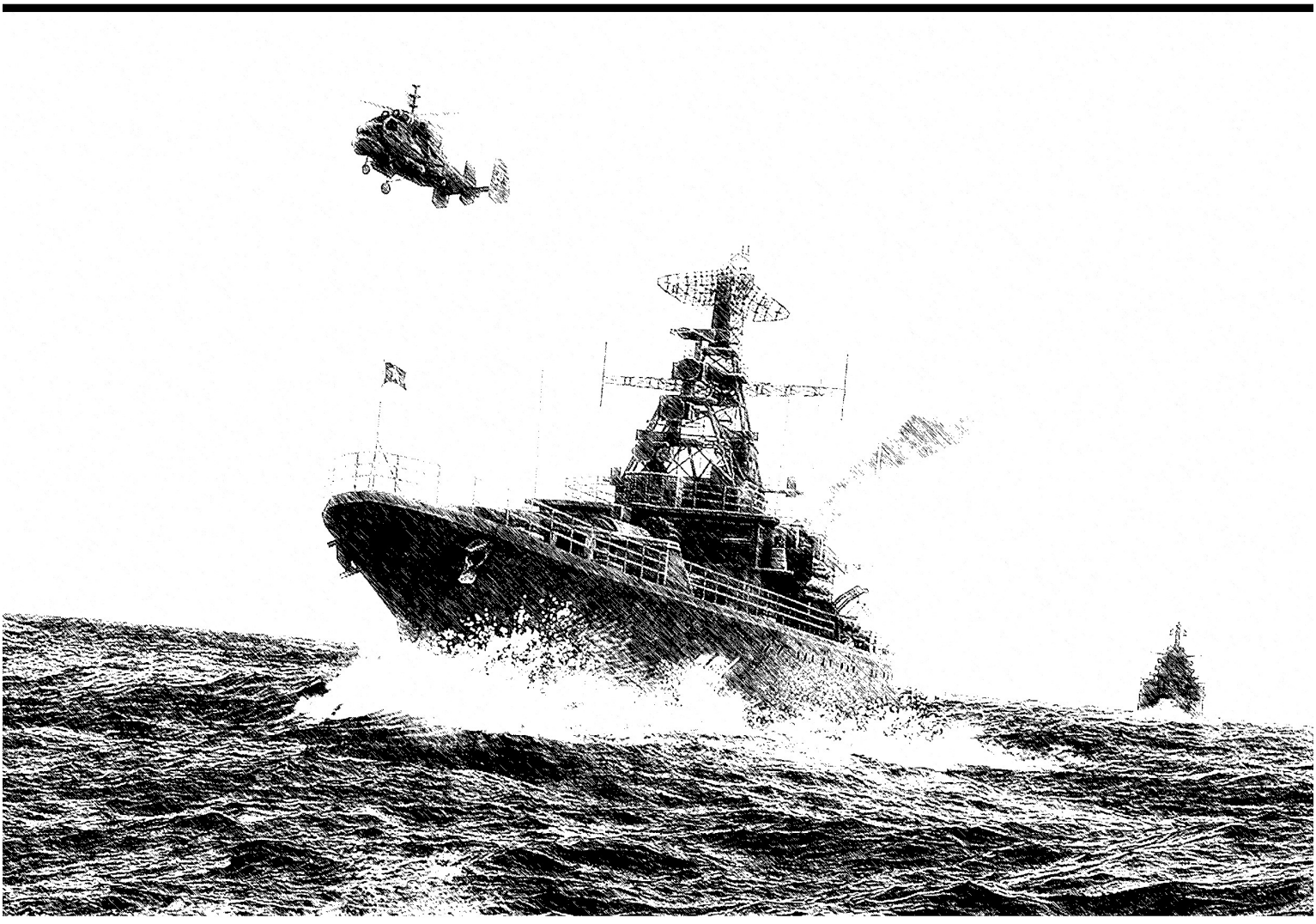
COLD WATERS



OPERATIONS MANUAL

RESTRICTED: USN Submarine Commanders Only.
Distribution limited to USN submarine commanders only; administrative/operational use; April 1984. Other requests for this document shall be referred to Commanding Officer, Submarine Force Atlantic.

KILLERFISH GAMES

CONTENTS

1. GENERAL

While in game, use **Shift F1** (***LeftControl H***) at any time to open this Help, a comprehensive in-game manual on playing Cold Waters. Help opens on the page deemed most relevant to what you are currently doing in game.

Unless otherwise specified, all interactions with the interface are performed with mouse **LEFT CLICK**.

Close Help by **Shift F1** (***LeftControl H***) again or use the **X** button in upper right.

Mac Users: all commands and referenced to interface are shown in **Red**. Commands specific to Mac users only are shown in ***Pale Blue***.

WELCOME TO COLD WATERS

From 1947 until 1991 the world was gripped in the Cold War, an era of geopolitical tension accompanied by massive military expenditure and build up by the two major superpowers of the United States and the Soviet Union. Thankfully the war failed to materialise, despite several close incidents, but what if it had?

Cold Waters puts you in that very situation as the commander of a nuclear submarine when the Cold War goes hot. Rather than focus on specific operational details of a submarine, Cold Waters puts you in the Commander's chair where your tactical decisions will determine mission outcome and whether you and your crew return home.

MAIN MENU

Training - Tutorial missions teaching you command of a submarine
Single Mission - Stand alone combat missions to test your mettle
Campaign - Go to war as the commanding officer of a submarine
Unit Reference - Encyclopaedia of vessels, aircraft, weapons of the era
Options - Edit various game settings
Credits - Peruse those behind Cold Waters
Cancel or Quit - Exit Cold Waters

TRAINING AND SINGLE MISSIONS

For your first time playing Cold Waters we recommend undertaking the Training missions.

Training and Single missions are played as follows:
Select **Training** or **Single Mission** from main menu.

MISSION LIST

Select a mission from the list. A brief summary of what the mission entails is provided in the lower left.
Start will begin the mission.
Back returns to the main menu.

SELECT VESSEL

If only one playable submarine class is available for the mission, it will be automatically assigned. Otherwise use D and A to cycle through various submarine classes available for the mission.

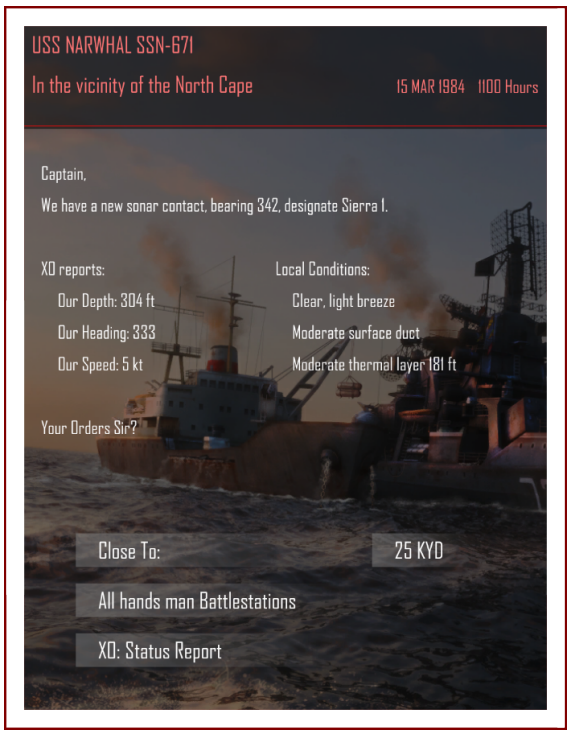
Camera controls can be used to view the submarine. See UNIT REFERENCE section below for camera controls.

Use **Accept** to choose your vessel.
Random will have a submarine assigned to you by naval command.
Back returns to the main menu.

After receiving a message assigning you command of a vessel, **Accept** enters the mission briefing or **Back** returns to the main menu.

MISSION BRIEFING

Prior to any combat, you are presented with a briefing of the current situation. Details on current state of your submarine and local conditions are displayed.



Use **XO: Status Report** to examine your weapons, change weapon loadout and view damage report prior to entering combat. Or use **F7** ***(LeftShift 7)*** and **F8** ***(Shift F8)*** to open stores or damage control panel respectively. These panels are explained during the tutorial series or see WEAPONS and DAMAGE sections for more information.

Use **Battlestations** to begin combat.

OR

Select **Close To:** to begin combat.
In actual combat (not training missions), this can be used to close in and start combat at about the range indicated. **LEFT CLICK** on the range value to change it.

However closure is not always successful as your starting range might already be below the range specified or you may be detected while closing.

Depending on the circumstances you may want to start combat at long range for missile attacks and shorter range for torpedo attacks.

COMBAT

Combat enters you into the 3D game world where you take command of your submarine. During tutorial missions, follow the on-screen prompts **Shift F1** (***LeftControl H***) to learn more about commanding your submarine in Cold Waters.

ENDING COMBAT

To end combat use **Escape** to enter the mission menu. Alternatively, sailing to the limits of the map (red boundary) will immediately open the mission menu where your only option will be to leave the combat area.

Entering the mission menu pauses combat.

Once here you may select one of the following:
1) **Abandon Ship**
May be attempted if your submarine is still intact and is currently above escape depth. If below escape depth, this option is not available.

2) **Options**
Bring in the game options to edit game settings.

3) **Exit Mission**
End combat and go to the After Action Report.
This option is available when reaching the map boundary or if the following criteria are met:
- No enemy vessel can detect you and you have no contacts
- No torpedo or missile is within 15,000 yards
- No enemy aircraft is within 15,000 yards
- Your submarine has no significant flooding

The briefing indicates which of these criteria may be preventing you from leaving combat.

4) **Back**
Return to combat

If your submarine is ever destroyed the combat interface will immediately be disabled.
Camera controls and moving camera between objects is still allowed, however you can no longer command your submarine.
Use **Escape** to enter the mission menu and end the mission, either through **Abandon Ship** (if possible) or **Quit**.

AFTER ACTION REPORT

Immediately after any combat you are presented with a summary of the engagement containing the vessels encountered and whether they were sunk, damaged or not detected. Your remaining weapons and a summary of any subsystems damaged are also provided.

Use **Continue** or **Space** to close the After Action Report and return to list of missions or to continue playing a campaign.

UNIT REFERENCE

The Unit Reference is an encyclopaedia of all ships, submarines, aircraft, torpedoes and missiles currently available in Cold Waters.

Use **D** and **A** to cycle through the various units and weapons.
Pan Camera: either use **Mouse1** or **Left Arrow**, **Right Arrow, Up Arrow** and **Down Arrow**.
Zoom Camera: either use **MOUSEWHEEL** or **Equals** and **Minus**.

Back will leave the Unit Reference and return to the main menu.

OPTIONS

The following describes the effect of in-game option settings.

GAME

Default Commander Name - textbox to enter the name of your commander to be used in all subsequent missions/campaigns.
Auto Save - Campaign only. Automatically saves the game when leaving port, before combat and after combat to a file named "AutoSave".
Player Marker - Displays an icon on the ocean surface to indicate player submarine position and direction.
Disable Ironman - Turns off Ironman mode, allowing AutoSave files to be used and saving of the campaign at will.
Hide Low SOL. Contacts - Vessels with a solution below maximum are hidden from view, unless detected through the periscope.
Event Camera - Camera automatically focuses on weapons being fired, aircraft attacks and weapon impacts.
Difficulty - Adjusts the overall difficulty of the game.
World Scale* - Scales horizontal distances. 1:4 makes combat faster paced while 1:1 is most realistic. Terrain is not modified.
Speed Multiplier* - Increases the speed of vessels and torpedoes. Higher values increase the pace of game play while 1 is most realistic.

* Requires game restart or returning to Main Menu to take full effect.

CONTROLS

Invert Mouse - Swaps the Y axis of the mouse when dragging to pan the camera.
Camera Sensitivity - Adjusts the sensitivity of mouse and key control of the camera.
Default Controls - Returns all key and mouse controls to their default values.

Remapping keys - **LEFT CLICK** a key to highlight it and then press desired key or mouse button to remap. Shift, Control and Alt are also supported in combination with a key.

VIDEO

Full Screen - Toggles the game between full screen and windowed mode.
V-Sync - Vertical synchronization (useful to enable to improve performance).
Trees - If terrain is enabled, displays trees (useful to disable to improve performance).
Underwater Particles - Displays the underwater particles.
Color Filter - Post processing color filter for improved visuals.
Ambient Occlusion - Post processing filter for improved shadows.
Shadows - Enables or disables shadows.
Bloom - Post processing effect for improved lighting and visuals.
Anti Aliasing - Improves jagged edges of graphics.
Ocean Quality - Effects ocean detail (decrease to improve performance).
HUD Size - Resize the "heads up display" in combat.
Resolution* - Toggle list of all resolutions supported by your monitor.

* Requires game restart or returning to Main Menu to take full effect.

Multiple Monitor Support: to run Cold Waters across multiple monitors, set **Full Screen** to OFF so as to run the game in windowed mode. Stretch the window out to any size you wish. Adjust **HUD Size** if needed.

Editing User Interface: see modding documentation in "ColdWaters_Data/StreamingAssets/default" folder of your Cold Waters install directory.

AUDIO

Music In Combat - Enable or disable music when in combat.
Volume - Master volume for all sound effects.
Music - Master volume for music.

2. WEAPONS

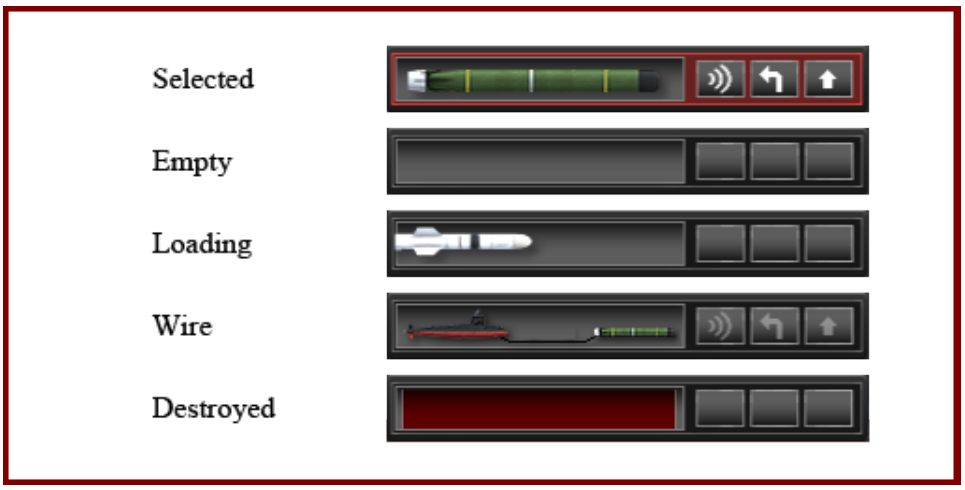
In the post-World War II era, the ongoing Cold War pushed naval weaponry to all new levels. This section will discuss how to use and manage the weapon systems on board your submarine. To understand how to maximise your chances of hitting targets with weapons as well as void hit, see Tactics section.

Weapons on board your submarine may be in one of three places:
1) stores
2) a torpedo tube
3) the Vertical Launching System (VLS) if your submarine possesses one

Weapons in stores need to be loaded into torpedo tubes in order to fire, while weapons in torpedo tubes are ready to fire, unless they are currently in the process of being loaded into that tube.

TORPEDO TUBES

At the very bottom right of the screen are the torpedo tubes for the current submarine. Different submarine classes may have different numbers of tubes.



A tube consists of the tube itself along with 3 associated settings buttons. If loaded, an image of the weapon ready to fire is shown. Click on a tube or use **F** to select tubes. The currently selected tube is highlighted in red.

A tube undergoing loading will have the weapon image slowly sliding into it. Using **R** cycles through weapons to load.

A tube running a wire-guided torpedo contains the icon shown above. Reloading a tube with a wire immediately cuts that wire.

A destroyed tube is shaded in red and cannot be repaired while at sea.

VERTICAL LAUNCHING SYSTEM (VLS)

Weapons in the VLS do not require reloading. Instead the VLS is a single-tube representation of the multiple VLS tubes aboard. Simply choose a weapon from this pool of tubes using **R** in order to fire it. VLS tubes cannot be re-loaded while at sea.

Since the VLS launches weapons perpendicular to the direction of your submarine's movement, it can only be used at low speed. The message log will notify you if your speed exceeds the VLS launch speed.

FIRING WEAPONS

Firing weapons in Cold Waters is relatively straight forward as your crew automatically performs all of the smaller tasks required, such as arming weapons and opening tubes. As commander, your role is to decide what weapon to fire and where to send it. All weapons in Cold Waters are fired using a waypoint system where the bearing and range to the waypoint are set using the tactical map display.

TACTICAL MAP DISPLAY

The tactical map is the nerve centre of your submarine's fire control system. It plots all information gathered by sensors and calculates target movement in order to predict their exact positions. The Sensors section will explain the tactical map in detail; however some basic understanding of its use is required to set weapon waypoints. Briefly;

In bottom left corner is a mini-map displaying your submarine, contact and torpedoes which is used to set weapon waypoints.

Pan Map: **LEFT CLICK** on the mini-map and drag the mouse.
Zoom Map: Position mouse over map and **MOUSEWHEEL** or **Equals** and **Minus**.
Maximise Map: **Tab** toggles full screen map (auto hides mini-map).
Hide Map: **LEFT CLICK** in upper portion of the mini-map hides/restores it.
Center Map: **Backslash** positions your submarine in the centre of the map.
Auto-Centre Map: **Shift Backslash** locks the map to your submarine.

Selecting your submarine with the mouse moves camera to your submarine.
Clicking on a contact selects it as your contact or if already selected, moves camera to it.
Clicking on a torpedo moves camera to it.

FIRE WEAPONS

To fire a torpedo;
1) select a loaded tube
2) place a waypoint on the map to send the torpedo to

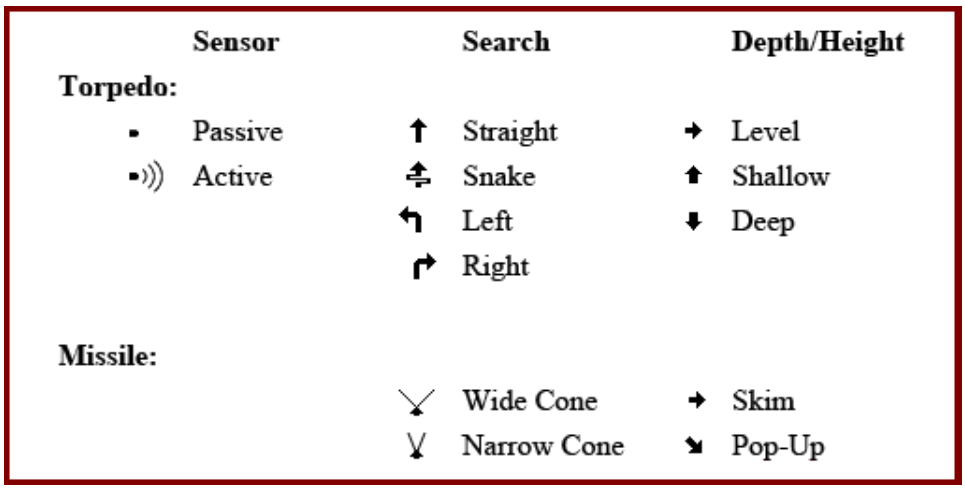
1) Select Tube
Use **F** or click directly on a weapon within the tube to select which tube to fire, it will be highlighted in red.

2) Place Waypoint
Ensure your submarine is visible on the mini-map and use **Space** to set the waypoint. Bearing and Range to the waypoint are displayed and a blue line now appears on the map which follows your mouse pointer.

Simply move your mouse pointer about the mini-map, placing it at the location you want your weapon to head to, then **RIGHT CLICK** ***(N)*** to set the waypoint and fire.

The map can be panned and zoomed while dragging a waypoint or if needed, use **Escape** to cancel setting a waypoint.

TUBE SETTINGS



Each tube may have up to 3 weapon settings, depending on the weapon loaded, for Sensor, Search and Depth/Height. Settings buttons can only be edited if the tube is currently selected and can be changed by clicking directly on them or by using **1**, **2** and **3**.

UNGUIDED TORPEDOES

Some weapons (and decoys) are simple straight running torpedoes. The torpedo will fire, engage a gyro to steer towards the waypoint you set and then simply continue running straight until it either hits a target or reaches its range limit.

Unguided torpedoes have no applicable tube settings. They will either run at the depth launched (decoys), or change depth to a pre-set running depth for that particular torpedo model.

WIRE-GUIDED TORPEDOES

These sophisticated weapons are directly linked to your fire control computer by a wire once launched. As long as the wire remains intact, their behaviour settings can be changed, it is even possible to set new waypoint positions or manually guide the torpedo. If the wire is broken or cut, the weapon will carry out its current programmed settings.

The third data column displays information about the current wire. Clicking a wire-guided torpedo on the map or selecting a wire-containing tube will display that tube's wire data:
WPN DATA Wire/Tube Number
CSE Course
RNG Range
BRG Bearing - direction from your submarine to the weapon
RTE Range To Enable - distance from weapon to its waypoint
TTR Time To Run - seconds left for weapon to run

A wire-guided torpedo will run to its waypoint. Upon reaching it becomes enabled and applies the homing, search and depth settings set on that tube.

TUBE SETTINGS

Tube settings can be modified for the highlighted tube by either using the settings directly or use **1**, **2** and **3** to toggle each of the three settings respectively.

Sensor Settings
Passive: Once enabled, the torpedo will use passive sonar to listen for its target. Passive searching torpedoes are much harder for the enemy to detect, but require the target to be making significant noise.
Active: Once enabled, the torpedo will use active sonar to search for its target. While active sonar is very loud, making the torpedo much easier to detect and anticipate by the target, it is very effective at detecting quiet targets.

Search Settings:
Straight Search: Torpedo searches in a straight line.
Snake Search: Torpedo searches in a weaving pattern left and right.
Left Search: Torpedo searches in a circle to the left.
Right Search: Torpedo searches in a circle to the right.

Depth Settings:
Run Level: Once enabled, the torpedo will stay at its current depth.
Run Shallow: Once enabled, the torpedo will change depth to be above the layer (if there is one) and search at approximately 30 ft depth.
Run Deep: Once enabled, the torpedo will change depth to be about 30 ft below the layer, or if no layer exists, search at about 350 ft depth.

If a wire-guided torpedo is enabled and still has its wire intact, changing any of the tube settings will immediately apply that setting to the torpedo.

Torpedoes on a wire have additional commands available:
Cut Wire: Use **Shift 4** to cut the wire on this tube.
Activate Torpedo: Use **4** to set the torpedo into enabled mode, just as if it had reached its waypoint.
Edit Waypoint: **LEFT CLICK** ***(M)*** waypoint on either the Tactical Map or Mini-Map and **RIGHT CLICK** ***(N)*** to place it at the current mouse position. Only torpedoes on a wire that have not yet reached their waypoint and become activated can have their waypoint changed.
Steer Torpedo: Use **Keypad 4** ***(Control A)*** and **Keypad 6** ***(Control D)*** to manually change torpedo course.
Torpedo Depth: Use **Keypad 5** ***(Control W)*** and **Keypad 8** ***(Control S)*** to manually change torpedo depth.

WIRE BREAKAGE

The wire connecting the torpedo to the fire control computer is relatively fragile and may unintentionally be broken. A wire may break on launch, which is unavoidable and a wire will automatically be cut if a new weapon is loaded into a tube with a wire. Some submarine classes have fewer wires than tubes such that additional wire-guided torpedo launches will not possess a wire.

Wire breakage while a torpedo is running can be minimised by;
- moving at slow speed
- keeping your submarine level
- keeping the weapon within a 60 degree arc of the bow of your submarine

GUIDED MISSILES

Guided missiles launch, head towards their waypoint and upon reaching it, become enabled. Once enabled the on-board guidance system uses radar to search for a surface target, which if found, will cause the missile to seek to out that target. Guided missiles can be fooled by the deployment of chaff, a countermeasure which confuses the radar guidance, or be shot down by ships possessing anti-missile defences such as CIWS guns. Also, if a missile becomes enabled but cannot find a target, it will self destruct.

TUBE SETTINGS

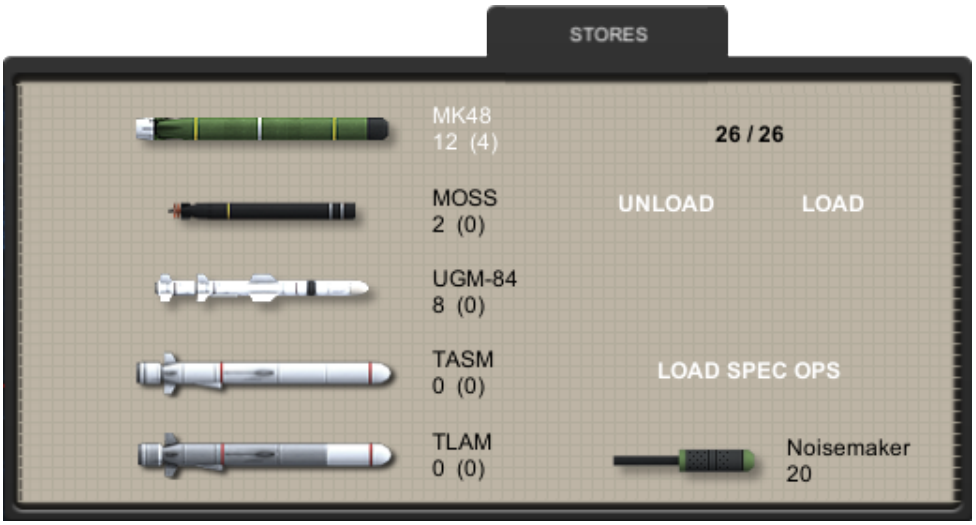
Tube settings can be modified for the highlighted tube by either directly using the setting buttons or **1**, **2** and **3** to toggle each of the three settings respectively. Once launched, a missile's settings cannot be modified.

Sensor Settings
None

Search Settings:
Wide Cone: Uses a wide sensor arc to search for a target. This can be useful if the target location has not been accurately determined or to swing the missile in from an angle.
Narrow Cone: Uses a narrow sensor arc to search for a target. Best used to focus the missile onto a specific target if other potential targets are nearby.

Height Settings:
Skim: Keeps the missile low, skimming the ocean surface all the way to the target.
Pop-Up: During terminal homing the missile will suddenly sweep upwards and then plunge down at the target.

STORES



The Stores panel is always available prior to combat, during the Mission Briefing, in order to set up weapons on board as well as pre-loaded weapons in tubes. Once combat begins, the Stores panel remains available in order to continue managing your weapons.

From the Mission Briefing, select **XO:Status Report** or use **F7** ***(Shift 7)*** to open the Stores Panel.
In combat use **F7** ***(Shift 7)*** or click directly on the Stores tab to open the Stores Panel.

The Stores Panel displays a list of all weapons your submarine is capable of carrying, including their name, how many are currently on board as well as the total weapons on board and the maximum allowed, namely "26/26" in the image above. Numbers in parenthesis " ( ) " are the number of that weapon currently loaded into a tube. Numbers following "VLS:" are the numbers of that weapon currently loaded into a vertical launching system (VLS) if your submarine possesses one. Note that not all weapons are compatible with VLS and only those listed with "VLS:" can be used.

CHANGING WEAPON INVENTORY

In Single Missions and Training Missions, weapon inventory may be changed during the mission briefing. When playing a campaign, weapon inventory can only be changed when at port and loading and unloading weapons or Spec Ops requires time.

Click on any weapon name or image to select it (highlighted in white).
Then use **UNLOAD** to remove the weapon or **LOAD** to add the weapon into your submarine's inventory.
Weapons in tubes will always be unloaded and loaded last. Weapons loaded into tubes and their settings will persist when combat starts.

Spec Ops can also be brought on board for specific missions requiring their drop off. Loading a commando team takes up all inventory space of your submarine, allowing weapons to only be carried in tubes and the VLS. The maximum allowed weapons on board will change to reflect this and any weapons not in tubes or VLS will be removed when loading commandos. They are loaded and unloaded by using **LOAD SPEC OPS** and **UNLOAD SPEC OPS**.

Your submarine will always be equipped with the maximum number of noisemakers at the start of a mission (or when returning to port during a campaign) and in combat the number remaining can be viewed on the Stores panel.

3. NAVIGATION

OWNSHIP DATA

Above the mini-map is a data panel which contains 3 columns of data (left to right).
1) Ownship data
2) Contact Data
3) Weapon data (torpedo on a wire)

The first column displays your current;
CSE Course
SPD Speed
DEP Depth
RUD Rudder
PLN Planes
BAL Ballast

As you adjust your submarine's rudder, planes and ballast, their current settings will be displayed here as will your current course, speed and depth.

SPEED

Use **Q** and **Z** to adjust speed.
Your submarine's speed can be adjusted in the following increments:
- Back Emergency
- All Stop
- Ahead 1/3
- Ahead 2/3
- Ahead Standard
- Ahead Full
- Ahead Flank

Changes in speed require some time to take effect, accelerating from stationary to flank speed may take several minutes. Travelling at Flank speed and cutting your speed to All Stop will allow your submarine to coast along for quite a long distance. While travelling fast and setting speed to Back Emergency will rapidly decelerate your submarine.

CAVITATION

Cavitation is the formation of bubbles by a fast turning propeller. These bubbles make significant amounts of noise that can give away your position. At deeper depths, higher water pressure decreases this effect, allowing you to go faster without cavitating. Note that cavitation is based on engine speed, not your submarine's speed, such that quickly reducing your speed setting can stop cavitation soon after it begins.

Your sonar operator will notify you via the message log if you are cavitating and a cavitating status icon will appear in the upper right.

FLOW NOISE

Higher speed increases the amount of noise your submarine generates, due to both machinery as well as flow of water around the hull. This flow of water, termed flow noise, can greatly interfere with sonar sensitivity, eventually drowning it out at higher speeds, resulting the loss of faint contacts. Towed arrays are extremely sensitive to flow noise and are drowned out at about 10 knots.

As flow noise decreases the signal to noise ratio when listening to contacts, it makes signature analysis more difficult. Flow noise also increases the ability of enemy sonar to detect you submarine.

The ability to balance getting into position, maintaining clear contact with the enemy and managing cavitation while not being detected by enemy sonar will make you a successful submarine commander.

EFFECTS OF DAMAGE

Upon damage to your submarine's propulsion, speed is limited to "Ahead 2/3". If your submarine's reactor is damaged, speed is limited to "All stop". Once these systems are repaired, maximum speed is restored to Flank.

STEERING

Use **A** and **D** to steer your vessel.
Rudder is set in 5 degree increments to a minimum of -30 degrees (left) and +30 degrees (right).
Current rudder setting is shown in the bottom left panel.

A turning vessel loses some speed during the turn.

EFFECTS OF DAMAGE

Damage to your submarine's rudder significantly increases your turn radius until repaired.

DEPTH CONTROL

Dive Planes: Use **W** and **S** to change depth using dive planes.
Planes are set in 5 degree increments to a minimum of -30 degrees (down) and 30 degrees (up) and require some forward movement in order to work.

Ballast: Use **C** and **E** change depth using ballast.
Ballast is set in 5 unit increments to a minimum of -30 (down) and +30 (up) and does not require any forward movement in order to work.

Emergency Blow: Use **Shift R** to immediately blow emergency ballast which sets ballast to +60 and prevents further changes to ballast until your submarine has surfaced. Once surfaced, compressed air must be replenished before you can dive again. The ballast readout will slowly count back to 0 and once reached you will be able to dive your submarine again.

TEST & CRUSH DEPTHS

Hulls of submarines are constructed to withstand the immense water pressure at the depths they operate. For each 33 ft (10 m) of depth close to 1 atmosphere of pressure is added.

Test depth is the safe depth at which a submarine can operate; during sea trials it has actually been reached. Crush depth is the actual depth causing the hull to structurally fail and implode, on average about 1.5 to 1.75 times that of test depth.

As you change depth, the helmsman will notify you via the message log as you pass 100 ft increments. If you are below test depth, any deeper 100 ft increments will be displayed in red.

EFFECTS OF DAMAGE

Damage to your submarine's planes or ballast decreases their effectiveness by 50% making surfacing and diving significantly slower and less efficient. Damage to your submarine's ballast also prevents the use of Emergency Blow, making the ballast system a very high priority to repair as quickly as possible. These effects are removed once the system is repaired.

As a submarine takes damage, hull integrity is decreased which impacts its ability to withstand water pressure. A heavily damaged hull may have its crush depth reduced by 50%, causing it to implode at more shallow and otherwise safe depths. Loss of hull integrity cannot be repaired while at sea.

Loss of hull integrity may also result in flooding. The severity of flooding increases with depth, due once again to the increase in water pressure.
See the Damage Section from more details.

STRAIGHT & LEVEL

Use **X** to set rudder, planes and ballast (if no Emergency Blow) immediately to 0.

COLLISIONS

Striking ice or land with your submarine immediately results in a rapid loss of speed. The speed at which the collision occurs determines how much damage (if any) may be incurred. Travelling at less than 5 knots usually results in no or minimal damage, while high speeds can cripple or destroy your submarine due to extensive hull damage, flooding and knocked out subsystems.

When operating in shallow waters or near the sea floor your helmsman will notify you if there is less than 50 ft of water under your keel. In addition, high frequency navigation sonar will detect ice or mines within about 4,000 yards in front of your submarine. Time compression will be disabled and status icons appear in the upper right to notify you of any ongoing navigational hazards.

Any collision will immediately disable time compression, if enabled, and time compression cannot be re-enabled until your submarine is clear of the hazard. In addition, Back Emergency can be used to pull your submarine away from ice or the sea floor if your submarine becomes stationary during a collision. Ballast can also be used to "float up" from the sea floor after a collision.

NAVIGATION ICONS

As you navigate your submarine the following status icons are displayed in the upper right under certain conditions to warn you of navigation hazards or alert you to certain conditions.

NAVIGATION ICON DESCRIPTIONS

Time Compression: Time compression can be enabled and disabled with **F9** ***(Shift 9)*** to speed up game play when transiting longer distances. When enabled, this status icon is displayed. Time Compression will automatically be cancelled whenever a navigation hazard is encountered or if your submarine takes any damage.

Event Camera: If enabled, the event camera will automatically focus on events of interest as they happen such as weapon launches and impacts, aerial drops or anti-missile guns firing. Use **Shift E** to toggle the event camera on or off.

Cavitating: You submarine is currently cavitating, causing the propeller to make additional noise. Decrease speed or dive deeper to prevent cavitation.

Running Silent: Shown when your submarine is rigged for silent running. Silent running decreases noise made by your submarine, but also decreases your maximum allowed speed and stops all repairs, pumping of water and reloading of weapons. Silent running is toggled on and off using **Shift S** and increasing speed, assigning damage control actions or loading a weapon will cancel silent running.

Shallow Depth: Displayed when the depth under the keel of your submarine is less than 50 ft.

Ice Hazard: High frequency under ice sonar has detected ice ahead of your submarine. Navigation sonar is limited to about 4,000 yards and can only detect hazards directly ahead of your submarine. Once detected, ice positions will be mapped onto your tactical map display.

Mine Hazard: High frequency mine avoidance sonar has detected mines ahead of your submarine. This sonar is limited to about 4,000 yards and can only detect hazards directly ahead of your submarine. Once detected, mines will be mapped onto your tactical map display.

4. TACTICAL MAP

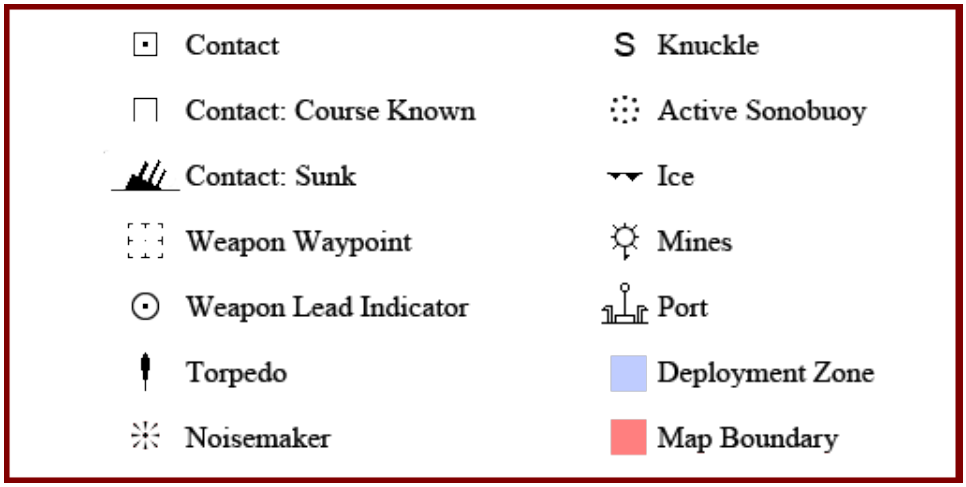
The Tactical Map, and associated Mini-Map, provides an overview of the battle based on your submarine's sensor data. This data is crucial to maintain situational awareness and stay in control of a battle as it unfolds. In addition, the Tactical Map is linked to your submarine's weapon systems to provide targeting information.

USING THE MAP

Note that when using the mini-map, mouse pointer must be over it in order to use pan and zoom.
Pan Map: **LEFT CLICK** and drag the mouse.
Zoom Map: **MOUSEWHEEL** or **Equals** and **Minus**.
Centre Map: **Backslash** will place your submarine in the centre of the map.
Auto-Centre Map: **Shift Backslash** locks the map to your submarine.
Maximise Map: **Tab** toggles between mini-map and full screen map. Auto hides mini-map when switching to full screen.
Hide Mini-Map: **LEFT CLICK** in upper portion of the mini-map hides/restores it. If you lose your submarine from mini-map, maximise map, drag your submarine to the centre, then minimise map.

The grid scale of the tactical map is shown in the upper right when in full screen mode.

Icons displayed on the map are as follows and are described in further detail below:



VESSEL POSITIONS

The map displays your submarine position and trail which is always 100% accurate. **LEFT CLICK** on your submarine will move the camera to it.

Contacts are displayed based on their current target solution, namely how accurately their speed, course and range have been determined. The better the solution, (closer to 100%) the more accurate will be the displayed position of that contact. Once course is known, the icon will change so as to display that course and once the solution is at a high enough level of confidence, that contact will be updated more frequently on the map as well as have a trail showing where it has travelled. The process of building up information about a contact is termed Target Motion Analysis and is explained in more detail below.

LEFT CLICK on a contact will either;
1) select that contact.
2) if already selected, move camera to that contact.

TORPEDOES
If your sensors can detect a torpedo, it will be displayed on the map along with its trail. Player fired torpedoes on a wire or straight running torpedoes are always displayed since their position does not require detection by your sensors.

LEFT CLICK on a torpedo will either;
1) select that torpedo for weapon guidance (if friendly and on a wire).
2) move camera to that torpedo.

WEAPON WAYPOINTS
When firing a weapon, a waypoint must be set. Simply **RIGHT CLICK** ***(N)*** to place the waypoint at the current mouse position over the map. To edit a waypoint, **LEFT CLICK** ***(M)*** to pick it up and **RIGHT CLICK** ***(N)*** to place it at the current mouse position. Only weapons on an active wire may have their waypoint edited if they have not yet reached their waypoint and become activated.

WEAPON LEAD INDICATOR
When firing torpedoes, a lead indicator appears in front of the target to show the intercept point for that weapon. This can be used to assist with setting your waypoint. Lead indicator is only shown if the target solution is at maximum.

NOISEMAKERS AND KNUCKLES
Countermeasures dropped by vessels or disturbances in the water induced by putting the rudder hard to one side at high speeds (a knuckle) are also indicated on the Tactical Map. These interfere with torpedo homing.

DIRECTIONAL INDICATORS
Active sonar pings that your submarine can hear are displayed as a line from your submarine in the direction the ping was heard from. Such pings from other vessels or active sonobuoys dropped by aircraft and are displayed in yellow. Pings from terminal homing active torpedoes (friendly or enemy) are displayed in red. Whenever your ESM mast is extended, radar emissions from vessels or aircraft are displayed in a similar way to indicate the direction of the emitting source. These indicators are shown in purple.

AIRCRAFT AND MISSILES
Airborne objects are not shown on the Tactical Map.

ICE and MINES
As ice and mines are detected by your high frequency navigation sonar, they are mapped onto the tactical map. Ice may also be mapped by marking it with the periscope, see Sensors, Periscope section for more information.

PORT
Shows the location of ports.

DEPLOYMENT ZONE
Circular area used for Insertion missions to deploy special forces or in Land Strike missions to fire land attack missiles into.

MAP BOUNDARY
Near the outside of the map is a red shaded boundary which demarcate the limit of the combat zone. While it is possible for other vessels, aircraft or weapons to move into this region, navigating your submarine here immediately ends combat. Ending combat in this manner does not require breaking contact with the enemy.

CONTACTS

Contacts are sound sources, usually vessels, detected by your sensors. The second data column above the mini-map displays information about the current contact.
CONTACT NAME The name or designation of the contact
BRG Bearing - direction from your submarine to the contact
CSE Contact's course
SPD Contact's speed
RNG Range to contact
SOL Target Solution quality, namely how accurate information about the contact is

For a given contact, the position and amount of detail plotted on the tactical map is based on the target solution confidence.

TARGET MOTION ANALYSIS (TMA)

TMA is the observation of a contact over time to build up information about its course, speed and range. This accumulated data is called the target solution and as mentioned above, calculating an accurate target solution accurately plots a contact's position and movement on the Tactical Map. With an accurate target solution you have a much better chance to hit with weapons and knowing when you might be risking detection by straying into enemy sensor range.

Rate of Target Solution Accuracy Increases with:
- Selecting a contact as your current contact
- Stronger signal detected from the contact.
- Knowing the type of contact you are tracking, see Signature Analysis.
- High rate of bearing change over time to contact.
- Accurately ranging the contact using active sonar, laser (marking the target with periscope) or radar.

Rate of Target Solution Accuracy Decreases with:
- Weaker signal coming from the contact.
- An unclassified or incorrectly classified contact.
- Changes in contact course or speed.
- Losing contact with the target.
- Low rate of bearing change over time to contact.
- Contact firing a decoy torpedo.

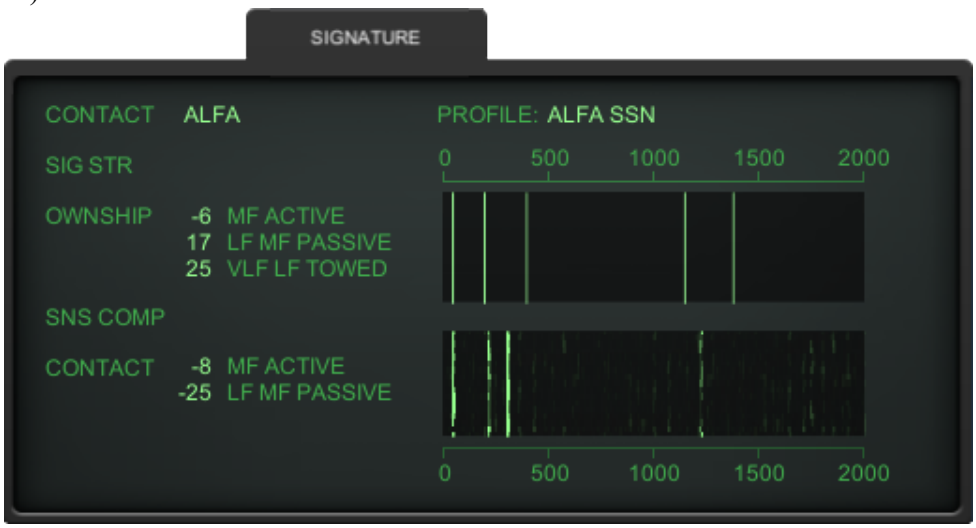
TMA is automatically performed by your crew as long as the contact is maintained. Losing a contact results in decay of the target solution over time as the data becomes less relevant to where that contact might actually be now.

Detection and analysis of a contact is based on your submarine's sensors which are described in detail in the Sensors section.

SIGNATURE ANALYSIS

Passive sonar signals from a contact can be compared to known sound profiles of various vessels in order to identify the class of ship you are tracking, a process termed signature analysis. Over time, your crew will automatically perform this task however a skilled commander can speed up the process. The sooner a contact has been correctly classified, less time TMA will take and the quicker

you can identify threats and prioritise targets. Note that a contact may also be classified by raising the periscope, establishing visual contact and marking that target (see Sensors, Periscope section for more information).



Use **F6** ***(Shift 6)*** or click on the Signature tab in the bottom right to open the Signature Panel and view the current contact's sound profile (lower panel). The upper panel contains a database of known vessel profiles for comparison. Following the vessel name is the designation for that type of vessel, see Reference section for a list of ship designations.

Use **Quote** and **Semicolon** to cycle through the various profile signatures until the lines (sound frequency peaks) between the two profiles correspond. Finally use **Return** to classify the contact as the class you've identified when confident the profiles are a match. Alternatively you may **LEFT CLICK** the left portion of the profile, **LEFT CLICK** the right portion of the profile or **LEFT CLICK** the centre portion of the profile.

If the classification is correct, TMA rate will increase, however if incorrect it will suffer a penalty. Your crew will eventually remedy an incorrectly classified contact, but valuable time will have been lost or you might be attacking the wrong target.

Sound profile for the contact is susceptible to flow noise, such that increasing speed increases background noise, making it more difficult to resolve the finer details of the profile and determine a correct match.

The Signature Analysis panel also contains additional information about your ownship and contact sensors.
"SIG STR OWNSHIP" is the signal strength of your ownship's various sensors. It lists the intensity of the sound detected in decibels for your active, passive and towed array (if applicable) sonar.

Likewise "SNS COMP" (sensor comparison) is comparison of the contact's various sensors. Again it lists active, passive and towed array (if applicable) intensity. This information can be crucial to determine how close you might be to being detected by the enemy. However if the contact has yet to be classified, this information is not available. Worse still, if the contact is incorrectly classified you might be looking at the wrong vessel's sensor data.

Negative values are theoretical calculations based on current noise levels and range for the current ocean conditions.

5. SENSORS

Sensors play a key role in modern naval warfare. They detect the enemy, determine where it is as well as where it is going and ultimately facilitate hitting it with weapons. Passive sensors listen for evidence of the enemy without revealing the presence of the listening vessel. Active sensors emit a signal then listen for any that returns. This emission of signals can give away your presence, but active sensors can quickly provide more accurate and detailed data about the enemy. Your submarine, and enemy naval vessels, possess the following sensors:

PASSIVE SONAR

Unless your bow sonar is damaged, passive sonar is always on, continuously listening for sounds emitted by enemy vessels or weapons. Passive sonar gives an accurate bearing to the contact which can be used over time to build up a target solution. It can also reveal a profile of sound emitted from the contact allowing the classification of that vessel type.

ACTIVE SONAR

Active sonar must be enabled with **Shift A**. Once enabled, active sonar will continue to emit pings until it is disabled by toggling off with **Shift A**. Although active sonar gives away your position and has a significantly shorter range than passive sonar, it provides rapid and accurate bearing and range data.

TOWED ARRAY

This long cable trailing behind your submarine contains listening devices which greatly improve the sensitivity of your sonar. It works most effectively at about 5 knots as any slower, the cable sinks, while at faster speeds flow noise begins to drown out the signal being received.

RADAR

Radar is an active sensor that emits radio waves (or microwaves) and receives reflected waves for analysis. It can rapidly determine bearing, range as well as relative movement of detected objects. As an active sensor, it gives away the position of the unit using Radar. Radar detection range is affected by rain and the size of the object being detected.

ESM (ELECTRONIC SUPPORT MEASURES)

ESM is a passive Radar receiver that detects Radar emissions from other sources. Since emissions are detected on striking the ESM receiver, it is much more sensitive than the emitting Radar, which has to rely on the signal to travel to and from the contact.

VISUAL

Visual contact with the enemy is usually made with the periscope or if your submarine is surfaced. Using the periscope, laser range finding can be conducted to accurately determine the enemy's range and relative movement, without revealing your position (unlike RADAR).

Note that radar, ESM and visual (periscope) require raising your masts above the water. Masts can be detected by enemy radar, revealing your position; furthermore your radar also broadcasts your position to the enemy!

Enemy aircraft possess radar, ESM and visual as well as:

Dipping Sonar: a passive or active sonar listening device lowered from a stationary helicopter.
Sonobuoy: passive or active sonarbuoys dropped by helicopters and aircraft.
MAD: Magnetic Anomaly Detector using Earth's magnetic field to detect submerged submarines. However it has a very limited range of 2,500 yards and is not effective at submarine depths below 500 ft.

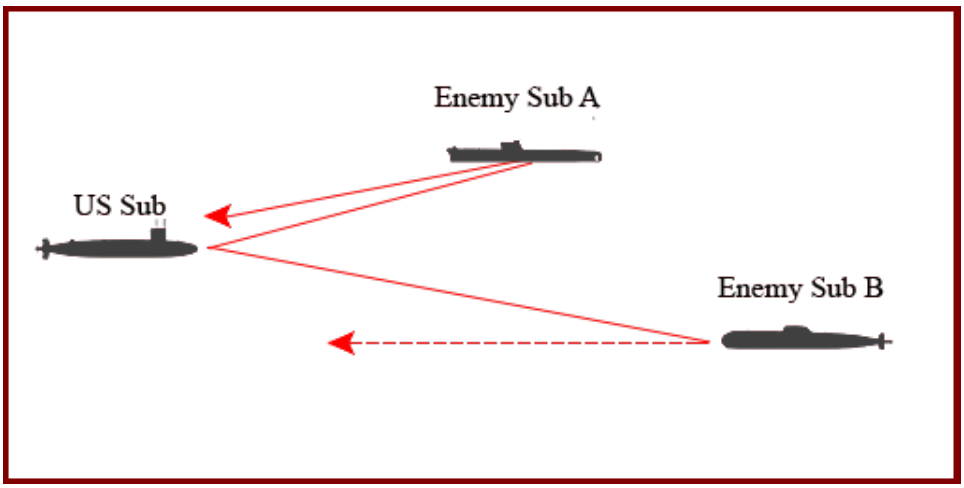
DETECTING CONTACTS

Any vessel detected by your sensors is termed a Contact and is prefixed with a letter/name based on the sensor type initially detecting it;
(S) Sierra - detected by sonar
(R) Romeo - detected by RADAR
(E) Echo - detected by ESM
(V) Victor - detected by visual observation (periscope or bridge)
(M) Master - upgraded to this if detected by more than one sensor type

Once classified, the contact designation is replaced by the class of the vessel.

SONAR

When submerged, passive sonar will primarily be used by your submarine to detect, classify and track contacts. Active sonar is also extremely useful and can greatly increase TMA against a contact, but has several limitations.



When using active sonar, the listening vessel (US Sub) emits a loud "ping" and listens for reflection of this noise from nearby objects (Enemy Sub A). Sound has to travel to and from the object, making active sonar range usually less than that of passive sonar. In addition, sound reaching Enemy Sub B that is too far to return to the listening vessel reveals the US Sub to Enemy Sub B, fails to detect Enemy Sub B, but reveals presence of the US Sub. Since active sonar relies on the reflection of sound from the contact such that a contact broadside to the listener reflects much more sound than one that is face on.

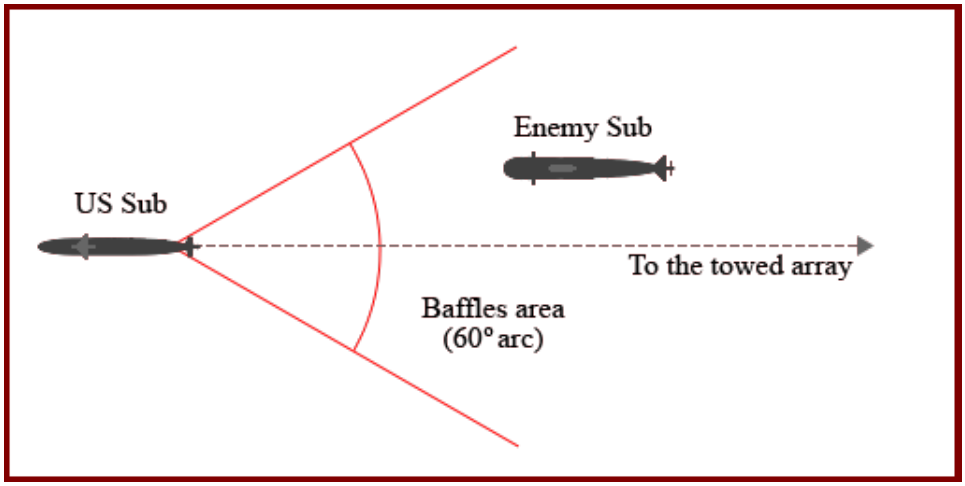
Enemy vessel active sonar pings are displayed as yellow directional indicators on the Tactical Map. Enemy torpedo active sonar pings are displayed as red directional indicators on the Tactical Map.

FLOW NOISE

As a vessel moves, the flow of water around the hull generates flow noise. The faster the vessel moves, the louder the flow noise generated. This noise makes it harder to hear signals with your sonar, thus decreasing their sensitivity.

BAFFLES

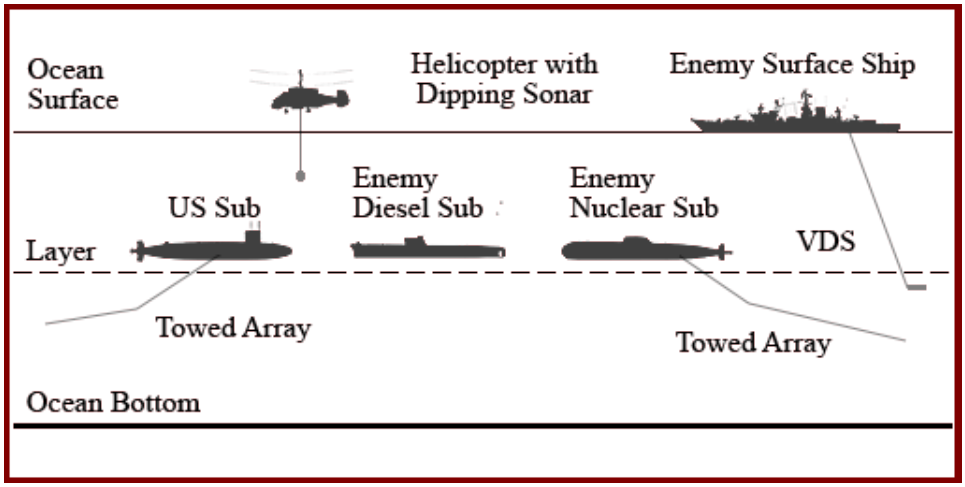
Hull mounted sonar is shielded from behind so that noise generated by the vessel itself does not interfere with their sensitivity. In addition, turbulence from the propellers and hull disrupt the flow of sound behind the vessel. This results in a blind area directly to the rear, usually about 60 degrees wide.



A towed array is not affected by the rear baffles as the listening device is towed far behind the vessel. However the towed array has a narrow blind spot forward as the noise from the submarine ahead masks incoming sound.

Finally all submarine sonar have a vertical limitation to detection such that they cannot hear sound sources directly above or below them. In Cold Waters this is represented by a +/- 45 degree listening arc.

While you will use sonar to detect enemy vessels when submerged, they will also be using sonar to detect you!



The diagram above illustrates the general listening capabilities of your sonar. Enemy surface warships tend to be noisy, making them readily detectable by your sonar at longer ranges. Submarines are usually quieter, although the constant running reactor of nuclear submarines makes them somewhat more noisy than their diesel-electric counterparts. In fact, diesel-electric submarines will usually be the most quiet and difficult of contacts to detect. Finally enemy helicopters (and aircraft) are practically impossible to detect by sonar. Your only warning of their presence will be active pings from their dipping sonar or active sonobuoys dropped nearby.

UNDERWATER ACOUSTICS

Sonar uses sound waves travelling through water and environmental factors impact its sensitivity, decreasing or even enhancing it.

AMBIENT NOISE

This is the background noise of the ocean itself, the louder this is, the more difficult it becomes to hear other sound sources with sonar. Increased sea state (wind and how large waves are) as well as rain, snow and sea ice all increase ambient noise while pack ice dramatically reduces ambient noise.

WATER DEPTH

Very shallow waters may result in scattering of sound waves as they strike the bottom and also have more biological activity, resulting in decreased sonar sensitivity. Water depth is also a major factor involved in increasing the propagation of sound in water by several phenomena as outlined below.

MOVEMENT OF SOUND IN WATER

The propagation of sound in water bends, due to changes in temperature and pressure. As water cools, it bends sound waves downward, while warming water bends them upward. In addition, increasing water pressure also bends sound waves upwards. Therefore sound waves travelling deep into the ocean will initially bend downward due to the temperature gradient near the surface, then bend back upward due to the increasing pressure gradient. This results in the sound waves travelling in a deep arc back to the surface.

CONVERGENCE ZONE

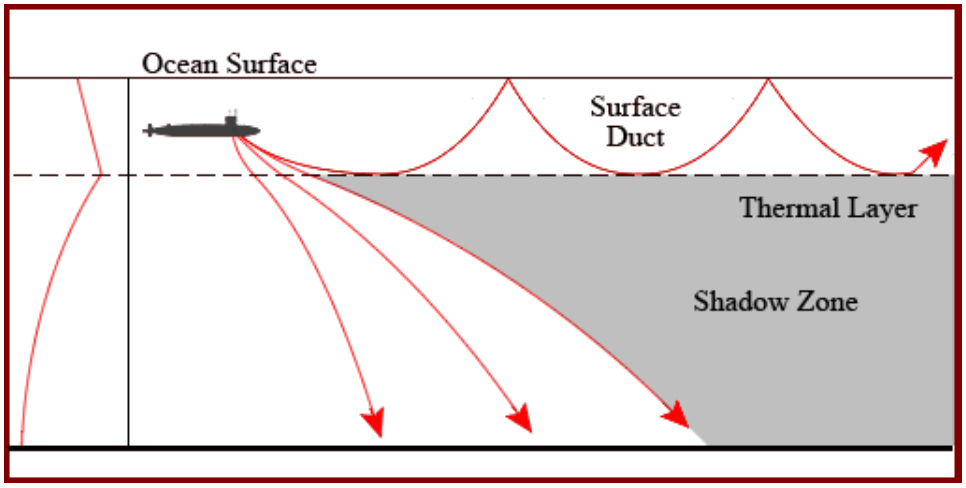
As mentioned above, sound is bent back upwards by water pressure such that if the water is deep enough (~10,000 ft in the Norwegian Sea) it will ultimately return to the surface. The zone in which these sound waves return to the surface is called a Convergence Zone and can be 40,000-50,000 yards away. A ship listening with sonar in this zone could detect the emitter, even though the range is far beyond the distance the sound could travel along the surface.

BOTTOM BOUNCE

In moderately deep waters (~2000 ft) a phenomenon called Bottom Bounce may occur. Sound waves strike the ocean floor and can be reflected back up to the surface, increasing their propagation. Bottom bounce requires a relatively flat and uniform ocean floor to reflect sound waves.

LAYERS AND DUCTS

As mentioned previously, cooling water bends sound waves downward while warming water and increased water pressure bends them upward. In general, water is warmest near the surface, cooling gradually with depth. Around 100-300 ft deep there is a sudden drop in water temperature, called the thermocline or thermal layer. Past the thermal layer, water temperature gradually decreases to about 4 degrees Celsius at 3000 ft and below.



THERMAL LAYER

As mentioned above, the sudden drop of water temperature results in a thermal layer. Heavy seas mix the water near the surface which can weaken the strength of the thermal layer. In regions where the surface water is too heavily mixed, the water is too shallow or the temperature is too consistent, a thermal layer will not form at all.

SURFACE DUCT

Above the thermal layer, sound waves tend to bend upwards. Upon striking the ocean surface, some are reflected back downward where once again they gradually bent back upwards. This continuous reflection of sound waves between the ocean surface and thermal layer is called a Surface Duct and can greatly increase propagation of sound. Heavy seas tend to decrease the strength of a surface duct due to scattering of sound by the disrupted ocean surface.

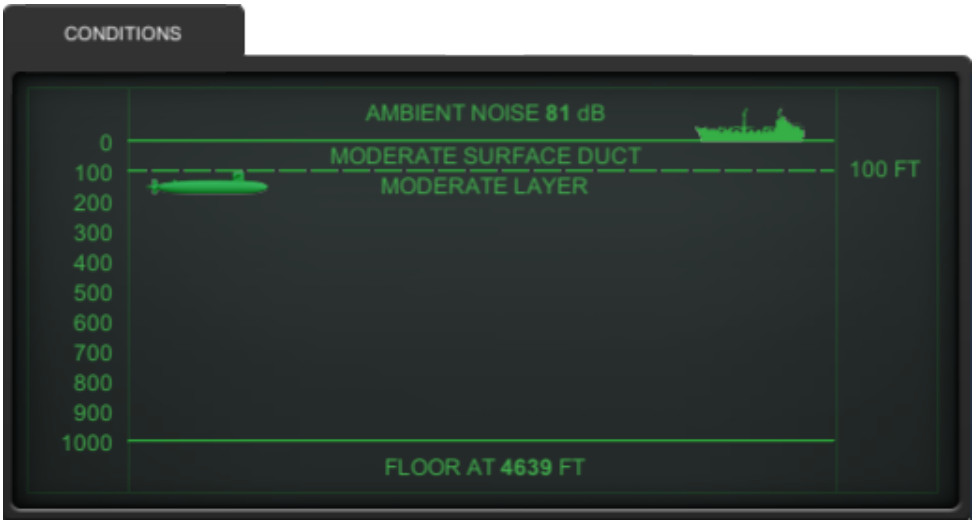
SHADOW ZONE

Directly below the thermal layer, a region known as the shadow zone may form. Sound waves are either trapped in the surface duct, or penetrate the thermal layer only to be bent downwards as the water cools. The bending of sound waves away from this area results in a shadow zone, a region of dramatically decreased sound propagation. A submarine in the shadow zone will find it difficult to detect vessels outside of the zone and vice versa.

Note that the effectiveness of a shadow zone is dependent on range between the vessels. As they get closer, sound waves travel more steeply between them, eventually penetrating the thermal layer as the submarine leaves the shadow zone.

CONDITIONS

Prior to combat, the local ocean conditions and presence of a layer and or duct are presented in the briefing. Once in combat use **F5** *(Shift 5)* or click on the Conditions tab to open the Conditions Panel.



The Conditions display lists the current ocean ambient noise level, the depth and strength of a layer (if one exists), the strength of a surface duct (if one exists) as well as the depth to the ocean floor. In addition, your submarine's depth is plotted (if above 1000 ft) and if your current contact's solution is high enough, that contact's depth is also shown.

The depth of the currently selected torpedo on a wire will also be displayed on the conditions panel.

The ability of a layer to mask sound or a duct to propagate sound is dependent on their strength. Stronger layers and ducts have a much more dramatic effect on sound propagation than do weak ones.

PERISCOPE & MASTS

Your submarine's other sensors, periscope, ESM and radar are mounted on masts that must be raised above the surface in order to function. Masts usually require less than about 50 ft of depth in order to be raised and used. The message log will notify you if your submarine is too deep to raise and use masts.

Masts are relatively fragile such that the flow of water at faster speeds, or water pressure from excessive depth can damage them. Running submerged at over 10 knots with a mast raised will damage and eventually destroy that mast. Likewise, diving below 100 ft without stowing a mast will damage and eventually destroy it.

PERISCOPE

Use **0** to raise your periscope when your submarine is at appropriate depth. Once fully raised, use **P** to enter and leave the periscope view. When in periscope view, **MOUSEWHEEL** or **Equals** and **Minus** can be used to change magnification of the view. The periscope view can by panned with **RIGHT CLICK** and dragging or using **Left Arrow** and **Right Arrow**.

Low light vision can be toggled on/off with **O**. Placing a target in crosshair and using **I** will use laser ranging to accurately determine the range, providing a massive target solution boost and automatically classifying that target. This is termed "marking" a contact. Laser range finding can also be used to map nearby ice which will be plotted on your tactical map.

The periscope mast also contains an ESM receiver which detects the strength (but not direction) of enemy radar transmissions. This sensor's purpose is to alert you to enemy radar signals that might

detect your raised periscope mast. If you see strong ESM readings while using the periscope, best lower it as soon as possible to avoid detection. Use **0** to lower your periscope.

ESM MAST

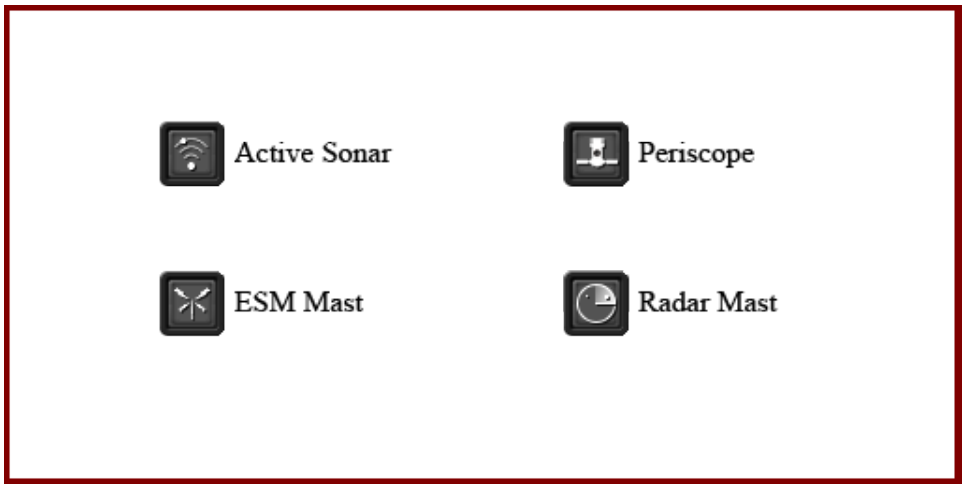
Use **9** to raise your ESM mast. This passive sensor detects radar signals, providing a measure of both their strength and originating bearing (shown as purple lines on the map). Detecting a contact by ESM provides a small boost to target solution. Use **9** to lower your ESM mast.

RADAR MAST

Use **8** to raise the radar mast.
Radar uses radio transmissions to accurately and continuously range contacts which provide a massive boost the target solution. However your outgoing radar signals travel long distances and are readily detected by enemy ESM. Use **8** to lower your radar mast.

SENSORS ICONS

As you use the various sensors of your submarine, status icons are displayed in the upper right to notify you of which sensors are being used.



NAVIGATION ICONS DESCRIPTIONS

Active Sonar: Your submarine is currently using Active Sonar.

Radar Mast: Your submarine's radar mast is currently raised.

ESM Mast: Your submarine's ESM mast is currently raised.

Periscope: Your submarine's periscope is currently raised.

Remember: using active sonar generates loud pings of sound and raising your radar mast broadcasts radio transmissions, both of which can quickly give away your position. In addition, masts which are raised about the water surface can be detected by enemy radar.

6. TACTICS

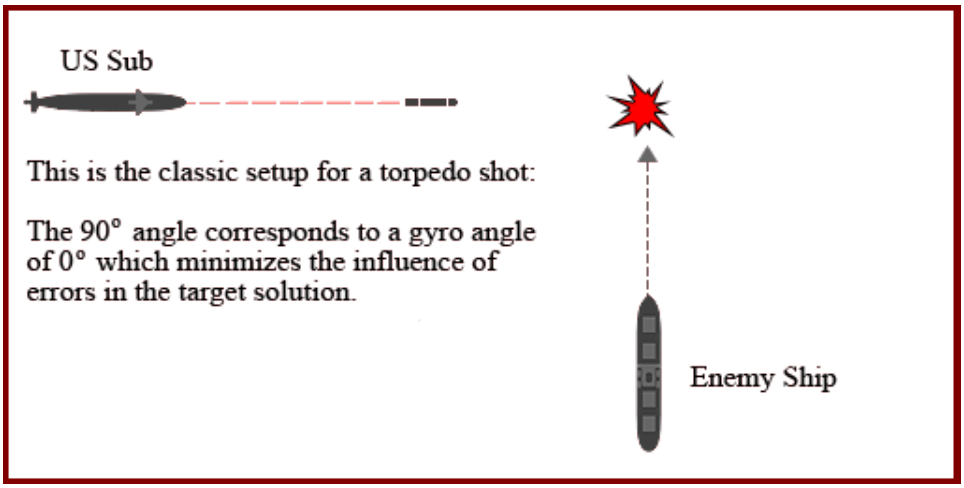
TORPEDOES

Both the Allies and Nazi Germany had experimented with passive acoustic homing and pattern-running torpedoes during World War II. Post-war the focus shifted from the anti-ship mission to anti-submarine (in an effort to counter Soviet diesel-electric subs operating in the North Atlantic) and the US Navy introduced the concept of wire-guidance. It was not until the 1950's when better sonar- and fire control equipment made attacks against submerged targets a credible proposition.

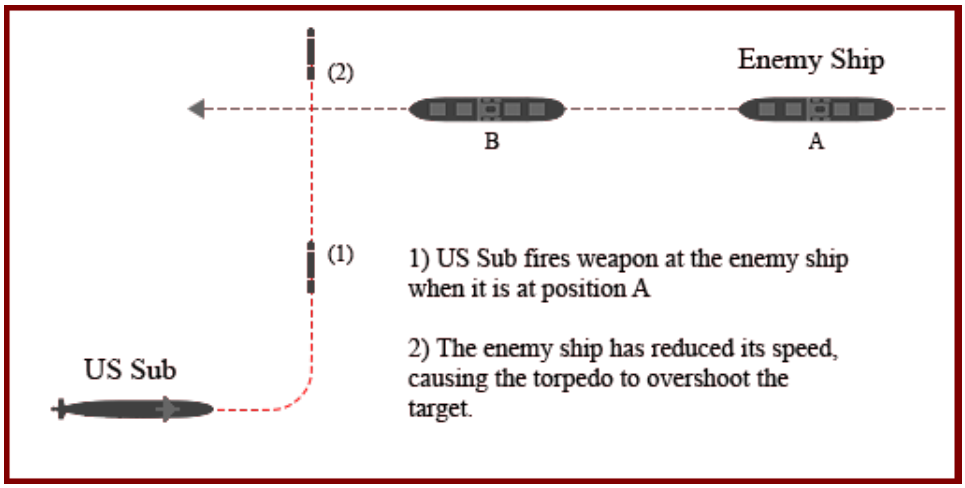
UNGUIDED TORPEDOES

When firing at a moving target, you have to aim a distance in front of it, so that your weapon hits the target at the point he is going to be when the weapon gets there. This is known as leading the target.

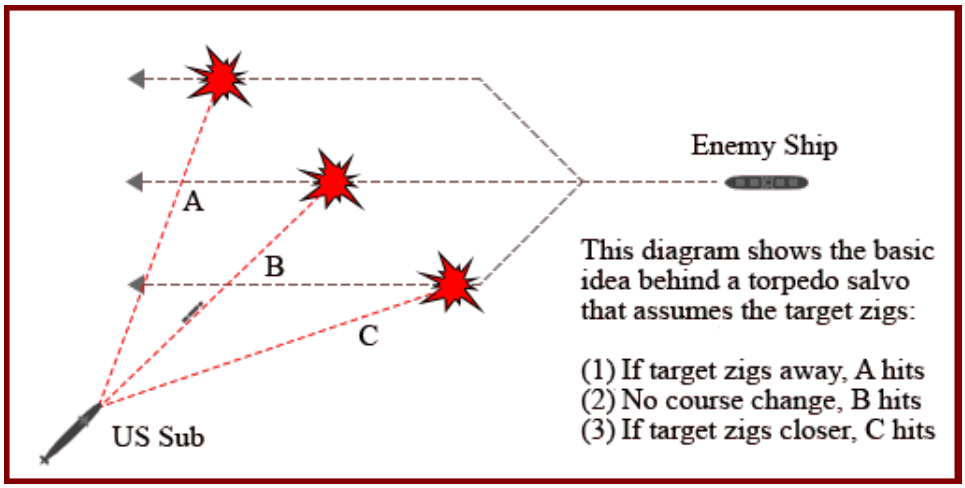
Ever since the 1920's, analog then digital computers have been employed to help with the fire control problem: Observations are made over time noting the target's course, speed and range. These are fed into the fire control system, which also takes input about the sub's own movement. The fire control system then calculates a continuously updated aim point where the target will be if you fired a torpedo at that time. This is known as the target solution.



The accuracy of the solution is dependent on several factors: Sudden movements by you or the target may invalidate the solution causing your weapons to miss. Therefore unguided torpedoes can easily be defeated by a manoeuvring target. This has been made into standard doctrine, and therefore all surface groups will make periodic course changes, or zigs, to throw off any skipper trying to ambush them.



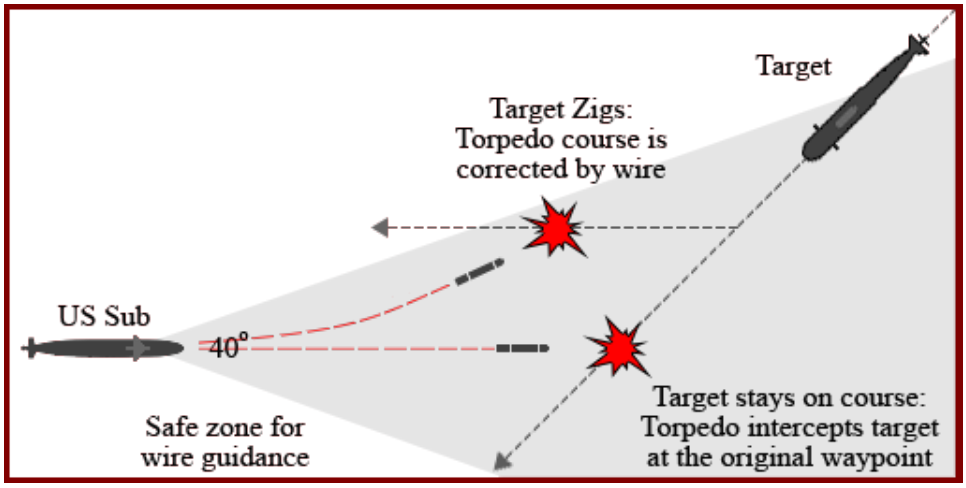
One way to hedge against target zigs is firing multiple torpedoes in a salvo, or spread:



In Cold Waters, an aim point appears on the tactical display when a target's solution reaches a good enough solution. To aim the weapons, simply drag the waypoint over the aim point and fire. The torpedoes will then run for a few hundred yards before turning to the gyro angle set by you.

GUIDED TORPEDOES

Modern torpedoes often use wire-guidance to dramatically increase hit probability against manoeuvring targets. As the torpedo leaves the tube, it pays out an umbilical wire, through which course corrections can be transmitted to update the weapon. This allows the attacking submarine to use its own much more powerful sonar to track the target, leaving the weapons on-board sensor for terminal guidance. Generally, the torpedo will swim out to a preset distance on a gyro angle, at which point it activates its on-board sonar and looks for targets. This is referred to as run-to-enable.



Weapons can be guided either by updating the activation point if the weapon is still in the run-to-enable phase of the torpedo run, or by directly steering the weapon if it is active. Steering an active weapon will override any terminal homing, and so is useful for guiding the weapon away from decoys or overriding a weapon that is homing on the wrong target.

The wires themselves are relatively flimsy, and are subject to break if strained too much. On most US subs, the torpedo tubes are set amidships and angled out towards the sides, which means the wires can snag on the edges of the tube muzzle if the boat is moving at any significant speed, in which case they will break. Firing the torpedo at an off angle exacerbates this problem. Generally, the greater the shot angle, the more likely the wire is to break.

Guided torpedoes dramatically extend the tactical repertoire of seasoned skippers. Assuming the wire stays intact, a weapon can be doglegged towards a target, creating a false datum for the enemy once it activates. With the capability of controlling several weapons at once, salvos can be arranged into complex, multi-directional time-on-target attacks that confuse enemy sensors and limit the effectiveness of their evasive measures. Another tactic involves setting up a pair of torpedoes with opposite Left and Right circle search patterns, with a third weapon on Snake search in the direction of the target. This technique allows you to bracket an elusive enemy target, and cut off his escape routes by flanking him.

GUIDED MISSILES

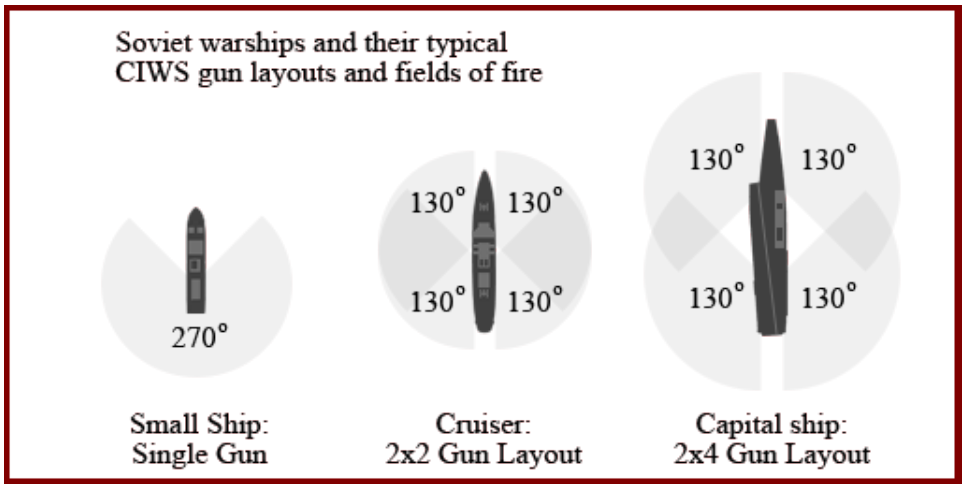
For many years after World War 2, US submarines had no other dedicated anti-shipping weapon than the unguided Mark 14 and Mark 16 torpedoes, of 1940's vintage. By the 1970's the sub force clearly needed a better weapon, and so the UGM-84 submarine-launched variant of the Harpoon anti-ship missile was developed and fielded aboard existing SSN's.

Harpoon is a rather small missile, and lacks enough punch to deal with large targets, so in the 1980's, an anti-ship version of the Tomahawk land attack cruise missile was developed, called TASM with twice the hitting power of the earlier missile.

These missiles can be thought of as faster guided torpedoes that have no mid-course guidance correction. They are launched in the anticipated direction of the target, fly out to an activation waypoint, and from there on search actively until they acquire a target. Missiles can be programmed to attack at wave top height, or perform a final pop-up manoeuvre and strike the target in a dive.

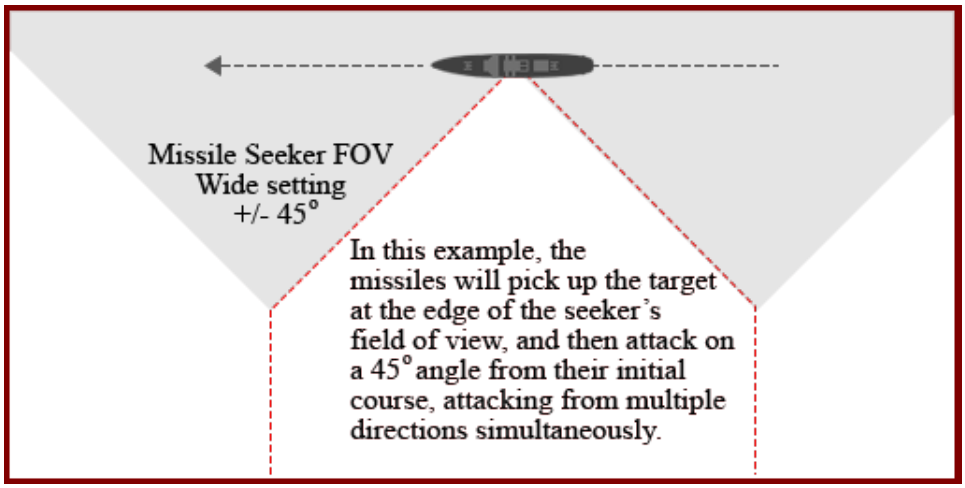
In Cold Waters, missile parameters that can be set are seeker field-of-view, and terminal attack mode. To understand how to use these parameters, one must first understand the nature of Soviet missile defences:

Most large surface combatants use a combination of active jamming, chaff launchers and rapid-fire anti-missile guns to defeat incoming missiles. On most Soviet destroyers and cruisers you will encounter, these guns are often arranged in either two per side or four per side, with each pair of guns controlled by single guidance radar. It is best to think of the guns as covering distinct 'quadrants' with fields of interlocking fire covering the broadsides.



These quadrants tend to leave the bow and stern areas undefended, with defensive fire being the weakest at angles < 45 degrees from the bow or stern.
It quickly becomes apparent that a single missile has a rather low probability of surviving the defences of even a cruiser-sized ship. The way around this is firing missiles in salvos, with the intent to overload the defences. This is where wave top vs pop-up is useful. Two missiles can be launched in a quick salvo - the first set to pop-up, the second to wave top. The missile defences will attack the first missile as it does its pop-up manoeuvre, but this leaves them unable to attack the second missile coming in at wave top height.

Missiles can be also be doglegged toward targets by exploiting the large range of their targeting radar. Position the waypoint accordingly and the missile will acquire the enemy, and turn towards him. Several missiles can be launched and set to attack the enemy from multiple directions.

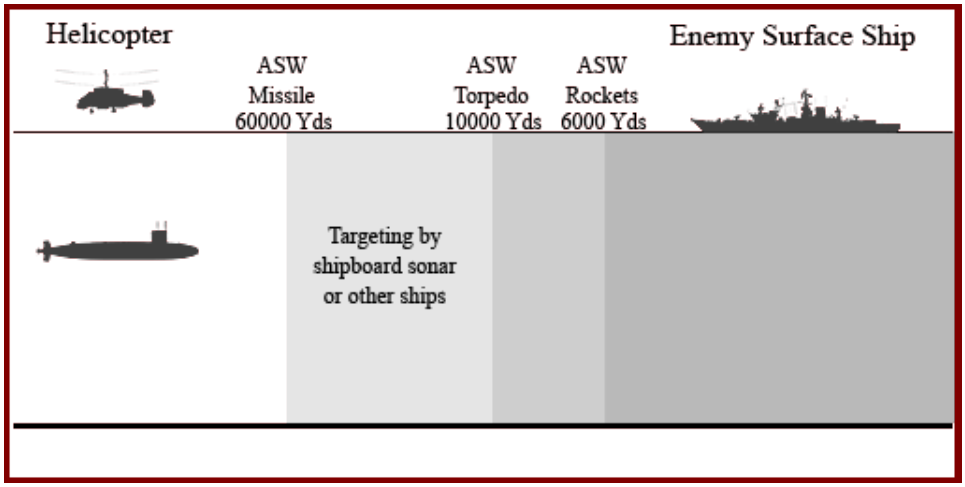


Due to the ranges at which missiles are commonly used, an important consideration is the activation distance from the target. A short distance means less time for the enemy's defences to react, but over large distances the enemy may have zigged or moved too far, causing the weapon to miss. Once you fire the missile, it is on its own - you cannot correct its course in-flight like you can with a torpedo.

The narrow seeker FOV setting can be useful for hitting a specific target within a formation, or for avoiding obstacles like icebergs and oil rigs. Once active, missiles tend to lock onto the biggest target they can find, and if you don't pay attention, you may well lose the missile.

EVASION

A submarine's primary weapon is its ability to stay undetected. However, sooner or later you will be detected, and you will have to evade enemy attacks. To successfully evade, you have to understand how the enemy attacks and how his weapons work. Cold Waters's 1980's-era Soviet adversaries use a layered approach to ASW weaponry, combining stand-off missiles with homing torpedoes and rocket-boosted depth charges. Surface groups employ collaborative targeting, which means any one ship or helicopter can share target information via datalink to any other ship. In practice this gives small ships and helicopters the ability to call in long-range fire from missile-equipped ships.



Enemy submarines likewise carry guided torpedoes, and unlike US subs, stand-off ASW missiles. This means they can attack you at significant ranges if they can detect you. Soviet doctrine places a much greater emphasis on active sonar than US passive tactics, and in theory a single ping is enough

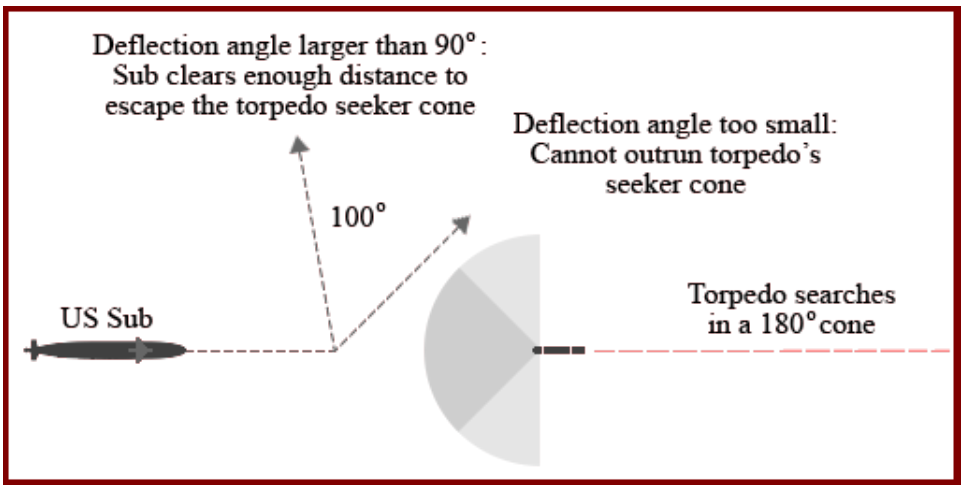
to fire an SS-N-16 down your bearing, which is guaranteed news to ruin the day. The best way to counteract this is to utilize the thermal layers, and always try to stay on the opposite side of the layer from an enemy sub, relying on your superior passive sensors to track and close the range.

The primary ASW weapon is the guided torpedo. To successfully evade it, you must understand how it works:

Typically, torpedoes search in a cone in front of them, similar to a flashlight. However, this cone is notably narrower in the vertical than in the horizontal. For instance, a Mk37 can cover roughly 400 ft of vertical space, but can look out to 1000 yards. What this means in practice is that the torpedo will generally search a slice, or corridor, of ocean (assuming it is a snaking weapon). If you move your sub outside of this corridor, the torpedo will never find you. There are several ways to accomplish this.

HORIZONTAL EVASION

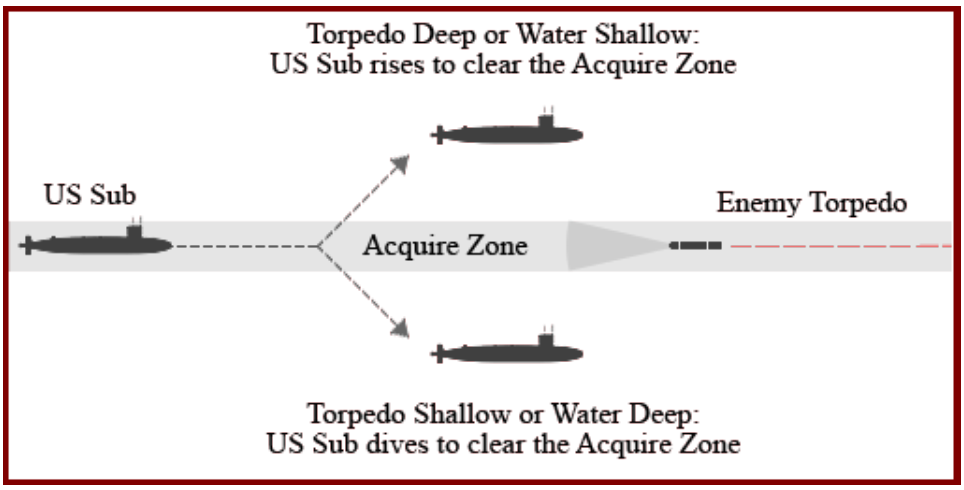
In this scenario the torpedo is generally detected as a transient and assumed to be heading down the reciprocal bearing, that means, right at us. At this point you should go to flank speed and turn 100 degrees to either side. This will let you clear enough distance that you end up well outside of the torpedo's search area.



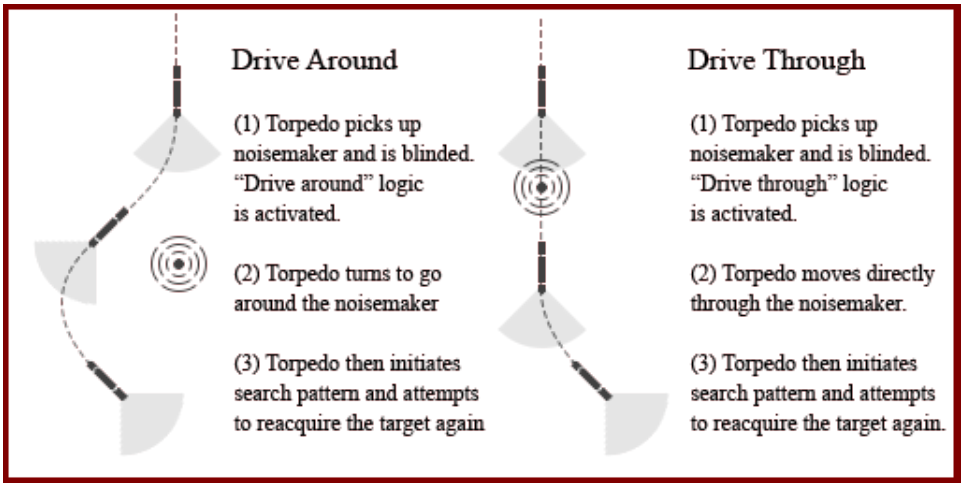
Notice that if you turn at too shallow an angle, the enemy weapon may well acquire and home on you. If the water is sufficiently deep, another option is vertical evasion.

VERTICAL EVASION

In this scenario, we will change depth enough that we move outside the 'slice' exploiting the narrower vertical spread. Depending on your depth, either dive or rise rapidly to clear the danger zone. Generally this maneuver also involves the sharp turn seen in horizontal evasion, to form a very effective evasive manuever. The real gutsy skippers will assume the enemy has set their activation point close and simply run at flank speed towards the weapon, so that they end up behind the active torpedo but with maintained contact and in position to counterfire with a fish of their own.



These evasion techniques assume the torpedo has not acquired your sub. If it does, you will have to use decoys in order to confuse it. You have two kinds of decoys: Noisemakers and self-propelled decoy torpedoes. Noisemakers are simply cans ejected from the submarine that emit a cloud of bubbles, presenting a false target to both active and passive weapons. However, as they are ejected from the sub, they will remain in the same spot behind you, roughly analogous to the chaff dropped by aircraft to spoof missiles. Decoy torpedoes are more sophisticated and are programmed to head in the direction of your choosing while mimicking your sound signature. Generally, while both types of decoys are quite capable of fooling even the most advanced torpedoes, enemy sonar operators will never be fooled by a noisemaker but they may be suckered by a decoy torpedo. This makes these decoys especially useful in situations where you may have inadvertently wandered within range of enemy ASW rockets, or other weapons that may attack rapidly and repeatedly.



Again, to evade it is necessary to understand how the weapon behaves.

If a torpedo has acquired and is closing, the standard response is to go flank and drop a noisemaker to act as a false target, giving you the time to escape. However, weapon designers have anticipated this and as a result almost all modern torpedoes have some form of re-attack logic. As the torpedo loses its target it will go into a re-attack pattern; this generally takes the form of a circle or spiral search. However, advanced torpedoes may be programmed with 'Drive around' logic.

In this case they will begin their circle search before the decoy, and if the initial turn is in the right direction, may steer around the decoy and pick up your sub! Older weapons may use 'Drive through'

logic, in which case they attempt to go past your decoy, then attempt a circle search to pick you up again. Here, knowledge is king: know your enemy and how his weapons behave, and make sure to identify contacts as early as possible. It might mean the difference between victory or cold, swift death in the depths of the ocean.

It is perhaps useful to think of submarine vs submarine combat as very slow air combat. Unlike typical surface engagements, the battlespace is very much in 3D and a lot of the same concepts apply. Submarine skippers and fighter jocks alike will try to get in their opponents' six (or baffles), use clouds (or thermal layers) to mask their approach or attack from the sun (or the direction of a noisy surface ship).

MAINTAINING STEALTH

Understanding evasion tactics will help keep you alive when under attack. Understanding stealth tactics may mean you don't get attacked in the first place.

Run silent: despite limitations to speed, repairs and reloading, silent running decreases noise made by your submarine.

Keep out of enemy sonar detection ranges: classifying the enemy and understanding their sonar detection capabilities allows you to stay outside of their detection threshold. Be careful though, a sudden drop in speed by the enemy, or a sudden turn to clear their baffles can quickly and significantly increase their passive sonar detection range.

Stay slow and don't cavitate: speed equals noise. Be sure to maintain a safe distance from the enemy if you intend to move at faster speeds.

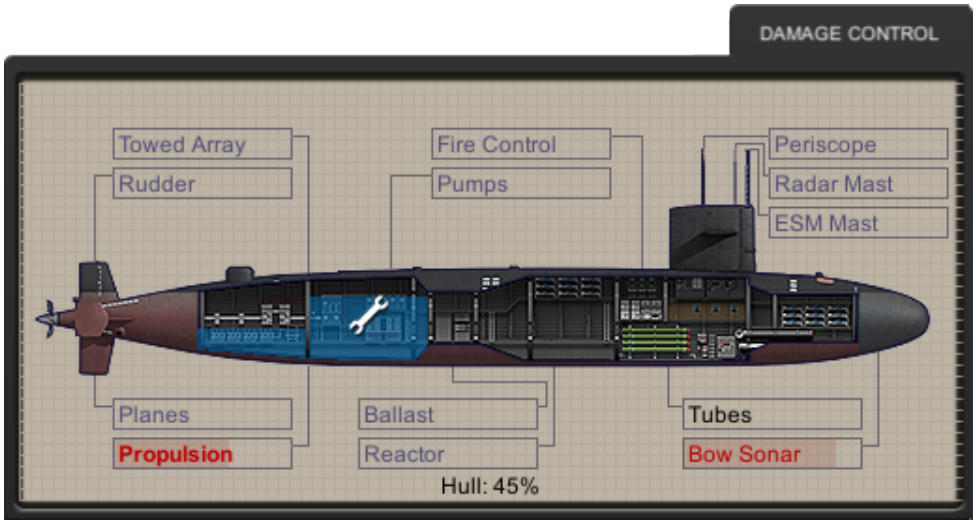
Put the layer between you and the enemy: if a layer is present, keeping it between you and your contact will decrease the sound transmission between you both (unless too close). This can be useful for sneaking in closer or for firing weapons, as the layer will decrease some of the noise from your transient.

Stay off the surface: enemy radar has a long range. You should not ever surface, except in the case of an emergency to save your submarine from flooding. But if enemy warships or aircraft are in the area, expect a rapid attack. When using masts, don't leave them exposed. Get the data you need from them and get them down again quickly.

Get on their six: positioning yourself at an enemy's 6 o'clock (directly behind) will put you in their baffles if they do not possess a towed array or are moving too fast for their towed array to be effective. When firing weapons, being in their baffles should decrease or even prevent them detecting noise from your transient.

Use decoys: firing a decoy and keeping it between you and the enemy may cause weapons and the enemy to focus on its position rather than yours.

7. DAMAGE CONTROL



Click the Damage Control tab or use **F8** ***(Shift 8)*** to open the Damage Control panel.
This panel can also be accessed from the briefing screen prior to any mission or when in port (campaign only) by selecting **XO:Status Report** or using **F8** ***(Shift 8)***.

The Damage Control panel shows a cut-out view of your vessel which is divided into 5 major watertight compartments. Various subsystems are also shown, many of which are associated with a given compartment, although some such as Periscope and Masts are not linked to a compartment as they are in the sail. The currently selected subsystem is in bold.

In addition, the overall hull integrity of your submarine is shown at the bottom centre. If hull integrity is reduced to 0%, your submarine will be destroyed and sink.

DAMAGE CONTROL PARTY

The current highlighted subsystem is the focus of your damage control party and the compartment they are within is shown by wrench/spanner icon. This subsystem (and only this subsystem) will be repaired at twice the normal rate. In addition, the compartment containing the damage control party, receives a bonus to pumping out water as they work to shore up bulkheads, but this pumping bonus requires the Pumps subsystem to be operational.

It is possible to assign your damage control party to an undamaged subsystem in order to assist with controlling flooding in that compartment.

SUBSYSTEMS

Each compartment may contain one or more subsystems. Select the name of a subsystem or use **Semicolon** and **Quote** to move through and highlight a subsystem.

Subsystems have 3 conditions:
1) Operational (Blue)
2) Damaged (Red)
3) Critical (Black)

An operational subsystem works normally while a damaged or critical subsystem is no longer functional and either cannot be used or incurs a penalty to performance. Damaged systems are filled with a red bar which represents about 5 minutes total repair time.

Damaged subsystems will automatically be repaired by your crew over time and can be restored to operational status during combat. In addition, damage control party can halve the repair time of one subsystem. However critical subsystems are permanently out of action while at sea and cannot be repaired or restored.

CAMPAIGN: PORT REPAIRS

When playing a campaign, critical subsystems require returning to port for repair. Once back in port, click on the name or use **Semicolon** and **Quote** to select a critical subsystem. The time required to repair it is displayed in the upper right of the damage control panel. To repair it either;
Click the name of an already highlighted critical subsystem.
Click on the time to repair.
Use **Return**.

Any damage to hull integrity is automatically repaired at port but incurs a time penalty based on the severity of damage to repair.

EFFECTS OF NON-OPERATIONAL SUBSYSTEMS

SENSORS
Bow Sonar - Your passive and active sonar sensitivity are greatly diminished, effectively rendering you nearly blind underwater.
Towed Array - No longer functions.
Periscope - Periscope mast can no longer be raised and can no longer be used.
ESM Mast - This mast can no longer be raised and no longer provides ESM data.
Radar Mast - This mast can no longer be raised and no longer provides radar data.

WEAPONS
Tubes - Individual torpedo tubes can be rendered unusable and cannot be repaired at sea. A torpedo tube will have the wire cut (if one exists) or the weapon within it lost (if one is loaded) upon being knocked out. Some submarines have angled tubes in their sides behind the bow. Attempting to fire an angled tube at higher speeds (20+ knots) has a chance to jam the torpedo, rendering the tube disabled as well as loss of the weapon jammed in the tube.
Fire Control - Loss of your fire control computer immediately halts all TMA (target motion analysis) of contacts and clears all contacts you were tracking.

MACHINERY
Pumps - Pumps automatically decrease the rate of flooding across all compartments. Once knocked out, flooding of compartments is no longer offset by pumping of water. In addition, the bonus to pumping in the compartment containing the damage control party is lost.
Propulsion - Propulsion consists of engines, propeller shafts and the propellers themselves. Damage to propulsion decreases maximum speed of your vessel, limiting maximum telegraph setting to 2/3 Ahead.
Rudder - When steering, reduces the turn rate of your vessel by half.
Planes - When using planes to change depth, reduces the surface and dive rate of your vessel by half.
Ballast - When using ballast to change depth, reduces the surface and dive rate of your vessel by half. Emergency blow ballast cannot be used.
Reactor - If damaged or if your crew is forced to SCRAM the reactor, power is lost to the engines. This limits maximum telegraph setting to All Stop, effectively rendering your vessel dead in the water.

FLOODING

There are 5 major water-tight compartments within your submarine. Damage to them can cause flooding, which is indicated by a blue water level indicator. The higher the level of blue, the worse the flooding. If flooding is too excessive or becomes uncontrolled, your vessel will lose buoyancy and ultimately sink.

Rate of flooding is increased by:
- deeper depth, due to increased water pressure
- increased damage to the compartment
- loss of pumps subsystem
- additional compartments taking on water

Rate of flooding is decreased by:
- shallow depth or surfacing
- an operational pumps subsystem, which pumps water out across all compartments
- damage control party, which doubles the effect or pumps within the compartment they occupy

If you are having difficulty controlling flooding:
- use ballast to offset any negative buoyancy
- be sure your pumps subsystem is operational, or the priority for repairs
- assign damage control party to the flooded compartment (only effective if pumps are operational)
- decrease your depth or surface as quickly as possible
- blow emergency ballast

UNCONTROLLED FLOODING

Once multiple compartments begin taking on water your submarine is in dire straits. You should take immediate action to get to shallow depth quickly. Keep in mind that reactor/propulsion or ballast getting knocked out while your submarine is deep and taking on water could prevent surfacing and be fatal.

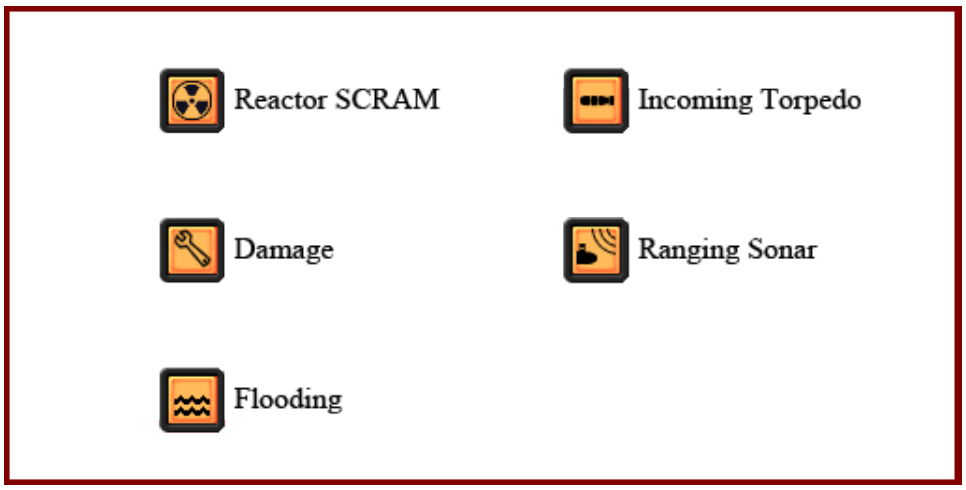
REPAIRING FLOODING

Getting to shallow depth or surfacing will greatly assist your pumps and damage control party in getting ahead of flooding. Once surfaced, damage control party should be able to pump all water out by moving them between the flooded compartments. However if you are unable to surface, even after blowing emergency ballast, it may be time to consider your crew and abandon ship.

While surfacing will allow all flooded compartments to be cleared of water, damage to the hull remains. Submerging will once again put the hull under stress and will likely result in flooding resuming, especially in the most damaged compartments first.

DAMAGE CONTROL ICONS & WARNINGS

Status icons are displayed in the upper right to notify you of damage requiring repair, flooding or the detection of an imminent attack.



DAMAGE CONTROL ICON DESCRIPTIONS

Reactor SCRAM: You submarine's reactor is offline.

Damage: A subsystem on board your submarine is damaged and in need of repair.

Flooding: A compartment of your submarine is over 10% flooded, or the total flooding is greater than 5%.

Incoming Torpedo: Active intercept has detected an incoming active torpedo or the sonar operator has detected a passive torpedo, homing in on your submarine.

Ranging Sonar: An enemy vessel is pinging with its fire control sonar in an attempt to determine your exact position. An attack is likely imminent.

LOSS OF YOUR SUBMARINE

Your submarine will be destroyed if;
- crush depth is exceeded, resulting in implosion
- hull integrity is reduced to 0%

It is important to remember that as hull integrity decreases, crush depth becomes more shallow and could result in up to a 50% reduction in crush depth. Depths that would otherwise be safe will now destroy your submarine.

Once destroyed, the HUD is disabled.
Use **Escape** to enter the mission menu and end the mission.

In the mission menu you may:
1) **Abandon Ship**. If your sub is still intact (has not imploded) and above escape depth you and your crew may survive yet by abandoning ship, otherwise nothing happens when selecting this option.
2) **Quit** to end this mission.

Either of these options will take you to the After Action Report.
When finished viewing the After Action Report, click **Continue** or use **Space**.

8. CAMPAIGN

It is recommended that you familiarise yourself with commanding a submarine by completing the Training Missions and practicing several Single Missions before attempting a Campaign.

Campaigns let you experience an armed conflict as the commanding officer of a submarine. In a campaign you will;
- receive orders to undertake various missions
- navigate the Strategic Map to identify and intercept your targets
- avoid detection by enemy reconnaissance aircraft and satellites
- engage the enemy in combat
- return to port occasionally to rearm and repair any battle damage
- receive medals and awards based on your performance
- help win the war by sinking enemy ships
- help win the war by successfully completing missions
- lose progress by failing to sink high priority targets
- lose progress for failing missions

Your success or failure throughout a campaign will have a direct impact on the outcome of the conflict.

EVENTS

All campaigns begin with a series of events outlining the background and geopolitical issues behind the current conflict. Events also occur when you complete or fail missions as well as being based on specific criteria, such as returning to port, the loss of your submarine or to award you with medals. Finally, events conclude the campaign, describing the outcome of the conflict and your ultimate fate. Your actions as commander will directly influence many events.

LAND WAR
Some campaigns have an accompanying land war. In these cases, additional events occur on a regular basis providing an update describing the loss or gain of territories as well as the overall balance of the war. The Strategic Map will be marked with icons indicating the ownership of territories.

CLOSING EVENTS
Use **Space** or click **Continue** to close an event and continue the campaign.

SKIPPING EVENTS
Use **Space** to immediately skip an event.

PORT

Your submarine will be docked in port at the start of a campaign. Here you are provided with a brief overview as to whether your submarine has room for additional weapons or requires any repairs.

Cast Off, Anchors Aweigh!
Leaves port, taking you to the Strategic Map for navigation.

Rearm and Repair
Opens the Stores and Damage Control panels for reloading of weapons and performing repairs.
F7 *(Shift 7)* and **F8** *(Shift 8)* may also be used.

Review Orders
Examine your current orders. Some missions require specific weapons or commandos on board, so it might be worth checking your orders when re-arming.

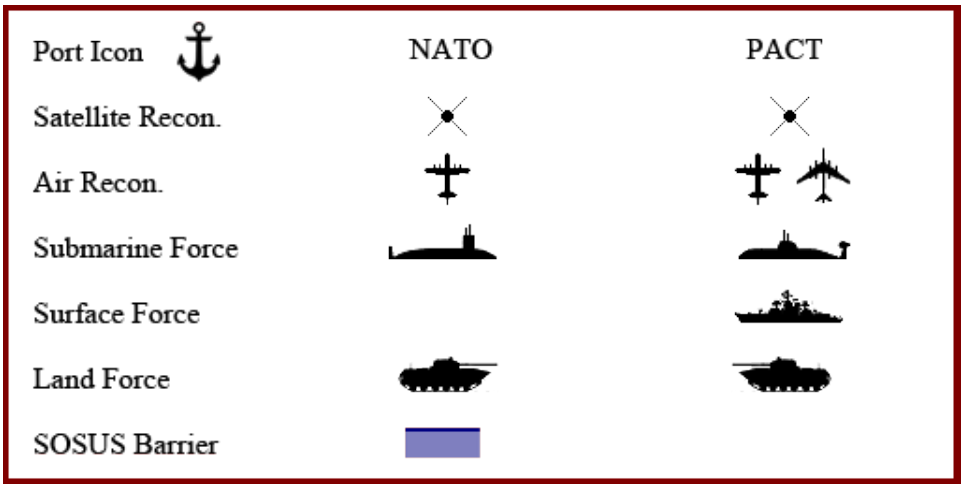
TIME IN PORT
Entering port takes several hours for navigation, docking and getting the crew ashore. Furthermore, additional time is required for:
- loading and unloading weapons
- taking on or removing commandos
- repairing subsystems
- hull repairs (automatic and based on severity)

Except for hull repairs, time required for these actions are shown in the Damage Control and Stores panels. The total time you have spent in port is indicated by the **Hours in Port:** display.

ENTER PORT
Opening the Briefing while in the vicinity of a friendly port will enter that port. A port icon appears in the toolbar to indicate proximity to a port (see below).

STRATEGIC MAP

The Strategic map is used to navigate the oceans and provides an overview of the theatre of war. The strategic map consists of a toolbar in the upper left, a sea chart of the theatre of operations along with various icons. With the exception of the port and SOSUS barriers, icons are coloured according to the side they fight for.



TOOLBAR

In the upper left is the toolbar. From left to right the toolbar displays:
1) Time of day in hours
2) Date
3) Labels button to toggle map text and locations on/off
4) Menu button to enter the Campaign Menu, or use **Escape**
5) Port icon indicating whether the player is in the vicinity of a friendly port

NAVIGATION

There are three movement speeds for your submarine on the Strategic Map
1) Stationary: Your submarine is listening. Combat starts at ~5 knots and at shallow depth.
2) Patrol Speed: Combat starts at ~15 knots and at moderate depth. **LEFT CLICK** ***(Comma)*** to move at patrol speed toward the mouse pointer.
3) Full Speed: Combat starts at ~25 knots and at deep depth. **RIGHT CLICK** ***(Period)*** to move at full speed toward the mouse pointer.
When encountering an enemy force, the speed at which you are moving impacts starting distances, as sonar is less effective due to flow noise at faster speeds. Start depth may be altered by terrain if in shallow waters.

Your submarine's speed also determines the range at which you reveal nearby enemy units. Faster speeds decrease detection range.

RECONNAISSANCE

In the Cold War era, reconnaissance is performed by satellites, aircraft, task forces and SOSUS barriers. Once encountered by your reconnaissance or directly by close proximity to your submarine, an enemy vessel or task force has been detected and will be revealed on the Strategic Map as an icon. The icon type, surface vessel or submarine, represents the type of enemy unit or units encountered. Mixed groups, containing submarines and surface units, default to the surface unit icon.

As the contact ages, it slowly darkens and its position stops being updated. These darker icons now show last known location, becoming less accurate over time as the enemy moves on, until the icon eventually disappears.

Satellites: both friendly and enemy satellites traverse the Strategic Map at regular intervals. Satellites have a very long detection range, but their passing is at regular intervals making it possible to time your positioning during a flyover by an enemy satellite.

Aircraft: launched from locations containing an airbase, aircraft patrol out from and then return to their base. Aircraft require some downtime to refuel between each patrol.

SOSUS Barriers: (SOund SUrveillance System) are chains of sonar listening devices designed to reveal the passage of submarines and ships. Predominately used by NATO, these barriers are strategically placed to guard the choke points of passage from the Norwegian Sea into the Atlantic by Soviet forces. Enemy units crossing a SOSUS barrier are revealed on the Strategic Map.

Vessels: your own submarine (and enemy forces) can detect and reveal nearby units on the Strategic Map.

If your submarine is detected by enemy reconnaissance, any nearby anti-submarine hunter killer groups will be vectored to your position in an attempt to intercept you. There is no notice of this detection, so keep an eye out for enemy satellite transits or nearby aircraft when in enemy waters.

LOCATIONS

Across the Strategic Map are numerous locations. They may be naval ports, airbases, SOSUS stations or a combination of these along with other strategic major cities and towns. Many of these locations may be directly involved in missions you are assigned and, if a campaign contains a ground war, these locations can be attacked by special forces (commandos) or even invaded and liberated by the opposing sides.

Naval Ports: these hubs of naval activity are usually the source of enemy forces and can be infiltrated and attacked by either side's commandos. Your home port cannot be attacked or invaded by the enemy.

Airbases: as mentioned above, these are the source of reconnaissance aircraft. If an enemy commando group attacks an airbase, it disrupts aircraft reconnaissance activity for several days. If an amphibious landing or land based invasion takes over a region containing an airbase, also it disrupts aircraft reconnaissance activity, but eventually restores it for the occupying side.

SOSUS Bases: If an enemy commando group attacks, or the region is invaded, any SOSUS barrier associated with the location is lost permanently for the remainder of that campaign.

Regions may be invaded as part of the ongoing land war, but may also be invaded by amphibious landing forces you have been tasked with stopping! In the latter case you have direct control over saving these valuable reconnaissance resources as well as preventing the enemy from opening new fronts.

BRIEFING

Use **Mouse2** *(Slash)* to open the briefing page whenever you are navigating on the Strategic Map.

Selecting **Continue On Course** returns you to the Strategic Map.

You can examine the current status of your weapon stores and damage as well as review orders for the current mission by selecting **XO: Status Report** or using **F7** *(Shift 7)* and **F8** *(Shift 8)*. As per regular Single missions, weapons pre-loaded into tubes and tube settings can be set and these will be ready to fire during the next engagement. However Stores cannot be modified as they require returning to port in order to bring new weapons on board.

Review Orders can be used to examine your current mission parameters to determine where to navigate and what enemy forces you might need to intercept on the Strategic Map.

CAMPAIGN MENU

From the Campaign Menu you may select one of the following;
1) **Summary** - displays your statistics for the current campaign
2) **Save** - saves the campaign using the file name specified at campaign creation
3) **Quit** - quit the campaign back to the main menu
4) **Back** - return to the Strategic Map and playing the campaign

INSERTION AND LAND STRIKE MISSIONS

These two missions require specific actions to be carried out.

INSERTION: you must return to your home base and take on a party of Spec Ops. Then sail to the destination where you need to infiltrate an enemy location. On the Tactical Map will be displayed a deployment zone into which you must sail (preferably undetected), then come to a stop at less than 100 ft depth for the Spec Ops team to depart. Once departed, they will attempt to undertake their mission. If your submarine is engaged by the enemy or detected on route, shore defences will be on high alert and may capture your Spec Ops team before they can carry out their mission, making stealth of the upmost importance.

LAND STRIKE: you must return to your home base to acquire the number of land strike weapons specified by your orders. Then sail to the destination where you need fire those weapons into a deployment zone (marked on your map). Missiles reaching the deployment zone will automatically be terminally guided to their target. Note that enemy ships may be in position with the ability to shoot down missiles en route. This mission type will only be given if your current submarine is capable of equipping land attack missiles.

LOSS OF YOUR SUBMARINE

Being sunk or abandoning ship in a Single Mission has no lasting consequences, after all it was a one off mission, but in a Campaign the stakes are much higher for you and your crew.

If you survive the loss of your submarine, you will eventually be returned to your home port. Here you will be able to select a new submarine to command and get back into the fight. However being rescued and returned safely takes many hours and may result in the failure of time sensitive missions.

9. REFERENCE

CONTROLS

All controls may be re-mapped in Options.

General

Help	**Shift F1**
Cancel or Quit	**Escape**
Continue	**Space**
Time Compression	**F9** *(Shift 9)*
Hide HUD	**F10** *(Shift 0)*

Unit Reference and Vessel Selection

Museum Next	**D**
Museum Previous	**A**

Camera Controls

Camera Left	**Left Arrow**
Camera Right	**Right Arrow**
Camera Up	**Up Arrow**
Camera Down	**Down Arrow**
Zoom In	**Equals**
Zoom Out	**Minus**
Drag Camera	**Mouse1**
Still Camera	**BackQuote**
Camera To Player	**F1** *(Control 1)*
Camera To Selected Contact	**F2** *(Control 2)*
Camera To Weapon	**F3** *(Control 3)*
Camera To Aircraft	**F4** *(Control 4)*
Camera To Scenery	**Shift F4** *(Control 5)*
Event Camera On/Off	**Shift E**

Weapons

Fire Tube	**Space**
Set Waypoint	**Mouse1** (N)
Edit Waypoint	**Mouse0** (M)
Next Tube	**F**
Load Tube	**R**
Weapon Sensor	**1**
Weapon Search	**2**
Weapon Depth	**3**
Activate Torpedo	**4**
Cut Wire	**Shift 4**
Steer Torpedo Left	**KeyPad4**
Steer Torpedo Right	**KeyPad6**
Steer Torpedo Shallow	**KeyPad5**
Steer Torpedo Deep	**KeyPad8**

Navigation

Increase Power	**Q**
Decrease Power	**Z**
Rudder Left	**A**
Rudder Right	**D**
Planes Up	**S**
Planes Down	**W**
Ballast Up	**E**
Ballast Down	**C**
Blow Ballast	**Shift R**
Straight & Level	**X**

Sensors, Map and Mast

Tactical Map	**Tab**
Centre Map	**Backslash**
Auto Centre Map	**Shift Backslash**
Next Contact	**T**
Active Sonar	**Shift A**
Periscope	**0**
Periscope View	**P**
Night Vision	**O**
Mark Target	**I**
ESM Mast	**9**
Radar Mast	**8**

Tab Panels

Conditions	**F5** ***(Shift 5)***
Signature	**F6** ***(Shift 6)***
Stores	**F7** ***(Shift 7)***
Damage Report	**F8** ***(Shift 8)***
Context Menu Previous	**Semicolon**
Context Menu Next	**Quote**
Context Menu Set	**Return**

Tactical

Silent Running	**Shift S**
Noisemaker	**Shift D**

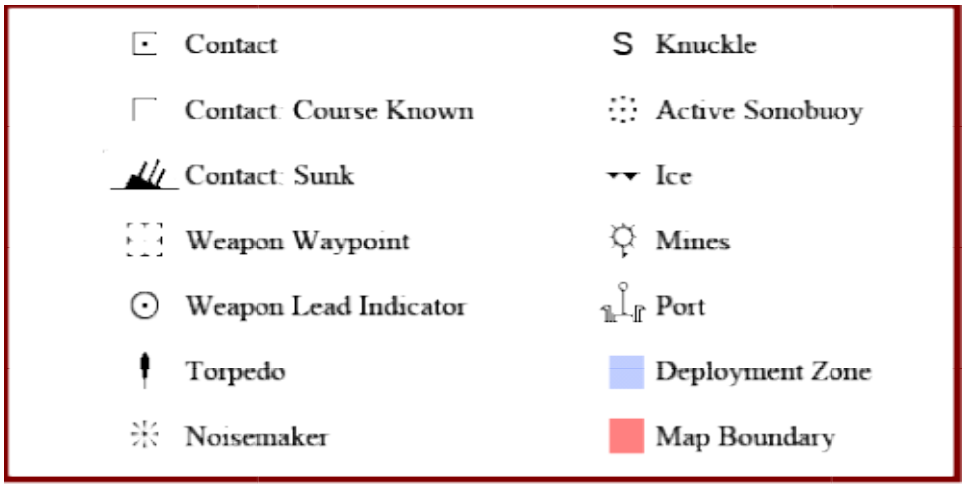
Strategic Map

Patrol Speed	**Mouse1** ***(Comma)***
Flank Speed	**Mouse0** ***(Period)***
Briefing	**Mouse2** ***(Slash)***

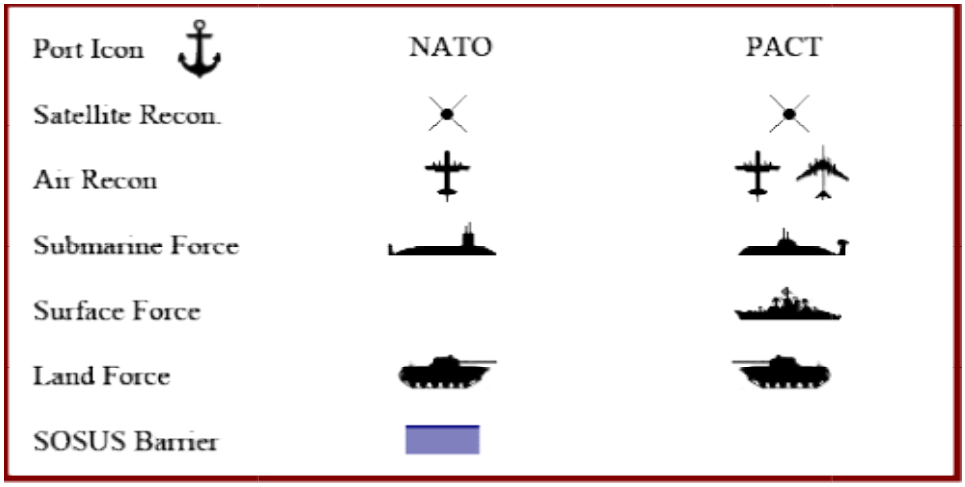
TUBE SETTINGS

Sensor	Search	Depth/Height
Torpedo:		
Passive	Straight	Level
Active	Snake	Shallow
	Left	Deep
	Right	
Missile:		
	Wide Cone	Skim
	Narrow Cone	Pop-Up

MAP ICONS



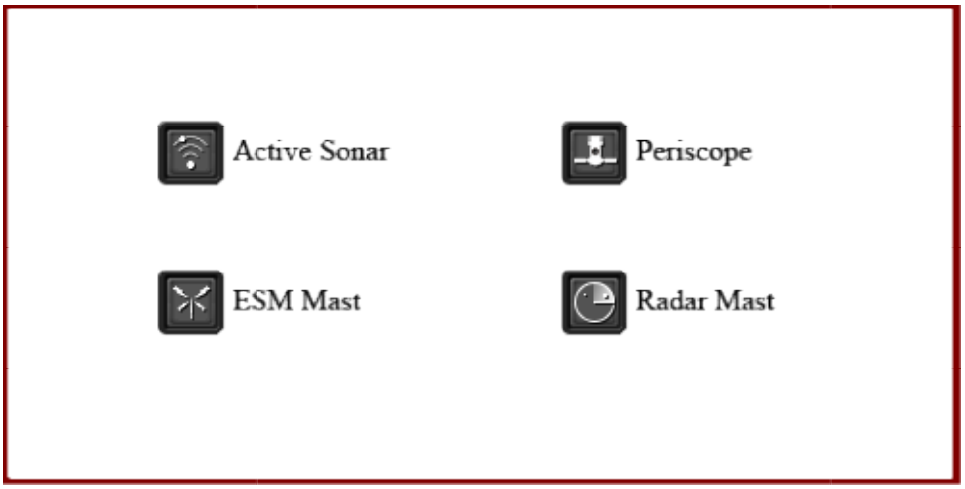
STRATEGIC MAP ICONS



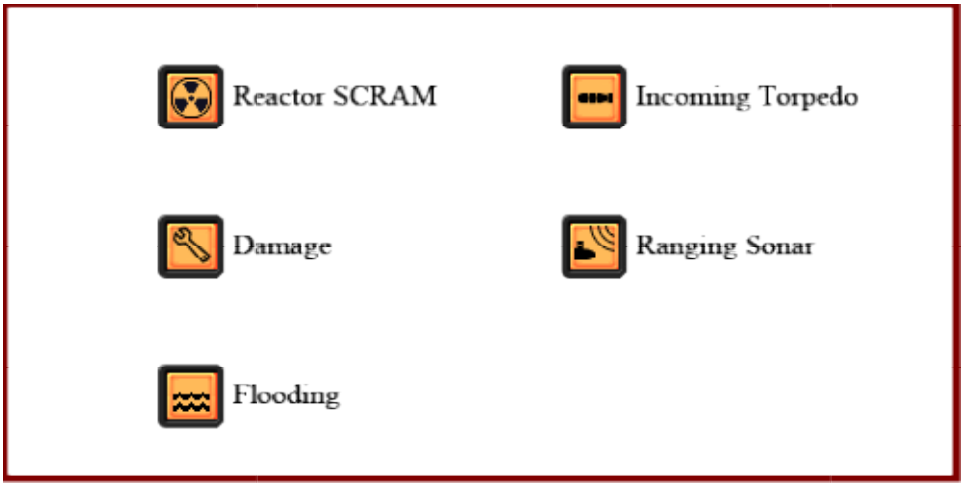
STATUS ICONS

NAVIGATION

SENSOR



DAMAGE & WARNINGS



SHIP DESIGNATIONS

LST	Landing ship Tank
AS	Submarine Tender
AOR	Replenishment Oiler
AE	Ammunition Ship
AP	Transport
FF	Frigate
FFG	Guided Missile Frigate
DD	Destroyer
DDG	Guided Missile Destroyer
CL	Light Cruiser
CG	Guided Missile Cruiser
CGN	Nuclear-powered Guided Missile Cruiser
CGH	Guided Missile Helicopter Carrier
CVGH	Guided Missile Helicopter Fixed-wing Carrier
SS	Submarine
SSK	Hunter Killer Submarine
SSG	Cruise Missile Submarine
SSN	Nuclear Submarine
SSGN	Nuclear Cruise Missile Submarine
SSBN	Nuclear Ballistic Missile Submarine
BIO	Biologic

10. CREDITS AND BIBLIOGRAPHY

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Special Thanks
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Mark Hessburg

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