

STANDING ORDER 3

SURFACED OPERATIONS

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- Ref: (a) COMSUBLANT/COMSUBPACINST 5400.39, Standard Submarine Organization and Regulations Manual (SSORM) (SSN)  
 (b) 688 CLASS SSM  
 (c) COMSUBLANT/COMSUBPAC JOINT OPORD 2000  
 (d) List Of Qualified Watchstanders

0300 (U) GENERAL

1. Operations on the surface will be the exception rather than the rule. The Officer of the Deck must be alert to unusual circumstances. Particular attention must be exercised in complying with the rules and customs pertaining to passing ships (e.g., rendering honors). The Operations Officer will ensure that appropriate weather SIDs are copied to incorporate storm avoidance factors in voyage planning. Storm information will be plotted on the environmental plot in accordance with COSO 9. If not being used for navigation or contact management, the Starboard MK 19 Plotter will be set up on the 200 yard scale in the event of a man overboard recovery.

0305 (U) PERSONNEL TOPSIDE

1. The danger of being washed overboard from the deck is very real, even in a fairly calm sea. At sea, no personnel are to be allowed on deck or outside the bridge cockpit (unless the flying bridge is rigged) without the permission of the Commanding Officer. When personnel are sent on deck, the safety requirements of Article 4318 of reference (a) will be followed.

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The Chief of the Watch and the individual in charge of the evolution will inspect for proper wearing of safety equipment prior to sending personnel topside. The OOD will be prepared to initiate immediate man overboard procedures according to the existing conditions.

**0310 (U) HEAVY WEATHER**

1. The Bridge provides little protection to personnel during heavy weather. The OOD will be prompt in recommending that the watch be shifted to Control in heavy weather if, in his opinion, conditions on the Bridge render a safe and effective watch difficult. Unless otherwise directed by the Commanding Officer, approved safety harnesses shall be worn by all Bridge personnel. The OOD will require every reasonable precaution to be taken to prevent injury to personnel.

a. Be alert to the possibility of inadvertently submerging. To prevent this:

(1) Run the low pressure blower on all Main Ballast Tanks periodically, at least each watch in low sea states and as often as every 30 minutes in higher sea states to ensure that air spilling from MBT flood ports is replaced.

(2) Shift the watch to Control and immediately shut the Upper Bridge Hatch to prevent water from getting into the Control Room in high sea states. In extremis (taking large amounts of water down the hatch), lay below with the lookout, shut the hatch and then inform me.

(3) Select a course and speed consistent with sea state and direction. Avoid a "pooping sea" which can lift the stern and create a significant down angle. Advise the Commanding Officer and Navigator if in your opinion the ordered course and speed are incompatible with sea conditions.

**0315 (U) CONTACT REPORTING**

1. On the surface report all warships and any contact within 16,000 yards. Track all contacts with a CPA less than 8,000 yards. Do not allow any contact to pass within 4,000 yards without my permission. Make contact reports in the following manner:

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Initial Report: "I have a (type contact), designated (S-#, V-#), bearing \_\_\_\_\_, range \_\_\_\_\_, angle on the bow \_\_\_\_\_, drawing (left, right). CPA is (bearing), (range) (time)."

**NOTE:**

Initial reports should not be delayed on close contacts or when a delay in obtaining a CPA will occur (e.g., radar secured).

Follow-up Report: "(Designation), now bears \_\_\_\_\_, range \_\_\_\_\_, CPA (bearing), (range), (time) (unchanged, if applicable)." Such reports as "maneuvered to his left/right," "contact is redesignated/reclassified as \_\_\_\_\_" should be added if increased clarity will result.

**0320 (U) CONTACT COORDINATOR RESPONSIBILITIES/SURFACE CONTACT AVOIDANCE**

1. As required by the Navigation and Piloting Procedure of reference (b), the Contact Coordinator is required to be stationed whenever the ship is operating on the surface unless specifically secured by me. Due to the vulnerable position own ship is in with respect to surface contacts when transitioning from the submerged to surfaced condition, I require that the Contact Coordinator be formally stationed in Control prior to the Officer of the Deck shifting the watch to the Bridge.

2. The ship's radar will be energized, tuned, and have ring time checked prior to surfacing. If not specified in my Night Orders, the Officer of the Deck shall make a recommendation as to rigging the ship's portable radar upon manning the bridge. In reduced visibility, it may often be prudent to operate both the ship's radar and the portable radar.

3. I expect the Officer of the Deck on the Bridge to keep track of the contact picture. This includes radar, visual and sonar contacts. I expect that the Officer of the Deck will conduct independent target motion analysis (e.g., determining bearing drift and whether range is opening or closing) to back up the reports and recommendations of the Contact Coordinator.

4. The General Prudential Rule of the International Rules of the Road states in part: "In construing and complying with these rules due regard shall be had...to any special circumstances, including the limitations of the vessel involved, which may make a departure from these rules necessary..."

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a. By virtue of the inability of a submarine to survive a collision which fractures the hull, because of the misleading appearance of the submarine hull and light configurations with respect to actual size and maneuverability, the Officer of the Deck is directed and authorized by these orders to invoke the General Prudential Rule as necessary to avoid passing within close range of shipping in the open sea. Specifically, do not hold course and speed as the stand-on vessel if this will cause the ship to pass closer than 4,000 yards to other vessels without my permission. In general, I will grant permission to pass within 4,000 yards of shipping only in restricted waters or when the vessel concerned is a small craft incapable of inflicting damage to the hull.

b. In changing course to avoid a contact, it is well to show the other vessel a distinct aspect change even if this will result in passing at a greater range than necessary.

5. Take avoiding action early. The Officer of the Deck should signal his intention by taking positive action that is clearly visible from the other ship. In this regard, a course change of at least 30 degrees is not excessive if adequate sea room is available. Avoid turning left in close quarters. If appropriate, consider a course reversal or circling to avoid getting into an embarrassing situation.

6. When ordering course changes to avoid obstacles, remember a course change of one degree will place the ship about thirty-five yards right or left of the original track over a distance of one mile.

7. Avoid passing starboard to starboard close aboard in a meeting situation. The other ship may evaluate the situation as being nearly head-on and cause a collision situation by altering course for a port to port passage. It is safer to alter course to starboard at an early stage and pass port to port.

8. Sound the danger signal early. This is legal and it declares that the other ship's intentions are not understood. It will prompt her to commit herself and thus clarify the situation. The bridge-to-bridge radio should be used to clarify intentions as soon as another vessel is within range.

9. If you should find yourself "in extremis" and a safe course of action is not apparent, order BACK EMERGENCY, sound the collision alarm, and turn so as to generate a glancing blow.

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**CAUTION**  
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**Use the Inland Danger Signal or the International Signal of Doubt followed by the backing signal and finally if in international waters, the steering signal to indicate intentions to come right or left. Use concise, explicit language on the bridge-to-bridge radio: "Approaching inbound tanker this is United States Submarine outbound. We are in extremis. I am backing and turning right."**

10. Controlling ship's head while backing a ship with the hull shape and rudder/screw configuration of a 688-class submarine is unpredictable. Following are guidelines that will maximize the likelihood of the ship responding in the manner desired:

a. With a backing bell on but the ship still proceeding with headway, the rudder should be used to control the ship's head as if the ship had an ahead bell on. The rudder should be brought amidships as the ship comes dead in the water.

b. Once sternway has been developed, the ship should respond to the rudder as normally expected with a backing ship (left rudder causes the stern to swing left). However, environmental factors and the exact speed/rudder combination may result in unpredictable shiphandling characteristics when backing down.

c. If the ship has developed sternway and the ship's head has started to swing, few actions on the part of the Officer of the Deck short of coming dead in the water will successfully stop this swing. Use of the SPM should be considered.

11. Reference (c) contains detailed requirements for bridge-to-bridge radio procedures and logs. While navigating in restricted waters, the ship shall maintain a listening guard on the frequency assigned (VHF Channel 13/Inland, VHF Channel 16/International) and shall maintain a log (written or magnetic tape) of all traffic of concern to the ship. An entry shall be made in the Deck Log as to the operating status of the ship's bridge-to-bridge radios prior to getting underway. With regard to bridge-to-bridge radio communications, the following applies:

a. The Officer of the Deck shall have one of the bridge-to-bridge radios on the Bridge at all times and shall maintain a continuous listening guard on the assigned frequency (VHF

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Channel 13/Inland, VHF Channel 16/International). He shall, when necessary, transmit and confirm the intended movement of the ship and any other information for the safe navigation of the ship and other vessels. He shall keep the Commanding Officer informed of the maneuvering intentions of own ship and other vessels within 8000 yards. He shall also ensure that traffic of concern to the ship is properly logged.

b. Radiotelephone communications will routinely be used in inland waters to establish and clarify intentions when approaching merchant ships, ferries, and all government vessels.

c. When using the bridge-to-bridge radio, the Officer of the Deck should identify our ship as "Inbound U.S. Submarine" instead of using the ship's name. However, use the ship's name if necessary to prevent confusion or to ensure safety of ship/personnel.

12. Ensure the ship's whistle is rigged, tested, and ready for use whenever the ship is on the surface. The only exception to this will be during brief periods on the surface in the course of exercises when we know that we will be diving shortly. Sound the proper whistle signals on your own initiative. If convenient, alert personnel topside before sounding whistle signals.

#### 0325 (U) REDUCED VISIBILITY

1. A submarine on the surface is particularly vulnerable in conditions of reduced visibility. Inform me when visibility in any sector is reduced to 5,000 yards or less. As required by the Reduced Visibility Procedure of reference (b), station the reduced visibility detail when visibility decreases to 4,000 yards in any sector. Ensure the Executive Officer and Navigator are immediately informed of the stationing of the Reduced Visibility Detail. Ensure that the portable radar reflector(s) are rigged on the bridge/sail in conditions of reduced visibility.

2. The Reduced Visibility Procedure specifies required manning of additional stations to ensure ship safety. If contact density warrants, I will station the Command Duty Officer or myself in the Control Room to provide command-level supervision of the radar picture and contact situation. In reduced visibility conditions, normally the ship will operate both the ship's radar and the ship's portable radar (with portable bridge

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repeater display unit rigged). The Navigator or Command Duty Officer (if stationed) will determine the operating modes of the individual radars (e.g. for navigation or contact avoidance) based on contact density and the navigation picture. The Contact Coordinator is expected to integrate navigational constraints into his maneuvering recommendations to the OOD for contact avoidance. The Navigator, when supervising the Reduced Visibility Detail, will work closely with the Contact Coordinator to integrate the contact situation with navigational constraints. If the picture is unclear, I expect the Contact Coordinator to immediately inform the Command Duty Officer (if stationed) or myself. If I deem it appropriate to go to the Bridge to assess conditions, I will normally station the Executive Officer or Command Duty Officer at the radar used for contact avoidance to evaluate the contact situation.

3. Courts have never found a speed in excess of seven knots to be safe and prudent in conditions of reduced visibility. Inform me immediately (even if the Command Duty Officer is stationed) if you deem it necessary to proceed at a speed greater than seven knots in reduced visibility.

4. When sounding fog signals, change the interval at each blast to avoid synchronization with another vessel's signals.

#### 0330 (U) LIGHTS AND NAVIGATIONAL AIDS

1. Navigation lights will be energized between the hours of sunset and sunrise, and in periods of reduced visibility unless otherwise ordered. The OOD should make periodic checks to ensure navigation lights are "bright" lights.

2. Always take bearings of ships, buoys, or other navigational aids on sighting and at intervals thereafter to determine if a risk of collision exists. The OOD should know and apply conditions of existing tides and currents.

3. Unless otherwise directed by the Commanding Officer, the Sub ID beacon will be energized when operating surfaced.

#### 0335 (U) BRIDGE PERSONNEL CONTROL

1. The Chief of the Watch will obtain permission from the OOD for visitors and relieving watchstanders to come up to the Bridge. The Chief of the Watch will keep track of all persons on the Bridge. In order for him to do this it is essential that

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each man coming down from the Bridge reports to the COW and informs him of personnel remaining on the Bridge, e.g., "COW, LT Jones down from the Bridge; on the Bridge are OOD, Lookout, and LTJG Smith."

**0340 (U) RIGGING FOR DIVE**

1. As Rig for Dive discrepancies are reported, the Officer of the Deck and Chief of the Watch should initiate immediate corrective action, including informing the cognizant Department Head, Division Officer and Leading Petty Officer of the material problems.
2. Only personnel formally qualified in accordance with ship's procedures and listed in reference (d) will be authorized to perform "Rig-for-Dive" for the specific space designated.
3. The OOD will keep apprised of the status of rig for dive. Thirty minutes prior to the dive time, the ship's Diving Officer will brief the Commanding Officer on the status of the rig for dive including the status of entering the proper compensation.
4. The OOD should anticipate any problems getting the Bridge rigged for dive, having all tools, locking pins, thread protectors, hatch ring cleaning gear, etc. available when this evolution begins. When lowering the windshield, radar or Bridge suitcase, use the safety line supplied by the QMOW. Plan ahead, especially in conditions of darkness or heavy weather. Any material problems associated with rigging for dive should be reported by the OOD to the appropriate department head, recorded on the Rig for Dive Summary Sheet of Addendum 2 of OP 61-1 (Rig for Dive Procedure) of reference (b), and annotated on the OOD's Status Board for reference by future OODs. When the ship reaches the designated dive point, all preparations and reports should be completed so that the OOD orders "Submerge the Ship" at the dive point.

**0345 (U) PERSONNEL TRANSFER AT SEA**

1. For personnel transfer at sea (in unsheltered waters), the Officer of the Deck shall:
  - a. Make a lee for the transfer vessel with minimum headway on. Readjust course to minimize the probability of water washing over topside. Consider conducting the personnel transfer on the starboard side of the ship if possible to take

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advantage of the towed array fairing and associated safety track.

b. Consider rigging out the SPM and training/energizing it as necessary to control ship's head during the transfer.

c. Ensure that "Man Overboard" gear is immediately available. Call away the "Small Boat Handling Party" in advance of the transfer to have a swimmer, tender, and equipment providers standing by as warranted by circumstances of weather and existing sea state.

d. For main deck transfers, have the ladder made up to the safety track or fixed cleat and positioned over the transfer side unless the transfer vessel is known to be equipped with a brow that will reach to the non-skid coated portion of the deck. Two men designated by the Watch, Quarter and Station Bill will be outfitted with a fibrous life jacket, safety harness, safety line, deck traveler, and turn around line. Outfitting requirements for additional personnel for the at sea transfer are found in Article 4318 of reference (a) and will be commensurate with the given situation (e.g. sea state, weather, transfer process, proximity to land). A man will be stationed at the Forward Escape Trunk Lower Hatch whenever the upper hatch is open to rapidly shut the lower hatch and prevent water from being taken in.

e. Cover the trim pump and electrical panels in AMR directly under the forward escape trunk. Normally, the bathtub will be rigged at the Forward Escape Trunk Lower Hatch to minimize hazards from taking water down the hatch.

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STANDING ORDER 4

NAVIGATION

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- Ref: (a) COMSUBLANT/COMSUBPACINST 5400.29, (Standard Submarine Navigation/Operations Department Organization and Regulation Manual (NODORM))
- (b) 688 CLASS SSM O/P 61-17, (Navigation and Piloting Procedure)
- (c) NWP 3-21.61.2, AN/BSY-1(V) Acoustic Subsystem Operating Guidelines
- (d) COMSUBLANT/ COMSUBPAC JOINT OPORD 2000

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0400 (U) GENERAL

1. Due to the complexity and potential hazards of submerged navigation, this standing order supplements the requirements of references (a) and (b) by giving specific guidance to the Officer of the Deck (OOD), Navigation Supervisor, if stationed, and all Navigation Department personnel.

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**0405 (U) RESPONSIBILITIES FOR SAFE NAVIGATION**

1. References (a) and (b) define specific responsibilities for safe navigation. In addition to those requirements, the following guidance is promulgated:

a. If the Officer of the Deck has any doubts or questions concerning the position or safety of the ship, his immediate duties are to inform the Navigator, Assistant Navigator, Executive Officer, and the Commanding Officer of his doubts and to take steps to fix the ship's position and ensure its safety.

b. When the piloting party is stationed, the Navigator shall supervise the Contact Coordinator and ensure that maneuvering recommendations to the Officer the Deck for contact avoidance anticipate any navigational constraints. To this end, the Navigator shall recommend and I shall approve use of the secondary plot to track contacts during conditions of reduced visibility and/or for conditions of heavy contact density.

c. The Quartermaster of the Watch, in addition to the duties and responsibilities of references (a) and (b), will inform the Officer of the Deck prior to the fix expansion circle approaching any buffer zone of an assigned OPAREA, transit lane or moving haven.

d. Operational requirements often require the approved navigation track to be changed. When a SUBNOTE/OPAREA change is issued, the new track/area will be laid out using the required procedures of reference (a) with signed review/approval of the new track/area (on the chart) by ANAV/NAV/XO/CO. If the change occurs to a chart already in use, the new approval shall include date and time to indicate approval after the DTG of the latest change to the operational directive. Transit on the new track/SUBNOTE/OPAREA shall not commence until all reviews and final approval are made as indicated by appropriate signatures on the chart.

**0410 (U) WATCH RELIEF**

1. The QMOW will complete the Watch Relief Checksheet (Appendix A) prior to watch relief.

2. The oncoming OOD and oncoming QMOW shall review the current SUBNOTE/LOI/OPORD and verify water space management/PMI schemes.

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They shall check for mutual interference and for any changes to the MHN or operating areas that may occur during their watch.

**0415 (U) RESTRICTED WATERS/NAVIGATION SUPERVISOR**

1. Operating in "restricted waters" is defined in reference (b) as "operating surfaced or submerged within ten miles of land, in shoal water, or near other hazards to navigation."

2. Operation in restricted waters requires the piloting party to be stationed. To provide maximum tactical flexibility when operating in "restricted waters" for extended periods of time, a Modified Piloting Party may be stationed with the Commanding Officer's permission. At a minimum, unless otherwise specified, the modified piloting party will consist of a Navigation Supervisor, QMOW, and a dedicated Fathometer Watch.

3. The Navigation Supervisor is that person qualified as Navigator, Assistant Navigator or other individual certified by the Commanding Officer to supervise the navigation party. The Navigation Supervisor, when stationed by me, will normally remain in the Control Room to supervise the Modified Piloting Party. He shall evaluate the Navigation Plot with periodic trips to the Navigation Center to independently evaluate GPS/ESGN conditions, ensuring that all navigational requirements of the CO's Standing Orders and Night Orders are carried out. The Navigation Supervisor reports to the OOD. Stationing of the Navigation Supervisor does not relieve the OOD or QMOW of any responsibilities set forth in references (a) and (b) for the safe navigation of the ship. If a situation develops that brings into question the ship's position or if the navigational challenge exceeds the capacity of the Modified Piloting Party, the Navigation Supervisor should inform the OOD and Navigator immediately.

**0420 (U) FATHOMETER OPERATIONS**

1. Operate the fathometer per references (b) and (c) unless otherwise directed by the Commanding Officer.

2. All soundings taken will be timed using a headset and stopwatch, then compared to the MPC digital readout and the chart recorder. All soundings will be reported to the OOD as depth beneath the keel and include a statement concerning actual water depth compared to charted depth.

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3. When the ship is operating in "restricted waters" as defined in Article 0415, a Fathometer Watch will be stationed and the fathometer operated continuously in AUTO tracker (if charts are corrected for sound velocity, otherwise use manual SV with operator entered sound velocity), per reference (c). Soundings will be recorded in the Fathometer Log in accordance with Article 6106 of reference (a), reported to the Officer of the Deck and the Quartermaster of the Watch and compared with the ship's position each time a fix is taken and at least every fifteen minutes. While in "restricted waters", continuous soundings may be discontinued and/or the Fathometer Watch secured only with the Commanding Officer's permission.

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4. When the ship is not in restricted waters or the fathometer is not in "continuous", the QMOW will take the soundings. Soundings will be logged and compared to the charted depth of the ship's plotted position at intervals specified in reference (b) unless restricted by the tactical situation. If a discrepancy of 10 percent (in water less than 1000 fathoms or 20 percent in water greater than 1000 fathoms) or more is noted between actual depth and charted depth, call the Navigator to Control and inform the Officer of the Deck, Assistant Navigator, Executive Officer, and the Commanding Officer.

5. The OOD and the QMOW will ensure that when the Fathometer Watch is stationed or a new watch relieves that he knows the RED, YELLOW and minimum expected soundings and sounding intervals. He will have no other duties other than to operate the fathometer and record and report soundings.

6. Whenever the ship is underway, RED and YELLOW soundings will be posted on the fathometer, in the Fathometer Log, on the chart in use, and on the Ship Control Panel. Additionally, minimum expected soundings will be indicated on the chart and fathometer. RED, YELLOW and minimum expected soundings will be selected by the Navigator and approved by the Commanding Officer. RED, YELLOW and minimum expected soundings will be conservative and realistic, selected not only to avoid shallow water but also to provide timely alert to possible navigational errors. Neither RED nor YELLOW soundings should normally be reached. If a RED or YELLOW sounding is reached carry out the following actions **SIMULTANEOUSLY**:

a. YELLOW SOUNDING

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(1) **IF SUBMERGED, COME SHALLOW IF NECESSARY.** If you must go into another submarine's assigned depth stratum to avoid a Red Sounding, steer safety course (if navigationally safe), sound out-of-depth zone signals on RACS and proceed to that depth which avoids a Red Sounding. Be alert for close aboard submarines and be ready to take action for collision avoidance.

(2) Announce "Yellow Sounding" on the 1MC and notify the Commanding Officer, Executive Officer, Navigator, and ANAV by the quickest means.

(3) Maneuver the ship towards known good water. This is usually done by reversing course towards water you just traversed. If you know the direction to good water, turn the ship in that direction.

(4) Slow to a prudent speed to allow time to resolve the sounding/navigational picture. If on the surface, consider stopping.

(5) Take continuous soundings.

(6) Verify ship's position by all possible means. Get a fix as soon as possible and proceed with due caution.

b. RED SOUNDING

(1) **IF SUBMERGED, IMMEDIATELY COME SHALLOW** and if necessary proceed to periscope depth or surface, if required.

(2) Announce "Red Sounding" on the 1MC and notify the Commanding Officer, Executive Officer, Navigator, and ANAV by the quickest means.

(3) Immediately reverse course and reduce speed. Use maximum rudder to make the course change and turn towards known good water. These actions are taken with due regard for the operational situation (e.g., surfaced in restricted channel, running a Q-route, etc.). If unable to reverse course due to tactical constraints, minimize advance along track by killing the ship's way (stop and back down using Back Emergency recognizing this may damage the towed array).

(4) Sound the collision alarm if a risk of grounding exists.

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(5) Conduct a short emergency blow if appropriate to prevent grounding.

(6) Take continuous soundings.

(7) Verify ship's position by all possible means. Get a fix as soon as possible.

7. Loss of soundings requires immediate actions by the Fathometer Operator when operating in restricted waters to prevent a potential grounding. Therefore, the following procedure shall be used to obtain initial bottom sounding data or to attempt to regain bottom soundings after a NO VALID ECHO alert:

**NOTE:**

When a NO VALID ECHO alert is displayed, increasing the transmit power may help regain bottom sounding data. If bottom sounding data is not regained, aural soundings should be obtained by using a stopwatch. The stopwatch is started at the beginning of the transmission and stopped when the return echo is received. The time interval (in seconds) between the transmission and the reception of the bottom sounding pulse multiplied by 400 provides an approximate sounding in fathoms. The bottom sounding operator should be aware of ship operating conditions (such as surfaced operations and speed increases) and environmental conditions (such as excessive or irregular bottom depths) that might cause NO VALID ECHO alerts.

- a. Select MANUAL TRACK and SINGLE PING.
- b. Set the LSR scale to encompass an estimate of bottom depth from the navigation chart or the last valid trace on the LSR.
- c. Place receiver gain in AUTO.
- d. Increase transmit power by 3 or 6 dB (depending on the submode selected) and initiate a single ping. Repeat as necessary until valid bottom sounding data is received or the maximum transmit power is reached. If a very shallow detection is consistently made, transmit power should be reduced.
- e. If valid bottom sounding data is received, select CONTINUOUS PING and AUTO TRACK and continue with bottom sounding operations; otherwise, proceed to step f.

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f. Place receiver gain in manual.

g. Initiate a single ping while aurally monitoring the signal. Repeat as necessary, adjusting the transmit power until the return pulse can be heard clearly. Adjust the receiver gain in an attempt to obtain valid bottom sounding data. If valid bottom sounding data is not received, increase the transmit power by 3 or 6 dB (depending on the submode selected) and adjust the receiver gain again. If valid bottom sounding data is received, select CONTINUOUS PING and AUTO TRACK and continue with bottom sounding operations. Once valid sounding data is being received, operations with AUTO receiver gain should be attempted.

h. If valid bottom sounding information has still not been received, the operator should, if permitted, select a non-secure submode (if not selected) or the other bottom sounding transducer and repeat the procedure from step 1.

**NOTE:**

The approval of the OOD shall be obtained before switching from a secure submode to a non-secure submode.

**0425 (U) COMPASS AND REPEATER ERROR**

1. The Navigator will specify which heading reference is to be used as the Master Heading and the steering compass.
2. Both the OOD and the QMOW will be continuously aware of the steering compass error. Compass error will be determined daily.
3. The full heading check of reference (b) shall be conducted at least once per watch and shall consist of the following: SCP inboard and outboard, both Master and WSN-2 (critical) headings, each ESGN heading (as read in CSES) and WSN-2 heading (as read directly from the WSN-2). The QMOW will view the OWN SHIP DATA display on the SDD to observe agreement between Master ESGN and WSN-2 heading (not required to be logged).
4. Hourly checks prescribed in reference (b) shall include all checks performed above with the exception of the direct reading of the WSN-2 by the AEF.

**0430 (U) ESGN OPERATION**

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1. The Navigator's permission must be obtained prior to entering a fix into the ESGN when at sea. The OOD will be informed when the fix is entered.

2. All changes in the operation of the ESGN will be immediately reported to the Navigator, the Executive Officer, and the Commanding Officer. The ESGN system may not be secured or taken out of the NAVIGATE mode without the Navigator's permission and the Commanding Officer's concurrence.

3. The Navigator, based on inputs from the Navigation LPO and ANAV, will select which ESGN Unit will be designated as Master. In addition, the ESGN/GPS interface will be aligned such that the Master ESGN will be displayed on the GPS unit in Control when the ship is submerged.

4. Set and drift will be determined from ESGN velocity vectors and a comparison of ESGN position plotted on the chart compared to DR from the last ESGN position each time the ship's position is fixed or the estimated position is plotted. If a fix has been obtained in the last half-hour, the ESGN position should be compared to the fix. Although this method is only as accurate as ESGN navigation at the time, it is useful when no fix data is available and when operating deep. It has proven invaluable when operating in the presence of significant currents.

**0435 (U) FIX INSERTION/FIX INTERVALS**

1. Optimum fix insertion interval for ESGN is normally 8-10 hours. Fix intervals may be more frequent depending on the status of the ESGN groom.

a. Submerged.

(1) As required by reference (b), fixes should be recorded by the QMOW and evaluated by the Navigator on every system available each time the ship is at periscope depth. The Navigation Watch shall ensure that the ESGN Kalman Filter is not degraded by allowing unwanted fixes into the system while ensuring desired fixes are entered at the desired interval.

NOTE:

While enabled, the ESGN/GPS interface will automatically calculate a fix upon receiving a Figure of Merit 3 or better and enter it into the ESGN Kalman Filter every 30 minutes. The Navigation Watch will line up and initialize the system IAW

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ODOI-100 so that once an FM-1 GPS fix is received, the ESGN/GPS interface will be enabled. When the fix has been accepted by the ESGN Kalman Filter, the ESGN/GPS interface will be disabled by the Navigation Watch. The fix data will be brought to Control and plotted on the Navigation Plot for evaluation by the Navigator. The time frame for removing a fix from the filter is 30 minutes from the time of the fix. If the fix is evaluated as a bad fix it must be removed within the 30-minute window.

b. Surfaced.

(1) The fix interval requirements for restricted waters of reference (b) must be observed.

(2) When on the surface in open ocean, use all available sources to obtain a fix at least every thirty minutes. A fix should be obtained just prior to diving.

c. Abnormal.

(1) In the event that both ESGN and GPS are functioning normally, but the ESGN/GPS interface is malfunctioning, manual fixes will be entered into ESGN IAW the Appendix B Checklist.

0440 (U) FIX ANALYSIS

1. The Navigator (or Assistant Navigator/Navigation Supervisor under special circumstances authorized in my Night Orders) will personally evaluate and compare every fix to determine accuracy and consistency. Such factors as source, time of day/night, geometry, transmission path, etc., will be considered but the primary factor in determining if a fix is good is correlation between independent means. Just because it is near the ship's estimated position does not mean the fix is a good fix. **IF THE SOUNDING DOES NOT CORRELATE WITH THE FIX, SOMETHING IS WRONG.** While receiving continuous fix information, fix accuracy should be reviewed at least once each watch or at some other interval as specified by the Navigator.

a. All available sources of fix information will be used. Bottom contour navigate whenever sufficient variation in the bathymetry exists to permit obtaining fixes.

b. A two bearing fix is not substantial evidence of the ship's position. Use three or more visual bearings where possible. Crossed radar ranges are preferable to radar bearings.

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c. In cases where only a line of position (LOP) is available, that LOP should be plotted and evaluated.

d. **NEVER ERASE A FIX BECAUSE IT APPEARS TO BE IN ERROR.** Determine the cause of the error, but do not disregard information because it is inconsistent. Report any inconsistent information such as a line of bearing that does not plot, a sounding not consistent with charted depth, etc., to the Navigator, the Executive Officer, and the Commanding Officer immediately.

e. Unless given further guidance in my Night Orders, maneuver the ship to keep the fix expansion circle outside the applicable buffer zone for the submarine operating area specified by reference (d).

f. If a fix indicates the ship is moving into dangerous waters, the Officer of the Deck will stop the ship or maneuver as necessary to avoid danger and report the situation to the Navigator, the Executive Officer, and Commanding Officer while the Quartermaster of the Watch obtains another fix if possible.

g. Bearings on fixed objects will be used for a fix if available. Buoys will be employed only as a last resort and then only with caution.

2. The following should be considered in the evaluation of the fix and the fix error: theoretical system accuracy, historical system performance, sounding information, and correlation of fix sources, EPs and DRs. Nothing should interfere with a careful and intelligent evaluation of all information available when evaluating a fix.

#### **0445 (U) FIX EXPANSION**

1. Section 2.3.4.f of reference (b) discusses the principle of position uncertainty and specifies two methods of determining position uncertainty as a function of ESGN performance and/or the availability of continuous fix information. The operating conditions for ESGN are defined below. The constant position uncertainty method of section 2.3.4.f of reference (b) will be followed with the specified radius when ESGNs are operating in either MODE I or when the ship is receiving continuous fix I information which is determined by the Navigator to be accurate. The expanding position uncertainty (fix expansion) method of

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Section 2.3.4.f will be employed when ESGNs are operating in MODE II.

a. MODE I: Both ESGNs are in NAVIGATE with less than 1.0 NM difference between them and no alarms present indicating system degradation. A fix has been obtained, optimally in the last 12 hours. When ESGNs are operating in MODE I, fix expansion is defined as follows: A constant area (circle) centered about the Master ESGN EP with a radius determined by the Navigator. This value will normally be 2 NM or greater but can be reduced to 1 NM with the Commanding Officer's concurrence. This radius may also be expanded to cover situations such as the presence of high currents or when it has been greater than 12 hours since the last fix.

b. MODE II: ESGNs do not meet the criteria for MODE I. If ESGNs are in MODE II, fix expansion will be determined by the Navigator employing the expanding position uncertainty method of Section 2.3.4.f of reference (b) using the Fix Expansion Worksheet (APPENDIX C).

2. In reviewing fix expansion, the Navigator, Assistant Navigator, Officer of the Deck, and the QMOW will ensure that no navigational hazards exist in the position uncertainty circle, that the position uncertainty circle does not enter the one nautical mile safety buffer of reference (d), and that all DRs are contained within the fix expansion circle.

3. The value for fix expansion (radius of the fix expansion circle) shall be logged in the Position Log next to the Master ESGN position. Tangent lines parallel to the ship's DR will be plotted from the plotted fix expansion circle for four hours ahead of the ESGN EP for MODE I. For MODE II an expanding fix expansion cone will be plotted from the fix expansion circle for two plotting intervals ahead of hand DR per reference (b). The expanding cone will expand based upon the time dependent factors. The QMOW and OOD should always ensure that there are no hazards to safe navigation of the ship within the projected fix expansion area. The value for fix expansion can never be reduced without the Navigator's permission. When in an operating area and significant maneuvering is expected, the Navigator shall recommend when plotting of the projected fix expansion areas should be secured and only the fix expansion circle plotted. Additionally, when operating in an assigned area the Navigator may employ area restriction vice fix

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expansion. This method will be specifically called out in the Night Orders or Temporary Standing Orders.

**0450 (U) GPS PLOTTING**

1. The following plotting procedures facilitate the incorporation of GPS data into piloting in restricted waters. Ensure the limitations regarding GPS and chart accuracy, selection of correct chart datum, errors, and data transformation are fully considered before applying these procedures.

a. Keep AN/WRN-6 in the POS position to obtain constant GPS fix data.

b. The ANAV will develop a GPS Turn Point Table (Appendix D) to assist in marking turns by using GPS. Appendix D will normally be attached to the Navigation Plan for a specific port or piloting evolution. This table should have the exact latitude and longitude for each turn. Each waypoint shall be second checked. Once entered in both commercial and AN/WRN-6 GPS, entries shall also be second checked. First and second checks for each waypoint shall be indicated on the turnpoint table.

2. GPS is a highly accurate navigation aid that is capable of providing real-time fix information for integration into the piloting routine. The availability of GPS as a fix source does not negate the requirement to employ all available means to fix the ship's position.

3. When navigating in the open ocean, operate GPS in accordance with Article 5106 of reference (a).

**0455 (U) POSITION UNCERTAINTY**

1. The OOD must call the Commanding Officer, Executive Officer, and the Navigator immediately if any doubt arises as to the ship's position or as to the action required to operate the ship safely. The decision that the tactical situation requires proceeding despite questionable navigation information is one that must be made only by the Commanding Officer.

2. Again, when in doubt, call me!

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-APPENDIX A

QMOW RELIEF CHECKLIST

DATE: \_\_\_\_\_

WATCH PERIOD: \_\_\_\_\_

\_\_\_\_\_ Obtain the position off the front panel of ESGN and verify ship's plotted position. Note ESGN Radial Position Error (RPE).

\_\_\_\_\_ Review the Current Operations Binder for operations during next 12 hours. Review water space management scheme.

\_\_\_\_\_ Determine the fix expansion method being used and verify the accuracy of the size of the circle being used. Review Fix Expansion Worksheet if being used.

\_\_\_\_\_ Review the intended track for the period of the watch plus two hours, and determine the uncertainty in the ship's position based on fix expansion, checking for navigation aids, depth of water, submerged interference and hazards to navigation.

\_\_\_\_\_ Ensure all necessary charts and publications are available in the Attack Center. Verify those charts listed in the Current Ops binder under the Navigation plan are in control and approved. If not, inform the ANAV and Navigator immediately.

\_\_\_\_\_ Ensure the Deck Log is up to date and accurate. Ensure that the Deck Log is signed and initialed up to date by the OOD and QMOW before you relieve the watch.

\_\_\_\_\_ Read and initial the Commanding Officer's Night Orders.

\_\_\_\_\_ Sight the accountable charts, publications, and Communications Log.

\_\_\_\_\_ Ascertain the ship's course and speed and the status of all unexecuted orders.

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\_\_\_\_\_ Check the operating condition of all navigation equipment, ship control equipment, visual signaling, and underwater communications equipment. (GPS, Loran C, ESGN's, Mk-19 plotters, Bottom Sounder, WSN- 2, and RACS).

\_\_\_\_\_ Know the whereabouts of the Commanding Officer, Executive Officer, Navigator, and Assistant Navigator.

\_\_\_\_\_ Ensure that the previous watch's logs are proper, completed and signed. (Fathometer Log, Current Ops Binder, and Night Order Book).

\_\_\_\_\_ Ensure that the starboard Mk-19 plotter is set up for man overboard recovery when operating on the surface.

\_\_\_\_\_ Be aware of the identity of all call signs of ships or units we are operating with.

\_\_\_\_\_ Know the time and planned means of the next fix and when the next fix will be inserted into ESGN.

\_\_\_\_\_ Verify that the ship is in its assigned operating area or moving haven as appropriate by using the message or document assigning the area as found in the Current Operations Binder.

\_\_\_\_\_ Review the Position Log. Ensure fix expansion, the radius of the position uncertainty circle, and soundings are all being properly logged.

\_\_\_\_\_ Review PMI Binder and PMI Plot. Ensure all applicable PMI has been transferred to the navigation charts to be used during the next 12 hours.

\_\_\_\_\_ Review filed PMI messages which have not been plotted for possible addition to navigation charts in use over the next 12 hour period.

ONCOMING QMOW: \_\_\_\_\_

OFFGOING QMOW: \_\_\_\_\_

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