HANDBOOK ON DISTRESS ALERT MESSAGES FOR RESCUE COORDINATION CENTRES (RCCs), SEARCH AND RESCUE POINTS OF CONTACT (SPOCs) AND IMO SHIP SECURITY COMPETENT AUTHORITIES

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INTRODUCTION

1.1 Overview

1 The purpose of this document is to provide Rescue Coordination Centre (RCC) personnel and Search and Rescue Point of Contact (SPOC) personnel with an overview of the Cospas-Sarsat System and an understanding of the Cospas-Sarsat distress alert messages and their contents. This will allow RCCs and SPOCs to manage the response to search and rescue (SAR) incidents involving Cospas-Sarsat distress alerts in an informed manner.

In the document, SAR Service will be used as a generic term to include both RCCs and SPOCs.

The document also provides an overview of Cospas-Sarsat Ship Security Alert System (SSAS) alerts, which are similar to search and rescue distress alerts except that the notification of the alert is sent to a Competent Authority rather than a SAR Service.

In the document, Responsible Agency will be used as a generic term to include both SAR Services and Competent Authorities.

1.2 Document Organisation

Section 1: provides a basic overview of the Cospas-Sarsat System.

Section 2: provides information on Cospas-Sarsat distress beacons.

Section 3: gives a brief overview of the satellite systems used by Cospas-Sarsat and the data produced using those satellite systems.

Section 4: explains how a Mission Control Centre (MCC) processes beacon detection and location data and how the data is sent to Responsible Agencies.

Section 5: provides detailed information on the types and contents of Cospas-Sarsat 406 MHz distress alert messages.

Section 6: gives examples of 406 MHz distress alert messages sent to Responsible Agencies.

Section 7: lists some questions that are frequently asked by personnel of Responsible Agencies and provides appropriate answers.

1.3 Cospas-Sarsat

The International Cospas-Sarsat Programme is a satellite-based search and rescue distress alert detection system. The system was established in 1979 by Canada, France, the United States and the former Soviet Union.

The name Cospas-Sarsat is formed from two acronyms. Cospas is an acronym for the Russian words "Cosmicheskaya Sistema Poiska Avariynich Sudov" which translates to "Space System for the Search of Vessels in Distress". Sarsat is an acronym for Search and Rescue Satellite-Aided Tracking.

The Mission Statement of the Programme states: “The International Cospas-Sarsat Programme provides accurate, timely and reliable distress alert and location data to help search and rescue authorities assist persons in distress.”

The objective of the Cospas-Sarsat System is to reduce, as far as possible, delays in the provision of distress alerts to Responsible Agencies, and the time required to locate a distress and to provide assistance. These delays have a direct impact on the probability of survival of the person in distress at sea or on land.

To achieve this objective, Cospas-Sarsat participant governments and agencies implement, maintain, co-ordinate and operate a satellite system capable of detecting distress alert transmissions from distress beacons that comply with Cospas-Sarsat specifications and performance standards, and of determining their position anywhere on the globe. The distress alert and location data are provided by Cospas-Sarsat Participants to the relevant Responsible Agencies.

Cospas-Sarsat co-operates with the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the International Telecommunication Union (ITU) and other international organisations to ensure the compatibility of the Cospas-Sarsat distress alerting services with the needs, standards and applicable recommendations of the international community.

Further information about the Programme can be found on the Cospas-Sarsat website (www.cospas-sarsat.int).

A list of acronyms used in this document is provided in Annex A.

1.4 The Cospas-Sarsat System

The Cospas-Sarsat system consists of:

- distress beacons that send transmissions on 406 MHz,
- satellites that process and/or relay the signals transmitted by distress beacons,
- a ground segment that consists of:
    - ground receiving stations called Local User Terminals (LUTs) which process the satellite signals,
    - Mission Control Centres (MCCs) that provide the distress alert data to Responsible Agencies. Each Responsible Agency is supported by an MCC that sends beacon detection and location data (known as beacons alerts) to the Responsible Agency. As the name suggests, the Responsible Agency is responsible for managing the response to the beacon alerts,

- ○ Return Link Service Provider (RLSP) that provides the service offered by some GNSS systems that sends a notification to the distress beacon after it has been detected by the Cospas-Sarsat System. (see section 2.6).

Figure 1.1: An Overview of the Cospas-Sarsat Beacon Detection System

The steps in Figure 1.1 are explained in the following sections.

1.4.1 Step 1: Distress Beacons

There are four types of Cospas-Sarsat distress beacons:

1. Emergency Locator Transmitters (ELTs) are designed for aviation use;
2. Emergency Position-Indicating Radio Beacons (EPIRBs) are designed for maritime use;
3. Personal Locator Beacons (PLBs) are intended for use by an individual person (i.e., not necessarily linked to an aircraft or a ship); and
4. Ship Security Alerting System (SSAS) beacons are designed for security situations for SOLAS vessels. Unlike the other types of beacons that have alert messages sent to a SAR Service, all SSAS alerts are sent to the Competent Authority for the country of registration of the SSAS beacon.

Each type of distress beacon has different characteristics (such as battery life and activation method) but all work in the same manner - by transmitting an emergency message on 406 MHz. A unique hexadecimal identifier (known as the Hex ID of the beacon) can be extracted from the emergency message. The Hex ID includes the country of registration for the beacon.

A distress beacon may contain an internal receiver capable of determining a Global Navigation Satellite System (GNSS) location or may be capable of receiving data from an external device able to supply a GNSS location. The GNSS systems includes the American Global Positioning System (GPS), the European Galileo system and the Russian Glonass system. The GNSS location may be transmitted as part of the emergency message and is also known as an encoded location.

1.4.2 Step 2: Search & Rescue Satellites

The Cospas-Sarsat System uses three different satellite systems to detect distress beacons. The three satellite systems have different characteristics, but all provide beacon detection and location data:

1. The MEOSAR (Medium-altitude Earth Orbit Search and Rescue) satellites are the most recent addition to the Cospas-Sarsat System. MEOSAR satellites orbit the Earth at altitudes between 19,000 and 24,000 kilometres.
2. The LEOSAR (Low-altitude Earth Orbit Search and Rescue) satellites were the original satellites used in the Cospas-Sarsat system. LEOSAR satellites orbit the Earth in near-polar orbits at altitudes between 700 and 1,000 kilometres.
3. The GEOSAR (Geostationary Earth Orbit Search and Rescue) satellites appear stationary from the Earth. The GEOSAR satellites are in orbit approximately 36,000 kilometres from the Earth.

1.4.3 Step 3: Local User Terminals

Each satellite system has its own type of LUT (Local User Terminal) that tracks the satellites and processes the signals received from the satellites.

The MEOSAR system has ground stations called MEOLUTs; each MEOLUT tracks multiple MEOSAR satellites simultaneously. Using Difference of Arrival (DOA) techniques (described in section 3.1), a MEOLUT that receives data that has been relayed from a beacon through three or more satellites can compute a location estimate for that beacon.

The LEOSAR system has LEOLUTs. Each LEOLUT has a single antenna that tracks a LEOSAR satellite when in view. The LEOLUT collects data from the satellite. A LEOLUT uses Doppler techniques (described in section 3.2) to generate location data.

The GEOSAR system has GEOLUTs. Each GEOLUT receives data from one satellite (as the GEOSAR satellite is always in view) and collects and processes the data from that satellite. A GEOLUT is unable to generate a location for a beacon unless the beacon transmits a GNSS position.

Each LUT forwards detection and location data to its associated Mission Control Centre.

1.4.4 Step 4: Mission Control Centres

The Mission Control Centres (MCCs) form a network that distributes the beacon detection data around the world. Each MCC receives data from its LUTs and also data from the network of MCCs. The MCC processes data for each beacon incident, using the unique Hex ID of the beacon to identify all the detections associated with the same beacon incident.

For each incident alert received the MCC determines the responsible MCC for the distribution of that alert. If it is itself the responsible MCC, it determines the Responsible Agency or Agencies to be informed of the beacon activation and sends the data to the Responsible Agency directly. Otherwise, the MCC sends the data through the MCC network to the responsible MCC that can deliver it to the relevant Responsible Agency.

1.4.5 Step 5: Responsible Agencies

A Responsible Agency is either an RCC or SPOC (for ELT, EPIRB and PLB activations) or a Competent Authority (for SSAS activations). The Responsible Agency receives beacon alerts from its associated MCC. Each beacon alert contains beacon detection data for the related beacon incident and may also have location data. The messages sent between an MCC, and its national Responsible Agencies are a matter of national sovereignty and are not explicitly defined by Cospas-Sarsat. The message formats described in this document are specified by Cospas-Sarsat for communications between an MCC and a foreign Responsible Agency. However, most MCCs use the same format (or something very similar to it) to communicate with their national Responsible Agencies.

The information that is distributed by an MCC is structured in a format known as Subject Indicator Type (SIT) format. In particular, the information that is sent from an MCC to a Responsible Agency is a plain text message in a format known as a SIT 185 format. An example of a SIT 185 message is shown in Figure 1.2. The fields of the SIT 185 message are explained in detail in sections 5 and 6.

```
1.   DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.   MSG NO 12590  AUMCC REF C00F429578002C1
3.   BEACON MESSAGE INFORMATION
     BEACON TYPE SERIAL USER - PLB
     SERIAL NO 0042334
     HEX ID C00F429578002C1
     COUNTRY OF BEACON REGISTRATION 512/NEWZEALAND
     BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
     HOMING SIGNAL 121.5
     ACTIVATION TYPE MANUAL
     GNSS POSITION PROVIDED BY NIL
     EMERGENCY CODE NIL
4.   ALERT POSITION INFORMATION
       DETECTED AT 08 JAN 17 0354 UTC BY SARSAT 10
       GNSS - NIL
       MCC REFERENCE - NIL
       DOA - NIL
       DOPPLER A - 41 14 S  172 31 E  PROB 79 PERCENT
       DOPPLER B - 48 20 S  135 51 E  PROB 21 PERCENT
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.0280 MHZ
6.   REMARKS NIL
END OF MESSAGE
```

Figure 1.2: A Sample SIT 185 Message

1.5 Reference Documents

The Cospas-Sarsat documents listed below are available free-of-charge from the Cospas-Sarsat web site at www.cospas-sarsat.int:

- **C/S A.001** – Cospas-Sarsat Data Distribution Plan (DDP)

  This document provides requirements for the exchange of alert and System data between MCCs and Responsible Agencies.

- **C/S A.002** – Cospas-Sarsat Mission Control Centre Standard Interface Description (SID)

  This document provides information on message content and formats for the automatic exchange of data between MCCs and to Responsible Agencies.

- **C/S A.005** – Cospas-Sarsat Mission Control Centre Performance Specification and Design Guidelines

  This document provides the specific performance requirements for a Cospas-Sarsat Mission Control Centre (MCC).

- **C/S G.003** – Introduction to the Cospas-Sarsat System.

  This document provides detailed information of the System history, Programme Management, concept of operation and a description of the various components. This is the ideal document to read to obtain a general understanding of the Cospas-Sarsat System.

- **C/S G.005** – Cospas-Sarsat Guidelines on 406 MHz Beacon Coding, Registration and Type Approval.

  This document was developed as an aide to help in understanding the beacon coding and the processes of registration and type approval. It also complements and assists in the understanding of some of the more complex details in the beacon technical specification document, C/S T.001.

- **C/S G.010** – MCC Handbook.

  This document describes the responsibilities and functions of an MCC and of MCC operators.

- **C/S P.011** – Cospas-Sarsat Programme Management Policy.

  As the name suggests, this is a high-level document that provides information on all aspects of the System and its management. In the main, it is intended for senior Managers.

- **C/S S.007** – Handbook of Beacon Regulations

  This document provides a summary of regulations issued by Cospas-Sarsat Participants and other countries regarding the carriage of 406 MHz beacons, and includes information on the coding and registration of 406 MHz beacons in each country.

- **C/S T.001** – Specifications for Cospas-Sarsat 406 MHz Distress Beacons

  This document defines the specifications for the development and manufacture of 406 MHz distress beacons and the beacon message content.

Other materials, such as sets of videos, graphics, images, history book, Information Bulletin and published articles are available free-of-charge from the Cospas-Sarsat website at www.cospas-sarsat.int under the Media Gallery tab.

The document listed below is available from the International Maritime Organization (www.imo.org) or the International Civil Aviation Organization (www.icao.int) for a fee:

- Doc 9731 –AN/958 – IAMSAR Manual (International Aeronautical and Maritime Search and Rescue Manual).

- END OF SECTION 1 -

COSPAS-SARSAT BEACONS

2.1 Beacon Types

2 The Cospas-Sarsat System provides alerting services for the following four types of beacons:

1. Emergency Locator Transmitters (ELTs) are designed for aviation use;
2. Emergency Position-Indicating Radio Beacons (EPIRBs) are designed for maritime use;
3. Personal Locator Beacons (PLBs) are intended for use by an individual person (i.e., not necessarily linked to an aircraft or a ship); and
4. Ship Security Alerting System (SSAS) beacons are designed for security situations for SOLAS vessels.

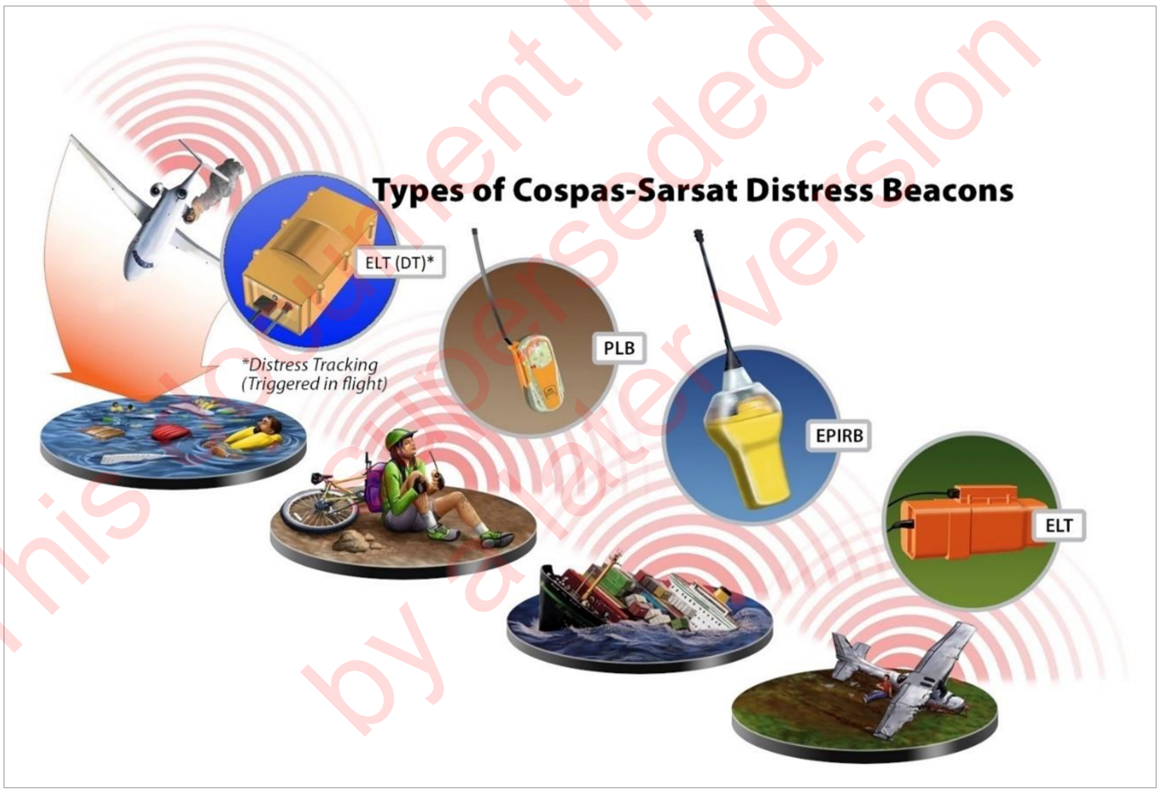


Figure 2.1: Beacon Types

2.1.1 ELTs

ELTs are designed for use in aircraft.

Most ELTs are installed in aircraft so that they activate on impact. An automatic activation is triggered by strong acceleration or deceleration on a “G” sensor device. These ELTs can also be activated manually by the crew in the cockpit.

Other ELT models are carried on an aircraft and must be activated manually.

ELTs are required to have a minimum battery life of 24 hours.

2.1.2 EPIRBs

EPIRBs are designed for maritime use and float in water. An EPIRB is required to have positive buoyancy in water to ensure that the antenna is vertically upright, providing the best antenna performance for beacon transmission.

There are two activation mechanisms for EPIRBs. EPIRBs can have an automatic activation switch that incorporates a water sensor. When the sensor comes in contact with water for a few seconds, the EPIRB will self-activate. EPIRBs with an automatic activation switch can also be manually activated.

Other EPIRB models can only be manually activated.

A float-free EPIRB is housed in an enclosure that deploys (using a pressure-sensitive hydrostatic release unit) the EPIRB when the enclosure is submerged. The float-free EPIRB has an automatic activation switch that activates when it comes in contact with water.

A non-float-free EPIRB is either loose in the vessel or mounted on a manual release bracket. Note that an EPIRB with an automatic activation switch is disabled while mounted in a manual release bracket and will not activate, even if it comes in contact with water while in the bracket.

All type-approved EPIRBs are required to have a minimum battery life of 24 hours; however, GMDSS requires a minimum battery life of 48 hours.

2.1.3 PLBs

PLBs are designed to be worn or carried by individuals rather than attached to an aircraft or vessel. PLBs are smaller and lighter than ELTs and EPIRBs.

In some countries, PLBs are permitted for use in aviation and maritime situations but are not necessarily designed for those environments. For example, PLBs are not required to float in water, and even if a PLB does float in water, it may not keep its antenna upright affecting the performance of the PLB.

PLBs are manually activated only and are required to have a minimum battery life of 24 hours.

2.1.4 SSAS Beacons

Cospas-Sarsat provides alerting services for the Ship Security Alert System (SSAS). An SSAS beacon is activated in case of attempted piracy or terrorism and appropriate law enforcement or military forces can then be dispatched. SSAS beacons are carried under the IMO's Safety of Life at Sea (SOLAS) Convention and are usually fitted in the bridge of a ship.

SSAS beacon transmissions are processed in the same manner as distress alerts by the Cospas-Sarsat System except that all messages relating to SSAS beacons are sent to the Competent Authority (per SOLAS Convention, Chapter XI-2, Regulation 6.2.1). Messages relating to SSAS beacons are not sent to a SAR Service unless the SAR Service is also the Competent Authority for the country of registration encoded in the beacon.

SSAS beacons can only be activated manually.

Figure 2.2: A Ship Security Alert System (SSAS) Beacon

2.1.5 ELT(DT)

Cospas-Sarsat is currently developing specifications for distress tracking of aircraft in-flight. Emergency Locator Transmitter for Distress Tracking beacons (ELT(DT)s) are compliant with ICAO GADSS (Global Aeronautical Distress and Safety System) requirements for Autonomous Distress Tracking to allow an aircraft crash site to be located within six Nautical Miles. This will be required in some new aircraft from 2021.

Although an ELT(DT) will share many characteristics with existing ELTs, an ELT(DT) may have some key differences:

- activation by an automatic triggering event including unusual attitude, altitude or speed or total loss of propulsion or thrust,
- a more rapid transmission schedule,
- every ELT(DT) will have a GNSS receiver and will be able to provide an accurate GNSS position with each burst,
- an ELT(DT) may be capable of being activated remotely by request from a responsible agency. The remote activation would use the Return Link Service (RLS) mechanism currently in development,
- a cancellation message which will indicate the activation event is no longer active (for example, the events generating the automatic triggering have returned to normal values).

LUTs and MCCs may have different processing rules for an ELT(DT); for example, locations may not be merged as the ELT(DT) is assumed to be on a fast-moving aircraft.

As the final specification for ELT(DT)s was not complete when this handbook was written, all descriptions of beacons in following sections will only include the existing beacon types (ELTs, EPIRBs, PLBs and SSAS beacons) and will not describe possible features and processing rules of ELT(DT)s.

2.2 Characteristics of a 406-MHz Beacon

Cospas-Sarsat type-approved 406-MHz-beacon models are compatible with Cospas-Sarsat satellites and comply with requirements of 406-MHz beacon specification standard described in Cospas-Sarsat document C/S T.001, "Specification for Cospas-Sarsat 406 MHz Distress Beacons". Beacons are verified by thorough testing at Cospas-Sarsat accepted test facilities for characteristics including compatibility of RF-characteristics and signal waveform, digital message structure, beacon performance at different temperature conditions, and minimum duration of continuous operation.

The list of type-approved 406 MHz beacon models is maintained by the Cospas-Sarsat Secretariat and may be seen on the Cospas-Sarsat website.

All the beacon types transmit a 5-Watt radio frequency burst of approximately 0.5-second duration every 50 seconds. The first burst of a beacon occurs approximately 50 seconds after activation of the beacon.

The burst transmitted includes a digital message that contains information that can be used to determine the Hex ID of the beacon.

2.3 The Beacon Message

The transmission from a distress beacon contains a digital message. The beacon message is either a short message of 112 bits or a long message of 144 bits.

Every message begins with 24 bits of synchronisation data. These bits allow the start of a valid message to be identified. The remaining bits in the message contain data that is organised depending on the beacon coding protocol used for the beacon. Every beacon message, however, has a unique Hex ID that includes the country of beacon registration.

Cospas-Sarsat has developed two major categories of beacon message protocols, User protocols, and Location protocols. User protocols are short messages that consist of 112 bits of data that include the beacon identification and other important SAR information, but do not allow for encoded GNSS position data. Location protocols are long messages that consist of 144 bits of data that include encoded GNSS position data (if available) as well as beacon identification data.

Both the User and Location protocols have various subtypes that provide a coding suited to the individual beacon. For example, the EPIRB-MMSI Location Protocol contains a field to store the last six digits of the MMSI (the country code provides the first three digits for the MMSI). A beacon with an EPIRB-MMSI protocol must be programmed with the known MMSI of the vessel that carries the EPIRB. In contrast, the Serial Location Protocols contain a field to store a 24-bit serial identification number. A beacon with a Serial Protocol can be programmed by the manufacturer using serial numbers provided by the national beacon authority.

More detailed information on beacon coding can be obtained from Cospas-Sarsat document C/S T.001, "Specification for Cospas-Sarsat 406 MHz Distress Beacons", and from document C/S G.005, "Cospas-Sarsat Guidelines on 406-MHz Beacon Coding, Registration and Type Approval". Both documents are available from the Cospas-Sarsat website at www.cospas-sarsat.int.

2.4 Hexadecimal Identity of a 406-MHz Beacon

Every beacon has a Unique Identification Number (UIN, also known as the beacon Hex ID). The Hex ID consists of 15 hexadecimal characters. For example, 3EF42AF43F81FE0 is the Hex ID of an Australian EPIRB. The Hex ID is displayed on the beacon (see Figure 2.3).

Figure 2.3: Beacon with Hex ID 3EF42AF43F81FE0

The Hex ID is used operationally as the identification in Cospas-Sarsat distress alert messages sent to Responsible Agencies. The Hex ID can be decoded to provide a variety of information about the beacon, depending on the protocol used to encode it. Beacon coding protocols are described in document C/S T.001 (available on the Cospas-Sarsat website). All Hex IDs include a country of registration provided as a MID (Maritime Identification Digit) code, a three-digit identity. A list of all MID codes used by Cospas-Sarsat is provided in Annex B of this document.

Hex IDs can be decoded using a software tool, also available on the Cospas-Sarsat website. Figure 2.4 shows the result of decoding the Hex ID of the beacon from Figure 2.3 using the decode tool on the Cospas-Sarsat website.

ITEM	BITS	VALUE
Message format: Not provided in 15 hex id	25	
Protocol: Location Protocol	26	0
Country code: 503 - **Australia**	27-36	0111110111
Type of location protocol: National Location - EPIRB	37-40	1010
Serial Number: 21992	41-58	000101010111101000
Latitude Flag: default	59	0
Latitude (Degrees): default	60-66	1111111
Latitude (Minutes): default	67-71	00000
Longitude Flag: default	72	0
Longitude (Degrees): default	73-80	11111111
Longitude (Minutes): default	81-85	00000
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	3EF42AF43F81FE0

Country code (given by ITU) and associated Country name

Protocol used for coding the beacon

Beacon Type

Beacon Serial Number

The Latitude and Longitude fields are used to transmit encoded location data when the beacon is activated.

Figure 2.4: Decode of Beacon 3EF42AF43F81FE0

2.5 Direction Finding on 406-MHz Beacons

Most 406-MHz beacons transmit a quasi-continuous secondary signal on 121.5 MHz to enable suitably equipped SAR forces to home on the distress beacon using radio direction finding techniques (see ICAO-IMO document 9873 known as the “IAMSAR Manual”).

Homing on the 406-MHz burst is also being undertaken by some SAR authorities. Direction finding on 406 MHz allows specially equipped SAR aircraft to accurately track the course to the 406-MHz beacon, even if the signal is not continuously transmitted.

2.6 Return Link Service (RLS)

The Return Link Service (RLS) provides notification to a 406-MHz beacon that an alert transmitted by the beacon has been detected by a LUT and distributed via the Cospas-Sarsat MCC network to the MCC whose service area covers the beacon confirmed position (see section 4.1.3 for a description of the MCC reference position). This service is intended to provide acknowledgement of the reception of the alert message to persons in distress and is only available for 406-MHz beacons coded to provide a return link.

Once notified that an RLS-capable beacon has been located, the RLSP interfaces to the Ground Segment for transmitting return link messages to appropriate satellites, which, in turn, transmit return link messages (RLMs) to the transmitting beacon. After receipt of the return link message by the beacon, subsequent beacon transmissions include the return link message receipt status, and a notification that includes the receipt status is distributed via the Cospas-Sarsat MCC network to the designated RLSP. Once notified that the beacon has received the return link message, the RLSP interfaces to the relevant ground segment which will cease transmitting return link messages to satellites. Illustration of RLS is provided at Figure 1.1. Further information on the Return Link Service is provided in document C/S R.012.

2.7 GNSS Positions

A distress beacon with GNSS capability is able to transmit a GNSS position as part of its beacon message. There are two mechanisms used to derive the GNSS position: either the distress beacon has an internal GNSS receiver, or the distress beacon receives the GNSS data from an external device that connects to the beacon.

If the distress beacon with GNSS capability does not provide a GNSS position (for example, as the internal receiver cannot derive a GNSS position as it cannot track sufficient GNSS satellites), default values are transmitted in the beacon message that indicate that there is no encoded GNSS position available.

Distress beacons that transmit GNSS position data are coded with a Location protocol; however, the particular Location protocol used affects the precision of the GNSS position data that can be sent in a beacon message. Table 2.1 lists the precision for the Location protocols.

Table 2.1: Maximum Precision of the Location Protocols

Protocol	Maximum Difference	Equivalent Distance at Equator
User Location	2 minutes	3.7 kilometres
Standard Location	2 seconds	60 metres
National Location	2 seconds	60 metres
RLS	2 seconds	60 metres
ELT(DT)	2 seconds	60 metres

In some situations, a beacon message may have errors that result in the LUT not being able to produce a fine GNSS position. Instead, a coarse GNSS position is produced. Table 2.2 shows the coarse precision for the Location protocols that may have a coarse precision GNSS position.

Table 2.2: Precision of the Location Protocols with only Coarse Position

Protocol	Maximum Difference*	Equivalent Distance at Equator
Standard Location	7 minutes 30 seconds	13.9 kilometres
National Location	1 minute	1.9 kilometres
RLS	15 minutes	27.8 kilometres
ELT(DT)	15 minutes	27.8 kilometres

* Assumes all available bits are used to provide the coarse position; see section 5.8.1.

2.8 Beacon Registration

As each beacon has a unique Hex ID, it is possible for each country to maintain a beacon database to store supplementary information about a beacon, such as contact details for its owner, other emergency contacts and details of any associated vessel or aircraft.

A country can either provide its own beacon database or use the Cospas-Sarsat International Beacon Registration Database (IBRD). Details of beacon databases can be found under the "406-MHz-Beacon Registers" section of the Contact Lists on the Cospas-Sarsat web site.

2.9 International Beacon Registration Database (IBRD)

Despite the clear advantage of registration, a significant number of beacons are not properly registered due to a lack of registration facilities in a number of countries. Furthermore, a number of beacon registers do not have 24-hour points of contact easily accessible by Responsible Agencies. Therefore, Cospas-Sarsat provides the International Beacon Registration Database (IBRD).

2.9.1 International Regulations and Purpose of the IBRD

IMO policy, as stated in IMO Assembly Resolution A.887(21), adopted on 25 November 1999, provides in paragraph 2 that "every State requiring or allowing the use of these GMDSS systems should make suitable arrangements for ensuring registrations of these identities are made, maintained and enforced." These arrangements are further clarified in paragraph 12 which provides that "Every State should maintain a suitable national database or co-ordinate with other States of their geographical area to maintain a joint database".

ICAO policy on registration of ELTs is contained in Chapter 5 of the ICAO Convention, which provides that "States shall make arrangements for a 406 MHz ELT register. Register information regarding the ELT shall be immediately available to search and rescue authorities. States shall ensure that the register is updated whenever necessary."

It is, therefore, the sole responsibility of States to provide the appropriate regulatory environment, facilities and resources that are required for an effective registration process. The IBRD is a means designed by Cospas-Sarsat to assist with the registration process when, due to a lack of resources, States have not implemented facilities for a national register. States may choose to selectively allow registration of beacons in the IBRD by beacon type. The IBRD is also meant to assist States in making their registration data available to SAR authorities on a 24-hour basis, seven days per week. However, it is not designed to become the unique central repository for all beacon registration data.

In providing the IBRD and making the IBRD available to States and users under their jurisdiction, Cospas-Sarsat does not accept or take over the specific responsibilities of States as stated by IMO and ICAO and declines all responsibilities or liabilities that might be associated with the registration of any data in the IBRD, or its availability or unavailability to SAR authorities.

When States choose to allow the registration of data from users under their jurisdiction in the IBRD, or upload national registration data into the IBRD, they retain full and exclusive responsibility for the integrity of such data, its accuracy and its availability to SAR. In this regard, Cospas-Sarsat does not provide any guaranty as to the continuous operation of the IBRD.

2.9.2 Using the IBRD

The IBRD is designed to be freely available to users with no access to national registration facilities and to Administrations who wish to avail themselves of the facility to make their national beacon registration data more available to SAR services. However, direct registration of beacons in the IBRD is not allowed for the country codes of Administrations that have informed Cospas-Sarsat of their decision to control the registration of beacons under their jurisdiction, whether in the IBRD or in their own national registration databases.

The IBRD provides various levels of access to:

a) beacon owners who wish to register their beacons when no registration facility exists in their country and the responsible Administration has agreed to allow direct registration in the IBRD;

b) Administrations who control the registration of beacons identified with their country code, but wish to make registration data available to international Responsible Agencies via the IBRD;

c) Responsible Agencies that need to access beacon registration data to efficiently process distress alerts; and

d) other authorised government entities or agencies for the purpose of controlling the proper coding or registration of beacons.

The functional requirements for the IBRD are provided in the document C/S D.001 “Functional Requirements for the Cospas-Sarsat International Beacon Registration Database” and the IBRD operations policy is defined in the document C/S D.004, “Operations Plan for the Cospas-Sarsat International Beacon Registration Database”.

Access to the IBRD (www.406registration.com) is controlled by user codes assigned by the Cospas-Sarsat Secretariat (www.cospas-sarsat.int) in accordance with Council guidelines. Administrations wishing to use the IBRD should designate a National Point of Contact. Cospas-Sarsat will accept designations from the Cospas-Sarsat Representative or, for non-participating countries, the IMO or the ICAO Representative for that country.

The Secretariat will provide each National IBRD Point of Contact with user identifications and passwords to be used by:

- National Data Providers for registration of beacons with their country code(s),
- Responsible Agencies for IBRD queries,
- authorised shore-based service facilities and inspectors to verify proper coding and actual registration of the beacon.

These IBRD user identifications and passwords should be distributed within each country under the responsibility of the National IBRD Point of Contact.

In case of forgotten password, Responsible Agencies are invited to urgently contact their National IBRD Point of Contact to retrieve their account details. If this is not possible, contact the Cospas-Sarsat Secretariat (www.cospas-sarsat.int), noting the Cospas-Sarsat Secretariat, situated in Montreal, Quebec, Canada, is defined as an administrative body which is consequently not reachable 24 hours a day, seven days a week.

Detailed rules for accessing the IBRD are provided in the document C/S D.004.

Annex D contains a guide to assist a Responsible Agency using the IBRD.

2.10 Beacon Regulation

International regulations applicable to 406 MHz beacons are contained in document C/S S.007; they include performance standards for 406 MHz beacons and guidelines to avoid false alerts, information on beacon maintenance and testing, as well as guidance on beacon protocols permitted by the country of registration.

2.11 Beacon Testing

406 MHz beacons are designed with a self-test capability for evaluating key performance characteristics. Initiating the beacon self-test function will not generate a distress alert in the Cospas-Sarsat System. However, it will use some of the beacon's limited battery power and should only be used in accordance with the beacon manufacturer's guidance.

On occasions, a Responsible Agency may wish to activate an operational 406 MHz beacon; for example, for SAR training purposes. As the beacon activation may be detected and treated as a live incident by the Cospas-Sarsat System, all activations for non-distress purposes must be approved in advance.

Requests to conduct a live beacon activation should be directed to the MCC that services the location in which the activation is planned and, if the location is not within the country of registration, the MCC responsible for the country in which the beacon is registered. When making a request the following information should be provided:

- Objective of the activation,
- Description of the event,
- Location,
- Date, time and duration,
- Beacon Hex ID (15 hexadecimal characters),
- Point of contact.

The responsible MCC will advise other MCCs of the planned beacon activation.

If the homing signal on the beacon will be active, relevant aviation authorities must also be advised of the planned beacon activation.

2.12 Future Developments

The Cospas-Sarsat system is continually evolving. Work is currently in progress to develop the next generation of Cospas-Sarsat beacons, known as "second-generation beacons". Some features of second-generation beacons will include a new signal form for improved performance with MEOSAR, an intelligent transmission schedule (so that the beacon transmits more bursts when first activated) and a new message structure that will allow more data from the beacon (including a more precise GNSS location and a timestamp on this GNSS location). The Hex ID of a second-generation beacon will change from a 15 Hex ID to a 23 Hex ID as part of the new message structure.

- END OF SECTION 2 -

COSPAS-SARSAT SATELLITE SYSTEMS

Cospas-Sarsat uses three satellite systems, MEOSAR, LEOSAR and GEOSAR. Further information on each satellite system can be found on the Cospas-Sarsat web site (www.cospas-
3 sarsat.int).

All the satellite systems have equipment known as a SAR payload placed on satellites that have been designed for and are primarily used for other purposes. The two general categories of equipment are:

1. SAR Repeater (SARR): A SAR repeater receives a beacon transmission on 406 MHz and retransmits the transmission on a different frequency, 1544 MHz. A SAR repeater is sometimes called a bent pipe as it simply redirects the signal from the beacon back to the earth for reception by a LUT. SARR instruments are carried on all Cospas-Sarsat satellites. The satellite must have mutual visibility to the beacon and the LUT for detection to occur.
2. SAR Processor (SARP): A SAR processor receives a beacon transmission on 406 MHz and stores the time of arrival, the received frequency and the beacon message in a buffer. The data in the buffer is re-transmitted until overwritten by a more recent detection. The retransmitted signal uses the 1544 MHz frequency. SARP instruments are carried only on the LEOSAR satellites.

The three satellite systems are described in more detail in the following sections with a description of the beacon detection and location data that can be determined by a LUT associated with the satellite system.

Every satellite has a footprint on the Earth's surface. The footprint is the area that the satellite can see at sea level on the Earth's surface. A satellite can only detect signals from beacons that are within its footprint. The footprints shown in the following sections (for example, figure 3.2) show the maximum footprint with a zero-degree elevation.

3.1 MEOSAR

The MEOSAR space segment consists of SAR repeaters placed on the satellites of the Global Navigation Satellite Systems (GNSS):

- GPS satellites operated by the United States,
- Russian Federation Glonass navigation satellites,
- European Galileo navigation satellites.

These MEOSAR satellites orbit the Earth at altitudes between 19,000 and 24,000 kilometres, a range considered as a medium-altitude Earth orbit. The radius of a MEOSAR satellite footprint is about 6,000 to 7,000 kilometres. MEOSAR is designed to provide continuous global coverage of the Earth.

Figure 3.1: A Schematic View of the Galileo Constellation

(which is one of the three constellations of the MEOSAR System)

The footprint of a GPS MEOSAR satellite is shown in Figure 3.2.

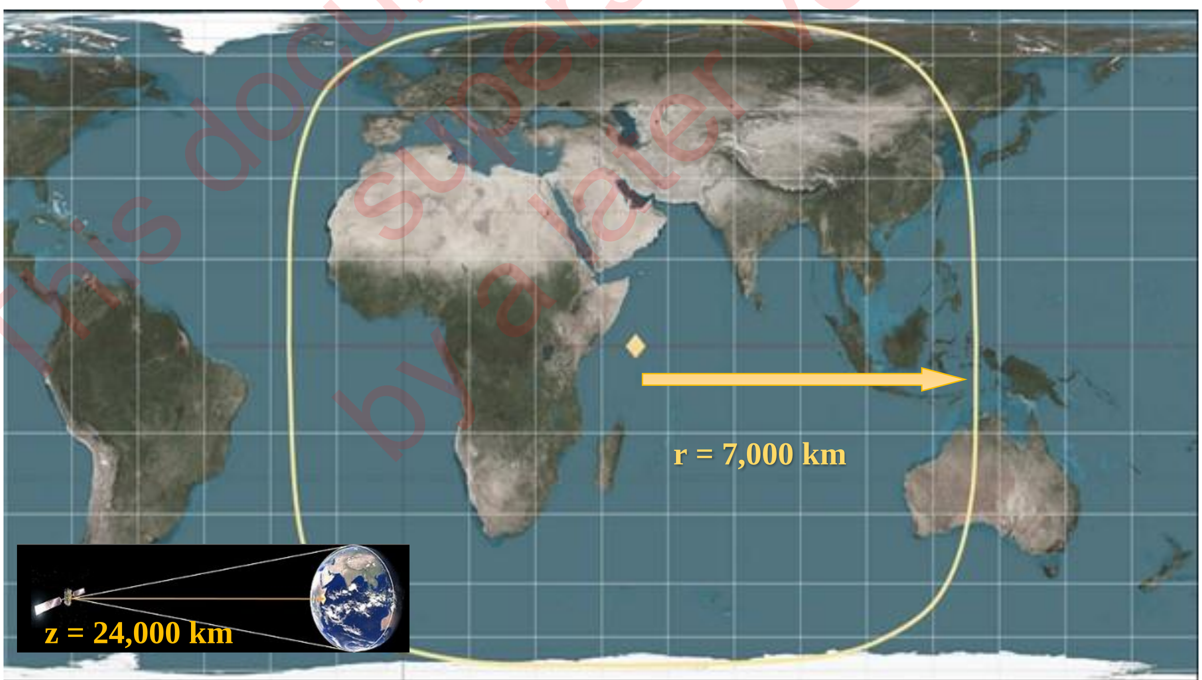


Figure 3.2: Footprint of a GPS MEOSAR Satellite

A MEOLUT tracks multiple MEOSAR satellites in view at the same time. Typically, a MEOLUT has a number of antennas, and each antenna tracks a separate MEOSAR satellite.

Upon receiving a transmission (a beacon burst) from a 406 MHz distress beacon via a MEOSAR satellite, a MEOLUT will generally measure two key values: the Time of Arrival (TOA) and the Frequency of Arrival (FOA). Assuming reception of beacon transmissions through at least three distinct MEOSAR satellites, MEOLUT processing can provide a two-dimensional (longitude and latitude) beacon location using a combination of time difference of arrival (TDOA) and frequency difference of arrival (FDOA) computations. The location computed by a MEOLUT is known as a difference of arrival (DOA) location. Three-dimensional locations (i.e., with the addition of a computed altitude) are possible when the beacon burst is relayed to a MEOLUT via four or more MEOSAR satellites.

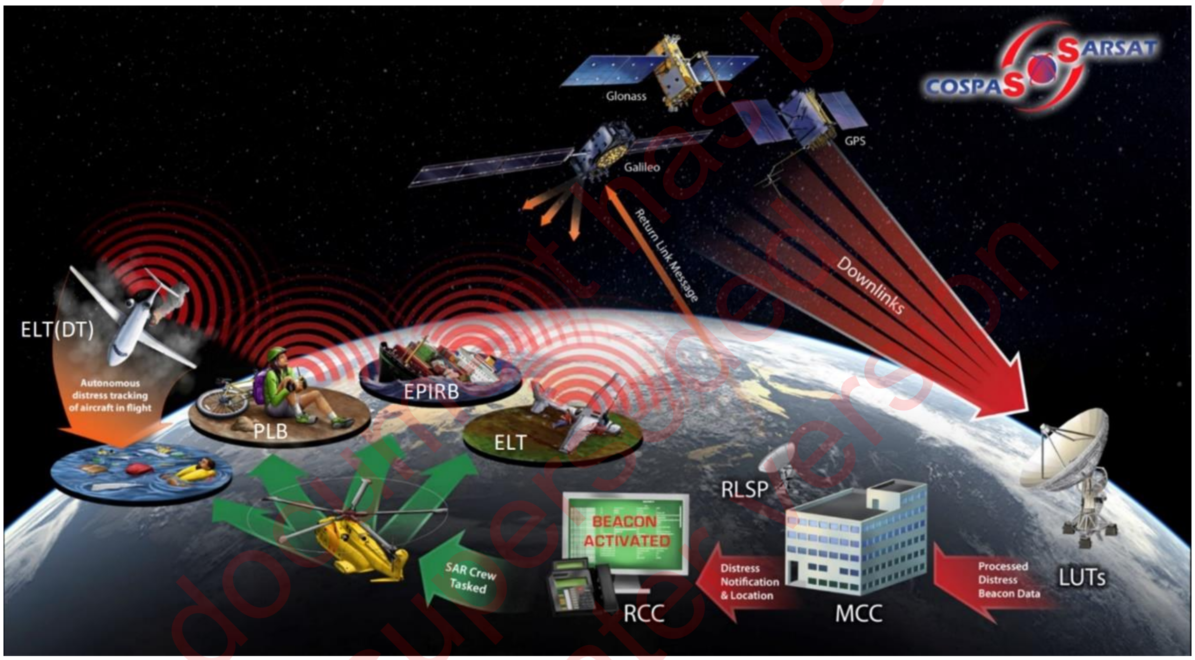


Figure 3.3: An Overview of the MEOSAR System

In Figure 3.3 above, distress beacons (EPIRB, PLB or ELT) transmit a 406 MHz signal that is detected by MEOSAR satellites in the GPS, Glonass and Galileo constellations. The beacon transmission is relayed on 1544 MHz and detected by a MEOLUT. Beacon and location data is sent from the MEOLUT to an MCC and then to a Responsible Agency to initiate a response. The diagram also shows the Return Link Service offered by MEOSAR. A message can be sent to particular MEOSAR satellites that are capable of sending a return link message to a beacon with return link functionality.

In addition to calculating beacon locations using a single burst relayed by different satellites, subsequent bursts can then be used to refine the beacon location. A location generated using more than a single burst is known as a multi-burst location.

A MEOLUT may produce any of four possible forms of data:

1. A beacon detection without location: A beacon is detected but there is no location data associated with the detection.

2. A beacon detection with a GNSS position: A beacon is detected and there is a GNSS position encoded in the beacon message.
3. A DOA (Difference of Arrival) location: A beacon is detected, and using DOA techniques, the MEOLUT is able to generate an independent estimate of the location of the beacon. Typically, three or more satellites must detect the beacon to generate a DOA location. A DOA location may be generated from a single burst from a beacon.
4. A DOA location and a GNSS position: A beacon is detected; the beacon message contains a GNSS position and a DOA position is also generated.

<u>Expected Accuracy for DOA Location</u>

For each DOA location, an Expected Accuracy (i.e., estimated error) value is computed. Information on the Expected Accuracy, also known as the Expected Horizontal Error (EHE), is provided in the SIT 185 message as described in Paragraph 4.

This value is the radius of the circle centered on the DOA location that should contain the true beacon location with a 95% probability. In other words, there is a 95% probability that the location error, which is defined as the distance between the DOA location and the actual beacon location, is lower than the Expected-Accuracy value.

The figure below illustrates the configuration for which the DOA location error is lower than the associated Expected-Accuracy value, with the corresponding confidence percentage.

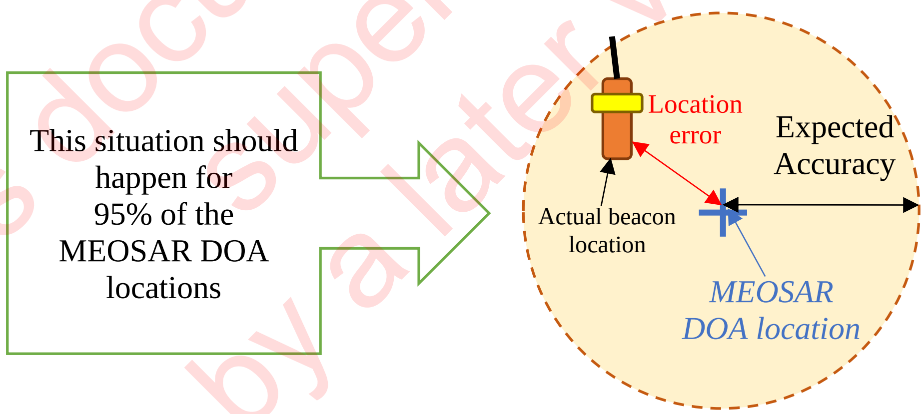


Figure 3.4: DOA Location Error Smaller than the Associated Expected-Accuracy Value

Additional details on the Expected Accuracy for DOA Location:

The Expected-Accuracy specification is further refined to ensure that Expected-Accuracy values associated with a DOA location provide a confident reflection of the location error, and in particular that the Expected Accuracy does not overestimate the location error in any significant way.

In addition to the 95% confidence, Expected-Accuracy values must meet the following requirement (per section 5.10 of document C/S T.019 - EHE). Namely, to ensure that the associated Expected-Accuracy value does not underestimate the MEOSAR location error, the DOA location error must be smaller than two times the associated Expected-Accuracy value at minimum 99% of the time. In other words, there is only a maximum 1% probability that the DOA location error is greater than two times the Expected-Accuracy value.

The figure below illustrates this additional Expected-Accuracy-related boundary:

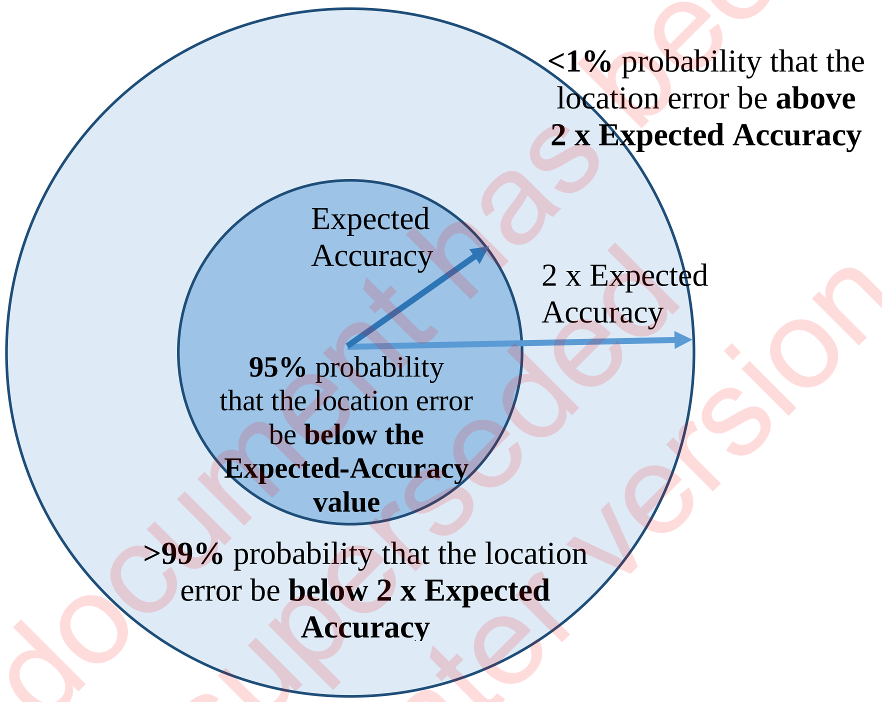


Figure 3.5: Additional Expected-Accuracy-Related Boundary

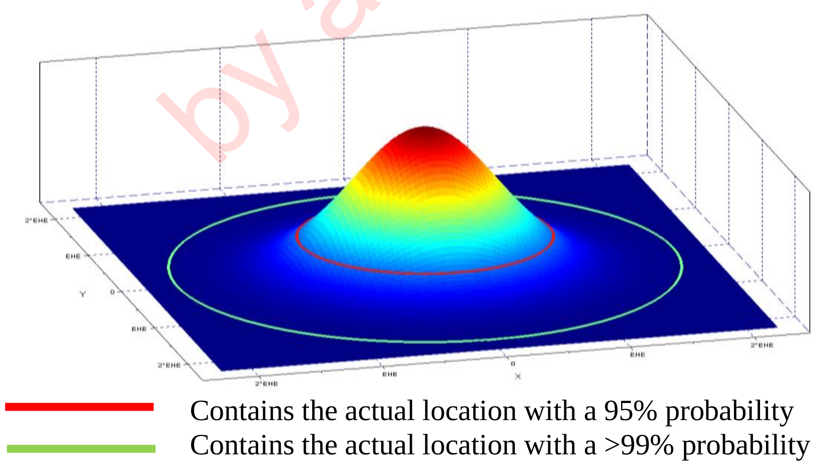


Figure 3.6: Probability of the Actual Beacon Location Being Within the Expected Accuracy-Radius and Two-Times Expected Accuracy-Radius Circles

3.2 LEOSAR

The LEOSAR satellites are low-altitude (between 700 and 1000 kilometres above the Earth) spacecraft in near-polar orbits. As the LEOSAR satellite's revolution takes about 105 minutes, two successive paths of the same satellite are separated, due to the Earth rotation, by approximately 25 degrees.

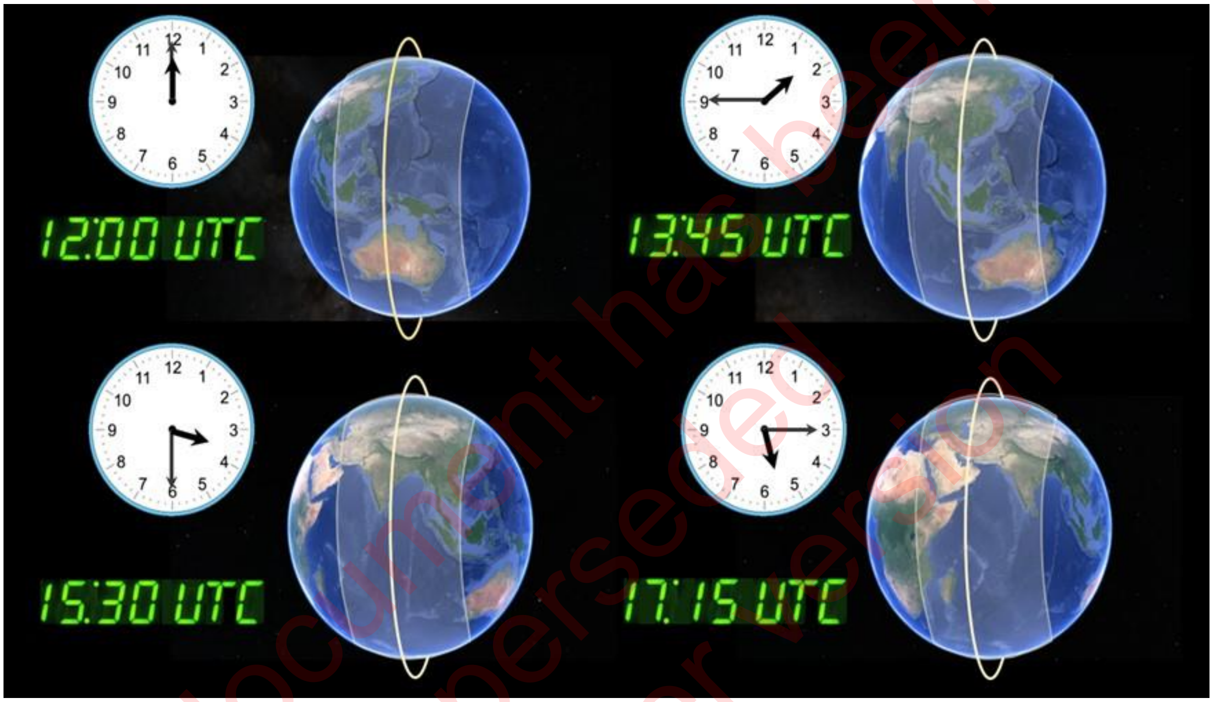


Figure 3.7: Four Passes of a LEOSAR Satellite

In Figure 3.7 above, at 1200 UTC, the satellite passes over Australia in a near-polar orbit. The orbit can be in either direction (i.e., north to south, or south to north). At 0145 UTC (i.e., 105 minutes later), the satellite has completed a full polar orbit but due to the rotation of the Earth, at 0145 UTC, the satellite is now approximately 25 degrees further west. A LEOSAR satellite covers the surface of the Earth approximately every 12 hours.

The LEOSAR constellation has a minimum of four satellites; in 2016, there were five LEOSAR satellites in the constellation.

Global, non-continuous coverage of the Earth is achieved. The coverage is not continuous because polar orbiting satellites can only view a relatively small portion of the Earth at any given time. The radius of the footprint is about 3,000 kilometres. Figure 3.8 shows the footprint of a LEOSAR satellite.

Figure 3.8: Footprint of LEOSAR Satellite (Sarsat-10)

The LEOSAR satellites cannot detect distress alerts until the satellite is in a position where it can receive transmission bursts from the distress beacon, in other words, when the beacon is in the footprint of the satellite. The LEOSAR satellites transmit a distress alert that the LEOLUT receives when the LEOLUT is in the footprint of the satellite. Since the LEOSAR satellites also have a SAR Processor, the satellites store distress beacon information and rebroadcast it continuously, so that the stored data can be received by a LEOLUT when the satellite comes within view of the LEOLUT, thereby providing global coverage (with inherent time delays).

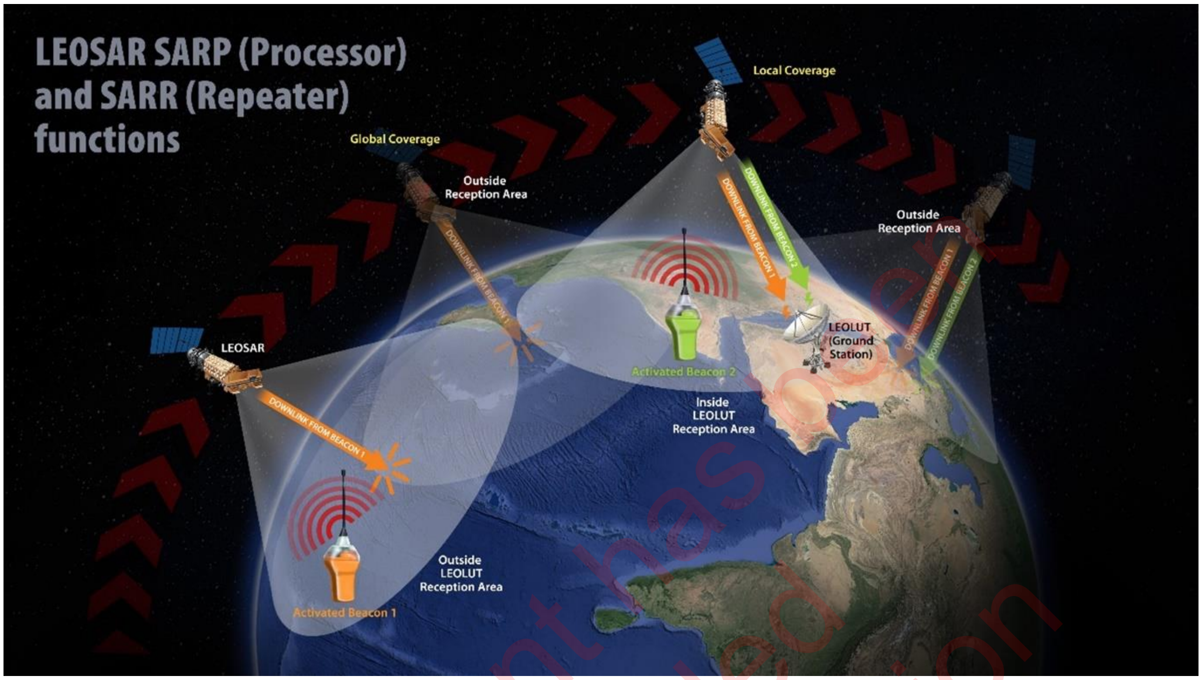


Figure 3.9: Global coverage of a LEOSAR satellite

In Figure 3.9 above, the footprint of a LEOSAR satellite is shown at two times. The first footprint (on the left) only contains a beacon. The LEOSAR satellite detects the beacon and stores the detection data in its SAR Processor. The second footprint (on the right) shows the satellite at a later time. The footprint contains another beacon and a LEOLUT. The LEOSAR satellite is able to download the detection data from the first beacon using the global coverage provided by the SAR Processor. The second beacon, as it is in the same footprint as the LEOLUT, can be directly relayed to the LEOLUT using the SAR Repeater on the LEOSAR satellite. Detections using the SAR Repeater are known as local detections.

The LEOSAR system calculates the location of distress events using Doppler processing techniques. Doppler processing is based upon the principle that the frequency of the distress beacon, as “heard” by the satellite instrument, is affected by the relative velocity of the satellite with respect to the beacon. By monitoring the change of the frequency of the received beacon signal from different beacon transmission bursts, and, knowing the exact position and velocity of the satellite, a LEOLUT is able to calculate two possible locations for the beacon. The two locations are equidistant from the satellite at the time when the satellite was closest to the beacon (the time of closest approach, or TCA).

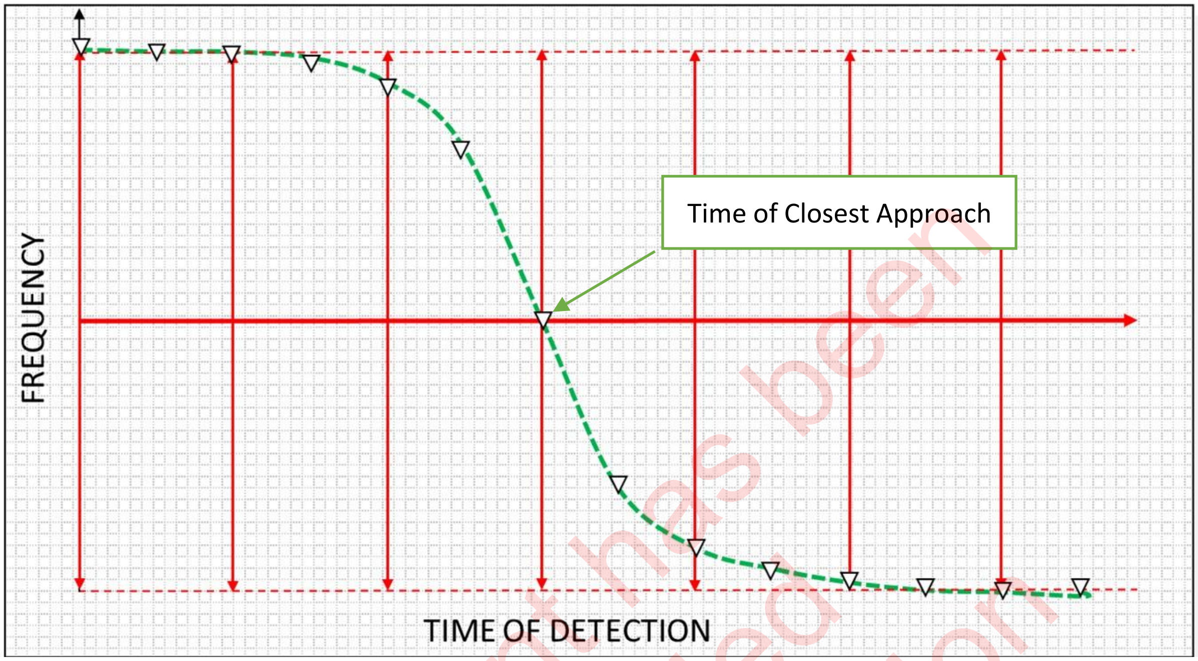


Figure 3.10: A Doppler Curve for a Hypothetical Beacon

In Figure 3.10 above, the plot has the time of detection on the x-axis and the frequency of the detection by the LEOSAR satellite on the y-axis. Each beacon burst (shown with the inverted triangle) occurs approximately every 50 seconds. Due to the Doppler Effect, the beacon frequency is initially detected at a higher frequency than the actual transmitted frequency, and it then decreases as the satellite passes closer to the beacon. When the satellite is at the closest point to the beacon (known as the TCA, or Time of Closest Approach), the frequency matches the actual frequency of the beacon. By analysing the shape of the Doppler curve, a LEOLUT can calculate the distance of the beacon from the satellite at the TCA, this produces two possible locations for the beacon known as the Doppler A-side and Doppler B-side.

The two Doppler locations are known as the A-side and the B-side of the Doppler solution; they are also known as the A-position and the B-position. The LEOLUT generates a probability for each of the two Doppler locations taking into account the Doppler effect of the earth's rotation.

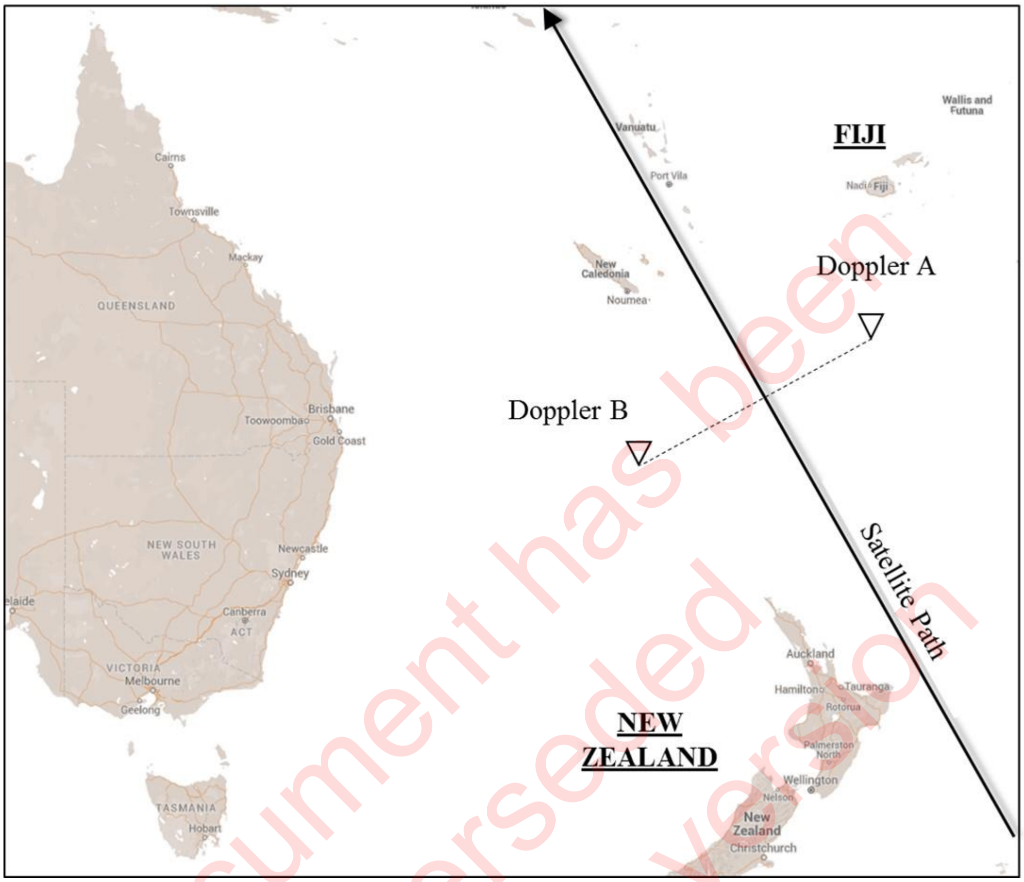


Figure 3.11: Two Doppler Locations from a LEOSAR Satellite Pass

In Figure 3.11 above, note that the two locations (Doppler A and Doppler B) are equidistant from the satellite at the time of closest approach (TCA).

The process of determining which of the two Doppler locations is the location of the beacon is known as position confirmation (or ambiguity resolution). The Doppler location that is not the location of the beacon is known as the mirror or image location.

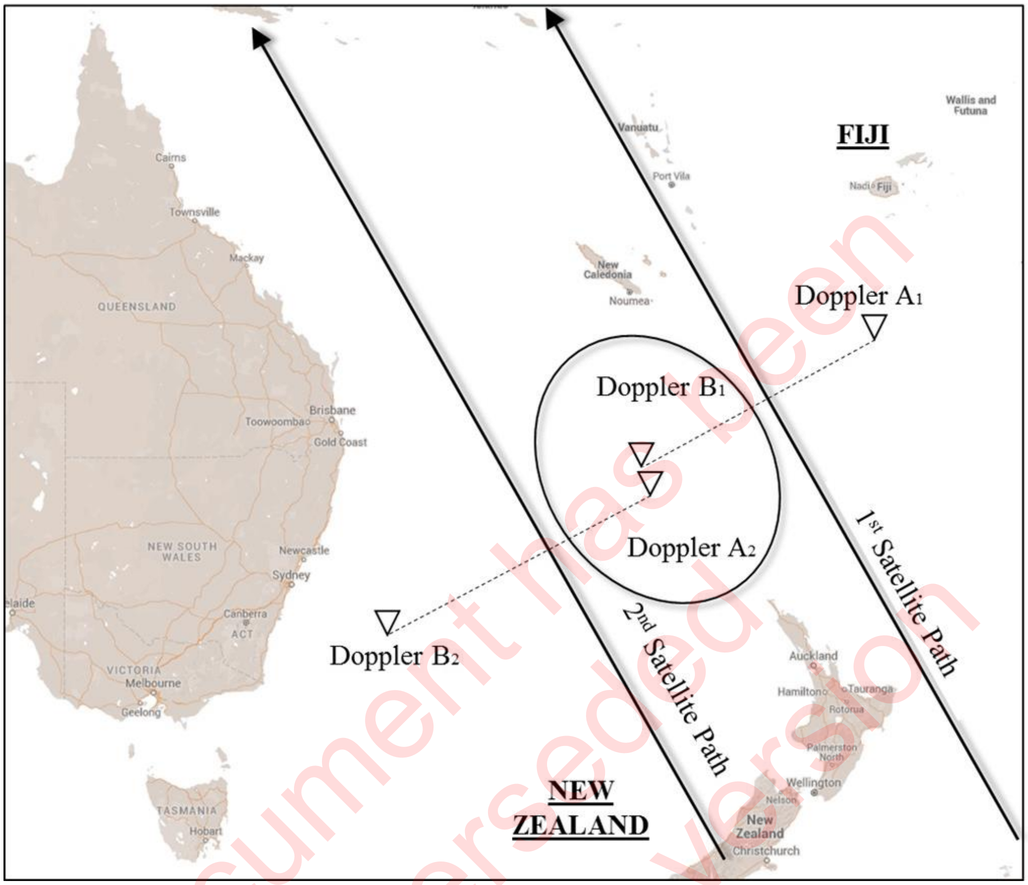


Figure 3.12: Confirmation by Two LEOSAR Passes

In Figure 3.12 above, this example continues the previous Figure 3.11. A second LEOSAR satellite pass has produced two new Doppler locations, Doppler A2 and Doppler B2. The location of the beacon would be confirmed by the matching of Doppler B1 (from the first satellite pass) and Doppler A2 (from the second satellite pass). Both Doppler A1 and Doppler B2 can now be determined to be mirror (image) locations.

A LEOLUT may use data from a GEOLUT to help generate the Doppler location for a given beacon. This is known as LEO-GEO processing.

A LEOLUT may produce any of four possible forms of data:

1. A beacon detection without location: A beacon is detected but there is no location data associated with the detection. Typically, this is due to the LEOLUT receiving insufficient bursts in order to perform the Doppler processing to produce locations.

2. A beacon detection with a GNSS position. A beacon is detected and there is a GNSS position encoded in the beacon message.

3. Two Doppler locations. A beacon is detected, and using Doppler techniques, the LEOLUT generates two possible estimates of the location of the beacon. The two locations are known as the A-position and the B-position. The LEOLUT will also generate a probability for each of these positions.

4. Two Doppler locations and an encoded GNSS position. A beacon is detected, the beacon message contains a GNSS position, and two Doppler locations are also generated.

3.3 GEOSAR

The GEOSAR satellites orbit the Earth at an altitude of approximately 36,000 kilometres, with an orbit period of 24 hours, thus appearing fixed relative to the Earth at approximately 0-degree latitude (i.e., over the equator). A single geostationary satellite has a footprint with a radius of approximately 7,500 kilometres and provides GEOSAR coverage of about one third of the globe. Due to their positions over the equator, the GEOSAR satellites are unable to detect beacons north or south of about 70 degrees of latitude. Figure 3.13 shows the footprint of the GEOSAR satellite MSG-2.

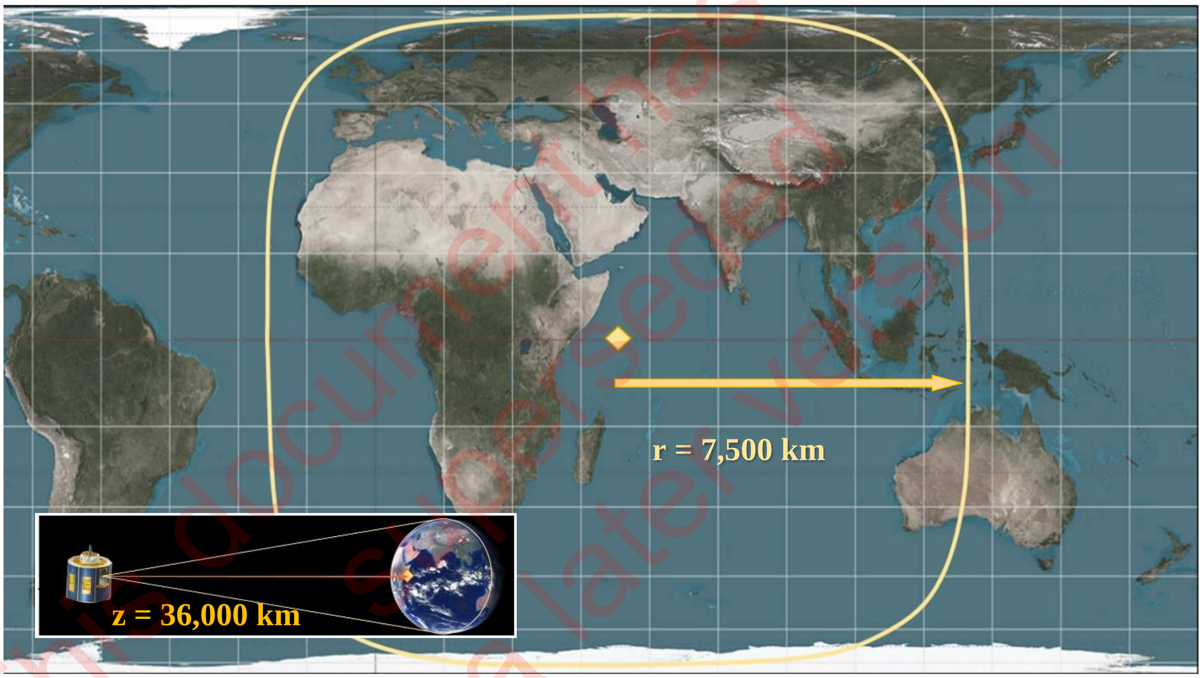


Figure 3.13: Footprint of GEOSAR Satellite (MSG-2)

A GEOLUT may produce either of two possible forms of data:

1. A beacon detection: A beacon is detected but there is no GNSS position data associated with the detection.
2. A beacon detection with an encoded GNSS position. A beacon is detected, and the beacon message contains a position generated by the GNSS equipment in the beacon.

- END OF SECTION 3 -

MISSION CONTROL CENTRES

Each MCC has a service area and provides beacon alert data to Responsible Agencies within
that service area. For example, the Norwegian MCC (NMCC) provides beacon alert data to
4 the Responsible Agencies in the following countries/regions: Denmark, Estonia, Faroe
Islands, Finland, Greenland, Iceland, Latvia, Lithuania, Norway and Sweden. Similar
information for all MCCs and their supported Responsible Agencies can be found on the
Cospas-Sarsat website.

MCCs are organized in a nodal network that allows efficient distribution of beacon alert data around the world. This nodal network is comprised of six Data Distribution Regions (DDRs), in which each DDR has a nodal (or hub) MCC that distributes alerts between other MCCs that are not nodes; see Figure 4.1. MCCs send beacon alert data to a Responsible Agency outside their service area using the MCC nodal network. For example, the Norwegian MCC (NMCC) distributes an alert for the Algerian RCC via the nodal French MCC (FMCC), which then distributes the alert to nodal Spanish MCC (SPMCC), which then distributes the alert the Algerian MCC (ALMCC) which delivers the alert to the Algerian RCC.

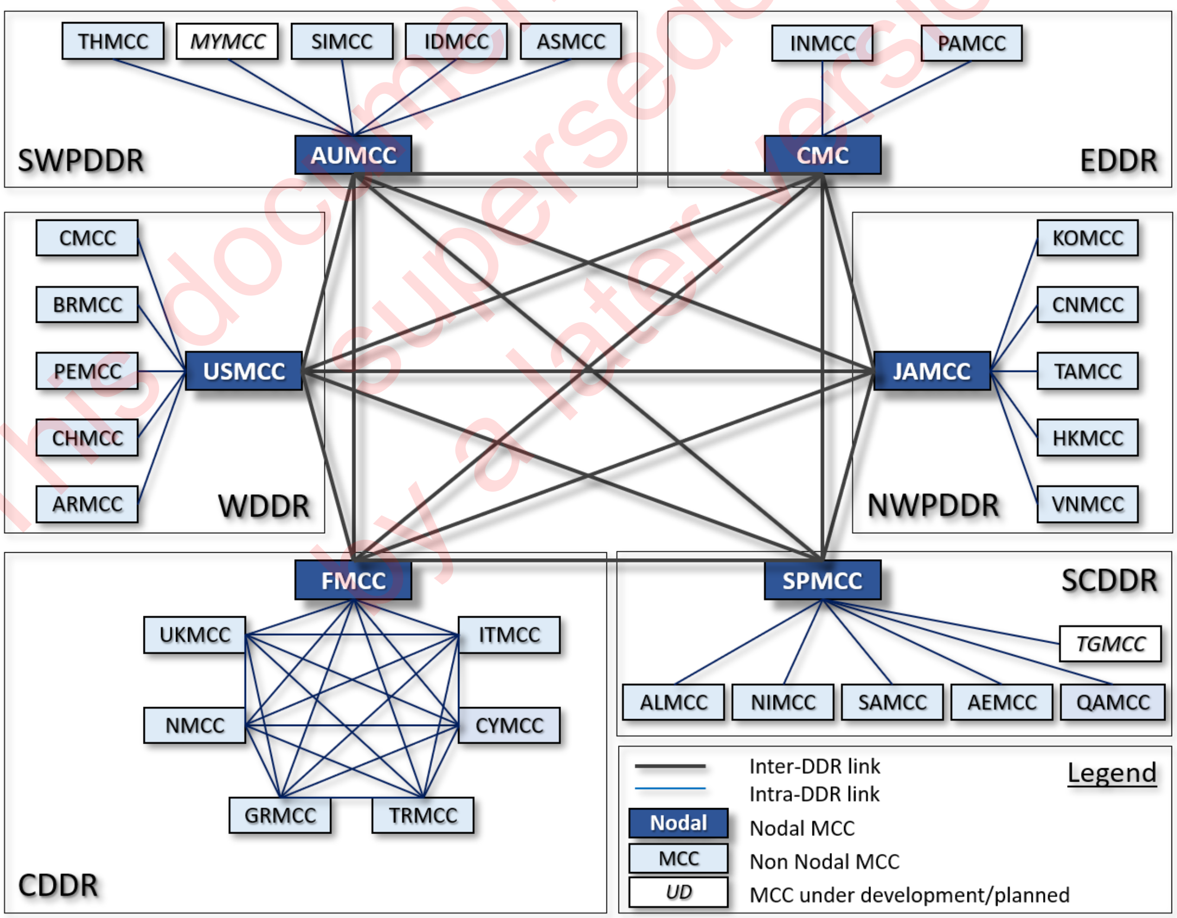


Figure 4.1: A Schematic View of the MCC Network

In Figure 4.1 above, there are six Data Distribution Regions (DDRs): the Western DDR (WDDR), the Central DDR (CDDR), the South Central DDR (SCDDR), the North-West Pacific DDR (NWPDDR), the Eastern DDR (EDDR) and the South-West Pacific DDR (SWPDDR). Data distribution between DDR regions is performed by the nodal MCCs. Within the CDDR, all MCCs are able to distribute data directly with other CDDR MCCs; in all other DDRs, data distribution between MCCs in the DDR is also performed via the nodal MCC.

An MCC therefore receives beacon alert data from its local LUTs and also from other MCCs. An MCC processes the beacon alert data with the objective of providing timely, accurate and reliable beacon alert data to the relevant Responsible Agencies. The MCC filters out redundant data to ensure that a Responsible Agency is not distracted or confused by unnecessary data.

The MCC network and the data processing rules are described in document C/S A.001 known as the Data Distribution Plan (DDP).

4.1 General Principles

An MCC follows three basic principles when processing and forwarding data as follows.

4.1.1 Timeliness

An MCC provides timely data. The MCC does not wait for additional data before sending data.

For example, if an MCC receives a beacon detection with no location, the MCC does not wait before sending to a Responsible Agency, just in case no more data is received. Instead the MCC would forward the beacon detection data to the Responsible Agency and, if more data is received, would send the additional data to the Responsible Agency later.

4.1.2 Redundancy

An MCC attempts to minimize redundant data sent.

For example, if an MCC receives a GNSS position for a beacon, it will forward that location to the appropriate Responsible Agency. If the MCC receives another beacon detection with no location data (e.g., from another satellite), it will normally not forward that data to the Responsible Agency. If the MCC received another detection with the same GNSS position, it would similarly not forward this redundant location data.

As another example, if an MCC receives Doppler position data from two LEOLUTs for satellite S-13 with the same TCA for the same beacon, then the MCC will not send the second Doppler solution unless it has reason to believe that the new data may be of better quality.

An MCC will send updates that would otherwise be considered redundant to allow a Responsible Agency to know that a beacon is still active. For example, MEOSAR position data will be sent every 15 minutes after position confirmation, even if the latest detection does not provide better quality data.

4.1.3 Confirmation:

Beacon position data is unconfirmed until it has been confirmed on the basis of information provided by two independent sources. Position confirmation requires that two positions for a beacon are from independent sources and match within 20 kilometres of each other, as specified in document C/S A.001. An MCC reference position is an approximation of the beacon position generated or selected by the MCC, based on a match of positions from independent sources within 20 kilometres. The MCC reference position is used as the reference position to determine if subsequent position data is deemed a position update or a position conflict, based on the 20-kilometre distance threshold match. The MCC reference position may be further updated based on new position data that matches the current MCC reference position within 20 kilometres.

A reference to a “position confirmed” alert or “position confirmation” in this document does not imply that any specific position provided in the associated alert message is the actual beacon position. Further information on the use of position data included in the alert message is provided in section 5.4.

Two locations are independent if they are two different types of location, or for two Doppler locations or for two DOA locations, if they are derived from different beacon events, as outlined in the following table.

Table 4.1: Determining if Two Locations for a Beacon are Independent

	GNSS	Doppler	DOA
GNSS	No	Yes	Yes
Doppler	Yes	Different satellites or time (TCA) difference of at least 20 minutes*	Yes
DOA	Yes	Yes	Each satellite set has a unique satellite or a time difference of at least 30 minutes

* Two pairs of Doppler locations are not independent if each Doppler location matches a Doppler location in the other solution; see “Unresolved Doppler Match” Section 4.2.6.

Note that the independence of two encoded GNSS position cannot be determined as the two positions come from the same source, i.e., the GNSS unit on (or attached to) the beacon. Section 7.22 provides clarifying examples of independence.

4.2 MCC Messages

The following sections describe the message types sent to a Responsible Agency by an MCC. The complete messages are described in section 5, and examples are provided in section 6.

4.2.1 Initial Alert (Unlocated) and Initial Location Alert

An initial alert indicates that a beacon has been detected.

An initial alert with no location information is known as an unlocated beacon alert and its message type is “INITIAL ALERT (UNLOCATED)”.

An unlocated beacon alert is sent to the Responsible Agencies associated with the country of registration contained in the beacon message.

Although an unlocated beacon alert has no location data, the beacon message provides useful data to a Responsible Agency. The beacon message contains the Hex ID of the beacon. If the beacon is registered in the country’s beacon registration database or the IBRD, the owner and emergency contacts can be determined. As well, some beacon messages contain the MMSI of a vessel or a call sign of an aircraft which allows the Responsible Agency to contact the vessel or aircraft associated with the beacon.

The message type for the first alert with location is “INITIAL LOCATED ALERT”, unless there is a “position conflict” as described in section 4.2.3. The first located alert may contain an MCC reference position, if the alert contains a GNSS position that matches a Doppler or DOA position, as discussed in section 4.2.2.

The Responsible Agency informed of alerts with location data depends on the type of beacon. For ELTs, EPIRBs and PLBs the location data is used to determine the SAR Service informed of the alert. For SSAS beacons the location data does not affect the Competent Authority informed as only the Competent Authority associated with the country of registration is informed of an SSAS beacon activation.

For an ELT, EPIRB or PLB, an MCC sends an initial located alert to any SAR Service relevant to the unconfirmed location data contained in the alert. For example, if a LEOLUT generates two Doppler locations for a New Zealand EPIRB, one in the Fiji RCC service area and another in the New Zealand RCC service area, the Australian MCC will send an initial alert to both the Fiji RCC and the New Zealand RCC.

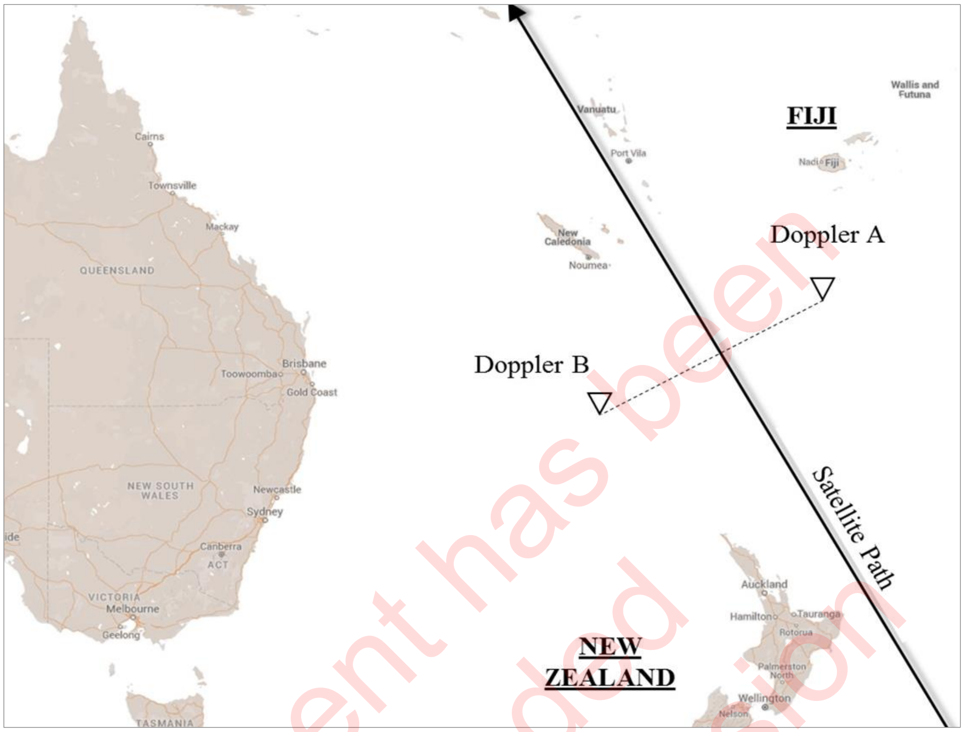


Figure 4.2: Two Doppler Locations from a LEOSAR Satellite Pass for an EPIRB

In the Figure 4.2 above, (that also appeared as Figure 3.11), a LEOSAR satellite has produced two Doppler locations (Doppler A and Doppler B) for a New Zealand EPIRB. As the Doppler A position is in the Fiji service area, the Fiji RCC will be sent an initial alert with both Doppler locations. As the Doppler B position is in the New Zealand service area, the New Zealand RCC will be sent an initial alert with both Doppler locations.

Prior to position confirmation, every located alert is sent to each Responsible Agency that previously received an alert for the beacon activation, as well the Responsible Agencies responsible for a location in the new alert. This enables all involved Responsible Agencies to coordinate a response.

A Responsible Agency may be able to use the unconfirmed location data along with other information in responding to the incident. For example, additional information from a phone call to an emergency contact using the beacon registration details or a flare sighting near an unconfirmed location may assist the tasking of resources.

4.2.2 Position Confirmed Alert

A position confirmed alert contains an MCC reference position, which is the result of two matching independent locations, as described in section 4.1.3 above. When a position is confirmed, the message type is “POSITION UPDATE ALERT” if an alert with position information was previously sent, or “INITIAL LOCATED ALERT” if no position information was previously sent. The presence of an MCC reference position indicates that position is confirmed.

A position confirmed alert is sent to all Responsible Agencies that have received alert messages about the beacon activation.

For example, if an initial alert from an EPIRB is sent to the Fiji RCC and the New Zealand RCC as the alert had two Doppler locations generated by a LEOLUT, when the location is confirmed as in New Zealand, the alert will be sent to both the Fiji RCC and the New Zealand RCC. The position confirmed alert informs the Fiji RCC that the beacon position has now been confirmed to be outside the Fiji RCC service area.

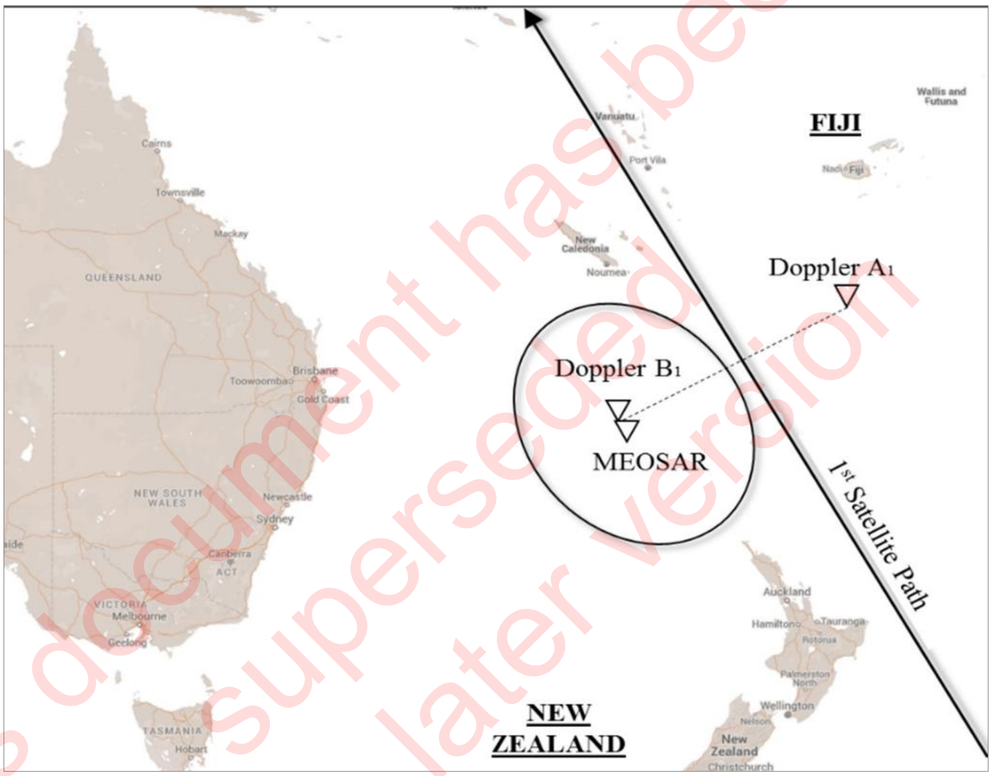


Figure 4.3: Confirmation of LEOSAR Data by a MEOSAR Detection

In the Figure 4.3 above, DOA location data from the MEOSAR system has confirmed the beacon location with the Doppler B1 location. As MCC reference position is in the service area of New Zealand, the New Zealand RCC will be sent the alert. As an initial alert had been sent to the Fiji RCC due to the earlier Doppler A1 location, the alert will also be sent to the Fiji RCC.

The first alert sent from an MCC to a Responsible Agency provides an MCC reference position when the first alert contains position data (DOA or Doppler) and a matching GNSS position.

The method used by the MCC to generate the MCC reference position from the matching independent locations is not defined by Cospas-Sarsat. Instead, the specifications state that this position may be formed by a merge of matching locations which may be based on a weighting factor assigned to each matching location. Each Responsible Agency should consult with its supporting MCC to obtain information on the method used to generate the MCC reference position by that MCC.

4.2.3 Position Conflict Alert

If an MCC receives new location data that does not match any of the previous location data for that beacon within 20 kilometres, then the new location data is labelled as "in conflict".

The MCC filters some conflict data (for example, if the new location data is of lesser quality) but otherwise sends a position conflict alert to indicate that the new location data does not match previously sent location data.

A fast-moving beacon (for example, on an aircraft) will typically generate an initial alert followed by a series of conflict alerts, as all the alerts after the initial alert will not match. The trail of conflicts may provide a path for the fast-moving beacon.

It is possible for a Responsible Agency to receive a conflict alert as the first message. For example, if an MCC receives a DOA location and a GNSS position as the first alert for a beacon, and if the DOA location and the GNSS position do not match, the MCC will send a conflict message to the relevant Responsible Agencies.

Prior to position confirmation, for ELTs, EPIRBs and PLBs, if non-matching locations are in the area of responsibility of different SAR Services, all the SAR Services would receive a conflict alert.

4.2.4 Position Update Alert

An MCC will send an update alert if it receives beacon detection data that is not redundant. Cospas-Sarsat has a very detailed definition of when an update is sent, but from the Responsible Agency perspective, an update will be sent when the MCC has additional data or better-quality data, or to indicate that the beacon is still active and transmitting.

An update can be sent before and after confirmation of the location.

Prior to position confirmation, a new alert with DOA position that is otherwise redundant will be sent every five (5) minutes.

To prevent too many MEOSAR alerts from being sent to a Responsible Agency after position confirmation, a MEOSAR alert with DOA position matching the MCC reference position that is not better quality will only be sent every 15 minutes. A MEOSAR alert with DOA position that does not match the MCC reference position and is not better quality will only be sent every ten (10) minutes. An alert with a better-quality DOA position (based on the expected horizontal error) is always sent, as specified in document C/S A.001.

An updated alert with GNSS position is sent if the new GNSS position differs from previously sent GNSS position by three (3) to twenty (20) kilometres or if the new GNSS position is refined (i.e., more precise) and no previous GNSS position was refined.

4.2.5 Notification of Country of Beacon Registration Alert

A Notification of Country of Registration (NOCR) alert is sent to the SAR Service associated with the country of registration in the beacon message. An NOCR is not sent to the Competent Authority for an SSAS alert as all SSAS alert messages are sent to the Competent Authority associated with the country of registration and hence there is no need for an NOCR alert.

For example, if a PLB with a country of registration of New Zealand is detected outside the New Zealand Search and Rescue Region (SRR), the RCC in New Zealand will be sent an NOCR alert.

An MCC that processes an ELT, EPIRB or PLB location in its service area will generate the NOCR and send the NOCR through the MCC network as required.

An NOCR alert is similar to an unlocated alert in that both alerts are sent based on the country of registration. However, an NOCR alert is only sent when there is a location associated with a beacon; an unlocated initial alert is sent when there is no location associated with the beacon.

An NOCR alert permits a SAR Service to commence a search for beacon registration details before a request is received from the SAR Service that is responding to the beacon incident. It also enables the national SAR Service in the country of registration to offer assistance, as appropriate, for the rescue of their fellow citizens.

4.2.6 Unresolved Doppler Position Match Alert

An Unresolved Doppler Position Match occurs when the two Doppler locations from one beacon event match the two Doppler locations from another beacon event prior to position confirmation. Since neither Doppler location can be ruled out as the actual position, neither of the two Doppler locations is confirmed by the second pair of Doppler locations.

Figure 4.4 shows an unresolved Doppler match that occurred in 2011. One LEOSAR satellite, Sarsat S-08, tracked on the red path and produced two Doppler locations (shown as purple dots). LEOSAR satellite Sarsat-11 tracked on the purple path at a later time and produced two Doppler locations (shown as red dots). The unresolved Doppler match does not confirm a location (as both of the two possible locations are still potentially valid). Note that in 2011 the matching distance for position matches was 50 kilometres; but has since changed to 20 kilometres.

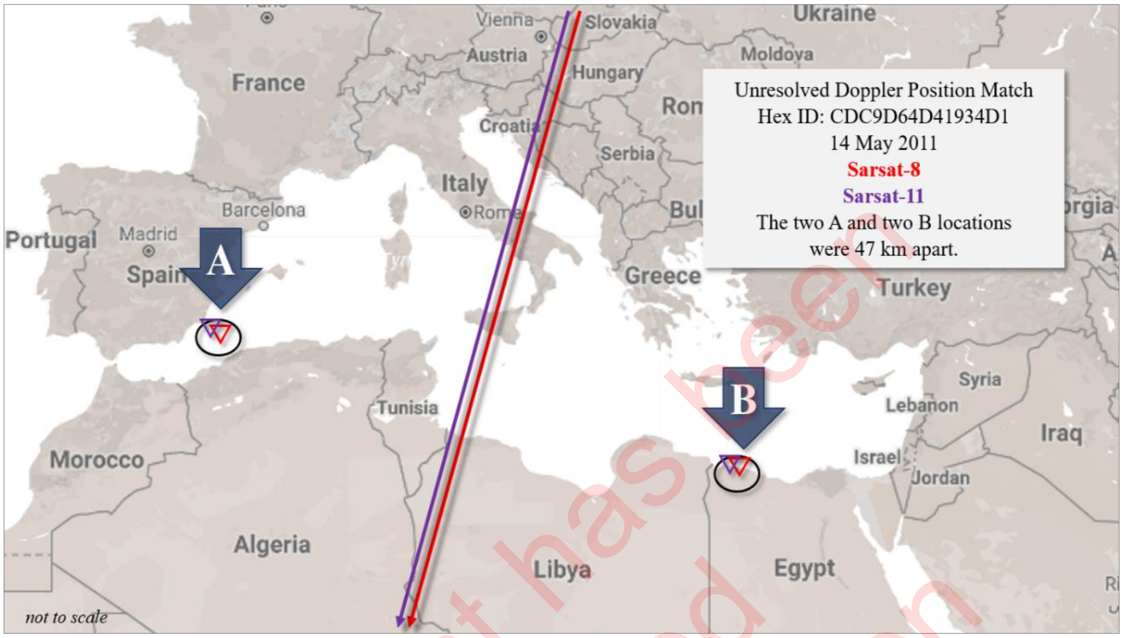


Figure 4.4: Example of an Unresolved Doppler Match

4.2.7 Interferer Alert

Some MCCs transmit 406 MHz interferer alerts to SAR Services using the SIT 185 message format.

The International Telecommunication Union (ITU) has allocated the 406 MHz band for low power distress beacons. Nevertheless, there are unauthorised signal sources in various areas of the world radiating in the 406.0 – 406.1 MHz range. Interferers degrade the performance of the Cospas-Sarsat System and reduce the ability of the System to detect and locate real beacon messages. Suitably equipped LUTs in the Cospas-Sarsat System are used to detect and locate the source of some of these interferers. Unlike the processing of 406 MHz digital beacon signals, no identification code is available from an interferer. An interfering source can only be identified by determining its location.

Persistent interferers are reported by MCCs to ITU through their national spectrum management agencies.

4.3 Alerts with Invalid or Suspect Data

In some cases, the beacon detection data or location data is invalid or may be inaccurate for various reasons. The SIT 185 message sent to a Responsible Agency by an MCC will indicate these situations.

4.3.1 Transmissions with an Invalid Beacon Message

The data transmitted in the message from a distress beacon includes error-correcting codes that allow a LUT to detect and to fix some errors in the data. If there are too many errors in the beacon message, the LUT cannot correct the errors and the message is treated as invalid. As well, for all beacon messages that the LUT receives correctly, the MCC performs additional validation of the beacon message and if data has invalid values (for example, an invalid country code), the whole beacon message is also treated as invalid.

An MCC will send the Hex ID associated with an invalid beacon message, but the Responsible Agency should note that the Hex ID is unreliable and should be treated with caution. Other data, including GNSS position data, from the beacon message is not sent to the Responsible Agency as the data may be invalid.

A beacon alert with an invalid beacon message does include the DOA or Doppler position data. Even if the beacon message is invalid, the DOA and Doppler location data are still reliable.

4.3.2 Suspect Doppler Locations

Doppler locations may be suspect for a number of reasons. An MCC will note any such Doppler locations when sent to a Responsible Agency.

If the LEOSAR satellite that detected the beacon has recently completed a satellite manoeuvre, the location of the satellite in space may be different from the location used by the LEOLUT to calculate the Doppler locations. Doppler locations with a detect time (TCA) within 24 hours after a satellite manoeuvre are noted as suspect when sent, if the expected location error resulting from the manoeuvre may exceed ten (10) kilometres.

The LEOLUT calculates the Doppler locations using time and frequency data from the satellite. Factors that contribute to the quality of the locations produced include the number of beacon bursts, the angle of the satellite to the beacon and the relationship of the TCA to the timing of the bursts. Any Doppler locations generated by poor quality data are noted as suspect and should be treated with caution by a Responsible Agency.

An MCC performs a satellite footprint check on all locations. The footprint check ensures that any location associated with an alert was visible to the satellite(s) that reported the beacon. The footprint check uses a minus 5-degree elevation in its calculation to provide some assurance that the location is indeed outside of the footprint. If the MCC determines that one of the Doppler locations in a LEOSAR detection is outside the footprint of the LEOSAR satellite that detected the beacon, the message sent will note that the location data is suspect.

4.3.3 Uncorroborated MEOSAR Alerts

A MEOSAR alert detected by only a single satellite and only a single beacon burst with no previous alert for the beacon activation that contains data from a different beacon burst or satellite is deemed uncorroborated and is treated as suspect. Normally these uncorroborated detections are only sent to a Responsible Agency if:

a) the beacon is a Distress Tracking ELT (ELT(DT));

b) the reporting MEOLUT meets relevant requirements for generating processing anomalies; or

c) it is known that the beacon ID associated with the MEOSAR alert is registered.

If such a detection is sent to a Responsible Agency, the message will note that this is a single uncorroborated detection and note if the associated beacon ID is registered. Such alerts should be treated with caution since they may not correspond to actual beacon transmissions.

4.3.4 Suspect DOA Locations

DOA locations provided include an estimate of accuracy. For example, a DOA location with an accuracy estimate of 20 nautical miles should be within 20 nautical miles of the beacon, 95% of the time.

Any DOA location with a large accuracy estimate should be treated with caution.

If a satellite footprint check indicates that the DOA is outside the footprint of any of the MEOSAR satellites that detected the beacon, the message sent will note that the location is suspect.

4.3.5 Suspect GNSS Positions

A GNSS position that fails the satellite footprint check is suppressed and is not transmitted.

- END OF SECTION 4 -

5 COSPAS-SARSAT DISTRESS MESSAGES

An MCC sends beacon alerts to Responsible Agencies in SIT 185 format. A SIT (Subject Indicator Type) 185 is a plain text message with information regarding the beacon activation. Examples of SIT 185 messages are presented and analysed in section 6. Figure 5.1 contains an example SIT 185 message.

```
080401Z JAN 2017
FROM AUMCC
TO RCC WELLINGTON
BT
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 12590  AUMCC REF C00F429578002C1
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE SERIAL USER – PLB
    SERIAL NO 0042334
    HEX ID C00F429578002C1
    COUNTRY OF BEACON REGISTRATION 512/NEWZEALAND
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 08 JAN 17 0354 UTC BY SARSAT 10
      GNSS - NIL
      MCC REFERENCE – NIL
      DOA - NIL
      DOPPLER A - 41 14 S  172 31 E  PROB 79 PERCENT
      DOPPLER B - 48 20 S  135 51 E  PROB 21 PERCENT
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0282 MHZ
    TAC NO 0176
    BEACON MODEL – STANDARD COMMS, AUSTRALIA MT410, MT410G
6.  REMARKS NIL
END OF MESSAGE
```

Figure 5.1: A Sample SIT 185 Message

SIT 185 messages may include a preamble. The format of the preamble is determined by the sending MCC. In figure 5.1, the four-line preamble includes the day and time of transmission in UTC and the identification of the originating MCC (AUMCC) and recipient (the RCC Wellington). The characters BT (for Begin Transmission) indicate the end of the preamble in the sample message above. As the format of the preamble is dependent on the MCC and is not part of the formal specification for SIT 185 messages, no preamble will be shown in following examples of SIT 185 messages.

When information with respect to a message field is not available, or is unknown or irrelevant, dependent upon the message type and beacon protocol, the distress message will indicate "NIL" for that message field, or, for certain message fields, the message field may be omitted.

A Cospas-Sarsat SIT 185 message consists of six (6) paragraphs. Table 5.1 lists the paragraphs of a SIT 185 message.

Table 5.1: Message Content for SIT 185 Messages

PARAGRAPH#	TITLE	
1.	MESSAGE TYPE	M
2.	CURRENT MESSAGE NUMBER	M
	MCC BEACON REFERENCE	M
3.	BEACON MESSAGE INFORMATION	M
	TYPE OF BEACON	O
	IDENTIFICATION	O
	BEACON HEX ID	M
	COUNTRY OF BEACON REGISTRATION	O
	BEACON NUMBER	O
	HOMING SIGNAL	O
	ACTIVATION TYPE	O
	SOURCE OF GNSS POSITION DATA	O
	EMERGENCY CODE	O
4.	ALERT POSITION INFORMATION	M
	DETECTION TIME & SPACECRAFT	M
	GNSS POSITION, TIME OF UPDATE AND ALTITUDE	O
	MCC REFERENCE POSITION	O
	DOA POSITION AND ALTITUDE	O
	A POSITION & PROBABILITY	O
	B POSITION & PROBABILITY	O
5.	OTHER INFORMATION	M
	DETECTION FREQUENCY	M
	OTHER ENCODED INFORMATION	O
6.	REMARKS	M
END OF MESSAGE		M

Notes:
1. "M" means that the field is mandatory
2. "O" means that the field may be omitted if the value is NIL.

5.1 Paragraph 1: Message Type

For an alert from a ship security (SSAS) beacon, the message type begins with "SHIP SECURITY COSPAS-SARSAT".

For an alert from a Distress Tracking ELT (ELT(DT)), the message type begins with "DISTRESS TRACKING COSPAS-SARSAT".

For all other beacon types, the beacon alert message type begins with "DISTRESS COSPAS-SARSAT".

The message types are described in section 4.2 and are listed here:

- "INITIAL ALERT (UNLOCATED)"
- "INITIAL LOCATED ALERT"
- "POSITION CONFLICT ALERT"
- "POSITION UPDATE ALERT"
- "NOTIFICATION OF COUNTRY OF BEACON REGISTRATION ALERT"
- "UNRESOLVED DOPPLER POSITION MATCH ALERT"

5.2 Paragraph 2: Current Message Number and MCC Beacon Reference

The current message number is a sequential message number assigned by the transmitting MCC to each message sent to a specific Responsible Agency. Responsible Agencies should ensure that they do not miss any message numbers.

The MCC beacon reference is a unique designator supplied by the MCC to identify all messages sent for that beacon. Some MCCs use an integer and other MCCs use the beacon 15 Hex ID for this message field.

Responsible Agencies wishing to discuss a particular alert with an MCC can assist the MCC by quoting the message number and the MCC reference designator of the alert.

5.3 Paragraph 3: Beacon Message Information

This paragraph provides key information about the beacon derived from the 406 MHz beacon message. Any message field in this paragraph with a value "NIL" may be omitted. If the beacon message is invalid, then the only message field provided without a "NIL" value in this section is the Hex ID and the following note is included:

"DATA DECODED FROM THE BEACON MESSAGE IS NOT RELIABLE"

5.3.1 Type of Beacon

The beacon type is the general category of the beacon protocol used to code the beacon. The protocol is provided as well as any identification fields. For example, the last six digits of the MMSI are shown for beacons coded with an EPIRB-MMSI protocol.

It should be noted that some beacons are coded inappropriately for the environment in which they are used. For example, there have been real world examples of EPIRBs being used as PLBs in the Himalayan Mountains. Some countries allow PLBs to be coded with an ELT protocol for use on an aircraft.

Examples of the different identification fields are shown in the following sections.

5.3.1.1 Serial Number

A serial number is assigned by the country of registration. The serial number does not provide any further identification by itself; the relevant beacon database of the country of registration must be searched for further details.

```
BEACON TYPE USER LOCATION - EPIRB (NON FLOAT FREE)
SERIAL NO 0106717
```

5.3.1.2 Aircraft Operator Designator and Serial Number

Aircraft operator designators are provided by ICAO in the airline designators document, published as ICAO document 8585 – “Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services”. These designators are 3-letter codes like BAW for British Airways or QFA for QANTAS.

Each operator designator can have a serial number from 1 to 4095.

```
BEACON TYPE STANDARD LOCATION - ELT
AIRCRAFT OPERATOR DESIGNATOR AND SERIAL NO QFA 0543
```

5.3.1.3 Aircraft 24-Bit Address

The ICAO 24-bit aircraft address is allocated to States to uniquely identify aircraft worldwide. The Appendix to Chapter 9 of the ICAO Annex 10, Aeronautical Communications document provides the worldwide scheme for the allocation, assignment and application of aircraft addresses. The 24-bit address is presented as six hexadecimal characters in the Cospas-Sarsat distress alert message.

```
BEACON TYPE STANDARD LOCATION - ELT
AIRCRAFT 24-BIT ADDRESS 7C5E8A
```

5.3.1.4 Radio Callsign

The Radio callsign allocations can be obtained from the ITU website: www.itu.int.

```
BEACON TYPE USER LOCATION - EPIRB
RADIO CALLSIGN VHN-259
```

5.3.1.5 MMSI

The last six digits of the Maritime Mobile Service Identity (MMSI) are provided as the identification information. The nine-digit MMSI is formed by adding the six digits to the country code provided in the country of registration field.

```
BEACON TYPE STANDARD LOCATION - EPIRB
MMSI LAST 6 DIGITS 004940
HEX ID 4664026980FFBFF
```

```
COUNTRY OF BEACON REGISTRATION 563/SINGAPORE
```

In the above example, the nine-digit MMSI would be 563004940.

5.3.2 Identification

Other information may be decoded from the 406 MHz message and may be used by the servicing MCC to provide information with respect to an aircraft 24-bit address country assignment and its registration marking.

```
AIRCRAFT 24-BIT ADDRESS 7C5E8A ASSIGNED TO AUSTRALIA
```

5.3.3 Beacon Hex ID

The Hex ID is the 15 character hexadecimal representation of a beacon identification code as described in section 2.4.

5.3.4 Country of Beacon Registration

The three-digit country code, based on the list provided by the International Telecommunication Union (ITU) is provided, followed by the name of the country of beacon registration.

A list of the three-digit country codes is given at Annex B of this document and is also provided on the Cospas-Sarsat web site (www.cospas-sarsat.int).

5.3.5 Beacon Number

For the first beacon on board the vessel or aircraft, the message field will be identified as zero (0). Other beacons on board the vessel or aircraft will be identified as 1 to 63 and A to Z. All the other programmed information will remain the same (e.g., MMSI, Radio Callsign, Aircraft Identifier, etc.).

Different protocols will allow different numbers of beacons to be recorded.

5.3.6 Homing Signal

Homing Signal Interpretation:

- "NIL", means no homing transmitter,
- "121.5", means a 121.5 MHz homing signal in addition to the 406 MHz satellite signal,
- "MARITIME", means Maritime 9 GHz Search and Rescue Radar Transponder (SART) in addition to 406 MHz,
- "NIL OR NOT 121.5", means no homing transmitter or homing transmitter other than 121.5 MHz

- "OTHER", means a nationally assigned homing signal has been included in the beacon.

5.3.7 Activation Type

A beacon can be activated either manually or automatically by immersion or shock.

The activation type provides information with respect to the switching mechanism built into the beacon; i.e., some beacons can only be activated manually, and others can be activated automatically or manually. For example, a float-free EPIRB will indicate "automatic or manual" activation in the distress alert message, an ELT can be either activated automatically because of a strong acceleration or deceleration on the "G" sensor, or manually by the crew in the cockpit.

Ship security alert messages always indicate "MANUAL" activation as SSAS beacons can only be activated manually.

The type of beacon activation is not available in all beacon coding protocols.

This information is not protected, i.e., is not subject to automated error detection and correction. As a consequence, the information provided for this message field should be treated with caution.

5.3.8 Source of GNSS Position Data

This message field indicates whether the GNSS location data was provided to the beacon by an internal or external GNSS device.

The update rate for a beacon with an internal GNSS device depends on the model of beacon. Cospas-Sarsat does not have any specific requirement that the GNSS position be updated after beacon activation; however, most current beacon models do provide updates. Based on the Type Approval Certificate (TAC) number associated with the beacon model, as provided in Paragraph 5, further information about the period (frequency) of GNSS position updates may be available on the Cospas-Sarsat website https://www.cospas-sarsat.int/en/beacons-pro/experts-beacon-information/approved-beacon-models-tacs?view=tac_beacons for "Type Approval Certificate Numbers".

Regardless of a beacon model's designed GNSS position update period:

- its GNSS position may not be updated if the beacon's visibility to GNSS satellites is significantly obstructed; and
- if an alert with a later detect time contains an updated refined position, then the updated GNSS position is current as of a time after the latest detect time associated with the previous refined GNSS position.

A beacon designed to accept position data from an external device prior to beacon activation should be provided with position data by the external device at intervals not longer than 20 minutes for EPIRBs and PLBs and 1 minute for ELTs. If the navigation input fails or is not available, the beacon will retain the last valid position for four (4) hours after which the GNSS position will be set to default values.

Note: If the beacon receives its encoded location from an external navigation system, it is possible that this location may have been derived from a source that is not a satellite (GNSS) navigation system."

5.3.9 Emergency Code

A provision exists in some beacon coding protocols to indicate the nature of distress in accordance with the International Maritime Organisation (IMO) maritime emergency codes. These codes can indicate “Fire/Explosion”, “Flooding”, “Collision”, “Grounding”, “Listing”, “in Danger of Capsizing”, “Sinking”, “Disabled and Adrift” or “Unspecified Distress”.

A provision also exists in the beacon coding to indicate non-maritime emergencies, and these include an indication of a fire, if medical assistance is required, or if disabled.

This message field is not protected; i.e., it is not subject to automated error detection and correction. As a consequence, the information provided for this message field should be treated with caution.

Currently there are no beacons type-approved with this capability and in most cases no emergency code is available. However, there are some beacons that have been coded by default to indicate “unspecified distress”.

5.4 Paragraph 4: Alert Position Information

Detection information (including detection time and satellite) and position information associated with the beacon alert is provided in Paragraph 4.

5.4.1 Detection Time and Spacecraft ID

For MEOSAR alerts, the detection time provided with the prefix “DETECTED AT” is the time of the first burst. As a MEOSAR detection may be detected by many satellites, the Spacecraft ID is shown as “MEOSAR”. As the alert may be a multi-burst detection, the time of the last MEOSAR burst in this alert is on the following line.

For LEOSAR alerts with Doppler location, the detection time is the time of closest approach (TCA) of the satellite to the beacon. Note that the actual time that the LEOSAR satellite first detected the beacon can be either slightly before or after the TCA, but the TCA provides a common point in time for processing. The time is followed on the same line by “LEOSAR” and the identity of the satellite which provided the alert data. The LEOSAR satellites are identified as Sarsat or Cospas. For a combined LEOSAR-GEOSAR solution, the identity of the LEOSAR satellite is given.

For LEOSAR alerts without Doppler location, the detection time is the time of the last beacon burst.

For GEOSAR alerts, the detection time is the time of the first beacon burst. The time is followed on the same line by "GEOSAR" and the identity of the satellite which provided the alert data. The GEOSAR satellites are identified as GOES (Geostationary Operational Environmental Satellite; USA), MSG/MTG (Meteosat Second/Third Generation; EUMETSAT), Electro-L and Louch-5 (Russia), and INSAT and GSAT (India).

5.4.2 Position Information (General)

An example of position information is shown below:

```
4.  ALERT POSITION INFORMATION
      GNSS - NIL
      MCC REFERENCE - NIL
      DOA - 05 10.1 S  178 01.4 E  ESTIMATED ERROR 002 NMS
      ALTITUDE 30 METRES
      DOPPLER A - NIL
      DOPPLER B - NIL
```

There may be multiple locations shown in this field. A position confirmed alert will have an MCC reference position and will also show the locations from the most recently processed detection used to confirm the location. Similarly, a position update alert sent after the position confirmation will have the current MCC reference position and will also show the locations from the most recently processed detection.

Noting that the uncertainty of a refined GNSS position is two (2) seconds of latitude and longitude (about 60 metres at the equator), a refined GNSS position is generally the most accurate position for a beacon, provided that the GNSS position has been updated recently or the beacon is not moving. Further information about GNSS position updates is provided in section 5.3.8. In accordance with document C/S A.001, a refined GNSS position is not confirmed (i.e., not confirmed as representing the actual beacon position) until it matches a Doppler or DOA position within twenty (20) kilometres; this requirement for a match with position data from an independent source addresses the possibility that the initial GNSS position after beacon activation may be inaccurate (e.g., provide a previously computed GNSS position) due to a beacon malfunction.

Summary guidance for the Use of Position Data is provided in section 5.4.7.

Section 6 provides examples of real distress alerts and illustrates how the position data is shown in this field. If the value for a specific position field is "NIL", then the associated data line may be omitted from the alert message.

5.4.3 GNSS Position, Time of Update and Altitude

The GNSS field is the latitude and longitude of the GNSS position. The GNSS update time is always shown as "within 4 hours of detection time" as the system does not record the time that the GNSS position was generated. If a GNSS position of the beacon has not updated within four hours on a beacon, the beacon stops transmitting the GNSS position (and would be shown as NIL in the GNSS field). As discussed in section 2.7, the precision of the GNSS position is dependent on the beacon protocol used and whether a fine or coarse GNSS position is received by the LUT.

For SGBs and FGB ELT(DT)s, if the altitude is available, it has the title "ALTITUDE OF GNSS LOCATION" and is provided in both metres and feet.

5.4.4 MCC Reference Position

If there is an MCC reference position, the latitude and longitude are provided. This position may be formed by a merge of matching locations, which may be based on a weighting factor assigned by the MCC to each matching location.

5.4.5 DOA Position and Altitude

The DOA field provides the latitude and longitude of the DOA location, the estimated error (i.e., expected accuracy) of the DOA location in nautical miles, and the altitude of the DOA location from the mean sea level in metres. If the estimated error value is greater than 277.8 kilometres (150 nautical miles), the error is shown as "OVER 150 NMS". If the estimated error is not available or the reporting MEOLUT is not commissioned to meet MEOSAR IOC requirements for DOA position accuracy and the reliability of the expected horizontal error (EHE) as specified in document C/S T.020, then the estimated error is shown as "UNKNOWN". Further information about the DOA position expected accuracy is provided in section 3.1 above.

If an altitude is not available, it will be indicated by "NIL" or it will be omitted. Note that the altitude is considered to be auxiliary information and is not verified as part of MEOLUT commissioning.

5.4.6 Doppler A and B Positions and Probability

The "DOPPLER A" and the "DOPPLER B" fields provide any Doppler locations and their probabilities. Further information about the reliability and expected accuracy of Doppler location data is provided in Paragraph 5.

5.4.7 Summary Guidance for the Use of Position Data

<u>GNSS Position</u>

The GNSS position is transmitted by the beacon and determined by a navigation source in, or connected to, the beacon (such as aircraft/vessel navigation consoles).

The GNSS position uncertainty that is provided in the "OTHER INFORMATION" section of the alert message may vary, as per section 2.7 above.

The GNSS position transmitted in a beacon distress message might be a stale/old position if the beacon subsequently becomes detached from an external navigation source providing the position to the beacon.

Note: The GNSS position is primarily derived from global navigation satellite systems (such as GALILEO, GPS, GLONASS, etc.) but could, on some occasions, include positions from other external, non-GNSS based systems, which may be subject to degradation of accuracy over time.

MCC Reference Position

An approximation of the beacon position estimated or selected by the MCC, based on a match of positions from independent sources within 20 kilometres. The MCC Reference position is used to determine if subsequent position data is deemed a position update or a position conflict, based on the 20-kilometre distance threshold match. The MCC reference position may be further updated based on new position data that matches the current MCC reference position within 20 kilometres. There is no standard algorithm for computing the MCC Reference position; contact the associated MCC for further information about its algorithm

DOA Position

A position computed by a MEOLUT, based on signals received from multiple MEOSAR satellites relaying the same beacon transmissions.

A MEOLUT can normally provide a position from a single beacon transmission. MEOLUTs typically calculate an estimated error for each position, which is the radius of the circle that is centered on the estimated location and contains the true location with a probability of about 95%.

When the estimated error is not available, then in the case of a stationary beacon, the positions shall meet the following accuracy requirements:

a) at least 90% should be within five (5) kilometres, from a single beacon transmission; and

b) at least 95% should be within five (5) kilometres, after ten (10) minutes of beacon transmissions.

When a DOA location is computed from a single beacon transmission, then the two detection times provided in Paragraph 4 of the alert message are the same.

Finally, the beacon altitude may also be provided by the MEOLUT. Note that the altitude is considered as auxiliary information and is not verified as part of MEOLUT commissioning.

Doppler Position

A Doppler position is computed by a LEOLUT based on signals received from a LEOSAR satellite. If a Doppler position is provided without the "SUSPECT" reliability warning (in the "OTHER INFORMATION" section of the alert message), the Doppler position should be accurate within five (5) kilometres 95% of the time. The SIT 185 message provides the probability that each of two provided Doppler positions (i.e., an "A" position and a "B" position) correspond to the real position.

The "OTHER INFORMATION" section of the SIT 185 message provides further information about position data that is "SUSPECT" (e.g., due to a satellite footprint check or a satellite manoeuvre).

Note: More detailed information on SIT 185 message content can be obtained by contacting your supporting MCC, or by reviewing document C/S A.002 on the Cospas-Sarsat web site (www.cospas-sarsat.int).

5.5 Paragraph 5: Other Information

Other information obtained by the MCC that may be valuable to SAR authorities. This information includes:

a) Doppler position reliability if suspect due to less than ideal satellite pass geometry processing parameters;

b) Doppler position reliability if suspect due to a satellite manoeuvre (when an error greater than ten (10) kilometres is suspected);

c) Doppler or DOA position reliability if suspect due to failure of satellite footprint check;

d) determination of an image (incorrect) position using a footprint check prior to Doppler location ambiguity resolution; and

e) if the beacon message is invalid then the warning is given that the data decoded from the beacon message is not reliable.

If Doppler position is provided without a warning that its reliability is suspect, then it is expected that the Doppler position is accurate within five (5) kilometres. Note that a nominal Doppler solution (i.e., one generated when satellite pass geometry is ideal, as specified in document C/S T.005), is required to be accurate within five (5) kilometres in 95% of cases.

The MCC may also provide additional information in this section; for example, the identity of the LUT that processed the beacon message or beacon database registry information.

5.5.1 Detection Frequency

The frequency is the actual frequency of the beacon transmission as determined by the LUT. As of 2021, Cospas-Sarsat distress beacons were using 406.025 MHz, 406.028 MHz, 406.031 MHz, 406.037 MHz and 406.040 MHz channels (an updated list of frequencies in use can be found at Annex H of document C/S T.012). If the actual frequency is not available, then the value "406 MHZ" is provided.

Knowledge of the individual frequencies may assist Responsible Agencies when tasking aircraft with a 406 MHz direction finding capability.

5.5.2 Other Encoded Information

Other information may be decoded and provided from the 406 MHz message, including:

- Cospas-Sarsat beacon type approval certificate number from which the beacon model and manufacturer can be ascertained,
- the precision of the GNSS position.

When GNSS position data is present, its uncertainty, which is the maximum possible difference between the GNSS position processed by the beacon and the GNSS position transmitted in the SIT 185 Message, is provided in the following format in Paragraph 5, where the degree of uncertainty is provided in Table 5.2.

"GNSS POSITION UNCERTAINTY PLUS-MINUS [X MINUTES/SECONDS] OF LATITUDE AND LONGITUDE."

Table 5.2: GNSS Position Uncertainty

Uncertainty	Comments
2 MINUTES	User location protocol
2 SECONDS	ELT(DT), RLS, standard and national location protocol, maximum resolution
15 MINUTES	ELT(DT), RLS protocol, minimum resolution
30 MINUTES	Standard location protocol, minimum resolution*
4 MINUTES	National location protocol, minimum resolution*

* For standard and national location protocols, the reported degree of uncertainty assumes that the associated beacon is coded with an older methodology, in which the last bit available to report a coarse GNSS position may not be used. The actual uncertainty is one fourth the reported uncertainty (i.e., 7 minutes 30 seconds for standard location protocol and one (1) minute for national location protocol, as noted in section 2.6), if it is known that the associated beacon is coded with a newer methodology in which all bits available to report a coarse GNSS position are used. Based on the Type Approval Certificate (TAC) number associated with the beacon model, as provided in Paragraph 5, further information about the uncertainty of a coarse GNSS position may be available on the Cospas-Sarsat website link for "Type Approval Certificate Numbers".

5.6 Paragraph 6: Remarks

Additional information may be provided at the discretion of the originating MCC in this paragraph and may include value-added information from the MCC operator.

For ship security alerts, advice is included that the alert will need to be processed in accordance with relevant security procedures.

5.7 End of Message

This text is added to the message to give an unambiguous indication to the message recipient that there is no further information.

- END OF SECTION 5 -

6 EXAMPLES OF BEACON INCIDENTS

This section contains examples of beacon incidents and the distress alerts sent to Distress authorities. Some examples are based on real-world incidents; others have been modified or created to demonstrate specific aspects of beacon processing.

Space and Ground Segment situations described in these examples do not reflect the current status and should be used for training purpose only.

6.1 An Unlocated Detection to a Position Confirmed Update

This incident shows how information relating to an EPIRB with the Hex ID: BEEE4634B00028D is presented to a SAR Service as four consecutive SIT 185 messages.

The four SIT 185 messages demonstrate a common sequence of messages received by a SAR Service. Figure 6.1 provides a graphical depiction of the message sequence.

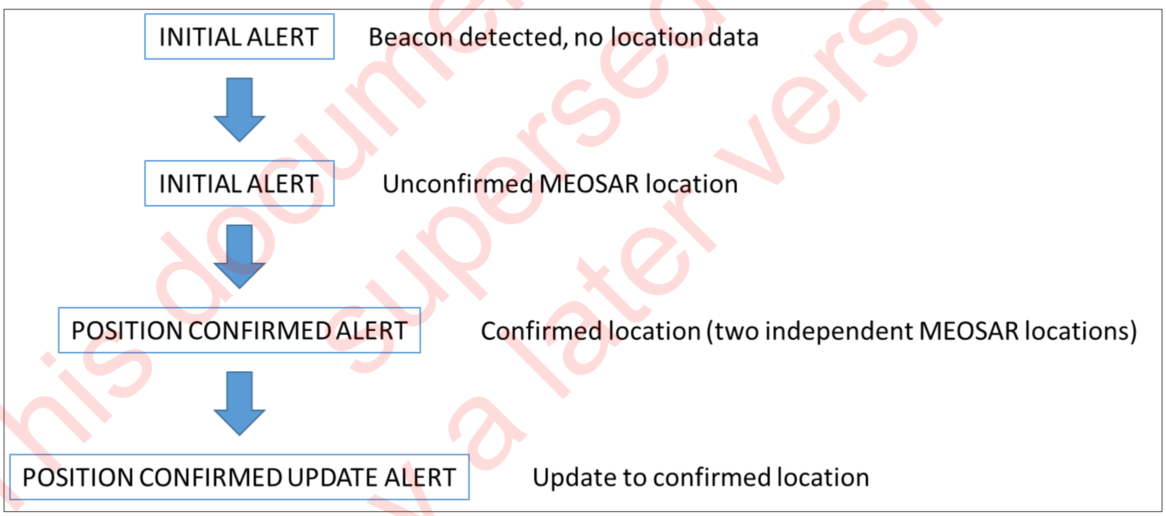


Figure 6.1: Sequence of Four SIT 185 Messages Sent to a SAR Service in Example 6.1

6.1.1 An Initial (Unlocated) Alert

```
1.  DISTRESS COSPAS-SARSAT INITIAL ALERT (UNLOCATED)
2.  MSG NO 00189  AUMCC REF BEEE4634B00028D
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE  SERIAL USER - EPIRB (NON FLOAT-FREE)
    SERIAL NO 101676
    HEX ID BEEE4634B00028D
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5
    ACTIVATION TYPE NIL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 15 MAR 16 1230 UTC BY MEOSAR
      ALERT LAST DETECTED AT 15 MAR 16 1230 UTC
      GNSS - NIL
      MCC REFERENCE - NIL
      DOA - NIL
      DOPPLER A – NIL
      DOPPLER B - NIL
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0280 MHZ
6. REMARKS NIL
END OF MESSAGE
```

Notes:

1. The type of alert is listed in Paragraph 1. This example is an initial alert. An initial alert that does not have a position is often called an “unlocated” alert.
2. Paragraph 2 lists the message number of 00189 and an MCC beacon reference. The message number allows all messages between an MCC and a SAR Service to be uniquely identified. A SAR Service can use the message number to check that there are no missing messages. The MCC beacon reference is used to identify the beacon incident; all alerts for this beacon incident will use the same beacon reference. The Australian MCC uses the Hex ID of the beacon as the reference, other MCCs may use a different reference system.
3. The initial alert contains the beacon Hex ID in Paragraph 3. In the example, the Hex ID also appears in Paragraph 2 as the AUMCC reference.
4. Paragraph 4 contains the detection time of the first MEOSAR burst of 15 MAR 16 1230 UTC. The next data line contains the detection time of the last MEOSAR burst used in this alert. In this example, the times of the first and last burst are the same, indicating that this is a single burst solution.

5. Paragraph 3 lists the country of registration. For this example, the country of registration is Australia.

6. This alert was an unlocated detection, and Paragraph 4 lists no positions. The positions are all shown as “NIL” to indicate that no position information is available. If the value for a specific position is “NIL”, then the associated data line may be omitted from the alert message.

   As this is an unlocated detection, the alert is sent to the SAR Service associated with country of registration for the beacon. In this example, the alert is sent to the Australian JRCC as the beacon has Australia as the country of registration.

7. Paragraph 3 contains information about the beacon. In this case, the serial number of the EPIRB is 101676. The serial number of the EPIRB can be used to look up the beacon in the Australian beacon registry. If the beacon is registered, the contact details may allow the Australian JRCC to commence responding to this initial detection.

6.1.2 An Initial Alert with a MEOSAR Location

```
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 00190  AUMCC REF BEEE4634B00028D
3.  BEACON INFORMATION
    BEACON TYPE SERIAL USER - EPIRB (NON FLOAT-FREE)
    SERIAL NO 101676
    HEX ID BEEE4634B00028D
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    HOMING SIGNAL 121.5
    ACTIVATION TYPE MANUAL
4.  ALERT POSITION INFORMATION
      DETECTED AT 15 MAR 16 1230 UTC BY MEOSAR
      ALERT LAST DETECTED AT 15 MAR 16 1237 UTC
      DOA - 17 47.2 S  146 04.5 E  ESTIMATED ERROR 005 NMS
      ALTITUDE 23 METRES
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0280 MHZ
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. This is an initial alert with a location. The location shown in Paragraph 4 is a DOA (Difference of Arrival) or MEOSAR location. The location is shown with an estimated error, and, in this example, the beacon will be located within five (5) nautical miles of the location, 95% of the time. An altitude of 23 metres is also provided. Fields in paragraphs 3 and 4 with a "NIL" value have been omitted.
2. The reference in Paragraph 2 (the Hex ID of the beacon) is used by the SAR Service to associate this alert to the same beacon incident as the alert shown in section 6.1.1.
3. Paragraph 4 contains the detection time of the first burst, 15 MAR 16 1230 UTC and the detection time of the last burst, 15 MAR 16 1237 UTC. As the two times are different, this a multi-burst solution.

6.1.3 A Position Confirmed Alert

```
1.   DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT
2.   MSG NO 00191  AUMCC REF BEEE4634B00028D
3.   BEACON MESSAGE INFORMATION
     BEACON TYPE  SERIAL USER - EPIRB (NON FLOAT-FREE)
     SERIAL NO 101676
     HEX ID BEEE4634B00028D
     COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
     HOMING SIGNAL 121.5
     ACTIVATION TYPE MANUAL
4.   ALERT POSITION INFORMATION
       DETECTED AT 15 MAR 16 1248 UTC BY MEOSAR
       ALERT LAST DETECTED AT 15 MAR 16 1248 UTC
       MCC REFERENCE - 17 47.5 S  146 06.2 E
       DOA - 17 47.6 S  146 07.4 E  ESTIMATED ERROR 005 NMS
       ALTITUDE 22 METRES
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.0280 MHZ
6.   REMARKS NIL
END OF MESSAGE
```

Notes:

1. A position confirmed alert (in this case, with title "Position Update Alert") is sent when two independent locations match, as described in section 4.1.3. In this example, the DOA (MEOSAR) location shown in Paragraph 4 has matched the location in the previous alert in section 6.1.2. See the description of "Confirmation" in section 4.1.3.

2. The MCC reference position shown in Paragraph 4 is determined based on a weighting factor assigned to each previous DOA location. The AUMCC merges DOA locations to produce an MCC reference position. Other MCCs may use other methods to determine the MCC reference position.

6.1.4 A Position Confirmed Update Alert

```
1.   DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT
2.   MSG NO 00194  AUMCC REF BEEE4634B00028D
3.   BEACON MESSAGE INFORMATION
     BEACON TYPE SERIAL USER - EPIRB (NON FLOAT-FREE)
     SERIAL NO 101676
     HEX ID BEEE4634B00028D
     COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
     HOMING SIGNAL 121.5
     ACTIVATION TYPE MANUAL
4.   ALERT POSITION INFORMATION
       DETECTED AT 15 MAR 16 1301 UTC BY MEOSAR
       ALERT LAST DETECTED AT 15 MAR 16 1301 UTC
       MCC REFERENCE - 17 47.6 S  146 05.3 E
       DOA - 17 47.9 S  146 04.5 E  ESTIMATED ERROR 002 NMS
       ALTITUDE 24 METRES
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.0280 MHZ
6.   REMARKS NIL
END OF MESSAGE
```

Notes:

1. If the SAR service is configured to receive ongoing updates after position confirmation, the MCC will send an update to the MCC reference position in a number of conditions; e.g., if a solution with matching DOA position is processed with a data time at least 15 minutes after the most recent data time of previous message with DOA position, or if a Doppler solution is processed for a new beacon event.

2. In this example, the updated MCC reference position was computed based on a weighting factor assigned to each previous DOA position.

6.2 From Unlocated Alert to Position Confirmation

The following incident has similar SIT 185 messages to those in section 6.1 but demonstrates detections from the GEOSAR and LEOSAR systems. The incident shows the SIT 185 messages sent to a SAR Service for an EPIRB with Hex ID BEEE43FCF8001AD. The three SIT 185 messages for this incident are depicted in Figure 6.2.

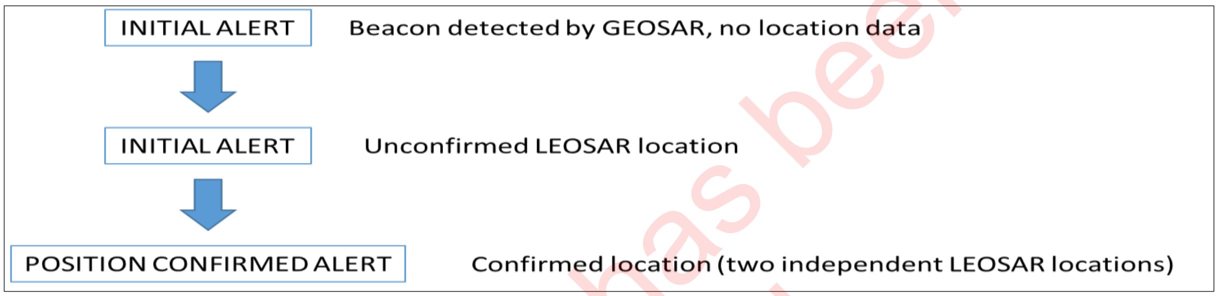


Figure 6.2: Sequence of Three Beacon Messages Sent in Example 6.2

6.2.1 A GEOSAR Unlocated Alert

```
1.  DISTRESS COSPAS-SARSAT INITIAL ALERT (UNLOCATED)
2.  MSG NO 12301  AUMCC REF BEEE43FCF8001AD
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE SERIAL USER - EPIRB (NON FLOAT FREE)
    SERIAL NO 0065342
    HEX ID BEEE43FCF8001AD
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 27 APR 13 1557 UTC BY GEOSAR INSAT 3A
      GNSS - NIL
      MCC REFERENCE - NIL
      DOA - NIL
      DOPPLER A - NIL
      DOPPLER B - NIL
5.  OTHER INFORMATION
    LUT ID 4191 BANGALORE GEOLUT, INDIA
    DETECTION FREQUENCY 406.0286 MHZ
    TAC 0107
    BEACON MODEL - ACR, USA RLB-32
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. Paragraph 4 states that the detection was by satellite INSAT-3A, a geostationary satellite. The beacon is expected to be located within the footprint of the INSAT-3A satellite which is centred at (0° N, 093.5° E). See Figure 6.3 below.
2. No position information is shown in Paragraph 4, since this is an unlocated initial detection of the beacon.

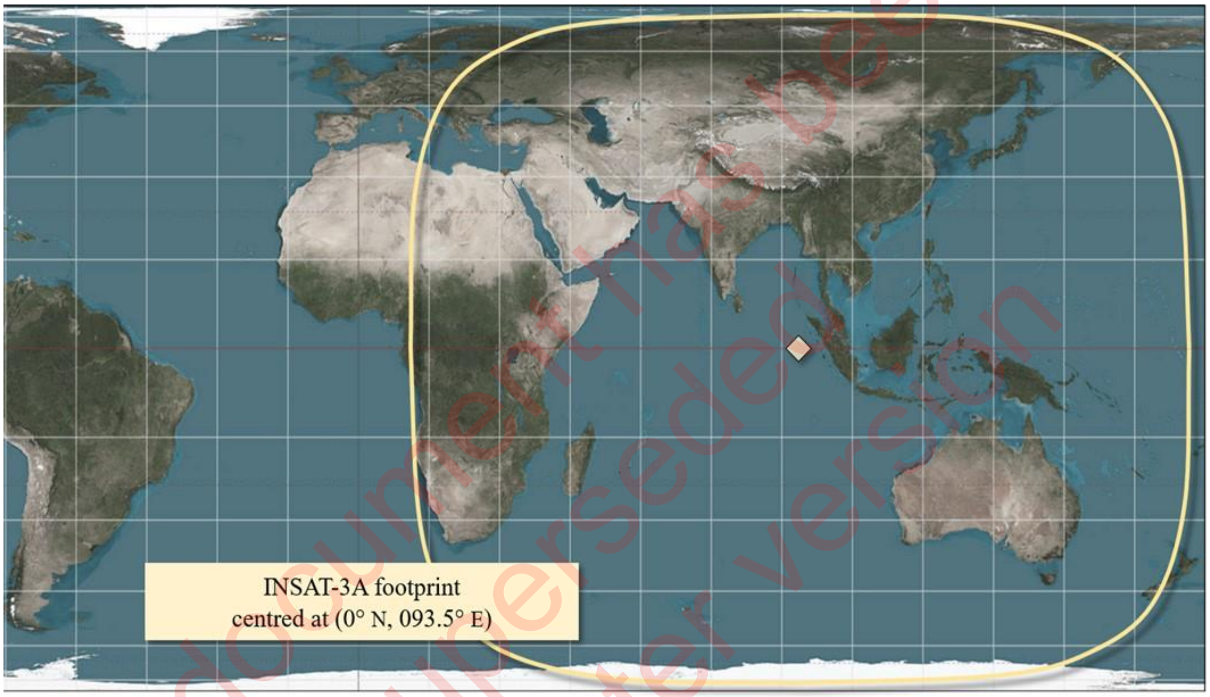


Figure 6.3: Footprint of the GEOSAR INSAT-3A Satellite

In the Figure 6.3 above, the outline of the footprint is shown by the yellow line. The position of the INSAT-3A satellite is shown by the yellow diamond in the centre of the footprint.

6.2.2 A LEOSAR Initial Alert

```
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 12307  AUMCC REF BEEE43FCF8001AD
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE SERIAL USER LOCATION - EPIRB (NON FLOAT FREE)
    SERIAL NO 0065342
    HEX ID BEEE43FCF8001AD
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 27 APR 13 1653 UTC BY LEOSAR SARSAT 12
      GNSS - NIL
      MCC REFERENCE - NIL
      DOA - NIL
      DOPPLER A - 43 04.04 S  147 15.75 E  PROB 83 PERCENT
      DOPPLER B - 51 45.19 S  167 48.58 W  PROB 17 PERCENT
5.  OTHER INFORMATION
    THE B POSITION IS LIKELY TO BE AN IMAGE POSITION
    DETECTION FREQUENCY 406.0277 MHZ
    TAC 0107
    BEACON MODEL - ACR, USA RLB-32
    LUT ID 6011
6. REMARKS NIL
END OF MESSAGE
```

Notes:

1. Paragraph 4 indicates that the detection was made by LEOSAR satellite Sarsat-12, a when it passed by the beacon. Paragraph 5 reports that the detection was further received by the LEOLUT 6011 in Cape Town, South Africa when Sarsat-12 and this LEOLUT were in mutual visibility.

2. Paragraph 5 indicates that the B position is the likely image position. Figure 6.4 shows the Doppler locations on a map. The B position is outside the footprint of INSAT-3A, the geostationary satellite that provided the first detection. Although image determination provides a strong indicator that the A position is the “real” position, image determination is not used by Cospas-Sarsat to provide confirmation of a position.

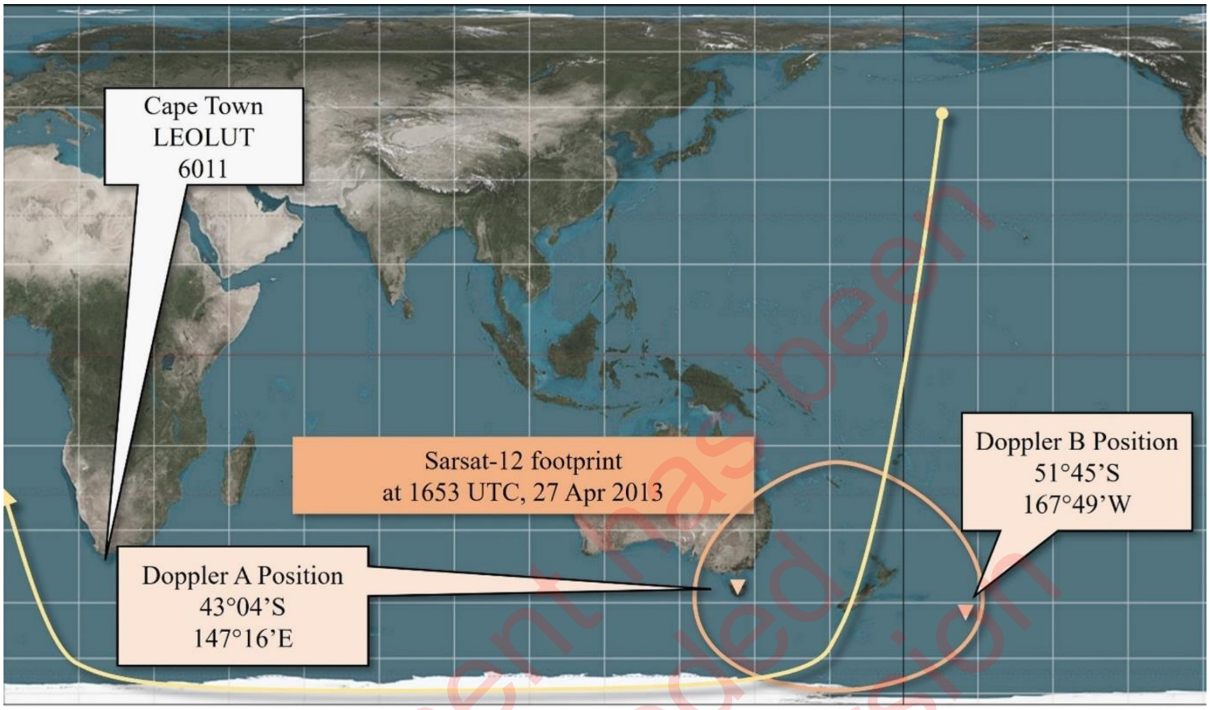


Figure 6.4: LEOSAR Initial Alert

The yellow line is the track (path) of the LEOSAR satellite Sarsat-12. The orange outline is the footprint of Sarsat-12 at the TCA (Time of Closest Approach) of the beacon. The two Doppler locations generated by this pass are shown. The location of the LEOLUT 6011 in Cape Town, South Africa is also shown.

6.2.3 A LEOSAR Position Confirmed Alert

```
1.  DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT
2.  MSG NO 63523  AUMCC REF BEEE43FCF8001AD
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE SERIAL USER LOCATION - EPIRB (NON FLOAT FREE)
    SERIAL NO 0065342
    HEX ID BEEE43FCF8001AD
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    HOMING SIGNAL 121.5
    ACTIVATION TYPE MANUAL
4.  ALERT POSITION INFORMATION
      DETECTED AT 27 APR 13 1716 UTC BY LEOSAR SARSAT 10
      MCC REFERENCE - 43 03.25 S  147 15.96 E
      DOPPLER A - 43 02.89 S  147 15.91 E
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0276 MHZ
    TAC 0107
    BEACON MODEL - ACR, USA RLB-32
    LEOLUT 6011
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. The position has been confirmed using data from a second LEOSAR detection (satellite Sarsat-10 shown in Paragraph 4) that matches a Doppler position from the previous initial alert. See the description of “Confirmation” in section 4.1.3.

2. The matching Doppler A position is provided along with the MCC reference position in Paragraph 4. In this example, the MCC reference position computed by the MCC from the initial and subsequent alerts is biased to the location that is more likely to be accurate (as the magnitude of the error ellipse is less). The Doppler A position information provides for a means to ensure that the MCC processing is normal and enables the SAR Service to reference the individual (un-merged) position in planning its SAR response.

3. The A position of the Sarsat-10 pass matches the A position of the initial alert from Sarsat-12 which results in an MCC reference position being computed (see Figure 6.5).

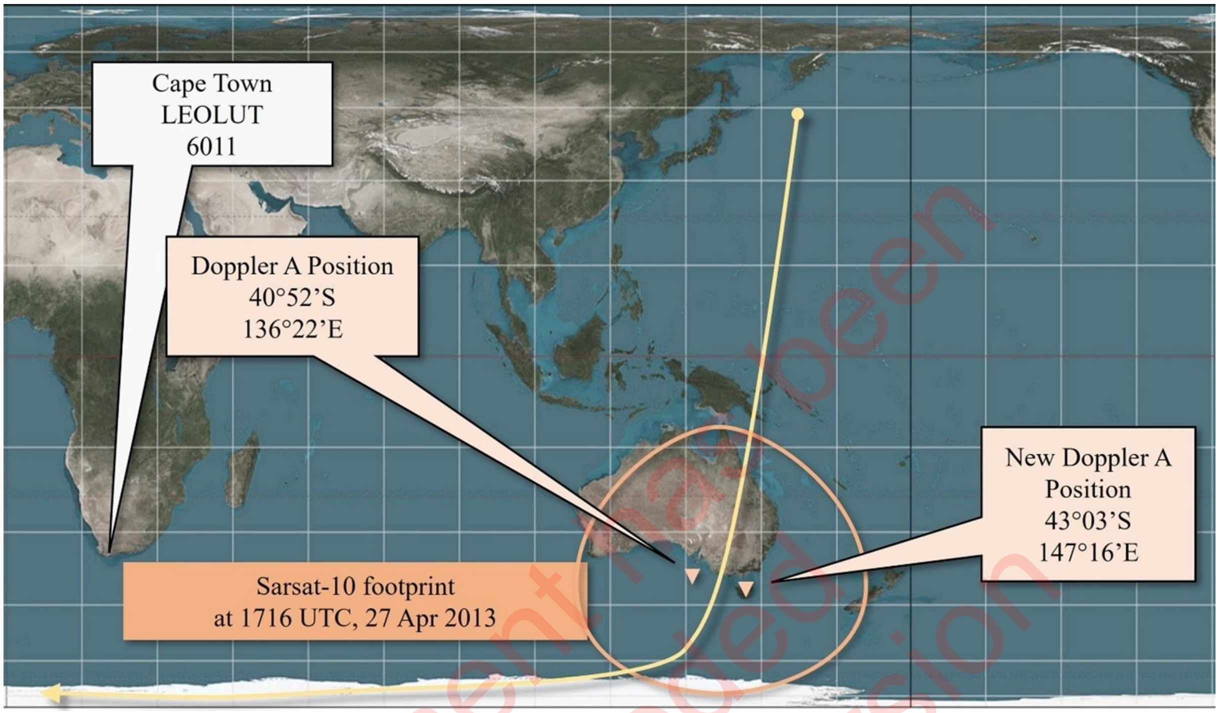


Figure 6.5: Confirmation of Position Using a LEOSAR Alert

In the Figure 6.5 above, the yellow line is the track of LEOSAR satellite Sarsat-10. The orange outline is the footprint of Sarsat-10 at the TCA for this beacon. The two Doppler locations generated by this pass are shown. The Doppler A position for this detection matches the Doppler A position from the previous detection (see Figure 6.4) and confirms the location.

6.3 A Position Confirmed Alert as the First Alert

In this example, the first alert received by the SAR Service is a position confirmed alert. The presence of a position in the field titled "MCC REFERENCE" indicates that position is confirmed, based on the matching of two independent locations, as described in section 4.1.3 above.

6.3.1 A Position Confirmed Alert

```
1.   DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.   MSG NO 00463  AUMCC REF 3EEC7B9076FFBFF
3.   BEACON MESSAGE INFORMATION
     BEACON TYPE STANDARD LOCATION - EPIRB
     SERIAL NO 2107
     HEX ID 3EEC7B9076FFBFF
     COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
     HOMING SIGNAL 121.5
     GNSS POSITION PROVIDED BY INTERNAL DEVICE
4.   ALERT POSITION INFORMATION
       DETECTED AT 03 APR 16 1124 UTC BY MEOSAR
       ALERT LAST DETECTED AT 03 APR 16 1124 UTC
       GNSS - 25 40.07S  113 39.00E
         UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME
       MCC REFERENCE - 25 39.5 S  113 37.3 E
       DOA - 25 39.5 S  113 37.3 E  ESTIMATED ERROR 004 NMS
       ALTITUDE 4 METRES
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.0402 MHZ
     GNSS POSITION UNCERTAINTY PLUS-MINUS 2 SECONDS OF
     LATITUDE AND LONGITUDE
6.  REMARKS NIL
END OF MESSAGE
```


Notes:

1. Paragraph 4 shows that this alert has a DOA position and a GNSS position.
2. As the DOA position and GNSS position match (the two positions are approximately three (3) kilometres apart and so are within the twenty-kilometre matching criterion) and are independent, the position is confirmed.
3. The AUMCC does not merge a DOA position and a GNSS position to produce an MCC reference position. Instead, the AUMCC uses the DOA position as the MCC reference position. Other MCCs may merge the DOA and GNSS position to produce the MCC reference position.
4. Paragraph 5 provides the uncertainty of the GNSS position as two (2) seconds of latitude and longitude, about 60 metres at the equator. A GNSS position with two (2) seconds of

uncertainty is generally the most accurate position for a beacon, provided that the GNSS position has been updated recently or the beacon is not moving.

A MEOSAR Alert Confirmed by a LEOSAR Alert

The beacon with the Hex ID: C809C70A34D34D1 is first detected with a MEOSAR location that is later confirmed with LEOSAR location data. Figure 6.6 depicts the two messages.

6.4

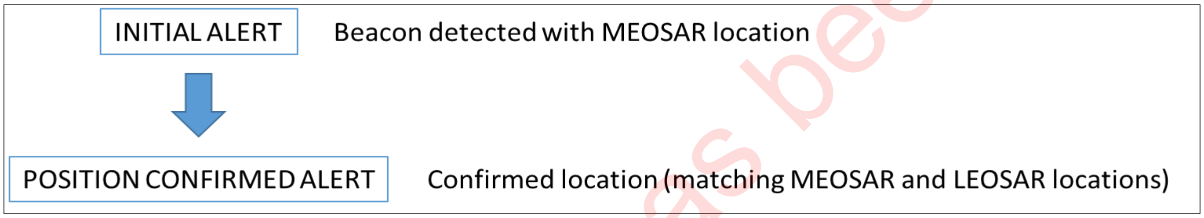


Figure 6.6: The Two SIT 185 Messages in Example 6.4

6.4.1 An Initial Alert from the MEOSAR System

```
1.   DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.   MSG NO 05714 AUMCC REF C809C70A34D34D1
3.   BEACON MESSAGE INFORMATION
     BEACON TYPE USER - EPIRB USER
     MMSI LAST 6 DIGITS 774000
     HEX ID C809C70A34D34D1
     COUNTRY OF BEACON REGISTRATION 576/VANUATU
     BEACON NUMBER ON AIRCRAFT OR VESSEL 0
     HOMING SIGNAL 121.5
     ACTIVATION TYPE AUTOMATIC OR MANUAL
4.   ALERT POSITION INFORMATION
       DETECTED AT 17 OCT 15 0637 UTC BY MEOSAR
       ALERT LAST DETECTED AT 17 OCT 15 0637 UTC
       DOA - 22 53.34 S  170 15.06 E  ESTIMATED ERROR UNKNOWN
       ALTITUDE 30 METRES
5.   OTHER INFORMATION
     DETECTION FREQUENCY 406.035 MHZ
6.   REMARKS NIL
END OF MESSAGE
```

Notes:

1. Paragraph 4 indicates that this is a MEOSAR alert and provides the initial position. The estimated error is shown as "UNKNOWN" because the reporting MEOLUT is not commissioned to meet MEOSAR IOC requirements for DOA position accuracy and the reliability of the estimated error.

2. The MMSI for the vessel is formed by using the country code (576) and the beacon information of 774000. The MMSI is therefore 576774000.

6.4.2 A Position Confirmed Alert using LEOSAR Data

A later LEOSAR detection provides further position information that is used to confirm the position for the beacon with Hex ID: C809C70A34D34D1, as shown below. See the description of "Confirmation" in section 4.1.3.

```
1.  DISTRESS COSPAS-SARSAT POSITION UPDATE ALERT
2.  MSG NO 05717 AUMCC REF C809C70A34D34D1
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE USER - EPIRB USER
    MMSI LAST 6 DIGITS 774000
    HEX ID C809C70A34D34D1
    COUNTRY OF BEACON REGISTRATION 576/VANUATU
    BEACON NUMBER ON AIRCRAFT OR VESSEL 0
    HOMING SIGNAL 121.5
    ACTIVATION TYPE AUTOMATIC OR MANUAL
4.  ALERT POSITION INFORMATION
      DETECTED AT 17 OCT 15 0647 UTC BY LEOSAR SARSAT 10
      MCC REFERENCE - 22 53.34 S  170 15.06 E
      DOPPLER A - 22 50.15 S  170 13.76 E
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0370 MHZ
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. The MCC reference position is identical to the previously received DOA position as the Doppler location matches the DOA position.

2. The AUMCC has used the previous DOA location as the MCC reference position and has not merged the DOA location with the matching Doppler location. Other MCCs may merge the matching DOA and Doppler location to produce the MCC reference position or use the Doppler location as the MCC reference position.

A Position Conflict Alert

The following example with an ELT with Hex ID 2DC753D464FFBFF shows an incident where two positions generated do not match and a conflict alert is sent to the SAR Service.

6.5 The example is based on a real-world incident but amended for presentation. (The actual format of SIT 185 messages sent by the USMCC differs somewhat from those shown in these examples. Note that the USMCC sends national formatted messages to its national SAR Services rather than SIT 185 messages.)

6.5.1 A GEOSAR GNSS Position Alert

The initial GEOSAR detection provides GNSS position information for the beacon with Hex ID: 2DC753D464FFBFF:

```
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 72554  USMCC REF 42321
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE STANDARD LOCATION PROTOCOL - ELT
    AIRCRAFT 24-BIT ADDRESS A9EA32 ASSIGNED TO USA
    HEX ID 2DC753D464FFBFF
    COUNTRY OF BEACON REGISTRATION 366/USA
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5
    ACTIVATION TYPE NIL
    GNSS POSITION PROVIDED BY EXTERNAL DEVICE
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 28 APR 19 1702 UTC BY GEOSAR GOES 17
      GNSS - 33 31.27 N  083 56.93 W
        UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME
5.  OTHER INFORMATION
    LUT ID 5123
    DETECTION FREQUENCY 406.0248 MHZ
    GNSS POSITION UNCERTAINTY PLUS-MINUS 2 SECONDS OF
    LATITUDE AND LONGITUDE
6.  REMARKS NIL
END OF MESSAGE
```


Notes:

1. Paragraph 4 shows the detection was made by the GOES-17 geostationary satellite.
2. Paragraph 4 provides the GNSS position detected by the GOES-17 satellite. The GNSS position is within the USMCC service area.
3. Paragraph 3 indicates that the GNSS position was provided by an external device and no further updates to the GNSS position will be possible under normal activation.
4. Paragraph 5 provides the uncertainty of the GNSS position.

5. Some message fields are “NIL” in Paragraph 3. Message fields containing “NIL” in Paragraph 4 have been omitted.

6. The "AIRCRAFT 24-BIT ADDRESS A9EA32" (in paragraph 3 of the message) is equivalent to the bit sequence “101010011110101000110010”. As noted in Figure 6.7 below, the ICAO 24-bit allocation for the USA is “1010”. Since the first four bits of the address match that value, paragraph 3 indicates that this address is assigned to the USA. The remaining 20 bits are used to code the individual US aircraft

7. SIT 185 messages sent by the USMCC contain a 5-digit alert site number associated with the beacon activation (e.g., 42321) as the “USMCC REF” in Paragraph 2. This number is unique to a beacon activation and if the same beacon is activated again at a different time, the 5-digit alert site number will be different.

State	*Number of addresses in block*					*Allocation of blocks of addresses (a dash represents a bit value equal to 0 or 1)*
	1 024	*4 096*	*32 768*	*262 144*	*1 048 576*	
Saint Vincent and the Grenadines	*					0000 10 111 100 00 ----------
Samoa	*					1001 00 000 010 00 ----------
San Marino	*					0101 00 000 000 00 ----------
Sao Tome and Principe	*					0000 10 011 110 00 ----------
Saudi Arabia			*			0111 00 010 --- -- ----------
Senegal		*				0000 01 110 000 -- ----------
Seychelles	*					0000 01 110 100 00 ----------
Sierra Leone	*					0000 01 110 110 00 ----------
Singapore			*			0111 01 101 --- -- ----------
Slovakia	*					0101 00 000 101 11 ----------
Slovenia	*					0101 00 000 110 11 ----------
Solomon Islands	*					1000 10 010 111 00 ----------
Somalia		*				0000 01 111 000 -- ----------
South Africa			*			0000 00 001 --- -- ----------
Spain				*		0011 01 --- --- -- ----------
Sri Lanka			*			0111 01 110 --- -- ----------
Sudan		*				0000 01 111 100 -- ----------
Suriname		*				0000 11 001 000 -- ----------
Swaziland	*					0000 01 111 010 00 ----------
Sweden			*			0100 10 101 --- -- ----------
Switzerland			*			0100 10 110 --- -- ----------
Syrian Arab Republic			*			0111 01 111 --- -- ----------
Tajikistan	*					0101 00 010 101 00 ----------
Thailand			*			1000 10 000 --- -- ----------
The former Yugoslav Republic of Macedonia	*					0101 00 010 010 00 ----------
Togo		*				0000 10 001 000 -- ----------
Tonga	*					1100 10 001 101 00 ----------
Trinidad and Tobago		*				0000 11 000 110 -- ----------
Tunisia			*			0000 00 101 --- -- ----------
Turkey			*			0100 10 111 --- -- ----------
Turkmenistan	*					0110 00 000 001 10 ----------
Uganda		*				0000 01 101 000 -- ----------
Ukraine			*			0101 00 001 --- -- ----------
United Arab Emirates		*				1000 10 010 110 -- ----------
United Kingdom				*		0100 00 --- --- -- ----------
United Republic of Tanzania		*				0000 10 000 000 -- ----------
United States					*	1010 -- --- --- -- ----------
Uruguay		*				1110 10 010 000 -- ----------
Uzbekistan	*					0101 00 000 111 11 ----------
Vanuatu	*					1100 10 010 000 00 ----------

Figure 6.7: ICAO 24-bit Addressing

Figure 6.7 above, contains an extract from the ICAO document [Annex 10 Vol III] concerning 24-bit addressing. The table shows that the allocation of addresses uses the four-bit sequence 1010 to indicate a US aircraft..

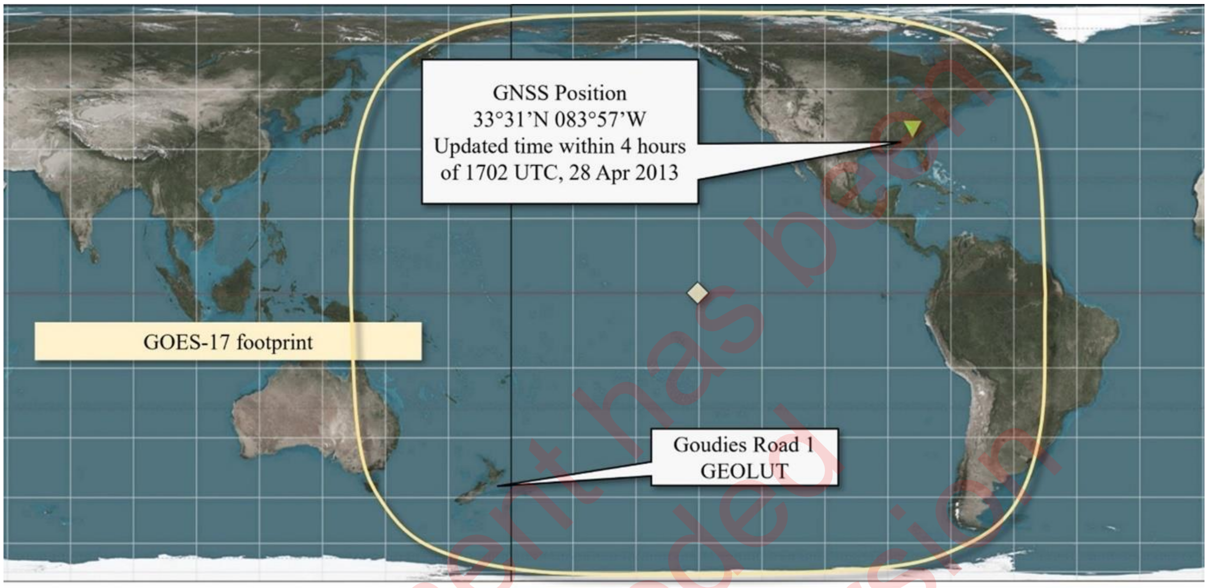


Figure 6.8: GEOSAR GNSS Position Alert

In the Figure 6.8 above, the footprint of the GEOSAR satellite GOES-17 is shown in yellow and the location of the GOES-17 is shown by the yellow diamond. The location of the GNSS position provided in the beacon message is shown by the green triangle in the USA.

6.5.2 A Position Conflict Alert from a LEOSAR Position

The alert in this example is a LEOSAR detection that has two Doppler locations and a GNSS position. Since neither Doppler location matches the GNSS position, a position conflict alert is generated.

```
1.  DISTRESS COSPAS-SARSAT POSITION CONFLICT ALERT
2.  MSG NO 72555  USMCC REF 42321
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE STANDARD LOCATION PROTOCOL – ELT
    AIRCRAFT 24-BIT ADDRESS A9EA32 ASSIGNED TO USA
    HEX ID 2DC753D464FFBFF
    COUNTRY OF BEACON REGISTRATION 366/USA
    HOMING SIGNAL 121.5
    GNSS POSITION PROVIDED BY EXTERNAL DEVICE
4.  ALERT POSITION INFORMATION
      DETECTED AT 28 APR 13 1702 UTC BY LEOSAR SARSAT 08
      GNSS - 33 31.27 N  083 56.93 W
        UPDATE TIME WITHIN 4 HOURS OF DETECTION TIME
      DOPPLER A - 33 09.82 N  085 19.92 W PROB 56 PERCENT
      DOPPLER B - 44 41.41 N  144 00.65 W PROB 44 PERCENT
5.  OTHER INFORMATION
    RELIABILITY OF DOPPLER POSITION DATA - SUSPECT DUE TO
    TECHNICAL PARAMETERS
    POSITION CONFLICT BASED ON DISTANCE SEPARATION AT LEAST 20 KM
    DETECTION FREQUENCY 406.0247 MHZ
    GNSS POSITION UNCERTAINTY PLUS-MINUS 2 SECONDS OF LATITUDE
    AND LONGITUDE
6. REMARKS NIL
END OF MESSAGE
```


Notes:

1. The two Doppler positions shown in Paragraph 4 do not match the GNSS position. The closer Doppler, the A position (33° 10’ N, 085° 19’ W) is some 285 kilometres from the GNSS position (33° 31’ N, 083° 57’ W). As the positions do not match, a position conflict alert is sent to the RCC.

2. In Paragraph 5, the Doppler position has been assessed as suspect due to technical parameters. The satellite pass geometry (Cross Track Angle 23.7 degrees) is such that the Doppler locations were near the edge of the satellite footprint and were assessed as suspect. See Figure 6.9. As the Doppler positions are suspect, the GNSS position is more likely to be the real beacon position than the Doppler positions, but the matching of position data from independent sources is required to determine the real position of the beacon.

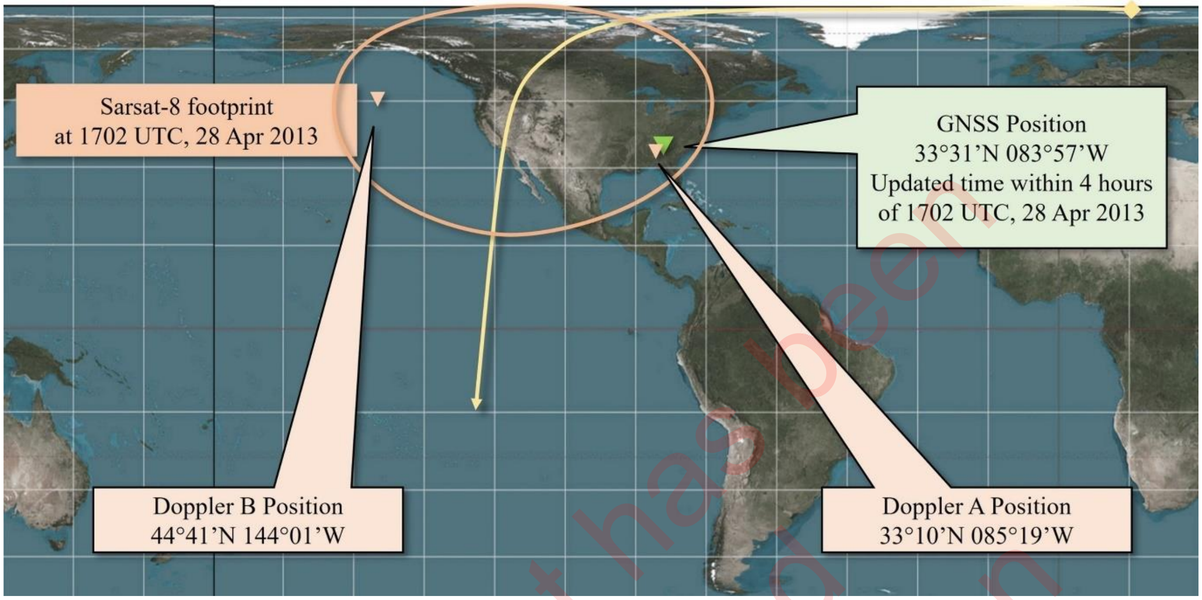


Figure 6.9: LEOSAR Position Conflict Alert

In the Figure 6.9 above, the footprint of LEOSAR satellite Sarsat-8 at the TCA is shown in orange, the yellow line is the track (path) of the satellite. The two Doppler locations generated for this beacon detection are shown on the map. A position conflict alert is generated as neither Doppler location is within the matching distance of 20 kilometres of the GNSS position.

A Notification of Country of Registration Alert

6.6.1 An NOCR Alert

6.6

An NOCR alert is sent by an MCC to the country of registration for a beacon located inside the service area of the MCC. In this example, the beacon with the Hex ID C809C70A34D34D1 which is a Vanuatu EPIRB has locations in the Brazilian MCC's service area. The Brazilian MCC would send the NOCR to the Vanuatu SAR Service via the MCC Network.

```
1.  DISTRESS COSPAS-SARSAT NOTIFICATION OF COUNTRY OF BEACON
    REGISTRATION ALERT
2.  MSG NO 05714 AUMCC REF C809C70A34D34D1
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE USER - EPIRB USER
    MMSI LAST 6 DIGITS 774000
    HEX ID C809C70A34D34D1
    COUNTRY OF BEACON REGISTRATION 576/VANUATU
    BEACON NUMBER ON AIRCRAFT OR VESSEL 0
    HOMING SIGNAL 121.5
    ACTIVATION TYPE AUTOMATIC OR MANUAL
4.  ALERT POSITION INFORMATION
      DETECTED AT 17 MAY 13 0637 UTC BY LEOSAR SARSAT 10
      DOPPLER A - 18 33.54 S  062 15.06 W PROB 60 PERCENT
      DOPPLER B - 22 53.34 S  043 21.60 W PROB 40 PERCENT
5.  OTHER INFORMATION
    LUT ID 7101 BRAZILIA, BRAZIL
    DETECTION FREQUENCY 406.0370 MHZ
6. REMARKS NIL
END OF MESSAGE
```

Notes:

1. A Notification of Country of Registration (NOCR) alert message is sent to the country of beacon registration by an MCC that has an alert with a position inside its service area when the MCC has no other location within the SAR region of the country of beacon registration. The NOCR alert message is intended to alert the SAR Service responsible for the country code when the SAR Service would not otherwise be sent a located alert for the beacon.

2. In the alert message above the Brazilian MCC (BRMCC), in whose service area the beacon was located, transmitted a NOCR alert message to the Australian MCC (AUMCC) via the USA MCC (USMCC) for forwarding to the Vanuatu authorities. As Vanuatu is serviced by the Noumea RCC in New Caledonia, the AUMCC has forwarded the NOCR alert to Noumea RCC for delivery to the Vanuatu SAR Service.

3. A graphical representation of the NOCR alert message is provided in Figure 6.10.

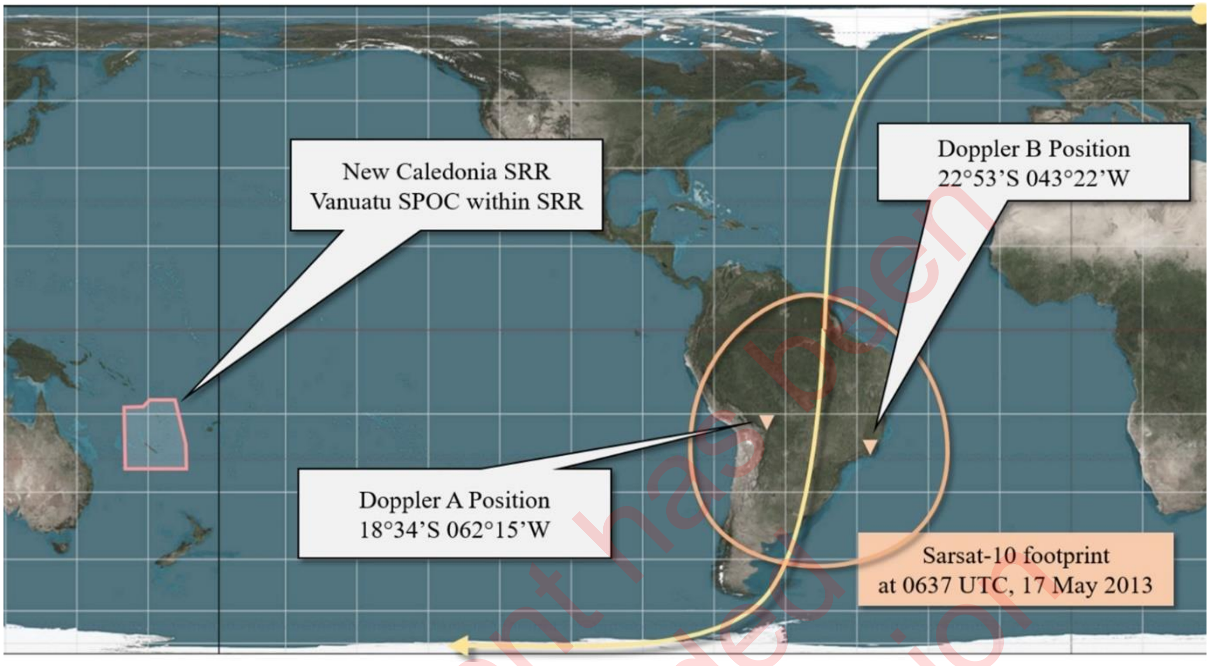


Figure 6.10: Graphical Representation of the NOCR Alert Message

In the Figure 6.10 above, the yellow line is the track of LEOSAR satellite Sarsat-10. The footprint of Sarsat-10 at the TCA is shown in orange. As the beacon has a country of registration of Vanuatu and has location data in the Brazilian MCC service area, the Brazilian MCC sends a NOCR via the MCC network. In this case, the NOCR would be sent via the United Status MCC, the Australian MCC and the New Caledonian SPOC to the Vanuatu SPOC.

An Unresolved Doppler Position Match Alert

6.7.1 A LEOSAR Unresolved Doppler Position Match Alert

An unresolved Doppler position match alert is sent when two independent LEOSAR
6.7 detections match both possible Doppler locations prior to position confirmation. In this example, the first detection is not shown. The second detection generated the unresolved Doppler position match alert.

```
1.  DISTRESS COSPAS-SARSAT UNRESOLVED DOPPLER POSITION MATCH ALERT
2.  MSG NO 55408  AUMCC REF CDC9D64D41934D1
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE USER LOCATION - EPIRB USER
    MMSI LAST 6 DIGITS 120320
    HEX ID CDC9D64D41934D1
    COUNTRY OF BEACON REGISTRATION 622/EGYPT
    BEACON NUMBER ON AIRCRAFT OR VESSEL 0
    HOMING SIGNAL 121.5
    ACTIVATION TYPE AUTOMATIC OR MANUAL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 17 MAY 11 0900 UTC BY LEOSAR SARSAT 11
      GNSS - NIL
      MCC REFERENCE - NIL
      DOA - NIL
      DOPPLER A - 36 34.74 N  000 22.26 W  PROB 99 PERCENT
      DOPPLER B - 31 03.12 N  026 24.30 E  PROB 01 PERCENT
5.  OTHER INFORMATION
    WARNING: AMBIGUITY IS NOT RESOLVED
    LUT ID 6011 CAPE TOWN, SOUTH AFRICA
    DETECTION FREQUENCY 406.0368 MHZ
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. When both pairs of Doppler positions meet the match criterion prior to ambiguity resolution for different satellite passes on similar orbital paths as shown in Figure 6.11, an unresolved Doppler position match alert will be generated. Note in this example from 2011, the match criterion was 50 kilometres. The match criterion has since been changed to 20 kilometres.

2. For the example above the following two pairs of Doppler locations were received:

   Satellite Sarsat-8 TCA 0704 UTC, 17 May 2011,
   A. 36° 18.1’ N - 000° 01.4’ E B. 31° 05.0’ N - 025° 55.1’ E
   Satellite Sarsat-11 TCA 0900 UTC, 17 May 2011,
   A. 36° 34.7’ N - 000° 22.3’ W B. 31° 03.1’ N - 026° 24.3’ E

3. Both the A pair and B pair locations from the two satellites were within 50 kilometres and this is depicted in Figure 6.8. As a consequence, ambiguity in position cannot be resolved and an unresolved Doppler position match alert is transmitted.
4. As a consequence, a warning will be inserted in the alert message in Paragraph 5 indicating that ambiguity has not been resolved.
5. Although ambiguity is unresolved (i.e., position is unconfirmed), the new "A" position is likely the true position based on its probability (99 percent).

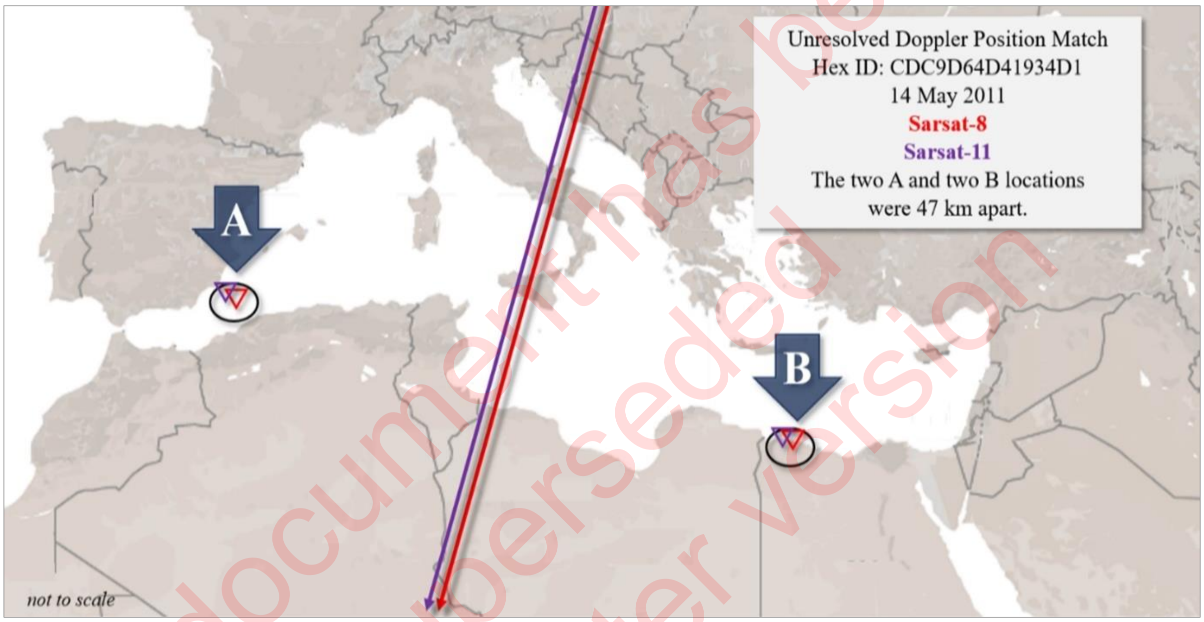


Figure 6.11: Unresolved Doppler Position Match

In the Figure 6.11 above, the red line is the track of LEOSAR satellite Sarsat-8. The purple line is the track of LEOSAR satellite Sarsat-11. The two Doppler locations generated by the Sarsat-8 pass are shown as the two red triangles. The two Doppler locations generated by the Sarsat-11 pass are shown as the two purple triangles. As both sets of Doppler positions match, neither location is confirmed.

6.8 A Ship Security Alert

SSAS (Ship Security Alert System) beacons are processed in the same manner as EPIRBs, ELTs and PLBs, except that the SIT 185 message is not sent to the SAR Service associated with the beacon location; instead, the SIT 185 message is sent to the Competent Authority in the country of registration. Typically, the Competent Authority has a security focus rather than the rescue focus of a SAR Service.

In the following example of a ship security alert, the beacon is first detected as an unlocated initial alert and then as an initial located alert with two Doppler locations.

6.8.1 An Unlocated Ship Security Alert

```
1.  SHIP SECURITY COSPAS-SARSAT INITIAL ALERT(UNLOCATED)
2.  MSG NO 00285  AUMCC REF 401917C900FFBFF
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE STANDARD LOCATION - SHIP SECURITY
    MMSI LAST 6 DIGITS 573000
    HEX ID 401917C900FFBFF
    COUNTRY OF BEACON REGISTRATION 512/NEWZEALAND
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY EXTERNAL DEVICE
4.  ALERT POSITION INFORMATION
      DETECTED AT 07 JAN 19 2020 UTC BY GEOSAR GOES 17
5.  OTHER INFORMATION
    LUT ID 5123
    DETECTION FREQUENCY 406.0278 MHZ
6.  REMARKS
    THIS IS A SHIP SECURITY ALERT.
    PROCESS THIS ALERT ACCORDING TO RELEVANT SECURITY REQUIREMENTS.
END OF MESSAGE
```

Notes:

1. This is an example of a ship security alert transmitted to a competent authority. MCCs would transmit this alert to the AUMCC for forwarding to the New Zealand relevant authority irrespective of the location of the alert.
2. The activation type provided in Paragraph 3 will always indicate “MANUAL” for an SSAS beacon, which can only be activated manually.
3. The graphics depiction of this alert is provided in Figure 6.12.

6.8.2 A Ship Security Initial Alert with Positions

An initial located alert is generated for the same beacon with two Doppler locations.

```
1.  SHIP SECURITY COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 00286  AUMCC REF 401917C900FFBFF
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE STANDARD LOCATION - SHIP SECURITY
    MMSI LAST 6 DIGITS 573000
    HEX ID 401917C900FFBFF
    COUNTRY OF BEACON REGISTRATION 512/NEWZEALAND
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY EXTERNAL DEVICE
4.  ALERT POSITION INFORMATION
      DETECTED AT 07 JAN 19 2021 UTC BY LEOSAR SARSAT 13
      DOPPLER A - 29 05 N  090 18 W  PROB 76 PERCENT
      DOPPLER B - 40 13 N  039 02 W  PROB 24 PERCENT
5.  OTHER INFORMATION
    THE B POSITION IS LIKELY TO BE AN IMAGE POSITION
    DETECTION FREQUENCY 406.0278 MHZ
6.  REMARKS THIS IS A SHIP SECURITY ALERT.
    PROCESS THIS ALERT ACCORDING TO RELEVANT SECURITY REQUIREMENTS.
END OF MESSAGE
```

Notes:

1. A second alert was received for this beacon incident. A ship security alert is processed like any other beacon incident except that the SIT 185 message is sent to the Competent Authority for the country of registration.
2. This ship security beacon has the capability to provide a GNSS position (as it is coded with a Location protocol) but in this case, no GNSS position was transmitted in the beacon message received by the LEOLUT.
3. Doppler position B with 24% probability has been further identified as being the likely image position given the initial GEOSAR detection. See the graphics in Figure 6.12.

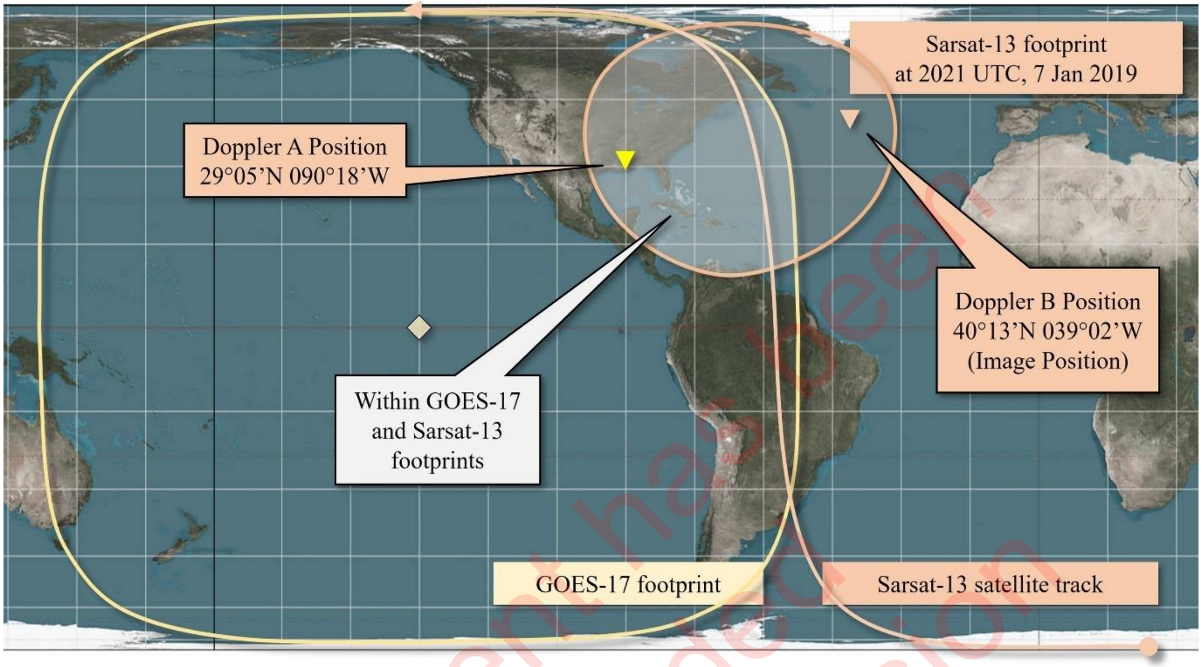


Figure 6.12: Ship Security Unlocated and Initial Alert

In the Figure 6.12 above, the orange line indicates the track of LEOSAR satellite Sarsat-13. The orange area is the footprint of Sarsat-13 at the TCA for the beacon. The GOES-17 footprint is indicated by the yellow line. The section of the Sarsat-13 footprint that overlaps with the GOES-17 footprint is shaded in light grey. The Doppler B location generated by the Sarsat-13 pass is outside the GOES-17 footprint, and hence, is reported as likely to be the image position.

An Alert with an Invalid Beacon Message

A beacon message is invalid when a LUT is unable to correct errors in the beacon message or the MCC detects an invalid value associated with the beacon message. All the fields in an invalid beacon message are omitted or reported as "NIL" in the SIT 185 message, except for
6.9 the Hex ID which (even though it is reported) may also be invalid. Any DOA or Doppler location data is valid and is reported in the SIT 185 message.

6.9.1 An Alert with an Invalid Beacon Message

```
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 79416  AUMCC REF 7722B4600017491
3.  BEACON MESSAGE INFORMATION
    DATA DECODED FROM THE BEACON MESSAGE IS NOT RELIABLE
    HEX ID 7722B4600017491
4.  ALERT POSITION INFORMATION
    DETECTED AT 09 JUN 21 0701 UTC BY LEOSAR COSPAS 14
      DOPPLER A - 18 36.66 S  146 11.05 E  PROB 66 PERCENT
      DOPPLER B - 13 02.22 S  171 15.38 E  PROB 34 PERCENT
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0367 MHZ
6.  REMARKS NIL
END OF MESSAGE
```

Notes:

1. Despite the error detection and correction capability of the system, the LUT was not able to correct all errors in the beacon message received for this particular detection. As a consequence, Paragraph 3 indicates that the decoded data is not reliable and the various beacon message fields are omitted because they are not reliable.
2. Note that the Hex ID of the beacon 7722B4600017491 decodes as an Orbitography beacon with an invalid country code which suggests the Hex ID is invalid and should be treated with caution by an RCC. The Hex ID for every invalid beacon message should be treated with caution, since the invalid information may not be evident from the decoded Hex ID.
3. The invalid beacon message does not imply that the Doppler location is invalid as the
6.10 Doppler location is generated from the beacon transmission, not the contents of the beacon message. The Doppler location in alerts with an invalid beacon message has been used to rescue persons in distress.

An Alert with a Satellite Manoeuvre Warning

The Cospas-Sarsat LEOSAR satellites sometimes have to undergo a manoeuvre to adjust the orbit of the satellite. After the satellite orbit has changed, LEOLUTs may have inaccurate orbit information for the satellite and may generate a position that is outside normal accuracy. A warning is included in SIT 185 messages for 24 hours after a satellite manoeuvre when the expected error for Doppler positions computed with data from a manoeuvred satellite may exceed ten (10) kilometres.

6.10.1 An Initial Alert (with a Satellite Manoeuvre Warning)

An initial alert has been generated for the beacon with Hex ID: BEEE43A58C0022D but the satellite used to determine the position has recently undergone a manoeuvre for which the maximum expected impact in Doppler location accuracy has exceeded ten (10) kilometres within 24 hours of this manoeuvre.

```
1.  DISTRESS COSPAS-SARSAT INITIAL LOCATED ALERT
2.  MSG NO 76380  AUMCC REF BEEE43A58C0022D
3.  BEACON MESSAGE INFORMATION
    BEACON TYPE SERIAL USER LOCATION - EPIRB (NON FLOAT FREE)
    SERIAL NO 0059747
    HEX ID BEEE43A58C0022D
    COUNTRY OF BEACON REGISTRATION 503/AUSTRALIA
    BEACON NUMBER ON AIRCRAFT OR VESSEL NIL
    HOMING SIGNAL 121.5 MHZ
    ACTIVATION TYPE MANUAL
    GNSS POSITION PROVIDED BY NIL
    EMERGENCY CODE NIL
4.  ALERT POSITION INFORMATION
      DETECTED AT 14 JAN 15 2310 UTC BY LEOSAR SARSAT 11
      GNSS - NIL
      MCC REFERENCE - NIL
      DOPPLER A - 39 15.04 S  151 15.77 E  PROB 54 PERCENT
      DOPPLER B - 37 56.05 S  144 36.48 E  PROB 46 PERCENT
5.  OTHER INFORMATION
    RELIABILITY OF DOPPLER POSITION DATA SUSPECT DUE TO
    SATELLITE MANOEUVRE
    DETECTION FREQUENCY 406.0280 MHZ
    TAC 0139
    BEACON MODEL - STANDARD COMMS, AUSTRALIA MT400
6.  REMARKS NIL
END OF MESSAGE
```


Notes:

1. This alert was generated within 24 hours of a manoeuvre of the Sarsat-11 satellite and contains a related warning in Paragraph 5.

6.11 An Interferer Alert

An interferer is a signal transmitting between 406.0 to 406.1 MHz that does not have the correct signal structure for a Cospas-Sarsat distress beacon. Interferers with a location are reported to the appropriate spectrum authority. While there is no defined SIT 185 message format for reporting interferer alerts, the sample message below is provided per national procedure.

6.11.1 An Initial Interferer Alert

```
1.  DISTRESS COSPAS-SARSAT 406 MHZ INTERFERER ALERT
2.  MSG NO 37533 THMCC REF 88047/88048
3.  BEACON MESSAGE INFORMATION
    HEX ID NIL
4.  ALERT POSITION INFORMATION
    DETECTED AT 16 MAY 13 0311 UTC BY LEOSAR SARSAT 13
      DOPPLER A - 17 40 N  096 11 E PROB 50 PERCENT
      DOPPLER B - 16 59 N  099 34 E PROB 50 PERCENT
5.  OTHER INFORMATION
    DETECTION FREQUENCY 406.0170 MHZ
6.  REMARKS
    PLEASE ADVISE YOUR SPECTRUM AGENCY OF ANY PERSISTENT INTERFERER
END OF MESSAGE
```

Note:

1. An interferer does not have a Hex ID, so no Hex ID is provided in Paragraph 3. An interferer reference number is provided in Paragraph 2.
2. The comments in Paragraph 6 request that the spectrum agency be advised of persistent interferers.

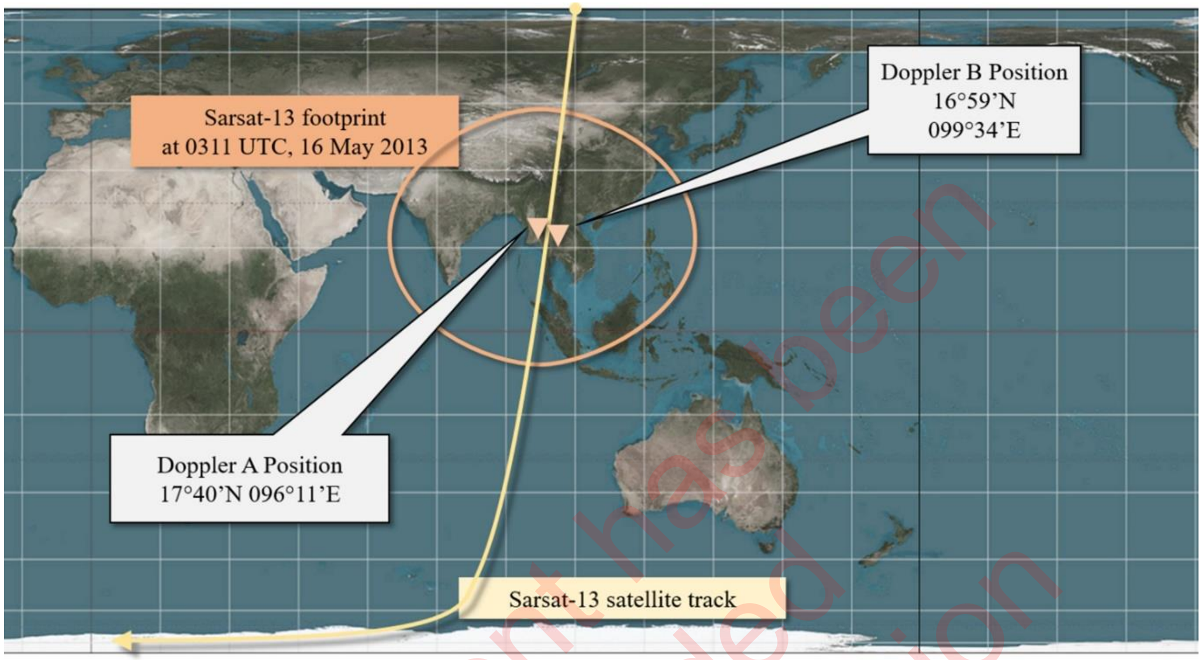


Figure 6.13: 406-MHz Interferer Alert

In the Figure 6.13 above, the yellow line marks the track of LEOSAR satellite Sarsat-13. The footprint for Sarsat-13 at the TCA for the interferer detection is shown by the orange outline. The two Doppler locations for the interferer are shown.

- END OF SECTION 6 –

7 FREQUENTLY ASKED QUESTIONS

7.1 What is the difference between an RCC and a SPOC?

Answer: An RCC is a Rescue Coordination Centre and provides a SAR response within a declared SAR region designated by IMO and ICAO. Cospas-Sarsat uses the term SPOC (SAR Point of Contact) as a generic term to refer to the SAR agencies sent SIT 185 alerts by an MCC. Many but not all SPOCs are RCCs. The list of SPOCs with their contact details is available on the Cospas-Sarsat website.

7.2 What Cospas-Sarsat training is available for Distress authority personnel?

Answer: Cospas-Sarsat document C/S P.015 includes a description of a model Cospas-Sarsat training course for SAR Service personnel.

7.3 My Distress authority needs to discuss the contents of a Cospas-Sarsat distress alert with an MCC. Where can it find contact information for the MCC?

Answer: The contact information for MCCs is provided on the Cospas-Sarsat website (www.cospas-sarsat.int).

7.4 My Distress authority has a question on a particular aspect of the Cospas-Sarsat system and is unable to find the answer in the Handbook. Who should the Distress authority contact to discuss the matter?

Answer: The Distress authority should contact its supporting MCC in the first instance for assistance. To establish your supporting MCC check Annex C and then the Cospas-Sarsat website (www.cospas-sarsat.int) for the MCC contact details.

7.5 What is the Hex ID? Why does a Distress authority need to know this Hex ID when the serial identity of the beacon is provided in Paragraph 3 in a manner that can be clearly understood by Distress authority personnel?

Answer: See section 2.4 for an explanation of Hex ID. MCCs worldwide use this Hex ID in the main to refer to a beacon and to undertake searches for specific beacon activations in their system. It should be noted that the Hex ID is unique and no two identical Hex IDs should exist on two different beacons. Furthermore, most 406 MHz beacon registration databases use the Hex ID as the primary field. Distress authority personnel will facilitate discussions with MCCs on distress alerts if reference is made to the Hex ID. The serial identity provided for some beacon protocols in Paragraph 3 of the alert message received by the Distress authority is decoded from the Hex ID and provides information in respect of the beacon coding protocol used, the beacon type and the specific identity of the source or carrier, such as the Callsign.

7.6 How can I decode the 15 character Hex ID?

Answer: There are several stand-alone programs available for this purpose. The Cospas-Sarsat website provides an online capability.

7.7 Why has the Distress authority received a MEOSAR alert but not a LEOSAR alert for a beacon? Why does the LEOSAR system sometimes detect a beacon but not the MEOSAR system?

Answer: The system may provide a MEOSAR detection but not a LEOSAR detection if there is no LEOSAR satellite that has passed over the beacon. The LEOSAR satellites do not continuously cover the surface of the earth, but each LEOSAR satellite covers the earth in approximately 12 hours. Alternatively, a LEOSAR satellite may have passed over the beacon, but the beacon transmission may have been shielded from the LEOSAR satellite, such as when the beacon is in a mountainous region, a canyon or gorge.

The LEOSAR satellites have a lower altitude orbit (between 700 and 1000 kilometres) so are able to detect weaker signals than the MEOSAR satellites which have an altitude of 19,000 to 24,000 kilometres. The weaker signal may be due to a damaged beacon or shielding if the beacon is activated indoors for example.

7.8 The Distress authority has received multiple CONFLICT alerts for the same LEOSAR beacon event, i.e., same satellite, same beacon Hex ID and same TCA (± 20 minutes). Why is this?

Answer: In all probability, the alerts are from different LEOLUTs, albeit the same beacon event. Different LEOLUTs may generate different Doppler locations because different beacon bursts were available from the satellite due to the different LEOLUT locations, detection capability or time of acquisition. Different processing algorithms or orbital configuration data could result in different Doppler locations, even when two LEOLUTs use the same beacon bursts. A subsequent Doppler position conflict alert for the same beacon event is transmitted unless the new alert is determined to be of poorer quality.

7.9 The TCA in the LEOSAR distress alert just received is some four (4) hours old. Why is this?

Answer: This happens when a LEOLUT tracks a particular satellite which it had not tracked for many hours and receives the recorded detection from an earlier orbit. It is assumed that the beacon had not been detected on subsequent passes by that particular satellite.

7.10 Position update alerts are being received multiple times after position confirmation, but the MCC reference position provided is changing. Why is this? Furthermore, why is the GNSS position remaining constant during this exchange?

Answer: In some MCCs, an MCC reference position is calculated based on the most current location data and the historical locations that meet the distance matching criterion. The MCC reference position may be biased to the location with the smaller likely error. No two locations will be identical even when the same data from a satellite is used for processing. The GNSS position will remain constant if it was received from an external source that is not providing updates, if the beacon is not designed to provide updates (likely an older beacon model), or if a Location Protocol beacon's location has not changed by at least four (4) seconds of latitude and longitude. (Since its component longitude and latitude are each rounded to the nearest four (4) seconds, a Location Protocol beacon's position could change by nearly six (6) seconds without a change in the GNSS position; i.e., Square Root of (4*4 + 4*4) = 5.66.)

7.11 Paragraph 5 of a Cospas-Sarsat distress alert reports that the Doppler A position is probably the image location, and it has a probability of 79%. Does this mean that B position is confirmed? Furthermore, why is the A position with a higher probability considered the image position? Is there a problem with the location processing?

Answer: The determination that one position is probably an image does not indicate that the other position is confirmed; confirmation of a Doppler location only occurs by matching it with independent locations. On occasion, the Doppler location with the lesser probability is in fact the real position of the distress, so this should not be construed as an anomaly. The reference to "image position" is made when one position in a Doppler solution is within the footprint of another satellite that detected the beacon, and the other Doppler position is not within the satellite footprint.

7.12 The SAR Service has received a 406 MHz interferer alert. What should the RCC do with this information?

Answer: Persistent 406 MHz interferer transmissions negatively impact the Cospas-Sarsat system and should be turned off. They should be reported to the national spectrum agency, who may deal with them directly (for internal sources) or report them to the ITU (for foreign sources). More information on 406 MHz interference is provided in the Cospas-Sarsat document C/S A.003, "Cospas-Sarsat System Monitoring and Reporting".

7.13 What does it mean when the alert states that the GNSS position update time is within four (4) hours of detection time? Why isn't a precise time provided?

Answer: Unfortunately, the time associated with the GNSS position is not part of the beacon transmission as there are not enough data bits available to transmit the time. The alert states that the location was updated within four (4) hours of the detection time because the 406 MHz Beacon Specification (C/S T.001) requires that GNSS position not be transmitted if it has not been updated within four (4) hours.

An alert indicating an "internal" source for the GNSS position is likely within a few minutes of the detection time (although the beacon is not required to update its GNSS position). In addition, when the GNSS position changes on a subsequent alert, the update time of the GNSS position is between the two reported detection times.

7.14 The alert provides 6 Hex characters for an ELT 24-bit address. What is the 24-bit address and how is it useful to a SAR Service? Is there a database that lists all these six (6) Hex characters?

Answer: The aircraft 24-bit address is used in applications which require the routing of information to or from individual, suitably equipped aircraft. Examples of this are the aeronautical fixed telecommunication network (AFTN), SSR Mode S, and the airborne collision avoidance system (ACAS). The 24-bit address transmitted by an ELT is expressed as six hexadecimal characters in the distress alert and can be used to identify the precise aircraft provided an appropriate database is maintained. The 24-bit address can also identify the country that assigned it, and thus assist an RCC in its fact-finding efforts. The allocation of 24-bit aircraft addresses, formerly known as Mode S addresses, is described in the ICAO convention, Chapter 9 of Annex 10, Volume III. Alternatively, contact your State-aircraft-registration authority.

7.15 How is it useful for the Distress authority to be notified that the GNSS position was provided by an external device? Is it useful for the Distress authority to know that the activation type is "NIL"?

Answer: The advice that the GNSS position is provided by an external device indicates that the beacon does not have an integral GNSS which can provide updated positions as long as the beacon remains active. An external input from a ship's or aircraft's GNSS (or other navigation system) will indicate that the GNSS position is unlikely to be updated after initial activation (as the beacon is usually separated from the external input).

The activation type is only available with the user protocol and not supported in any of the location protocols. A manual activation type indicates that the beacon was activated by a survivor. A manual or automatic activation type indicator is probably not useful.

7.16 Paragraph 3 of the Cospas-Sarsat distress alert provides information on "beacon number on aircraft or vessel". What is the significance of this information? Why does this Paragraph often indicate "NIL" or "0" (zero)?

Answer: Certain beacon coding protocols, e.g., Maritime User and Radio Callsign User protocols, allow multiple beacons to be coded with the same callsign or MMSI. In order to differentiate between these beacons on board the same vessel and to provide a unique Hex ID, the beacon is coded with a specific beacon number, 0 to 9 and A to Z. If the vessel carries only one such coded beacon, then the specific number will be zero. Receiving a distress alert with the specific beacon number given as, say 1, indicates that there are additional beacons on board the vessel.

7.17 The Distress authority has received an alert for the first time for a beacon indicating a position conflict alert. How is this possible when the Distress authority did not receive a prior alert?

Answer: For non-SSAS alerts, the initial alert might have been transmitted to another SAR Service because the initial location or locations were in that SAR Service's

SRR. The subsequent alert, which is in conflict, contains positions in the subject SAR Service's SRR.

Alternatively, the position conflict alert sent to the Distress authority may contain a GNSS position that does not match either the DOA or Doppler location in the alert.

7.18 The Distress authority has reported that it has received message number 00533 from its support MCC as per Paragraph 2 of the distress alert message. However, the previous message number received was 00530. The Distress authority wishes to account for all messages and requests an explanation.

Answer: A communication problem could cause messages to be missed. The Distress authority should request the support MCC to retransmit any missing messages.

7.19 Why does the MCC send regular communication checks to my SAR Service? Should I respond to the communication check?

Answer: The IMO and ICAO have noted that there are known and documented problems in regard to SAR Services initiating SAR action in response to Cospas-Sarsat distress alerts. It was further noted that there were cases where the Cospas-Sarsat System successfully delivered distress alerts but the SAR Service did not respond. It was recognised that the fault lay in the SAR response system and not with the delivery of alerts by Cospas-Sarsat MCCs.

For this reason, IMO and ICAO have requested that Cospas-Sarsat MCCs undertake regular communication checks with the SAR Services they support.

SAR Services should respond promptly to the MCC when they receive a communication check.

7.20 Are there examples of how independence is determined when matching locations?

Answer: Here are some examples of how an MCC determines if two locations can be used to determine a matching location:

A GNSS position from a MEOLUT and a GNSS position from a LEOLUT can not confirm location, even if the two GNSS positions are the same, as the two GNSS positions come from the same source (the beacon) and can never be assumed to be independent.

A Doppler location and a GNSS position confirm a location if the two locations match (i.e., are within 20 kilometres of each other) as a Doppler location and a GNSS position are independent of each other.

Data from LEOSAR satellite Sarsat-10 gives two Doppler locations (L1 and L2) and DOA data from a MEOLUT gives location L3. If L1 and L3 match, then the MCC will provide an MCC reference position derived from L1 and L3.

A Doppler location generated by satellite Sarsat-12 from one LEOLUT and a Doppler location generated by satellite Sarsat-12 with the same TCA from a different

LEOLUT would not confirm the location as the Doppler locations are from the same beacon event.

Data from LEOSAR satellite Sarsat-12 gives two Doppler locations (L1 and L2) and data from LEOSAR satellite Sarsat-12 gives two Doppler locations (L3 and L4). If the second pair of locations have a different TCA (i.e., are from a different satellite pass) and only L1 and L3 match, then the location is confirmed. The MCC will provide an MCC reference position derived from L1 and L3.

Data from LEOSAR satellite Sarsat-10 gives two Doppler locations (L1 and L2) and data from LEOSAR satellite Sarsat-12 gives two Doppler locations (L3 and L4), and there are two matches, both L1 and L3, as well as L2 and L4. This situation is known as an Unresolved Doppler Match and the second pair of Doppler locations does not confirm a location.

A DOA location with three satellites (X1, X2, X3) with time T1 and a DOA location with four satellites (X2, X3, X6, X7) with time T2. If the two locations match, then if the times are not within two (2) seconds and as each satellite set has a unique satellite combination (X1 is not in the second set and X6 is not in the first set), the location is confirmed.

A DOA location with three satellites (X1, X2, X3) with time T1 and a DOA location with four satellites (X1, X2, X3, X4) with time T2. If the times are within 30 minutes, then as the satellite sets are not different (the first set of satellites is contained in the second set) the location is not confirmed, even if the two locations match. If two DOA locations match and the data times for the two alerts differ by at least 30 minutes, then the location is confirmed, regardless of the sets of satellites.

Data from a LEOLUT gives two Doppler locations: the A-position has a probability of 97% and the B-location has a probability of 3%. Despite the strong indication that the A-position is the real location of the beacon, the location is not confirmed as in some cases the location of the beacon will be the B-position.

An MCC may be able to use footprint information to indicate which of two Doppler locations is likely to be the image location (i.e., the location that is not the location of the beacon). For example, if a beacon is detected by a GEOSAR satellite and there are two Doppler locations from a LEOSAR detection, and if one location is outside the footprint of the GEOSAR satellite, then it is likely that this is the image location. Despite this information, footprint determination is not used to confirm a location. See section 6.2 for an example of this processing.

7.21 How is the nine-digit MMSI formed using the six digits provided in a SIT 185?

<u>Answer:</u> For beacons coded with an MMSI protocol, Paragraph 3 of the SIT 185 provides the last six digits of the Maritime Mobile Service Identity (MMSI). The nine-digit MMSI is formed by adding the six digits to the country code provided in the country of registration field.

Note that some countries have more than one country code (known as the Maritime Identification Digits (MID)). For example, Panama has seven country codes, so there could be seven nine-digit MMSIs with the same last six digits provided in Paragraph

3. If the beacon has not been correctly coded with correct MID, then the resulting nine-digit MMSI will not be correct.

Similarly, it is possible that a beacon with a particular MMSI is transferred to a different vessel without the beacon being re-programmed with the MMSI of the new vessel. Incidents have occurred where a beacon with an MMSI has been activated that does not match the MMSI of the vessel in distress.

7.22 Why does a beacon take 50 seconds to transmit its first burst once activated?

Answer: The current generation of Cospas-Sarsat beacons are designed to have a warm-up time to allow the oscillator frequency to stabilize before the beacon begins transmitting. For the LEOSAR system, an unstable oscillator frequency would probably generate an inaccurate location estimate.

The proposed specification for the next generation of Cospas-Sarsat beacons (which was still being developed in 2022) will require transmission of the first burst shortly after beacon activation.

7.23 What is the difference between a coarse GNSS position and a refined GNSS position?

Answer: The data transmitted in the message from a distress beacon includes error-correcting codes that allow a LUT to fix some errors in the data. The data from a beacon has two components known as PDF-1 (Protected Data Field 1) and PDF-2 (Protected Data Field 2). A beacon message may have a valid PDF-1 but an invalid PDF-2 that cannot be corrected by the error-correcting codes.

A beacon message with a valid PDF-1 that contains GNSS position, and an invalid PDF-2 will provide a coarse GNSS position. The coarse GNSS position is less accurate than the refined GNSS position that is provided when both data fields are valid.

For example, consider a beacon with a National Location protocol with the GNSS position (33 23.73 S, 150 19.60 E). The GNSS position is contained in the beacon message as a coarse GNSS position (33 24.00 S, 150 18.00 E) with an adjustment of -0.27 minute latitude and +1.6 minute longitude. The coarse location is contained in the PDF-1 field and the fine adjustment is contained in the PDF-2 field. If the PDF-1 field is valid but the PDF-2 field is invalid (as it has too many errors), the GNSS position will be reported in the SIT 185 message as (33 24.00 S, 150 18.00 E). If the LUT detects a later transmission that has valid PDF-1 and PDF-2 fields, then the refined GNSS position of (33 23.73 S, 150 19.60 E) will be sent to the MCC.

The alert message sent from an MCC to a Distress authority indicates the precision for a GNSS position.

7.24 Could the following confusing incident be explained? The New Zealand RCC received an initial alert for beacon 400E70784B59A9F with two Doppler locations and no GNSS position and later received a position confirmed alert for beacon 400E70784AFFBFF containing a Doppler location and a GNSS position

that matched, and an MCC reference position. The MCC reference position was near one of the Doppler locations in the initial alert. Were two beacons active? If it was the same beacon, why were the Hex IDs different (but similar) and why did the first detection not have a GNSS position?

Answer: There was only one beacon in this incident. The initial alert contained a warning in Paragraph 3 that the data decoded from the beacon message was not reliable. For this reason, the GNSS position, which is part of the beacon message, was suppressed and not included in the first SIT 185 message sent to the New Zealand RCC.

When a LUT receives a beacon message, it performs processing on the data to produce the Hex ID. As the first beacon message was invalid, the LEOLUT did not perform the processing on the Hex ID and this is why it is different (but similar) to the Hex ID in the position confirmed alert. Any Hex ID associated with a SIT 185 with a warning that the data is not reliable should be treated with caution by a Distress authority. Although the data in a beacon message may be invalid, the Doppler or DOA locations in such a message are valid, as demonstrated in this incident, as one of the Doppler locations in the initial alert was very near the actual location of the beacon.

7.25 Where can a SAR Service get more information about the Return Link Service function in the MEOSAR system?

Answer: The Return Link Service (RLS) is described in a video available at https://www.cospas-sarsat.int/en/search-and-rescue/programme-videos-en. A SAR Service should contact its supporting MCC to obtain more information about the RLS.

7.26 What is the difference between an LG MCC and an LGM MCC?

Answer: An LG MCC is an MCC that is only capable of processing LEOSAR and GEOSAR data. An LGM MCC is an MCC that is capable of processing LEOSAR, GEOSAR and MEOSAR data.

MEOSAR is the most recent satellite system added to the Cospas-Sarsat system. Before the introduction of MEOSAR, all MCCs were LG MCCs. An LG MCC must be upgraded and commissioned in order to become an LGM MCC.

7.27 Why does my Distress authority receive multiple DOA position update alerts with the same detection time (as reported in Paragraph 3 of the SIT 185 message)?

Answer: This could occur for two reasons:

1) The new alert contains a DOA position with better expected accuracy, as indicated in Paragraph 4.

2) While the new alert contains the same first detection time (per Paragraph 4), the new alert contains new detection data, as indicated by the last detection time reported

in the subsequent data line. An updated DOA position alert is sent if the new alert contains data that is newer than data in all previous alerts, by at least five (5) minutes before position confirmation and at least 15 minutes after position confirmation.

- END OF SECTION 7 –

ANNEX A

ACRONYMS AND TERMINOLOGY

ACRONYM	TERMINOLOGY
ACAS	Airborne Collision Avoidance System
AFTN	Aeronautical Fixed Telecommunication Network
ALMCC	Algeria Mission Control Centre
ARMCC	Argentina Mission Control Centre
ASMCC	South Africa Mission Control Centre
AUMCC	Australia Mission Control Centre
BRMCC	Brazil Mission Control Centre
BT	Begin Transmission
C/S	Cospas-Sarsat
CDDR	Central Data Distribution Region
CHMCC	Chile MCC
CMC	Cospas Mission Centre (Russian Federation)
CMCC	Canada Mission Control Centre
CNMCC	China Mission Control Centre
COSPAS	*Cosmicheskaya Sistema Poiska Avariynich Sudov* (Russian for Space System for the Search of Vessels in Distress)
CSTA	Cospas-Sarsat Type Approval
CYMCC	Cyprus Mission Control Centre
DDP	Data Distribution Plan
DDR	Data Distribution Region
DOA	Difference of Arrival
EDDR	Eastern Data Distribution Region
EHE	Expected Horizontal Error
ELT	Emergency Locator Transmitter
ELT(DT)	Emergency Locator Transmitter for Distress Tracking
EPIRB	Emergency Position-Indicating Radio Beacon
FMCC	France Mission Control Centre
FOA	Frequency of Arrival
GADSS	Global Aeronautical Distress and Safety System
Galileo	European global navigation satellite system
GEOLUT	Local User Terminal for GEOSAR
GEOSAR	Geostationary Earth Orbit Search and Rescue
GHz	Giga Hertz
GLONASS	Russian global navigation satellite system
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satellite System
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System (USA)
GRMCC	Greece Mission Control Centre
Hex ID	Hexadecimal identifier

ACRONYM	TERMINOLOGY
HKMCC	Hong Kong Mission Control Centre
IAMSAR	International Aeronautical and Maritime Search and Rescue
IBRD	International Beacon Registration Database
ICAO	International Civilian Aviation Organization
IDMCC	Indonesia Mission Control Centre
IMO	International Maritime Organization
INMCC	India Mission Control Centre
INSAT	Indian Satellite
ITMCC	Italy Mission Control Centre
ITU	International Telecommunication Union
JAMCC	Japan Mission Control Centre
JRCC	Joint Rescue Coordination Centre
KOMCC	Korea Mission Control Centre
LEOLUT	Local User Terminal for LEOSAR
LEOSAR	Low-altitude Earth Orbit Search and Rescue
LP-STD	Location Protocol - Standard
LUT	Local User Terminal
LUT ID	Local User Terminal Identifier
MCC	Mission Control Centre
MEOLUT	Local User Terminal for MEOSAR
MEOSAR	Medium-altitude Earth Orbit Search and Rescue
MHz	Mega Hertz
MID	Maritime Identification Digits
MMSI	Maritime Mobile Service Identity
MSG	Message
MSG	Meteosat Second Generation (EUMETSAT Satellite)
MTG	Meteosat Third Generation (EUTMETSAT Satellite)
MYMCC	Malaysia Mission Control Center
NM	Nautical Mile
NMCC	Norway Mission Control Centre
NMS	Nautical Miles
NOCR	Notification of Country of Registration
NIMCC	Nigeria Mission Control Centre
NWPDDR	North-West Pacific Data Distribution Region
PAMCC	Pakistan Mission Control Centre
PDF	Protected Data Field
PEMCC	Peru Mission Control Centre
PLB	Personal Locator Beacon
QAMCC	Qatar Mission Control Center
RCC	Rescue Coordination Centre
REF	Reference
RLM	Return Link Message
RLS	Return Link Service

ACRONYM	TERMINOLOGY
RLSP	Return Link Service Provider
SAMCC	Saudi Arabia Mission Control Center
SAR	Search and Rescue
SARP	Search and Rescue Processor
SARR	Search and Rescue Repeater
SARSAT	Search and Rescue Satellite-Aided Tracking
SCDDR	South Central Data Distribution Region
SID	Standard Interface Description
SIMCC	Singapore Mission Control Centre
SIT	Subject Indicator Type
SOLAS	Safety of Life at Sea
SPMCC	Spain Mission Control Centre
SPOC	Search and Rescue Point of Contact
SRR	Search and Rescue Region
SSAS	Ship Security Alert System
SSR	Secondary Surveillance Radar
SWPDDR	South-West Pacific Data Distribution Region
TAC	Type-Approval Certificate (number)
TAMCC	ITDC Mission Control Centre (Chinese Taipei)
TCA	Time of Closest Approach
TDOA	Time Difference of Arrival
TGMCC	Togo Mission Control Center
THMCC	Thailand Mission Control Centre
TOA	Time of Arrival
TRMCC	Turkey Mission Control Centre
UKMCC	United Kingdom of Great Britain and Northern Ireland Mission Control Centre
USMCC	USA Mission Control Centre
UTC	Universal Coordinated Time
VNMCC	Vietnam Mission Control Centre
WDDR	Western Data Distribution Region

Abbreviations and acronyms used in this document are also defined in document C/S S.011 "Cospas-Sarsat Glossary", available on the Cospas-Sarsat website at https://www.cospas-sarsat.int/en/documents-pro/system-documents

- END OF ANNEX A –

ANNEX B

LIST OF MID (COUNTRY CODES)

This table is a copy of the list of MID (Maritime Identification Digits) on the Cospas-Sarsat website (as of 1 December 2021) (see also ITU website at https://www.itu.int/en/ITU-R/terrestrial/fmd/Pages/mid.aspx).

Name	MID	Abrv 3	Abrv 10
Adelie Land	501	ADE	ADELIELAND
Afghanistan	401	AFG	AFGHAN
Alaska (State of) (USA)	303	ALA	ALASKA
Albania	201	ALB	ALBANIA
Algeria	605	ALG	ALGERIA
American Samoa	559	ASA	SAMOA USA
Andorra	202	AND	ANDORRA
Angola	603	ANG	ANGOLA
Anguilla	301	ANA	ANGUILLA
Antigua and Barbuda	304	ANT	ANTIGUA
Antigua and Barbuda	305	ANT	ANTIGUA
Argentina	701	ARG	ARGENTINA
Armenia	216	ARM	ARMENIA
Aruba	307	ARU	ARUBA
Ascension Island	608	ASC	ASCENSION
Australia	503	AUS	AUSTRALIA
Austria	203	AUT	AUSTRIA
Azerbaijan	423	AZR	AZERBAIJAN
Azores	204	AZC	AZORES
Bahamas	308	BAA	BAHAMAS
Bahamas	309	BAA	BAHAMAS
Bahamas	311	BAA	BAHAMAS
Bahrain	408	BAH	BAHRAIN
Bangladesh	405	BAN	BANGLADESH
Barbados	314	BAR	BARBADOS
Belarus	206	BLR	BELARUS
Belgium	205	BEL	BELGIUM
Belize	312	BEZ	BELIZE
Benin	610	BEN	BENIN
Bermuda	310	BER	BERMUDA
Bhutan	410	BHU	BHUTAN
Bolivia	720	BOL	BOLIVIA
Bosnia and Herzegovina	478	BOS	BOSNIAHERZ
Botswana	611	BOT	BOTSWANA
Brazil	710	BRA	BRAZIL

Name	MID	Abrv 3	Abrv 10
British Virgin Islands	378	BVI	VIRGIN GB
Brunei Darussalam	508	BRU	BRUNEI
Bulgaria	207	BUL	BULGARIA
Burkina Faso	633	BUF	BURKINA FS
Burundi	609	BUI	BURUNDI
Cambodia	514	CMB	CAMBODIA
Cambodia	515	CMB	CAMBODIA
Cameroon	613	CAM	CAMEROON
Canada	316	CAN	CANADA
Cape Verde	617	CAP	CAPE VERDE
Cayman Islands	319	CAY	CAYMAN IS
Central African Republic	612	CAR	CENAFR REP
Chad	670	CHA	CHAD
Chile	725	CHI	CHILE
China	414	CHN	CHINA
China	412	CHN	CHINA
China	413	CHN	CHINA
Chinese Taipei	416	TAI	TAIPEI
Christmas Island	516	CHR	CHRISTMAS
Cocos (Keeling) Islands	523	COC	COCOS ISLE
Colombia	730	COL	COLOMBIA
Comoros	620	COM	COMOROS
Comoros	616	COM	COMOROS
Congo	615	CON	CONGO
Cook Islands	518	COO	COOK ISLES
Costa Rica	321	COS	COSTA RICA
Côte d'Ivoire (Ivory Coast)	619	IVO	IVORY COAST
Croatia	238	CRT	CROATIA
Crozet Archipelago	618	CRP	CROZET
Cuba	323	CUB	CUBA
Cyprus	209	CYP	CYPRUS
Cyprus	210	CYP	CYPRUS
Cyprus	212	CYP	CYPRUS
Czech Republic	270	CZH	CZECH REP
Democratic People's Republic of Korea	445	KDR	KOREA NOR
Democratic Republic of the Congo	676	ZAI	ZAIRE
Denmark	219	DEN	DENMARK
Denmark	220	DEN	DENMARK
Djibouti	621	DJI	DJIBOUTI
Dominica	325	DOM	DOMINICA
Dominican Republic	327	DOR	DOMINICAN
Ecuador	735	ECU	ECUADOR

Name	MID	Abrv 3	Abrv 10
Egypt	622	EGY	EGYPT
El Salvador	359	ELS	ELSALVADOR
Equatorial Guinea	631	EQG	EQ GUINEA
Eritrea	625	ERT	ERITREA
Estonia	276	EST	ESTONIA
Eswatini	669	SWA	ESWATINI
Ethiopia	624	ETH	ETHIOPIA
Falkland Islands (Malvinas)[1]	740	FAL	FALKLAND I
Faroe Islands	231	FAR	FARO ISLE
Fiji	520	FIJ	FIJI
Finland	230	FIN	FINLAND
France	227	FRA	FRANCE
France	226	FRA	FRANCE
France	228	FRA	FRANCE
French Polynesia	546	PLY	POLYNESIA
Gabon	626	GAB	GABON REP
Gambia	629	GAM	GAMBIA
Georgia	213	GOG	GEORGIA
Germany	211	GER	GERMANY
Germany	218	GER	GERMANY
Ghana	627	GHA	GHANA
Gibraltar	236	GIB	GIBRALTAR
Greece	241	GRE	GREECE
Greece	240	GRE	GREECE
Greece	239	GRE	GREECE
Greece	237	GRE	GREECE
Greenland	331	GRN	GREENLAND
Grenada	330	GRA	GRENADA
Guadeloupe (French Dept. of)	329	GUA	GUADELOUPE
Guatemala	332	GUT	GUATEMALA
Guiana (French Dept. of)	745	GUI	GUIANA
Guinea	632	GUN	GUINEA REP
Guinea-Bissau	630	GUB	GUINEA BIS
Guyana	750	GUY	GUYANA
Haiti	336	HAI	HAITI
Honduras	334	HON	HONDURAS
Hong Kong, China	477	HKG	HONG KONG
Hungary	243	HUN	HUNGARY
Iceland	251	ICE	ICELAND

[1] A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and the Northern Island concerning the sovereignty over the Falkland Islands (Malvinas).

Name	MID	Abrv 3	Abrv 10
India	419	IND	INDIA
Indonesia	525	INO	INDONESIA
Iran	422	IRN	IRAN
Iraq	425	IRQ	IRAQ
Ireland	250	IRE	IRELAND
Israel	428	ISR	ISRAEL
Italy	247	ITA	ITALY
Jamaica	339	JAM	JAMAICA
Japan	431	JPN	JAPAN
Japan	432	JPN	JAPAN
Jordan	438	JOR	JORDAN
Kazakhstan	436	KAZ	KAZAKHSTAN
Kenya	634	KEN	KENYA
Kerguelen Islands	635	KER	KERGUELEN
Kiribati	529	KIR	KIRIBATI
Korea (Republic of)	440	KOR	KOREA SOU
Korea (Republic of)	441	KOR	KOREA SOU
Kuwait	447	KUW	KUWAIT
Kyrgyz Republic	451	KYR	KYRGYZIA
Laos	531	LAO	LAO
Latvia	275	LAT	LATVIA
Lebanon	450	LEB	LEBANON
Lesotho	644	LES	LESOTHO
Liberia	636	LIB	LIBERIA
Liberia	637	LIB	LIBERIA
Libya	642	LBY	LIBYA
Liechtenstein	252	LIE	LIECHTEN
Lithuania	277	LIT	LITHUANIA
Luxembourg	253	LUX	LUXEMBOURG
Macao, China	453	MAC	MACAO
Madagascar	647	MAD	MADAGASCAR
Madeira	255	MAE	MADEIRA
Malawi	655	MAW	MALAWI
Malaysia	533	MLY	MALAYSIA
Maldives	455	MAV	MALDIVES
Mali	649	MLI	MALI
Malta	229	MAL	MALTA
Malta	215	MAL	MALTA
Malta	248	MAL	MALTA
Malta	249	MAL	MALTA
Malta	256	MAL	MALTA
Marshall Islands	538	MAR	MARSHALL I

Name	**MID**	**Abrv 3**	**Abrv 10**
Martinique (French Dept. of)	347	MTQ	MARTINIQUE
Mauritania	654	MAA	MAURITANIA
Mauritius	645	MAU	MAURITIUS
Mexico	345	MEX	MEXICO
Micronesia	510	MIC	MICRONESIA
Moldova	214	MOL	MOLDOVA
Monaco	254	MON	MONACO
Mongolia	457	MNG	MONGOLIA
Montenegro	262	MNT	MONTENEGRO
Montserrat	348	MOT	MONTSERRAT
Morocco	242	MOR	MOROCCO
Mozambique	650	MOZ	MOZAMBIQUE
Myanmar	506	BUR	BURMA
Namibia	659	NAM	NAMIBIA
Nauru	544	NAU	NAURU
Nepal	459	NEP	NEPAL
Netherlands (The)	244	NET	NETHERLAND
Netherlands (The)	245	NET	NETHERLAND
Netherlands (The)	246	NET	NETHERLAND
Netherlands Antilles (formerly-). Sint Maarten (Dutch part); Bonaire, Sint Eustatius and Saba; and Curacao	306	NEA	N ANTILLES
New Caledonia	540	NCA	CALEDONIA
New Zealand	512	NZL	NEWZEALAND
Nicaragua	350	NIC	NICARAGUA
Niger	656	NIG	NIGER
Nigeria	657	NIA	NIGERIA
Niue	542	NIU	NIUE ISLE
North Macedonia (Republic of)	274	MKD	NORTH MAC
Northern Mariana Islands	536	MAI	MARIANA IS
Norway	257	NOR	NORWAY
Norway	258	NOR	NORWAY
Norway	259	NOR	NORWAY
Oman	461	OMN	OMAN
Pakistan	463	PAK	PAKISTAN
Palau	511	PAL	PALAU
Palestine	443	PAA	PALESTINE
Panama	373	PAN	PANAMA
Panama	351	PAN	PANAMA
Panama	352	PAN	PANAMA
Panama	353	PAN	PANAMA
Panama	354	PAN	PANAMA

Name	MID	Abrv 3	Abrv 10
Panama	355	PAN	PANAMA
Panama	356	PAN	PANAMA
Panama	357	PAN	PANAMA
Panama	370	PAN	PANAMA
Panama	371	PAN	PANAMA
Panama	372	PAN	PANAMA
Panama	373	PAN	PANAMA
Panama	374	PAN	PANAMA
Papua New Guinea	553	PAP	PAPUA NG
Paraguay	755	PAR	PARAGUAY
Peru	760	PER	PERU
Philippines	548	PHI	PHILIPPINE
Pitcairn	555	PIT	PITCAIRN I
Poland	261	POL	POLAND
Portugal	263	POR	PORTUGAL
Puerto Rico	358	PUE	PUERTORICO
Qatar	466	QAT	QATAR
Réunion (La) (same country code for Mayotte)	660	REU	REUNION
Romania	264	ROM	ROMANIA
Russian Federation	273	RUS	RUSSIA
Rwanda	661	RWA	RWANDA
Saint Kitts and Nevis	341	SKN	ST KITTS
Saint Lucia	343	SLU	ST LUCIA
Saint Paul and Amsterdam Islands	607	SPL	ST PAUL
Saint Vincent and the Grenadines	375	SVG	ST VINCENT
Saint Vincent and the Grenadines	376	SVG	ST VINCENT
Saint Vincent and the Grenadines	377	SVG	ST VINCENT
Samoa	561	WSA	WEST SAMOA
San Marino	268	SAN	SAN MARINO
Sao Tome and Principe	668	SAO	SAO TOME
Saudi Arabia	403	SAU	SAUDI
Senegal	663	SEN	SENEGAL
Serbia	279	SER	SERBIA
Seychelles	664	SEY	SEYCHELLES
Sierra Leone	667	SIL	SIERRA LEO
Singapore	563	SIN	SINGAPORE
Singapore	564	SIN	SINGAPORE
Singapore	565	SIN	SINGAPORE
Singapore	566	SIN	SINGAPORE
Slovak Republic	267	SLV	SLOVAKIA
Slovenia	278	SVN	SLOVENIA

Name	MID	Abrv 3	Abrv 10
Solomon Islands	557	SOL	SOLOMON IS
Somalia	666	SOM	SOMALI
South Africa	601	SAF	SO AFRICA
South Sudan	638	SSD	SOUTHSUDAN
Spain	224	SPA	SPAIN
Spain	225	SPA	SPAIN
Sri Lanka	417	SRI	SRI LANKA
St. Helena	665	SHE	ST HELENA
St. Pierre and Miquelon (French Dept. of)	361	SPI	ST PIERRE
Sudan	662	SUD	SUDAN
Suriname	765	SUR	SURINAME
Sweden	265	SWE	SWEDEN
Sweden	266	SWE	SWEDEN
Switzerland	269	SWT	SWISS
Syria	468	SYR	SYRIA
Tajikistan	472	TJK	TAJIKISTAN
Tanzania	674	TAN	TANZANIA
Tanzania	677	TAN	TANZANIA
Thailand	567	THA	THAILAND
Timor-Leste	550	TIM	TIMORLESTE
Togo	671	TOG	TOGO
Tonga	570	TON	TONGA
Trinidad and Tobago	362	TAT	TRINIDAD
Tunisia	672	TUN	TUNISIA
Turkey	271	TUR	TURKEY
Turkmenistan	434	TKM	TURKMENIST
Turks and Caicos Islands	364	TUK	CAICOS IS
Tuvalu	572	TUV	TUVALU IS
Uganda	675	UGA	UGANDA
Ukraine	272	UKR	UKRAINE
United Arab Emirates	470	UAE	UAE
United Arab Emirates	471	UAE	UAE
United Kingdom of Great Britain and Northern Ireland	232	UKM	G BRITAIN
United Kingdom of Great Britain and Northern Ireland	233	UKM	G BRITAIN
United Kingdom of Great Britain and Northern Ireland	234	UKM	G BRITAIN
United Kingdom of Great Britain and Northern Ireland	235	UKM	G BRITAIN
United States of America	338	USA	USA
United States of America	366	USA	USA

Name	MID	Abrv 3	Abrv 10
United States of America	367	USA	USA
United States of America	368	USA	USA
United States of America	369	USA	USA
United States Virgin Islands	379	USV	VIRGIN US
Uruguay	770	URU	URUGUAY
Uzbekistan	437	UZB	UZBEKISTAN
Vanuatu	577	VAN	VANUATU
Vanuatu	576	VAN	VANUATU
Vatican City State	208	VAT	VATICAN
Venezuela	775	VEN	VENEZUELA
Vietnam	574	VIE	VIETNAM
Wallis and Futuna Islands	578	WAL	WALLIS IS
Yemen	473	YEM	YEMEN
Yemen	475	YEM	YEMEN
Zambia	678	ZAM	ZAMBIA
Zimbabwe	679	ZIM	ZIMBABWE

This table listing the MID codes in order uses data from the Cospas-Sarsat website downloaded (as of 1 November 2019) (see also ITU website at https://www.itu.int/en/ITU-R/terrestrial/fmd/Pages/mid.aspx).

MID	Name	Abrv 3	Abrv 10
201	Albania	ALB	ALBANIA
202	Andorra	AND	ANDORRA
203	Austria	AUT	AUSTRIA
204	Azores	AZC	AZORES
205	Belgium	BEL	BELGIUM
206	Belarus	BLR	BELARUS
207	Bulgaria	BUL	BULGARIA
208	Vatican City State	VAT	VATICAN
209	Cyprus	CYP	CYPRUS
210	Cyprus	CYP	CYPRUS
211	Germany	GER	GERMANY
212	Cyprus	CYP	CYPRUS
213	Georgia	GOG	GEORGIA
214	Moldova	MOL	MOLDOVA
215	Malta	MAL	MALTA
216	Armenia	ARM	ARMENIA
218	Germany	GER	GERMANY
219	Denmark	DEN	DENMARK
220	Denmark	DEN	DENMARK
224	Spain	SPA	SPAIN
225	Spain	SPA	SPAIN
226	France	FRA	FRANCE
227	France	FRA	FRANCE
228	France	FRA	FRANCE
229	Malta	MAL	MALTA
230	Finland	FIN	FINLAND
231	Faroe Islands	FAR	FARO ISLE
232	United Kingdom of Great Britain and Northern Ireland	UKM	G BRITAIN
233	United Kingdom of Great Britain and Northern Ireland	UKM	G BRITAIN
234	United Kingdom of Great Britain and Northern Ireland	UKM	G BRITAIN
235	United Kingdom of Great Britain and Northern Ireland	UKM	G BRITAIN
236	Gibraltar	GIB	GIBRALTAR
237	Greece	GRE	GREECE
238	Croatia	CRT	CROATIA
239	Greece	GRE	GREECE

MID	Name	Abrv 3	Abrv 10
240	Greece	GRE	GREECE
241	Greece	GRE	GREECE
242	Morocco	MOR	MOROCCO
243	Hungary	HUN	HUNGARY
244	Netherlands (The)	NET	NETHERLAND
245	Netherlands (The)	NET	NETHERLAND
246	Netherlands (The)	NET	NETHERLAND
247	Italy	ITA	ITALY
248	Malta	MAL	MALTA
249	Malta	MAL	MALTA
250	Ireland	IRE	IRELAND
251	Iceland	ICE	ICELAND
252	Liechtenstein	LIE	LIECHTEN
253	Luxembourg	LUX	LUXEMBOURG
254	Monaco	MON	MONACO
255	Madeira	MAE	MADEIRA
256	Malta	MAL	MALTA
257	Norway	NOR	NORWAY
258	Norway	NOR	NORWAY
259	Norway	NOR	NORWAY
261	Poland	POL	POLAND
262	Montenegro	MNT	MONTENEGRO
263	Portugal	POR	PORTUGAL
264	Romania	ROM	ROMANIA
265	Sweden	SWE	SWEDEN
266	Sweden	SWE	SWEDEN
267	Slovak Republic	SLV	SLOVAKIA
268	San Marino	SAN	SAN MARINO
269	Switzerland	SWT	SWISS
270	Czech Republic	CZH	CZECH REP
271	Turkey	TUR	TURKEY
272	Ukraine	UKR	UKRAINE
273	Russian Federation	RUS	RUSSIA
274	North Macedonia (Republic of)	MKD	NORTH MAC
275	Latvia	LAT	LATVIA
276	Estonia	EST	ESTONIA
277	Lithuania	LIT	LITHUANIA
278	Slovenia	SVN	SLOVENIA
279	Serbia	SER	SERBIA
301	Anguilla	ANA	ANGUILLA
303	Alaska (State of) (USA)	ALA	ALASKA
304	Antigua and Barbuda	ANT	ANTIGUA

MID	Name	Abrv 3	Abrv 10
305	Antigua and Barbuda	ANT	ANTIGUA
306	Netherlands Antilles (formerly-). Sint Maarten (Dutch part); Bonaire, Sint Eustatius and Saba; and Curacao	NEA	N ANTILLES
307	Aruba	ARU	ARUBA
308	Bahamas	BAA	BAHAMAS
309	Bahamas	BAA	BAHAMAS
310	Bermuda	BER	BERMUDA
311	Bahamas	BAA	BAHAMAS
312	Belize	BEZ	BELIZE
314	Barbados	BAR	BARBADOS
316	Canada	CAN	CANADA
319	Cayman Islands	CAY	CAYMAN IS
321	Costa Rica	COS	COSTA RICA
323	Cuba	CUB	CUBA
325	Dominica	DOM	DOMINICA
327	Dominican Republic	DOR	DOMINICAN
329	Guadeloupe (French Dept. of)	GUA	GUADELOUPE
330	Grenada	GRA	GRENADA
331	Greenland	GRN	GREENLAND
332	Guatemala	GUT	GUATEMALA
334	Honduras	HON	HONDURAS
336	Haiti	HAI	HAITI
338	United States of America	USA	USA
339	Jamaica	JAM	JAMAICA
341	Saint Kitts and Nevis	SKN	ST KITTS
343	Saint Lucia	SLU	ST LUCIA
345	Mexico	MEX	MEXICO
347	Martinique	MTQ	MARTINIQUE
348	Montserrat	MOT	MONTSERRAT
350	Nicaragua	NIC	NICARAGUA
351	Panama	PAN	PANAMA
352	Panama	PAN	PANAMA
353	Panama	PAN	PANAMA
354	Panama	PAN	PANAMA
355	Panama	PAN	PANAMA
356	Panama	PAN	PANAMA
357	Panama	PAN	PANAMA
358	Puerto Rico	PUE	PUERTORICO
359	El Salvador	ELS	ELSALVADOR
361	St. Pierre and Miquelon	SPI	ST PIERRE
362	Trinidad and Tobago	TAT	TRINIDAD

MID	Name	Abrv 3	Abrv 10
364	Turks and Caicos Islands	TUK	CAICOS IS
366	United States of America	USA	USA
367	United States of America	USA	USA
368	United States of America	USA	USA
369	United States of America	USA	USA
370	Panama	PAN	PANAMA
371	Panama	PAN	PANAMA
372	Panama	PAN	PANAMA
373	Panama	PAN	PANAMA
374	Panama	PAN	PANAMA
375	Saint Vincent and the Grenadines	SVG	ST VINCENT
376	Saint Vincent and the Grenadines	SVG	ST VINCENT
377	Saint Vincent and the Grenadines	SVG	ST VINCENT
378	British Virgin Islands	BVI	VIRGIN GB
379	United States Virgin Islands	USV	VIRGIN US
401	Afghanistan	AFG	AFGHAN
403	Saudi Arabia	SAU	SAUDI
405	Bangladesh	BAN	BANGLADESH
408	Bahrain	BAH	BAHRAIN
410	Bhutan	BHU	BHUTAN
412	China	CHN	CHINA
413	China	CHN	CHINA
414	China	CHN	CHINA
416	Chinese Taipei	TAI	TAIPEI
417	Sri Lanka	SRI	SRI LANKA
419	India	IND	INDIA
422	Iran	IRN	IRAN
423	Azerbaijan	AZR	AZERBAIJAN
425	Iraq	IRQ	IRAQ
428	Israel	ISR	ISRAEL
431	Japan	JPN	JAPAN
432	Japan	JPN	JAPAN
434	Turkmenistan	TKM	TURKMENIST
436	Kazakhstan	KAZ	KAZAKHSTAN
437	Uzbekistan	UZB	UZBEKISTAN
438	Jordan	JOR	JORDAN
440	Korea (Republic of)	KOR	KOREA SOU
441	Korea (Republic of)	KOR	KOREA SOU
443	Palestine	PAA	PALESTINE
445	Democratic People's Republic of Korea	KDR	KOREA NOR
447	Kuwait	KUW	KUWAIT
450	Lebanon	LEB	LEBANON

MID	Name	Abrv 3	Abrv 10
451	Kyrgyz Republic	KYR	KYRGYZIA
453	Macao, China	MAC	MACAO
455	Maldives	MAV	MALDIVES
457	Mongolia	MNG	MONGOLIA
459	Nepal	NEP	NEPAL
461	Oman	OMN	OMAN
463	Pakistan	PAK	PAKISTAN
466	Qatar	QAT	QATAR
468	Syria	SYR	SYRIA
470	United Arab Emirates	UAE	UAE
471	United Arab Emirates	UAE	UAE
472	Tajikistan	TJK	TAJIKISTAN
473	Yemen	YEM	YEMEN
475	Yemen	YEM	YEMEN
477	Hong Kong, China	HKG	HONG KONG
478	Bosnia and Herzegovina	BOS	BOSNIAHERZ
501	Adelie Land	ADE	ADELIELAND
503	Australia	AUS	AUSTRALIA
506	Myanmar	BUR	BURMA
508	Brunei Darussalam	BRU	BRUNEI
510	Micronesia	MIC	MICRONESIA
511	Palau	PAL	PALAU
512	New Zealand	NZL	NEWZEALAND
514	Cambodia	CMB	CAMBODIA
515	Cambodia	CMB	CAMBODIA
516	Christmas Island	CHR	CHRISTMAS
518	Cook Islands	COO	COOK ISLES
520	Fiji	FIJ	FIJI
523	Cocos (Keeling) Islands	COC	COCOS ISLE
525	Indonesia	INO	INDONESIA
529	Kiribati	KIR	KIRIBATI
531	Laos	LAO	LAO
533	Malaysia	MLY	MALAYSIA
536	Northern Mariana Islands	MAI	MARIANA IS
538	Marshall Islands	MAR	MARSHALL I
540	New Caledonia	NCA	CALEDONIA
542	Niue	NIU	NIUE ISLE
544	Nauru	NAU	NAURU
546	French Polynesia	PLY	POLYNESIA
548	Philippines	PHI	PHILIPPINE
550	Timor-Leste	TIM	TIMORLESTE
553	Papua New Guinea	PAP	PAPUA NG

MID	Name	Abrv 3	Abrv 10
555	Pitcairn	PIT	PITCAIRN I
557	Solomon Islands	SOL	SOLOMON IS
559	American Samoa	ASA	SAMOA USA
561	Samoa	WSA	WEST SAMOA
563	Singapore	SIN	SINGAPORE
564	Singapore	SIN	SINGAPORE
565	Singapore	SIN	SINGAPORE
566	Singapore	SIN	SINGAPORE
567	Thailand	THA	THAILAND
570	Tonga	TON	TONGA
572	Tuvalu	TUV	TUVALU IS
574	Vietnam	VIE	VIETNAM
576	Vanuatu	VAN	VANUATU
577	Vanuatu	VAN	VANUATU
578	Wallis and Futuna Islands	WAL	WALLIS IS
601	South Africa	SAF	SO AFRICA
603	Angola	ANG	ANGOLA
605	Algeria	ALG	ALGERIA
607	Saint Paul and Amsterdam Islands	SPL	ST PAUL
608	Ascension Island	ASC	ASCENSION
609	Burundi	BUI	BURUNDI
610	Benin	BEN	BENIN
611	Botswana	BOT	BOTSWANA
612	Central African Republic	CAR	CENAFR REP
613	Cameroon	CAM	CAMEROON
615	Congo	CON	CONGO
616	Comoros	COM	COMOROS
617	Cape Verde	CAP	CAPE VERDE
618	Crozet Archipelago	CRP	CROZET
619	Côte d'Ivoire (Ivory Coast)	IVO	IVORYCOAST
620	Comoros	COM	COMOROS
621	Djibouti	DJI	DJIBOUTI
622	Egypt	EGY	EGYPT
624	Ethiopia	ETH	ETHIOPIA
625	Eritrea	ERT	ERITREA
626	Gabon	GAB	GABON REP
627	Ghana	GHA	GHANA
629	Gambia	GAM	GAMBIA
630	Guinea-Bissau	GUB	GUINEA BIS
631	Equatorial Guinea	EQG	EQ GUINEA
632	Guinea	GUN	GUINEA REP
633	Burkina Faso	BUF	BURKINA FS

MID	Name	Abrv 3	Abrv 10
634	Kenya	KEN	KENYA
635	Kerguelen Islands	KER	KERGUELEN
636	Liberia	LIB	LIBERIA
637	Liberia	LIB	LIBERIA
638	South Sudan	SSD	SOUTHSUDAN
642	Libya	LBY	LIBYA
644	Lesotho	LES	LESOTHO
645	Mauritius	MAU	MAURITIUS
647	Madagascar	MAD	MADAGASCAR
649	Mali	MLI	MALI
650	Mozambique	MOZ	MOZAMBIQUE
654	Mauritania	MAA	MAURITANIA
655	Malawi	MAW	MALAWI
656	Niger	NIG	NIGER
657	Nigeria	NIA	NIGERIA
659	Namibia	NAM	NAMIBIA
660	Reunion (same country code for Mayotte)	REU	REUNION
661	Rwanda	RWA	RWANDA
662	Sudan	SUD	SUDAN
663	Senegal	SEN	SENEGAL
664	Seychelles	SEY	SEYCHELLE
665	St. Helena	SHE	ST HELENA
666	Somalia	SOM	SOMALI
667	Sierra Leone	SIL	SIERRA LEO
668	Sao Tome and Principe	SAO	SAO TOME
669	Eswatini	SWA	ESWATINI
670	Chad	CHA	CHAD
671	Togo	TOG	TOGO
672	Tunisia	TUN	TUNISIA
674	Tanzania	TAN	TANZANIA
675	Uganda	UGA	UGANDA
676	Democratic Republic of the Congo	ZAI	ZAIRE
677	Tanzania	TAN	TANZANIA
678	Zambia	ZAM	ZAMBIA
679	Zimbabwe	ZIM	ZIMBABWE
701	Argentina	ARG	ARGENTINA
710	Brazil	BRA	BRAZIL
720	Bolivia	BOL	BOLIVIA
725	Chile	CHI	CHILE
730	Colombia	COL	COLOMBIA
735	Ecuador	ECU	ECUADOR

MID	Name	Abrv 3	Abrv 10
740	Falkland Islands (Malvinas) [2]	FAL	FALKLAND I
745	Guiana (French Dept. Of)	GUI	GUIANA
750	Guyana	GUY	GUYANA
755	Paraguay	PAR	PARAGUAY
760	Peru	PER	PERU
765	Suriname	SUR	SURINAME
770	Uruguay	URU	URUGUAY
775	Venezuela	VEN	VENEZUELA

- END OF ANNEX B -

[2] A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and the Northern Island concerning the sovereignty over the Falkland Islands (Malvinas).

ANNEX C

COSPAS-SARSAT DATA DISTRIBUTION REGIONS

C.1 WESTERN DDR

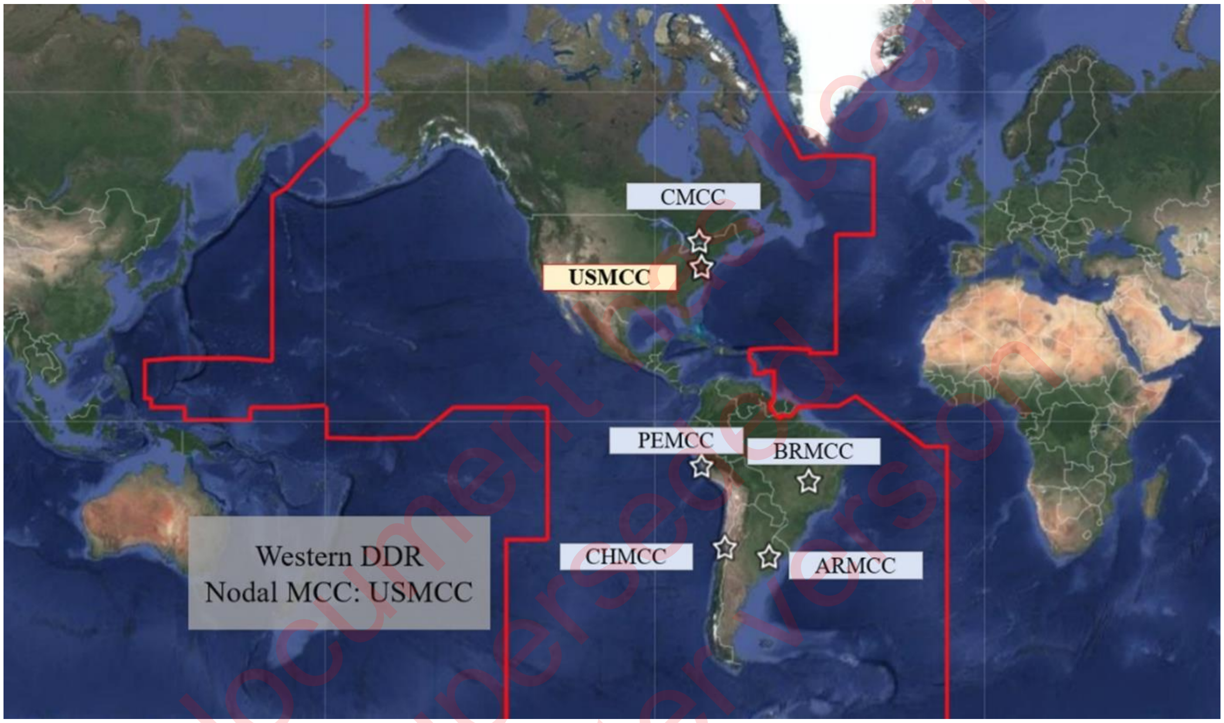


Figure C.1: Western DDR Map

Countries/Regions and MIDs Supported by the Western DDR MCCs:

ARMCC				
Argentina 701	Falklands Islands/Malvinas 740			
BRMCC				
Brazil 710				
CHMCC				
Bolivia 720	Chile 725	Paraguay 755	Uruguay 770	
CMCC				
Canada 316	St. Pierre and Miquelon 361			
PEMCC				
Peru 760				
USMCC				
Alaska 303	Aruba 307	Bahamas 308/309/311	Barbados 314	Belize 312
Bermuda 310	British Virgin Islands 378	Cayman Islands 319	Colombia 730	Costa Rica 321
Cuba 323	Dominican Republic 327	Ecuador 735	El Salvador 359	Grenada 330
Guatemala 332	Guyana 750	Haiti 336	Honduras 334	Jamaica 339
Marshall Islands 538	Mexico 345	Micronesia 510	Netherlands Antilles 306	Nicaragua 350
Northern Mariana Islands 536	Palau 511	Panama 351/352/353/354/ 355/356/357/370/ 371/372/373/374	Puerto Rico 358	St. Vincent and the Grenadines 375/376/377
Trinidad and Tobago 362	Turks and Caicos Islands 364	USA 338/366/367/368/ 369	US Virgin Islands 379	Venezuela 775

C.2 NORTH WEST PACIFIC DDR

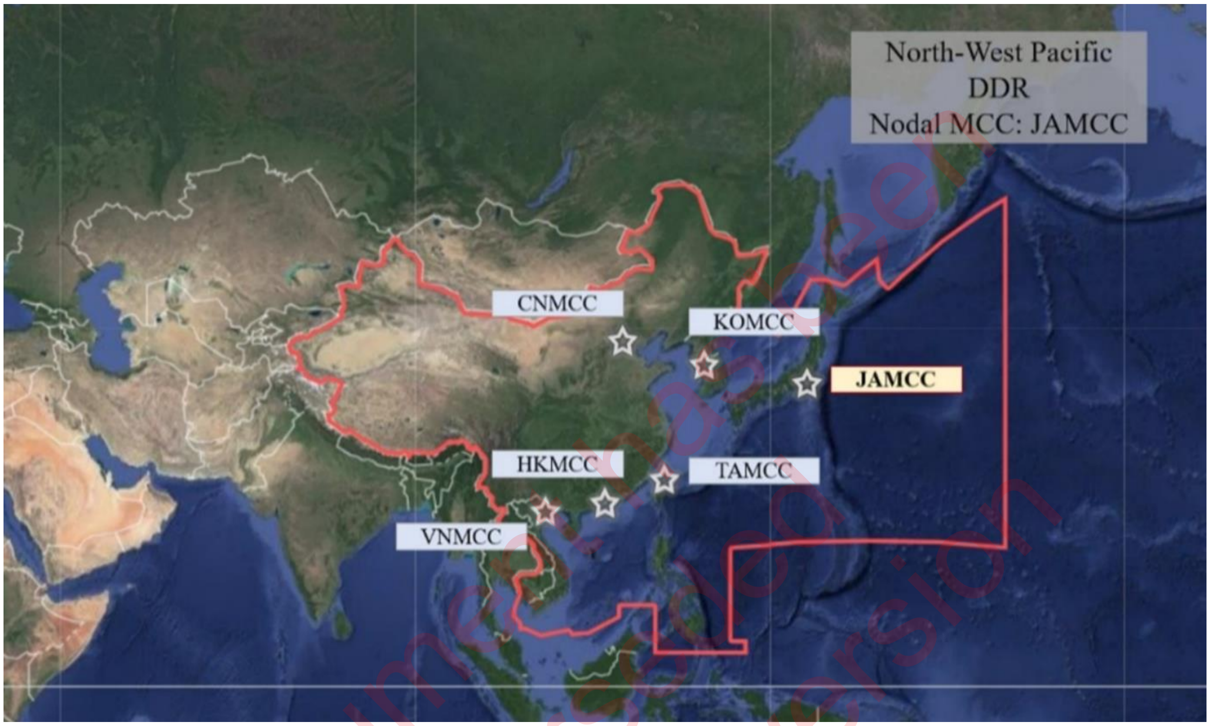


Figure C.2: North West Pacific DDR Map

Countries/Regions and MIDs Supported by the North-West Pacific DDR MCCs

CNMCC				
China 412/413				
HKMCC				
Hong Kong, China 477	Macao, China 453	Philippines 548	Democratic People's Rep. of Korea 445	
JAMCC				
Japan 431/432				
KOMCC				
Korea (Rep. of) 440/441				
TAMCC				
Chinese Taipei 416				
VNMCC				
Cambodia 514/515	Laos 531	Viet Nam 574		

C.3 SOUTH WEST PACIFIC DDR

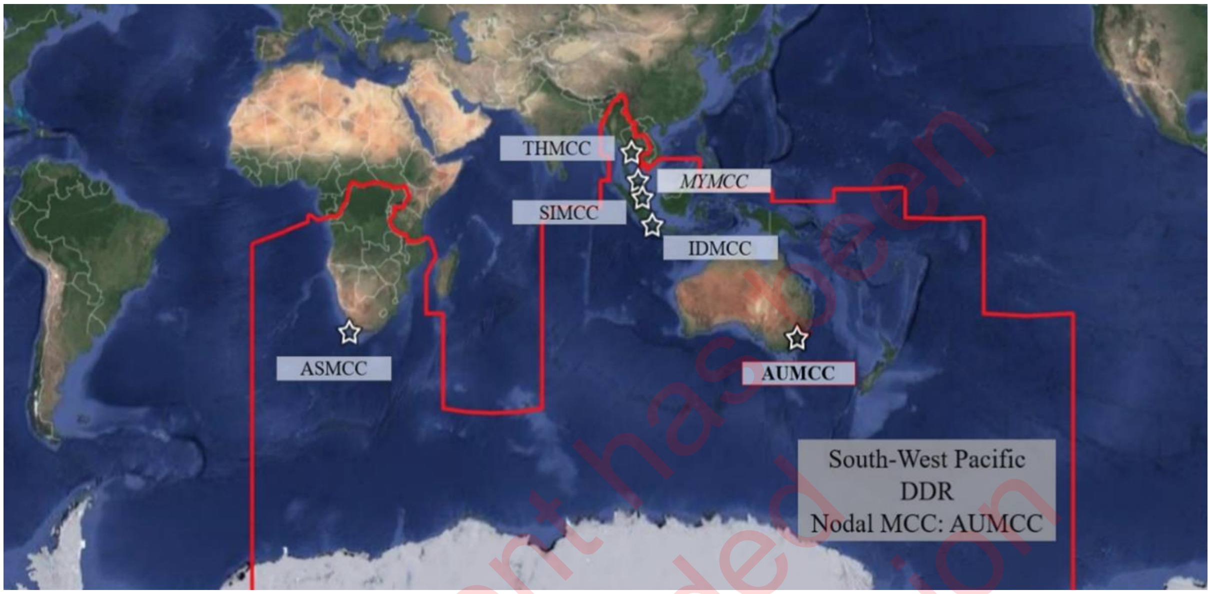


Figure C.3: South West Pacific DDR Map

Countries/Regions and MIDs Supported by the South West Pacific DDR MCCs

ASMCC				
Angola 603	Botswana 611	Burundi 609	Dem. Rep. of Congo 676	Eswatini 669
Lesotho 644	Malawi 655	Mozambique 650	Namibia 659	Rwanda 661
South Africa 601	St. Helena 665	Uganda 675	Zambia 678	Zimbabwe 679
AUMCC				
Adelie Land 501	American Samoa 559	Australia 503	Christmas Island 516	Cocos Islands 523
Cook Islands 518	Fiji 520	Kiribati 529	Nauru 544	New Caledonia 540
New Zealand 512	Niue 542	Papua New Guinea 553	Saint Paul & Amsterdam 607	Samoa 561
Solomon Islands 557	Tonga 570	Tuvalu 572	Vanuatu 576	Wallis and Futuna 578
IDMCC				
Indonesia 525	Timor-Leste 550			
SIMCC				
Brunei 508	Malaysia 533	Myanmar 506	Singapore 563/564/565	
THMCC				
Thailand 567				

C.4 CENTRAL DDR

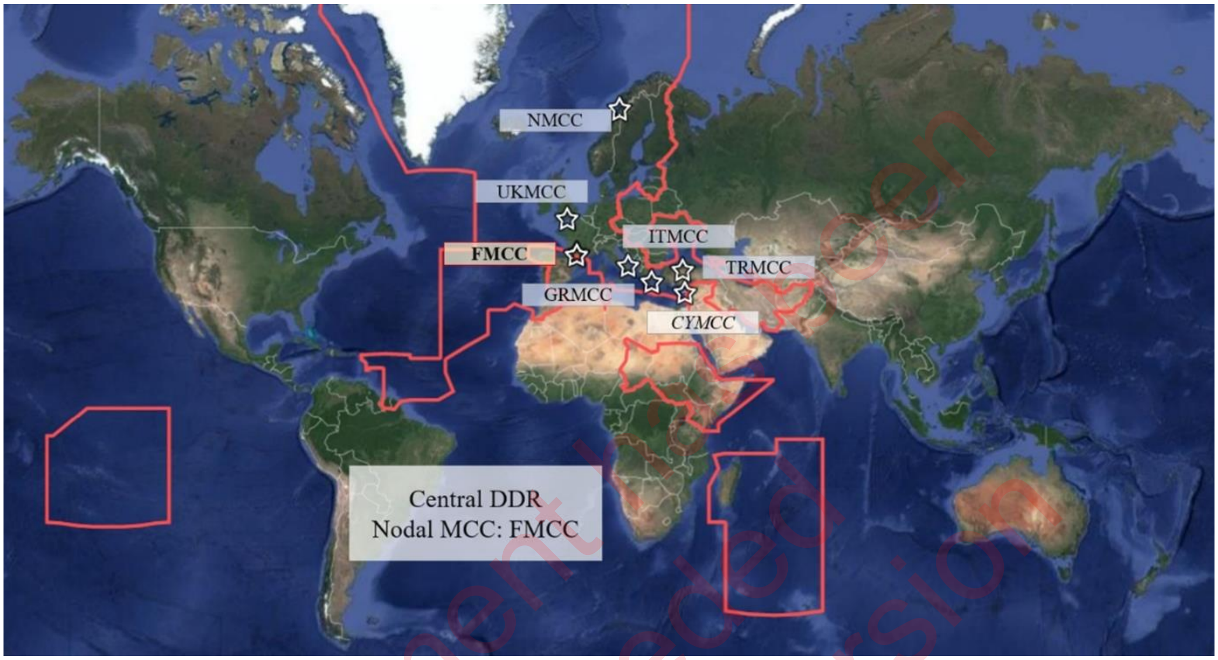


Figure C.4: Central DDR Map

Countries/Regions and MIDs Supported by the Central DDR MCCs

CYMCC				
Cyprus 209/210/212				
FMCC				
Andorra 202	Anguilla 301	Antigua and Barbuda 304/305	Austria 203	Azores 204
Belgium 205	Chad 670	Djibouti 621	Comoros 616	Crozet Archipelago 618
Dominica 325	France 226/227/228	French Guiana 745	French Polynesia 546	Germany 211/218
Gibraltar 236	Guadeloupe 329	Kerguelen Islands 635	Liechtenstein (Swiss) 252	Luxemburg 253
Madagascar 647	Madeira 255	Martinique 347	Mauritius 645	Monaco 254
Montserrat 348	Morocco 242	Netherlands 244/245/246	Pitcairn 555	Portugal 263
Reunion/Mayotte 660	Saint Kitts and Nevis 341	Saint Lucia 343	Suriname 765	Switzerland 269
Tunisia 672				
GRMCC				
Greece 237/239/240				
ITMCC				
Albania 201	Bosnia and Herzegovina 478	Croatia 238	Eritrea 625	Ethiopia 624
Israel 428	Italy 247	Kenya 634	Malta 215/248/249/256	Montenegro 262
North Macedonia 274	Palestine 443	San Marino 268	Serbia 279	Slovenia 278
Somalia 666	South Sudan 638	Sudan 662	Vatican City 208	
NMCC				
Denmark 219/220	Estonia 276	Faroe Islands 231	Finland 230	Greenland 331
Iceland 251	Latvia 275	Lithuania 277	Norway 257/258/259	Sweden 265/266
TRMCC				
Afghanistan 401	Georgia* 213	Iran 422	Iraq 425	Turkey 271
Ukraine* 272				
UKMCC				
United Kingdom 232/233/234/235	Ireland 250			

* See also CMC service area.

C.5 SOUTH CENTRAL DDR

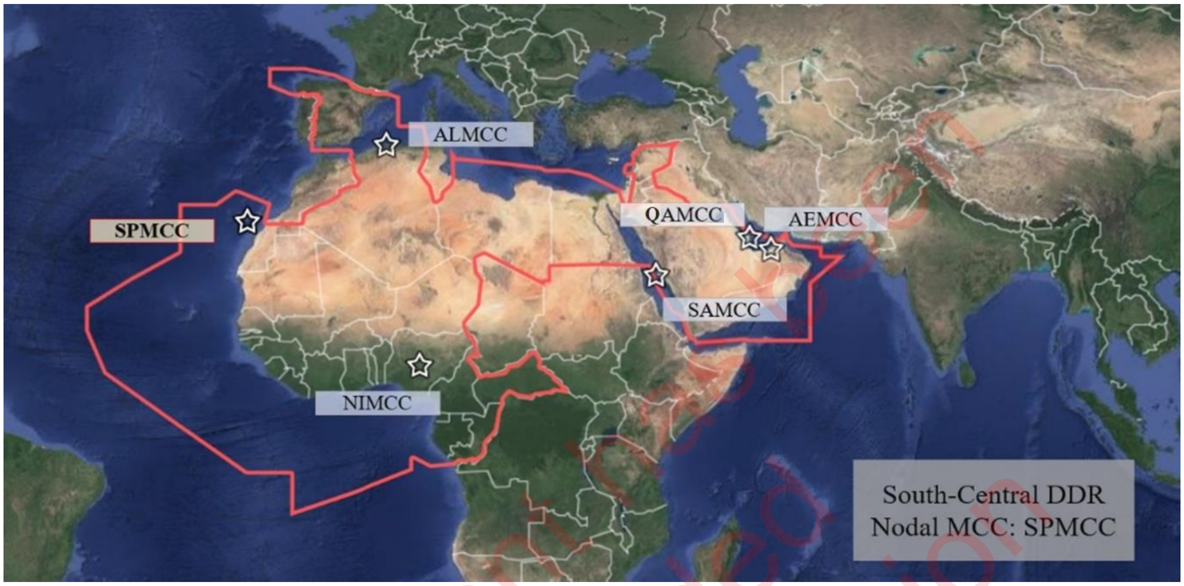


Figure C.5: South Central DDR Map

Countries/Regions and MIDs Supported by the South-Central DDR MCCs

ALMCC				
Algeria 605	Burkina Faso 633	Egypt 622	Libya 642	Niger 656
AEMCC		**NIMCC**		
United Arab Emirates 470/471		See SPMCC		
SAMCC				
Bahrain 408	Jordan 438	Kuwait 447	Lebanon 450	Oman 461
Saudi Arabia 403	Syria 468	Yemen 473/475		
SPMCC				
Ascension 608	Benin 610	Cameroon 613	Cape Verde 617	Central African Republic 612
Congo 615	Equatorial Guinea 631	Gabon 626	Gambia 629	Ghana 627
Guinea 632	Guinea-Bissau 630	Ivory Coast 619	Liberia 636/637	Mali 649
Mauritania 654	Sao Tome and Principe 668	Senegal 663	Sierra Leone 667	Spain 224/225
Togo 671	Nigeria 657			

C.6 EASTERN DDR

Figure C.6: Eastern DDR Map

Countries/Regions and MIDs Supported by the Eastern DDR MCCs

CMC				
Armenia 216	Azerbaijan 423	Belarus 206	Bulgaria 207	Czech Republic 270
Georgia* 213	Hungary 243	Kazakhstan 436	Kyrgyz Rep. 451	Moldova 214
Mongolia 457	Poland 261	Romania 264	Russia 273	Tajikistan 472
Turkmenistan 434	Ukraine* 272	Uzbekistan 437		
INMCC				
Bangladesh 405	Bhutan 410	India 419	Maldives 455	Nepal 459
Seychelles 664	Sri Lanka 417	Tanzania 674/677		
PAMCC				
Pakistan 463				

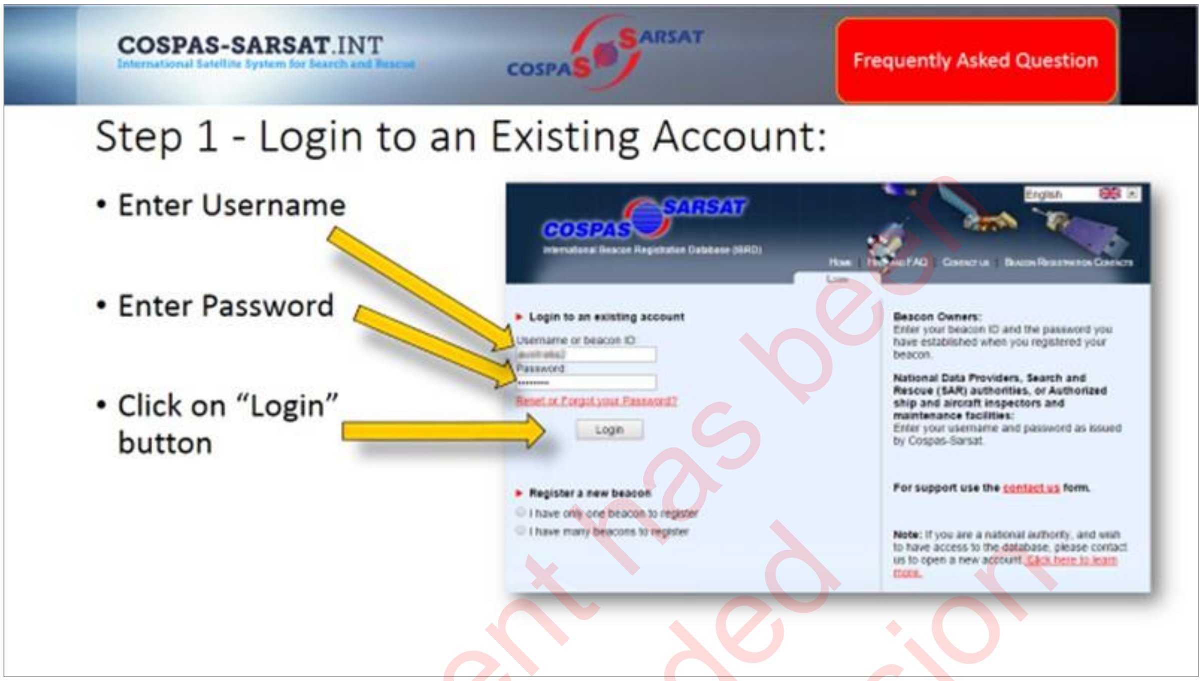
* See also TRMCC service area.

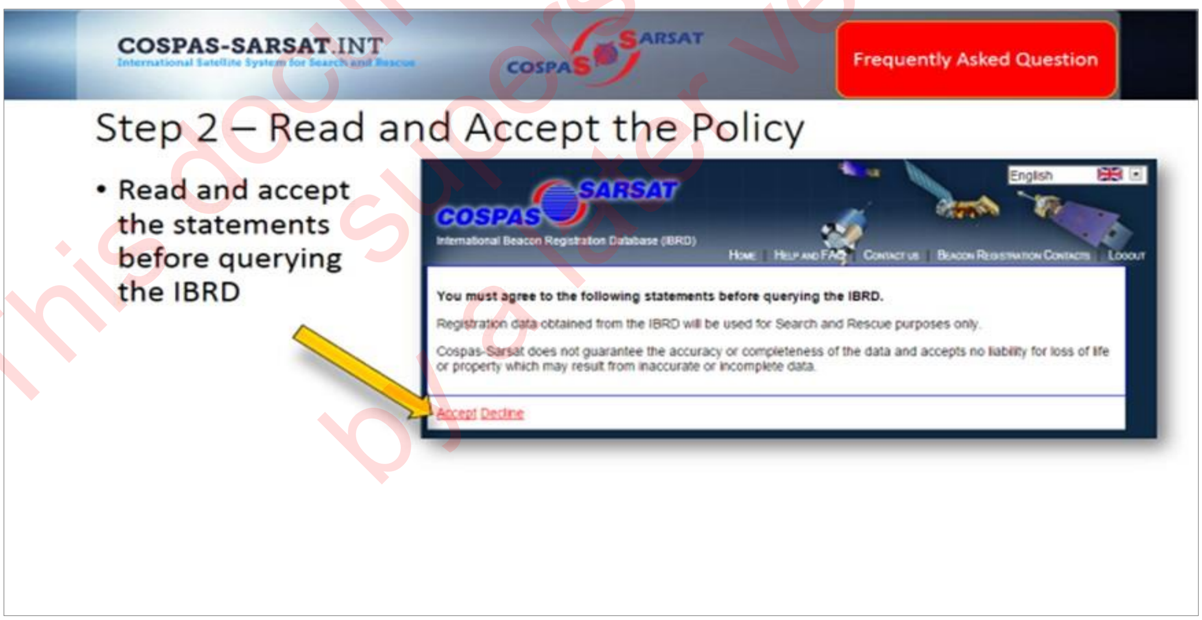
- END OF ANNEX C -

ANNEX D

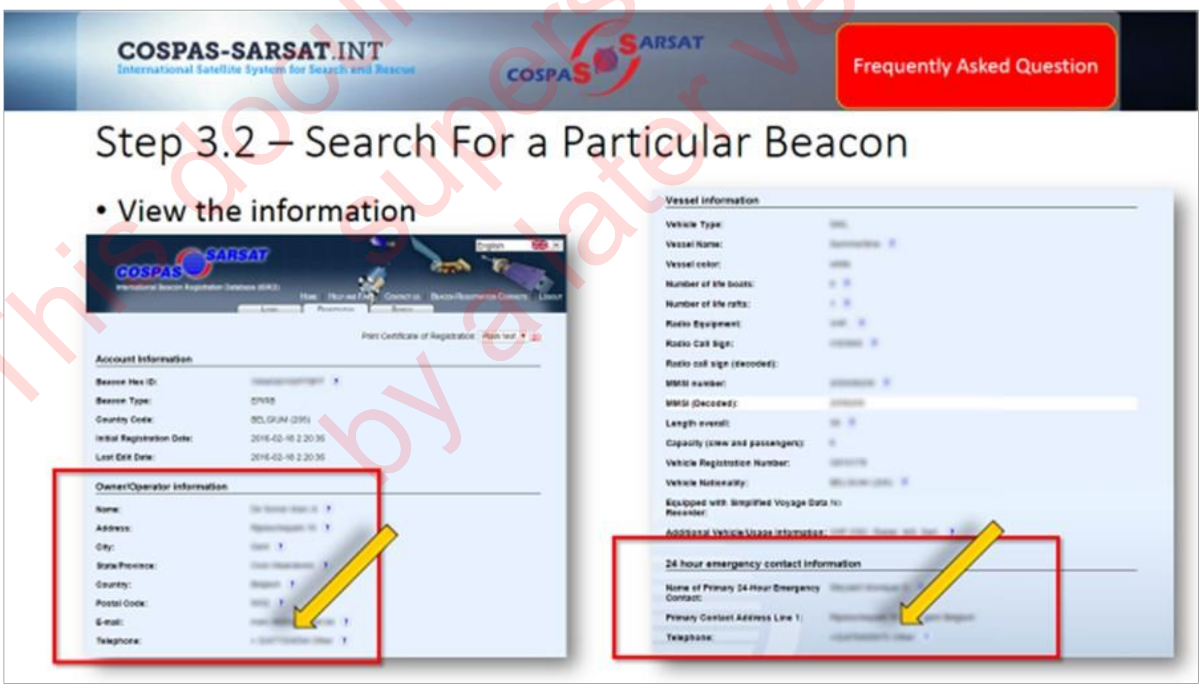
HOW TO USE THE IBRD

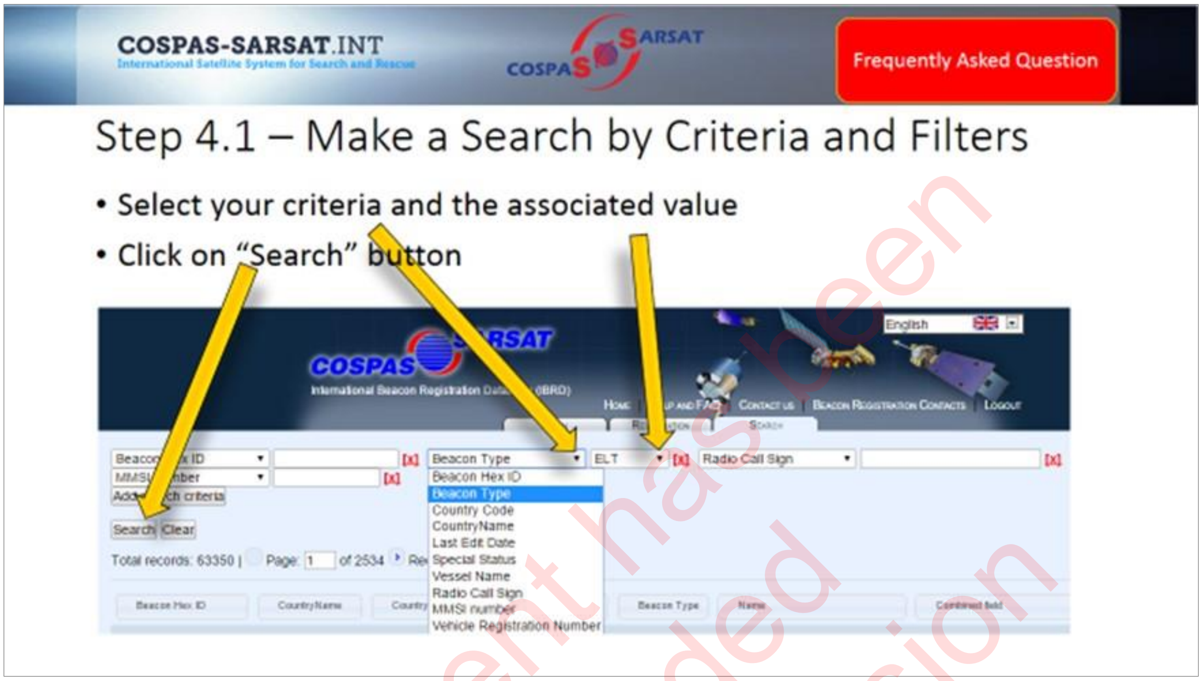
Annex D is sequence of slides that shows how a SAR Service can use the IBRD. Please send an email to admin@406registration.com for any questions.

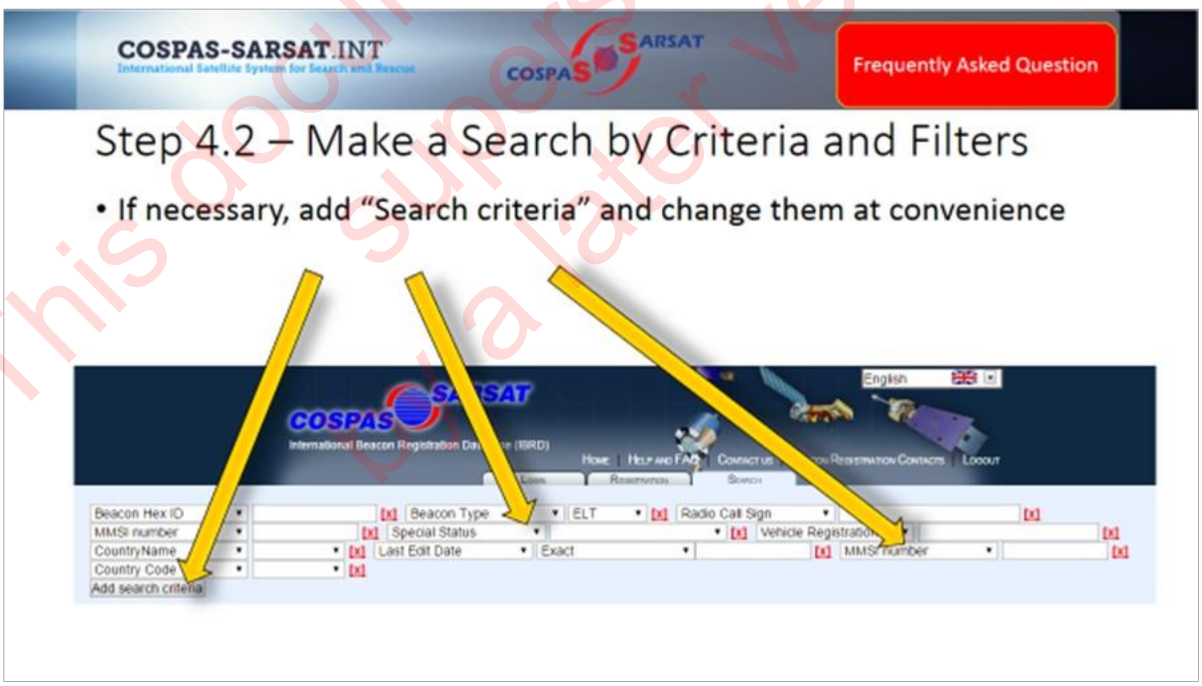

COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
COSPAS SARSAT
Frequently Asked Question
Step 1 - Login to an Existing Account:
• Enter Username
• Enter Password
• Click on "Login" button
COSPAS SARSAT
International Beacon Registration Database (IBRD)
English
Login to an existing account
Username or beacon ID
Password
Reset or Forgot your Password?
Login
Register a new beacon
I have only one beacon to register
I have many beacons to register
Beacon Owners:
Enter your beacon ID and the password you have established when you registered your beacon.
National Data Providers, Search and Rescue (SAR) authorities, or Authorized ship and aircraft inspectors and maintenance facilities:
Enter your username and password as issued by Cospas-Sarsat
For support use the contact us form.
Note: If you are a national authority, and wish to have access to the database, please contact us to open a new account. Click here to learn more.


COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
COSPAS SARSAT
Frequently Asked Question
Step 2 – Read and Accept the Policy
• Read and accept the statements before querying the IBRD
COSPAS SARSAT
International Beacon Registration Database (IBRD)
English
Home | Help and FAQ | Contact us | Beacon Registration Contacts | Logout
You must agree to the following statements before querying the IBRD.
Registration data obtained from the IBRD will be used for Search and Rescue purposes only.
Cospas-Sarsat does not guarantee the accuracy or completeness of the data and accepts no liability for loss of life or property which may result from inaccurate or incomplete data.
Accept Decline


COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
Frequently Asked Question
Step 3.1 – Search For a Particular Beacon
• Go on tab "SEARCH"
• Enter the 15 Hex ID of the beacon
• click on the "Search Button"
Beacon Hex ID
1234567890FFBFF
Vessel Name
MMSI number
Add search criteria
Search
Clear
Total records: 63350
Page: 1 of 2534
Records per page: 25


COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
Frequently Asked Question
Step 3.2 – Search For a Particular Beacon
• View the information
Account Information
Owner/Operator information
Vessel information
24 hour emergency contact information


COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
Frequently Asked Question
Step 4.1 – Make a Search by Criteria and Filters
• Select your criteria and the associated value
• Click on "Search" button
English
Beacon Type
ELT
Radio Call Sign
Beacon Hex ID
Country Code
CountryName
Last Edit Date
Special Status
Vessel Name
MMSI number
Vehicle Registration Number
Search
Clear
Total records: 63350
Page: 1
of 2534


COSPAS-SARSAT.INT
International Satellite System for Search and Rescue
Frequently Asked Question
Step 4.2 – Make a Search by Criteria and Filters
• If necessary, add "Search criteria" and change them at convenience
English
Beacon Hex ID
Beacon Type
ELT
Radio Call Sign
MMSI number
Special Status
CountryName
Last Edit Date
Exact
Country Code
Add search criteria

– END OF ANNEX D –

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