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SAR Seamanship Reference Manual

Canada

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Foreword

This SAR Seamanship Reference Manual is published under the authority of the Manager, Search and Rescue, of the Canadian Coast Guard. Funds associated for the development of this manual were provided by a generous contribution from the National SAR Secretariat's New SAR Initiatives Fund program. Without this financial contribution, the publication of this manual would not have been possible.

Purpose

To be able to perform safely and effectively, a rescue mission involves a huge amount of operational knowledge. Most of that knowledge is already available. However, in the context of small vessels, it is dispersed under a number of specialised and individually prepared courses or, under bits of documented information. In addition, the background and theory that sustains SAR operational knowledge is in many cases developed for larger ships involved in offshore rescue. Although the information is helpful, it does not always reflect the reality of small boat operations. A prime example would be first aid where all courses are developed around a movement free stable ground, which is quite different from a small bouncing boat deck.

Another issue is standardisation. Search and Rescue is essentially a humanitarian activity with the prime purpose of saving lives. In most cases, it involves the participation of number of dedicated people that may not have the same background. In order to make operations more efficient, it is paramount to have people executing operational tasks the same way. Therefore, this manual is aiming at introducing and standardising small boat operations for SAR. In fact, the purpose is to bring together under one manual all known best operational procedures and practices that usually apply to small boat involved in a SAR mission.

This manual targets two main groups of small boat rescuers. One is the Canadian Coast Guard Auxiliary and the other one is the Canadian Coast Guard Inshore Rescue Boat Program. However, other organized response units such a local Fire Department can certainly benefit from this manual. We hope that it will incorporate and standardise the current best practices employed within the Canadian Coast Guard operations community. It is intended to be the primary reference for the above noted two targeted groups, mainly for shore based boat operations and seamanship training.

The standardised methods and procedures presented in this Manual can apply to all boat operations and crew training and, Commanding Officers, Officers in Charge or Coxswains are encouraged to ensure that personnel tasked with boat crew responsibilities are trained or familiar in all methods and procedures in the Manual.

As the scope of this knowledge is quite vast, it will be under continuous review and will be updated as necessary. In addition, errors, omissions or suggestions should be forwarded to:

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Abbreviations and Acronyms

NOTE: The abbreviations are listed alphabetically in the first column, with the French equivalent in brackets. Bold characters indicate that the abbreviation is the same in both languages.

AMVER	Automated Mutual Assistance Vessel Rescue System
CASARA (ACRSA)	Civil Air Search and Rescue Association
CCG (GCC)	Canadian Coast Guard
CCGS (NGCC)	Canadian Coast Guard Ship
CCGA (GCAC)	Canadian Coast Guard Auxiliary
CF (FC)	Canadian Forces
CGRS (SRGC)	Coast Guard Radio Station
COSPAS	Russian for: Space system search for distressed vessels
CSA (LMMC)	Canada Shipping Act
CSS	Co-ordinator surface search
DF	Direction finder
DFO (MPO)	Department of Fisheries and Oceans
DND (MDN)	Department of National Defence
DMB	Data marker buoy
DSC (ASN)	Digital selective calling
ECAREG Canada	Eastern Canada Traffic Zone Regulations
ELT	Emergency locator transmitter
EPIRB (RLS)	Emergency position-indicating radio beacon
ETA (HPA)	Estimated time of arrival
FRC (ERS)	Fast rescue craft
F/V (B/P)	Fishing vessel
GMDSS (SMDSM)	Global Maritime Distress and Safety System
GPS	Global Positioning System
IMO (OMI)	International Maritime Organisation
Inmarsat	International Mobile Satellite Organisation
IRB (ESC)	Inshore rescue boat
kt (nd)	Knot (nautical mile per hour)
LKP	Last known position
m	Metre
MCTS (SCTM)	Marine Communications and Traffic Services Centre
MARB	Maritime assistance request broadcast
Medevac	Medical evacuation
MSI	Maritime safety information
MRSC	Maritime rescue sub-centre
M/V (N/M)	Merchant vessel or motor vessel
NM (MN)	Nautical mile
NSS (SNRS)	National Search and Rescue Secretariat
OBS (BSN)	Office of Boating Safety
OSC	On-scene co-ordinator

PIW	Person in water
PLB	Personal locator beacon
POB	Persons on board
RCC	Rescue co-ordination centre
SAR	Search and Rescue
SARSAT	Search and Rescue Satellite-Aided Tracking
SART	Search and rescue (radar) transponder
SERABEC	Sauvetage et recherche aériens du Québec
SITREP	Situation Report
SKAD	Survival kit air droppable
SLDMB	Self-locating datum maker buoy
SMC	Search and rescue mission co-ordinator
SOLAS	International Convention of the Safety of Life at Sea
SRR	Search and rescue region
SRU	Search and rescue unit
S/V (B/V)	Sailing vessel
UTC	Co-ordinated universal time
VTS (STM)	Vessel traffic services
VHF	Very high frequency (30 to 300 MHz)

CHAPTER 11 – SAR Operations

11 SAR Operations

11.1 Awareness and initial actions

When the SAR system first becomes aware of an actual or potential emergency, the information collected and the initial action taken are often critical to successful SAR operations. It must be assumed that in each incident there are survivors who will need assistance and whose chances of survival are reduced by the passage of time. The success of an SAR operation depends on the speed with which the operation is planned and carried out. Information must be gathered and evaluated to determine the nature of the distress, the appropriate emergency phase, and the action to be taken. Prompt receipt of all available information by the RCC/MRSC is necessary for thorough evaluation, immediate decision on the best course of action, and a timely activation of SAR facilities to make it possible to:

- locate, support and rescue persons in distress in the shortest possible time; and
- use any contribution that survivors may be able to make towards their own rescue while they are still capable of doing so.

Experience has shown that the chances for survival of injured persons decrease by as much as 80% during the first 24 hours, and that those for uninjured persons diminish rapidly after the first three days. Following an accident, even uninjured persons who are apparently able-bodied and capable of rational thought are often unable to accomplish simple tasks, and are known to have hindered, delayed or even prevented their own rescue.

This section introduces the five stages of an SAR response, briefly describes three emergency phases of an SAR incident and provides basic information about the first two SAR stages.

11.2 SAR stages

The response to an SAR incident usually proceeds through a sequence of five stages. These stages are groups of activities typically performed by the SAR system in responding to an SAR incident from the time the system becomes aware of the incident until its response to the incident is concluded. The response to a particular SAR incident may not include every stage. For some incidents, the activities of one stage may overlap the activities of another stage such that portions of two or more stages are being performed simultaneously. The five SAR stages are described below:

11.2.1 Awareness

Knowledge by any person or agency in the SAR system that an emergency situation exists or may exist.

11.2.2 Initial action

Preliminary action taken to alert SAR facilities and obtain more information. This stage may include evaluation and classification of the information, alerting of SAR facilities, communication checks, and in urgent situations, immediate performance of appropriate activities from other stages.

11.2.3 Planning
The development of operational plans, including plans for search, rescue, and final delivery of survivors to medical facilities or other places of safety as appropriate.

11.2.4 Operations
Dispatching SAR facilities to the scene, conducting searches, rescuing survivors, assisting distressed craft, providing necessary emergency care for survivors, and delivering casualties to medical facilities.

11.2.5 Conclusion
Return of SRUs to a location where they are debriefed, refuelled, replenished, and prepared for other missions, as well as return of other SAR facilities to their normal activities, and completion of all required documentation.

This section discusses the first two stages, awareness and initial action and should give you a general understanding of how the SAR system works. These two stages will rarely involve SRUs. SRUs are usually recruited for the other three stages.

11.3 EMERGENCY PHASES

Emergency phases are based on the level of concern for the safety of persons or craft which may be in danger. Upon initial notification, an SAR incident is classified by the notified RCC/MRSC as being in one of three emergency phases: Uncertainty, Alert, or Distress. The emergency phase may be reclassified by the RCC/MRSC as the situation develops. The current emergency phase should be used in all communications about the SAR incident as a means of informing all interested parties of the current level of concern for the safety of persons or craft which may be in need of assistance.

11.3.1 Uncertainty phase
An uncertainty phase is said to exist when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require dispatching of resources. When there is doubt about the safety of an aircraft, ship, or other craft or persons on board, or it is overdue, the situation should be investigated and information gathered. A communication search may begin during this phase. An Uncertainty Phase is declared when there is doubt regarding the safety of an aircraft, ship or other craft, or persons on board.

11.3.2 Alert phase
An Alert Phase exists when an aircraft, ship, or other craft or persons on board are having some difficulty and may need assistance, but are not in immediate danger. The alert phase is usually associated with apprehension, but there is no known threat requiring immediate action. SRUs may be dispatched or other SAR facilities diverted to provide assistance if it is believed that conditions might worsen or that SAR facilities might not be available or able to provide assistance if conditions did worsen at a later time. For overdue craft, the alert phase is considered when there is a continued lack of information concerning the progress

or position of a craft. SAR resources should begin or continue communications searches, and the dispatch of SRUs to investigate high-probability locations or overfly the craft's intended route should be considered. Vessels and aircraft travelling through areas where the concerned craft might be located should be asked to maintain a sharp lookout, report all sightings and render assistance if needed.

11.3.3 Distress phase

The distress phase exists when there is reasonable certainty that an aircraft, ship, or other craft or persons on board is in danger and requires immediate assistance. For overdue craft, distress exists when communications searches and other forms of investigation have not succeeded in locating the craft or revising its ETA so that it is no longer considered overdue. If there is sufficient concern for the safety of a craft and the persons aboard to justify search operations, the incident should be classified as being in the distress phase.

11.4 AWARENESS STAGE: METHODS FOR COMMUNICATING DISTRESS

The SAR system's first notification of an actual or potential SAR incident initiates the awareness stage. Persons or craft in difficulty may report a problem, alerting posts may receive information, nearby personnel may observe an incident, or an uncertainty may exist due to lack of communication or non-arrival. Anyone who becomes aware of an actual or potential SAR incident should report it immediately to the appropriate RCC/MRSC. If an SRU receives the information, it should also respond to the incident as appropriate.

Many methods for communicating distress are available to those involved in a maritime distress situation. Some of these communication methods are targeted directly to the rescue centres, while others aim to be seen or heard by anyone nearby. These methods of communication are described next.

11.4.1 Distress signals targeted to rescue centres

These will be seen or heard by the RCC/MRSC first. Then, the RCC/MRSC will relay the information to the other players of the SAR system. Among these means of communication are:

- phone calls (through the RCC/MRSC emergency line);
- EPIRBs and ELTs.

11.4.2 Distress signals targeted to anyone nearby

Most important to your operations are the distress signals that you may see or hear. In some situations, you may be the only link between the vessel in distress and the SAR system. Knowing the distress signals and knowing how to respond to them is of paramount importance for anyone involved in maritime search and rescue.

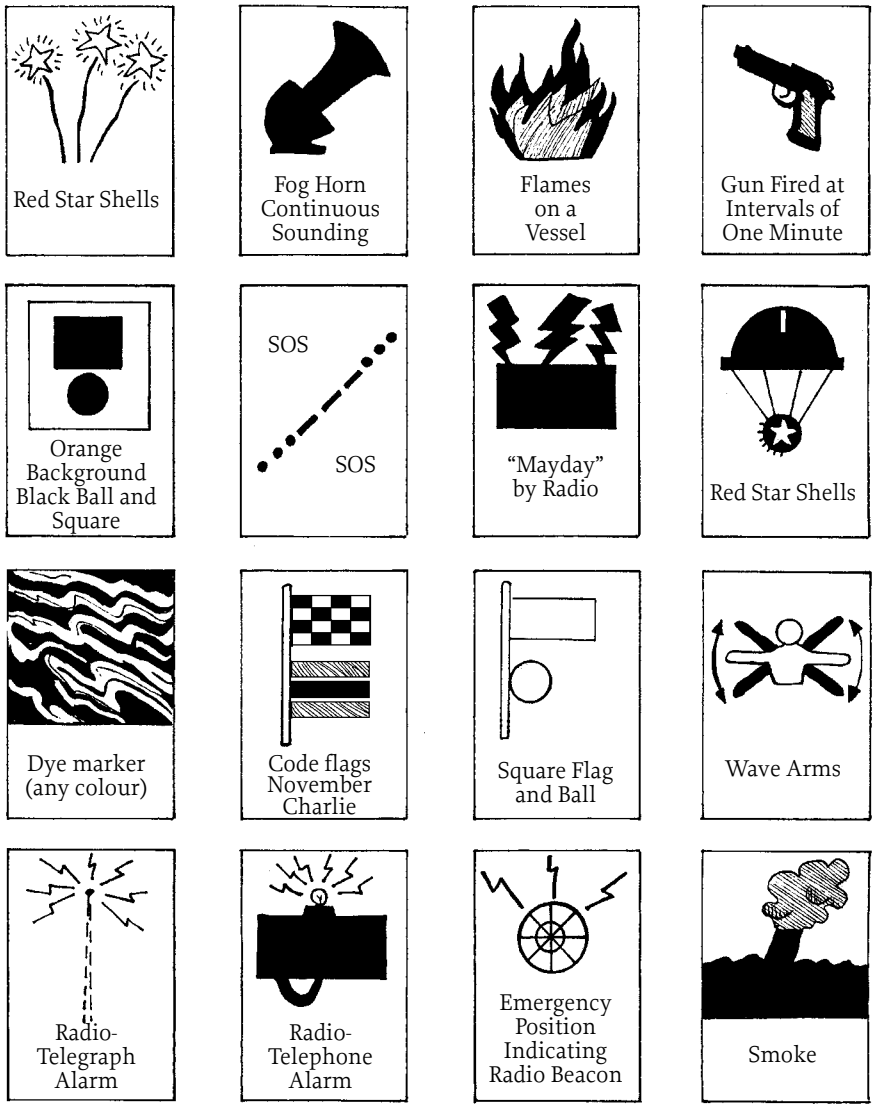


Figure 11.1: Distress signals

Note: Any unusual signal or action you see could be a signal that a craft is in trouble. You should investigate any peculiar or suspicious signals such as the Canadian flag flown upside down or continuous sounding of a horn or fog-signaling device.

11.4.3 Radio communications

When an emergency occurs, different prowords can be used to show the degree of urgency. Hearing one of these urgency calls should trigger specific responses in a listener, such as preparing to collect information on an emergency or refraining from transmitting on the frequency until all is clear. It is normally the responsibility of the MCTS to answer radio distress calls. SRU should respond directly to distress calls only if the MCTS has not responded. The meaning of each urgency call is outlined below.

11.4.3.1 MAYDAY

MAYDAY is a distress call of the highest priority. Spoken three times, it shows that a person, boat, or aircraft is threatened by grave or imminent danger and requires immediate assistance.

A MAYDAY call has absolute priority over all other transmissions and is not addressed to a particular station. All units hearing a MAYDAY call should immediately cease transmissions that may interfere with the distress traffic, and continue to listen on the distress message's frequency.

If the unit transmitting the distress call is determined to be some distance from you, pause a few moments to allow MCTS to answer. Note all the information regarding the distress situation. If MCTS does not respond, you may have to relay that information to them.

Note: When working a distress situation on Channel 16, do not attempt to change (shift) to a working channel until enough information is obtained to handle the distress, in case communications are lost during the act of shifting.

11.4.3.2 PAN-PAN

This urgency signal consists of three repetitions of the group of words "PAN-PAN" (PAHN-PAHN). It means that the calling station has a very urgent message to transmit concerning the safety of a ship, aircraft, vehicle, or person.

11.4.3.3 SÉCURITÉ

"SÉCURITÉ" (SEE-CURE-IT-TAY) is a safety signal spoken three times and transmitted on 2182 kHz or Channel 16. It indicates a message on the safety of navigation, or important weather warnings which will be transmitted on another channel soon (such as 21, 22, 83, etc.).

11.4.3.4 Radio alarm signal

The radio alarm signal consists of two audible tones of different pitch sent alternately, producing a warbling sound. If used, the alarm sends the signal continuously for not less than 30 seconds and not more than one minute, and the recipient of the signal should follow the signal by the radio distress signal and message. There are two primary reasons to use a radio alarm signal:

- to attract the attention of listeners on the frequency;
- to actuate the automatic listening devices found on large ships and occasionally at shore stations.

11.4.4 Receiving a distress message

In the areas where communications with one or more MCTS stations are practicable, ships should wait a short period of time to allow these stations to acknowledge receipt. If MCTS does not respond, and when the distressed unit is in your vicinity, acknowledge receipt of the message. Take all the information and relay that info to MCTS or RCC/MRSC. However, if the unit is determined to be some distance from you, pause a few moments to allow ships or stations nearer the scene to answer.

The receipt of distress messages should be in the following manner:

- the distress signal MAYDAY;
- the call sign of the unit in distress (spoken three (3) times);
- the words THIS IS (spoken once);
- the call sign of your unit (spoken three (3) times);
- the words RECEIVED MAYDAY;
- request essential information needed to effect assistance (position, number of people on board, nature of distress, vessel's description). Obtain less important information in a later transmission;
- the proword OVER.

Inform the distressed unit of any assistance being dispatched and direct them to stand by.

Vessels and shore stations receiving distress traffic should do the following by the most rapid means:

- Forward the information to the MCTS or RCC/MRSC;
- Set a continuous radio watch on frequencies of the distress unit;
- Maintain communications with the distressed unit;
- Maintain distress radio log;
- Keep the RCC/MRSC informed of new developments in the case;
- Obtain radio direction finder bearing of distressed unit if equipment and conditions permit.

Every SRU which acknowledges receipt of distress messages shall transmit the following information to the unit in distress as soon as possible, after ensuring it will not interfere with stations in a better position to render immediate assistance:

- acknowledgment of unit's name and position;
- speed of advance of assisting unit to scene;
- estimated time of arrival at scene.

Keep the distressed unit informed of any circumstances that may effect your assistance, such as speed, sea conditions, etc. Speak in a tone of voice that expresses confidence. After receiving a distress call or information pertaining to one, the SRU shall, (within equipment capabilities), set a continuous radio guard on the frequency of the distressed unit and set up a radio schedule if the distressed unit is unable to stand a continuous watch.

11.4.5 Pyrotechnics

The following are some pyrotechnic emergency signals you may encounter:

- gun or explosive signal fired at about one minute intervals;
- red or orange flare fired one at a time in short intervals;
- rocket parachute showing a red light;
- smoke;
- any flame on a vessel may be used for signaling.

11.4.6 Flag hoists

Flag hoists are a quick method of emergency signaling, but can only be used in the daytime. These are some of the best known examples:

- a square flag with a ball, or ball-shaped object above or below the flag;
- an orange flag;
- November Charlie (N/C) flag.

11.4.7 Hand signals

Possibly the oldest form of signaling is hand signals, but like other methods of visual communication, the signals are not standardized and can be easily misunderstood. Crew members must be constantly alert for hand signals being sent by other mariners that are not standard distress signals, but that may be attempts to indicate an emergency situation. These three standard hand signals are used as distress signals:

- slowly raising and lowering an outstretched arm;
- signaling with an oar raised in the vertical position;
- holding a life jacket aloft.

11.4.8 Light signals

The Morse Code symbols "SOS" (Save Our Ship) transmitted by a flashing light may be used to communicate distress.

S = • • • **O** = — — — **S** = • • •

Strobe lights (possibly attached to a personal flotation device) can also be used. Distress strobe lights will usually emit 50-70 flashes per minute.

11.5 INITIAL ACTION STAGE

The initial action stage is entered when the SAR system begins response, although some activities, such as evaluation, may begin during the preceding awareness stage and continue through all stages. Initial action may include the designation of an SAR mission coordinator (from the staff of a RCC/MRSC), incident evaluation, emergency phase classification, SAR resources alert and communication searches.

11.6 TIMING OF AN SAR MISSION

The order of events in an SAR incident is thus as follows:

- RCC/MRSC is made aware of a marine distress. This could be by telephone from any source, by marine radio from a distress vessel to a MCTS, or by a radio call from another vessel;
- RCC/MRSC gathers information on the case and uses its authority to task vessels;
- The vessel or vessels to be tasked are alerted by a variety of means including radio, telephone, pager, 9-1-1 System, or other emergency alert system;
- If alerted by telephone, an SRU is normally given available information and a tasking (incident) number at that time;
- If alerted by other means, vessels normally contact the RCC/MRSC by telephone (or any other available means) for further information and a task number;
- When ready to launch, or ready to depart, the vessel informs RCC/MRSC with a SITREP of their readiness and situation through MCTS. The MCTS may have further information and instructions from RCC/MRSC and will indicate whether the task is to go forward;
- If a vessel is already on the water when it is alerted, it will be given instructions about the task, a task number, and directions on how to proceed;
- Tasked vessels proceed with the task and transmit SITREPS as necessary or as requested by RCC via MCTS;
- It is normal, and highly recommended, that communications with RCC/MRSC be conducted by VHF communications to the MCTS. The MCTS is in constant and immediate contact with RCC/MRSC and will transmit information and instructions between the SRU and the controller at RCC/MRSC;
- The MCTS will indicate which radio channel is to be used and the frequency of SITREPS they prefer;
- In emergency or special circumstances, you may request MCTS to connect you directly to RCC/MRSC through a duplex channel. This involves the MCTS setting up a radiotelephone connection through a landline to RCC/MRSC.

11.7 SAR COMMUNICATIONS

For any SAR incident, the standard VHF communications procedures are followed. This includes Marine Information broadcasts, Maydays, and Mayday relays. Vessels are required to maintain a continuous radio watch on channel 16 or any frequencies allotted by the controlling authority during a search. When communicating with any civil agencies (e.g., police forces), civil communications procedures may be adopted and employed.

All communications with both the RCC/MRSC and any MCTS are recorded. These daily recordings are kept in secure storage in the event of any legal ramifications.

11.7.1 Communication methods

Communications with RCC/MRSC can be conducted via two modes. One is by telephone (land-based, cellular and satellites) and the other is by radio through the assistance of a radio operator at an MCTS. The RCCs/MRSCs and MCTSs are all linked with dedicated telephone circuits.

It is good practice to log all radio transmissions to and from your station. Also, writing down messages before you send them ensures that all information gets transmitted correctly. When initiating SAR communications with a MCTS, the operator will state "This is Coast Guard/auxiliary vessel (vessel's name) with SAR priority traffic. Over."

The only reason NOT to send information through the MCTS is if the information is of a sensitive nature.

11.7.2 SITREPS

The following information should be included in SITREPS to RCC/MRSC:

- Case number or description of case;
- Number of the situation report (e.g., first, second, eighth, etc.);
- Current date and time;
- Present status – all case details that RCC does not have, including weather conditions;
- Action taken – include all search patterns and movements since departing wharf;
- Future action includes all items that will impact on the future. Include in this section any request for air support; and
- Your signature and vessel name.

Note: All SITREPS should be written prior to transmission.

11.7.3 Communication priorities

The order of priority of radio communications is:

- distress communications;
- urgency communications;
- safety communications.

11.7.4 Release of information to the media and the public

If you are involved in SAR operations, you may sometimes be contacted by the media or the public for information. Facing them is not an easy exercise. Often the local reporters will call you first, even if they know that they should call the closest RCC/MRSC in your area. Their general objective is to have you express emotion or shocking statements for their own audience, particularly in remote stations where the crew is part of a small community. An unsuccessful search is all the more likely to affect you emotionally if the missing souls are people you know from your own town.

Coast Guard and Coast Guard Auxiliary members should follow these guidelines when dealing with the media:

- It is more prudent to respond than to give the impression of being unaware or unresponsive;
- Clearance must be obtained from the RCC/MRSC. The facts given in an interview should be limited to the following (remember to limit your answers to what you know):
  - numbers of resources engaged in the search;
  - number of crew aboard the search unit;
  - numbers of hours your unit has been engaged in the search;
  - the area searched and search results of your unit;
  - weather conditions;
  - your unit's search capabilities.
- Refer of other questions, particularly concerning decisions to carry on with the search, to RCC/MRSC;
- Personal opinions, your feelings about the outcome of the operation, the conduct of the operation or departmental policy must not be discussed. Always refer these types of questions to your RCC/MRSC.

11.8 Planning

All SAR missions are different, yet all SAR mission should be prepared in a similar manner. The following are the general steps involved in the planning of an SAR mission.

11.8.1 Before departure and during transit

The following should be done before departure:

- Gather all the relevant information:
  - Exact location of the incident;
  - Kind of vessel and any useful clues (colour, name, distinctive features, etc.);
  - Number of persons on board;
  - Means of communication with the distressed vessel (cellular phone, radio, etc.);
  - Any other pertinent information.
- Find the best route to reach your destination;
- Calculate your ETA;
- Bring everything you need with you. When deciding what to bring, consider:
  - Weather (raingear? warm clothes? sunglasses? etc.);
  - Expected duration of the mission (bring extra food and water if necessary);
  - Kind of incident (any special equipment needed?).
- Brief the crew:
  - Prepare short-term strategies;
  - Define priorities;
  - Assign tasks;
  - Prepare the equipment that will be needed (pumps, first aid material, towlines, etc.).

11.9 BASIC SEARCH PLANNING

Before SRUs are dispatched, careful planning is needed to accurately determine the area where the survivors are or will be located when the boat arrives on scene. Good SAR planning significantly increases the probability of successfully locating and rescuing those in distress. Planning the search involves calculating datum and then outlining the boundaries of the search area. Most search planning is done by the RCC/MRSC and results in a search action plan. The boat crew then conducts SAR operations based on this search action plan. However, there may be times where you will have to do basic search planning. Search planning also includes risk management to determine what response, if any, is appropriate and which resources are the right ones needed to respond.

11.9.1 Datum

The term "datum" refers to the most probable location of the distressed vessel, corrected for drift over a given period of time. Depending on the information available and its accuracy, datum may be:

- a point;
- a line;
- an area.

As the case develops, datum must be corrected to account for wind and current. Datum is established by the RCC/MRSC.

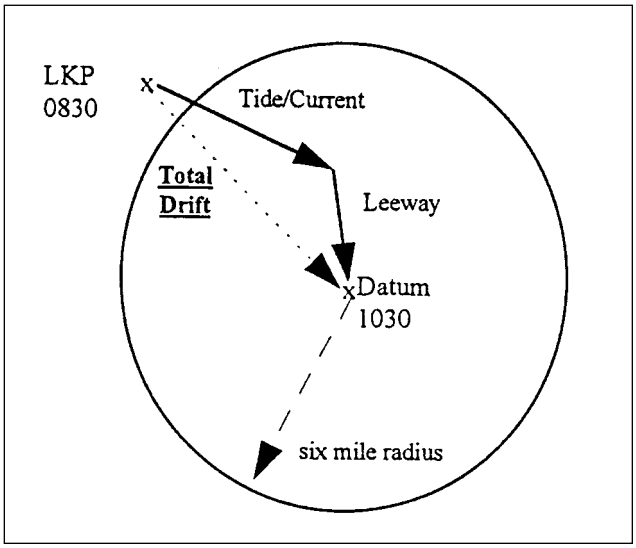


Figure 11.2: Coastal search area calculation

11.9.1.1 Datum point

A point at the centre of the area where it is estimated that the search object is most likely located. The probability of detection (POD) is maximal at that point and decreases as you get away from that point.

11.9.1.2 Datum line

If you cannot pinpoint the location of a distressed boat, you may be able to determine its intended trackline or a line of bearing. The datum line is the intended trackline or line of bearing plotted on the chart. Without more information, it is assumed that the distressed vessel may be anywhere along the length of the plot. The line could also be a direction-finding line of position.

11.9.1.3 Datum area

When you cannot determine either the exact position of the distress or a datum line, a datum area is developed based on many factors, but including as a minimum:

- fuel endurance of the vessel in distress;
- vessel's maximum cruising range;
- wind and currents which affect the search object;
- operator's intentions.

11.9.2 Forces affecting datum

As time progresses, datum must be corrected to compensate for the effects of wind and current. Some of the many natural forces which affect a search object are listed below.

11.9.2.1 Leeway

Leeway is the movement of a search object through the water. Leeway is caused by local winds blowing against the exposed surface of the vessel.

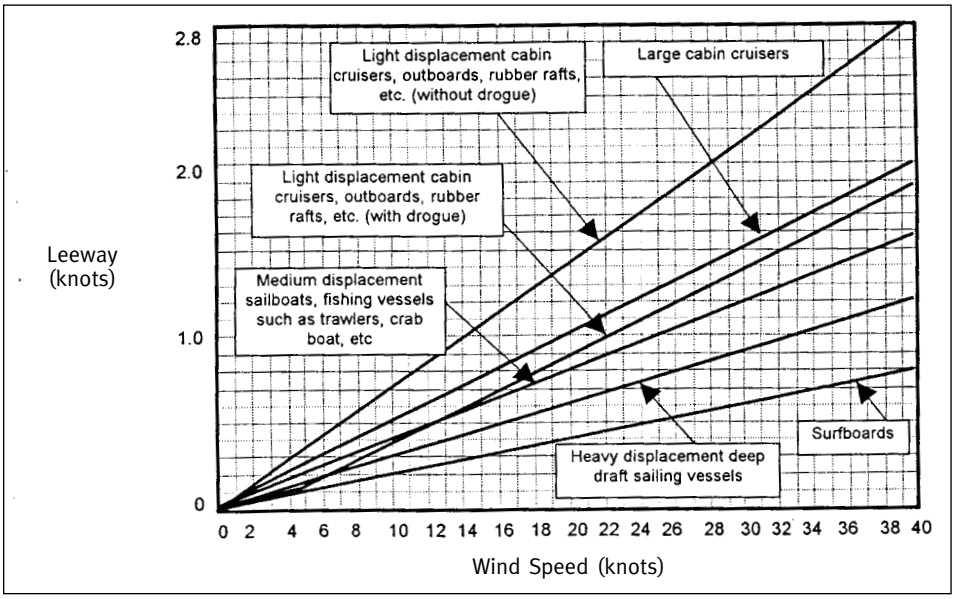


Figure 11.3: Leeway speed graph

11.9.2.2 Local wind-driven current

Wind blowing over the water's surface tends to push the water along in the same direction the wind is blowing. This wind current affects the movement of a search object in open waters. Wind-driven current may not be a factor when searching in coastal waters, small lakes, rivers, or harbours because nearby land masses may block or reduce the effect of wind.

11.9.2.3 Sea current

Sea current refers to the movements of water in the open sea.

11.9.2.4 Tidal current

Tidal current is caused by the rising and falling of tides.

11.9.2.5 River current

The flow of water in a river is called river current. These currents can quickly move a search object over a long distance. This factor should be considered in rivers or at the mouth of a large river.

Note: Drift, in search planning, is the movement of a search object caused by all of the environmental forces.

11.9.3 Search area description

The search area is a geographic area determined by RCC/MRSC as most likely to contain the search object. The amount of error inherent in drift calculations and the navigational capabilities of both the distressed craft and the SRU are used to calculate a search radius.

Note: When response times are short, RCC/MRSC may use a standard radius, adjusted for physical surroundings. When a search can begin in less than six hours, a six-mile radius around a datum adjusted for drift is usually large enough to include most search objects.

Search areas may be described by many methods, including the following:

11.9.3.1 Corner point

In this method, the latitude and longitude (or geographic features) of each corner of the search area are given.

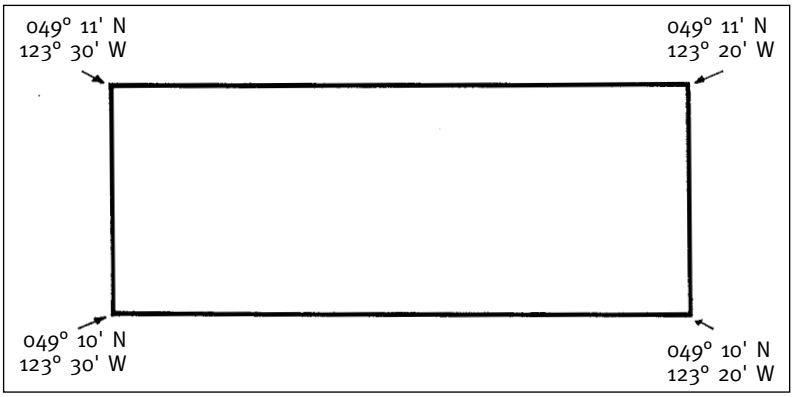
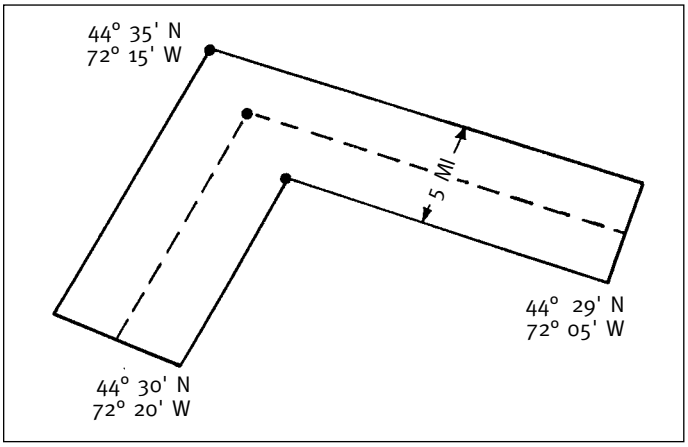


Figure 11.4: Corner Point



11.9.3.2 Trackline

The latitude and longitude of the departure point, turn points, and destination point are given with a specific width along the track.

Figure 11.5: Trackline

11.9.3.3 Centre point (circle)

The latitude and longitude of datum are given, along with a radius around datum.

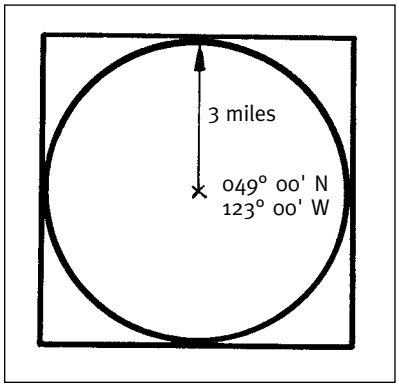


Figure 11.6: Centre point (circle)

11.9.3.4 Centre point (rectangle)

The latitude and longitude of datum are given with the direction of major (longer) axis plus the length and width of the area.

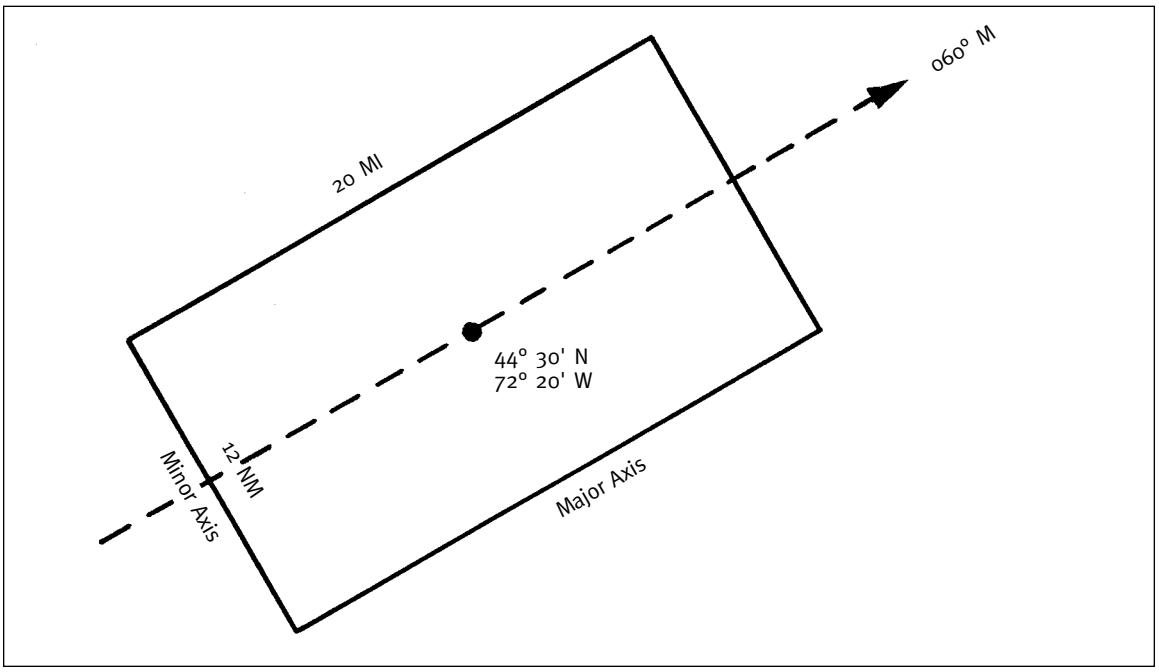


Figure 11.7: Centre point (rectangle)

11.9.3.5 Centre point-landmark (rectangle, bearing and distance)

The centre point, or datum, may also be designated by a bearing and distance from some geographic landmark.

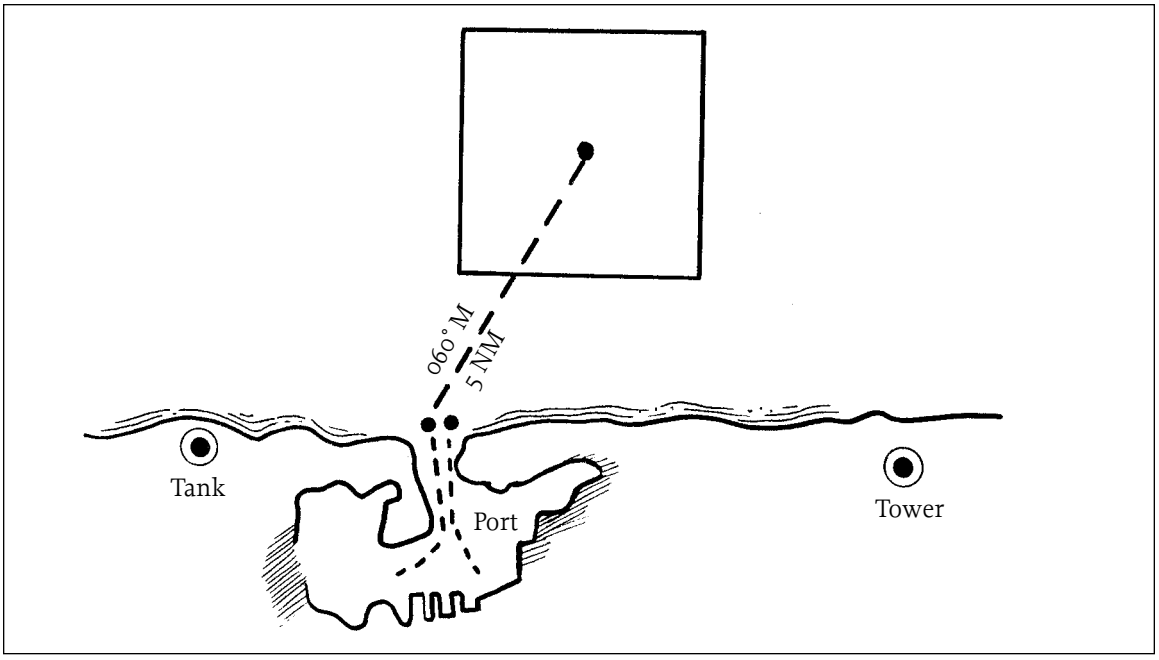


Figure 11.8: Centre point method (rectangle, bearing and distance)

11.9.3.6 Landmark boundaries

Two or more landmarks along a shoreline are given as boundaries of the search area.

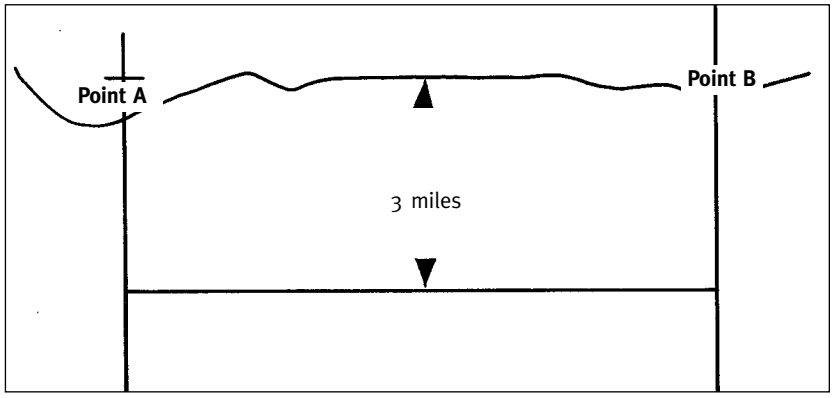


Figure 11.9: Landmark boundary method

11.10 SEARCH PATTERNS

Once a search area has been determined, a systematic search for the object must be planned. If you did the search planning, you will now have to determine which is the best search pattern to use. If RCC/MRSC did all the planning, they should tell you what pattern to use.

Consider the following to determine which search pattern to use:

- weather conditions;
- size of search area;
- size of search object;
- number of search units involved;
- search area location;
- time limitations.

11.10.1 Search pattern designation

Typical search patterns are designated by letters. The first letter indicates the general pattern group:

T = Trackline;
C = Creeping line;
P = Parallel;
V = Sector;
S = Square.

The second letter indicates the number of search units:

S = Single-unit search;
M = Multiunit search.

The third letter indicates specialized SRU patterns or instructions, for example:

R = Return;
N = Non-return.

11.10.1.1 Square patterns (S)

The square search pattern is used when the last known position of a search object has a high degree of accuracy, the search area is small, and a concentrated search is desirable.

Square Single-unit (SS)

In the SS pattern for boats, the first leg is normally in the direction of the search object's drift, and all turns are made 90° to starboard.

Square Multi-unit (SM)

The SM pattern is used when two units are available. The second unit begins on a course 45° to the right of the first unit's course.

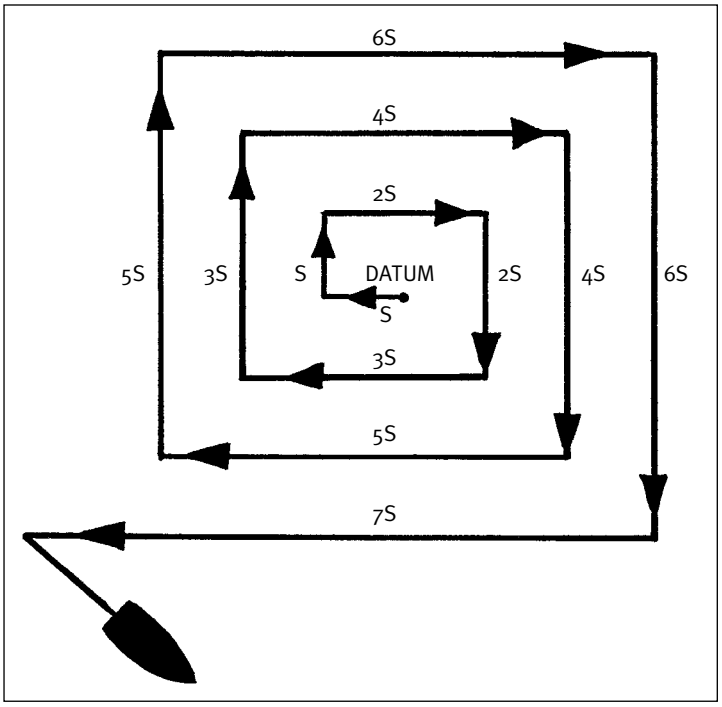


Figure 11.10: Expanding square search (SS)

11.10.1.2 Sector patterns (V)

Sector search patterns are used when datum is established with a high degree of confidence, but the search object is difficult to detect, such as a person in the water. The search unit navigates through datum several times, each time increasing the chances of finding the search object. The pattern resembles the spokes of a wheel with the centre of the wheel at datum. Datum should be marked by the first SRU on scene with a Data Marker Buoy (DMB) or other floating object. By marking the centre of the search pattern, the coxswain has a navigation check each time the boat comes near the centre of the search area (datum). This pattern consists of nine legs. There are two types of sector search patterns: a single-unit and a multi-unit type.

Sector Single-unit (VS)

The VS pattern is used by a single boat. The first leg begins in the same direction as the one the search object is drifting toward. All legs and crosslegs of this pattern are of equal length. After running the first leg, your first turn will be 120° to starboard to begin the first crossleg. All subsequent turns will be 120° to starboard to a course determined by adding 120° to your previous course. Notice that after completing the first leg and crossleg, the second and third legs of the pattern are completed in sequence without turning between.

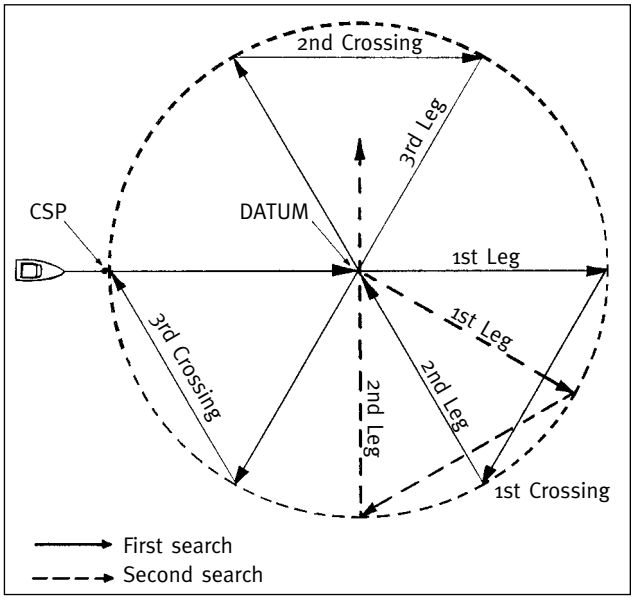


Figure 11.11: Sector pattern: single-unit (VS)

Sector Multi-unit (VM)

The VM pattern is used when a second boat is available. The second boat starts at the same datum, but begins the first leg on a course 90° to the left of the first boat. The search is then the same as a VS pattern. The second boat should start the search at a slower speed than the first boat, if both boats start at the same time. When the first boat is one leg ahead of the second boat, the second boat accelerates to search speed. This slow start by the second boat will keep both boats from arriving at the centre of the search pattern at the same time.

11.10.1.3 Parallel track pattern (P)

Parallel track patterns are used when there is a probability that the search object could be anywhere in the search area. It is a good pattern to use when the approximate location of the search object is known and uniform coverage is desired. Parallel track patterns are the simplest of the search patterns. You steer straight courses on all legs. Each leg is one track spacing from the other. The legs are parallel to the long side or major axis of the search area. There are two types of parallel track patterns.

The Commence Search Point (CSP) for parallel patterns is located at a point $^1/_2$ of the distance selected as the search track spacing inside a corner of the search area. The first and last search legs then run $^1/_2$ track spacing inside the search area boundaries. This prevents excessive duplicate coverage, eliminates the possibility of leaving an unsearched track at the search area boundary, and gives SRUs in adjacent search areas a margin of safety.

Parallel Track Single-unit (PS)

The PS pattern is conducted by a single SRU. The legs of the search are run parallel to the long side (Major Axis) of the search area.

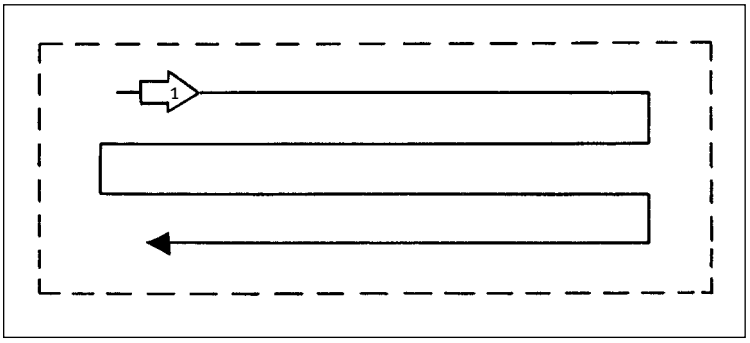


Figure 11.12: Parallel track Single-unit (PS)

Parallel Track Multi-unit (PM)

The Multi-unit (PM) pattern is used under the same circumstances as the (PS), but with more than one SRU. The SRUs are separated by a single track spacing. They search parallel to the long side of the search area. After completing the first search leg, they move over a distance equal to the track spacing times the number of SRUs, and then search back on the reciprocal heading of the first leg.

11.10.1.4 The creeping line single-unit pattern (CS)

The CS pattern is used when the probable location of the search object has been determined to be more likely at one end of the search area than at the other end. Creeping line search patterns are the same as parallel patterns, except that the legs are run parallel to the short side (minor axis) of the search area. This pattern's CSP and search legs are also located 1/2 track spacing inside the search area.

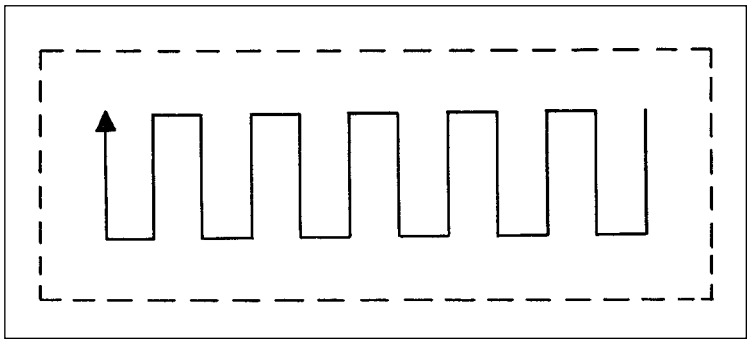


Figure 11.13: Creeping line single-unit (CS)

11.10.1.5 The trackline single-unit return pattern (TSR)

The Trackline Single-unit Return (TSR) pattern is used to search when the only information available on the missing vessel is the intended track of the search object.

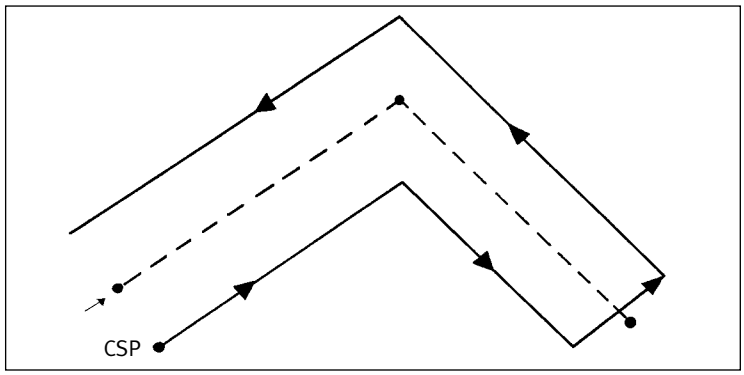


Figure 11.14: Trackline single-unit return (TSR)

11.10.2 Additional search patterns

11.10.2.1 Barrier

The barrier pattern is used in areas with strong current such as a river. The search lies along the path of the current. The boat moves back and forth over the same track. This can be done by steering on an object on each side of the river bank. The boat moves from one side of the search area to the other while the current carries the water and objects past the search barrier.

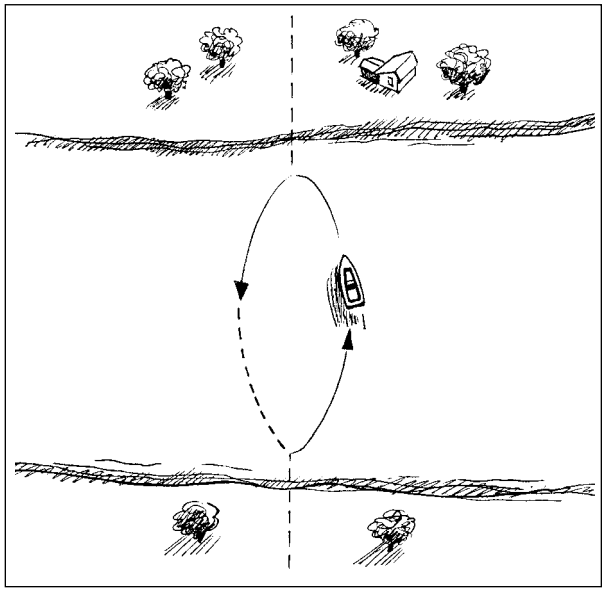


Figure 11.15: The barrier pattern

Since river currents can vary across the width of a river, a more effective barrier might be established by forming a line abreast. This is done by placing observers on each bank and having a boat in the area of swiftest current hold station between the observers on shore. Additional boats, if available, could be added to the line abreast to reduce the effective track spacing and increase the effective coverage. This technique produces a more effective, and predictable, barrier.

11.10.2.2 Shoreline search

Small vessels are normally used to perform the shoreline search, since they can sail close enough to the shoreline to permit careful inspection. Vessels engaged in shoreline searches must be aware of navigational constraints and any limitations imposed by sea conditions. Search planners should consider the possibility of survivors clinging to navigational aids such as buoys, or to rocks off shore. Survivors may make their way to any dry land they drift close enough to see. Survivors may also anchor their boat or raft, or tie it to an offshore navigational aid if they drift into shallow water but still cannot see land or believe they cannot make it to shore unaided.

11.10.3 Initial response

Whenever a case occurs which has an SRU on scene and the object of the distress is not immediately seen or located, report the situation to the RCC/MRSC through the quickest means possible. The RCC/MRSC will immediately start planning and then develop a search action plan. In the meantime, the SRU shall be conducting either an expanding square or sector search using a search radius of 6 NM.

11.10.3.1 Initial response search area

If the search object is not located at arrival on scene, the SRU is to assume it is adrift unless the distressed boat indicated it was at anchor.

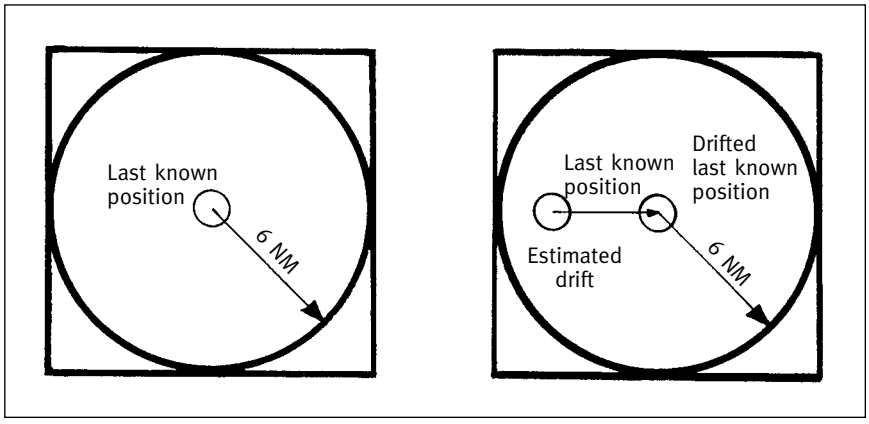


Figure 11.16: Initial response search area

11.10.3.2 Procedure

- Draw a circle with a 6 NM radius centred at the last known position (LKP). If drift is considered significant, the SRU should estimate the drift based on local knowledge/on scene conditions, and centre the 6 NM circle around the drifted LKP;
- Confirm the new datum with the SMC. Remember that the time of datum must take into consideration the underway transit times for the SRU;
- Next draw the search pattern within the tangent of the circle. Datum for the search is the commence search point (CSP). Track spacing can be obtained from the following table.

Table 11.1: Initial track spacing (NM)

Search object	Good conditions Wind < 14 knots Seas < 3 feet	Poor conditions Wind > 15 knots Seas > 3 feet
Person in water	0.1*	0.1*
Object < 15 ft. long	0.5	0.2
Object > 15 ft. long	1.0	1.0

* > 0.1 up to SRU's minimum ability to navigate.

- Orient the search area in the same direction of drift, that is, in the same direction as the total drift vector;
- If the reported position of the distressed craft is in shallow water, it could be at anchor, and a search down the drift line may be appropriate.

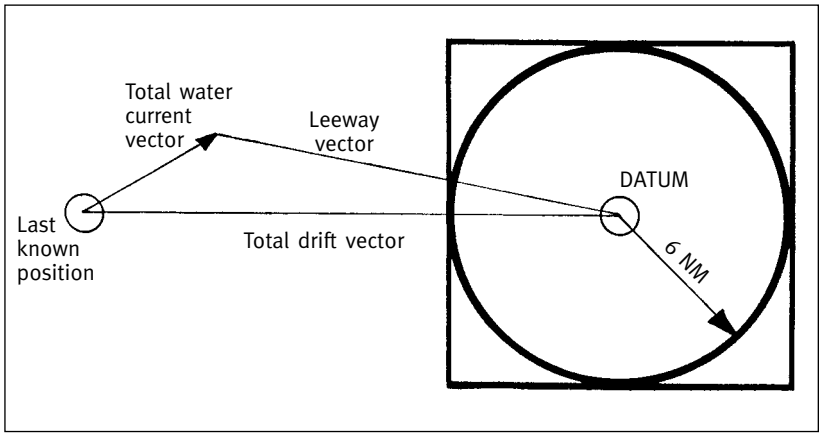


Figure 11.17: Vessel adrift

11.10.4 Communications with RCC/MRSC

The SRU shall also keep the RCC/MRSC constantly updated on conditions and findings, and when nearing completion of initial response search. This direction should not preclude an SRU from using an alternate search pattern or area when it is clearly not practical (e.g., narrow waterway or other physical barrier).

11.10.5 Appropriate search pattern

The preestablished operations and search procedures for the first SRU on scene should be to immediately report to RCC/MRSC the on-scene conditions and findings. Next, begin appropriate search pattern.

Usually an expanding square (SS) is used. This is because it concentrates the search closer to datum, and because the RCC/MRSC usually gives direction and information for conducting and starting a first search fairly quickly. If the search area is confined or there is reason to have a high degree of confidence in the selected datum (e.g., debris found), the surface SRU may use a sector search (VS). Other search patterns may be used as appropriate.

11.10.6 Search area coverage

Search area coverage considers the area to be searched and the SRUs available to search. Once the search area has been determined and the search patterns selected, the next step is to have SRUs conduct the search. Based on the sweep width, an SRU will be assigned its own part of the overall areas to search. Essentially, your boat will start at an assigned commence search point (CSP), steer the track (search leg), and search (sweep down) on both sides of the boat.

11.10.6.1 Sweep width (W)

Sweep width is a distance measured on both sides of an SRU. A sweep width of one mile means 1/2 mile to starboard and 1/2 mile to port for a total "width" of one mile. Sweep width is determined by:

- search object type, size and construction;
- environmental conditions;
- sensor (e.g., visual or radar).

Sweep width is the mathematical expression of a measurement of search potential. It represents the range at which the number of dispersed targets that can be detected beyond these limits is equal to the number which could be missed within the limits. This value is thus less than the maximum detection range.

Table 11.2: Sweep width *(in nautical miles)*

DAYLIGHT SEARCH

	Visibility in nautical miles						
Device	1	3	5	10	15	20	30
Red Balloon	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Life Raft	0.5	1.0	1.4	1.8	1.9	2.0	2.2
Boat (0-30 ft.)	0.5	2.5	2.7	3.9	5.2	5.3	5.5
Boat (30-60 ft.)	0.5	3.5	4.2	6.5	8.5	8.6	8.7
Boat (60-90 ft.)	1.0	3.9	5.0	8.0	11.0	12.0	12.5

Note: Use 1/10 of the life raft width for a man in the water

DARKNESS SEARCH

Life jacket light	1.0
Hand flashlight	3.0
Strobe light	3.5
Hand flare	8.0
Parachute flare	10.0

Note: Estimation only in good visibility

11.10.6.2 Track spacing (S)

Track spacing is the distance between adjacent parallel legs within a search area. These tracks may be conducted simultaneously by multiple units separated by fixed intervals, or they may be the result of successive sweeps conducted by a single SRU. Most of the search patterns described in this chapter consist of equally spaced, parallel search legs (tracks). The distance between adjacent search legs is called the track spacing (S). The best track spacing is a distance which permits maximum expectation of search object detection in the shortest period of time.

11.10.6.3 Commence search point

The commence search point is a point normally specified by the RCC/MRSC at which an SRU must begin its search pattern.

11.10.7 Search preparation

Before beginning a search, you must collect all available facts about a case. The RCC/MRSC should provide most of this information as the search action plan. The checklist below will help you determine whether you have everything you need to begin a mission. Once you have collected all available facts and performed the required search planning, you are ready to get underway.

Answers to the following questions will help determine if you have done everything you need to do before getting underway:

- What is the object of this search and what equipment do the personnel aboard have?
- How many people are involved?
- What is the assigned search area?
- What are the circumstances of their distress?
- What search pattern will be used?
- What is the desired search speed?
- What special equipment is required?
- What radio frequencies will you use?
- Are other units assigned? If so:
  - What kind?
  - What are their search areas?
  - What are their search speeds?
  - What search patterns will they employ?
  - What radio frequencies will they use?
- Do you have all required charts aboard?
- What are the weather and sea conditions?
- Who is on-scene coordinator/coordinator of surface search (OSC/CSS)?
- What unusual circumstances may be encountered? How will you correct for them?

11.10.7.1 Brief crew and lookouts

Crewmembers must be briefed before getting underway. Make sure all crewmembers:

- understand the mission;
- know what they are looking for;
- know where the search will be conducted;
- understand how the search will be conducted.

The coxswain is responsible for the safe operation of the vessel, the safety of all crewmembers on board, and the supervision of lookouts. The coxswain must brief the lookouts so that they are able to perform their duties properly. The following should be considered:

- The coxswain must ensure that lookouts realize the importance of their duties. Lookouts must understand that there are lives at stake and they should search as intently as they would wish someone to search for them. Motivating the lookouts to think positively creates a good chance of success;

- Lookouts should have a full understanding of the details of the case. They should know the nature of the distress, the object of the search, and possible variations to the scenario;
- Caution lookouts to be alert for audible signals of distress such as a whistle or shouting, particularly at night;
- Assign the lookouts a sector of the vessel to search from, and explain the track spacing of the search. Some guidance as to how far from the side of the vessel they should search can be given at this time;
- Instruct lookouts on how to search the area and how to delay fatigue and maintain interest;
- Keep the crew informed of updates and progress of the search including the activities of other units involved in the search;
- Instruct lookouts on the preferred method of reporting a sighted object. The reports should be continuous until the coxswain has sighted the object;
- The coxswain should always confirm to crewmembers the sighting of the object reported.

As the supervisor of the lookouts, coxswains should ensure proper rest for the lookouts. Light refreshments should be on board for the lookouts during their rest periods. Light conversation between lookouts should be encouraged as a means of keeping them alert, but conversation should not detract from their main duty.

11.10.7.2 Search object briefing

Before arrival at the search area, the coxswain of the search vessel should brief all lookouts as to the nature of the distress and the object of the search.

Lookouts should be informed of the nature of the distress. This brings the lookout into the overall picture and establishes the reason for the search. Most searches are the result of an overdue vessel, and the lookout should understand the types of situations the craft may have encountered.

In the marine environment, there may be uncertainty regarding the precise object of the search. The search object may have commenced as a 12 m (40 ft.) vessel but shifted to a life raft or to people in the water. Ensure that all lookouts understand these possibilities.

11.10.7.3 Lookout assignments

The coxswain of the search craft has many duties to perform, including the safe navigation and control of the vessel, communications and plotting. As well, the coxswain must attend to the general supervision of all lookouts. Consequently, she/he cannot devote attention to searching the water surface with the degree of concentration required by a lookout.

The coxswain of the search vessel should not take on any lookout duties except those relating to the safe navigation and control of the vessel, unless numbers of lookouts dictate otherwise.

The coxswain of the search vessel should ensure there are enough crew aboard to conduct an effective search. The minimum number of crew is two, one searching to starboard and one to port. An additional crewmember is desirable to relieve the lookouts and the helmsman, if possible. Sufficient lookouts permit a relief rotation system, thus allowing each an opportunity to rest their eyes between periods of lookout. Even a change of sector may require a rest, given the differences in wind and light conditions.

11.11 CONDUCTING A SEARCH

It is critical that an SRU perform all duties assigned in a correct and predictable fashion. In this case the term SRU includes the vessel, crew, and equipment. Search planners, OSCs/CCSs, RCCs/MRSCs and others all make plans based on assumptions they have made. These assumptions are considered when making decisions that could have life and death consequences for someone who may be the object of a major Coast Guard search effort. One assumption made by SAR planners is that the SRU, its crew, and equipment all perform as planned, completing all missions assigned unless advised otherwise.

In some instances, SRUs have failed to properly complete their assigned mission. Reasons may include not having proper equipment on board, or a crewmember not fully prepared, trained, or qualified, or a failure to complete some task. There have been instances when an SRU failed to fully search an assigned area or, due to careless navigation, failed to search in the area assigned. Actual searches and rescues are typically carried out when conditions are at their worst, making even simple and routine tasks extremely difficult. Accurate navigation, observant lookouts, and trained and knowledgeable crewmembers can make the difference between successful cases and disasters.

All effort expended to carefully gather key information, to plan the most effective search, or select exactly the right SRU is wasted if the SRU performing the search or rescue fails to do so in a professional manner to the best of its ability. If you are not able to complete the search (e.g., equipment failure, poor visibility or worsening weather), advise the RCC/MRSC what areas were searched.

11.11.1 Visual search procedures

Be conscious at all times that there is no one else scanning your search sector. You have a heavy responsibility to stay alert and to be thorough. A lookout should use the proper equipment, have a methodical

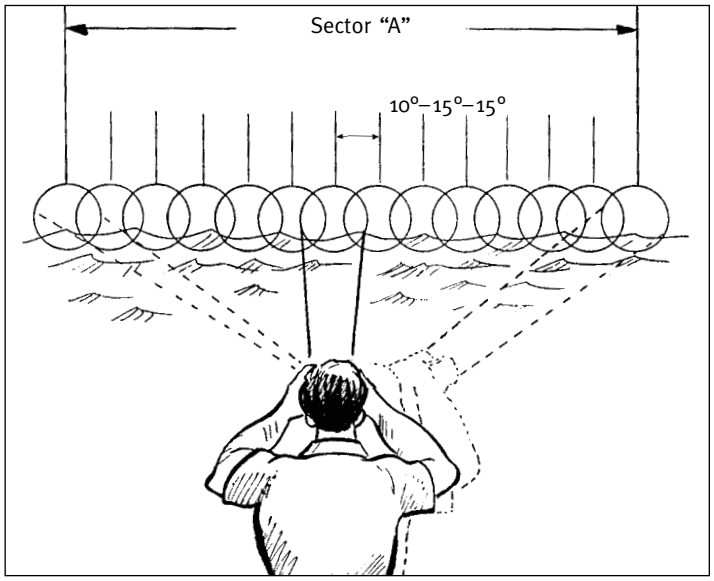


Figure 11.18:
The SCAN-FOCUS-SCAN technique

approach to searching, and be able to report any sightings within the assigned sector to the search vessel coxswain in a clear manner.

Use a methodical approach to searching an assigned area. Begin to search the assigned sector by starting a sweep near the vessel and working out in a series of parallel lines to the edge of the search sector. When you have completed the sweep, give your eyes a five to ten second rest. Then begin another search of your sector.

With the eyes focused straight ahead, the lookout should move his/her head to search the assigned area. Searching an area using eyes alone, without any head movement, can lead to an overexertion of the eye muscles, causing early fatigue.

The sequence of "SCAN-FOCUS-SCAN" should be performed in segments of 10-15°, as this technique allows your eyes to register objects within an 8° radius around the focused position. If you scan continuously without focusing, or focus beyond the 15° limit, efficiency decreases.

In night searches, weak lights are detectable at the edge of sight, not at the point of focus. Consequently, focus slightly higher than the horizon and be alert for distant flares or other visual distress signals.

It is usual for a person to take up to 30 minutes or more to become fully adapted to night-light. Therefore, avoid glare and reflection on board in order to preserve night vision.

Relate the speed for searching the assigned area to the speed of the search platform. The faster the search vessel proceeds through an area, the faster you have to search the sector.

Sunglasses should be used when scanning up-sun, and are recommended for continuous use during searches in bright daylight or high glare conditions. Sunglasses that filter rays from the infrared and ultraviolet spectrum provide proper eye protection.

Binoculars should not be used for scanning. Once an object has been located, binoculars may be used to identify it. Binoculars should be kept clean and readily available to the lookout.

Rotate positions every half-hour with increased frequency during poor or dull weather. In good conditions, you will be effective no more than two hours without rest. After this time, your concentration will deteriorate rapidly, and the vessel will become less effective as a search unit.

Maintain eye contact with any sighting. Attention should be attracted through a prearranged method of reporting by hailing, intercom, or other means. At no time should eye contact with the sighted object be lost while notifying the coxswain.

11.11.2 Locating the search object

Whatever the search object may be, the initial sighting of all search objects must be reported to the RCC/MRSC. The initial report will often be brief, because of the lack of information on approach, but should include:

- a description of the search object including the number of persons sighted;
- the location and on-scene weather;

- any special problems anticipated in approach or recovery;
- need for additional resources; and
- your intentions.

After the initial sighting, and while still approaching, the coxswain must continue to evaluate the situation, while formulating a rescue plan (SAP). Assessing a rescue situation is a continuous process of evaluating existing conditions. It is more than just a single step in an operation, because the assessment is never complete until the situation is under control. Communication between the crewmembers at this phase is extremely important. The coxswain must inform the crew of his or her rescue plan (and, preferably, an alternative or contingency plan). Crews must quickly prepare any required equipment or rescue devices.

The coxswain must continue to keep the RCC/MRSC informed of developments throughout the rescue phase and, in particular, the number of persons recovered and/or still unaccounted for.

11.11.2.1 Locating surface craft

A marine distress often involves a vessel still afloat but in need of assistance. In good weather and sea conditions, larger vessels are normally good visual and radar targets. Small surface vessels are usually more difficult to detect by either visual or electronic means. The best detection aid during good visibility periods is an alert lookout.

The probability of detection of even large vessels in rough seas is greatly over-estimated by many searchers. In some cases, large vessels are not detected until the SRU is close. Small craft are usually extremely difficult to detect under such conditions. In many instances, search aircraft have flown directly overhead without sighting them. At night, if the disabled vessel has the ability to turn on lights, the probability of detection is increased. When radar is used in the search for a distressed vessel, adverse sea conditions may interfere with radar and hamper identification of the target. When searching, lookouts should be alert for pyrotechnics, lights, smoke, or visual signals of any type or colour. When a possible rescue craft is sighted or heard, survivors will usually grab the closest signaling device available. Lookouts should also be alert for shouts, screams, or whistles from the survivors, as they may see the rescue craft before it sees them.

If a single distressed vessel has foundered prior to the arrival of rescue units, the most probable search objects will be lifeboats, rafts, debris, oil, and people in the water.

The scene of a major incident is usually marked with considerable debris. Often an oil slick is present. The debris will usually be found downwind of the origin of the oil slick, and boats and rafts will usually be downwind of the debris. Persons in the water are often found in the area of the debris clinging to floating objects. If the vessel was abandoned sometime before sinking, lifeboats, rafts, and personnel may be located upwind of the point of the foundering. Because of this, SRUs should search in all directions from the oil and debris area.

Lifeboats from large vessels are usually equipped with ample pyrotechnic and visual aids, and may carry emergency radios. Many also have power and/or sail propulsion. If more than one boat is launched, they might be grouped or tied together to make sighting easier. Dinghies or rafts for small craft usually have only a limited supply of visual detection aids, and in many cases do not have any.

Remember that vessel operators who are in distress are often disoriented. Be prepared to ask the types of questions that will assist you in determining the correct position of the distressed vessel. You may obtain valuable clues to its whereabouts by asking the vessel operator what he or she can see in the way of prominent landmasses, navigation aids, other vessels, or aircraft. By asking the operator to determine the bearings of such objects, you may be able to cross-reference these observations with your charts, and thus considerably reduce the search area.

Ask the operator what depth of water the vessel is in. The answer may enable you to ascertain a fathom line to follow for search purposes.

In darkness you may request the distressed vessel to fire a flare or to use some other type of illumination for you to observe (such as a searchlight). If such equipment is not available to the distressed vessel, you may use your own flares so that the distressed vessel can give you a reciprocal bearing. Whenever flares are used to obtain bearings or for illumination purposes, RCC must be advised.

11.11.2.2 Locating overdue vessels

Contact marina managers to see if the missing vessel has been in the area. If so, find out when they were there, when they left, and where they were going. (Boaters change their plans and forget to tell anyone, but may have mentioned alternate plans.)

Contact all marinas in the area to see if the vessel has docked somewhere other than the original destination. Check every vessel carefully for license number, description, and name. REMEMBER, there is no time limit on a search. It is not a race, and the watchword is thoroughness.

The vessel description may not always be accurate. Check each boat closely. There have been cases where the search has been for a pleasure craft, and the boat turned out to be a sailing vessel or a fishing boat.

Check the parking lot for the missing person's vehicle (assuming they have one). If the vehicle is still there, the person may not have returned yet. If the vehicle is not there, then the person may have returned and not told anyone. Relay this information to the CGRS by radio or RCC via landline.

Check all over the marina and floats. The missing party may have returned and tied up at a different spot than expected.

If there are other people around on the floats, tell them who you are and what you are doing. You may receive unexpected information concerning the whereabouts of the missing vessel.

Always do a thorough check of the area that the vessel departed from. Some people reported as overdue never actually began their journeys. Remember, they may have been reported overdue because they have simply not arrived at their destination.

11.11.2.3 Locating disoriented or lost vessels

This type of incident involves anything from a full-scale search to simply contacting the vessel (if possible) to ascertain their heading, course, and speed before they became lost. If possible, the vessel might relay the relative bearings of passing ships, aircraft, prominent landmarks, and the depth of the water in the area.

At night, a lost vessel could fire flares, flash navigation or searchlights, and use sound signals. You may also fire flares, and flash your navigation lights to get a relative bearing from the subject vessel. If VHF communications are established, MCTS may assist by Direction Finding (DF), or by providing positions of unidentified radar targets.

This is a "Sherlock Holmes" type of situation where the searcher must rely on information from the subject vessel, including the provisions of signals. Use your ingenuity and common sense at all times.

Note: Any time a flare is fired in order to establish bearing, rcc/mrsc must be advised.

11.11.2.4 Locating abandoned vessels

Treat abandoned vessels as though there might be a person or persons overboard or in a raft or dinghy close by. Check all circumstances and available information carefully. Often the vessel has broken or been cut free from its moorings. But, if it is full of fishing gear with lines out, someone is probably missing.

Always advise RCC/MRSC of the position and circumstances of an abandoned vessel. If any doubt exists, begin an Expanding Square or Sector Search. Use the vessel as datum and continue searching until RCC/MRSC advises further action.

11.11.2.5 Locating distressed aircraft

With the exception of seaplanes, aircraft usually sink rapidly after ditching, and the only objects normally found are pneumatic rafts and pieces of debris. If the aircraft has crashed rather than made a controlled ditch, there may be nothing more than an oil slick. Large aircraft flying over water have an adequate supply of life rafts, visual aids, and emergency portable radios. The rafts in transport aircraft are, for the most part, the large 20-man type. In military aircraft, the 7-man type is still in wide use, as well as the 20-man type. Single-engine military aircraft will usually be equipped with a one or two-man raft. Small civilian aircraft will probably carry only the one-man life raft if they carry any at all.

11.11.2.6 Locating person in the water

Locating a person in the water can be a difficult task due to sea state, weather conditions, time of day, and most importantly, absence of a flotation device. If the person is not wearing a flotation device, in most instances all that will be visible is the head. If they are wearing a flotation device, the head and shoulders will probably be visible. Be on the lookout for floating debris. The missing person(s) may be clinging to the debris.

11.11.3 Foundered or sunken vessels

If the search object has been located after it has sunk, follow these general guidelines:

- Deploy a DMB;
- Inform RCC/MRSC of the location, depth, and evidence of the sunken vessel;
- Commence a search for survivors;
- If survivors are located, determine whether any others may be trapped in the vessel. If trapped persons are suspected, request divers;
- If an emergency position-indicating radiobeacon (EPIRB) is found, do not recover it. Leave it to mark the position.

11.11.4 Search reduction

RCC/MRSC is the only authority that can recommend the reduction of a search. In certain circumstances, the decision is then relayed to NDHQ, which can either approve or deny the recommendation.

The OSC/CSS may make a recommendation for reduction of the search only after the search area has been adequately covered and there is no likelihood that survivors will be recovered. To make the reduction decision, RCC/MRSC needs to have a complete list of facts from the SAR crews involved. These facts include:

- all important times (time on scene, time search commenced, etc.);
- the weather and especially the visibility in the area;
- the area covered in each search and the type of search;
- all sightings of debris and other objects in the water;
- other relevant information such as crew fatigue; and
- any change in any condition on scene (change in wind direction, increased wave height, etc.).

The above facts should be relayed to the RCC/MRSC, as applicable, with the regular sitreps.

11.11.4.1 Cessation of searches

The ending of a search is looked upon as a reduction in the search. Searches may be reopened whenever new evidence indicating that survivors may be located is uncovered.

11.12 Rescue

Once the search object has been located, you will have to begin the rescue part of the mission. The prime objective of all rescue operations is to ensure the safety of human life. Rescue operations begin when the search object location is known, and includes all actions taken to free persons from suffering, injury, or death.

It is obvious that no two rescue situations will be alike in all respects. Each situation must be evaluated by the rescue crew to determine the strategy and tactics required to bring about a successful conclusion. However, some procedures can be standardized to a certain extent with due regard to the variables of sea, weather, geographic location, and physical characteristics of the disabled craft, persons, and the rescue vehicle.

11.12.1 Arriving on scene

When arriving on the scene:

- advise RCC/MRSC of your arrival on scene;
- SAP (Stop, Assess and Plan):
  - persons in the water?
  - vessel's position;
  - direction of wind and current;
  - best approach angle;
  - lines in the water;
  - good securing points;
  - any obstructions on vessel;
  - general condition of the vessel;
  - modify or adapt your short-term strategies if needed;
  - determine closest safe heaven;
  - assign duties to crewmembers.
- recover all PIW;
- board the vessel in the most appropriate manner:
  - instruct the crew of the vessel to don PFDs;
  - discuss your plans with the master of the vessel in need of assistance;
  - ask the master to sign the waiver.
- advise RCC/MRSC of your intentions;
- provide the required assistance.

11.12.2 Recovering persons in the water

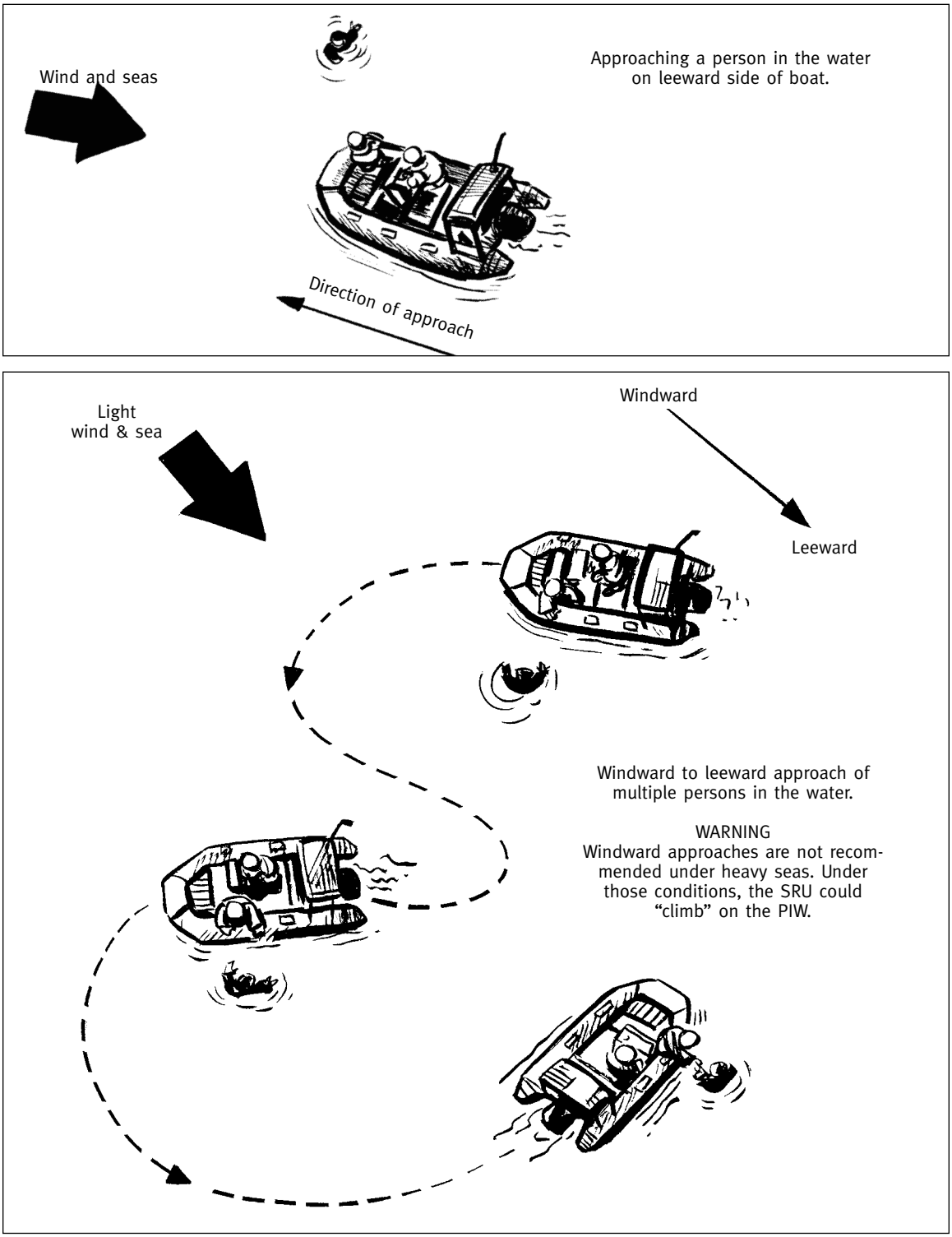


Figure 11.19: Approaching a person in the water

WARNING

Recoveries of persons in the water are delicate operations. Inappropriate techniques could cause serious injuries.

11.12.2.1 General guidelines

The crew must be briefed of the coxswain's intentions for the method of recovery and maintain situation awareness at all time. All required equipment should be prepared in advance (e.g., blankets, hot packs, Heat Treat, ladders, tender, scramble nets, rescue frames, etc.).

The system for approaching a person in the water should be well-known to all crewmembers, because it is exactly the same as person-overboard recovery operations (which should be practiced regularly by every vessel engaged in SAR). A pointer must be designated and endeavor to always keep the person in the water in sight. The pointer will position himself or herself in visual and verbal contact with the coxswain and direct him or her to the person until the person is alongside the rescue zone. The coxswain manoeuvers into position under the guidance of the pointer and stops the propellers upon approaching the person. The pickup person or team takes direction from the coxswain regarding the pickup side, and positions itself to aid the person out of the water.

People immersed in cold water will rapidly lose muscle strength and coordination, and may not be able to help themselves. They may have to be assisted every step of the way to recovery.

Normally, people in the water receive the highest priority. Seconds count, but bear in mind that suspected hypothermia victims should always be recovered gently and horizontally to reduce the chance of rapid blood pressure drop.

The general guideline for PIW recovery are as follows:

- Recover those persons who are without flotation aid before those with flotation;
- Recover those without hypothermia protection before those with hypothermia protection;
- Interview all survivors at the earliest opportunity to determine whether others are in the water and were seen;
- In cases of locating numbers of people in the water, provide temporary flotation during recovery operations (life rings, life raft, utility boat, etc.);
- Treat all immersed victims for hypothermia;
- Do not leave the scene until you are sure that all survivors have been recovered and the RCC/MRSC concurs.

11.12.2.2 Methods of recovery

Two broad categories of recovery methods exist. Direct methods involve direct contact between the rescuers and the victim, while indirect methods involve the use of various devices to assist the recovery. Since direct methods are often more hazardous to the rescuers, indirect methods should be used first. When all indirect methods have failed, use direct methods to conclude the recovery. When you need to rely on a direct method, ensure that the crewmember attempting the recovery is familiar with possible hazards (panicked victim grabbing the rescuer, cold water, etc.) and have him or her properly dressed for the job (cold protection, fins, swimming goggles if necessary, etc.).

Indirect methods to recover persons in the water involve the use of various piece of equipment. The usual methods of recovery generally involve the use of:

- floating objects;
  - – throwing bags;
  - – life buoy;
  - – any buoyant line.
- rescue frames and Jason's ladders;
- Man Overboard Rescue System (inflatable platform);
- ladders;
- fishing nets;
- etc.

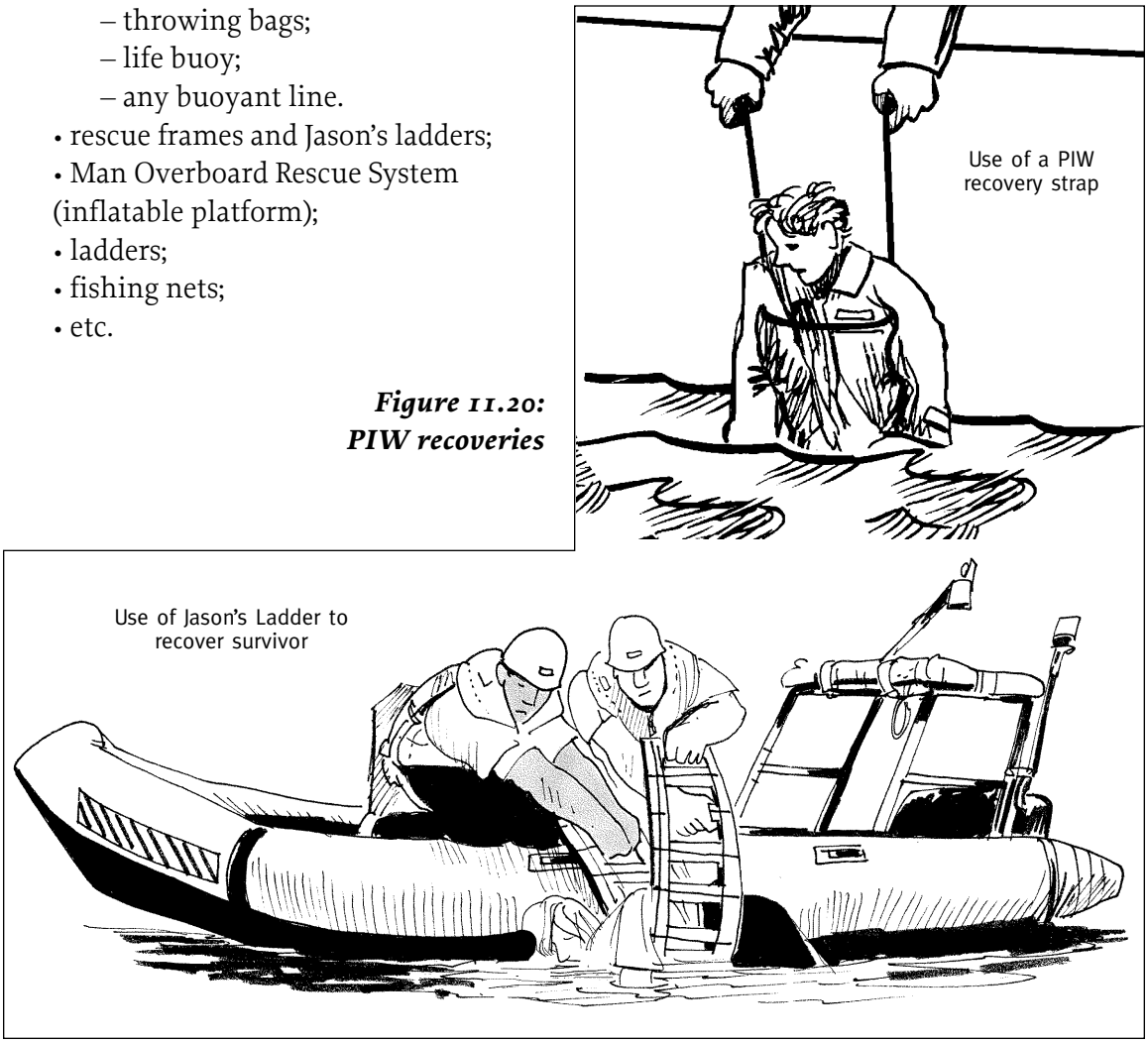


Figure 11.20: PIW recoveries

11.12.3 Rescue of persons from burning vessels

Burning vessels present a difficult situation for SAR crews. The problem must be dealt with on the basis of elimination. The first priority is to save lives. The second is to prevent the fire from endangering other vessels or third parties, and the third is to reduce property damage. A small SAR crew is limited in its ability to save persons from a burning vessel and go into a fire-fighting mode to extinguish the fire and save the burning vessel. Complete emergency systems, including fire departments, emergency health services, and police may accomplish this task ashore, but an SAR crew of three or four cannot be directly compared to such a system. Often, when the lifesaving aspects are dealt with, the victims must be treated and evacuated to medical care, leaving the vessel to continue burning.

WARNING

The coxswain must be aware of the unit's limitations, and in particular, know when to call off an operation. All fire-fighting operations are inherently dangerous. Any fire-fighting

attempt must take into consideration the limited training and equipment provided to SAR crews for this purpose.

Crews should avoid entering burning vessels at all cost. If you do enter, do it only if there is a possibility of rescuing victims and only if proper protective gear is available. If all persons are accounted for, any fire fighting operations to reduce property damage should not include entering the vessel until the fire is out and the situation is at the overhaul stage.

SAR crews must exercise particular caution when attending a burning gasoline-powered craft. If the gasoline vapours have not already ignited by the time the SAR craft is on scene, the risk of gasoline vapor explosion will be very high. Rescue efforts must be concentrated on securing the safety of the persons aboard. DO NOT EXPOSE THE SAR CREW TO TOXIC FUMES OR RISK OF EXPLOSION FROM COMPRESSED GAS, PROPANE, ETC.

11.12.3.1 Guidelines

The following are general guidelines for rescue from a burning vessel at sea:

- The first task is to establish the safety of all persons aboard. Rescue persons as you see them and in order of greatest peril (i.e., from the vessel or in the water based on who appears most endangered). Establish the number of persons on board and whether they are accounted for. If the fire is very small, putting a crewmember aboard to search for victims may be appropriate. If approaching the vessel for transfer, approach from upwind, and if possible, conduct personnel transfers bow to bow. If a crewmember boards, all protective clothing and equipment must be worn, and communication maintained between the coxswain and crewmember boarding;
- When transferring personnel bow to bow, ensure that the transfer will be done quickly and effectively. Ideally, you should ask the crew of the burning vessel to regroup on the bow and conduct only one transfer (if boat sizes permits). Remember that you are in a very vulnerable position and that your own lives could be at risk if an explosion was to occur;
- If the bow-to-bow approach is impossible, advise the crew of the burning vessel to don PFDs and protective clothing (if available) and ask them to jump in the water;
- People in the water will generally be found on the upwind side of a burning and drifting vessel, as the wind will tend to push the vessel faster than the persons in the water;
- Use appropriate techniques for the search and rescue of either victims in the water or persons on the vessel. The latter may require an aggressive attack on the fire;
- After all victims are accounted for and secure, proceed with first aid and evacuation as required. If there is no requirement for first aid or evacuation, the fire may be fought to reduce property damage, but the SAR crew should not be placed at risk. In some cases, the vessel is best left to burn, particularly in the case of smaller vessels, which are often totally destroyed within minutes. However, in situations where the burning vessel is in a confined area that may jeopardize other structures or vessels, or block channels, etc., towing the vessel clear of the area may be required. It may also be appropriate to tow a burning vessel clear of a fishing bank, as it may become a hazard for fishing trawlers.

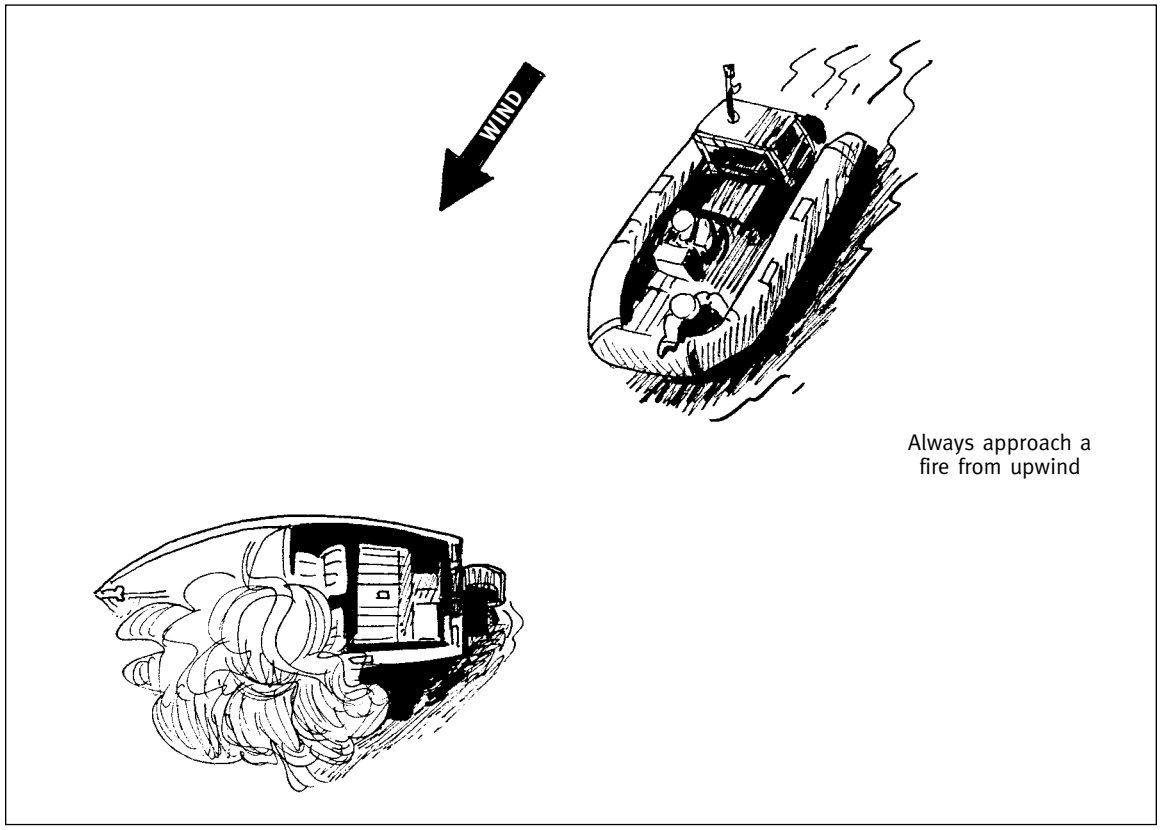


Figure 11.21: Approaching burning vessel

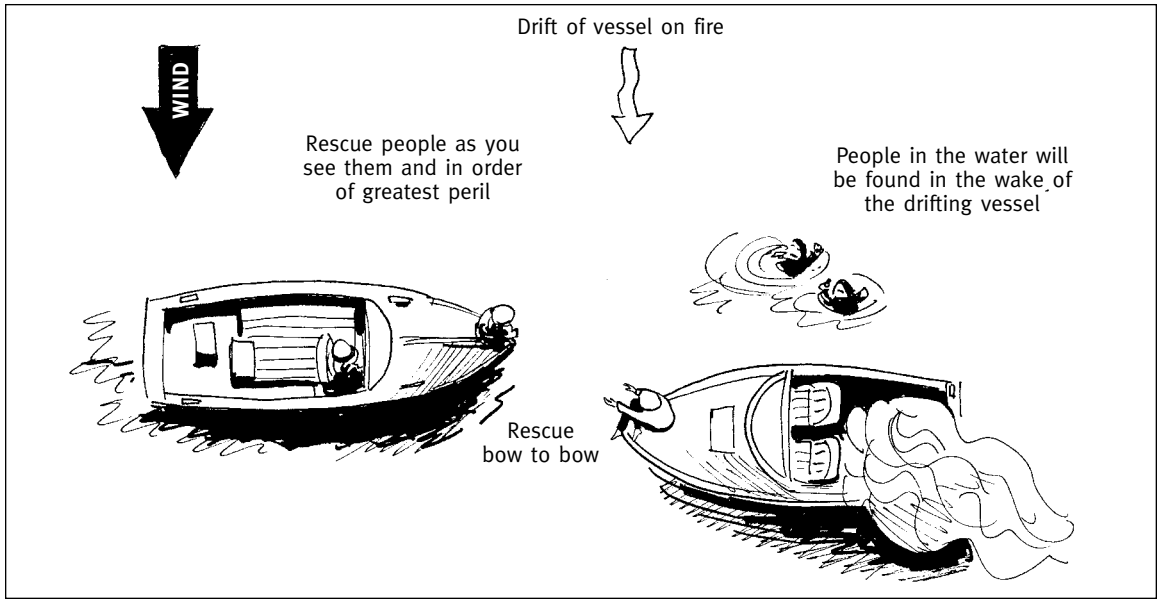


Figure 11.22: Bow-to-bow transfer

11.12.3.2 Vessel on fire at fuel docks and marinas

Vessels may catch fire while secured to fuel docks and marinas, exposing persons and other property to danger. The first task as always is to save lives and reduce injury, even though the fire may rapidly spread and destroy adjacent property.

The following are general guidelines for responding to vessel fires at fuel docks and marinas:

- Ensure that all persons from the vessel and immediate surroundings are accounted for;
- Explosions often throw people from the vessel into the water or onto adjacent vessels and structures. Check the vessel and surrounding areas for victims;
- Towing the burning vessel away from other vessels and structures is often necessary to protect property. Often, when an SRU arrives on scene, people have already slipped the vessel and pushed it off. This can have drastic consequences if the vessel drifts into others and spreads the fire further. The safest method of removal is to throw a grapnel hook and chain aboard the vessel and tow into clear water, where the fire may be attacked or allowed to burn out. Always have a crewmember ready to cut the towline when towing a burning vessel should it sink or endanger the SRU;
- If the burning vessel cannot be removed, remove other vessels that may be in danger of fire spread. Cool exposures with a fog fire stream;
- Do not endanger crewmembers by entering burning vessels that have no persons to be rescued aboard. The fire may be attacked from outside the vessel.

11.12.4 Rescue from survival craft

Rescue from survival craft may involve dealing with life rafts, open lifeboats, enclosed lifeboats, or any of a number of types of survival capsules. Rescue and transfer of personnel may be complicated by the physical condition of the survivors and the physical characteristics of the survival craft. Modern, totally-enclosed survival craft are designed to provide an optimum survival platform, and are often not conducive to sea-kindly riding and manoeuvering. Many of the enclosed survival craft are very buoyant by nature of their construction, and have an extremely lively motion at sea. Each situation requires careful evaluation before approaching the survival craft to determine whether:

- immediate removal of personnel is safe or required;
- standby is required to await improvements in weather/sea conditions or removal by other means (such as helicopter); or
- towing the craft without removing personnel is safe and appropriate (e.g., enclosed survival craft).

There have been cases of survivors found safe in a survival craft only to be accidentally rammed in heavy seas by their would-be rescue ship trying to manoeuver alongside. Modern enclosed survival craft can safely and effectively maintain survivors in relative protection for long periods of time. In some cases, there is no need for immediate removal of personnel from the craft.

Some survival craft are self-righting with all hatches sealed and all personnel strapped into their seats. These boats are capable of operating at full capacity and at six knots for a period of 24 hours. Boats for tanker vessels will have a self-contained breathing air supply together with water spray coverage for the exposed hull, and can operate in fire or a toxic atmosphere safely for a period of ten minutes. The hatches on these craft are very small in order to accommodate both the self-righting and fire survivability features. However, the small hatches also make transfer of personnel difficult. Transfer of injured or sick personnel may be extremely dangerous in even a moderate sea.

Approaching survival craft in a seaway may require the SRU to get close enough to remove personnel or to pass a line to the craft. The lee provided by a vessel is approximately triangular in shape and extends about one and one-half ship lengths downwind at its farthest point. The exact size and shape of this lee will depend on the freeboard, length, and shape of the vessel's house works.

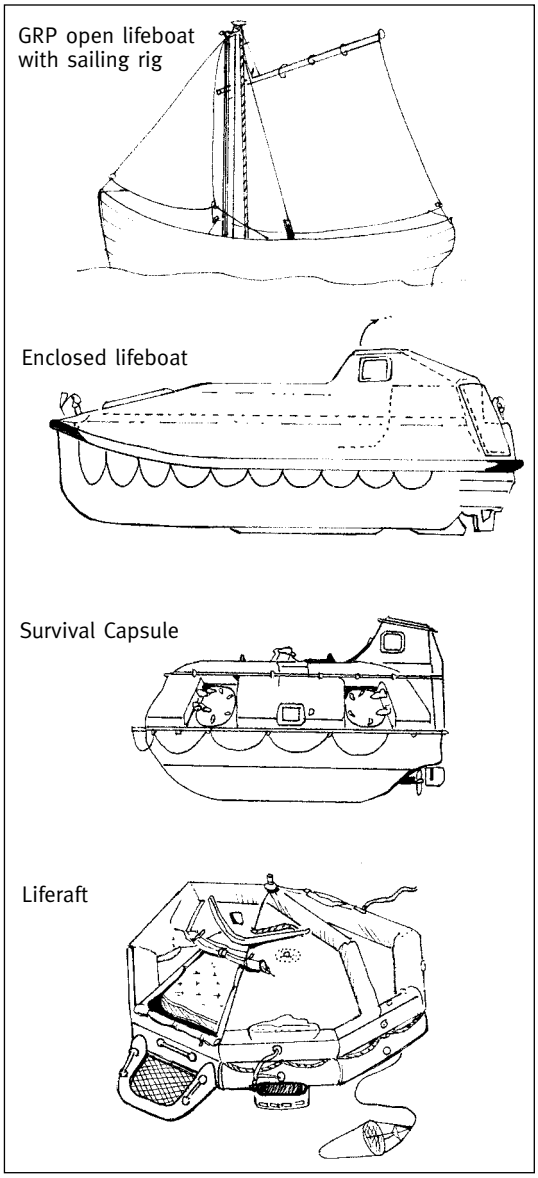


Figure 11.23: Survival craft

11.13 GROUNDED VESSELS AND DAMAGE CONTROL

Before assisting a boat aground, the coxswain must make a thorough analysis of the situation. The following are some key points to consider:

- Was anyone injured in the grounding? Are all occupants safe and accounted for? Is there any risk of having to enter the water? Advise occupants to don life jackets, and hypothermia protection as the circumstances dictate. Advise them to prepare life raft/lifeboat as the circumstances dictate. Is medical aid required? Above all, remember that your number-one priority is to save lives. In some cases, that may be all that you do in your tasking;
- Is the vessel damaged or taking on water or leaking contaminants into the sea?

Note: No immediate attempt should be made to pull off a vessel that has been or is suspected to have been seriously damaged. If there is any doubt as to the vessel's ability to remain afloat, no attempt to refloat the vessel should be made by the SAR unit.

- Is it necessary to refloat the vessel, or can anchors be set to await the tide?
- What are sea conditions, tidal conditions, and weather (both present and forecasted)?
- If the vessel is to be refloated, are its towing attachment points of adequate strength?
- Is the SRU capable of pulling the vessel off?
- Are your pumps ready and adequate to handle the situation should damage occur in towing the vessel off?
- Does the operator agree to the towing waiver?

Immediately after arriving on scene and conducting an initial assessment, the coxswain should inform RCC/MRSC of the situation and request any additional aid required (MEDEVAC, pollution equipment, etc.).

If the vessel is damaged, anchors should be set to prevent further damage, and no immediate attempt should be made to pull the vessel off.

Even if there is no damage at the time of your arrival on scene, there is the ever-present danger of the situation deteriorating in a short time. Two severe dangers are broaching and pounding.

11.13.1 Broaching

Broaching is the result of surf striking a vessel on the side or quarter and throwing the vessel broadside. It is particularly dangerous for two reasons:

- Broaching tends to drive the vessel harder aground;
- Currents are established about the bow and stern. Sand will be scoured away from the bow and stern and deposited amidship on the leeward side of the vessel, consequently leaving the vessel supported only amidships. This situation often results in breaking the keel of the vessel, rendering the vessel a total loss. Refloating should not be attempted in these cases.

11.13.2 Pounding

Pounding is caused by the varying degrees of buoyancy in a grounded vessel. The waterline changes continuously as waves influence the forces of buoyancy in the beached vessel. Simply stated, an alternate increase and decrease in the vessel's total buoyancy occurs. Bottom damage occurs when the buoyancy increases sufficiently to lift the vessel off the bottom and then decreases and drops it back again. Damage may range from tearing a few seams open to serious holing of the vessel. The striking of each wave tends to drive the vessel further aground.

11.13.3 Refloating procedures

Guideline procedures for assisting a grounded vessel are as follows:

- Ascertain set, and plan to use it to your advantage;
- Ensure that anchors have been laid out to seaward to prevent the vessel from being driven further aground;
- If hull damage exists, determine the location and extent. If the boat is beached, have a beach party from your unit visually inspect and evaluate the condition of the vessel (if possible). Ensure the vessel's interior hull is free of sand, water and leaks. Be sure that it is not leaking pollutants into the sea. If the vessel is holed, temporary repairs will be required to reduce leakage to a minimum. If the vessel has a wooden hull, ascertain whether any seams have worked open. Effect temporary repairs if possible.

Note: Consideration must be given to the fact that a damaged vessel that is refloated by an SAR unit will have to be towed or escorted to safety. The SAR unit cannot be laboured with the responsibility of assisting the vessel for long periods of time, effectively keeping the SAR unit from responding to other SAR incidents.

CAUTION

If there is ANY doubt as to the vessel's ability to remain afloat, NO attempt to refloat the vessel should be made by the SAR unit.

If the assessment reveals that the vessel will remain afloat, and if the SAR unit intends to attempt refloating, further action must be planned carefully to avoid unnecessary and excessive stress on the grounded vessel's hull and/or towing equipment. The following are factors to be considered:

- Does the towing vessel have adequate power?
- Does the towing equipment have a sufficient SWL to carry the static load?
- Are the attachment points and hull structures of both vessels adequate? Employ the strongest fittings on both vessels;
- What are the sea conditions?
- What are the tidal conditions? What was the state of tide on grounding? Unless weight is removed from the grounded vessel, refloating should not be considered at a lower tidal height than that at which it went aground;
- What is the present and forecasted weather?
- Has the vessel's stability changed since the grounding? (e.g., have tanks been pumped out, fish holds emptied, ice dumped? Removal of "low" weight in an attempt to lighten the vessel may mean that it will no longer be stable when partially afloat or afloat);
- Is shoring required to support the vessel while awaiting the tide?

CAUTION

Any attempt to refloat a vessel before the tide rises to the level of the vessel's draft will result in excessive strain to towing hardware and damage to the hull of the stranded vessel.

- Sound around the grounded vessel and the general area of the grounding. The soundings assist in determining the direction in which the boat will be pulled in refloating;
- Carefully determine the refloating procedures to use.

Note: sailing vessels and deep-keeled vessels will require prompt action to either refloat or shore up. On an ebbing tide, they can shift position quickly, causing immediate structural damage and/or allowing the vessel to flood through above-deck openings on the flood tide.

11.13.3.1 Straight pull

When the vessel is slightly aground (bow into the bottom and the stern afloat), a straight pull off is the simplest and most effective method of assistance. The straight pull is conducted as follows:

- Ascertain the direction of current;
- Consider anchoring at a safe distance and backing down on your anchor line to the stranded vessel;
- If you can safely get close enough, hand the towline directly aboard. If you must use a messenger line, the hand-thrown heaving line is preferred. Another method to transfer this line is by using a buoyed, floating line. This must be done cautiously in order to avoid fouling your propellers with the line and putting your own vessel aground. The line should not be floated straight down to the vessel. Pay it out parallel to the shore. Position your vessel upstream from the grounded vessel, and pay out the messenger until the end is near the shore. Turn about and manoeuver past the stranded vessel, paying out the messenger as you go;
- Instruct the disabled vessel on securing the towline, clearing personnel from the deck area and letting the anchor go after it clears the beach or shoal;
- After the towline is secured and the crew clear of the danger area on deck, go ahead slowly, weighing anchor and paying out the towline to maintain a generous catenary. This requires pre-planning and flawless crew communication and coordination;
- Commence pulling so that optimum force can be applied at maximum high water. The stranded vessel can best be pulled off in the direction opposite to that in which it ran aground.

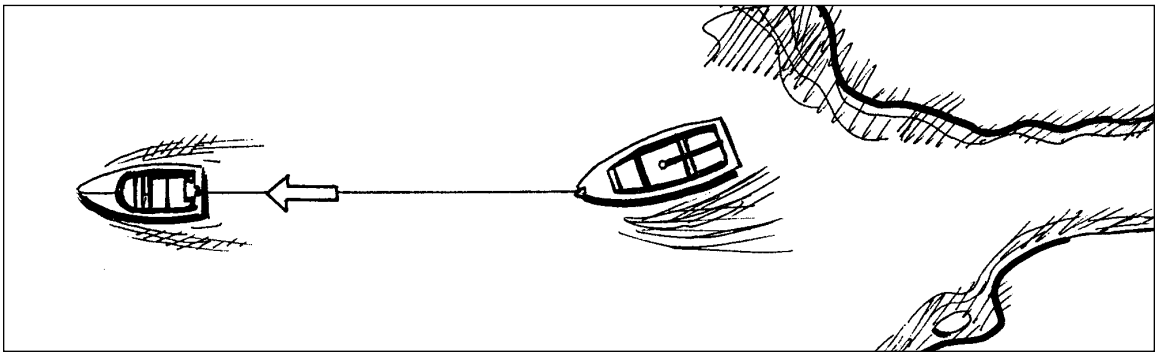


Figure 11.24: Straight pull

11.13.3.2 Wrenching and pulling

Although the name sounds violent, this method is much the same as the straight-pull method. The difference is that the vessel is pulled alternately from side to side. This method is utilized when the grounded vessel is on bottom that cannot be scoured or the water is too shallow to allow work alongside the grounded vessel. The goal of this method is to break the grip of the hull on the bottom by pulling from side to side (wrenching) and rotating the hull.

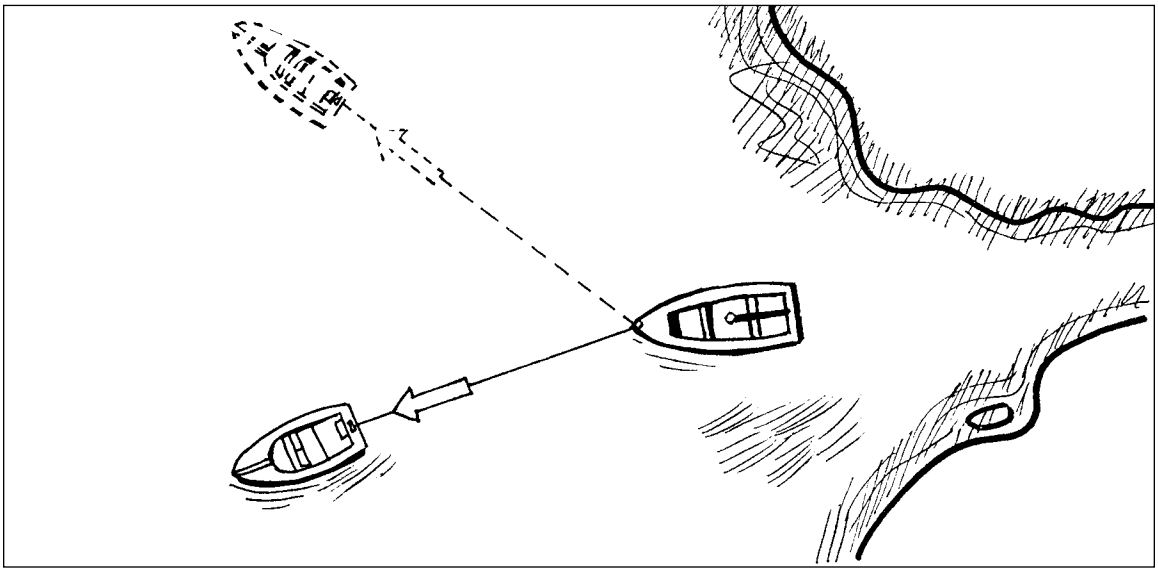


Figure 11.25: Wrenching and pulling

11.13.3.3 Bow-on pull

The bow-on pull is employed when the wind and current are offshore or from inland and no surf conditions are present. This method is as follows:

- Fully brief the disabled vessel on the procedures. Approach the casualty bow from windward or up current, drifting toward the stern of the vessel;
- Pass the messenger and towline from your bow;
- Secure the towline to a suitable connection point aft of your bow. You will lose pivoting ability if the towline is secured directly at the bow;
- Apply power gradually and back down slowly.

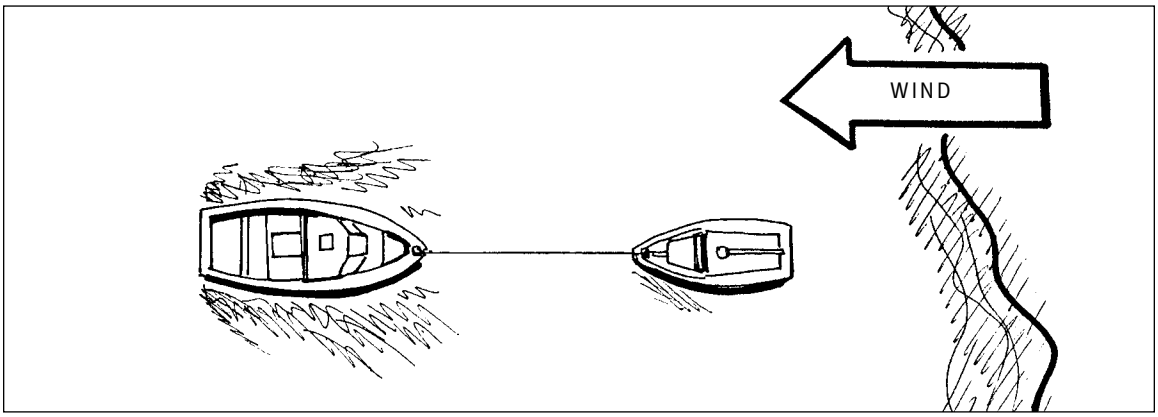


Figure 11.26: Bow-on pull

11.13.3.4 Scouring

Note: The scouring method is not recommended for use on vessels that have grounded in a broaching situation. Such vessels may be in a very unstable and precarious position because of the sand accumulated in the midships region. Use of the scouring method in a broach situation may cause severe damage to the vessel and/or injury to personnel.

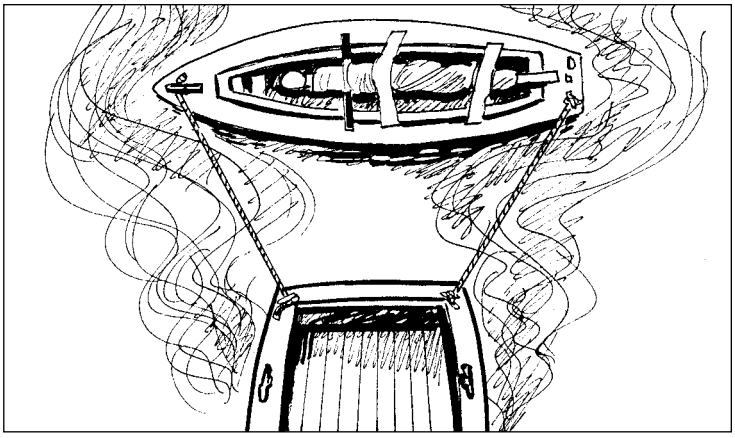


Figure 11.27: Scouring

Scouring is a very effective aid in refloating a stranded vessel. However, the damaging effects of the bottom material on your shaft bearings and raw-water cooling systems must be considered. Scouring a channel for the distressed vessel can be done only when the endangered vessel is grounded in sand, mud, or gravel bottom, and only when water depth permits you to work alongside the other vessel. Scouring a channel is accomplished by:

- Moor alongside the stranded vessel amidship so that your boat's screw current will be directed diagonally down and under the grounded vessel;
- Initiate scouring amidships and, as the application advances, move your vessel aft or forward as required.

11.13.3.5 Heeling sailing vessels

Sailing vessels with deep keels, aground on an ebb tide, will have to be either shored up or removed from the grounded position as quickly as possible. If action is not taken, the hull may sustain severe damage from pounding. Heeling the sailing vessel over to one side creates a corresponding change in angle of the deep keel and reduces the effective draft. To free a grounded sailing vessel, proceed as follows:

- Lead a spinnaker halyard from the mast to another vessel or a fixed object. Pull on the line either by hand or by gently towing;
- Often the vessel will drift off on its own when heeled by the mast. If it does not, either have the operator apply power or gently tow it off;
- When the vessel is free of the shallow area, immediately release the line used to heel it over.

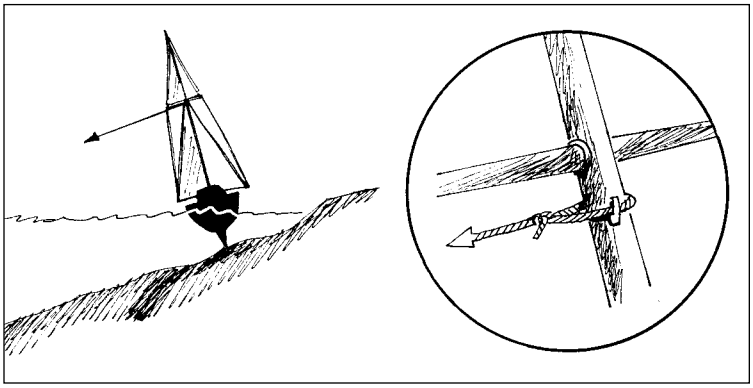


Figure 11.28: Heeling sailing vessels

11.13.4 Damage control in SAR incidents

WARNING

If there is any doubt as to the vessel's ability to remain afloat, or if there is potential danger to the crew, no action should be undertaken to dewater the disabled vessel. Information gathering from a disabled vessel is important to ensure adequate situation analysis. Always bear in mind that the primary role of your SAR unit is saving life, not salvaging.

Performing damage control in SAR incidents is a very hazardous task. Often it is very difficult to assess the extent of damage and to determine what, if any, actions are appropriate. In addition, there may be panic on the disabled vessel, especially if the water level is rising. In most cases, passing the pump is the only required action. Sometimes, however, greater help is needed, and this section offers suggestions.

With small holes, dewatering can be attempted right away, but with larger holes the water flow must be reduced. Various methods exist to perform this task, requiring a variety of material. If a ready locker is being used by an SRU due to the lack of space on board, it would be wise to have a Damage Control Kit in the locker at the station.

11.13.4.1 Water flow control methods

There is no standard method of controlling the flow of water. It is the coxswain's responsibility to determine which of the following methods will be used.

Wood plugs and wedges

Use them from inside when the hole is accessible; it could be very hazardous to try to plug a hole from outside the hull. Wrapping a piece of cloth around wood plugs or wedges will increase their efficiency.

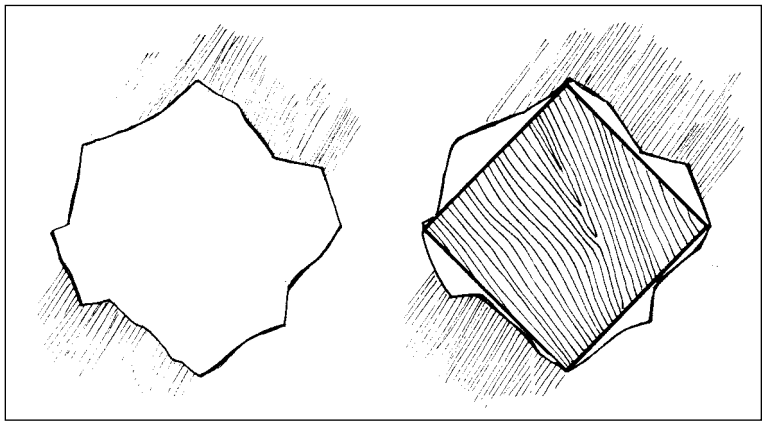


Figure 11.29: Wood plug

Hinged patch

Patching below the waterline can be done with a hinged patch. To use it, fold the patch and push it through the hole. Then, pull it back tightly against the hole with the line and secure it to a fixed point. If the water pressure is too high or the hole is not accessible, the line can be floated through the opening from outside. It has to be guided to the opening, and with the water flow it will be sucked through. The line should be of polypropylene, which will allow the line to float inside and then be pulled as stated above.

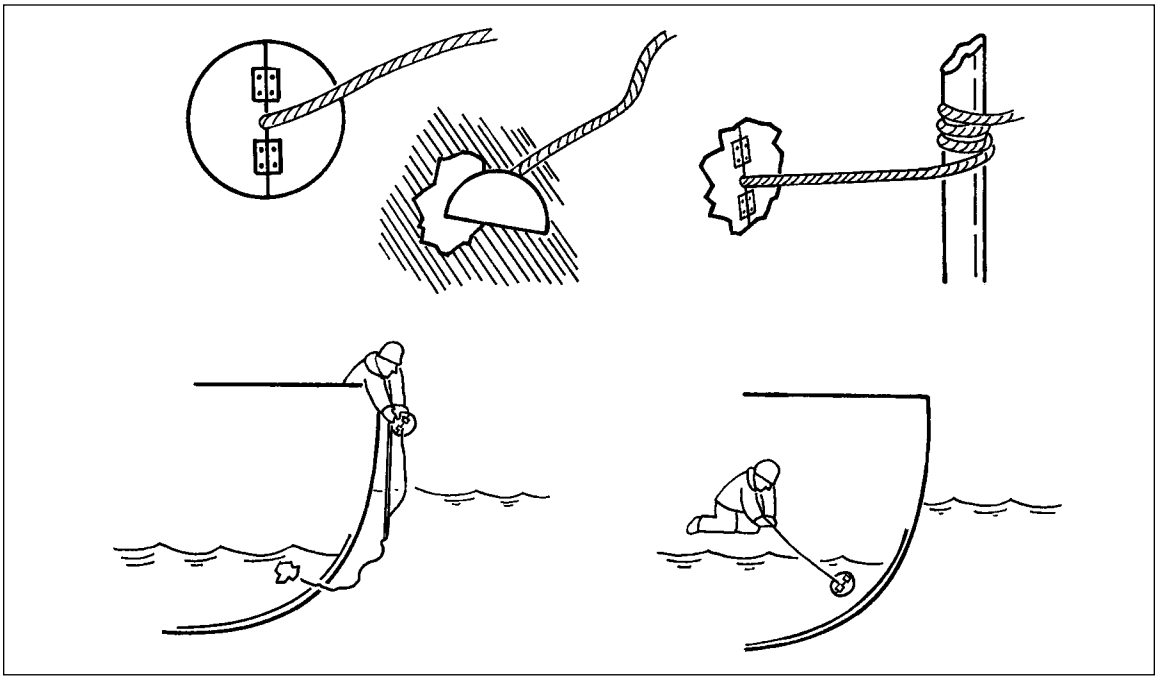


Figure 11.30: Hinged patches

Collision mats

These can be a very effective way to control flooding, particularly if the damage is on the bow and the vessel is underway. The water pressure will keep the mat in place. It will also be possible to place additional patching on the inside.

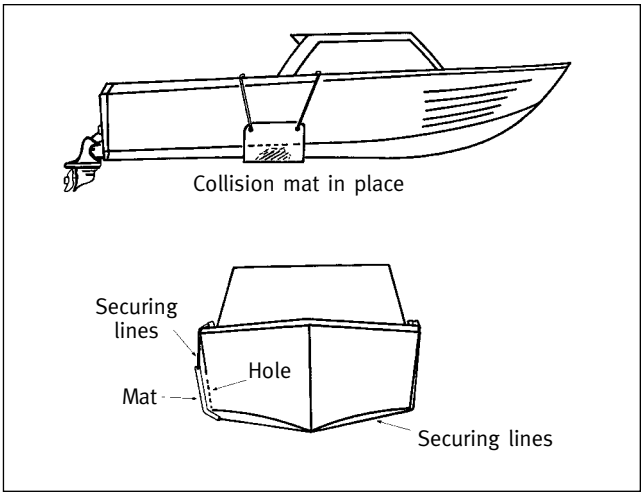


Figure 11.31: Collision mat

Tarpaulin

When collision mats are not available, simple tarpaulins can be used. These are easily available from most hardware stores and can be quite helpful for damage control purposes.

Shoring

As every hull has a different shape, it is difficult to provide guidelines for installing shoring. Using what is available in accordance with the damaged environment is the best rule to apply.

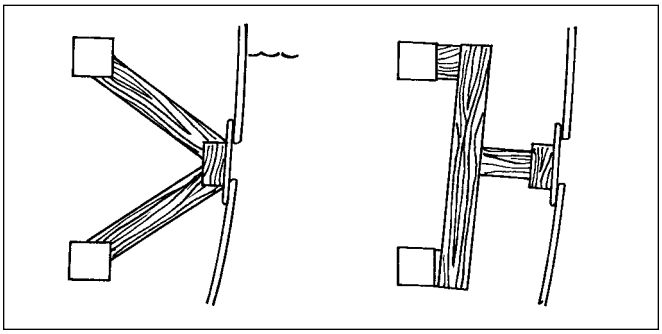


Figure 11.32: Shoring

Other options

The use of the disabled vessel's pump is obviously an option to take into account. On some vessels, it may be possible to use the seawater cooling pump by diverting its suction to the bilge. Use of eductors is also possible with the SAR unit's fire pump.

11.13.5 Suggested damage control kit

Small SRUs such as RHIB have limited space. A tarpaulin is probably the best option. It may not be necessary for those vessels to carry a full complement of plugs, hinged patches, etc. since these are not designed to operate very far from the shore. Larger vessels such as fishing vessels (CCGA) might consider having a more complete kit that would include some of the following:

- soft wooden wedges (six 2" x 2" x 8"; six 4" x 4" x 12"; eight 2" x 4" x 12");
- plywood patch (twelve 8" x 8" x 1/4");
- soft wooden plugs (three 3" x 4"; three 2" x 4"; three 1" x 4");
- hammers (one 16-oz. and one 24-oz. ball pin head);
- four 4-ft. long 2 x 4s;
- set of saws;
- lineman's pliers, 8";
- 36" canvas, oakum, rags, rubber sheets, etc.;
- one tube of RTV (silicone rubber);
- waterproof flashlight with spare batteries ;
- one bit and brace and 7/16 wood auger;
- hinged patches (one 12" and one 18");
- one box of nails, no. 10, 2";
- putty knife;
- roofing caulking;
- tie wire and tarred marlin;
- one roll of tape, scotch brand no. 33;
- one 16-ft. measuring tape;
- plywood (two 2' x 4' x 1/2");
- quick-set cement.

11.14 Rescue of capsized vessels

When assisting capsized vessels, SAR crews should always remember that their priority is life. SAR crews should never waste too much time preventing damage to a capsized vessel when there is a potentially life-threatening situation developing.

Any attempt you make to right a capsized vessel must be carefully thought through before beginning. You must make absolutely certain that all crewmembers from a distressed vessel are accounted for before beginning any procedure to right the vessel. Survivors may be trapped inside the overturned hull.

When an inboard boat capsizes, dewatering cannot begin until the craft has been righted. There are several methods for righting vessels of this type. You will have to select the best one after evaluating the conditions on scene. Regardless of the method used, always get an accurate count of the persons aboard the capsized boat. Give them PFDs if necessary, and bring them aboard your boat before beginning the righting operation. Approach a disabled craft cautiously, watching for debris that may damage your boat or foul its propellers.

When assisting a capsized vessel:

- recover all PIW immediately;
- check all recovered PIW for injury and/or hypothermia;
- if anyone is injured or hypothermic, organize transport toward shore and have another unit (if possible) take care of the boat. If no one can deal with the boat right now, leave it there and notify MCTS;
- if RCC allows and no other urgent situation is present, have the waiver of claims signed and prepare the righting procedure;
- choose an appropriate righting technique;
- discuss the procedure with the boat operator(s);
- assign tasks to everyone and proceed.

Most righting techniques require the presence of a crewmember in the water as a last resort. When sending a crewmember into the water is necessary, follow these guidelines:

- Pick a strong swimmer;
- Have your swimmer properly equipped (thermal protection, fins, mask, PFD, strobe light, etc.);
- Tie the swimmer to a line so he or she could be easily recovered if anything went wrong. The swimmer should carry a knife in case the line must be cut;
- Ensure that the swimmer knows exactly what to do.

11.14.1 Righting powerboats

The means you select for attaching lines determines the method of righting. Procedures for each method are outlined below.

11.14.1.1 Righting a powerboat by parbuckling

Follow these procedures when righting powerboats by parbuckling:

- Select a crewmember to enter the water to prepare the boat for righting;
- Direct a crewmember to secure your towing bridle or mooring lines to the nearest gunwale of the capsized boat;
- A person in the water then leads bridle lines or mooring lines over the keel and down under the boat. Ensure that these lines are outboard of all handrails, lifelines, and stanchions. Then run the bridle back to your tow line, or run the mooring lines to your boat's rear quarter cleats or bitts;
- Recover the tethered swimmer from the water;
- Pay out enough towline to prevent the boat from hitting your stern during righting and towing. Then, secure the towline;
- Gradually add power to your boat and increase speed. The boat should right itself;
- Bring the righted boat alongside your boat and dewater with the most appropriate method;
- Take in tow astern or alongside.

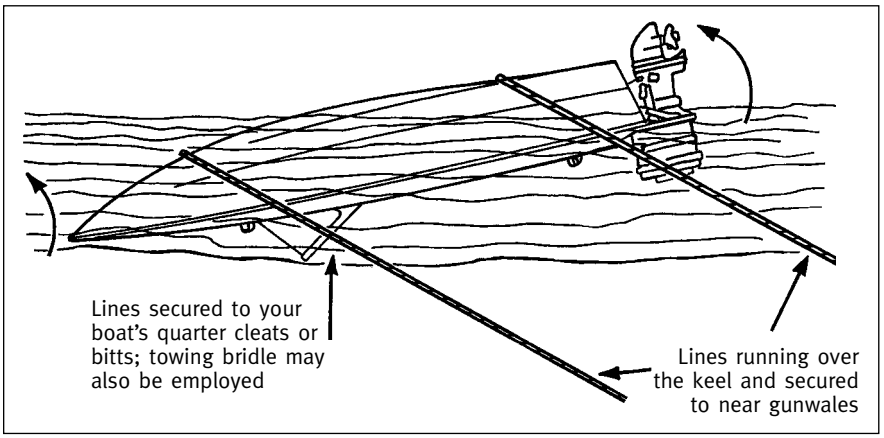


Figure 11.33: Re-righting powerboats by parbuckling

11.14.1.2 Righting using bow and transom eyebolt

Follow procedures below for righting a vessel using the bow and transom eyebolt:

- Bring the capsized boat alongside the working area of your boat;
- Use a shackle to secure your tow line to the trailer eyebolt of the capsized boat;
- Secure a piece of mooring line to the capsized boat's outboard transom eyebolt;
- Pay out both a towline and a scrap/mooring line and walk the capsized boat to a position astern of and athwartships to (from side to side) your boat;
- Secure the scrap/mooring line to your boat's rear quarter cleat or bitt;
- Pay out enough towline to enable the boat to remain clear of your stern when righting and towing commences. Secure the towline;
- Gradually add power to your boat and increase speed. When the righting motion begins, cut or slip the scrap/mooring line. The boat should right itself. Tow the righted boat until you observe water being forced over the transom of the disabled boat;
-

When water ceases to flow over the towed boat's transom, reduce speed gradually, ensuring that enough water has been forced out of the boat during towing to allow it to float on its own;

- Bring the righted boat alongside your boat and dewater it using the most appropriate method;
- Take in tow astern or alongside.

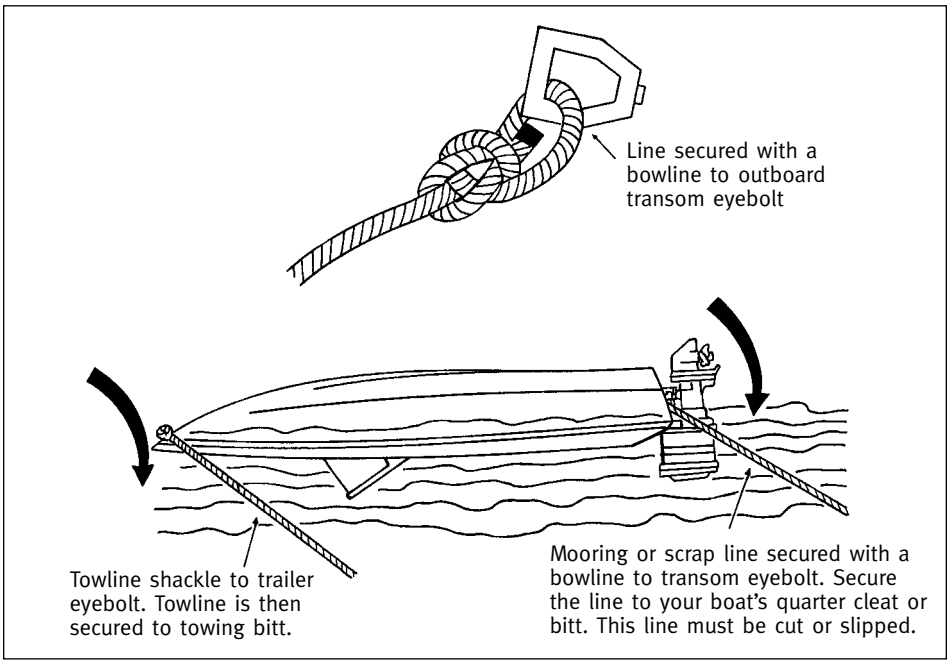


Figure 11.34: Righting capsized boats using bow and transom eyebolts

11.14.1.3 Righting using towline fore and aft of boat's keel

Follow the procedures below for righting a boat using a towline fore and aft of the boat's keel:

- If the operator is willing, one person wearing a PFD may be left in the water to assist in righting the boat;
- If no one aboard the boat is able to assist, direct a crew member (as a last resort) to enter the water to prepare the boat for righting;
- Direct the person in the water or a crewmember to run your towline fore and aft alongside the capsized boat's keel;
- The person in the water will then secure your towline with a shackle to the capsized boat's trailer eyebolt;
- Ensure the disabled boat is positioned fore and aft, directly astern of your boat (capsized boat's stern toward your boat's stern), and that the towline is running fore and aft along the capsized vessel's keel;
- Pay out enough slack in the towline to enable the boat to clear your stern when righting commences. Secure the towline;
- Gradually add power to your boat and increase speed. pulling on the bow of the capsized boat. This pull will be countered by the aft portion of the disabled boat, which is the heaviest part of the craft. As a result of these two forces, the boat will be righted;

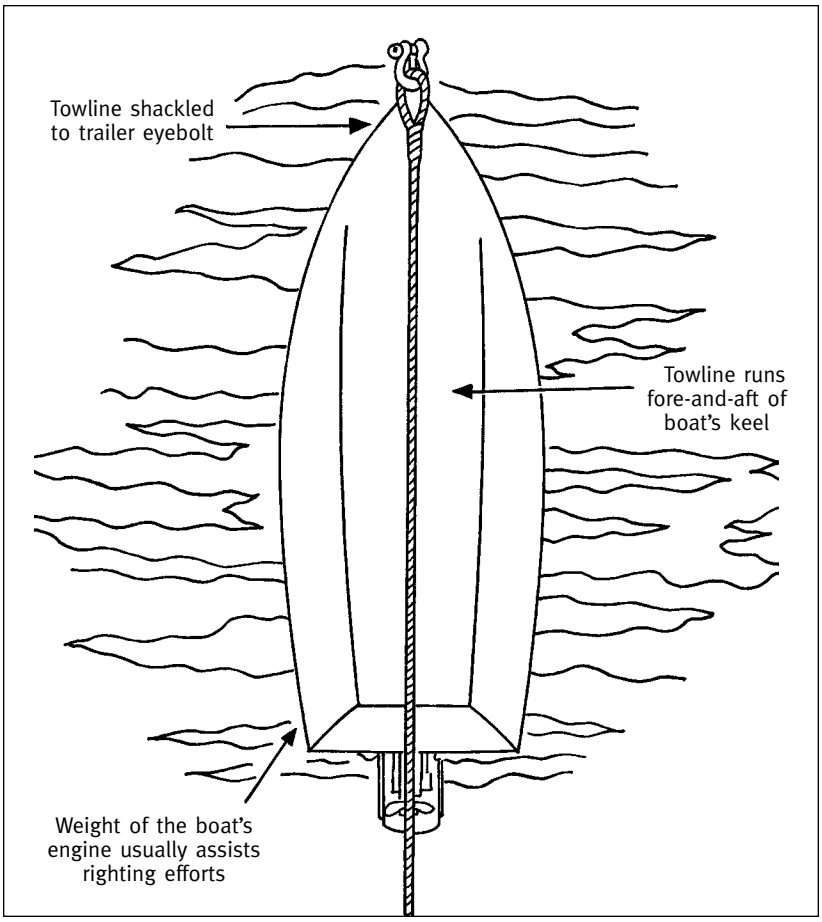


Figure 11.35: Righting using towline fore and aft of boat's keel

- Tow the righted boat until you observe water being forced over the transom of the disabled boat;
- When water ceases to flow over the towed boat's transom, reduce speed gradually, ensuring that enough water has been forced out of the boat during the towing to allow it to float on its own;
- Bring the righted boat alongside your boat and dewater it using the most appropriate method;
- Take in tow astern or alongside.

11.14.1.4 Refloating swamped boats astern using trailer eyebolt

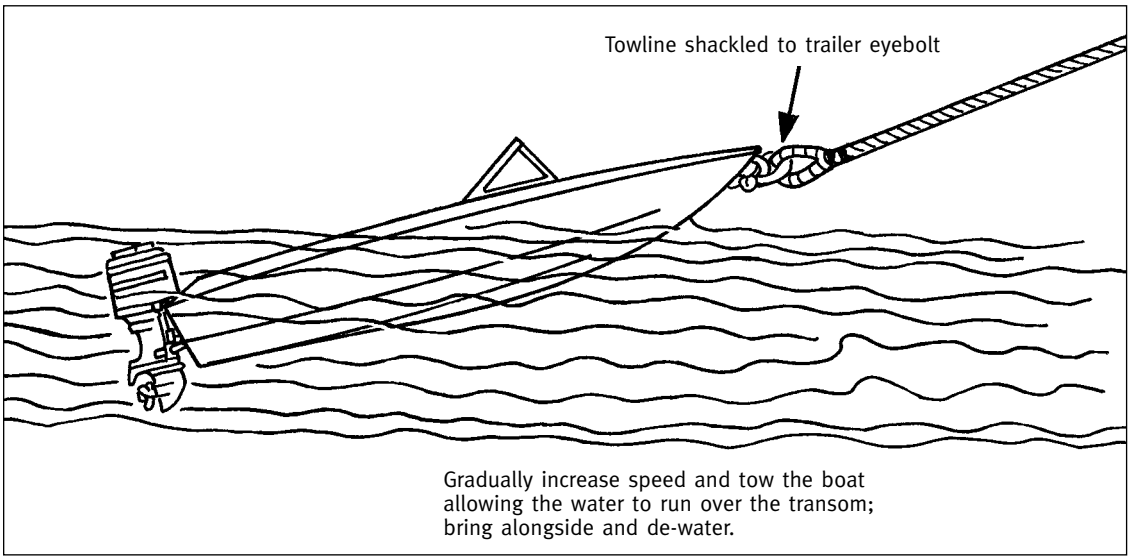


Figure 11.36: Refloating boats swamped astern using trailer eyebolt

This procedure is used for refloating a boat that has been swamped from astern:

- Bring the swamped boat alongside the working area of your boat;
- Use a shackle to secure your towline to the trailer eyebolt of the swamped boat;
- Pay out your towline and walk the swamped boat directly astern of your boat;
- Pay out enough towline to permit the swamped boat to remain clear of your stern when towing commences. Secure the towline;
- Gradually add power to your boat and increase speed taking the swamped boat in tow. Tow the boat until you observe water being forced over the transom of the disabled boat;
- When water ceases to flow over the towed boat's transom, reduce speed gradually, ensuring that enough water has been forced out of the boat during towing to allow it to float on its own;
- Bring the boat alongside your boat and dewater it using the most appropriate method;
- Take in tow astern or alongside.

11.14.2 Righting small sailboats

Always try to unship the sails (or at least to loose the halyards) before attempting the righting procedure. If you do not lower the sails, the boat may capsize again once righted. Approach the capsized sailboat from upwind, up current, or both, remaining clear of lines and debris. Account for all personnel from the sailboat and recover them as necessary. At least one person from the capsized boat will be needed in the water, to help in righting the boat. Do not attempt righting if the weather presents a hazard to the rescue boat or personnel.

Procedure:

- The person in the water unships or removes the sails;
- The sails, if removed, should be put aboard the rescue boat or secured to the disabled boat;
- Whenever possible, try to position the capsized vessel so it faces the wind;
- The person in the water then stands on the keel or centreboard and leans back while holding on the gunwale. The boat should slowly begin to come back over;
- Once the sailboat is righted, recover the swimmer and begin dewatering.

This technique will almost always work when the wind is not too strong and the mast is not buried in the bottom. With a boat hook, lift the mast above the water and swing it upward as the operators are doing their usual righting technique. Be careful not to be struck by the falling mast if the righting attempt failed. Ideally, your vessel should never get directly below the mast of the capsized vessel.

11.14.3 Righting larger vessels

Large overturned vessels present the possibility that occupants may be trapped inside. The following are general guidelines for rescue of persons trapped inside a capsized vessel:

- Search the immediate area for survivors that may have escaped from the vessel;
- Approach the vessel slowly to eliminate wash that may break a sealed air pocket. Try to determine whether any persons are trapped in the vessel and, if so, their location;
- Question other survivors to assist in determining possible locations of survivors and the vessel layout;
- Do not put rescue personnel directly on the overturned vessel. Work from the rescue craft or tender. Communicate through the hull by tapping on it and calling to the occupants. If contact is made, reassure the survivors that rescue efforts are underway. Instruct them to stay calm, to move out of the water as far as possible, and to minimize their physical activity to aid in conserving air. Throughout the operation, keep them informed on steps that are being taken in their rescue. Any changes, movement, or noise will be very frightening to them. If they don't know the source, they may panic and try to climb out;
- Request passing or approaching vessels to reduce their speed and wash;
- If necessary, hold the vessel off a lee shore (especially if potential survivors are still inside);
- Rescue may be achieved by trained divers. Request divers with rescue training (such as DND or RCMP divers) through RCC/MRSC;
- If possible, locate someone familiar with the vessel layout;
- Stabilize the hull by using emergency air bags, boats secured alongside, or heavy shipboard lifting tackle. If using vessels secured on either side, pass a line under the capsized vessel and secure between the two vessels. DO NOT ATTEMPT TO RIGHT THE VESSEL AT THIS STAGE;
- Tag the vessel with a line and marker to mark the position in case it sinks;
- If a person familiar with the vessel layout is contacted, consider having that person coach the survivors on how to escape or divers on how to locate the trapped persons;
- If divers arrive, fully brief them on all known details and assist them as required;
- If you must tow the vessel, tow extremely slowly to avoid breaking the air seal.

WARNING
Never attempt to cut through the vessel's hull while it is still afloat unless some procedures to keep afloat have been undertaken.

11.14.3.1 Righting technique
If you are absolutely certain that all survivors have been evacuated from the overturned vessel, you may attempt a righting procedure. Parbuckling may be used to right capsized powerboats or sailboats over 8 m (25 ft.) in length. Also, parbuckling should be used for righting small sailboats that cannot be righted by the method previously described.

As a last resort, a person from the overturned boat or a crewmember from the rescue boat must enter the water to prepare the boat for righting. The following procedures are for righting a sailboat using parbuckling.

CAUTION
If the weather presents a danger to the person in the water or the boats involved, do not attempt righting.

The following are procedures for righting a small sailboat:
- Unship or remove the sails;
- Have the person in the water run a bridle or towline to the capsized boat;
- Ensure that the lines rigged for righting are outboard of all stays, shrouds, lifelines and stanchions;
- Secure lines to available deck fittings;
- Connect the other end of the bridle to the towline. Pay out enough line to prevent the distressed boat's mast (if so equipped) from striking the rescue boat should the distressed boat continue to roll in that direction;
- Recover the person in the water;
- Commence righting by going ahead slowly on the engines;
- Once a sailboat is righted, crewmembers should board it from the stern (because of the boat's instability) and secure all loose lines;
- Secure the boom to stop it from swinging and possibly capsizing the boat again;
- Begin dewatering.

11.14.4 Kayaks, canoes and small rowboats
Kayaks and canoes are so small that the best way to reright them is to bring them on board. Once they are on board, empty them and put them back in the water.

11.14.5 Rescue of a vessel drifting onto a lee shore

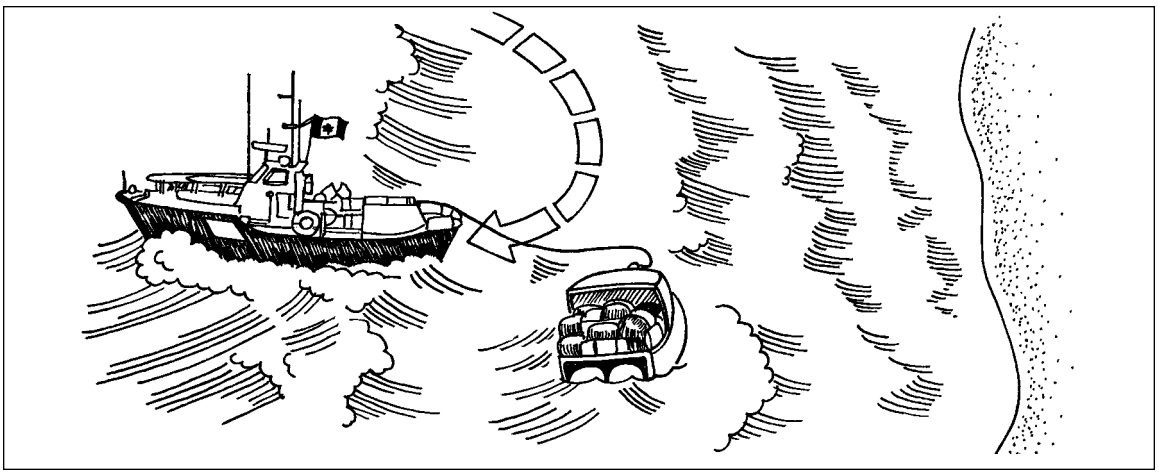


Figure 11.37: A vessel drifting onto a lee shore

A vessel drifting onto a lee shore in rough seas can incur serious consequences if rescue is not effected in a timely manner. If you encounter such circumstances, follow these general guidelines:

- En route, advise the vessel operator to have everyone aboard don life jackets and to drop anchor. (There have been cases involving vessels drifting ashore in which a ready and available anchor was not used. People may forget that they have an anchor for use in just such an emergency.);
- If anchoring is not possible or will not hold, it is important to get the towline passed as quickly as possible. Have all required towing equipment ready for arrival on scene, bearing in mind that the seas on scene may be agitated (e.g., secure towline to prevent the possibility of fouling screws). Approach the disabled vessel in an arc from seaward, keeping the SRU to windward of the disabled vessel. The path of the arc should bring the stern of the SRU across the beam of the disabled vessel. At this point the line should be passed, but at no time should the SRU lose headway or be allowed to drift toward the shore. When the line is secured, the SRU should start towing immediately to slowly pull the distressed vessel out of danger;
- Once the disabled vessel is clear of the lee shore danger, the towline should be checked and adjusted as necessary to carry on with the tow;
- If water depth or sea conditions are such as to endanger the SRU, the towline should be passed by floating down to the casualty or firing a line from a line-throwing apparatus.

11.14.6 Grounded vessels on lee shore or in other danger

Grounded vessels on a lee shore or in other dangerous circumstances require immediate assistance to ensure the safety or rescue of the crew. The following general guidelines should be considered in assisting a grounded vessel in a dangerous position:

- En route, establish communication, advise the crew to don life jackets and prepare emergency equipment. Try to determine the degree of danger and urgency of abandoning;

- On arrival on scene, further assess the situation and determine:
  - the danger and need to remove the crew;
  - your ability to remove the crew;
  - need for helicopter assistance to remove the crew;
  - any danger to your vessel; and
  - whether you can assist the vessel off.
- If the situation will allow the SRU to assist the vessel off, take precautions to ensure that the vessel will not take on water and sink when it is refloated. Take precautions to ensure the crew's safety (e.g., remove crew, provide a tender, pass pumps, etc.);
- If the vessel will not be refloated and the crew will be taken off, consider your vessel's ability to approach the disabled vessel and remove the personnel. Is the depth of water adequate? Are there underwater obstructions, debris in the water, or appendages on the vessel below or above the waterline? Is there a lee or a safe position to approach with the least aerated water? Could wave oil be used to reduce the risk?
- If the decision is made to approach the vessel and remove the crew directly, discuss your plan with the master. Maintain communication. Have the crew ready to abandon on your approach. You may want to divide a large crew into more than one transfer.

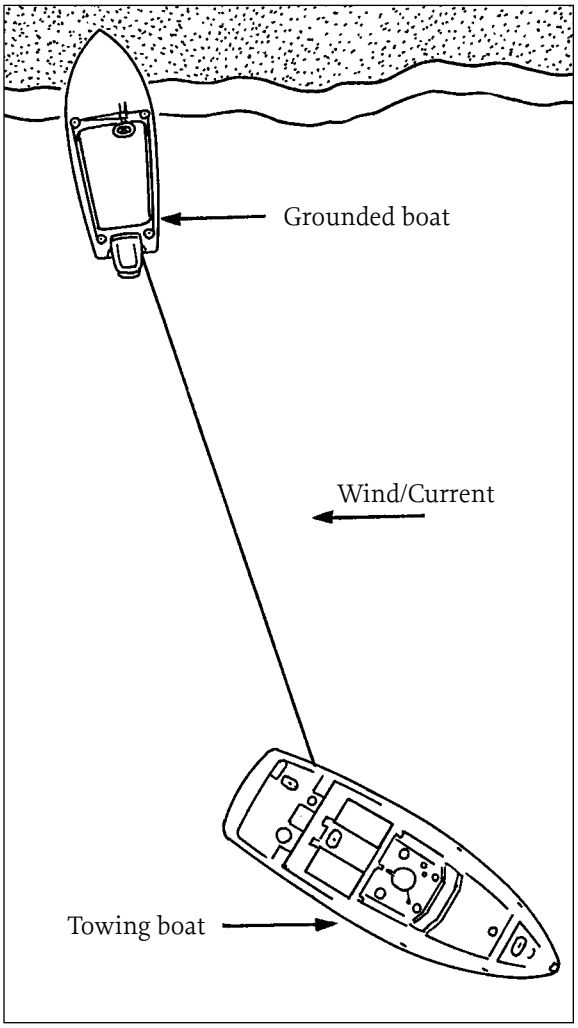


Figure 11.38: Grounded boat

CAUTION
Never take your vessel into the surf line!

If the vessel cannot be approached to conduct a direct removal of personnel, consider using a tender to conduct the transfer, either by manning the craft or floating it down on a line. A life raft may also be floated down to the vessel.

11.14.7 Boosting another vessel

WARNING
Boosting is a dangerous procedure, and proper guidelines should be closely followed. To increase safety and minimize the risk of explosion, consider installing boosting outlets away from your battery compartments. Another option is to boost from a boosting battery (spare battery). Never let the operator of the disabled vessel plug the cables. Always send one crewmember to handle the boosting cables.

11.14.7.1 Procedure for boosting

- Wear protective clothing (gloves and safety glasses). If an explosion occurs, this clothing will provide some protection against battery acid and projected debris;
- Ventilate the battery compartments before clipping the cables. This is of paramount importance to minimize the risk of explosion;
- Turn off the ignition and all battery-powered accessories on both vessels. It is not necessary to have the engine running while boosting;
- Use appropriately-sized boosting cables. Ensure that the cables are in good condition. Remember that the red jumper clip goes on the positive (POS or +) battery terminal and the black jumper clip, on the negative (NEG or –) terminal. If the battery terminals cannot be identified clearly, do not attempt to boost;
- Clip the cables in the following order:
  - Red jumper clip to the positive terminal on the dead battery;
  - Other red clip to the positive terminal on the good battery or boosting outlet;
  - Black clip to the negative terminal on the dead battery;
  - Other black clip on the negative terminal on the good battery or boosting outlet.
- Now that the two batteries are connected, try to start the disabled engine. Do not run the starter for more than 15 seconds. If the engine does not start after 5 minutes, disconnect the battery and abort the procedure. If you persist, you are likely to deplete your battery as well. At this point, consider towing;
- Once the engine is started, remove the cable clips in the reverse order:
  - Black clip of the negative terminal on the good battery or boosting outlet;
  - Other black clip of the negative terminal on the previously dead battery;
  - Red clip of the positive terminal on the good battery or boosting outlet;
  - Other red clip of the positive terminal on the previously dead battery.
- Advise the master of the previously disabled vessel to leave the engine running for at least 30 minutes to recharge the battery. Another option is to charge the battery to full capacity with a battery charger. When using a battery charger, always clip the battery before plugging the charger.

If an explosion occurs and acid is spilled on a person, treat that person for chemical burns and trauma. Rinse the exposed areas with water for 15 to 20 minutes and send the person to a hospital. If acid is spilled in the eyes, remove contact lenses (if applicable) and rinse as usual.

11.14.8 Escorting a vessel

Vessels engaged in SAR may need to escort other vessels for various situations. The most common situations where escorting may be considered are the following:

- disoriented vessels;
- damaged vessels that may eventually require a tow;
- boats in heavy weather.

Escorting is a good method to provide assistance without affecting the readiness of the SRU. Whenever possible, consider escorting before towing.

11.14.8.1 Escorting procedure

When you need to escort a vessel, follow these guidelines:

- Determine the kind of problem and consult with RCC/MRSC to determine whether escorting is required;
- Your destination should be the closest safe haven;
- Explain the route you intend to follow to the operator of the other vessel;
- Advise the other boat operator to follow you at a safe distance. Be aware that he or she may try to take shortcuts. Escorted vessels taking shortcuts are quite likely to run aground in some areas;
- When escorting, make wide manoeuvers and try to stay well clear of any hazard to navigation;

Sometimes, an SRU may be called to a more urgent situation. When this situation arises:

- Determine whether the vessel can continue on her own. If not, advise RCC/MRSC. Other vessels in the vicinity may sometimes continue the escort if necessary;
- Advise the operator of the other vessel to drop an anchor if anything goes wrong for the remainder of the trip. If you can, you may have the opportunity to come back once the more urgent situation is resolved.

11.15 Removing/delivering persons from/to shore

Several scenarios of SAR incidents require the removal of persons from shore to complete the mission. Some cases may occur in protected waters (or even better at a dock) or, at the other extreme, in exposed or treacherous locations. In all cases, the strategy is to remove the persons safely and to reduce injury or suffering.

11.15.1 Procedure

Evaluate the situation:

- Is communication established?
- What are the circumstances requiring removal (immediate danger, hypothermia, injured, etc.)?
- Do you have the means of safely removing the persons (adequate crew size, FRC, tender, etc.)?
- What are the consequences of leaving the people until a helicopter is available, the conditions improve, or another more suitable unit arrives to remove the persons?
- Is the rescue vessel safely manned to complete the task and able to deal with internal emergencies?
- What are the risks in attempting removal (seas, injuries, geographical hazards, etc.)?
- Is there another means of evacuating them?
- How can the SAR unit best perform the task (straight transfer from shore, pick up with tender or FRC, float in a life raft, use rescue swimmer and immersion suits)?

Preparation:

- Establish communication (radio, loud hailer, hand signals, etc.);
- Brief crew of intentions, including cautions and/or contingency plan;
- Brief distressed persons of intentions;
- Prepare equipment.

Procedures:

- Choose a landing area that is free of obstacles (both on shore and in the water) and has the least disturbed (aerated) water. DO NOT LAND ON SURF BEACHES. Approach the landing area and stand off to observe the action of the seas in the chosen area. After observing the cycle of motion, time your approach to take maximum advantage of the waves;
- Choose an approach angle that will allow you to view the landing zone and protect your stern from the seas. Time your approach to allow persons to board or disembark during lulls or the smallest seas;
- In incidents where a secure, protected landing can be affected, the vessel may be beached during the transfer;
- All persons must wear PFDs or life jackets during transfer.

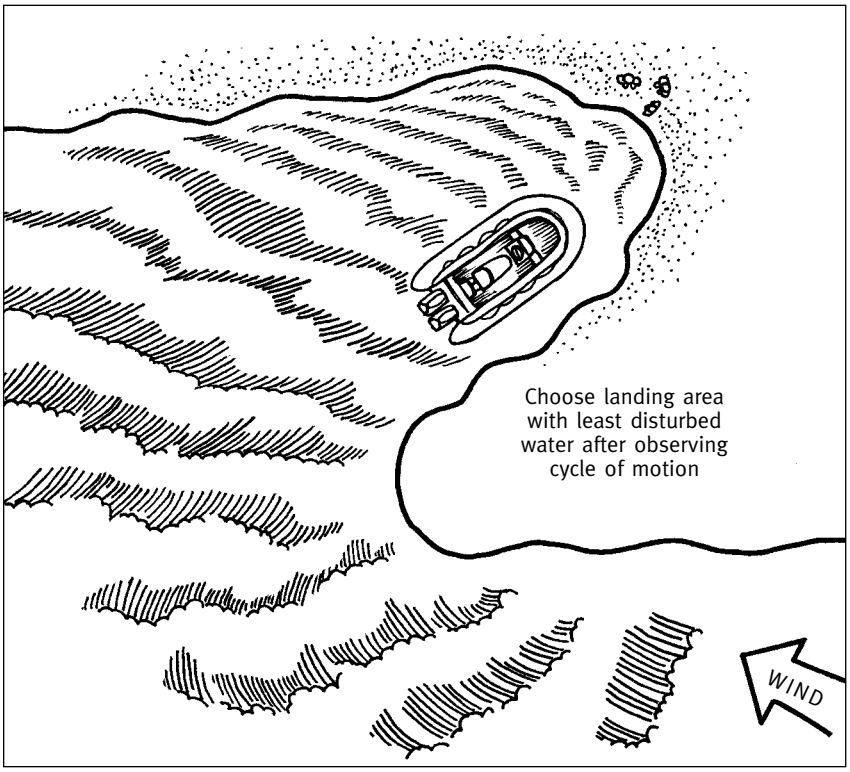


Figure 11.39: Choose an appropriate landing area

11.15.1.1 Life Raft method

Some vessels engaged in SAR may carry a life raft. The life raft can be used to conduct the safe transfer of persons to/from a shore. To use a life raft for such purposes, follow these guidelines:

- Before launching the life raft, the SRU should be positioned to take advantage of wind and current to drift the raft into the beach;
- Consider deflating the canopy of the life raft before sending ashore;
- If the situation will not allow the raft to drift in on its own, a messenger line may be sent ashore by line-throwing gun, heaving line, or floating in with a smaller object;
- The raft will have to be inflated and have adequate line attached to send it in to the beach. Depending on the circumstances, the coxswain may want to send a crewmember in the life raft to assist the survivors. If a crewmember does board the raft, he must be dressed in full protective clothing including hypothermia protection and a helmet;
- Transferring personnel from a life raft to a rescue vessel can be very difficult, particularly in less than calm sea conditions. The life raft will experience constantly varying motion from the soft bottom and soft floor as well as a constantly changing movement of the whole raft, making safe movement of personnel difficult. Good physical handholds must be executed on each survivor by the rescue crew before the transfer takes place from raft to rescue vessel.

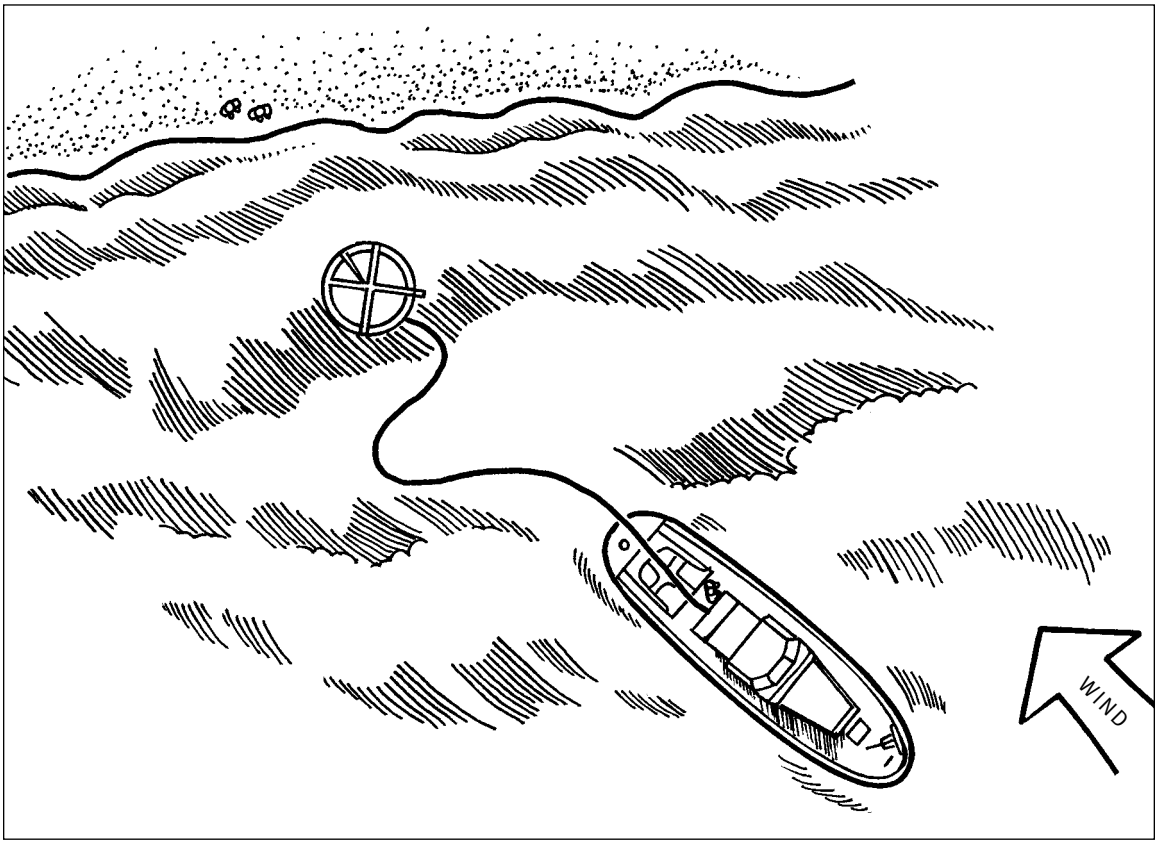


Figure 11.40: Using a life raft to conduct a transfer from/to shore

11.16 REMOVING/DELIVERING PERSONS FROM/TO OTHER VESSELS

Transferring personnel from one vessel to another at sea can be dangerous at all times, but is particularly difficult in cases of medical injuries or people who are not accustomed to being at sea. To further complicate matters, sea conditions may be miserable. In all cases, consideration must be given to the safety and consequences of proceeding with the transfer or not. The degree of danger anticipated by leaving the person aboard the vessel must be weighed against the dangers of transfer. This decision to proceed or abort the transfer is generally made on scene and involves consultation between the coxswain, the RCC/MRSC, and the master of the vessel concerned. Removal of persons from other vessels can cover a broad spectrum of incident types; however, the basic techniques employed remain much the same for all types of incidents requiring personnel transfers.

11.16.1 General guidelines

Preparation:

- After determining the need to proceed with a transfer, discuss the intended procedures with the master. Be certain that he or she fully understands your intentions and the actions required from his or her vessel;
- Discuss the intended procedures with the SAR crew. Designate duties;
- PFDs or life jackets must be worn by all personnel involved in the transfer operation;
- Fenders must be placed on both vessels (where practical);
- Consider the use of harnesses or lifelines on deck.

Approach:

- Generally the safest approach is upwind to maintain manoeuverability on your vessel, except for vessels on fire;
- One crewmember on deck should be designated to communicate with the persons on the distressed vessel. Others should refrain from calling instructions to avoid confusion;
- Fenders should be tended.

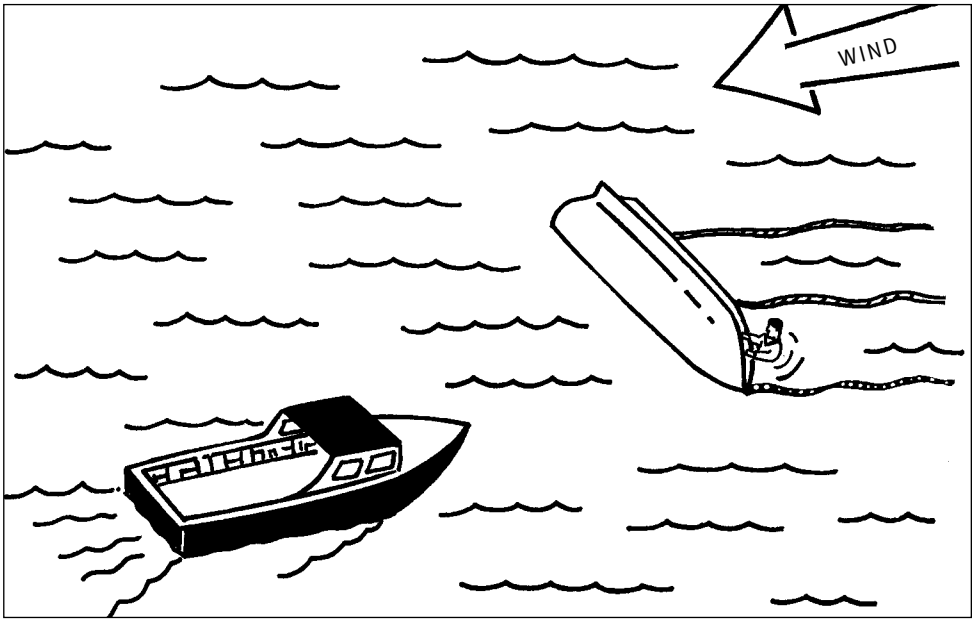


Figure 11.41: An upwind approach

Transfer:

- In ideal conditions, the SRU may be placed alongside the distressed craft and secured. Lines should be ready to slip quickly as necessary;
- If securing to the distressed craft is not appropriate in the circumstances, manoeuver your vessel in to touch the craft (preferably at a point where decks are levelled and where seas are not breaking on the vessel) and conduct a quick transfer before manoeuvering away from the craft. Have the designated deck person instruct the rescuer when to step aboard. Have personnel ready to assist the person aboard;
- If coming alongside is not possible, and persons must be transferred, consider removing them using a tender, having them launch and board their life raft, floating a life raft down to them, or passing lines and pulling them to your vessel using life rings or immersion suits. In these circumstances, people are often hesitant to leave the apparent safety and shelter of a vessel to enter a raft or the sea and may have to be coaxed to do so. Be explicit but reassuring in your instructions and guidance. People often do not think of obvious safety precautions under the strain of the situation and may have to be guided through every step of the rescue procedure;
- Rails in the rescue zone may be removed.

11.16.2: Use of life raft for transfer

If the SRU cannot be moved close to the distressed vessel, the SRU's life raft may be used (if available). To conduct the transfer, follow these general guidelines:

- Remove the raft from its stowage position and place it in the water on the lee side of the SRU;
- Pull the painter and inflate the raft;
- Secure to the towing bridle two lines of sufficient length to span the two vessels;
- Pass one line to the persons on the distressed vessel and have them pull the raft to their vessel. As the raft is pulled to the distressed craft, pay out the second line;
- When the raft reaches the distressed vessel, the persons should board it and remove the first line or pull it aboard. (If there is more than one raft of people to be transferred, the persons remaining on the distressed vessel pay out the second line as the raft is pulled to the SRU);
- The SAR crew pulls the raft to the SRU. BE GENTLE. Pull the slack and allow the SRU to drift down onto the raft;
- After recovering the people from the raft, bring the raft aboard and deflate it. Water may have to be removed from the raft before it can be lifted aboard. If it is impossible to recover the raft, consider towing it.

11.16.3 Patients in stretchers

Stretcher patients being transferred from one vessel to another must be fitted with a flotation device and tended with safety lines when appropriate during transfer as a safety precaution for accidental immersion.

Always use your own equipment, if possible. Use the other ship's equipment as a last resort.

If the stretcher is not equipped with a floatation device, put a PFD on the victim, if possible, or on the stretcher.

If circumstances permit, try to avoid strapping the victim into the stretcher during overwater transfers, especially if the stretcher doesn't have the floatation while the victim does. This approach avoids a face-down situation if the stretcher falls into the water.

If there is a person with first aid or medical training, send him or her on board for the preparation of transfer.

Designate one person other than the rescue craft's operator who will oversee the transfer.

11.16.4 Larger ocean-going vessels

Communication is often difficult with foreign vessels because of language and cultural differences. You will have to speak clearly and slowly and listen carefully. Avoid the use of slang or "joke statements" and presume that the listener will interpret all of your statements in the literal sense. Consider communicating through MCTS if necessary.

Note: When dealing with foreign ships in medical evacuations, ensure that RCC/MRSC has notified Customs.

Means of disembarking from the large vessel will vary widely. Common configurations include:

- pilot ladder located either close to the accommodation or near midships as on some tankers;
- accommodation ladders located either close to accommodation or near midships;
- stretcher patients lowered by means of a crane; and
- launching of a lifeboat from the ship to transfer persons to the SRU.

Choose a place where the decks are of similar height. Make a horizontal transfer wherever possible.

The following procedures apply to larger ocean-going vessels:

- Generally, the safest approach is made with the ship forming a lee for the SRU and keeping way on at slow speed as in boarding a pilot. The SRU should not approach until the ship has stopped reversing its screws and all effects of reverse screw race have cleared. The SRU should approach the ship with the side of approach well fendered;
- Advise the ship of your approach;

- Pace with the ship alongside the area of disembarkation and get a feel for the action of the seas. Alter course gently to slip in alongside the point of disembarkation. You may pass a sea painter to the ship if needed. NEVER SECURE TO THE STEM OR OUTBOARD SIDE. THE RESULTING FORCES COULD CAPSIZE THE SRU;
- If you did pass a sea painter, reduce your engine speed slowly and set back on the painter;
- When the SRU is in place, you may initiate the transfer. Crews must be ready on deck to assist those coming aboard. The coxswain may be fully concentrating on keeping the vessel in place at the point of disembarkation and may not be able to perform other tasks. If there are enough crew available, it helps to designate one to handle radio communication during this phase. As with all personnel transfers, only one crewmember on deck should be designated to handle verbal communication at the point of disembarkation;
- When the transfer is completed, sheer off the bow by putting your stern into the ship's side.

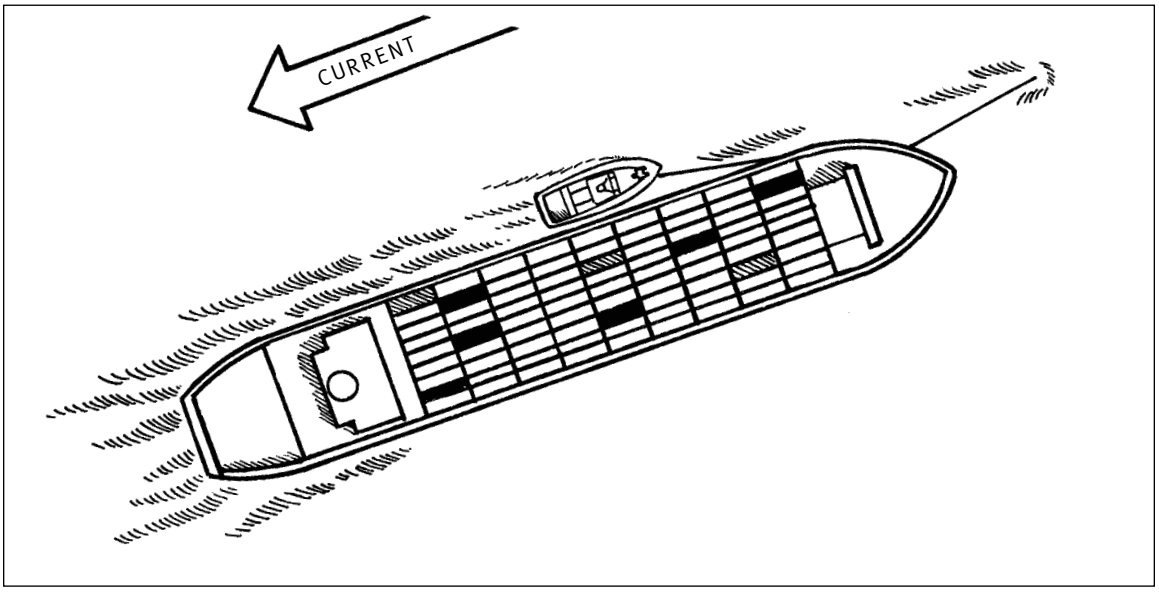


Figure 11.42: Passing a sea painter

Transfers from large vessels generally involve transferring the sick and injured. Use all available crew that you think you require to safely conduct the transfer, and bring along all equipment (extra fenders, etc.) that you may need. Generally, the SAR crew will not know what to expect until on scene.

Be aware that you may have to abort the mission. Transferring patients at sea is a potentially dangerous mission for both the patient and the SAR crew. The degree of need for evacuation must be weighed against the dangers involved in transfer.

Be prepared with a contingency plan. A man-overboard situation could occur.

11.16.5 Passenger ship

Some passenger ships will prefer to evacuate by way of a service door. These doors are usually located near midships and may be 3-4 m (10-13 ft.) above the waterline. The patient may be lowered by crane or davit from the service door, or by climbing down an accommodation ladder.

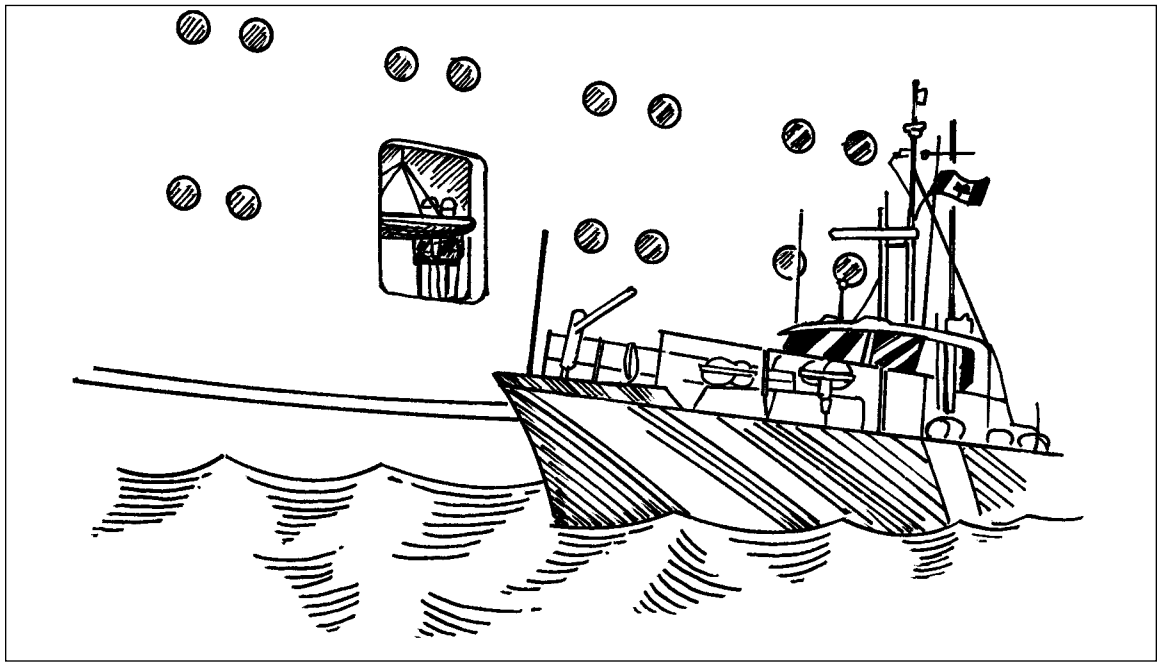


Figure 11.43: Evacuation point on a passenger ship

WARNING

Never approach near the stern of the ship; the SRU may be affected by the ship's screw race, which may suck the SRU toward the ship's stern. With some ships, the SRU may be sucked toward the ship at other points along the ship's side. The coxswain must be aware of these possibilities and ready to counter these actions with his or her vessel.

11.16.6 Ship at anchor

The anchorage will generally have enough current running to require a sea painter. Approach is made from leeward and against the current.

11.16.7 Heavy weather

Transfers in heavier weather conditions may not allow the SRU to rest alongside on a painter. If the coxswain decides to proceed with a transfer, it may be conducted by slipping alongside for a momentary transfer (touch and go). This method requires an alert crew and expert boat handling by the coxswain. Generally the person transferring must be reasonably ambulatory and able to make the step aboard independently. The SRU may have to stay in position at the point of disembarkation for a few minutes, requiring constant station-keeping by the SRU. DO NOT SECURE TO THE SHIP IN THIS CASE. After the transfer is completed, the SRU should break away by gently altering course away from the ship's course and slowly increasing power until clear.

11.17 Aircraft rescue

11.17.1 Airborne

Aircraft planning to ditch usually report their intentions beforehand. You may be tasked to attend a planned ditching. Ditched aircraft usually sink within minutes.

Seaplanes or float-equipped aircraft commonly transit almost every stretch of water in Canada. In addition, large commercial aircraft use flight paths all across the country. The number of aircraft in service today necessitates SAR operational preplanning for aircraft incidents. (Be prepared for incidents involving large numbers of people by familiarizing yourself with your local Major Marine Disaster Plan or SAR Contingency Plan.)

Some common occurrences with smaller aircraft are:

- structural or mechanical problems which require an SRU on standby during landing on the sea;
- fog or low visibility that may cause the aircraft to land in a dangerous area and require guidance or towing to a safe area by an SRU.

11.17.2 Ditching nearby – general guidelines

Note: In the case of aircraft carrying large numbers of people preparing to ditch, activate your local Major Marine Disaster Plan or SAR Contingency Plan.

- Take extra SAR equipment aboard, (life rafts, first aid, blankets, etc.). Take extra crewmembers, if necessary and immediately available;
- Prepare to provide information to the pilot, including wind direction and speed, sea state, primary and secondary swell size and direction, visibility, and any other pertinent weather information;
- Clear the ditching area of all vessels not involved in the rescue effort. Instruct vessels involved in the rescue effort to stay well clear of the ditching area until the aircraft has stopped and they are instructed to approach the aircraft. In darkness, instruct them not to shine any lights on the aircraft until it has stopped moving on the water. Instruct them to be alert for aviation fuel spilling after the ditching and to avoid any action that produces open flame or spark;
- If requested, transmit signals for the aircraft to take a bearing;
- Prepare heaving lines, life rings, life rafts, tenders, and means of boarding your vessel. Prepare first-aid equipment and blankets. If available, have a rescue swimmer prepare to go over the side;
- The pilot of the aircraft will choose his own ditching heading. If it is made known to you, set your course parallel to his or hers. If the course is not known, set your course parallel to the primary swell and as much as possible into the wind;
- In darkness, turn on all deck lights, turn on blue SAR light, and direct a searchlight vertically. Do not direct any lights toward the aircraft, until it has stopped moving on the water, to avoid blinding the pilot's vision;
- In a prepared ditching, survivors should be wearing aviation life vests. Be alert for survivors in the water and on the aircraft;

- If the aircraft crashes or breaks up on impact, there is a strong possibility of aviation fuel being spilled. Allow no smoking, use of electrical equipment, or outboard motors in the vicinity of the fuel;
- Immediately deploy a datum marker buoy (DMB) at the ditching site to aid in search efforts in case of missing persons. Get an accurate fix on the ditching site. The aircraft may not be afloat long;
- Start rescue efforts immediately. Deploy extra life rafts if you are dealing with large numbers of people, or rescue efforts will take too much time.

11.17.3 Helicopter ditching

A helicopter making a successful ditching will generally still have power or momentum to turn the rotors. Stay away from the rotors until they have stopped turning.

Helicopters have a high centre of gravity, which makes them quite unstable when sitting on the water. In all but the calmest of sea conditions, the aircraft can be expected to roll over. Most helicopters operating offshore in Canadian waters are equipped with emergency inflation bags. (Exceptions are the Sikorsky S-61N and DNDs Labrador, which are equipped with sponsons.) Emergency inflation bags are generally secured to the skids or the underside of the aircraft. During normal operations, the bags are deflated and contained in a protective cover. The bags can be inflated by a control at the pilot's position in the cockpit, which directs a flow of nitrogen or helium to the bags. The purpose of the emergency inflation bags is to allow sufficient time for the occupants of the aircraft to evacuate.

Ditching procedures in a helicopter require persons to remain in their seat with the seat belt fastened if the aircraft rolls over. Once the aircraft has settled in its inverted position, the survivors should start the escape routine.

11.17.4 Aircraft crash – general guidelines

- If large numbers of people are involved, activate your local contingency plan or major marine disaster plan;
- Take extra SAR equipment (life rafts, first aid, blankets, etc.). Take extra crewmembers, if necessary and immediately available;
- Prepare SAR equipment en route. If a rescue swimmer is available, have him or her prepared to deploy;
- AN SRU arriving on scene should deploy a datum marker buoy (DMB), get an accurate fix and notify RCC/MRSC;
- Allow no smoking, open flame, or any means of creating an arc by anyone in the area in case aviation fuel has spilled;
- If the aircraft is afloat, commence removal of survivors immediately. Flag the aircraft with a line and float in case it sinks. If the aircraft has sunk, commence search efforts immediately;
- Deploy life rafts or life rings for temporary survivor support;
- Interview survivors regarding the number of persons aboard and their whereabouts. Ask divers if there are persons trapped inside.

11.18 Rescue operations with DND planes and helicopter

11.18.1 Equipment drops

11.18.1.1 Survival Kit Air Droppable (SKAD)

CAUTION
If you are operating near a deployed SKAD, be alert for the polyline in the water.

Fixed-wing SAR aircraft carry survival kits consisting of two 10-man life rafts and two survival containers. These kits are referred to as SKAD kits and can be dropped either to persons in the water or to persons who must abandon their vessel but do not have life rafts. The following procedure will be used:

- The aircraft will make several passes at an altitude of approximately 100-150 m (300-500 ft.) to check the wind drift. It may drop several smoke canisters to check wind speed and direction and mark the target;
- Depending on the target's rate of drift, the aircrew will try to lay the kit in a line either upwind or downwind. All the components of the SKAD are linked by 85 m (280 ft.) of polyline. The objective is to allow the target to make contact with this line so that the components may be hauled in by the line. DO NOT CUT THE LINE;
- The rafts will inflate in the air after they are jettisoned out of the aircraft. No parachute is used.

11.18.1.2 Air-droppable pump

An emergency floatable pump kit may be passed to a vessel in need of emergency dewatering by fixed-wing or rotary SAR aircraft. The pump may be dropped by parachute, lowered by hoist, or dropped to an SRU for transfer to the distressed vessel.

11.18.1.3 Parachute drops

CAUTION
When recovering an air-droppable pump, be alert for the recovery line and parachute in the water. Keep them away from your propellers.

- The aircraft will make several low passes dropping smoke canisters to check wind drift and direction and mark the target;
- The pump will be dropped to windward of the target. The objective is to drop the pump attached to a 180 m (600 ft.) line with a drogue at the other end so that the line drifts down onto the vessel and the pump can be pulled aboard with the line;
- The pump canister is orange in colour, weighs 40 kg (90 lb.) and contains a 3.5 hp fire and salvage pump. It also contains oil for the pump, gasoline, intake and discharge hoses, and instructions. The pump can lift water a maximum of 7.5 m (25 ft.) and will run for approximately two hours on 4.5 L (1 gal.) of fuel.

11.18.2 Joint operations with DND helicopters

The main objective of this section is to standardize joint operations involving SRUs and helicopters, and to allow for maximum safety in the conduct of hoisting operations.

The aircraft captain will control the conduct of all hoisting operations, and his or her directions will be followed by the operator of the SAR surface vessel, unless there is evident danger to the vessel or crew in so doing.

Communication may be established on 123.1 MHz VHF-AM prior to commencing a hoisting process. If this frequency is not available, any other mutually agreeable working frequency may be utilized; this frequency should be determined by opening communications on 156.8 MHz (channel 16) or 157.1 MHz (channel 22A). A backup frequency shall also be established. VHF-FM is suitable for this purpose.

Assigned SRU names will be utilized by surface craft. The designator "rescue helicopter" may be utilized to establish communications with an SAR helicopter whose numerical designator is unknown. Once the numerical designator has been determined, the numerical designator will be utilized. For example: "Rescue 307."

The initial communications between the SRU and the aircraft will be as follows:

- The aircraft commander will advise the SRU of the details of the planned evolution and the number of persons aboard the aircraft;
- The SRU coxswain will advise the aircraft of wind velocity, magnetic direction, and the number of persons aboard the vessel. He or she will also indicate when the SRU is prepared to receive the aircraft for the hoisting process.

11.18.2.1 Preparation of the SRU

Emergency equipment:

- The surface vessel will have readily at hand, away from working areas and properly secured, a fire axe and fire extinguishers.

Personnel:

- Two persons only will normally be on the deck of SRUs during hoisting to assist the SAR technicians to get safely aboard. Non-essential personnel will be off the decks;
- Deck crew shall wear floater suits and protective helmets with chinstraps fastened, and use eye protection and gloves. Safety harnesses shall be utilized as required;
- Crewmembers on deck shall be positioned so as to offer maximum assistance to SAR technicians as they alight on, and leave, the vessel.

Deck equipment:

- All lines and loose equipment shall be secured prior to beginning hoisting;
- Antennae should be so tied as to provide added clearances for the helicopter;
- No searchlight or other glaring light source shall be directed toward the aircraft. No illumination flares or rockets shall be discharged without the prior concurrence of the aircraft commander;

- Ship radar should be selected so that it is not transmitting during hoisting operations to prevent hoisting cable from being tangled with the rotating scanner.

Safety precautions:

- Allow the hook, line or cable from the aircraft to touch the water or the surface vessel prior to handling it, to avoid shock from static electricity. If spilled fuel is present on the deck of the surface vessel, the aircraft must be advised so that it can ground the hoist cable safely;
- Vessels with gasoline stored on deck must be especially cognizant of this cautionary step;
- Beware of lines from the aircraft fouling on the surface vessel. Attach nothing to the vessel that is also attached to the aircraft. Carry no attached equipment inside the vessel;
- Rotor wash can blow personnel overboard. Be aware that it will fill the air with flying spray and reduce visibility. The accompanying noise levels will render voice communication difficult or impossible. Thus, visual signals and leadership amongst deck personnel must be finalized by the coxswain or commanding officer before the aircraft is overhead;
- Injured or sick persons to be hoisted into helicopters will be kept inside the vessel (if possible), not on deck, until the SAR technician is aboard the vessel to supervise their placement in the aircraft's stretcher, which is specially fitted for hoisting. All clothing and lines are to be well secured to avoid fouling of the hoist system of the aircraft.

11.18.2.2 Control of deck operations

Once the military SAR technician is on deck of the SRU, he or she will direct the hoisting process, and SRU crewmembers will follow these directions. All visual signals to the aircraft commander will be given by the SAR technician.

11.18.2.3 Positioning of vessel and conduct of normal hoist process

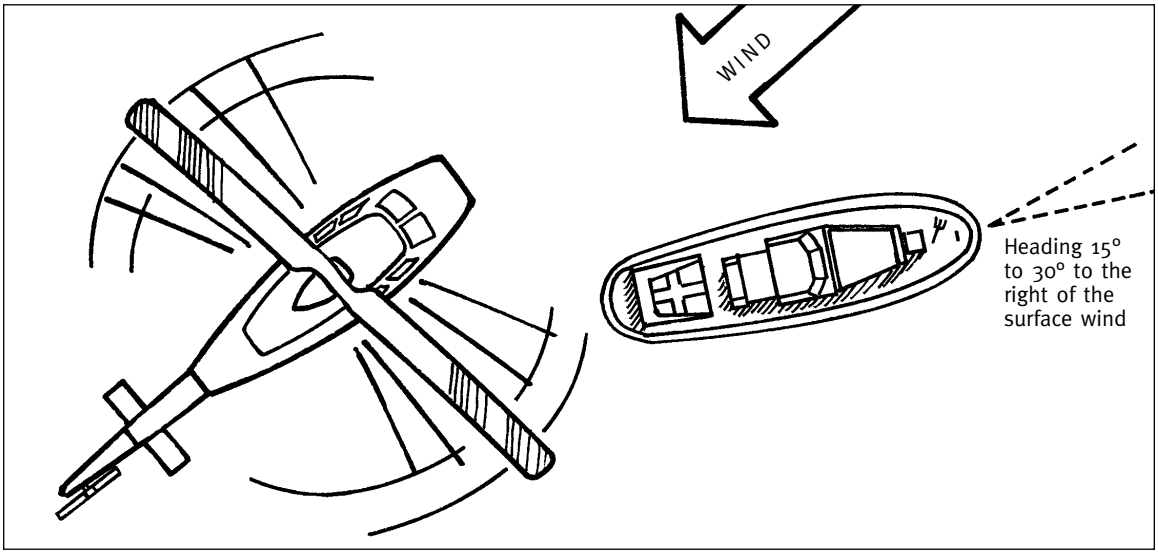


Figure 11.44: Positioning of vessel for hoist operation

Normally, the vessel will direct her heading 15° to 30° to the right of the surface wind, thus keeping the wind on her port bow. This allows the aircraft commander visual reference to the vessel and places the rescue hoist – which, like the pilot, is located in the starboard forward area of the aircraft – over the vessel's stern. Vessel speed should be five to eight knots. A military SAR technician will usually be lowered directly onto the stern of the vessel to take charge of preparing the person or item to be hoisted into the aircraft, with the assistance of the deck crew of the surface vessel. If the aircraft is unable to lower the SAR technician directly due to weather or sea conditions, a line will be lowered to the surface vessel from the aircraft. When this line has been "grounded" electrically and is held by the surface vessel crew, the aircraft will take up a position clear of the vessel, but still attached to the line extending to the vessel. The SAR technician will then be lowered on the hoist and simultaneously pulled to the surface vessel manually by means of the line held by the vessel. This line will at no time be attached to the vessel.

11.18.2.4 Aircraft engine failure

In the event of aircraft engine failure, the aircraft will break away to the nearest safe area. If a person is on the hoist at this time, the aircraft commander will sever the hoist cable and drop the person into the sea, simultaneously making a decision as to whether to land the aircraft itself in the sea. If such a landing is made, the first priority for the surface vessel crew is to manoeuver the vessel to avoid damage or injury from the helicopter rotors while picking up the person cut free from the hoist, and assisting the rest of the crew of the aircraft as required.

11.18.2.5 Aircraft emergency entry

Generally, the aircraft crew will carry out their own craft's abandonment if necessary, utilizing an on board 10-man inflatable raft for flotation. If assistance must be given by the crew of a surface vessel, do not approach the helicopter while the rotors are still turning. When alongside the aircraft, utilize the information indicated on the attached outline drawing of the Labrador helicopter to determine the best entry route. The entry of choice is the upper portion of the cabin main door indicated in Figure 11.46. Use of this door should retain the watertight integrity of the aircraft, which may be lost if other emergency entrances are opened. However, if necessary, either the emergency exit door, or the escape window panels, may be released by means of external pull tapes. Either the pilot's or copilot's side windows in the cockpit, may be released by first pressing the button on the side window's external handle to activate the spring-loaded emergency release handle. Turn this handle to release the side window.

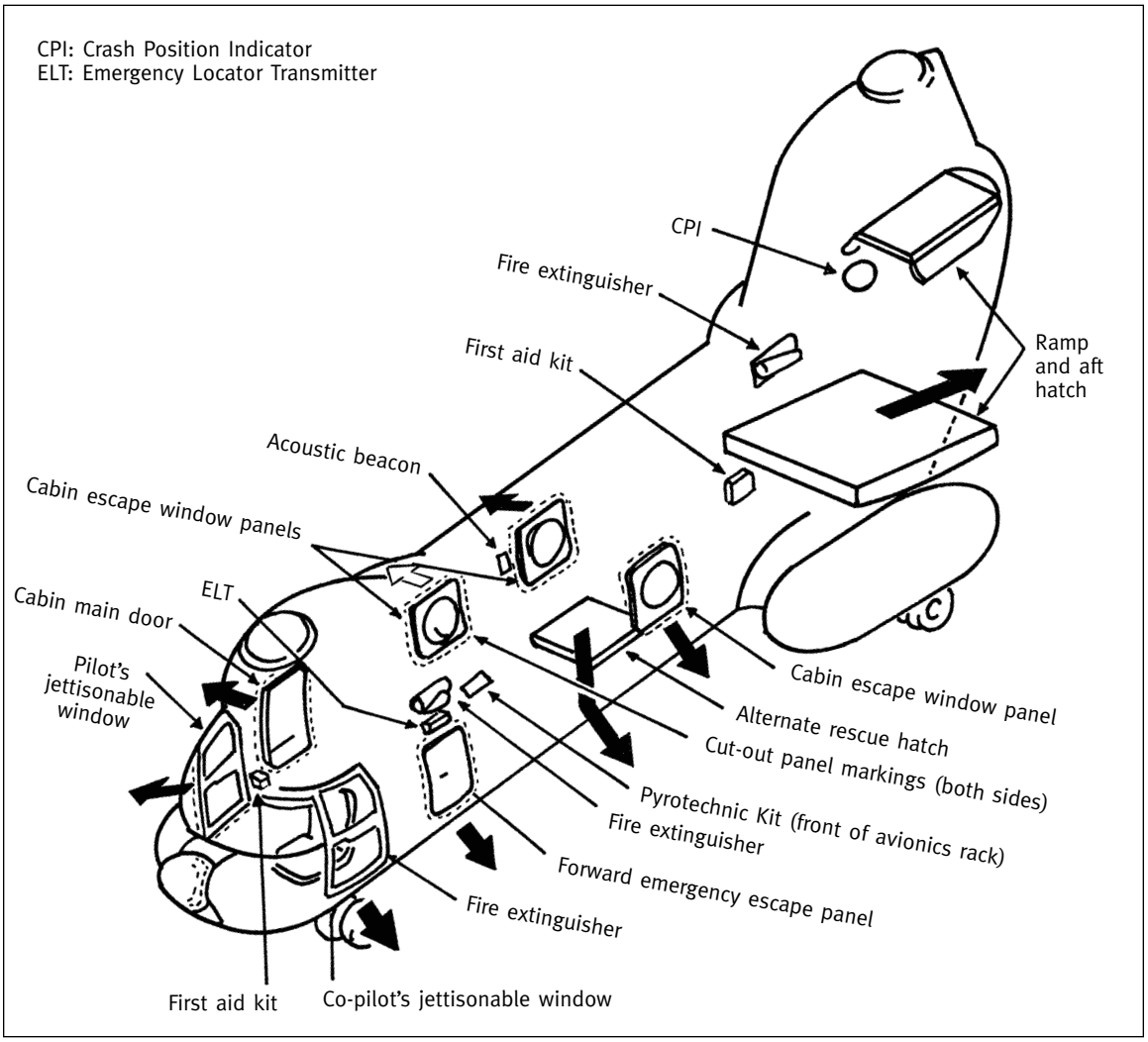


Figure 11.45: Labrador helicopter

11.19 RECOVERING SUBMERGED VICTIMS

Recovery of submerged victims may be quite difficult and hazardous for the untrained rescuer. Under no circumstances should any untrained rescuer, including certified scuba diver, attempt to enter the water to recover a submerged victim. Statistics show that untrained rescuers attempting such recoveries often die or get injured in the process. Submerged victims quite often have very little chance of survival. It is not advisable to risk the life of a crewmember to rescue someone that may already be dead. In those situations, the only rescue actions available to you are those that can be performed from the deck of your unit.

11.19.1 What agencies can recover victims?

When a submerged victim needs to be recovered, Coast Guard or Coast Guard Auxiliary units contact RCC/MRSC and ask for the assistance of trained professional divers. The following government agencies may provide divers for the purpose of recovering submerged victims:

- municipal or provincial police departments;
- RCMP;
- fire departments;
- Department of National Defense;
- some professional diving agencies or specialized rescue squads.

Recovering a dead person

Many persons still die at sea and, unfortunately, bodies are not always recovered during the initial search operation. When the conditions permit, drown victims may refloat after a period of submersion. Vessels engaged in SAR can be dispatched to recover dead bodies. When doing so, it is essential to follow proper procedures to avoid contamination and to facilitate legal issues.

11.19.2 General guidelines

When recovering a body, follow these guidelines:

- If possible and practical, have a police officer on board during body recoveries. Ensure that police officers and morgue personnel will be waiting for you at the delivery point;
- Wear protective gear (goggles, masks and long rubber gloves) before approaching the body;
- Manipulate the cadaver with metal or plastic poles (or boat hooks). Wood should be avoided, since it will not be easy to disinfect afterward;
- Do not directly handle the body;
- Try to keep the cadaver away from your unit. Avoid any direct contact if possible ;
- Be careful when handling the cadaver in order to protect the integrity of the body, in case of further investigation by legal authorities. In case of doubt, try to contact the closest coroner's office;
- It is paramount to keep in mind that this is a very emotional time for the family of the victim. In this regard, the body needs to be treated with the utmost respect and dignity;
- Communications must be conducted with the proper terminology when reporting bodies;
- If identification is present in the pockets of the body's clothes, try to recover it before towing. Anything removed from a body should be stored in a sealed bag. Remember to hand over the bag when transferring the body to the proper authorities;
- Tow the body at reduced speed. Avoid towing against the current. The body may be fragile and may lose pieces if towed at high speed;
- On arrival at destination, leave the body in the water until the proper authorities arrive. Avoid any contact between the body and the dock;

- After the operation, wash everything that came in contact with the body with soap and disinfect with a solution of water and bleach (1/4 cup of bleach per gallon of fresh tap water). Used rubber gloves should be replaced;
- Unless the SAR unit is fully equipped with body bags and protective gear, we recommend towing the body away from the boat. Never take a body on board when you do not have the appropriate equipment.

11.20 MISSION CONCLUSION

Once the mission is concluded:

- Inspect the equipment used during the mission;
- Prepare the unit for another mission (tidy and clean it up);
- Refuel your unit;
- Follow local procedures regarding SAR paperwork;
- Conduct a debriefing to identify the strong and weak points of your mission;
- Ensure crew readiness (rest, eat and drink if needed).

Note: Additional information on debriefings can be found in Chapter 2 (Human Factors).

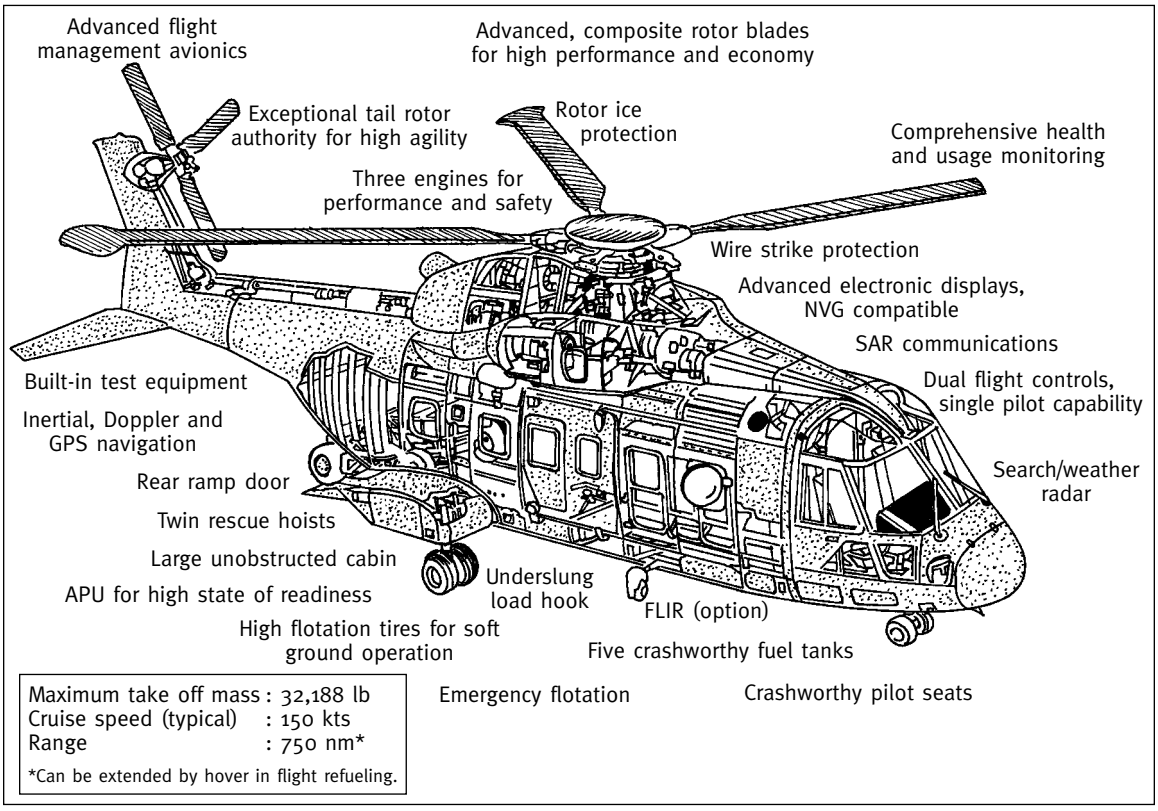


Figure 11.46: The new Cormorant SAR helicopter

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