INTERNATIONAL MARITIME ORGANIZATION

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27 January 2025

AMENDMENTS TO THE INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE (IAMSAR) MANUAL

1 The Maritime Safety Committee, at its 109th session (2 to 6 December 2024), having been informed that the International Civil Aviation Organization (ICAO) had approved the amendments* to the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual prepared by the ICAO/IMO Joint Working Group on Harmonization of Aeronautical and Maritime Search and Rescue, and that they had been agreed by the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) at its eleventh session (4 to 13 June 2024), approved the amendments to Volumes I, II and III of the Manual, as set out in annexes 1, 2 and 3, respectively, in accordance with the procedures for amending and updating the IAMSAR Manual set out in resolution A.894(21).

2 The Committee agreed that the amendments should become applicable on 1 January 2026.

3 Member States are invited to bring the amendments to the attention of all parties concerned.

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* The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

a) ~~Text to be deleted is shown with a line through it.~~

b) New text to be inserted is highlighted with grey shading.

c) ~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.

ANNEX 1

AMENDMENTS TO IAMSAR MANUAL VOLUME I

Editorial Note.— Page numbering to be sequential

Contents

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Abbreviations and acronyms

Editorial Note.— Consolidate the list of abbreviations and acronyms from Volumes I, II and III into one

. . .

~~**Inmarsat** an IMO-recognized mobile satellite service~~

. . .

PLB……………. personal locator beacon
Radar SART….. search and rescue radar transponder
RANP………….. regional air navigation plan
RCC……………. rescue coordination centre
RMSS………… recognized mobile satellite service
RSC…………… rescue sub-centre
SAC…………… special access code
SAR……………. search and rescue
SAREX…………~~S~~search and rescue exercise
~~**SART** search and rescue radar transponder~~

. . .

Glossary

Editorial Note.— Consolidate the Glossary from Volumes I, II and III into one

. . .

Flight information centre (FIC)	A unit established to provide flight information and alerting services.
Flight tracking system	A generic term applied to various forms of flight tracking systems where aircraft position and tracking information is derived from ATS surveillance, satellite or terrestrially based systems and applications.

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Vessel tracking	A generic term applied to all forms of vessel track data derived from multiple sources such as ship reporting systems, AIS, LRIT, ~~SAR aircraft~~, VMS and VTS.

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Chapter 1

General system concept

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1.3 Legal basis for services

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1.3.8 International law addresses concerns for saving lives and concerns for sovereignty. Neighbouring States should seek practical means to balance these concerns for situations where entry of foreign SAR facilities into territorial waters or territory may be necessary or appropriate. RCCs need to understand the processes to be followed to obtain expeditious approval to allow SAR units from an assisting State to enter the territory of the State of the RCC for the conduct of search and rescue. Such processes may vary dependent upon which State is offering assistance. The SMC should facilitate the approval process and also be authorized to notify the assisting SAR service or units. Appendix Q provides a sample approval process. An RCC plan of operation can be developed based on the sample approval process.

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Chapter 2

System components

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2.3 Rescue coordination centres

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Table 2.1 – *Capabilities of a fully capable RCC*

Required	Desired
. . . Means of plotting Ability to receive distress alerts, e.g. from MCCs, LESsRMSS providers, etc. Immediate communications with: . . .	. . . Vessel tracking information including AIS, LRIT, VMS and SRS Flight tracking system information

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2.7 Support facilities

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2.7.2 A SAR organization can benefit from the use of computers by either possessing the capability, or in many instances, knowing where and how to gain computer services and database support from other organizations, including support for specialized functions such as developing a search plan and gaining access to flight tracking information systems and applications, and vessel tracking information such as AIS, LRIT, VMS used by fisheries and ship reporting systems (SRSs). Chapter 4 provides specific information on other sources of data. Additional information may be found in paragraph 1.11 of the IAMSAR Manual, volume II, Mission Coordination.

2.7.4 Databases can perform a number of useful functions. Most databases hold detailed information which can be quickly accessed, used and also consolidated into reports. SAR managers can use this for SAR system management support, including budget efforts and the RCC can use it for search planning. Environmental databases, including weather and maritime currents, are maintained by numerous academic, oceanographic, military, scientific and meteorological organiszations which may make them available for search planning. The SAR system has a growing global network of SAR data providers (SDPs) available to States. The International Telecommunication Union has information for identifying mobile radio stations which transmit distress alerts. Cospas-Sarsat also maintains registration databases with basic SAR information. These databases rely upon States to submit timely and correct information. Examples of other databases include InmarsatRMSS numbers, call signs (C/S), maritime mobile service identityies (MMSIs) numbers and shipping registers. When such databases are implemented, the data should be made readily available on a 24-hour basis to any RCC in receipt of a distress alert.

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Chapter 3

Training, qualification, certification and exercises

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3.2.11 RCC and RSC SAR training should include at least the following topics. If search planning expertise gained from formal training is not used on a regular basis for operations or exercises, periodic refresher training will normally be needed. General categories include:

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Fatigue factors
Flight tracking systems and applications
IMO-recognized mobile satellite services (such as Inmarsat, Iridium)

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Chapter 4

Communications

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4.4 Mobile equipment

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4.4.12 SAR authorities may also provide SRUs with:

– ability to operate on the frequencies 3023 kHz, 4125 kHz, 5680 kHz, 121.5 MHz, 123.1 MHz and 2182 kHz;

– AIS to detect ~~the~~ AIS search and rescue transmitters (AIS-SARTs) and/or search and rescue radar transponders (radar SARTs) ~~compatible 9 GHz radars~~;

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4.5 Land-based infrastructure

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SAR communications network

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4.5.11 ARCCs and MRCCs may install and use ~~LESs or~~ ship earth stations (SESs) to improve communications with units in distress, mobile facilities performing SAR functions, other RCCs, etc. Such installations may be unnecessary where reliable landline links exist between the RCC and the RMSS providers ~~its serving LES~~; however, when ~~Inmarsat's SafetyNET is used (see appendix G) to~~ relaying distress alerts or other SAR-related information, suitable arrangements will be needed with RMSS providers to facilitate monitoring of the broadcasts. For maritime purposes, ~~the Inmarsat-C~~ SESs, depending on the RMSS and equipment model, can ~~is the most versatile; although it only~~ handles voice and data communications, ~~it can~~ be programmed for various functions~~, it can relay SAR alerts over SafetyNET,~~ and are carried on board most ships ~~carry it~~.

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4.5.28 As well as ship reporting systems, other vessel tracking systems and services are valuable for search and rescue. AIS, LRIT, VMS and vessel traffic services (VTS) are all valuable sources of vessel position data and can be displayed to provide a surface picture (SURPIC). The surface picture can assist in the identification and location of suitable rescue vessels and be used to locate potential rescue vessels. In accordance with SOLAS regulation V/19-1, Contracting Governments should make provision to Flight tracking systems and applications receive LRIT vessel position data for SAR, in accordance with applicable IMO guidance. The SAR service of the Contracting Government requests LRIT information for SAR only via the LRIT data centre serving the Contracting Government.

Flight tracking systems and applications

4.5.29 Flight tracking systems and applications are valuable sources of aircraft position data and can be displayed on mapping systems. Such tracking systems may assist in the identification and location of an aircraft subject to an emergency phase or indicate suitable aircraft in flight that may be able to assist a craft in distress. A major benefit of RCCs having this capability is that it improves the speed and efficiency of coordination and communications with ATS units, enables faster situational awareness of relevant aircraft in flight, and decreases ATS unit and RCC workload. For example, by removing the need for ATS units to relay multiple position reports and the manual plotting of aircraft positions.

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4.7 MEDICO communications

4.7.1 The ITU *List of ~~Radiodetermination~~ Coast Stations and Special Service Stations* lists commercial and Government radio stations which provide free medical message service to ships. These incoming or outgoing messages should be prefixed with "DH MEDICO". Messages requesting medical advice are normally delivered only to hospitals or other facilities with which State authorities or the communications facility involved has made prior arrangements. Inmarsat provides service access codes (SACs) for medical advice and medical assistance. Iridium provides medical advice and medical assistance services over voice communications only. RCCs should be able to communicate 24 hours a day with a designated telemedical assistance service (TMAS) to coordinate the provision of medical advice and medical assistance and to arrange for medical evacuations from vessels at sea.

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Chapter 5

System management

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5.2 Planning processes

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5.2.15 Appendix K contains sample text to describe arrangements for the division of responsibilities between the rescue coordination centre (RCC) and the air traffic services (ATS) provider as component organizations contributing to the national emergency response system for aircraft.

5.2.16 RCCs should have arrangements in place for situations where RCCs need to conduct SAR operations (in accordance with ICAO Annex 12) at the same time as the accident investigation authority needs to conduct search and recovery operations (in accordance with ICAO Annex 13). Appendix P contains a sample MOU regarding this matter.

5.2.~~16~~17 Sometimes, Ministers of Transport sign regional SAR plans since often both civil aviation and maritime safety programmes are under their purview. They are usually in the best position to designate and support SCs, who may include the Directors of Civil Aviation, Merchant Marine Safety or other officials with similar duties. The Ministers of Transport are often in the best position to promote coordination and harmonization of maritime and aeronautical SAR.

Editorial Note.— Renumber subsequent paragraphs

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5.4 Resources

Obtaining resources

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5.4.4 Different geographic areas pose varying problems for SAR operations because of climates, topography or physical characteristics. Such factors will influence which facilities, equipment and personnel are required and available for SAR services. Appendix C lists potential sources from which assistance may be obtained; common sources include:

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- ship reporting systems and vessel tracking systems;
- flight tracking systems;
- auxiliaries (privately owned craft organized for SAR);

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Chapter 6

Improving services

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6.5.3 Alert Phase activities, i.e. receiving knowledge of a distress incident, effectively processing that information, and directing appropriate response actions, can be improved upon by the following initiatives:

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– providing access to ship reporting and vessel tracking systems (AIS, LRIT, VMS, VTS);
– providing access to flight tracking systems and applications;
– actively promoting and supporting IMO and ICAO efforts to improve distress alerting;

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Appendix D

Information sources

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Inmarsat 99 City Road London EC1Y 1AX United Kingdom	Website: www.inmarsat.com Email: customer_caremaritime.safety@inmarsat.com

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Appendix G

Mobile communication services

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G.5 Global Maritime Distress and Safety System

G.5.1 Ships subject to the SOLAS Convention are obliged to be outfitted with certain communications equipment, collectively referred to as the shipboard portion of the Global Maritime Distress and Safety System (GMDSS). Certain fishing vessels and other marine craft may also be obligated to carry GMDSS-compatible equipment, or may do so voluntarily.

G.5.2 Development of GMDSS was recommended by the SAR experts who drafted the IMO International Convention on Maritime Search and Rescue, 1979 (SAR Convention) in Hamburg, Germany in 1979. The intent of the recommendation was to develop communications adequate to support the global SAR Plan prescribed by the Convention and to improve maritime safety

G.5.3 The SAR Convention and other IMO documents can be obtained from IMO.

G.5.4 GMDSS also sets out the functional and carriage requirements for shipborne equipment and services used in the GMDSS to perform distress, urgency and safety communications in the ship-to-ship, ship-to-shore and shore-to-ship directions. In addition, provisions for continuous radio watch, shipborne equipment performance standards, maintenance and radio personnel are also included in the GMDSSaddresses problems like radio congestion; delayed, poor-quality and limited-range communications; uncertainty about receipt of messages; and vessels vanishing without a trace or a successful call for help. When theThe system is mature, it should be able to provide capable of providing alerting and locating with minimal delay, automatic alerting, a reliable network for SAR communications, integration of satellite and terrestrial communications and adequate frequencies in all maritime bands.

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G.5.8 Modern communications systems and technologies are capable of tend to offering reliable, fast and automated services for locating distress alerts anywhere at sea. For efficient use of these capabilities, challenges, e.g. new training requirements and more complex equipment controls; relatively low reliability of automated distress alerts; varying levels of integration of GMDSS systems; inadequacy of supporting databases; and incomplete development of related shore-based infrastructure. Until these matters are resolved, the level of effort needed for providing SAR units with the necessary communication infrastructure and equipment and maintaining a training programme for SAR personnel and others on communications matters, and for coping with and reducing difficulties with GMDSS, will be a substantial effort.

G.5.9 The equipment which ships must carry to comply with SOLASthe GMDSS may be affected by CRSs with DSC availability, NAVTEX transmitters, etc. For example, if a State does not provide short-range DSC coastal coverage, ships must outfit with longer-range equipment even if itthey sails only in those coastal waters.

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G.6 Global Aeronautical Distress and Safety System

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G.6.4 For GADSS to function as intended, flight crew and aircraft operators, air traffic controllers and air navigation services providers, ADT service providers, and rescue coordination centres (RCCs) need to understand each other's roles, responsibilities and processes to ensure effective communication, robust coordination and harmonized implementation across the globe.

G.6.5 For aircraft tracking in GADSS, the aircraft operator is required to establish an aircraft tracking capability throughout its area of operations. Such tracking is required in oceanic areas (airspace which overlies waters outside of the territory and territorial sea of a State), and recommended in all areas of operations. Tracking is accomplished through automated four-dimensional (latitude, longitude, altitude and time) position reports transmitted at an interval of 15 minutes or less, unless ATS surveillance obtains aircraft position information at 15-minute intervals or less.

G.6.6 The location of an aircraft in distress (achieved through autonomous distress tracking (ADT) of aircraft in flight) element has the greatest potential impact upon aeronautical and maritime SAR services.

G.6.7 The ~~s~~Standard defining location of an aircraft in distress requires that, as of 1 January ~~2023~~2025, aircraft first issued with a certificate of airworthiness ~~for the first time~~on or after 1 January 2024, with a maximum certificated take-off mass of over 27,000 kg, "shall autonomously transmit information from which a position can be determine by the operator at least once every minute, when in distress." The ICAO provisions also recommend that this requirement be applied to aircraft with a maximum certificated take-off mass of over 5,700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2023.

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G.8 Satellite communications

G.8.1 The primary systems now used for SOLAS compliance are Cospas-Sarsat and IMO-recognized mobile satellite services.

G.8.2 ~~The most capable Inmarsat equipment~~GMDSS-compliant SESs can handle distress communications~~, telephone, telex, facsimile~~using voice, data ~~and other general~~ or a combination of both services. ~~The~~For example, Inmarsat C SES does not handle voice communications, ~~but it is important because of its ability to receive maritime safety information, relatively low cost to obtain and operate, versatile when coupled with a personal computer and in widespread use~~ whereas Iridium SES support both voice and data.~~ Inmarsat~~All SESs can communicate to subscribers ashore via national and international public switched telephone networks (PSTNs) and public switched data networks (PSDNs) which interlink ~~Inmarsat~~RMSSs to other systems, and which can also help to establish ~~communicate~~communications with suitably equipped SESs in any ocean area.

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Appendix N

Sample contract between RCC and TMAS for the provision of medical advice and assistance to masters of ships at sea

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3 Communications arrangements

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3.2 Communication between the TMAS and ships at sea

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3.2.4 *Inmarsat communications*

3.2.4.1 The various Inmarsat systems offer two abridged codes (special access codes – SAC) 32 and 38, which can be used for medical advice or medical assistance at sea through telephone, fax or telex using satellite communications.

.1 **SAC 32** is used to obtain medical advice. The land earth station will provide a direct link with the TMAS when this code is used.

.2 **SAC 38** is used when the condition of an injured or sick person on board a ship justifies medical assistance (evacuation to shore or services of a doctor on board). This code allows the call to be routed to the associated RCC.

3.2.4.2 The Iridium system offers direct voice communication service to a pre-defined medical entity to obtain medical advice or medical assistance at sea. Iridium GMDSS-compliant SESs can set up this call automatically, using the built-in functionality provided within the equipment menu.

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Appendix O

Sample template for a joint search and rescue exercise

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O.3 Scenario

Discussion and development of exercise scenario with participating State or States and agencies
involved. The scenario created should be as realistic as possible to simulate a real incident. A fictitious flight plan or ship's passage plan can be included to provide additional information pertaining to the distressed aircraft/ship. Using fictitious names and/or call signs for the distressed aircraft/ship and its airline/operator will avoid confusion on, for example, social media. Provide a fictitious manifest to indicate the number of people at risk.

States should consider incorporating recently developed technologies and processes in the exercise scenario.

For example:

O.3.1 At …………… *(time in UTC)*, a …………… *(type of aircraft/ship)*, …………… *(name/call sign of distressed aircraft/ship)*, departed from …………… *(point of departure)* to …………… *(destination)* with ………… *(persons on board)*. At …………… *(time in UTC)*, aircraft/ship declared "MAYDAY" or distress signal received owing to …………… *(nature of emergency)* at ………….. *(location in Lat and Long or with reference to a prominent location known to all)*. ……………………. *(further details of the scenario, as required)*.

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O.5 Deployment of exercise search and rescue facilities and call signs

State all the SAR facilities that will take part in the SAREX. It is recommended that SRU call signs should be prefixed with the word "SAREX" to indicate that it is an exercise aircraft or surface vessel. This will help avoid confusion between a SAREX and a real incident. A call sign assigned to a particular SAR facility should not be changed and should be used throughout the exercise. Each SRU should have a unique call sign.

If datum marker buoys are to be used in an exercise involving a maritime scenario for the provision of an accurate and up-to-date drift model, it is recommended that the deployment of such devices be carried out by the first SAR asset to arrive at the scene. This information can be provided in the list of SRUs participating in the exercise.

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O.6 Communications

State the agreed radio frequencies and other communications facilities to be used in the SAREX. List communication arrangements between the RCCs involved and between the RCCs and the SRUs and other mobile SAR facilities. It is recommended that a communication check be conducted between all parties before the SAREX to ensure the serviceability of communication equipment. A standby day may be necessary if the communication check is not satisfactory.

Alternative communication platforms like videoconferencing tools and mobile messaging tools can be used as alternate means to simulate communication between RCCs, SRUs and SAR facilities if radio frequencies are not preferred.

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O.8 Alerting and activation

State clearly the alert and activation processes for the SAREX, including which agency will initiate
the distress phase and how the other participating agencies will be notified. In a joint SAREX, if the distress location is within the area of responsibility of a particular State, the State concerned should initiate the alerting and activation phase.

States may consider including coordination and/or communication tests between RCC, SAR point of contact (SPOC), Cospas-Sarsat Mission Control Centre (MCC) and agencies concerned as part of the alerting and notification process.

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O.9 Search area

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O.9.3 If there is a great difference between the two search areas, the coordinating RCC shall decide on the most probable area and take the necessary action to promulgate the area as a restricted area for SAR operations accordingly.

O.10 Publication of essential information

Coordinate between States or responsible agencies on the publication or dissemination of essential information regarding the exercise activity, for the safety of navigation within and in proximity of the exercise area.

For example:

O.10.1 ………… *(State)* will issue a NOTAM/navigational warning for the SAREX.

O.~~10~~11 Diplomatic clearance

In a joint SAREX, make necessary arrangements for applying for diplomatic clearance if State assets may be or are required to enter another State's territorial airspace or waters. The application process should be made known to all relevant participating agencies. If there is an agreement in place between participating States, then the agreed procedure should be followed. Provide information regarding the SRUs and particulars of the personnel on board. It is recommended that particulars of the SRUs be provided to the State(s) concerned during the SAREX instead of prior to the SAREX. This will ~~assist in the~~ test the diplomatic clearance process to ensure timely approval.

For example:

O.~~10~~11.1 …………… *(State)* RCC will send a request to …………… *(State)* for diplomatic clearance to allow …………… *(State's)* SRUs to enter …………… *(State's)* territorial airspace/waters.

Editorial Note.— **Renumber subsequent paragraphs**

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***Editorial Note.*— Insert new appendix P**

Appendix P

Sample memorandum of understanding between the SAR service and the accident investigation authority

Notification and Cooperation during concurrent *[Search and rescue service]* **Search and Rescue (SAR) and** *[Accident investigation authority]* **Accident Investigation Operations**

1. **Purpose**. This MOU between the *[Search and rescue service]* and the *[Accident investigation authority]* is to address the *[Search and rescue service's*] obligations under the Convention on International Civil Aviation (ICAO), Annex 12 — *Search and Rescue*; and, the *[Accident investigation authority's]* obligations under ICAO Annex 13 — *Aircraft Accident and Incident Investigation* during concurrent responses to an aircraft accident.

2. **General.** The *[Search and rescue service]* is the *[State name]* lead agency with regard to its obligations in support of Annex 12. It establishes and provides SAR services in accordance with the Annex. The *[Search and rescue service]* is the national SAR Coordinator for aircraft in distress in the *[maritime and/or aeronautical]* search and rescue region(s). The *[Accident investigation authority]* leads the investigation of all civil aircraft accidents or incidents.

3. **SAR and Accident Investigation Protocols.** The *[Search and rescue service]* and *[Accident investigation authority]* agree that mutual coordination and cooperation between the two agencies promotes efficient and effective SAR and accident investigation operations. The *[Accident investigation authority]* does not participate in the search and rescue of persons that are involved in an aircraft accident but may assist *[SAR authority]* with information and expertise that assists the SAR operation. The *[SAR authority]* may assist the *[Accident investigation authority]* with information resulting from the SAR operation that assists with accident investigation and may also provide assistance with search and recovery operations.

a. When a SAR operation involving an aircraft accident occurs in a SAR region in which the *[Search and rescue service]* is responsible, the *[Search and rescue service]* will notify the *[Accident investigation authority]* at the earliest opportunity. The point of contact for the *[Accident investigation authority]* is: *[contact details such as telephone number and email address].*

1) If an *[Accident investigation authority]* investigator-in-charge has been named, the *[Accident investigation authority]* point of contact will inform the *[Search and rescue service]* point of contact.

2) The *[Accident investigation authority]* point of contact may share the investigator-in-charge's contact information with the *[Search and rescue service]* point of contact.

3) The *[Search and rescue service]* SAR point of contact is the rescue coordination centre (RCC) or rescue sub-centre (RSC) responsible for the coordination of the SAR operation.

b. The State of occurrence, i.e. the State in the territory (and territorial sea) of which an accident or incident occurs, is responsible for the conduct of the investigation in accordance with ICAO Annex 13. For accidents and incidents outside the territory and territorial sea of any State, the State of Registry of the aircraft is responsible for the conduct of the investigation.

c. States nearest the scene of an accident in international waters, particularly the State with the search and rescue region responsibility, are to provide assistance as they are able and respond to requests by the State of Registry. If the State of Registry takes control of the investigation, then the *[Accident investigation authority]* will coordinate with the State of Registry investigator-in-charge to meet the intent of this MOU.

d. Typically, the *[Accident investigation authority's]* on-scene investigative work begins after the SAR operation concludes and the recovery phase begins, but it may begin during the SAR operation on the understanding that the SAR operation takes priority whilst there is an opportunity to rescue survivors.

1) The *[Accident investigation authority]* may conduct its investigation of wreckage recovered during a SAR operation. The *[Accident investigation authority]* investigator-in-charge will coordinate with the RCC or RSC responsible for coordinating the SAR operation to ensure neither agency's work hinders that of the other, and that both coordinate any updates to the media to ensure consistency of facts.

e. The *[Search and rescue service]* will provide data and information related to the SAR operation requested by the *[Accident investigation authority]* for its accident investigation. Where appropriate, arrangements should also be mutually agreed for the securing of any debris or wreckage retrieved during the SAR operation as practicable without diverting effort from the SAR operation.

f. The *[Search and rescue service]* and the *[Accident investigation authority]* will abide by the terms of this MOU.

Note: *This template serves as guidance for States to draft an agreement (which may take the form of an MOU or Arrangement or other instrument title) and the text to be included in this document is for the Parties involved to decide.*

Depending on national rules and procedures, this sample MOU may need to be modified for arrangements between one national search and rescue service and one national accident investigation authority.

This template may also assist with the development of separate arrangements for investigation of maritime craft.

Editorial Note.— Insert new appendix Q

Appendix Q

Sample process for expeditious approval to allow SAR units from an assisting State to enter into the territory of the State of the RCC

1. Identify the nature of the assistance being offered. (For example, number and type of SAR units, current location of SAR units and geographical areas to which assistance is being offered.)

2. Is the RCC/SMC authorized to grant approval for the type of assistance being offered from the offering State? Is the RCC authorized to notify the assisting SAR service or craft of acceptance of assistance? (For example, by existing national arrangements or SAR agreement.)

YES, take action
NO, go to next step

3. Identify other agency(s) to be involved in approval process; review scenarios below to decide which agency(s) and their role(s).

Examples of potential SAR units needing approval for expedited entry:

- **a.** civil vessel
- **b.** State vessel
- **c.** civil aircraft
- **d.** State aircraft
- **e.** land facilities
- **f.** vessel requests to enter port to:
  - **i.** refuel, resupply
  - **ii.** disembark survivors, human remains, debris or wreckage retrieved during the SAR operation
- **g.** aircraft requests to land to:
  - **i.** refuel, resupply
  - **ii.** disembark survivors, human remains, debris or wreckage retrieved during the SAR operation

Examples of other agencies and their roles:

- **a.** SAR service
- **b.** Customs
- **c.** Immigration
- **d.** Health service
- **e.** Ministry of foreign affairs
- **f.** Military

4. Initiate contact with other agency(s). (Telephone conference call is outlined below but other forms of direct contact may be appropriate.) SMC representative initiates the call and guides the discussion or hands it off to a facilitator that the group has agreed to for guiding the discussion.

<u>Telephone conference call – example sequence of discussion/agenda:</u>

· Participants roll call (initiated by SMC or facilitator)

· Discussion to establish guidelines on conducting the meeting (SMC or facilitator)

· Purpose of the call/meeting (SMC or facilitator)

· Review of the current situation (lead agency)

- Summary of SAR case
- Which foreign SAR unit is requesting expedited entry and the reason for the request
- Lead and supporting agencies
- Amplifying information from meeting participants (led by SMC or facilitator)
- Desired end state(s) (lead agency)

· Questions (led by SMC or facilitator)

- What policy and legal issues must be considered?
- What authorities are required to achieve desired end state(s)?
- What precedents, if any, are there for allowing expedited entry of the foreign SAR unit into the State's territory?

· Proposed course of action (led by SMC or facilitator) focusing on current operations and desired outcome

- What are the steps to attain approval?
- What action items must be completed by each supporting agency?
- Lead agency transitions / hand-offs
- What additional briefings/discussions must be conducted?
- Resolve agency disputes

· Follow-up intentions/discussions required (led by SMC or facilitator), if needed

- Future calls
- Email coordination

· Final comments or issues

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ANNEX 2

AMENDMENTS TO IAMSAR MANUAL VOLUME II

Editorial Note.— Page numbering to be sequential

Contents

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Appendices

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Abbreviations and acronyms

Editorial Note.— Consolidate the list of abbreviations and acronyms from Volumes I, II and III into one

. . .

ELT…………….. emergency locator transmitter
EO/IR………….. electro-optic/infrared
EPRIB………… emergency position-indicating radio beacon
. . .

~~**Inmarsat……….** an IMOrecognized mobile satellite service~~
. . .

L_b....................... datum baseline
LADR ………….. Location of an Aircraft in Distress Repository
LCB……………. line of constant bearing
. . .

NVD…………… night vision devices
. . .

PS…………….. parallel ~~sweep~~track search
. . .

***R_o* ……………..** optimal search radius
Radar SART …. search and rescue radar transponder
RANP ………… (ICAO) Regional Air Navigation Plan
. . .

RCC…………… rescue coordination centre
RMSS………… recognized mobile satellite service
RPA……………. remotely piloted aircraft
. . .

~~**SART …………**~~ ~~Search and Rescue (radar) transponder~~
. . .

Glossary

Editorial Note.— Consolidate the Glossary from Volumes I, II and III into one

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Coverage factor (*C*)	The ratio of the search effort (*Z*) to the area searched (*A*). *C* = *Z/A*. For search areas covered by search patterns with equally spaced parallel search legs, the Coverage factor (C) ~~For parallel sweep searches, it~~ may be computed as the ratio of sweep width (*W*) to track spacing (*S*). *C* = *W/S*.
. . .	
Effort factor (f_Z)	(1) For point and leeway divergence datums, the effort factor is the square of the total probable error of position (*E*). *f*Zp = *E*2. **(**2) For line datums, the effort factor is the product of the total probable error of position (*E*) and the length of the line (*L*). *f*Zl = *E* × *L*.
Electro-optic/infrared (EO/IR) system	Electronic imaging systems which include both visible and infrared sensors that can be used day and night and in low light conditions with the ability to view objects at long distance.
Emergency locator transmitter (ELT)	A generic term (related to aircraft) describing equipment which broadcast distinctive signals on designated frequencies and, depending on application, may be automatically ~~activated by impact~~ or ~~be~~ manually activated.
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Flight information centre (FIC)	A unit established to provide information and alerting services.
Flight tracking system	A generic term applied to various forms of flight tracking systems where aircraft position and tracking information is derived from ATS surveillance, satellite or terrestrially based systems and applications.
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NAVTEX	The system for the broadcast and automatic reception of maritime safety information by means of narrow-band direct-printing telegraphy.
Night vision device (NVD)	Night vision enhancement equipment fitted to, or mounted in or on, an aircraft, vessel or vehicle, or worn by a person, that can: .1 detect and amplify light in both the visual and near-infrared bands of the electromagnetic spectrum; or .2 provide an artificial image representing topographical displays. *Note – NVD is used as a collective term incorporating all aspects associated with night vision such as night vision imaging systems (NVIS) and night vision goggles (NVGs).*

On scene	The search area or the actual distress site.

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Vessel tracking	A generic term applied to all forms of vessel track data derived from multiple sources such as ship reporting systems, AIS, LRIT, ~~SAR aircraft,~~ VMS and VTS.

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Visual meteorological conditions (VMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.
Visual search	A search using human eyesight, which may include the use of corrective lenses, without the aid of specialized equipment such as binoculars, digital television or night vision imaging systems.
Wave (or Chop)	The condition of the surface is caused by local wind and characterized by irregularity, short distance between crests, whitecaps and breaking motion.

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Chapter 1

The search and rescue system

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1.3 SAR resources

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1.3.9 Introduction of GMDSS aboard only some vessels adds capabilities for those vessels, but also introduces incompatibility between those vessels and vessels not GMDSS equipped. It also introduces the need for some SAR authorities to support two maritime mobile and fixed systems. An initial goal of GMDSS was to eliminate the need for a continuous listening watch on VHF-FM channel 16. However, since most other vessels depend on channel 16 for distress, safety and calling, IMO has decided that all GMDSS ships, while at sea, shall continue to maintain, when practicable, continuous listening watch on VHF-FM channel 16.

Aeronautical systems

1.3.10 A range of flight tracking information and data sources are available to support RCC operations. Sources include air traffic services surveillance data and commercial providers of flight tracking data. These sources compliment the information provided by the Global Aeronautical Distress and Safety System (GADSS).

1.3.11 Direct access by RCCs to flight tracking systems provides significant efficiencies and benefits including:

- Ability for RCCs to determine aircraft position data independently of ATS units and in real time (or near real time)
- Reduced requests by RCCs to ATS units and therefore reduced coordination communications
- Reduced distraction to ATS officers
- Provide an ability for tracking data to be automatically input and updated within RCC incident management systems, including display within mapping systems, support to historical data searches and efficient record-keeping
- For RCCs without incident management systems or the ability to import source data, online systems are available to provide tracking data using a web browser or web application
- Improved and timelier situational awareness within an RCC.

1.3.12 RCCs should note that ATS units, in particular ACCs, may not be in communication with, or have knowledge of, all aircraft shown by flight tracking systems to be within their area of responsibility. This is particularly so of general aviation aircraft operating outside controlled airspace.

1.3.13 Flight tracking information is available from a number of sources, including satellite and terrestrially derived information. Examples include:

- ATS surveillance data from Air Navigation Service Providers, such as RADAR, ADS-B and Flight Information System (FIS) data
- Commercial systems used by aircraft operators and SAR aircraft
- Web-based systems that use aircraft ADS-B or Mode S transponder information

- Electronic Flight Bag systems and apps, including associated web-based interfaces.

1.3.14 Formal arrangements may be required for RCC access to flight tracking data from service providers. Some service providers provide their data freely on websites, while others offer online paid subscription services.

Global Aeronautical Distress and Safety System

1.3.~~10~~15 The Global Aeronautical Distress and Safety System (GADSS) was established to mitigate challenges in the global air navigation system, regarding the timely identification and localization of aircraft in distress. GADSS provides an effective and globally consistent approach to enhancing the alerting procedures of search and rescue services by addressing a number of key improvement areas.

1.3.~~11~~16 GADSS has three main elements:

– aircraft tracking (typically between the ATS unit and the aircraft operator);
– location of an aircraft in distress (achieved through autonomous distress tracking (ADT) of aircraft in flight); and
– post-flight localization and recovery.

1.3.~~12~~17 GADSS ensures an up-to-date record of aircraft progress is maintained and, in case of a crash, forced landing or ditching, ensures information on the location of survivors, the aircraft and recoverable flight data is available. For GADSS to function as intended, flight crew and aircraft operators, air traffic controllers and air navigation services providers, ADT service providers, and rescue coordination centres (RCCs) need to understand each other's roles, responsibilities and processes to ensure effective communication, robust coordination and harmonized implementation across the globe.

1.3.~~13~~18 For aircraft tracking in GADSS, the aircraft operator is required to establish an aircraft tracking capability throughout its area of operations. Such tracking is required in oceanic areas (airspace which overlies waters outside of the territory and territorial sea of a State) and recommended in all areas of operations. Tracking is accomplished through automated four-dimensional (latitude, longitude, altitude and time) position reports transmitted at an interval of 15 minutes or less, unless ATS surveillance obtains aircraft position information at 15-minute intervals or less.

1.3.~~14~~19 The aircraft tracking element enhances the ability of RCCs to obtain information on an aircraft in an emergency situation but also to provide information on other aircraft in the area that may be able to assist, for example, to divert to a distress location, relay communications, etc. However, aircraft tracking responsibilities and actions are typically performed between the ATS unit and the aircraft operator.

1.3.~~15~~20 The location of an aircraft in distress (achieved through autonomous distress tracking (ADT) of aircraft in flight) element has the greatest potential impact upon aeronautical and maritime SAR services.

1.3.~~16~~21 The ~~s~~Standard defining location of an aircraft in distress requires that, as of 1 January ~~2023~~2025, aircraft first issued with a certificate of airworthiness ~~for the first time~~on or after 1 January 2024, with a maximum certificated take-off mass of over 27,000 kg, "shall autonomously transmit information from which a position can be determined by the operator at least once every minute, when in distress." The ICAO provisions also recommend that this requirement be applied to aircraft with a maximum certificated take-off mass of over 5,700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2023.

1.3.~~17~~22 More detailed information on responsibilities and procedures regarding ADT and aspects of post-flight localization and recovery is provided in appendix V, Autonomous distress tracking of aircraft in flight.

1.3.~~18~~23 Aircraft post-flight localization and recovery is improved by standards on aircraft carriage of underwater locating devices (ULD). This is intended more for the recovery of flight recorder data by the aeronautical accident investigators. SAR services should be aware that detecting the ULD is not an SAR responsibility or task. Two types of ULD are in use, which assist in locating wreckage below the surface of water where it is not possible to detect an ELT signal.

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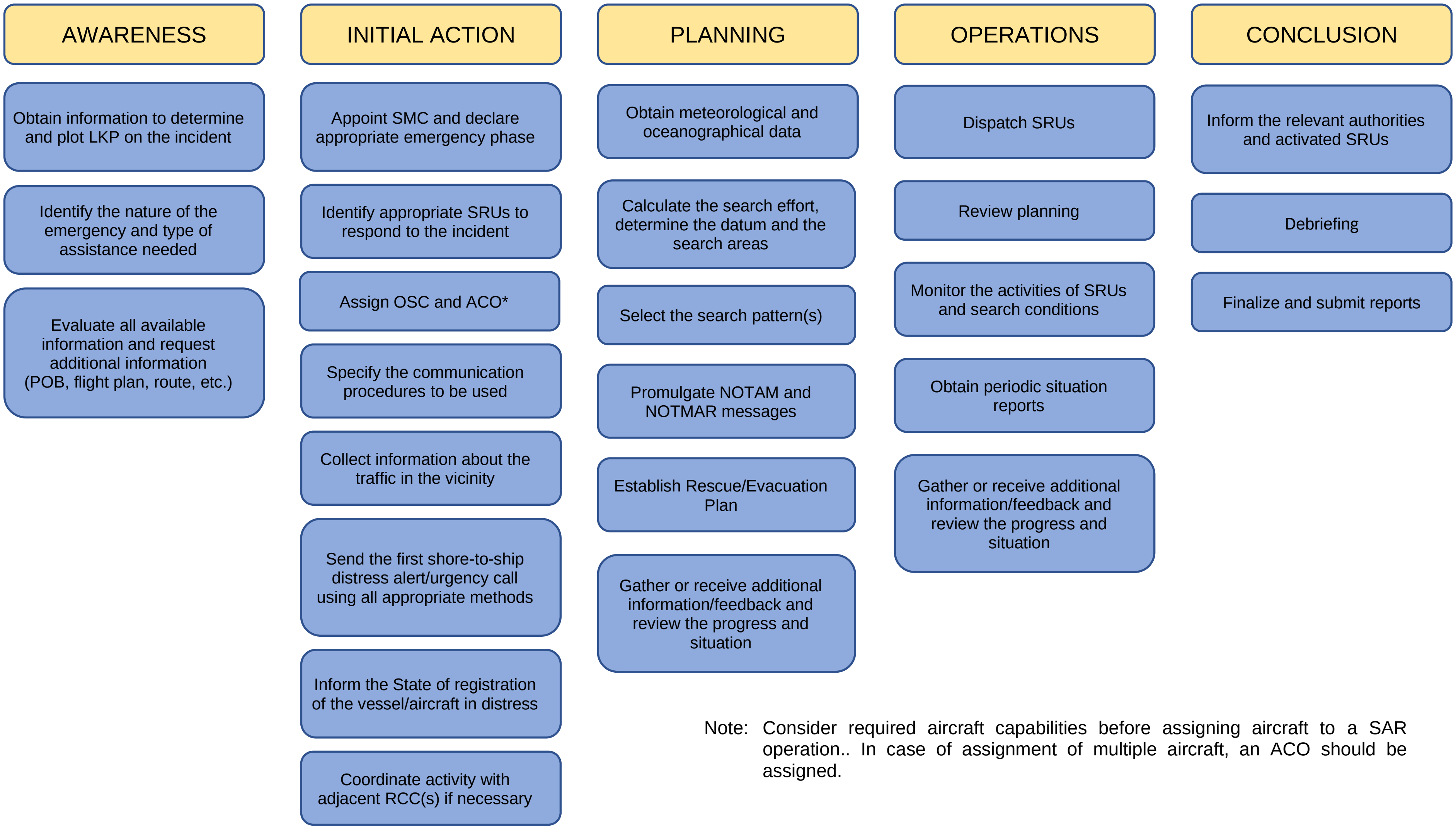
1.6 SAR operations stages

1.6.1 The success of a SAR mission often depends on the speed with which the operation is planned and carried out. The prompt receipt of all available information by the RCC is necessary for thorough evaluation of the situation, immediate decision on the best course of action, and a timely activation of SAR facilities. While no two SAR operations follow exactly the same pattern, SAR incidents do generally pass through defined stages, which can be used to help organize response activities. These stages are discussed in general terms below and expanded discussion is found in the remaining chapters of this volume. These stages should be interpreted with flexibility, as many of the actions described may be performed simultaneously or in a different order to suit specific circumstances. Figure 1-1 - SAR process chart outlines the steps to be followed for these stages.

Editorial Note.— insert new figure 1 – 1 – SAR process chart in landscape orientation



Note: Consider required aircraft capabilities before assigning aircraft to a SAR operation.. In case of assignment of multiple aircraft, an ACO should be assigned.

Figure 1-1 – SAR process chart

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Training of RCC and RSC personnel

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1.8.15 RCC and RSC SAR training should also include many other topics. If search planning skills, knowledge and expertise gained from formal training are not used on a regular basis for operations or exercises, then periodic recurrent training must be implemented to ensure reliable and effective delivery of SAR services. Subject matter should include:

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Fatigue factors
GADSS
GMDSS
International aspects
Interviewing techniques

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1.11 Computer resources

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1.11.10 *Display of vessel tracking data*. A computer system with geographic information system (GIS) display capability is important for displaying vessel tracking data sourced from AIS, LRIT, VMS, VTS and other sources. The location of SAR units can also be tracked and displayed, as can search areas and other information.

1.11.11 *Display of flight tracking system data.* A computer system with geographic information system (GIS) display capability is important for displaying flight tracking system data sourced from ATS surveillance systems and other flight tracking systems and applications. The in-flight position and tracking details can be displayed for aircraft experiencing an emergency, aircraft that may be able to provide immediate assistance to a distress situation, SAR aircraft and other information. Historical data can also be retrieved, displayed and analysed for aircraft that have been reported overdue or are missing.

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Chapter 2

Communications

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2.5 Global Maritime Distress and Safety System

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2.5.5 Most SOLAS ships can be expected to have at least the following equipment (consult the SOLAS Convention and paragraphs 2.5.6 through 2.5.14 for requirements):

- VHF radiotelephone (channels 6, 13 and 16);
- VHF DSC (channel 70) transmitter and watch receiver;
- Radar SART ~~(radar)~~ and/or AIS-SART;
- NAVTEX receiver;
- EGC if operating outside NAVTEX range; and
- EPIRB, as appropriate.

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2.5.10 A radar ~~search and rescue radar transponder (~~SART~~)~~ interacts with vessel or aircraft radars (9 GHz) for locating survival craft. Radar SART responses show up as a distinctive line of 12 equally spaced blips on compatible radar displays, providing a bearing and range to the radar SART. A radar SART is a portable device which should be taken into a lifeboat or liferaft when abandoning ship.

Note: Ship and aircraft radar signal processing and other functions may have to be disabled or adjusted to detect a radar SART. Doing so may degrade the radar's performance in detecting other targets. Consult the radar operating manual or radar's manufacturer.

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2.6 406 MHz distress beacons – EPIRB, ELT and PLB

2.6.1 Maritime emergency position-indicating radio beacons (EPIRBs) have been accepted into the GMDSS. These beacons operate on 406 MHz and may ~~have~~ include a 121.5 MHz final homing signal and/or an AIS locating signal. The signals are relayed via Cospas-Sarsat satellites, local user terminals (LUTs) and mission control centres (MCCs) to SAR points of contact (SPOCs) which include RCCs.

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2.6.5 ~~Most ELTs, EPIRBs and PLBs provide homing signals on 121.5 MHz; some also use 243 MHz and some EPIRBs may also integrate SARTs into their designs.~~ ELT(DT)s are designed for in-flight distress tracking and are not mandated to provide a homing signal. Some ELT(DT)s are specifically designed to withstand a crash impact or are designed as ELT(DT)s combined with automatic ELT functionality and include homing signal capability which can activate after the aircraft is no longer in flight.

2.6.6 Most 406 MHz distress beacons are designed to activate automatically when a vessel sinks or an aircraft crashes (EPIRB alerts tell whether the beacon was activated automatically or manually). PLBs are manually activated. Some PLB users may carry the devices for use aboard aircraft or vessels, though they are not designed to be equivalent to, nor suitable for use as, EPIRBs or ELTs. ELT(DT)s are designed to automatically activate when an aircraft is in a state which, if left uncorrected, can result in an accident, such as abnormal attitude or speed, or ground proximity, or can be manually activated.

2.6.7 Cospas-Sarsat position information can be determined by several methods. The LEOSAR system uses a Doppler plot resulting from relative motion between the 406 MHz distress beacon signal source and the orbiting satellites. Alert messages provide two positions an equal distance on each side of the satellite track, and a confidence level (annotated as a percentage) to help in assessing which position is correct. Cospas-Sarsat ~~is~~has transition~~ing~~ed to a system (MEOSAR) which ~~will~~ calculates position based on time difference of arrival (TDOA) and frequency difference of arrival (FDOA) of the beacon signal at multiple satellites. This method ~~will~~ provides a single position and an estimated error distance (the radius of the circle having a 95% probability of containing the actual location of the beacon). ~~Some~~ Many 406 MHz distress beacon messages ~~may also~~ include information derived from the Global Navigation Satellite System (GNSS). RCCs should consult the Cospas-Sarsat ~~Handbook on Distress Alert Messages for Rescue Coordination Centres (RCCs), search and rescue points of contact (SPOCs) and IMO Ship Security Competent Authorities (C/S G.007~~*Handbook on Distress Alert Messages for Rescue Coordination Centres (RCCs), search and rescue points of contact (SPOCs) and IMO Ship Security Competent Authorities (C/S G.007)*, available on the Cospas-Sarsat website at www.406.org) and other appropriate Cospas-Sarsat documentation for more information.

2.6.8 RCCs use the ~~message~~ country codes in the beacon message to direct them to the appropriate States where information can be obtained about the distressed craft from ~~emergency~~registration databases (including beacon registries if owners of ~~coded~~ 406 MHz distress beacons properly register them ~~ELTs~~); 121.5 and 243 MHz-only beacons ~~are not coded and~~cannot be registered, nor are they detected by the Cospas-Sarsat System. (The country codes in the beacon message directly correspond to the ITU maritime identity digits (MIDs) used to identify flag States.)

2.6.9 In the ~~original (LEOSAR)~~ Cospas-Sarsat LEOSAR ~~S~~system, signals from 406 MHz distress beacons can be stored aboard a satellite and relayed to ground later if no LUT receiver is immediately within view of the satellite, enabling the system to operate in a global mode with fewer LUTs required. The GEOSAR system relays beacon messages to LUTs and includes a GNSS position, if provided in the beacon message. In the MEOSAR system ~~which will augment the Cospas-Sarsat System~~, the signal from a 406 MHz distress beacon ~~will be~~is relayed through multiple satellites and received by an extensive network of LUTs, providing near instantaneous notification and location of distress ~~events~~ beacon activations. As with the GEOSAR system, the LEOSAR and MEOSAR systems may also provide a GNSS position if received from a GNSS enabled beacon.

Note: For more information on equipment, performance standards, alert messages, distribution procedures, users' instructions, and other Cospas-Sarsat related matters, the Cospas-Sarsat website should be consulted (www.406.org) or the Cospas-Sarsat Secretariat ~~should be~~ contacted (mail@406.org).

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2.7 Satellite communications

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2.7.2 Iridium is a system of 66 polar orbiting cross-linked satellites for worldwide mobile voice and data communications services and which supports the Global Maritime Distress and Safety System and other safety services. Iridium satellite constellation provides the communication links between Iridium SESs and the teleport(s), which are interconnected to the Iridium Gateways. The Iridium Gateways serve as the switching centre, routeing all communications into and from terrestrial networks, such as the public switched telephone network (PSTN) and public switched data network (PSDN).

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2.9 Survival and emergency radio equipment

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2.9.5 Passenger ships, regardless of size, and cargo ships of ~~300~~ 500 gross tons and over must carry one radar SART or AIS-SART on each side of the ship ~~radar transponders operating in the 9 GHz band~~ and have to be outfitted with a radar capable of operating on the 9 GHz band. ~~Ships may carry either a radar transponder(s) and/or an AIS-SART~~ Cargo ships of 300 gross tonnage and upwards but less than 500 gross tonnage may carry only one radar SART or AIS-SART instead.

2.9.6 ~~Passenger ships, regardless of size, and~~ Cargo ~~cargo~~ ships of 300 gross tonnage and upwards but less than 500 gross tons ~~and over~~ must carry at least two portable survival craft VHF transceivers, and passenger ships, regardless of size, and cargo ships of 500 gross tons and over must carry at least three. ~~If they operate in the 156-174 MHz band, they will use channel 16 and at least one other channel in this band~~ The equipment must be capable of operation on the frequency 156.8 MHz (VHF channel 16) and on at least one additional channel. ~~Portable DSC equipment can transmit on at least one of the following frequencies: 2,187.5 kHz, 8,414.5 kHz, or on channel 70 VHF.~~

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2.13 Communication equipment identities

2.13.1 A mobile station is normally identified by the vessel or aircraft radio call sign; ~~a~~the maritime mobile service identity (MMSI)~~ number~~; or an ~~seven- or nine- digit~~ RMSS SES identity~~ for Inmarsat terminals~~. Survival craft radios use the parent craft's call sign followed by two digits (other than 0 or 1 if they immediately follow a letter). ~~Satellite~~406 MHz ELTs and EPIRBs are identified by ~~a three-digit MID or (country code) followed by~~ either a ~~six~~ nine-digit MMSI ~~number~~ (for EPIRBs), a type-approval certificate number and a serial number, an ICAO 24-bit address (for ELTs), an operator 3-letter designator and a serial number (for ELTs), or a radio call sign. Country codes should indicate the State where the associated registration data to support SAR operations may be obtained, but may just indicate the flag State if the beacon is not properly registered or coded, allowing RCCs to consult the ITU Maritime mobile Access and Retrieval System (MARS) database, the IBRD (www.406registration.com), or other national registration databases that might be available.

2.13.2 MMSIs are usually assigned by flag State Administrations, and all are supposed to be reported to and published by ITU. MMSI numbers consist of three digits representing the MID, followed by digits indicating the particular vessel. ~~A list~~Allocation of MIDs is managed by~~available in the~~ ITU ~~Radio Regulations~~, and ~~a more updated~~an up-to-date MID list may be obtained from ITU via the Internet. This can be a useful database when following up a DSC distress alert. MMSIs are also used in the AIS for vessels, base stations, aids to navigation, SAR aircraft and AIS-SARTs. The various platforms can be differentiated by reference to the MMSI format and from databases.

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2.15 SAR data providers

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2.15.3 ~~Inmarsat~~RMSS data are available to SAR organi~~s~~zations on a 24-hour basis unless owners have requested an unlisted registration. RCCs must request the data directly from ~~Inmarsat~~RMSS providers, or, in the case of Inmarsat, from its LESs if the data have been downloaded to them.

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2.15.6 The IMO Global SAR Plan or the GMDSS Master Plan may provide information about how to acquire registration data for various systems, along with the information these documents and ICAO RANPs contain on RCCs and SPOCs. If no other information is available about national databases and SDPs of other nations, RCCs should consult with an RCC in the State concerned to see whether and how the data are available.

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2.16 RCC and RSC communications

2.16.1 National plans should provide for operational matters to be handled promptly at the RCC level or below in the SAR system, including making and responding to requests for assistance. Advance provisions should be made for rapid coordination with other agencies for SAR-related territorial entry if necessary. An RCC plan of operation for expeditious approval to allow SAR units to enter the territory of the State for the conduct of search and rescue can be developed based on IAMSAR Manual Volume I, appendix Q *Sample process for expeditious approval to allow SAR units from an assisting State to enter into the territory of the State of the RCC*. Supporting guidance is in the provisions for SAR agreements as outlined in IAMSAR Manual Volume I, appendix I *SAR Agreements*.

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2.23 On-scene communications

2.23.1 Besides equipping SAR aircraft to communicate on the frequencies 2,182 kHz, 3,023 kHz, 4,125 kHz, 5,680 kHz, 121.5 MHz, and 123.1 MHz, some SAR authorities have provided for other communication equipment on scene, such as:

- AIS, to detect ~~the~~AIS-SARTs~~, search and rescue transmitter (SART)~~ and/or ~~SART-compatible~~ 9 GHz radars, for ~~SAR facilities~~radar SARTs;

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2.27 SAR operations communications

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2.27.4 Additional information on communications planning for mass rescue operations is provided in chapter 6 and appendix C.

2.27.5 Additional information on communications interference within wind farms is provided in chapter 6, 6.15.6.

2.28 SAR operations messages

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RCC – RCC distress alert information formats

2.28.3 When an RCC must pass distress information to another RCC, there is a need for consistency of formats and styles, for all essential information to be provided, and for the information to be easily and clearly understandable. Model formats provided in appendix B have been developed for the relay of ~~Inmarsat-C, and DSC~~ distress alerts between RCCs.

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Search action message

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2.28.17 The message normally includes seven parts:

(a) *Situation:* includes a brief description of the incident, position and time; the number of persons on board (POBs); primary and secondary search objects, including the amount and types of survival equipment; weather forecast and period of forecast; and SAR facilities on scene.

(b) *Action:* specific tasking for a particular SAR agency or facility.

(c) *Search area(s):* presented in column format with headings for area, size, corner points (or centre point details), other essential data.

(d) *Execution:* presented in column format with headings for area, SAR facility, parent agency, pattern, creep direction, commence search points, and altitude.

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MEDICO communications

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2.28.31 Communication between the ship and TMAS can be established via cost radio stations using VHF, MF or HF radio or via RMSSs (e.g. Inmarsat and Iridium). Inmarsat satellite communications can be accessed by use of special access codes (SAC) 32 for medical advice and 38 for medical assistance or MEDEVAC. Inmarsat Land Earth Stations (LES) normally route SAC 32 direct to a TMAS and SAC 38 to the associated RCC. ~~Inmarsat~~RMSSs can support voice and telex (text only for Inmarsat C).

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2.32 Unbarring of Inmarsat SESs by RCCs

2.32.1 InmarsatRMSS providers sometimes findss it necessary to bar a vessel's SES from transmitting and receiving communications. In such cases, the SES can still be used by vessels to send distress alerts or make distress calls. In the case of an emergency, an RCC will initially attempt to contact the vessel to ascertain whether the distress alert is real or inadvertent. If the RCC is unable to communicate with the vessel, they will then check its status in the MRCC Database. Mandatory or discriminatory barring will prevent communications with the vessel. The RCC may then contact the RMSS provider concerned, or call its associatedrelevant component (e.g. LES for Inmarsat), to confirm the barring status of the terminal. The LESRMSS provider will verify the barring status of the terminalby referring to the appropriate tables (barring/authorization etc.). If the terminal status is confirmed as barred, the RCC will then request the LESRMSS provider to unbar the terminal so that communications with the vessel can be established. If the RCC is unable to communicate with the LES, or requires the terminal to be unbarred by more than one LES, it should contact Inmarsat Customer Services or Inmarsat Network Operations Centre (NOC),or both.

2.32.2 Any RCC that is not associated with an Inmarsat LESRMSS may not know through which LES it is attempting to communicate with a vessel. There can be a number ofthe reasons why a non-associated RCC it is unable to communicate with the vessel, including barring of the vessel or local/national telecommunications issues. If local/national telecommunication issues are not relevant and barring is suspected, the RCC should first try to contact the vessel via an InmarsatRMSS associated RCC, who will be able to arrange for the barring to be lifted. Alternatively, the non-associated RCC may contact the RMSS providereither Inmarsat Customer Services or Inmarsat NOC (or both) which operate on a 24-hour basis. Inmarsat will to check its Electronic Service Activation System (ESAS) for the correct status of the terminal, i.e. active, barred etc. If the terminal is found to be active and not barred, Inmarsatthe RMSS provider will assist the RCC by providing any other information or advice as requested.

2.32.3 Additionally, vessels equipped with Voice Distress-enabled Fleetbroadband terminals may be similarly barred. However, LESs will be unable to assist in these cases and the RCC should contact either the Inmarsat Customer Services which operates on a 24-hour basis or the Network Operations Centre (NOC), which also operates on a 24-hour basis, who will be able to arrange the necessary unbarring.

2.32.43 When the distress situation is resolved, the RCC should inform the LES(s)RMSS provider and either the Inmarsat Customer Services or the NOC, at the earliest opportunity, to reinstate the barring on the terminal.

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2.34 Vessel tracking communications

2.34.1 Various forms of communication can be used for vessel tracking. Ship reporting systems can use voice reporting over VHF and HF, and data reporting over DSC and mobile satellite services (IMO-recognized or other mobile service). Many ship reporting systems use Inmarsat-C polling or Inmarsat automated position reporting (APR). AIS uses a time-division multiple access (TDMA) scheme to share the VHF frequency, also known as the VHF Data Link (VDL). There are two dedicated frequencies used for AIS: AIS 1 (161.975 MHz) and AIS 2 (162.025 MHz). LRIT can employ any form of communication which meets the required functional specification, but most vessels use Inmarsat for the shipborne equipment to report its identity, position and timestamp information every six hours to their data centre via a communications provider an application service provider. Vessel monitoring systems (VMS) can use various systems for tracking, including Inmarsat, Iridium and Argos.

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Chapter 3

Awareness and initial action

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3.4 Awareness stage

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3.4.6 *Notification by other sources*. All persons are encouraged to report any abnormal occurrence they have witnessed or heard about. Notification that an aircraft has crashed, or an aircraft, ship or other craft is overdue or in a state of emergency, may therefore reach an RCC from any source, either directly or relayed through an alerting post. The ICAO Location of Aircraft in Distress Repository (LADR) will notify SAR authorities, if appropriately subscribed, that data related to an aircraft in distress may be available.

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3.4.8 After evaluating all available information and if an emergency phase is declared, the RCC or RSC should immediately inform all appropriate authorities, centres, services or facilities. When more than one RCC may have received the distress alert, the RCCs should quickly coordinate and each should advise the other of the action it has taken on the alert. This can be done by any practical means, including IMO-recognized mobile satellite services or ICAO's AFTN. This especially applies when an initial Cospas-Sarsat alert provides a~~n~~ LEOSAR A and a B Doppler position or a MEOSAR DOA position with a large estimated error, since the A and the B Doppler positions or the DOA positions can be in different SRRs.

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3.5 Initial action stage

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Uncertainty phase initial actions

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3.5.3 The communication search can be conducted by two primary methods.

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(b) Determine its most probable location by:

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– contacting other appropriate sources, e.g. aircraft known or believed to be on the same route or within communication range, flight tracking systems, vessels at sea which may have sighted the ship or craft, ship reporting and vessel tracking systems that may provide SURPICs, and other persons who have knowledge of the intentions of the pilot in command or ship's captain, such as the craft's operating authority.

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Distress phase initial actions

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3.5.9 Upon the declaration of a distress phase, the RCC or RSC should:

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(d) Determine the availability of SAR facilities to conduct SAR operations and attempt to obtain more facilities if a need for them is anticipated. Check flight tracking systems and vessel tracking systems (e.g. AIS, LRIT, VMS and VTS) for aircraft and vessels which may be able to assist.

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Chapter 4

Search planning and evaluation concepts

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4.3 Estimating the distress incident location

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Initial distress incident location probability distributions

4.3.4 Several types of probability distribution are described and illustrated below. In the graphic representations, peaks represent locations where the probability density (amount of probability per unit area) is highest. There are basically three types of information which may be available about the location of a distress incident.

(a) *Point*. This is the simplest and most specific type. It may be specified by latitude and longitude, range and bearing from a known point, or other method for specifying a geographic position. It is usually obtained from either the distressed craft itself or from external position-fixing equipment (such as two or more lines of bearing from independent direction-finding stations or positions provided by satellites, e.g. Cospas-Sarsat or from information obtained about mobile telecommunications device location and/or activity). If the time of the incident is known but not the datum, the incident position may be estimated based on the LKP and the craft's intentions. The distribution of incident location probabilities is generally assumed to be that given by a circular normal probability density function. Under this assumption, the probability density is highest near datum and decreases as the distance from datum increases. The incident's probable position error (X) (discussed in paragraph 4.3.5) is defined to be the radius of the circle having a 50% chance of containing the actual location of the incident. A circle with three times this radius would contain virtually all possible incident locations. Figure 4-1 illustrates the graphs of a circular normal distribution in a three-dimensional view where the vertical axis represents probability density, and also as a contour graph (similar to a topographic map of mountainous terrain). For a MEOSAR DOA position sent by Cospas-Sarsat, the Estimated Error included in the SIT185 message is the radius of the circle having a 95% chance of containing the actual location of the beacon.

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4.7.7 *Other factors*. The preceding paragraphs describe how to optimally allocate search efforts based on theoretical considerations. There are also many practical, and sometimes conflicting, considerations which may influence the final search plan. Some things the search planner should evaluate are:

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(e) *Late clues*. Sometimes, the assumptions upon which previous search plans were based are shown to be incorrect in some way by the arrival of new information not available earlier. If the most probable scenario based upon the new information is significantly different from the previous one, it may be necessary to re-compute all previous results, accounting for the impact of the new information. It may even be necessary, in extreme cases, to discard all previous results and start over.

(f) *Wind farms*. The requirement to plan a search in the vicinity of, or within, a wind farm is likely to present additional challenges to a search planner. Consideration should be given to the impact a wind farm may have on leeway and total water current. Sweep width values may be reduced owing to the presence of turbines hampering detection opportunities. Survivors may attempt to swim to nearby structures for refuge resulting in a requirement to search the base, boat landing and transition piece of turbines.

~~(f)~~(g) *Practical considerations…*

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Chapter 5

Search techniques and operations

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5.3 Assessing search conditions

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Sweep width

5.3.2 One of the primary indicators of whether search conditions are ideal or normal is the sweep width. Experiments have shown that sweep width decreases as search conditions deteriorate. Experiments have also shown that detection profiles under normal search conditions are generally lower and flatter than they are under ideal search conditions. These results are also supported by search theory. In addition, search theory goes on to predict that probabilities of detection for the same coverage factors will be lower for searches performed under normal conditions than for searches performed under ideal conditions. Therefore, the corrected sweep width is important for two reasons. First, it is one of the three factors which determine how much search effort is available (see paragraph 4.6.8). Second, when it is compared to the uncorrected sweep width for ideal search conditions, it may be used to determine how ideal or normal the actual search conditions are. The following list describes factors which separately, or in combination, may affect sweep width.

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(c) The type of terrain, presence of offshore structures and obstacles (e.g. wind turbines, fixed or floating navigational aids) or conditions of the sea can affect sweep widths in almost all situations. On a flat area with little or no vegetation, a search object can be seen easily, while it may be very difficult to detect the search object in a forested area or mountainous terrain. On a smooth sea, any object or disturbance of reasonable size may be seen fairly easily, but whitecaps, foam streaks, breaking seas, salt spray, ~~and~~ the reflection of the sun, and offshore structures and obstacles tend to obscure a search object or reduce the chances of seeing it or its signals.

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(e) The time of day is another important consideration. The best time for visual searching during daylight is from mid-morning to mid-afternoon, when the sun is at a relatively high elevation. Visual search at night will be futile unless ~~it is known that~~ the survivors have night signalling devices such as flares or lights, or can generate light in some other way such as by building a fire. However, where it is safe for search units to ~~continue and~~ search at night using active aids, such as searchlights, radar, electro-optic systems, infrared devices, low light television, ~~or~~ night vision devices ~~are available and usable,~~ or parachute flare searches, then searches could continue.

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Accuracy of navigation by search facilities

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5.3.5 To be effective, search patterns must be accurately navigated. The size of the search facility's probable position error relative to the size of the sweep width determines how much the probability of detection will be affected by the search facility's navigational limitations. A position error of two miles is not usually significant if the sweep width for that search is 20 miles. However, if the sweep width is only two miles, the effect of a two-mile position error on probability of detection will be substantial.

5.3.6 A common practice for SRUs and facilities conducting maritime or aeronautical SAR searches is to use electronic navigation systems programmed for computation of search pattern waypoints and navigation between the computed waypoints. Electronic navigation systems use specialized computers that provide navigation data and computations. When connected to the SRU's controls, they also provide functions such as automatic pilot, including the automated performance of search patterns. However, these electronic navigation systems can create inaccurate searches due to a lack of established standards for the entry of search pattern descriptions and methods for computing search pattern waypoints from the descriptions. A single keystroke error or omission of a single necessary keystroke (such as an indicator that entered directions are true compass rather than magnetic compass) can drastically alter the pattern computed by the SRU's navigation system. Interim steps are provided in section 5.13 Search Action Plans, so that the SMC can compare the area actually searched as reported by the search facility to the search area assigned in the search action plan.

5.3.7 Developing and implementing the necessary search pattern specification standards for both search planning software applications and electronic navigation systems capable of performing the assigned search patterns will take many years. The corner-point method and, in particular, the centre-point method of pattern specification, may be more commonly used to attain such a standard. Both are discussed in paragraph 5.11 and are displayed in appendix L as a search action plan worksheet and message.

Evaluating search conditions

5.3.~~6~~8 Search conditions should be considered normal:

(a) whenever the corrected sweep width is less than or equal to one-half of the uncorrected value for a given search object and sensor under ideal environmental conditions; and

(b) whenever the search facility's probable error of position (*Y*) is equal to or greater than the sweep width.

For example, the conditions for a visual search from a merchant vessel for a 12 m (40 ft) boat when the visibility is 9 km (5 NM) or less should be considered normal because the sweep width is less than one-half the value for visibilities of 37 km (20 NM). Table N-4 shows a sweep width of 8.3 km (4.5 NM) for a visibility of 9 km (5 NM), which is less than half the sweep width value of 21.5 km (11.6 NM) for visibilities of 37 km (20 NM) or more. If a fixed-wing aircraft is being used to search for a 4-person liferaft from an altitude of 300 m (1,000 ft) on a clear, calm day and the aircraft's probable error of position is 5.6 km (3.0 NM), search conditions should be considered normal since the sweep width for such a search is only 4.3 km (2.3 NM).

Note: Search conditions should be considered ideal only when the sweep width is at or near its maximum value and the navigational error of the search facility is small in comparison to the sweep width. Search conditions are normal more often than they are ideal.

5.3.~~7~~9 Procedures for computing sweep width from the sweep width tables in appendix N are included with the Effort allocation worksheet in appendix L.

5.4 Selecting search patterns

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5.4.2 The selection and orientation of a search pattern are very important and all pertinent factors should be considered before a selection is made. Search pattern(s) and their directional orientation(s) should meet the criteria listed below.

(a) They should be appropriate for the:

. . .

(d) The selected search patterns should minimize the risk of collision with other search facilities, allow adequate fuel reserves, and avoid, where practicable, navigation hazards.

(e) Searches in the vicinity of, or within, a wind farm may create a restricted search environment where standard search patterns are not effective or possible. Such an environment may also have an impact on standard sweep width and search effectiveness calculations. The layout of the wind farm will be key in determining suitable search patterns. Where turbines are in alignment, standard search patterns may be possible, although track spacing is likely to be limited.

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5.4.4 When it is known or likely that a ~~survival~~distress beacon may be available in the distressed craft or survival craft or be carried on the person of a survivor, an electronic beacon search using an appropriate pattern should be carried out by a fast aircraft flying at a high level while a visual search is carried out at a lower level or on the surface.

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5.4.6 The search patterns, techniques and guidance described ~~below~~in this chapter are arranged in the following four general categories:

- visual search patterns;
- electronic search ~~patterns~~techniques;
- night search ~~patterns~~techniques; and
- land search patterns.

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5.5 Visual search patterns

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Track line search (TS)

5.5.6 The track line search pattern is normally employed when an aircraft or vessel has disappeared without a trace while en route from one point to another. It is based on the assumption that the distressed craft has crashed, made a forced landing or foundered on or near the intended route and concentrates the search effort near this datum line. It is usually assumed that the survivors are capable of attracting the search facility's attention at a considerable range by some means such as a signalling mirror or coloured smoke (daylight), flares, flashing light or signal fire (night), or electronic beacon (day or night). The track line search consists of a rapid and reasonably thorough search along the intended route of the distressed craft. The search facility may search along one side of the track line and return in the opposite direction (TSR), as shown in figure 5-4, or it may search along the intended track and once on either side, then continue on its way and not return (TSN), as shown in figure 5-5. Owing to their high speed, aircraft are frequently employed for visual track line searches, normally at a height of 300 m to 600 m (1,000 ft to 2,000 ft) above the surface during daylight or at 600 m to 900 m (2,000 ft to 3,000 ft) at night. This pattern is often used as an initial search effort because it requires relatively little planning and can be quickly implemented. If the track line search fails to locate the survivors, then a more intensive search over a wider area should be undertaken.

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Editorial Note.— MOVE **Figure 5-3** – *Second expanding square search* to after paragraph 5.5.5, and before Track Line Search (TS), paragraph 5.5.6

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5.6 Electronic search ~~patterns~~techniques

~~Survival~~Distress beacon search

5.6.1 When it is known or believed that an aircraft, vessel or persons in distress are equipped with a ~~survival~~distress beacon, such as an ELT, EPIRB or PLB, ~~an electronic~~a beacon search at high level should be initiated immediately whether or not any message has been received via the Cospas-Sarsat System (see section 2.6). ~~In addition to EPIRBs and PLBs operated by survivors, many aircraft carry ELTs that start operating when the G-forces reach a certain level, such as in a crash.~~ The ~~electronic~~beacon search should not preclude the simultaneous initiation of a visual search at lower levels since the success of ~~an electronic~~a beacon search depends on the ability of the ~~survival~~distress beacon to transmit a signal. Although it is not mandated that ELT(DT)s transmit a homing signal, ELT(DT)s that are specifically designed to be crash survivable, or function as ELT(DT)s combined with automatic ELTs, are capable of transmitting a 121.5 MHz homing signal after a crash.

5.6.2 The sweep width chosen in ~~an electronic~~a beacon search should be estimated based on horizon range for the level chosen for the search, since ~~most emergency~~distress beacons operate on frequencies that may be received only by line of sight. However, if the probable detection range is known and is less than the horizon range, it should be used instead. When the probable detection range of a ~~survival~~distress beacon is not known, the estimated sweep width over the sea or over flat terrain with little or no tree coverage should be about one-half of the horizon range shown in table N-12. Over jungle areas and in mountainous terrain, the sweep width estimate may have to be reduced to as little as one-tenth of the horizon range. In mountainous terrain or areas covered with dense vegetation, the range of the signal will be reduced considerably as compared to the range over water or flat land. Other variables which may reduce the probable detection range of the signal include:

(a) beacon antenna condition – the beacon's antenna may not be correctly deployed, is damaged or obstructed;

(b) beacon transmitter power output – different beacon models can have different homing signal transmission power; and

(c) aircraft radio equipment – the capability of both the reporting aircraft and search aircraft may vary dependent on their aircraft radio receiver sensitivity, antenna gain and squelch setting.

Because any of these variables may be applicable, it is important to appreciate that the actual range may differ substantially from the theoretical range.

5.6.3 Normally, a parallel sweep or creeping line pattern should be employed for ~~survival~~ distress beacon searches. Although the detection profiles for ~~electronic~~ beacon searches are likely to be different from those of visual search, the optimal search effort allocation techniques described in chapter 4 may be applied and should give results that are reasonably close to optimal. If the initial search of an area does not locate the beacon, the area should be searched again with the search legs of the second pattern oriented at right angles to those of the first pattern. If the beacon remains unlocated but confidence is high that it is in the area and working, a third search with search legs parallel to those of the first search but offset by one-half of a track space may be considered. In mountainous areas, the first search should be arranged so the search legs cross the predominant ridge lines at right angles if at all possible.

5.6.4 One of the following procedures may be used to locate a ~~survival~~distress beacon once it has been detected.

(a) For search facilities with homing capability, the search facility homes on the ~~survival~~distress beacon as soon as the signal is detected. The ~~survival~~distress beacon signal may be picked up quickly if the search facility proceeds towards the datum point where the search object location probability density is the highest. If this is unsuccessful, a systematic search of the area will have to be made, using the sector, expanding square, parallel sweep, or creeping line search pattern with a track spacing based on the optimal value for the available search effort.

(b) When reports are received of detections of a 121.5 MHz or 243 MHz distress beacon signal from overflying aircraft (these signals are not processed by the Cospas-Sarsat System), a search area will need to be established so that ~~an electronic~~a beacon search can be conducted~~ for the beacon~~. Appendix S can be used for guidance on gathering, recording, coordination and processing of aircraft distress beacon reports on 121.5 MHz, determining a search area and how that area should be searched.

Note – For distress beacon signals received on 243 MHz, the guidance in Appendix S may also be used; however, when calculating the radio horizon, in general the range for 243 MHz signals will be around 20% less than for 121.5 MHz signals.

(c) For aural ~~electronic~~beacon search by a facility without homing capability, a radio-frequency signal from a ~~survival~~distress beacon is detected and converted electronically to an audible sound which at least one member of the search facility crew can hear via a speaker or earphones. The following procedures are normally used only by aircraft. (The procedures could be used by vessels but the lack of equipment for detecting the signal as well as the low height of the vessel make this a less practical search technique.)

(1) In a map-assisted aural ~~electronic~~beacon search, the aircraft flies a "boxing in" pattern on the assumption that the area of equal radio signal strength is circular. The position of the aircraft is plotted on an appropriate map or chart as soon as the signal is heard for the first time. The pilot continues on the same heading for a short distance, then turns 90° left or right and proceeds until the signal fades. This position is noted. The aircraft now turns 180° and once again the positions of where the signal is heard and where it fades are plotted. The approximate position of the ~~survival~~distress beacon can now be found by drawing lines (chords) between each set of "signal heard" and "signal faded" positions, then drawing the perpendicular bisectors of each line and noting the position where they intersect. The aircraft can then proceed to that position and descend to a suitable altitude for visual or electronic sensor search. The construction of such a plot is shown in figure 5-13.

Editorial Note.— Retain figure 5-13 without change

Figure 5-13 – *Map-assisted aural ~~electronic~~beacon search*

(2) With the time-assisted aural ~~electronic~~beacon search, the time when the signal is first heard is noted, but the aircraft continues on the same heading until the signal fades, when the time is noted again and the length of time during which the signal was heard is computed as the difference between the two. The aircraft then performs a 180° procedure turn and returns along its original track in the opposite direction for half the amount of time just computed. At that point, the aircraft turns 90° right or left and continues until the signal fades. The aircraft then makes another 180° procedure turn and the time when the signal is heard again is noted. The aircraft continues on that heading until the signal again fades, noting the time and computing the signal's duration as the difference between the two times. The aircraft then performs a third 180° procedure turn and proceeds in that direction for one half of the last computed signal duration. It then descends to an appropriate altitude for visual or electronic sensor search. Figure 5-14 illustrates the geometry of this procedure.

Note: En-route aircraft may be very helpful and should be requested to listen on the ~~survival~~distress beacon's 121.5 MHz or 243 MHz alerting or homing frequency and report the positions where the signal is first heard and where it fades.

Editorial Note.— Retain figure 5-14 without change

Figure 5-14 – *Time-assisted aural ~~electronic~~beacon search*

Search by infrared and electro-optic devices

5.6.5 Infrared (IR) devices, such as IR TV cameras or forward-looking infrared radar (FLIR), are passive detection systems used to detect thermal radiation. They operate on the principle of detecting temperature differences to produce a video picture. Therefore, IR devices can often detect survivors by their body heat.

5.6.6 IR devices are normally preferred for night use. For aircraft, search height should normally be from 70 m to 150 m (200 ft to 500 ft) for small search objects such as persons in the water and up to a maximum of approximately 450 m (1,500 ft) for larger search objects or those having a stronger heat signature. The sweep width can be estimated based on the effective detection range as provided by the manufacturer.

5.6.7 Electronic imaging systems which include both visible and infrared sensors (electro-optic/infrared, or EO/IR, systems) can be used day and night and in low light conditions with the ability to view objects at long distance.

5.6.8 **Appendix W** contains general guidance for RCC staff on night searches by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices (NVDs).

Night vision devices

5.6.9 Use of night vision devices (NVDs) can be effective in searches carried out by helicopters, fixed-wing aircraft, rescue vessels, utility boats and ground search parties.

5.6.10 The following factors may influence the effectiveness of NVDs for searching:

– NVD quality;

– crew training and experience;

– environmental conditions (meteorological visibility, moisture, moonlight, cloud coverage, precipitation, etc.);

– level and glare effects of ambient light (including natural light like moonlight and starlight, and artificial light like illumination from search, navigation and other lights, inside and outside the search facility), and whether the light sources are within the NVD wearer's field of view;

– search-craft speed;

– height of the observers above the surface;

– surface conditions (such as the presence of snow) and sea state;

– size, illumination, and reflectivity of the search object (reflective tape on survivors or their craft can significantly improve the chances of detection with NVDs); and

– types of survival equipment or light sources (such as signalling devices and pyrotechnics) used by the survivors.

5.6.11 Glare should be minimized as much as possible within the facility's environment where the NVD users are stationed. This may involve opening or removing windows where practicable. Also, proper scanning techniques are important for reducing the adverse effects of moonlight or artificial light sources like light-houses, offshore rigs, ships, anti-collision lights, etc.

5.6.12 Visible moonlight can significantly improve detection of unlighted search objects when using NVDs. Search object light sources, like strobe or similar lights, or even cigarettes, can greatly improve detection even in poor visibility conditions such as light snowfall.

5.6.13 RCC staff should be aware that sweep width estimates should take into account local conditions and the advice of the facility on scene.

5.6.14 **Appendix W** contains general guidance for RCC staff on night searches by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices (NVDs).

Editorial Note.— *Renumber* subsequent paragraphs following '*Radar searches'*

Radar searches

5.6.~~5~~15 *Radar is primarily used in maritime search. Most available airborne radars would be unlikely to detect typical search objects on land except for metal wreckage in open areas such as desert or tundra.*

5.6.~~6~~16

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5.7 Night search ~~patterns~~techniques

5.7.1 For visual search at night, detection of survivors is unlikely if they have no means of night signalling such as flares, lights or signal fires. The use of electronic sensor equipment such as electro-optic, infrared, night vision devices and radar may detect survivors but these technologies have limitations which must be considered.

Survivor considerations

5.7.2 Survivors may be equipped with the ability to signal at night but may not be aware that search units are looking for them. The presence of night search units in the vicinity may elicit a signal from survivors if they see or hear search units. For example, when a search aircraft first arrives in the search area at night, if possible, the aircraft should be made as conspicuous as possible by flying through the search area or orbiting at lowest safe altitude with as many external lights visible before commencing the search. It is also important to consider that survivor morale can be lifted when they see or hear a search aircraft during the night, even if the search aircraft does not find the survivor.

Parachute flare searches

~~5.7.1~~5.7.3 ~~Detection of survivors at night is unlikely if they have no night signalling devices such as flares or lights.~~ The use of aircraft parachute flares does not appreciably increase the chance of detection of survivors at night. This type of illumination has very limited potential in searches for anything other than large objects located in well-defined search areas on flat land or at sea. It should also be noted that over land, a lookout will be confused by silhouettes or reflections from objects other than the search object.

5.7.~~2~~4 Parachute flares should not be dropped over inhabited areas unless exceptional circumstances warrant their use. Flares should not be used over any land area unless there is no risk that a ground fire may be started. Flare usage over land is always subject to the prescribed procedures and policies of the State(s) where the search area lies.

5.7.~~3~~5 Parachute flares are normally dropped from fixed-wing aircraft flying above and ahead of the search facilities. In this type of search, vessels and helicopters are the most efficient search facilities. Fixed-wing aircraft will normally be less effective. Parachute flares should not be dropped in such a way that casings or other material could fall on a search facility. It is essential to ensure flight separation between helicopters and fixed-wing aircraft in these situations. If the flare is of the type which falls free after burn-out, the flare must be dropped in such a way that it does not burn out over a search facility. Flares must be handled with care by crewmembers familiar with their use.

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~~*Search by infrared devices*~~

~~**5.7.4** Infrared (IR) devices, such as IR TV cameras or Forward-Looking Infrared Radar (FLIR), are passive detection systems used to detect thermal radiation. They operate on the principle of detecting temperature differences to produce a video picture. Therefore, IR devices can often detect survivors by their body heat.~~

~~**5.7.5** IR devices are normally preferred for night use. For aircraft, search height should normally be from 70 m to 150 m (200 ft to 500 ft) for small search objects such as persons in the water and up to a maximum of approximately 450 m (1,500 ft) for larger search objects or those having a stronger heat signature. The sweep width can be estimated based on the effective detection range as provided by the manufacturer.~~

~~***Night vision devices***~~

~~**5.7.6** Use of night vision devices (NVDs) can be effective in searches carried out by helicopters, fixed-wing aircraft, rescue vessels, utility boats, and ground search parties.~~

~~**5.7.7** The following factors may influence the effectiveness of NVDs for searching:~~

~~– NVD quality;~~

~~– crew training and experience;~~

~~– environmental conditions (meteorological visibility, moisture, moonlight, cloud coverage, precipitation, etc.);~~

~~– level and glare effects of ambient light (including natural light like moonlight and starlight, and artificial light like illumination from search, navigation and other lights, inside and outside the search facility), and whether the light sources are within the NVD wearer's field of view;~~

~~– search-craft speed;~~

~~– height of the observers above the surface;~~

~~– surface conditions (like the presence of snow) and sea state;~~

~~– size, illumination, and reflectivity of the search object (reflective tape on survivors or their craft can significantly improve the chances of detection with NVDs); and~~

~~– types of survival equipment or light sources (like signalling devices and pyrotechnics) used by the survivors.~~

~~**5.7.8** Glare should be minimized as much as possible within the facility's environment where the NVD users are stationed. This may involve opening or removing windows where practicable. Also, proper scanning techniques are important for reducing the adverse effects of moonlight or artificial light sources like light-houses, offshore rigs, ships, anti-collision lights, etc.~~

~~**5.7.9** Visible moonlight can significantly improve detection of unlighted search objects when using NVDs. Search object light sources, like strobe or similar lights, or even cigarettes, can greatly improve detection even in poor visibility conditions such as light snowfall.~~

~~**5.7.10** RCC staffs should be aware that sweep width estimates should take into account local conditions and the advice of the facility on scene.~~

Night search by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices (NVDs)

5.7.6 It is preferable, safer, and normally more effective to search in daylight. The timing of distress situations is not always optimal for a daylight search. Where suitably capable night search aircraft with aircrew trained and competent in safe night search operations are available, SMCs may consider a night search using such aircraft is necessary where the urgency of the situation may be critical to saving lives.

5.7.7 **Appendix W** contains general guidance for RCC staff on night search by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices (NVDs).

5.8 Land search patterns

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5.10 Assignment of search sub-areas to individual facilities

5.10.1 When planning a search involving several search facilities, the search planner has to simultaneously balance a number of interrelated factors. These factors include, but are not limited to, the following:

- size, shape, and orientation of sub-areas so the desired search area is covered;
- type of search (visual or electronic) and coverage factors;
- track spacing and orientation of search patterns;
- maintaining safe separations between search facilities;
- search endurances, operating ranges, required fuel reserves, and alternate aerodromes for aircraft;
- transit times to and from the search area; ~~and~~
- search speeds~~.~~; and
- where a search area encompasses (part of) a wind farm, the wind farm section may need to be treated as a separate search or sub-area.

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5.11 Designation and description of search sub-areas

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5.11.5 *Centre-point method*. Any rectangular or square area can be described by giving the geographical coordinates of the centre of the area, the direction of the longer axis, the lengths of the longer and shorter axes and the ~~direction of creep~~

orientation (direction) of the longer (Major) axis. For example, search sub-area A-1 shown as:

AREA	CENTRE POINT	MAJOR TRACK LENGTH	WIDTH	AXIS	SPACING	~~CREEP~~
A-1	34 17N 136 22W	80NM	40 NM	025T	5.0 NM	~~115T~~

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5.13 Search action plans

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5.13.2 The message format is flexible but normally includes ~~six~~ seven parts as described in sub-paragraphs (a) to (g) below. Those parts described in (b) to (d) are closely linked with one another because they contain information about search sub-areas and search facility assignments. As a group, these three parts should provide all of the necessary information for plotting and performing the search assignments. Within this group of three parts, certain data elements may be placed in parts different from the ones shown below, at the SMC's discretion. Additional information, such as the desired search speed, may also be added to whichever part seems most appropriate.

(a) *Situation:* includes a brief description of the incident, position and time; number of persons on board (POBs); primary and secondary search objects, including the amount and types of survival equipment; weather forecast and period of forecast; and search facilities on scene.

(b) *Action*: list of search facilities and the designations of the search sub-area(s) assigned to each.

(~~b~~c) *Search sub-area(s):* presented in column format with headings for sub-area designator, ~~size, corner points, other essential data,~~ followed by data that describes the sub-area. This data should be sufficient for plotting the sub-area's outline (perimeter). For example, one method uses columns for centre point, length, width and direction of the major axis for each rectangular or square sub-area. Another method uses corner points to describe search sub-areas, usually (for rectangular sub-areas) as four columns of latitude, longitude pairs in clockwise order. Other essential data may also be present, such as track spacing. Additional formats for search sub-area descriptions are in section 5.11.

(~~c~~d) *Execution:* ~~presented in column format with headings for area, search facility, parent agency or location, pattern, creep direction, commence search points, and altitude~~. details for searching each sub-area, usually presented in columns with the sub-area designator in the first column. The remaining columns may contain the assigned search facility's identifier, the location from which it is operating, the type of search pattern to be performed, direction of creep, commence search point, search altitude and search speed. The format is flexible and some of these columns may be eliminated as redundant or unnecessary. The SMC may also choose to put some of this information in other parts.

(~~d~~e) *Coordination:* designates the SMC, OSC and ACO; search facility on-scene times; track spacing and coverage factors desired; OSC and ACO instructions, such as on the use of datum marker buoys; airspace reservations; aircraft safety instructions; search facility change of operational control information if pertinent; parent agency relief instructions; and authorizations for non-SAR aircraft in the area.

(~~e~~f) *Communications:* prescribes control channels; on-scene channels; monitor channels; method to identify OSC, ACO and search facilities (such as radar transponder codes); and press channels.

(~~f~~g) *Reports:* requirements for OSC and ACO reports of on-scene weather, progress, and other SITREP information; and for parent agencies to provide at the end of daily operations, such as sorties, hours flown, hours and area(s) searched, and coverage factor(s). During the search, search facilities should record from their navigation systems and report the actual observed positions/times for the following unless there are independent means available for tracking search facility movements during the search:

- commence search point latitude, longitude, time;
- first turn point (end of first search leg) latitude, longitude, time;
- start of last search leg actually performed latitude, longitude, time;
- end of last search leg actually performed latitude, longitude, time; and
- sightings and the time spent investigating those sightings,

Plotting and comparing these positions/times to those anticipated by the search planner will provide a clear indication of how well the pattern that was performed matched the pattern that was assigned.

A sample search action message is provided in appendix L using corner-point or centre-point methods.

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5.15 Briefings

5.15.1 Briefing of SAR personnel should, if possible, be held in sufficient time before departure. SAR personnel should be given all relevant details of the distress and all instructions for the SAR operation. Time permitting, this may be done by issuing a search operation briefing/tasking form to the crew, giving as much information as possible (see appendix H). Situation updates should be provided to the search facility en route. Descriptive information regarding merchant vessels and small craft is given in the Maritime Search and Rescue Recognition Code (MAREC) in appendix I. If the SMC receives additional pertinent information after the briefing, the information should be passed to facilities en route or on scene. The SMC should consider advising search crews that when using autopilot they need to be vigilant when selecting waypoints for SAR tasks to ensure the whole search area is covered and that they stay within their assigned search area. When briefing verbally, such as for situations where crews have already been dispatched, obtaining a correct readback of critical waypoints also helps to avoid errors.

Briefing of air search personnel

5.15.2 Briefings should include all items detailed on the briefing form in appendix H and any other important information available, and should include:

– a full description and nature of distress;

– full details of the search area(s) and any description of clues that may indicate the presence of the search object, including:

  – distress signals and visual signal codes (listed in appendix A) that survivors might use to attract attention or communicate their status or direction of movement;

  – broken treetops;

- wreckage;
- dye markers, burnt patches, oil slicks;
- smoke;
- signs of a landslide or other unusual occurrence affecting the terrain;
- coloured or white objects; and
- reflections from metal or glass;

Note: Details that are already known to be of no significance for the present search, such as locations of wreckage from previous unrelated incidents, should also be pointed out.

- type and method of search and method to record areas searched;
- latitudes, longitudes, times for both end points of the first and last search legs performed as observed via the navigation system during the search;
- details of other SAR facilities engaged and their search or other operating areas;

. . .

5.19 Debriefing of search personnel

5.19.1 A timely and comprehensive debriefing of search crews is as important as the briefing. A careful debriefing and evaluation of the reports of search crews is necessary for an accurate evaluation of the search activities. This evaluation in turn will determine if and where further searching should be done. Areas covered during the search should be recorded on the plot in the RCC. The information obtained should be entered on the SAR briefing and debriefing form (see appendix page H-1).

5.19.2 In order to ensure the accuracy of the information about the area searched, the latitudes, longitudes, and times for both end points of the first and last search legs actually performed should be obtained if they were not already reported.

5.19.23 All relevant debriefing information should be plotted on a chart showing the search area or areas. A careful study of the data will enable the SMC to update probability of containment (POC), probability of success (POS), and cumulative probability of success (POS_c) values (see chapter 4), and use them together with other information to determine whether an area has been sufficiently searched.

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Chapter 6

Rescue planning and operations

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6.2 Sighting and subsequent procedures

6.2.3 The SMC may also request the search facility to:

– establish the location of stretches of land or water suitable for use by aircraft, pararescuers, and paramedics and the best route for use by a land facility;

– direct rescue facilities and other aircraft to the distress scene;

– if the search facility is an aircraft, take photographs of the distressed craft from normal search heights and directions, from a low level, and from an angle, taking in prominent landmarks, if possible; ~~and~~

– if the search facility is an aircraft, drop equipment that may assist SAR operations such as datum marker buoys; and

– remain on scene until relieved, forced to return to base, or rescue has been effected.

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6.5 Supply or equipment dropping

6.5.1 When deciding ~~whether or not supplies should be dropped, consider whether communications have been established with the survivors, and if so,~~ if supplies or equipment which may assist SAR operations should be dropped, consider whether:

– communications have been established with the survivors;

– additional information/data or support from such equipment is required for continued SAR planning or operations;

– the ~~needed~~required supplies or equipment have been identified;

– suitable aircraft are available; ~~and~~

– the conditions on scene may preclude the safe dropping of supplies or equipment; and

– the crew has adequate training and experience.

. . .

6.12 Ditching assistance

6.12.1 RCC assistance for ditching should include:

– obtaining the latest position, course and speed of the aircraft by any means available, e.g. from the aircraft, from its escort (if applicable), by flight tracking systems, by direction finding, or by radar;

. . .

Page 6-14

After existing 6.14.16, insert new paragraphs 6.15 to 6.15.9:

6.14.6 Medical advice should be sought before air transport of submarine accident victims.

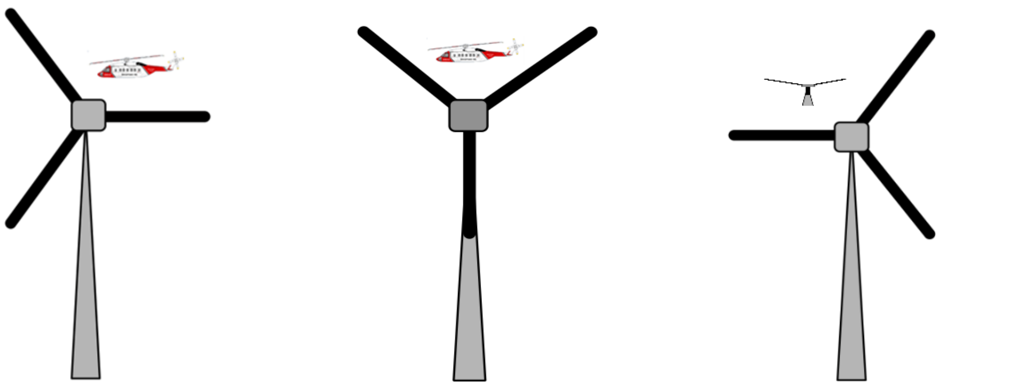
6.15 Search and rescue within wind farms

Overview

6.15.1 Wind farms alter the winds and currents inside and in the vicinity of the wind farm area, modifying the drift of persons at sea and thus complicating the use of search and rescue planning tools and programmes. Moreover, by modifying the surface currents, upwelling/downwelling may occur, changing the sea surface temperature and affecting survivability time estimates.

6.15.2 Access into wind farms by vessels and aircraft is likely to create some challenges for the RCC. Several factors and considerations, such as poor weather conditions, darkness, turbine orientation or few straight lines, may deter SRUs from entering a wind farm area.

6.15.3 Although it may not be desirable to send rescue helicopters into a wind farm, such units may be the best or only available resource to an RCC. Should this happen, it is good practice to request that turbines be shut down and rotated so that their blades are of least impact to any SAR helicopter, especially if this latter proceeds to a rescue from the nacelle of a turbine. According to the size and type of the aircraft, any of the three options below may be appropriate.



Retreating blade horizontal | Y blade | Advancing blade horizontal

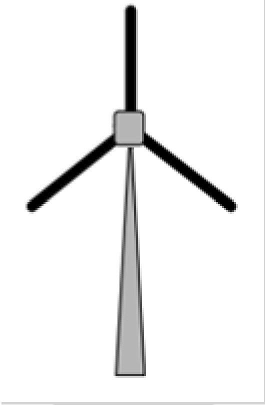
Figure 6-1 – *Blade Positions*

- Retreating blade horizontal: this provides good references with the blade in the 2 o'clock position of the pilot and winch operators whilst maintaining a clear area for the tail rotor should the crew wish to offset the aircraft for wind or to improve visual references or escape headings.

– Bunny ears ("Y blade"): this also provides good references with the blade in the 2 o'clock position of the pilot and winch operators. The retreating turbine blade aft of the helicopter in the winching position slightly compromises the tail rotor area.

– Advancing blade horizontal ("Orientation stop", "Heli-Stop" or "Lazy Y"): this is the position usually selected for delivery/recovery of turbine technicians by wind farm helicopters. It nonetheless offers the poorest visual references, and the retreating turbine blade occupies the area closest to the tail rotor, therefore is less favoured for SAR aircraft.

A fourth position ("upside down Y" or "exclamation") should be considered to maximize clearance under the blades to help prevent damage in case a surface craft drifts underneath. This option is unlikely to be suitable for aircraft operations.



Exclamation

Emergency response

6.15.4 Country emergency response requirements may vary. However, it is expected that wind farm operators should have sound arrangements to cover foreseeable emergencies. Some wind farms will provide the SAR support to their personnel; however, consideration should be given to how SAR services can respond to persons in distress, regardless of wind farm resources in the area.

6.15.5 RCCs should have access to comprehensive contact information for the wind farm as well as details of their emergency plans, resources and capabilities, which should include procedures for ordering a shutdown, positioning the blades and depowering the turbine, thus ensuring electrical safety for SRUs. Detailed charts should also be provided to enable the SAR authorities to have full awareness of turbine locations and access requirements.

6.15.6 Good situational awareness implies, for SMCs, to be aware of the existence of wind farms within their RCC's SRR and to have full knowledge of the installations, such as:

- their type (turbines, substations, met masts);
- their construction (floating, seabed-based, or land-based);
- their dimensions, including tip height and vertical clearance from sea level;
- the presence and locations of aids to navigation;
- layout of undersea cables, including their burial status;
- their staffing;
- operator emergency contact information;

- the presence of vessels during the installation, operation and dismantling of wind farms; and
- their potential impact on radiocommunications, radio-direction finder, radar, automatic identification system and navigation system.

Studies have confirmed that wind farms can cause VHF interference, which under certain conditions can impact not only voice communications but also DSC and AIS signals.

Industry resources

6.15.7 Industry resources will vary depending on company requirements. The operations of the wind farm will generally be controlled by an onshore coordination centre, which would be responsible for the daily management of the wind farm and the turbines themselves. This may be done from multiple locations, or from other countries.

6.15.8 These onshore coordination centres should have access to comprehensive weather measurements as well as forecasting, which may be beneficial to the SAR authorities. There may be the availability of CCTV or other communications or surveillance equipment such as AIS and/or radar. In some circumstances, these provisions can be provided directly to RCCs.

6.15.9 Industry onshore coordination centre resources will likely often be available to assist with incidents, including under international obligations such as SOLAS. This may include vessels, aircraft and in some cases autonomous craft. Additional capabilities such as the provision of medical services or refuelling may be accessible.

6.15.10 Some remote onshore sites may have less available resources although they should still be capable of providing an initial response to their own emergencies.

Editorial Note.— renumber existing paragraph 6.15 as 6.16 and renumber subsequent paragraphs

6.~~15~~16 Mass rescue operations

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Chapter 7

Multiple aircraft SAR operations – General guidance

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7.8 Effects of the environment and weather

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Night vision devices

7.8.4 Night vision devices ~~are often being~~ worn by SAR aircrew~~, as they~~ can compensate for the effects of darkness. When used appropriately, night vision devices significantly improve safety and effectiveness over land as well as in coastal and maritime operations.

7.8.5 Although using night vision devices can improve multiple aircraft SAR operations, these devices can be affected by the weather conditions at night in a similar way that visual flying can be affected by day. Night vision devices also need at least a small amount of light in order to work adequately.

7.8.6 ~~The v~~Visual conditions at night are affected by many factors, including the amount of moonlight, cloud and lighting made by human activity, such as structures and buildings. All authorities and units involved in SAR operations in which night vision devices are used should be aware of the effect that weather and light conditions can have on their performance. In very dark conditions, such as when there is no moon at all and significant clouds, night vision devices may be of little use during a SAR operation.

Effect of artificial lighting on night vision devices

7.8.7 Night vision devices can be adversely affected by powerful sources of artificial lighting, such as searchlights and pyrotechnic flares used by SRUs. These light sources should not be used without prior warning or agreement with SAR aircraft on scene.

7.8.8. **Appendix W** contains general guidance for RCC staff on night searches by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices (NVDs).

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Appendices

Editorial Note.— Page 'Appendix list i'

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Appendix B Message formats

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Editorial Note.— Page 'Appendix list ii'

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Appendix L Search planning and evaluation worksheets

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Appendix B

Message formats

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Examples of Cospas-Sarsat Formats

Note: Not all variations have been included in the examples but may be developed using the message field table and examples that follow.

Message Content of a Cospas-Sarsat Alert

Field Number	Field Name
45	MESSAGE TYPE
46	CURRENT MESSAGE NUMBER
47	MCC BEACON REFERENCE
50a	BEACON MESSAGE INFORMATION
51	TYPE OF BEACON
52	IDENTIFICATION
57a	BEACON HEX ID
50b	COUNTRY OF BEACON REGISTRATION
59	BEACON NUMBER
57b	HOMING SIGNAL
58	ACTIVATION TYPE
55	SOURCE OF GNSS POSITION DATA
53	EMERGENCY CODE
54	ALERT POSITION INFORMATION
48	DETECTION TIME AND SPACECRAFT ID
54e	GNSS POSITION, TIME OF UPDATE AND ALTITUDE
54a	MCC REFERENCE POSITION
54d	DOA POSITION AND ALTITUDE
~~49~~	~~DETECTION FREQUENCY~~
~~50~~	~~COUNTRY OF BEACON REGISTRATION~~
~~51~~	~~USER CLASS OF BEACON~~
~~52~~	~~IDENTIFICATION~~
~~53~~	~~EMERGENCY CODE~~
~~54~~	~~POSITIONS~~
~~54a~~	~~RESOLVED POSITION~~
54b	A POSITION AND PROBABILITY
54c	B POSITION AND PROBABILITY
61a	OTHER INFORMATION (GENERAL)
49	DETECTION FREQUENCY
~~54d~~	~~ENCODED POSITION AND TIME OF UPDATE~~
~~55~~	~~SOURCE OF ENCODED POSITION DATA~~
~~56~~	~~NEXT PASS TIMES~~
~~56a~~	~~NEXT TIME OF VISIBILITY OF RESOLVED POSITION~~
~~56b~~	~~NEXT TIME OF VISIBILITY A POSITION~~
~~56c~~	~~NEXT TIME OF VISIBILITY B POSITION~~
~~56d~~	~~NEXT TIME OF VISIBILITY OF ENCODED POSITION~~
~~57~~	~~BEACON HEX ID & HOMING SIGNAL~~
~~58~~	~~ACTIVATION TYPE~~
~~59~~	~~BEACON NUMBER~~
60	OTHER ENCODED INFORMATION
~~61~~	~~OPERATIONAL INFORMATION~~
62	REMARKS
63	END OF MESSAGE

. . .

Sample 406 MHz Initial GNSS Encoded Position Alert
(FGB - Standard Location – EPIRB: Serial Number)

1. DISTRESS COSPAS-SARSAT INITIAL ALERT

2. MSG NO: 00306 AUMCC REF: 12345

3. DETECTED AT: 17 APR 07 1627 UTC BY GOES 11

4. DETECTION FREQUENCY: 406.0250 MHz

5. COUNTRY OF BEACON REGISTRATION: 316/ CANADA

6. USER-CLASS: STANDARD LOCATION - EPIRB

SERIAL NO: 05918

7. EMERGENCY CODE: NIL

8. POSITIONS:
-RESOLVED - NIL
-DOPPLER A - NIL
DOPPLER B - NIL
ENCODED - 05 00 00 S 178 00 00 E TIME OF UPDATE UNKNOWN

9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE

10. NEXT PASS TIMES:-RESOLVED - NIL
DOPPLER A - NIL
DOPPLER B - NIL
ENCODED - NIL

11. HEX ID: 278C362E3CFFBFF HOMING SIGNAL: 121.5 MHZ

12. ACTIVATION TYPE: NIL

13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL

14. OTHER ENCODED INFORMATION:

CSTA CERTIFICATE NO: 0108
BEACON MODEL - ACR, RLB-33

ENCODED POSITION UNCERTAINTY: PLUS-MINUS 30 MINUTES OF LATITUDE AND LONGITUDE

15. OPERATIONAL INFORMATION:

LUT ID: NZGEO1 WELLINGTON GEOLUT, NEW ZEALAND (GOES 11)

BEACON REGISTRATION AT [CMCC]

16. REMARKS: NIL

END OF MESSAGE

1. DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT

2. MSG NO 00306 AUMCC REF 12345

3. BEACON MESSAGE INFORMATION

BEACON TYPE STANDARD LOCATION - EPIRB

SERIAL NO 05918

HEX ID 278C362E3CFFBFF

COUNTRY OF BEACON REGISTRATION 316/CANADA

HOMING SIGNAL 121.5 MHZ

GNSS POSITION PROVIDED BY EXTERNAL DEVICE

4. ALERT POSITION INFORMATION

```
      DETECTED AT 17 APR 07 1627 UTC BY GEOSAR GOES 17
      GNSS - 05 00.00 S  178 00.00 E
        UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME
5.  OTHER INFORMATION
    BEACON REGISTRATION AT CMCC
    TAC 0108
    BEACON MODEL - ACR, RLB-33
    DETECTION FREQUENCY 406.0250 MHZ
    GNSS POSITION UNCERTAINTY PLUS-MINUS 30 MINUTES
    OF LATITUDE AND LONGITUDE
      LUT ID 5123 WELLIGTON GEOLUT, NEW ZEALAND
6.  REMARKS NIL
END OF MESSAGE
```

Sample 406–MHz Unlocated Alert
(FGB - National Location – ELT)

1. DISTRESS COSPAS-SARSAT ALERT

2. MSG NO: 00141 SPMCC REF: 12345

3. DETECTED AT: 21 FEB 07 0646 UTC BY MSG-2

4. DETECTION FREQUENCY: 406.0249 MHz

5. COUNTRY OF BEACON REGISTRATION: 408/ BAHRAIN

6. USER CLASS: NATIONAL LOCATION - ELT

   SERIAL NO: 000006

7. EMERGENCY CODE: NIL

8. POSITIONS: RESOLVED - NIL
   DOPPLER A - NIL
   DOPPLER B - NIL
   ENCODED - NIL UPDATE TIME UNKNOWN

9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE

10. NEXT PASS TIMES: RESOLVED - NIL
   DOPPLER A - NIL
   DOPPLER B - NIL
   ENCODED - NIL

11. HEX ID: 331000033F81FE0 HOMING SIGNAL: 121.5 MHZ

12. ACTIVATION TYPE: NIL

13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL

14. OTHER ENCODED INFORMATION: NIL

15. OPERATIONAL INFORMATION:

   BEACON REGISTRATION AT WWW.406REGISTRATION.COM

16. REMARKS: NIL

   END OF MESSAGE

1. DISTRESS COSPAS-SARSAT INITIAL ALERT (UNLOCATED)

2. MSG NO 00141 SPMCC REF 12345

3. BEACON MESSAGE INFORMATION

   BEACON TYPE NATIONAL LOCATION - ELT

   SERIAL NO 000006

   HEX ID 331000033F81FE0

   COUNTRY OF BEACON REGISTRATION 408/BAHRAIN

   HOMING SIGNAL 121.5 MHZ

   GNSS POSITION PROVIDED BY EXTERNAL DEVICE

4. ALERT POSITION INFORMATION

   DETECTED AT 21 FEB 07 0646 UTC BY GEOSAR MSG-2

5. OTHER INFORMATION

BEACON REGISTRATION AT WWW.406REGISTRATION.COM

DETECTION FREQUENCY 406.0249 MHZ

6. REMARKS NIL

END OF MESSAGE

Sample 406 MHz Resolved Position Alert
(FGB - National Location – PLB)

~~1. DISTRESS COSPAS-SARSAT POSITION RESOLVED ALERT~~

~~2. MSG NO: 00812 AUMCC REF: 2DD747073F81FE0~~

~~3. DETECTED AT: 28 APR 07 0920 UTC BY SARSAT S11~~

~~4. DETECTION FREQUENCY: 406.0278 MHz~~

~~5. COUNTRY OF BEACON REGISTRATION: 366/ USA~~

~~6. USER CLASS: NATIONAL LOCATION - PLB~~

~~SERIAL NO: 167438~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~RESOLVED - 33 27 N 038 56 E~~
~~DOPPLER A - 33 27 N 038 56 E~~
~~DOPPLER B - NIL~~
~~ENCODED - 33 25 56 N 038 55 40 E~~
~~UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME~~

~~9. ENCODED POSITION PROVIDED BY: INTERNAL DEVICE~~

~~10. NEXT PASS TIMES: RESOLVED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~ENCODED - NIL~~

~~11. HEX ID: 2DD747073F81FE0 HOMING SIGNAL: 121.5 MHZ~~

~~12. ACTIVATION TYPE: NIL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL~~

~~14. OTHER ENCODED INFORMATION: NIL~~

~~15. OPERATIONAL INFORMATION:~~

~~LUT ID: FRLUT2 TOULOUSE, FRANCE~~

~~16. REMARKS: NIL~~

~~END OF MESSAGE~~

1. DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT

2. MSG NO 00812 AUMCC REF 2DD747073F81FE0

3. BEACON MESSAGE INFORMATION

BEACON TYPE NATIONAL LOCATION - PLB

SERIAL NO 167438

HEX ID 2DD747073F81FE0

COUNTRY OF BEACON REGISTRATION 366/USA

HOMING SIGNAL 121.5 MHZ

GNSS POSITION PROVIDED BY INTERNAL DEVICE

4. ALERT POSITION INFORMATION

DETECTED AT 28 APR 07 0920 UTC BY LEOSAR SARSAT 11

```
      GNSS - 33 25.93 N  038 55.67 E
      UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME
      MCC REFERENCE - 33 27.1 N  038 56.2 E
      DOPPLER B - 33 27.1 N  038 56.2 E  PROB 45 PERCENT
5.  OTHER INFORMATION
    TAC 123
    DETECTION FREQUENCY 406.0278 MHZ
       LUT ID 2272 TOULOUSE, FRANCE
6.  REMARKS NIL
END OF MESSAGE
```

Sample 406 MHz Initial Position Alert
(FGB – Standard Location – ELT: 24-BIT Address)

~~1. DISTRESS COSPAS-SARSAT INITIAL ALERT~~

~~2. MSG NO: 00741 AUMCC REF: 3266E2019CFFBFF~~

~~3. DETECTED AT: 22 APR 07 0912 UTC BY SARSAT S10~~

~~4. DETECTION FREQUENCY: 406.0247 MHz~~

~~5. COUNTRY OF BEACON REGISTRATION: 403/ SAUDI ARABIA~~

~~6. USER CLASS: STANDARD LOCATION - ELT~~

~~AIRCRAFT 24 BIT ADDRESS: 7100CE~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~RESOLVED - NIL~~
~~DOPPLER A - 32 49 N 081 54 E PROB 69 PERCENT~~
~~DOPPLER B - 24 18 N 041 18 E PROB 31 PERCENT~~
~~ENCODED - NIL UPDATE TIME UNKNOWN~~

~~9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE~~

~~10. NEXT PASS TIMES:~~
~~RESOLVED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~ENCODED - NIL~~

~~11. HEX ID: 3266E2019CFFBFF HOMING SIGNAL: 121.5 MHZ~~

~~12. ACTIVATION TYPE: NIL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL~~

~~14. OTHER ENCODED INFORMATION:~~

~~AIRCRAFT 24-BIT ADDRESS ASSIGNED TO: SAUDI ARABIA~~

~~15. OPERATIONAL INFORMATION:~~

~~LUT ID: INLUT1 BANGALORE, INDIA~~

~~16. REMARKS: NIL~~

~~END OF MESSAGE~~

1. DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT

2. MSG NO 00741 AUMCC REF 3266E2019CFFBFF

3. BEACON MESSAGE INFORMATION

BEACON TYPE STANDARD LOCATION - ELT

AIRCRAFT 24 BIT ADDRESS 7100CE ASSIGNED TO SAUDI ARABIA

HEX ID 3266E2019CFFBFF

COUNTRY OF BEACON REGISTRATION 403/SAUDI

HOMING SIGNAL 121.5 MHZ

GNSS POSITION PROVIDED BY EXTERNAL DEVICE

4. ALERT POSITION INFORMATION

```
      DETECTED AT 22 APR 07 0912 UTC BY LEOSAR SARSAT 10
      DOPPLER A - 32 49.1 N  081 54.2 E  PROB 69 PERCENT
             DOPPLER B - 24 18.1 N  041 18.2 E  PROB 31 PERCENT
5.  OTHER INFORMATION
           DETECTION FREQUENCY 06.0247 MHZ
    LUT ID 4191
6.  REMARKS NIL
END OF MESSAGE
```

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Sample 406 MHz Resolved Update Position Alert
(FGB - Standard Location – Ship Security)

~~1. SHIP SECURITY COSPAS-SARSAT POSITION RESOLVED UPDATE ALERT~~

~~2. MSG NO: 00192 AUMCC REF: 2AB82AF800FFBFF~~

~~3. DETECTED AT: 03 MAY 07 0853 UTC BY SARSAT S09~~

~~4. DETECTION FREQUENCY: 406.0276 MHz~~

~~5. COUNTRY OF BEACON REGISTRATION: 341/ ST KITTS~~

~~6. USER CLASS: STANDARD LOCATION – SHIP SECURITY~~

~~MMSI LAST 6 DIGITS: 088000~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~RESOLVED - 02 15 N 046 00 E~~
~~DOPPLER A - 02 25 N 046 06 E~~
~~DOPPLER B - NIL~~
~~ENCODED - 01 54 24 N - 045 37 32 E UPDATE TIME UNKNOWN~~

~~9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE~~

~~10. NEXT PASS TIMES:~~
~~RESOLVED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~ENCODED - NIL~~

~~11. HEX ID: 2AB82AF800FFBFF HOMING SIGNAL: OTHER (NOT 121.5 MHZ) OR NIL~~

~~12. ACTIVATION TYPE: NIL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: 00~~

~~14. OTHER ENCODED INFORMATION: NIL~~

~~15. OPERATIONAL INFORMATION:~~

~~LUT ID: NZLUT WELLINGTON, NEW ZEALAND~~

~~16. REMARKS:~~

~~THIS IS A SHIP SECURITY ALERT.~~

~~PROCESS THIS ALERT ACCORDING TO RELEVANT SECURITY REQUIREMENTS~~

~~END OF MESSAGE~~

1. SHIP SECURITY COSPAS-SARSAT POSITION UPDATE ALERT

2. MSG NO 00192 AUMCC REF 2AB82AF800FFBFF

3. BEACON MESSAGE INFORMATION

BEACON TYPE STANDARD LOCATION – SHIP SECURITY

MMSI ALL 9 DIGITS 341088000

HEX ID 2AB82AF800FFBFF

COUNTRY OF BEACON REGISTRATION 341/ST KITTS

BEACON NUMBER ON AIRCRAFT OR VESSEL 0

HOMING SIGNAL NIL OR NOT 121.5 MHZ

ACTIVATION TYPE MANUAL

GNSS POSITION PROVIDED BY EXTERNAL DEVICE

4. ALERT POSITION INFORMATION

DETECTED AT 03 MAY 07 0853 UTC BY LEOSAR SARSAT 09

GNSS - 01 54.40 N 045 37.53 E

UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME

MCC REFERENCE - 02 15.1 N 046 00.2 E

DOPPLER A - 02 25.1 N 046 06.2 E

5. OTHER INFORMATION

GNSS POSITION UNCERTAINTY PLUS-MINUS 2 SECONDS IN LATITUDE AND LONGITUDE

DETECTION FREQUENCY 406.0276 MHZ

6. REMARKS

THIS IS A SHIP SECURITY ALERT.

PROCESS THIS ALERT ACCORDING TO RELEVANT SECURITY REQUIREMENTS

END OF MESSAGE

Sample 406 MHz Initial Alert
(FGB - Serial User – EPIRB: Non-Float Free)

~~1. DISTRESS COSPAS-SARSAT INITIAL ALERT~~

~~2. MSG NO: 01087 AUMCC REF: ADCE402FA80028D~~

~~3. DETECTED AT: 20 MAY 07 1613 UTC BY SARSAT S08~~

~~4. DETECTION FREQUENCY: 406.0266 MHz~~

~~5. COUNTRY OF BEACON REGISTRATION: 366/ USA~~

~~6. USER CLASS: SERIAL USER – EPIRB (NON-FLOAT FREE)~~

~~SERIAL NO: 0003050~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~RESOLVED - NIL~~
~~DOPPLER A - 36 38 S 168 58 E PROB 50 PERCENT~~
~~DOPPLER B - 36 39 S 169 01 E PROB 50 PERCENT~~
~~ENCODED - NIL~~

~~9. ENCODED POSITION PROVIDED BY: NIL~~

~~10. NEXT PASS TIMES:~~
~~RESOLVED - NIL~~
~~DOPPLER A - 21 MAY 07 0812 UTC~~
~~DOPPLER B - 21 MAY 07 0812 UTC~~
~~ENCODED - NIL~~

~~11. HEX ID: ADCE402FA80028D HOMING SIGNAL: 121.5 MHZ~~

~~12. ACTIVATION TYPE: MANUAL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL~~

~~14. OTHER ENCODED INFORMATION:~~

~~CSTA CERTIFICATE NO: 0163~~

~~BEACON MODEL - MCMURDO LTD: G5 OR E5 SMARTFIND~~

~~15. OPERATIONAL INFORMATION:~~

~~RELIABILITY OF DOPPLER POSITION DATA - SUSPECT~~

~~LUT ID: AULUTW ALBANY, AUSTRALIA~~

~~16. REMARKS: NIL~~

~~END OF MESSAGE~~

1. DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT

2. MSG NO 01087 AUMCC REF ADCE402FA80028D

3. BEACON MESSAGE INFORMATION

BEACON TYPE SERIAL USER - EPIRB (NON-FLOAT FREE)

SERIAL NO 0003050

HEX ID ADCE402FA80028D

COUNTRY OF BEACON REGISTRATION 366/USA

HOMING SIGNAL 121.5 MHz

ACTIVATION TYPE MANUAL

4. ALERT POSITION INFORMATION

DETECTED AT 20 MAY 07 1613 UTC BY LEOSAR SARSAT 13

DOPPLER A - 36 38.1 S 168 58.2 E PROB 70 PERCENT

DOPPLER B - 36 39.1 S 169 01.2 E PROB 30 PERCENT

5. OTHER INFORMATION

TAC 0163

BEACON MODEL - MCMURDO LTD G5 OR E5 SMARTFIND

RELIABILITY OF DOPPLER POSITION DATA – SUSPECT DUE TO SATELLITE MANOEUVRE

DETECTION FREQUENCY 406.0266 MHZ

6. REMARKS NIL

END OF MESSAGE

Pages B-8 to B-10

Sample 406 MHz Resolved Alert
(FGB - ~~ELT~~Aviation User – Aircraft Registration)

~~1. DISTRESS COSPAS-SARSAT POSITION RESOLVED ALERT~~

~~2. MSG NO: 00932 AUMCC REF: 9D064BED62EAFE1~~

~~3. DETECTED AT: 10 MAY 07 0654 UTC BY SARSAT S11~~

~~4. DETECTION FREQUENCY: 406.0246 MHz~~

~~5. COUNTRY OF BEACON REGISTRATION: 232/ G. BRITAIN~~

~~6. USER CLASS: ELT USER~~

~~AIRCRAFT REGISTRATION: VP-CGK~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~RESOLVED - 25 13 N 055 22 E~~
~~DOPPLER A - 25 17 N 055 23 E~~
~~DOPPLER B - NIL~~
~~ENCODED - NIL~~

~~9. ENCODED POSITION PROVIDED BY: NIL~~

~~10. NEXT PASS TIMES:~~
~~RESOLVED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~ENCODED - NIL~~

~~11. HEX ID: 9D064BED62EAFE1 HOMING SIGNAL: 121.5 MHZ~~

~~12. ACTIVATION TYPE: MANUAL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: NIL~~

~~14. OTHER ENCODED INFORMATION: NIL~~

~~15. OPERATIONAL INFORMATION: NIL~~

~~16. REMARKS: NIL~~

~~END OF MESSAGE~~

1. DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT

2. MSG NO 00932 AUMCC REF 9D064BED62EAFE1

3. BEACON MESSAGE INFORMATION

BEACON TYPE USER LOCATION - ELT USER

AIRCRAFT REGISTRATION VP-CGK/1

HEX ID 9D064BED62EAFE1

COUNTRY OF BEACON REGISTRATION 232/G.BRITAIN

BEACON NUMBER ON AIRCRAFT OR VESSEL 0

```
     HOMING SIGNAL 121.5 MHZ
     ACTIVATION TYPE MANUAL
4.   ALERT POSITION INFORMATION
      DETECTED AT 10 MAY 07 0654 UTC BY LEOSAR SARSAT 11
      MCC REFERENCE - 25 13.1 N  055 22.2 E
      DOPPLER A - 25 17.1 N  055 23.2 E  PROB 90 PERCENT
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.0246 MHZ
6.   REMARKS NIL
  END OF MESSAGE
```

Sample 406 MHz Position Alert
(SGB - ELT(DT))

~~1. DISTRESS TRACKING COSPAS-SARSAT ALERT~~

~~2. MSG NO: 00192 AUMCC REF: B27400F81FD4710~~

~~3. DETECTED AT: 03 MAY 22 085310 UTC BY MEOSAR~~

~~4. DETECTION FREQUENCY: 406.0500 MHZ~~

~~5. COUNTRY OF BEACON REGISTRATION: 403 / SAUDI~~

~~6. USER CLASS: SGB - ELT DISTRESS TRACKING~~

~~AIRCRAFT 24 BIT ADDRESS 7100CE~~
~~TAC 10062 SERIAL NO 509~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~CONFIRMED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~DOA - 02 25.1 N 046 06.2 E~~
~~ENCODED - 01 54.40 N - 045 37.53 E~~

~~9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE~~

~~10. NEXT PASS/EXPECTED DATA TIMES:~~
~~CONFIRMED - NIL~~
~~DOPPLER A - NIL~~
~~DOPPLER B - NIL~~
~~DOA - NIL~~
~~ENCODED - NIL~~

~~11. HEX ID: B27400 F81FD4 7100CE 00000 (SGB in this example)~~

~~12. ACTIVATION TYPE: NIL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: 00~~

~~14. OTHER ENCODED INFORMATION:~~

~~TIME SINCE ENCODED LOCATION 4 SECONDS~~

~~ALTITUDE OF ENCODED LOCATION 125 METRES~~

~~GNSS RECEIVER STATUS 3D LOCATION (for SGB only) AIRCRAFT 24-BIT ADDRESS ASSIGNED TO SAUDI BEACON ACTIVATED BY [AAA] where [AAA] is:~~
~~- "CREW (MANUAL)",~~
~~- "AVIONIC (AUTOMATIC)", or~~
~~- "G-SWITCH/PROBABLE CRASH (AUTOMATIC)"~~

~~15. OPERATIONAL INFORMATION:~~

~~MEOSAR ALERT LAST DETECTED AT 03 MAY 22 085310 UTC~~

~~ELAPSED TIME SINCE ACTIVATION 13 MINUTES~~

~~REMAINING BATTERY CAPACITY BETWEEN 75 AND 100 PERCENT%~~

~~BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE~~

~~16. REMARKS:~~

~~THIS DISTRESS TRACKING MESSAGE IS BEING SENT TO APPROPRIATE SAR AUTHORITIES.~~

~~PROCESS THIS ALERT ACCORDING TO RELEVANT REQUIREMENTS~~

~~END OF MESSAGE~~

1. DISTRESS TRACKING COSPAS-SARSAT DOA POSITION MATCH ALERT

2. MSG NO 00192 AUMCC REF B27400F81FD4710

3. BEACON MESSAGE INFORMATION

BEACON TYPE SGB – ELT DISTRESS TRACKING

AIRCRAFT 24 BIT ADDRESS 7100CE ASSIGNED TO SAUDI ARABIA

TAC 62 SERIAL NO 509

HEX ID B27400F81FD4 7100CE00000

COUNTRY OF BEACON REGISTRATION 403/SAUDI

ACTIVATION TYPE AUTOMATIC BY BEACON (G-SWITCH/PROBABLE CRASH)

4. ALERT POSITION INFORMATION

DETECTED AT 03 MAY 19 085310 UTC BY MEOSAR

ALERT LAST DETECTED AT 03 MAY 19 085310 UTC

GNSS - 02 24.40 N 046 04.11 E

TIME OF GNSS POSITION UPDATE: 03 MAY 19 085308 UTC

TIME SINCE GNSS LOCATION GENERATED: 0 MINUTES

ALTITUDE OF GNSS LOCATION: 125 METRES (410 FEET)

DOA - 02 25.1 N 046 06.2 E

5. OTHER INFORMATION

BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE

GNSS POSITION UNCERTAINTY PLUS-MINUS 10 METRES

ELAPSED TIME SINCE ACTIVATION: 0 HOURS

REMAINING BATTERY CAPACITY BETWEEN 75 AND 100 PERCENT

DETECTION FREQUENCY 406.05 MHZ

ELT(DT) POSITION DOES NOT REFERENCE ANY PREVIOUS POSITION

6. REMARKS

THIS DISTRESS TRACKING MESSAGE IS BEING SENT TO APPROPRIATE SAR AUTHORITIES.

PROCESS THIS ALERT ACCORDING TO RELEVANT REQUIREMENTS.

END OF MESSAGE

Sample 406 MHz Cancellation Message
(SGB - ELT(DT))

~~1. DISTRESS TRACKING COSPAS-SARSAT USER CANCELLATION ALERT~~

~~2. MSG NO: 00192 AUMCC REF: B27400F81FD4710~~

~~3. DETECTED AT: 03 MAY 22 085810 UTC BY MEOSAR~~

~~4. DETECTION FREQUENCY: 406.0500 MHZ~~

~~5. COUNTRY OF BEACON REGISTRATION: 403 / SAUDI~~

~~6. USER CLASS: SGB - ELT DISTRESS TRACKING~~

~~AIRCRAFT 24 BIT ADDRESS 7100CE~~
~~TAC 10062 SERIAL NO 509~~

~~7. EMERGENCY CODE: NIL~~

~~8. POSITIONS:~~
~~CONFIRMED - NIL~~
~~DOA - 02 25.1 N 046 06.2 E~~
~~ENCODED - NIL~~

~~9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE~~

~~10. NEXT PASS/EXPECTED DATA TIMES - NIL~~

~~11. HEX ID: B27400 F81FD4 7100CE 00000 (SGB in this example)~~

~~12. ACTIVATION TYPE: NIL~~

~~13. BEACON NUMBER ON AIRCRAFT OR VESSEL: 00~~

~~14. OTHER ENCODED INFORMATION:~~

~~AIRCRAFT 24-BIT ADDRESS ASSIGNED TO SAUDI~~

~~15. OPERATIONAL INFORMATION:~~

~~MEOSAR ALERT LAST DETECTED AT 03 MAY 22 085310 UTC~~

~~ELAPSED TIME SINCE ACTIVATION 13 MINUTES (SGB only)~~

~~REMAINING BATTERY CAPACITY BETWEEN 75 AND 100 PERCENT% (SGB only)~~

~~BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE (SGB only)~~

~~16. REMARKS:~~

~~MEOSAR ALERT LAST DETECTED AT 03 MAY 22 085810 UTC~~

~~THIS DISTRESS TRACKING MESSAGE IS BEING SENT TO APPROPRIATE SAR AUTHORITIES~~

~~PROCESS THIS ALERT ACCORDING TO RELEVANT REQUIREMENTS~~

~~ELT(DT) POSITION DOES NOT REFERENCE ANY PREVIOUS POSITION~~

~~CANCELLATION CONFIRMED~~

~~END OF MESSAGE~~

1. DISTRESS TRACKING COSPAS-SARSAT USER CANCELLATION ALERT

2. MSG NO 00192 AUMCC REF B27400F81FD4710

3. BEACON MESSAGE INFORMATION

BEACON TYPE SGB – ELT DISTRESS TRACKING

AIRCRAFT 24 BIT ADDRESS 7100CE ASSIGNED TO SAUDI ARABIA

TAC 62 SERIAL NO 509

HEX ID B27400F81FD4 7100CE00000

COUNTRY OF BEACON REGISTRATION 403/SAUDI

ACTIVATION TYPE AUTOMATIC BY EXTERNAL MEANS (AVIONICS)

4. ALERT POSITION INFORMATION

DETECTED AT 03 MAY 19 085810 UTC BY MEOSAR

ALERT LAST DETECTED AT 03 MAY 19 085310 UTC

DOA – 02 25.1 N 046 06.2 E ESTIMATED ERROR UNKNOWN

5. OTHER INFORMATION

ELT(DT) POSITION DOES NOT REFERENCE ANY PREVIOUS POSITION

CANCELLATION CONFIRMED

BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE

REMAINING BATTERY CAPACITY BETWEEN 75 AND 100 PERCENT

DETECTION FREQUENCY 406.0510 MHZ

6. REMARKS

THIS DISTRESS TRACKING MESSAGE IS BEING SENT TO APPROPRIATE SAR AUTHORITIES

PROCESS THIS ALERT ACCORDING TO RELEVANT REQUIREMENTS

END OF MESSAGE

Sample 406 MHz Position Alert
(First Generation Beacon – ELT(DT))

```
1.  DISTRESS TRACKING COSPAS-SARSAT DOA POSITION CONFLICT ALERT
2.  MSG NO 21013  CMCC REF 1D1220F03BBFDFF
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE   ELT DISTRESS TRACKING
    AIRCRAFT 24 BIT ADDRESS 41E077 ASSIGNED TO G BRITAIN
    AIRCRAFT OPERATOR DESIGNATOR MMB
    HEX ID 1D1220F03BBFDFF
    COUNTRY OF BEACON REGISTRATION 232/G BRITAIN
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY EXTERNAL DEVICE
4.  ALERT POSITION INFORMATION
      DETECTED AT 04 AUG 20 101501 UTC BY MEOSAR
      ALERT LAST DETECTED AT 04 AUG 20 101501 UTC
      GNSS - 01 54.40 N  045 37.53 E
      UPDATE TIME WITHIN 2 – 60 SECONDS OF DETECTION TIME
      ALTITUDE OF GNSS LOCATION BETWEEN 1600 AND 2200 METRES(BETWEEN
       5200 AND 7200 FEET)
      DOA - 02 00.1 N  046 06.2 E
5.  OTHER INFORMATION
    GNSS POSITION UNCERTAINTY PLUS-MINUS 2 SECONDS OF LATITUDE AND
      LONGITUDE
    DETECTION FREQUENCY 406.0400 MHZ
    POSITION CONFLICT BASED ON DISTANCE SEPARATION OF AT LEAST 20 KM
    ELT(DT) POSITION DOES NOT REFERENCE ANY PREVIOUS POSITION
6.  REMARKS
    THIS DISTRESS TRACKING MESSAGE IS BEING SENT TO APPROPRIATE SAR
AUTHORITIES
    PROCESS THIS ALERT ACCORDING TO RELEVANT REQUIREMENTS
END OF MESSAGE
```

~~Inmarsat-C~~RMSS format

FROM (*Name of organi~~s~~zation/RCC)*

TO (*Name of organi~~s~~zation/RCC)*

1. DISTRESS ALERT - INMARSAT C/IRIDIUM *(Delete as appropriate)*

2. DISTRESS MESSAGE RECEIVED FROM INMARSAT C/IRIDIUM *(Delete as appropriate)*

NUMBER *(Insert Mobile Number)* AT TIME *(UTC time and date of receipt)*

3. POSITION LAT . . . . LONG. . . . .

UPDATED AT TIME . . . . UTC DATE / UNKNOWN *(Delete as appropriate)*

COURSE . . . .

SPEED . . . . KNT

4. OTHER INFORMATION

DISTRESS TYPE	NOT SPECIFIED *(Default, change as required)*
#INMARSAT REGION	PACIFIC *(Default, change as required)*
#RECEIVING STATION	LES *(Insert name of Inmarsat LES)*
PROTOCOL	MARITIME *(Default, change as required)*
POSITION UPDATED LAST 24 HRS	YES *(Default, change as required)*
COURSE/SPEED UPDATED LAST 24 HRS	YES *(Default, change as required)*

5. *(Insert RCC name)* ACKNOWLEDGED MESSAGE VIA INMARSAT C/IRIDIUM *(Delete as appropriate)*

*● AND MESSAGE DELIVERED TO VESSEL BUT NO REPLY RECEIVED

*● AND VESSEL CALLED BUT NOT ANSWERED

*● BUT MESSAGE COULD NOT BE DELIVERED TO VESSEL

*● BUT CALL COULD NOT BE ESTABLISHED TO VESSEL

*● UNABLE TO IDENTIFY VESSEL FROM OUR RECORDS

*● OUR RECORDS IDENTIFY VESSEL AS *(Insert name and call sign of vessel)*

6. PASSED FOR YOUR COORDINATION. PLEASE ACKNOWLEDGE *(Insert RCC contact details)*

Only applicable for distress alerts received from Inmarsat C. Delete if not relevant.

* *Delete whichever line does not apply*

Iridium format

FROM (Name of organization/RCC)
TO (Name of organization/RCC)

1. DISTRESS ALERT – IRIDIUM GMDSS

2. DISTRESS COMMUNICATIONS RECEIVED FROM IRIDIUM GMDSS TERMINAL

   PHONE NUMBER: (Insert Iridium GMDSS Terminal Number)
   VESSEL MMSI: (Insert MMSI Number)
   AT TIME/DATE: (UTC Time Date of Receipt)

3. POSITION LAT: ……………… LONG: …………………….

   UPDATED AT TIME: …………………. UTC DATE ……………………
   COURSE: ………………….
   SPEED: ……………………

4. OTHR INFORMATION

   DISTRESS TYPE NOT SPECIFIED (Default, change as required)
   POSITION UPDATED LAST 24 HOURS YES (Default, change as required)
   COURSE UPDATED LAST 24 HOURS YES (Default, change as required)

5. (Insert RCC Name) ACKNOWLEDGED MESSAGE TO IRIDIUM TERMINAL

☐ *AND CALLS TO VESSEL FAILED

☐ *CALL TO VESSEL WAS COMPLETED AND NOTES SUPPLIED (Attached)

   o *REASON FOR DISTRESS: ____

   o *PERSON(s) ONBOARD (and Status): __________________________________

   o *RESPONSE TO SITUATION: ____

☐ *NEAREST IRIDIUM VESSEL INFORMATION SUPPLIED (Attached)

☐ *DETAILS FOR OTHER IRIDIUM GMDSS VESSELS NEARBY (Attached)

6. PASSED FOR YOUR COORDINATION. PLEASE ACKNOWLEDGE (Insert RCC Contact details)

   *Delete whichever line does not apply

- DSC format

FROM *(Name of organization/RCC)*

TO *(Name of organization/RCC)*

1. DISTRESS ALERT – DIGITAL SELECTIVE CALLING (DSC)

2. DISTRESS MESSAGE RECEIVED ON **(Insert frequency)* kHz

DISTRESS RELAY RECEIVED ON **(Insert frequency)* kHz

DISTRESS ACKNOWLEDGEMENT RECEIVED ON **(Insert frequency)* kHz

AT TIME *(UTC Time and date of receipt)* UTC

MMSI NUMBER OF VESSEL IN DISTRESS *(Insert MMSI number)*

...

Appendix D

Uncertainty phase data

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Communications searches

. . .

Communications search for aircraft

. . .

4 Contact ATS units, check flight tracking systems, alert airfields, refuelling points, radar and DF stations within areas through which the aircraft may have flown.

5 If persons on board aircraft are known or believed to have mobile devices, attempt to obtain information about these, and attempt contact. If anyone on board has a tracking and locating app, including the pilot(s) use of an Electronic Flight Bag with this capability, attempt to obtain information from the app (e.g. track history, current or last known position).

. . .

Appendix F

Distress phase checklist

. . .

16 Issue distress broadcasts.

17 Consider use of flight tracking systems to identify aircraft in flight that may be able to assist and for monitoring SAR aircraft progress.

~~**17**~~**18** Consider tracking and locating capabilities of mobile telecommunication devices, e.g. mobile phones and apps.

Editorial Note.— Renumber subsequent paragraphs

. . .

Appendix G

Facilities and equipment selection

. . .

G.2 Air facilities

G.2.15 Equipment for aircraft participating in SAR operations includes:

Navigation equipment. Accurate navigation is essential for maximizing the probability of success in search operations and for determining the exact position of survivors or wreckage. Since long- and medium-range aircraft may need to search far from their bases over isolated or ocean areas, extensive navigation equipment is essential. Precise navigation equipment such as the Global Positioning System (GPS) or GLONASS can be helpful in covering a search area carefully or locating a datum, especially when operating over terrain or water with few navigation references. Short-range aircraft normally will not require extensive navigation equipment if used to search areas familiar to the pilot close to their bases. Aircraft tasked for SAR operations should be equipped to receive and home on radio signals, including those emitted by emergency locator transmitters (ELTs), emergency position-indicating radio beacons (EPIRBs), and if practical, radar SARTs and AIS-SARTs~~SAR radar transponders (SARTs)~~.

. . .

Appendix H

Operation briefing and tasking forms

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- SAR briefing and debriefing form

  - **Briefing**

SAR__________________

Date____________

A/C type and number______________Unit______________________Captain____________

Details as to nature of distress or emergency ____

Description of search object

(1) Type of aircraft or vessel____

(2) Number or name of craft____

(3) Length____________________ Width (wingspan)________________________________

(4) Number on board____

(5) Full description of craft, including colour and markings______________________

____

____

____

(6) Frequencies of missing craft____

____

Assigned search areas

Area____

Type of search ____________________ Altitude/visibility________________________

Time on task____

Commence search at (position)____________________ and track (N–S)(E–W)____________________

Care should be taken when programming flight management systems to ensure search area coverage while remaining within the assigned search area.

Frequencies

(1) Controlling agency____________________________ (2) Aircraft

(3) Surface vessels ______________________ (4) Others ______________________________

Progress reports

To be passed to ______ every __________ hours with weather report included every _______ hours.

Record actual latitudes, longitudes, times for the beginning and end of the first search leg, and the beginning and end of the last search leg as they occur, and report via the next progress report.

Special Instructions:

Debriefing

SAR ____ A/C No. ____________________

Date ___

Point of departure ______________________________ Point of landing __________

Time off ______On task__________ Off task __________ Landed ______________

Area actually searched (include the four observed latitudes, longitudes, times for the starting and ending points of first and last search legs.) ________________________________ ________

____

____

Type of search ______________________ Altitude/visibility ______________________

Terrain or sea state ____ Number of observers ___

Weather conditions in search area (visibility, wind velocity, ceiling, etc.)

____

____

Object of search (located) at position____

____

Number and condition of survivors ____

____

____

Sightings and/or other reports____

____

____

____

____

Telecommunications (Note quality of communications and/or any changes other than briefed)

____

____

Remarks (to include any action taken on search, any problems, criticism, suggestions)

____

____

____

____

Date/time (local)	Captain

- Abbreviated SAR briefing and debriefing form

  - **Briefing**

SAR ___

Date ____
A/C type and number ________________ Captain ________________

Take-off time ____

Search area ____

____

____

Search height ________________ Scanning range ________________

Type of search ____

Remarks: Record actual latitudes, longitudes, times for the beginning and end of the first search leg, and the beginning and end of the last search leg as they occur, and report via the next progress report.

____

____

____

Debriefing

Area actually searched ____

____

____

____

Search time ________________ Transit time ________________

Effectiveness of search: ________________% Percent of area covered ________________%

Remarks: (include the four observed latitudes, longitudes, times for starting and ending points of first and last search legs.) ____

____

____

. . .

Appendix L

Search planning and evaluation worksheets

. . .

Editorial Note.— Page 'L-23'

Search action plan worksheet – Corner-point method or centre-point method of pattern specification

Note: Use only one of corner-point method part 3 or centre-point method part 3, as shown in square brackets.

Search action plan message

(Precedence and date/time group of the message)
FROM *(RCC or RSC responsible for the search)*
TO *(All agencies/facilities tasked with conducting the search)*
INFO *(Agencies concerned, but not participating, in the search)*
BT

(*Emergency Phase, i.e.* DISTRESS, ALERT, UNCERTAINTY), (Identification of the search object, *e.g.* M/V NEVERSEEN) *(Two-letter abbreviation for the flag of the search object, e.g.* (PN)) *(One- or two- word description of the SAR cause, e.g.* UNREPORTED, SUNK, DITCHED, *etc.), (General description of the search location, e.g.* GULF OF OMAN, CABO SAN ANTONIO TO KEY WEST, *etc.*)

SEARCH ACTION PLAN FOR *(Date)*

A *(References)*

1 SITUATION:

A SUMMARY: *(A brief summary of the case, without repeating information previously provided to all addressees.)*

B DESCRIPTION: *(Description of the missing craft,* e.g. MOTOR VESSEL, 150 METRES, BLACK HULL, WHITE SUPERSTRUCTURE AFT)

C PERSONS ON BOARD: *(Number)*

D SEARCH OBJECTS:

PRIMARY: *(Description of the primary search object, e.g.* 8-PERSON ORANGE LIFERAFT WITH CANOPY)

SECONDARY: *(Description of secondary search object(s), e.g.* POSSIBLE SURVIVORS IN WATER, WRECKAGE/DEBRIS, ~~121.5~~406 MHZ ~~EPIRB~~DISTRESS BEACON, MIRROR FLASH, ORANGE SMOKE, FLARES)

E ON-SCENE WEATHER FORECAST PERIOD *(date/time)* TO *(date/time):* CEILING *(in feet, with cloud cover, e.g.* 8000 OVERCAST), VISIBILITY *(in nautical miles or kilometres),* WIND *(direction from which the wind is blowing in degrees true/speed in knots, e.g.* 190T/30KTS), SEAS *(direction from which the seas are coming in degrees true/height range and unit of measure, e.g.* 210T/3-6 FEET)

2 ACTION:

A (Specific tasking for a particular SAR agency or facility)

B (A separate sub-paragraph should be used for each agency or facility participating in the search)

[3 SEARCH AREAS (READ IN FIVE COLUMNS):

AREA CORNER POINTS

(Search area designations may follow a "Letter hyphen number" format, e.g. A-4, C-1. *The first day's searches use the letter "A" and are sequentially numbered, the second day's searches use the letter "B", and so forth.) (Corner points are given in degrees and minutes of latitude and longitude, e.g.* 38-52.0N 077-14.0W. *Usually, search areas are rectangular with the four corner points listed in clockwise order.)***]**

[*Or if using centre-point method substitute with part 3 below*]

[3 SEARCH AREAS (READ IN SIX COLUMNS):

				MAJOR	TRACK
AREA	CENTRE POINT	LENGTH	WIDTH	AXIS	SPACE

(Search area designations may follow a "Letter hyphen number" format, e.g. A-4, C-1. *The first day's searches use the letter "A" and are sequentially numbered, the second day's searches use the letter "B", and so forth.)* (Centre *points are given in degrees and minutes of latitude and longitude, e.g.* 38 52.0N 077 14.0W. *Search areas are rectangular with the length, width, direction of the major axis, and the track space listed.)***]**

4 EXECUTION (READ IN SEVEN COLUMNS. ALTITUDES IN FEET):

. . .

Editorial Note.— Page 'L-25' – remove hyphens from lat/long

Sample search action plan message

FROM SANJUANSARCOORD SAN JUAN PUERTO RICO
TO COGARD AIRSTA BORINQUEN PUERTO RICO//OPS//
MARINE FORT DE FRANCE MARTINIQUE//MRCC//
RCC CURACAO NETHERLANDS ANTILLES
INFO CCGDSEVEN MIAMI FLORIDA//CC/OSR//
MRCC ETEL
RCC LA GUIRA VENEZUELA
ATC SAN JUAN PUERTO RICO

BT

ATTN: COMMAND DUTY OFFICER

DISTRESS N999EJ (US) DITCHED - EASTERN CARIBBEAN

SEARCH ACTION PLAN FOR 17 SEPTEMBER 2022

A TELCON LTJG BASS/LT LAFAYETTE (MARTINIQUE) 162115Z SEP 22

B TELCON LTJG BASS/LTC VAN SMOOT (CURACAO) 162130Z SEP 22

C TELCON LTJG BASS/MR. C. SMITH 162145Z SEP 22 (ATC SAN JUAN)

1 SITUATION:

A SUMMARY: N999EJ (US REGISTERED) EN ROUTE FROM PORT OF SPAIN TRINIDAD TO AGUADILLA PUERTO RICO REPORTED ENGINE FAILURE AND DESCENDING THROUGH 5000 FEET IN POSITION 14-20N 64-20W AT 152200Z WITH INTENTIONS TO DITCH. NIGHT FLARE SEARCHES 15 AND 16 SEP AND DAY SEARCH 16 SEP. NEGATIVE SIGHTINGS.

B DESCRIPTION: CESSNA CITATION III, WHITE WITH BLUE TRIM.

C PERSONS ON BOARD: 4

D SEARCH OBJECTS:
PRIMARY: 8-PERSON ORANGE RAFT WITH CANOPY.
SECONDARY: POSSIBLE SURVIVORS IN WATER, WRECKAGE/DEBRIS, ~~121.5 MHZ ELT~~406 MHz DISTRESS BEACON, MIRROR FLASH, ORANGE SMOKE, FLARES.

E ON-SCENE WEATHER FORECAST PERIOD 171200Z TO 172400Z: CEILING 8000 BROKEN, VISIBILITY 16 NM, WIND 190T/30KTS, SEAS 300T/3-6 FEET.

2 ACTION:
A AS PER REFERENCE A, REQUEST MRCC FORT DE FRANCE PROVIDE [FIXED-WING] AIRCRAFT TO SEARCH SUB-AREA C-1.

B [FIXED-WING] CGNR 1742, CALL SIGN RESCUE 1742, SEARCH SUB-AREA C-2 AND ASSUME OSC DUTIES.

C AS PER REFERENCE B, REQUEST RCC CURACAO PROVIDE [FIXED-WING] AIRCRAFT TO SEARCH SUB-AREA C-3.

[3 SEARCH AREA (READ IN FIVE COLUMNS):
AREA CORNER POINTS
C-1 15-46.7N 65-13.1W, 15-59.4N 65-00.0W, 15-00.0N 63-58.8W, 14-47.3N 64-11.9W
C-2 15-23.4N 65-37.0W, 15-46.7N 65-13.1W, 14-47.3N 64-11.9W, 14-24.0N 64-35.8W

C-3 15-00.0N 66-01.0W, 15-23.4N 65-37.0W, 14-24.0N 64-35.8W, 14-00.6N 65-00.0W]

[*Or if using centre-point method substitute with part 3 below*]

[3 SEARCH AREAS (READ IN SIX COLUMNS):

				MAJOR	TRACK
AREA	CENTRE POINT	LENGTH	WIDTH		
				AXIS	SPACE
C-1	15 23.3N 64 35.6W	84.0 NM	18.0 NM	315T	3.0 NM
C-2	15 03.3N 64 54.3W	84.0 NM	33.0 NM	135T	3.0 NM
C-3	14 42.0N 65 18.4W	84.0 NM	33.0 NM	135T	3.0 NM]

4 EXECUTION (READ IN SEVEN COLUMNS. ALTITUDES IN FEET):

AREA	SAR FACILITY	LOCATION	PATTERN	CREEP	COMMENCE SEARCH POINT	ALT
C-1	[FIXED-WING]	MARTINIQUE	PS	225T	15-00.0N 64-00.5W	1000
C-2	[FIXED-WING]	PUERTO RICO	P~~C~~S	225T	15-44.5N 65-13.0W	500
C-3	[FIXED-WING]	CURACAO	PS	225T	15-21.2N 65-37.1W	1000

...

Appendix N

Tables and graphs

. . .

Editorial Note.— Insert the following Note below the table of contents on page N-i

Note – the use of tables regarding sweep width are applicable to daylight visual search only, not for search operations in night conditions.

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Appendix S

Search planning for 121.5 MHz distress beacon ~~alerts~~ signals

Note 1 – This guidance is intended to assist with using 121.5 MHz signals to locate:

- 406 MHz distress beacons equipped with a 121.5 MHz homing signal; or
- older analogue distress beacons which transmit on 121.5 MHz.

Note 2 – For distress beacons which also transmit on 243 MHz, this guidance may also be used; however, when calculating the radio horizon, in general the range for 243 MHz signals will be around 20% less than for 121.5 MHz signals.

Overview

1. Searching for beacons is often difficult~~,~~ and may be impossible without additional information. However, the methods in this appendix should be followed as practicable. Homer-equipped aircraft, communications authorities, maritime SAR authorities or others might be able to obtain fixes or bearings on 121.5 MHz signals.

2. Search planning for 121.5 MHz or 243 MHz beacon alerts typically result from reports received from ~~commercial~~ aircraft flying at high altitude. ~~The beacon could be located anywhere within a large search area.~~ Reports might also be received via low-flying aircraft and ground stations (including aircraft on aerodromes, heliports, etc.). ~~The methods that follow will help define and reduce beacon search areas.~~ Maximum detection ranges for beacon signals are assumed to be limited by line of sight and dependent upon the altitude of the reporting aircraft, the beacon could be located anywhere within a large search area.

3. RCCs may wish to establish a specific procedure with appropriate air traffic services units (ATS units) to gather, record and coordinate aircraft distress beacon reports. This could supplement the required alerting process consistent with the current ATS alerting service provisions of ICAO Annex 11 – *Air Traffic Services,* chapter 5.

4. This appendix will help RCCs to establish procedures:

(a) for obtaining the required distress beacon signal data from aircraft reports in order to plan search areas; and

(b) to define and reduce distress beacon search areas.

~~3~~5. Figure S-1 depicts the geometry when an aircraft receives a beacon signal, and shows labelling used in planning a search for the beacon. *However, potential scenarios discussed in the cautionary notes below may limit the applicability of figure S-1 and should be taken into account when deemed appropriate*.

Cautionary notes

. . .

Reports from a single aircraft may occur at different altitudes or courses. Aircraft~~, particularly those under instrument flight rules,~~ may be ~~ascending~~climbing, descending and/or changing course according to their flight plan, navigation ~~and~~ or air ~~route~~ traffic control needs. The first heard and last heard reports could be from different altitudes or on different courses.

For a course change, knowing the turn point would allow drawing another range circle to combine with the first heard and last heard generated range circles to more narrowly define the area. When the reports occur at different altitudes, range circles should be drawn for each altitude to identify their intersect points.

The transmitting beacon antenna may have some height above sea level or above its surrounding terrain. The height of the sending antenna, if able to be ascertained or estimated, should be added to the height of the radio receiver when estimating the detection range.

. . .

The detected beacon may be aboard an in-flight aircraft, and the aircraft, course, speed or altitude could change. The procedures in this appendix do not account for an in-flight beacon scenario, but the search planner should be aware that apparently conflicting data or unexpected search planning outcomes could be caused by this situation.

The estimated detection range of the beacon may be reduced by factors such as:

- **Beacon location** – in mountainous terrain or areas covered with dense vegetation, the range of the signal is more likely to be reduced considerably or radiate in a non-uniform manner due to radio pattern lobing caused by terrain shielding as compared to the range over water or open flat land with little or no tree coverage.
- **Beacon antenna condition** – the beacon's antenna may not be correctly deployed, is damaged or obstructed, for example an aircraft in distress that has come to rest inverted or on its side.
- **Beacon transmission power output** – different beacon models can have different homing signal transmission power.
- **Aircraft radio equipment** – the capability of both the reporting aircraft and search aircraft may vary dependent on their aircraft radio receiver sensitivity, antenna gain and squelch setting.

Because any of these variables may be applicable, it is important to appreciate that the actual range may differ substantially from the theoretical range.

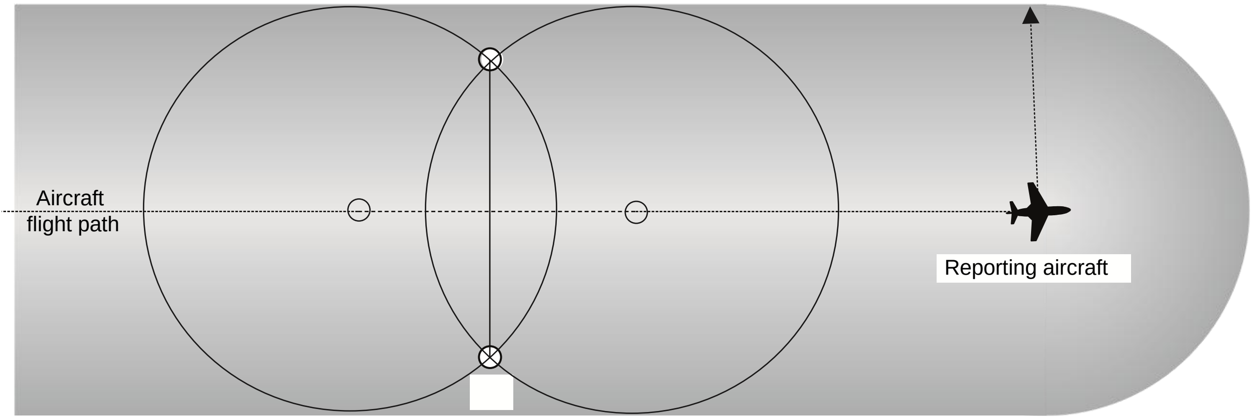

Figure S-1 — *Geometry where reporting aircraft passes within reception range of beacon signal*

Aircraft distress beacon report procedure

6. Obtain required aircraft report data.

(a) The following data should be obtained to assist RCCs to carry out search planning:

(1) the time (UTC), position (latitude/longitude) and level (height, altitude or flight level) of the aircraft when the signal was first heard and last heard;

(2) the aircraft's departure point, destination and route;

(3) description of signal characteristics including whether it commenced abruptly or faded in and signal strength variations.

(b) To assist with narrowing down the search area, other aircraft transiting the area should be requested to monitor 121.5 MHz and report the same details if the signal is heard or not heard, noting that reports of no signal being heard can assist in reducing the search area. Aircraft should be requested to monitor without adjusting the aircraft radio equipment squelch setting.

(c) An efficient way for RCCs to obtain the required data is to establish an operational procedure with ATSUs that have responsibility for the airspace, aerodromes and heliports within their SRR. The sample ***Distress Beacon Signal Report Form*** template at Table S-4 provides a method to gather, record and coordinate this information. This form could be made readily available at ATS unit consoles for the recording of reports in a standardized manner for sending onto the RCC and serves as a reminder to ATS officers of the information required by the RCC. Using this form also reduces the opportunity for human error during verbal exchanges of report data.

(d) Mindful of the workload many reports create for ATS units, when many similar aircraft reports are being received which don't assist with reducing the search area, the RCC may request the ATS unit to hold such reports and only provide further reports that add value, such as reports from lower altitude aircraft or reports of the beacon signal ceasing at a previously reported position and altitude.

(e) When receiving multiple reports, consider the possibility that more than one activated 121.5 MHz beacon might be heard.

Search planning procedure

47. **Record reported data.** RCC computerized incident management systems or ~~Use~~ table S-1 may be used to record data received about a transmitting 121.5 MHz beacon. Of all data collected about the beacon signal, the position and height of the receiving antenna for points first heard (PFH) and last heard (PLH) are most important.

~~**Note:** Obviously, reports from multiple sources can help substantially in narrowing down the search area for a 121.5 MHz beacon. The SAR mission co-ordinator (SMC) should use all reports, and also solicit additional reports from other aircraft in the area, either directly or via the appropriate flight services as appropriate. Aircraft should be asked to report their own altitudes and positions where the signal was first heard, when the maximum signals were heard, and when the signal faded or was lost. Flight services, communications authorities, maritime SAR authorities or others might also be able to obtain fixes or bearings on activated beacons. When receiving multiple reports, consider the possibility that more than one activated 121.5 MHz beacon might be heard. The authorities might also be able to help locate and silence an inadvertently activated beacon.~~

~~5~~8. **Plot the reporting aircraft track.** Use a rhumb line or great circle navigation depending on the track being followed by the reporting aircraft, as depicted in figure S-2, noting that aircraft normally fly great circle routes.

Note: The geographic area used as an example in figures S-2, S-3, S-4, S-5, S-8 and S-10 is Hawaii and the surrounding area. The illustration shows a Lockheed C-130 search aircraft from Air Station Barbers Point in response to a report from an aircraft at high altitude, but similar plots could be developed for any area and other situations.

Table S-1 – *121.5 MHz beacon alert report data*

Point	**Date-time (UTC)**	**Position (latitude/longitude)**	**Aircraft altitude (*h*) (ft)**	**Course (degrees ~~true~~magnetic)**	**Course (degrees true)**
PFH (first heard)		N/S E/W			
PLH (last heard)		N/S E/W			

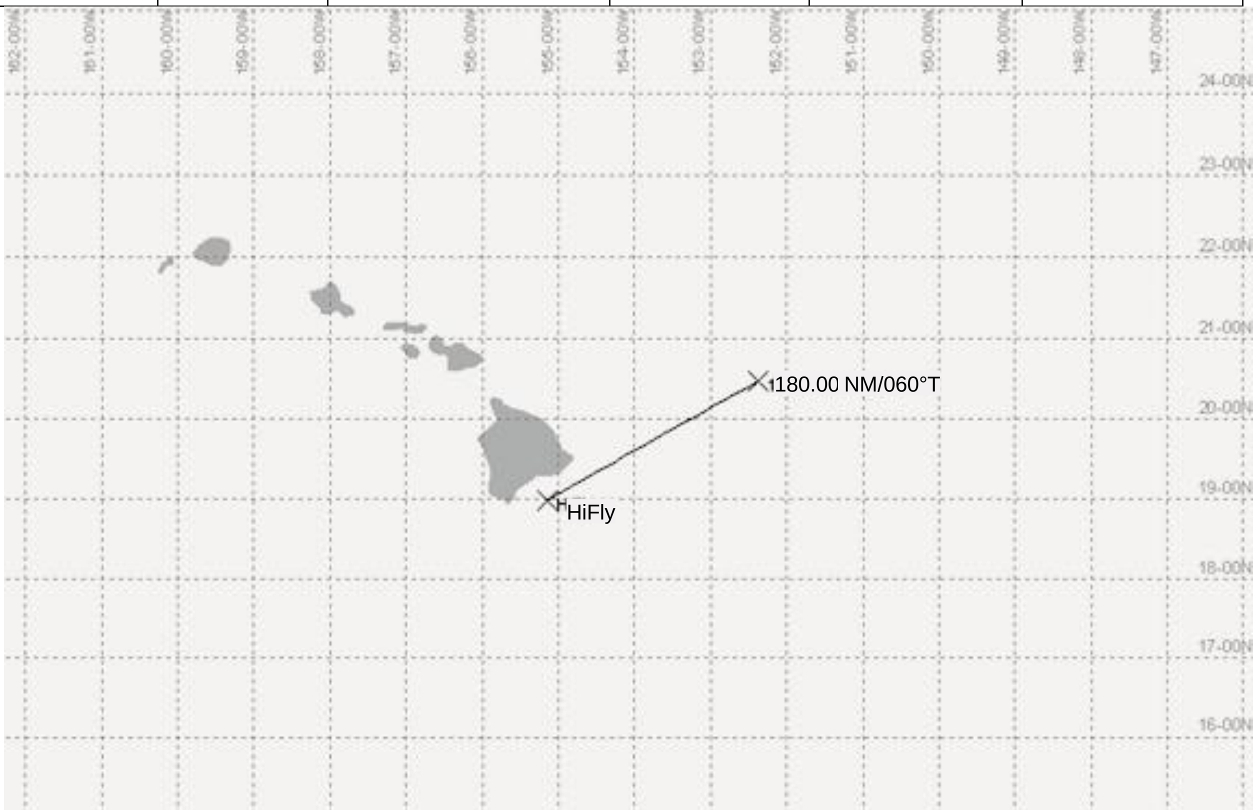

Figure S-2 – *Plot of PFH and PLH*

~~6~~9. **Plot the radio horizons.** Compute and plot the distance to the 121.5 MHz radio (VHF/~~UHF~~) horizon for the reporting aircraft at PFH and PLH.

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~~8~~11. **Plan the search.** With only a single report from a high-flying aircraft and the associated long distances, large search areas will result and search options will be limited.

(a) Generally, with a single report, an electronic search will be needed to attempt to reacquire and home on the beacon signal. An electronic search can often be accomplished reasonably fast with a single aircraft SAR unit (SRU) search track.

(b) The aircraft SRU should proceed to the nearest point of either:

- where the two circles intersect and then fly at a high altitude to the other point where the two circles intersect as illustrated in figure S-5; or

- a position which intercepts the route and altitude where the previous aircraft reported receiving the signal.

This should allow the beacon signal to be detected so the SRU can home on it.

Note: The other two legs of the triangle are flight from the base to commence search point (CSP) and also return to base from the second intersection point/end of the intersect line.

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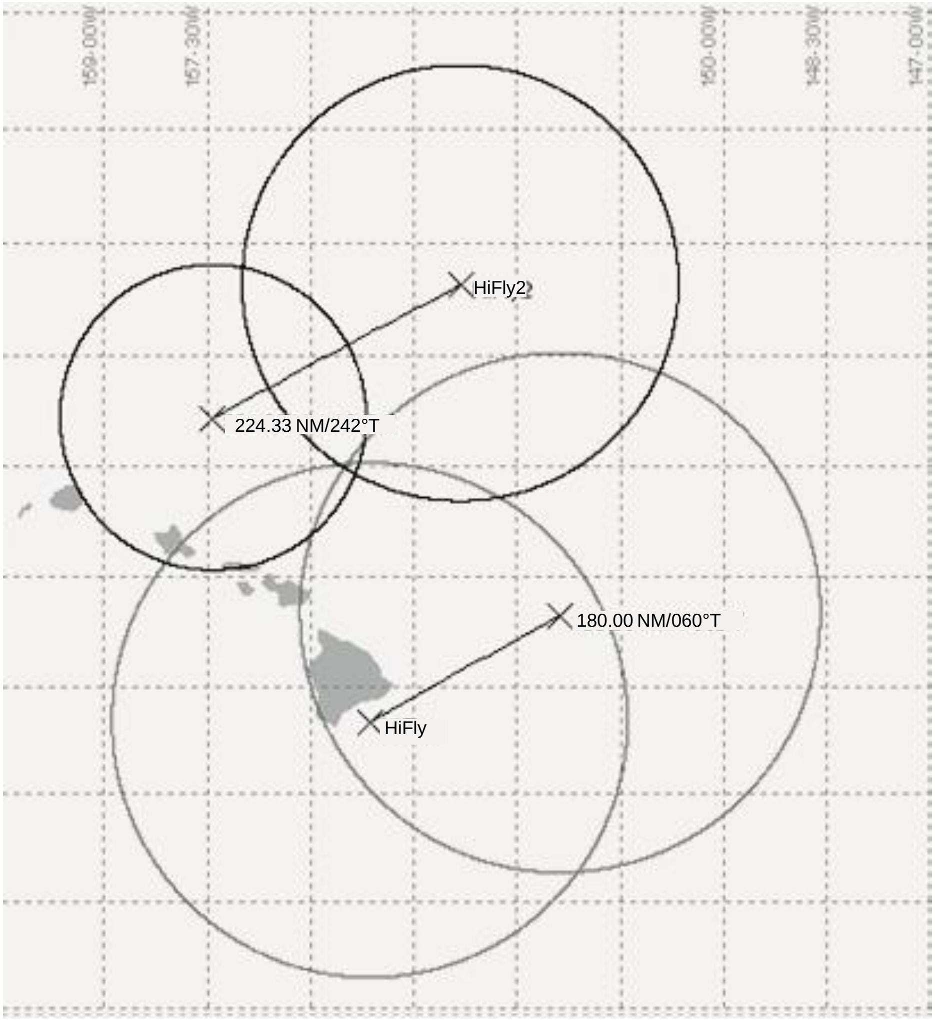

Figure S-10 – *Plot of PFH, PLH and respective radio horizon range circles; Hifly at 30,000 ft and course of 060 degrees T; Hifly2 at 20,000 ft and descending to 10,000 ft and course of 242 degrees T*

15. **Nil heard reports.** Reports by aircraft in the area that do not receive the beacon signal may assist with reducing the search area by calculating and plotting a circle in the same way as for an aircraft receiving the signal. The assumption is that the beacon is not likely to be within that area if it cannot be heard by the aircraft.

Note – Care needs to be taken on whether to discount areas where aircraft report not hearing the beacon signal for reasons outlined in the cautionary notes regarding factors which may reduce detection range. For example, one aircraft may not receive the signal while another aircraft in close proximity and altitude does receive the signal owing to differences in radio receiver sensitivity, antenna gain or squelch setting, or the aircraft not receiving the signal may have flown through an area shielded by terrain.

Table S-3 – *Distance to radio horizon*

Altitude (feet)	Radio distance (NM)	Altitude (m)	Radio distance (km)
500	28	152	52
1,000	39	305	72
2,000	55	610	102
3,000	67	914	124
4,000	78	1,219	145
5,000	87	1,524	161
6,000	95	1,829	176
7,000	103	2,134	191
8,000	110	2,438	204
9,000	117	2,743	217
10,000	123	3,048	228
11,000	129	3,353	239
12,000	135	3,658	250
13,000	140	3,962	259
14,000	146	4,267	271
15,000	151	4,572	280
16,000	156	4,877	289
17,000	160	5,182	297
18,000	165	5,486	306
19,000	170	5,791	315
20,000	174	6,100	322
21,000	178	6,400	330
22,000	182	6,706	337
23,000	187	7,010	347
24,000	191	7,315	354
25,000	195	7,620	361
26,000	198	7,925	367
27,000	202	8,230	374
28,000	206	8,534	382
29,000	210	8,839	389
30,000	213	9,150	395
31,000	217	9,450	402
32,000	220	9,754	408
33,000	223	10,058	413
34,000	227	10,363	421

Altitude (feet)	Radio distance (NM)	Altitude (m)	Radio distance (km)
35,000	230	10,668	426
36,000	233	10,973	432
37,000	237	11,278	439
38,000	240	11,582	445
39,000	243	11,887	450
40,000	246	12,192	456

Editorial Note.— Table S-4 to be sized to fit on one page

Table S-4 — Sample aircraft distress beacon report form

<table>
<tr><td colspan="6">Distress Beacon Signal Report Form</td></tr>
<tr><td colspan="2">To: [name of RCC]</td><td colspan="4">Address: AFTN [8-letter code] SS priority
Email [RCC email address]
FAX No.: [RCC facsimile number]</td></tr>
<tr><td colspan="2">From: (ATSU name)</td><td colspan="4">[An option is to insert all ATSU names within the SRR which ATS officers may then simply circle]</td></tr>
<tr><td colspan="6"><u>REPORTING AIRCRAFT DETAILS</u></td></tr>
<tr><td colspan="6">CALLSIGN:</td></tr>
<tr><td colspan="3">FROM [Departure AD]:</td><td colspan="3">TO [Destination AD]:</td></tr>
<tr><td colspan="6">ROUTE:</td></tr>
<tr><td colspan="2"><u>SIGNAL FIRST HEARD</u></td><td rowspan="2">OR</td><td colspan="3" rowspan="2">NIL SIGNAL HEARD ☐ tick</td></tr>
<tr><td>Faded in ☐ tick</td><td>Abrupt ☐ tick</td></tr>
<tr><td>TIME (UTC):</td><td colspan="5">AIRCRAFT POSITION (LAT/LONG):</td></tr>
<tr><td colspan="3">FLIGHT LEVEL / ALTITUDE:
HEADING:</td><td>circle</td><td>circle</td><td>circle</td></tr>
<tr><td colspan="2"><u>SIGNAL LAST HEARD</u></td><td colspan="4" rowspan="2"></td></tr>
<tr><td>Faded out ☐ tick</td><td>Abrupt ☐ tick</td></tr>
<tr><td>TIME (UTC):</td><td colspan="5">AIRCRAFT POSITION (LAT/LONG):</td></tr>
<tr><td colspan="3">FLIGHT LEVEL / ALTITUDE:
HEADING:</td><td>circle</td><td>circle</td><td>circle</td></tr>
</table>

REMARKS
NOTE to ATS units: • **Request pilots not to alter any settings for squelch on the aircraft's radio.** • On receipt of an initial high-level distress beacon signal report, to assist the RCC in localizing the source attempt to obtain low-level reports from other aircraft. • Reports from aircraft not receiving the distress beacon signal also assist the RCC in localizing the source. • Where LAT/LONG cannot be easily established, then reference using a bearing and distance from a published waypoint or geographical location may be used.

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Appendix V

Autonomous distress tracking of aircraft in flight

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Introduction

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6 This document, however, provides guidance to these entities specifically on the implementation of 3.2 regarding the location of an aircraft in distress aspect of GADSS, in order to assist with the development of each entity's procedures, so as to be compliant with the ICAO sStandards concerned.

7 The Standard defining location of an aircraft in distress* requires that, as of 1 January 20232025, aircraft first issued with a certificate of airworthiness for the first timeon or after 1 January 2024, with a maximum certificated take-off mass of over 27,000 kg, "shall autonomously transmit information from which a position can be determined by the operator at least once every minute, when in distress." The ICAO provisions also recommend that this requirement be applied to aircraft with a maximum certificated take-off mass of over 5,700 kg.

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11 A simplified schematic timeline for an emergency situation is shown in figure V-1 to illustrate the sequenceanticipated flow of events occurring when an ADT device is activated.

. . .

15 The ICAO Standards and Recommended Practices (SARPs) related to ADT devices are not technology-specific; aircraft operators may select the device most suited to their operations. While multiple systems which meet the requirements of the SARPs are available, RCCs should note that there exists one system which behaves differently from the others in one significant aspect. Utilizing their existing data distribution network, as well as the LADR process described herein, Cospas-Sarsat has developed a system whichthe Cospas-Sarsat ELT(DT) will delivers ADT notifications to RCCs via both the LADR and SIT185 messages. This system is described in **Attachment A.**

Location of an aircraft in distress repository (LADR)

16 The LADR, a secure storage facility with a web-based viewer, collects, stores and makes available (to holders of a free subscription holders) position information supplied from ADT devices, so that operators can comply with ICAO aAnnex 6 – *Operation of Aircraft*, pPart I – *International Commercial Air Transport – Aeroplanes*, paragraph 6.18.3.

* Annex 6 — *Operation of Aircraft*, pPart I — *International Commercial Air Transport — Aeroplanes*, paragraph 6.18.

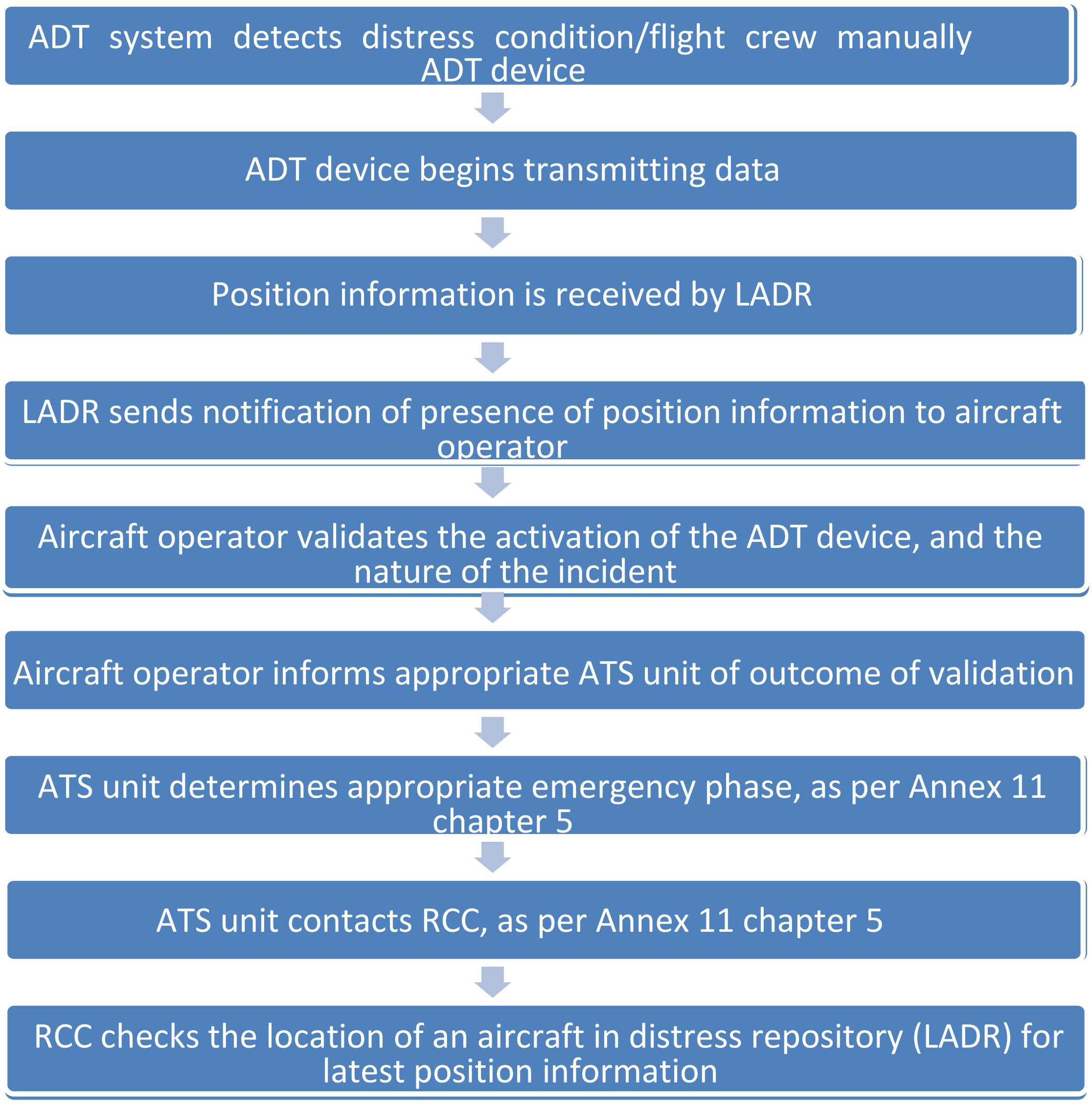

Figure V-1 – *~~Schematic sequence~~Anticipated flow of events arising from an autonomous distress tracking device activation*

. . .

21 ~~Subscribing to the LADR is voluntary for all entities other than a~~Aircraft operators~~,~~ ~~who will need~~ are required to subscribe to the LADR in order to "ensure that the location of an aircraft in distress repository (LADR) is automatically updated with autonomous distress tracking (ADT) data from an aircraft in a distress condition" (Doc 8168, *Procedures for Air Navigation Services – Aircraft Operations*, ~~v~~Volume III – *Aircraft Operating Procedures*, ~~s~~Section 10, ~~c~~Chapter 2). ~~However, RCCs~~ RCCs are required by ICAO Annex 12 — *Search and Rescue,* paragraph 2.3.7, to subscribe to the LADR. Other entities are strongly encouraged to subscribe in order to have access to up-to-date and accurate position information of aircraft potentially in distress.

. . .

24 As per the responsibilities outlined in ICAO aAnnex 6 – *Operation of Aircraft*, pPart I – *International Commercial Air Transport – Aeroplanes*, aAppendix 9, the aircraft operator will inform the appropriate area control centre if there is reason to believe that the aircraft is in distress. This could be due to a confirmation of the validity of the activation, or inability to contact the crew to validate the nature of the activation. Contact details for area control centres can be obtained from the ICAO OPS Control Directory (OPS CTRL), which can be accessed at: www.icao.int/safety/globaltracking. Access to data is governed by user profiles, in line with those for the LADR.

Area control centre

25 The appropriate area control centre will record all information relevant to the state of emergency of the aircraft, including the outcome of actions taken under paragraph 22, and forward such information to the appropriate RCC in accordance with the uncertainty, alert and distress phases, as per ICAO aAnnex 11 – *Air Traffic Services*, cChapter 5, pParagraph 5.2.

26 It is possible that the appropriate ACC and/or RCC will already be aware of a distress condition by means other than the LADR (via a MAYDAY transmission for instance) and appropriate action may already have commenced.

~~**Other points to note**~~

~~27 ICAO annex 6 – *Operation of Aircraft*, part I – *International Commercial Air Transport – Aeroplanes* was amended to allow an ADT device to replace the automatic ELT. Consequently, after 1 January 2023, some aircraft may no longer automatically transmit a 121.5 MHz homing signal. An ADT device is not required to have a homing transmitter.~~

~~28 The ICAO SARPs apply only to aircraft over 27 000 kg maximum take-off mass for which an individual certificate of airworthiness is first issued on or after 1 January 2023. However, operators have the option to retrofit older aircraft, thereby avoiding the need to equip with an automatic ELT.~~

Attachment A

Utilizing ELT(DT) to locate aircraft in distress

. . .

2 The Cospas-Sarsat System utilizes a network of satellites that provides global coverage. Distress alerts are detected, located and forwarded to over 200 countries and territories at no cost to beacon owners or the receiving government agencies. Since the first rescue using Cospas-Sarsat technology in September 1982, the Cospas-Sarsat System has provided assistance in rescuing more than ~~5~~60,000 persons in more than ~~15~~20,000 SAR events.

. . .

4 Notification of the activation of the ELT(DT) and other associated information will be automatically transmitted via the Cospas-Sarsat Space and Ground Segments directly to relevant RCCs, and automatically sent to the LADR. This dual delivery ~~differs from other ADT system and~~ may result in RCCs being notified of the same event by multiple means.

5 As well as the standard information transmitted in any ELT alert, Cospas-Sarsat will include in the ELT(DT) message sent to RCCs and the LADR the three letter designator for the aircraft operating agency, aircraft position and level, and whether the device was triggered manually or automatically, in compliance with the specifications of the LADR. The age of the latest position report received will also be provided; e.g. "position 23-34.44N 070-33.55W is less than 1 minute old".*

. . .

7 An ELT(DT) may also include the following capabilities:

.1 for an ELT(DT) that is crash survivable, sufficient battery life to provide at least 370 minutes of in-flight transmission within a total of 24 hours of transmission of 406 MHz messages ~~transmissions~~, and 48 hours of 121.5 MHz direction-finding signal transmissions; or

.2 for an ELT(DT) combined with the function of an ELT(AF) (automatic fixed), an ELT(AP) (automatic portable), or an ELT(AD) (automatic deployable), sufficient battery life to provide at least 370 minutes of in-flight transmission plus 24 hours of post-crash transmission ~~plus 370 minutes~~ of 406 MHz messages ~~transmissions~~, and 48 hours of 121.5 MHz direction-finding signal transmissions.

Editorial Note.— Insert new appendix W:

APPENDIX W

NIGHT SEARCH BY AIRCRAFT USING ELECTRO-OPTIC/INFRARED (EO/IR) EQUIPMENT AND/OR NIGHT VISION DEVICES (NVDs)

Definitions

Term	**Definition**
EO/IR, or Electro-Optic/Infrared systems	Electronic imaging systems which include both visible and infrared sensors that can be used day and night and in low light conditions with the ability to view objects at long distance.
NVD, or night vision device	Night vision enhancement equipment fitted to, or mounted in or on, an aircraft, vessel or vehicle, or worn by a person, that can: .1 detect and amplify light in both the visual and near-infrared bands of the electromagnetic spectrum; or .2 provide an artificial image representing topographical displays.

General Considerations

1 This information provides general guidance for search planners when considering night searches by aircraft using electro-optic/infrared (EO/IR) equipment and/or night vision devices.

Note 1 *- Searches during daylight using visual observation plus EO/IR may be beneficial, but this guidance focuses on night search only. There are a number of references within this guidance to considerations which are applicable to searching during daylight or night conditions.*

Note 2 *– NVD is used in this guidance as a collective term incorporating all aspects associated with night vision such as night vision imaging systems (NVIS) and night vision goggles (NVGs).*

2 It is preferable, safer, and normally more effective to search in daylight. Of course, the timing of distress situations is not always optimal for a daylight search. Where suitably capable night search aircraft with aircrew trained and competent in safe night search operations are available, SMCs may consider a night search is necessary where the urgency of the situation may be critical to saving lives.

3 Factors generally common to selection of aircraft and the ability for pilots to safely accept any search task apply, including regulatory requirements, risk factors, aircraft performance and capability, equipment fitted, aircrew training and experience, weather, nature of search area (topography, vegetation, distance offshore, availability of forced landing areas, obstacles and powerlines), fuel endurance available, transit times, available time on scene, and fatigue.

4 Search planners and coordinators should have a good understanding of the capability and limitations of EO/IR and NVD searching. This will enable them to discuss and brief an effective search plan with the aircrew and to establish reasonable expectations of possible outcomes and best use of the asset. Given the range of variables for these types of searches, search planners should be guided by the aircrew's expertise and plan the search accordingly with safety of the operation as the priority.

Aircraft and equipment factors

5 Aircraft type and the type of EO/IR and NVD equipment available on board provide different search options. Aircrew training and experience play a central role in night search effectiveness.

6 Ideally the use of a combination of EO/IR and NVD is the most effective. NVDs can provide a wide viewing area with any sightings being able to be examined in more detail using IR which has a narrower field of view and greater acuity. EO/IR cameras with the ability to zoom in on sightings provide advantages over EO/IR systems without this capability. Aircraft lighting, both internal and external, needs to be compatible with NVDs.

7 It is possible that an object can be visible in the NVD but not be visible in the EO/IR, or vice versa, depending on the object's characteristics. This may present challenges where search aircraft equipped with only one of these two types of electronic night search capability needs to transfer sighting details to another search aircraft with the other means of detection for investigation.

8 Advanced systems integrated with navigation systems, moving map displays and recording capabilities provide additional benefits to assist operators to provide greater search integrity, efficiency and effectiveness. For search aircraft suitably fitted, the ability for the RCC to send search patterns and search areas via data files (for example KML files) to be uploaded to aircraft mission management systems, GNSS units or aircrew portable electronic devices (if equipped) can provide efficiencies by reducing the need for complex conversations, relay of information and human error. Such aircraft, if also fitted with a GNSS flight tracking system may also be able to provide the RCC with a debrief of the actual search tracks flown.

9 Visual and IR lasers are visible using NVDs. SAR coordinators should note that some aircraft operators may have visual or IR laser capability which may be used for the purpose of guiding other aircraft and surface SAR units to a distress location. IR lasers can also be used by crew members on the same aircraft operating with different sensors to help each other acquire a sighting, for example, the crew member operating the EO/IR is having difficulty acquiring a sighting detected on an NVD by another crew member. Depending on the laser type there may be hazards associated with their use. SAR units who intend to use lasers should be appropriately authorized and trained in their use. Other assets involved in a search operation, both aircraft and surface units, should be informed when lasers are being used by search assets so they can take their own precautions with respect to laser safety and prevent confusion as to the reason for the laser.

10 Aircraft fitted with an external public address or loudhailer system may assist with providing verbal directions to a person on the surface and may give comfort to a missing person not yet located that they are being looked for.

11 Safety and capability can be enhanced for aircraft fitted with a terrain warning system, weather, or ground mapping radar and, for helicopters, auto-hover.

12 Some light-emitting diode (LED) lighting systems, clearly visible to the naked eye, fall outside the combined visible and near-infrared spectrum of NVDs and therefore will not be visible to aircrew using NVDs. This may present a hazard where LED lighting is used for surface obstacles. Emergency or other equipment fitted with LED lighting used by survivors may also impact detectability using NVDs.

13 Poor visibility due to contaminants in the air such as dust or smoke may compromise EO/IR and NVD effectiveness. In maritime areas, strong winds can blow salt spray across camera lenses and windows obscuring the electronic image or the view through windows, potentially leading to missed detection. Rain in the area can help clear this residue away.

14 In maritime areas, detectability of unlit targets on the sea surface using NVDs will be degraded, particularly in calm conditions because of the low albedo (reflective properties) and contrast.

Survivor factors

15 Search success can be limited where people being searched for are not actively trying to be located or are not capable of actively aiding search crews, for example owing to exposure or injury, or if they are hiding.

16 Ideally, persons in distress will have a light source which can be easily seen by NVD equipped crews, such as a torch, light from a mobile phone or signal fire. Reflective material may also assist. It is also possible that laser pointers may be used by persons in distress.

17 A person in the water without a light or reflective surface in broad-scale searches where a specific last known position is not known is very difficult to locate at night. Where a last known position in the water is available, the prompt arrival of the search aircraft will increase the probability of locating the target before the effects of maritime drift increase the search area.

18 To assist survivor awareness of the presence of the search aircraft and to elicit a survivor response signal, when the aircraft first arrives in the search area, if possible, the aircraft should be made as conspicuous as it can be by flying through the search area or orbiting at lowest safe altitude with as many external lights visible before commencing the search pattern.

19 A person in distress may see or hear the search aircraft and respond by activating a light or flare. Crews should be alert to the possibility that the person in distress may not have had the opportunity to activate their light signal by the time their aircraft passes and where possible adjust their search technique accordingly, for example, by flying both directions along the same search leg or, if capable and practicable, directing their detection equipment to search both forward and behind the aircraft.

20 Survivor morale can be lifted when a search aircraft is sighted or heard during the night, even if the search aircraft does not find the survivor.

Search planning factors

21 The timeliness and accuracy of intelligence information for search area determination have a bearing on search effectiveness.

22 Search coordinators should also consider that an NVD capable aircraft may not necessarily be capable of conducting an NVD search. This is because NVDs may be used by pilots and aircrew solely for the purposes of safe air navigation and terrain avoidance functions in compliance with aviation regulations, and they may not have any capacity to conduct dedicated NVD searching.

23 Search planning should also take into account that search crews, when using EO/IR and NVD equipment, will need periodic breaks to manage operator fatigue and provide an opportunity to view the search area unaided by electronic vision. This may result in detection of lights that both EO/IR and NVD cannot detect.

24 It is important to note that aircraft EO/IR equipment can normally only search one side of a search leg at a time, or only a forward or rear splay area at any time. Using NVDs to detect possible search targets, then using the EO/IR to investigate those sightings is generally the most effective search technique, especially for small targets.

25 The target type will influence the type of night search to be conducted. Considerations include whether the primary target is to be a person, aircraft, vessel, or other object, its size, and its potential to provide a light source or light signal, and the amount of heat it may produce. The potential condition of the target should also be considered such as whether a survivor is likely to be capable of signalling or moving, a distressed aircraft has been damaged, or a vessel has capsized or is semi-submerged.

26 Night searches may be more effective in areas with reduced numbers of people to avoid false sightings. Wildlife and livestock can be a distraction.

27 Environmental conditions to consider include:

.1 **Weather conditions** – both for search effectiveness and compliance with flight operations regulations, such as NVD minima, ability to maintain visual meteorological conditions (VMC), risk of inadvertently entering instrument meteorological conditions (IMC), availability of optimal search altitude due to the amount of cloud cover, precipitation, visibility, the action of wind over terrain and impacts of turbulence, freezing level, surface and air temperature, humidity, fog or mist, thunderstorms and sea conditions.

.2 **Ambient light** – amount of moonlight and moon phase, position and elevation, effect of twilight and other ambient light sources. Nights with good ambient light enable more effective searching with NVDs.

.3 **Thermal crossover** – the natural phenomenon that normally occurs twice daily when temperature conditions result in a loss of contrast between two adjacent objects on IR imagery which may have an adverse effect on IR detection.

.4 **Bushfire/wildfire activity** – EO/IR detection capability will be affected by the heat from the fire(s). NVD detection capability will be affected by the light from the fire(s) which can cause blooming (distortion or blotting out of the image) and smoke can reduce visibility.

.5 **Thunderstorms –** distances from thunderstorms may be difficult to estimate visually when using NVDs and the fitment of airborne weather radar or other electronic detection devices to the aircraft will assist. The NVD image may be adversely affected by lightning flashes.

.6 **For searches over land** – the topography including type of terrain, type and degree of vegetation, ground cover such as snow, and shadows from overhanging rocks and cliffs can impact search effectiveness. Different terrain can have positive and negative impacts on night searches. For EO/IR, a hot night may cause image wash out and a lack of obvious contrast between hot and cold and cause other structures and material to maintain heat for a longer period. Rocky terrain can be difficult to search by EO/IR where objects have the ability to retain heat during the day and provide "false positives" during a night search. Time spent by ground crews checking these sightings can limit overall search effort.

.7 **For searches over water** – sea conditions will determine search effectiveness. Rough water, waves, choppy surfaces and whitecaps can impede identification of people in the water. Whitecaps splashing over the head of a survivor limits detectability.

28 Searching over water presents different challenges to searching over land. Helicopter operations may be limited by the ability of the crew to maintain continuous visual contact using NVDs with land or a shoreline, including any illumination levels and potential hover references. Large areas of open water such as oceans can be difficult to comprehensively search. Operations in close proximity to coastline, islands or other obstacles can limit ability to search at optimum search altitude owing to minimum safe altitude requirements.

29 A more finite and smaller search area would benefit from a low altitude and slow speed search; however, a vast expansive search area such as in an open rural environment might require a higher altitude and faster search speed to cover. Higher probability locations may need smaller and repeated sweep widths or multiple orbits depending on field of view and to vary the slant ranges to potentially reveal previously unseen detail. Lower altitudes and low search speeds are most suitable for searching for a person in the water.

30 For best use of available aircraft search time, the best search progression will generally be in order of firstly covering the last known position, then the intended route, likely routes or locations based on local knowledge and intelligence, before a broad area search. For overwater searches, search planners will need to allow for drift of the target.

31 Search pattern and sweep width choice and suitability will be dependent on the various factors described in this guidance and should be guided by aircrew expertise. Search patterns using parallel legs may be best in some cases while flying orbits/circular patterns may be better. Adjustments may be required when the aircraft arrives in the search area owing to the conditions encountered, and aircrews should be provided with flexibility to adjust their search parameters where possible.

32 Search altitude variations may be applicable depending on the type of search, search aircraft type, its electronic night search capability and aviation regulatory requirements. The lowest safe search altitude at night over land is terrain and weather dependent but can generally be expected to be not below 1,500 – 2,000 feet above ground level (AGL). For helicopters with NVD capability and regulatory approval, lower altitudes may be possible where conditions allow, and it is safe to do so. Higher search altitudes may be optimal such as those generally flown by high-performance SAR aircraft using a circle search technique, which would normally be flown between 5,000 – 10,000 feet AGL and typically not above 15,000 feet AGL. As different aircraft operators, both civil and military, may have different capabilities and regulatory authorizations, SAR coordinators should be guided by the operator/aircrew on a case-by-case basis when planning search altitudes.

33 Searching areas of thick vegetation such as forested areas can be difficult. Searching over forested areas can be more effective at a higher altitude to allow for a higher viewing angle through the tree canopy. Circling an area of thick vegetation to provide a view from different angles may also assist.

34 EO/IR and NVDs can fail to detect a person owing to the limitations and variables outlined in this guidance, and depending on where and how they are situated, for example under thick vegetation, covered in mud. Search planning decisions made regarding potentially discounting areas searched by EO/IR and NVDs need to be carefully considered and searching those areas again by different search methods are likely to be needed for better search integrity.

35 Sector searches over a datum improve detectability through the cumulative effect of repeatedly covering the datum area. Circular patterns or orbits may also offer the same effect.

36 Most night search operations are likely to occur outside controlled airspace and where more than one aircraft is to be used for searching in the same area, as for day searches, those aircraft should be planned to allow aircrew to maintain deconflicted operations, both laterally and vertically, not only for safety purposes but also to maximize available search time while minimizing the need for pilots to organize self-separation with other aircraft. To maintain safety, planning for such operations must be arranged and discussed between the RCC and the pilots-in-command of those aircraft before such flights begin. For operations within controlled airspace, air traffic services (ATS) requirements will need to be factored into the planning in consultation with the responsible ATS unit.

Surface unit support

37 The success of night searches can be dependent on surface (land or marine) unit support to investigate sightings by search aircraft. The deployment of surface units in the search area in support of the aircraft night search may also assist the aircrew to establish suitable reference parameters for their sensor equipment for the search conditions.

38 Where aircraft and surface resources are to search concurrently, identification of high probability areas suitable for air search while surface resources search more easily accessible areas can provide more efficient search area coverage.

39 Where surface search personnel are likely to be present there should be a method for the aircraft search crew to easily identify them, for example, radiocommunications, identifying light signals, and IR strobes where aircraft NVDs are used. Surface units may be assisted by search aircraft to locate distress locations or identify a point of interest, for example by use of helicopter search lights to illuminate a search location or use of search aircraft laser systems.

Note – see precautions regarding aircraft laser systems in Aircraft and equipment factors section above.

40 Helicopter night winching has limitations, especially overwater, where a suitable visual reference is required or an auto-hover capability. NVD capability may assist in safely permitting night winching within regulatory requirements; however, using surface unit support to investigate sightings or perform a rescue presents a lower risk option.

Circle Search technique - General guidance

41 A circle search is based on the search aircraft having the capability to search using a combination of EO/IR and NVD operating at a fixed distance around a datum. As the aircraft flies the circular search pattern, the aircraft's NVD and EO/IR are used as search sensors. Observers are afforded a broad but less detailed view of the search area utilizing NVDs while EO/IR may provide both a wide field of view for target acquisition and a detailed, narrow field of view for target investigation. Owing to the nature of this search technique and aircraft bank angle, observers and search equipment only search from one side of the aircraft, i.e. towards the inside of the circle.

42 The circle search flight profile depends on three key inputs:

.1 a datum to define the centre of the search area;

.2 a search radius appropriate for the individual aircraft type and capability, for example 3NM for faster fixed-wing aircraft, or a smaller radius for a slower helicopter, to balance search area coverage against the aircraft's NVD and EO/IR capability, aircraft handling characteristics and search platform stability. The optimum radius will depend on the performance limitations of the aircraft; and

.3 an altitude appropriate for the individual aircraft type and equipment capability. For example, the optimum for a high-performance fixed-wing aircraft could be a search between 5,000 and 10,000ft AGL and typically not above 15,000ft for aircraft capable of higher altitudes, whereas a helicopter may be more effective at lower altitudes.

Note 1 *– the optimum radius flown may require multiple or overlapping searches by individual search aircraft to complete the RCC defined search area. Refer to paragraph 45.*

Note 2 *– NVDs may become less effective at higher altitude, but may assist with identifying light sources or potential search targets for closer inspection.*

Note 3 *– refer to paragraph 33 regarding potential limitations with viewing angles through vegetation at lower altitudes.*

43 Search planners need to be guided by the aircrew as to the optimum circle search radius, search altitude and speed.

44 The search area should be relatively confined and made up of terrain considered suitable for a circle search.

45 Before the search is initiated, the aircrew sensor operator breaks the search area into several smaller areas defined by human-made or geographic boundaries such as roads, rivers and property lines. Multiple orbits of the search area allow for each sub-area to be observed from multiple angles until the crew is confident the entire area has been searched as effectively as possible within the limits of the aircraft sensor capability and search conditions. For this reason, circle searches are ordinarily confined to land areas and are not normally appropriate for over water searches owing to the lack of maritime surface features available. However, if multiple fixed points of reference are available overwater, like islands, reefs and mud flats, then a circle search may be an option if the search area is geographically constrained to those areas.

46 For broader areas, several circle searches may be combined adjacent to, or overlapping, each other to complete that area in stages, for example a search along a track. This is dependent on aircraft endurance, crew duty time and on-scene search time available.

47 The number of circle searches required will depend on the time taken to clear each individual search area and this will depend on the nature of the terrain, weather, light levels, and aircrew operator skill.

48 The nature of terrain will determine the ideal search altitude. For example, heavily wooded or mountainous terrain are best searched at higher altitudes to improve the look down capability of the EO/IR, but the ideal search height will always be secondary to the lowest safe altitude.

49 Cloud and/or poor visibility may compromise a circle search; however, the EO/IR capability can be utilized to look through cloud breaks where they occur.

50 When search planners are considering tasking suitably capable aircraft for a sector or expanding square search, the use of a circle search should also be considered.

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ANNEX 3

AMENDMENTS TO IAMSAR MANUAL VOLUME III

Contents

Editorial Note.— Consolidate section contents pages to one table of contents. Page numbering to sequential

Abbreviations and acronyms

Editorial Note.— Consolidate the list of abbreviations and acronyms from Volumes I, II and III into one

. . .

~~**Inmarsat**……… an IMO recognized mobile satellite service~~
. . .

R ……………… search radius
Radar SART …. search and rescue radar transponder
RANP …………. regional air navigation plan
RCC …………… rescue coordination centre
RMSS………….. recognized mobile satellite service
RPA …………… remotely piloted aircraft
. . .

~~**SART …………..** search and rescue radar transponder~~
. . .

SS …………….. expanding square search
SSAS………….. ship security alert system
SSB……………. single-sideband
. . .

Glossary

Editorial Note.— Consolidate the Glossary from Volumes I, II and III into one

. . .

Coverage factor (*C*)	The ratio of the search effort (*Z*) to the area searched (*A*). *C* = *Z/A*. For search areas covered by search patterns with equally spaced parallel search legs, the Coverage factor (C) ~~For parallel track searches, it~~ may be computed as the ratio of sweep width (*W*) to track spacing (*S*). *C* = *W/S*.

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Vessel tracking	A generic term applied to all forms of vessel track data derived from multiple sources such as ship reporting systems, AIS, LRIT, ~~SAR aircraft,~~ VMS and VTS.

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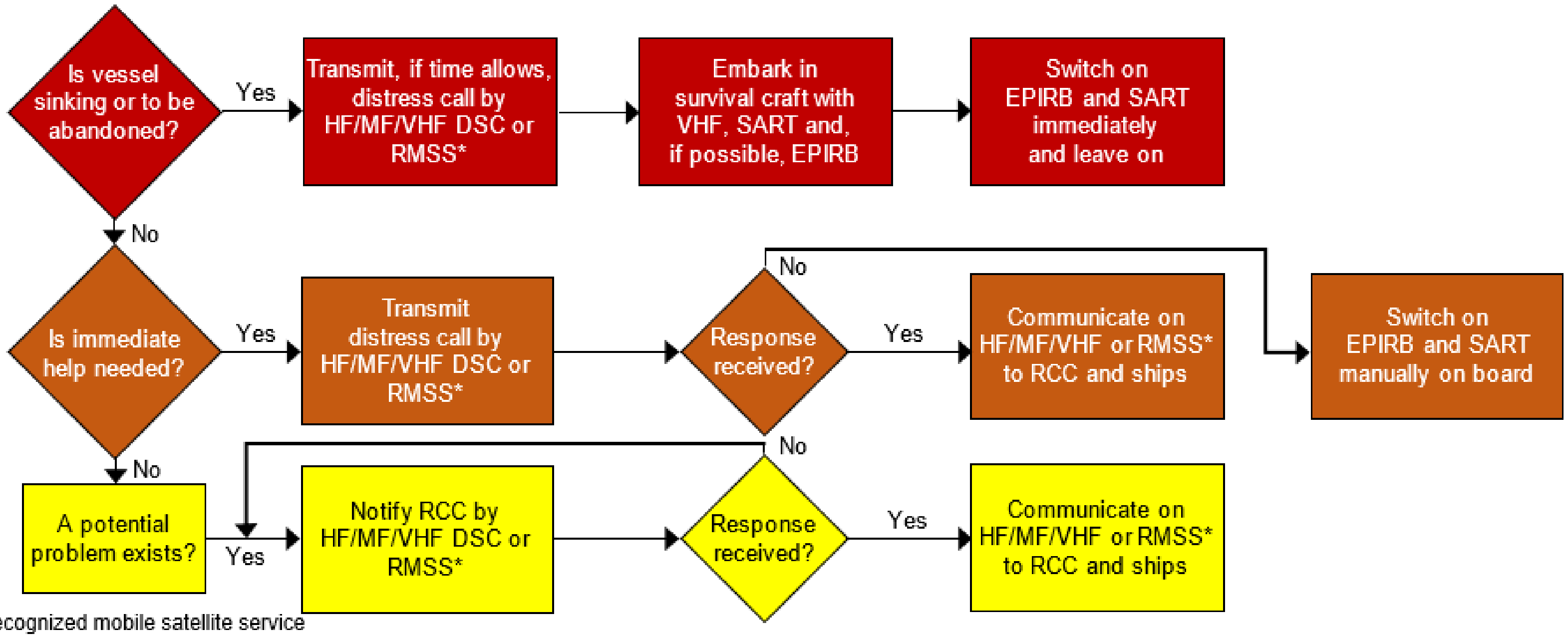
Section 2

Distress alerts and messages

Editorial Note.— Diagram on pages 2-6 is replaced by the following (reproduction of annex to MSC.1/Circ.1656):

GMDSS OPERATING GUIDANCE FOR SHIPS IN DISTRESS SITUATIONS



* Recognized mobile satellite service

1. EPIRB should float free and activate automatically if it cannot be taken into survival craft.
2. Where necessary, ships should use any appropriate means to alert other ships.
3. Nothing above is intended to preclude the use of any and all available means of distress alerting, including those listed in COLREG 72, annex IV.

Frequencies for Distress Communications

	Digital selective calling (DSC)	Radiotelephone
VHF	Channel 70	Channel 16
MF	2 187.5 kHz	2 182 kHz
HF4	4 207.5 kHz	4 125 kHz
HF6	6 312.0 kHz	6 215 kHz
HF8	8 414.5 kHz	8 291 kHz
HF12	12 577.0 kHz	12 290 kHz
HF16	16 804.5 kHz	16 420 kHz

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Section 3

Medical Assistance

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Satellite communications

- Inmarsat systems offer two special access codes (SACs) which can be used for medical advice or medical assistance at sea:
  - SAC 32 is used to obtain medical advice. The land earth station will provide a link with the TMAS when this code is used.
  - SAC 38 is used when the condition of an injured or sick person on board a ship justifies medical assistance (evacuation to shore or services of a doctor on board). This code allows the call to be routed to the associated RCC.
- Iridium provides medical advice and medical assistance service over voice communications only.

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Section 4

Vessel emergencies at sea

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Abandoning ship

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- make sure sea painter is attached to vessel
- take radar SART, AIS-SART and/or EPIRB with you, if possible
- load crew and launch
- keep lifeboat or liferaft tethered to vessel as long as possible.

Unlawful acts

Pirates and armed robbers

- ~~There is a special signal~~Vessels to which chapter XI-2 of the SOLAS Convention applies are provided with a ship security alert system (SSAS) for use by a vessel under attack or threat of attack from pirates of armed robbers. SSAS, when activated, transmits a security alert to a competent authority designated by the flag Administration of the vessel, identifying the vessel, its location and indicating that the security of the vessel is under threat or it has been compromised.

- "Piracy/armed robbery attack" is a category of distress message for all classes of DSC equipment and ~~Inmarsat~~ suitable shipborne GMDSS radio equipment (e.g. SESs) may be used for SSAS ~~has added a piracy message to the Inmarsat-C menu for the GMDSS~~.

  - for their own safety, vessels may have to covertly ~~send out a "piracy/armed robbery attack" message~~ activate the SSAS.

. . .

Pirates detected prior to boarding of the vessel

- Providing that the vessel has not been ordered by the pirates to maintain radio silence, contact should immediately be made with vessels in the vicinity and shore authorities by ~~sending a "piracy/armed robbery attack" message through Inmarsat or on an available DSC or other distress and safety frequency~~activating the SSAS.

Pirates board unnoticed

- A vessel should comply with any order by pirates or armed robbers not to make any form of transmission informing shore authorities of the attack. Pirates may carry equipment capable of detecting terrestrial radio signals.
  - a recommended ~~alternative~~method of action in this scenario is to activate SSAS operating~~for the alarm signal to be automatically made~~ through satellite so as not to be detected by the pirates
  - ~~the alarm signal should be made through Inmarsat by using the Inmarsat-C "piracy/armed robbery attack" message along with the vessel's current position.~~"

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Section 6

Initial action by assisting vessels

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Vessels assisting

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Immediate action

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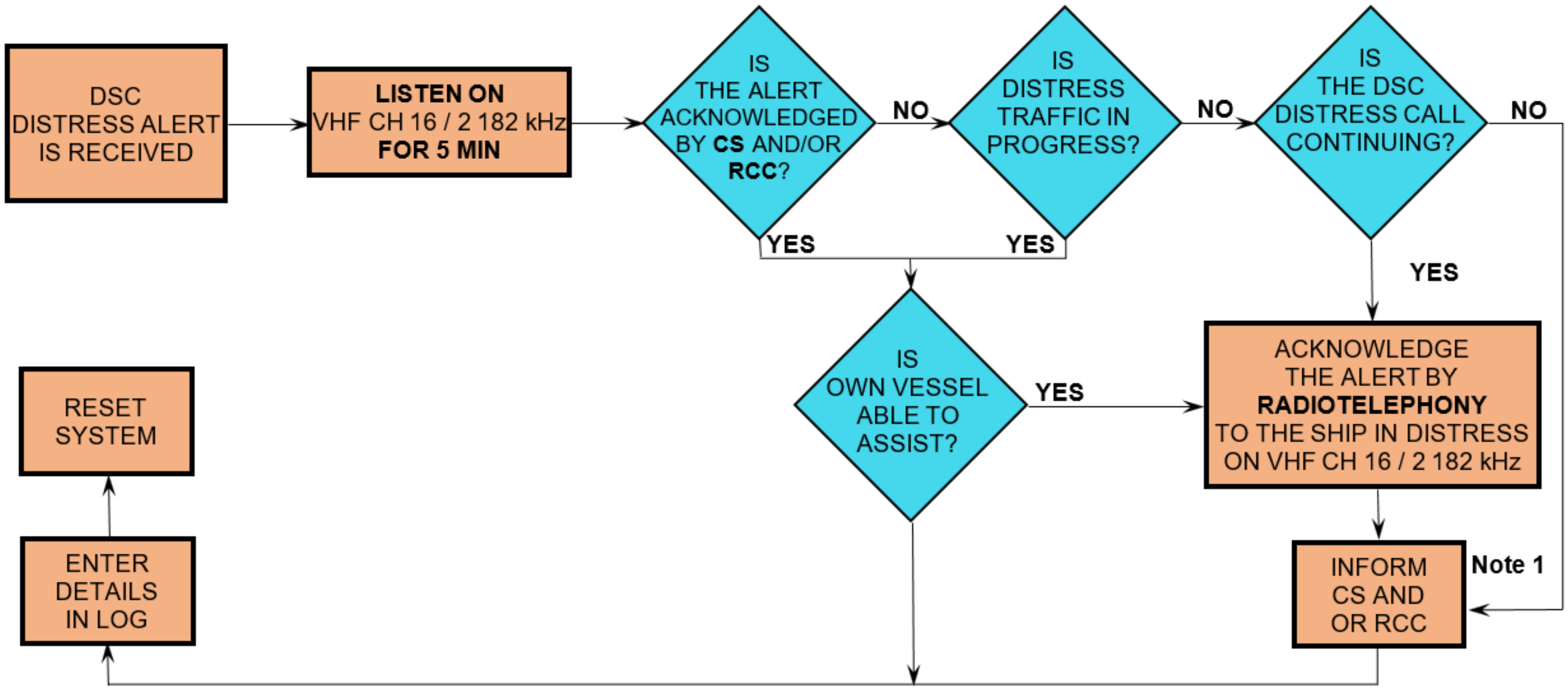
Editorial Note.— On page 6-2, replace the diagram "Actions by ships upon reception of VHF/MF DSC distress alert" with the one below (reproduction of flow diagram 1 set out in the annex to MSC.1/Circ.1657)

FLOW DIAGRAM 1

ACTIONS BY SHIPS UPON RECEPTION OF A **VHF / MF** DSC DISTRESS ALERT



REMARKS:

Note 1: Appropriate or relevant RCC and/or coastal station should be informed accordingly. If further DSC distress alerts are received from the same source and the ship in distress is beyond doubt in the vicinity, a DSC acknowledgement may, after consultation with an RCC or coastal station, be sent to terminate the call.

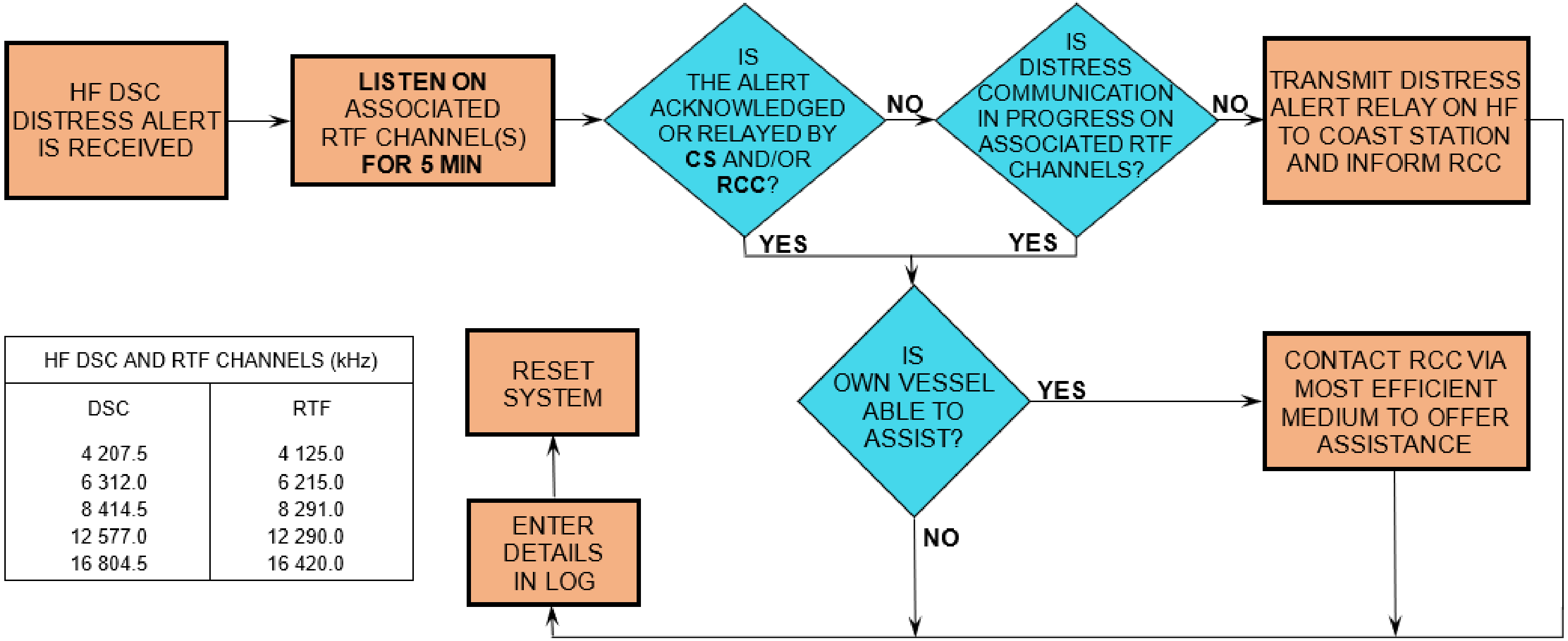
Note 2: In no case is a ship permitted to transmit a DSC distress alert relay on receipt of a DSC distress alert on either VHF channel 70 or MF channel 2 187.5 kHz.

CS = coastal station RCC = rescue coordination centre

Editorial Note.— On page 6-3, replace the diagram "Actions by ships upon reception of HF DSC distress alert" with the one below (reproduction of flow diagram 2 set out in the annex to MSC.1/Circ.1657):

FLOW DIAGRAM 2

ACTIONS BY SHIPS UPON RECEPTION OF A **HF** DSC DISTRESS ALERT



HF DSC AND RTF CHANNELS (kHz)	
DSC	RTF
4 207.5	4 125.0
6 312.0	6 215.0
8 414.5	8 291.0
12 577.0	12 290.0
16 804.5	16 420.0

REMARKS:

NOTE 1: If it is clear the ship or persons in distress are not in the vicinity and/or other crafts are better placed to assist, superfluous communications which could interfere with search and rescue activities are to be avoided. Details should be recorded in the appropriate logbook.

NOTE 2: The ship should establish communications with the station controlling the distress as directed and render such assistance as required and appropriate.

NOTE 3: Distress alert relays should be initiated manually.

CS = coastal station RCC = rescue coordination centre

Onboard preparation

- A vessel en route to assist a distressed craft should prepare for possible SAR action on the scene, including the possible need to recover people from survival craft or from the water. See section 14.

- Masters of vessels proceeding to assist should assess the risks they may encounter on the scene, including the risks such as those associated with leaking cargo or SAR operations in the vicinity of offshore structures or other obstacles, etc. Information should be sought as necessary from the distressed craft and/or from the RCC.

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Section 7

Initial action by assisting aircraft

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Miscellaneous equipment

☐ The following equipment, as appropriate, should be readily available for SAR operations:

- binoculars
- a copy of the *International Code of Signals*
- signalling equipment, such as pyrotechnics
- buoyant VHF/UHF marker beacons, floating lights
- fire-fighting equipment
- cameras for photographing wreckage and location of survivors
- first-aid supplies
- loud hailers
- containers for dropping written messages
- inflatable liferafts
- lifejackets and lifebuoys
- portable hand-held battery-powered droppable radio for communicating with survivors
- datum marker buoys (DMBs)
- any other equipment which may assist with rescue operations.

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Section 8

On-scene communications

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Survival and emergency radio equipment

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- SOLAS ships should have a radar SART to interact with 9 GHz vessel or aircraft radars for locating survival craft (radar SART responses show up as a distinctive line of about 2012 equally spaced blips on compatible radar displays, providing a bearing and range to the radar SART).

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Radio frequencies available for distress, maritime safety and SAR communications

- The frequencies in the following tables are available for safety purposes, distress communications and SAR operations.

Frequencies for use in the GMDSS

DSC distress and safety calling	Radiotelephony distress and safety traffic	RMSS NBDP distress and safety traffic
2,187.5 kHz	2,182.0 kHz	2,174.5 kHz 1,544.0-1,545.0 MHz (Inmarsat)
4,207.5 kHz	4,125.0 kHz	4,177.5 kHz 1,626.5-1,645.5 MHz (Inmarsat)
6,312.0 kHz	6,215.0 kHz	6,268.0 kHz 1,621.35-1,626.5 MHz (Iridium)
8,414.5 kHz	8,291.0 kHz	8,376.5 kHz
12,577.0 kHz	12,290.0 kHz	12,520.0 kHz
16,804.5 kHz	16,420.0 kHz	16,695.0 kHz
156.525 MHz (VHF channel 70)	156.8 MHz (VHF channel 16)	
MSI NBDP broadcasts by coast radio and earth stations		
490.0 kHz	518.0 kHz	
4,209.5 kHz	4,210 kHz	
6,314 kHz	8,5416.5 kHz	
12,579 kHz	16,806.5 kHz	
19,680.5 kHz	22,376 kHz	26,100.5 kHz
On-scene search and rescue radiotelephony		
2,182.0 kHz (RTF)		
3,023.0 kHz (Aeronautical frequency)		
4,125.0 kHz (RTF)		
5,680.0 kHz (Aeronautical frequency)		
123.1 MHz (Aeronautical frequency)		
156.8 MHz (VHF channel 16)		
156.5 MHz (VHF channel 10)		
156.3 MHz (VHF channel 6)		
Locating/homing signals		
121.5 MHz (homing)		
156-174 MHz (VHF maritime band – radiotelephony) 161.975 MHz/162.025 MHz (AIS-SART)		
406.0-406.1 MHz (Cospas-Sarsat satellite locating)		
9,200 to 9,500 MHz (X-band radar transponders – SART)		

Alerting, SAR operations, maritime safety, distress and safety, and survival craft frequencies

Alerting	406 MHz distress beacon Inmarsat SES Iridium SES VHF DSC ~~(~~channel 70~~)~~ MF/HF DSC[2] VHF AM VHF ~~FM~~ ~~(~~channel 16~~)~~	406-406.1 MHz (earth-to-space) 1,544-1,545 MHz (space-to-earth) 1,626.5-1,64~~6~~5.5 MHz (earth-to-space) ~~1,645.6-1,645.8 MHz (earth-to-space)~~ 1,621.35-1,626.5 MHz 1~~,~~56.525 MHz[1] 2,187.5 kHz[3] 4,207.5 kHz 6,312 kHz 8,414.5 kHz 12,577 kHz 16,804.5 kHz 121.5 MHz 156.8 MHz
On-scene communications	VHF channel 16 VHF channel 06 VHF AM MF radiotelephony ~~MF NBDP~~	156.8 MHz 156.3 MHz 123.1 MHz 2,182 kHz ~~2,174.5 kHz~~
. . .	. . .	. . .
Homing signals	406 MHz distress beacon 9 GHz radar ~~transponders (~~SART~~)~~	121.5 MHz and the 406 MHz signal 9,200-9,500 MHz
Maritime safety information (MSI)	NAVTEX warnings NBDP ~~Satellite~~ SafetyNET (Inmarsat) SafetyCast (Iridium)	518 kHz[7] 490 kHz 4,209.5 kHz[8] 4,210 kHz 6,314 kHz 8,416.5 kHz 12,579 kHz 16,806.5 kHz 19,680.5 kHz 22,376 kHz 26,100.5 kHz 1,530-1,54~~5~~4 MHz (space-to-earth) 1,621.35-1,626.5 MHz
. . .	. . .	. . .
Distress and safety traffic	Satellite 406 MHz distress beacon	Inmarsat 1,530-1,544 MHz (space-to-earth) and 1,626.5-1,646.5 MHz (earth-to-space) Iridium 1,621.35-1,626.5 MHz 2,182 kHz 4,125 kHz 6,215 kHz 8,291 kHz

	Radiotelephony NBDP	12,290 kHz 16,420 kHz 156.8 MHz 2,174.5 kHz 4,177.5 kHz 6,268 kHz 8,376.5 kHz 12,520 kHz 16,695 kHz
Survival craft	VHF radiotelephony 9 GHz radar transponders (SART) AIS-SART	156.8 MHz and one other frequency in the 156-174 MHz band 9,200-9,500 MHz 161.975 MHz/162.025 MHz

(footnote) 2 For ships equipped with MF/HF DSC equipment and engaged in voyages within sea area A4, there is a DSC watch requirement on 2,187.5 kHz, 8,414.5 kHz and one other DSC frequency (i.e. 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz)

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Section 12

Searching

General

- For surface and aircraft facilities to search effectively, search patterns and procedures must be pre-planned so ships and aircraft can cooperate in coordinated operations with the minimum risks and delay.

- Standard search patterns have been established to meet varying circumstances

- Certain SAR operations, e.g. those in the vicinity of offshore structures or other obstacles, may create a restricted search environment where standard search patterns are not effective or possible. Such an environment may also have an impact on standard sweep width and search effectiveness calculations.

- When applying automated search patterns, selected waypoints should:

  - ensure coverage of the whole search area; and

  - when possible, and taking account of other nearby search facilities, allow the search facility to remain within the assigned search area.

- When executing search patterns using automation, such as autopilot or auto-helm, SAR facilities should check by other means that they are accurately covering the search area assigned to them.

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Sweep width, track spacing and coverage

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- In addition to the weather correction factors, other factors may be considered, such as time of day, position of the sun, effectiveness of observers, obstacles such as wind turbines, etc.

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Search patterns

- Factors to consider in deciding what type of search pattern to use include:
  - ☐ available number and types of assisting craft
  - ☐ size of area to be searched
  - ☐ type of distressed craft
  - ☐ size of distressed craft
  - ☐ meteorological visibility
  - ☐ cloud ceiling
  - ☐ type of sea conditions
  - ☐ time of day
  - ☐ arrival time at datum.
  - ☐ presence of offshore structures, wind turbines or other obstacles such as elevated power transmission lines or cables.

Editorial note: Insert a new section between ***Coordinated vessel-aircraft search pattern*** *and* ***Land search patterns****:*

Coordinated vessel-aircraft search pattern

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Creeping line search, coordinated (CSC)

Search patterns within wind farms

- Wind farms create a hazard during a search and may impact the ability to utilize a standard search pattern

- It is usually preferable to search from above the wind farm but where this is not possible, searching between the turbines, by vessel or aircraft, may be required.

- The layout of the wind farm will be key in determining suitable search patterns. Where turbines are in alignment, standard search patterns may be possible, although track spacing is likely to be limited. When operating below the height of the structures, use of aircraft automation (automated and/or fully coupled search patterns) should be carefully considered to minimize the risk of collision with structures.

- Additional attention should be paid to the turbine itself as survivors may use the structure for shelter. SRUs should take time to carefully investigate foundation, boat landing and transition piece of the turbine, noting that the latter may be tens of metres above sea level.

- Search speed may have to be reduced, particularly in the case of aircraft, for safe operations.

- Fatigue may be increased due to the heightened workload of operating a search facility in a wind farm.

Land search patterns

- Aircraft search over land differs from maritime searching in that it is usually more difficult to locate search objects.

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Section 15

Rescue or assistance by aircraft

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Assistance by SAR aircraft – supply or equipment dropping
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- Miscellaneous equipment includes:
  - individual liferafts
  - liferafts linked by a buoyant rope
  - buoyant radio beacons and transceivers
  - dye and smoke markers and flame floats
  - parachute flares for illumination
  - salvage pumps
  - datum marker buoys (DMBs)

- The following factors should be considered when deciding ~~whether or not~~if supplies or equipment which may assist SAR operations should be dropped:
  - ☐ communications with the survivors
  - ☐ whether additional information or support from such equipment is required for continued SAR planning or operations
  - ☐ supplies needed by survivors
  - ☐ whether the conditions on scene may preclude the safe dropping of DMBs
  - ☐ availability of suitable aircraft and trained crew.

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ACTION CARD

MEDICO-MEDEVAC

Medical assistance is available using telemedical assistance services (TMASs)

Inmarsat systems offer two special access codes (SACs) which can be used for medical advice or medical assistance at sea

- SAC 32 is used to obtain medical advice
- SAC 38 is used when the condition of an injured or sick person on board a ship justifies medical assistance (evacuation to shore or services of a doctor on board)

The Iridium system provides medical advice and medical assistance service over voice

SAR services may also provide medical advice either from their own doctors or via arrangements with TMAS

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