National Defence
Fisheries and Oceans Canada
Canadian Coast Guard

Défense nationale
Pêches et Océans Canada
Garde côtière canadienne

B-GA-209-001/FP-001
DFO 5449

CAMSAR II

CANADIAN AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL

Volume II – Mission Coordination

(ENGLISH)

Supplement to the IAMSAR Manual, Volume II

Canada

CANADA

COAST GUARD • VOLUNTEERS • CANADIAN FORCES

TEAM SEARCH & RESCUE

Chapter 1 THE SAR SYSTEM

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1.01 Search and Rescue Units

Primary SRUs

1.01.1 As described in *CAMSAR I*, the Canadian Armed Forces (CAF) and the Canadian Coast Guard (CCG) are required to provide primary search and rescue (SAR) units (SRUs).

NOTE:	Refer to *CAMSAR I, sections 1.06 – National Defence SAR Responsibilities,* and *1.07 – Fisheries and Oceans SAR Responsibilities*.

Secondary SRUs

1.01.2 All CAF and CCG units that are not designated primary SRUs are considered secondary SRUs. While secondary SRUs do not maintain a SAR standby posture, they may be tasked to aid in the resolution of a SAR incident.

Tasking of SRUs

1.01.3 **Aeronautical or Maritime SAR –** SAR Region (SRR) Commanders may utilize all primary and secondary SRUs available in providing aeronautical or maritime SAR services. In instances where an SRR Commander's SRUs are considered to be inadequate for a specific task, he should request assistance from any suitable source. These may include:

.1 CAF secondary SRUs, which shall be requested through the Combined Air Operations Centre (CAOC);

.2 CCG secondary SRUs, which may be tasked through the appropriate CCG regional operations centre (ROC);

.3 the primary SRUs of neighbouring SRRs, which may be available and are requested through the appropriate joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC);

.4 secondary SRUs of other federal government departments; and

.5 other facilities, which may be tasked under the *Canada Shipping Act, 2001* by the SMC, acting for the SRR Commander.

NOTE:	JRCCs/MRSCs may charter required facilities in accordance with *section 1.04, paragraphs 1.04.7 to 1.04.11 – Hiring of Civilian Personnel and Services*. Any MRSC arranged charter which will be costed against the JRCC's accounting base must be approved by the Officer in Charge of the JRCC.

1.01.4 SMCs have the authority to task SRUs on aeronautical and maritime SAR incidents only.

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1.01 Search and Rescue Units

1.01.5 Other Than Aeronautical or Maritime SAR – Requests made to the SMC for the use of primary SRUs in functions not related to an aeronautical or a maritime SAR incident shall be referred to the appropriate authority within the CAF or the CCG.

1.01.6 Requests for CCG SRUs assistance on other than SAR incidents, i.e. police escort, salvage, etc., shall be transferred to the appropriate CCG ROC.

NOTE: Requests for CCG SRUs assistance on humanitarian incidents shall be in accordance with *section 3.04 – Humanitarian Incidents*.

On-scene Coordination

1.01.7 On-scene Coordinator – Whenever there is more than one SRU (primary or secondary) engaged in an operation, one SRU should be designated to coordinate the operation at the scene, whether the participating SRUs are aeronautical, maritime or a combination of both. Since the crews of primary SRUs will be experienced and trained in SAR operations, one of these will normally be designated as on-scene coordinator (OSC). If primary SRUs, either aeronautical or maritime, are not available and only secondary maritime SRUs are engaged, then one of these should assume the duty of OSC.

1.01.8 Aircraft Coordinator – Whenever more than one aircraft is engaged in a search where a vessel is OSC, then one of these aircraft should be designated as aircraft coordinator (ACO) to coordinate the aeronautical portion of the search as directed by the SMC.

NOTE: Refer to *CAMSAR III, section 3.01 – On-scene Coordinator* for the duties and responsibilities of the OSC and ACO.

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1.02 CAF SAR Technicians

1.02.1 The role of Canadian Armed Forces Search and Rescue Technicians (SAR Techs) in SAR and other Domestic/Expeditionary operations is to save lives and reduce human suffering. This is accomplished by:

.1 searching for and accessing the incident site to determine the nature of distress;

.2 penetrating the incident site;

.3 initiating and maintaining medical treatment;

.4 sustaining and protecting the survivors by the provision of site security, food, water and shelter; and

.5 evacuating the survivors.

NOTE:	SAR Techs shall NOT normally dive for salvage or body recovery operations.

1.02.2 The method of penetrating and accessing the distress site rests with the aircraft commander and the SAR Tech team leader. It may be achieved by one of the following:

.1 parachute, day or night;

.2 helicopter hoist;

.3 helicopter descent device[1];

.4 helicopter free entry[2];

.5 mountain/rope rescue;

.6 rescue diving, open water or confined space; and

.7 technical rescue, over land or over water.

1.02.3 The operational deployment of the SAR Tech team for SAR or other incidents should normally be preceded by authorization from the SAR Mission Coordinator to ensure that it is the most effective method of resolving the situation.

[1] Helicopter descent device is a device authorized within the 1 Cdn Air Div FOM or aircraft SMM used in the absence of a helicopter hoist.

[2] Helicopter free entry is any approved method used without the aid of a hoist/descent device to depart the helicopter normally into open water.

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1.02 CAF SAR Technicians

1.02.4 With regard to safety, the SAR Tech team shall not be deployed without the complete concurrence of the SAR Tech Team Leader and of the Aircraft Commander.

1.02.5 Procedures pertaining to operational deployment of SAR Techs are detailed in the RCAF *flight operations manual*, *CAF Diving Manual, Vol 2, B-GG-308-000/FP-002*, *CC-130H SMM, CC-115 SMM, CH-149 SMM, CH-146 SMM and the CFACM 60-ST-00101 SAR Tech checklist.*

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1.03 CCG Rescue Specialists

General

> ***Background***
>
> *As a signatory to the* International Convention on Maritime Search and Rescue (SAR) 1979*, the Canadian government is responsible for "the provision of medical advice, initial medical assistance, or medical evacuation".*
>
> *The Rescue Specialist (RS) Program was created in 1992 to address this requirement and recommendations contained in the Royal Commission Inquiry on the Ocean Ranger Disaster (1984).*
>
> *Recommendations included the need for Coast Guard rescue personnel to be trained and equipped in an advanced level of first aid – including hypothermia and Cardio-Pulmonary Resuscitation (CPR) – and trained in offshore survival and rescue techniques.*
>
> ***Policy***
>
> *Rescue Specialists are regular ships' crew members who, in addition to performing the duties required by the work description for their position on board the vessel, volunteer to undergo the RS training to provide this service.*
>
> *In order to provide pre-hospital care, it is the policy of the CCG to carry RS capabilities on board all CCG ships […].*
>
> Excerpts from the *Fleet Order (FO) 535.00 – Rescue Specialists on board Canadian Coast Guard Vessels*

1.03.1 The role of the Canadian Coast Guard (CCG) rescue specialists is to save lives. They are the front line of the CCG when it comes to providing medical assistance on coastal waters or the high seas. They may be deployed to rescue or assist survivors aboard distressed vessels, in remote locations along shorelines, or in water rescue situations. In addition to responding to SAR incidents, the rescue specialists also serve as the first aid attendants for the officers and crews of their vessels.

1.03.2 The approved CCG minimum crewing level is one to two rescue specialists per vessel, depending on the type of vessel, as stated in the CCG *FO 535.00, Annex A*.

Responsibilities

1.03.3 The roles and responsibilities pertaining to CCG rescue specialists are described in the CCG *FO 535.00*.

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1.03 CCG Rescue Specialists

1.03.4 Rescue specialists provide a level of pre-hospital medical care with basic life support and advanced first aid skills for the injured or sick. In addition to assessing injuries/illnesses and performing field treatment, the rescue specialists:

.1 provide monitoring and support to survivors;

.2 communicate with other professionals involved in the rescue to make sure they have full understanding of the extent of the victim's injuries;

.3 conduct triage and disaster scene management at the site of major maritime disasters;

.4 conduct treatment given under telemedical advisory service from medical practitioners, until patients can be transferred to a higher level of medical care; and

.5 maintain the SAR readiness equipment (rescue and first aid) at CCG stations and on board CCG vessels.

Requirements

1.03.5 In order to become rescue specialists, CCG personnel must meet specific advanced training and recertification requirements, as stated in the CCG *FO 535.00, Annex B*.

1.03.6 Other training may be taken, such as:

.1 marine emergencies duties (MED);

.2 rigid hull inflatable operational training (RHIOT);

.3 confined space rescue; and

.4 ice rescue.

Deployment

1.03.7 Operational deployment of the rescue specialist is under the authority of the commanding officer. Procedures are detailed in the CCG *Fleet Safety and Manual*.

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1.04 Civilian Agencies and Volunteers

Use of Civilian Associations

1.04.1 When tasking a civilian association unit, the joint rescue coordination centre (JRCC)/maritime rescue sub-centre must ensure that the crew members clearly understand that the tasking is in fact a request and that they are not obligated to comply with this request.

1.04.2 **CASARA –** Civil Air Search and Rescue Association (CASARA) members may be tasked for distress beacon homing missions, as spotters on military flights, or to provide fully manned civilian search aircraft as considered appropriate by the search and rescue (SAR) mission coordinator (SMC) or searchmaster (SM).

NOTE:	CASARA invoices shall be certified and paid by the SMC or SM staff at SAR headquarters prior to CASARA members leaving the search. Other invoices shall be certified by the JRCC and submitted to the section of the base associated with the JRCC for payment. Where possible, invoices shall be reimbursed with minimum delay owing to the personal expenses incurred by CASARA members.

1.04.3 **CCGA –** Tasking of Canadian Coast Guard Auxiliary (CCGA) units is to be considered in the absence of more appropriate SAR facilities or when it is perceived that by utilizing CCGA units, the SAR objectives can be achieved more quickly.

Use of Civilian Volunteers

1.04.4 When civilian aircraft, vessel or vehicle operators volunteer to assist in a search, but their assistance is considered not essential to the search, the SMC/SM may permit them to participate under his/her direction on the understanding that no reimbursement of expenses will be made. When tasking civilian volunteers, the SMC/SM must ensure that they clearly understand that the tasking is in fact a request and that they are not obligated to comply with this request.

1.04.5 **Spotters –** Trained CASARA or Canadian Armed Forces (CAF) spotters should be used as required. When trained spotters are unavailable, other civilians may be used if they are essential to the conduct of the search. Civilians volunteering their services in this capacity shall be advised that there will be no remuneration for their services. However, the SMC/SM is authorized to provide in-flight lunches for volunteer civilian spotters and to reimburse them for out-of-pocket expenses incurred due to their volunteer services (i.e., lodging and meals necessitated by an overnight stay as the result of an aircraft diversion). Invoices shall be utilized.

Hiring of Civilian Personnel and Services

1.04.6 When the SMC/SM considers that the assistance of civilian services is required, these services may be employed, at pay/charter rates, on the authority of the SAR Region

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1.04 Civilian Agencies and Volunteers

Commander or his delegated representative. These services include the hiring of civilian aircraft, vessels, vehicles and personnel (guides, trackers, etc.) that are essential to the successful completion of a SAR distress operation.

1.04.7 Before recommending the hiring of civilian personnel services, the SMC/SM shall determine that the rates quoted are fair and reasonable and include charges for all services rendered. The SMC/SM is also to mention to the chartered operators that they, and well as those in their employ, are responsible for their own actions.

1.04.8 Invoices charged to the CAF shall be certified by the SMC/SM in accordance with standard procedures, and submitted to the accounting section of the Wing/Base serving the JRCC for certification and payment action.

1.04.9 When necessary, SAR personnel may be carried by chartered civilian facilities. This carriage will normally be limited to the transport of personnel to and from the scene of the incident.

1.04.10 Once hired, the responsibility to adhere to normal safe operating procedures remains with the operator.

Carriage of Civilians

1.04.11 The Commander, 1 Canadian Air Division, through Senior Staff Officer (SSO) SAR, may authorize civilian personnel such as next-of-kin to be carried as additional crew in aircraft engaged in SAR operations, as long as their participation is in the interest/support of the actual SAR operation. Foreign civilians will require ministerial level approval, as there may be diplomatic concerns or considerations.

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1.05 Support to SAR

Position Locating Services

1.05.1 Radar – Numerous radar sites located across Canada are used to record the progress of aircraft and vessel movements. These systems have a capability to assist in locating aircraft or vessels in distress and search planners should make full use of this capability.

1.05.2 Air Defence – Military radar sites of the North American Aerospace Defence Command (NORAD) may provide valuable information, which could help locate distressed aircraft transiting through the area coverage of the defence radar. Search and rescue (SAR) mission coordinators (SMC) can be provided with specific recorded radar information from NORAD sites by contacting appropriate military authorities. Joint rescue coordination centres (JRCCs) shall maintain a current list of contacts within NORAD to ensure timely provision of such information when required.

1.05.3 Air Traffic Control – Recorded radar or voice information from civilian and military air traffic control (ATC) installations may also be used to assist in responding to an aeronautical distress incident. In addition, some ATC radar installations have the capability to direct SAR aircraft to the scene of a suspected aeronautical distress. When it is believed that ATC information can assist in SAR operations, the Wing's Operations Officer of Canadian Armed Forces (CAF) bases, or the Transport Canada Regional Manager of Air Traffic Services, should be contacted as soon as possible.

1.05.4 In addition, ATC should be requested to issue notices to airmen about the search areas in order to provide added safety for search crews.

1.05.5 Marine Communications and Traffic Services – Marine Communications and Traffic Services (MCTS) centres within the SAR region may also be able to provide JRCCs/maritime rescue sub-centres (MRSCs) with real-time radar information concerning incidents and/or traffic within the limits of a traffic zone.

1.05.6 Vessel Traffic Services and Reporting Systems – Organizations that manage vessel traffic services and/or vessel traffic reporting systems are capable of providing, to varying degrees, information about participating vessels (location, construction, cargo, etc.) that may be of use in resolving a SAR incident.

.1 selected MCTS centres are designated to administer the following Canadian offshore vessel traffic reporting systems:

.a **ECAREG –** The Eastern Canada Traffic System (ECAREG) covers all eastern Canadian waters south of 60°N, including the Gulf of Saint Lawrence but excluding designated vessel traffic services zones.

.b **NORDREG CANADA –** The Arctic Canada Traffic System (NORDREG CANADA) covers all waters north of 60°N, including all of Hudson Bay and Ungava Bay but excluding those portions of MacKenzie Bay and Kugmallit Bay that are south of 70°N and east of 139°W.

.2 **St Lawrence Seaway –** Operated in Canada by the St. Lawrence Seaway Management Corporation, the St. Lawrence Seaway (commonly called "The Seaway") Traffic Management System (TMS) covers the area from west of 073°30'W in Montréal Harbour to Port Colborne, Lake Erie. The Seaway TMS centres maintain very high frequency (VHF) – frequency modulation (FM) contact and the reporting procedures are the same as those of other vessel traffic services.

1.05.7 Each joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) should develop mutually agreed upon procedures with all MCTS and Seaway TMS centres within their area of responsibility. These local procedures are to be included in the JRCC/MRSC standard operating procedures.

NOTE: Refer to *CAMSAR I, section 5.04 – JRCC/MRSC SAR Documentation*.

1.05.8 **Amver –** The Automated Mutual Assistance Vessel Rescue System (Amver) is a voluntary ship reporting system operated by the United States Coast Guard (USCG). Participating vessel information is made available to JRCC/MRSC coordinators via any USCG rescue coordination centre.

NOTE: Refer to *section 3.07 – Maritime Electronic Positioning Information Tools*.

Direction Finding

1.05.9 **VHF DF –** Some MCTS centres have direction finding (DF) capability on selected VHF aeronautical and maritime frequencies. JRCC/MRSC coordinators should familiarize themselves as to which MCTS centres provide which type of DF services. These centres should be contacted if their assistance is likely to contribute to the resolution of the SAR incident.

1.05.10 Under regulation, all primary SAR vessels have a VHF DF capability, which should be used to the maximum extent.

1.05.11 **HF DF –** There are two high frequency (HF) DF nets in Canada, one operated by the Canadian Forces Information Operations Group (CFIOG) and the other by Industry Canada. These may be used by the SAR system to pinpoint the source of an HF transmission from a distressed vessel or aircraft.

1.05.12 One of the primary services of the nets is support to SAR; they should therefore be contacted if their assistance is likely to contribute to the success of the SAR effort.

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1.05.13 To facilitate maximum opportunity for HF DF net prosecution, the SAR authority should attempt to have the distressed unit transmit, at maximum power, an easily identified signal such as:

.1 a long count from zero to 10 or longer and reverse followed by the distressed unit's identification, repeated frequently; and

.2 a steady carrier or alarm signal.

1.05.14 The following information should be provided when the net stations are contacted:

.1 urgency of the situation (life-threatening or not);

.2 SAR incident name;

.3 call sign of unit in distress;

.4 distress frequency;

.5 mode of transmission (voice, auto-alarm, tone, etc.);

.6 nature of emergency;

.7 any positional data known or previously received; and

.8 length of watch requested (note that CFIOG will continue to prosecute a SAR event until stood down by the requesting authority).

1.05.15 Canadian Forces Information Operations Group (CFIOG) – The following procedures are to be employed by the JRCCs and CFIOG stations:

.1 on notification that an aircraft with the ability to transmit in the 2 to 32 megahertz range is in distress, the applicable JRCC will include Canadian Forces Stations (CFS) Alert and Leitrim as action addresses in its *Missing Aircraft Notice (MANOT)*. The Senior Staff Officer of Operations (SSO Ops) at the CFIOG Headquarters (HQ) will be included as an information addressee;

NOTE: Refer *to section 2.03, paragraphs 2.03.4 to 2.03.7 – Missing Aircraft Notices*.

.2 CFIOG stations shall respond to all MANOTs using dedicated HF DF facilities, treating requests for CAF assistance to actual or potential distress cases as an emergency;

.3 negative reports shall be submitted every eight hours or at shift turnover. Positive reports shall be submitted as they occur, in accordance with the format shown on the next page. All reports will be submitted as immediate precedence to the initiating JRCC, info CFIOG HQ/SSO Ops, with follow-up reports numbered in sequence. If the JRCC wishes to extend the surveillance

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beyond the initial 48-hour period, it shall address its request to the CFIOG addresses, specifying the period of extended cover requested, e.g., 24 hours, 48 hours. Unless requested to extend surveillance, contributing stations shall submit their final report as "FOLLOW-UP NUMBER xx AND FINAL".

.4 Netted HF DF stations may initiate tip-offs to the appropriate net for SAR support as required. When available, netted results will be reported in *paragraph G of the SAR support message* as follows:

Message to be sent IMMEDIATE/ROUTINE

Distribution

FM: Applicable CAF Communication Station

TO: Appropriate JRCC

INFO: CFIOG HQ OTTAWA//SSO OPS//

Required Information

SUBJ: SAR HF DF SUPPORT

A. MANOT Identification.

B. Time of bearing in UTC or negative results.

C. True bearing in three digits with validity indicator.

D. Latitude and longitude of reporting station.

E. Signal type/frequency.

F. Amplifying data.

G. Netted fix report.

Example

SUBJ: SAR HF DF SUPPORT

A. MANOT 58, SAR COMOX FOLLOW-UP NUMBER 10 AND FINAL

B. 1800 UTC

C. 320 TRUE PLUS OR MINUS 10 DEGREES

D. 485704N 0543133W

E. VOICE/5680

F. N/A

G. N/A

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1.05 Support to SAR

1.05.16 JRCCs are authorized to contact the CFIOG by telephone. Contact telephone numbers are:

CFS Leitrim: 613-945-3135 (General Purpose Canadian Switched Network: 627-3135)

1.05.17 The Canadian Forces Station (CFS) Leitrim has promulgated formal and annually reviewed procedures through their chain of command. Any changes in procedures between JRCCs and the CFIOG are to be forwarded to the Senior Staff Officer of Operations, at the CFIOG HQ.

Satellite, Aerial and Infra-Red Photography

1.05.18 If the use of air or infrared photography may aid the conduct of a search, a request for its use is to be forwarded to the Canadian Forces Integrated Command Centre (CFICC).

1.05.19 Space-based and other multi-spectrum detection systems may be capable of assisting in detecting the search object. JRCCs may request this service, as required, through the appropriate Joint Task Force Intelligence or through the CFICC.

NOTE: Also refer to *paragraph 1.05.21 – CAF Weather Service*.

Meteorological Services

1.05.20 In the initial planning of a SAR operation, the SMC shall have available comprehensive information on the past, prevailing, and forecast meteorological conditions in the search area, and the prevailing and forecast conditions search facilities will encounter en route to and from the search area. In the case of winter maritime SAR operations, forecast and prevailing ice conditions also need to be obtained.

1.05.21 **Canadian Forces Weather Service –** The provision of meteorological support to SAR operations is the responsibility of the Canadian Forces Weather Service (CFWS) and procedures to that effect are in place with the JRCCs. Also, most CFWS centres are equipped to receive satellite photos. These pictures are available for the visual and infrared frequencies and may be of assistance to search planners. The deployed SMC or searchmaster will coordinate with the CFWS to arrange for the meteorological services to be provided at the search headquarters.

1.05.22 **Environment Canada –** Available to all, the Environment Canada (EC) Weather Office website: weatheroffice.gc.ca provides detailed online weather information. MRSCs will normally obtain meteorological information directly from their established point of contact

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1.05 Support to SAR

with EC. The Canadian Search and Rescue Planning System (CANSARP) is linked to EC databases and is a particularly useful tool for determining wind forces.

1.05.23 Canadian Ice Service – Ice information is collected and collated by the Canadian Ice Service, EC, on behalf of the Canadian Coast Guard (CCG). This information may be obtained from one of the CCG operated Ice Offices or Ice Centre.

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1.06 Public Relations

1.06.1 Whenever possible, all public information releases to the news media concerning search and rescue (SAR) operations should be made through the Canadian Armed Forces (CAF) Public Affairs or through the Fisheries and Oceans Communications branch.

1.06.2 Unless otherwise directed by the SAR Region Commander, releases will be authorized by the Officer in Charge (OIC) of the joint rescue coordination centre (JRCC) or his/her representative.

1.06.3 The Regional Supervisor, Maritime SAR, (RSMS) of a JRCC may develop press releases for maritime incidents. However, approval of the OIC JRCC must be obtained prior to actual release of the information.

1.06.4 The RSMS of a maritime rescue sub-centre (MRSC) may develop press releases for incidents which are solely controlled by the MRSC; however, approval of the OIC JRCC must be obtained prior to actual release of the information.

1.06.5 Press releases on incidents for which the control has been transferred from an MRSC to a JRCC shall originate through the OIC JRCC, or, if applicable, the SMC. Prior to issuance of a press release in these cases, a copy of the contents shall be forwarded to the MRSC for near-simultaneous transmittal to news media.

1.06.6 All releases from JRCCs shall be in accordance with current CAF directives.

NOTE: Refer to the *IAMSAR Manual, Volume II, section 1.10 – Public Relations*.

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1.06 Public Relations

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2.01 Global Maritime Distress and Safety System

GMDSS

2.01.1 Maritime Mobile Service – The Maritime Mobile Service is defined by the International Telecommunication Union (ITU) as, "A mobile [communications] service between coast stations and ship stations, or between ship stations, or between associated on-board communications stations; survival craft stations and emergency position-indicating radio beacon stations may also participate in this service".

2.01.2 Maritime Mobile-Satellite Service – The Maritime Mobile-Satellite Service is defined by the ITU as, "A mobile-satellite [communications] service in which mobile earth stations are located on board ships: survival craft stations and emergency position-indicating radio beacon stations may also participate in this service".

2.01.3 These services interface with carriage requirements and other shore-side services, required under the *International Convention for the Safety of Life at Sea* and the *International Convention on Maritime Search and Rescue, 1979*, to form the overall Global Maritime Distress and Safety System (GMDSS).

2.01.4 In the Canadian search and rescue (SAR) area of responsibility (AOR), Canadian Coast Guard (CCG) Marine Traffic and Communications Services (MCTS) centres provide 24/7 "coast watching" services required for the detection of all distress alerts issued within the maritime mobile service. Further, these centres provide the follow-on broadcast and mobile communications services required during SAR operations.

Distress Beacons

2.01.5 There are two types of distress beacons regulated for use:

.1 COSPAS-SARSAT 406 megahertz (MHz) emergency locator transmitters (ELTs), emergency position-indicating radio beacons (EPIRBs) and personal locator beacons (PLBs); and

.2 very high frequency (VHF) digital selective calling (DSC) EPIRBs.

2.01.6 COSPAS-SARSAT 406 MHz Beacons – Alerts from 406 MHz distress beacons—ELTs, EPIRBs and PLBs—are received by the COSPAS-SARSAT constellation of geostationary (GOES) and low-earth orbiting (LEO) satellites and relayed to ground stations called local users terminals. Alerts are then forwarded to the associated mission control centre (MCC) for processing and determination of position. The Canadian Mission Control Centre (CMCC) forwards all ELT and EPIRB alerts to the joint rescue coordination centre (JRCC) responsible for the SAR region (SRR) in which the beacon is detected. The JRCC or maritime rescue sub-centre (MRSC) coordinator then actions the alert to resolve the incident.

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2.01 Global Maritime Distress and Safety System

NOTE:	Refer to *section 3.06 – Alert Response*.

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2.01 Global Maritime Distress and Safety System

2.01.7 The 406 MHz distress beacons are coded, and when properly registered, identify the aircraft or vessel and give contact information, which the JRCC/MRSC coordinator uses in resolving the incident. Some distress beacons also transmit a low-power 121.5 MHz homing signal. JRCC/MRSC coordinators who encounter improperly registered beacons shall advise CMCC.

NOTE:	Refer to *section 3.06, paragraph 3.06.8 – Canadian Beacon Registry*.

2.01.8 The 406 MHz COSPAS-SARSAT beacon transmission contains information that is vital to the efficient coordination of SAR cases originating from such beacons. Beacons that are capable of calculating and transmitting their own position provide SAR authorities with an immediate location for the distress signal. All 406 MHz beacons transmit a 15 digit hexadecimal code that is cross referenced to the Canadian Beacon Registry when the beacon is activated in order to provide SAR authorities with the beacon registration file. Beacon coding is explained in detail in COSPAS-SARSAT document "G.005 406MHz Beacon Coding, Registration and Type Approval" which is publicly available online.

.1 Canadian PLBs may only be coded with the Serial User Protocol, User Location Protocol or Standard Location Protocol. All other operational coding protocols are forbidden.

.2 Canadian ELTs may only be coded with either, Serial User (24 bit Address) Protocol or Standard Location (24 bit Address) Protocol. All other operational coding protocols are forbidden.

.3 Canadian EPIRBs may only be coded with Serial User (Serial Number) Protocol or Standard Location (Serial Number) protocol. All other operational protocols are forbidden.

2.01.9 406 MHz COSPAS-SARSAT beacon alerts are instantaneously detected by the GOES satellites which, however, cannot ascertain the position of beacons not coded with GPS information because there is no Doppler shift. A position for those beacons can only be calculated when a LEO satellite detects the signal. An unlocated signal is initially passed to the MCC of the country that holds the database for that beacon, until a probable position of the beacon can be ascertained. If it is a Canadian registered beacon, CMCC forwards the alert to the JRCC responsible for the SRR in which the aircraft or vessel normally operates.

2.01.10 VHF-DSC EPIRBs – Ships operating exclusively in a GMDSS "A1 sea area" may, in lieu of satellite EPIRBs, use VHF-DSC EPIRBs transmitting on channel 70. These EPIRBs transmit their MMSI number, their GPS position and other vital information. They are registered in the national MMSI database for each country. In Canada, distress alerts from these beacons are detected by CCG MCTS centres and all alert information is forwarded to the appropriate JRCC/MRSC as soon as possible. The JRCC/MRSC coordinator then actions the alert to resolve the incident similarly to VHF-DSC distress alerts.

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2.01 Global Maritime Distress and Safety System

NOTE: Refer to section *3.06, paragraph 3.06.9 – DSC Distress Alerts.*

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2.01 Global Maritime Distress and Safety System

Inmarsat

2.01.11 Inmarsat A, B or C distress and urgency alerts transmitted from a vessel are first detected by an Inmarsat land earth station (LES) and forwarded directly to its associated rescue coordination centre (RCC). A vessel in distress in Canada's SAR AOR will have its automatic distress alert sent to the RCC associated with the LES which that vessel has chosen. Vessels may also contact any Canadian JRCC/MRSC directly by telephone, fax, or telex using Inmarsat A, B or C.

2.01.12 Terminal Return ID – The Inmarsat return ID is a "hidden" identification code assigned to a ship earth station (SES) and used by the system for security purposes. Occasionally alerts are received from terminals that have been installed on a ship but have not yet been commissioned on the Inmarsat system. In these cases there will be no terminal ID to identify the vessel. The return ID is programmed into the terminal at the manufacturing stage, as opposed to a terminal ID, which is assigned by Inmarsat when the SES is commissioned. It can be obtained from the Inmarsat Network Operations Centre or the LES operator that received the distress alert. Inmarsat equipment manufacturers have records to match return IDs with serial numbers and should be able to identify the dealer to whom the terminal was sold.

2.01.13 Follow-on Communications – Each Inmarsat system provides different services and can be recognized by the first digit of the Inmarsat Mobile Number.

Type	First Digit	Services
Inmarsat-A	1	telephone, telex, fax, data
Inmarsat-B	3	telephone, telex, fax, data
Inmarsat-C	4	telex, send fax, data
Inmarsat-M	6	telephone, fax, data

2.01.14 To call a vessel on Inmarsat, follow the instructions in the *Inmarsat User Manual* or use the assistance of the LES or Network Operations Centre operator.

2.01.15 Inmarsat-C Shore-to-ship Distress Priority Message – A JRCC/MRSC may initiate an Inmarsat-C distress priority message for follow-on communications. This internet-based service gives the shore-to-ship message the same priority for immediate delivery as a distress message originating from a ship. An Inmarsat-C distress priority message can be sent from the JRCC/MRSC or via an MCTS centre with access to the service. An acknowledgement request can be attached to the message, which means the LES will send a positive delivery notification to the originator when the message is delivered to the vessel, thus ensuring that the message has been delivered on-board the vessel.

2.01.16 Barred Inmarsat Terminals – Inmarsat may bar a ship's terminal from accessing the system due to non-payment of invoices or improper use. The ship will still be

Chapter 2 COMMUNICATIONS

2.01 Global Maritime Distress and Safety System

able to send a distress alert to an RCC via a LES even when normal access is barred. If a JRCC/MRSC receives a distress alert from a barred terminal, the JRCC/MRSC coordinator can request that the operator at the LES that received the alert activate the terminal for distress communications. Since reception of maritime safety information broadcasts is a requirement in the GMDSS, all barred terminals will still receive all priorities of enhanced group calling broadcasts.

Radiotelephones

2.01.17 Upon receipt of a radio telephone transmitted alert at an MCTS centre, the duty MCTS officer will take action in accordance with the *MCTS Standards Manual*. First, the MCTS officer will obtain relevant vital data from the source. Then, if it is clear that there are persons in distress and more assistance is required, the MCTS officer shall broadcast a "Mayday Relay" on behalf of the master of the distressed vessel. As soon as possible, the MCTS officer shall forward all information and any actions taken related to the alert to the JRCC/MRSC coordinator. This should be done via voice and followed-up with a hardcopy message. Upon notification, the JRCC/MRSC coordinator shall action the alert to resolve the incident.

NOTE:	For frequencies, refer to *section 2.02 – SAR Radio Frequencies and Channels*.

Digital Selective Calling

2.01.18 DSC distress and other alerts are detected by CCG MCTS centres equipped with DSC, foreign coast radio stations and vessels within propagation range of the alert broadcast.

2.01.19 Alert Message Composition

.1 format specifier:

- .a distress;
- .b urgency; or
- .c safety;

.2 nine-digit MMSI:

- .a ship station: MIDXXXXXX; or
- .b coast station: 00MIDXXXX;

where "MID" is maritime identification digits or country code, and "X" is any integer from 0 to 9;

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2.01 Global Maritime Distress and Safety System

.2 nature of the distress (default setting is "undesignated");

.3 distress coordinates (default is "no position information" or 99999 99999);

.4 Coordinated Universal Time (UTC): hhmm (default is "no time information" or 8888); and

.5 mode of subsequent communication (default is "radiotelephony").

2.01.20 VHF-DSC – If an MCTS officer receives a VHF-DSC distress alert and the distress coordinates are within the MCTS centre's AOR, the MCTS officer will transmit a VHF-DSC distress alert acknowledgement. If no coordinates are transmitted or if the coordinates are outside VHF range and the alert is not being acknowledged, the MCTS Officer will acknowledge. After acknowledgement, radiotelephone communications will be established on VHF channel 16 in order to obtain vital data. If required, a Mayday Relay may be broadcasted. The MCTS Officer will then advise the JRCC or MRSC as soon as possible.

2.01.21 HF-DSC – If an HF-DSC distress alert is received and the distress coordinates are within the Canadian AOR for SAR, the most appropriate MCTS centre will immediately transmit a HF-DSC distress alert acknowledgement on the same frequency. After acknowledgement, communications will be established on radiotelephone or narrow band direct printing using the associated frequency in order to obtain vital information. If required, a Mayday Relay may be broadcasted. The MCTS officer will then advise the JRCC/MRSC. If the distress coordinates are outside the Canadian SAR AOR or no coordinates were included in the transmission, a DSC distress alert acknowledgement will not be sent without consultation with the JRCC/MRSC coordinator.

NOTE: Refer to *section 3.06, paragraph 3.06.8 – DSC Distress Alerts*.

Mobile Phones (Terrestrial and Satellite)

2.01.22 JRCCs/MRSCs should make arrangements with the cellular service providers' regional network operation centres to provide SAR assistance such as:

.1 directory assistance;

.2 when last and next call is made from a particular cellular number;

.3 which cell site a particular call was received through; and

.4 locating services, where available.

2.01.23 Satellite Communications Services – Many mobile satellite communications services are not regulated for the provision of aeronautical or maritime distress alerting, nor are they suitable substitutes for approved means of distress communications. JRCC/MRSCs must still be capable of coordinating the response to incidents alerted via these services. There are numerous international services (systems) used aboard aircraft and vessels for the provision of voice, fax, e-mail, and data communications. Quite often these services automatically interface with public communications networks.

2.01.24 Most satellite service providers maintain a network operations centre that is staffed 24/7. JRCC/MRSC should maintain contact information for these centres to assist in establishing follow-on communications and obtaining vital data in the event of an alert being transmitted via one of their services. If an alert is transmitted via one of these services, either directly to a JRCC/MRSC or relayed to a JRCC/MRSC via another source, the JRCC/MRSC coordinator shall then action the alert to resolve the incident.

SARTs

2.01.25 SAR transponders (SARTs) are used for locating survivors by SAR units and their signals are also to be considered as a distress alert. The SART should normally be taken to the survival craft when abandoning a vessel. SARTs transmit in the X-band (3 cm) radio frequency used by common aeronautical and maritime radar. The signals are detected at various distances depending on scanner height, tuning and bandwidth of the radar.

2.01.26 Any JRCC/MRSC coordinator that is advised of the detection of a SART shall action the alert to resolve the incident.

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2.02 SAR Radio Frequencies and Channels

2.02.1 Distress, Safety and Calling

Service	Band	Frequency/ Channel (CH)	Description	Mode
Maritime	MF	2174.5 kHz	International – distress	NBDP
		2182 kHz	International – distress	RT
		2187.5 kHz	International – distress and calling	DSC
Maritime	HF	4125 kHz	International – distress	RT
		4177.5 kHz	International – distress	NBDP
		4207.5 kHz	International – distress and calling	DSC
Maritime	HF	6215 kHz	International – distress	RT
		6268 kHz	International – distress	NBDP
		6312 kHz	International – distress and calling	DSC
Maritime	HF	8291 kHz	International – distress	RT
		8376.5 kHz	International – distress	NBDP
		8414.5 kHz	International – distress and calling	DSC
Maritime	HF	12 290 kHz	International – distress	RT
		12 520 kHz	International – distress	NBDP
		12 577 kHz	International – distress and calling	DSC
Maritime	HF	16 420 kHz	International – distress	RT
		16 695 kHz	International – distress	NBDP
		16 804.5 kHz	International – distress and calling	DSC
Land	HF	27 066.5 kHz/ CB-CH 09	International – unofficial safety and calling General Radio Service frequency (citizen's band)	RT
Aeronautical	VHF-AM	121.5 MHz	International – distress and distress beacon	RT
Maritime	VHF-FM	156.525 MHz/ CH 70	International – distress and calling	DSC
		156.75 MHz/ CH 15	Canadian – frequency for old emergency position-indicating radio beacons which may still be in existence but are not allowed under regulations	RT
		156.8 MHz/ CH 16	International – distress and calling	RT
Aeronautical/ Maritime	UHF	243 MHz	North Atlantic Treaty Organization (NATO) – combined voice aeronautical distress frequency; International – life boat and life raft; distress beacon	RT
Aeronautical/ Maritime/Land	UHF	406 MHz to 406.1 MHz	International – distress beacon frequency	–

Chapter 2 COMMUNICATIONS

2.02 SAR Radio Frequencies and Channels

2.02.2 Mission Coordination

Service	Band	Frequency/ Channel (CH)	Description	Mode
Aeronautical/ Maritime	HF	3023 kHz	International – Search and rescue (SAR) on-scene (to be used between commercial aircraft and vessels if communications are not established on 4125 kHz)	RT
		4125 kHz	International – SAR on-scene (recommended between commercial aircraft and vessels)	
		5680 kHz	International – SAR on-scene	
Aeronautical	HF	5717 kHz	Canadian – SAR air/ground/air	RT
		6694 kHz	Canadian – SAR air/ground/air	
		8992 kHz	Canadian – SAR air/ground/air	
		11 187 kHz	Canadian – SAR air/ground/air	
Aeronautical	VHF-AM	123.1 MHz	International – SAR on-scene and emergency locator transmitter training	RT
Aeronautical/ Maritime/Land	VHF-FM	149.08 MHz	Canadian SAR interagency frequency (SAR-IF)	RT
Maritime	VHF-FM	156.3 MHz/ CH 06	International – SAR on-scene	RT
		156.95 MHz/ CH 19A	Canadian - Coast Guard general operations (East Coast and Great Lakes)	
		157.125 MHz/ CH 82A	Canadian - Coast Guard general operations (West Coast)	
Aeronautical	UHF	246.2 MHz	Canadian – SAR on-scene and Canadian Forces personal locator beacon training	RT
Aeronautical/ Maritime	UHF	252.8 MHz	NATO – combined SAR training	RT
		282.8 MHz	NATO – combined SAR on-scene	

2.02.3 Radio Stations – Working frequencies and frequencies for maritime safety information broadcasts used by Marine Traffic and Communications Services centres are listed in the current volume of *Radio Aids to Marine Navigation, Pacific*, or *Atlantic and Great Lakes* editions. The *Admiralty List of Radio Signals, Volume 5*, lists those for all international radio stations.

2.02.4 On-scene Ground Search Parties - Ground search parties involved in crash guard team duties may use any of the following additional on-scene working frequencies while so employed:

2 216 kHz	3 280 kHz	4 480 kHz	5 832 kHz
9 292 kHz	12 115 kHz	15 733 kHz	18 204 kHz

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2.03 Broadcasts

General

2.03.1 After an alert of an actual or potential aeronautical or maritime incident has been detected, a broadcast of search and rescue (SAR) related safety information, which requires and initiates a response by all fixed or mobile stations (aircraft and vessels) in the vicinity, may aid in resolving the incident. The broadcasts are issued via various systems.

2.03.2 In general, a broadcast of SAR related aeronautical or maritime safety information shall consist of:

.1 Priority:

.a distress, transmitted as "MAYDAY RELAY" (repeated three times);

.b urgency, transmitted as "PAN PAN" (repeated three times);

.c safety, transmitted as "SÉCURITÉ" (repeated three times); and

.d no specific priority (general broadcast); and

.2 ALL STATIONS (repeated three times);

.3 THIS IS (name of transmitting station);

.4 details of the situation;

.5 action required by all stations; and

.6 contact instructions for follow-on communications.

2.03.3 Broadcasts of SAR related information are normally initiated by the SAR Mission Coordinator (SMC). A distress broadcast (Mayday Relay) may, however, be retransmitted or initiated by a station that learns that a mobile station (aircraft or vessel) or person is in distress and it is apparent that further assistance is required.

Missing Aircraft Notices

2.03.4 Once a distress phase has been declared by a joint rescue coordination centre (JRCC) for an aeronautical incident, an *Initial Missing Aircraft Notice (Initial MANOT)* is to be completed and issued by the JRCC.

2.03.5 A *Final MANOT* is to be issued on successful completion or reduction of a search.

2.03.6 When a search has been reactivated a MANOT is to be issued using the original number and format, and adding the word "REOPENED" after the number.

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2.03 Broadcasts

2.03.7 Each JRCC will number the MANOTs consecutively, commencing each calendar year with the number 1 and a suffix of the four digits of the year, i.e., 1/2011 INITIAL, 1/2011 FINAL, and 1/2011 REOPENED.

NOTE: Refer to *Appendix A* for the *MANOT Message* formats.

Maritime Safety Information Broadcasts

2.03.8 Unless it has already been done by a Marine Communications and Traffic Services (MCTS) officer, the SMC shall initiate the broadcast appropriate to the type of SAR incident and degree of emergency. To this end, a completed *Maritime Safety Information (MSI) Broadcast Message* form will be transmitted to the appropriate MCTS centre(s) for broadcast. This action may be done verbally and followed-up with a hard copy.

2.03.9 SMCs and MCTS officers should consult and reach a mutual agreement to ensure that the broadcast is properly prioritized, sent via the most appropriate media and transmitted over the most effective area. This will help ensure the best resolution of the incident while not impacting more stations than necessary.

NOTE: Should a conflict occur that cannot be immediately resolved, the SMC will exercise ultimate authority and accept responsibility for actions taken to resolve the incident.

2.03.10 Finally, the SMC shall always cancel or downgrade the priority of MSI broadcasts as soon as practicable, by transmitting the *MSI Broadcast Cancellation Message* to the MCTS Centre.

NOTE: Refer to *Appendix A* for the *MSI Message* formats, and to *Annex 1 – Excerpts from the MCTS Standards Manual*.

MSI DSC Broadcasts

2.03.11 Dependent upon the priority of a MSI radiotelephone broadcast and the availability of digital selective calling (DSC) equipment, the MCTS officer will normally precede the radiotelephone broadcast with the appropriate distress or urgency priority DSC broadcast, known as a "relay". The radio auto alarm tone may also precede a radiotelephone broadcast. Because DSC relays can be addressed to ships within a rectangular area and due to the negative impact that multiple DSC relays can cause within the Maritime Mobile Service, consultation should occur between the MCTS officer and the SMC when relays are used.

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2.03 Broadcasts

2.03.12 VHF-DSC Distress Relay Alert Broadcast – In accordance with the *MCTS Standards Manual*, MCTS officers will broadcast a VHF-DSC Distress Relay Alert for vessels or persons in distress who require further assistance.

2.03.13 HF-DSC Distress Relay Alert Broadcast – In accordance with the *MCTS Standards Manual*, MF/HF-DSC Distress Relay Alert Broadcast shall only be broadcasted after consultation between the MCTS Officer and the SMC. This is required to control the near global impact associated with these broadcasts.

MSI Radiotelephone Broadcasts

2.03.14 In accordance with the *MCTS Standards Manual*, MCTS officers shall make MSI broadcasts of SAR information via VHF/MF/HF radiotelephone in consultation with the SMC.

2.03.15 Continuous Marine Broadcast – In accordance with the *MCTS Standards Manual*, once the priority of an incident has decreased or for other reasons, the MCTS officer may, in consultation with the SMC, place the SAR related MSI broadcast on the centre's continuous marine broadcast.

MSI NAVTEX Broadcasts

2.03.16 In accordance with the *MCTS Standards Manual*, MCTS officers shall make MSI broadcasts of SAR information via NAVTEX in consultation with the SMC.

MSI SafetyNET EGC Broadcasts

2.03.17 SafetyNET is the satellite service for dissemination of MSI using Inmarsat-C. Navigational warnings, meteorological warnings and SAR messages are broadcast over the Inmarsat-C system using the enhanced group calling (EGC) facility. The Canadian Coast Guard (CCG) is licensed as a "SAR SafetyNET Provider" for the purpose of broadcasting SAR related EGCs using this service. One MCTS centre per CCG Region acts as the sole provider of the SafetyNET service.

2.03.18 In accordance with the *MCTS Standards Manual*, MCTS officers shall make MSI broadcasts of SAR information via SafetyNET in consultation with the SMC in order to ensure that the most effective broadcast parameters are used. Further, to ensure consistency of information received aboard vessels, only one MCTS centre shall issue SafetyNET broadcasts for each SAR incident. SMCs shall monitor SafetyNET broadcasts they have initiated by using an Inmarsat-C terminal.

Chapter 2 COMMUNICATIONS

2.03 Broadcasts

MSI NOTSHIPs and NAVAREA Warnings

2.03.19 In relation to SAR incidents, situations arise where a MSI notice should be transmitted to mariners (e.g., abandoned vessels adrift). If the SMC becomes aware of such situations, he or she shall advise the regional CCG Notices to Shipping (NOTSHIPs) issuing authority and request a safety notice be issued.

2.03.20 If there is a requirement to issue a safety notice on the high seas, this can only be done by the NAVAREA 4 and 12 Coordinator at the National Imagery and Mapping Agency in Washington, District of Columbia:

SARNET

2.03.21 SARNET is an Inmarsat-C EGC broadcast service maintained by Her Majesty's Coastguard, United Kingdom, that provides international wide-area messaging to rescue centres. It is recommended that joint rescue coordination centres and maritime rescue sub-centres make use of this service, where appropriate, in the resolution of international SAR incidents.

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2.04 Mission Coordination Communications

General

2.04.1 In the process of coordinating a search and rescue (SAR) mission, the SAR Mission Coordinator (SMC) shall issue messages to mobile facilities (aircraft, vessels and others), as required, such as:

.1 briefings;

.2 taskings;

.3 SAR actions plans; and

.4 debriefings.

2.04.2 Mobile facilities, in return, will issue to the SMC:

.1 situation reports (SITREPs);

.2 notices of crash/casualty location; and

.3 debriefings

2.04.3 Normally, these verbal or hardcopy messages shall be transmitted via radio telephone service providers such as Marine Traffic and Communications Services (MCTS) centres, Air Traffic Control units or Canadian Forces (CF) Radio Stations, so that all relevant parties are informed and kept up-to-date as to the status of the mission. If not necessary, secure communications should be avoided.

NOTE: For frequencies, refer to *section 2.02 – SAR Radio Frequencies and Channels*.

2.04.4 The SMC or mobile facility may, however, choose to communicate directly using point-to-point communications. This may be required to ensure privacy, pass large messages automatically or because the facility is not within radio telephone range. If these communications are used for coordination, the SMC shall attempt to keep necessary parties advised of the mission status.

Briefings/Taskings

2.04.5 SMCs must provide a complete and detailed briefing when tasking responding facilities. Where tasking is directed by telephone or other verbal means, efforts should be made to confirm by message or other written form. Although a hard-copy is not required at all times, the SMC must note the details of each tasking in the case file and be prepared to provide the hard-copy when it is deemed appropriate or requested.

NOTE: *SAR tasking and briefing forms* may be obtained from the SAR Mission Management System (SMMS) and are also available in *CAMSAR III, Appendices*.

Chapter 2 COMMUNICATIONS

2.04 Mission Coordination Communications

> **NOTE:** SRUs shall only accept the proposed mission if, in the commander/master/operator's judgement, the SRU's equipment and crew capability will permit completion of the task with safety.

2.04.6 When possible, the briefing shall commence with a comprehensive description of the weather situation and forecast given by a meteorologist or qualified meteorological technician. If such personnel are not available, then the SMC shall provide as detailed a weather picture as is possible.

2.04.7 **SRU SITREPs –** SAR units (SRUs) are obligated to maintain regular communications with the SMC and this should be emphasized to secondary SRUs. During the briefing, the SMC shall specify the reporting times of individual SRUs. These SITREPs should be made at least once per hour for aircraft and once every four hours or less for vessels.

2.04.8 SRUs should also be instructed to contact the SMC:

.1 before departure;

.2 when arriving on-scene;

.3 any time there is a change in the situation;

.4 prior to departing the scene; and

.5 upon return.

2.04.9 SMCs shall employ all means to verify the status of the SRU if an expected communications check-in is missed. This could include the dispatch of another SRU if consecutive communications check-ins are missed. The SMC should also not hesitate to task a fixed wing primary SRU to provide top cover for a helicopter secondary SRU if the SMC feels this SRU may require assistance (e.g. communications).

2.04.10 **Aeronautical SRUs –** The initial briefing to the first aircrews participating in a search operation shall normally be given by the joint rescue coordination centre (JRCC) via telephone/fax/e-mail. The briefing shall cover all the items detailed in the appropriate *SAR Briefing Form for Aircraft*, and any additional information items considered pertinent to the case.

2.04.11 When search headquarters (HQ) have been set up and an SMC has been deployed or a searchmaster (SM) appointed, it is the responsibility of the deployed SMC/SM to ensure that all search crews are adequately briefed prior to each sortie. The appropriate *SAR Briefing Form for Aircraft* shall be filled out by the deployed SMC/SM and made available to each aeronautical SRU commander prior to each mission.

2.04.12 Secondary aeronautical SRUs will be tasked through normal tasking procedures; however, in emergency situations where this procedure would not be practicable, the

Chapter 2 COMMUNICATIONS

2.04 Mission Coordination Communications

request for assistance may be made directly to the SRU commander. In these cases, the SRU commander or the requesting SAR official shall, as soon as possible, take steps to report through regular channels the action being taken and the circumstances which made a direct approach necessary.

2.04.13 To ensure secondary aeronautical SRU commanders fully understand the scope of the mission, SMCs shall provide each commander with a detailed briefing covering all the items of the *SAR Briefing/Debriefing Form for Aircraft – Secondary SRUs*.

2.04.14 **Maritime SRUs –** SAR taskings of Canadian Coast Guard (CCG) SRUs are routinely done via a verbal message and deemed to be sufficient. Provision of a formal tasking message is suggested for non-federal resources. If the master of a vessel requires a formal copy, then such copy will be provided as soon as practicable, owing to the circumstances of the case.

2.04.15 More complex taskings of maritime SRUs should be done following the *SAR Briefing Form for Vessels*. These taskings can be sent electronically, via fax, MCTS, or satellite communication.

Notification of Next-of-Kin

2.04.16 An SMC must ensure that the immediate next-of-kin (NOK) of persons involved in a SAR incident have been notified prior to the release of names to the media. Notification of NOK shall be accomplished as follows:

.1 for CF personnel, the JRCC shall notify the Commanding Officer of the casualties' parent unit;

.2 for CCG personnel, contact the Superintendent, Regional Operations Centre;

.3 for casualties resulting from a SAR incident involving a commercial aircraft or maritime craft, the JRCC/maritime rescue sub-centre (MRSC) shall request that the operating company notify the NOK;

.4 for casualties resulting from a SAR incident involving a privately owned aircraft or maritime craft, the JRCC/MRSC shall request that the federal, provincial, or municipal police, as applicable, notify the NOK;

.5 in instances where the SMC has established regular contact with the NOK to keep them informed of search development, notification of the NOK concerning casualties may be made by the SMC if he/she considers it the most appropriate method of conveying the news; and

.6 in instances where foreign nationals are involved, the JRCC shall inform the CFICC.

Chapter 2 COMMUNICATIONS

2.04 Mission Coordination Communications

Communicating with the Media

NOTE:	Refer to *section 1.06 – Public Relations*.

Transferring control of an incident

2.04.17 Assuming or transferring control of an incident is a formal event and shall be done officially, with timed and detailed log entries made to record the event. Transfer is not complete until the responsible SMC, centre or agency has acknowledged and accepted the transfer. Early and ongoing communication with applicable OGDA's and CAF Provincial Liaison Officers is key.

2.04.18 SAR to SAR – All parties involved must be made aware of the change, the time of the change and that all further reports are to be passed to the new responsible SMC with an information copy to the former one if necessary.

2.04.19 SAR to CCG Other Than SAR – Transfer of incidents to or from a CCG responsibility centre other than SAR, i.e. Regional Operations Centres (ROCs), Environmental Response, Ice Centres, etc., must adhere to the *Handover Procedures for Canadian Coast Guard Operations*:

> ***Handover Message***
>
> *When the responsibility for an incident or tasking is transferred from one vessel, program, centre or region to another, the ROC or Rescue Centre will transmit a handover message to the vessel receiving the tasking and copy all other Rescue Centres, ROCs, ICE Centres, MCTS Centres and resources as appropriate. The handover message must contain all relevant case history information.*
>
> ***Acknowledgement Message***
>
> *When a vessel receives a handover message transferring a tasking or an incident from another vessel, program, centre or region, the vessel shall transmit an acknowledgement of receipt of the handover to the ROC or Rescue Centre and copy all other Rescue Centres, ROC, ICE Centres, MCTS Centres, Regions and resources as appropriate.*
>
> Excerpts from the *Handover Procedures for Canadian Coast Guard Operations*, November 2010

Chapter 2 COMMUNICATIONS

2.05 Informing Authorities

JRCC Daily SITREPs

2.05.1 In prolonged distress incidents and in all incidents where the search object is not located, situation reports (SITREPs) shall be issued by the joint rescue coordination centres (JRCCs). SITREPs from maritime rescue sub-centres (MRSCs) shall be forwarded to the Officer in Charge of the parent JRCC, for approval and onward transmission. SITREPs shall be sent with priority precedence in the following sequence:

.1 SITREP ONE AND INITIAL;

.2 SITREP TWO, etc.; and

.3 SITREP (number) AND FINAL.

NOTE:	SITREP formats to be used have been grouped at the end of this volume, in *Appendix B – Reports and Returns*.

2.05.2 A SITREP shall contain all information and action taken. Wherever possible, plain language shall be used in lieu of terse format phrases. Enough information must be relayed to enable headquarters staff officers to process queries and requests for future reduction.

2.05.3 When the search and rescue (SAR) operation is successfully completed or search reduction has been authorized, the JRCC shall send a final SITREP. The final SITREP shall state whether a *SAR Operation Report* will be prepared on the case.

2.05.4 In cases where only one SITREP is required (*SITREP ONE AND FINAL)*, a combined initial and final SITREP format shall be used, replacing the *SITREP ONE AND INITIAL paragraphs J. and K.* by the *SITREP (number) AND FINAL paragraphs B. to E.*, renamed *paragraphs J. to M.*

Daily SARSUMs

2.05.5 Daily SAR Summaries (SARSUMs) shall be prepared each day by each JRCC. SARSUMs shall provide a logical story of the events that occurred for each of the incidents mentioned.

NOTE:	The SARSUM format is provided at *Appendix B.05 – Daily SAR Summary*.

2.05.6 MRSCs shall only provide the required daily SARSUM data to their parent JRCC.

CCG National Incident Notification Procedure

NOTE:	Refer to *Annex 2 – Excerpts from the CCG National Incident Notification Procedure*.

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2.05 Informing Authorities

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3.01 SAR Incident Progression

Assigning the Degree of Emergency

3.01.1 In emergency situations requiring immediate assistance, positive action must be taken quickly. The ability to take appropriate action is a function of the information available to the search and rescue (SAR) mission coordinator (SMC), and of his/her judgment and experience. Initially, the SMC should not hesitate to classify an incident at the highest degree of emergency that the available information supports. Later, the degree of emergency can be lowered if the situation warrants it.

NOTE:	This paragraph confers the authority to declare distress on behalf of a vessel whether or not the vessel has declared a distress. Whenever a distress is declared under these circumstances, the rationale is to be recorded in the case file log.

3.01.2 If apprehension as to the safety of the search object and its occupants continues to exist, or if new evidence implies the persons on board are in grave and imminent danger, the current emergency phase should be increased to a higher degree of emergency phase, as appropriate, given the circumstances and information available. The decision to declare this change of phase should be taken without delay and based on past experience with similar situations.

NOTE:	Nothing in this manual is meant to prevent the SMC from assigning the highest degree of emergency.

Distress Beacons

NOTE:	In the absence of other information, a signal from a 406 megahertz distress beacon, on its own, is to be considered as a sign of distress and shall be investigated immediately.

Major SAR Operations

3.01.3 Major SAR Operations are those that meet any of the following criteria:

.1 any aeronautical or maritime SAR incidents which the SRR Commander, on advice from the OIC, deems that additional assets and resources beyond the primary SAR allocation may be required;

.2 incidents which the SAR Region (SRR) Commander assesses as being potentially sensitive; or

.3 special cases, as directed by Canadian Joint Operations Command or Canadian Coast Guard Headquarters.

Chapter 3 AWARENESS AND INITIAL ACTION

3.01 SAR Incident Progression

Appointing an SMC

3.01.4 For day to day SAR operations, the joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) as a whole acts as SMC. If a SAR case has the potential to become a major SAR operation, then the appointment of a specific SMC or a searchmaster (SM) is to be considered.

3.01.5 Appointment of an SMC/SM facilitates:

.1 search plan continuity;

.2 the provision of a single point of contact for the SRR Commander, the next of kin and all participants; and

.3 the completion of the *SAR Operation Report* in a timely and accurate fashion.

3.01.6 Examples of situations where the appointment of an SMC/SM could be warranted are:

.1 a SAR case continuing through a second and into a third JRCC/MRSC shift;

.2 a search object has not been located during the first 24 hours of search operations; and

.3 a case where SAR activity is escalating or involving numerous resources.

Chapter 3 AWARENESS AND INITIAL ACTION

3.02 Aeronautical Incidents

Degrees of Emergency

3.02.1 There are three phases in the conduct of search and rescue (SAR) aeronautical emergencies: UNCERTAINTY, ALERT and DISTRESS.

NOTE:	These phases are also defined in the *IAMSAR Manual, Volume II, section 3.3 – Emergency Phases*.

3.02.2 Aeronautical Degrees of Emergency Defined:

.1 **Uncertainty Phase –** An aeronautical emergency UNCERTAINTY phase exists in any one of the following circumstances:

.a no communication has been received from an aircraft within a period of 30 minutes after the time communications should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made;

.b a flight plan has been filed and no arrival report has been received by the area control centre (ACC) within 60 minutes of when the arrival time was last estimated by the aircraft or by an ACC, whichever is later;

.c a flight itinerary has been filed and no arrival report has been received by the ACC within 24 hours of the arrival time that the pilot indicated on the flight itinerary;

.d a situation exists wherein there is uncertainty as to the safety of an aircraft and its occupants, e.g. a responsible person has declared an aircraft overdue which was not on a flight plan but whose tardiness is of sufficient concern; or

.e a signal from an analog emergency locator transmitter (ELT) has been reported by an aircraft or a ground station but there is no reason to suspect that an actual distress situation exists.

.2 **Alert Phase –** An aeronautical emergency ALERT phase exists when:

.a the analog ELT signal reported in the uncertainty phase is still being reported and cannot be isolated or otherwise accounted for;

.b following the uncertainty phase, the communication search procedure has failed to reveal any new information on the aircraft;

.c an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft; or

.d information has been received which indicates that the operating efficiency of the aircraft has been impaired, but not to the extent that a forced landing is likely.

.3 **Distress Phase –** An aeronautical emergency DISTRESS phase exists when:

.a a 406 megahertz (MHz) ELT has been reported by the COSPAS-SARSAT system (elemental or composite position);

.b the fuel on board is considered to be exhausted or to be insufficient to enable the aircraft to reach safety;

.c information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely;

.d information is received that the aircraft is about to make or has made a forced landing or requires immediate assistance;

.e a downed aircraft is located; or

.f the analog ELT transmission referred to in the uncertainty or alert phase; has been linked to an overdue aircraft.

Initial Actions

NOTE:	For more information on the initial actions to be taken during an emergency, consult the *IAMSAR Manual, Volume II, section 3.5 – Initial Action Stage*.

3.02.3 Uncertainty Phase – During the UNCERTAINTY phase of an aeronautical emergency, the SAR Mission Coordinator (SMC) shall, when applicable:

.1 obtain the data contained on the flight plan or notification;

.2 confirm that all airports or possible alighting areas along the route of flight and within the possible flight range of the aircraft concerned are checked;

.3 notify position fixing agencies to attempt establishment of the aircraft's position, informing them of all known frequencies;

NOTE:	Refer to *section 1.05 – Support to SAR*.

.4 notify Region Operational Control Centre at the North American Air Defence (NORAD) Headquarters, North Bay, and request air surveillance;

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3.02 Aeronautical Incidents

.5 notify the Royal Canadian Mounted Police, the provincial police, and/or the Civil Air Search and Rescue Association (CASARA) along the route of flight, as they may be requested to verify alighting areas, or obtain information on the aircraft and its occupants;

.6 if the flight is over water, request Marine Traffic and Communications Services centres to alert the vessels in the area;

.7 if the flight originated in, or intended entering, a country other than Canada, notify the SAR authorities in that country;

.8 notify the appropriate ACCs for air surveillance (radar/transponder) and request all ground stations in the area to monitor the primary frequency of the missing aircraft as well as distress frequencies;

.9 in the case of an analog ELT signal, request all ground stations, including private strips, flight service stations, towers, ACCs, vessels, etc., to monitor the appropriate frequency (121.5 or 243.0 MHz) in an attempt to verify and isolate the ELT;

.10 advise the Canadian Mission Control Centre (CMCC) of the details of the possible emergency and request a query of the COSPAS-SARSAT system; and

.11 select a name for the incident, such as the aircraft registration.

NOTE:	Normally, the investigation and communication search should not be pursued for more than one hour in the uncertainty phase without upgrading to the alert phase.

3.02.4 Alert Phase – During the ALERT phase of an aeronautical emergency, the SMC shall, when applicable:

.1 expand the communication search area as the case warrants;

.2 alert the rescue squadron to prepare aircraft equipment and personnel, especially in circumstances that may require more than the standard configuration;

.3 alert secondary and other facilities, including ships at sea, which may be required to assist, in order to establish availability;

.4 alert CASARA to prepare aircraft and personnel;

.5 ensure that the appropriate ACCs have alerted air traffic flying through the area involved so that a watch will be maintained;

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3.02 Aeronautical Incidents

.6 obtain additional details on aircraft, equipment on board, the pilot and the passengers;

.7 obtain weather along the aircraft's route and assess its effect on the tasking of SAR units (SRUs);

.8 plan initial briefing of search crews;

.9 action all incoming reports and consolidate them into the initial briefing plan;

.10 in the case of an analog ELT signal, task individuals, airport managers, Industry Canada or CASARA ground personnel to isolate the source of the signal, if its general location has been determined and indicates that a distress is unlikely; and

.11 advise CMCC of the details of the emergency and request a query of the COSPAS-SARSAT system.

NOTE: Tasking of aeronautical SRUs from other SAR regions (SRRs) should be considered when

- significant improvement in on-scene time would be realized, and
- there would be no adverse effect on the responding SRR(s).

NOTE: Normally, the investigation and communication search should not be pursued for more than one hour in the alert phase without upgrading to the distress phase.

3.02.5 Distress Phase – During the DISTRESS phase of an aeronautical emergency, the SMC shall, when applicable:

.1 initiate action with the appropriate SRUs and services: this action will normally be to task the standby crew to immediately take off on an initial search;

.2 notify appropriate ACC and other agencies concerned, such as the Canadian Forces Integrated Command Centre when deemed appropriate; issue a *missing aircraft notice (MANOT)* and a *situation report (SITREP)*;

NOTE: Refer to *Appendices A.01 – Initial MANOT*, and *B.01 – Initial JRCC SAR SITREP*.

.3 develop a search plan by ascertaining the position of the aircraft; estimating the degree of uncertainty of this position; and, on the basis of this information, the circumstances and the historical weather, determine the extent of the search area;

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3.02 Aeronautical Incidents

.4 task additional search units as deemed suitable to meet the requirements of the search plan, and appoint an on-scene coordinator as required;

.5 in conjunction with the SAR squadron, arrange for the appointment of a searchmaster and assess and determine the most suitable location for the search headquarters;

.6 assess and coordinate the requirements for telecommunication facilities, weather services and equipment and ensure that appropriate telecommunication personnel are available and briefed;

.7 notify the operating agency and keep it informed on SAR developments. The operating agency shall be requested to:

.a provide all known information regarding the aircraft, its occupants, the experience of the flight crew, and any special equipment carried; and

.b inform and update the NOK of all occupants. Failing this option, JRCC will deal directly with the NOK;

NOTE:	The operating agency shall be afforded the opportunity to appoint liaison personnel and participate in the search, subject to *section 1.04, paragraphs 1.04.7 to 1.04.11 – Hiring of Civilian Personnel and Services*.

.8 advise CMCC of the details of the emergency and request a query of the COSPAS-SARSAT system;

.9 in the case of a 406 MHz ELT, investigate the cause of the signal by contacting owners and emergency contacts in the various registries and databases;

.10 when an aircraft accident has been confirmed, notify the Transport Safety Board with the pertinent details;

.11 when the incident involves an aircraft of foreign registry, the JRCC shall inform the Canadian Forces Integrated Command Centre to advise the appropriate embassy if required; and

.12 develop a rescue plan in the event casualties require assistance. The plan should have provisions for the notification of medical facilities and police/coroner, and should establish the most expeditious means and method of rescue.

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3.02 Aeronautical Incidents

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3.03 Maritime Incidents

Degrees of Emergency

3.03.1 There are three phases in the conduct of search and rescue (SAR) maritime emergencies: UNCERTAINTY, ALERT and DISTRESS.

NOTE:	These phases are defined in the *IAMSAR Manual, Volume II, section 3.3 – Emergency Phases*.

Initial Actions

NOTE:	For more information on the initial actions to be taken during an emergency, consult the *IAMSAR Manual, Volume II, section 3.5 – Initial Action Stage*.

3.03.2 **Uncertainty Phase –** During the UNCERTAINTY phase of a maritime emergency, the SAR Mission Coordinator (SMC) shall, when applicable:

.1 if the voyage originated in, intended entering, or may have entered other than Canadian waters, notify the SAR authorities in that country;

.2 select a name for the operation, this will normally be the name of the vessel and will be used throughout the operation when reference to such is made;

.3 verify the information received and if it is suspected that the vessel is in danger, its master should be asked: "ARE YOU IN IMMEDIATE DANGER?" If the reply is negative and the joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) judges it appropriate, request that the Marine Communications and Traffic Services (MCTS) centre issue a maritime assistance request broadcast, allowing up to 15 minutes for vessels in the area to respond (the SMC should use the replies to prioritize the SAR response);

NOTE:	Refer to *section 6.02 – Assistance to Vessels*.

.4 attempt to obtain information on the route and points and times of departure and arrival of the vessel;

.5 start a plot of the situation based on the information obtained;

.6 conduct a communication search, utilizing appropriate resources; and

.7 issue an "All stations" broadcast for information on the vessel's whereabouts.

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3.03 Maritime Incidents

3.03.3 Alert Phase – During the ALERT phase of a maritime emergency, the SMC should, where possible:

.1 issue an "All stations" broadcast under the urgency PAN PAN prefix for information on the vessel or, if the vessel is disabled, to locate vessels able to render assistance;

.2 alert personnel and SAR facilities, and plan initial briefing of SAR crews;

.3 verify the information received;

.4 endeavour to obtain information concerning the vessel from sources not previously contacted;

.5 thoroughly evaluate information on the vessel's intended route, weather, possible communications delays, last known position (LKP) and last radio communication;

.6 consider the possibility of fuel exhaustion and the estimated performance of the vessel under adverse conditions;

.7 maintain close liaison with associated MCTS centres so that information from ships at sea can be evaluated;

.8 plot relevant details obtained through the actions described above to determine the probable position of the vessel and its maximum range of action from its LKP, and determine the extent of search area. Also plot the positions of any vessel known to be operating in the vicinity;

.9 if so indicated by the situation appraisal, initiate appropriate search action and notify the associated MCTS centres of any action taken; and

.10 whenever possible, communicate to the owner or agent all information received and action taken.

NOTE: Tasking of SAR units (SRUs) from other SAR regions (SRRs) should be considered when

- significant improvement in on-scene time would be realized, and
- there would be no adverse effect on the responding SRR(s).

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3.03 Maritime Incidents

3.03.4 Distress Phase – During the DISTRESS phase of a maritime emergency, the SMC shall, when applicable:

.1 initiate action in accordance with the detailed plans or instructions for the conduct of SAR operations in his/her area of responsibility;

.2 issue an "All stations" broadcast for vessels to render immediate assistance;

NOTE:	This action may already have been taken by an MCTS centre in the form of a MAYDAY or a MAYDAY RELAY, as appropriate.

.3 develop a search plan;

.4 advise appropriate authorities;

.5 notify the owner or agent, if possible, and keep them informed of developments;

.6 notify adjacent JRCCs or MRSCs, which may be able to render assistance or which may be involved in the operation;

.7 if possible, inform the vessel in distress of SAR actions taken;

.8 when the incident involves a vessel of foreign registry, notify the consular authorities concerned;

NOTE:

- Formal requests for information received from a consulate are to be acknowledged by the Regional Supervisor, Maritime SAR, and forwarded, through the regional Director, Operational Support, (or designate), to the Manager SAR, Canadian Coast Guard Headquarters, for action as soon as possible.
- Correspondence with any consular authority shall be through the Officer in Charge of the JRCC.

NOTE: If any report is produced about an incident involving a foreign vessel, refer to *Appendix B.07 – SAR Operation Report*.

.9 assess and determine the most suitable SRU for assuming the duties of on-scene coordinator;

.10 assess and determine the most suitable location for the search headquarters and arrange for the deployment of an SMC if required; and

.11 develop a rescue plan in the event casualties require assistance; consider using the provincial emergency measures organization for their contacts with local hospitals, police, etc.

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3.04 Humanitarian Incidents

General

3.04.1 Any joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) search and rescue (SAR) coordinator who is notified of the existence of a life-threatening emergency and is not aware of the involvement of any other competent authority, shall initiate suitable action. If the emergency is not related to an aeronautical or maritime SAR incident, the appropriate responsible authority shall be advised as soon as possible.

3.04.2 All such cases are to be classified as humanitarian incidents.

NOTE:	Refer to *section 8.03 – Classification of SAR Incidents*.

Tasking of SRUs

3.04.3 Canadian Armed Forces (CAF), Canadian Coast Guard (CCG), Civil Air Search and Rescue Association (CASARA) and Canadian Coast Guard Auxiliary (CCGA) SAR units (SRUs) may be tasked for humanitarian incidents to preserve human life or relieve suffering. SRUs may be tasked:

.1 when properly requested and approved by the Officer in Charge (OIC) of the JRCC, or designate, for aeronautical SRUs; or by the Regional Supervisor, Maritime SAR (RSMS), or designate, for maritime SRUs;

.2 when these SRUs are not employed in an aeronautical or maritime SAR incident; and

.3 if SAR coverage will not be unduly compromised.

NOTE:	Refer to *section 1.01, paragraph 1.01.5 – [Tasking of SRUs on] Other Than Aeronautical or Maritime SAR*.

3.04.4 **Use of CAF SRUs –** On behalf of the SAR Region Commander, the OIC of a JRCC shall consider requests from non-defence agencies for humanitarian assistance, and determine if CAF SAR facilities are appropriate for the mission and whether such tasking falls within the guidelines of the National SAR Program. The appropriate Joint Task Force Headquarters shall be informed when SAR facilities are tasked for such missions. The OIC JRCC is responsible for the coordination of CAF and/or civilian aeronautical facilities employed for such missions. Cost recovery actions for CAF aeronautical SAR facilities are the responsibility of the Commander, Canadian Joint Operations Command, in accordance with the *CAF Provision of Services Manual*.

3.04.5 **Use of CCG SRUs –** CCG SRUs may be tasked for humanitarian incidents. JRCC/MRSC maritime SAR coordinators receiving requests for such assistance from federal,

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3.04 Humanitarian Incidents

provincial or territorial health or emergency planning authorities shall, as soon as practicable, forward the request to the RSMS (or designate).

3.04.6 If satisfied that certain specific conditions have been met, the RSMS (or designate) shall advise the appropriate CCG regional authority of the request. These conditions are:

.1 other appropriate facilities are not readily available;

.2 the CCG units are suitable and available for the mission at hand; and

.3 the request is from and approved by a recognized federal or provincial authority.

3.04.7 If the RSMS (or designate) is of the opinion that the tasking of the required units would hamper the maritime response capability in the Region, the use of the CCG primary SRUs may be denied or deferred. Any such denial or deferral shall be immediately forwarded to the appropriate regional authority/manager (or delegate) in order that other arrangements may be made.

3.04.8 The *National Incident Notification Procedure*.(NINP) shall be followed for any Humanitarian Incident.

Ground SAR Assistance

3.04.9 Ground SAR is an integral part of the National SAR Program. Hence, Canadian Armed Forces primary SRUs and Canadian Coast Guard primary SRUs may be tasked, when available, for ground SAR missions such as searches for missing persons.

Diving Accidents

3.04.10 Diving accidents are the responsibility of local authorities. It may be necessary, however, for a SAR coordinator from a JRCC/MRSC to ensure that appropriate action is taken until the responsible authority can take charge of the incident.

3.04.11 In all serious diving accidents, and when in doubt, specialized medical assistance must be arranged without delay. Therapeutic recompression can best be conducted in a compression chamber capable of holding two or more people and fitted with an inner and outer compartment. A one-person chamber can be used for emergency treatment of decompression sickness but, on such occasions, this chamber must be conveyed to the site of a multi-person chamber by the quickest means after therapeutic treatment has started.

3.04.12 Preferably, a diving casualty should be accompanied by a person adequately trained in the medical aspects of diving accidents. In all cases, detailed written information concerning patient and accident must travel with the casualty.

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3.04 Humanitarian Incidents

3.04.13 Diving accidents occurring in coastal waters and remote areas usually require medical assistance on short notice. Therefore, rescue of the casualty by helicopter or transportation of medical assistance will be asked for in most cases. Assistance by a vessel equipped for therapeutic recompression or with medical facilities is also possible. Where suitable helicopters or vessels are not available, the requirement may be to transport casualty ashore by boat and then by road to medical assistance or recompression facilities.

3.04.14 The choice between helicopter and vessel depends on various factors, such as:

.1 helicopter capability;

.2 weather conditions and sea state;

.3 distance to be covered; and

.4 condition of the casualty.

3.04.15 A helicopter landing will only be attempted on a platform equipped for this purpose; therefore, in most cases, a helicopter rescue hoist has to be used.

3.04.16 Evacuation by helicopter of a patient being treated in a recompression chamber should only be attempted if the helicopter is capable of accommodating the recompression chamber.

3.04.17 During the flight, the recompression chamber is to be attended constantly and sufficient breathing gas must be available for adequate ventilation of the chamber.

3.04.18 Helicopters evacuating a diving casualty not being treated in a recompression chamber should preferably fly as low as possible.

Missing Swimmers

3.04.19 The JRCC/MRSC will advise provincial and/or local authorities of a swimming incident, and will arrange assistance when requested. If, for any reason, the proper civil authorities cannot be advised, the JRCC/MRSC is to take appropriate action until civil control is assumed.

Medical Evacuations

NOTE:	Refer to *section 3.05 – Medical Evacuations*.

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3.04 Humanitarian Incidents

Protocols in support of Provincial/Territorial led GSAR were introduced in all SAR regions in March 2012. The key to this protocol is the implementation of a confirmation/feedback mechanism, where the JRCC will re-establish communication with the requesting authority (RA) prior to closing an active case file (even if no assistance has been provided). In short, a GSAR related case file cannot be closed until this positive action "call back" is completed between the JRCC and the requesting authority.

3.04.20 The following specific protocols have been implemented:

.1 when a request for assistance from a Provincial or Territorial Requesting Authority (RA) is received, the appropriate JRCC will automatically open a case file;

.2 the JRCC will obtain from the RA all possible information on the case in order to establish clear situational awareness and the severity/urgency of the incident. For example, the search model being used by GSAR operators would provide the JRCC with detailed information with which to make decisions;

.3 the JRCC will record what assets the province has committed, or will commit, to the incident. After reviewing this information, a needs assessment will be made as to what SAR asset could be best suited to assist the Provincial or Territorial authority;

.4 the RA will be advised whether or not the CF can assist and if so, how this will be done as quickly as possible following the needs assessment described above;

.5 if unable to assist, the JRCC will explain why this is the case and ask the RA to re-establish contact (normally a call back) at a suitable time based on the conditions and circumstances affecting this situation. The case file will remain open throughout this period;

.6 as operational conditions permit, and on a periodic basis, should the case remain open for a lengthy period of time, the JRCC should contact the RA to receive an update on the situation and review the needs assessment if the situation warrants such a review; and

.7 prior to the JRCC closing the case, a confirmation call with the RA will be made to ensure that no further assistance is required. The JRCC case file cannot be closed until this positive action "handshake" is complete between the JRCC and the RA.

3.04.21 Requests for assistance for a known body recovery, where the RA has provided sufficient information which would conclude there is no distress situation or potential for distress, the standard process for requests for assistance should be followed.

3.04.22 Recovery of remains are not typically performed by primary SAR resources other than as a consequence of an AI or M1.

Chapter 3 AWARENESS AND INITIAL ACTION

3.05 Medical Evacuations

General

3.05.1 A medical evacuation (MEDEVAC) is the evacuation of a person for medical reasons. There are three types of MEDEVACs:

.1 **Rescue MEDEVAC –** The critical evacuation of injured or stranded persons from isolated areas, or the recovery of sick or critically injured persons from vessels at sea and transport to a higher medical authority.

.2 **Critical Patient Transfers (CPT) –** The transportation of patients already under medical care in a Medical Treatment Facility (MTF) to another MTF in circumstances when delay would cause undue risk to the patient.

.3 **Routine Patient Transfer (RPT) –** Transportation of patients already under medical care in a MTF to another MTF when time is not of the essence. Requests must be routed through 1CAD/CAOC for tasking. A JRCC may coordinate an RPT, but the tasking will originate from 1 CAD/CAOC.

Rescue

3.05.2 A Rescue is an operation to retrieve persons in distress, provide for their initial medical or other needs and deliver them to a place of safety.

Maritime Incidents

3.05.3 A rescue from vessels at sea are actioned and classified as maritime search and rescue (SAR) incidents.

Humanitarian Incidents

3.05.4 A rescue from isolated areas and Critical Patient Transfers are considered humanitarian assistance.

Routine Patient Transfer

3.05.5 Routine Patient Transfers or hospital to hospital transfers are beyond the mandate of a humanitarian incident; they are not considered to be SAR incidents and should be dealt with by provincial or territorial authorities.

Level of Care

3.05.6 In Canada there are liability and moral issues associated with the level of care for a patient receiving medical attention. It is not normally permitted to electively hand-off a patient to a lower level of medical care, therefore caution must be taken by the Duty JRCC Flight Surgeon / telemedical assistance service (TMAS) and the SAR Mission Coordinator to

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3.05 Medical Evacuations

ensure the patient is always provided a suitable level of professional medical care. For instance, SAR Techs / Rescue Specialists must not be the only medical personnel during patient transfers where a patient requires ongoing nursing or physician services which are beyond SAR Tech / Rescue Specialist medical capabilities. Extenuating circumstances may arise where a Critical Patient Transfer (CPT) must take place without a higher medical authority onboard. In these situations the SAR Tech / Rescue Specialist and JRCC Duty Flight Surgeon / TMAS will discuss the patient condition with the attending medical authority. If the patient transfer is deemed an emergency, the CPT then becomes a Rescue. The SAR Tech / Rescue Specialist and / or civilian medical team must subsequently hand over the patient to the receiving physician at the definitive care hospital. SMC's should consult the duty medical officer for any patient transfers involved on CAF assets. This consultation should not hinder or affect the tasking timeline of SAR resources.

Medical Equipment

3.05.7 Air transport of a critically-ill patient often requires the use of specialized medical equipment in the cabin of the aircraft. The possibility exists that certain types of medical equipment may cause interference with aircraft systems (or vice-versa). The 1 Cdn Air Div Surgeon is the OPI for all medical equipment procured for patient air transport, and for use by SAR Techs. This medical equipment has been tested, proven compatible with a number of CAF aircraft and should, wherever possible, be the equipment that is used. If civilian or uncertified medical equipment is required during the patient transport, the Duty JRCC Flight Surgeon and aircraft commander shall discuss the requirement for the equipment and risk involved in its use. Medical equipment installation and use must be accomplished according to an approved patient transport configuration for that aircraft type. In MOST CASES, CAF (certified) medical equipment should be the only equipment permitted in CAF aircraft.

Required Documentation

3.05.8 Upon completion of a patient transport mission, the particulars must be properly documented. Each mission tasked through a JRCC or the CAOC requires a SAR Mission Report completed by the aircraft commander, with copies forwarded to CJOC SAR, SSOSAR and the applicable JRCC. Further, each patient transported requires a SAR Tech Patient Care Report. SAR Techs and civilian medical staff will complete this report, have it reviewed by the local SAR and Wing Flight Surgeons, and then forward it to the 1 Cdn Air Div Surgeon to retain as the official record of the patient care provided on the mission.

Infectious Disease Direction

3.05.9 The CAF does not currently possess the capability to safely hoist or provide rotary wing transport for a patient with a highly communicable disease of public health significance. Future risk assessments will be based on a threat assessment and screening criteria specific for the disease in question and may be communicated to the JRCC from any one of a number of sources including the 1 CAD Surgeon, Force Health Protection, Public Health Agency of Canada, etc. If there is a patient who has symptoms that raise concern for a significant public health disease, the JRCC should contact the Duty Div Surg at any time using pager 204-931-1622 or BB 204-801-8983. The physician on call will evaluate the situation based on the specific threat and provide advice in an effort to prevent putting the SAR Tech in a situation they are untrained or ill-equipped to deal with.

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3.05 Medical Evacuations

This service is available 24 hours a day 7 days a week and is fully capable of providing consultation on preventative and public health matters.

Reference: RCAF Flight Operations Manual Chap 2 Sec 4.6 Para 2.4.6.16

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3.06 Alert Response

Reception of Alerts

3.06.1 The joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) may be alerted of aeronautical or maritime distress, or other incidents requiring a coordinated response from the Search and Rescue (SAR) System, by numerous means, such as:

1. radiotelephone, monitored by Air Traffic Control (ATC), Marine Communication and Traffic Services (MCTS) or others;
2. radio digital selective calling (DSC), monitored by MCTS;
3. distress beacons, monitored by COSPAS-SARSAT;
4. very high frequency (VHF)-DSC beacons, monitored by MCTS;
5. Inmarsat;
6. SAR transponders;
7. reports of official visual or audible distress signals or of other indications of distress;
8. reports of overdue or missing aircraft;
9. reports of overdue or missing vessels and persons at sea;
10. reports of overdue or missing aircraft or vessels participating in an ATC, vessel traffic services or offshore reporting system; and
11. requests for assistance via mobile phone aboard an aircraft or vessel or on behalf of an aircraft or vessel.

NOTE: Refer to *section 2.01 – Global Maritime Distress and Safety System* for details on means of communication that may be used to alert SAR authorities.

3.06.2 Regardless of the means and method, whether regulated by aeronautical or maritime regulations or not, by which a JRCC/MRSC SAR mission coordinator has been alerted of an actual or potential aeronautical or maritime incident, the coordinator shall take affirmative action to prosecute all calls received and resolve the incident.

Vital Incident Data

3.06.3 As a minimum, the JRCC/MRSC SAR mission coordinator shall obtain data vital to coordinating the effective resolution of the incident. At no time shall the coordinator delay the response to a life-threatening incident, if all vital data is not readily available.

NOTE: Checklists may be found in the *IAMSAR Manual, Volume II, Appendix D – Uncertainty Phase Data*, and *Appendix E – Alert Phase Data*.

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3.06 Alert Response

Establishing Communications

3.06.4 If the MCTS centre or other station that received the alert is unable to communicate with the vessel that sent the alert, the JRCC/MRSC shall establish communications directly with the vessel or shore-side contact for the vessel by:

.1 identifying the distressed vessel and obtaining registry information from a maritime mobile service identity (MMSI) registry, and attempting to establish communications using all available means such as Inmarsat; and/or

.2 identifying other vessels in the area of the distressed vessel using maritime safety information broadcasts and electronic positioning information tools, and request they attempt to contact the distressed vessel; and/or

NOTE:	Refer to *section 3.07 – Maritime Electronic Positioning Information Tools*.

.3 contacting other rescue centres and requesting any further information they may have on the distressed vessel; and/or

.4 contacting the 24/7 "SAR data provider" for the national MMSI or distress beacon registries.

3.06.5 **Canadian MMSI Registry –** The Canadian Maritime Mobile Service Identity (MMSI) registry is maintained by Industry Canada and is available via the Internet. The International Telecommunication Union also maintains an international MMSI registry available via the Internet. JRCC Halifax is designated as the 24/7 emergency "SAR Data Provider" for the Canadian MMSI registry.

Distress Beacons Alerts

3.06.6 Through the COSPAS-SARSAT system, the Canadian Mission Control Centre (CMCC) receives 406 MHz distress alerts from Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs) and Personal Locator Beacons (PLBs).

.1 The combined mandate of DND and CCG includes the coordination of the SAR response to distress alerts within the aeronautical and federal marine domains.

.2 The mandate of provincial and territorial (P/T) authorities, and in some instances Parks Canada, includes the coordination of SAR response to distress alerts within the land and inland water domains.

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3.06 Alert Response

3.06.7 Investigation of PLB alerts and coordination of any SAR activities related to PLB alerts is the responsibility of the Province or Territory for the geographic position of the alert. When CMCC receives a PLB distress alert from the COSPAS-SARSAT system the alert position and any information from the CBR associated with the PLB are sent to the appropriate JRCC for onward transmission to the appropriate Provincial or Territorial authority.

1. In the event that CMCC receives a PLB alert that does not have an associated geographic position, CMCC will transfer the alert to the appropriate JRCC based upon the owners address as obtained from the CBR.

2. In the event that CMCC receives a PLB alert that does not have an associated geographic position and for which the owner is unknown, CMCC will retain responsibility until a geographic position is calculated by the COSPAS-SARSAT system.

3.06.8 **Canadian Beacon Registry –** The CBR is co-located with the CMCC and is accessible 24/7. Its coordinates are:

Telephone: 1-877-406-SOS1 (7671)	Fax: 1-877-406-FAX8 (3298)
Email: cbr@sarnet.dnd.ca	Online: www.cbr-rcb.ca

DSC Alerts

3.06.9 Upon notification of a DSC urgency or distress alert at the JRCC/MRSC, the JRCC/MRSC SAR mission coordinator shall:

.1 obtain the distressed vessel's MMSI and other vital data;

.2 if not received directly by an MCTS centre, obtain the receiving station's name, frequency alert received on and time of receipt, MMSI, position, and details of any actions taken;

.3 if the position is within the JRCC's SAR region (SRR) or MRSC's SAR sub-region (SRS), assume SAR Mission Coordinator functions and continue to resolve the incident;

.4 if the position is outside the JRCC's SRR or the MRSC's SRS, attempt to pass responsibility to the appropriate RCC; and

> **NOTE:** The format provided in the *IAMSAR Manual, Volume II, Appendix B – Message Formats – DSC Format*, shall be used for forwarding DSC distress alerts between rescue centres.

.5 if passing responsibility to the appropriate RCC is not possible, or no position is transmitted, the JRCC/MRSC SAR mission coordinator shall continue to action the incident in accordance with the policy of "First RCC". Further, the Flag State for that particular vessel should be advised.

NOTE:	The policy of "First RCC" is detailed in the *IAMSAR Manual, Volume II, section 3.6 – Designation of the RCC or RSC Responsible for Initiating SAR Action*.

Inmarsat Alerts

3.06.10 Upon reception or notification of an Inmarsat alert at a JRCC/MRSC, the JRCC/MRSC SAR mission coordinator shall:

.1 if the distress position is within the JRCC's SRR or the MRSC's SRS, acknowledge reception of the alert by establishing contact with the vessel by the same means to which alert was transmitted and resolve the incident. If contact cannot be established in this method, JRCCs/MRSCs are to utilize any other means possible;

.2 if the position is outside the JRCC's SRR or within an MRSC's SRS, acknowledge reception of the alert and attempt to pass responsibility to the appropriate rescue coordination centre (RCC)/MRSC;

NOTE:	The formats provided in the *IAMSAR Manual, Volume II, Appendix B – Message Formats*, shall be used for the forwarding of Inmarsat distress alerts between rescue centres.

.3 if passing responsibility to the appropriate RCC/MRSC is not possible, the JRCC/MRSC SAR mission coordinator shall continue to action the incident in accordance with the policy of "First RCC"; and

NOTE:	Refer to the *IAMSAR Manual, Volume II, section 3.6 – Designation of the RCC or RSC Responsible for Initiating SAR Action*.

.4 use the services of the Inmarsat Land Earth Station or Network Operations Centre operator to help establish direct follow-on communications, if required.

Mobile Phone (Terrestrial or Satellite) Alerts

3.06.11 Although a cellular phone is not an approved or suitable substitute for radiotelephone distress communications, JRCC/MRSC SAR mission coordinators must be capable of coordinating the response to incidents alerted via this method.

3.06.12 In Canada, cellular users can:

.1 dial *16, to be connected directly to an MCTS centre;

.2 dial 911, to be connected directly with a 911 emergency centre; or

.3 call the JRCC/MRSC directly.

3.06.13 In addition to the vital data, the following information should also be initially obtained:

.1 the caller's complete cellular telephone number;

.2 the cellular service provider;

.3 the roam number if needed to recall caller;

.4 an alternative point of contact; and

.5 the remaining battery power.

3.06.14 The caller should be advised to keep the cellular phone on and ensure any call forwarding or messaging is disabled. If the cellular telephone has insufficient battery charge to be left on, then an appropriate communication schedule should be arranged. Further, if possible, the caller should attempt to make a distress alert on standard distress radiotelephone frequencies.

NOTE:	For frequencies, refer to *section 2.02 – SAR Radio Frequencies and Channels*.

Flare Sightings

3.06.15 Red flares are recognized internationally as a distress signal. Coordinating the response to a flare sighting is especially challenging due to the lack of useable information and the high rate of false alarms. However, it is important that JRCC/MRSC SAR mission coordinators do not become complacent in their response to flare sightings and that actions are taken as per the appropriate emergency phase.

NOTE:	Refer to the *IAMSAR Manual, Volume II, section 3.8 – Flares*.

3.06.16 Some special considerations for resolving flare-sighting incidents are:

.1 colour of flare and burn time;

.2 location of flare (over water/land/island);

.3 weather and possibility of meteor shower in progress;

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3.06 Alert Response

.4 aircraft operating or military operations being conducted in the vicinity;

.5 if more than one flare, did they appear at once from the same location or spread out (fireworks); and

.6 deck illumination lights, aids to navigation, or ascending or descending aircraft.

3.06.17 If the JRCC/MRSC SAR mission coordinator escalates the incident to the distress phase and tasks a facility to locate the source of the flare, the initial objective should be to prompt the victim to set off another flare.

Sail Plans

3.06.18 Many vessels are required by regulation to participate in either coastal or offshore vessel traffic systems. Reports of participating vessels overdue within these systems shall be actioned according to the emergency phase.

3.06.19 For vessels not required to participate in these systems, it is the policy of the CCG that mariners are expected, and are encouraged, to file sail plans with a responsible person. In circumstances where this is not possible, sail plans may be filed with any CCG MCTS Centre. MCTS Officers will collect voyage data and process sail plans in accordance with the *MCTS Standards Manual*. The JRCC/MRSC shall be notified when vessels become overdue on these sail plans.

Underwater SAR

NOTE:	Refer to *section 6.03 – Underwater SAR*.

Chapter 3 AWARENESS AND INITIAL ACTION

3.07 Maritime Electronic Positioning Information Tools

General

3.07.1 Although not all are designed for the purpose of being search and rescue (SAR) information providers, a variety of maritime information management systems, accessible through the SAR Mission Management System (SMMS) or the Internet, can be utilized to gain information during the incident prosecution.

3.07.2 Incidents involving overdue vessels or distress beacon elementals are examples of situations where electronic sources can provide useful data. Joint rescue coordination centre (JRCCs) and maritime rescue sub-centre (MRSCs) SAR coordinators will be able to locate potential sources of distress of known or unknown vessels, as well as locate secondary and non SAR resources closest to the position or area of interest.

Amver

3.07.3 Managed through the United States Coast Guard (USCG) Operational Support Command in Martinsburg, Virginia, the Automated Mutual Assistance Vessel Rescue (Amver) system is a voluntary ship reporting system which provides information to aid in the resolution and coordination of SAR efforts in the ocean areas of the world.

3.07.4 Information concerning the predicted locations and characteristics of the ships known to be near the scene of an emergency is made available to recognized SAR agencies of any country or to vessels and persons in distress for use during the emergency.

3.07.5 **SURPIC –** Information provided by Amver is in the form of a surface picture (SURPIC). A SURPIC is a listing or graphical image of vessels, their SAR capabilities and dead reckoning positions within a specified geographical area at a specific time. It will also indicate the time and distance to the distress, and the new course each vessel must come to in order to make the intercept.

3.07.6 There are three types of SURPIC:

.1 **Radius SURPIC**

.a the requesting agency determines the geographic area by providing:

- a datum (latitude and longitude), with the date and time of the information desired, which can be either real-time or projected; and
- a radius, defined as a distance around the datum; and

.b the listing of vessels is given in the order of increasing distance from the datum.

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3.07 Maritime Electronic Positioning Information Tools

.2 **Hi/Lo SURPIC**

.a two limiting parallels of latitude and two limiting meridians of longitude are provided by the requesting agency; and

.b the listing is in random order unless listing by latitude or longitude is specified by the requesting agency.

.3 **Trackline SURPIC**

.a the listing is arranged along a track line (which may be obliquely oriented) from the origin to the destination (the first and second positions provided by the requesting agency); and

.b the SURPIC can be obtained for a great circle track if requested.

3.07.7 Each SURPIC can be further modified according to specific needs, for example by making one of the following requests for listing:

.1 all ships, or just those with a doctor, nurse or paramedic aboard (as reported in the sail plans);

.2 all ships, or just those heading east or just those heading west; and

.3 the medical personnel and direction specifications in combination.

3.07.8 Participating vessel information is supplied to the JRCC/MRSC SAR coordinators via any USCG rescue coordination centre or through the Amver.com web site. It is not available on SMMS.

AIS

3.07.9 The Automatic Identification System (AIS) is a short range coastal tracking system used on ships and by Vessel Traffic Services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and VTS stations.

INNAV

3.07.10 INNAV ("Information sur la navigation maritime") is a waterway management information tool developed by the Canadian Coast Guard (CCG) Marine Traffic and Communications Services (MCTS).

3.07.11 The AIS and INNAV systems, not available on SMMS in all regions, may be accessed by JRCC/MRSC SAR coordinators via MCTS or CCG regional operations centres.

Chapter 3 AWARENESS AND INITIAL ACTION

3.07 Maritime Electronic Positioning Information Tools

LRIT

3.07.12 The Long-Range Identification and Tracking (LRIT) system provides for the global identification and tracking of ships. Contracting Governments may request, receive and use, LRIT information for safety and marine environment protection purposes.

3.07.13 The obligations of ships to transmit LRIT information and the rights and obligations of SOLAS Contracting Governments and of Search and rescue services to receive LRIT information are established in *regulation V/19-1 of* the *International Convention for the Safety of Life at Sea, 1974*. The LRIT regulation applies to the following ship types engaged on international voyages:

.1 passenger ships, including high-speed passenger craft;

.2 cargo ships, including high speed craft, of 300 gross tonnage and upwards; and

.3 mobile offshore drilling units.

3.07.14 The ship's terminal automatically transmits the following long-range identification and tracking information:

.1 the identity of the ship;

.2 the position of the ship (latitude and longitude); and

.3 the date and time of the position.

3.07.15 A request for the provision of LRIT information for the search and rescue of persons in distress at sea will result in a SAR SURPIC message, which is a picture of ships within the geographical area specified by the SAR service requesting the information. From that information the SAR service can identify which ships are more favourably positioned to respond to the situation and can poll those ships directly to determine their current locations.

NOTE:	Refer to *Annex 3* – Excerpts from the *Maritime Safety Committee Circular MSC.1/Circ.1308* for the procedure to make a request for the provision of LRIT information.

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3.07 Maritime Electronic Positioning Information Tools

VMS

3.07.16 Vessel Monitoring Systems (VMS) are used in commercial fishing to allow environmental and fisheries regulatory organizations to monitor selected fisheries activity by recording the position, time at a position, and course and speed of participating fishing vessels.

3.07.17 VMS is displayed on SMMS electronic charts and searchable in the Resource Data Management (RDM). The system will display fishing vessels' name, last known position and time, if they are participating in the Fisheries and Oceans monitoring process and are fitted with transponders (satellite monitoring system). JRCC/MRSC SAR coordinators may access the information by selecting a geographical area of interest and polling the information displayed on the chart or in the RDM search window.

VTOSS

3.07.18 Participating Commercial ships and Government vessels and aircraft of the Pacific Coast can be located with the Vessel Traffic Operations and Support Systems (VTOSS) by checking a geographical area of interest in SMMS.

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4.01 Search Planning

NOTE:	This chapter covers the practical application of the basic search theory concepts described in the *IAMSAR Manual, Volume II (Chapter 4)*. In addition, specific Canadian search procedures are included.

General

4.01.1 Search planning is necessary when:

.1 the location of the distress is not known; or

.2 a significant period of time has passed since the search object's position was last known.

4.01.2 The degree of search planning can range from the simple tasking of a search and rescue (SAR) unit on an electronic search, to the complicated coordination of a weeklong search, using many aeronautical and/or maritime SAR facilities. The planning can be carried out manually or by one of the computer programs available.

4.01.3 **Record Keeping –** Search planning may be carried out completely by the SAR mission coordinator (SMC) at the joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) or may be initiated by the SMC at the JRCC/MRSC and continued by a remotely deployed SMC/searchmaster (SM). Since more than one person may be involved in the planning process, a record shall be kept of all assumptions and factors which affected the development of the plan. This record of assumptions and factors is especially critical on extended searches where new information may cause the SMC/SM to re-evaluate the assumptions made during the initial planning phase. The record is also critical for legal purposes where the conduct of a search may be called into question.

4.01.4 It is important that throughout the process all participating agencies are included in the communications net and kept advised of the search action plan. On-scene coordinators also have search planning responsibilities.

Search Planning Methods

4.01.5 The method used to determine the search plan will depend on the location of the incident, its complexity, and the SAR facilities available for its prosecution. Complex incidents, involving more than one uncertainty or a number of SAR facilities, may require the use of automated planning tools. Less complex incidents may be resolved by the application of manual planning methods. The search planner may have to deal with more than one method, regardless of whether the search is happening in the inland or maritime environment.

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4.01 Search Planning

4.01.6 Inland Searches – Canada has developed two predefined methods of determining and plotting inland searches, the Canadian Search Area Definition (CSAD) and the Mountain Visual Flight Rules (VFR) methods:

.1 **CSAD Method –** This method is based on empirical data collected on Canadian inland SAR incidents from 1981 to 1986, excluding the data used for the Mountain VFR study. The CSAD method applies in point-to-point cases.

.2 **Mountain VFR Method–** For utilization in mountainous regions in which visual flight routes are accepted, published and flown, the Mountain VFR method is based on empirical data collected on Canadian inland incidents involving VFR flights in mountainous regions. The Mountain VFR method applies in cases where the intended route of the missing aircraft involves navigation by following such things as valley floors, rivers and roads (in mountainous terrain) as opposed to point-to-point navigation.

4.01.7 These methods were developed for cases where there is little information to go on besides a last known position and a destination. If the SMC/SM has evidence to suggest that these methods are not applicable, then they should be modified, subject to the concurrence of the SAR Region Commander, through the officer in charge of the JRCC. Details of the modification to the search area and SMC/SM reasoning for the modification are to be included in the situation report (SITREP).

NOTE:	The CSAD and Mountain VFR methods are explained in *section 4.02 – Inland Search Planning Methods*.

4.01.8 Maritime Searches – In contrast to the inland search environment, the search object in the maritime environment is rarely static; it drifts due to the effect of the various water currents and surface winds. All maritime search planning methods use the same types of information and are based on the assumed drift errors of these individual drift forces. As these drift errors increase proportionally with the passage of time, it is recommended that search planning be commenced early in the incident, to minimize the search area, and therefore, the effort required to resolve the incident.

4.01.9 In Canada, worksheets for several of the maritime search planning steps have been devised to aid in the planning process, to avoid overlooking pertinent data, and to establish a logical sequence for the planning computations when it must be done without computer-based search planning aids.

NOTE:	Refer to *Appendix C – Search Planning Worksheets (Minimax)*.

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4.01 Search Planning

Computer-Based Search Planning Aids

4.01.10 CANSARP – The Canadian Search and Rescue Planning Program (CANSARP) is an automated search-planning tool for calculating drift plots and conducting search planning and effort allocation. In all maritime searches, CANSARP should be used as the primary means for search planning.

4.01.11 The advantages of CANSARP are that the program:

.1 accepts more available incident data than is possible in the manual solution: The search planner can evaluate many possible scenarios with a range of incident times, positions, search objects, situations, and environmental factors, while the manual method averages data to estimate the search object location;

.2 uses computer simulation to graphically depict the range of possible search object locations, and areas most likely to contain the search object. When more than one search is necessary, CANSARP can use previous search results in estimating the probable search object location for the next search;

.3 calculates the probability of detection (POD) for individual searches, a measure of search effectiveness. CANSARP maintains a record of the POD for each SAR facility, allowing the search planner to more effectively evaluate the search effort, especially in large incidents when a number of searches or SAR facilities are required;

.4 divides the divergence angle of the assigned targets by a factor of ten, and drifts each individual set of vectors over the desired time interval. This results in eleven drift tracks per search object, with resulting drift error. In a uniform wind and current field, this results in a series of overlapping probability circles, or "arc of probability". The arc of probability defines the area where the search object is most likely to be found, and the search planner can concentrate the search effort in this area. In a less uniform current field, such as a tidal zone, the arc of probability may be less regular in shape. However, it still defines the best areas to search. The amount of calculations required to make similar predictions manually is prohibitive; and

.5 also calculates the minimax probability area derived by the manual method. If adequate SAR facilities are available to the search planner, this area may still be covered.

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4.01 Search Planning

4.01.12 SARMaster – Search and Rescue Mission Management Software (SMMS).

.1 SARMaster is a SAR incident management system from Honeywell Global Tracking, with whom a technical support contract is maintained, that provides the JRCCs and MRSCs with a complete view of SAR data. This data includes emergency beacon locations, information about local SAR resources (e.g. marine vessels, aircraft and personnel) as well as extensive SAR planning tools used to coordinate all SAR efforts in a cohesive fashion. As national SAR responsibilities are shared between DND and CCG, SARMaster is also deployed to the Coast Guard College (CCGC) in Sydney NS for training purposes.

.2 SARMaster is a client-server system that incorporates databases (e.g. Geographic Information System (GIS), incident information, SAR resources, ship and aircraft registries) and automates case information gathering tasks like logging, data entry, registration database lookup, rescue resources lookup, checklists, mapping and reporting. SARMaster displays both spatial and text-based data on a single desktop platform, used by each Controller, employing up to four monitors per system to manage and conduct SAR operations.

.3 Controlled by the consolidation database server, SARMaster uses database replication over wide area network infrastructure to synchronize rescue Centre databases across the country. This ensures that all rescue Centres have a common operating picture of national SAR information, and that data is automatically backed up off site in multiple distributed databases. Replication allows for rescue Centres to share information and to collaborate on SAR incidents. Should a JRCC become incapacitated due to a natural or manmade disaster, its operations, including all current SAR incidents, are handed off to the adjacent JRCC. This critical capability is only available because the affected Centre's information will have been replicated to all other Centres.

4.01.13 Other Search Planning Models – Other search planning models are available for determining the search area. However, as with all planning tools, the user should be aware of their limitations and proper application. Two of these models are:

.1 **SARIS –** "Search and Rescue Information System", used in the United Kingdom; and

.2 **SAROPS –** "Search and Rescue Optimal Planning System", used by the United States Coast Guard (USCG). SAROPS uses simulation methods and is most efficient in cases where information concerning the incident position is vague.

NOTE:	Canadian users may access SAROPS by having the JRCC contact a USCG maritime rescue coordination centre, either at Norfolk or at Seattle.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.02 Inland Search Planning Methods

Canadian Search Area Definition Method

4.02.1 Based on historical data, two definitive probability areas have been established. These zones are categorized according to the priority with which they should be searched. The Canadian Search Area Definition (CSAD) method takes into account the variations in known crash positions along track and across track. Those variations are combined, giving rectangular areas within which the crash position is likely to be found.

4.02.2 Other factors may influence the search area based on known habits of the pilot, aircraft equipment, available navigation aids, weather, equipment, local procedures and other considerations. In 2010 DRDC CORA re-examined the validity of the existing Canadian Search Area Definition (CSAD) methodology using crash data from the 2003-2010 period. For crashes in non-mountainous terrain, the data showed that crash locations tend to be closer to track than previous studies on which current CSAD areas are based. CSAD Area Two, offers minimal additional likelihood of covering crash sites.

4.02.3 Notwithstanding, the Search Master will consider all known factors to define a search area best suited for the unique circumstances of a particular search effort and may modify from CSAD in consultation with the Officer in Charge (OIC) of the joint rescue coordination center (JRCC) and the Search and Rescue Region (SRR) Commander.

4.02.4 The use of the CSAD requires the following information:

.1 the last known position (LKP);

.2 the intended route; and

.3 the intended destination.

4.02.5 **CSAD Search Areas –** The CSAD method applies to all intended track lengths. The two areas are:

.1 **AREA ONE –** A rectangle, 10 nautical miles (NM) each side of track, beginning 10 NM before LKP and extending 10 NM beyond destination; and

.2 **AREA TWO –** A rectangle, 15 NM each side of track, beginning at the LKP and extending 15 NM beyond destination. AREA TWO includes that portion of AREA ONE where overlapping occurs.

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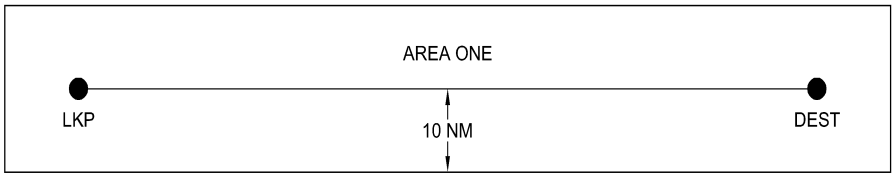
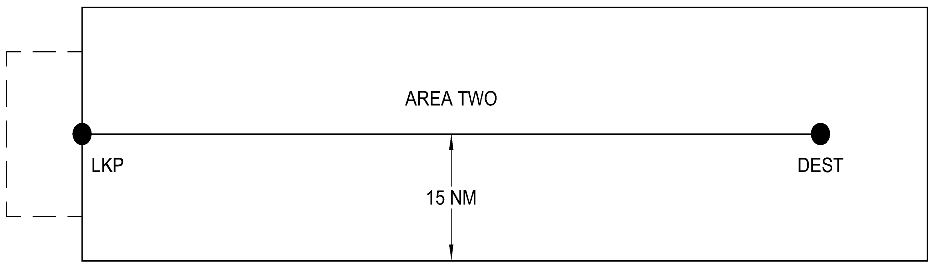
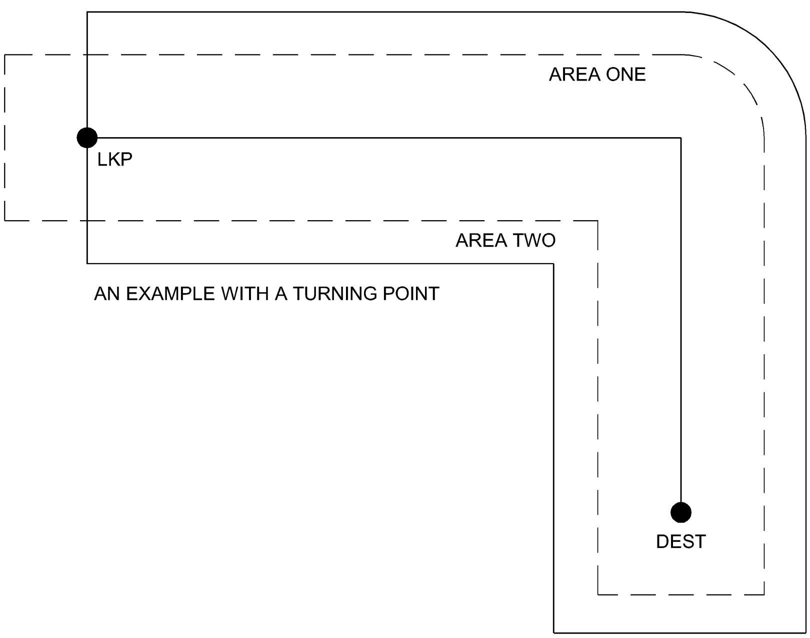
4.02 Inland Search Planning Methods





4.02.6 CSAD Turning Point – Where an en route turning point includes a track direction change of greater than 20°, the outside boundary of each area shall be an arc using the turning point as centre and a radius equal to 10 NM for AREA ONE and 15 NM for AREA TWO.



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4.02 Inland Search Planning Methods

4.02.7 Normally, there is no requirement to adjust the search areas in an inland search. Such adjustment would have to be considered, however, if any of the three basic factors listed in *paragraph 4.02.4* should change during the search.

4.02.8 **Probability of Containment –** The probability of containment (POC), or density of crash positions based on the data, varies in the along-track and off-track directions. Generally, incidents tend to cluster close to the intended track, with the density dropping off sharply as offset increases. There are concentrations of incidents in the first tenth and last tenth of track but very few incidents in the underfly and overfly areas. There also tends to be more incidents in the second half of track than in the first half.

NOTE: *Appendix D.01 – CSAD Square Mileage Graph* provides a ready reference for determining the square mileage of search areas.

4.02.9 **CSAD Search Strategy and Sequence –** There is no single sequence of search types or patterns which will be suitable for all searches. For searches where the CSAD method is used, the following search sequence is suggested, unless circumstances dictate otherwise:

.1 **Phase I**

.a Carry out track crawls along the missing aircraft's intended track and thoroughly check in the vicinity of the LKP and destination.

.b Carry out electronic searches to detect any distress beacon signals.

.c Carry out a search for visual detection aids over the high probability areas, covering 15 NM either side of the missing aircraft's intended track.

.2 **Phase II –** Thoroughly search AREA ONE in the following sequence, for all track lengths:

.a The last quarter of the intended track, from the track outwards, with equal priority along the track.

.b The third quarter of the intended track, from the track outwards, with equal priority along the track.

.c The first quarter of the intended track, from the track outwards, commencing at the LKP.

.d The second quarter of the intended track, from the track outwards, with equal priority along the track.

.e The overfly area, expanding from the intended destination.

.f The underfly area, expanding from the LKP.

.g Upon satisfactory completion of CSAD Area One the SM should re-assess all relevant information prior to proceeding to phaseIII. Circumstances may preclude the employment of Phase III.

.3 **Phase III –** Expand the search to AREA TWO and use the same sequence as in Phase II.

Mountain Visual Flight Rules Method

4.02.10 Canadian search and rescue data involving Visual Flight Rules (VFR) flight plans has revealed distinct differences in the POC between the mountainous regions and other regions of the country. In particular:

.1 although there tend to be more crash sites between one-half and three-quarters of the way along the intended track, a substantial portion occurs along the other areas of the track;

.2 very few crash sites are found before the LKP or beyond the intended destination;

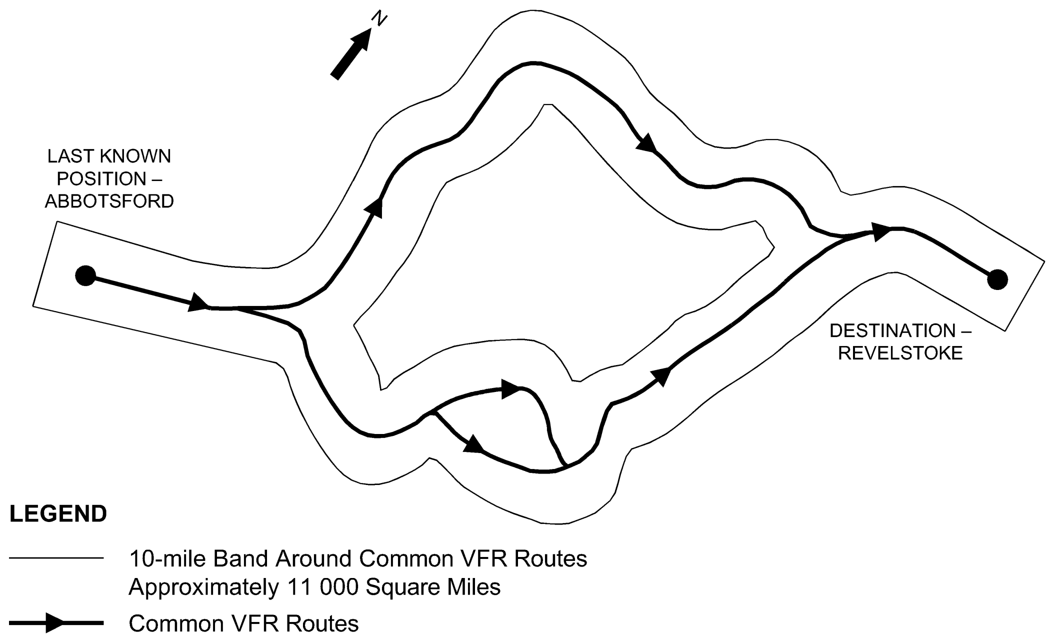
.3 crash sites tend to cluster close to the intended track with the POC decaying sharply as you move away from the track; and

.4 the minimum search area for a given POC always stretches along the entire length of the track.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.02 Inland Search Planning Methods

4.02.11 Mountain VFR Search Areas – Two probability areas are defined for incidents involving VFR flight plans in mountainous regions:



.1 **AREA A –** Area stretching along the entire intended track of the missing aircraft, from the LKP to the destination, and extends 5 NM either side of the track. Based on previous data and assuming the intended track is known, this area should include a large portion of crash sites. In order to include incidents where the crash occurs shortly after takeoff or on approach for landing, this area is extended 5 NM before the LKP and 5 NM beyond the destination.

.2 **AREA B –** Area stretching along the entire intended track of the missing aircraft, from the LKP to the destination. It extends 10 NM either side of the track, and is also extended 10 NM before the LKP and 10 NM beyond the destination.

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4.02 Inland Search Planning Methods

NOTE: AREA B also includes all of AREA A.

NOTE: If the missing aircraft's intended route is not known with any certainty, all likely routes must be covered or another search planning method used.

4.02.12 Mountain VFR Search Strategy and Sequence – Given that an aircraft is missing on a VFR flight in the mountainous regions of Canada and all the preliminary checks have been completed without success, the following procedure is recommended:

.1 **Phase I**

.a Carry out track crawls along the missing aircraft's intended VFR route and thoroughly check LKP and destination for near take-off/landing incidents.

.b Carry out electronic searches to detect any distress beacon signals.

.c Carry out a search for visual detection aids over the high probability areas, covering 10 NM either side of the missing aircraft's intended VFR route. This should include all likely routes if the intended route is unknown.

.2 **Phase II –** Thoroughly search AREA A in the following sequence, for all track lengths. Once again, if the missing aircraft's intended route is not known with any certainty, all likely routes must be covered:

.a the third quarter of the route, from the track outwards;

.b the fourth quarter of the route, from the track outwards;

.c the second quarter of the route, from the track outwards;

.d the first quarter of the route, from the track outwards;

.e the overfly area, expanding from the intended destination; and

.f the underfly area, expanding from the LKP.

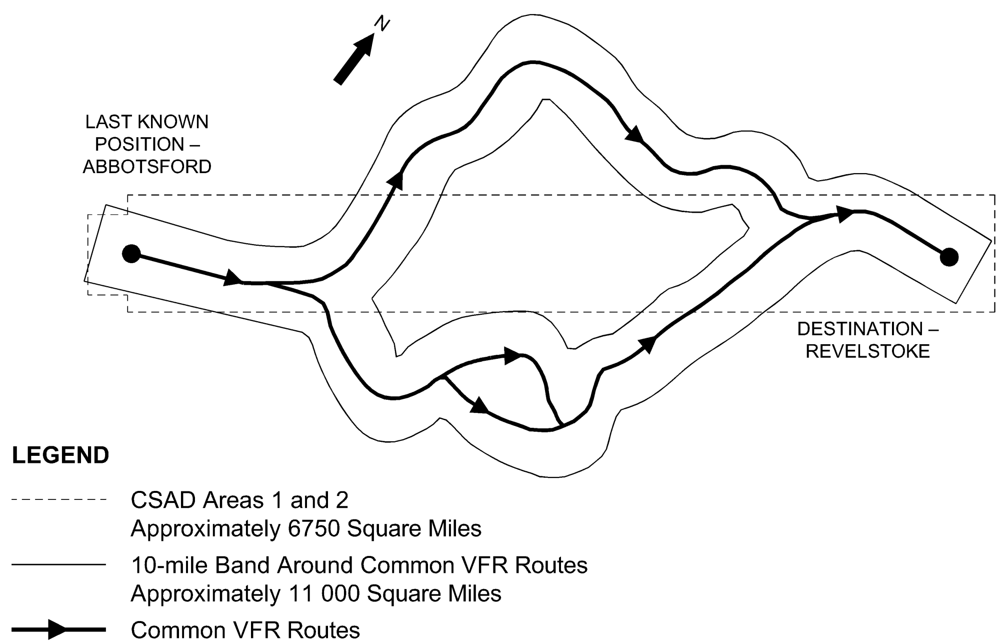
.3 **Phase III –** Expand the search to AREA B, and use the same sequence as in Phase II. Any valleys, dead-end canyons, passes, etc., that may have been taken accidentally by the missing aircraft should also be covered.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.02 Inland Search Planning Methods

Comparisons of CSAD and Mountain VFR Search Areas

4.02.13 The following figure shows a comparison between the CSAD and the Mountain VFR methods, for an incident involving a flight from Abbotsford to Revelstoke, where more than one common VFR route is possible. The practicality of the Mountain VFR method is demonstrated by the fact that the CSAD method covers only about one-third of the possible VFR routes.



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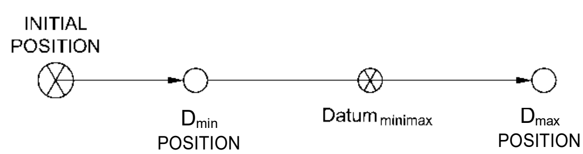
Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.03 Maritime Search Planning Methods

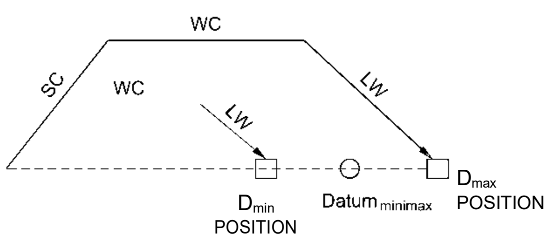
Oceanic Environment

4.03.1 Non-Minimax – If the drift is less than four (4) hours, compute the search radius without considering drift error. If the drift is more than four (4) hours, consider using the minimax method.

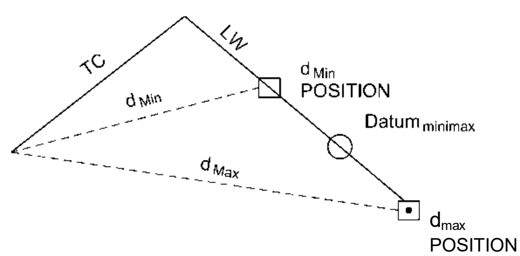
4.03.2 Minimax – Often the information available about a maritime incident is so uncertain that the planner must make several assumptions to determine a datum. This is accomplished by deciding on the least and greatest practical values of all unknown or uncertain factors. These factors include the earliest and latest times the incident may have occurred, the various positions where the incident may have occurred and the many drift forces that may affect the object. Then, the least practical values are added vectorially to provide the minimum distance an object should be from the last known position (LKP), just as the greatest practical values are added to provide the maximum distance. The datum point is established midway. This procedure is called minimax (minimum/maximum) plotting, and some examples are shown below. The minimum drift distance is labelled d_{min}, the maximum drift distance, d_{max}, and the datum point, $Datum_{minimax}$.



BASIC PLOT



TIME UNCERTAINTY



DROGUE/NO DROGUE UNCERTAINTY

4.03.3 It will be apparent that when minimum and maximum values of all uncertainties, such as time, position and drift, are incorporated into one minimax computation, the result will be an extremely complex computation, and so only one uncertainty is normally considered. Thus, if a time uncertainty is imposed, a single position will be used and leeway (LW) will be considered as downwind. If drift rate (and therefore, LW) uncertainty is imposed, time and position uncertainty will not be included in the computation.

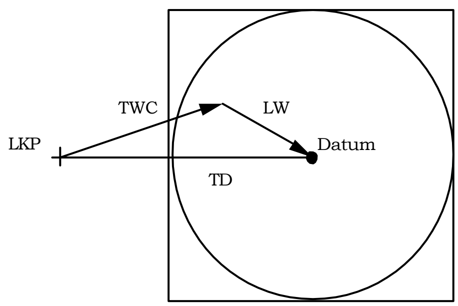
Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.03 Maritime Search Planning Methods

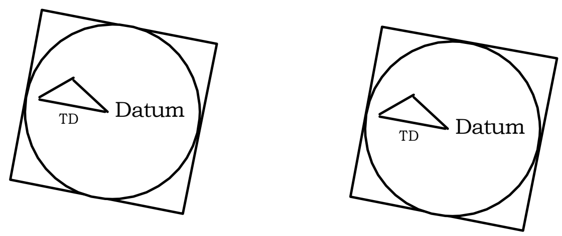
Coastal Waters

4.03.4 Coastal search planning differs from oceanic planning in that sea current and wind current are not usually included in the total water current. In the initial search, radius is set at six (6) nautical miles and, normally, only the downwind LW is taken into consideration.

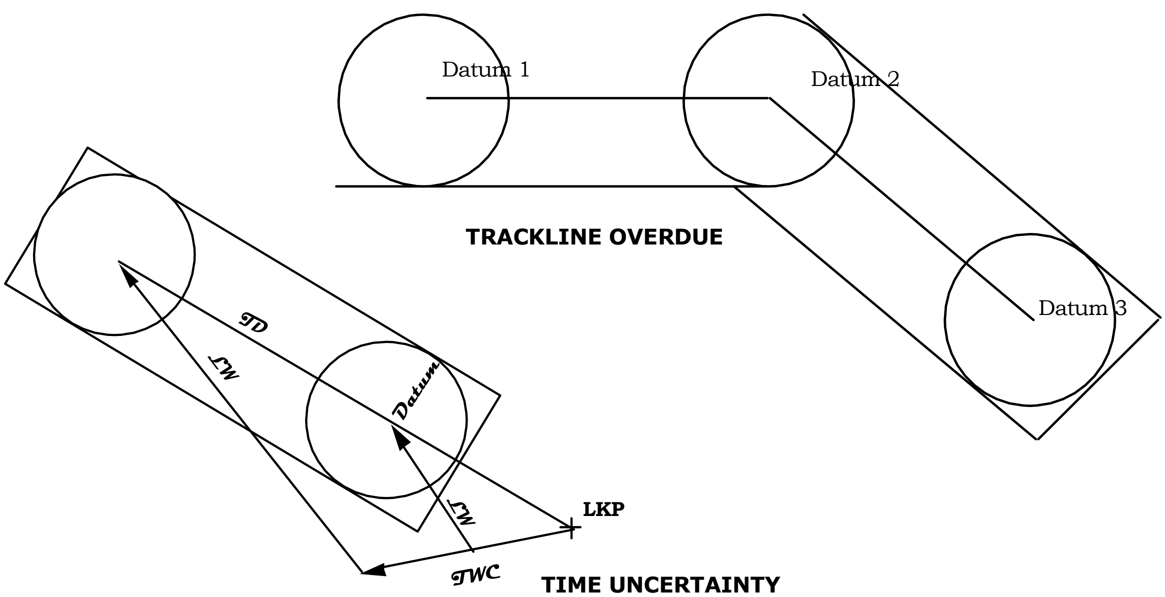
4.03.5 The intent of coastal search planning is to furnish simplified procedures that can be acted upon in the early stages of an incident.



VESSEL ADRIFT



POSITION UNCERTAINTY



TRACKLINE OVERDUE

TIME UNCERTAINTY

NOTE:	If the distressed craft reports a position that is in shallow water, it may anchor. Therefore, particular attention should be paid to the LKP when it is located outside the determined search area. If this is the case, the search facility should proceed to check the LKP first.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.04 SAR Incident Location

General

4.04.1 At the initiation of search planning, the search planner may know a reported position, the proposed track or only the general area of the search object. This knowledge is used to determine the object's most probable position, which is then corrected for drift if necessary. When searching for an aircraft on land, the result is a datum which will remain stationary throughout the search. For an object in the water, the result is a moving datum from which continually moving search areas may be derived. In both cases, the object is to determine an area which has the greatest chance of including the most probable position of the search object.

4.04.2 In the computation of the search and rescue (SAR) incident location, the planner must collect, weigh and review information from all practical sources. These might include:

.1 airfields where an aircraft might have attempted to land;

.2 possible vessel docking areas;

.3 military or civil radar services, such as the Terminal Radar and Control System (TRACS) or the Joint Enroute/Terminal System (JETS);

.4 aviation or maritime authorities along the route;

.5 Marine Communications and Traffic Services;

.6 Canadian Forces high frequency (HF)– and Canadian Coast Guard very high frequency (VHF)– direction finding nets;

.7 owner/operator/next-of-kin, to:

.a obtain information on the crew and the aircraft/vessel operating characteristics, relating these to the enroute weather and terrain; and

.b assess the ability of the crew to survive and the type of assistance likely from survivors; and

.8 Environment Canada Meteorological Service, for weather information which may have influenced the intended voyage.

Possible Area

4.04.3 This area is the region bounded by the object's limit of endurance in all possible directions from the last known position (LKP) of the search object. It approximates a circle centred on the LKP with the radius being expressed in terms of distance. The basic methodology may be applied to both aeronautical and maritime cases. Normally, it will be impractical to search this wide area, but it should be determined so that the planner will be aware of all possibilities.

Probability Area

4.04.4 Aeronautical – In the absence of information to the contrary, it may be assumed that the most probable area within which a missing aircraft will be found is that along the intended track from the LKP to the intended destination and within a reasonable distance either side of track. The study of Canadian data, which led to the Canadian Search Area Definition and Mountain Visual Flight Rules methods, confirmed this assumption for aircraft cases. It also determined that definitive area sizes could be established in relation to probability of whereabouts values of an incident location for various track length groupings.

NOTE:	Refer to *section 4.02 – Inland Search Planning Methods*.

4.04.5 Maritime – In maritime cases, the probability area consists of an increasing area about a periodically repositioned datum. The area is determined using the oceanic or coastal search planning methods.

NOTE:	Refer to *section 4.03 – Maritime Search Planning Methods*.

4.04.6 Adjustment of the probability area may be necessary for a variety of reasons, including:

.1 the initial search of a determined probability area has proven unsuccessful.

.2 information becomes available which suggests a deviation from the intended route may have occurred. This might include:

- .a adverse weather differing from that expected by the crew;
- .b unserviceable or unreliable navigation aids en route;
- .c advice on preferred routes from qualified witnesses; and
- .d reliable sighting reports; and

.3 the effect of drift in the case of maritime incidents.

NOTE:	Refer to *section 4.08 – Search Areas*.

NOTE:	To aid in the computation of the area and time involved in sequential coverage of various search areas, a series of nomographs and tables have been developed. Refer to *Appendices D.02 to D.04 – Search Nomographs*.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.04 SAR Incident Location

Distress Beacon Detection

4.04.7 Often, distress beacon reports are received from pilots of other than SAR aircraft. In Canada, anyone hearing a distress beacon signal is required to advise the nearest air traffic control unit, flight service station or joint rescue coordination centre, stating the position where the signal was first and last heard and the strength of the signal.

4.04.8 With this information, and the theoretical reception range for VHF and ultra high frequencies (UHF) signals, the search planner can arrive at a rough estimate of the most appropriate search area, keeping in mind that while in theory distress beacon signals should extend to line of sight range, they may be affected by a number of factors such as terrain shielding, transmitter strength and receiver sensitivity.

NOTE: Refer to *Appendices D.05 – VHF/UHF Theoretical Reception Range Table*, and *D.06 – ELT Detection Distance Graphs*.

4.04.9 Because of the limited operating life of most distress beacon batteries, it is essential that search planning be premised on saturating the high probability areas as soon as possible. An electronic search should be conducted during the first 24 hours after a search object is missing. For the remainder of the search, a listening watch on the appropriate frequencies shall be maintained.

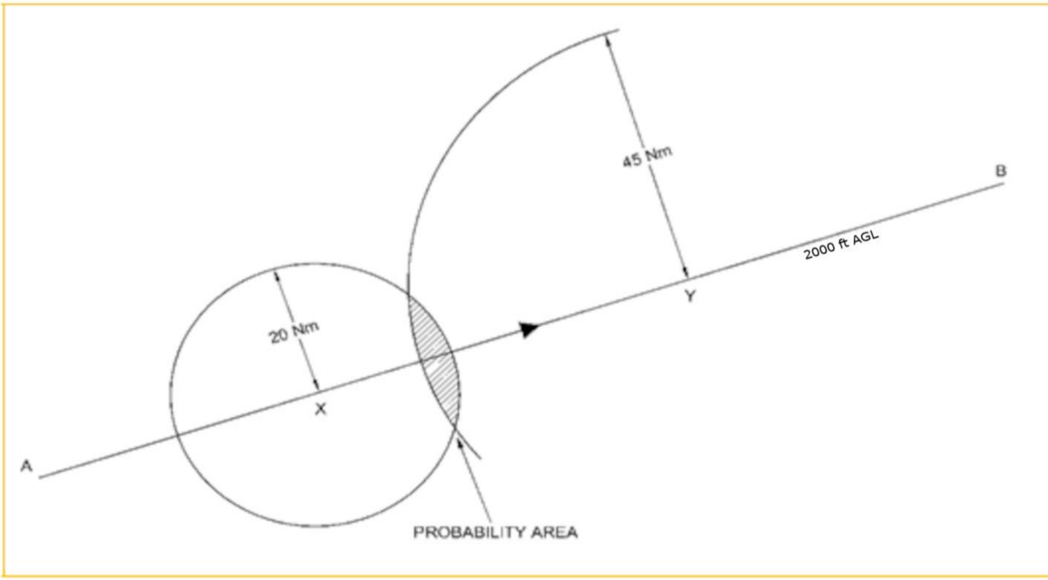
4.04.10 **ELT Searching Examples –** There are several methods of working out the most appropriate search area. The following examples show how ELT tone information received from overflying aircraft can be used to locate the source of the signal.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.04 SAR Incident Location

Example A

Situation – The pilot of a Beaver is flying from point A to point B. Over point X, at 600 metres (2,000 feet) above ground level (AGL), he receives a loud and clear steady ELT signal. He notes the time and his location but because of fuel considerations does not attempt an aural homing. He continues his flight and keeps monitoring 121.5 megahertz. Thirty minutes later at point Y, after covering approximately 60 NM, the signal fades out.

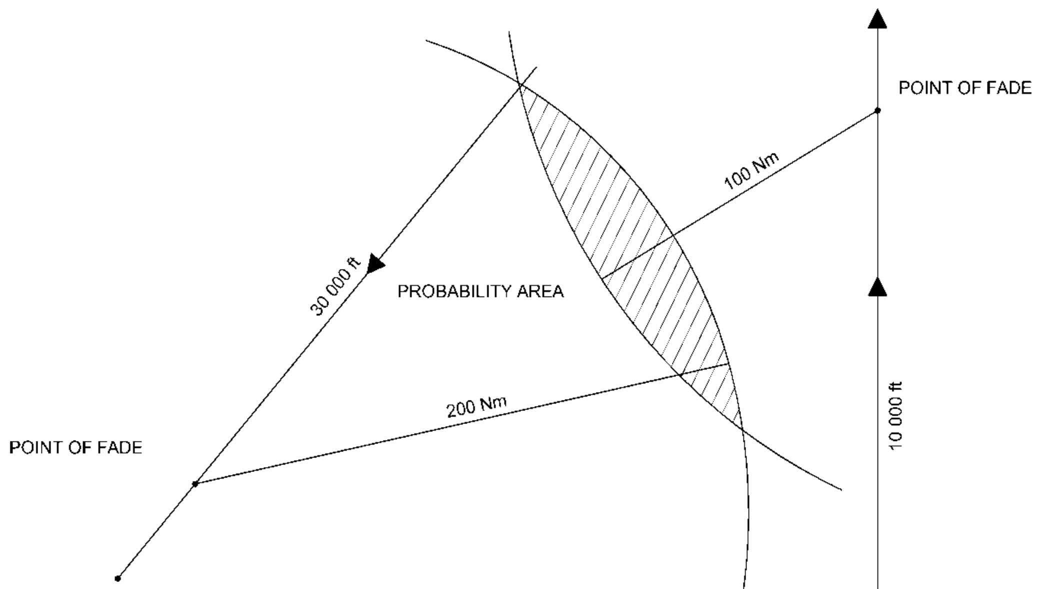


S

Solution – It is most likely, judging from the way that the signal was first received ("loud and clear") that the downed pilot did not turn the ELT on until he saw or heard the Beaver. At that time, the Beaver was probably within 20 NM of his position. Since the Beaver pilot continued to hear the beacon until it faded at point Y, we can use the VHF/UHF theoretical reception range for 600 metres (2,000 feet) of 45 NM and draw an arc cutting the 20 NM circle drawn around point X. The probability area would then be the relatively small shaded area.

Example B

Situation – Two different aircraft on two different routes, one flying at an altitude of 3000 metres (10,000 feet) AGL and the other at 9 000 metres (30,000 feet) AGL, each receiving ELT signals.

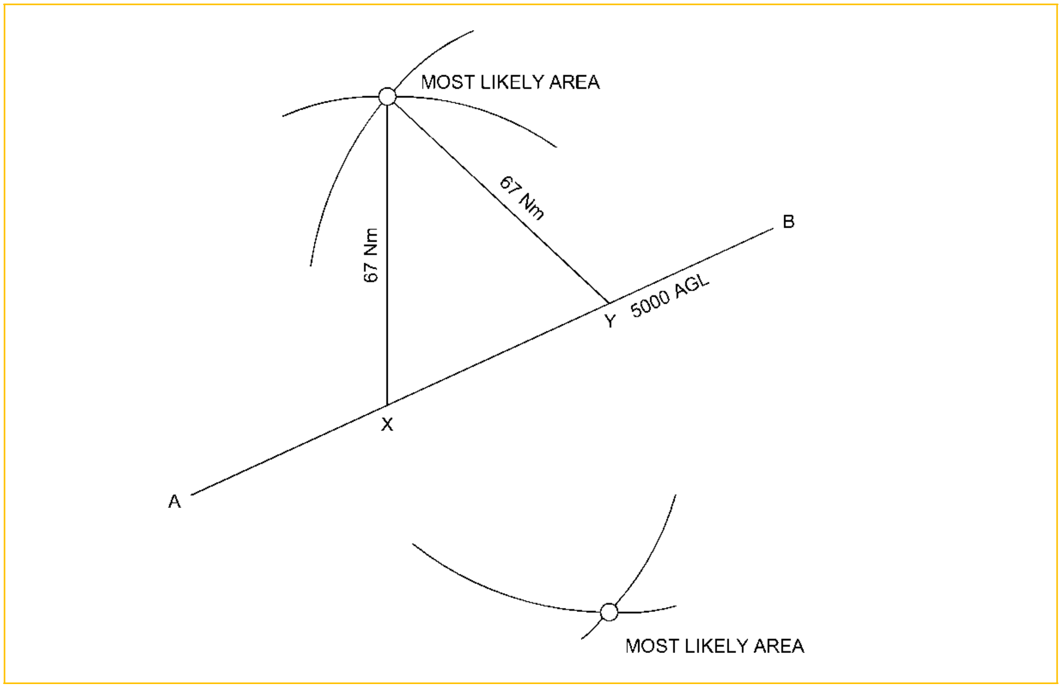


PROBABILITY AREA – EXAMPLE B

Solution – By using the theoretical reception range of 100 NM for aircraft flying at an altitude of 3000 metres (10,000 feet), and of 200 NM for aircraft flying at an altitude of 9000 metres (30,000 feet), we can draw two arcs and arrive at a relatively small probability area.

Example C

Situation – One aircraft, flying at 1500 metres (5,000 feet) AGL, picks up a weak signal at point X and tracks it until it fades at point Y.



Solution – By using the theoretical reception range of 67 NM for 1500 metres (5,000 feet), we can draw two arcs from each of the X and Y points and arrive at two most likely areas, one on either side of the track.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.05 Datum

Inland Environment

4.05.1 When planning a search in the inland environment, determining a starting reference point or datum is simply establishing the last known position (LKP), that is, the last position for which there is indisputable evidence of the search object's location.

Maritime Environment

4.05.2 In the maritime environment, datum is defined as the most probable position of the search object, corrected for drift, at any specific time.

4.05.3 In the maritime environment, many forces act on a search object, such as wind, sea and tidal current, etc. Unless the search object is immobilized, such as a vessel aground, the actual position of the search object may be substantially different from the initial position or LKP. The search planner should therefore include all the appropriate forces, considering the location, when calculating a particular datum.

4.05.4 As the search object continues to be acted upon by these forces during the search, datum should be periodically recalculated. Datums are usually labelled sequentially (e.g., Datum 1, Datum 2, Datum 3), with the calculation time.

4.05.5 To compute a datum, the search planner must first consider the time and location of the search object's last reliable position, or LKP. Four datum types may be derived from the four possible situations that usually exist:

.1 Single Datum, where a <u>single position is known</u>;

.2 Multiple Datums, where there is an <u>uncertainty in the position</u>;

.3 Datum Line, where the <u>intended track is known</u>; and

.4 Datum Area, where the LKP is actually a vicinity rather than a position.

4.05.6 **Single Datum** – If the incident has been reported by the distressed craft itself or witnessed by another craft or observer, or the position may be established from a previously reliable position, the search planner applies the drift to the search object's position for the appropriate time interval and computes a unique, or single, datum.

4.05.7 **Multiple Datums –** A variation of the single datum is the "position uncertainty" situation. In this case, the reported position may be vague, or described in such a manner that the planner must drift two or more possible locations (this should not be confused with the trackline).

4.05.8 **Datum Line –** If the craft's intended track is known, but not its position along the track, or a single line of position, such as a direction finder bearing, is obtained, a datum line can be computed by correcting the track for the drift.

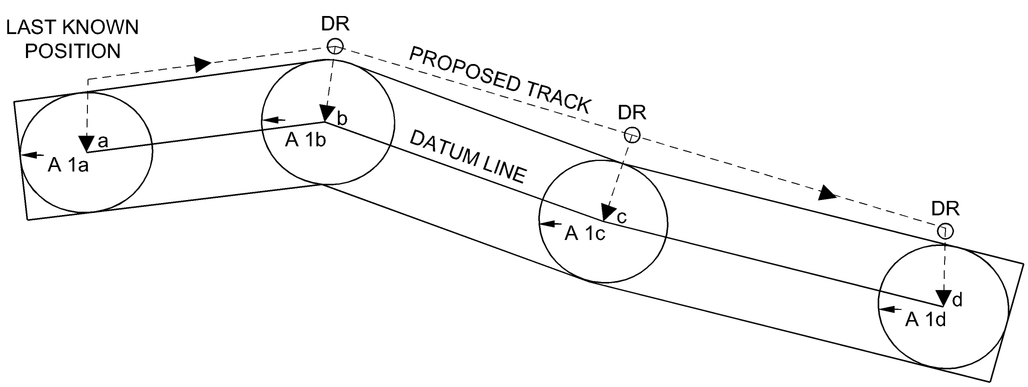
Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.05 Datum

4.05.9 To do so, dead reckoning (DR) positions should be established at the beginning and end of the track, and along the track as required. Each DR is used to develop a datum point for a common time. These are analyzed for possible error factors and the resultant search radii are tangentially joined to construct a search area along the intended track:

.1 The intended track is first plotted. A series of DR positions are then computed at frequent and regular intervals for estimated progress along the track, including the DR position at the end of the track and the turning points along the track.

.2 Each DR position is considered as a known position and drift is computed for each position up to a common single time. Thus, a series of datum points is developed. All datum points are then sequentially connected by straight lines to form a datum line.



NOTES

1. Drift is exaggerated.
2. Points a, b, c and d are datum points for DR positions corrected for drift.

4.05.10 Datum Area – If neither the position nor the intended track is known, but the general area the search object was probably in, such as a lake, a military exercise area, or an offshore fishing ground, is known, it will be necessary to determine a datum area.

4.05.11 First, using the information available on the endurance and normal cruising speed of the missing craft, and on the drift forces, an area of possibility will be determined. This area will normally be much too large to search effectively; the search planner will therefore be required to do extensive detective work to determine a reasonable search area.

4.05.12 Datum area calculations depend on many factors, such as fuel endurance, natural boundaries, and known or suspected areas of occupancy. These calculations may range from reasonably exact to a best guess.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.06 Drift Forces

General

4.06.1 In all searches where the search object is believed to be in the water, it will be necessary to re-compute datum periodically to account for drift or new information by determining the various forces that cause the search object to move in and with the water. The periods at which the datum must be re-computed will vary according to this expected drift. The forces that must be considered may include:

1. sea current (SC);
2. tidal current (TC);
3. lake current;
4. river current;
5. bottom current;
6. long shore current;
7. wind current (WC); and
8. leeway (LW).

4.06.2 While the list may seem overwhelming, some are rarely used. Typically, one drift force might be used for aircraft incidents over land, three for surface water incidents, and none for ground incidents.

NOTE:	*Appendix C – Search Planning Worksheets (Minimax)* contains forms that may be used as guides for these calculations.

4.06.3 There is a *Maritime Environment Search Planning Decision Matrix* which illustrates four possible paths that a planner may use to determine a datum and, ultimately, a search area in the maritime environment. Other factors may occur that will warrant the planner determining the datum via some other method, and the decision matrix should be used as a guideline only.

NOTE:	Refer to *Appendix D.07 – Maritime Environment Search Planning Decision Matrix*.

Water Currents

4.06.4 **Sea Current –** SC is the permanent, large-scale flow of ocean waters, not caused by local winds or tides. SC is normally only significant in the oceanic environment, and is generally not calculated in depths of less than 90 meters (300 feet), unless local knowledge suggests differently. While several sources for obtaining SC information are available, the most recent and preferred sources are the Canadian Hydrographic Service publications. The instructions for deriving SC from these and other publications are included in the publications. It must be remembered that SC publications are based on recorded climate data and should be verified whenever possible with more recent on-scene information.

4.06.5 Tidal Current – The effect of tide on current in any given area may be determined by consulting tide tables or current charts which will include the effects of coastal geography. Whenever possible, local knowledge should be sought to verify TC computations. While the ebb and flow of tides may tend to nullify the cumulative effect, tide must be considered since:

.1 when tides reverse, the current effect in one direction may be greater than in the other;

.2 the tidal flow will cause changes in the probable position of the search object for different search times; and

.3 the cumulative effect may be such as to thrust the search object into areas where sea current may take effect.

4.06.6 Lake Current – Any large lake will likely have a water current, which can vary due to changes in season, weather, etc. Information on current may be found in regional Canadian Hydrographic publications. If charts do not exist, potential sources of local knowledge are boat or marina operators who are familiar with the lake.

4.06.7 River Current – Some large rivers, such as the St. Lawrence, have data published on their current. It should be remembered that, where large rivers empty into the sea, their current might have an effect some distance from the river mouth. This should be considered when computing the offshore or long-shore current, and the only reliable source of information will usually be local knowledge.

4.06.8 Bottom Current – Although Canadian search and rescue (SAR) facilities are seldom involved in underwater incidents, it may be necessary for the SAR planner to obtain information on bottom current. This data can be obtained from the Canadian Hydrographic regional facility.

4.06.9 Long-shore Current – Caused by incoming swells striking the shoreline at an angle, the long-shore current is only considered within one mile of the shoreline and must be obtained from direct observation or local knowledge.

4.06.10 In general, when planning any kind of inshore search, it is advisable to seek outside and/or local knowledge. Each joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) should establish reliable contacts that can provide such data. These might include:

.1 oceanographic institutes;

.2 Coast Guard or naval experts;

.3 professional fishers or tug operators;

.4 marina operators;

.5 ferry operators; and

.6 local area marine pilots.

4.06.11 Wind Current – Also called wind driven current or wind drift current, the WC is the result of wind acting on the surface of the water for a long period. WCs are virtually ignored in coastal, lake, river and harbour areas due to the many variable effects of the water/land interface. A rule of thumb is to calculate WC when water depths are greater than 30 metres (100 feet) and at distances of 20 NM or more from shore.

4.06.12 The United States Coast Guard Oceanographic Unit developed a procedure to calculate the wind current by determining the wind effect for six-hour time periods and vectorially adding these effects. To do this, the most accurate wind speed possible should be obtained for the 48-hour period prior to the incident, divided into eight six-hour periods of which the first period is the most recent. Winds are usually available for the normal synoptic hours, 0000 UTC, 0600 UTC, 1200 UTC and 1800 UTC, or from weather maps. Wind speed and direction for each period are considered to be those which were valid at the end of the period. The first period should be selected so that it begins and ends on the synoptic times bracketing the time for which the current is to be calculated. While a 48-hour wind record is preferred, a shorter period could be used with some loss of accuracy.

NOTE:	Refer to *Appendix C, Sheet 9 – Wind Current Calculation*.

4.06.13 On-scene Observations – Since almost all information available for computing the various drifts is based on historical record, every effort should be made to verify or update it with recent observed data. Some of the means available are:

.1 oceanographic vessels operating in the area of the incident, which can provide information on winds or current;

.2 expendable surface current probes (ESCPs), which are carried by some oceanographic research vessels and should be deployed if available. The same constraints exist with ESCP as with datum marker buoys (DMBs);

.3 self-locating datum marker buoys (SLDMBs), which are drifting buoys that transmits a signal automatically tracked by JRCC/MRSC via satellite and input into CANSARP. SAR units should not deploy a SLDMB without first consulting with the JRCC/MRSC, to ensure that it is being tracked;

.4 DMBs, which are carried by SAR aircraft and vessels and by some naval aircraft and vessels. A DMB is a drifting buoy that transmits a homing signal and must be tracked by a mobile unit on scene. A DMB should be employed at the earliest opportunity in a maritime search. The DMB vector can then be added to the LW vector for a more reliable datum. However, it must be remembered that the DMB will only provide information on the current existing at the time and place it is used;

.5 other vessels operating in the area of the incident, which can provide information on winds or current;

.6 visual markers such as smoke floats or dye markers, which can be used but must be continually replaced to ensure continuous marking; and

.7 if no other marker is available, the planner might consider the use of a "drifter", such as a boat, a raft or a large float, to simulate the search object movements. The search planner must realize that the object used may have a different draft and plane area from the search object, and may thus have a different LW speed and direction.

4.06.14 Total Water Current – The vectorial sum of all applicable current in a particular drift plot may be referred to as total water current (TWC).

4.06.15 All of the above methods are used to increase search effectiveness by one or more of the following:

.1 determining actual TWC;

.2 marking a search object's location;

.3 acting as a reference point for a drifting datum; and

.4 emulating the drift of a specific search object.

Leeway

4.06.16 LW is the movement of the search object through water, caused by the action of the wind on the exposed surfaces of the object. The shape, size and orientation of the search object cause LW to vary to the point where it is extremely difficult to determine a precise value for LW direction and magnitude for any given object. Also, experiments have shown that objects tend to diverge either side of the downwind direction.

NOTE:	Refer to *Appendix D.08 – Leeway Tables and Taxonomy.*

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.07 Datum and Search Unit Errors

General

4.07.1 Once datum has been determined, the planner must consider the effect of possible errors in the computations and later planning. The three basic errors which must be considered are:

.1 initial position error (X);

.2 total drift error (D_e); and

.3 search facility error (Y).

Initial Position Error

4.07.2 X is based on the position fixing accuracy of the reporting agency, whether it was the search object, a passing vessel or aircraft, an electronic direction finding (DF) source such as radar or HF-DF, or a COSPAS-SARSAT position. The more sophisticated the reporting agency, the smaller the error that may be expected.

4.07.3 When the initial position is reported as a fix, X is the same as the fix error ($Fix_{e)}$. When the initial position is reported as a dead reckoning (DR) position, X is the sum of Fix_e and the DR error ($DR_{e)}$:

$$X = Fix_e + DR_e$$

NOTE:	*Appendix D.09 – Position Error Tables* lists the position errors which may be assumed for various types of reporting agencies and search facilities.

Total Drift Error

4.07.4 D_e is either the combination of all individual drift errors (d_e) or the minimax drift error ($d_{e\ minimax}$).

NOTE:	In the early hours (up to four) of a search, drift error can be disregarded. Again, for practicality, drift error is ignored if it is less than one nautical mile (NM), and needs only to be considered when calculating the surface drift.

4.07.5 The individual drift errors are the errors which develop during computation and are possible when computing any kind of drift. These errors are due to the assumptions and generalizations which must be made to keep the computations practical and simple. For search planning, d_e is established as one-eighth (0.125) of the determined drift, or, if confidence is low, at three-tenths (0.3) of the drift.

4.07.6 The precise definition of D_e is the arithmetic sum of all the accumulated d_e, from the time the search object was first exposed to drift to the time of the latest computed datum. In the calculation of the first datum on a mission, d_e will usually equal D_e but, as the mission progresses and another datum is calculated, D_e will equal $d_{e1} + d_{e2}$ ... and so on.

4.07.7 **Minimax –** The minimax drift error is determined using the formula:

$$d_{e\ minimax} = \frac{Distance + d_{e\ min} + d_{e\ max}}{2}$$

where Distance is the distance between the minimum drift distance (d_{min}) and maximum drift distance (d_{max}); the minimum total drift error ($d_{e\ min}$) is one-eighth d_{min} (or three-tenths, depending on confidence) and the maximum total drift error ($d_{e\ max}$) is one-eighth d_{max} (or three-tenths, depending on the confidence).

NOTE: If aeronautical drift is incorporated to minimax calculations, then the aeronautical drift error (d_{ea}) is added to the $d_{e\ minimax}$:

$$D_e = d_{ea} + d_{e\ minimax}$$

4.07.8 This method is appropriate for all cases except when minimax plotting is used to account for directional uncertainty. In such cases the addition of drift errors from a series of minimax calculations causes an unwarranted enlargement of the total drift error. When using minimax plotting to account for directional uncertainty, D_e must be determined for the final datum position only.

Search Facility Position Error

4.07.9 Position errors may also be anticipated for search facilities, depending on their individual capabilities to navigate. However, only fix errors need be considered for search facilities since they will normally do little or no dead reckoning, so Y is estimated as:

$$Y = Fix_e$$

NOTE: Refer to *Appendix D.09 – Position Errors Tables*.

Total Probable Error

4.07.10 The total probable error (E) can be estimated using a basic statistical method, which holds that the sum of the squares of all possible errors will equal the square of the total probable error. E may therefore be found using the formula:

$$E = \sqrt{De^2 + X^2 + Y^2}$$

4.07.11 This calculation is of great importance since the size of the search area which will be developed depends directly on E.

4.07.12 Finally, it will be necessary for the search planner to recompute E periodically, for example to account for:

.1 drift changes, as datum is redefined;

.2 search facility changes; or

.3 initial position revision.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.08 Search Areas

General

4.08.1 One of the most important phases of the search planning process is the delineation of the area to be searched. The objective of the search planner in all cases will be to define an area which will ensure a better than 50% chance that the search object is in the area.

Oceanic Search Areas

4.08.2 For maritime searches in the oceanic environment, this area can be described as a circle with the datum point as centre and having a radius (R) equal to the product of the total probable error (E) multiplied by a safety factor, called the optimal search factor (f_s):

$$R = E \times f_s$$

4.08.3 While it would obviously be desirable to increase the radius to achieve the highest possible probability, there are usually limitations, including the number of search facilities available, the time available and the track spacing required.

NOTE:	*Appendix D.10 – Search Area Delineation Table* shows the f_s which must be applied to E to determine search radius.

4.08.4 Using the search radius, the planner describes a circle about the datum point, usually squaring it off with tangential lines parallel to the direction of drift. As the datum point moves, the search area is redefined by the same process, using the new R to enlarge the search area. In this way, the search keeps re-covering the water surface area within which the search object is most likely to be.

4.08.5 **Search Area Expansion –** The procedures described above result in repeated expansion of the search area as the search continues. While the table provided expands the search area to a radius 2.5 times the total probable area by the fifth search, the area will continue to grow larger on successive searches by virtue of the fact that E will continue to increase.

Coastal Search Areas

4.08.6 Coastal search planning differs from oceanic planning in that:

.1 sea current and wind current are not usually included in the total water current; and

.2 the initial search radius is set at six (6) nautical miles.

NOTE:	If the drift is for periods greater than six hours, apply the oceanic methodology.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.08 Search Areas

4.08.7 Search Area Expansion – After the first search in a coastal case, the search areas will be increased using the same method of computing E and f_s as for searches in the oceanic environment. The datums will be developed by using minimax plotting.

NOTE:	Refer to *paragraph 4.08.5* and to *Appendix D.10.*

Inland Search Areas

4.08.8 Currently available data does not allow for more than a subjective estimate of the effectiveness of aerial search in the inland environment. Factors such as the type of terrain, the weather, the available light and the capability of the searchers all affect the efficiency of the search facilities. It will be the responsibility of the search planner to evaluate the coverage of each of the individual sections of the search area to reach a rational search conclusion in unsuccessful searches.

4.08.9 Search Area Expansion – Unlike maritime searches, inland searches do not normally require an expansion of the search area. Rather, repeated coverage of the same areas will usually be required until the conclusion of the search.

Search Area Coverage

4.08.10 Search area coverage involves the systematic search of defined areas to ensure the optimum probability of detection of the search object. The many factors that influence detection capability during a search can be reduced to four mathematical expressions:

.1 Track Spacing (S), which is a measure of search effort;

.2 Probability of Detection (POD), which is a measure of search effect;

.3 Sweep Width (W), which is a measure of detection capability; and

.4 Coverage Factor (C), which is a measure of search quality.

4.08.11 Track Spacing – S is the distance between adjacent search tracks, whether these are by simultaneous sweeps of several facilities or successive sweeps of a single facility. It should be apparent that the smaller S is, the higher will be the likelihood of detecting any object which is within the area searched. It must be remembered, however, that decreasing S increases the time for any given search facility to cover the search area, or alternatively requires more facilities to complete the search in the same time. The object of the search planner will be to achieve an optimum value for S, one that will permit expecting search object detection to be within the constraints of time and search facility availability.

Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.08 Search Areas

4.08.12 Probability of Detection – Usually expressed as a percentage, the POD refers to the odds of detecting the search object. An observer can be expected, under normal conditions, to sight most of the objects in close range, fewer objects at greater range and no object at all beyond the maximum detection range. A typical curve for search aircraft spotters is depicted at the end of this section. It has been shown in field experiments that the curve is not a straight line, that is, there is not a constant rate of decrease as the range increases. To make optimum use of this concept, sweep widths tables have been developed to achieve particular PODs.

4.08.13 Probability of Detection vs. Coverage Factor – As S and W control C, so C controls POD. The POD is determined using the *Probability of Detection Graph*, the curves providing POD when C is given for a single search of an area, and for up to four repeated searches in the same area. When repeated searches of the same area are completed, POD is determined by entering the average C for all those searches on the appropriate curve. While this is not strictly accurate, it is sufficiently so for manual calculations, given the basic level of accuracy of the graphs.

NOTE: Refer to *Appendix D.11 – Probability of Detection Graph*.

4.08.14 Sweep Width – W is a mathematically expressed measure of detection capability based on search object characteristics, weather and other variables. W is obtained by choosing a value less than the maximum detection range so that scattered objects that may be detected beyond W are equal in number to those, which may be missed within W. This concept is expressed in the graph at Appendix D.11. Thus, W will always be less than the maximum detection range.

4.08.15 The W concept is applicable for any type of search, including electronic or aural searches, and its computation depends on the search methods being used by search facilities, such as:

.1 visual search;

.2 electronic search; and

.3 miscellaneous search methods.

NOTE: The tables shown at *Appendix E – Sweep Width Computation* provide W values for various types of searches. Also refer to *section 5.01 – Search Patterns and Sweep Widths*.

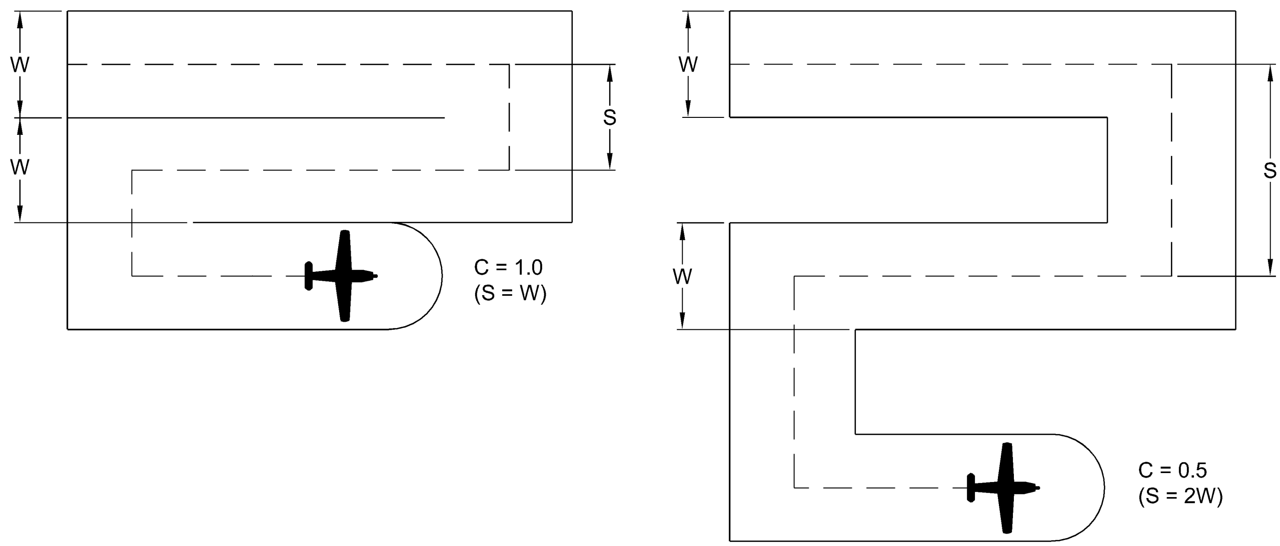
Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.08 Search Areas

4.08.16 **Coverage Factor –** C is a measure of search effectiveness or quality. It depends on the relation between W and S, and is expressed:

$$C = \frac{W}{S}$$

4.08.17 The following figure demonstrates the difference between a C of 1.0 and one of 0.5:



NOTE:	In the case of inland searches, the POD varies according to the changing terrain and vegetation within a given search area. Canadian visual W tables have not been developed for inland searches and therefore C for these searches cannot be determined.

4.08.18 **Search Concentration –** The likelihood of survivors decreases with time, making it imperative that the search planner completes a maximum search effort at the outset of the search. Usually, a large area will be involved, compounding the problem. Adherence to the following principles has proven successful in the past:

.1 define an area large enough to encompass the survivors;

.2 use an S equal to W (C = 1.0);

.3 select a time frame to complete the search;

.4 determine the number of aircraft and/or vessel hours needed to complete the search in the allotted time;

.5 dispatch sufficient search facilities to complete one search of the area within the allotted time;

.6 if unsuccessful, expand and repeat the search; and

.7 avoid re-orienting the search or reassigning search facilities unnecessarily.

4.08.19 In any search, re-orientation of the search area once a particular search has commenced is both difficult and wasteful. Thus, planning should be thorough and then adhered to. The temptation to reassign search facilities for every new lead or sighting report should be resisted. Rather, additional facilities should be dispatched to check out such possibilities.

4.08.20 Inland Search Area Coverage – The number of times an area should be searched depends on the probability of containment (POC) and on the POD. Both of these values are subjective. However the following guidelines are suggested:

.1 Lateral coverage from the airplane is improved to some extent with increasing altitude without degrading the POD appreciably. Therefore, a minimum search altitude of approximately 300 metres (1000 feet) should be considered where terrain and/or vegetation are factors.

.2 Since lateral coverage varies with terrain and vegetation, spotters must adjust their searching accordingly. For example, in densely forested areas, lateral coverage may only be a few hundred feet whereas in open ground, it may be one-half mile.

.3 Adequate coverage of a forested, high probability area may require multiple intensive searches with the narrow track spacings. There are also advantages in varying the search direction, if possible.

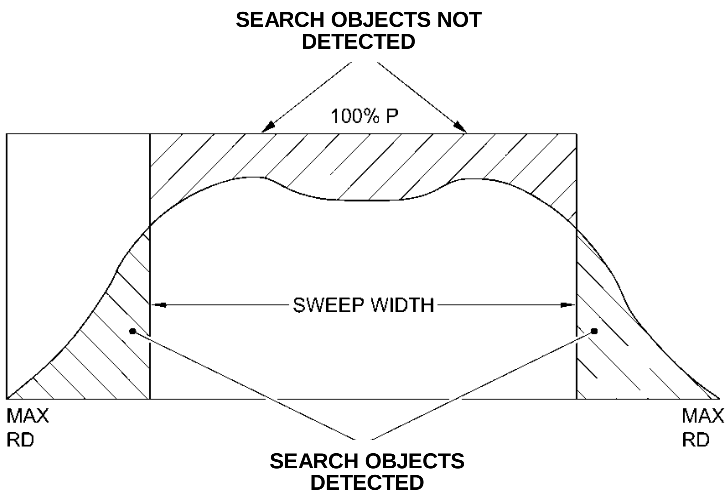
4.08.21 Any pre-defined search areas like those of the Canadian Search Area Definition and Mountain Visual Flight Rules methods are intended as guides when there is little else to go on. Any valid information on the missing aircraft, pilot, route flown, weather, etc., should be used to modify or re-define search areas. This same route may involve a dead-end canyon that could have been taken accidentally by the pilot; this canyon should be searched even if it extends more than 10 miles from the intended track. The key is common sense and flexibility.

NOTE: For further information, refer to the *IAMSAR Manual, Volume II, section 4.6 – Search Planning and Evaluation Factors*.

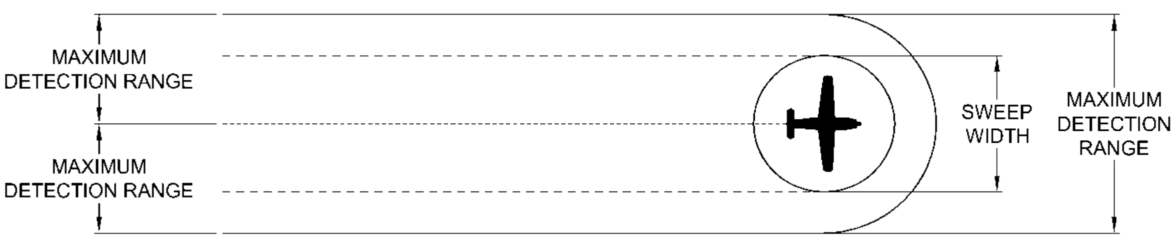
Chapter 4 SEARCH PLANNING AND EVALUATION CONCEPTS

4.08 Search Areas

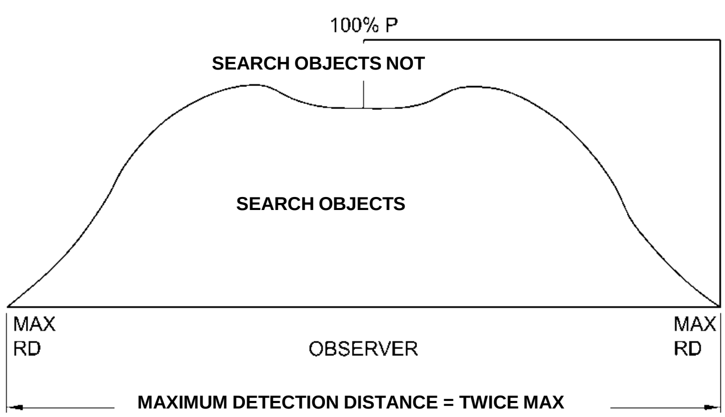
A. GRAPHIC PRESENTATION OF SWEEP WIDTH



B. PICTORAL PRESENTATION OF SWEEP WIDTH



C. RELATIONSHIP OF SEARCH OBJECTS SIGHTED TO SEARCH OBJECTS NOT



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Chapter 5 SEARCH TECHNIQUES AND OPERATIONS

5.01 Search Patterns and Sweep Widths

General

NOTE: The information pertaining to this chapter is comprehensively covered in the *IAMSAR Manual, Volume II, Chapter 5 – Search Techniques and Operations*. The following is additional information for Canadian implementation.

5.01.1 No single sequence of search types or patterns will be suitable for all searches. Many practical considerations are used in deciding exactly which sub-areas and what coverages to use, such as maintaining safe separations among the search facilities, search facility sensor and navigational capabilities, and choices of search patterns.

5.01.2 In all cases, search planners will be expected to use their judgment and the available units to establish a sensible and attainable search sequence, based on search object or signalling device expected and the environmental conditions encountered.

5.01.3 The following table shows a representative search sequence, in this case where a large area is to be searched and the number of search facilities is limited. Night searches should be considered when terrain is suitable and when there is likelihood that survivors might have night or electronic signalling capability.

Search	Type	Period	Search Object	Preferred Aircraft	Speed (knots)	Spacing	Altitude (metres (feet))
1 and initial	Trackline	Day/ Night	Communication wreckage, electronic beacons	Jet	300/600	50 NM	3 000 to 12 000 (10 000 to 40 000)
2	Electronic	Day/ Night	Electronic beacons	Jet	300/600	50 NM	3 000 to 12 000 (10 000 to 40 000)
3	Visual (Aids)	Night	Fires, flares, torch, etc.	Turbo-prop	150/300	20 NM	450 to 900 (1 500 to 3 000)
4	Visual (Aids)	Day	Mirrors, dye	Prop	130/190	10 NM	450 to 900 (1 500 to 3 000)
5	Visual (Rafts)	Day	Rafts	Prop, helo	100/180	3.1 NM	90 to 450 (300 to 1 500)
6	Visual (Wreckage)	Day	Wreckage	Prop, helo	75/130	0.3 NM	60 to 150 (200 to 500)
* ALL AIRCRAFT TO KEEP RADAR SEARCH *							
NOTE: Initial, electronic and visual (aids) searches could take place simultaneously at night and (aids)/(rafts)/(wreckage) searches could take place during the ensuing daylight hours; six searches being completed by the end of a 24 or 36-hour period.							

Visual Searches

NOTE: The tables necessary for the calculation of sweep widths (W) for visual searches over water are shown at *Appendix E – Sweep Width Computation*. Tables for visual searches over land are available in the *IAMSAR Manual, Volume II, Appendix N, Tables N-9 to N-11*.

Chapter 5 SEARCH TECHNIQUES AND OPERATIONS

5.01 Search Patterns and Sweep Widths

5.01.4 Searches for Visual Detection Aids – If it is initially known that the survivors have visual signalling equipment, the W information from the example in *paragraph 5.01.3* should be used.

5.01.5 Correction Factors – There are many factors which may modify visual sweep widths. While the effects of some of these factors may be variable or indefinite, the search planner must take them into consideration when developing a search plan. These factors (search object, sea/terrain conditions, search craft speed, position of sun, and lookout effectiveness) tend to affect the corresponding probability of detection.

5.01.6 Correction tables account for the effect of weather (f_w), crew fatigue (f_f) and search aircraft speed (f_v). The values from these tables are applied to W_u as follows:

$$W = W_u \times f_w \times f_f \times f_v$$

NOTE:	Refer to *Appendix E.01 – Uncorrected Visual Sweep Width (W_u) Tables*.

.1 **Weather Correction Factor–** It will be noted that in some cases f_w is less than 1 in calm winds; this is due to the detrimental effect glassy water conditions have on sighting small objects. These tables are for daylight use only.

NOTE:	Refer to *Appendix E, table E.02.1* **–** *Weather Correction Factor (f_w).*

.2 **Fatigue Correction Factor –** If the crew on the search facility is likely fatigued, reduce W values by 20%. Crew will be fatigued if they have been involved in a search for an extended period, and they may exhibit signs of fatigue which include missed communications, problems with memory, irritability, and increased time to complete tasks or make decisions.

NOTE:	Refer to *Appendix E, table E.02.2* **–** *Fatigue Correction Factor (f_f).*

.3 **Search Aircraft Speed Correction Factor –** High speed can reduce effectiveness in aircraft, particularly at low altitude, or in any type of search vehicle if turbulence is being encountered.

NOTE:	Refer to *Appendix E, table E.02.3* **–** *Search Aircraft Speed (Velocity) Correction Factor (f_v).*

5.01.7 Horizon Range – A table has been drawn to help the search planner determine the horizon range from different heights of eye.

NOTE:	Refer to *Appendix E.03 – Horizon Range vs. Height of Eye Table*.

Chapter 5 SEARCH TECHNIQUES AND OPERATIONS

5.01 Search Patterns and Sweep Widths

Night Searches

NOTE:	*Appendix E.04 – Uncorrected NVG Sweep Width Tables* shows the available sweep width information for night vision goggles (NVG) searches.

NOTE:	For more information on searches involving NVG and infrared devices, refer to the *IAMSAR Manual, Volume II, section 5.7 – Night Search Patterns.*

Electronic Searches

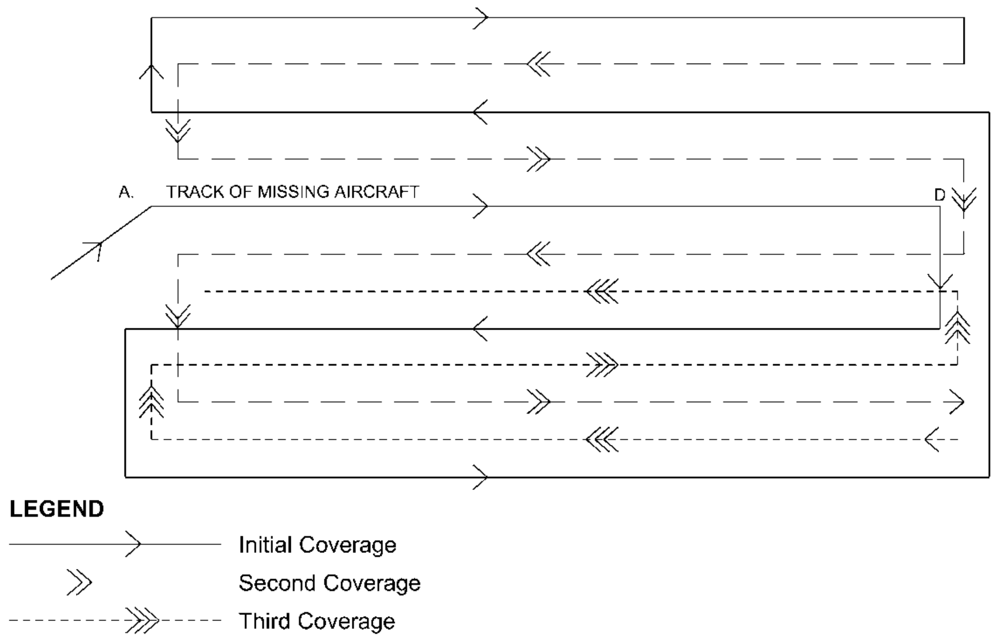
5.01.8 Distress Beacon Searches – The standard visual search patterns are applicable to electronic searches for distress beacons with the following modifications:

.1 effective electronic search can be carried out under all weather conditions at normal cruise speed;

.2 Track Spacing (S) should be 60 nautical miles (NM) at 6000 metres (20,000 feet) and 30 NM at 3000 metres (10,000 feet), with the S reduced by one half over mountainous terrain; and

.3 the beacon's location and orientation on the ground can cause erroneous "on top" indications; caution should be used on all homing with a second procedure carried out if doubt exists.

5.01.9



Normally, a parallel sweep or creeping line should be employed for distress beacon searches. Maximum S should be used for the initial rapid sweep of the area, followed by a further sweep of the area at right angles to the first, followed by a further sweep stepped over one-half the S, as shown in the figure above. In mountainous areas, the search should be arranged to cut the ridge lines at right angles if at all possible.

NOTE: For more information, refer to the *IAMSAR Manual, Volume II, section 5.6 – Electronic Search Patterns*.

5.01.10 The detection range of distress beacons varies and the search planner should attempt to determine the specific range of the equipment in question. The same may be true of the search unit capability. Dedicated search units will normally have published standard operating procedures regarding electronic track spacing and detection ranges to which the search planner may refer.

NOTE: Examples of these are shown in *section 4.04, paragraph 4.4.9 – VHF/UHF Theoretical Reception Ranges*.

5.01.11 SART Searches – Sweep width tables for search and rescue transponder (SART) detection have not been developed. Search planners should however be aware of the following data:

.1 The International Maritime Organization Specification for SART is detection at 5 NM with SART mount 1 metre above sea level. United States Coast Guard trials, when searching with large ships in various sea states were able to detect SARTs mounted at 1 metre above sea level at 6 to 7 NM. The same SART was detected by 360° airborne search radar mounted on a King Air at 18 NM.

.2 Canadian trials have recorded good detection at between 10 and 16 NM with the SART mounted on the bottom of the raft (the 10 NM result was achieved with the Labrador and Hercules, with the better results from the Aurora and Sea King).

.3 The detection range data available to the search planner may be reported as minimum, average or maximum detection ranges. The classification would be based on a series of ranges at which targets have been first detected. When such data is available, the following guidelines are recommended, in order of preference:

.a when minimum detection range is known,
W = 1.7 x the minimum detection range;

.b when average detection range is known,
W = 1.5 x the average detection range;

.c when maximum detection range is known,
W = the maximum detection range;
and

.d when no detection range is known,
W = 0.5 x the horizon range.

Chapter 5 SEARCH TECHNIQUES AND OPERATIONS

5.02 Describing Search Areas

General

5.02.1 When the search area has been determined it will be necessary to define it to search facilities and others who may require the information. The total area will need to be divided in sub-areas for allocation to search facilities. The accurate definition of these areas is of the utmost importance to the search planner; the information will have to be recorded and may be referred to over a long period of time.

NOTE:	Refer to the *IAMSAR Manual, Volume II, section 5.11 – Designation and description of search sub-areas*.

GEOREF Grid

5.02.2 The GEOREF latitude and longitude system of squares is the preferred reference method used on inland searches for missing aircraft in Canada, both for tasking and for reporting, and should be used during the intensive search phase. It is especially suitable for large-scale searches where a wide area can be covered without complication.

5.02.3 The GEOREF system is used with the National Topographical Series, Aeronautical Edition, scale 1:500 000. These maps are printed with each GEOREF grid square (1° of latitude by 1° of longitude) labelled with a two-letter code. Thirty-minute grid lines are also provided, subdividing each 1° x 1° area into four sub-areas. These are identified numerically from 1 to 4, with 1 being the Northwest corner, 2 the Northeast corner, 3 the Southwest corner and 4 the Southeast corner. These 30 minute by 30 minute squares are referred to as "primary squares" and can be further divided into "secondary squares". These secondary squares are labelled alphabetically from A to D in the same fashion as the primary squares. An example of an assigned sub-area might read as Map 42 NW, square CG4A.

NOTE:	Refer to the figure on the next page.

5.02.4 An added advantage of this system is that the GEOREF overlay is printed not only on the 1:500 000 maps but on the 1:1 000 000 as well. Also, the legend on the 1:250 000 maps indicates a GEOREF grid that can be easily extrapolated onto the map.

Other Methods

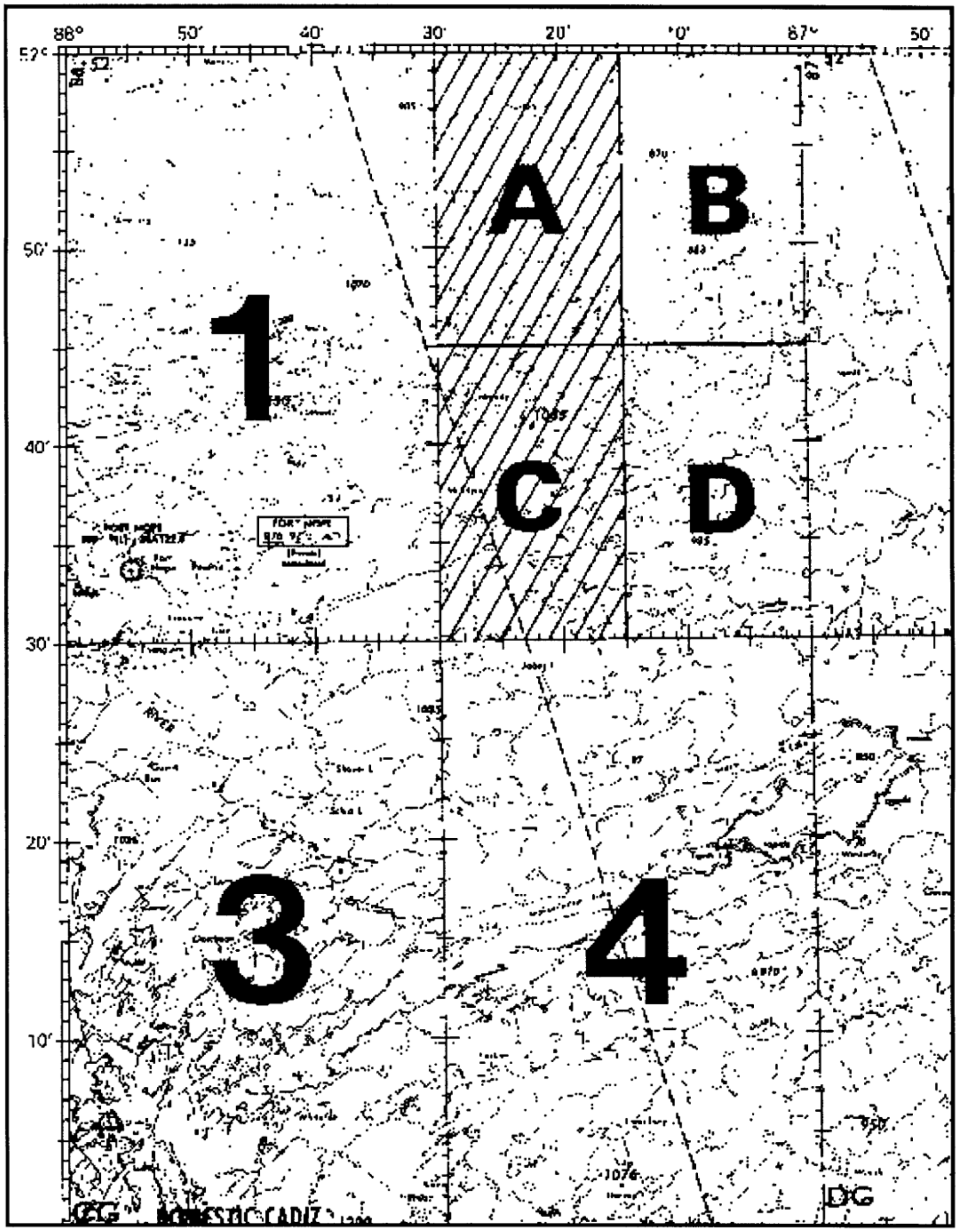
5.02.5 The use of other methods may be more practical during the initial visual detection aids searches, when it is important to follow a priority sequence along the track. It should always be remembered that the method used should be simple, effective and easy to work with, not only for the search and rescue (SAR) mission coordinator, but for the other agencies involved with the operation.

5.02.6 Maritime SAR units simply use latitude and longitude expressed by the convention degrees and decimal degrees.

Chapter 5 SEARCH TECHNIQUES AND OPERATIONS

5.02 Describing Search Areas

GEOREF GRID



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Chapter 6 RESCUE PLANNING AND OPERATIONS

6.01 Assistance to Aircraft

Intercept and Escort of Distressed Aircraft

NOTE:	Refer to *section 7.01 – Intercept and Escort Services*.

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6.01 Assistance to Aircraft

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Chapter 6 RESCUE PLANNING AND OPERATIONS

6.02 Assistance to Vessels

Assistance to Disabled Vessels

NOTE: Refer to *Annex 4 – Excerpts from the Canadian Coast Guard (CCG) Operational Procedures on Assistance to Disabled Vessels*.

Also of interest:

- *CAMSAR I, Annex 4 – Excerpts from the CCG Policy on Assistance to Disabled Vessels;* and
- *CAMSAR III, Annex 1 – Excerpts from the CCG Operational Procedures on Assistance to Disabled Vessels*.

6.02.1 The joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) shall facilitate the provision of assistance to disabled vessels and if necessary, the participation of search and rescue (SAR) units (SRUs) of the Federal Government or its agents. An appropriate case classification shall be assigned to this activity. Available SRUs may, however, not be capable for such operations, so the JRCC/MRSC must consider their capabilities, the risks involved and the type of disabled vessel, with the tasking.

NOTE: No waiting period should delay the tasking of any mobile facility to any situation where there is an uncertainty as to the safety of persons at sea.

6.02.2 In response to disabled vessels in non-distress or non-potential distress situations, tasking for the provision of technical assistance by CCG SRUs remains a high priority for safety reasons, but may be considered a secondary priority to other CCG taskings (i.e., fisheries enforcement, pollution clean up, etc.). In consultation with the Commanding Officer and appropriate CCG regional operations centre (ROC), departure for the tasking may be reasonably delayed until such time that the SRU has completed the critical mission, or another SRU may be tasked as dictated by the circumstances of the incident. This same principle applies to other SRUs of the Federal Government or its agents.

6.02.3 SRUs of the Federal Government or its agents will not assist disabled vessels merely on request and will not compete with commercial or private interests to provide assistance. If a disabled vessel requesting assistance refuses commercial or private assistance when available, this shall be considered a cancellation of the initial request for assistance and the master of the disabled vessel is to be notified accordingly.

6.02.4 SRUs of the Federal Government or its agents will not be tasked nor provide a tow to disabled vessels for the sole purpose of getting from one place of refuge to another.

6.02.5 If a disabled vessel refuses to evacuate when the Commanding Officer of the mobile facility responding requires the personnel to evacuate, this shall be considered a cancellation of the initial request for assistance and the master of the disabled vessel is to be notified accordingly.

Chapter 6 RESCUE PLANNING AND OPERATIONS

6.02 Assistance to Vessels

6.02.6 To prevent more serious safety risks from developing, SRUs of the Federal Government or its agents may be tasked to provide assistance to vessels aground with people onboard only when such operations incur no further endangerment to lives or property and commercial assistance is not available or cannot be on scene in sufficient time.

6.02.7 **Salvage –** JRCC/MRSC SMCs shall not task SRUs of the Federal Government or its agents to engage in salvage operations for vessels with no persons on board, including Unmanned Air Vehicles and/or Unmanned Surface Vehicles. Requests for this type of assistance shall be forwarded to the appropriate CCG ROC.

NOTE:	Refer to *section 7.04 – Protection of Property*;

Assistance to Disoriented Vessels

6.02.8 When the JRCC/MRSC maritime SAR coordinator is advised of a disoriented vessel, he/she shall evaluate the degree of emergency and take such action, as deemed appropriate under the circumstances, such as:

.1 attempt to locate the disorientated vessel by using any available communication network or information source, such as Marine Communications and Traffic Services centres; and

.2 task available SRUs to locate the disoriented vessel and either escort the vessel to safety or provide guidance so that it can proceed safely.

Chapter 6 RESCUE PLANNING AND OPERATIONS

6.03 Underwater SAR

NOTE:	Refer to the *IAMSAR Manual, Volume II, section 6.14 – Underwater Search and Rescue*.

General

6.03.1 Suspension or continuation of a search may depend on underwater detection and recovery measures to locate a missing aircraft or vessel, to establish the fate of its occupants. However, if identification of floating wreckage or an accumulation of evidence, clearly establishing the fate of the aircraft or vessel and its occupants, is possible without recourse to underwater search, then there is no responsibility for the search and rescue (SAR) system to coordinate or participate in underwater detection or recovery action.

6.03.2 Assistance may be rendered when requested by a competent provincial or federal authority; however, nothing in this manual should be construed as committing the SAR system to undertake or to continue underwater search when such action is considered by the SAR Region (SRR) Commander to be impractical.

Diving Operations

6.03.3 When required, the SAR Mission Coordinator (SMC)/Searchmaster (SM) may coordinate diving operations using units of the Canadian Armed Forces, Canadian Coast Guard (CCG), Royal Canadian Mounted Police, or of any provincial or federal agency that is prepared to assist and can provide suitable equipment and qualified personnel.

6.03.4 The CAF and the CCG have specific diving procedures:

.1 the CAF SAR Technician diving procedures are contained in the B-GG-380 *Canadian Forces Diving Manual, Guidelines for Survivor Extraction from Overturned Vessels,* B-GA-002-146/FP-001 Standard Manoeuvre Manual (SMM) CH146, the SMM 60-149 *and in 1 Canadian Air Division Orders FOM.*

.2 CCG diving procedures are contained in the *Fleet Safety and Security Manual*.

6.03.5 Should the use of CAF units and capability be required, direct communications should be effected with the Joint Task Force (Atlantic) (JTF[A]) or the Joint Task Force (Pacific) (JTF[P]) Headquarters, as appropriate. Commercial facilities may be engaged on authority of the SRR Commander if suitable government facilities are not available and underwater investigation is deemed necessary to the expeditious conduct of the search.

6.03.6 The decision to continue an underwater search will be as a result of consultation between the SMC/SM, the joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) and the appropriate diving advisor/supervisor.

Chapter 6 RESCUE PLANNING AND OPERATIONS

6.03 Underwater SAR

6.03.7 Despite the above considerations, it is provincial authorities that have jurisdiction in the matter of drowned persons. Therefore, any participation in recovery must be with the cognizance and consent of the provincial authorities concerned.

Submarine SAR (SUBSAR)

6.03.8 Military Submarines – The overall responsibility for SAR in the event of a lost Canadian submarine remains with the SRR Commander. The formulation of plans for a missing or sunk military submarine (SUBMISS/SUBSUNK) is the function of the Commander (Comd), JTF(A), or JTF(P). The control of SAR operations in a missing or sunk military submarine (SUBMISS/SUBSUNK) operation is the function of the Maritime Component Commander. In the event of a lost United States (US) Navy submarine, the responsibility for overall coordination of SAR activities rests with the US Navy submarine operating authority.

6.03.9 Detailed instructions covering submarine disaster SAR operations are contained in the North Atlantic Treaty Organization publication ATP-57, CJOC Expeditionary SUBSAR CONPLAN and operational orders issued by the Comd JTF(A) and Comd JTF(P).

6.03.10 Civilian Submersibles – A rescue operation where the vehicle in distress is a submersible will require specialized equipment and personnel who are familiar with the lay out and operation of submersibles and rescue equipment. The role of the SAR organization will be to assist the rescue efforts to save the lives of persons involved. The JRCC/MRSC shall coordinate such action.

6.03.11 Each JRCC/MRSC shall maintain a contact list, which will enable appropriate response to be carried out immediately upon receiving information of a submersible in distress.

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6.04 Rescue/Crash Sites

Restricting Airspace Access

6.04.1 In the event that press or private aircraft are interfering with rescue operations or jeopardizing flight safety, the rescue airspace can be immediately restricted to search and rescue (SAR) operations by advising the Transport Canada (TC) Civil Aviation Contingency Operations Division at the following 24/7 emergency number:

1-877-992-6853 (toll free)

Securing a Crash Site

6.04.2 When the subject of an aeronautical search has been found, the SAR Mission Coordinator (SMC) shall inform the appropriate Transport Safety Board (TSB) regional office and confirm the requirements for preserving the wreckage pending the arrival of the accident investigation team.

6.04.3 The SMC shall ensure that, when necessary, the integrity of the crash site is maintained until civil authorities arrive. This is done to preserve the wreckage or any marks made by the aircraft in landing. The aircraft wreckage should not be disturbed except to assist in the recovery of survivors.

Transporting the Bodies/Coroner/TSB Representatives

6.04.4 During a SAR operation, authority to transport the coroner, the coroner's representatives, or local authorities to a crash site is vested in the SMC.

NOTE: Hoisting of the coroner, the coroner's representatives, local authorities, or representatives of the TSB is NOT authorized.

6.04.5 Bodies can be removed once approved by the coroner.

Marking the Wreckage

6.04.6 The Canadian Armed Forces will be responsible for the marking of the wreckage of military aircraft that have not been removed from a crash site.

6.04.7 TC will be responsible for marking the wreckage of civilian aircraft.

Chapter 6 RESCUE PLANNING AND OPERATIONS

6.04 Rescue/Crash Sites

6.04.8 Military aircraft wreckage will be marked by metal plaques manufactured locally by the SAR squadrons. The plaques are to be screwed or bolted firmly to the wreckage or a nearby tree, and will bear the words:

THIS CRASH HAS BEEN REPORTED
CET ÉCRASEMENT A ÉTÉ SIGNALÉ

6.04.9 If the wreckage was not marked during either the SAR operations or the investigation phase, the plaques may be placed during ground party or SAR Technicians jump-training exercises. Priority should be given to marking wreckage likely to be encountered by hunters or prospectors.

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Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.01 Intercept and Escort Services

NOTE:	Intercept and escort procedures for both aircraft and vessels are explained in the *IAMSAR Manual, Volume II, section 7.2 – Intercept and Escort Services* and *Appendix J – Intercepts*.

Intercept and Escort of Distressed Aircraft

7.01.1 Intercept and escort services will be provided for aircraft in distress, as required, in areas of Canadian search and rescue (SAR) responsibility. If primary SAR aircraft are unable to provide this service owing to unavailability or limitations in operational capability—lack of necessary range or speed—the SAR Region Commander is empowered to direct any Canadian Armed Forces aircraft operating within his area to perform the task, providing it possesses the necessary capability.

7.01.2 When an aircraft is required to provide intercept and escort service, the captain will be provided with as much of the following information as possible:

.1 the distressed aircraft’s identification;

.2 its last known position (LKP), with amplification as to the type of navigation aids used, i.e. GPS, VOR,TACAN, Celestial, Inertial, or estimated;

.3 the time of the LKP;

.4 the aircraft’s altitude and whether or not it is descending or climbing;

.5 its true course;

.6 its ground speed;

.7 its true air speed; and

.8 a brief description of the emergency.

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7.01 Intercept and Escort Services

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Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.02 Nuclear Emergencies

7.02.1 Joint rescue coordination centres will action nuclear emergency responses in accordance with the instructions contained in *the Federal Nuclear Emergency Response Plan.*

7.02.2 Nuclear emergencies may range from incidents involving military nuclear weapons or civilian reactors to incidents involving civilian aircraft or vessels carrying industrial or medical isotopes.

Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.02 Nuclear Emergencies

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Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.03 Piracy

Aircraft

7.03.1 When a joint rescue coordination centre (JRCC) is advised by any source of an actual or suspected hijacking, they shall immediately notify Canadian Joint Operations Command and the 1 Canadian Air Division Combined Air Operations Centre (CAOC), Air Traffic Control, the other JRCCs, and the Royal Canadian Mounted Police, as appropriate. The JRCC within whose boundaries the incident exists shall declare an alert phase. The JRCC shall maintain communications with the alerting agency and AOC and provide the latter with expert advice and recommendations pertaining to the search and rescue (SAR) response.

Vessels

7.03.2 When a JRCC/maritime rescue sub-centre (MRSC) is notified by any source of an actual or suspected act of piracy; they shall immediately notify the Regional Supervisor, Maritime SAR; the Director, Incident Management (or designate) and the Maritime Security Operations Centre. The JRCC/MRSC within whose boundaries the incident exists shall declare an alert phase.

Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.03 Piracy

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Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.04 Protection of Property

Salvage

7.04.1 Salvage assistance is the provision of aid for the protection or saving of property such as dewatering, provision of critical supplies, refloating of vessels and the recovery of aircraft, to name a few examples.

NOTE:	For the assistance to vessels other than salvage, refer to *section 6.02 – Assistance to Vessels*.

7.04.2 Canadian Armed Forces (CAF) and Canadian Coast Guard (CCG) search and rescue (SAR) units (SRUs) shall not undertake salvage unless it is instrumental to the saving of life or it will avoid undue physical hardship, or it will alleviate an imminent risk of pollution.

7.04.3 However, in support of the national SAR objective, CAF and CCG SRUs may, in exceptional circumstances, be tasked to provide salvage assistance to civilian aircraft or vessels, providing no commercial means are available and appropriate approval has been obtained by the requesting persons or agencies.

NOTE:	Salvage operations will NOT be performed if they jeopardize operations, disrupt training, or unduly hazard SAR personnel or equipment.

NOTE:	Refer to *Annex 4 – Excerpts from the CCG Operational Procedures on Assistance to Disabled Vessels*; and to *section 1.01, paragraphs 1.01.3 to 1.01.5 – Tasking of SRUs*.

Use of Aeronautical SRUs

7.04.4 When a request is made to use aeronautical SRUs for the salvage of civilian aircraft, full details of the commitment shall be obtained and its feasibility assessed by the 1 Canadian Air Division, in conjunction with the applicable joint rescue coordination centre (JRCC).

Use of Maritime SRUs

7.04.5 When a request is made to use maritime SRUs for the salvage of maritime property, full details of the commitment shall be obtained and its feasibility assessed by the applicable CCG Regional Operations Centre. The Regional Supervisor, Maritime SAR, of the appropriate JRCC or maritime rescue sub-centre must approve any such tasking of primary maritime SRUs.

Chapter 7 EMERGENCY ASSISTANCE OTHER THAN SAR

7.04 Protection of Property

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Chapter 8 CONCLUSION OF SAR OPERATIONS

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Chapter 8 CONCLUSION OF SAR OPERATIONS

8.01 Reduction of Search Operations

Search for Survivors

8.01.1 The Canadian search and rescue (SAR) System is responsible to search for survivors of SAR incidents. Not locating a survivor at the scene when an aircraft or vessel is found does not alter this obligation. A search will continue until the SAR Mission Coordinator (SMC) determines that there is no longer a reasonable expectation of survivability, that every reasonable effort has been expended and that all leads have been exhausted.

Successful Searches

8.01.2 When search efforts indicate that danger no longer exists, e.g., the communication search was successful and no problem exists, or the object and/or the survivors have been located and rescued, and all SAR facilities are accounted for, the joint rescue coordination centre (JRCC)/maritime rescue sub-centre shall close the incident and immediately inform the operating agency and any centre, service or facility that has been alerted or activated.

Unsuccessful Searches

8.01.3 When it has been determined that further search would be to no avail because the area has been adequately searched and all probability areas investigated, or because there is no longer any probability of survival, or for other pertinent reasons, a search reduction should be recommended. Next-of-kin (NOK) should be made aware that search reduction is being sought. The authority to reduce unsuccessful searches is the SAR Region (SRR) Commander.

NOTE:	In the case of maritime incidents, such recommendation shall be made under the advice of the Regional Supervisor, Maritime SAR.

NOTE:	Requests for a major maritime search reduction shall be evaluated in consultation with Canadian Coast Guard (CCG) Headquarters (HQ) SAR staff.

8.01.4 Approval for the reduction of any SAR operation should be obtained by submitting a *Request for Search Reduction* message at least one working day prior to the proposed reduction, to ensure adequate time for the SRR Commander to action the request. The message must summarize search activities, outline the reasons for recommending search reduction, and resolve any apparent anomalies. The SRR Commander must also be advised of any factor which might provoke controversy. The reduction request should be based on the completion of a specified search plan as detailed in the message.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.01 Reduction of Search Operations

NOTE:	Refer to *Appendix B.06 – Request for Search Reduction* for the format, priority and classification of the message.

8.01.5 SMCs shall ensure that situation reports are completed in sufficient detail to substantiate the reduction request. A delay in reduction after all reasonable steps have been taken would likely result in a needless waste of SAR resources. It is therefore important that the SRR Commander and CCG HQ staff officers have full and accurate supporting data when presented with the search reduction request.

8.01.6 Authorization for reduction shall not prevent the SMC from prolonging the search, should a change in circumstances so demand. In this case, the SRR Commander shall be advised as soon as it is practicable. For cases involving maritime units, the Director Operational Support, CCG HQ, shall also be advised if the National Incident Notification Procedure (NINP) has not been initiated.

8.01.7 **Minor SAR Operations –** The reduction of SAR operations that involve missing people shall be conducted under the authority of the SRR Comd prior to transferring responsibility to civilian authorities.

Transferring Responsibility to Civilian Authorities

8.01.8 In order to conclude a search reduction, responsibility of the case must be accepted by the appropriate civilian authorities. Details of the transfer must be properly documented in accordance with established procedures.

NOTE:	Refer to *section 2.04, paragraph 2.04.17 – Transferring control of an incident*.

Notification of NOK

8.01.9 When approval of a search reduction has been obtained, the NOK, if known, shall be advised immediately and the circumstances explained fully. This shall include a frank explanation that the SMC is convinced that there is no longer any hope of finding survivors in the search area, that every reasonable effort has been expended and that all leads have been exhausted.

8.01.10 The NOK shall be informed that although the incident will remain open, further search activity is not planned unless new evidence indicates a strong likelihood of locating survivors. The SMC shall state that aircraft/vessels in the area will be asked to keep a lookout, but that, while it may be possible to hold a SAR exercise in the search area at some future date, there will be no further formal search activity.

8.01.11 In particular, NOK shall not be left with any perception that search activity might resume because of climate changes such as melting snow, changes in foliage or changes in sea-ice conditions.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.01 Reduction of Search Operations

Informing the Public

8.01.12 After notification of NOK, the following information may be passed to news media and as required, members of the public:

.1 the full scale search for the (type of aircraft/vessel) missing in (area) since (date) has been reduced;

.2 a total of (number) government and civilian aircraft/vessels have flown/steamed (number) hours and covered (number) square kilometres;

.3 the aircraft/vessel was owned by (name) and was (describe mission) at the time of its loss. Aboard were (names and hometowns of persons on board);

.4 the aircraft/vessel was/was not equipped with an electronic locating device and survival gear (if applicable); and

.5 further search activity is not planned unless new evidence indicates a strong likelihood of locating survivors.

NOTE: Also refer to *section 1.06 – Public Relations*.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.01 Reduction of Search Operations

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Chapter 8 CONCLUSION OF SAR OPERATIONS

8.02 Reopening of Searches

New Evidence

8.02.1 Searches may be reopened on the authority of the Search and Rescue Region Commander when new evidence indicates a strong likelihood of locating survivors. Changes in climate conditions, which might make wreckage more visible at a later date, would not constitute grounds for reopening a general search since, if there was any hope of discovering survivors, the search would not have been reduced.

Other Situations

8.02.2 Requests for reopening searches which do not meet the criteria of the previous paragraph are to be referred to the Commander, Canadian Joint Operations Command.

SITREPs

8.02.3 When searches are reopened, normal daily situation reports (SITREPs) shall recommence.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.02 Reopening of Searches

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Chapter 8 CONCLUSION OF SAR OPERATIONS

8.03 Classification of SAR Cases

General

8.03.1 Records of search and rescue (SAR) incidents are an important instrument in the management of the Canadian SAR system. All joint rescue coordination centres and maritime rescue sub-centres shall use the same guidelines for reporting SAR incidents and classifying SAR cases.

NOTE:	Classification of SAR cases is based on a post-case dispassionate assessment of what actually occurred, not on the perceived level of distress during the case.

Definitions

NOTE:	The following definitions are for Canadian use and may differ from those of the *IAMSAR Manual* for their corresponding terms.

8.03.2 **SAR Incident** – A reported situation which has the potential to require a response from the SAR System. There are four types of SAR incidents:

.1 **Aeronautical –** A SAR incident involving an aircraft.

.2 **Maritime –** A SAR incident on the water involving a vessel or person(s) from a vessel, including the medical evacuation (MEDEVAC) of person(s) from a vessel.

.3 **Humanitarian –** A SAR incident not otherwise classified as an aeronautical or maritime incident.

.4 **Unknown –** A SAR incident of unknown origin, its source remaining untraced at the conclusion of the incident.

8.03.3 **SAR Case** – A SAR incident becomes a SAR case when the SAR system responds, would have responded had it been alerted at the time of the incident or when a documentary file is opened whether or not SAR services are dispatched.

8.03.4 **SAR System** – The coordinated SAR system is the combined facilities, equipment and procedures established in each SAR Region to provide the response to SAR incidents.

8.03.5 **SAR Response** - A SAR response is defined as the actions required from the SAR system to resolve a situation. These may include:

.1 tasking SAR services. SAR services typically result from notification to the SAR system of a potential or actual distress situation;

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.03 Classification of SAR Cases

.2 issuing an "All Stations" broadcast (e.g., distress, urgency, missing aircraft notice, maritime assistance request, etc.);

.3 monitoring, when situation dictates, for one half hour of working time;

.4 investigating, for one half hour working time, to determine if a SAR incident is occurring;

.5 investigating an official aeronautical or maritime distress alert, as defined under regulations, regardless of the amount of working time; and

.6 performing other actions as defined in this manual.

SAR Case Identification

8.03.6 For the purpose of reporting and statistical data, SAR cases are to be assigned a SAR case number and a name. The SAR case name should refer to the "what and where", not the "who". Personal names are not to be used.

8.03.7 As per CAMSAR Vol. II 3.02.3.11 and 3.03.2.2, the case name may include the aircraft registration or vessel name.

SAR Case Categories

8.03.8 SAR cases are classified in accordance with the categories described next.

NOTE:	Cases involving divers or swimmers are classified as humanitarian, as the case category is not determined by the vehicle or platform from which they entered the water; that information will however be recorded in the case file.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.03 Classification of SAR Cases

.1	**AERONAUTICAL**
Category	Definition
A1	**Distress –** A person or persons (in relation to an aircraft) are threatened by grave and imminent danger and require immediate assistance.
A1P	**Distress Reported After the Fact –** An A1 case that has been resolved but would have required a response had the SAR system been alerted at the time of the case.
A2	**Potential Distress –** The potential exists for an A1 case if timely action is not taken; i.e., an immediate response is required to stabilize an aeronautical situation in order to prevent distress.
A3	An aeronautical situation other than an A1 or A2 case, where assistance is rendered to prevent case degradation to greater potential danger.
A4	A known aeronautical related false alarm or hoax.
A5	An aeronautical case that is subsequently determined to be outside of the Canadian AOR and successfully transferred to a responsible agency; there has been no involvement by Canadian SAR units (SRUs) and information on the SAR operation may be limited.

.2	**MARITIME**
Category	Definition
M1	**Distress –** A person or persons from a vessel are threatened by grave and imminent danger and require immediate assistance.
M1P	**Distress Reported After the Fact –** An M1 case that has been resolved but would have required a response had the SAR system been alerted at the time of the case.
M2	**Potential Distress –** The potential exists for an M1 case if timely action is not taken; i.e., immediate response is required to stabilize a situation in order to prevent distress.
M3	A maritime situation other than an M1 or M2 case, where assistance is rendered to prevent case degradation to greater potential danger.
M4	A known maritime related false alarm or hoax.
M5	A maritime case that is subsequently determined to be outside of the Canadian AOR and successfully transferred to a responsible agency; there has been no involvement by Canadian SRUs and information on the SAR operation may be limited.
NOTE:	Maritime MEDEVACS should normally be classified in category 1 or 2.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.03 Classification of SAR Cases

.3	**HUMANITARIAN**
Category	Definition
H1	**Distress –** A person or persons are threatened by grave or imminent danger (not maritime or aeronautical related) and require immediate assistance.
H2	**Potential Distress –** The potential exists for an H1 case if timely action is not taken; i.e., immediate response is required to stabilize a situation in order to prevent distress.
H3	A humanitarian situation other than an H1 or H2 case, where assistance is rendered to prevent case degradation to greater potential danger.
H4	A known humanitarian related false alarm or hoax.
H5	A humanitarian case that is subsequently determined to be outside of the Canadian AOR and successfully transferred to a responsible agency; there has been no involvement by Canadian SRUs and information on the SAR operation may be limited.
NOTE:	Normally, a case number will only by assigned to a humanitarian case when the Federal SAR system is used.

.4	**UNKNOWN**
Category	Definition
U	A case of unknown origin, such as: • A distress beacon false alert, the signal being interrupted before it could be located. • An alert for a visual distress signal whose origin remains unknown after a search or investigation.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.04 Reports and Returns

General

8.04.1 Accurate reports and returns are essential for the effective control of search and rescue (SAR) aircraft, vessels, and personnel. They are also needed for the compilation of data and statistics required to indicate or support organizational changes and equipment requirements, and to facilitate planning. Analysis of actions conducted during SAR operations provides the basis to change regulations, policy, standards, guidelines and international practices.

NOTE:	The joint rescue coordination centre (JRCC)/maritime rescue sub-centre (MRSC) SAR *Reports and Returns* formats have been grouped together at the end of this volume, in *Appendix B*.

SAR Operation Reports

8.04.2 SAR operation reports are compiled for the purpose of improving the SAR System and safety procedures. They are required for Major SAR Operations, or as directed by higher headquarters through the SAR Region (SRR) Commander, in order to make recommendations or comments on the command, control, and/or coordination aspects of the incident.

8.04.3 SAR operation reports shall contain the pertinent details of an incident for the information of participating SAR agencies, other agencies, the owners and/or operating agencies of the aircraft or vessel. It is necessary to detail sufficient information to allow others to infer the rationale for the more important decisions and actions taken during the search. This information should include weather and SAR facilities considerations, the impact of sighting reports, the effectiveness of search facilities and patterns, and any other factors that aided or interfered with the progress of the search. Recommendations that are supported by fact and offer insight into ways of avoiding similar accidents or improving the SAR response to these accidents are useful to SAR and safety officials and should be included.

NOTE:	For the format and distribution, refer to *Appendix B.07 – SAR Operation Report*.

8.04.4 The JRCC/MRSC or SAR Mission Coordinator (SMC) shall produce the *SAR Operation Report* as soon as possible after completion of the incident (normally within 30 days). For maritime incidents, the Officer in Charge (OIC) of the JRCC and the Regional Supervisor, Maritime SAR, shall co-sign the report. SAR operation reports from MRSCs or deployed SMCs shall be forwarded to the OIC of the parent JRCC for approval and onward transmission.

8.04.5 The SRR Commander, or a delegated senior officer, shall review the report and indicate on the report those items which will be actioned by the SRR Commander and those on which other comment or action is desired.

Chapter 8 CONCLUSION OF SAR OPERATIONS

8.04 Reports and Returns

Unnecessary SAR Alerts/Hoaxes Reports

8.04.6 Unnecessary SAR alerts (UNSAR) and hoaxes are serious drains on SAR resources. UNSAR's can be intentional or unintentional; the circumstances will be recorded and as appropriate, reported to the appropriate authorities for follow-up action. Maintaining a record of these alerts will aid in proposed changes to regulations and SAR responses in the future. Those found to be malicious will also be referred to local authorities.

8.04.7 **UNSAR Message –** An *UNSAR message* is to be sent by the OIC JRCC when the SAR system is unnecessarily activated in a maritime or aeronautical case. Only UNSAR's where the type and identity of the search object is known require an UNSAR message. Examples would be unauthorized diversions from or failing to file or close flight/float plans, or the inadvertent or illegal use of distress beacons.

NOTE:	The UNSAR message format is shown at *Appendix B.04 – UNSAR Message*.

Appendices

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Appendix A Broadcast Messages

NOTE:	*SAR tasking and briefing forms* may be obtained from the SAR Mission Management System (SMMS) and are also available in *CAMSAR III, Appendices*.

A.01 INITIAL MISSING AIRCRAFT NOTICE (MANOT)

Distribution List

TO: CMCC; All FSSs and ACCs as appropriate.

INFO: CJOC// CFICC/CJOC SAR; 1 Cdn Air Div//SSO SAR; All JRCCs and MRSCs as appropriate; CFIOG HQ *(if aircraft as HF)*; TC Aviation//AAB/AANDO; TSB Ottawa//DIA; any other, as appropriate.

Required Information

NAME OF SAR OPERATION

A. MANOT NUMBER__________ – SAR OPERATION________________________ – INITIAL –
(aircraft registration)
JRCC ______________________

B. Registration – Type of aircraft – Colour ____

C. Number of crew and passengers ____

D. Route ____

E. Departure (local time) ____

F. Last known position and date (local time) _______________________________________

G. Fuel exhaust time ____

H. Type and frequency of emergency locator transmitter ____________________________

I. REQUEST FSS AT ___
AND ATC AT _______
REVIEW VOICE AND RADAR TAPES IN ____
____AREA
FOR PERIOD___________________________UTC TO___________________________UTC.

Appendix A Broadcast Messages

A.02	FINAL MANOT

Distribution List

TO: CMCC; All FSSs and ACCs as appropriate.

INFO: CJOC// CFICC/CJOC SAR; 1 Cdn Air Div//SSO SAR; All JRCCs and MRSCs as appropriate; CFIOG HQ *(if aircraft as HF)*; TC Aviation//AAB/AANDO; TSB Ottawa//DIA; any other, as appropriate.

Required Information

NAME OF SAR OPERATION

A. MANOT NUMBER__________– SAR OPERATION________________________– FINAL –
(aircraft registration)
JRCC ______________________

B. SEARCH SUSPENDED AS OF___________________(local time)
(date/time)

C. Success of mission ____

____

____

D. Remarks ____

____

____

____

____

If located, indicate method and by whom and give other pertinent info that may be of general interest.

If not located, recommend continued watch by overflights, and include route and description of missing aircraft.

Appendix A Broadcast Messages

A.03	MARITIME SAFETY INFORMATION (MSI) BROADCAST

Distribution List

TO: All MCTS centres, as appropriate ____________________

____

____

Required Information

Date/Time____________________UTC

SAR ____________________
(name and case number)

Message: ____________
(number)

The following SAR message is to be issued upon receipt and repeated, in accordance with MCTS standard procedures, until cancelled.

INSTRUCTIONS: *(consult MCTS Officer to ensure most effective broadcast)*

Mode(s): *(circle)*

VHF-DSC	HF-DSC	MF-DSC	NAVTEX
VHF-RT	HF-RT	MF-RT	SafetyNET
VHF-CMB			

Priority and Prefix: *(circle)*

Distress "Mayday Relay"

Urgency "PanPan"

Safety "Sécurité"

Routine

(continued on next page)

Appendix A Broadcast Messages

MSI BROADCAST (continued from previous page)

DSC Parameters (if required): *(circle)*

No Geographical Area Defined

Rectangle Geographical Area ______________________________

____

NW Corner Point *(lat/long)* ______________________________

Side Length__________________degrees

Top Length__________________degrees

SafetyNET Parameters (if required): *(circle)*

The broadcast shall be sent via all Inmarsat satellites appropriate for the area.

Circular Geographical Area _____

Centre *(lat/long)* ______________________________

Radius__________________nautical miles

Rectangular Geographical Area ______________________________

____

SW Corner Point *(lat/long)* ______________________________

Side Length__________________degrees

Top Length__________________degrees

TEXT ______________________________

____

____

____

____

____

____

Contact the nearest MCTS Centre or JRCC/MRSC _

____

at *(coordinates)* ______________________________

____

Appendix A Broadcast Messages

A.04 MSI BROADCAST CANCELLATION

Distribution List

TO: All MCTS centres, as appropriate ______________________________

____

Required Information

Date/Time____________________UTC

SAR ______________________________
(name and case number)

Message: __________
(number)

The MSI broadcast message issued at date/time______________UTC is to be cancelled.

REASON FOR CANCELLATION:

____

____

____

____

____

____

____

____

Appendix A Broadcast Messages

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Appendix B Reports and Returns

B.01	INITIAL JRCC SAR SITREP

Distribution List

TO: Canadian Joint Operations Command//CFICC/CJOC SAR; 1 Cdn Air Div; CCG HQ; CMCC; TC Operations Centre; TSB Ottawa.

INFO: All JRCCs and MRSCs; appropriate CAF Regional JTF; CAF Public Affairs; CCG ROC of applicable Region; NSS; others, as appropriate.

Required Information

NAME OF SAR OPERATION

A. Number and type of SITREP

B. Alerting agency or individual and date/time group in UTC (local time group in brackets) when the JRCC was alerted

C. Type of distress and reason for declaring distress

D. Flight Plan or Float Plan of craft in distress. Include following information:
- Call sign and type of aircraft or vessel
- Number of POB
- Owner
- Colour
- Electronic equipment carried
- Distress beacon on board? If yes, indicate type

E. LKP of craft

F. Weather along route including LKP

G. Weather at destination or possible alternates

H. Name of SMC/SM and location of search HQ

J. Remarks to include action since receiving alert (to include tasking times and SRU departure times)

K. Future plans

NOTE: If the requested information is not available at time of origin of the initial SITREP, it is to be forwarded at the earliest possible date and indicated as an addendum to the initial SITREP.

Appendix B Reports and Returns

B.02	DAILY JRCC SAR SITREP (SITREP TWO, ETC.)

Distribution List

TO: Canadian Joint Operations Command//CFICC/CJOC SAR; 1 Cdn Air Div; CCG HQ; CMCC; TC Operations Centre; TSB Ottawa.

INFO: All JRCCs and MRSCs; appropriate CAF Regional JTF; CAF Public Affairs; CCG ROC of applicable Region; NSS; others, as appropriate.

Required Information

NAME OF SAR OPERATION

A. Progress SITREP numbered consecutively starting with TWO

B. Period covered

C. Record for this period of: Squadrons and SRU employed on search, with times for each SRU broken down into search, transit, and total hours

D. Complete search, transit, and total times this period and totals to date

E. Total square miles this period; total square miles to date

F. Search areas covered this period; type of search, effectiveness

G. Weather conditions at search areas and bases

H. Details of search not indicated above to include major instances and possible leads

J. Proposed operations for the next 24 hours

Appendix B Reports and Returns

B.03	FINAL JRCC SAR SITREP

Distribution List

TO: Canadian Joint Operations Command//CFICC/CJOC SAR; 1 Cdn Air Div; CCG HQ; CMCC; TC Operations Centre; TSB Ottawa.

INFO: All JRCCs and MRSCs; appropriate CAF Regional JTF; CAF Public Affairs; CCG ROC of applicable Region; NSS; others, as appropriate.

Required Information

NAME OF SAR OPERATION

A. SITREP____________AND FINAL
(number)

B. Authority for termination/reduction (may be the SRR commander or NDHQ message with date/time group)

C. General areas covered during entire search indicating specific altitude and visibility distances

D. Record for the entire search of Squadrons and SRUs employed on search, with times for each SRU broken down into search, transit, and total hours

E. REMARKS: Including type of SAR Operation Report to be filed, crash/wreck location, and briefly covering the “who, what, when, where and how”

Appendix B Reports and Returns

B.04	UNSAR MESSAGE

Distribution List

TO: *(for aeronautical cases only)* Transport Canada//AAB/AANDO//

TO: *(for maritime cases only)* Transport Canada Ottawa//AARBI/AARQ// and the appropriate Regional Director Marine Safety as follows:

- Atlantic Region – Dartmouth *(or)*
- Quebec Region – Quebec *(or)*
- Ontario Region – Sarnia *(or)*
- Prairies and Northern Region – Ottawa *(or)*
- Pacific Region – Vancouver

INFO: Canadian Joint Operations Command//CFICC/CJOC SAR; CCG HQ *(for maritime cases and aeronautical cases using maritime facilities only)*; CMCC; NSS.

Required Information

UNNECESSARY SAR ALERT NUMBER _____

A. Date/time of incident

B. Type and identity of search object

C. Owner and/or operator.

D. Flight/float plan or location.

E. Communications equipment on board or at destination

F. SAR action required; number of hours flown or steamed

G. Reason for alert (for distress beacon cases, include: type, model, switch position, time since last sortie, and reason for activation)

Appendix B Reports and Returns

B.05 DAILY SAR SUMMARY

Distribution List

TO: AIG 2645

Required Information

DAILY SAR SUMMARY FOR______________________________SRR

FOR PERIOD__________________00:00:00 UTC TO__________________23:59:59 UTC.
(date) *(date)*

A. INCIDENT SUMMARY	DAY	MONTH	YEAR
1. CATEGORY 1	______	______	______
2. CATEGORY 2	______	______	______
3. CATEGORY 3	______	______	______
4. CATEGORY 4	______	______	______
5. CATEGORY 5	______	______	______
6. TOTAL INCIDENTS	______	______	______
7. PREVIOUSLY UNREPORTED	______	______	______

B. INCIDENT TYPE	DAY	MONTH	YEAR
1. AERONAUTICAL	______	______	______
2. MARITIME	______	______	______
3. HUMANITARIAN	______	______	______
4. UNKNOWN	______	______	______
5. OUTSIDE CANADIAN AOR	______	______	______

C. SRU UTILIZATION *[refer to NOTES]*	DAY	MONTH	YEAR
1. CAF	______	______	______
2. CCG	______	______	______
3. OTHER FEDERAL	______	______	______
4. CASARA	______	______	______
5. CCGA	______	______	______
6. CHARTER	______	______	______
7. OTHER	______	______	______

(continued on next page)

Appendix B Reports and Returns

DAILY SAR SUMMARY (continued from previous page)

D. DISTRESS BEACON RELATED INCIDENTS	DAY	MONTH	YEAR
1. CATEGORY 1	______	______	______
2. CATEGORIES 2/3/4	______	______	______
3. UNRESOLVED	______	______	______

E. State cases in progress, providing a brief description of the case, actions taken and SRUs employed.

F. For category 1 and 2 cases: give a short narrative containing the SAR case number, classification, date–time group when the JRCC/MRSC was alerted, and a brief description of actions taken, SRUs employed and case conclusion. Include the location, POBs, survivor condition, which SRU resolved the case, the position of the rescue if different from the case location and on-scene weather. Also include any other incident where CAF SRUs were employed.

G. REMARKS: include late departure reasons, oil rig positions, aircraft that remain off base overnight, and any other terms of interest not associated with a specific case.

NOTES:

1. SRU utilization means the number of times a specific SRU was used for a specific case, i.e.:

- ◇ Three sorties of same SRU on same case counts as one use.
- ◇ Three cases completed during one sortie by one SRU counts as three uses.
- ◇ Three SRUs on one case counts as three uses.
- ◇ CAF SRUs detached with a Search HQ in your Region are to be included.
- ◇ CASARA spotters on one CAF aircraft count as one CASARA use.

2. This is a daily summary of SRUs used. If the sortie of an SRU starts before 2400 UTC and ends thereafter, then the SRU will be included in messages for both days, however, the SRUs times will only be included in the cumulative total of the second day.

Appendix B Reports and Returns

B.06	REQUEST FOR SEARCH REDUCTION

Distribution List

TO: SRR Commander

INFO: Canadian Joint Operations Command//CFICC/CJOC SAR; 1 Cdn Air Div; CCG HQ *(when appropriate)*.

NOTE: Message to be sent PRIORITY and UNCLASS.
Contents of draft message should be discussed with 1 Cdn Air Div A3 SAR prior to release. The message can be classified depending upon the situation.

Appendix B Reports and Returns

Required Information

SAR___________________________________– REDUCTION REQUEST
(name)

A. SEARCH OBJECT (aircraft or vessel – brief description)

B. PERSONS ON BOARD (names of POBs and names and addresses of NOK)

C. DISTRESS BEACON (yes/no and type)

D. ROUTE (intended route or flight/float plan/notification)

E. LAST KNOWN POSITION (as reported)

F. DATE/TIME (of last known position)

G. SEARCH COMMENCED (time JRCC notified)

H. SEARCH HEADQUARTERS (location)

I. SAR MISSION COORDINATOR/SEARCHMASTER (identification)

J. TOTAL MILITARY FLYING HOURS (at time of search reduction request)

K. TOTAL CIVILIAN FLYING HOURS (at time of search reduction request)

L. TOTAL VESSEL STEAMING HOURS (at time of search reduction request)

M. TOTAL SEARCH HOURS (at time of search reduction request)

N. AREA COVERED____________SQUARE MILES (total coverage)
(e.g., a 30 NM by 60 NM area covered three times is 5400 NM^2)

O. Narrative summating search activities, explaining reasons for recommending reduction, resolving any apparent anomalies, and advising of any factors that might provoke controversy.

Appendix B Reports and Returns

B.07 SAR OPERATION REPORT

TITLE ***SAR operation name and case number***

PART I ***SEARCH OBJECT DETAILS*** *(as captured in SMMS)*

PART II ***DETAILS OF SAR OPERATION***

1. JRCC ACTION
   a) Brief narrative of initial actions from log
   b) SAR facilities tasked, response times
   c) SMC/SM appointment, name, location of SAR HQ
   d) Basic assumption regarding search object
2. SEARCH OPERATIONS
   a) Rationale for arriving at particular search plan
   b) Explanation of any departures from a)
   c) Brief outline of each day's search activities including areas covered, SAR facilities used and general weather
   d) If object is found, a complete explanation of how, to include type of SAR facilities, altitude and/or distance, from what position in SAR facility, what was visual reference, was spotter trained, phase of flight, time of day, search conditions, distress beacon details, etc.
   e) If object not found, why (in general terms)
   f) Problem areas, if any
3. RESCUE OPERATIONS
   a) Condition of survivors
   b) SAR facilities used (Rescue Specialists, SAR Techs, etc.)
   c) Evacuation details
   d) Problem areas, if any

NOTE: A copy of the *SAR Mission Report* may suffice here.

(continued on next page)

Appendix B Reports and Returns

SAR OPERATION REPORT (continued from previous page)

PART III CESSATION

1. OBJECT LOCATED
   a) Date/time group ____________________
   b) Location ____________________N____________________W
   c) Number on board ____________________*(from Part I)*
   d) Survivors ____________________
   e) Fatalities ____________________
   f) Missing ____________________
2. SEARCH REDUCED
   a) Authority ____________________*(message date/time group)*
   b) Number on board ____________________*(from Part I)*
   c) Survivors ____________________
   d) Fatalities ____________________
   e) Missing ____________________

PART IV CONCLUSIONS/RECOMMENDATIONS

1. SMC/SM CONCLUSIONS
2. SMC/SM RECOMMENDATIONS (may include recommendations to TC and TSB to help prevent future accidents of this kind)
3. JRCC OIC and RSMS REMARKS
4. AC CCG REMARKS (for maritime cases and aeronautical cases using maritime facilities)
5. SRR COMMANDER REMARKS

ATTACHMENTS

1. Weather reports
2. Sighting reports
3. SAR HQ maps
4. SRU utilization (flying/steaming hours)
5. List of objects recovered
6. Photographs (if applicable)

(continued on next page)

Appendix B Reports and Returns

SAR OPERATION REPORT (continued from previous page)

Distribution List

For *all cases*, copies of the SAR operation report shall be forwarded to:

- ✓ Canadian Joint Operations Command/CJOC SAR, Ottawa
- ✓ 1 Cdn Air Div, SSO SAR, Winnipeg
- ✓ All JRCCs
- ✓ All participating SRUs
- ✓ Transport Canada:

Transport Canada
Transport Canada Building
Place de Ville
Ottawa (Ontario)
K1A 0N8
Attention: AAB

- ✓ NSS:

National Search and Rescue Secretariat
275 Slater Street, 4th Floor
Ottawa (Ontario)
K1A 0K2

- ✓ CCGC:

Canadian Coast Guard College
Search and Rescue Training Section
P.O. Box 4500
Sydney (Nova Scotia)
B1P 6L1

(continued on next page)

Appendix B Reports and Returns

SAR OPERATION REPORT (continued from previous page)

- For *aeronautical cases*, copies of the SAR operation report shall be forwarded to:
  - ✓ TSB:

    Canadian Transportation Accident Investigation and Safety Board
    Director of Air Investigations
    Place du Centre
    200 Promenade du Portage, 4th Floor
    Gatineau (Québec)
    K1A 1K8

  - ✓ Regional Aviation Safety Officer
- For *maritime cases and aeronautical cases using maritime facilities*, copies of the SAR operation report shall be forwarded to:
  - ✓ CCG HQ:

    Director Operational Support
    Canadian Coast Guard
    Centennial Towers
    200 Kent Street, 6N144
    Ottawa (Ontario)
    K1A 0E6

  - ✓ MRSC Quebec and St. John's
  - ✓ Regional Marine Investigation Officer
- If a report is produced about *an incident involving a foreign vessel*, a copy should be forwarded to the Department of Foreign Affairs and International Trade, Legal Advisory Division, for information purposes.
- Further distribution shall be made to other agencies cooperating in the search effort or investigation at the discretion of the appropriate SRR Commander.

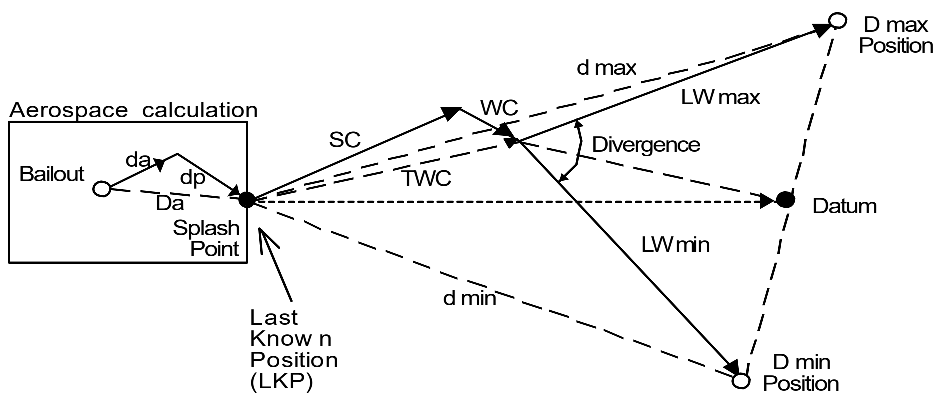
Appendix C Search Planning Worksheets (Minimax)

Case Name: ______________________ **Sheet 1**

SMC: ______________________

Search number: ______________________

DATUM



~~**A. Aeronautical drift (D_a)**~~

	Bailout position	*Minimum*	*Maximum*
1	Time	____________UTC	____________UTC
2	Latitude	____________N	____________N
3	Longitude	____________W	____________W
4	Total aerospace vector	____________°T	____________°T
		____________NM	____________NM

B. Position where surface drift will start

Choose one of:

- ☐ Last known position (LKP) or estimated incident position (EIP);
- ☐ d_{min} and d_{max} positions; or
- ☐ Previous datum (non-minimax).

		Minimum	*Maximum*
1	Latitude	____________N	____________N
2	Longitude	____________W	____________W
3	Time	____________UTC	____________UTC

C. Datum time

1	Commence search time or mid search time		____________UTC	____________UTC
2	Drift interval	*(C1 – B3)*	____________h	____________h

Appendix C Search Planning Worksheets (Minimax)

Complete either "D", or "E and F", <u>not both</u>. **Sheet 2**

D. Observed Total Water Current (TWC) *(to be used <u>instead of</u> SC and WC, e.g. data from DMB)*

			Minimum	*Maximum*
1	Source: ____________			
2	Set		________°T	________°T
3	Rate		________kt	________kt
4	Total water current direction	*(D2)*	________°T	________°T
5	Total water current distance	*(D3 x C2)*	________NM	________NM

E. Sea Current (SC), Tidal Current (TC)

1	Publication: ____________			
2	Set		________°T	________°T
3	Rate		________kt	________kt
4	Current direction	*(E2)*	________°T	________°T
5	Current distance	*(E3 x C2)*	________NM	________NM

F. Wind Current (WC)

1	Wind current vector *(resultant from Sheet 9)*	________°T	________°T
		________NM	________NM

G. Leeway (LW)

1	Search object(s): ____________		
2	Leeway vector *(from Sheets 11 and 12)*	________°T	________°T
		________NM	________NM

H. Total Surface Drift (TD) Plotting sheet ☐ Calculator ☐

1	Direction	________°T	________°T
2	Distance	d_{min} ________	d_{max} ________NM
3	Distance between D_{min} and D_{max}		________NM

I. Datum Minimax ☐ Other ☐

1	Time	________UTC	________UTC	________UTC
2	Latitude	Datum ________	D_{min} ________	D_{max} ________N
3	Longitude	Datum ________	D_{min} ________	D_{max} ________W

Appendix C Search Planning Worksheets (Minimax)

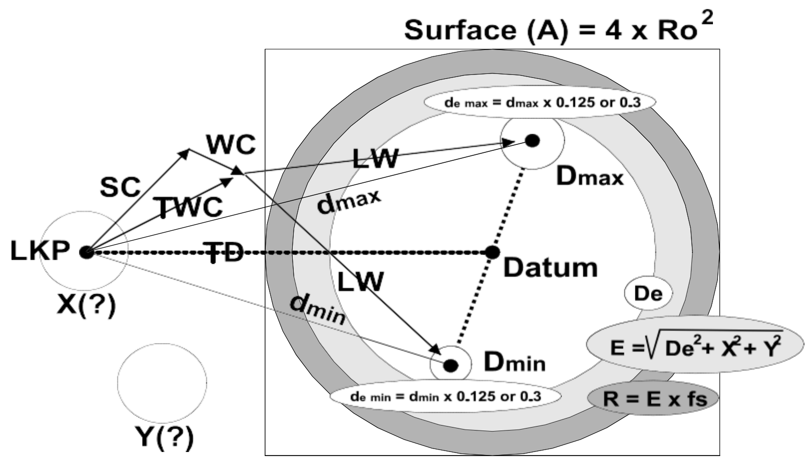
Sheet 3

Case Name: ____________________

SMC: ____________________

Search number: ____________________

SEARCH AREA



J. Aeronautical Drift Error (D_{ea})

1 Aeronautical drift distance D_a ____________ NM

2 Drift error confidence factor CF ____________

3 Aerospace drift error $D_{ea} = D_a \times CF$ ____________ NM

K. Surface Drift Error Minimax ($de_{minimax}$)

1 Sum of previous drift errors *($d_{e\ min}$ and $d_{e\ max}$)* sum ____________ NM

2 Surface drift distance *(from H2 on Sheet 2)* d_{min} ____________ NM d_{max} ____________ NM

3 Drift error confidence factor *(choose and circle one)* **0.125** **0.3**

4 Drift error min-max $d_{e\ min}$ ______ NM ($d_{min} \times CF$) $d_{e\ max}$ __ NM ($d_{max} \times CF$)

5 Distance between latest D_{min} and D_{max} positions *(from plot or H on Sheet 2)* distance ____________ NM

6 Surface drift error minimax $d_{e\ minimax}$ ____________ NM

$$d_{e\ minimax} = \frac{d_{e\ min} + d_{e\ max} + \text{distance} + \text{sum}}{2}$$

Appendix C Search Planning Worksheets (Minimax)

Sheet 4

K. Surface Drift Error (Non-Minimax)

7	Surface drift distance	d ______	NM
8	Drift error confidence factor	CF ______	
9	Individual drift error	(d_e = d x CF) ______	NM

L. Total Drift Error

1	Minimax *(from J3 + K6)*	$D_e = d_{ea} + d_{e\ minimax}$ ______	NM
2	Non minimax *(from K9)*	$D_e = d_{e1} + d_{e2} + d_{e3}$ + etc. ______	NM

M. Initial Position Error (X)

1	Navigational fix error	Based on ______	Fix_e ______	NM
2	Navigational DR error		DR_e ______	NM
3	Initial position error		$X = Fix_e + DR_e$ ______	NM

N. SRU Position Error (Y)

1	Navigational fix error	Based on ______	Fix_e ______	NM
2	Navigational DR error		DR_e ______	NM
3	Initial position error		$Y = Fix_e + DR_e$ ______	NM

O. Total Probable Error (E) $E = \sqrt{De^2 + X^2 + Y^2}$ ______ NM

P. Optimal Search Factor (f_s) *(choose and circle one)* **1.1 1.6 2.0 2.3 2.5**

Q. Desired Search Radius (R)

	Search radius minimax	$R = E \times F_s$ ______	NM
☐	Search radius *(round up to next whole number)*	R_o ______	NM
☐	Search radius for coastal search *(6 NM)*	R_o ______	NM

R. Optimum Search Area (A)

☐	Oceanic search area (square)	$A = 4R_o^2$ ______	NM^2
☐	Coastal search area (square)	$A = 4 \times 6^2$ ______	NM^2
☐	Rectangle search area	A = length x width ______	NM^2

Appendix C Search Planning Worksheets (Minimax)

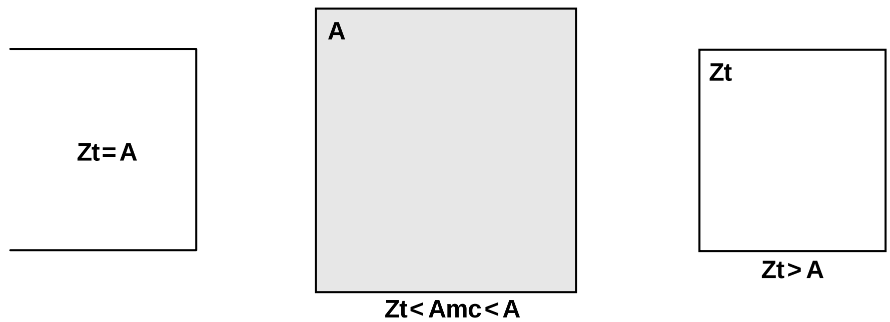
Sheet 5

Case Name: ____________________

SMC: ____________________

Search number: ____________________

EFFORT ALLOCATION



	S.	Effort Allocation					
	1	Search sub-area designation		____	____	____	____
	2	Search facility assigned		____	____	____	____
V	3	Search facility speed		____	____	____	____
	4	On-scene endurance		____	____	____	____
	5	Daylight hours remaining		____	____	____	____
T	6	Search endurance		____	____	____	____
			(Lesser value of S4 or S5, use 0.85 of result for aircraft)				
VxT	7	Trackline distance (in NM)		____	____	____	____
	8	Search altitude		____	____	____	____
W_u	9	Uncorrected sweep width		____	____	____	____
f_w	10	Weather factor		____	____	____	____
f_f	11	Fatigue correction factor		____	____	____	____
f_v	12	Search facility speed correction factor		____	____	____	____
W	13	Corrected sweep width	$W = W_u \times f_w \times f_f \times f_v$	____	____	____	____
Z_n	14	Individual effort	$Z_n = V \times T \times W$	____	____	____	____
Z_t	15	Total effort	$Z_t = Z_{n1} + Z_{n2} + Z_{n3} + Z_{n4}$				____
A	16	Optimum search area	$A = 4 \times R_0^2$				____
		If Z_t >A then go to section T1, otherwise continue with line S17.					
A_{mc}	17	Midpoint compromise search area	$A_{mc} = \frac{A + Z_t}{2}$				____
C_{mc}	18	Midpoint compromise coverage factor	$C_{mc} = \frac{Z_t}{A_{mc}}$				____

Appendix C Search Planning Worksheets (Minimax)

Sheet 6

	1	Search sub-area designation	______ ______ ______ ______
	2	Search facility assigned	______ ______ ______ ______
S_{mc}	19	Midpoint compromise track spacing $S_{mc} = \frac{W}{C_{mc}}$	______ ______ ______ ______
S_a	20	Track spacing assignable *(within usable limits of SRU navigational capability – rounded down if C < 1)*	______ ______ ______ ______
C	21	Search sub-area coverage factor $C = \frac{W}{S_a}$	______ ______ ______ ______
	22	Individual search area POD	______ ______ ______ ______
A_n	23	Individual adjusted search area $A_n = V \times T \times S_a$	______ ______ ______ ______
T	24	Search endurance (*for excess search facilities only*) **(– 15% for aircraft)** $T = \frac{A_n}{V \times S_a}$	______ ______ ______ ______
A_t	25	Total search area $A_t = A_{n1} + A_{n2} + A_{n3} + A_{n4}$	______ $\sqrt{A_t}$ ______
	26	Search area coverage factor $C = \frac{Z_t}{A_t}$	______
	27	Search POD	______%
l′	28	Estimated area length	______ ______ ______ ______
w′	29	Estimated area width $w' = \frac{A_n}{l'}$	______ ______ ______ ______
n′	30	Number of tracks required $n' = \frac{w'}{S_a}$	______ ______ ______ ______
n	31	Round off to whole number	______ ______ ______ ______
w	32	Area actual width $w = n \times S_a$	______ ______ ______ ______
l	33	Area actual length $l = \frac{A_n}{w}$	______ ______ ______ ______

Complete Drift Compensation Sheet 7 for each assigned SRU.

T. Excess Search Facilities Planning

C	1	Search sub-area coverage factor *(C = 1.0 recommended, except in areas of suspected high probability)*	______ ______ ______ ______
S	2	Track spacing $S = \frac{W}{C}$	______ ______ ______ ______
	3	*Go back to section S20 and complete the rest of the worksheet.*	

Appendix C Search Planning Worksheets (Minimax)

Sheet 7

Case Name: ____________________________

SMC: ____________________________

Search number: ____________________________

DRIFT COMPENSATED SEARCH PATTERNS

SRU ____________________________

U. Search Planning Summary

1	Search object drift (direction and distance)	______________°T	______________NM
2	Search object drift (rate per hour)		**v**______________kt
3	Search area (length and width)	**l** ______________	**w**______________NM
4	SRU search speed		**V**______________kt
5	SRU track spacing		**S**______________NM
6	Time required to complete the area		**T**______________hours

Use the lesser T in lines S4 or S5, or in line S24 from sheet 5; x 0.85 for aircraft)

V. Compensation Methods

1 *To determine whether drift compensation is recommended, complete the following formula:*

(vl) + (VS) (_____) x (_____) + (_____) x (_____) = (_____) ÷ (_____) = _____

a. If the value is < 0.1, then drift compensation is not recommended.

STOP HERE. *No further computation is necessary*.

b. If the value is > 0.1, then drift compensation is recommended.

Orient the search area so that the major axis is parallel to the search object drift direction.

2 *Complete the following formula to see if further drift compensation is recommended.*

(vw) + (VS) (_____) x (_____) + (_____) x (_____) = (_____) ÷ (_____) = _____

a. If the value is < 0.1, then further drift compensation is not recommended.

STOP HERE. *No further computation is necessary.*

b. If the value is > 0.1, then further drift compensation is recommended.

Select one option as indicated in next section W.

Appendix C Search Planning Worksheets (Minimax)

Sheet 8

W. Options for further direct compensation (in descending order of preference)

1 Create a parallelogram along the major axis as follows:

a. Select a CSP for a PS search pattern.

b. Advance the down creep side of the search area by the following:

Distance = T x v = (_________) x (_________) =________________NM

c. Connect advanced sides to unadvanced sides.

Determine new latitudes and longitudes of corners.

2 Keep the major axis oriented parallel to the drift direction, and:

a. Conduct a CS search pattern with drift compensated headings as follows:

1 v ÷ V = (_________) ÷ (_________) = _______________

2 Heading correction = ARCTAN (above value)________________°

3 Round off correction to the nearest whole degree________________°

b. Apply the heading correction in the direction of the search object drift.

c. Extend the search area in the direction of the search object drift by the following distance:

T x v = (_________) x (_________) =________________NM

3 If the major axis cannot be oriented parallel to the drift direction, orient the search area so that the minor axis is parallel to the drift direction, and conduct one of the following:

a. A PS search pattern with the SRU creeping in the *same* direction as the search object drift, using drift compensated headings.

b. A PS search pattern with the SRU creeping in the direction *opposite* to the search object drift, using drift compensated headings.

c. A CS search pattern, and construct a parallelogram.

4 If none of the above situations is feasible, conduct an XSB search.

Appendix C Search Planning Worksheets (Minimax)

Case Name: ______________________

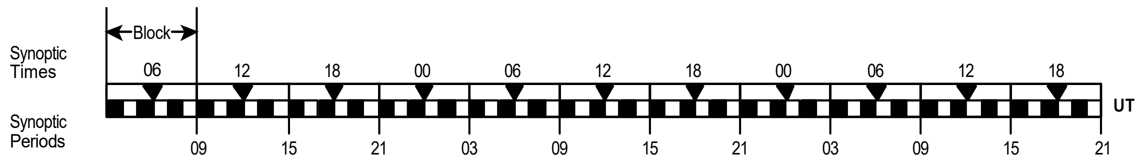
SMC: ______________________

Search number: ______________________

Sheet 9

SYNOPTIC BLOCKS

(repeat as necessary)



Block # [ ]

	Synoptic Times	**Synoptic Winds** Direction (A)	Speed (B)	**Coefficients** Direction (C)	Speed (D)	**Effect** (A + C)	(B x D)
1	________UTC	______ °T	______ kt	______ °T	______ kt	______°T	______ kt
2	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
3	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
4	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
5	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
6	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
7	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
8	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt

Vectorial addition of effect of above eight vectors x Influence duration = Block resultant vector

______ °T ______kt x ______ hours = ______°T______NM

Block # [ ]

	Synoptic Times	**Synoptic Winds** Direction (A)	Speed (B)	**Coefficients** Direction (C)	Speed (D)	**Effect** (A + C)	(B x D)
1	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
2	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
3	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
4	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
5	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
6	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
7	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt
8	________UTC	______°T	______ kt	______ °T	______ kt	______°T	______ kt

Vectorial addition of effect of above eight vectors x Influence duration = Block resultant vector

______ °T ______kt x ______ hours = ______°T______NM

Wind current (WC) is the vectorial addition of all block resultants: ______°T______NM

(Transfer to block E1 on Sheet 2)

Appendix C Search Planning Worksheets (Minimax)

Sheet 10

WIND CURRENT COEFFICIENT TABLE

(North latitudes only)

PERIOD	LATITUDE 5°N	10°N	15°N	20°N	25°N	30°N	35°N	40°N	45°N	50°N	55°N	60°N	65°N
1	185° 0.029	190° 0.028	196° 0.028	200° 0.027	205° 0.027	210° 0.026	214° 0.025	217° 0.024	221° 0.023	224° 0.022	226° 0.021	228° 0.020	230° 0.020
2	203° 0.012	226° 0.012	249° 0.012	271° 0.011	292° 0.011	312° 0.011	332° 0.011	350° 0.010	007° 0.010	022° 0.09	036° 0.009	049° 0.009	059° 0.008
3	219° 0.009	258° 0.009	296° 0.009	333° 0.009	009° 0.008	043° 0.008	076° 0.008	107° 0.008	136° 0.007	162° 0.007	186° 0.007	207° 0.007	224° 0.006
4	235° 0.008	289° 0.008	342° 0.008	035° 0.007	085° 0.007	134° 0.007	180° 0.007	223° 0.006	264° 0.006	301° 0.006	334° 0.006	003° 0.006	028° 0.005
5	250° 0.007	320° 0.007	029° 0.007	096° 0.006	162° 0.006	224° 0.006	283° 0.006	339° 0.006	031° 0.005	079° 0.005	121° 0.005	159° 0.005	192° 0.004
6	266° 0.006	352° 0.006	076° 0.006	158° 0.006	238° 0.006	314° 0.005	027° 0.005	095° 0.005	159° 0.004	217° 0.004	269° 0.004	315° 0.004	355° 0.004
7	282° 0.006	023° 0.006	123° 0.006	220° 0.005	314° 0.005	044° 0.005	130° 0.005	211° 0.004	286° 0.004	355° 0.004	056° 0.004	111° 0.003	158° 0.003
8	298° 0.005	054° 0.005	169° 0.005	281° 0.005	030° 0.005	134° 0.004	233° 0.004	327° 0.004	053° 0.004	132° 0.003	204° 0.003	267° 0.003	321° 0.003

Appendix C Search Planning Worksheets (Minimax)

Case Name: ______________________

SMC: ______________________

Search number: ______________________

Sheet 11

AVERAGE SURFACE WINDS AND LEEWAY

Incident Summary

1	LKP or EIP	Latitude	*(Use Block B1 Sheet 1)*	______________	N
		Longitude	*(Use Block B2 Sheet 1)*	______________	W
	Time of incident		*(Use Block B3 Sheet 1)*	______________	UTC
	Commence search time		*(Use Block C1 Sheet 1)*	______________	UTC
2	Drift interval		*(Use Block C2 Sheet 1)*	______________	hours

3 Search object (description): ____

4 Average surface winds (ASW)

Synoptic Date/Time	Wind Period	Number of hours	x	Wind Speed	=	Vectorial Value	Wind Direction
0000 UTC	0300 – 2100	________	x	________	=	________	________°T
1800 UTC	2100 – 1500	________	x	________	=	________	________°T
1200 UTC	1500 – 0900	________	x	________	=	________	________°T
0600 UTC	0900 – 0300	________	x	________	=	________	________°T
0000 UTC	0300 – 2100	________	x	________	=	________	________°T
1800 UTC	2100 – 1500	________	x	________	=	________	________°T
1200 UTC	1500 – 0900	________	x	________	=	________	________°T
0600 UTC	0900 – 0300	________	x	________	=	________	________°T
0000 UTC	0300 – 2100	________	x	________	=	________	________°T
1800 UTC	2100 – 1500	________	x	________	=	________	________°T
1200 UTC	1500 – 0900	________	x	________	=	________	________°T
0600 UTC	0900 – 0300	________	x	________	=	________	________°T
0000 UTC	0300 – 2100	________	x	________	=	________	________°T

5 Total wind vector resultant ________NM ________°T

6 Average surface wind (ASW) Speed = $\frac{\text{line 5}}{\text{line 2}}$ ________kt ________°T

Appendix C Search Planning Worksheets (Minimax)

Sheet 12

Leeway – Non Minimax Solution (downwind leeway)

a.	Average surface wind	*(block 6 from Sheet 11)*	______ kt	______°T
b.	Set (reciprocal of ASW)	*(wind direction – 180°)*		______°T
c.	Leeway rate	*(as per formula)*		______kt
d.	Drift interval	*(block C2 from Sheet 1)*	______ h	______h
e.	Leeway vector(s)	*(block 1b.)*	______ °T	______°T
		(block 1c. x block 1d.)	______ NM	______NM

(Transfer to block G2 on Sheet 2)

Leeway – Minimax Solution (select a scenario)

1 ☐ **Drift Rate Uncertainty (downwind leeway)**
Leeway with minimum drift rate, e.g. drogue/no drogue, search object uncertainty.

a.	Average surface wind	*(block 6 from Sheet 11)*	______kt	______°T
b.	Set (reciprocal of ASW)	*(wind direction – 180°)*		______°T
c.	Leeway rate	*(as per formula)*		______kt
d.	Drift interval	*(block C2 from Sheet 1)*		______h
e.	Leeway vector(s)	*(block 1b.)*	______ °T	______°T
		(block 1c. x block 1d.)	______ NM	______NM

(Transfer to Block G2 on Sheet 2)

2 ☐ **Time Uncertainty (downwind leeway)**

a.	Average surface wind	*(block 6 from Sheet 11)*	______kt	______°T
b.	Set (reciprocal of ASW)	*(wind direction – 180°)*		______°T
c.	Leeway rate	*(as per formula)*		______kt
d.	Drift interval	*(block C2 from Sheet 1)*	______h	______h
e.	Leeway vector(s)	*(block 2b.)*	______ °T	______°T
		(block 2c. x block 2d.)	______ NM	______NM

(Transfer to Block G2 on Sheet 2)

3 ☐ **Direction Uncertainty (divergence – no other uncertainty)**

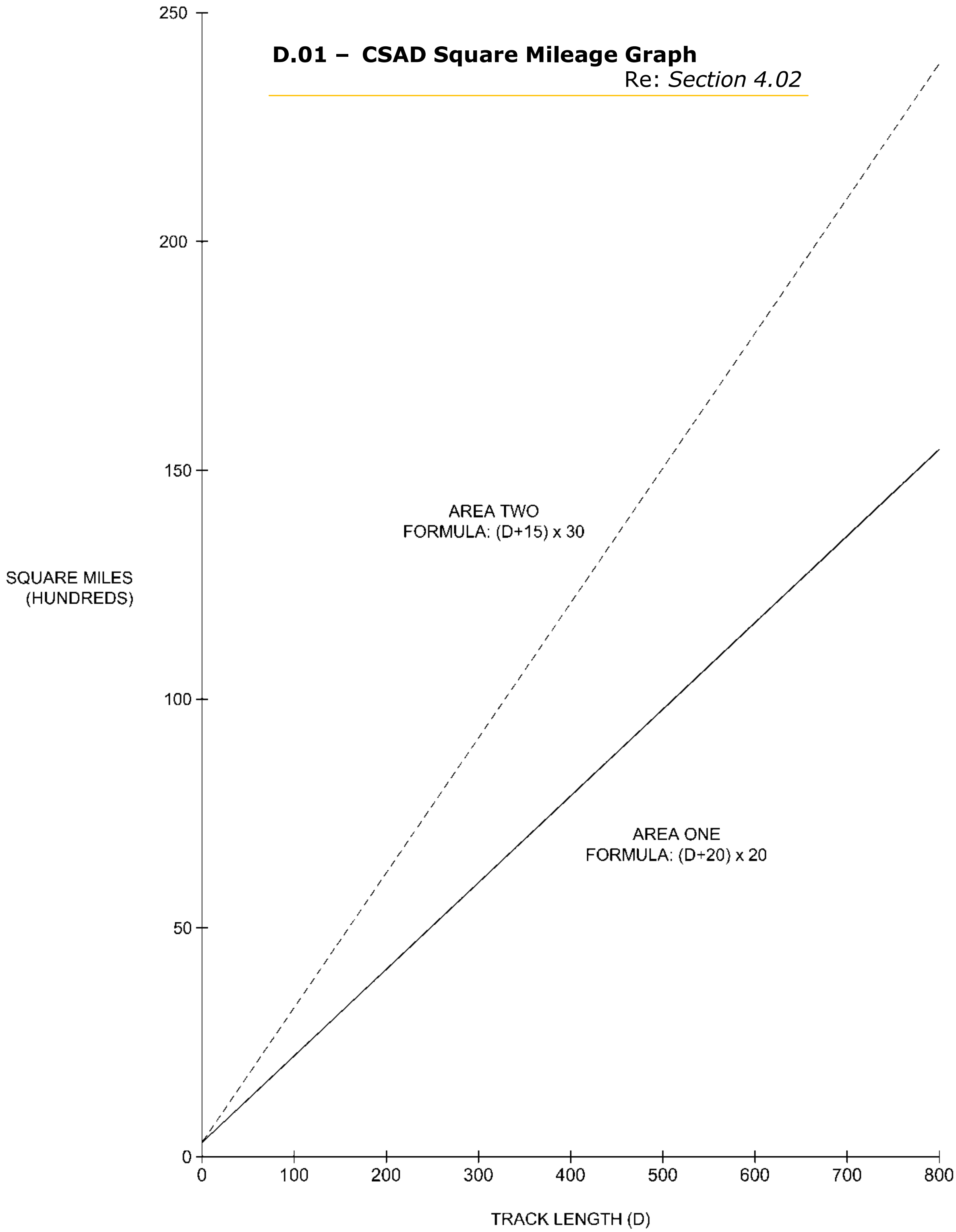
a.	Average surface wind	*(block 6 from Sheet 11)*	______kt	______°T
b.	Set (reciprocal of ASW)	*(wind direction – 180°)*		______°T
c.	Maximum expected divergence			±______°
d.	Leeway rate	*(as per formula)*		______kt
e.	Drift interval	*(block C2 from Sheet 1)*		______h
f.	Leeway vector(s)	*(block 3b. ± block 3c.)*	______ °T	______°T
		(block 3d. x block 3e.)	______ NM	______NM

(Transfer to Block G2 on Sheet 2)

Appendix D Search Planning Tables and Graphs

D.01 – CSAD Square Mileage Graph

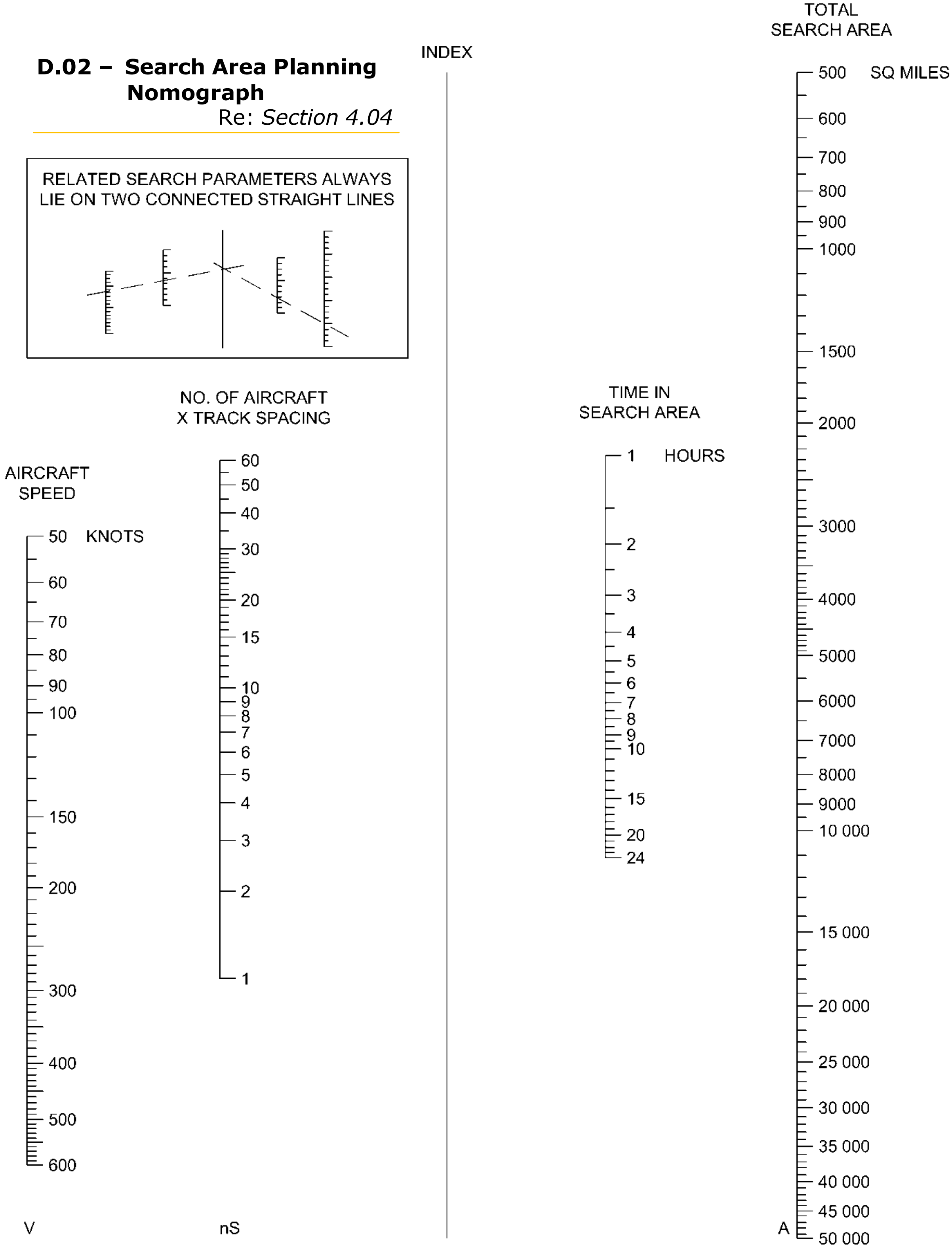
Re: *Section 4.02*



Appendix D Search Planning Tables and Graphs

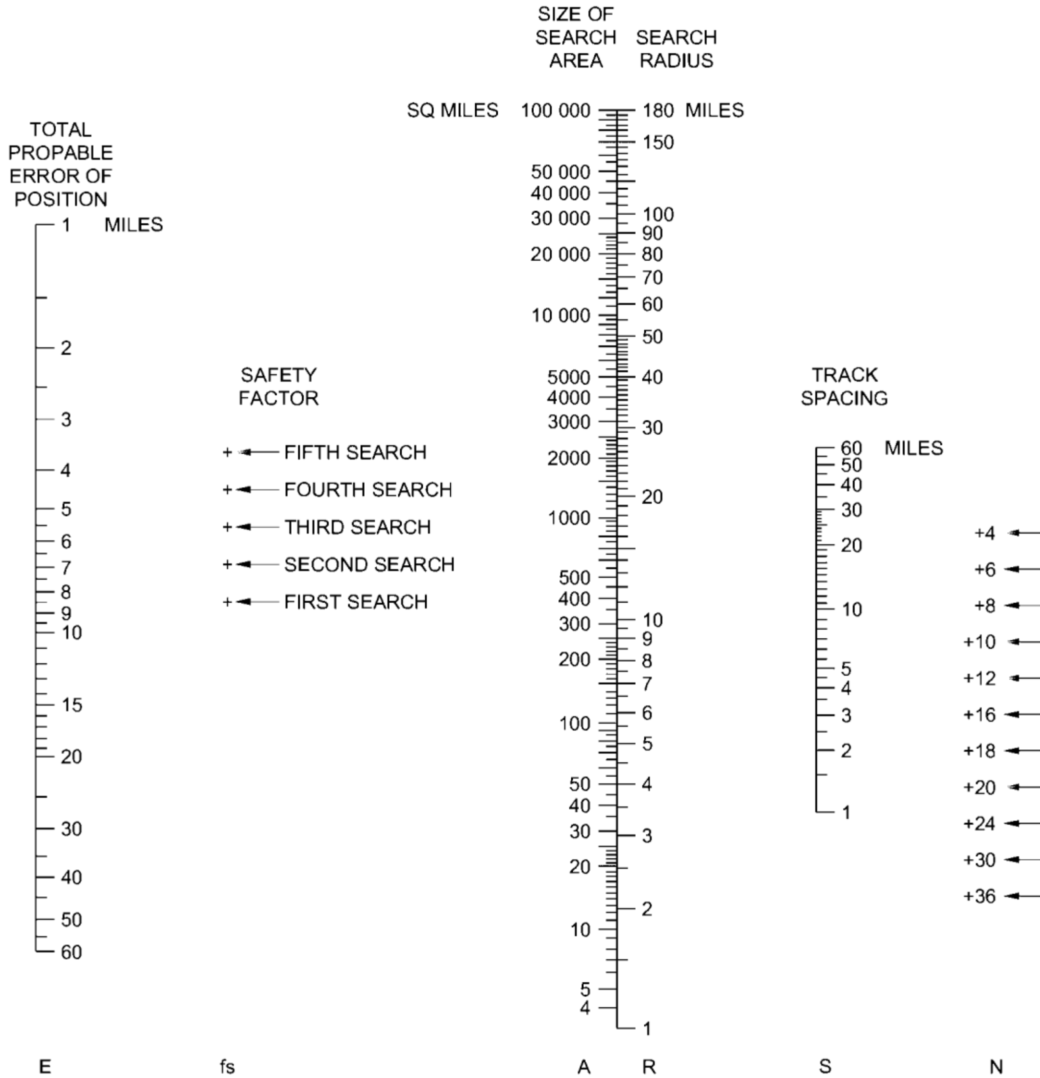
D.02 – Search Area Planning Nomograph

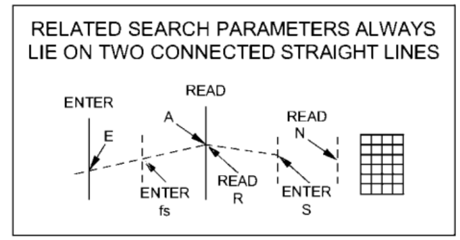
Re: *Section 4.04*



Appendix D Search Planning Tables and Graphs

D.03 – Sector Search Area Nomograph Re: *Section 4.04*



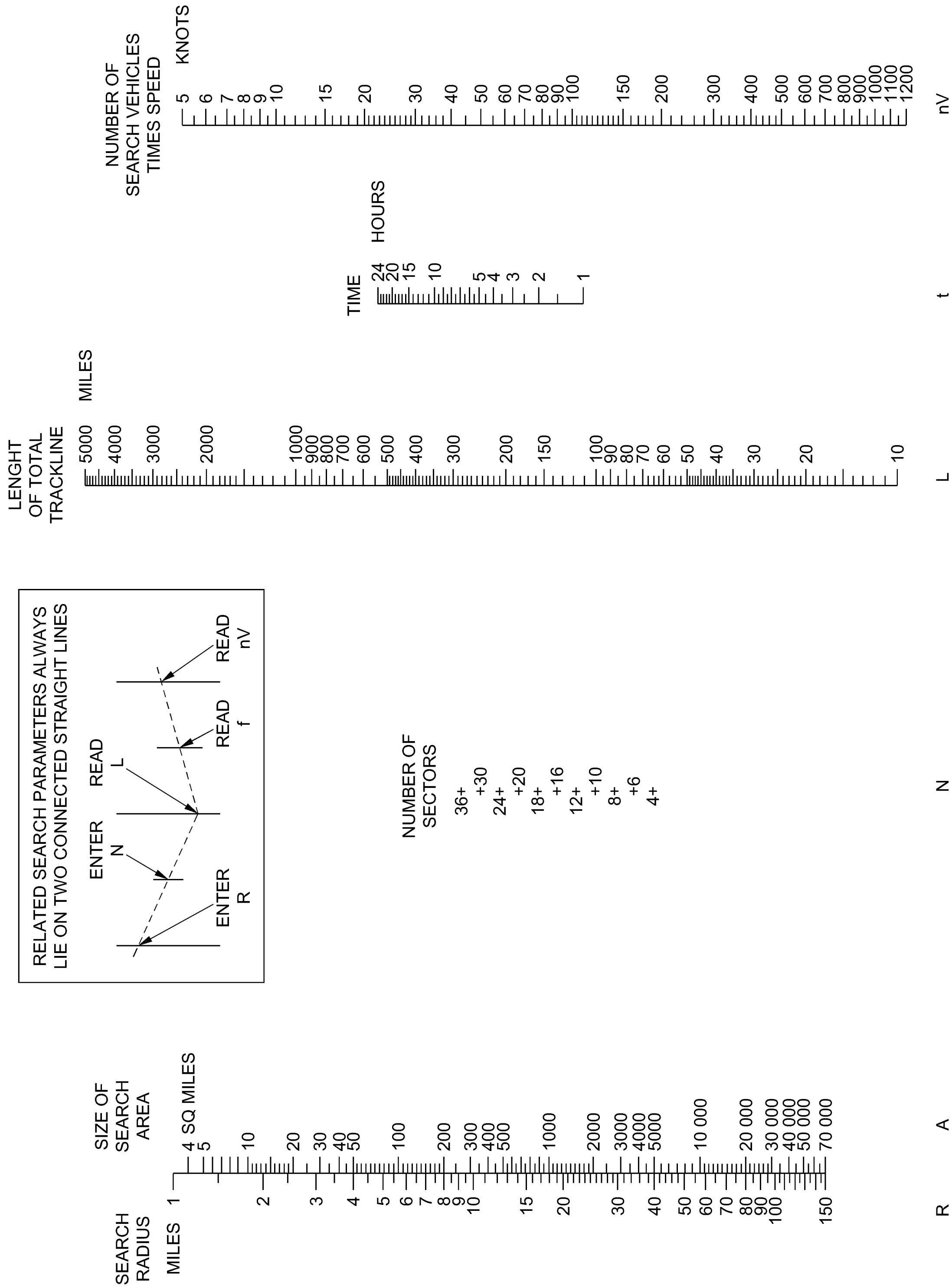


NO. OF SECTORS N	NO. OF LEGS	NO. OF CROSS LEGS	CENTRAL ANGLE	COURSE CHANGE ANGLE
4°	2	1	90°	135°
6	3	2	60°	120°
8°	4	3	45°	112 1/2°
10°	5	4	36°	108°
12	6	5	30°	105°
16°	8	7	22 1/2°	101°
18	9	8	20°	100°
20°	10	9	18°	99°
24	12	11	15°	97 1/2°
30	15	14	12°	96°
36	18	17	10°	95°
AVOID WHEN USING SEARCH CRAFT				

Appendix D Search Planning Tables and Graphs

D.04 – Sector Search Time Nomograph

Re: *Section 4.04*



Appendix D Search Planning Tables and Graphs

D.05 – VHF/UHF Theoretical Reception Range Table

Re: *Section 4.04*

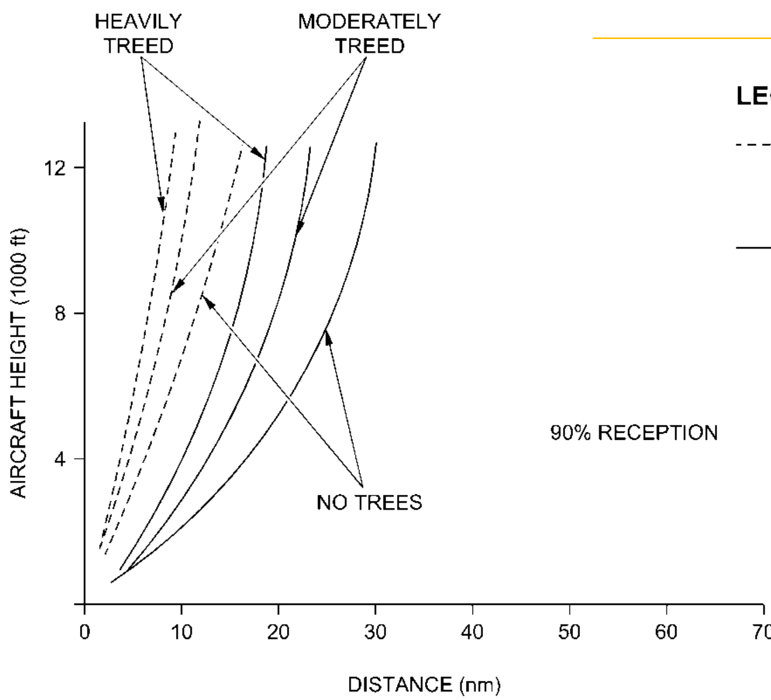
VHF/UHF THEORETICAL RECEPTION RANGES[1]	
Altitude Above Ground Level	Range
300 metres (1,000 feet)	30 nautical miles (NM)
600 metres (2,000 feet)	45 NM
900 metres (3,000 feet)	55 NM
1200 metres (4,000 feet)	67 NM
1500 metres (5,000 feet)	85 NM
3000 metres (10,000 feet)	100 NM
4500 metres (15,000 feet)	127 NM
6000 metres (20,000 feet)	150 NM
9000 metres (30,000 feet)	200 NM

[1] The ranges are for an ELT operating at full power. Actual reception range will depend on terrain, signal strength and other factors.

Appendix D Search Planning Tables and Graphs

D.06 – ELT Detection Distance Graphs

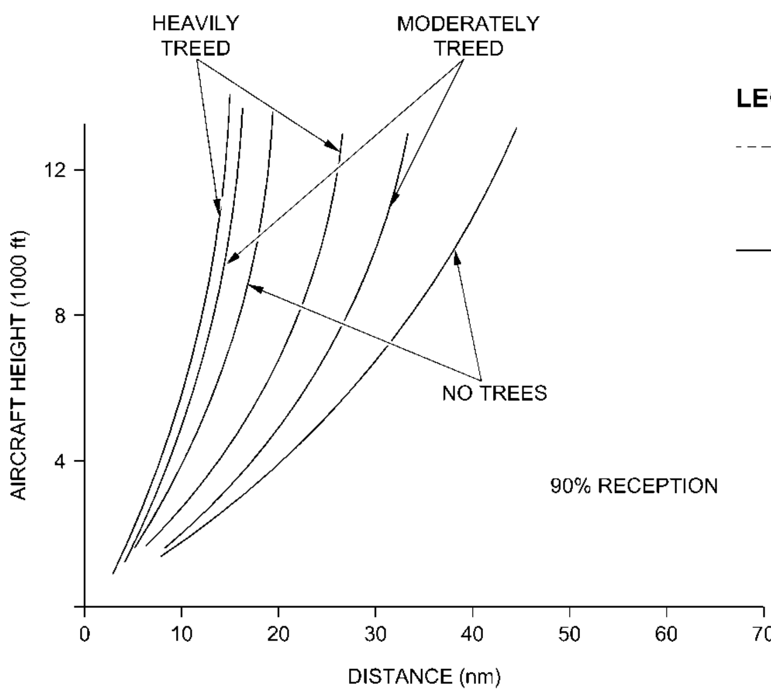
Re: *Section 4.04*



LEGEND

- - - - - - - - Frequency: 243 MHz
Height of base: 10 feet
Terrain: Mountain

———— Frequency: 243 MHz
Height of base: 10 feet
Terrain: Plains



LEGEND

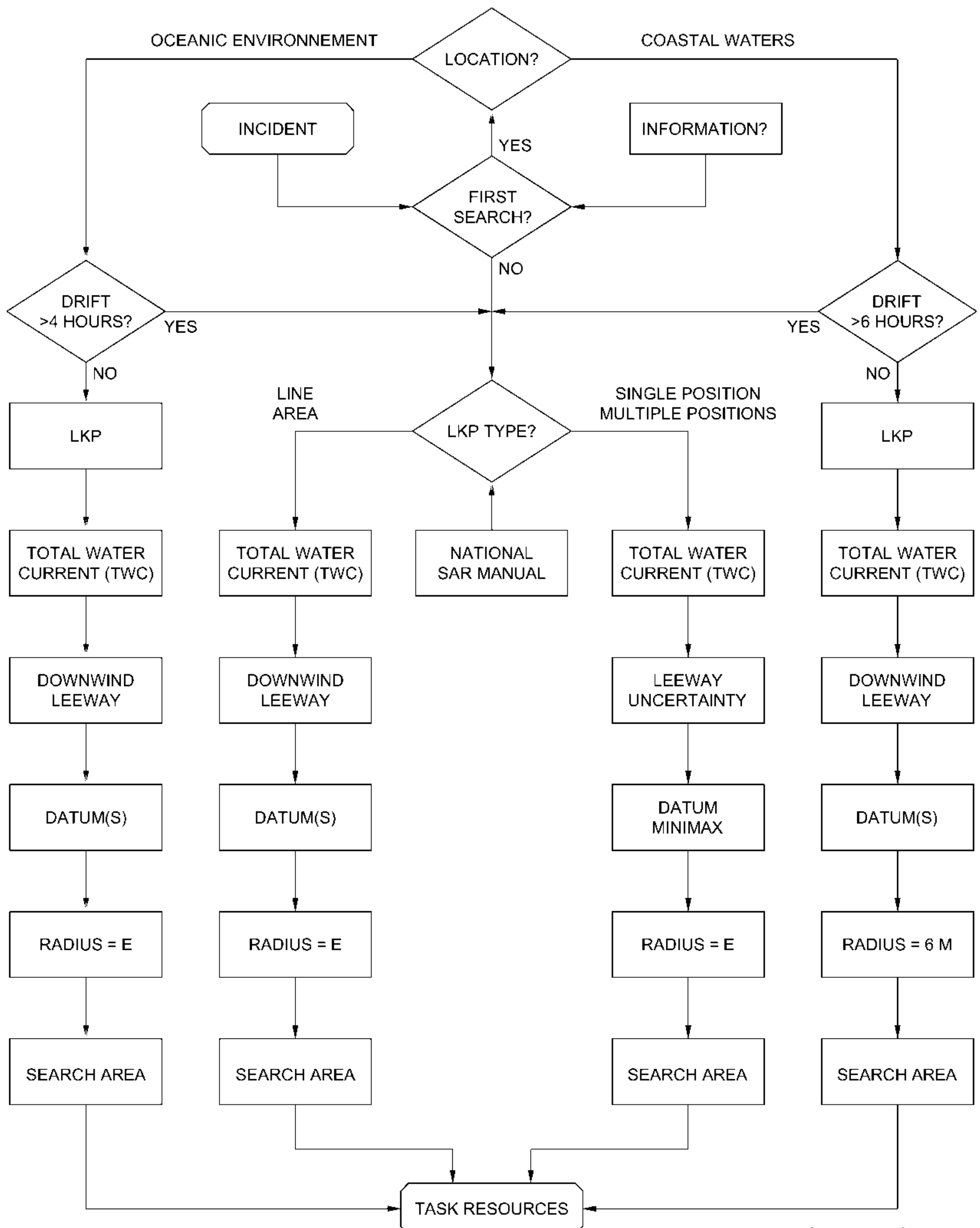
- - - - - - - - Frequency: 121.5 MHz
Height of base: 10 feet
Terrain: Mountain

———— Frequency: 121.5 MHz
Height of base: 10 feet
Terrain: Plains

Appendix D Search Planning Tables and Graphs

D.07 – Maritime Environment Search Planning Decision Matrix

Re: *Section 4.06*



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Appendix D Search Planning Tables and Graphs

D.7 – Maritime Environment Search Planning Decision Matrix *(continued from previous page)*

The following steps describe the use of the matrix:

1. **First Search or Subsequent Searches?** If planning a first search, the planner must consider the location of the incident; for subsequent searches, determine the last known position (LKP) type.

2. **Determine Location –** Establish whether the search object is in coastal waters or in the oceanic environment.

3. **Determine Total Drift Time –** Estimate how long the search object has been adrift. This is normally the time interval between the actual occurrence of the incident and the time chosen by the planner for datum calculation.

4. **Determine LKP Type –** Establish the LKP type, considering one of the following: single position, multiple position, area or trackline.

5. **Compute Total Water Current –** Consider all the water current acting on the search object (SC, TC, WC, etc.).

6. **Compute LW –** Leeway is applied downwind in coastal waters and in cases in the oceanic environment where the LKP is determined to be an area or trackline, or if the total drift time is four (4) hours or less. LW uncertainly is applied in situations where the LKP is a single position or multiple positions and the total drift time is greater than four (4) hours.

7. **Establish Datum(s) or $\text{Datum}_{\text{minimax}}$ –** If the planner uses the downwind LW, then he will determine a datum per LKP. If he uses the LW uncertainty, he will determine $\text{Datum}_{\text{minimax}}$.

8. **Establish the Search Radius**

   a. In coastal waters, if the drift period is equal to or less than six (6) hours, use a 6 nautical miles (NM) radius. If the drift period is more than six (6) hours, use oceanic methodology.

   b. In oceanic environment, if the drift period is less than four (4) hours, compute the search radius without considering the total drift error (D_e). If the drift period is more than four (4) hours, compute the search radius using the total probable error (E).

9. **Define the Search Area(s)**

   a. For coastal waters, a 6 NM radius around datum(s) will normally create the desired search area(s). If these radii are drawn about a series of positions, as trackline datums, then the circles are grouped together in a simple geometric shape to form the search area.

   b. For the oceanic environment, the search area is determined by the search radius when using the minimax solution. In other cases, the search area will be determined by drawing search radii about the datum positions as in the coastal solution.

Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy

Re: *Section 4.06*

NOTE: SMCs should evaluate the calculated results obtained from using the tables with actual known conditions, and adjust leeway values as appropriate.

D.08.1 LEEWAY SPEED AND DIRECTION VALUES FOR DRIFT OBJECTS[1]

Leeway Search Object Class				Leeway Speed		Divergence Angle (degrees)
Category	Sub Category	Primary Leeway Descriptor	Secondary Leeway Descriptor	Multiplier	Modifier (knots)	
Person In Water				0.011	0.07	30°
		vertical		0.005	0.07	18°
		sitting		0.012	0.00	18°
		horizontal	survival suit	0.014	0.10	30°
			scuba suit	0.007	0.08	30°
			deceased	0.015	0.08	30°
Survival Craft	Maritime Life Raft	no ballast system		0.042	0.03	28°
			no canopy, no drogue	0.057	0.21	24°
			no canopy, w/ drogue	0.044	-0.20	28°
			canopy, no drogue	0.037	0.11	24°
			canopy, w/ drogue	0.030	0.00	28°
		shallow ballast system & canopy		0.029	0.00	22°
			no drogue	0.032	-0.02	22°
			w/ drogue	0.025	0.01	22°
			capsized	0.017	-0.10	8°
		deep ballast system & canopy	*(see table D.08.2 for next levels)*	0.030	0.02	13°
	Other Type of Maritime Survival Craft	life capsule, powered		0.038	-0.08	22°
		USCG sea rescue kit		0.025	-0.04	7°
		fibreglass rigid hull life capsule, light loading, no drogue		0.03907	0.04180	40°
			4 person, no drogue	0.03833	0.01282	30°
			7 person no drogue	0.03818	0.07948	40°
		fibreglass rigid hull life capsule, full loading, w/ drogue		0.01018	0.06533	25°
			4 person w/ drogue	0.01085	0.04920	25°
			7 person w/ drogue	0.00969	0.07627	25°
	Aviation Life Raft	no ballast, w/canopy	4-6 person, no drogue	0.037	0.11	24°
		evacuation slide	4-6 person	0.028	-0.01	15°
Person Powered Craft	Sea Kayak	w/ person on aft deck		0.011	0.24	15°
	Surf board	w/ person		0.020	0.00	15°
	Windsurfer	w/ person & mast	& sail in water	0.023	0.10	12°

(continued on next page)

[1] The leeway tables are adapted from *Allen and Plourde 1999 Review of Leeway: Field Experiments and Implementation. USCG Research and Development Centre Report No CG-D-08-99*; and updated from *Oceans, March 2006, Investigation of Leeway and Drift for Ovatek Life Rafts*.

Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy *(continued from previous page)*

D.08.1 – Leeway Speed and Direction Values for Drift Objects *(continued)*

Leeway Search Object Class				Leeway Speed		Divergence Angle (degrees)
Category	Sub Categories	primary leeway descriptors	secondary leeway descriptors	Multiplier	Modifier (knots)	
Sailing Vessel	Mono-hull	full keel	deep draft	0.030	0.00	48°
		fin keel	shoal draft	0.040	0.00	48°
Power Vessel	Skiff	flat bottom	Boston whaler	0.034	0.04	22°
		V-hull	standard configuration	0.030	0.08	15°
			swamped	0.017	0.00	15°
	Sport Boat	cuddy cabin	modified V	0.069	-0.08	19°
	Sport Fisher	center console	open cockpit	0.060	-0.09	22°
	Commercial Fishing Vessel			0.037	0.02	48°
		sampan		0.040	0.00	48°
		side-stern trawler		0.042	0.00	48°
		longliner		0.037	0.00	48°
		junk		0.027	0.10	48°
		gill-netter	w/ rear reel	0.040	0.01	33°
	Coastal Freighter			0.028	0.00	48°
Boating Debris	F/V debris			0.020	0.00	10°
	Bait/wharf box holds a cubic meter of ice			0.013	0.27	31°
		lightly loaded		0.026	0.18	15°
		fully loaded		0.016	0.16	33°

D.08.2 SUB-TABLE FOR MARITIME LIFE RAFTS w/ Deep Ballast Systems & Canopies

Leeway Search Object Class				Leeway Speed		Divergence Angle (degrees)
Leeway Descriptors	Capacity Modifier	Drogue Modifier	Loading Modifier	Multiplier	Modifier (knots)	
Maritime life raft w/ deep ballast system & canopy	4-6 person			0.029	0.04	15°
		no drogue		0.038	-0.04	15°
			light loading	0.038	-0.04	15°
			heavy loading	0.036	-0.03	15°
		w/ drogue		0.018	0.03	12°
			light loading	0.016	0.05	24°
			heavy loading	0.021	0.00	20°
	15-25 person			0.036	-0.09	10°
		no drogue	light loading	0.039	-0.06	9°
		w/ drogue	heavy loading	0.031	-0.07	9°
	capsized			0.009	0.00	12°
	swamped			0.010	-0.04	8°

(continued on next page)

Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy *(continued from previous page)*

> **NOTE:** The experimental data used to produce these tables used wind speeds measured at the 10 metres wave height (U_{10}). Search planners should be aware that winds measured at a higher height might be significantly greater than the U_{10} winds.

> **NOTE:** The tables provide values at wind speeds of 5 to 40 knots. They should be used with caution for winds of more than 40 knots, keeping in mind that high waves may reduce the wind speed effect on the search object; *for wind speeds of less than 5 knots, do not apply the correction factor*.

D.08.3 Taxonomy Class Definition/Descriptions.[2]

The following provides information about each of the leeway drift objects in the *above tables*. For each description, the search object characteristics are summarized and pictures are provided where available. These search object descriptions are in no way meant to be all-inclusive; they are intended to assist a search planner in search object identification. Proper identification will make the application of more specific leeway values possible. Some categories do not require further explanation and therefore descriptions/pictures are not included. The search planner should also be reminded that any classification system will have overlap between some categories. *In these cases, a decision must be made about the most probable situation.*

(a) **Person in Water –** Persons in the water (PIW) include persons without any floatation, and those with a throw able cushion, with a personal flotation device (PFD), in an anti exposure suit and in survival/immersion suits.

(1) **Vertical –** Generally requires a conscious and active PIW to maintain this position. *PIWs wearing a sport/work vest, an anti-exposure suit, or a float coat, or having no flotation, must actively maintain a vertical position in the water or become victims in the horizontal position.*

(2) **Sitting –** This is the classic fetal position with legs drawn up and arms huddled across the PFD. This is the preferred position a conscious or unconscious person assumes, especially in cold water, when wearing an offshore lifejacket, a horse collar lifejacket, or an inflatable vest. A conscious PIW hanging onto a throw able device will also assume the sitting position until he become unconscious at which time he become a victim.

(3) **Horizontal –** Three separate configurations place the PIW in a horizontal position:

a. A conscious or unconscious PIW wearing a survival suit will float flat on his back.

b. A PIW in scuba gear, with an inflated buoyancy vest, will float in a semi reclined position.

c. The classic floating position of a victim is floating face down in the water.

(continued on next page)

[2] Adapted from the *U.S. Coast Guard Addendum to the United States National Search and Rescue Supplement (NSS) To The International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), Appendix H*; and from the *Australian National Search and Rescue Manual, Appendix I – Tables and Graphs*.

Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy *(continued from previous page)*

(b) **Maritime Survival Craft –** Maritime survival craft include life rafts, lifeboats, and life capsules. They do not include dinghies or inflatable boats that may be carried for the same purpose. *figure D.08.4*

(1) **Maritime Life Raft –** If there is any question about what type of life raft a vessel may carry, a phone call to life raft repair and repackaging facilities close to the homeport of the distressed vessel may provide ballast, canopy, size, and drogue information.

a. **Shallow Ballast System –** Consists of a series of fabric pockets generally 10 cm (4 inches) in diameter and less than 15 cm (6 inches) in depth.

b. **Deep Ballast System –** Consist of large fabric bags, from 3 to 7 on the raft, that are at least 30 x 60 x 60 cm (1 x 2 x 2 feet).

(2) **Other Type of Maritime Survival Craft**

a. **Life Capsule –** Fully enclosed craft commonly used on large merchant and military vessels.

b. **Fibreglass Rigid Hull Life Capsule –** This type of life raft has become a popular alternative to the inflatable life raft on board fishing vessels in Atlantic Canada and the west coast of North America.

(3) **Aviation Life Raft –** Aviation life rafts fall basically into two groups, life rafts and slide rafts. They are similar to marine life rafts, but are usually made from lighter materials.

- **Evacuation/Slide –** Slide rafts are specifically designed devices intended to ease evacuation from an aircraft. They mount to doorframes or near wing emergency exits and are cut loose from the airframe once fully loaded.

(c) **Person-Powered Craft –** Person-powered craft include all forms of rowed or paddled boats, including rowboats, inflatable boats without motors, canoes, kayaks, surfboards and windsurfers. *Figure D.08.5*

(d) **Sailing Vessel**

- **Mono-hull –** It is assumed that all search objects in this category are adrift; therefore sails are down or missing and the crew is unable to manoeuvre the vessel at all. A class of small to medium sized sailing vessels generally less than 6 metres (20 feet) and never more than 9 metres (30 feet) in length, they are typically designed for a single purpose such as racing or day sailing. Although this type of boat can have an outboard engine when day sailing, they will almost never have inboard engines.

  a. **Full Keel –** Full keel mono-hull sailing vessels are small to medium sized sailboats whose keel runs the full length or nearly the full length of the hull. While the forward portion of the keel is modified or eliminated on some full keel sailboats, the keel on all full keel sailboats extends aft to the rudder. This is an old hull design and is not commonly used in new hull construction due to the relatively slow sailing speeds of this hull design. *Figure D.08.6*

  b. **Fin Keel –** Small to medium sized sailboats with permanent keel skegs that do not extend aft to the rudder. *Figure D.08.7*

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Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy *(continued from previous page)*

(e) **Power Vessel**

(1) **Skiff –** Skiffs are open boats less than 6 metres (20 feet) long that use an outboard motor as the primary source of propulsion. Some have characteristics identical to rowed boats with the exception that an outboard motor has been attached to the stern. This group includes, but is not limited to, tenders for larger vessels, bass boats, hunting boats, Jon boats, and a large category of utility boats. Skiffs are usually found on lakes and rivers, but are also common in the calm waters of many bays and rivers that provide access to the open ocean. *Figure D.08.8*

(2) **Personal Water Craft –** Personal water craft (PWC) include a number of different designs for one or more persons. Generally there are stand up models and ride on models. Some craft marketed as PWC closely resemble small sport boats. Most PWC have water jet propulsion. No leeway drift experiments have yet been performed on PWC and they do not appear within the above tables. Leeway category choice should be based on number of passengers/loading of PWC and on its size (draft, length, freeboard). These factors may be comparable (not exactly) to several other leeway search objects. *Figure D.08.9*

(3) **Sport Boat –** Sport boats include pleasure craft from 4,5 to 8,5 metres (15 to 28 feet) long with beam widths from roughly 2 to 3 metres (6 to 9 feet). They include metal, fibreglass, and wood vessels, with a V, modified V, or deep-V hull form. They can be outfitted with inboard, outboard, or I/O propulsion. This category includes side console (closed bow and bow riders) and cuddy cabin boats. *Figure D.08.10*

(4) **Sport Fisher –** Sport fishers include pleasure and commercial craft from 5 metres (17 feet) to approximately 30 metres (100 feet) long with beam widths up to 7,3 metres (24 feet). The majority are between 9 to 15 metres (30 to 50 feet), with beam widths between 3 to 4,5 metres (10 to 15 feet). This class includes both semi displacement and planning hull forms that can be outfitted with inboard, outboard, or I/O propulsion. This category includes boats with simple centre console or walk round cabin. Convertibles are sport fishers with a walk around cabin and flying bridge. Convertibles designed for offshore fishing may also have a spotting tower. Many convertibles provide extended cruising capabilities similar to sport cruisers, but their after deck design provides a larger open area to work fishing gear. Some of these vessels can also be found in the cruiser or motor yacht categories. *Figure D.08.11*

(5) **Commercial Fishing Vessel –** Commercial fishing vessels include vessels from 14 to 30 metres (45 to 100 feet) long designed for fishing or shell fishing in coastal and ocean waters. They include side and stern trawling rigs, long liners, bottom dragging rigs, and purse seiners. Pole fishers are simply modified use of a sport fisher or sport cruiser and should be treated as such. Commercial fishers can be working alone, as paired vessels, or can be the mother ship to a group of smaller fishing skiffs. These vessels have different design features based on their purpose, but all have some form of deckhouse and an open area from which nets can lines are worked. A deck winch and boom system is commonly used to handle nets or lines. *Figure D.08.12*

(continued on next page)

Appendix D Search Planning Tables and Graphs

D.08 – Leeway Tables and Taxonomy *(continued from previous page)*

(6) **Coastal Freighter –** Coastal freighters include a wide range of commercial shipping platforms up to 30 metres (100 feet) in length. These vessels transfer cargo from one port to another, and shipping agents can provide estimated voyage schedules. Coastal freighters include vessels with a deckhouse on the forecastle, amidships deckhouse (common to cargo vessels), and an aft deckhouse (common to tankers and container ships). Leeway of these vessels will not only vary with respect to deckhouse location; it will also be greatly affected by loading, amount, and type of cargo. *Figure D.08.13*

(f) **Boating Debris –** Boating debris include any debris that can be expected from a boat that is sinking and/or breaking up. It may include paper or plastic containers, bedding or clothing, and a variety of fragmented boat sections.

(1) **Fishing debris –** Fishing debris are debris typical to a fishing vessel such as lifejacket, life ring, fishing float balls, a fishing box lid, or wooden boards.

(2) **Bait/wharf box –** This is a commercially available 1.1 x 1.5 meter plastic box used by commercial fisherman for holding ice and/or fish. Although not its intended use, it could also serve as a floatation/life raft by persons in distress.

a. **Lightly loaded –** Approximately 90 kg (200 lbs) (simulation of one person)

b. **Fully loaded –** Approximately 360 kg (800 lbs) (simulation of four persons)

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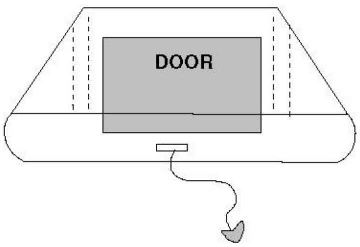
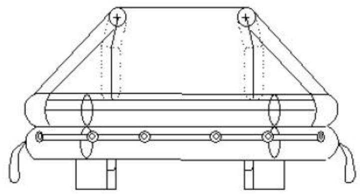
Appendix D Search Planning Tables and Graphs

D.8 – Leeway Tables and Taxonomy *(continued from previous page)*

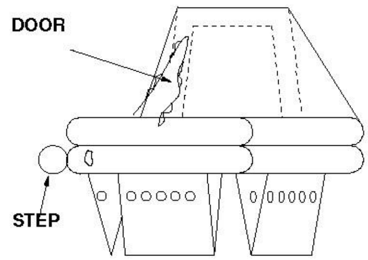
D.8.4 MARITIME SURVIVAL CRAFT



No Ballast Life Raft



Shallow Pocket Ballast



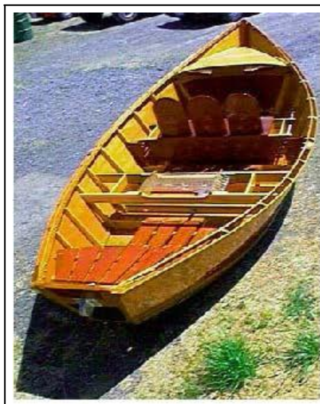
Deep Pocket Ballast

Fibreglass rigid hull life capsule w/ drogue

Life Capsule

Fibreglass rigid hull life capsule

D.8.5 PERSON POWERED CRAFT



Row Boat

Sea Kayak

Canoe

Surf Board

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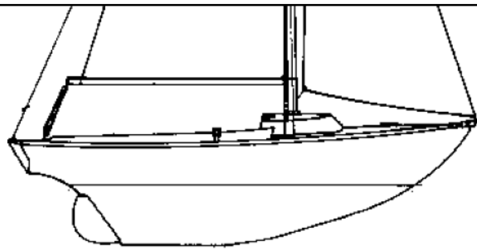
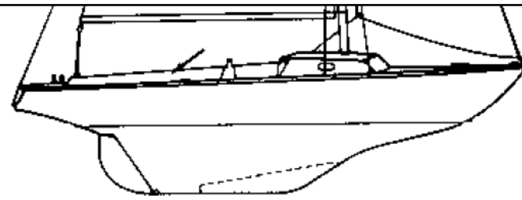
Appendix D Search Planning Tables and Graphs

D.8 – Leeway Tables and Taxonomy *(continued from previous page)*

D.8.6 FULL KEEL ONE-DESIGN SAILBOATS

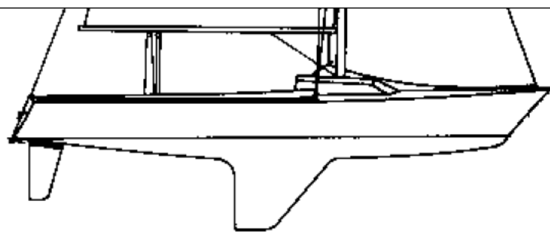


Open Cockpit

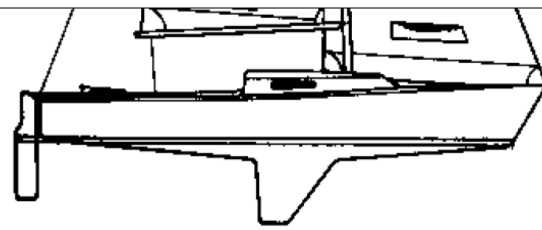


Cabin

D.8.7 FIN KEEL ONE-DESIGN SAILBOATS



Open Cockpit



Cabin

D.8.8 SKIFFS

Flat Bottom Skiff

V-Hull Skiff

(continued on next page)

Appendix D Search Planning Tables and Graphs

D.8 – Leeway Tables and Taxonomy *(continued from previous page)*

D.8.9 PERSONAL WATER CRAFT

D.8.10 SPORTS BOATS

Bow Rider

Closed Bow

Cuddy Cabin

High Performance

D.8.11 SPORT FISHERS

Center Console

Walk Around Cuddy

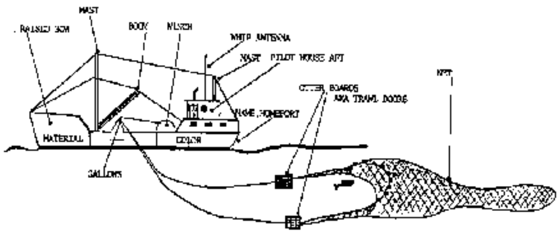
Convertible

(continued on next page)

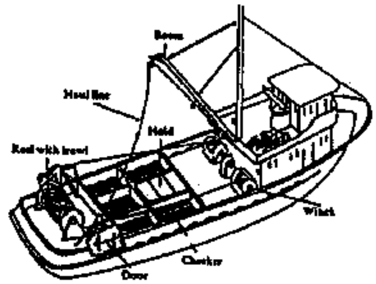
Appendix D Search Planning Tables and Graphs

D.8 – Leeway Tables and Taxonomy *(continued from previous page)*

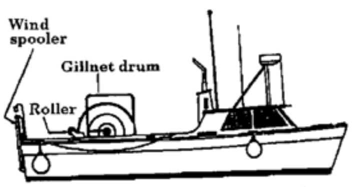
D.8.12 COMMERCIAL FISHERS



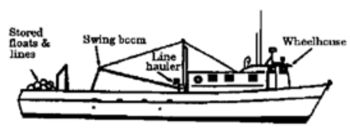
Side Trawler



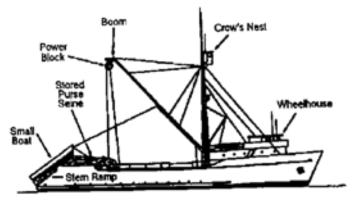
Stern Trawler



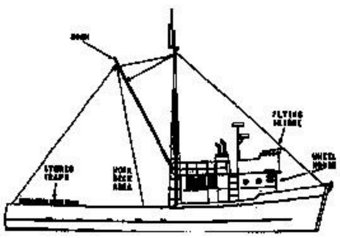
Gillnetter



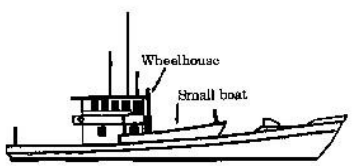
Longliner



Purse Seiner



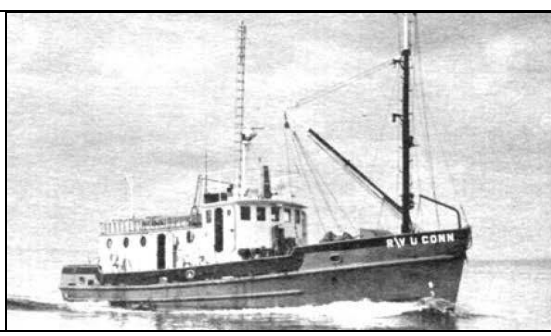
Trap Boat



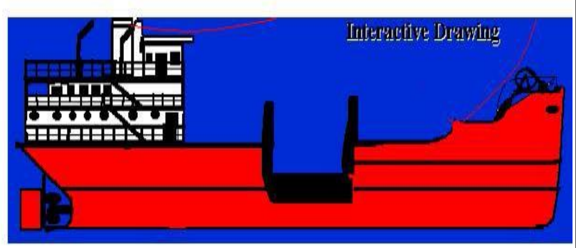
Sampan

Lobster Boat

D.8.13 COASTAL FREIGHTERS



Coastal Freighter with Mid Deckhouse



Coastal Freighter with Aft Deckhouse

Appendix D Search Planning Tables and Graphs

D.9 – Position Error Tables

Re: *Section 4.07*

NOTE: The search planner should keep in mind that these values are guidelines only, and should alter them should he have information indicating that the accuracy is substantially different from that suggested.

D.09.1	POSITION ERRORS WITH NAVIGATION SYSTEMS
Means of Navigation	Fix Error (Fix_e)
Global Positioning System (GPS)[1]; Differential GPS (DGPS)[1]	0.1 nautical mile (NM)
Satellite navigation (NAVSAT)	0.5 NM
Visual Fix (3 lines)[2]; Loran C ; Radar	1 NM
Celestial Fix (3 lines)[2]	2 NM
Marine Radio Beacon (3 beac on-fix)	4 NM
Inertial Navigation System (INS)	0.5 NM per flight hour without position update
VHF Omni-directional Range (VOR); Tactical Air Navigation (TACAN)	±3° arc and 3 % of distance, or 0.5 NM radius, whichever is greater

[1] Published accuracy of the system is much greater.
[2] Should be evaluated upward according to circumstances.

D.09.2	POSITION ERRORS IF THE MEANS OF NAVIGATION IS UNKNOWN
Type of Aircraft or Vessel	Fix Error (Fix_e)
Ship; Military submarine; Aircraft with more than 2 engines	5 NM
Twin-engine aircraft	10 NM
Boat < 20 metres (65 feet); Submersible; Single engine aircraft	15 NM

D.09.3	DEAD RECKONING ERRORS
Type of Aircraft or Vessel	DR Error (DR_e)
Ship; Military submarine; Aircraft with more than 2 engines	5% of the DR distance
Twin-engine aircraft	10% of the DR distance
Boat < 20 metres (65 feet); Submersible; Single engine aircraft	15% of the DR distance

Appendix D Search Planning Tables and Graphs

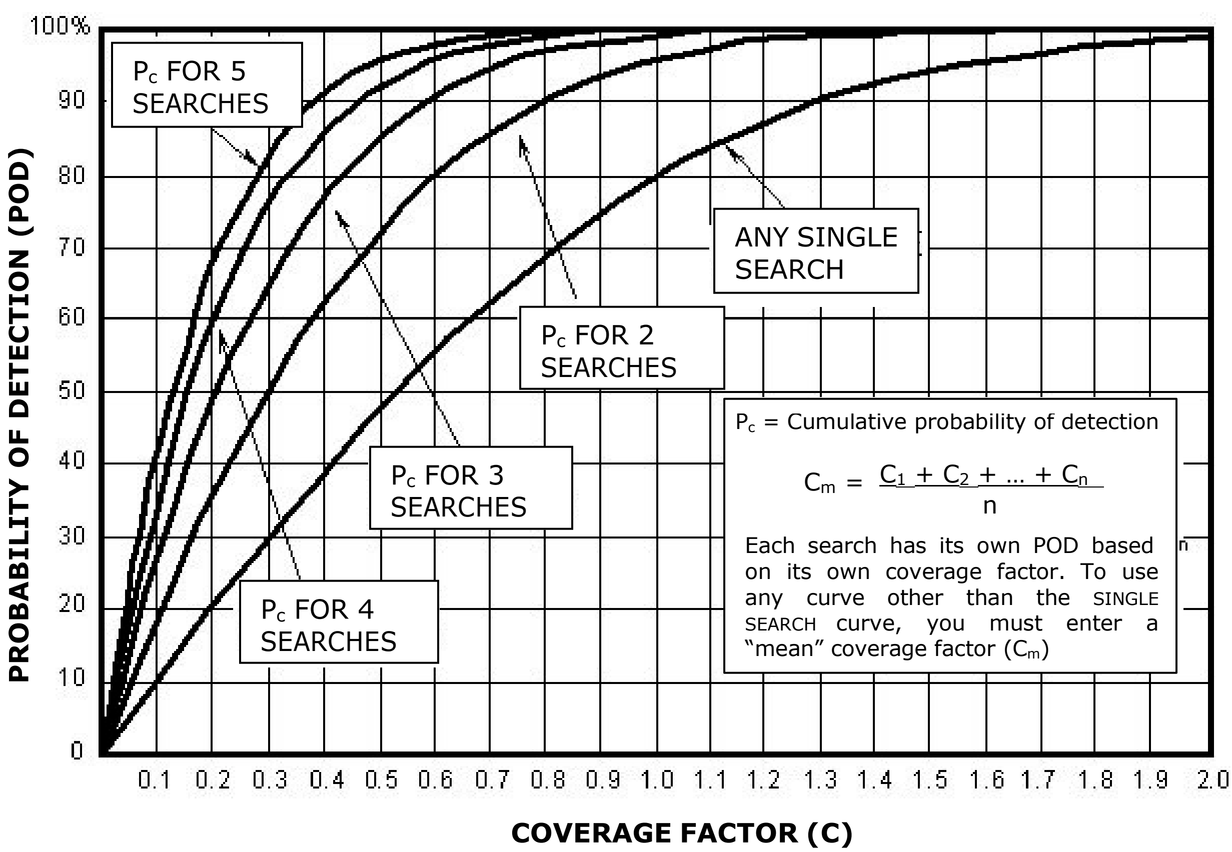
D.10 – Search Area Delineation Table

Re: *Section 4.08*

OPTIMAL SEARCH FACTORS AND SEARCH RADII		
Search	f_s	R
1st	1.1	1.1 E
2nd	1.6	1.6 E
3rd	2.0	2.0 E
4th	2.3	2.3 E
5th	2.5	2.5 E

D.11 – Probability of Detection Graph

Re: *Section 4.08*



Appendix E Sweep Width Computation

E.1 – Uncorrected Visual Sweep Width (W_u) Tables

Re: *Sections 4.08* and *5.01*

NOTES:

1. The following tables give values for ***visual searches over water***. Some of these values are too small to be flown or sailed but provide the search planner with an indication of search effectiveness and a guide for deciding how long to continue the search effort.
2. Interpolation is to be used within these tables as needed.
3. When vessel length is larger than the largest "power boat" or "sail boat", interpolate between the largest "power boat" or "sail boat" line and the smallest "ship" line.
4. When searching for small objects, high search altitudes for aircraft search units yield little to no improvement in sweep width while actually making it more difficult for aircraft scanners to visually identify the search object. For normal search operations, giving consideration to on scene weather and aircraft separation needs, search altitudes should be restricted to no higher than 300 metres (1000 feet) for small objects. For the purposes of using the following tables, entries for small objects are shaded in the tables for higher search altitudes for combinations of search object and altitude that should be avoided. Small objects include:
    a. persons in the water (PIW)
    b. rafts ≤ 6 person
    c. power boats < 4,5 metres (< 15 feet)
    d. sailboats < 4,5 metres (< 15 feet)
5. For search altitudes up to 150 metres (500 feet) only, the values given for sweep width for a person in water may be increased by a factor of four (4) if it is known that the person is wearing a personal floatation device.
6. Visual searches are seldom conducted from altitudes above 900 metres (3000 feet); however, for altitudes up to 1500 metres (5000 feet) where visibility exceeds 3 nautical miles (NM) and the size of the search object exceeds 7,5 metres (25 feet), the sweep widths given for 900 metres (3000 feet) remain applicable.
7. A sailboat is only a sailboat if the sails are up. If the sails are down, the craft should be classed as a powerboat.

NOTE: The sweep widths tables for ***visual searches over land*** are available in the *IAMSAR Manual, Volume II, Appendix N, Tables N-9 to N-11.*

(continued on next page)

Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.1	FIXED-WING AIRCRAFT – Altitude 100 metres (300 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water [1]	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Raft 1 person	0.3	0.7	0.9	1.2	1.3	1.3	1.3
Raft 4 persons	0.4	0.9	1.3	1.7	2.0	2.2	2.2
Raft 6 persons	0.4	1.1	1.5	2.1	2.5	2.7	2.7
Raft 8 persons	0.4	1.2	1.6	2.3	2.6	2.9	2.9
Raft 10 persons	0.4	1.2	1.7	2.4	2.9	3.2	3.2
Raft 15 persons	0.5	1.3	1.9	2.7	3.2	3.5	4.0
Raft 20 persons	0.5	1.4	2.1	3.1	3.7	4.2	4.8
Raft 25 persons	0.5	1.5	2.2	3.4	4.1	4.6	5.2
Power boat < 4,5 (< 15)	0.4	0.8	1.1	1.4	1.6	1.7	1.7
Power boat 4,5 to 7,5 (15 to 25)	0.5	1.6	2.4	3.5	4.3	4.8	4.8
Power boat 7,5 to 12 (25 to 40)	0.6	2.1	3.3	5.3	6.6	7.6	9.1
Power boat 12 to 20 (40 to 65)	0.6	2.6	4.5	8.1	10.9	13.1	16.4
Power boat 20 to 28 (65 to 90)	0.6	2.8	5.0	9.7	13.5	16.6	21.6
Sailboat 4,5 (15)	0.5	1.5	2.2	3.2	3.8	4.3	4.3
Sailboat 6,0 (20)	0.6	1.8	2.6	4.0	4.9	5.6	5.6
Sailboat 7,5 (25)	0.6	2.0	3.1	4.8	6.0	6.9	6.9
Sailboat 9,0 (30)	0.6	2.3	3.6	5.9	7.5	8.8	10.6
Sailboat 12,0 (40)	0.6	2.6	4.3	7.5	10.0	11.9	14.8
Sailboat 15,0 (50)	0.6	2.7	4.6	8.4	11.3	13.6	17.3
Sailboat 19,5 to 23,0 (65 to 75) [2]	0.6	2.8	4.9	9.3	12.7	15.5	20.0
Sailboat 23,0 to 28,0 (75 to 90) [2]	0.6	2.8	5.1	9.9	13.7	16.9	22.1
Ship 28,0 to 45,0 (90 to 150)	0.6	2.9	5.4	11.1	15.9	20.0	26.9
Ship 45,0 to 90,0 (150 to 300)	0.6	3.0	5.7	12.5	18.8	24.7	34.8
Ship > 90,0 (> 300)	0.7	3.0	5.8	13.2	20.6	27.9	41.4

[1] For search altitudes up to 150 metres (500 feet) only, the values given for sweep width for a person in water may be increased by a factor of four (4) if it is known that the person is wearing a personal floatation device.

(continued on next page)

Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.2	FIXED-WING AIRCRAFT – Altitude 150 metres (500 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water [1]	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.4	0.4	0.4	0.4	0.4	0.4
Raft 1 person	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 persons	0.4	1.0	1.3	1.8	2.0	2.2	2.2
Raft 6 persons	0.4	1.1	1.5	2.2	2.5	2.8	2.8
Raft 8 persons	0.4	1.2	1.6	2.3	2.7	2.9	2.9
Raft 10 persons	0.4	1.2	1.7	2.5	2.9	3.2	3.2
Raft 15 persons	0.5	1.3	1.9	2.7	3.3	3.6	4.0
Raft 20 persons	0.5	1.5	2.1	3.2	3.8	4.2	4.8
Raft 25 persons	0.5	1.6	2.3	3.4	4.1	4.6	5.3
Power boat < 4,5 (< 15)	0.4	0.9	1.2	1.5	1.7	1.8	1.8
Power boat 4,5 to 7,5 (15 to 25)	0.5	1.7	2.4	3.6	4.3	4.8	4.8
Power boat 7,5 to 12 (25 to 40)	0.6	2.1	3.3	5.3	6.7	7.7	9.1
Power boat 12 to 20 (40 to 65)	0.6	2.7	4.5	8.1	10.9	13.1	16.5
Power boat 20 to 28 (65 to 90)	0.6	2.8	5.0	9.8	13.5	16.7	21.7
Sailboat 4,5 (15)	0.5	1.6	2.2	3.2	3.9	4.3	4.3
Sailboat 6,0 (20)	0.6	1.8	2.7	4.1	5.0	5.6	5.6
Sailboat 7,5 (25)	0.6	2.0	3.1	4.9	6.1	7.0	7.0
Sailboat 9,0 (30)	0.6	2.3	3.6	5.9	7.6	8.8	10.6
Sailboat 12,0 (40)	0.6	2.6	4.3	7.6	10.0	11.9	14.8
Sailboat 15,0 (50)	0.6	2.7	4.6	8.4	11.3	13.7	17.3
Sailboat 19,5 to 23,0 (65 to 75) [2]	0.6	2.8	4.9	9.3	12.7	15.5	20.0
Sailboat 23,0 to 28,0 (75 to 90) [2]	0.6	2.8	5.1	9.9	13.7	17.0	22.1
Ship 28,0 to 45,0 (90 to 150)	0.6	2.9	5.4	11.1	15.9	20.1	26.9
Ship 45,0 to 90,0 (150 to 300)	0.6	3.0	5.7	12.5	18.9	24.7	34.8
Ship > 90,0 (> 300)	0.7	3.0	5.8	13.2	20.6	27.9	41.4

[1] For search altitudes up to 150 metres (500 feet) only, the values given for sweep width for a person in water may be increased by a factor of four (4) if it is known that the person is wearing a personal floatation device.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.3	FIXED-WING AIRCRAFT – Altitude 230 metres (750 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 persons	0.4	1.0	1.3	1.8	2.1	2.2	2.2
Raft 6 persons	0.4	1.1	1.6	2.2	2.6	2.8	2.8
Raft 8 persons	0.4	1.2	1.7	2.3	2.7	3.0	3.0
Raft 10 persons	0.4	1.3	1.8	2.5	3.0	3.3	3.3
Raft 15 persons	0.4	1.4	1.9	2.8	3.3	3.7	4.1
Raft 20 persons	0.5	1.5	2.2	3.2	3.8	4.3	4.9
Raft 25 persons	0.5	1.6	2.3	3.5	4.2	4.7	5.4
Power boat < 4,5 (< 15)	0.4	0.9	1.2	1.6	1.8	1.9	1.9
Power boat 4,5 to 7,5 (15 to 25)	0.5	1.7	2.4	3.6	4.4	4.9	4.9
Power boat 7,5 to 12 (25 to 40)	0.6	2.1	3.3	5.3	6.7	7.7	9.2
Power boat 12 to 20 (40 to 65)	0.6	2.7	4.5	8.2	10.9	13.1	16.5
Power boat 20 to 28 (65 to 90)	0.6	2.8	5.0	9.8	13.5	16.7	21.7
Sailboat 4,5 (15)	0.5	1.6	2.3	3.3	3.9	4.4	4.4
Sailboat 6,0 (20)	0.5	1.8	2.7	4.1	5.0	5.7	5.7
Sailboat 7,5 (25)	0.6	2.1	3.1	5.0	6.2	7.0	7.0
Sailboat 9,0 (30)	0.6	2.3	3.6	6.0	7.6	8.9	10.7
Sailboat 12,0 (40)	0.6	2.6	4.3	7.6	10.0	11.9	14.9
Sailboat 15,0 (50)	0.6	2.7	4.6	8.5	11.4	13.7	17.4
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.6	2.8	4.9	9.3	12.7	15.6	20.0
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.6	2.8	5.1	9.9	13.8	17.0	22.2
Ship 28,0 to 45,0 (90 to 150)	0.6	2.9	5.4	11.1	15.9	20.1	27.0
Ship 45,0 to 90,0 (150 to 300)	0.6	3.0	5.7	12.5	18.9	24.7	34.9
Ship > 90,0 (> 300)	0.7	3.0	5.8	13.2	20.6	27.9	41.4

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.4	**FIXED-WING AIRCRAFT – Altitude 300 metres (1000 feet)**						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 persons	0.3	1.0	1.3	1.8	2.1	2.3	2.3
Raft 6 persons	0.4	1.1	1.6	2.2	2.6	2.8	2.8
Raft 8 persons	0.4	1.2	1.7	2.4	2.8	3.0	3.0
Raft 10 persons	0.4	1.3	1.8	2.6	3.0	3.3	3.3
Raft 15 persons	0.4	1.4	2.0	2.8	3.4	3.7	4.2
Raft 20 persons	0.4	1.5	2.2	3.2	3.9	4.3	4.9
Raft 25 persons	0.4	1.6	2.3	3.5	4.2	4.7	5.4
Power boat < 4,5 (< 15)	0.4	1.0	1.3	1.7	1.8	2.0	2.0
Power boat 4,5 to 7,5 (15 to 25)	0.5	1.7	2.5	3.7	4.4	5.0	5.0
Power boat 7,5 to 12 (25 to 40)	0.5	2.2	3.4	5.4	6.8	7.8	9.3
Power boat 12 to 20 (40 to 65)	0.6	2.7	4.5	8.2	10.9	13.1	16.6
Power boat 20 to 28 (65 to 90)	0.6	2.8	5.1	9.8	13.6	16.7	21.7
Sailboat 4,5 (15)	0.5	1.6	2.3	3.3	4.0	4.4	4.4
Sailboat 6,0 (20)	0.5	1.8	2.7	4.2	5.1	5.7	5.7
Sailboat 7,5 (25)	0.5	2.1	3.2	5.0	6.2	7.1	7.1
Sailboat 9,0 (30)	0.6	2.3	3.6	6.0	7.6	8.9	10.7
Sailboat 12,0 (40)	0.6	2.6	4.3	7.6	10.9	12.0	14.9
Sailboat 15,0 (50)	0.6	2.7	4.6	8.5	11.4	13.7	17.4
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.6	2.8	4.9	9.3	12.8	15.6	20.1
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.6	2.8	5.1	9.9	13.8	17.0	22.2
Ship 28,0 to 45,0 (90 to 150)	0.6	2.9	5.4	11.1	15.9	20.1	27.0
Ship 45,0 to 90,0 (150 to 300)	0.6	3.0	5.7	12.5	18.9	24.7	34.9
Ship > 90,0 (> 300)	0.6	3.0	5.8	13.2	20.6	27.9	41.4

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.5	FIXED-WING AIRCRAFT – Altitude 450 metres (1500 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.1	0.1
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Raft 1 person	0.2	0.7	0.9	1.3	1.4	1.4	1.4
Raft 4 persons	0.3	1.0	1.3	1.9	2.1	2.3	2.3
Raft 6 persons	0.3	1.1	1.6	2.3	2.6	2.9	2.9
Raft 8 persons	0.3	1.2	1.7	2.4	2.8	3.1	3.1
Raft 10 persons	0.3	1.3	1.8	2.6	3.1	3.4	3.4
Raft 15 persons	0.3	1.4	2.0	2.9	3.4	3.8	4.3
Raft 20 persons	0.4	1.5	2.2	3.3	4.0	4.4	5.1
Raft 25 persons	0.4	1.6	2.4	3.6	4.3	4.8	5.6
Power boat < 4,5 (< 15)	0.3	1.0	1.3	1.7	2.0	2.1	2.1
Power boat 4,5 to 7,5 (15 to 25)	0.4	1.7	2.5	3.7	4.5	5.1	5.1
Power boat 7,5 to 12 (25 to 40)	0.5	2.2	3.4	5.5	6.8	7.9	9.4
Power boat 12 to 20 (40 to 65)	0.5	2.6	4.5	8.2	11.0	13.2	16.6
Power boat 20 to 28 (65 to 90)	0.5	2.8	5.1	9.8	13.6	16.7	21.8
Sailboat 4,5 (15)	0.4	1.6	2.3	3.4	4.1	4.5	4.5
Sailboat 6,0 (20)	0.4	1.8	2.8	4.2	5.2	5.8	5.8
Sailboat 7,5 (25)	0.5	2.1	3.2	5.1	6.3	7.2	7.2
Sailboat 9,0 (30)	0.5	2.3	3.7	6.1	7.7	9.0	10.8
Sailboat 12,0 (40)	0.5	2.6	4.3	7.6	10.1	12.0	14.9
Sailboat 15,0 (50)	0.5	2.7	4.6	8.5	11.4	13.8	17.5
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.5	2.8	4.9	9.4	12.8	15.7	20.2
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.5	2.8	5.1	10.0	13.8	17.1	22.3
Ship 28,0 to 45,0 (90 to 150)	0.5	2.9	5.4	11.1	16.0	20.1	27.0
Ship 45,0 to 90,0 (150 to 300)	0.5	3.0	5.7	12.5	18.9	24.7	34.9
Ship > 90,0 (> 300)	0.6	3.0	5.8	13.2	20.7	27.9	41.4

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.6	FIXED-WING AIRCRAFT – Altitude 600 metres (2000 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.0	0.1
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Raft 1 person	0.1	0.6	0.9	1.2	1.4	1.4	1.4
Raft 4 persons	0.2	0.9	1.3	1.9	2.2	2.3	2.3
Raft 6 persons	0.2	1.1	1.6	2.3	2.7	2.9	2.9
Raft 8 persons	0.2	1.2	1.7	2.5	2.9	3.2	3.2
Raft 10 persons	0.2	12	1.8	2.7	3.1	3.5	3.5
Raft 15 persons	0.2	1.4	2.0	3.0	3.5	3.9	4.4
Raft 20 persons	0.3	1.5	2.2	3.4	4.0	4.5	5.1
Raft 25 persons	0.3	1.6	2.4	3.6	4.4	4.9	5.7
Power boat < 4,5 (< 15)	0.2	1.0	1.3	1.8	2.0	2.2	2.2
Power boat 4,5 to 7,5 (15 to 25)	0.3	1.7	2.5	3.8	4.6	5.1	5.1
Power boat 7,5 to 12 (25 to 40)	0.3	2.2	3.4	5.5	6.9	8.0	9.5
Power boat 12 to 20 (40 to 65)	0.4	2.6	4.5	8.3	11.0	13.3	16.7
Power boat 20 to 28 (65 to 90)	0.4	2.8	5.0	9.8	13.6	16.8	21.8
Sailboat 4,5 (15)	0.3	1.6	2.3	3.5	4.1	4.6	4.6
Sailboat 6,0 (20)	0.3	1.8	2.8	4.3	5.2	5.9	5.9
Sailboat 7,5 (25)	0.3	2.1	3.3	5.2	6.4	7.3	7.3
Sailboat 9,0 (30)	0.3	2.3	3.7	6.1	7.8	9.1	10.9
Sailboat 12,0 (40)	0.4	2.5	4.3	7.7	10.1	12.1	15.0
Sailboat 15,0 (50)	0.4	2.7	4.6	8.6	11.5	13.9	17.5
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.4	2.7	4.9	9.4	12.9	15.7	20.2
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.4	2.8	5.1	10.0	13.9	17.1	22.3
Ship 28,0 to 45,0 (90 to 150)	0.4	2.9	5.4	11.1	16.0	20.1	27.1
Ship 45,0 to 90,0 (150 to 300)	0.4	2.9	5.7	12.5	18.9	24.7	34.9
Ship > 90,0 (> 300)	0.5	3.0	5.8	13.2	20.7	27.9	41.5

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.7	FIXED-WING AIRCRAFT – Altitude 750 metres (2500 feet)[1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.5	0.8	1.2	1.4	1.4	1.4
Raft 4 persons	0.1	0.8	1.3	1.8	2.2	2.4	2.4
Raft 6 persons	0.1	1.0	1.5	2.3	2.7	2.9	2.9
Raft 8 persons	0.1	1.1	1.7	2.5	2.9	3.2	3.2
Raft 10 persons	0.2	1.2	1.8	2.7	3.2	3.5	3.5
Raft 15 persons	0.2	1.3	2.0	3.0	3.6	4.0	4.5
Raft 20 persons	0.2	1.4	2.2	3.4	4.1	4.6	5.2
Raft 25 persons	0.2	1.5	2.4	3.7	4.5	5.0	5.7
Power boat < 4,5 (< 15)	0.1	0.9	1.3	1.8	2.1	2.2	2.2
Power boat 4,5 to 7,5 (15 to 25)	0.2	1.6	2.5	3.8	4.6	5.2	5.2
Power boat 7,5 to 12 (25 to 40)	0.2	2.1	3.4	5.6	7.0	8.1	9.6
Power boat 12 to 20 (40 to 65)	0.3	2.6	4.5	8.3	11.3	13.3	16.7
Power boat 20 to 28 (65 to 90)	0.3	2.7	5.0	9.8	13.6	16.8	21.9
Sailboat 4,5 (15)	0.2	1.5	2.3	3.5	4.2	4.7	4.7
Sailboat 6,0 (20)	0.2	1.8	2.8	4.3	5.3	6.0	6.0
Sailboat 7,5 (25)	0.2	2.1	3.3	5.2	6.5	7.5	7.5
Sailboat 9,0 (30)	0.2	2.2	3.7	6.1	7.8	9.1	11.0
Sailboat 12,0 (40)	0.3	2.5	4.3	7.7	10.2	12.1	15.1
Sailboat 15,0 (50)	0.3	2.6	4.6	8.6	11.5	13.9	17.6
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.3	2.7	4.9	9.4	12.9	15.8	20.3
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.3	2.8	5.1	10.0	13.9	17.2	22.4
Ship 28,0 to 45,0 (90 to 150)	0.3	2.8	5.4	11.1	16.0	20.2	27.1
Ship 45,0 to 90,0 (150 to 300)	0.3	2.9	5.6	12.5	18.9	24.8	35.0
Ship > 90,0 (> 300)	0.3	2.9	5.7	13.2	20.7	27.9	41.5

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.8	FIXED-WING AIRCRAFT – Altitude 900 metres (3000 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.5	0.8	1.1	1.3	1.3	1.3
Raft 4 persons	0.1	0.7	1.2	1.8	2.1	2.3	2.3
Raft 6 persons	0.1	0.9	1.5	2.2	2.7	2.9	2.9
Raft 8 persons	0.1	1.0	1.6	2.5	2.9	3.2	3.2
Raft 10 persons	0.1	1.1	1.8	2.7	3.2	3.5	3.5
Raft 15 persons	0.1	1.2	2.0	3.0	3.6	4.0	4.5
Raft 20 persons	0.1	1.4	2.2	3.4	4.1	4.6	5.3
Raft 25 persons	0.1	1.5	2.4	3.7	4.5	5.1	5.8
Power boat < 4,5 (< 15)	0.1	0.8	1.3	1.8	2.1	2.3	2.3
Power boat 4,5 to 7,5 (15 to 25)	0.1	1.6	2.5	3.9	4.7	5.3	5.3
Power boat 7,5 to 12 (25 to 40)	0.2	2.1	3.4	5.6	7.1	8.1	9.7
Power boat 12 to 20 (40 to 65)	0.2	2.5	4.5	8.3	11.1	13.4	16.8
Power boat 20 to 28 (65 to 90)	0.2	2.7	5.0	9.9	13.7	16.8	21.9
Sailboat 4,5 (15)	0.1	1.5	2.3	3.5	4.3	4.7	4.7
Sailboat 6,0 (20)	0.1	1.7	2.8	4.4	5.3	6.0	6.0
Sailboat 7,5 (25)	0.2	2.0	3.3	5.3	6.6	7.5	7.5
Sailboat 9,0 (30)	0.2	2.2	3.7	6.2	7.9	9.2	11.1
Sailboat 12,0 (40)	0.2	2.4	4.3	7.7	10.2	12.1	15.1
Sailboat 15,0 (50)	0.2	2.6	4.6	8.6	11.6	14.0	17.7
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.2	2.6	4.9	9.4	13.0	15.8	20.3
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.2	2.7	5.1	10.0	14.0	17.2	22.5
Ship 28,0 to 45,0 (90 to 150)	0.2	2.8	5.3	11.1	16.0	20.2	27.1
Ship 45,0 to 90,0 (150 to 300)	0.2	2.8	5.6	12.5	18.9	24.8	35.0
Ship > 90,0 (> 300)	0.2	2.9	5.7	13.2	20.7	27.9	41.5

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

NOTE: Where visibility exceeds 3 NM and the size of the search object exceeds 7,5 metres (25 feet), these sweep widths remain applicable for altitudes up to 1500 metres (5000 feet).

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.9	HELICOPTERS – Altitude 100 metres (300 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM 1	3	5	10	15	20	30
Person in water [1]	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Raft 1 person	0.4	0.9	1.2	1.5	1.7	1.7	1.7
Raft 4 persons	0.5	1.2	1.6	2.2	2.5	2.7	2.7
Raft 6 persons	0.5	1.4	1.9	2.7	3.1	3.4	3.4
Raft 8 persons	0.6	1.4	2.0	2.8	3.3	3.6	3.6
Raft 10 persons	0.6	1.5	2.1	3.0	3.6	3.9	3.9
Raft 15 persons	0.6	1.6	2.3	3.3	3.9	4.3	4.9
Raft 20 persons	0.6	1.8	2.6	3.8	4.5	5.1	5.8
Raft 25 persons	0.6	1.9	2.7	4.1	4.9	5.5	6.3
Power boat < 4,5 (< 15)	0.5	1.1	1.4	1.9	2.1	2.2	2.2
Power boat 4,5 to 7,5 (15 to 25)	0.7	2.0	2.9	4.3	5.2	5.8	5.8
Power boat 7,5 to 12 (25 to 40)	0.8	2.5	3.8	6.1	7.7	8.9	10.6
Power boat 12 to 20 (40 to 65)	0.8	3.1	5.1	9.2	12.2	14.7	18.5
Power boat 20 to 28 (65 to 90)	0.8	3.3	5.7	10.8	15.0	18.4	23.9
Sailboat 4,5 (15)	0.7	1.9	2.7	3.9	4.6	5.2	5.2
Sailboat 6,0 (20)	0.7	2.2	3.2	4.8	5.9	6.6	6.6
Sailboat 7,5 (25)	0.8	2.4	3.6	5.7	7.1	8.1	8.1
Sailboat 9,0 (30)	0.8	2.7	4.2	6.8	8.7	10.1	12.2
Sailboat 12,0 (40)	0.8	3.0	4.9	8.6	11.3	13.4	16.7
Sailboat 15,0 (50)	0.8	3.1	5.2	9.5	12.7	15.3	19.3
Sailboat 19,5 to 23,0 (65 to 75) [2]	0.8	3.2	5.5	10.3	14.1	17.2	22.1
Sailboat 23,0 to 28,0 (75 to 90) [2]	0.8	3.3	5.7	11.0	15.2	18.7	24.3
Ship 28,0 to 45,0 (90 to 150)	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 45,0 to 90,0 (150 to 300)	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship > 90,0 (> 300)	0.8	3.5	6.4	14.3	22.1	29.8	43.8

[1] For search altitudes up to 150 metres (500 feet) only, the values given for sweep width for a person in water may be increased by a factor of four (4) if it is known that the person is wearing a personal floatation device.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.10	HELICOPTERS – Altitude 150 metres (500 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water [1]	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.4	0.4	0.4	0.4	0.4	0.4
Raft 1 person	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 persons	0.5	1.2	1.6	2.2	2.6	2.8	2.8
Raft 6 persons	0.5	1.4	1.9	2.7	3.2	3.5	3.5
Raft 8 persons	0.6	1.5	2.0	2.8	3.3	3.7	3.7
Raft 10 persons	0.6	1.6	2.2	3.1	3.6	4.0	4.0
Raft 15 persons	0.6	1.7	2.3	3.3	4.0	4.4	5.0
Raft 20 persons	0.6	1.8	2.6	3.8	4.6	5.1	5.9
Raft 25 persons	0.6	1.9	2.7	4.1	5.0	5.6	6.4
Power boat < 4,5 (< 15)	0.5	1.2	1.5	1.9	2.2	2.3	2.3
Power boat 4,5 to 7,5 (15 to 25)	0.7	2.0	2.9	4.3	5.2	5.8	5.8
Power boat 7,5 to 12 (25 to 40)	0.8	2.5	3.9	6.2	7.8	9.0	10.7
Power boat 12 to 20 (40 to 65)	0.8	3.1	5.1	9.2	12.3	14.7	18.5
Power boat 20 to 28 (65 to 90)	0.8	3.3	5.7	10.8	15.0	18.4	23.9
Sailboat 4,5 (15)	0.7	1.9	2.7	3.9	4.7	5.2	5.2
Sailboat 6,0 (20)	0.7	2.2	3.2	4.8	5.9	6.7	6.7
Sailboat 7,5 (25)	0.8	2.4	3.7	5.7	7.1	8.2	8.2
Sailboat 9,0 (30)	0.8	2.7	4.2	6.9	8.7	10.2	12.3
Sailboat 12,0 (40)	0.8	3.0	4.9	8.6	11.3	13.5	16.8
Sailboat 15,0 (50)	0.8	3.1	5.2	9.5	12.7	15.3	19.4
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.8	3.2	5.5	10.4	14.1	17.3	22.2
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.8	3.3	5.7	11.0	15.2	18.7	24.4
Ship 28,0 to 45,0 (90 to 150)	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 45,0 to 90,0 (150 to 300)	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship > 90,0 (> 300)	0.8	3.5	6.4	14.3	22.1	29.8	43.8

[1] For search altitudes up to 150 metres (500 feet) only, the values given for sweep width for a person in water may be increased by a factor of four (4) if it is known that the person is wearing a personal floatation device.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.11	HELICOPTERS – Altitude 230 metres (750 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 persons	0.5	1.2	1.7	2.3	2.6	2.8	2.8
Raft 6 persons	0.5	1.4	2.0	2.7	3.2	3.5	3.5
Raft 8 persons	0.5	1.5	2.1	2.9	3.4	3.7	3.7
Raft 10 persons	0.6	1.6	2.2	3.1	3.7	4.0	4.0
Raft 15 persons	0.6	1.7	2.4	3.4	4.0	4.5	5.0
Raft 20 persons	0.6	1.8	2.6	3.9	4.6	5.2	5.9
Raft 25 persons	0.6	1.9	2.8	4.2	5.0	5.6	6.5
Power boat < 4,5 (< 15)	0.5	1.2	1.6	2.0	2.3	2.4	2.4
Power boat 4,5 to 7,5 (15 to 25)	0.7	2.0	2.9	4.4	5.3	5.9	5.9
Power boat 7,5 to 12 (25 to 40)	0.7	2.5	3.9	6.2	7.8	9.0	10.7
Power boat 12 to 20 (40 to 65)	0.8	3.1	5.1	9.2	12.3	14.7	18.5
Power boat 20 to 28 (65 to 90)	0.8	3.3	5.7	10.9	15.0	18.4	23.9
Sailboat 4,5 (15)	0.7	1.9	2.7	4.0	4.8	5.3	5.3
Sailboat 6,0 (20)	0.7	2.2	3.2	4.9	6.0	6.7	6.7
Sailboat 7,5 (25)	0.7	2.5	3.7	5.8	7.2	8.3	8.3
Sailboat 9,0 (30)	0.8	2.7	4.2	6.9	8.8	10.2	12.3
Sailboat 12,0 (40)	0.8	3.0	4.9	8.6	11.3	13.5	16.8
Sailboat 15,0 (50)	0.8	3.1	5.3	9.5	12.7	15.4	19.4
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.8	3.2	5.5	10.4	14.2	17.3	22.2
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.8	3.3	5.7	11.0	15.2	18.8	24.4
Ship 28,0 to 45,0 (90 to 150)	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 45,0 to 90,0 (150 to 300)	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship > 90,0 (> 300)	0.8	3.5	6.4	14.3	22.2	29.8	43.8

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.12	HELICOPTERS – Altitude 300 metres (1000 feet)						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.1	0.1	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 persons	0.5	1.2	1.7	2.3	2.6	2.9	2.9
Raft 6 persons	0.5	1.4	2.0	2.8	3.2	3.5	3.5
Raft 8 persons	0.5	1.5	2.1	2.9	3.4	3.8	3.8
Raft 10 persons	0.5	1.6	2.2	3.2	3.7	4.1	4.1
Raft 15 persons	0.6	1.7	2.4	3.5	4.1	4.5	5.1
Raft 20 persons	0.6	1.8	2.7	3.9	4.7	5.2	6.0
Raft 25 persons	0.6	1.9	2..8	4.2	5.1	5.7	6.5
Power boat < 4,5 (< 15)	0.5	1.2	1.6	2.1	2.3	2.5	2.5
Power boat 4,5 to 7,5 (15 to 25)	0.7	2.1	3.0	4.4	5.3	5.9	5.9
Power boat 7,5 to 12 (25 to 40)	0.7	2.6	3.9	6.3	7.9	9.1	10.8
Power boat 12 to 20 (40 to 65)	0.7	3.1	5.2	9.2	12.3	14.8	18.6
Power boat 20 to 28 (65 to 90)	0.8	3.3	5.7	10.9	15.0	18.5	23.9
Sailboat 4,5 (15)	0.6	1.9	2.8	4.0	4.8	5.4	5.4
Sailboat 6,0 (20)	0.7	2.2	3.2	4.9	6.0	6.8	6.8
Sailboat 7,5 (25)	0.7	2.5	3.7	5.8	7.3	8.3	8.3
Sailboat 9,0 (30)	0.7	2.7	4.2	6.9	8.8	10.3	12.4
Sailboat 12,0 (40)	0.7	3.0	4.9	8.6	11.4	13.5	16.8
Sailboat 15,0 (50)	0.7	3.1	5.3	9.5	12.8	15.4	19.5
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.8	3.2	5.6	10.4	14.2	17.3	22.2
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.8	3.3	5.7	11.0	15.3	18.8	24.4
Ship 28,0 to 45,0 (90 to 150)	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 45,0 to 90,0 (150 to 300)	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship > 90,0 (> 300)	0.8	3.5	6.4	14.3	22.2	29.8	43.9

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.13	HELICOPTERS – Altitude 450 metres (1500 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.1	0.1	0.1	0.1
PIW with PDF/surfboard	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 persons	0.4	1.2	1.7	2.3	2.7	2.9	2.9
Raft 6 persons	0.4	1.4	2.0	2.8	3.3	3.6	3.6
Raft 8 persons	0.4	1.5	2.1	3.0	3.5	3.9	3.9
Raft 10 persons	0.4	1.6	2.2	3.2	3.8	4.2	4.2
Raft 15 persons	0.5	1.7	2.4	3.5	4.2	4.6	5.2
Raft 20 persons	0.5	1.9	2.7	4.0	4.8	5.3	6.1
Raft 25 persons	0.5	2.0	2.9	4.3	5.2	5.8	6.7
Power boat < 4,5 (< 15)	0.4	1.3	1.7	2.2	2.5	2.6	2.6
Power boat 4,5 to 7,5 (15 to 25)	0.6	2.1	3.0	4.5	5.4	6.1	6.1
Power boat 7,5 to 12 (25 to 40)	0.6	2.6	4.0	6.3	7.9	9.2	10.9
Power boat 12 to 20 (40 to 65)	0.7	3.1	5.2	9.3	12.4	14.8	18.6
Power boat 20 to 28 (65 to 90)	0.7	3.2	5.7	10.9	15.1	18.5	24.0
Sailboat 4,5 (15)	0.6	2.0	2.8	4.1	4.9	5.5	5.5
Sailboat 6,0 (20)	0.6	2.2	3.3	5.0	6.1	6.9	6.9
Sailboat 7,5 (25)	0.6	2.5	3.8	5.9	7.4	8.4	8.4
Sailboat 9,0 (30)	0.6	2.7	4.2	7.0	8.9	10.3	12.5
Sailboat 12,0 (40)	0.6	3.0	4.9	8.7	11.4	13.6	16.9
Sailboat 15,0 (50)	0.7	3.1	5.3	9.6	12.8	15.5	19.5
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.7	3.2	5.6	10.4	14.3	17.4	22.3
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.7	3.3	5.7	11.1	15.3	18.8	24.5
Ship 28,0 to 45,0 (90 to 150)	0.7	3.3	6.0	12.2	17.5	22.0	29.4
Ship 45,0 to 90,0 (150 to 300)	0.7	3.4	6.3	13.6	20.4	26.6	37.3
Ship > 90,0 (> 300)	0.7	3.4	6.4	14.3	22.2	29.8	43.9

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

(continued on next page)

Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.14	HELICOPTERS – Altitude 600 metres (2000 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.1	0.1
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Raft 1 person	0.2	0.8	1.2	1.6	1.8	1.8	0.8
Raft 4 persons	0.3	1.2	1.7	2.3	2.7	3.0	3.0
Raft 6 persons	0.3	1.4	2.0	2.8	3.3	3.6	3.6
Raft 8 persons	0.3	1.5	2.1	3.0	3.6	3.9	3.9
Raft 10 persons	0.3	1.6	2.3	3.3	3.9	4.2	4.2
Raft 15 persons	0.3	1.7	2.5	3.6	4.3	4.7	5.3
Raft 20 persons	0.4	1.8	2.7	4.0	4.9	5.4	6.2
Raft 25 persons	0.4	1.9	2.9	4.3	5.3	5.9	6.8
Power boat < 4,5 (< 15)	0.3	1.3	1.7	2.3	2.6	2.7	2.7
Power boat 4,5 to 7,5 (15 to 25)	0.4	2.1	3.0	4.5	5.5	6.1	6.1
Power boat 7,5 to 12 (25 to 40)	0.5	2.6	4.0	6.4	8.0	9.3	11.0
Power boat 12 to 20 (40 to 65)	0.5	3.0	5.2	9.3	12.4	14.9	18.7
Power boat 20 to 28 (65 to 90)	0.5	3.2	5.7	10.9	15.1	18.5	24.0
Sailboat 4,5 (15)	0.4	1.9	2.8	4.2	5.0	5.6	5.6
Sailboat 6,0 (20)	0.5	2.2	3.3	5.1	6.2	7.0	7.0
Sailboat 7,5 (25)	0.5	2.5	3.8	6.0	7.5	8.6	8.6
Sailboat 9,0 (30)	0.5	2.7	4.3	7.0	9.0	10.4	12.6
Sailboat 12,0 (40)	0.5	3.0	4.9	8.7	11.4	13.6	17.0
Sailboat 15,0 (50)	0.5	3.1	5.3	9.6	12.9	15.5	19.6
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.5	3.2	5.6	10.5	14.3	17.4	22.4
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.5	3.2	5.7	11.1	15.4	18.9	24.6
Ship 28,0 to 45,0 (90 to 150)	0.5	3.3	6.0	12.2	17.5	22.0	29.4
Ship 45,0 to 90,0 (150 to 300)	0.5	3.4	6.3	13.6	20.4	26.6	37.4
Ship > 90,0 (> 300)	0.6	3.4	6.4	14.3	22.2	29.8	43.9

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

(continued on next page)

Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.15	HELICOPTERS – Altitude 750 metres (2500 feet) [1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.0	0.1
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Raft 1 person	0.1	0.8	1.1	1.6	1.8	1.8	1.8
Raft 4 persons	0.2	1.1	1.6	2.3	2.7	3.0	3.0
Raft 6 persons	0.2	1.3	1.9	2.8	3.3	3.7	3.7
Raft 8 persons	0.2	1.4	2.1	3.1	3.6	4.0	4.0
Raft 10 persons	0.2	1.5	2.2	3.3	3.9	4.3	4.3
Raft 15 persons	0.2	1.7	2.5	3.6	4.3	4.8	5.4
Raft 20 persons	0.3	1.8	2.7	4.1	4.9	5.5	6.3
Raft 25 persons	0.3	1.9	2.9	4.4	5.3	6.0	6.9
Power boat < 4,5 (< 15)	0.2	1.2	1.7	2.3	2.6	2.8	2.8
Power boat 4,5 to 7,5 (15 to 25)	0.3	2.0	3.0	4.6	5.5	6.2	6.2
Power boat 7,5 to 12 (25 to 40)	0.4	2.5	4.0	6.5	8.1	9.3	11.1
Power boat 12 to 20 (40 to 65)	0.4	3.0	5.2	9.3	12.4	14.9	18.8
Power boat 20 to 28 (65 to 90)	0.4	3.2	5.7	10.9	15.1	18.6	24.1
Sailboat 4,5 (15)	0.3	1.9	2.8	4.2	5.1	5.6	5.6
Sailboat 6,0 (20)	0.3	2.2	3.3	5.1	6.3	7.1	7.1
Sailboat 7,5 (25)	0.4	2.5	3.8	6.1	7.6	8.7	8.7
Sailboat 9,0 (30)	0.4	2.7	4.3	7.1	9.0	10.5	12.6
Sailboat 12,0 (40)	0.4	2.9	4.9	8.7	11.5	13.7	17.0
Sailboat 15,0 (50)	0.4	3.1	5.3	9.6	12.9	15.6	19.7
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.4	3.1	5.6	10.5	14.3	17.5	22.4
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.4	3.2	5.7	11.1	15.4	18.9	24.6
Ship 28,0 to 45,0 (90 to 150)	0.4	3.3	6.0	12.2	17.5	22.0	29.4
Ship 45,0 to 90,0 (150 to 300)	0.4	3.3	6.3	13.6	20.4	26.6	37.4
Ship > 90,0 (> 300)	0.5	3.4	6.4	14.3	22.2	29.8	43.9

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.16	HELICOPTERS – Altitude 900 metres (3000 feet)[1]						
SEARCH OBJECT in metres (feet)	VISIBILITY in NM						
	1	3	5	10	15	20	30
Person in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PIW with PDF/surfboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.7	1.0	1.5	1.8	1.8	1.8
Raft 4 persons	0.1	1.0	1.6	2.3	2.7	3.0	3.0
Raft 6 persons	0.1	1.2	1.9	2.8	3.3	3.7	3.7
Raft 8 persons	0.1	1.3	2.1	3.1	3.6	4.0	4.0
Raft 10 persons	0.1	1.4	2.2	3.3	3.9	4.3	4.3
Raft 15 persons	0.2	1.6	2.4	3.7	4.4	4.9	5.5
Raft 20 persons	0.2	1.7	2.7	4.1	5.0	5.6	6.3
Raft 25 persons	0.2	1.9	2.9	4.4	5.4	6.0	6.9
Power boat < 4,5 (< 15)	0.1	1.1	1.7	2.3	2.7	2.9	2.9
Power boat 4,5 to 7,5 (15 to 25)	0.2	2.0	3.0	4.6	5.6	6.3	6.3
Power boat 7,5 to 12 (25 to 40)	0.2	2.5	4.0	6.5	8.2	9.4	11.2
Power boat 12 to 20 (40 to 65)	0.3	3.0	5.2	9.3	12.5	15.0	18.8
Power boat 20 to 28 (65 to 90)	0.3	3.1	5.7	10.9	15.1	18.6	24.1
Sailboat 4,5 (15)	0.2	1.9	2.8	4.3	5.1	5.7	5.7
Sailboat 6,0 (20)	0.2	2.1	3.3	5.2	6.3	7.1	7.1
Sailboat 7,5 (25)	0.2	2.4	3.9	6.1	7.7	8.8	8.8
Sailboat 9,0 (30)	0.2	2.6	4.3	7.1	9.1	10.6	12.7
Sailboat 12,0 (40)	0.3	2.9	4.9	8.7	11.5	13.7	17.1
Sailboat 15,0 (50)	0.3	3.0	5.3	9.7	13.0	15.6	19.7
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.3	3.1	5.6	10.5	14.4	17.5	22.5
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.3	3.1	5.7	11.1	15.4	19.0	24.7
Ship 28,0 to 45,0 (90 to 150)	0.3	3.2	6.0	12.2	17.5	22.0	29.5
Ship 45,0 to 90,0 (150 to 300)	0.3	3.3	6.3	13.6	20.4	26.6	37.4
Ship > 90,0 (> 300)	0.3	3.3	6.4	14.3	22.2	29.8	43.9

[1] Shaded entries indicate combinations of search object and altitude that should be avoided.

NOTE: Where visibility exceeds 3 NM and the size of the search object exceeds 7,5 metres (25 feet), these sweep widths remain applicable for altitudes up to 1500 metres (5000 feet).

(continued on next page)

Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.17	MERCHANT SHIPS or LARGE PRIMARY SAR VESSELS					
SEARCH OBJECT in metres (feet)	VISIBILITY in NM					
	1	3	5	10	15	20
Person in water	*	0.4	0.5	0.6	0.7	0.7
PIW with PDF/surfboard	*	*	*	*	*	*
Raft 1 person	*	*	*	*	*	*
Raft 4 persons	*	2.3	3.2	4.2	4.9	5.5
Raft 6 persons	*	2.5	3.6	5.0	6.2	6.9
Raft 8 persons	*	*	*	*	*	*
Raft 10 persons	*	*	*	*	*	*
Raft 15 persons	*	2.6	4.0	5.1	6.4	7.3
Raft 20 persons	*	*	*	*	*	*
Raft 25 persons	*	2.7	4.2	6.2	6.5	7.5
Power boat < 4,5 (< 15)	*	1.1	1.4	1.9	2.1	2.3
Power boat 4,5 to 7,5 (15 to 25)	*	2.0	2.9	4.3	5.2	5.8
Power boat 7,5 to 12 (25 to 40)	*	2.8	4.5	7.6	9.4	11.6
Power boat 12 to 20 (40 to 65)	*	*	*	*	*	*
Power boat 20 to 28 (65 to 90)	*	3.2	5.6	10.7	14.7	18.1
Sailboat 4,5 (15)	*	*	*	*	*	*
Sailboat 6,0 (20)	*	*	*	*	*	*
Sailboat 7,5 (25)	*	*	*	*	*	*
Sailboat 9,0 (30)	*	*	*	*	*	*
Sailboat 12,0 (40)	*	*	*	*	*	*
Sailboat 15,0 (50)	*	*	*	*	*	*
Sailboat 19,5 to 23,0 (65 to 75)[2]	*	*	*	*	*	*
Sailboat 23,0 to 28,0 (75 to 90)[2]	*	*	*	*	*	*
Ship 28,0 to 45,0 (90 to 150)	*	*	*	*	*	*
Ship 45,0 to 90,0 (150 to 300)	*	*	*	*	*	*
Ship > 90,0 (> 300)	*	*	*	*	*	*

* Information not available.

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.18	BOATS, i.e. type 500 (90' all weather patrol boat)					
SEARCH OBJECT in metres (feet)	VISIBILITY in NM					
	1	3	5	10	15	20
Person in water	0.3	0.4	0.5	0.5	0.5	0.5
PIW with PDF/surfboard	0.3	0.4	0.5	0.5	0.5	0.5
Raft 1 person	0.9	1.8	2.3	3.1	3.4	3.7
Raft 4 persons	1.0	2.2	3.0	4.0	4.6	5.0
Raft 6 persons	1.1	2.5	3.4	4.7	5.5	6.0
Raft 8 persons	1.1	2.5	3.5	4.8	5.7	6.2
Raft 10 persons	1.1	2.6	3.6	5.1	6.1	6.7
Raft 15 persons	1.1	2.8	3.8	5.5	6.5	7.2
Raft 20 persons	1.2	3.0	4.1	6.1	7.3	8.1
Raft 25 persons	1.2	3.1	4.3	6.4	7.8	8.7
Power boat < 4,5 (< 15)	0.5	1.1	1.4	1.9	2.1	2.3
Power boat 4,5 to 7,5 (15 to 25)	1.0	2.0	2.9	4.3	5.2	5.8
Power boat 7,5 to 12 (25 to 40)	1.1	2.5	3.8	6.1	7.7	8.8
Power boat 12 to 20 (40 to 65)	1.2	3.1	5.1	9.1	12.1	14.4
Power boat 20 to 28 (65 to 90)	1.2	3.2	5.6	10.7	14.7	18.1
Sailboat 4,5 (15)	1.0	1.9	2.7	3.9	4.7	5.2
Sailboat 6,0 (20)	1.0	2.2	3.2	4.8	5.9	8.6
Sailboat 7,5 (25)	1.1	2.4	3.6	5.7	7.0	8.1
Sailboat 9,0 (30)	1.1	2.7	4.1	6.8	8.6	10.0
Sailboat 12,0 (40)	1.2	3.0	4.9	8.5	11.2	13.3
Sailboat 15,0 (50)	1.2	3.1	5.2	9.4	12.5	15.0
Sailboat 19,5 to 23,0 (65 to 75)[2]	1.2	3.2	5.5	10.2	13.9	16.9
Sailboat 23,0 to 28,0 (75 to 90)[2]	1.2	3.3	5.7	10.8	15.0	18.4
Ship 28,0 to 45,0 (90 to 150)	1.8	3.3	6.0	12.0	17.1	21.5
Ship 45,0 to 90,0 (150 to 300)	1.8	3.4	6.3	13.4	20.1	26.1
Ship > 90,0 (> 300)	1.8	3.4	6.4	14.1	21.8	29.2

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Appendix E Sweep Width Computation

E.01 – Visual W_u Tables *(continued from previous page)*

E.01.19	SMALL BOATS, i.e. type 300 (12,5 metres [41’] utility boat)					
SEARCH OBJECT in metres (feet)	VISIBILITY in NM					
	1	3	5	10	15	20
Person in water	0.2	0.2	0.3	0.3	0.3	0.3
PIW with PDF/surfboard	0.2	0.2	0.3	0.3	0.3	0.3
Raft 1 person	0.7	1.3	1.7	2.3	2.6	2.7
Raft 4 persons	0.7	1.7	2.2	3.1	3.5	3.9
Raft 6 persons	0.8	1.9	2.6	3.6	4.3	4.7
Raft 8 persons	0.8	2.0	2.7	3.8	4.4	4.9
Raft 10 persons	0.8	2.0	2.8	4.0	4.8	5.3
Raft 15 persons	0.9	2.2	3.0	4.3	5.1	5.7
Raft 20 persons	0.9	2.3	3.3	4.9	5.8	6.5
Raft 25 persons	0.9	2.4	3.5	5.2	6.3	7.0
Power boat < 4,5 (< 15)	0.4	0.8	1.1	1.5	1.6	1.8
Power boat 4,5 to 7,5 (15 to 25)	0.8	1.5	2.2	3.3	4.0	4.5
Power boat 7,5 to 12 (25 to 40)	0.8	1.9	2.9	4.7	5.9	6.8
Power boat 12 to 20 (40 to 65)	0.9	2.4	3.9	7.0	9.3	11.1
Power boat 20 to 28 (65 to 90)	0.9	2.5	4.3	8.3	11.4	14.0
Sailboat 4,5 (15)	0.8	1.5	2.1	3.0	3.6	4.0
Sailboat 6,0 (20)	0.8	1.7	2.5	3.7	4.6	5.1
Sailboat 7,5 (25)	0.9	1.9	2.8	4.4	5.4	6.3
Sailboat 9,0 (30)	0.9	2.1	3.2	5.3	6.6	7.7
Sailboat 12,0 (40)	0.9	2.3	3.8	6.6	8.6	10.3
Sailboat 15,0 (50)	0.9	2.4	4.0	7.3	9.7	11.6
Sailboat 19,5 to 23,0 (65 to 75)[2]	0.9	2.5	4.2	7.9	10.7	13.1
Sailboat 23,0 to 28,0 (75 to 90)[2]	0.9	2.5	4.4	8.3	11.6	14.2
Ship 28,0 to 45,0 (90 to 150)	1.4	2.5	4.6	9.3	13.2	16.6
Ship 45,0 to 90,0 (150 to 300)	1.4	2.6	4.9	10.3	15.5	20.2
Ship > 90,0 (> 300)	1.4	2.6	4.9	10.9	16.8	22.5

Appendix E Sweep Width Computation

E.2 – Correction Factor Tables

Re: *Section 5.01*

E.02.1	WEATHER CORRECTION FACTOR (f_w)	
WEATHER WINDS in km/h (knots) SEAS in metres (feet)	SEARCH OBJECT Person in water, raft or boat < 10 metres (33 feet)	Other search objects
WINDS < 28 (< 15) or SEAS 0 to 1 (0 to 3)	1.0	1.0
WINDS 28 to 46 (15 to 25) or SEAS 1 to 1.5 (3 to 5)	0.5	0.9
WINDS > 46 (> 25) or SEAS > 1.5 (> 5)	0.25	0.9

E.02.2	FATIGUE CORRECTION FACTOR (f_f)
Not fatigued	1.0
Fatigued	0.8

E.02.3 SEARCH AIRCRAFT SPEED (VELOCITY) CORRECTION FACTOR (f_v)							
SEARCH OBJECT in metres (feet)	FIXED WING SPEED in knots			HELICOPTER SPEED in knots			
	≤ 150	180	210	≤ 60	90	120	140
Person in water	1.2	1.0	0.9	1.5	1.0	0.8	0.7
Raft 1 to 4 persons	1.1	1.0	0.9	1.3	1.0	0.9	0.8
Raft 6 to 25 persons	1.1	1.0	0.9	1.2	1.0	0.9	0.8
Power boat < 8 (25)	1.1	1.0	0.9	1.2	1.0	0.9	0.8
Power boat 10 (33)	1.1	1.0	0.9	1.1	1.0	0.9	0.9
Power boat 16 (53)	1.1	1.0	1.0	1.1	1.0	0.9	0.9
Power boat 24 (78)	1.1	1.0	1.0	1.1	1.0	1.0	0.9
Sailboat < 8 (25)	1.1	1.0	0.9	1.2	1.0	0.9	0.9
Sailboat 12 (39)	1.1	1.0	1.0	1.1	1.0	0.9	0.9
Sailboat 25 (83)	1.1	1.0	1.0	1.1	1.0	1.0	0.9
Ship > 27 (> 90)	1.0	1.0	1.0	1.1	1.0	1.0	0.9

E.3 – Horizon Range vs. Height of Eye Table

Re: *Section 5.01*

NOTE: The table on the following page is used to help determine the horizon range from different heights of eye. If the search is in a mountainous or heavily wooded area, W should be further reduced by half.

(continued on next page)

Appendix E Sweep Width Computation

Height of eye (in feet)	**Horizon Range** (nautical miles)	**Horizon Range** (statute miles)
1	1.1	1.3
2	1.6	1.9
3	2.0	2.3
4	2.3	2.6
5	2.6	2.9
6	2.8	3.2
7	3.0	3.5
8	3.2	3.7
9	3.4	4.0
10	3.6	4.2
11	3.8	4.4
12	4.0	4.6
13	4.1	4.7
14	4.3	4.9
15	4.4	5.1
16	4.6	5.3
17	4.7	5.4
18	4.9	5.6
19	5.0	5.7
20	5.1	5.9
21	5.2	6.0
22	5.4	6.2
23	5.5	6.3
24	5.6	6.5
25	5.7	6.6
26	5.8	6.7
27	5.9	6.8
28	6.1	7.0
29	6.2	7.1
30	6.3	7.2
31	6.4	7.3
32	6.5	7.5
33	6.6	7.6
34	6.7	7.7
35	6.8	7.8
36	6.9	7.9
37	7.0	8.0
38	7.1	8.1
39	7.1	8.2
40	7.2	8.3
41	7.3	8.4
42	7.4	8.5
43	7.5	8.6
44	7.6	8.7
45	7.7	8.8
46	7.8	8.9
47	7.8	9.0
48	7.9	9.1
49	8.0	9.2
50	8.1	9.3
55	8.5	9.8
60	8.9	10.2
65	9.2	10.6
70	9.6	11.0
75	9.9	11.4
80	10.2	11.8
85	10.5	12.1
90	10.9	12.5
95	11.2	12.8
100	11.4	13.2
105	11.7	13.5
110	12.0	13.8
115	12.3	14.1

Height of eye (in feet)	**Horizon Range** (nautical miles)	**Horizon Range** (statute miles)
120	12.5	14.4
125	12.8	14.7
130	13.0	15.0
135	13.3	15.3
140	13.5	15.6
145	13.8	15.9
150	14.0	16.1
160	14.5	16.7
170	14.9	17.2
180	15.3	17.7
190	15.8	18.2
200	16.2	18.6
210	16.6	19.1
220	17.0	19.5
230	17.3	20.0
240	17.7	20.4
250	18.1	20.8
260	18.4	21.2
270	18.8	21.6
280	19.1	22.0
290	19.5	22.4
300	19.8	22.8
310	20.1	23.2
320	20.5	23.6
330	20.8	23.9
340	21.1	24.3
350	21.4	24.6
360	21.7	25.0
370	22.0	25.3
380	22.3	25.7
390	22.6	26.0
400	22.9	26.3
410	23.2	26.7
420	23.4	27.0
430	23.7	27.3
440	24.0	27.6
450	24.3	27.9
460	24.5	28.2
470	24.8	28.6
480	25.1	28.9
490	25.3	29.2
500	25.6	29.4
520	26.1	30.0
540	26.6	30.6
560	27.1	31.2
580	27.6	31.7
600	28.0	32.3
620	28.5	32.8
640	28.9	33.3
660	29.4	33.8
680	29.8	34.3
700	30.3	34.8
720	30.7	35.3
740	31.1	35.8
760	31.5	36.3
780	31.9	36.8
800	32.4	37.3
820	32.8	37.7
840	33.2	38.2
860	33.5	38.6
880	33.9	39.1
900	34.3	39.5
920	34.7	39.9

Height of eye (in feet)	**Horizon Range** (nautical miles)	**Horizon Range** (statute miles)
940	35.1	40.4
960	35.4	40.8
980	35.8	41.2
1 000	36.2	41.6
1 100	37.9	43.7
1 200	39.6	45.6
1 300	41.2	47.5
1 400	42.8	49.3
1 500	44.3	51.0
1 600	45.8	52.7
1 700	47.2	54.3
1 800	48.5	55.9
1 900	49.9	57.4
2 000	51.2	58.9
2 100	52.4	60.4
2 200	53.7	61.8
2 300	54.9	63.2
2 400	56.0	64.5
2 500	57.2	65.8
2 600	58.3	67.2
2 700	59.4	68.4
2 800	60.5	69.7
2 900	61.6	70.9
3 000	62.7	72.1
3 100	63.7	73.3
3 200	64.7	74.5
3 300	65.7	75.7
3 400	66.7	76.8
3 500	67.7	77.9
3 600	68.6	79.0
3 700	69.6	80.1
3 800	70.5	81.2
3 900	71.4	82.2
4 000	72.4	83.3
4 100	73.3	84.3
4 200	74.1	85.4
4 300	75.0	86.4
4 400	75.9	87.4
4 500	76.7	88.3
4 600	77.6	89.3
4 700	78.4	90.3
4 800	79.3	91.2
4 900	80.1	92.2
5 000	80.9	93.1
6 000	88.6	102.0
7 000	95.7	110.2
8 000	102.3	117.8
9 000	108.5	124.9
10 000	114.4	131.7
15 000	140.1	161.3
20 000	161.8	186.3
25 000	180.9	208.2
30 000	198.1	228.1
35 000	214.0	246.4
40 000	228.8	263.4
45 000	242.7	279.4
50 000	255.8	294.5
60 000	280.2	322.6
70 000	302.7	348.4
80 000	323.6	372.5
90 000	343.2	395.1
100 000	361.8	416.5
200 000	511.6	589.0

Appendix E Sweep Width Computation

E.4 – Uncorrected NVG Sweep Width Tables

Re: *Section 5.01*

NOTES:

1. The following tables show the available sweep width information for ***night vision goggles (NVG) searches***. These values should be viewed as rough estimates, the accuracy of which has to be assessed by the search planner on a case-by-case basis.
2. These tables are valid for both aeronautical and maritime search facilities.

E.04.1	**NVG SEARCHES FOR UNLIGHTED LIFE RAFTS**[1]
Sea Heights	Sweep Width
1 to 1.5 metres (3 to 5 feet)	1.3 NM
1.5 to 2,2 metres (5 to 7.2 feet)	0.6 NM

[1] These figures were achieved from maritime search and rescue units during trials and should be used with caution until verification data is gathered.

E.04.2	**NVG SEARCHES FOR SURVIVAL CRAFT LIGHTS**[2]
Wind Speed	Sweep Width
> 24 knots	4.0 NM
18 knots	5.0 NM
< 14 knots	5.7 NM

[2] These figures are for NVG searches of lighted life rafts without illumination provided by the search craft (i.e., infrared or illumination flares).

Appendix E Sweep Width Computation

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Annexes

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Annexes

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Annex 1 Excerpts from the *MCTS Standards Manual*

Part A1 – DISTRESS COMMUNICATIONS

1.1 General *(ITU Article RR32)*

a) Distress communications shall consist of all communications relating to the immediate assistance required by the mobile unit or person in distress.

b) Where a distress situation is not formally declared, but the mobile unit or person is in immediate danger, the MCTS Officer shall apply distress procedures.

c) In order to quickly and effectively resolve a SAR incident, there must always be close consultation between the MCTS Officer and the SAR Coordinator for the duration of that incident. Although JRCC/MRSC will provide instructions regarding the SAR action to be taken during a distress, the application of radio procedures regarding distress communications, the use of alarm signals, the ship-shore frequency, the mode and site(s) and handling of the transmissions shall be the responsibility of the MCTS Officer. Should a conflict occur that cannot be resolved immediately, the SAR Coordinator will exercise ultimate authority and accept responsibility for actions taken to resolve the incident.

To initiate SAR coordination, any MCTS Centre that receives information regarding a marine occurrence or aircraft emergency shall forward to a JRCC/MRSC, as soon as possible, all related information and any action taken.

1.17 JRCC/MRSC Request for an “ALL STATIONS” Broadcast

a) In some cases, the JRCC/MRSC may request an "ALL STATIONS" broadcast in response to certain situations. The MCTS Officer, in consultation with JRCC/MRSC, will determine the communication priority of broadcast. The MCTS Officer shall take immediate action upon request.

Part A3 – EMERGENCIES

3.9 Notification of Other Resources

Normally the MCTS Officer shall consult with the JRCC/MRSC prior to informing resources such as IRB units, CCG vessels and staffed lighthouse stations of the details of a marine occurrence. However, it is recognized that alerting rescue units about extremely serious situations, prior to contacting JRCC, may be justifiable. To prevent any confusion with respect to the “tasking” of such resources the MCTS Officer shall ensure that the notification is presented in a manner which clearly identifies that the unit has not yet been tasked by JRCC.

NOTE: The complete text of this manual may be found on the CCG Intranet web site: http://ccg-gcc.ncr.dfo-mpo.gc.ca/mcts-sctm/Publications/Manual5608/standardsmanual_e.htm.

Annex 1 Excerpts from the *MCTS Standards Manual*

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Annex 2 Excerpts from the *CCG National Incident Notification Procedure*

3 PURPOSE

The intention of the National Incident Notification Procedure is to provide CCG and DFO Senior Management, including the Deputy Minister, with an immediate initial alert to inform the organization that an event of significance has or is occurring.

4 INFORMATION GATHERING AND NOTIFICATION

4.1 Initial Notification

It is the responsibility of every CCG program to gather the relevant information and initiate this Procedure for significant events.

The implicated program is expected to gather the information from all relevant sources, where CCG is the lead response agency, as well as information on situations where CCG is not the lead response agency however the significant event may impact upon CCG operations and/or program delivery.

4.2 Information updates

The originating program will issue updates to the incident as significant changes occur, or every 24 hours.

4.3 Termination of event updates

The originating program will send a final message indicating that the incident has been terminated.

5 INCIDENT NOTIFICATION TO HEADQUARTERS

5.1 Regional Program Duty Officer:

Upon determination of a significant incident, the regional duty officer of the implicated program (or others) will make the following notification by telephone:

- **Verbally notify** their respective Assistant Commissioner Office as per regional processes;
- **Verbally notify** the appropriate regional Marine Communications and Traffic Services Centre to action an Incident Notification.

Original: 2010-08-18; revised: 2010-11-04.

Annex 2 Excerpts from the *CCG National Incident Notification Procedure*

CRITERIA FOR REPORTING SIGNIFICANT INCIDENT

- Major damage to a CCG facility, vessel, or aircraft;
- Threats against CCG personnel, facility, vessel or aircraft;
- Serious injury or loss of CCG personnel at work;
- Serious injury or loss of person(s) in a CCG facility, vessel or aircraft;
- Any marine incident where CCG resources have been tasked and where there is a loss of life;
- Any maritime SAR incident where a vessel(s) is (are) abandoned;
- Any SAR incident in which the Pacific Region Rescue Diving Unit is involved;
- Collision, sinking, grounding or any incident involving the release of significant marine pollution;
- Catastrophic loss of CCG operational systems (eg. INNAV, AIS, MCTS Centre, etc);
- Event requiring significant CCG resources (from one or more regions) that will impact on other CCG operations or programs;
- Natural disasters (occurring or anticipated) which may have an impact on the maritime transportation system and/or CCG operations or programs;
- Any incidents, which may cause a major disruption or threat of disruption to commercial shipping, or the maritime transportation system;
- Incidents with cross-border implications which in your opinion need to receive wide distribution within CCG/DFO;
- An increase in MARSEC levels of a port in Canada or of a vessel in Canadian waters;
- Other issues, which in your opinion, need to receive wide distribution within CCG/DFO (if unsure, contact the NCC Duty Officer at (613) 990-0123).

[The following shaded] criteria denote that no verbal notification is required.

- Prolonged unexpected loss of staff in operational centres or vessels resulting in decreased operational capacity;
- Special interest events as defined by Senior Management;
- Any high profile marine incident, directly or indirectly impacting the CCG, and would result in the attention on the House of Commons or the media;
- Any high profile incident resulting in the attention of another level of government, e.g. provincial, municipal, international, etc;
- Significant events received from external sources (eg. GOC, RCMP, DND, TC, CBSA, etc).

Annex 3 Excerpts from the *Maritime Safety Committee Circular MSC.1/Circ.1308*

GUIDANCE TO SEARCH AND RESCUE SERVICES IN RELATION TO REQUESTING AND RECEIVING LRIT INFORMATION

4 Requesting LRIT information

4.5 […] the SAR service of Contracting Governments shall be entitled to receive LRIT information for the search and rescue of persons in distress at sea.

4.7 Regulation […] does not draw any distinction between maritime and aeronautical search and rescue incidents and allows SAR services to request LRIT information, as long as it is for the purpose of the search and rescue of persons in distress at sea. […]

4.8 A request for the provision of LRIT information for the search and rescue of persons in distress at sea is initiated by the LRIT Data Centre serving the SAR service transmitting a SAR SURPIC message via the International LRIT Data Exchange for broadcast to all LRIT Data Centres. This message requests the most recent data from the databases within all LRIT Data Centres in order to provide the SAR services with the ability to obtain a picture of ships within the geographical area specified by the SAR service requesting the information. In order to determine whether ships within the geographical area specified by the SAR service are transiting towards or away from the specific location the SAR service can request up to the last 4 preset transmission LRIT information from of all ships within the geographical area. All LRIT information which would be provided to the SAR service would be located within the geographical area specified by the SAR service. From that information the SAR service can identify which ships are more favourably positioned to respond to the situation and can poll those ships directly to determine their current locations.

5 Information to be provided when requesting LRIT information

5.1 A SAR service, when wishing to receive LRIT information should indicate to the LRIT Data Centre the criteria to be used by the centre when providing the requested information.

5.2 The criteria to be provided are:

.1 the geographical area within which LRIT information is requested; and

.2 the number of LRIT information transmissions requested.

5.3 All LRIT Data Centres are required to provide to SAR services LRIT information irrespective of the location of the geographical area within which the information is requested. Thus, SAR services are able to request LRIT information for geographical areas which are located outside the search and rescue regions which are under their responsibility.

5.3.1 The geographical area may be either circular or rectangular and for these the Technical specifications for communications within the LRIT system use the terms SAR circular area and SAR rectangular area, respectively. SAR services are advised to take into account the information provided in paragraphs 5.4 to 5.4.2 below when defining the geographical areas within which they are requesting the provision of LRIT information. In addition, SAR services, when formulating their initial request

Annex 3 Excerpts from the *Maritime Safety Committee Circular MSC.1/Circ.1308*

for the provisions of LRIT information, are advised to define the geographical area within which they are requesting the provision of LRIT information in a manner that is larger than the search area they have identified for search and rescue purposes, so as to be able to easily identify which ships are transiting towards or away from the specific location.

5.3.2 When requesting LRIT information within a SAR circular area the geographical position of the centre of the area should be indicated in latitude and longitude and the radius in nautical miles. The radius of the SAR circular area should not exceed 999 nautical miles. Any requests which include a radius in excess of 999 nautical miles would be rejected by the LRIT Data Centres which are asked to process them.

5.3.3 When requesting LRIT information within a SAR rectangular area the geographical position of the Southwest corner of the area should be indicated in latitude and longitude and the North and East offsets in degrees and minutes. Each offset should not exceed 2,000 nautical miles. Any requests which include an offset in excess of 2,000 nautical miles would be rejected by the LRIT Data Centres which are asked to process them.

5.3.4 The LRIT system operates using WGS 84 datum and thus all geographical positions should be with reference to the WGS 84 datum.

5.3.5 All geographical positions (latitude and longitude) should be in degrees and minutes, with a single space between the coordinates and no other spaces, without punctuation, with leading zeros for single number minutes, but not for degrees and with the minutes tick following the minutes part, for example 51°42´N 5°07´E.

5.4 The number of LRIT information transmissions requested relates to the LRIT information received within the LRIT system during the 24 hours preceding the time the LRIT Data Centre will lodge the request of the SAR service for LRIT information and for these the Technical specifications for communications within the LRIT system use the term number of position reports. In this respect, it should be noted that, unless there is a demand for the transmission of LRIT information at more frequent intervals, the shipborne equipment are preset to transmit LRIT information at 6-hour intervals.

5.4.1 When a SAR service indicates a value of 2 in relation to the number of positions it is requesting, it will receive the last two LRIT information transmissions from all ships within the defined geographical area during the previous 24 hours.

5.4.2 SAR services are advised to indicate to the LRIT Data Centre the number of positions they are requesting as it will provide them information in relation to the direction the various ships are heading. However, the number of positions to be requested should not exceed 4.

Annex 3 Excerpts from the *Maritime Safety Committee Circular MSC.1/Circ.1308*

7 Requesting additional LRIT information

7.1 A SAR service, after it has assessed the LRIT information it has received following its initial request, is able to request the provision of additional LRIT information on demand (i.e. to request the polling of ships in a geographical area).

10 Obligations of SAR services

10.1 […] Contracting Governments shall, at all times:

.1 recognize the importance of long-range identification and tracking information;

.2 recognize and respect the commercial confidentiality and sensitivity of any long-range identification and tracking information they may receive;

.3 protect the information they may receive from unauthorized access or disclosure; and

.4 use the information they may receive in a manner consistent with international law. […]

10.3 […] Contracting Governments may report to the Organization any case where they consider that provisions of the regulation or of any other related requirements established by the Organization have not been or are not being observed or adhered to.

11 Cost of the LRIT information provided to SAR services

11.1 […] SAR services shall be entitled to receive, free of any charges, LRIT information in relation to the search and rescue of persons in distress at sea.

11.2 SAR services should note that the provision of LRIT information to them entails expenditures and costs for the LRIT Data Centres and the International LRIT Data Exchange which need to be paid by the other LRIT Data Users as an overhead on the charges they have to pay for the provision of LRIT information to them.

11.3 SAR services are strongly urged, notwithstanding the purpose for which they might be requesting the provision of LRIT information, to exercise the right to request LRIT information with due care and to avoid excessive requests.

12 Performance review and audit of the LRIT system

12.1 SAR services are, subject to the provisions of the national legislation of the Contracting Government in whose territory they are located, expected to provide, when requested by the LRIT Coordinator, information, to enable the holistic review of the performance of the LRIT system and for the investigation of any disputes.

12.2 SAR services are thus expected to maintain the necessary records identifying the cases for which they have requested the provision of LRIT information; what information they have requested and when, what LRIT information they have received and when; and how the information was used.

Annex 3 Excerpts from the *Maritime Safety Committee Circular MSC.1/Circ.1308*

12.2.1 Such records may form part of the operational records maintained by the SAR services.

12.2.2 SAR services should note that all LRIT Data Centres are required to archive LRIT information for at least one year and until such time as the Committee reviews and accepts the annual report of the audit of their performance by the LRIT Coordinator. Thus, SAR services are expected to retain the related records until the Committee reviews and accepts the annual report of the audit of their performance of the LRIT Data Centre providing services to them.

12.3 SAR services are also expected to provide, when requested by the LRIT Coordinator, information on the arrangements they have in place in order to protect the LRIT information they may receive from unauthorized access or disclosure.

International Maritime Organization, 9 June 2009

Annex 4 Excerpts from the CCG *Operational Procedures on Assistance to Disabled Vessels*

NOTE:	Different excerpts from the Canadian Coast Guard (CCG) *Policy and Operational Procedures for Assistance to Disabled Vessels* are shown in *CAMSAR I, Annex 4,* and in *CAMSAR III, Annex 1.*

2. Assistance to a Disabled Vessel (i.e. not in Distress)

2.1 IN OPEN WATER

2.1.1 No waiting period should delay the tasking of any mobile facility to any situation where there is an uncertainty as to the safety of the persons at sea.

2.1.2 When the master of a disabled vessel requesting assistance (non-distress or non-potential distress) is in direct communication with a Marine Communications and Traffic Services (MCTS) Centre, Regional Operations Centre, or Ice Office and has advised that persons onboard are in no immediate danger, the centre/office shall ensure that the Maritime SAR Mission Co-ordinator (at the joint rescue co-ordination centre or maritime rescue sub-centre (JRCC/MRSC)) for the area in which the disabled vessel is located is informed and provided with all pertinent information in order for the Maritime SAR Mission Co-ordinator to take the lead. As the vessel is not in distress, sufficient time will be taken to evaluate the request before deciding on a course of action. CCG will not compete with commercial salvage or towing interests and therefore will not tow disabled vessels unless all efforts to obtain commercial or private assistance have been carried-out and have failed to resolve the situation. In general[1]:

1. The Maritime SAR Mission Co-ordinator, normally through the appropriate MCTS Centre, shall advise the owner/operator to make his or her own arrangements for assistance;

2. If the owner/operator is unable or unwilling to secure arrangements for assistance, the Maritime SAR Mission Co-ordinator shall request that the MCTS Centre issue a Maritime Assistance Request Broadcast (MARB) alerting all private, commercial and vessels of opportunity in the area of the need for assistance and thus giving them the opportunity to provide this assistance;

3. If there is no response to the MARB, in special circumstances, the Maritime SAR Mission Co-ordinator may contact other mobile facilities such as CCG primary SAR units or CCGA to provide an expeditious response;

4. The Maritime SAR Co-ordinator will consult with the Regional Operations Centre if it is determined that assistance will be needed from a CCG vessel not on primary SAR as the tasking may impact other programs. In all cases, when the Maritime SAR Mission Co-ordinator tasks CCG resources they shall provide all pertinent information regarding the vessel requiring assistance and instruct the Commanding Officer to take any reasonable action in order to resolve the situation.

[1] Refer to the *Towing Decision Flow Chart*, shown at the end of this annex.

Annex 4 Excerpts from the CCG *Operational Procedures on Assistance to Disabled Vessels*

5. The Maritime SAR Mission Co-ordinator through their regional alert network must provide Transport Canada Marine Safety and Transportation Safety Board with details of the incident in order to support actions preventing similar incidents from occurring in the future. Special emphasis should be placed on situations when the SAR Mission Co-ordinator and/or the Commanding Officer of the assisting vessel reasonably believe that the disabled vessel had to be assisted because it was un-seaworthy or otherwise in violation of *Canada Shipping Act, 2001*, and/or the regulations made there under.

2.1.3 Although the Maritime SAR Mission Co-ordinator should not routinely engage in obtaining third party assistance for a disabled vessel, in exceptional circumstances and in complete consultation with the owner/operator of the disabled vessel, the Maritime SAR Mission Co-ordinator may aid in co-ordinating commercial or private assistance. The owner/operator shall be informed and agree that he or she will always remain responsible for any and all costs incurred. It must be made clear to the supplier and the end user of the assisting service that the CCG or the Crown has no contractual or other obligation whatsoever in any arrangement.

2.1.4 Regions are to ensure that CCG Environmental Response and partner agencies, such as Transport Canada Marine Safety and the Transportation Safety Board are informed of the details of requests for assistance according to established protocols. Any requests received by Regional Operations Centre for CCG resources to assist disabled vessels on behalf of partner agencies shall be forwarded to the Assistant Commissioner. The Assistant Commissioner's approval will be required before any CCG resource is tasked to tow disabled vessels of 33 metres or more in length.

2.1.5 For disabled vessels in open water, in order to prevent more serious safety risks from developing, technical assistance may be provided on an as available basis by the CCG only after efforts to obtain commercial or private assistance have been carried out and have failed to resolve the situation.

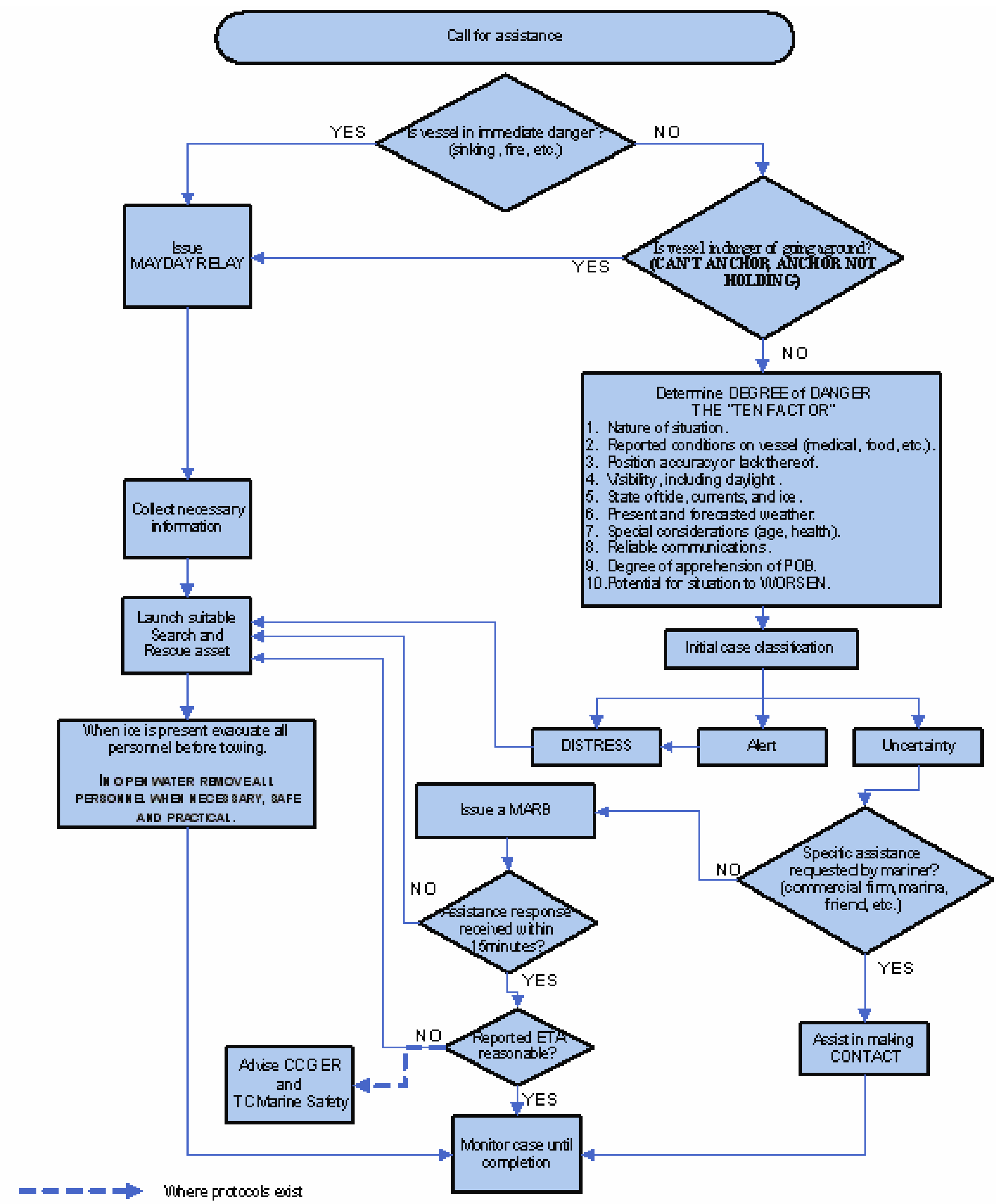
2.1.8 Requests to use a CCG resource to engage in salvage operations of vessels, outside of a SAR operation, with no persons on board shall be carefully assessed prior to authorization by the Assistant Commissioner. Since salvage is normally the responsibility of the vessel owner, the status of the owner must be determined to be unknown, unwilling or unable. Recovery of an abandoned vessel including towing to a place of refuge should be made under the CCG Environmental Response mandate.

21 December 2010

NOTE:	The complete text of this document may be found on the CCG Intranet web site: http://ccg-gcc.ncr.dfo-mpo.gc.ca/commissioner-commissaire/policies-eng.html.

Annex 4 Excerpts from the CCG *Operational Procedures on Assistance to Disabled Vessels*

TOWING DECISION FLOW CHART



Annex 4 Excerpts from the CCG *Operational Procedures on Assistance to Disabled Vessels*

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