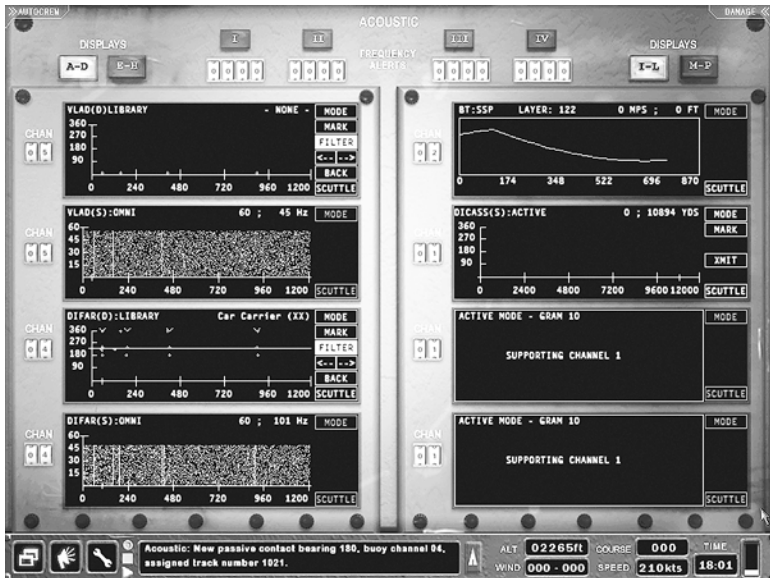


SECTION 5

TRAINING



5: TRAINING	5-3
SONAR SCHOOL	5-3
SONAR	5-3
Passive Sonar	5-3
Active Sonar	5-3
High Frequency Active Sonar	5-4
ACOUSTIC SIGNALS	5-5
Signal Strength	5-5
Noise	5-5
Broadband Signals	5-5
Narrowband Signals	5-6
UNDERWATER SOUND PROPAGATION	5-6
Thermal Layers	5-7
Sound Speed Profile (SSP)	5-7
Generating a Sound Speed Profile (SSP)	5-8
Utilizing Thermal Layers	5-9
SONAR SYSTEMS	5-9
Towed Arrays	5-10
Surface Ship Hull Sonar	5-10
Submarine Spherical/Cylindrical Bow Arrays	5-10
Submarine Hull/Conformal Arrays	5-10
Submarine Flank Arrays	5-11
Sonobuoys	5-11
Sonobuoys in S.C.S. - Dangerous Waters	5-13
Sonobuoy Data Display Windows (Grams)	5-14
Dipping Sonar	5-19
CAVITATION IN SUBMARINES	5-19
TMA BASICS	5-20
WHAT IS TMA?	5-20
HOW DOES TMA WORK?	5-20
TMA TOOLS	5-23
Submarines TMA Tools	5-23
FFG TMA Tools	5-23
The TMA Display Board (Subs)	5-24
The TMA Plot (FFG)	5-25
Merging and Dropping Contacts	5-25
The TMA Ruler	5-26
TMA Dot Stack (Subs only)	5-28
Trial Solution Area	5-28
Entering a Firing Solution	5-28
Lines of Bearing (LOBs)	5-29
Contact ID Naming Conventions	5-30
TMA ON UUV SENSOR CONTACTS	5-31

5: TRAINING

This section contains information needed to successfully complete some S.C.S. - *Dangerous Waters* game tasks. To effectively use the various stations you encounter in the game it is helpful to have some background and general information about why you need various stations and what happens there.

SONAR SCHOOL

Subs, ships and aircraft all use Sound Navigation And Ranging (Sonar) to detect submarines, although sonar also detects surface ships in the area. All controllable platforms in *Dangerous Waters* have some form of sonar capability. These are described later in this section.

SONAR

A sonar array is an interconnected group of hydrophones or transducers that focus either the transmission or reception of sound. There are two types of sonar: **passive** and **active**. Each has an important place in anti-submarine warfare.

Passive Sonar

A passive sonar system can only listen. A hydrophone (sensor) or a set of hydrophones is positioned to receive sounds produced by sources in the water. Its major purpose in this game is to detect and help classify submarines and ships. Depending on environmental conditions passive sonar can detect contacts several miles away; however, you can only determine the direction, or bearing, of the contact. The distance, or range, to the contact is not immediately known. It is helpful to know the range to successfully target the contact.

By tracking a contact over time with passive sonar you can fairly accurately determine a contact's bearing, range, course, and speed by using a process called Target Motion Analysis (TMA). See *Training/TMA Basics*.

Active Sonar

An active sonar system transmits a high-energy acoustic signal or "ping". Any object in the area reflects the transmitted signal and the sonar sensors pick up the returning echo. The time from the initial transmission to the reception of the echo accurately reveals the range to the contact and the direction of the returning echo indicates the bearing.

Active sonar quickly provides range information but the active transmission can also be received by enemy ships and used to locate the transmitting sensor. Because of this risk submarines should use active sonar only as a last resort for determining a target's range. Using TMA on passive sonar contacts is a safer approach to localization when time permits.

Tip: When commanding an aircraft do not use sonobuoys in active mode unless you are very sure where the submarine is. The submarine can detect active sonobuoys outside active detection range and evade.

High Frequency Active Sonar

High Frequency Active Sonar (HFAS) is usually a separate system from the lower frequency "active sonar" that is a part of the platform's integrated sonar suite. It produces higher frequency transmissions that have shorter wavelengths than those of medium frequency (MF) active sonars. These transmissions provide excellent bearing and range resolution for contacts in the vicinity of Ownship. HFAS does not have the range of MF active sonar and also is less likely to be counter detected at longer ranges because HF sound is absorbed more quickly than lower frequency transmissions. Because of its high resolution, HFAS is the sensor of choice for traversing minefields or navigating under the ice when commanding a submarine with that capability. It also can be used for rapid localization (range and bearing) of a close-in contact when counter detection is no longer a consideration, as when coming to periscope depth noncovertly or when a quick firing solution is needed for a close aboard enemy.

As modeled in *S.C.S. - Dangerous Waters*, the HFAS marks all contacts it detects at one time, placing a HF Sonar marker on the Nav Map at the location of each return. Additionally, the active returns display an outline of the detected object on the High Frequency Active Sonar display, providing a visual image of the detected object. A HFAS contact is not assigned a track number and consists only of a marker placed at the location of the first detection. To update the location, delete the current marker and mark the contacts again. Marking contacts in HFAS is described below:

FFG: In the Hull Sonar Station [F4] click ACTIVE mode then click High Frequency. Click BACK to access the MARK button. Click on a contact on the display and then click MARK.

Kilo: In the Periscope Station [F8] click the screen transition button at the top of the screen to access the High Frequency Sonar console. Contacts appear in red. Click the display once to mark all currently detected contacts.

Akula: In the Periscope Station [F8] click the Under Ice/High Frequency button. In the High Frequency console, ensure that FORWARD LOOKING is selected for mine detection. Select UPWARD LOOKING to find a polynya during under ice operations. Click the display once to mark all currently detected contacts.

Seawolf: In the Sonar Suite [F2] click the ACTIVE Sonar icon button. Click FREQUENCY in the matrix button panel. Click HIGH and then click BACK. Contacts appear as orange dots or an outline depending on the range to the contact. Click on a contact in the display then click MARK.

688(I): In the Ship Control Station [F1] click the toggle switch to the ON position on the High Frequency Display in the center of the screen. Click the display once to mark all currently detected contacts.

ACOUSTIC SIGNALS

Passive sonar is used to detect and determine the location of the sources of acoustic energy, or sound, in the water. The ocean has numerous sources of acoustic energy including seismic events, biologics such as whales and shrimp, and waves, as well as noise generated by ships and submarines.

The sound that is ever present in the water and doesn't appear to come from a specific contact is known as **background** or **ambient noise**. Ships, subs and other acoustic contacts emit energy, or signals, that stand out against this backdrop of ambient noise when processed by a sonar system.

Detection ranges for sonar arrays are influenced by the strength of the signal being detected and the amount of background noise interference between the contact and the sensor. This is called the **Signal To Noise Ratio (SNR)**. Directional sonar increases SNR by focusing the sonar beam into a smaller area pointed at the target.

Signal Strength

The amount of noise a contact generates is known as its signal strength. Depending on the sonar display, a signal appears as a line, a spike, or a dot. Thick lines, tall spikes and larger, darker dots indicate stronger signals. The signal strength generated by a contact is influenced by the type of contact it is (loud merchant ship or quiet diesel sub), its range and its speed.

In general loud, fast contacts generate a strong signal while quiet contacts generate a faint signal. Distant contacts can be faint while close contacts are stronger. However, a faint signal doesn't always mean a distant contact. It could be a quiet submarine close by traveling at a slow rate of speed while a strong signal could be a merchant ship at a greater distance traveling at a high rate of speed.

Noise

The amount of noise detected by your sonar sensors is influenced by the speed of your Ownship as well as several environmental factors. The noise generated by Ownship's movement through the water increases as your speed increases. The more noise you generate the less your sensors can detect. It is possible that all signals can be lost in the noise if you travel fast enough.

The wave action of a high sea state also generates background noise that can influence signal detection. Thermal layers, discussed later in this section, can significantly reduce the ability of signals to travel through the water.

Broadband Signals

Sonar systems detect acoustic signals in the **broadband** and **narrowband** frequency ranges. Contacts of interest emit both broadband and narrowband signals.

Passive broadband (PBB) acoustic sources, which can be generated by a ship's movement through the water and its propeller and shaft, emit acoustic energy over a wide range of frequencies. The broadband display shows all contacts that emit acoustic energy that fall within the broadband range. A broadband sonar receiver is used primarily to detect and track contacts for TMA and also can contribute to classification through both DEMON and aural analysis.

Narrowband Signals

Passive narrowband (PNB) sources emit energy at a distinct frequency. A narrowband acoustic source is typically generated by a specific piece of equipment on a ship such as a pump or a motor. Because it is possible to detect a contact at a longer range by searching for a distinct frequency it is sometimes helpful to start the search for contacts in narrowband sonar. The increased detections are possible because narrowband focuses the sonar in frequency, rejecting ambient noise that is outside the frequency band of the target signature.

Additionally, the specific frequencies emitted by a contact are unique and readily identifiable; therefore, narrowband frequencies can be used to classify contacts. The specific frequencies associated with a ship are known as its **sonar signature**, sometimes called its **sound profile**. Sonar systems access a library of known sonar signatures or profiles to aid in the classification process.

Contacts can be classified in each submarine's Sonar Narrowband Station, and in the Acoustic Station on the FFG, P-3C and the MH-60R platforms. The MH-60's dipping sonar in passive mode can also be used to classify contacts.

Tip: Use Narrowband sonar for detection and classification of contacts.

UNDERWATER SOUND PROPAGATION

Sound travels in waves of alternating high and low pressure created when a vibrating object disturbs the air or water around it. While sound in air generally travels in a straight line until it is reflected or simply fades away, sound in water tends to bend depending on conditions in the water it is traversing.

The speed of sound in the ocean is related to temperature, salinity, and depth. Salinity usually does not change for a given ocean area. Increasing depth or increasing temperature tends to increase the speed of sound. Temperature may increase or decrease with depth near the surface, depending upon atmospheric conditions, but eventually begins to decrease until a depth of about 3000 feet, where it becomes nearly constant (isothermal). While the temperature is decreasing with depth, the speed of sound will also decrease unless the change in temperature is very small. But at deep depths, the speed of sound increases with depth.

In the ocean, acoustic energy travels along paths that are determined by changes in the speed of sound through the water. Sound waves are refracted (bent) away from a region where the speed of sound is increasing.

Thermal Layers

Sometimes conditions in the ocean give rise to an effect known as the **layer**. As the surface of the ocean cools late in the day, a region of increasing temperature near the surface creates a layer where the temperature increases with depth. At the layer depth the normal cooling with increased depth resumes, so that the layer depth is the depth with the greatest temperature. Sound energy bends away from the layer, so that a contact is much harder to detect if it is on the opposite side of the layer depth from the sonar array. Very little sound energy passes through this layer depth, especially at higher frequencies.

Sound Speed Profile (SSP)

Locating a thermal layer in your area of operation can help you to avoid detection or even an incoming torpedo if you are in a sub. If you are in a ship or aircraft, knowing the depth of the layer can also alert you to the need to adjust the depth setting of sonobuoys to detect a contact that might be lurking on the other side of the layer. A Sound Speed Profile (SSP) is a useful tool in determining the location of a thermal layer in your area of operation. The SSP contains a graph (and in the subs also a table) depicting the speed of sound at different depths. The profile is generated from information provided by an **Expendable Bathythermograph (XBT or BT)** probe.

There are three types of ocean environments modeled in *Dangerous Waters*: Bottom Limited, Surface Duct and Convergence Zone.

Bottom Limited

In a bottom limited ocean environment, the water depth is not great enough for the isothermal region to be present. Instead, the temperature decreases with depth all the way to the bottom. This means that sound waves are bent toward the bottom, and any sound detected beyond direct path range will have one or more bottom bounces, losing energy with each bottom bounce. In addition, background noise is high since the surface noise bounces off the shallow ocean floor and propagates for some distance.

- ✓ **Note:** If a mission designer designates the area as bottom limited there will be no layer in the mission regardless of the depth of the ocean in the area. Surface Duct is the default environment for user-generated missions in the S.C.S. - *Dangerous Waters* Mission Editor.

Surface Duct

Sound speed increases down to the thermal layer in a surface duct, then decreases to the bottom. While detection ranges are roughly the same

above and below the layer, detection ranges are cut roughly in half across the layer.

Convergence Zone

In some deep ocean environments, the bending of sound energy results in rings around a sound source where the sound rays are focused, so that the propagation loss is reduced by large amounts. These areas are called convergence zones (CZ), and when present, occur at intervals of 20 to 35 nm depending upon surface temperature. The CZ width is typically 5 to 10 % of the CZ range. Between the convergence zones, bottom paths usually prevail, so that contact is not maintained for any but the loudest contacts. This results in a characteristic condition where a contact will be held at a high SNR while in the CZ and then lost for 30 minutes or more before appearing as a direct path contact – or possibly not being detected until it has passed the closest point of approach and is again in the CZ as an opening contact.

Generating a Sound Speed Profile (SSP)

The FFG-7 and controllable aircraft deploy Bathythermograph Sonobuoys called simply BT sonobuoys. Once the buoy hits the water it deploys a probe that descends at a constant rate and transmits the sound speed data it collects to the deploying ship or aircraft. BT sonobuoys are launched in the same manner as all other sonobuoys.

XBT probes are launched from submarines somewhat like a countermeasure. The probe rises to the surface before it begins to drop at a constant rate and starts returning data. If the sub is deep it may be some time before data begins to appear. The temperature data gathered by the XBT probe is transmitted to the sub where the returning data is plotted at Sonar SSP station.

To launch a BT Sonobuoy in S.C.S. – *Dangerous Waters*:

FFG-7: BT sonobuoys are launched from the **ASTAC Station**.

MH-60R: Sonobuoys are launched from the **ATO Station**.

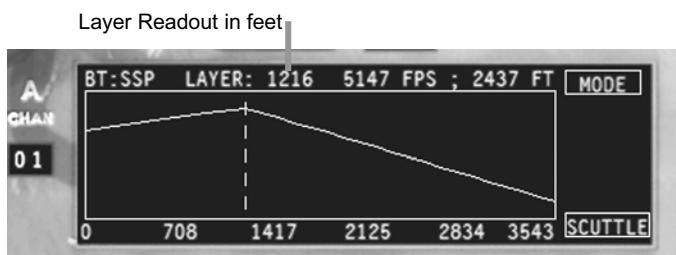
P-3 C Orion: Sonobuoys are launched from the **TACCO/Sonobuoy station**.

- ☐ In the above platforms the SSP graph appears in a Sonobuoy Display Window (gram) in the Acoustic Station once you tune to the channel receiving data from the BT sonobuoy. The depth of the layer appears in the top line of the display following the LAYER label.

Tip: To determine the channel number for a specific sonobuoy, visit the Nav Map. The channel number for a buoy is noted beside its NTDS symbol on the Nav Map and is shown in the DDI when a buoy symbol is selected.

Below is a view of a Sound Speed Profile from a BT sonobuoy launched by a MH-60R and processed by the FFG with the location of the layer identified. In *S.C.S. Dangerous Waters* the SSP depth data displays in feet

on the horizontal (X) axis. In the subs, depth data displays on the vertical axis in feet.



To Launch an XBT from a Sub: XBTs are launched from the Sonar Suite's SSP Station.

- ☐ The Sound Speed Profile displays in graph and table form at the SSP station.

Utilizing Thermal Layers

Understanding the effects of thermal layers on sound propagation is very important when using sonar or attempting to limit sonar detection of ownship. Since sound waves bend away from the layer, it acts as a screen to shield your sub from sonar on the other side of the layer. This bending also lessens the ability of *your* sonar to *detect* a contact on the other side of the layer. When commanding a submarine it is wise to stay below the thermal layer to avoid detection by surface ships or submarines operating above the layer. If an enemy sub is also below the layer it may be prudent to move above the thermal layer to decrease the likelihood of being detected. There are no clear-cut rules for utilizing the layer since how you use the layer depends on whether you hope to remain undetected or maximize your sonar range.

When commanding the FFG or an aircraft it is important to know the location of the layer so you can set your sonobuoys to the correct depth to optimize the probability of detecting a submarine.

SONAR SYSTEMS

Every controllable platform has at least one sonar or sonobuoy system. Trackers available on the FFG's and submarine sonar systems work directly with the Target Motion Analysis and Fire Control systems to help assure accurate localization and targeting data.

Sonobuoy systems both in passive and active mode are used to determine the location of subsurface contacts using a process called triangulation.

Tip: To determine the location of a contact in S.C.S. - *Dangerous Water*, view the intersection of the lines of bearing from three sonobuoys on the Nav Map. The intersection fairly accurately pinpoints the location of the contact. The depth of the contact is still unknown.

Each sonar system or array has a specific alphanumeric designation or name. However, an array is frequently referred to by its shape or location on the platform.

Towed Arrays

A **towed array** is a linear array dragged behind a ship or sub. It is a passive sonar system used by both submarines and surface ships.

FFG-7: The FFG-7 utilizes the AN/SQR-19 Tactical Towed Array Sonar System (TACTASS) for broadband and narrowband detection and tracking. In the case of the FFG-7 the array is towed a mile behind the ship, thus, the ship does not interfere with the array's ability to search any part of the environment (masking.) TACTASS provides full 360° detection.

Subs: The number of towed arrays and their capabilities vary from sub to sub.

Towed arrays are for both broadband and narrowband detection and tracking in the subs. They are used at low to medium speeds and optimized for lower frequencies.

Because a sub masks a certain amount of the environment from a sub-mounted or towed array no individual sub-mounted sensor provides full 360° detection. Together the subs' arrays provide omni-directional detection capabilities

✓ Note: No towed array is modeled for Kilos in <i>Dangerous Waters</i> .

Surface Ship Hull Sonar

The FFG-7 is equipped with the SQS-56 active-passive hull sonar. Located at the bow of the ship this sonar is primarily used in active mode since its passive sonar capability is limited. Passive mode supports detection of broadband contacts and has no narrowband capability.

Submarine Spherical/Cylindrical Bow Arrays

Arrays housed in the bow of a submarine are usually spherical or cylindrical in shape. These bow arrays can track broadband as well as narrowband contacts.

At higher speeds, there is some degradation of performance because of flow noise caused by the water moving across the surface of the array. The bow array is not as sensitive to low frequencies, so it's not the array of choice for low frequency, narrowband contacts.

Submarine Hull/Conformal Arrays

The hull/conformal array, also near the bow of the ship is a linear array conforming to the shape of the hull. It provides low speed capability to detect low frequency narrowband contacts). As such, its primary use is for classifying targets.

Submarine Flank Arrays

A flank array is a flat rectangular panel on the side of the sub.

Seawolf Wide Aperture Array (WAA): The WAA consists of three flank arrays on each side of the Seawolf class submarines. In *S.C.S. - Dangerous Waters* the Seawolf's WAA can provide rapid passive localization (RAPLOC) for sonar contacts within a 15 kyd range. See *Seawolf Stations/Seawolf Sonar Suite/Seawolf Broadband Station* for information on how to use the WAA to determine the range of a contact.

Kilo: Some Kilos carry the MG-53 passive sonar set. There is some thought that this may be a flank array while others believe it is an active intercept set.

- ✓ **Note:** For gameplay purposes a passive sonar flank array and active intercept are modeled for the Kilos in *S.C.S. - Dangerous Waters*.

Sonobuoys

Sonobuoys are part of an acoustic system used by naval forces to detect, localize and classify hostile submarines. Some sonobuoys are used to determine specialized information regarding environmental conditions in an area of interest.

Sonobuoys can be dropped into the ocean by ASW aircraft and also “over the side” (OTS) by ships. The sonobuoy deploys a floating transmission unit and its hydrophone array descends to a preset depth on a cable.

- ✓ **Note:** The sonobuoy cylinder is discarded when the contents are deployed and drops to the bottom. In the game the 3D sonobuoy object is depicted as a floating cylinder in the water making it easier to find the 3D object in 3D View.

When the sonobuoy's submerged sensors detect acoustic energy in the water the information is sent up the cable to the buoy's radio transmitter. The monitoring platform receives the transmitted data and it is processed, analyzed and recorded for further analysis or replay.

In the game sonobuoys dropped by any controllable platform have a life span of two hours and can be scuttled by the player at any time while the receiver is tuned to the transmitting channel.

Sonobuoys can be **active**, **passive** or **special purpose**. Within those types several modes may be available. All three types are modeled in *S.C.S. - Dangerous Waters*.

- ✓ **Note:** In *S.C.S. - Dangerous Waters* when a contact detected by a buoy in passive mode is marked, a white line appears on the Nav Map and extends from the buoy along the line of bearing where the contact is detected. Contacts marked in passive mode result in LOB ending with a symbol for and unknown category/unknown alliance at

the default range of 10 nm from the buoy. Contacts marked by a buoy in active mode appear on the Nav Map at the end of a white LOB ending with the unknown/unknown symbol at the range reported by the active return.

Passive Sonobuoys

Passive sonobuoys deploy **hydrophones** that listen for sound energy created by ships and submarines and report bearing and/or target signature information about the sound source. A passive sonobuoy buoy can have **directional** or **omni-directional** hydrophones or both.

Omni-directional hydrophones detect and relay information about a specific frequency band. They cannot determine the bearing to the contact; they only indicate that something is out there. Generally, omni-directional sonobuoys have a short detection range, so that detection indicates a nearby submarine.

Directional hydrophones provide a bearing to detected sound energy but not a range.

By dropping a pattern of directional sonobuoys the location of the sound source can be identified by a process called triangulation. In *S.C.S. - Dangerous Waters* the intersection of three or more sonobuoy LOBs can indicate the location of the sound source. The U.S. Navy's DIFAR, LOFAR and VLAD sonobuoys are examples of passive sonobuoys. All three are modeled in the game although LOFAR are not carried by the controllable platforms. DICASS can operate in Omni and Directional passive modes as well as in Active mode.

In *S.C.S. - Dangerous Waters* when a buoy is hot (detecting and transmitting information) the Nav Map symbol for the buoy has a red dot in the center.

Tip: Passive buoys should be used for the initial detection and classification of submarine contacts. This keeps the target sub 'in the dark' as to the presence of the deploying aircraft.

Active Sonobuoys

Active buoys emit an acoustic ping into the water. By examining the return echo the exact range of the target can be established. Some active buoys return both bearing and range, some only range. Ships and aircraft in *S.C.S. - Dangerous Waters* carry the DICASS sonobuoy. As modeled, it returns both range and bearing to the contact.

Active sonobuoys are typically used a) to determine the location of a submarine contact when the ASW aircraft is in attack mode, b) when localization information is needed quickly, c) when environmental conditions make it difficult for passive buoys to collect the necessary data and/or d) when the contact is extremely quiet.

The U.S. Navy's DICASS Sonobuoy has an active mode and is modeled in *Dangerous Waters*. Additionally DICASS has both Omni and Directional passive modes.

Special Purpose Sonobuoys

The Bathythermograph sonobuoy is used to measure the speed of sound through the water at various depths and temperatures and sends a reading of sound speed versus depth to the deploying unit. This information is useful in determining the location of thermal layers in the area of interest.

Sonobuoys in S.C.S. - *Dangerous Waters*

In S.C.S. - *Dangerous Waters* sonobuoys have the following properties.

Lifespan: 2 hours from the time of deployment.

- ❑ Buoys can be scuttled, or sunk, at any time by clicking the Scuttle VAB in the gram display when the Display Window is tuned to the transmitting channel.
- ❑ **Depth:** All buoys (except BTs) are designated either "Deep" or "Shallow" when selected for launch.

Shallow: 90 feet

Deep: 400 feet

Detection Range: Whether or not a buoy detects a contact depends on target type, sensor and target depth, water depth, sea state, target speed, target aspect, bottom type, and other factors. Given the buoy sensitivities modeled in the game, the VLAD will generally detect contacts at a much greater range than a DICASS or DIFAR buoy,

As a point of reference, assuming the same environmental conditions, the DICASS might be expected to detect a contact at 3000 yards, while the VLAD will be able to detect it at 8,000 yards. The maximum detection range in passive mode for any buoy is approximately seven nautical miles.

Transmitting Range: Platforms within line of sight of buoys placed by Ownside can detect sonobuoy transmissions. For the FFG detection range is approximately 12 nautical miles. Aircraft detection ranges vary based on the aircraft's altitude.

The following sonobuoys are modeled in S.C.S. - *Dangerous Waters*:

DIFAR (Directional Frequency and Ranging) Sonobuoy

Sensors: Four directional hydrophones and one omni-directional hydrophone

Primary Use: Search, detection and classification of submarines.

VLAD (Vertical Line Array Directional Frequency Analysis and Recording)

Sensor: Directional passive sonar (Same as DIFAR) plus array of eight omni-directional hydrophones.

Primary Use: Signal detection in areas of high ambient noise.

Tip: When a high sea state increases the level of background noise, VLAD should be your buoy of choice.

LOFAR (Low Frequency Analysis and Recording) Sonobuoy:

Sensors: Omni-directional hydrophone

Primary Use: Gathering data on ambient noise levels.

- ✓ **Note:** LOFAR buoys are not carried by controllable platforms in *S.C.S. - Dangerous Waters* but can be placed in scenarios by mission creators. They can be picked up by buoy processors and may appear in gameplay.

DICASS (Directional Command Activated Sonobuoy System)

Sensor: Active sonar (Passive directional and omni-directional modes are possible)

Primary Use: Active mode provides range, bearing

BT (Bathymograph) Sonobuoy

Sensor: Thermistor temperature probe.

Primary Use: Determining the location of thermal layers.

Tip: As modeled in *S.C.S. - Dangerous Waters*, VLAD sonobuoys have a longer passive detection range than other sonobuoys modeled in the game. DICASS buoys have the shortest passive detection range but also have active sonar capability. Use VLADs to make initial detections and DIFAR to narrow the search. When you are certain there is a contact of interest in a specific area, use a DICASS buoy in active mode to pinpoint the target.

Sonobuoy Data Display Windows (Grams)

The FFG-7, MH-60R and the P-3C all process sonobuoy data. In these platforms sonobuoy data are received in the Acoustic Station and display in CRT Display Windows. Sometimes these display windows are referred to collectively as grams, although technically that term usually applies to LOFAR gram data that displays in the window. In the game interfaces some sonobuoy display interfaces are labeled GRAMS regardless of the type of data displayed.

Sonobuoy data display windows (grams) default to Omni mode. A sonobuoy in Omni mode returns non-directional frequency data, and requires one display window. Directional mode, which returns received frequencies and bearings, requires two windows. Active (pinging) mode returns bearing and range data, and requires three windows.

- ⇒ To free other display windows for use by sonobuoys set to Directional or Active modes, set the required number of supporting windows to channel 00. Then change the mode in the active

channel to Directional or Active. (Turn Acoustic Autocrew OFF or he may change your channel selections.)

Sonobuoy Data Display Window Functionality

In S.C.S. - *Dangerous Waters* a sonobuoy has a lifespan of two hours from the time of deployment. When the buoy is out of transmitting range or has lost its connection, a message displays in the gram window indicating that the connection has failed and NO DATA is being received on the selected channel. If the buoy has not timed-out, changing course could bring you back within range, particularly when in an aircraft.

- ❑ Buoys that are “hot” (detecting sound data) appear in the Nav Map with a red center. Buoy symbols disappear from the Nav Map and Geoplot when they have timed out.

The FFG Acoustic Station Display Windows are seen here. Their Variable Action Buttons are digital and contained within the Display Window. The Sonobuoy Display Windows for the P-3C are similar but have green text. In the MH-60R Acoustic Station, the text labels are the same but the push buttons that control the functionality are outside the display window next to the label.

- ⇒ In the MH-60 click the button next to the desired text.
- ⇒ In the FFG and P-3 click the text of the desired digital button.
- ❑ In the FFG buttons rimmed in grey are disabled.
- ❑ In the P-3C buttons with no rim are disabled.

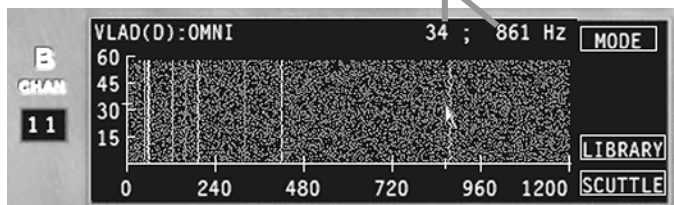
- ✓

Note: Setting a buoy display to Directional or Active mode requires supporting windows. Each platform is slightly different. In the case of the FGG, directional and Active modes can only be set in windows A- D. See the Acoustic Station section for the FFG, P-3C, and MH-60R for information on how each platform handles changing mode and freeing supporting windows.

Omni Mode Display: In Omni mode detected signals appear as lines in a ‘waterfall’ display moving from bottom to top above the number indicating the detected frequency. A sixty-second record is visible.

Time and Frequency at location of the cursor

Omni Mode



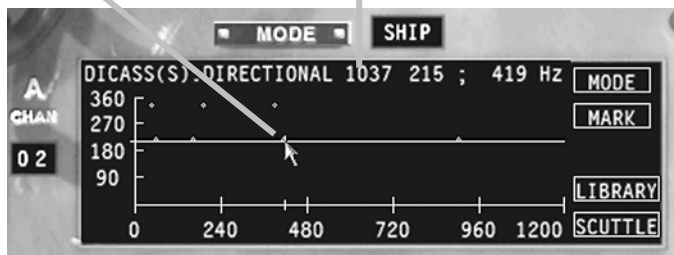
Directional Mode Display: Dots indicate detected frequencies on a specific bearing. The bearing-frequency cursor consists of a short vertical line on a horizontal bearing indicator. Click on a specific frequency dot to select it then click MARK. The track number assigned displays in the top

row. Selected frequencies can be marked but no trackers can be assigned to sonobuoy data. If a frequency is marked, the assigned Track Number appears when the cursor is held over the dot.

Bearing-Frequency Cursor

Track # of contact under cursor

Directional Mode

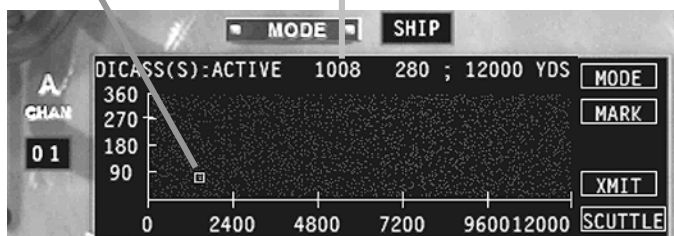


Active Mode Display: Once activated, the buoy transmits continuously. Returns fill in from left to right and contacts appear as bright spots in the noise background. Click on the contact to select it with the square cursor. (The cursor appears once the display is clicked.) Once a track number is assigned it displays in the top row when the contact is selected. Click XMIT to begin active transmissions.

Active Mode Selection Cursor

Track Number

Active Mode



BT Display: The BT sonobuoy returns the speed at which sound travels at varying depths. This information pinpoints the depth of any thermal layer in the area. The layer depth appears in the LAYER: field in the top row. There is no alternate mode. The only user functionality is to scuttle the buoy.

Sonobuoy Data Display Window Labels

Top Line Readouts (From left to right:)

Buoy Name: DICASS, DIFAR, VLAD, LOFAR or BT

Buoy Depth: (D) = Deep; (S) = Shallow

Buoy Sensor Mode: Omni, Directional or Active; SSP

Track Number: When the selected contact or frequency is marked, the track number appears here.

Cursor Location:

Omni Mode: Seconds; Frequency

Directional Mode: Degrees; Frequency

Active Mode: Degrees; Yards

BT: Sound Speed in Meters per second

X /Y Axis

Omni Mode: Y: Time in seconds; X: Frequency

Directional Mode: Y: Degrees; X: Frequency

Active Mode: X: Degrees; Y: Yards

BT: X: Sound Speed (not labeled); Y: Depth

Sonobuoy Data Display Window VABs

Variable Action Buttons (VABs) are present on the right side of all gram Data Display Windows.

In the FFG and P-3 these are digital buttons contained within the window itself.

In the MH-60R these are “push buttons” on the right side of a label. When a buoy is in Active mode on the MH-60R, the XMIT Button appears on the left side of the gram. The Library VAB set includes Filter and Arrow buttons on the left side of the display window.

The following button labels are seen in all Sonobuoy Display Windows.

MODE: Click to cycle through available modes. If there are insufficient empty windows to support Directional or Active mode, the mode cannot be changed. Directional mode requires one empty window. Active mode requires two empty windows. (Empty=Set to channel 00.)

- ☐ When ON, Autocrew sets displays to Omni and Directional Mode only.
- ☐ Mode is disabled when there are no alternative modes and when the gram window is supporting Directional or Active mode.

SCUTTLE: Click to scuttle the buoy. The buoy no longer transmits and its symbol is removed from the Nav Map. Clicking Scuttle in a window supporting a buoy in Active or Directional mode scuttles the buoy it is supporting.

Omni and Directional Mode VABs

In addition to Mode and Scuttle the following VABs are available for Omni and Directional modes:

LIBRARY: Click to access the ship's sound signature profile database. See *Classifying a Contact with the Acoustic Library* later in this section. The following button set is revealed when LIBRARY is clicked.

- ☐ When a display window is in OMNI mode while supporting a channel in Directional mode, the Library button is not available.

MARK: (Directional mode only) Click on a contact to select it then click MARK to assign a track number and reports a line of bearing to the Nav Map and TMA.

FILTER: Click to filter out all but the most likely library profile matches. Button or label is illuminated when ON.

BACK: Click to return to the previous VAB set.

Arrows: Click the right and left facing arrow buttons to cycle through the available sound profiles.

Active Mode VABs

In addition to Mode and Scuttle, the following VABs are available when Active mode is selected.

MARK: When the buoy is actively transmitting, click a detected contact to select it then click MARK to assign a track number and send bearing and range data to the Nav Map and TMA.

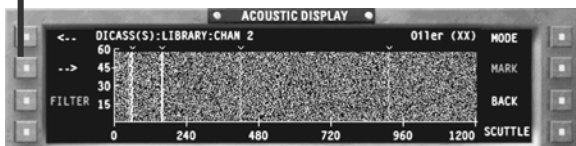
XMIT: Click to start active transmission. Once activated the buoy continues to ping at a set interval. There is no need to click XMIT again.

Classifying a Contact with The Acoustic Library

The library provides a means to compare the detected frequency profile in the waterfall display with recorded profiles of a variety of ship classes and weapons. The Library is available in Omni and Directional modes.

- ⇒ Click LIBRARY to display the Library VAB set. Click BACK to close the Library.

Click to cycle the library profiles



The CLASS name of the selected library profile appears in place of the cursor data in the top line of the display.

The frequencies that make up the selected Library profile are represented by V-shaped Profile Frequency Indicators above the waterfall at the location of the frequencies that make up the sound profile of the ship or weapon named in the selected profile.

- ⇒ Filter OFF: Click the left or right facing arrows to click through all of the profiles in the database.
- ⇒ Filter ON: Click the left or facing arrows to view the profiles that most closely match the detected profile. When four or more lines (Omni mode) or dots (Directional mode) are visible, the list is narrowed to one or a very few options.

Omni Mode: When the profile frequency indicators line up closely with the signals in the waterfall it is a good indication that the contact might be that of the class indicated in the top row.

Contacts cannot be marked in OMNI mode. No information is available on the contacts' location, only that it is out there and an educated guess as to what it is. If you have marked many contacts on the Nav Map, you may not immediately know to which contact you should apply the classification determined in the Omni Mode Library.

- ⇒ When a good match between the detected profile and the library profile is found, take note of the class or weapon name in the top line and use that information to classify the contact using the right-click Contact Menu from the Nav Map when you have determined the contact to which the classification belongs.

Directional Mode: Dots indicate frequencies detected on a specific bearing. When at least four dots are present on a specific bearing, click on a dot to select the contact on that bearing. The name of a class in the LIBRARY appears on the top row. There may be other classes that are similar to the detected frequency profile in the Library profiles available for viewing.

1. Turn on the Filter if it is not on.
2. Click the left and right-facing arrow buttons to cycle through the available classes in the profile library.
3. Click on a dot in the display then click MARK to apply the selected class to the contact. The classification then appears in the DDI when the track is selected on the Nav Map or Geoplot.

Dipping Sonar

Dipping sonar is a hydrophone lowered on a cable into the water from a helicopter. A hydraulic winch is used to raise and lower the sensor to varying depths. The helicopter can hover over a specific area of interest keeping a passive or active sensor at a relatively precise location. The helicopter must maintain a low altitude and speed to ensure that the sensor reaches the desired depth and that the sensor is not damaged or lost. (An altitude of fifty feet and a speed of zero are recommended.) See *MH-60R Stations/Dipping Sonar Station* for complete instructions on using this feature in *S.C.S. - Dangerous Waters*.

CAVITATION IN SUBMARINES

Submarines experience a noisy event known as cavitation when their propellers move so fast that low pressure bubbles form and collapse in the water around the propeller. Your sub's speed and depth influence the occurrence of this phenomenon. In general, increasing speed tends to increase the likelihood and strength of cavitation, while going deeper reduces the likelihood.

When at all possible, avoid cavitation. The resulting noise alerts the enemy to your presence and can pinpoint your bearing. Your crew alerts you to the

fact that the ship's propellers are cavitating. When near the surface, lower your speed to reduce the possibility of cavitation.

TMA BASICS

This section provides an overview of the principles behind Target Motion Analysis (TMA). It explains what it is, a bit about how it works and what you do with the information gathered in TMA. The FFG-7 and all submarines in S.C.S. - *Dangerous Waters* have TMA capabilities. Information on how to use TMA within a specific platform is found in that platform's Stations section in the TMA sub-section.

✓ Note: To use the TMA station effectively a basic understanding of the TMA functionality found here is imperative.
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WHAT IS TMA?

At the TMA station, bearing returns from your ship's sensors are manipulated and analyzed to determine a contact's bearing, range, course and speed. This information, called a target solution, a firing solution or simply the solution, is necessary to accurately target a contact with your ship's weapons.

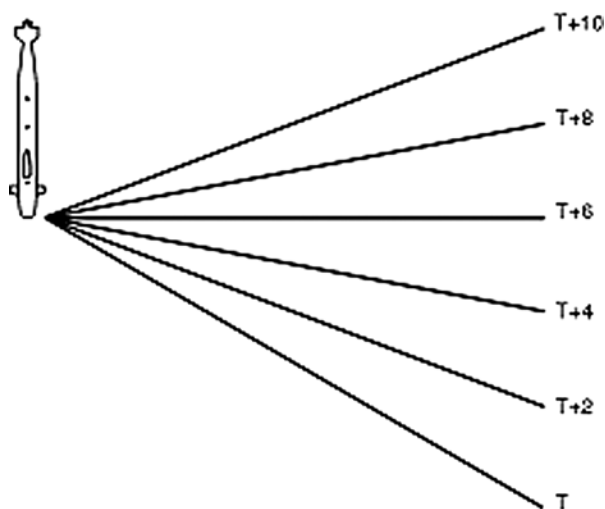
The contact designation number for each contact detected and marked by you or your Autocrew appears in a drop-down list at the TMA station. Selecting a contact designation from the list displays a history of the reported lines of bearing (LOB) to that contact on the TMA Board (Subs) or TMA DRT Plot (FFG).

HOW DOES TMA WORK?

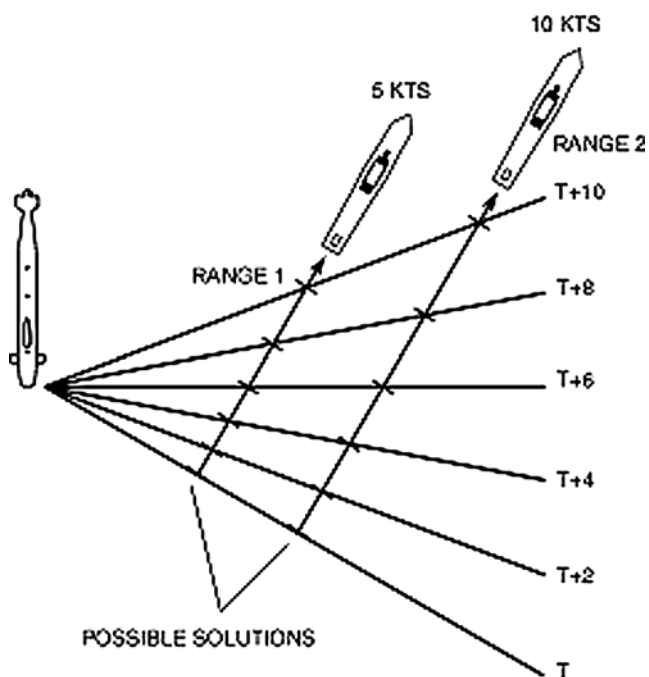
Target Motion Analysis is a process by which a contact's course and range are estimated using timed bearing readings and an estimate of the target's speed. At the TMA Station you examine available sensor data on a contact and develop possible or trial solutions.

While the examples shown here refer to submarines, the principles are the same for surface ships.

Suppose your ship is stationary and one of your passive sonar sensors is tracking an unknown contact. If at two-minute intervals you could draw a line from your ship along the bearing at which the contact is detected, it would look something like the diagram below.



When using passive sonar, the exact range of the contact is not known. Several solutions for the target might match this bearing fan. For example, the contact could be close to you moving at 5 kts or twice as far from you and moving at 10 kts. If you know the speed at which the contact is traveling, its range and course can be estimated.

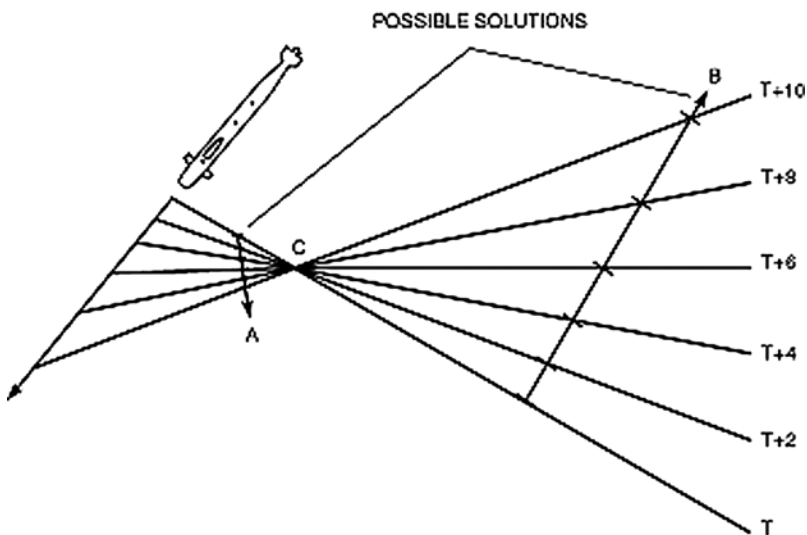


A new factor influences the **bearing rate** (change in bearing over time) when your ship is moving as well. However, the principle remains the same.

A concept that many commanders find helpful is that of lead and lag courses (legs) for Ownship. A **lead course** is one where Ownship's course and the target's course are on the same side of the line of bearing. With a **lag course**, the target's course and Ownship's course are on opposite sides of the line of bearing. In the drawing below, Ownship has a lead course on possible solution A and a lag course on possible solution B.

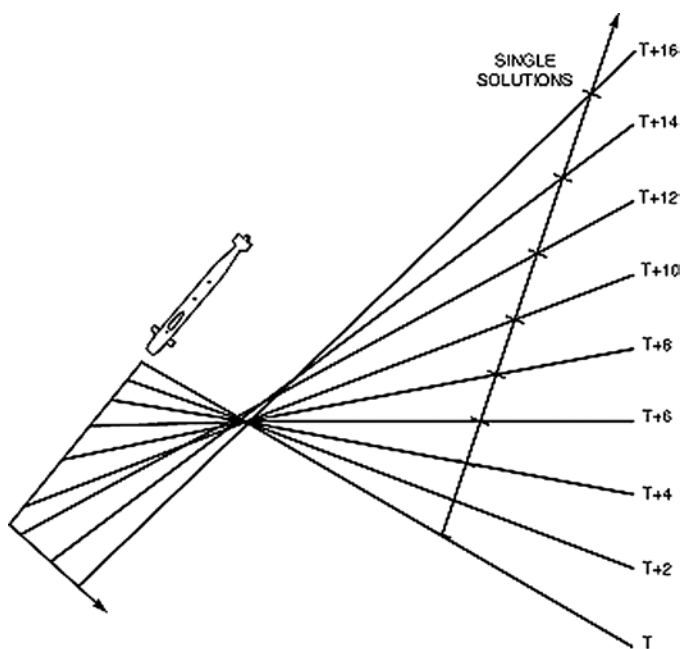
Point C where the lines of bearing cross indicates the maximum range for lead course contact A and a minimum range for lag course contact B.

As you can see in the drawing, you cannot initially be sure whether you are leading or lagging a contact. You can determine this after you turn your ship to a course on the opposite side of the line of bearing.



By changing your ship's contribution to the bearing rate you can mathematically reduce the number of possible solutions for the available data. You do this by changing the course and/or speed of your ship. The more you change your ship's contribution to the bearing rate, the more dramatic the change in the data. In most cases the leg with the larger bearing rate indicates a lag course. For a broadband contact, this may be easier to see on the sonar waterfall display.

If the contact maintains its course and speed and the sonar bearings are very accurate (they may not be for weak contacts), two or three Ownship maneuvers, or legs, will result in a single possible solution if the maneuver produces a moderate change in bearing rate. If large changes in own ship's speed across the line of bearing produce only a small change in bearing rate, then the contact is likely distant.



Use all available information when creating your trial solutions. If an intelligence message informs you the contact is on a specific course, enter that value in the Course trial solution field and lock that field. Knowing a second value, such as speed, eliminates a large number of possible target solutions. Once a contact is classified, determine its speed using the DEMON function in Sonar. See the *Stations/Sonar/Demon* section of the manual for the desired platform for information on using the DEMON interface.

TMA TOOLS

The TMA tools are the same in all classes of controllable submarines in *SCS-Dangerous Waters*. The FFG's TMA tools are visually and functionally different but the principles of TMA remain the same. The tools are described here.

Submarines TMA Tools

The TMA Station in submarines consists of a TMA board, a ruler, also known as a speed strip, trial solution fields used for entering possible or trial solution elements (bearing, range, course, and speed) and a means for entering a firing solution to the Fire Control System. The TMA stations in the submarines also contain a dot stack that the FFG-7 does not have.

FFG TMA Tools

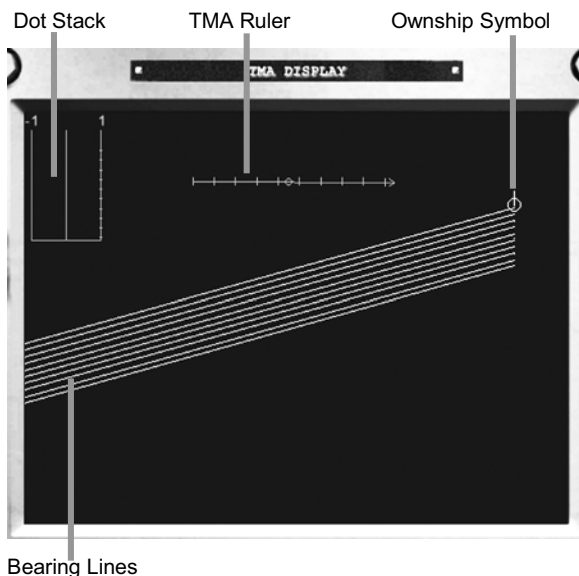
The FFG's TMA Plot resembles a Dead Reckoning Tracer (DRT). The TMA Plot appears as a large sheet of paper, a set of rulers indicating various

speeds, Ownship Indicator light, a TRACK UPDATE REPORT notebook used for entering trial solutions elements (bearing, range, course, and speed), and a means for entering a firing solution.

✓ **Note:** This training portion of the manual deals primarily with the Submarine TMA since all of them work the same way. The FFG's TMA Station functions a little differently. See *FFG Stations/FFG TMA Station* for information on using the FFG's unique TMA. However, FFG commanders should read this entire TMA training section to learn the basics.

The TMA Display Board (Subs)

The sub's TMA Display Board is located in the upper left area of the TMA Station. The board displays a representation of Ownship, a history of bearing data for a selected contact, a TMA ruler and an error dot stack. These tools are used to analyze sensor inputs. The Akula's TMA board components are seen and described below.



When a contact is selected from the track selection drop-down list, the most recent sensor information for that contact is displayed on the TMA Board. The information consists of a line of bearing extending from a point representing Ownship's position at the time of the report. If a tracker is assigned to the contact, every two minutes the latest line of bearing is added to the board. Over time these lines provide a history of bearing changes that provides valuable information.

Dragging and positioning the ruler across the lines of bearing allows you to test out possible solutions. The dot stack in the subs provides a visual cue as to the accuracy of your trial solution. The oldest bearing lines are deleted

after a set amount of time. (In the subs right-click on the TMA board to set the level of time history desired: 10, 20, 60 minutes or 4 hours) The tools used on the TMA board and the specifics of this process are described below. Learning TMA is not easy. If necessary, pause the game while you attempt to develop an accurate solution.

The TMA Plot (FFG)

The TMA plot looks and functions a bit differently in the FFG. The plot represents a Dead Reckoning Tracer (DRT). The white dot (initially in the middle of the plot) is a light representing Ownship's position. The light moves along under the plot representing Ownship's course and speed. When the light reaches the edge of the paper the sheet must be torn off and all lines of bearing previously displayed are lost. They do not reappear when the contact is re-selected. You must create new ones by re-marking the contact if no tracker is assigned or waiting for the tracker's next two-minute report.

Once a contact is selected in the dropdown list, its lines of bearing remain on the TMA plot until the page is torn off. The lines are not removed when a new contact is selected as they are on the submarine TMA board. Each time a contact is marked, a line of bearing is added to that contact's record. The time that the mark was made (in minutes into the mission) displays at the end of each line of bearing.

Since all LOBs remain on the plot when a different contact is selected, you must click on an LOB to determine which contact ID that line belongs to. More on the FFG's TMA functionality is found in *FFG Stations/FFG TMA Station*.

Merging and Dropping Contacts

A contact detected by two sources can be merged (and split apart again) at the TMA station. Merging contacts cleans up clutter and helps you better localize the contact. The Subs and the FFG handle this function slightly differently.

Merged Contacts in the Subs: Merging two contacts results in the data from both sensors being reported as a single merged contact in TMA and on the Nav Map in the Subs. The dual bearing reports on the merged contacts provide additional information and the location where the bearing lines from the two sensors intersect can be a good indication of the range to the contact. When contacts are merged in a submarine TMA station, the resulting contact is given an M (Master) designation. To split a merged contact back into its original components select it in the SELECT list and click Split. The tracks are split and revert to their original track numbers.

Merged Contacts in the FFG: When two contacts are merged, the merged contact retains the number of the contact showing in the upper Track Update Report. The contact number seen in the lower Track Merge Report is no longer seen in the Track selection dropdown. There is no indication that a track is merged except that when the track number is selected in the TMA Track Update Report, data from the merged sensor reports updates

as you watch. When FGG contacts are split they revert to their original track numbers.

The TMA Ruler

Be it the FFG's flat ruler or the submarine's digital speed strip ruler, the TMA ruler is used to indicate your best estimate of the contact's course and speed. Its location on the board relative to Ownship indicates your estimate of the range of the contact.

TMA ruler is used to determine your best guess as to the course and speed of the contact. By adjusting the location and orientation of the ruler to fit the lines of bearing to a selected contact, the speed and course of the contact can be estimated and the suspected range to the contact and its suspected course are entered into the trial solution based on the rulers' location on the board or plot and its orientation.

Known or trial values for solution elements can be entered directly into the appropriate fields and the ruler moves to reflect those values. Any portion of the solution (range, bearing, course, speed) can be locked as different portions of the solution are verified.

Sub's Speed Strip Ruler:

With each new bearing line that appears on the TMA Board an additional tick mark is added to the ruler. Each tick mark is associated with a dot in the stack in the upper left of the screen. Moving the ruler and adjusting the location of the tick marks allows you to line up the dots along the center vertical line.

When TMA Autocrew is off, the first time a contact is selected from the selection list, the speed strip appears at the end of the most recent line of bearing facing Ownship. It stays on that LOB until moved. For passive contacts this is a default range and not indicative of the actual range of the contact. When the end tick is on the correct LOB, the bottom dot in the stack is on the centerline of the dot stack.

The ruler components and functionality are described below:

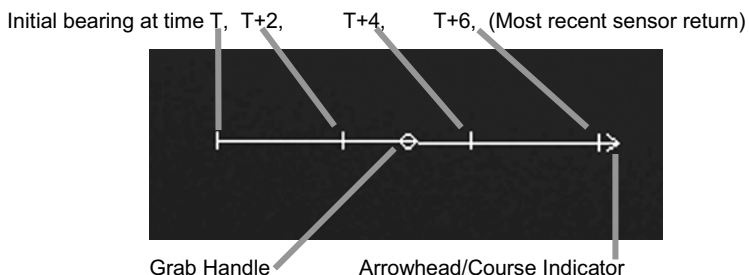
- ☐ The arrowhead on the ruler indicates the *course* of the contact.
- ☐ The length of the ruler represents the current estimate of the contact's speed: the longer the ruler, the faster the estimated speed.
- ☐ The distance of the ruler from the Ownship marker represents the contact's estimated *range* at the time of any given LOB.
- ☐ Each tick mark represents a specific interval of time. (Towed and Bow arrays update every two minutes while radar and continuous active sonar update with every sweep or ping.) The tick mark at the end of the ruler represents the initial or oldest information.
- ☐ The *estimated current bearing* of the contact is a point just ahead of the arrowhead. The *last reported bearing* is represented by the tick mark closest to the arrowhead.

Manipulating the Speed Strip Ruler:

Adjusting length and direction: Click and drag the end mark or the arrowhead to adjust the length or direction of the ruler.

Positioning Tick marks: The tick mark closest to the arrowhead should be placed on the most recent bearing line. The end tick mark should be positioned on the initial or oldest bearing line.

Using the Handle: A circle appears at the center of the ruler when more than one tick is present and speed is more than zero. The circle acts as a handle. Click the handle and drag the entire ruler to another location. The handle maintains the current course and speed settings of the ruler and adjusts range and bearing.



Speed Strip Ruler showing returns sent every two minutes from a sonar tracker.

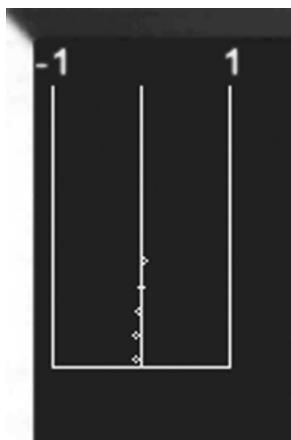
FFG's Ruler:

The FFG has a separate ruler for each unique speed. Click or right-click the digits in the SPD field of the trial solution area or click the up and down arrow to the left of the SPD label to select a speed ruler with tick marks representing the selected speed. FFG's Ruler functionality is described below

- ☐ The ruler appears on the plot only when a contact is selected in the track update report and there are LOBs on the plot.
- ☐ The arrows on the ruler indicate the suspected course of the contact.
- ☐ Click the center of the ruler to move the entire ruler in its current orientation.
- ☐ Click on an end of the ruler to rotate the ruler on the axis of the other end.
- ☐ If a range greater than that of the viewable range is entered into the RNG field the ruler disappears from the TMA Plot. Enter a smaller range or reselect the contact from the dropdown list.
- ☐ A tiny circle indicates the probable location of the contact at this time, given the speed, range, course and time at the last reported LOB.

TMA Dot Stack (Subs only)

The dot stack in the upper left corner of the Submarines TMA plot is a graphical representation of the error between tick marks and bearing lines. The dot at the top of the stack is associated with the most recent bearing line. The analysis is probably correct when the top most dots are on the centerline. This process is called stacking the dots. The FFG has nothing similar to the dot Stack.



Trial Solution Area

As the ruler or speed strip is manipulated to determine a possible solution for a contact, the fields in the trial solution area are populated with the values represented by the ruler's location and orientation. Entering a value directly into one of the solution fields reorients the ruler to reflect the value entered. (No entry can be made in the FFG 's trial solution bearing field.)

Entering a Firing Solution

Once you are confident that you have a plausible firing solution for the contact you have been analyzing, you can send the solution to the fire control system.

- ⇒ **Subs:** Click ENTER SOLUTION (ENTER SOLN in Seawolf).
- ⇒ **FFG-7:** Click ENTER at the lower right corner of the TRACK UPDATE REPORT notebook.

For complete instructions for performing TMA in the FFG-7 see *FFG Stations/FFG TMA Station*.

Tip: Be sure that you don't rush the TMA process. Before sending a report to the Fire Control system ensure that you have analyzed and manipulated bearing reports for some time and maneuvered Ownship as much as needed to eliminate all but a few possible solutions.

Lines of Bearing (LOBs)

The color of each line of bearing (LOB) on the TMA board or Plot is an indication of which sensor detected the contact.

Submarine LOB Colors

Bow sonar array:	White
Hull/Flank/Conformal array:	Blue
Towed sonar arrays:	Purple
Active sonar:	Green
Periscope or ESM:	Red
Radar and Active Intercept:	Yellow
UUV passive sonar	White
UUV active sonar	Green

- ✓ **Note for Sub Commander:** When a sonar tracker is assigned to a contact, bearing updates are automatically sent to the TMA board. While radar, ESM/EW, single-ping active sonar and periscope contacts appear in the list, these contacts are not updated on the TMA board unless you physically mark them again. The history for these contacts may contain only one line. Your Radar Autocrew, when activated, sends updates for radar contacts as long as the radar is on.

FFG LOB colors

Hull sonar, passive:	White
Hull sonar, active	Green
Towed Array:	Purple
Sonobuoy, passive:	White
Sonobuoy, active:	White
EW:	Red
Lookout:	Red
Radar	Yellow

- ✓ **Note for FFG-7 Commander:** When an ATF (Automatic Tag Follow) tracker is attached to a passive sonar contact in Towed Array, bearing updates are sent automatically to TMA. If the ATT (Automated Target Tracker) tag is assigned to a single track in Active Sonar, bearing and range data are sent automatically to TMA. Contacts marked by active sonar (Hull Sonar or sonobuoys) or reported by the Lookout or FFG Radars appear in the Track list and appear on the TMA Plot with a tiny x at the end of the line of bearing at the reported range. The x only appears on the TMA Plot if the end of the LOB is visible in the currently selected TMA Plot range scale.

Contact ID Naming Conventions

As tracks are detected and marked by various ship sensors they are assigned a contact ID or contact designation. Once marked, applicable Contact IDs appear in the SELECTED TRACKS dropdown list at the TMA Station where they can be selected and the available data on them is analyzed on the TMA Board or Plot. The conventions used to number contacts in S.C.S. - *Dangerous Waters* are explained briefly below. See *Navigation Station/ 2D Navigation Map/Contact Designations* for a full description.

Submarine Contact IDs: The submarine Contact IDs give you a clue as to which sensor has detected each contact. The first letter of the contact designation represents the source of the data: S for Sonar, R for Radar, V for visual (Periscope and Stadimeter), and E for ESM. TMA bearing lines are color coded to indicate the reporting sensor. Contacts detected by a submarine's sensors are given an alphanumeric contact designation. The first contact detected by Ownship's sonar is S01 and the second is S02. The first contact marked by Ownship's ESM sensor is designated E01, the fourth contact marked by a sub's Radar is R04, the third visual contact marked in the periscope is V03, etc. Each sensor maintains its own list. When two contacts are merged, the merged contact is designated with an M. Merged contacts are numbered sequentially as they are created.

Link contact numbers do not appear in the TMA list. Contacts marked by the ship's bow, hull and towed array sonar, ESM, Active Intercept, Radar and Periscope all appear in the TMA track list and can be manipulated and merged.

FFG Contact IDs: Your Platform ID number determines contact IDs for contacts marked by your FFG-7 sensors. In Single Player games, your Ownship Platform (Track) ID is always 1001. All tracks marked by any of your sensors are numbered sequentially from that number regardless of the sensor. The first contact marked is 1002 and numbering continues through 1299. In multiplayer games, each player's Ownship is assigned a platform ID as the game is loaded starting with 1001. The next player ID is incremented by 300, so the next player's Ownship ID is 1301, the next 1601, etc., up to 30 players. Each player's contacts are numbered based on their Platform ID up to 298 contacts.

Link contact numbers do not appear in the TMA list. Contacts marked by the FFG's towed array, hull sonar, EW sensor and sonobuoys appear in the FFG's TMA track list. For gameplay purposes contacts marked by the FFG Lookout and radars also appear in TMA so that you can merge them with contacts detected via your passive sensors. This helps clear up the Nav Map and eliminates multiple occurrences of 3D models in one location.

TMA ON UUV SENSOR CONTACTS

All controllable submarines can carry Unmanned Underwater Vehicles (UUVs). UUVs in S.C.S. – *Dangerous Waters* have sonar capabilities only and cannot launch weapons. The lines of bearing for contacts detected by a UUV are drawn from the location of the UUV at the time of the report, not from Ownship's location. TMA on UUV contacts is performed as for any other sonar contact in active or passive mode.