CHAPTER 13

SEARCH AND RESCUE

LEARNING OBJECTIVES

After you finish this chapter , you should be able to do the following:

1. Discuss the National Search and Rescue Plan.
2. Describe the SAR organization.
3. Identify the various types of SAR incidents and emergency signals.
4. Describe the procedures followed in CIC during a SAR mission.
5. Describe the procedures for a SUBLOOK/SUBMISS/SUBSUNK situation.

INTRODUCTION

"Search and rescue (SAR)" is the use of available personnel and facilities to render aid to persons and property in distress. Since ancient times, sailors have recognized the moral obligation to assist persons in distress. The armed forces have traditionally accepted, to the extent practical, a moral or humanitarian obligation to aid nonmilitary persons and property in distress. However, the acceptance of formal search and rescue procedures as a part of standard military operations is fairly recent. This acceptance has been further implemented for the United States by the National SAR Plan.

THE NATIONAL SEARCH AND RESCUE PLAN

The National SAR Plan provides for the control and coordination of all available assets for all types of search and rescue operations. The plan established the three SAR regions shown in figure 13-1 (inland, maritime, and overseas) and designated a SAR coordinator for each region. By government interagency agreement, the regional coordinator, through a cooperative network of participants, coordinates all SAR operations in its area. The SAR coordinators and their assigned area are:

- Inland Region — U.S. Air Force
- Maritime Region — U.S. Coast Guard
- Overseas Region — Overseas unified commanders.

Regional SAR coordinators are responsible for organizing existing agencies and their facilities into a basic network for rendering assistance both to military and nonmilitary persons and to property in distress.

SEARCH AND RESCUE ORGANIZATION

The basic objectives of the SAR organization are to ensure that the following actions are taken:

1. Prompt dissemination to interested commands of information about a distress incident requiring SAR assistance.
2. Prompt dispatch of appropriate and adequate rescue facilities.
3. Thorough support of SAR operations until a rescue has been made or until it is apparent that further efforts are not warranted.

SAR FACILITIES

The term "SAR facilities" encompasses the personnel, equipment, and accommodations necessary to perform SAR operations. The term essentially pertains to boats, vessels, aircraft, land vehicles and the personnel to man them.

Since there is a continuing requirement for military SAR in support of military operations, each armed service is responsible for providing SAR facilities in support of its own operations. Therefore, each armed service must consider its own SAR needs first. However, all DOD facilities are available for use

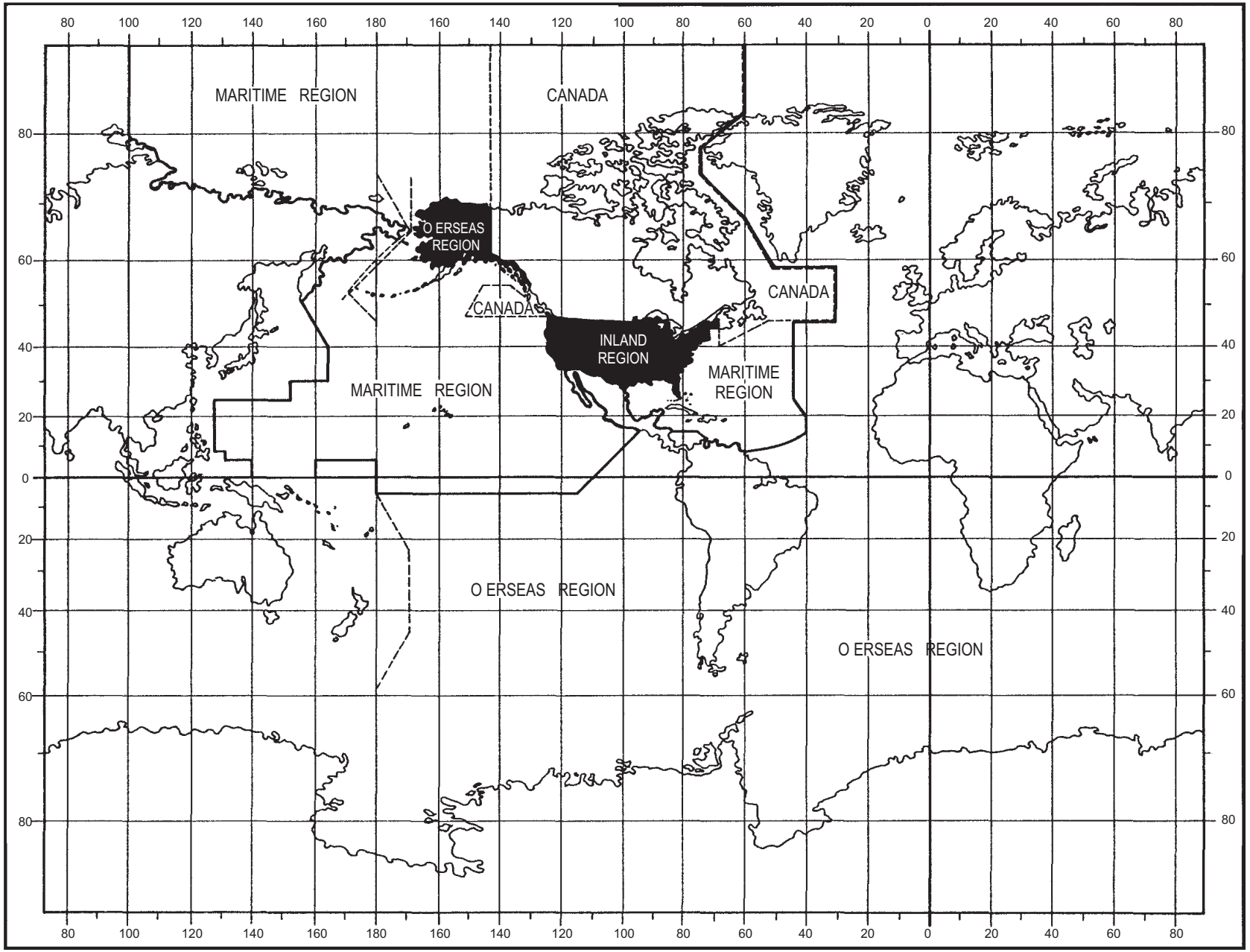

Figure 13-1.—Inland, Maritime, and Overseas SAR Regions.

to meet civil needs on a not-to-interfere (with military operations) basis.

U.S. Navy Facilities

SAR facilities are inherent to all naval operations. U.S. Navy forces, both ashore and afloat, are well adapted for SAR due to the mobility and extensive communication networks common to their operations. Along with the available SAR facilities of aircraft, ships, and submarines, the Navy maintains a worldwide long-range DF (direction-finding) network that can provide bearing and fix information for SAR missions. In numbers, equipment, and widespread geographical location, Navy facilities constitute a major SAR potential for all areas included in the National SAR Plan.

U.S. Coast Guard Facilities

The Coast Guard is a branch of the Armed Forces of the United States. In time of peace, it operates as a service within the Department of Transportation. In time of war or when the President directs, it operates as a specialized service within the Naval Establishment.

The Coast Guard has specific statutory authority and responsibility for developing, establishing, maintaining, and operating rescue facilities on and over the high seas and waters subject to the jurisdiction of the United States. In carrying out its search and rescue function, the Coast Guard may, by mutual consent, use the facilities and personnel of other agencies. It may also use its own facilities and personnel to assist the other agencies. Coast Guard SAR facilities include cutters, boats, fixed-wing and rotary-wing aircraft, numerous shore stations, and rescue coordination centers. Coast Guard operations also are supported by an extensive communications network, specialized landline circuits, and numerous communications centers.

SAR REGIONS

As we mentioned earlier, the National SAR Plan organizes SAR responsibilities into regions as the basic structure for SAR operations. The boundaries of the SAR areas were established for broad planning purposes. When necessary, SAR forces move into other SAR areas of responsibility without restriction or change in operational direction.

Inland Region

The Commander, Aerospace Rescue and Recovery Service, U.S. Air Force, is the Inland Region SAR coordinator. He is responsible for establishing and implementing SAR procedures in his region.

Maritime Region

The Commandant, U.S. Coast Guard, coordinates the Maritime Region. The maritime region is divided into two main areas of responsibility—the Atlantic Maritime Region and the Pacific Maritime Region. These 2 regions are divided into 11 subregions and finally into 12 sectors.

Overseas Region

The Secretary of Defense, with recommendations from the Joint Chiefs of Staff, designates certain officers as unified commanders of specified areas where U.S. forces are operating. The two major areas are the Atlantic Overseas Region and the Pacific Overseas Region. Wherever such commands are established, the unified commander, as regional SAR coordinator, has responsibility for coordinating and, as appropriate, controlling military and civil SAR within the Inland or Maritime Regions.

SAR COORDINATOR

A SAR coordinator (SC) is an official responsible for coordinating and, as appropriate, controlling SAR operations in a SAR region, subregion, or sector. A SAR region is the highest level of coordination. A SAR subregion is the geographical area formed by dividing a SAR region into smaller areas of responsibility. A SAR subregion may be broken down into sectors.

Each SC establishes a *rescue coordination center (RCC)* to coordinate and control all participating search and rescue units and facilities within his area of responsibility.

SAR MISSION COORDINATOR

The SAR mission coordinator (SMC) is the official designated by the SAR coordinator for coordinating and controlling a specific SAR mission. There must be an SMC for each SAR mission, and he must keep the SC informed of all pertinent details of the SAR mission in progress.

The SMC has the following general duties:

1. Alert appropriate SAR facilities and organizations that may be of assistance.
2. Dispatch the initial SAR force, if required.
3. Provide for the search crew's briefing and debriefing, and designate the on-scene commander (OSC).
4. Maintain a continuous plot, usually in the RCC, of DF bearings, areas searched, and fixes.

ON-SCENE COMMANDER

The on-scene commander (OSC) controls SAR operations and communications at the scene of a distress mission when the SAR mission coordinator cannot exercise control of the mission.

The commander of the first unit on the scene assumes OSC duties, pending designation by the appropriate SMC. Once a commander assumes OSC duties, he will usually remain the OSC, even when a unit arrives whose commanding officer is senior to him.

We have provided the general OSC check-off list below to familiarize you with the specific duties of an OSC, since your ship could become the on-scene commander in a SAR incident.

On-Scene Commander's Check-off List (General)

1. Establish and maintain effective communications with the SMC and the RCC.
2. Assume operational control and coordinate the efforts of all SAR facilities assigned to the established search area.
3. Establish communications with all SAR facilities within the area. Receive position reports and other reports. Be responsible for communications between and performance of SAR facilities. Make regular position reports and other reports as warranted to the SAR mission coordinator, via established communication links.
4. Report weather, wind, and sea conditions to the SAR mission coordinator immediately upon arrival at the scene. Report at least every 4 hours thereafter unless otherwise directed.
5. Determine the endurance of the SAR facilities.
6. Provide details of the mission to participating SAR facilities.
7. Using the SMC action plans, assign specific search subareas and specify search patterns to be used. In short, search the area in the most efficient manner possible, taking into account the limitations and capabilities of the SAR facilities as well as the sea, wind, weather, visibility, and other conditions on the scene.
8. Notify the SMC when action plans must be modified due to on-scene conditions.
9. Control and coordinate all SAR operations within the assigned area, keeping the SAR mission coordinator fully advised of conditions and developments.
10. Advise the SAR mission coordinator as various SAR units depart the search area.
11. If your ship must depart the assigned search area, turn over OSC duties to that SAR unit with the best capabilities to perform them and notify the SAR mission coordinator accordingly.
12. Submit numbered situation reports (SITREPS) to the SAR mission coordinator.
13. Request additional assistance from SMC if needed.
14. Conduct air traffic control services in the area, if capabilities permit, to provide separation of search aircraft (advisory control only).

SEARCH AND RESCUE UNIT

A search and rescue unit (SRU) is a SAR facility that actually conducts the search, rescue, or similar operation during any of the SAR stages. SRUs may be surface vessels, submarines, ground parties, aircraft or ground vehicles. While on the scene, SRUs carry out the SMC's SAR action plans under the direction of the OSC. Units are responsible for efficiently and thoroughly searching the assigned area(s) and reporting all facts of search progress to the OSC. General duties of the SRU are as follows:

1. Establish communications with the OSC approximately 15 minutes before it arrives at the SAR scene. Maintain communications with the OSC until it is released and departs the area.
2. Upon reporting for duty, inform the OSC of all capabilities or limitations of the unit that will affect operations. This includes breakdowns in

navigation, communications, radar, and sonar equipment; and anything else that may affect the ship's speed on station or its endurance capability.

3. Notify the OSC of the sighting and pickup of survivors, informing him of their position, identity, physical condition, and immediate needs for health and welfare.
4. Pick up all lifeboats, life rings, debris and unusual objects, if possible, and report the findings to the OSC, regardless of any seemingly insignificance.
5. Monitor SAR radio frequencies and report all possible survivor transmissions; determine the DF/EW bearings, if they are obtainable.
6. Search continually with passive sonar for possible bearing cuts on noises from distress craft and emergency devices.
7. Be prepared to direct other SRUs to the scene of rescue.
8. Continually monitor IFF for emergency codes or squawks, particularly if the subject of search is an aircraft.

To be adequately prepared for a SAR incident, you should be familiar with the *National Search and Rescue Manual* (NWP 3-50.1). It is likely that CIC will "run the show" for your unit in the search phase, guided primarily by your knowledge and experience and that of your fellow Operations Specialists.

Q1. Who controls SAR operations and communications at the scene of a distress mission?

THE SAR INCIDENT

Speed is of the essence during a SAR incident. The probability of finding survivors and their chances of survival diminish with each minute that passes after an incident occurs. All units must therefore take prompt and positive action so that no life will be lost or jeopardized through wasted or misdirected effort. In each incident, you must presume that there are survivors who need medical aid or other assistance. You must also assume that there is no able-bodied, logical-thinking survivor at the scene. The shock following an accident is often so great that even strong-minded individuals tend to think and act illogically.

TYPE OF INCIDENT

Different criteria have been established to determine if a type of craft (aircraft, surface vessel, or submarine) needs SAR assistance. The following paragraphs identify the criteria that require SAR action for each type of craft.

Aircraft Incident

A SAR incident involving an aircraft is considered imminent or actual when any of the following conditions exist:

1. The position of the aircraft raises doubt about its safety.
2. Reports indicate that the operating efficiency of the aircraft is so impaired that a forced landing may be necessary.
3. The aircraft is overdue. An aircraft on an IFR flight plan is considered overdue when neither communications nor radar contact can be established with it and 30 minutes have passed after its estimated time over a specified or compulsory reporting point or at a clearance limit. An aircraft on a VFR flight plan is considered overdue when communications cannot be established with it and it fails to arrive 30 minutes (15 minutes if it is a jet) after its estimated time of arrival. An aircraft not on a flight plan is considered overdue if a reliable source reports it 1 hour overdue at its destination.
4. The aircraft is reported to have made a forced landing or is about to do so.
5. The crew is reported to have abandoned the aircraft or is about to do so.
6. Any unit receives an emergency IFF/SIF signal.
7. A unit has received a request for assistance, or distress is apparent.
8. A unit has a radar contact flying a left-handed or right-handed triangular pattern.

Surface Vessel Incident

A SAR incident involving a surface vessel is considered imminent or actual when any of the following conditions exist:

1. It is apparent that the vessel is in distress, or it has sent a request for assistance.

2. The vessel is considered overdue at its destination, or its position report is overdue.
3. The vessel has transmitted a distress signal.
4. The vessel is reported to be sinking or to have sunk.
5. The crew of the vessel is reported to have abandoned ship or is about to do so.
6. The vessel is reported to have its operating capability so impaired that it may sink or that its crew may have to abandon it.

Submarine Incident

Submarine incidents differ from other SAR incidents in that they are complex operations involving special equipment and procedures. When a submarine incident occurs, the SAR coordinator will take whatever action is possible with forces available to him and will coordinate activities as in any other SAR incident until special forces can be organized to conduct the operations. We will discuss submarine incident procedures (SUBLOOK, SUBMISS, and SUBSUNK) later in this chapter.

EMERGENCY SIGNALS

Various types of signals may be used to indicate an emergency or distress situation. In a SAR incident, Operations Specialists are concerned with signals that may be heard on CIC communication circuits or seen on CIC detection equipment. Knowledge of such signals is essential since they may be seen or heard only once, and then briefly.

Urgency Signal

The urgency signal consists of three transmissions of the word PAN preceding the transmission of the urgent message. The urgency signal indicates that the calling station has a message to transmit concerning the safety of a ship, aircraft, or other vehicle, or of some person on board or within sight.

Distress Signals

Distress signals are used to indicate that a craft or person is threatened by grave and imminent danger. One distress signal consists of the spoken word MAYDAY.

Another distress signal is the Emergency Position Indicating Radio Beacon (EPIRB) or Emergency Locator Transmitter (ELT). You may hear the EPIRB or ELT signal, commonly referred to as *the beeper*, on the VHF/UHF distress frequencies 121.5 and 243.0 MHz. The tone you hear may be the sweeping down of the modulated carrier frequency, a steady tone, a warbling tone, or a "beep beep" tone.

Radar

Two methods that an aircraft can use to show distress on radar are dropping chaff and flying a triangular pattern.

CHAFF.—Chaff dropped from an aircraft at a rate of four drops at 2-minute intervals, followed by four 360° left-hand turns, is recognized as a distress signal. Survivors may also fire chaff from a flare gun.

TRIANGULAR PATTERNS.—If you are operating a radar scope or console and observe an aircraft making a 120° turn every 1 or 2 minutes to form a triangular pattern, inform your supervisor immediately. This is a commonly used distress signal for aircraft, indicating communication difficulty. Left-hand turns indicate complete radio failure, while right-hand turns indicate that the aircraft can only receive (it cannot answer) transmissions.

Q2. What word spoken three times on a radio circuit is the urgency signal?

Q3. What frequencies do the EPRIB and ELT transmit on?

CIC PROCEDURES

Any time a SAR incident occurs, it is possible that your ship may be the SRU. This task may be assigned by higher authority if it involves duty at a position far from your operating area. It will normally be assigned by the OTC of your task organization if it involves aiding a craft or person within the immediate area. A unit does not necessarily need to be tasked to become an SRU. Any commander of an organization, including a commanding officer of a vessel or aircraft, is expected to engage in SAR operations on his own initiative should the circumstances warrant.

The function of a CIC in SAR may be to assist the RCC or, when directed, to assume primary control as OSC. It is likely that CIC will control and coordinate the ship's efforts in its SAR responsibilities under the direction of the commanding officer. CIC receives and evaluates all reports of distress, organizes and controls

the rescue and return of survivors, and keeps all interested commands informed of SAR progress.

Shipboard procedures, particularly CIC duties and responsibilities, differ from ship to ship. Therefore, we will discuss only general internal requirements in this section. As an Operations Specialist, you should be review the SAR information contained in your ship's CIC/Combat Systems Doctrine for specific onboard procedures.

GENERAL CIC RESPONSIBILITIES

Just as other SAR coordinating participants need action checklists, so does your CIC. The following check-off list will aid any CIC in accomplishing the preliminary duties designated to an SRU by the *National Search and Rescue Manual*.

Preliminary CIC SAR Check-off List

1. Contact radio central as quickly as possible to set up SAR communication frequencies for CIC.
2. As soon as communications are established, contact the OSC for specific requirements and amplifying information or instructions.
3. Brief CIC personnel and lookouts on all aspects of the SAR mission and each watchstander's specific search priorities.
4. Review emergency and distress signals with CIC personnel and lookouts.
5. Keep abreast of weather conditions, both en route and at the scene, so that CIC can notify search and rescue personnel, in advance, of any environmental states that may require them to make special preparations.
6. Plot the datum area, including the established datum error, on the appropriate chart and show the sea current at the scene. Indicate all areas already searched and by whom.
7. Plot the information from item 6 on the DRT/DDRT and nautical chart, using the appropriate scale as the ship approaches or arrives at the scene.
8. Fifteen to 30 minutes before your ETA at the scene, prepare a message for transmission to the OSC by voice or broadcast. The message should contain the following information:
   a. ETA on scene.
   b. Current IFF/SIF transponder setting.
   c. Whether the SAR vessel's aerobeacon is tuned and identified.
   d. Limitations of communications, navigation, or other operational capability.
   e. Speed of advance.
   f. On-scene endurance.
   g. Intended departure point and time, if not via the OSC position.
9. Prepare a search plan of your area (if one is assigned) for the commanding officer's approval.

DETERMINING THE SEARCH AREA

Planning a search involves (1) estimating the most probable position of a distress incident or its survivors, (2) determining a search area large enough to ensure that the survivors are somewhere within the area, (3) choosing the equipment to be used in the search, and (4) selecting the search patterns to be used in covering the area. Detailed procedures for calculating distress craft position, search area characteristics, and search patterns are contained in the *National SAR Manual*. The following overview is provided as an introduction to SAR planning.

Estimating Probable Position

Regardless of the perfection with which search patterns are carried out, all is for naught unless the survivors are within the area searched. Thus, the most important factor is the initial estimation of probable position.

There are several ways to determine the most probable position of a distress incident:

- by a navigational fix,
- by a radar or DF net,
- by the position reported by a witness or the distressed craft at the time of the incident, or
- by dead reckoning from the last known or reported position.

The extent of the search area is based on the most probable position of the survivors, taking into account such factors as errors in position, survivors' drift,

navigation errors of search craft, and meteorological conditions.

Surface Drift Forces

Survivors adrift are at the mercy of the winds and currents. The longer survivors are adrift, the farther they will be from their original position. The probable position of survivors, with a drift correction, is called the *datum*. Datum calculations are made using the *drift interval* — the interval in time between the time of the incident and *the time of the rescue unit arriving on the scene (datum time)*. The datum must be corrected constantly throughout the search as factors affecting it change. Also, keep in mind that the datum referred to in SAR is the *best estimated position* of the distress vessel and *not* the last known position, as in ASW.

Drift is the movement of a floating object due to various currents. To be more specific, drift in the open sea depends on—

1. Sea current (set and drift applied over the entire drift interval)
2. Wind current (current generated by local winds)
3. Leeway (movement of an object through the water due to the local wind's pushing against the exposed surfaces of the object, less the countering force of drag caused by water pushing against the underwater surfaces of the object. This phenomenon does nor occur with submerged objects or a man in the water, as there is not sufficient exposed surface area.)

You can compute the sea current by obtaining the average sea current from nautical charts and publications and multiplying that figure by the drift interval.

To determine wind current, refer to chapter 5 of the *National SAR Manual* or chapter 6 of ATP-10.

Calculate leeway by averaging local surface winds to obtain average surface winds (ASW) and then use that data in one of three uncertainty situations (discussed later in this chapter) to determine datum. Leeway direction is based on the reciprocal direction of the ASW, and varies depending on which uncertainty situation is being used. You can estimate leeway speed by using table 13-1 (considered reasonably accurate up to 40 knots of wind speed, *U*). The *National SAR Manual* and ATP-10 provide details.

Drift is plotted as shown in figure 13-2. Point E is the datum point.

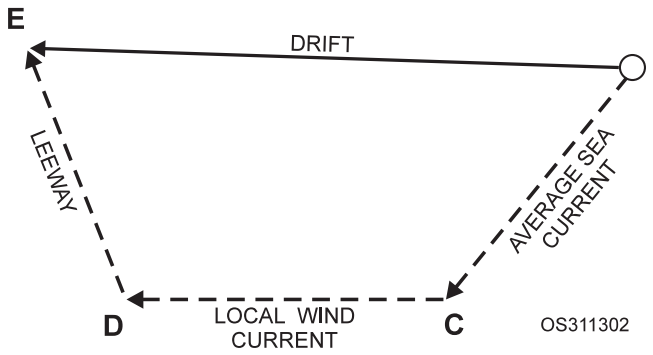

Figure 13-2.—Plotting drift.

Table 13-1.— Leeway Table

TYPE OF CRAFT	LEEWAY SPEED
Light displacement cabin cruisers, outboards, rubber rafts, etc. (without drogue)	0.07U + 0.04kt*
Large cabin cruisers	0.05U
Light displacement cabin cruisers, outboards, rubber rafts, etc. (with drogue)	0.05U - 0.12kt*
Medium displacement sail-boats, fishing vessels such as trawlers, trollers, tuna boats, etc	0.04U
Heavy displacement deep draft sailing vessels	0.03U
Surfboards	0.02U

***Note: Do not use for values of U below 5 knots**

Q4. What are the four most used ways to determine the probable position of a distressed vessel?

Minimax Plotting

In cases where leeway is a factor (i.e. the search object is not submerged and is not a man in the water) a minimax solution is used. Due to the specific uncertainties in data, you will need to plot both a minimum drift (D_{min}) and a maximum drift (D_{max}) estimate. There are three uncertainty situations:

1. Time uncertainty — uncertainty about the time the distress craft has been adrift.
2. Drift rate uncertainty — there are two different types of distress craft and there is uncertainty about the rate at which the distress craft are drifting.
3. Directional uncertainty—uncertainty about the direction in which the distress craft is drifting.

Time uncertainty occurs when you have doubt concerning when the craft actually went adrift. For example, when a fishing boat is overdue you might not be able to determine whether the boat went adrift early in the day or later. Using the earlier estimated start of drift time, calculate a maximum drift distance. Then use the later estimated start of drift time to calculate a minimum drift distance.

Drift rate uncertainty occurs when you are searching for *2 different types* of objects with different rates of speed of drift. For example, a raft with a drogue and a raft without a drogue will drift at different rates. Also, a destroyer and one of its life rafts will drift at different rates because of their different physical characteristics. By using the drift rate of the slower drifting object, you can determine the minimum drift distance; and by using the drift rate of the faster drifting object, you can determine the maximum drift distance.

Use directional uncertainty when you know drift start time and there is a single drift rate. Directional uncertainty takes into account the type of distressed craft and the estimated angle its drift will diverge from the wind axis due to wing angles, drag and so forth. Divergence values vary from 45° for large-keel vessels to 60° for small-keel vessels. The *National SAR Manual* contains a table of values. The divergence value is plotted as a vector on either side of the wind axis. Drift distance, determined by using the leeway speed and drift interval, is plotted along each of those vectors. The minimum drift distance is the plotted position closest to the incident position.

No matter which uncertainty situation you use, determine and label the position midway between the D_{min} and D_{max} positions *datum minimax ($D_{minimax}$)*. This is the best estimate position of the distress craft and is the point around which search efforts will be centered.

Drift is plotted as shown in figure 13-2. Sea current, wind current, and leeway are added vectorially to the incident position to determine $D_{minimax}$ position (figure 13-3).

Q5. What are the three types of current that affect the drift of a floating object?

Sinking Drift

Sometimes, you may have to estimate the position (underwater datum) of a vessel on the ocean, sea, lake, or river bottom. When a vessel sinks, it is subject to various underwater currents. We assume that after an object sinks it will continue to descend until it comes to rest on the bottom.

Determining an underwater datum is easier if you understand underwater currents and boundary layers, and if you take advantage of information contained in appropriate nautical charts and publications and various environmental messages. You also need to know how to apply the rate of descent. Since we know that a submarine not under power sinks at a rate of 2 feet per second, we can assume (lacking any other available information or statistics) that this is also the rate for other objects.

To compute sinking drift, we will use an example of a submarine not under power that has sunk in 480 feet of water. At a sinking rate of 2 feet-per-second, the submarine took 4 minutes or .07 hour to reach the bottom. Available information indicates an underwater current of 160°T at 5 knots. Unlike wind direction, water currents are reported in the direction that they are moving. Therefore, the sinking submarine would have moved in a 160°T direction from its last surface position.

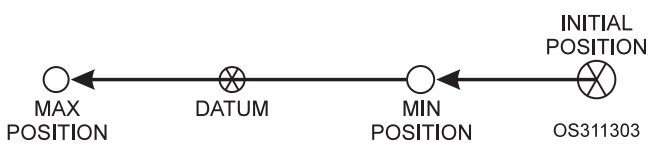

Figure 13-3.—Minimax plotting.

To compute the distance the submarine traveled underwater, convert the underwater current speed to either yards per hour (2,000 yards = 1 mile) or feet per hour (6,000 feet = 1 mile). Five knots is equal to 10,000 yards per hour. During the 4-minute sinking time, the submarine should have traveled 700 yards (0.07 hour x 10,000 yards/hour) in a 160°T direction from its last surface position.

SEARCH AREA COVERAGE

As time passes in a SAR situation, the area of probability must be enlarged because drift error increases as time passes. In addition, the area itself must be shifted to account for drift. (See figure 13-4.)

Probability of Detection

Careful planning and organization are essential in setting up a SAR operation. Despite these efforts, however, a successful recovery depends completely on the accuracy of the SRUs at the scene. Assuming that watchstanders and lookouts are searching properly and diligently, the ability for initial detection is greatest when the target is closest to the observer. As the survivors' range from the observer increases, the probability of detection decreases.

Track Spacing

Any organized search of a recovery area is based on having the search vessel(s) follow specified, usually parallel tracks through the area in order to cover the area properly (See figure 13-5). The tracks may be swept simultaneously by several search units or successively by a single search unit.

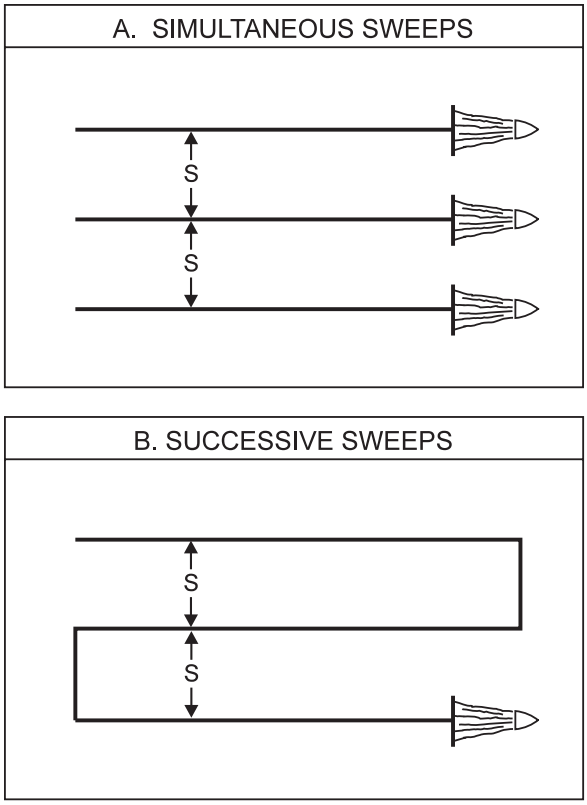

Figure 13-5.—Track spacing.

The distance between adjacent search tracks is called *track spacing*. The probability of detection increases as the track spacing is decreased; however, decreasing track spacing also reduces the amount of area that the SRUs can cover in a given amount of time. Track spacing can be increased for searching larger areas, but this reduces the probability of detection and, in extremes, may even produce gaps in search coverage between SRUs.

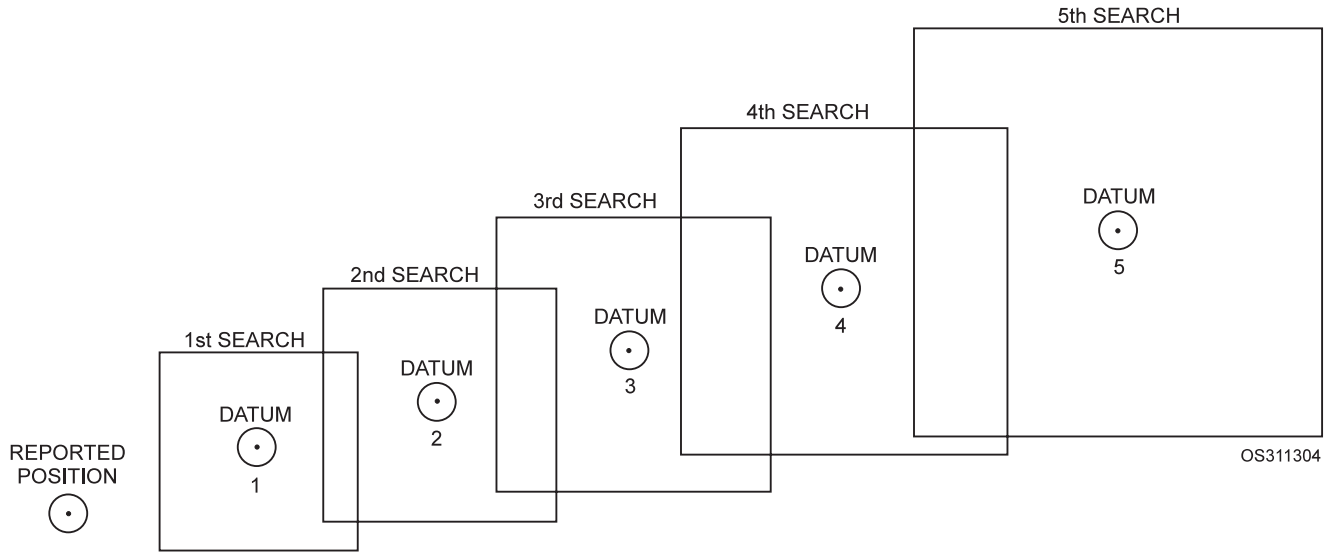

Figure 13-4.—Search areas based on moving datum point.

So how do you know what track spacing is the optimum for a particular situation? Optimum track spacing is whatever spacing provides the best expectation of target detection in the available time and that is consistent with the economical use of the available SRUs. Ideally, optimum track spacing will eliminate both gaps and excessive overlap between units and will still cover the largest area possible with the best detection probability. Track spacing, like sweep width, is measured in yards for underwater search and in nautical miles for all other searches. Specific procedures for calculating track spacing based on search, environmental, and search unit characteristics are in the National SAR manual.

Time

Time is an essential factor in determining the most efficient way to deploy available search units in a particular area. Once the required time is established, the SMC or OSC can determine whether or not to request additional SAR facilities.

CONDUCTING THE SEARCH

The preparations a vessel assigned as a search unit takes will depend upon its electronic detection and communication capabilities. If aircraft are to be used in the search, another consideration is how well the vessel's aircraft control personnel have been trained.

Normally a naval vessel or Coast Guard cutter will use CIC for laying out the various plots and status boards, coordinating on-scene communications, monitoring search progress, issuing advisories to aircraft, carrying out coordinated search patterns, etc. Generally, only ships that operate with established CICs are ever assigned to control radar-coordinated searches.

Aircraft

When your ship is tasked to control an aircraft in radar-coordinated searches, CIC should make immediate preparations before the aircraft reports on station. CIC must first compute the various headings, speeds, and times required for both the ship and the aircraft to execute each search leg in timed coordination. Next, CIC must lay out a "surface" or "true" plot (figure 13-6) on the DRT/DDRT to depict the geographical area to be covered during the search and the planned search tracks of both the vessel and the aircraft. The plot should also include the tracks of other surface vessels of interest.

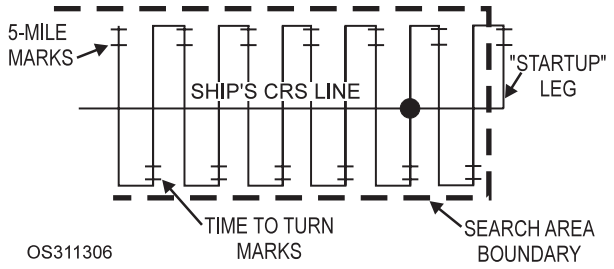

Figure 13-6.—Surface plot/true plot.

If your ship is the OSC and, at the same time, conducts a coordinated search pattern, your DRT plot must also show the subareas assigned to other SRUs, with the first two or three search legs plotted in each subarea. Each leg should show the *commence search point (CSP)*, search leg orientation, and the direction of creep. Vectors to the CSP for each arriving aircraft SRU should also be shown.

After the DRT/DDRT plot is completed, CIC should make up an air plot or relative plot showing the relative motion pattern that will be continually executed during the search. This plot should also show magnetic headings, true headings, wind direction and speed, sea swell direction, and recommended ditch headings for the search aircraft. The plotter should maintain the tracks of all aircraft of interest on this plot during the search.

Finally, CIC should prepare the various advisories for search aircraft operating in the coordinated search pattern.

Surface Craft

With known values for the ship's course, search leg length, and track spacing, the search pattern can be layed out on the DRT/DDRT. When the aircraft and ship are ready to begin searching, the ship will take a position one-half track spacing inside the search area and vector the aircraft to the ship and then onto its initial "startup" search leg. As the aircraft passes over the ship and begins the first search leg, the DRT/DDRT bug should be started, with ship's speed cranked in. Both the aircraft's and the ship's positions should be marked each minute on an appropriate chart or standard tracing paper placed on the surface plot. The surface plot provides the only permanent record of the search since the air plot, on which the controller bases most of his flight advisories, is scrubbed after each leg is completed. Therefore, all sightings must always be plotted on the surface plot.

In addition to the time and position of all sightings, the following information should be placed on the surface plot:

1. Ship's course.
2. Search pattern. (Draw in the search legs at the proper track spacing):
    a. Each leg marked 5 miles from its end.
    b. Each leg marked at the time to turn onto the cross leg.
3. Coordinates of the datum, if known.
4. Area designation (A-1, A-2, etc.) in each designated area.
5. Coordinates of the center point.
6. Major axis.
7. Search legs:
    a. Direction of creep (arrow).
    b. First two or three legs drawn in (need not be to scale).
8. Search altitude.
9. Type and call sign of each search unit.
10. Vector from the OSC position to the commence search point (CSP).
11. IFF/Mode 3A squawk and air-to-air TACAN channel assignments.

Outside the coordinated search area, but adjacent to it, the following information should be plotted:

1. Aircraft's radio call.
2. Aircraft's assigned search altitude.
3. Assigned track spacing.
4. Type of pattern.

It is essential that CIC supervisory personnel establish procedures, documented in the CIC doctrine, to provide for the effective and continuous flow of information between the surface plotter and other vital stations, such as air controller, air plotter, radar and EW search operators, lookouts, and the bridge. This ensures a complete and accurate surface plot, and subsequent relay of necessary data from one station to another.

Sightings

As we previously stated, all sightings should be reported to CIC for inclusion on the surface plot and the air plot. Generally, sightings may be anything observed that is unusual or out of place in relation to the surrounding environment. Such sightings should be reported even if they seem irrelevant to the observer. The following is a list of some of the items that should be reported:

1. Persons in the water.
2. Liferafts and life jackets.
3. Oil slicks.
4. Debris and trash of any kind.
5. Water discoloration and colored dye marker.
6. Clothing.
7. Buoys.
8. Flares.
9. Smoke.
10. Any audible screams, whistles, etc.
11. Concentrations of marine life.
12. Lights or mirror-like flashes.
13. Erratic or unusual maneuvers by vessels or aircraft.

SUBMARINE DISASTER INCIDENT-EVENT SUB LOOK/SUBMISS/SUB SUNK

A form of SAR that operates within, but is slightly different from standard SAR procedures is identified as EVENT SUBLOOK/SUBMISS/SUBSUNK. This form is unique to the Navy, as it involves the search for a missing submarine.

SUBLOOK is the general uncertainty phase; SUBMISS is the initial search stage; and SUBSUNK is the full-scale search. These three stages make up the Navy's submarine disaster search and rescue operations, the primary mission of which is to render prompt assistance to the submarine through rapid search, location, and rescue.

Responsibility for executing SUBLOOK/SUBMISS/SUBSUNK procedures is tasked to the commander exercising operational control of submarine units, i.e., the submarine operating

authority (SUBOPAUTH). His operation orders contain detailed instructions on policies and procedures for SUBMISS/SUBSUNK for submarines under his control.

ORGANIZATION

The basic organization of personnel for submarine rescue is the submarine SAR mission coordinator, the on-scene commander, the commander rescue force, the search force, and the rescue force. We describe their duties briefly below, but you can find additional details in the *USN Addendum to NWP 3-50.1).*

Submarine SAR Mission Coordinator

The submarine SAR mission coordinator is the SUBOPAUTH of the submarine involved in the disaster incident. He assumes this duty under the overall direction of the SAR coordinator of the area in which the incident occurred.

On-Scene Commander

Usually, the commander of the first SRU to arrive at the disaster scene or the datum point is the OSC. His duties and qualifications, and the circumstances of his relief, are the same as for any other SAR incident.

Search Force

The search force consists of submarines, aircraft, and surface units that will conduct the search for the submarine in distress.

Rescue Force

The rescue force consists of a rescue unit, a service unit, and a base unit that supports the submarine SMC. The rescue unit is used to rescue survivors, using a rescue chamber and other special equipment.

EXECUTION

Should a submarine fail to report on time, the SUBOPAUTH will initiate EVENT SUBLOOK. To do this, he initiates a message to the submarine by radio, alerts other Navy ships in the vicinity, and possibly initiates an air search.

EVENT SUBMISS

When actions taken during EVENT SUBLOOK yield no results, the SUBOPAUTH executes EVENT SUBMISS and advises the appropriate SAR coordinator of his action. He also alerts other commanders who may be of assistance during the SAR mission.

Execution of EVENT SUBMISS indicates the following conclusions:

1. The safety of the submarine is in doubt.
2. The arrival or other accountability report/message is overdue, and the steps required in EVENT SUBLOOK have been completed.

Execution of EVENT SUBLOOK initiates the following procedures:

1. Ordering all suitable ships and submarines available to head for the submarine's position or best estimated position at best speed and to commence search as directed by the OSC.
2. Requesting that at least one aircraft from any command begin an air search.

EVENT SUBSUNK

If any of the following conditions are met, EVENT SUBSUNK must be started:

1. A submarine fails to surface promptly, following a known accident.
2. There is reason to suspect that a submarine has suffered a casualty and requires assistance. Indications of a submarine disaster that call for the immediate execution of EVENT SUBSUNK include:
   a. Sighting a submarine messenger buoy.
   b. Sighting green dye marker.
   c. Sighting a distress pyrotechnic (red) fired from a submarine.
   d. Sighting survivors, an oil slick, debris, or large air bubbles.
   e. Receiving a distress communication by sonar, emergency radio buoy, or submarine emergency communication transmitter buoy.
3. The requirements of EVENTS and SUBMISS have been completed.

The initiation of EVENT SUBSUNK requires the following actions to be taken:

1. Augmenting the search force.

2. Requesting a full-scale air search.
3. Establishing and issuing a datum for the search, giving the depth in fathoms and indicating how the datum will be marked.
4. Establishing the search areas.

Search

Factors and conditions considered in planning the search and determining search plans are generally the same as for any other SAR mission. There are several additional considerations that must be weighed when the target is a distressed submarine.

A datum must be established as accurately as the available information will permit. The method of determining the datum must be passed to all units (for example, loran "C," loran "A," and celestial) and the actual readings provided.

The datum will be marked by the most practical means (a buoy or anchored ship, if the depth of the water permits) to provide a visual reference point.

The entire established probability area should be searched as soon as possible by all possible means.

Of particular significance to CIC is a transmission from the submarine's emergency radio buoy or the emergency communication transmitter buoy. The emergency radio buoy, if released, should transmit "SOS SUB SUNK SOS" on 121.5 MHz or 243.0 MHz. The submarine emergency communication transmitter (CLARINET MERLIN) buoy, if released, should transmit a coded message at 13 to 15 words per minute. The message should consist of the CW characters "HM," repeated 10 times, "USS OSC," and three word groups of three characters each. The transmission is about 3 minutes long on each of four frequencies: 6721.5 kHz, 9033.5 kHz, 11264.5 kHz, and 15055.5 kHz. Since the buoy is large and untethered, the geographical location must be fixed and its drift determined before it is recovered.

SAR AND THE OPERATIONS SPECIALIST

The Navy carries out SAR responsibilities as detailed in step-by-step procedures contained in appropriate OPORDERS. Procedures vary slightly from OPORDER to OPORDER. Therefore, you must know the specific procedures that apply to your particular area of operations.

Since time is such a critical factor in SAR operations, all involved commands are obligated to use every service or facility available. Suppose, for example, the survivors of a downed Navy aircraft are out of UHF range, but they can be heard on a HF distress frequency. How does your ship acquire a DF bearing? Most likely, your ship is unable to do so, but the RCC can obtain the bearing and possibly a fix on any HF transmission, and you may be the only one who hears it. You will not have time to break out the books and research the subject. CIC is usually the SAR center aboard ship; and you must have complete knowledgeable of the subject. To be able to perform your SAR duties properly when the time comes, keep yourself up to date!

Q6. What are the three types of submarine disaster situations?

Q7. Who is responsible for executing a submarine disaster event?

ANSWER TO CHAPTER QUESTIONS

A1. The on-scene commander (OSC).

A2. PAN.

A3. 121.5 and 243.0 MHz.

A4. Navigational fix, radar or DF net, position reported by a witness or the distressed craft at the time of the incident, dead reckoning from the last known or reported position.

A5. Sea current, wind current, leeway.

A6. EVENT SUBLOOK/ SUBMISS/SUBSUNK.

A7. The commander exercising operational control of submarine units, i.e., the submarine operating authority (SUBOPAUTH).