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Chapter 3. SEARCH AND RESCUE FACILITIES

300 SAR FACILITIES COMPONENT

The SAR facilities component supports the total SAR system, and is comprised of governmental, commercial, and private facilities that may be employed during the course of a SAR mission. SAR facilities are the tools with which the SAR coordinator and SMC are able to accomplish their responsibilities. A SAR facility is any SAR unit, station, net or other operational activity which can be usefully employed during the prosecution of a SAR mission. SAR units are any craft, vehicle or team capable of operating independently. A thorough knowledge of the capabilities and limitations of those facilities normally employed in SAR missions is a requisite for the safe, efficient, and economical prosecution of SAR missions. The difficulty very often is in recognizing those existing organizations, agencies, and facilities which may provide the most effective assistance. This chapter limits itself to those facilities which are normally available to U.S. SAR coordinators.

301 SAR Facility Resources

The SAR coordinator is charged with organizing available SAR resources within his area for maximum efficient use during a SAR mission. He publishes a SAR plan for his search and rescue area, which includes a listing of available SAR facilities and a priority for their use. Therefore the SMC will normally select facilities from those listed in the SAR plan for the area within which the mission is occurring. Other facilities may be requested by the SMC during the course of a SAR mission.

310 SELECTING SAR FACILITIES

a. General Considerations

Those who must select, assign, employ, and operate facilities must be familiar with the capabilities, limitations, and recommended employment of such facilities in order to intelligently plan and prosecute a SAR mission. The selection of specific SAR facilities will depend upon their availability and their capability of performing a SAR task under the prevailing conditions. The basic requirement is to select the SAR facility which can best accomplish the task.

b. SAR Unit Selection

SAR unit selection involves two major evaluations: (1) The operational capability of the unit, and (2) the training and experience of the crew operating the unit.

The unit selected should be able to reach the scene quickly, and should be suitable for at least one—and preferably as many as possible—of the SAR operations stage events.

Evaluating the experience of the operating crew is more subtle. The normal primary duties of the agency furnishing the SAR unit are weighed against the specific event that must be accomplished. In other words, would the crew be trained for, or experienced in, the type of operation that must be accomplished.

A comparative weighting of parent agency duties is usually sufficient to make a suitable selection, since it is presumed that the parent agency will insure that adequately trained and experienced personnel will crew its apparatus for the duties assigned.

311 Aircraft Types

a. Land Helicopters

The helicopter is one of the most efficient search and rescue craft in use today. Its slow speed and ability to hover make it suitable for search as well as for rescue operations, particularly where small targets are sought or close scrutiny of terrain or sea is required. Its ability to land in a confined area and to operate from ships enables it to remove persons from inaccessible areas or rough seas, or to rescue and give aid to survivors long before a surface ma-

rine craft could do so. All SAR helicopters are equipped with a hoisting cable and a hoisting device for effecting a rescue from the hovering position. Non-SAR helicopters usually are not equipped with this type of hoisting capability and must effect rescue either by landing or by hovering just off the surface of the terrain and permitting the survivors to be brought aboard. Helicopter hovering capability decreases with altitude, and is generally limited to about 6,000 to 10,000 feet maximum altitude. Small, light helicopters usually have minimum instrumentation and are limited to visual flight and in some cases to daylight flight only. SAR helicopters are usually instrumented for both instrument meteorological conditions and night flying. Short and medium range helicopters usually have minimum navigational capability, although newer SAR helicopters are being introduced with a full navigational capability for flight in isolated and oceanic areas. Turbulence and gusting wind limit employment of helicopters due to their inherent instability. High winds may also preclude engagement of their rotors.

b. Amphibious Helicopters

Amphibious helicopters have the additional capability of being able to operate on both land and water surfaces. This feature provides the pilot with an optional method for rescuing survivors from the water.

c. Land Fixed-Wing Aircraft

Land fixed-wing aircraft can nearly always be used as a search platform or as a carrier of droppable supplies or pararescuemen. Their use as rescue craft on the other hand is limited unless they can land and take off from a suitable surface near the distress scene. When climatic conditions permit, land-based aircraft may effect rescue by using frozen lakes and rivers as runways. If equipped with skis, land aircraft are able to land and take-off on snow and ice. These operations are hazardous, and the urgency of the situation should be carefully considered before they are attempted. Normally large land aircraft require prepared surfaces from which to operate, while many small land aircraft are capable of safely conducting operations from flat terrain such as grassy or improvised strips. Where suitable landing strips are not too distant from the distress scene, the land plane can be used for speeding up the evacuation of survivors brought to it by helicopters, ground party, or other means.

Another capability is that of directing a surface craft or ground rescue party to the scene once the target is located.

d. Amphibious Fixed-Wing Aircraft

An amphibious fixed-wing aircraft, like the land aircraft, is an excellent search platform and carrier of droppable supplies or pararescuemen. In addition they may be employed to rescue personnel from the water, providing suitable water and wind conditions exist. Amphibious aircraft are generally slower and less maneuverable than land aircraft. Their operation in the open sea is hazardous and seriously affected by sea and wind conditions. For these reasons amphibious aircraft water operations are usually restricted to lakes, rivers, sheltered bays and inlets, and close-to-shore ocean areas. Open sea landings are left to the discretion of the aircraft commander except when permission to land has been refused or temporarily withheld by higher authority. Prior to authorizing or attempting an open sea landing, both the SMC and the aircraft commander should consider the availability and estimated time of arrival of other rescue craft which might more safely effect the rescue. Authorization to make an open sea landing by higher authorities does not obligate the aircraft commander to attempt the landing. His on scene decision should be based on his knowledge of the situation, condition of the distressed persons, sea and weather conditions, calculated risk to aircraft crew, and all other factors considered a part of good seamanship, airmanship and judgment. In general, an offshore landing by amphibious fixed-wing aircraft should not be attempted if more suitable means of rescue are available.

e. Ship-Based Aircraft

1. Carrier. Carrier based aircraft operate with a great flexibility, particularly in open sea areas, because they have the advantage of a well equipped and mobile base. Carrier based aircraft are capable of sustained search operations of long duration. This is of particular advantage in remote areas where land based aircraft would require an exceptionally lengthy en route

time with resultant short duration on scene. Carrier based helicopters are available for plane guard duty and are capable of SAR operations. The aircraft carrier furthermore is well equipped to carry out rescue operations and to receive and provide medical assistance to survivors.

2. Aviation Facilities Ship. Numerous naval vessels operate rotary wing and other vertical takeoff and landing (VTOL) aircraft. Each vessel so equipped is of obvious benefit in a SAR situation. All aircraft are useful in the search phase and most rotary wing aircraft are suitable vehicles for actual rescues. Though useful in the search phase, existing helicopter assets may not be capable of performing night over water rescues when there are insufficient external references to enable a pilot to maintain a safe hover. In such situations, the rescue may be affected by ship's boat with the aircraft marking the survivor's location. These vessels are similarly equipped to provide medical assistance to survivors.

312 Selecting Aircraft SRU's

a. General Considerations

Aircraft are normally the most satisfactory unit for conducting a search, as distant areas may be reached quickly, and a larger area may be covered within a given time. When weather and terrain conditions are suitable, SAR helicopters are normally the most satisfactory unit for conducting a rescue of a small number of survivors. In addition aircraft SRUs may be used for interception and escort of disabled aircraft, for flying cover for other units, and for aerial delivery of supplies, equipment, rescue personnel and medical personnel to the distress scene. Medium and long range SAR aircraft have communications capabilities comparable to medium size surface vessels. SAR helicopters are capable of conducting a rescue without requiring the aircraft to land.

The speed and higher altitudes of aircraft, which increase the rate of area coverage, are not so advantageous when searching visually for small targets such as survivors floating in the water. When using aircraft for visual search the following general points should be kept in mind: Slower aircraft are better for smaller targets; search effectiveness is better at lower altitudes for small targets; the maximum possible number of scanners is desirable; helicopters are better for small search areas; flight durations must be relatively short due to high fatigue factors affecting the crew; and aircraft use may be curtailed when icing, hail, turbulence, or low-visibility weather conditions exist.

Specific items that should be considered by the SMC when selecting a particular aircraft SRU are discussed in the following subparagraphs.

b. Operational Capabilities

1. Speed. The search speed employed is usually a compromise between a minimum speed—which will give the best target detection, and a maximum speed—which will give rapid coverage of the search area. Generally, rotary-wing aircraft search at 60 to 130 knots, light aircraft between 80 to 130 knots and large aircraft from 130 to 180 knots. Pure jet aircraft are not normally employed for low-level visual search due to their high fuel consumption at low altitudes. However, a fast flying aircraft such as a jet is appropriate for a quick exploratory, low-level sweep through a large search area of flat and unobstructed terrain. An aircraft that is capable of both fast flying and high flying is more efficient for electronic search for emergency locator beacons.

Another speed consideration is the en route speed. The quicker an aircraft can arrive on scene the quicker assistance can be rendered to the distressed craft or persons. Thus it can be seen that a high en route speed with a slow on scene search speed is the ideal combination for visual searches.

2. Altitude. Visual searches are usually conducted from the surface to 3,000 above the surface, depending upon the type of target, the terrain, and the weather. Rotary-wing and fixed-wing propeller driven aircraft are normally selected for visual searches. Electronic searches for emergency beacons are usually conducted from 10,000 feet upwards to 40,000 feet. Pure jet and turboprop aircraft are normally selected for electronic searches of this nature.

3. Radius of Action. The aircraft should have sufficient radius of action to proceed to the scene, remain on scene as long as required, and return to base with sufficient fuel reserve (usually 10 percent of sortie fuel loading). Radius

of action can be extended if a refueling base is available nearer the scene.

4. Maneuverability. Greater maneuverability is required for searches in mountainous areas than for searches over flat terrain. A measure of maneuverability is basically the smallest turning diameter that the aircraft can safely accomplish. Rotary-wing aircraft have the greatest maneuverability; light fixed-wing aircraft are next, large fixed-wing aircraft have less maneuverability, and jet aircraft have the least maneuverability.

5. Hovering. Vertical takeoff and landing (VTOL) aircraft are capable of stopping forward flight and checking all sightings made during a search. In addition they usually have the capability of rescuing a limited number of survivors as soon as sighted. VTOL aircraft includes all rotary-wing aircraft.

6. Short Field Landing. Short takeoff and landing (STOL) aircraft are useful for inland searches which require landing in small open areas or upon highways.

7. Amphibious. Fixed-wing and rotary-wing aircraft which have the capability of landing on either water surface or land surface are very effective in searches occurring over oceanic areas or inland rivers and lakes. Many times amphibious aircraft can land and effect a rescue where other aircraft cannot. Amphibious helicopters can complete a water landing, effect the rescue and then lift-off more quickly, and sometimes more safely, than by hoisting. Amphibious helicopters are capable of landing in much heavier seas than fixed-wing amphibians, and with a much greater degree of safety in all cases. As a general rule fixed-wing amphibious aircraft are only employed for water landing in sheltered waters or when the open seas are relatively calm. Open sea fixed-wing operations are extremely hazardous and this use is normally considered to be a last resort measure only.

8. Weather Penetration. Aircraft have varying degrees of capabilities for operating in deteriorating weather. Generally the larger the aircraft, the better will be its weather penetration capability. Helicopters have the least capability in this regard, usually being prohibited from flight in anything worse than light turbulence or light icing. Almost all aircraft are prohibited from flight in thunderstorms, severe turbulence, and severe icing.

9. Scanner/Lookout Positions. *The main purpose of any SAR unit engaged in a visual search is to provide a platform for scanners/lookouts to search for the target.*—With this in mind, the larger the number of scanner/lookout positions, the more suitable will be the aircraft for a visual search. A search aircraft crewed only by a single pilot is neither an efficient nor an effective search unit. At least one scanner/lookout should accompany each search aircraft. The pilot is required to maintain the safe operations of his aircraft. This necessitates a large degree of concentration within the aircraft, to the detriment of outside visual search.

c. Installed Electronics

1. Communications. A capability for communicating with both the OSC and the distressed craft or survivors is the desired minimum communications capability. Consideration should be given to the possibility of temporarily installing portable communications equipment in aircraft not suitably configured.

2. Navigation. Accurate navigation is essential throughout a SAR mission for both search pattern flying and for reporting exact positions of survivors when found. Larger aircraft have a greater capability for accurate navigation than light aircraft. For searches over isolated or oceanic areas, sophisticated navigation equipment is essential.

3. Sensors. Sensors for electronic detection of the distress or survivors is a desirable feature. This enables a search unit to conduct simultaneous searches such as visual search combined with a radar search, or a radar search combined with direction finder search and other types of specialized searches.

4. Homing. The ability to home-in on a distressed craft is another desirable feature for participating search aircraft. Many times the radio equipment or other energy emitting device used by the survivors is limited in transmitting time due to battery life. Therefore as soon as any type of detectable signal is received, immediate diversion of SAR units is desirable. It is also possible to temporarily install a compact radio homing device in light aircraft, and this should be considered by the SMC. Special mission aircraft such as Navy antisubmarine war-

fare aircraft have an outstanding capability for conducting electronic searches as well as for having a homing-in capability.

5. Instrumentation. The aircraft should have adequate instrumentation for the type of terrain and climatic conditions within which it will be conducting its search. If instrument meteorological conditions are forecast en route to the scene, or at altitudes above the assigned search altitude, the aircraft will require instrumentation to enable the pilot to conduct flight under these circumstances. Some small fixed-wing aircraft and most small helicopters do not have suitable instrumentation for instrument flying conditions.

d. Installed Equipment

1. Aerial Delivery. The capability to deliver supplies, equipment, or personnel to the scene is always desirable. For example a search craft upon sighting survivors should be able to deliver suitable survival and/or communications equipment while he is still present on scene. Helicopters have the greatest capability in this area for limited amounts of equipment delivery. Helicopters are usually the primary means for delivering personnel to the scene. Personnel delivery by fixed-wing aircraft is limited to trained pararescue personnel only.

2. Aerial Recovery. The capability to not only search for the survivors, but also upon locating them to recover them, is an obvious advantage to the overall search efficiency. Helicopters are ideal aircraft for this reason. Some ARRS fixed-wing aircraft are equipped to recover one or more survivors by air-dropping them suitable equipment and then effecting an inflight surface-to-air recovery but this method of recovery of survivors would only be attempted if no other means were available.

3. Life Support. The ability to provide continuing life support for survivors recovered or being transported by SAR units is another desirable feature when considering SAR aircraft. There is dubious value in rescuing a person from a position of peril, and then allowing him to die en route to an emergency care center, when his death could have been prevented by proper emergency care en route. Closely allied with this consideration is the training of the SAR crewman.

4. Rescue Equipment. The best available rescue equipment that can be used under the circumstances of the mission should be installed aboard the rescue aircraft and employed during the mission. Many rescues require specialized equipment which the aircraft will not have intalled. A stockpile of commonly required equipment is usually maintained at the permanent bases of SAR-dedicated aircraft. This includes equipment designed for dropping to survivors.

5. Extraction Equipment. Suitable equipment should be carried aboard rescue helicopters where appropriate, to aid in extracting survivors from wreckage or from parachute entanglement. This may include metal cutter, axe, pry bar, knife, and a body splint for immobilizing an injured survivor's head and spinal column prior to his removal.

6. Camera. A simple, fool-proof camera should be carried aboard SAR units for the purpose of photographing aircraft wreckage sites and crash evidence, exposed sunken vessels, survivor sightings, unidentifiable sightings, and miscellaneous sightings such as terrain disfigurations and oil slicks, and documenting rescue activity.

7. Surface Illumination. The capability to illuminate the scene of distress is another desirable feature during the search and after landing for a helicopter. Illumination includes not only the visual spectrum but also infrared.

8. Loud Hailer. The capability of communicating audibly with survivors on the surface is advantageous when radio contact with the survivors is not available. Some SAR helicopters and law enforcement aircraft have permanently installed loud hailers. Portable loud hailers can be carried by SAR units.

9. Self-Starting. Aircraft utilized should have capabilities for starting their engines without reliance upon external auxiliary power units. Almost all types of aircraft except some pure jets have self-starting capability. This consideration is a factor when selecting appropriate staging bases for deployed aircraft.

313 Marine Craft Types

a. SAR Boats

SAR boats are short range marine craft capable of operating in sheltered or semisheltered waters, or to a limited distance offshore in mod-

erate sea and weather conditions. Some are built with a capability to operate off shore in relatively heavy seas. SAR boats include such types as utility boats, motor lifeboats, crash boats, and air cushion vehicles. Pleasure craft and skiffs may also be used for short range SAR.

b. SAR Patrol Boats

SAR patrol boats are capable of operating at further distances off shore than SAR boats. They range in size from 80 to 100 feet and are adequately manned and equipped to conduct both visual and electronic searches. Their average search endurance is about 3 days. Endurance of crew is usually a more stringent limitation.

c. SAR Vessels (Ships)

SAR vessels can participate in operations at considerable distances from their bases. Their main requirements are: good maneuverability and seaworthiness, long-range, reasonable speed, adequate communications, and sufficient size to accommodate large numbers of survivors and equipment. Marine craft of various types will meet these general specifications, but some are more suitable than others. Coast Guard high endurance cutters (HEC) and Naval vessels of destroyer class and larger make excellent platforms for long range SAR operations. Coast Guard medium endurance cutters (MEC) and seagoing buoy tenders, as well as seagoing tugs. belonging to both the Coast Guard and Navy, make excellent medium range SAR platforms. These vessels are of particular value in SAR operations because of their special equipment and trained personnel.

d. Ocean Station Vessels (OSV)

An OSV is a vessel that is manning one of the ocean stations located in the North Atlantic or North Pacific Oceans. Vessels en route to and from ocean station duty are not referred to as OSV's. The primary purpose of these vessels is to collect meteorological data. They also provide certain oceanographic, communications, navigational, and search and rescue services. Coast Guard HEC's man those stations operated by the United States.

While search and rescue service is ancillary to the primary mission of OSV's, it becomes paramount during specific instances. The OSV's of any nation are therefore available for SAR incidents which occur within their sphere of operations. They are particularly useful because their crews are usually specially trained in search and rescue techniques.

e. Fishing Vessels

Most fishing vessels (F/V) are equipped with voice radio and some types of navigation capability. Fishing vessels which engage in offshore operation are usually equipped with loran receivers and radio direction finders. Their employment in search missions is usually limited to multiple-unit sweeps through an area with adjacent fishing vessels in continuous sight of each other.

f. Merchant Vessels

Merchant vessels are by far the most numerous of large marine craft and this fact alone emphasizes their importance as potential SAR vessels.

Merchant vessels are useful for oceanic visual search missions requiring single sweeps through an area by individual units, for making a rendezvous with each other when one has a doctor and the other has an injured or ill seamen, for rescue of crewmen abandoning a sinking vessel, and for providing rescue capability for aircraft which ditch.

Many merchant vessels have surface radar, VHF–FM radio on 156.8 MHz voice, and/or MF radio on 2182 kHz voice, and/or 500 kHz CW capability. Many can transmit homing signals on 522, 532, and 410 kHz as well as obtain bearings on those frequencies, to assist in making a rendezvous with other vessels or aircraft. Their navigation equipment usually includes Loran, and a few also have navigation satellite (NAVSAT) equipment. Merchant vessels have poor maneuverability, particularly if in ballast (carrying no cargo), and may be unable to reverse course in strong winds and seas. The larger the vessel, the less will be its maneuverability. Merchant vessels often carry both lifeboats and life rafts.

RCCs responsible for maritime areas must have the capability of alerting, and communicating with, merchant vessels, as well as the capability of rapidly obtaining the positions of merchant vessels within their area.

g. Yachts and Pleasure Craft

Yachts and other small, privately-owned pleasure craft (including vessels of the Coast Guard Auxiliary) provide another potent source from which the SAR System may obtain SAR units. Many boats of this type are equipped with radio telephone, which considerably enhances their value. The Coast Guard frequently receives original reports of distress from this type of marine craft, and often requests them to escort or stand by the distressed craft until more effective assistance can be provided. Pleasure craft frequently aid each other by recovering survivors or providing towing, refueling and other services. The larger yachts and pleasure craft are sometimes equipped with surface radar, Loran receivers, and radio direction finders which further enhances their value as temporary assisting SAR units. Common abbreviations for pleasure craft are: Outboard, O/B; inboard, I/B; cabin cruiser, C/C; sailboat, S/B; houseboat, H/B; and inboard/outboard, I/O.

h. Hydrofoil Marine Craft

This type of marine craft is capable of high-speed water operations in the range of 30 to 80 knots. However, their best use would be in coastal or semisheltered water searches in which a high speed is desired. They are limited in their rescue capability if they are equipped with fixed hydrofoils which tend to keep them away from survivors in the water or away from another marine craft in distress. These craft are operated commercially, privately, and by the Navy.

i. Hovercraft (Air Cushion Vehicles)

Hovercraft are ideal rescue units in areas where water and flatland terrain are adjacent to each other. Their amphibious capability and speed, also makes them ideal for rescue in ice covered areas, swamps, and shallow coastal areas. Most have a capability of maintaining their position 2 to 6 feet off the surface and thus are not hindered by such things as moderate seas, floating debris, or small obstructions. They are generally capable of speeds in the range of 30 to 80 knots.

j. Amphibious Marine Craft

There are several different types of amphibious marine craft used by the military. The most common type used for SAR operations is the Lighter Amphibious Resupply Cargo (LARC). The LARC combines a boat hull on a wheeled land vehicle, and is capable of operating on highways, beaches, flat natural terrain, water, and in surf. It is equipped for firefighting, dewatering, towing, and surface delivery operations. Its speed in water is about 10 knots and on land about 35 knots. Its range is 50 miles on water and 150 miles on land.

k. Specialized Marine Craft

Marine craft with specialized capabilities may be necessary in some instances. Specialized craft, both surface and submersible, may be needed for underwater search and recovery. Likewise, craft designed for other purposes, such as oceanographic work, may have reasonably good capability to assist in underwater cases. Icebreakers designed for polar operations may be the only craft which can provide assistance in heavy ice conditions. Some sea-going buoy tenders also have limited icebreaking capability as well as booms and tackle arrangements which may be of value in some cases

314 Selecting Marine Craft SRU's

a. General Considerations

Marine SAR units are normally the most satisfactory units for conducting SAR under adverse weather conditions in the maritime environment. There are three general areas where marine craft are most effective: (1) When combined with aircraft for a coordinated air/surface search in which the aircraft performs most of the search effort and the vessel performs the rescue effort; (2) assignment as an OSC where its long endurance and larger OSC working space may be used advantageously; (3) responding to distress incidents close to their position where search is not a factor. The type of marine craft selected for a mission depends upon its availability, the location of the distress scene, the number of survivors; weather conditions, sea conditions, the craft's sea-going qualities, speed and range.

Marine craft are the most satisfactory for rescues involving large numbers of survivors at

sea. In addition a marine SRU may be used for escort and towing of disabled surface craft, and for surface delivery of supplies, equipment, rescue personnel or medical personnel to the distress scene. Medium- and long-range Coast Guard cutters have excellent communications capabilities for working merchant vessels, naval vessels, fishing vessels, small boats, civil aircraft, military aircraft, and shore radio stations. When using marine craft for SAR the following general points should be kept in mind: Larger vessels have greater on-scene endurance and better communications capability; small boats have greater rescue capability in shallow waters. Marine craft may be used singly or in groups to conduct searches and effect rescues. In many cases a coordinated surface/air search may be conducted This method of searching is particularly effective in providing a high detection probability.

Specific items that should be considered by the SMC when selecting a particular marine SRU are discussed in the following subparagraphs.

b. Operational Capabilities

1. Speed. The speed employed by marine craft is usually their maximum speed possible under existing sea conditions. Generally small boats search at 15 to 40 knots, hovercraft search at 30 to 80 knots, and large vessels search at 10 to 30 knots. At these speeds excellent coverage for small targets is possible. However, the area that can be scanned is limited due to the low-level of the vessel and the earth's curvature. Another limiting factor is the effect of the higher surface speeds on stability of the marine craft. In rough seas marine craft are unable to maintain their higher speed capabilities due to the stresses placed on the craft and the rough ride resulting from adverse sea conditions.

En route speed is not usually a governing consideration since the marine craft will normally proceed at their maximum possible speed to the scene, and then maintain that speed throughout the search.

2. Radius of Action. Marine craft should have sufficient radius of action to proceed to the scene, remain on scene as long as required, and return to base with sufficient fuel reserve. Range factors are usually only a problem with SAR boats and hovercraft. SAR vessels will have a capability of remaining on scene for extended lengths of time. Small boat duration is usually measured in hours up to a maximum of about 10 hours. SAR patrol boat duration is usually measured in hours up to a maximum of 100 hours. SAR vessel duration is measured in days up to approximately 30 days.

3. Maneuverability. Greater maneuverability is required for SAR operations in crowded harbors, near irregular shorelines, and in high density surface traffic areas. A measure of maneuverability is basically the smallest turning diameter that the vessel can safely accomplish. Generally the smaller the marine craft the greater will be its maneuverability.

4. Seaworthiness. The ability to operate in adverse sea conditions is important to consider prior to committing a vessel to proceed from port. Generally the larger the vessel the better will be its seaworthiness, seakeeping qualities, and weather/sea penetration capability. As sea conditions become more extreme, a marine craft must decrease its speed in order to reduce pounding and fatigue on the crew. SAR boats, 30 to 40 feet, are usually limited to seas up to 4 feet and winds less than 25 knots. Motor lifeboats and larger sized boats can operate in wind and sea conditions of over 4 feet and 25 knots. During winter operations there are two main hazards to marine craft: Floating ice which may break propellers or puncture the hull if it is not specially reinforced for this operation; and superstructure icing from ocean spray which may eventually cause vessel capsizing.

5. Draft. The depth of water in which the vessel can safely operate, and the depth of water on scene must be compared. Generally the larger the vessel the greater must be the depth of water. Average drafts of SAR boats is between 4 and 6 feet; SAR patrol boats between 6 and 12 feet; medium size SAR vessels between 12 and 16 feet; and large SAR vessels between 16 and 25 feet. Deep draft vessels such as the large supertankers may have drafts exceeding 80 feet.

6. Scanner/Lookout Positions. The main purpose of any SAR unit engaged in visual search is to provide a platform for scanners/lookouts to search for the target. The larger the vessel the

more suitable will it be for visual search, due to the larger number of crew members that may be assigned to scanner/lookout duties and the higher level at which the lookouts may be positioned. (The higher a lookout is positioned the greater will be the detection range of a surface target.)

7. Amphibious Capability. Marine craft with amphibious capability are useful for missions which involve both land and water surfaces. Amphibious marine craft are usually limited by steepness of land surface inclines (10°–20°), minor obstruction heights (4–6 feet) and, in the case of a LARC, by wind/sea combinations similar to those limiting small boat operations.

c. Installed Electronics

1. Communications. A capability for communicating with both the OSC and the distressed craft or survivors is the desired minimum communications capability. Small boats generally have a very limited communications capability consisting of VHF–FM equipment and/or a high frequency capability. Generally, the larger the marine craft the better will be its communications capability. SAR vessels usually have a capability which spans the low frequency, medium frequency, high frequency, very high frequency (both amplitude modulation and frequency modulation) and ultra high frequency bands. Medium- and high-endurance cutters of the Coast Guard, and Naval vessels of destroyer escort size and above may, in addition, have capabilities which include radioteletype (RATT) weather facsimile (FACS) and data communications capability.

2. Navigation. Accurate navigation is essential throughout the SAR mission for surface craft as well as for aircraft. Again the larger the vessel the better will be its navigation capability. Navigational accuracy of vessels is considered to be within 5 miles in oceanic areas. Sophisticated navigation equipment may improve this to less than a mile. Small boats are usually limited to a minimum of navigation equipment and are generally considered to have navigational accuracy within 15 miles.

3. Homing. The ability to home on a distressed craft is another desirable feature for marine craft. Marine craft capability in this area is usually restricted to low-frequency navigation beacon reception and MF homing capability in the 300–3000 kHz frequency range, with a homing range of 30 miles. Most marine craft are not equipped with automatic direction finders, but must rely instead upon a manually rotated radio direction finder.

4. Underwater SAR Capability. Only specially equipped surface vessels and submersibles have any effective capability for conducting underwater search and recovery operations. The Navy operates or contracts for, most of these vessels. Deep sea tugs and Coast Guard seagoing buoy tenders have a limited capability for underwater recovery in shallow water. Scuba divers may be launched from almost any type of marine platform.

d. Installed Equipment

1. Surface Delivery. Marine craft are the most reliable method for delivering supplies, equipment, and personnel to the scene under adverse weather conditions. Marine craft are mostly concerned with delivering equipment and personnel to prevent the sinking or destruction of another surface craft. Equipment items in this category include dewatering pumps, towing equipment, firefighting equipment, etc., which would tend to lessen the degree of distress when applied on scene. Personnel delivery by marine SRU is usually limited to delivery of doctors, medical technicians, or medical supplies to assist in aiding injured or seriously ill seamen or to the delivery of damage control parties.

2. Surface Recovery. SAR boats are ideal craft for recovery of personnel from the water in sheltered and semisheltered waters where helicopters are unavailable, or where helicopter's operational characteristics might restrict their employment. SAR vessels are employed for personnel recovery offshore and in open seas. SAR vessels can recover personnel from the water by launching their small boats to recover the personnel, deploying rescue swimmers instead of rescue boats to recover personnel from the water, or by bringing the vessel alongside the survivors and recovering the survivors directly aboard.

3. Life Support. SAR vessels usually have the capability for providing emergency care and

continuing life support for survivors recovered or being transported by them. SAR boats are more limited in their capabilities for providing emergency care. Many SAR boats are manned with SAR crewmen capable of providing first aid care.

4. Rescue Equipment. SAR vessels are equipped to conduct rescues using a variety of equipment carried aboard the vessel at all times. SAR boats are more limited in this respect, being normally equipped to perform only a rescue of personnel from the water, basic administration of first aid, and rapid surface transportation to a nearby harbor or SAR vessel. Boat rescue equipment is usually limited to heaving lines, liferings, life jackets, litters, boathooks, boarding ladder and, in some cases, dewatering pumps and firefighting apparatus. SAR vessel equipment may include a variety of specialized equipment such as loud hailers, portable radios, searchlights, rescue swimmers, scramble nets, boarding ladders, manual and automatic hoisting capability, rescue slings and rescue baskets, portable floodlights, line throwing guns, heaving lines, grapnels, cutting tools, body splints, litters, emergency care supplies, rescue rafts, rescue boats, high-line transfer equipment, survival equipment, food, water, floating lights, and other markers such as smoke generators and electronic beacons.

5. Extraction Equipment. Equipment carried by SAR marine craft to aid in extracting survivors from wreckage or from parachute entanglement may include metal cutters, axe, pry bar, knife, body splint for immobilizing the injured survivor's head and spinal column prior to his removal, and a hydraulic rescue kit.

6. Camera. SAR marine craft may carry a simple, foolproof camera. Photographic coverage is always desired of mission activities, for the purposes of documentation and public information.

7. Illumination. The capability to illuminate the scene of distress or a small portion of the search area is a desirable feature for marine SAR units. Many SAR vessels have this capability to some degree.

8. Loud Hailer. The capability to communicate with survivors in the water or distressed craft when approaching them is a great advantage. SAR vessels and some SAR boats carry loud hailers for this purpose.

9. Dewatering Pumps. Most SAR vessels carry portable dewatering pumps which may be placed aboard sinking vessels or boats. Some SAR boats also carry a dewatering pump for this purpose.

10. Survivor Capacity. Medium- and high-endurance cutters operated by the Coast Guard and Navy vessels of destroyer and destroyer escort size have a capacity for accommodating between 100 and 150 survivors for a few days. Smaller craft have varying capacities for limited times depending on size and endurance of the craft.

11. Helicopter Platform. Many SAR vessels have the ability to bring aboard, transport, and launch helicopters. The ship/helicopter team is a most desirable combination for many missions. When selecting this combination, compatability between the ship's helicopter deck and type helicopter must be considered.

315 Land SAR Unit Types

Land SAR units basically consist of personnel equipped with essential portable equipment and with either motorized or animal transportation required to complete their SAR task.

Land SAR units may be organized for search, rescue, or both. Most established land SAR units are specialized for a specific type of environment. For example: Desert search units, cave search and rescue units, mine rescue units, vertical cliff rescue units, underwater SCUBA rescue units, mountain rescue units, parachute rescue units, etc.

However the SMC will occasionally have to organize a land SRU from locally available personnel and equipment. Manpower and equipment suitable for land SAR units can be obtained from various sources:

a. Military services are an important source of trained, well equipped, mobile land units. These units include pararescuemen, National Guard units, and military oriented organizations such as the Civil Air Patrol rangers.

b. State and local law enforcement agencies are often trained and equipped to search for and rescue missing persons as well as for providing

emergency medical care and transporting injured survivors, or have specially trained auxiliaries that they can call upon.

c. State and National Forest Service and park departments have equipment and personnel trained for wilderness operations.

d. National Red Cross, Civil Defense, and similar organizations are trained and equipped to provide assistance during a disaster or other emergency conditions.

e. Many sports, amateur, and recreational organizations specialize in scouting, hiking, mountaineering, skiing, spelunking, skin diving, scuba diving, etc. and may be useful for search and rescue operations.

316 Selecting Land SRU's

a. General Considerations

Land SAR units are usually used in missions in which the search is conducted by aircraft and the rescue is accomplished by land SAR units. A land SAR unit may be used to penetrate inaccessable areas for the purpose of providing immediate emergency medical care, means of survival, and subsequent evacuation of survivors. Search by land units alone is usually impracticable because of the slowness with which it must be accomplished. However, to meet the needs of special circumstances, land units may be required to participate in search operations, even though the normal function of a land SRU is to recover survivors after they have been located by aerial search. Ground searching is practical for covering a high probability area during an aerial search, searching an area which cannot be adequately covered from the air, tracking down survivors who have left the site of the crashed aircraft, searching beaches for survivors or debris which might have washed ashore, and for other SAR operations that can only be conducted by land SRU's. Ground search is particularly effective in forest, jungle, and mountainous terrain. The advantages of ground searching are that it may be continued regardless of most weather conditions and it provides a complete coverage of the area when conducted properly.

Specific items that should be considered by the SMC when selecting a particular land unit are discussed in the following subparagraphs.

b. Training Background

Since the actual functioning of any land SAR unit revolves around an individual or team effort, the training background of the members of the land SAR unit is usually the most important consideration for the SMC. In this regard the pararescuemen of ARRS are the most highly trained of any land SAR unit. Pararescuemen have received intensive training in parachuting—both into open sea and into wooded terrain, self-contained underwater breathing apparatus (SCUBA), survival, advanced emergency medical care, mountain climbing, and aircraft firefighting. There are other military teams available for land SAR. However, they are lacking in one or more of the major qualifications that the pararescuemen possess. Therefore ARRS pararescuemen are usually the first land SAR unit considered for supervision of ground search teams. When pararescuemen are not available, specialized teams such as Army, Navy, and Air Force explosive ordnance disposal (EOD) teams, Naval sea-air-land (SEAL) teams, CAP ranger teams and similar specialized teams, should be considered next. Nonmilitary, governmental land SRU's, such as those of county sheriffs, U.S. Forest and National Park Services are next in training level and scope. Privately organized and amateur rescue teams which are active in land SAR operations are next in training level, and the final level would be military and civilian volunteers for a simple, guided type of land search mission.

Specific areas to consider on an individual basis are: Good physical condition, first aid training, advanced emergency medical care training, experience in specialized terrain and rescue equipment, experience in operation and repair of communications equipment, experience in subsisting with little or no outside assistance, experience in ground navigation in similar type of terrain, and familiarity with the terrain within which the SAR operation will be conducted, survivor extrication, search methods, and aerial delivery methods.

c. Motorized Equipment

A land SRU must be able to reach the distress scene or vicinity as rapidly as possible. Some land SAR units maintain an inventory of four-

wheel drive vehicles, ambulances, trucks, buses, snowmobiles, motorcycles, trail bikes, or truck personnel carriers. Motorized equipment belonging to the land SAR unit may not be an important consideration when the SMC has helicopters available or some other type of rapid means for transporting the land SAR unit to the scene.

d. Portable Equipment

The equipment carried by the land SAR unit should be evaluated by the SMC considering the following general areas.

1. Communications: Portable hand-held or back-pack type transceiver for radio communications with covering SAR aircraft and with the staging base when one is established.
2. Medical equipment: Medical supplies for survivors and for use of the team's members. (Additional medical supplies can usually be aerially delivered subsequent to the land SAR unit's departure.)
3. Navigational equipment: Sufficient maps of the search area showing all terrain features, landmarks, and water sources; plus reliable compasses.
4. Operational equipment: Appropriate equipment for the specialized type of terrain within which the team will be operating, such as mountaineering, scuba, or parachuting equipment.
5. Food and water: Sufficient food and water for 48 to 72 hours.
6. Photographic equipment: Simple reliable camera for those missions involving aircraft crashes. Photographic evidence of aircraft wreckage, instrument panels, aircraft controls, and terrain disfigurations are always desired for accident analysis purposes.
7. Survivor extraction equipment: Metal cutters, axe, knife, body splint, litter, pry bar, and hydraulic rescue kit.
8. Loud hailer: For coordinating team actions on scene.

317 Other Types of Rescue Units

There are a number of other types of rescue units existing which have been established for special purposes. These special purposes are those which are not normally within the purview of the National SAR Plan but for which the SAR organization and its facilities should be used to the maximum extent feasible. Special training and equipment is usually necessary for these types of rescue activity. Requests to SAR activities or other military commands will usually be for some form of logistics support or special capability not available to the rescue unit (e.g. helicopter with hoist or paramedical personnel). Conversely, these organizations may be of great value to the SAR system in cases of aircraft crashes or cases where unusual incidents are reported directly to a SAR facility or activity.

Incidents of the nature discussed above include but are not limited to:

(a) Persons trapped in caves or mines.
(b) Persons trapped in mountain areas.
(c) Highway and railway accidents.
(d) Civil disasters such as bridge collapses and building collapses.
(e) Persons trapped by avalanches.

320 COAST GUARD FACILITIES

321 General

The Coast Guard maintains a wide variety of marine craft, aircraft, communications nets, RCCs, and RSCs, to meet its statutory obligations for providing primary SAR facilities on, over and under the high seas and navigable waters, and its executive obligations for coordinating search and rescue in the Maritime Region under the National SAR Plan. In addition to its facilities committed to the primary SAR mission, the Coast Guard maintains a variety of facilities committed to other mission areas but which will be diverted as required for SAR missions.

322 Coast Guard Marine Craft

a. Coast Guard Cutters

Coast Guard cutters are normally classified as high endurance cutters (HECs), medium endurance cutters (MECs) and patrol boats (PBs). HECs are vessels of destroyer or gunboat size ranging from 255 to 378 feet in length. These cutters are capable of sustained search operations at sea without replenishment for approximately 30 days. Newer, replacement HECs are all equipped with helicopter flight decks and support equipment for servicing helicopters at sea. HECs may have air and sur-

face search radar, IFF/SIF interrogator and transponder, radio direction finder, sonar, and oceanographic equipment, but do not have an icebreaking capability. MECs ranging in size from 150 to 210 feet in length are capable of sustained operations without replenishment for about 2 weeks. The newer replacement MECs are also equipped with helicopter flight decks and support facilities for servicing helicopters at sea. MECs may have surface search radar, IFF/SIF interrogator and transponder, and radio direction finder, but no icebreaking capability. Replenishment of supplies and refueling at sea can extend HEC and MEC at-sea endurance indefinitely. The newer HECs and MECs are the most advanced SAR vessels of the United States. Their sustained operational capability when accompanied by a SAR helicopter make them an ideal SAR unit. Patrol boats are either 82 or 95 feet in length and are capable of sustained operations for about 4 days. PBs have surface search radar and radio direction finder but no icebreaking capability. Other ships operated by the Coast Guard include buoy tenders, icebreakers, and seagoing and harbor tugs. These ships are available for SAR operations whenever the situation demands. Coast Guard cutters are located on the coasts of the United States and its possessions. The employment of Coast Guard ships is controlled by Coast Guard District and Area Commanders who also act as Maritime SAR Coordinators.

b. Coast Guard Boats

Boats used for SAR operations usually range in size from 30 feet to 65 feet. Smaller size boats are employed for special flood relief missions and SAR missions in shallow waters. 30- and 40-foot utility boats and 44-foot motor lifeboats are especially designed for SAR work at short ranges. They are excellent for water rescue operations and can be used for search operations within limitations of both the boat and the crew. 44-foot motor lifeboats have surface search radar, radio direction finder, and some icebreaking capability of 8 inches fast ice and 12 inches broken ice.

323 Coast Guard Aircraft

The primary SAR fixed-wing aircraft are the HC–130, a four-engine turboprop long-range aircraft, and the HU–16 amphibian, which is being phased out. SAR helicopters are the HH–52, a single-engine jet amphibian, and the HH–3, a twin-engine jet amphibian. Other types of aircraft committed to other missions may be diverted when SAR operations require.

324 Coast Guard Stations

A large number of small Coast Guard stations are strategically located along the coastlines of the United States, on the shores of the Great Lakes, and some of the major river systems. They are equipped with various types of SAR boats specifically designed to assist surface craft in distress; four-wheel-drive vehicles suitable for operation on sandy beaches; direct communications links with an established RCC or RSC; and in some cases, amphibious land vehicles or helicopters. A limited amount of firefighting equipment is maintained at stations. One primary purpose of these stations is to obtain early information of life and property in danger within the operational range of the station's SAR craft, and to take immediate action to assist them. These stations may also provide supervision of SAR land parties although this is usually limited to a shore line or coastal beach search effort.

325 Coast Guard Groups

Group commands consist of two or more SAR stations and sometimes include ships and a Coast Guard Air Station (CGAS). Group commands have been established to more efficiently conduct various Coast Guard duties, and are on an intermediate level between the Coast Guard District Commanders and the stations.

326 Coast Guard Auxiliary (CGAUX)

The Coast Guard Auxiliary provides several thousand privately owned boats throughout the United States for supplementing Coast Guard operational needs in SAR operations. In some coastal areas CGAUX boats are the only available SAR facilities and their use should not be overlooked by the SMC. In addition CGAUX personnel have been employed to supplement Coast Guardsmen at various SAR stations during heavy SAR operations. Single-engine CGAUX aircraft are limited to operations

within gliding distance of the shoreline, therefore their use is normally restricted to coastal and inland search. The CGAUX communications net is an important supplement for the established Coast Guard coastal radio net, sometimes providing direct communications to a vessel in distress that is unable to work as established Coast Guard radio facility.

327 Automated Mutual-Assistance Vessel Rescue System/AMVER

AMVER is a computerized system for maintaining the dead reckoning navigation position of participating merchant vessels. Merchant vessels of all nations making coastal and oceanic voyages are encouraged to voluntarily send movement reports and periodic position reports to the AMVER center in New York via designated coastal, foreign, or ocean station vessel radio stations. Any vessel between 80° N. and 80° S. worldwide may participate. Information from these reports is entered into a computer which generates and maintains dead reckoning positions for the vessel during its voyage. Characteristic of each vessel which are valuable for determining SAR capability are also entered into the computer from available sources of information. This SAR data is also published periodically by AMVER and distributed to RCCs. (Coast Guard publication CG-871). The AMVER center can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a SAR incident, including their predicted positions and their characteristics. This service is available to any RCC throughout the world where established communications links permit, in addition to all U.S. RCCs. SMCs handling an oceanic mission of any type should always consider requesting a SURPIC regardless of whether it appears at the moment that merchant vessel assistance can be used. A SURPIC should be requested any time a mission is classified in the distress phase or alert phase.

The SURPIC may be requested in three formats: radius, trackline, or hi-lo. A radius SURPIC will list all vessels within the distance, specified by the SMC, of a distress position, with the closest vessels listed first. A trackline SURPIC between two positions and extending on either side of the track a distance specified by the SMC will list the vessels in order from the first position to the second position. A hi-lo SURPIC will list all vessels within a rectangle bounded by latitude and longitude lines, listed from the first set of coordinates given to the second.

330 AIR FORCE FACILITIES

331 General

The Air Force maintains a wide variety of aircraft, communications nets, radar nets, reconnaisance nets, RCCs, RSCs, and land SAR units to meet USAF global aerospace and rescue operations, to support unified commanders in certain overseas regions and to meet its executive obligations for coordinating search and rescue in the Inland Region under the National SAR Plan. In addition to its facilities committed to the primary SAR mission, the Air

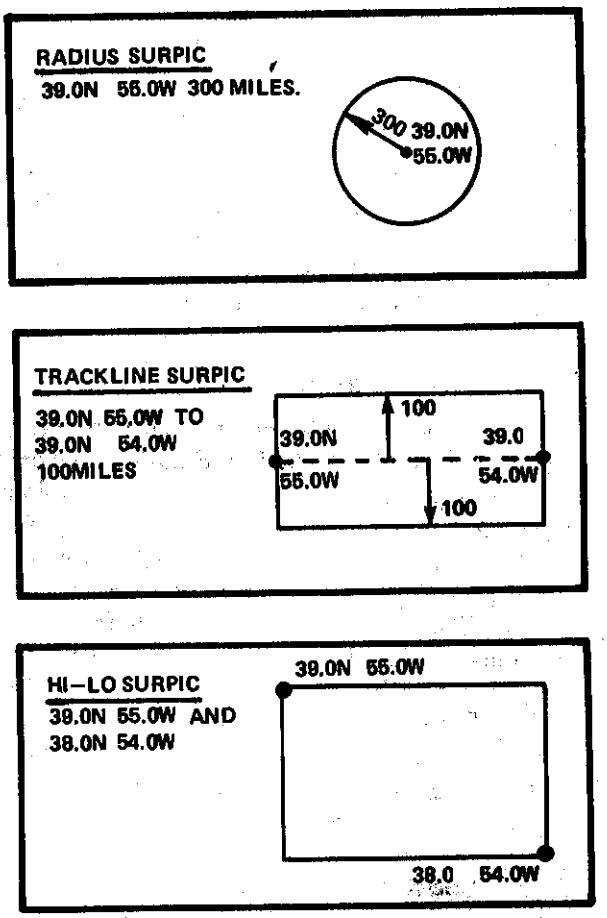

FIGURE 8-1

Force maintains a large variety of facilities committed to other missions which may be diverted for SAR missions provided their primary missions are not degraded. SAR missions do not take precedence over other mission areas of the Air Force except for those facilities that are dedicated for SAR support. However, in practice Air Force commanders cooperate as much as possible with the SAR coordinator and SMC prosecuting a SAR mission.

332 ARRS Aircraft

ARRS operates the HC–130 as a primary SAR fixed-wing aircraft. ARRS SAR helicopters are the HH–3, a twin-engine jet amphibian; the HH–1H, a single-engine land helicopter; the HH–53, a twin-engine jet land helicopter; the UH–1F, a single-engine jet land helicopter and the UH–1N, a twin-engine jet land helicopter. Many ARRS HC–130 aircraft are equipped for a surface-to-air recovery system (STAR) and all may be outfitted for an air-to-air recovery system (ATAR). HH–3 and HH–53 helicopters are equipped with air-to-air refueling capability. The ARRS fixed-wing/rotary-wing air refuelable team is a unique and versatile SAR team. This combination permits the helicopter to proceed without regard to normal range limitations. ARRS squadrons of fixed-wing and rotary-wing aircraft are strategically stationed throughout the world.

333 Aeromedical Evacuation Aircraft

USAF Military Airlift Command (MAC) is charged with the aeromedical evacuation of military personnel, their dependents, and authorized civilian patients throughout the world.

Within the United States, the 375th Aeromedical Airlift Wing is headquartered at Scott Air Force Base, Ill. Subordinate detachments, plus almost 50 Air National Guard and Air Force Reserve aeromedical units, are located throughout the United States and are available for airmedevac missions. The aeromedical evacuation control centers (AECC) are continuously manned and all requests for patient movement received by an AECC are processed immediately.

Requests for patient movement are assigned one of three classifications:

Routine.—Patient is picked up and en route to destination hospital within 72 hours after request is made.

Priority.—Patient is picked up within 24 hours after request is made.

Urgent.—Patient is picked up as soon as possible and speed is imperative. A medevac aircraft is normally en route within 1 hour after request is made.

334 ARRS Pararescuemen

ARRS pararescuemen are highly trained SAR personnel, having completed over 1 year of formal training in such fields as parachuting, mountaineering, survival in all environments, advanced emergency medical care, underwater scuba swimming, and aircraft crash-fire fighting. Pararescuemen are stationed at every ARRS squadron location, and at some of the ARRS detachments. They are qualified to be deployed from aircraft over any type of terrain or ocean, day or night, to assist survivors of any type of disaster. Pararescuemen are extremely valuable to an SMC who needs to provide medical assistance without delay to personnel beyond the range or acceptable ETA of surface vessels, land vehicles, or helicopters. The basic ARRS pararescue team consists of two pararescuemen equipped with emergency medical care kits, survival kits, and either scuba or forest penetration parachute kit.

335 CAP SAR Facilities

The Civil Air Patrol operates facilities in every State and Puerto Rico. At least one rescue sub-center (RSC) is maintained in each State wing. The RSCs are normally unmanned except while conducting an active mission. CAP forces are normally activated by the Inland Regional SAR Coordinator, who controls the issuance of orders for CAP SAR missions. In the Alaskan overseas region the Alaskan CAP Wing is activated by the regional SAR coordinator. CAP emergency services personnel are trained and oriented for inland SAR operation and, in fact, conduct more than three-fourths of the search hours flown on inland SAR missions. Except in Hawaii and Puerto Rico, single engine CAP aircraft normally do not fly beyond gliding distance of a water shoreline, whereas multiengine CAP aircraft may be employed for

searches over large areas of water in the inland region. CAP personnel work closely with civil defense personnel, and have a ground and airborne radiological survey mission within the civil defense organization. CAP has established ground teams which are capable of being deployed into the field for ground search and rescue operations. These self-contained teams are supported by other CAP members who establish base camps providing meals and some shelter in the field.

336 ADC Radar Net

The Air Defense Command (ADC) operates independent radar sites and joint radar sites with the FAA. These radar sites provide a complete coverage around the perimeter of the continental United States. Input from the radar sites is fed into various ADC direction centers which are located at strategic points within the United States. ADC is responsible for the air defense of the United States and its coastlines. ADC direction centers continuously monitor all radar targets outside the borders and coastlines of the United States. If a radar target is not identified positively within 2 minutes, ADC will scramble fighter-interceptor aircraft which are located at strategic air bases around the coastline and borders. Intercept directors at the ADC direction centers will guide the fighter-interceptor to intercept unknown radar targets. The SMC may use the ADC radar net in several ways. He may request a radar check for any target in the vicinity of a distress scene. He may ask for a fighter-interceptor aircraft to intercept a disabled aircraft. He may employ the ADC radar net to assist with on-scene search control, providing communications, radar control, and ATC services to SAR aircraft. Radar control may include providing aircraft vectors for intercept, or maintaining desired search tracks, radar separation between aircraft on scene, warnings of non-SAR aircraft penetrating a SAR airspace reservation which may hazard participating SAR aircraft, or vectors given to a distressed aircraft towards an intercepting aircraft or suitable landing field. The ADC radar net should always be alerted when aircraft are reported lost in coastal and oceanic areas off the United States in addition to alerting the FAA radar net. ADC radar coverage may extend as much as 500 miles offshore in certain areas. The ADC radar net may also be the original source of SAR information for aircraft in distress within their radar coverage area, and may be able to provide a precise position at which an aircraft has ditched at sea or where a bailout has occurred. This service may entail a search of previous ADC radar net information that has been removed from their current display, but is still stored within their computer. ADC personnel use the term zero-velocity position to indicate the point at which the aircraft either ditched or descended below the radar covered air space.

337 Special Purpose Aircraft

a. Photographic Reconnaissance Aircraft

A photographic search can be employed over water and over land. It is also useful as a final search after extensive visual and electronic searches have been unsuccessful, and serious consideration is being given to suspending the mission.

Most photographic reconnaissance squadrons in the United States are training type squadrons and will combine a SAR mission photo-recon flight with their own normal training missions, providing it does not interfere with their primary mission.

b. SLAR Reconnaissance Aircraft

Side looking radar (SLAR) is an airborne reconnaissance system that transmits narrow beam microwave energy outwards from one or both sides of an aircraft. The forward motion of the aircraft sweeps this beam across the surface of the earth and radar returns are then imaged onto a continuous filmstrip and may also be displayed on a cathode ray tube. The SLAR filmstrip resembles a photographic filmstrip in many ways and they can be used in conjunction for postflight comparative analysis.

c. ELINT/ECM Reconnaissance Aircraft

Electronic intelligence (ELINT) and electronic counter measures (ECM) aircraft are equipped with a variety of sensors for determining the location of any electromagnetic emitter. Their equipment includes the most sophisticated direction finding equipment avail-

able, and in addition they usually have some type of filmstrip recording capability for photographic, radar, and electronic targets.

d. AGIL/BIAS Equipped Aircraft

Airborne General Illumination Lightself (AGIL) (sometimes referred to as a battlefield illumination assistance system (BIAS)) has been installed in a limited number of military aircraft which could prove effective in search efforts and invaluable in the lighting of distress areas. Systems of this type are more dependable, more economical and less hazardous than the use of parachute flares. Helicopter installations with lesser capabilities may be available through military, law enforcement or commercial sources.

338 Military Jet Interceptors

Military interceptors have the ability to proceed at very high speed and intercept a distressed aircraft. If the interceptor is immediately available, an intercept (radar or visual) can be made prior to a distressed aircraft actually having to force land or ditch.

When such intercepts are made, the jet interceptor can fix the location of the distressed aircraft, provide navigation and communications aid as necessary, and escort the distressed aircraft until relieved by a SAR aircraft. If the intercept cannot be made prior to the distressed unit's forced landing, the jet is in excellent position to locate the crash site. FAA radio facilities are well equipped to control intercept aircraft.

RCC controllers should realize that intercept aircraft will not always be available. However, the expeditious use of such resources can markedly reduce rescue/recovery time.

340 NAVY FACILITIES

341 General

The U.S. Navy operates a wide variety of marine craft and aircraft, in addition to a SOFAR net, radio direction finding net, and a movement reporting system. Naval task forces are charged with providing their own SAR requirements, although they are authorized to, encouraged to, and often do call upon established SAR coordinators for assistance. Naval facilities may be employed for SAR operations providing the primary Navy missions are not derogated. SAR missions do not take precedence over all other Navy missions. However, in practice naval commanders cooperate as much as possible with the SAR coordinator and SMC prosecuting a SAR mission.

342 Navy Marine Craft

a. Navy Ships

Navy ships most often employed for SAR missions are destroyers and fast frigates for surface search, aircraft carriers for air search, and submarines, salvage vessels and oceanographic vessels for subsurface search. Destroyers and fast frigates are comparable to Coast Guard high endurance cutters in operational capabilities and installed equipment that may be employed for a SAR mission. Many destroyers (DD) and fast frigates (FF) have the capability to refuel a hovering helicopter and thereby extend the range and on scene endurance of a helicopter which is equipped to receive the fueling hose. This capability should be included as a valuable addition to the SMC's selection of forces to employ on a SAR mission when made available. If available helicopters are suitably equipped to receive fuel in this manner, the SMC should ascertain through direct communications with an assigned destroyer or fast frigate whether or not it has this particular capability.

b. Navy Boats

Navy boats such as the crash-rescue boats, patrol craft, patrol torpedo boats, and riverine craft may be used for sheltered or semisheltered water surface search. Their most effective use, however, is in rescue of personnel from the water. Many other varieties of Navy boats have upon ocassion been successfully used on SAR missions.

343 Navy Aircraft

The fixed-wing Navy aircraft which are most suitable for SAR missions are anti-submarine warfare aircraft such as the P–3 and S–3. These aircraft are equipped with a large variety of sophisticated sensors and communications equipment. In addition, they have extended en-

durance and make excellent OSC platforms. When the SAR mission is within range of a Naval Air Station or a naval vessel with embarked aviation assets, the SMC may request the employment of available assets. The Navy's SH–3 helicopter which is carried by CV's is an excellent all-weather SAR vehicle; and when used in conjunction with a suitable surface vessel, endurance is greatly increased. The primary Navy SAR helicopter is the HH–46A, a twin-turbine land helicopter capable of search and rescue in visual meteorological conditions (VMC). The H–46 is also frequently embarked on aviation facilities ships.

344 Navy Pararescuemen

The Navy maintains a small number of pararescue units in isolated areas such as the Antarctic. In addition, the Navy's Underwater Demolition and Sea-Air-Land (UDT/SEAL) teams are qualified in parachuting, underwater swimming, survival, and demolition. Each UDT/SEAL team has at least one member that is highly trained in advance emergency medical care.

345 Movement Reporting System

The Navy operates a movement reporting system for monitoring the positions of Navy vessels throughout the world. When the SMC is attempting to find a suitable marine craft for an oceanic SAR mission, the appropriate fleet commander should be queried for possible Navy vessels that may be in the area. Navy vessel movements are classified and shall not be released by the SMC. When a complete Navy ship position listing is provided to the SMC, individual vessel data may be extracted for SAR purposes, but the information source, code words, departure points, and destinations must not be revealed.

346 Navy Salvage Forces

The Navy has statutory authority to provide salvage facilities for public and private vessels, and to claim reimbursement for such operations. The policy of the Navy is to assist in the salvage of non-Navy shipping when such assistance is requested, and where adequate privately owned salvage facilities do not exist or are not available. Seagoing tugs and/or salvage vessels may be deployed for salvage missions. In addition the Navy maintains stock points of salvage equipment and material available for airlifting to the airport nearest to a salvage incident.

347 Navy SOFAR Nets

Sound fixing and ranging (SOFAR) nets are capable of pinpointing the location of small SOFAR devices which detonate at predetermined depths in the ocean. SOFAR nets are only effective in ocean depths greater than the continental shelves (600 feet depth). Land masses, including underwater sea mounts, will block the SOFAR sound signals.

SOFAR devices may be released by aircraft, vessels, or boats experiencing difficulties, by survivors adrift on the ocean, or if time does not permit and the distressed craft ditches and/or sinks, the device will automatically arm itself at approximately 800 feet and then detonate itself between 2,500 and 4,000 feet. One station can obtain a line of position (LOP) and an approximate range on each signal it receives. Two stations can use their LOP's to obtain a fix with an accuracy of approximately 2 miles.

The SMC should interrogate the SOFAR net any time there is a craft missing which is known to carry a SOFAR device. If a craft is definitely overdue, the SOFAR net should be asked to search its recordings for SOFAR signals from the time of last contact with the distressed craft to the present time, since survivors may have SOFAR devices in their rafts as well as in their craft. SAR aircraft which carry SOFAR devices can use them in coordination with SOFAR stations to maintain a constant bearing coincidence with a distressed craft's bearing. Upon arrival on scene, the SOFAR net may also be able to vector the SAR aircraft directly to the SOFAR datum. In addition the SAR aircraft can release a SOFAR device at a distress scene where a lack of navigational aids prevents accurately fixing the position of the distress. Only one SOFAR device is required to provide a signal throughout the SOFAR net, but two SOFAR devices released approximately one minute apart are preferred as a distress SOFAR signal.

348 Navy HF DF Net

a. Alerting

The Navy operates a military high-frequency direction finding net that may be used by the SAR system. The net has a frequency range between 2000 kHz and 30,000 kHz, and covers both the Atlantic and Pacific Oceans. This net should only be alerted when it can reasonably be expected to contribute to the successful location of the distressed craft. When the net is alerted, the SMC should provide the following information:

1. Emergency phase (distress, alert, uncertainty).
2. SAR mission title.
3. Name and call sign of distressed craft.
4. Frequency distressed craft is using.
5. Transmitting instructions passed to the distressed craft.
6. Name and call sign of SRU attempting to communicate with the distressed craft.
7. Nature of emergency situation.
8. SAR coordinator controlling the mission. (If responsibility is transferred to another SAR coordinator, the net should be advised of this shift.)

b. Position Information Format

Details on position information is contained in U.S. Navy OPNAVINST C2520.1 series and U.S. Coast Guard COMDTINST 03130.16 series.

c. Dealerting

The net should be dealerted as soon as possible after locating the distressed craft and advised of final disposition of the emergency situation.

349 Special Purpose Aircraft

The Navy also operates some aircraft similar to those described in paragraph 337.

350 ARMY FACILITIES

351 General

The Army operates a very large number of helicopters, light aircraft, ground vehicles, and surface detection nets. These facilities may be made available to an SMC providing Army missions are not derogated. A SAR mission does not take precedence over all other Army missions.

352 Army Aircraft

Army aircraft are either rotary-wing or light fixed-wing aircraft. Both of these types are excellent search aircraft. Very few of the Army helicopters are equipped with a hoisting capability. As a result they must rely upon landing or hovering just off the terrain for survivors to be brought aboard. A common procedure is to deploy a knotted rope which survivors may grab and be lifted to a nearby area where the helicopter can land and they can enter the cabin of the helicopter. Another system which the Army uses is a locking wrist strap similar to that used by a trapeze artist which insures the person being picked up cannot fall while he is being airlifted to another area. Some Army aircraft have highly sophisticated side looking airborne radar (SLAR) and other types of sensors which make them a good selection for electronic and radar search purposes as well. Army pilots are experienced in, and continually practice, extreme low-level flying and are highly trained in visually detecting search targets of various types. Army aircraft operations are usually limited to overland only.

353 Land Units

The Army has a wide variety of ground vehicles and personnel trained in land search operations. The Army is probably the best source of trained land search units requiring large numbers of personnel and equipment.

354 Disaster Equipment

The Army maintains large stocks of portable hospitals which can be transported by 2½-ton truck, or airlifted by helicopter or fixed-wing aircraft, plus cots, food, medicines, and other equipment to meet its mission of disaster assistance for the United States. This equipment may be issued directly by the Army or may be released to the American National Red Cross for distribution at disaster sites.

360 OTHER FEDERAL GOVERNMENT FACILITIES

361 FAA Aircraft

The Federal Aviation Administration (FAA) operates approximately 100 aircraft of various types for the purposes of aerially checking the proper functioning of aids to air navigation and other regulatory missions. These aircraft are equipped with high sophisticated sensors and area navigation capabilities. They may be made available to SMCs for SAR operations. FAA aircraft are deployed in approximately equal numbers in each of the FAA regions at any one time. SAR Coordinators should make prearrangements with controlling FAA officials to establish procedures for obtaining the use of these aircraft.

362 FAA Radar Nets

The FAA operates independent radar sites and joint radar sites with the Air Defense Command. These radar sites provide almost complete coverage of the continental United States, Alaska, Hawaii, Panama, and San Juan. This radar net is comprised of long range radar sites, all of which are equipped with interrogators for use in air traffic control. Most major civil and military aerodromes have short range terminal radar which may obtain radar contact with distressed aircraft flying in the vicinity.

The SMC may use the FAA radar net in the same general manner as he would employ the ADC radar net by contacting the appropriate ARTCC.

363 FAA VHF/UHF DF Nets

a. Coverage

The FAA operates VHF/UHF direction finding nets for the frequency bands of 118–156 MHz and 225–400 MHz. The FAA nets are composed of DF sites at aerodromes and flight service stations (FSSs), which are supplemented by military aerodrome DF sites. The large number of DF stations provides almost complete coverage of the continental United States and Alaska, providing the distressed aircraft is at sufficient altitude for radio reception. In addition FAA DF sites are located in San Juan, Virgin Islands, Hawaiian Islands, and Wake Island.

b. Net Control

The FAA operates approximately 27 air route traffic control centers (ARTCCs) for all areas in which the United States provides air traffic control (ATC) services. Each ARTCC is responsible for maintaining a VHF/UHF DF net within its area of control, and acts as net control station. ARTCC may delegate net control to any DF station within its net.

c. DF Services

VHF/UHF DF nets are used to locate aircraft lost or experiencing an emergency and then to vector the distressed aircraft to the nearest suitable airport. In addition, the net can vector SAR aircraft to the same line of bearing as the distressed aircraft, assist the SAR aircraft to then maintain the same bearing line, and thus aid in completing an intercept using the radio bearing coincidence method.

d. Alerting

An FAA DF net is alerted any time a pilot admits he is lost or declares an emergency. The net may be alerted via any ARTCC, FSS, FAA tower, military air station tower, or RCC. When the FAA DF net is alerted by an RCC, the SMC should provide the following information:

1. Name and call sign of distressed aircraft.
2. Frequency distressed craft is using.
3. Type of transmission, MCW or voice, distressed craft is using.
4. Distressed craft's position, if known.
5. Name and call sign of SRU attempting to intercept or communicate with distressed aircraft.
6. Additional information as received.

e. Dealerting

The net control station will dealert the net automatically upon termination of the emergency. The net will continue its alert status in those missions involving aircraft forced to ditch or crash-land in order to obtain bearings on emergency radio beacons or crash position indicating radio beacons, which may be actuated shortly after aircraft impact.

364 FAA Flight Following and Alerting Service

The FAA maintains a network of air route traffic control centers (ARTCCs) and flight

FAA Air Route Traffic Control Centers

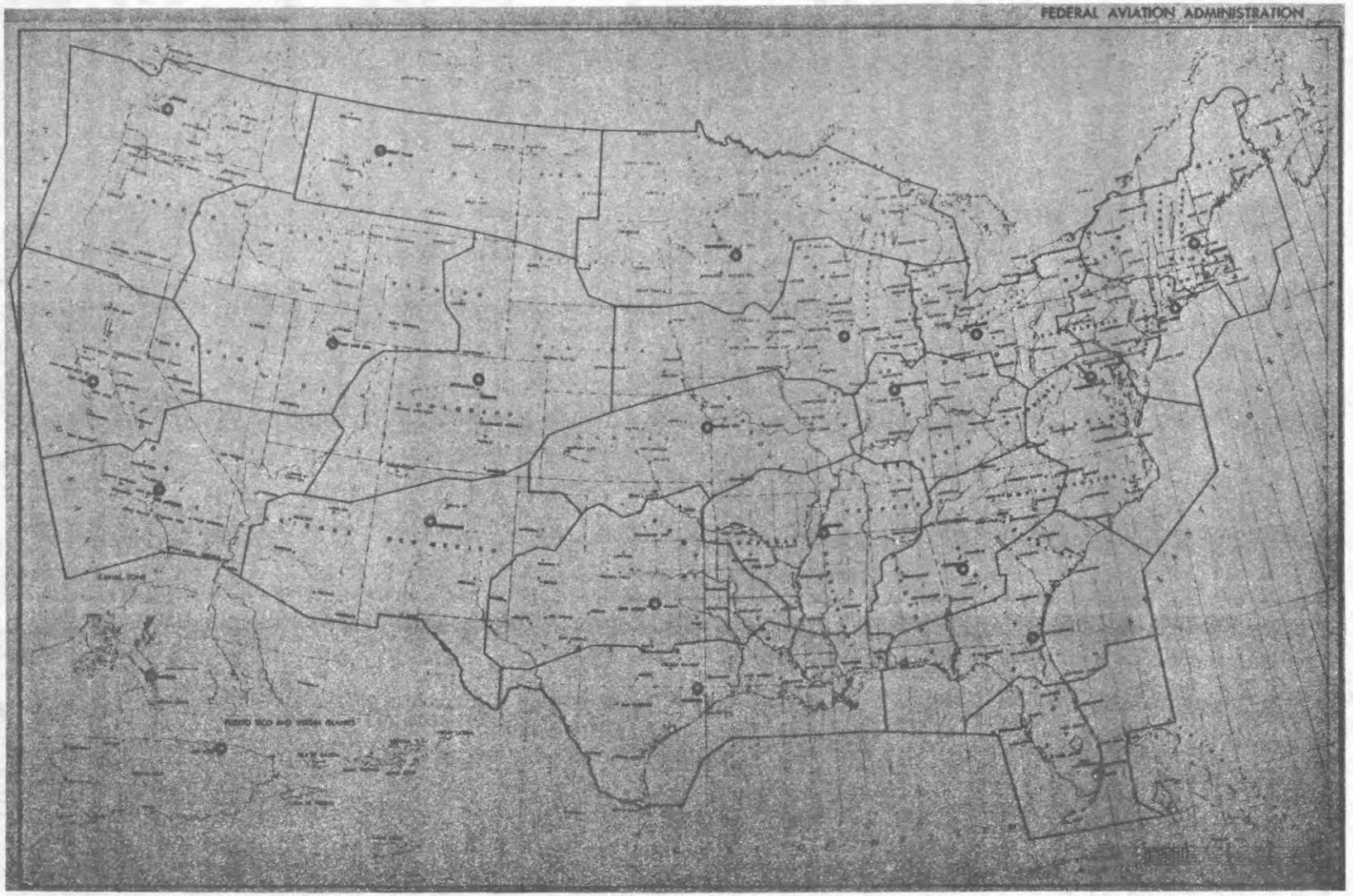

FIGURE 3–2

service stations (FSSs). See figure 3-2 for location of ARTCCs. ARTCCs provide flight following service for aircraft on instrument flight plans and alert associated RCCs when an aircraft is considered overdue. FSSs provide flight following service for aircraft on visual flight plans and alert associated RCC's when these aircraft become overdue.

365 FCC DF Net

a. General

The Federal Communications Commission operates a law enforcement medium frequency and high frequency direction finding net that may be used by the SAR system. This net operates between 2000 kHz and 30,000 kHz and covers the inland United States, Pacific Ocean, and Atlantic Ocean (see fig. 3-3). About half of the FCC stations have the capability for operating on 500 kHz, however, the accuracy and reliability of information obtained on this frequency is considered very poor by the FCC, and this fact should be kept in mind by the SMC when required to obtain DF information on a craft working 500 kHz.

For the most favorable direction finding the SMC should try to have the distressed craft transmit on a frequency within the general limits of 6000 to 9000 kHz during daylight hours and between 4000 and 6000 kHz during night-time. Every attempt should be made to clear other stations from the frequency being used by the distressed craft to permit DF positions to be obtained with minimum interference.

If the distressed craft is transmitting on CW, he should be instructed to transmit two 10-second dashes followed by his call sign, and continue for 5 minutes. If a distressed craft is transmitting on voice, he should be instructed to depress his microphone button for two 10-second intervals followed by a voice announcement of his call sign, and continue for 5 minutes. When the distressed craft is ditching or sinking, he should be instructed to lock his transmitter key to permit a continuous carrier signal as long as possible.

b. Alerting

The FCC DF net should only be alerted when it can reasonably be expected to contribute to the successful location of the distressed craft. When the net is alerted the SMC should provide the same information as when alerting the Navy HDF net (see para. 348a).

c. Position Information

FCC DF fixes are given in degrees and minutes of latitude and longitude followed by its accuracy classification code. The following classification codes are used by the FCC:

Class A—Within 20 miles of fix.

Class B—Within 40 miles of fix.

Class C—Within 60 miles of fix.

Class D—No degree of accuracy. Indicates general area only.

A preliminary fix will be evaluated and given to the SMC as soon as the initial DF bearings indicate the general area in which the distressed craft is located. This fix will usually be of Class D accuracy, and will be followed with more accurate fixes as additional bearings are obtained. It takes approximately 5 to 10 minutes to collect, plot, and evaluate the bearings for an accurate DF fix.

The FCC DF net does not normally release individual DF bearings when a DF fix is determined. However they may be obtained when a fix is not available. The SMC should explain the circumstances of the emergency to the FCC watch officer and request all available bearings. FCC watch officers are not authorized to provide courses to aircraft or vessels.

d. Position Information Example

39°10′ N. 70°25′ W. Class B 1730 GMT.

e. Dealerting

The net should be dealerted as soon as possible after locating the distressed craft. Advise the net of final disposition of the emergency situation.

366 FBI National Crime Information Center (NCIC)

The Federal Bureau of Investigation maintains the National Crime Information Center (NCIC) at FBI Headquarters in Washington, D.C. This center is the computerized hub of a nationwide criminal justice information network which serves as a national index on crime and criminals. NCIC is an instant storage and retrieval computer network—facilitating the sharing of crime information through the

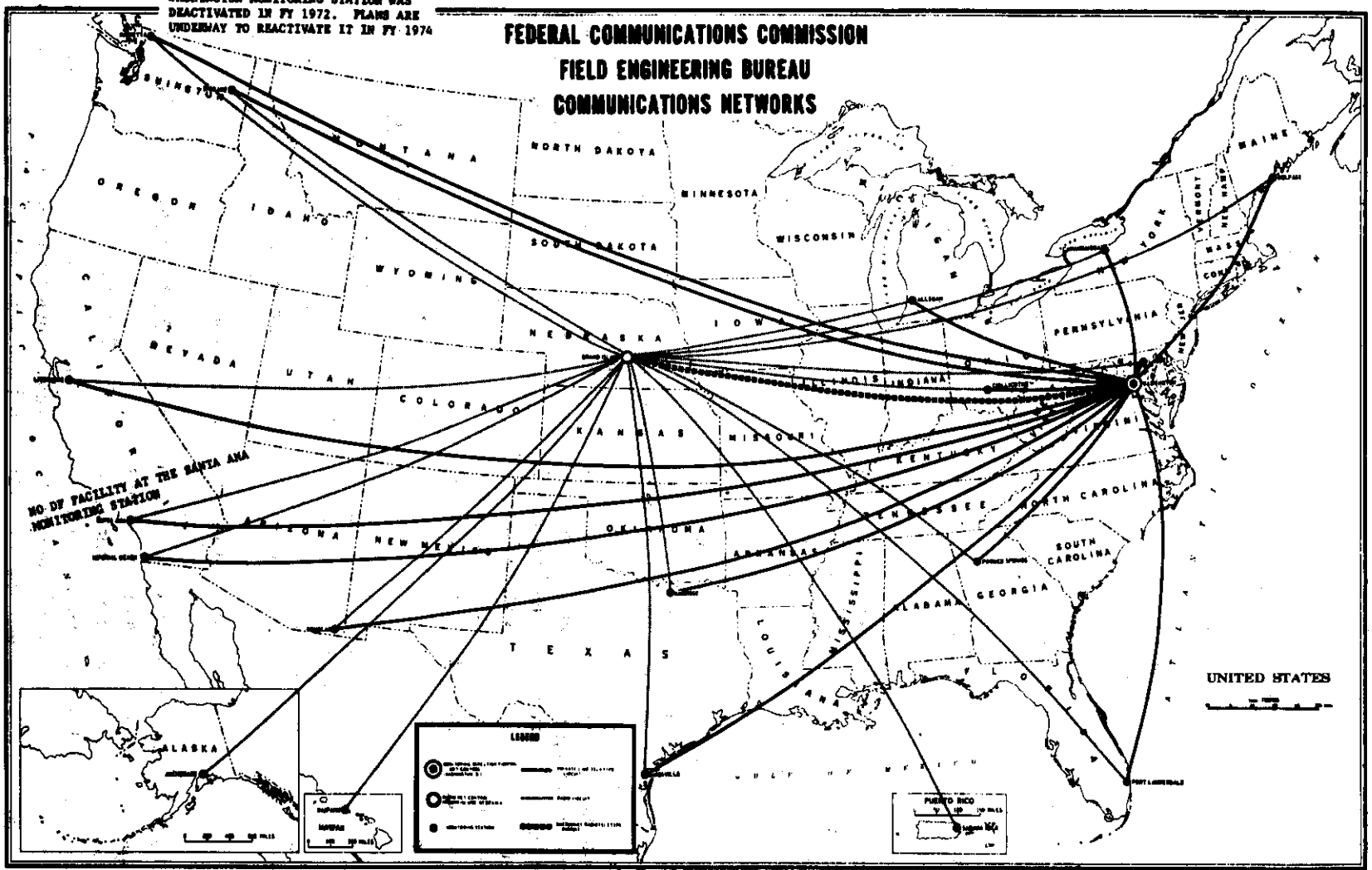
THE DF FACILITY AT THE MARIETTA, WASHINGTON MONITORING STATION WAS DEACTIVATED IN FY 1972. PLANS ARE UNDERWAY TO REACTIVATE IT IN FY 1974
FEDERAL COMMUNICATIONS COMMISSION
FIELD ENGINEERING BUREAU
COMMUNICATIONS NETWORKS
NO DF FACILITY AT THE SANTA ANA MONITORING STATION
UNITED STATES
ALASKA
LEGEND

FIGURE 3-3

cooperative efforts of the criminal justice community including all levels of government: municipal, county, State, and Federal. NCIC provides for the immediate flow of pertinent data to any authorized criminal justice agency on six categories of stolen/missing property, a category on wanted persons, and another on criminal histories.

The NCIC may be of assistance in obtaining in a matter of seconds information on missing, stolen, or lost boats, stolen aircraft, stolen vehicles, and wanted persons. Contact with NCIC would normally be made through law enforcement agencies.

367 Law Enforcement Agencies

a. General

Federal, State, county, and municipal law enforcement agencies can provide a variety of services and facilities to the SAR system. Law enforcement facilities may include aircraft, boats, patrol cars, ambulances, snowmobiles, scuba teams, and bloodhound tracking teams. Most of these facilities are radio equipped and coordinated by a central communications system. Services that can be provided the SAR system by law enforcement agencies include registration data for automobiles, snowmobiles and small boats, harbor checks, airport ramp checks, small boat launching ramp checks, recovery of drowned victims from water, coordination of ground search teams, ground search parties, vehicle and spectator control at distress scene, and emergency transportation of injured survivors.

b. State Police

Most States have established a statewide police organization. Their primary mission is law enforcement and assistance to the public in rural areas. Their efforts are normally coordinated through a statewide communications system. The State police organization in each State also has access to the Federal Bureau of Investigation's National Crime Information Center (NCIC) and usually has control of or access to some type of interstate communications link with other out-of-state law enforcement agencies. The interstate law enforcement communications system provides a national communications service which can be utilized for large searches involving more than one State. (For example, overdue aircraft or lost hunters.) In addition this system can provide registration data and other pertinent information on lost or stolen automobiles, aircraft, and small boats. Some States have highly sophisticated communications networks, including such features as automatic message routing and processing, priority preemption, and automatic relay. Both teletype and voice (VHF–FM) are usually available within a State's police communication systems. RCCs, if appropriate, should consider a permanent drop on this circuit for the purpose of rapidly alerting State police agencies for such incidents as overdue boats, missing aircraft, or missing personnel.

c. County Police Organizations

Almost all of the States have county governmental organizations. The county police agency is usually directed by a sheriff who is most often the State official with the most direct responsibility for SAR within his county. In some States where the county law enforcement agency is organized along the lines of a municipal police organization, this function usually is vested in the chief of the county police. This function usually only involves ground search efforts, although some counties have developed more advanced and complete SAR systems. The sheriff is usually empowered to form possees for ground search, requisition rescue equipment, and in general coordinate the efforts of municipal, county, and State governmental personnel during the SAR mission.

d. Municipal Police

Municipal police of large cities have facilities comparable to State police organizations, whereas smaller cities and towns may have only a few patrol cars. Local municipal facilities and services are utilized during a SAR mission in the same manner as State and county police organizations.

370 COMMERCIAL SAR FACILITIES

371 General

There are commercial organizations and units which provide SAR services under certain conditions. These are described in the following paragraphs.

372 Merchant Ships

Merchant ships have a moral and legal obligation to assist those in distress on and over the sea wherever they can, but they are not prepared, and should not be requested to participate in searches which are likely to be of long duration.

In a SAR mission involving the use of merchant ships the SMC must consider the following points:

(a) The final decision on whether or not to proceed to the assistance of a craft in distress is made by the master of the merchant ship which received the distress message or request for assistance.

(b) The obligation imposed by international treaty on masters to assist others pertains to actual distress situations, and is not obligatory in the uncertainty and alert phases of the SAR mission.

(c) Merchant ships are requisitioned and relieved only by the craft in distress or their representatives. Since the SMC is in fact a "go-between," he should avoid directive-type language when originating requests for merchant ships to assist in a SAR mission. Assistance should be "requested" rather than "directed." Likewise when a merchant ship is no longer needed, the SMC should advise the vessel that his "assistance is no longer needed" rather than "releasing him." Whenever practicable the SMC should arrange for the ship requiring assistance to communicate directly with other ships which are apparently best able to assist.

(d) As a general rule merchant and other commercial craft should not be expected to perform the duties of regular SAR forces when the latter are available, adequate, and can reach the scene in time to render the necessary assistance.

(e) See paragraph 313f for merchant ship capabilities.

373 Salvage Companies

Salvage companies operate in a highly competitive field, and normally will promptly respond upon receipt of any information of a medium or large size commercial vessel in distress. This includes the dispatching of sea-going tugs which can provide towing, dewatering, and firefighting services to the distressed craft. If the vessel is aground this may include the dispatching of a suitable salvage and refloating force to the scene, either by water, by land, or by air. When the agent or master of a vessel in distress authorizes a particular company to attempt salvage or assist him, all costs incurred by the salvage company are borne by the owner of the vessel. Coast Guard and Navy commanders should be guided by their service directives in relationships with commercial salvage companies.

374 Maritime MF/HF DF

The majority of merchant vessels, Navy vessels, and Coast Guard vessels; some FCC DF stations; and many military and commercial civil aircraft have the capability for taking bearings on 500 KHz. Most USCG and some DOD aircraft; most USCG vessels and some USN vessels; and all FCC and USN DF stations have the capability for taking bearings on 2182 KHz. The potential of these facilities should not be overlooked by the SMC when the position of a distressed craft is doubtful. When using these combined facilities, the RCC should act as net control station for coordinating communications and distressed craft transmissions, and plotting of bearings. Net control may be delegated to an assigned OSC. Since the positions of facilities providing bearings must be accurately plotted prior to plotting his bearing, the SMC should remind each mobile facility to provide his geographical position as well as all bearing information.

380 PRIVATE SAR FACILITIES

381 General

There are numerous amateur, sports, and other organizations which provide SAR services for their communities. When they are trained, properly equipped, and practice periodically in their SAR speciality, these organizations should be considered for use by the SMC.

Some of the better known and trained national amateur organizations are:

a. Mountain Rescue Association

The Mountain Rescue Association is comprised of private mountain rescue teams in Alaska, Canada, and over a dozen States of the United States. These teams may be alerted

through local liaison or through either the American Alpine Club in New York or the Mountain Rescue Association in Seattle, Wash. Mountain rescue teams are highly proficient in conducting rough terrain or mountain searches and rescues of lost or stranded personnel.

b. National Ski Patrol

Members of the National Ski Patrol are trained in first aid, search in snow covered and avalanche areas, and ground evacuation of injured personnel from snow covered terrain. Ski patrol rescue teams can usually be alerted through any major ski resort.

c. National Speleological Society

The National Speleological Society is an organization of cave explorers, who participate in regular exploration and mapping of underground caves. They have established a national cave rescue coordinator and staff for compiling procedures and practices for the conduct of underground cave rescues. Each grotto (local club) throughout the United States maintains a cave rescue team. These teams are well trained and are extensively qualified to conduct underground search and rescue missions. Their teams usually include a doctor.

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Chapter 4. SEARCH AND RESCUE COMMUNICATIONS

400 COMMUNICATION COMPONENT

401 General

SAR Communications supports the total SAR System by providing the capability to accomplish three major purposes: a distressed craft or person can inform the SAR System of an existing emergency, the SAR System can respond to the incident and conduct its mission effectively, and the survivor can help SAR units locate and rescue him. The communications component permits obtaining rapid and reliable information on actual or possible emergency situations from any source and then relaying it to any facility capable of providing assistance. Communications is the backbone of the total SAR System, for without adequate and reliable communications, SAR missions are inevitably less efficent, less effective, and less successful. It consists of all the communications means used to: alert the SAR organization that an emergency exists, to coordinate the SAR assistance provided, and to assist in the successful conclusion of a SAR case.

410 EMERGENCY SIGNALS

411 General

Although there are only two alarm signals, four emergency position indicating radio beacon signals and 11 distress signals that are accepted internationally, there are over 100 signals in use today that indicate a distress or other emergency, or are used during a SAR mission. SAR personnel must be familiar with the types of emergency signals which they may encounter during a SAR mission in order to properly evaluate their meaning and take appropriate action. These emergency signals may be made by radio, radar, flag hoist, pyrotechnic light, rockets, star shell, flame, flashing light, pyrotechnic smoke or stack smoke, water or snow staining, paulin, body position, waving, or sound signals. Appendix C lists the more common emergency signals in use throughout the world that may be encountered by SAR personnel.

412 Radio Alarm Signals

a. General

There are two international radio alarm signals which are used to alert other craft or radio stations that a distress call or message, or some other specified emergency message is about to follow.

1. Radiotelegraph. The radiotelegraph alarm signal is a signal consisting of a series of 12 4-second dashes with 1 second spacing transmitted on 500 kHz, for the purpose of actuating automatic alarm devices on ships and coastal marine radio stations which do not maintain a continuous listening watch on 500 kHz.

2. Radiotelephone. The radiotelephone alarm signal is a warbling signal consisting of 2 tones, 1300 Hz and 2200 Hz, alternating 4 times/second and continued for 30 seconds to 1 minute. It is transmitted on 2182 kHz or 156.8 MHz under the same circumstances as the radiotelegraph alarm signal for the purpose of attracting attention and actuating automatic alarm devices.

413 Distress Signals

A distress signal indicates that a craft or person is threatened by grave and imminent danger, and requires immediate assistance. See appendix C for a list of distress and emergency signals.

414 Emergency Position Indicating Radio Beacon (EPIRB) Signals

International standardization of EPIRB signals has been accomplished in recent years. Description of four of these signals is given in appendix C under "Miscellaneous Emergency Signals". Of these four signals, the one most

likely to be heard and used by SAR units is the down-swept tone of the VHF/UHF beacons. If any of these signals are heard or reported, they should be investigated as probable distress cases.

415 Urgency Signals

Urgency signals are used in radio communications to indicate that a calling station has a very urgent message to transmit concerning the safety of a craft or person. In radiotelegraph transmission, the urgency signal is a CW transmission of the characters XXX. In radiotelephone transmission, it is spoken word PAN. The urgency signal is usually transmitted three times immediately prior to transmission of the urgent message. Units hearing the urgency signal must cease transmitting and listen for an urgent message for at least 3 minutes before resuming normal communications.

416 Safety Signals

Safety signals are used in radio communications to indicate that a calling station is about to transmit a message concerning safety of navigation or giving important meteorological warnings. In radiotelegraph transmissions, the safety signal is the CW transmission of the characters TTT. In radiotelephone transmissions, it is the spoken word SECURITE. The safety signal is usually transmitted three times immediately prior to transmission of the safety message. Units hearing the safety signal must listen until satisfied it does not concern themselves, and must not make any transmission which would interfere with the safety message.

417 Emergency Frequencies

Several frequencies in different radio bands are designated to be used for the transmission of distress, urgency, safety, or SAR signals and messages. SAR personnel must have a thorough understanding of the specific frequencies and their authorized use.

a. Frequencies Used for Emergency Communications

The control of distress traffic on one of the designated distress frequencies is the responsibility of the station in distress, or the station which has been delegated controlling responsibility by the station in distress. However, in distress cases involving international civil aviation, control of distress traffic is the responsibility of the station addressed by the distress message. The following frequencies have been designated as distress or emergency frequencies as shown:

500 kHz—International CW/MCW distress and calling.

2182 kHz [1]—International voice distress, safety and calling.

8364 kHz—International CW/MCW lifeboat, liferaft and survival craft.

40.5 MHz—U.S. Army FM distress (Most Army aircraft have the capability to home on FM frequencies).

121.5 MHz—International voice aeronautical emergency.

156.8 MHz—FM INTERNATIONAL voice distress and international voice safety and calling

243.0 MHz—Joint/Combined military voice aeronautical emergency and international survival craft.

b. SAR Dedicated Frequencies

Certain frequencies have been specified for use during a SAR mission. These are:

3023.5 kHz—International voice SAR on scene.

5680 kHz—International voice SAR on scene.

123.1 MHz—International voice SAR on scene.

138.78 MHz—U.S. military voice SAR on scene, and DF.

155.16 MHz—FM frequency used by some states and local agencies for coordinating SAR operations.

282.8 MHz—Joint/combined on-scene and DF.

420 EMERGENCY SIGNALING DEVICES

421 General

Distressed craft and personnel may use any possible means or methods for alerting others to their emergency situation. There are hundreds of different devices available for assisting a distressed craft or survivor to attract the attention of others, or to aid in their own rescue.

[1] 2182 kHz is particularly useful for communications between aircraft and ships.

422 Visual

a. Daylight Devices

Reflective mirrors which are used by survivors to reflect the sun's rays toward an SRU are an effective daylight device—providing the sun is visible to the survivor. Mirrors have been detected as faraway as 45 miles and from as high as 16,000 feet although an average distance is about 10 miles. Fluorescent material which reflects a large percentage of sunlight is usually sewn on one side of liferaft paulins. It has been detected as faraway as 5 miles with an average of 3.5 miles. Fluorescent sea-dye marker which stains the water or snow a green or red color has been sighted as faraway as 10 miles, with an average of 3 miles. Sea-dye is not visible when searching up sun with surface glare reflecting from the surface. Orange smoke generating signals have been sighted as faraway as 12 miles with an average of 8 miles. Smoke signals are most effective in calm wind conditions and open terrain. The effectiveness decreases rapidly with an increase of wind speed above 15 knots.

b. Night Devices

Fires are probably the most effective nighttime signal that survivors may use. Fires have been sighted as far as 50 miles away, with the average range varying with the size of the fire and the absence of other light sources on the earth's surface. Flashing strobe lights are an effective compact night signaling device available for individual survivors. Strobe lights have been sighted as far as 20 miles away with an average of 3.5 miles. Incandescent lights which are used on some individual lifejackets have a much smaller detectability range than strobe lights, generally about 0.5 mile. Flares, star shells, and rockets have been detected as faraway as 35 miles, with an average of 25 miles. Tracer bullets have been detected from 6 miles distance, but difficulty in pinpointing the survivor usually occurs. Pyrotechnic flares may be used in daylight, however, the detectability ranges are only about 10% of nighttime ranges.

423 Radar

Besides the obvious radar target of the distressed craft itself, there are several devices used by both the distressed craft or survivors to increase their detectability by radar.

Chaff is a bundle of short lengths of aluminum or aluminized glass strips cut to the length of the radar microwaves. Chaff radar targets are usually circular in appearance upon their initial release by distressed aircraft or initial dispersal by chaff flares fired by survivors. The target gradually grows elongated due to wind currents as the chaff slowly descends. Any chaff target should be considered a distress signal until its source has been determined to be otherwise. Military high performance aircraft of the United States and several foreign nations incorporate a chaff dispersal which is actuated upon ejection of the pilot. This provides an excellent distress signal of at least 30 minutes duration when the ejection is at or above 4,000 feet. In addition a series of four chaff drops spaced 2 minutes apart followed by four 360 degree left hand turns spaced 2 minutes apart by any aircraft is recognized as a distress signal (it is similar to the IFF emergency signal). Chaff flares which are used by survivors can be fired from the surface and reach altitudes of between 3,000 and 6,000 feet. Their duration is approximately 30 minutes. Chaff has been detected from over 150 miles, and generally is detectable if within radar range of most radars.

IFF/SIF is the abbreviation for *I*dentification *F*riend or *F*oe equipment modified with a *S*election *I*dentification *F*eature. The basic equipment consists of an interrogator and a transponder. The interrogator, which is usually incorporated into air search radar systems, transmits electronic challenges, and if any replies are received will display them on the radar scope. The transponder, which is usually installed in aircraft, ships and boats, is triggered into operation by the interrogator's challenge and transmits a one or two pulse reply. The reply is displayed as small bars slightly beyond the radar target of the transponder-equipped craft. Since interrogators usually use the same antenna as the air search radar, replies are only received as the search radar beam sweeps across the transponder-equipped craft. In addition, transponder replies will be detected at much greater ranges than the radar return from the craft itself. Secondary Surveillance Radar (SSR) is the name used to describe similar equipment used by the Air Traffic Services and civil aircraft. Military mode 3 is the same as civil mode A and thus, the systems are compat-

able for air traffic control and emergency purposes. Military mode 3, code 7700 and civil mode A, code 7700 transmits an emergency signal and, unless amplified by additional information, will be considered as a distress signal.

Caution: For SAR purposes, other than indicating distress or marking the position of distress, IFF/SIF should normally only be used as an aid in the interception of aircraft and, for other purposes, only when 50 miles or more offshore. The reason for this is that some difficulties have been experienced by the Air Traffic Services in domestic airspace due to oversaturation of airborne IFF/SIF type equipment interrogators which causes reduced sensitivity and fading of signals.

Radar corner reflectors and radar cloth reflectors are sometimes used by survivors. These have not proved too effective so that searches should not be planned based on the availability of these devices.

424 Radio

In addition to the obvious uses of standard radio for transmitting emergency signals and messages, there are many small emergency radio equipments designed for use by survivors. These range in size from emergency lifeboat radios used by merchant ships to the pocket sized personal locator beacons used by aviators. Some are fully automatic, some are semi-automatic and others are hand activated. Some are transmitters only, some are transceivers, some are beacons only and some are combinations. The radio beacon as a survival locating device is coming into widespread use, particularly in military and civil aviation. Generic terms for all emergency radio beacons used for survival purposes are Emergency Position Indicating Radio Beacon (EPIRB) and Emergency Locator Transmitter (ELT). Newer EPIRBs incorporate a distinctive signal on one or more of the distress or emergency frequencies.

425 Sound

Sound devices are used in underwater and surface search operations. SOFAR devices have the greatest range, having been detected as far as 6,000 miles away when detonated underwater. (See para. 347.) Self-contained pingers, actuated by immersion in saltwater or by remote sound signals, can be detected by sonar at ranges of approximately 3 miles with an average of 1 mile.

Surface sound devices include gunshots, whistle signals, sirens, and the human voice. Gunshots are usually limited to approximately 1 mile range of detectability, while whistles are limited to about 100 yards. Detectability of sound on the earth's surface depends upon the loudness of the device, the amount of moisture in the air, and the direction and force of the surface wind.

430 SAR MISSION COMMUNICATIONS

431 General

a. Responsibility

SAR mission communications closely follow the command structure of the SAR Mission Organization. The SAR coordinator is responsible for establishing and publishing in his SAR plan those frequencies that are available for assignment as control, on scene, monitor, homing, and press channels during a SAR mission. The SMC is responsible for establishing reliable communications between the OSC, participating SRUs, adjacent RCCs and appropriate parent agencies. The OSC when designated, is responsible for establishing reliable communications between all participating SAR units and with the SMC.

The SMC should select specific frequencies and inform all SAR participants of these frequancies selected. He should designate a primary and a secondary frequency in appropriate frequency bands (HF, VHF, and UHF) for use as on scene channels.

b. On Scene Communications

No facility should be designated OSC if his communications capability is insufficient to maintain both the control channel and the on scene channels. The OSC controls communications at the scene, and must consider the various capabilities of each SRU under his control. SAR units normally report to the OSC on one of the designated on scene channel frequencies. Prior to shifting frequencies between SAR units or to another on scene channel frequency, explicit instructions should be issued covering the procedures to follow if communications

cannot be established on the new frequency. All aircraft, most SAR ships, and many SAR boats have a capability of shifting frequencies in less than a minute. ALL SAR SHIPS AND SAR AIRCRAFT IN MARITIME AREAS, SHALL CARRY THE INTERNATIONAL CODE OF SIGNALS, H.O. 102(1969).

c. SRU Call Signs

Any aircraft of the armed forces, the CAP, or Coast Guard Auxiliary, should insert the word "Rescue" in their normal call sign any time they are actually engaged in a SAR mission. The use of the word "Rescue" in an aircraft's call sign when it is not engaged in a SAR operation is prohibited. For example the following aircraft would be assumed to be conducting some form of SAR operation: Army Rescue 1234, Air Force Rescue 68999, Coast Guard Rescue 5432, Bonanza Rescue 23, Navy Rescue 67899. SAR units initially checking in with the OSC use their full plain language call sign. Thereafter call signs should be in abbreviated plain language without introducing tactical call signs. For example the call sign HAMILTON would be used in lieu of Coast Guard Cutter HAMILTON, 348 would be used in lieu of Navy Rescue 56348, and 670 would be used in lieu of Coast Guard Boat 40670.

432 Control Channel

The control channel is used for command and control communications between the OSC and the SMC. This communications link may be direct between the OSC and SMC, or if necessary, via a radio station which serves the SMC during the prosecution of his mission. The SAR coordinator designates which frequencies are available for assignment as control channels in the SAR plan for his area. The frequency designated as the control channel should not be the same as the on scene channel frequency.

433 On Scene Channel

The on scene channel is the frequency used by SAR units and the OSC to transmit all communications on scene between themselves. If at all possible, all SAR units on scene will use the same frequency. The SMC will normally designate primary and secondary HF, VHF, and UHF frequencies for use as on scene channels, and the OSC may select any one of these frequency bands, or more if necessary, in order to maintain a communications link with every SRU on scene. Generally 5680 KHz (USB), 123.1 and 282.8 MHz (AM) are the primary on scene channel frequencies available for use by the OSC and SAR units. The OSC controls communications on the scene and will attempt to shift all SRUs to one of these frequencies for on scene SAR communications. Using distress frequencies for on scene SAR channels should be avoided if possible in order not to block a distress transmission from another unit experiencing difficulty or the signal from an EPIRB. Parent agencies, interested parties, and other facilities which are not active SAR units on scene, are prohibited from transmitting on the on scene channels unless authorized by the OSC who then acts as a net control station. The SAR coordinator lists the available on scene channel frequencies in his SAR plan.

434 Monitor Channel

Monitor channels are those frequencies which SAR units are requested to monitor throughout the search for possible transmission from distressed craft or from survivors. The monitor channel frequencies are normally the established distress frequencies. The specific frequencies to monitor will be designated by the SMC, and are determined by the type of survival radio equipment, and installed radio equipment of the distressed craft.

435 En Route Channel

En route channel frequencies are those frequencies used by SAR units during the time they are en route between the scene of SAR operations and their staging base or home port. En route channels are designated by the parent agency supplying the SAR unit. SAR units are under the operational control of their parent agency during their en route transit, and do not change operational control (CHOP) to the OSC until they arrive on scene. Upon departure from the scene the SAR unit CHOPs back to its parent agency and establishes communications on its en route channels.

436 Homing Channel

Homing channels are those frequencies used to home on the distressed craft or person. In general any distress frequency or on scene chan-

nel may be used as a homing channel. However 522 and 532 KHz have been predesignated for air-to-air or air-to-surface homing use, and 410 KHz has been predesignated for marine surface-to-surface homing use. These channels are most often used by SRUs when attempting a rendezvous with a merchant vessel, or between merchant vessels when making a rendezvous.

437 Press Channel

On large scale SAR missions, the SMC may designate a press channel frequency for the use of news media personnel in filing stories from on scene to shore radio stations. This is particularly useful when news media personnel are carried aboard SAR units and it is not desired to clutter the control channel with press releases.

438 SAR Channel Summary

A typical sequence for the participating SAR unit would be as follows. A SAR unit departs its home port or staging base and employs the en route channel for communications; upon arrival on scene the SRU commander will shift to the on scene channel for communicating with the OSC and other SRUs as necessary and he will listen on the monitor channel. Upon departure from the scene, he will shift to the en route channel and maintain that until his arrival at his return base. The OSC will guard the monitor channel, control channel and on scene channel simultaneously. He will use the control channel to transmit summaries of all information on scene, normally using SITREP messages, to the SMC; he will use the on scene channel for coordinating and communicating with all SRUs on scene; and he will listen on the designated monitor channel.

439 Aircraft/Marine Craft Channels

a. Aircraft Channels

Aircraft normally communicate on voice channels only, and usually maintain a continuous listening guard on at least one channel. HF (AM/SSB) is used for long range, by both military and civil aircraft, VHF (AM) is used for short range by civil aircraft, and UHF (AM) is used by military aircraft. If the ground aeronautical radio station that is working the aircraft is known, contact may be established through it. Military aircraft on long range or oceanic flights normally maintain communications guard with one of the military airways ground aeronautical radio stations. Civil commercial aircraft on both long range and short range flights normally maintain communications guard with Aeronautical Radio Incorporated (ARINC) radio stations. Military aircraft not on instrument flight plans normally maintain communications guard with a parent activity's radio station, usually their home base. All aircraft on instrument flight plans maintain communications guard with an ATC facility and may be contacted through the nearest Air Route Traffic Control Center (ARTCC) or Oceanic Area Traffic Control Center (OATCC).

b. Merchant Vessel Channels

Merchant vessels normally communicate on the MF or HF CW frequencies, and only use MF voice for short range communications. When attempting to establish contact with a merchant vessel, a call should first be made on 500 kHz (CW), 2182 kHz voice or 156.8 MHz voice. When contact is made, a shift to a working frequency should be made if one is available. However, all merchant ships do not keep a continuous guard on these frequencies, and if an actual distress is occurring the auto alarm signal should be transmitted.

Commercial marine radio stations such as Mackay, RCA, ITT World Communications, handle most communications for merchant ships world-wide. Certain stations broadcast a "Traffic List" every 2 hours which is copied by most merchant ships throughout the world. If a Maritime SAR coordinator or SMC is unable to contact a merchant ship directly, he may obtain the assistance of a commercial station by notifying either New York RCC or San Francisco RCC who will in turn contact the appropriate commercial radio station and request that the desired ship's call sign be included in their next traffic list. The ship's call sign will be inserted for two broadcasts only. If the ship does not establish contact after two traffic list broadcasts, then the requesting SAR coordinator must reinitiate the same procedure. An example of such traffic list announcement would be "GLJH QRZ NMN HF" which would immediately

alert GLJH to the fact that it is to contact Coast Guard Radio Station Portsmouth (NMN).

Merchant ships underway in U.S. harbors and waterways may possibly be monitoring bridge-to-bridge or vessel traffic system frequencies.

c. Small Craft Channels

Fishing vessels and pleasure craft normally communicate on HF voice and VHF–FM voice. Only commercial boats carrying passengers for hire are required to guard 2182 kHz continuously. If initial attempts to contact fishing boats or pleasure craft on 2182 kHz or ~~156.3~~ 156.8 mHz are unsuccessful, the following voice frequencies may be tried:

2003 kHz—Great Lakes.
2638 kHz—All areas.
2738 kHz—All areas except Great Lakes and Gulf of Mexico.
2830 kHz—Gulf of Mexico.
156.3 MHz—(FM)–All areas.

440 SAR MISSION MESSAGES

441 General

There are several different types of messages that are employed by SAR personnel during the prosecution of a SAR mission. These include situation reports (SITREPS), search action plans, rescue action plans, all ships broadcasts, aircraft alerting messages, and miscellaneous SAR messages. All of these messages are normally unclassified, in plain language, use no tactical call signs, and preferably, are self-contained messages requiring no key to interpret. RCCs should establish a canned message file for aid in quickly drafting and releasing those messages which are used often by that RCC.

442 Situation Reports (SITREPS)

a. SITREP Use

SITREPS are employed by the OSC to keep the SMC informed of on scene mission progress and conditions, and by the SMC to keep interested agencies informed of overall mission progress. The OSC will address his SITREPs to the SMC only, unless directed otherwise by the SMC. On the other hand the SMC may address his SITREPs to as many agencies as necessary to keep them informed of mission progress. SITREPs prepared by an SMC usually include a summary of pertinent information received from OSCs.

b. SITREP Content

The format of SITREPs is usually dictated by instructions of seniors in the chain of command. For SAR situations, they should contain at least the following minimum information:

1. Identification of the Case and SITREP. This is usually accomplished in the subject line with SITREP number, identification of unit with emergency, and a one- or two-word description of the emergency. The phase of the emergency may also be indicated.

2. Situation. A description of the case, the conditions which affect the case and any amplifying information which would clarify the problem in the mind of the recipient. After the first SITREP, only changes to the original reported situation need be included.

3. Action Taken. A report of all action taken in response to the situation since the last report. Include results of such action. Where unsuccessful search has been conducted, include area searched, a measure of effort such as sorties flown or hours searched, and the probability of detection.

4. Future Plans. A description of actions planned for future execution. Include recommendations and requests for additional assistance if appropriate.

5. Status of Case. Use only on final SITREP to indicate that the case is closed or that search is suspended pending further developments.

c. SITREP Submission

SITREPs are originated by the OSC in accordance with the circumstances detailed in paragraph 233.e.5. The SMC screens all SITREPS he receives from the OSC to extract pertinent information that other commands and agencies need to know, or have requested. The SMC then originates his own SITREPs to necessary commands. SITREPs are numbered sequentially. When an OSC is relieved on scene, the new OSC should continue the numbering sequence started by the previous OSC.

The SMC should release his initial SITREP as soon as possible after the first information is received. Subsequent SITREPs are released

when important new developments occur during a mission, and at least once daily to keep other interested agencies informed of the mission progress. On all missions involving USN or USMC units in distress, the Naval Safety Center, NAS, Norfolk, Va. should be an information addressee on all SITREPs originated by the SMC.

443 Search Action Plan

a. General

A search action plan is a message adaptation of the standard operational organization plan. It is used to formally disseminate the specific actions required of participating SAR units and agencies to carry out the search. Search action plans must be developed by the SMC, or by the OSC if the SMC does not do so. However, on small scale or rapidly moving missions, the detailed format of this paragraph is not required. This format is designed for complex missions. Smaller scale missions may require a modified format based on the outline of the formal search action plan of this paragraph.

The basic search action plan contains six paragraphs titled as follows:

1. Situation.
2. Search Area.
3. Execution.
4. Coordination.
5. Communications.
6. Reports.

b. Search Action Plan Format

The following format and typical paragraph content is recommended for issuing message search action plans. The contents of each paragraph is determined by the originator, and must be completely self explanatory.

1. Situation.

(a) Brief description of incident, position and time.

(b) Number of persons on board (POB).

(c) Search targets.

(d) Amount and type of survival equipment if known.

(e) Weather forecast and period for forecast.

(f) SAR units on scene (if any).

2. Search Area (read in Columns).

Area; Size; Major Axis; Center Point

3. Execution (read in columns).

Area; SRU; Parent Agency; Pattern: Creep; Altitude

4. Coordination.

(a) SMC designated.

(b) OSC designated.

(c) On scene time for units.

(d) Track spacing/coverage factor desired.

(e) Air space reservations.

(f) Aircraft safety comments.

(g) SRU CHOP instructions.

(h) Parent agency relief instructions.

(i) Authorization for non-SAR aircraft in area.

5. Communications.

(a) Control channels, primary and secondary.

(b) On scene channels, primary and secondary.

(c) Monitor channels.

(d) Press channels.

(e) SAR vessel's aerobeacon and IFF/SIF identification.

6. Reports.

(a) OSC.

(b) Parent activity reports.

(c) End of day operations: sorties, hours flown, area searched and coverage factor achieved for search targets.

c. Special Passing Instructions

Occasionally, the SMC will desire to specify special passing instructions to insure that proper personnel receive the search action plan. Passing instructions are inserted immediately before the message title line. Examples of special passing instructions are:

ATTN: Command Post Duty Officer 55th ARRS. Pass to aircraft commander Coast Guard 1275.

ATTN: Include aircraft commander Navy P-3 in SAR briefing.

d. Search Action Plan Example

The following is an example of a typical search action plan:

UNCLAS
ATTN: COMMAND POST DUTY OFFICER 55th ARRS
DISTRESS MAC 17341 DITCHED SEARCH PLAN 171100Z to 172300Z
1. SITUATION

A. C-141 MAC 17341 REPORTED DITCHING DUE FLAMEOUT OF 3 ENGINES AT 162300Z. LAST REPORTED POSITION 38-40N 65-10W at 162200Z.
B. 135 POB.
C. SEARCH TARGETS. EIGHT 20-MAN RAFTS. (STANDARD SURVIVAL EQUIPMENT OF PYRO, SEA DYE AND MIRRORS). SURVIVORS IN WATER. WRECKAGE/DEBRIS. POSSIBLE CRASH POSITION INDICATOR BEACON.
D. WEA FCST PERIOD 171200Z to 172400Z. CEILING 8000 BROKEN, VIS 16, WIND 190/30, SEA 210/2-3 FT.
F. CG-1385, CG-1390, CGC CAMPBELL CONDUCTING NIGHT SEARCH IN AREA. ACFT DIRECTED TO DEPART AREA PRIOR 17100Z.

2. SEARCH AREA (READ IN FOUR COLUMNS)

AREA	CORNER POINTS	TACAN
BRAVO-1	38-42N 66-20W, 39-21N 65-20W, 39-02N 64-58W, 38-22N 65-57W.	NONE.
BRAVO-2	38-04N 66-00W, 38-42N 65-02W, 38-23N 64-42W, 37-45N 65-40W.	10.
BRAVO-3	37-43N 65-39W, 38-22N 64-41W, 38-03N 64-22W, 37-24N 65-19W.	73.

3. EXECUTION (READ IN SIX COLUMNS)

AREA	SAR UNIT	PARENT ACT	PATT	CREEP	MAX ALT.
BRAVO-1	HC-130	55th ARRS	PS	320T	1500 FT.
BRAVO-2	P3A	VP-49 BDA	PS	320T	1500 FT.
BRAVO-3	HC-130	CGAS ECITY	CSR	050T	1000 FT.
BRAVO-3	CAMPBELL	NONE	CSR	050T	NONE

4. COORDINATING INSTRUCTIONS

A. ATLANTIC SAR COORDINATOR REMAINS SMC
B. CGC CAMPBELL DESIG OSC
C. ALL UNITS ON SCENE 171100Z
D. TRACK SPACING OF 2 MILES DESIRED
E. OSC AUTHORIZED ALTER SEARCH PLAN AS SITUATION DICTATES. PROVIDE ALTITUDE SEPARATION FOR ALL ACFT.
F. NYK OAC APPROVED SAR OPERATIONS WARNING AREA SFC TO 6000 FT FROM 37-00N to 38-00N BETWEEN 64-30W AND 66-00W.
G. ACFT FILE ROUND ROBIN FLT PLAN WITH REMARKS "MARSA AND COMM GUARD IN SEARCH AREA." COAST GUARD ACFT NOT AUGMENTED FOR AIRBORNE TIME IN EXCESS OF 8 HOURS. NOT AUTHORIZED AIRCREW TIME WAIVER.
H. ACFT CHOP OSC UPON ARR SEARCH AREA, CHOP OAC UPON DEPT SEARCH AREA.
I. ONE ACFT DESIRED EACH AREA CONTINUOUS DURING DAYLIGHT. PARENT ACTIVITIES PROVIDE RELIEF ACFT IF REQUIRED.
J. ONE ACFT CARRYING PRESS AUTHORIZED IN WARNING AREA. IDENT N-1768-C. DIRECTED CONTACT OSC PRIOR ENTRY OF AIRSPACE RESERVATION.

5. COMMUNICATIONS

A. CONTROL CHANNEL PRI 5696 KHZ USB. SEC 8984 kHz USB.
B. ON SCENE CHANNEL PRI 282.8 MHZ SEC. 123.1 MHZ.
C. MONITOR CHANNEL 243.0 MHZ.
D. CGC CAMPBELL BEACON 522 KHZ, IDENT NRDC, IFF/SIF

6. REPORTS

A. OSC SEND SITREPS WITH WEATHER AND RAFT COVERAGE FACTOR ATTAINED EVERY 4 HOURS.
B. PARENT ACTIVITY PROVIDE OSC WITH ACFT DEPT AND ARR TIMES.
C. END OF DAYS OPERATIONS, PARENT ACTIVITY RPT SORTIES, HRS FLOWN, AREA SEARCHED.

BT

e. Search Action Plan Release

The Search Action Plan developed by the SMC must be released in time to arrive at all parent agencies providing SAR units for that search effort at least 6 hours prior to the required departure time of SAR units. If at all possible the SMC should strive to have the Search Action Plan arrive at the parent agencies much sooner than the minimum 6 hours, preferably 10 to 12 hours prior to departure times. Because of this requirement it is necessary for the SMC to develop his follow-up search effort while the current search effort is still being prosecuted. It is always best to release the Search Action Plan early. If debriefing reveals some additional factor that was previously not considered, the SMC can always send a modification to his original Search Action Plan. This is the preferred procedure.

444 Rescue Action Plan

a. General

The rescue action plan is in the same general format as the search action plan, in that it is based on the standard operational organization plan. It is used to formally disseminate the specific actions required of participating SAR units and agencies to carry out an effective, efficient and safe rescue. A rescue action plan is not required for most SAR missions, since it is either combined with the Search Action Plan, or the rescue may logically follow a successful Search Action Plan without requiring specific SMC-directed rescue actions. However, when a rescue action plan is employed, the following format is recommended.

The basic rescue action plan contains six paragraphs titled as follows:

1. Situation.
2. Rescue area.
3. Execution.
4. Coordination.
5. Communications.
6. Reports.

b. Rescue Action Plan Format

The following format and typical paragraph content is recommended for issuing message rescue action plans. The contents of each paragraph is determined by the originator, and must be completely self-explanatory.

1. Situation.

(a) Brief description of incident.
(b) Number of persons requiring rescue.
(c) Extent of injuries of persons involved.
(d) Amount and type of survival equipment.
(e) Weather forecast and period for forecast.
(f) SRU on scene, if any.

2. Rescue Area.

(a) Position of the incident described by proper name, latitude/longitude, or by bearing and distance from a well known geographical point.

(b) Detailed description of access route to be followed by rescue unit, including beaching sites, overland routes, and referencing to well known and easily identifiable geographical features, roads, rivers, highway mileage markers, etc.

3. Execution.

(a) Rescue Units assigned including the unit's call sign and parent agency furnishing the SRU.

(b) Rescue method to be attempted by SRU on scene.

(c) Aerial delivery of supplies and other supporting equipment to ground SRU.

d. SMC supportive arrangements.

4. Coordination.

(a) SMC designated.

(b) OSC designated.

(c) On scene/rendevzous time for SRU.

(d) SRU CHOP instructions if appropriate.

(e) Parent agency relief instructions.

(f) Temporary flight restrictions.

(g) Authorization for non-SAR aircraft in area.

5. Communications.

(a) Control channels, primary and secondary.

(b) On scene channels, primary and secondary.

(c) Call signs of aircraft assigned high altitude communications relay duties.

6. Reports.

(a) OSC SITREPs.

(b) Parent activity reports.

(c) End of day operations, summarizing rescue effort, estimate of success and time required for completion of rescue.

(d) SRU reports of departure, arrival, rendevzous accomplished, etc.

c. Rescue Action Plan Example

The following is an example of a typical Rescue Action Plan:

UNCLAS

DISTRESS PAW PAW VILLAGE EXPLOSION RESCUE PLAN 17 JAN.

1. SITUATION.
   - A. THE MAIN POWER PLANT OF PAW PAW VILLAGE EXPLODED 162300Z AND RESULTANT FIRE HAS CONSUMED MOST OF THE VILLAGE.
   - B. TOTAL VILLAGE POPULATION 17 PERSONS (10 ADULTS 7 CHILDREN).
   - C. 16 VILLAGERS RECEIVED MAJOR BURNS AND ALL IN STATE OF SHOCK.
   - D. VILLAGE MAYOR RECOMMENDS TOTAL EVACUATION AND TREATMENT OF VILLAGERS.
   - E. WEA FCST 171200Z to 172400Z. CEILING 8000 SCATTERED, VISIBILITY 16. WIND 190/10 KTS.
   - F. HC–130 AF–17333 CONDUCTED NIGHT RECONNAISSANCE IN AREA AND REPORTED 90% OF VILLAGE IN FLAMES. AIR DROPPED EMERGENCY RADIO AND ESTABLISHED CONTACT WITH VILLAGE MAYOR. WILL REMAIN ON SCENE UNTIL 171500Z.
2. RESCUE AREA
   - A. PAW PAW VILLAGE, SOUTHEASTERN TIP OF CADILAC ISLAND, LATITUDE 60.00N 166.00W.
   - B. NO FIXED-WING AIRCRAFT LANDING SITE AVAILABLE.
   - C. SUITABLE HELICOPTER LANDING SITE AVAILABLE AT NORTH END OF VILLAGE.
   - D. VILLAGE ACCESSABLE BY LAND SRU FROM BEACHING SITE APPROXIMATELY 3 MILES NORTHWEST OF VILLAGE. SMALL, 1 LANE ROAD CONNECTS VILLAGE AND BEACHING SITE, WITH NO SIDE ROADS.
3. EXECUTION
   - A. CGC CONFIDENCE DIVERTING FROM PATROL AT 162350Z TO PROCEED TO PAW PAW VILLAGE. DOCTOR, MEDICAL SUPPLIES AND HH–52/CG–1311 ABOARD CONFIDENCE.
   - B. CONFIDENCE LAUNCH HELICOPTER WITH DOCTOR AND SUPPLIES WHEN 200 MILES FROM PAW PAW IF WEATHER CONDITIONS SUITABLE.

C. AF–17333 DEPLOY ARRS PARARESCUEMEN TEAM AT SUNRISE IF WEATHER, VISIBILITY, AND WIND CONDITIONS SUITABLE.

D. PARARESCUEMEN AND DOCTOR TO PROVIDE EMERGENCY MEDICAL CARE UNTIL CONFIDENCE WITHIN 100 MILES VILLAGE AT WHICH TIME HELO EVAC OF VILLAGERS TO CONFIDENCE WILL COMMENCE.

E. EVACUATED VILLAGERS WILL BE TRANSPORTED TO ALACAN HARBOR FOR TRANSFER TO FIXED-WING MEDICAL EVACUATION AIRCRAFT.

F. EVACUATED VILLAGERS WILL THEN BE TRANSPORTED TO ELEMENDORF AFB FOR FURTHER TRANSFER TO ALASKAN NATIVE HEALTH SERVICE HOSPITAL.

4. COORDINATION

A. KODIAK SAR COORDINATOR REMAINS SMC.

B. AF–17333 DESIGNATED OSC UNTIL 171500Z.

C. CG–1622 DESIGNATED OSC UPON DEPARTURE OF AF–17333.

D. HC–130/CG–1622 WILL AIRDROP ADDITIONAL MEDICAL SUPPLIES AFTER ARRIVAL OF PARARESCUEMEN OR DOCTOR ON SCENE. MEDICAL SUPPLIES INCLUDE TEN GALLONS OF WHOLE BLOOD AND ASSORTED BURN MEDICATIONS. PRESENT ETA OF CG–1622 OVER PAW PAW VILLAGE IS 171300Z.

E. CONFIDENCE DIRECTED CHOP OSC WHEN 200 MILES FROM PAW PAW. AIRCRAFT CHOP OSC UPON ARRIVAL RESCUE AREA, CHOP ARTCC UPON DEPARTURE RESCUE AREA.

F. ANCHORAGE ARTCC HAS ESTABLISHED TEMPORARY FLIGHT RESTRICTIONS SURFACE TO 2000 FEET, 5 MILE RADIUS OF PAW PAW VILLAGE.

G. CGAIRSTA KODIAK PROVIDE RELIEF HC–130 FOR CG–1622 WHEN REQUIRED.

H. ONE AIRCRAFT CARRYING PRESS AUTHORIZED IN AREA OF TEMPORARY FLIGHT RESTRICTION. IDENT–N1777C. DIRECTED CONTACT OSC PRIOR ENTRY.

5. COMMUNICATIONS

A. CONTROL CHANNEL PRI 5696 KHZ USB.
SEC 8964 KHZ USB.

B. ON SCENE CHANNEL PRI 282.8 MHZ, SEC 123.1 MHZ.

C. COMMUNIATIONS RELAY TO BE COORDINATED BY OSC.

D. GROUND SRU CALL SIGN RESCUE ONE RESCUE TWO.

6. REPORTS

A. OSC SEND SITREPS WITH WEATHER EVERY FOUR HOURS AND UPON ARRIVAL OF EACH SRU.

B. PARENT ACTIVITIES SEND END OF DAY OPERATIONS REPORT OF SORTIES, HOURS FLOWN, AND ANY RECOMMENDATIONS.

d. Rescue Action Plan Release

The criteria for releasing Rescue Action Plans and getting them to parent agencies and SAR units are the same as those required for releasing Search Action Plans.

445 Alerting Ships at Sea and En Route Aircraft

Frequently the most immediate help available to a distressed ship or aircraft is that which can be provided by ships or aircraft already in the

vicinity. The SMC can alert ships and aircraft to the need for assistance via appropriate communication channels. Emergency messages for this purpose should be originated as early as possible in order to bring to bear the nearest help as soon as practicable. Generally, such messages are sent during the alert or distress phases of an incident.

1. Alerting Ships at Sea. Ships at sea can best be alerted by a maritime coastal radio station. The normal method is for the RCC to originate a broadcast type message to all ships and transmit it to its associated coastal radio station for broadcast. The RCC should include instructions to the coastal radio station on whether to use the alarm signal and whether to issue the broadcast as a distress broadcast or as an urgent marine broadcast. The coastal radio station should then use the procedures prescribed in the international radio regulations.

A distress broadcast should be used when the unit is in the distress phase and it is believed that the distressed unit may not be able to transmit a distress message, or when a distressed unit has sent a distress message which has not been acknowledged by assisting units. An urgent broadcast should be used when the unit is in the alert phase. The alarm signal should be used before an initial distress broadcast. Under certain circumstances a judicious use of the alarm signal for subsequent distress traffic may be warranted.

The frequency 500 kHz should be used for emergency broadcasts when the incident is in waters usually traversed by ocean-going merchant ships. The frequency 2182 kHz should be used when the incident is within 300 miles of shore. Since many incidents occur within 300 miles of shore, many cases will require broadcasts on both frequencies.

In exceptional circumstances, an SMC may direct an additional broadcast on another frequency after broadcasts on 500 kHz and/or 2182 kHz and/or 156.8 MHz (Ch 16) 2638 kHz Local factors known to the SMC, such as ship-to-ship and ship-to-shore frequencies in use by fishing or pleasure craft in the area of the incident, will dictate the additional frequencies to be used.

A supplementary procedure which some SAR Coordinators have found useful in alerting small craft who might not be listening to the above frequencies is to request the marine operator and commercial radio broadcast stations to include information about the missing craft in their regular marine news broadcasts with a request that anyone having information on the craft contact the controlling RCC.

SAR coordinators should prepare amplifying procedures for their units and for the maritime coastal radio stations normally used by them. These should include provisions for cancelations of emergency messages when they are no longer needed.

Where a need exists to alert surface craft for an extended period of time, a Notice to Mariners should be issued in coastal areas and an appropriate Navy Hydro message should be issued for ocean areas.

2. Alerting En Route Aircraft. Aircraft on an IFR flight plan can be informed of emergency situations in their vicinity by the appropriate Air Route Traffic Control Center. The ARTCC is in the best position to know which aircraft are in position to assist and will have the facilities to communicate with them. In many instances it will be necessary for these aircraft to be alerted by selective calling. Therefore, the emergency message to the ARTCC should not designate the broadcast method but should leave the method up to the ARTCC. Under some circumstances en route aircraft might also be alerted by aircraft towers or approach control facilities, particularly in those instances where incidents occur in the vicinity of these facilities.

Alerting of en route aircraft should usually only be done during the Alert or Distress phases of an incident when it is considered that the en route aircraft may be of assistance. Examples of such cases are:

(a) An intercept and escort is needed.

(b) Survivors may be transmitting on aeronautical emergency frequencies.

(c) The incident might be sighted by aircraft flying in the vicinity. Where a need exists to alert aircraft for an extended period of time an appropriate Notice to Airmen (NOTAM) should be issued.

SAR Coordinators should consult with aeronautical authorities to determine the best method of alerting en route aircraft in their

area and develop suitable instructions for their RCCs.

446 Medico Messages

Maritime and Overseas SAR Coordinators often become involved with medical emergencies at sea. Medico messages are those messages from and to a ship which request or transmit medical advice.

The U.S. Public Health Service and the International Radio Medical Center (CIRM) provide free medical advice to ships at sea, and most coastal radio stations will relay medico messages without charge. Medico messages are of interest to SAR coordinators since each one is a potential mission. Medico messages may be addressed to SAR coordinators from ships at sea. Replies to such messages must indicate in the text the medical facility which provided the advice in order to avoid giving the impression that the SAR coordinator is prescribing.

Medico messages should be prefixed "DH MEDICO" to indicate to communications personnel to handle them as medico messages. However, fishing vessels and small craft will probably not know about this procedure. Accordingly, personnel who might become involved with such traffic should be instructed to be alert for incoming medico messages which can only be identified by the text.

Further information on radio medical advice to ships at sea can be found in the Defense Mapping Agency publication, *H.O. 117, Radio Aids to Navigation.*

450 COMMUNICATION FACILITIES

451 General

There are many communications facilities available to prosecute SAR missions. Many are common to RCCs and SAR facilities regardless of geographic location; others depend upon the specific location. Some are dedicated for SAR purposes; others are designed for some other primary purpose but available for SAR when needed, usually on a high priority basis. Since there are such a wide variety of communications services available, it is imperative that personnel engaged in SAR learn what facilities and services are available at their specific location and throughout their area of operations. Some of the most common types of communications facilities are listed below.

452 Printed Communications

Among the teletype systems providing "hard copy" communications are:

a. TWPL—Teletypewriter Private Line

These are installed when the volume of traffic justifies private line dedicated printed communications. In some areas, particularly the continental United States, special SAR dedicated circuits have been established to carry operational SAR traffic. TWPLs may serve a network of stations or they may be established between two stations only.

b. AUTODIN—Automatic Digital Network

A widespread teletype network using automatic switching circuits for relay. It is used extensively for military communications and by some other government agencies for operational and administrative point-to-point printed communications.

c. AFTN—Aeronautical Fixed Telecommunications Network

An international teletype network based on ICAO requirements for air navigation services, including SAR. FAA Flight Service Stations are the normal points of interface for RCCs in the United States. Diagrams of implemented and planned circuits can be found in the communications sections of the ICAO Regional Air Navigation Plans.

d. FAA Domestic Teletype Networks

The FAA operates extensive teletype networks within the United States primarily for the purpose of air traffic control service and flight following service. Information concerning missing or overdue aircraft is carried from point to point by these circuits. Air Route Traffic Control Centers and Flight Service Stations are the normal points of interface for RCCs.

e. TWX—Teletypewriter Exchange

A commercial method of establishing direct communications with subscribers. TWX service is used within the United States and Canada.

Connection between subscribers is made through a commercial switchboard. The switchboard can also connect with international TELEX (see below) systems.

f. TELEX—Teletype Exchange

An international commercial service similar to TWX. TELEX service is provided by the international communications companies. In some foreign countries it also serves domestic needs as well as international needs. Also, in some foreign countries, the various TELEX systems provided by different international companies interconnect. However, there are some countries where this is not so and, in these, it is possible to have two or three different systems which are operated separately. In such cases, the use of TELEX for SAR can be complicated.

g. RATT—Radio Teletype

This is a generic term for teletype circuits which use radio connection instead of cable or landline. RATT circuits may be integral with some of the systems described above or they may be of special purpose type. More and more ships and aircraft are becoming equipped with RATT so that SMCs may find it convenient in some cases to use a RATT circuit for the control channel during a mission.

453 Voice Communications

Direct voice communications provide the most rapid means of transmitting urgent information from point to point. They also provide the most practical communications for direction of operations on scene. Among the voice systems in use for SAR are:

a. TPL—Telephone Private Line

Similar to dedicated TWPL lines but used for voice communications instead of teletype. When established specifically for SAR nets they are sometimes referred to as SARTELS. Air Route Traffic Control Centers have widespread voice circuits for traffic control purposes, both domestic and international, which can be extremely valuable for SAR, particularly in aircraft incidents. Urgent communications between two RCCs can often be relayed by their associated Air Route Traffic Control Centers in this manner.

b. AUTOVON—Automatic Voice Network

A world wide direct-dial system of voice communications for military purposes.

c. FTS—Federal Telephone System

A direct dial system within the United States for use by Federal Government agencies.

d. Commercial Telephone

The most widespread method of domestic and international voice communications. It often provides the most rapid means of transmitting or obtaining information.

e. Radiotelephone

This is the most common type of radio communications among surface, air and fixed stations. There are innumerable uses of radiotelephone circuits and a considerable number of networks which can provide some use in SAR operations. SAR personnel must familiarize themselves with the most important of these from communications manuals, instructions and liaison with communications specialists. Radiotelephone links may be an integral part of some of the above voice systems. Commonly called phone patches, these important links are provided by the commercial telephone system through the marine operator to craft at sea and by aeronautical radio stations to enroute aircraft.

454 Telegraphy

Most of the telegraphy that is used in SAR communications is radiotelegraphy between fixed stations and ships or between ships. It is still of considerable importance in communicating with large merchant ships at sea. This must be done through a government or commercial coastal marine radio station.

455 Facsimile

Facsimile circuits may be either by cable or radio. They are used for transmission of a picture of the information to be transmitted. They are most used for transmitting pictures or charts such as weather maps. With future developments however, facsimile may well become another means of transmitting printed communications.

456 Data Link

The term "data link" is used in several contexts in communications. In general it is used with those communications circuits which are designed for transmitting raw data of some type from one place to another without having to translate it to some other form. These links are most useful when transferring data to and from computers and between computers without the need for an intermediate step. While the use of data links for SAR is not widespread at present, the increased use of computers for SAR applications will make this means of communications of increasing importance.