COSPAS-SARSAT
MISSION CONTROL CENTRE (MCC)
PERFORMANCE SPECIFICATION
AND DESIGN GUIDELINES

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COSPAS SARSAT

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1. INTRODUCTION

1.1 Overview

The purpose of the Cospas-Sarsat System is to provide distress alert and location data for search and rescue (SAR) by using spacecraft and ground facilities to detect and locate distress signals. The position of the distress and other related information is transmitted to appropriate SAR authorities.

Distress beacons (Emergency Locator Transmitters - ELTs, Emergency Position Indicating Radio Beacons - EPIRBs, Personal Locator Beacons - PLBs) transmit signals that are detected by Cospas-Sarsat polar-orbiting and geostationary orbiting spacecraft. These signals are relayed to Cospas-Sarsat ground receiving stations termed Local User Terminals (LUTs), which process the signals to determine the beacon location. Alerts are then relayed, together with location data, via a Mission Control Centre (MCC), either to another MCC, the appropriate search and rescue point of contact (SPOC), or to a Rescue Co-ordination Centre (RCC) to initiate SAR activities.

The geographical area within which an MCC takes responsibility to distribute Cospas-Sarsat alert data to responsible SAR authorities (i.e. RCCs and SPOCs) is called its service area. The principles applicable to the definition of an MCC service area, its coordination with other MCCs to ensure efficient alert data distribution, and its description for effective implementation of the geo-sorting of alert data by other MCCs, are provided in the document C/S P.011 “Cospas-Sarsat Programme Management Policy” and further expanded in the document C/S A.006 “Cospas-Sarsat MCC Commissioning Standard”.

The Cospas-Sarsat Ground Segment (LUTs and MCCs) is an important link in the rescue effort. To be effective it must be organised to ensure:

a. speed (timely distribution of alert data);

b. reliability (distribution of alert data and System information in the event of failure of LUTs or MCCs);

c. accuracy (correctness of information delivered);

d. efficiency (economic and smooth flow of data); and

e. accountability (tracking of messages in the Ground Segment).

To achieve these objectives, each unit of the Ground Segment must comply with certain standards. The standards contained in this document provide a framework for the functions of the MCC including the exchange of data, performance levels and operating procedures. MCCs that meet specified standards of performance are commissioned to operate within the Cospas-Sarsat Ground Segment.

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Procedures for processing and exchanging data between MCCs (alert data and System information) and the procedures for distributing alert data to the appropriate authorities are defined in document C/S A.001 “Cospas-Sarsat Data Distribution Plan” (DDP). MCCs are required to apply the procedures described in document C/S A.001 in compliance with the data exchange formats and protocols defined in document C/S A.002 “Cospas-Sarsat Mission Control Centres Standard Interface Description” (SID).

Furthermore, national agencies and administrations involved must ensure ongoing verification of System operation and performance parameters. The requirements for System monitoring by each Ground Segment operator are defined in document C/S A.003 (System monitoring and reporting), including the format for regular reporting of System status by all MCCs.

As part of the Cospas-Sarsat System, an MCC is subject to acceptance testing based on this specification, and tests defined in document C/S A.006 "Cospas-Sarsat MCC Commissioning Standard". Providing that all requirements are fulfilled, each Ground Segment operator decides on the most suitable means for implementing its MCC.

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1.2 Scope

This specification describes the minimal operational, functional and performance requirements of a Cospas-Sarsat MCC. This specification also describes the additional requirements to be met by those MCCs designated as ‘nodal’ MCCs.

1.3 Document Organization

The document is structured as follows:

a. Section 2 presents an overview of a Cospas-Sarsat MCC.

b. Section 3 describes the operational requirements governing the general responsibilities of the MCC relative to the Cospas-Sarsat Ground Segment.

c. Section 4 contains functional requirements governing the specific functions to be performed by the MCC.

d. Section 5 contains performance requirements applicable to the MCC.

e. Section 6 describes the additional requirements for those MCCs designated as ‘nodal’ MCCs.

Annex A contains a list of acronyms used in this document.

1.4 Reference Documents

The following documents contain useful information pertaining to MCC specifications, and the procedures for integration into the Cospas-Sarsat System:

a. C/S A.001 “Cospas-Sarsat Data Distribution Plan”.

b. C/S A.002 “Cospas-Sarsat Mission Control Centres Standard Interface Description”.

c. C/S A.003 “Cospas-Sarsat System Monitoring and Reporting”.

d. C/S A.006 “Cospas-Sarsat MCC Commissioning Standard”.

e. C/S T.002 “Cospas-Sarsat LEOLUT Performance Specification and Design Guidelines”.

f. C/S T.005 “Cospas-Sarsat LEOLUT Commissioning Standard”.

g. C/S T.006 “Cospas-Sarsat Orbitography Network Specification”.

h. C/S T.009 “Cospas-Sarsat GEOLUT Performance Specification and Design Guidelines”.

i. C/S T.010 “Cospas-Sarsat GEOLUT Commissioning Standard”.

j. C/S P.011 “Cospas-Sarsat Programme Management Policy”.

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2. COSPAS-SARSAT MCC DESCRIPTION

An MCC is part of the Cospas-Sarsat Ground Segment. It collects, sorts and stores data from its associated LUT(s) and other MCCs. MCCs are the primary System component that provide for data exchange within the international Cospas-Sarsat System, and to SAR authorities. MCCs exchange two types of data: alert data and System information.

Alert data is a generic term for Cospas-Sarsat 406 MHz and 121.5 MHz data derived from emergency beacons. 121.5 MHz alerts only include Doppler positions derived from the LEOSAR system. 406 MHz alert data includes beacon identification and may contain Doppler position information or encoded location data. System information is used primarily to keep the Cospas-Sarsat System operating effectively. It consists of satellite ephemeris and time calibration data used to determine beacon locations, the current status of the Space and Ground Segments, and co-ordination messages.

The MCC is defined in this document as a function. It may be implemented in many ways, such as sharing equipment with other Ground Segment equipment. At a minimum it must have the following components:

a. access to, and appropriate interfaces to national and international communication networks;

b. processor(s) to automatically process alert and System data;

c. time reference;

d. an operator interface; and

e. staff.

A typical MCC functional block diagram is shown in Figure 2.1.

An MCC must communicate with its associated LUT(s), other MCCs, SPOCs and RCCs. Therefore, it must maintain as many communication links as is operationally required. A communication link, in the context of this document, is defined as the conceptual link between an MCC and other System components with which it must communicate (i.e., associated LUTs, other MCC(s), SPOCs, and RCCs). Annex III/A of C/S A.001 (DDP) provides details on the communication links used in the Cospas-Sarsat System.

A communication network is the physical or virtual means by which data is exchanged. Networks are described in detail in document C/S A.002 (SID). A single communication link may use one or more networks to meet operational requirements.

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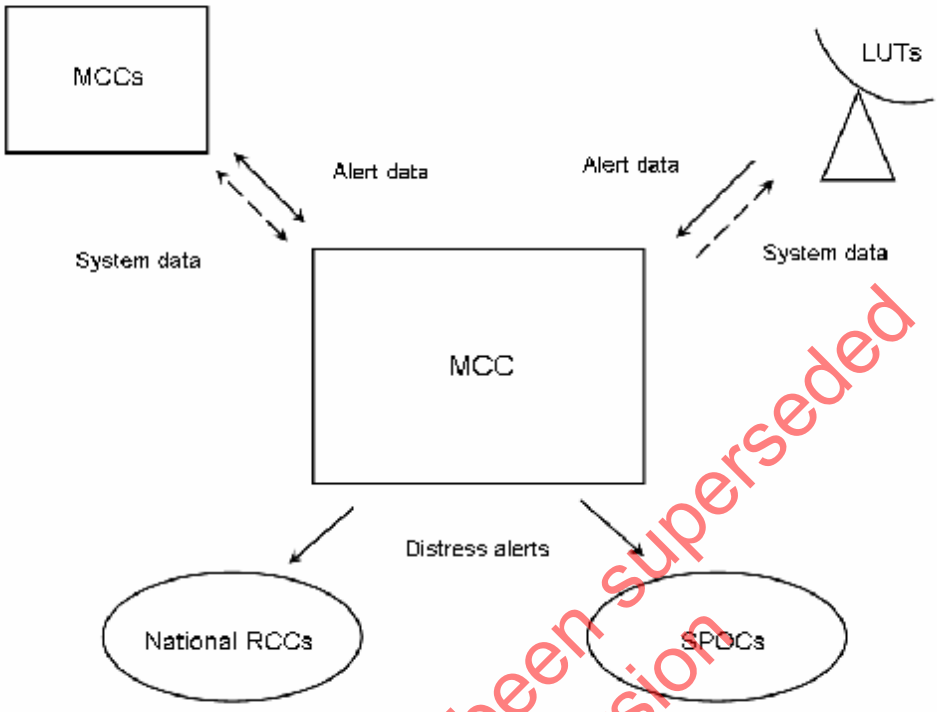

Figure 2.1: Typical Cospas-Sarsat MCC Functional Block Diagram

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3. OPERATIONAL REQUIREMENTS

The basic operational objective of an MCC is to receive alert data from its associated LUT(s) or other MCCs, and distribute this information to the appropriate MCC or SAR authority.

3.1 General Operations

3.1.1 An MCC shall be responsible for establishing procedures for the distribution of Cospas-Sarsat alert data, System information, and other data within its own service area.

3.1.2 An MCC shall respond to direct requests for information from other MCCs, SPOCs or RCCs.

3.1.3 An MCC shall be capable of accounting for all messages, received or transferred through its own system.

3.1.4 An MCC shall be configurable to selectively process or suppress alert data to another MCC, SPOC, or RCC.

3.1.5 An MCC shall at all times be able to establish voice communications with other MCCs via the international telephone network. Availability of a facsimile capability is also recommended.

3.1.6 An MCC shall transmit solution data for the McMurdo Station and Longyearbyen orbitography beacons (Annex II/E of C/S A.001 (DDP)) received from each of its associated LEOLUTs to its nodal MCC in accordance with the Cospas-Sarsat Quality Management System (QMS) continuous monitoring and objective assessment process described in section 9 of document C/S A.003 (System monitoring and reporting).

3.1.7 An MCC shall transmit solution data for designated reference beacons (Annex II/E of document C/S A.001) received from each of its associated GEOLUTs to its nodal MCC in accordance with the Cospas-Sarsat QMS continuous monitoring and objective assessment process described in section 9 of document C/S A.003.

3.2 Availability

Once an MCC has been commissioned and attained Initial Operational Capability (IOC), it shall be in operation 24 hours per day, seven days a week and personnel shall be available to satisfy the operational and performance requirements documented herein.

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3.3 LUT Co-ordination

3.3.1 An MCC shall be able to receive and process all alert data from its associated LUT(s).

3.3.2 An MCC shall be able to provide System information to its associated LUT(s).

3.4 Data Communication

An MCC shall maintain communication links according to operational requirements.

3.4.1 The choice of communication link and network to be used between an MCC and its associated LUTs and national RCCs is a national prerogative.

3.4.2 An MCC shall only use communication networks identified in document C/S A.002 (SID) for communications with other MCCs. An MCC shall be capable of receiving text messages in non-SIT format sent by SAR authorities.

3.4.3 An MCC shall maintain communication links with other MCCs for the distribution of information as shown in document C/S A.001 (DDP). An MCC shall maintain access to at least two international communication networks to allow for backup. An MCC may enter into bilateral agreements with other MCCs with regard to communication networks, protocols, and other communication matters, consistent with requirements of documents C/S A.001 (DDP) and C/S A.002 (SID) and other provisions of this document (C/S A.005).

3.4.4 An MCC shall establish appropriate arrangements with all the countries/SPOCs in its service area on communication networks to be used for the distribution of alert data. If arrangements cannot be made for a particular country in the MCC service area, the MCC shall notify its own national SAR authorities of any Cospas-Sarsat alert data in that country's search and rescue region (SRR) for handling in accordance with national SAR procedures. It is recommended that MCCs maintain access to two communication networks to countries/SPOCs within its service area. These communication links and networks should be documented in C/S A.001 (DDP).

3.4.5 An MCC shall implement communication links consistent with the standards and protocols contained in document C/S A.002 (SID).

3.4.6 MCC data communication shall be implemented such that all communication links and networks can operate simultaneously without loss of information.

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3.5 Data Formats

3.5.1 An MCC may communicate in any format with its associated LUT(s) and with its own national RCCs and national SAR agencies.

3.5.2 MCCs shall employ only formats specified in document C/S A.002 (SID) for communications with each other. Each MCC must have the capability to send or receive the following Subject Indicator Type (SIT) messages.

Alert Messages											
SIT	115	117	121	122	123	124	125	126	127	132	133	185
Action	B	B	R	B	B	B	B	B	B	B	B	S

Alert Messages															
SIT	215	216	415	416	417	425	435	445	515	525	535	545	605	915	925
Action	R	R	R	-	R	-	-	-	-	-	-	-	B	B	R

(S: Send, R: Receive, B: Both send and receive)

SITs 416, and 425 through 545 are used by MCCs providing Space Segment resources.

In the case of SITs 215 and 216 (orbit vectors) and 415 and 417 (SARP calibration), all MCCs must be capable of receiving these messages from other MCCs and retransmitting the corresponding data to their associated LUT(s).

3.5.3 MCCs shall be able to interface with different communication networks (receive a message on one network and retransmit it, possibly after processing, to another contact on a different network), and change the message format, as appropriate (e.g., receive input data from associated LUT(s) and other MCCs and convert to SIT 185 for transmission to a SAR authority). Messages received in a non-standard format, that require retransmission, shall be transmitted in SIT 915 format.

3.5.4 An MCC shall use the SIT 185 format as specified in C/S A.002 (SID) to transmit messages to SPOCs of countries in their service area.

3.6 Monitoring of National Ground Segment

An MCC shall monitor the following System elements in its national Ground Segment.

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3.6.1 An MCC shall monitor the performance of its LUT(s) to determine degradation of its operational capability. LUT monitoring guidance is provided in document C/S A.003 (System monitoring and reporting).

3.6.2 An MCC shall monitor the LUT/MCC communication link. The LUT/MCC communication link may be actively monitored (i.e., sending periodic test messages), or passively monitored (e.g., monitoring the time delay between the forecast loss of signal at the LUT and the reception of the alert data at the MCC, or the LUT/MCC data transfer time).

3.6.3 An MCC shall monitor its own operation to ensure availability and to avoid distributing unreliable or corrupted data.

3.6.4 An MCC shall have the capability to monitor external communications with other MCCs, SPOCs or national RCCs.

3.6.5 An MCC shall immediately notify all other MCCs if it is unable to receive, process, and transmit data according to Cospas-Sarsat specifications.

Any anomaly detected that might affect the Cospas-Sarsat System shall immediately be reported in accordance with documents C/S A.001 (DDP) and C/S A.003 (System monitoring and reporting), and backup procedures shall be implemented, as appropriate.

3.7 Backup Provisions

3.7.1 In the event of a failure of a Ground Segment element or in case of a scheduled interruption, the MCC concerned shall implement backup procedures, possibly with the assistance of other MCCs, as described in Annexes of the Cospas-Sarsat Data Distribution Plan (C/S A.001). The affected MCC must be capable of informing other participants in the Ground Segment network using status messages as defined in document C/S A.001 (DDP).

3.7.2 An MCC shall be implemented such that failure of any associated LUT(s) will not affect the operation of the MCC with regard to reception and handling of alert data from other LUTs and other MCCs.

3.7.3 The MCC operator shall be able to compose and transmit messages manually in the event of a failure within the MCC, other than a communication system failure.

Additionally, MCCs should make bilateral arrangements where necessary to transfer LUT data from other Ground Segment operators in order to maintain the LUT data flow if another MCC fails.

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3.8 Re-routing of Messages

An MCC may possess the optional capability to re-route (provide alternate path(s)) messages between two other MCCs when the direct communication link between them fails. When this capability is available, re-routing procedures will be developed and agreed by the participating MCCs in advance of the operational use of message re-routing. Prior to activation of the agreed re-routing procedures, all involved MCCs will be notified.

This capability shall be designed such that:

a. the SIT message content sent by the originating MCC is the same as it would have been if re-routing were not in effect;

b. the SIT message content is preserved by the MCC(s) providing the re-routing service; and

c. the "MCC Data Routing Matrix" and "System Information Distribution" as given in Figure III/A.8 and Figure III/A.9 of document C/S A.001 (DDP) are not affected, and the SIT content of the message is not changed by the MCC(s) providing the re-routing service.

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3.9 406 MHz Beacon Register

An MCC shall maintain access to a register of 406 MHz beacons bearing its own country code and other States' country code, as provided for under bilateral agreements. An MCC shall also be capable of requesting information from States which maintain a beacon register for 406 MHz beacons using a serial coding protocol. This register should be accessible using the 15 hexadecimal character beacon identification code (with any position bits defaulted) or the mobile identification.

An MCC shall respond to requests from other MCCs for register information on 406 MHz beacons within the framework of its national regulations.

3.10 Information Archival and Retrieval

An MCC shall be able to archive and retrieve information concerning beacons for which it has received alert data (either from its own LUTs or from other MCCs) and any messages transmitted or received during a defined time-frame. The MCC shall then be capable of retransmitting the appropriate information to the MCC, SPOC or RCC which issued the request.

3.10.1 An MCC shall be able to retrieve alert (beacon) data using any of the following parameters:

a. Period of time to be covered by database search.

b. Beacon frequency (121.5, 243, 406 MHz).

c. Geographical area, given by (1) a rectangle (with sides running N-S and E-W) defined by latitude and longitude of extremities of one diagonal, or (2) a circle defined by centre and radius.

d. Beacon identification (MF#22, document C/S A.002).

e. Mobile identification (MMSI, ship call sign, aircraft registration, 24-bit aircraft address).

f. Country code.

The database interrogation modes shall be (a) + any one of the remaining items from the above list, consistent with beacon frequency. An MCC may implement other retrieval modes as determined by national needs.

3.10.2 An MCC shall be able to retrieve a Cospas-Sarsat message using any of the following parameters:

a. Message number.

b. Starting time/ending time of the search.

c. Type of message (incoming or outgoing).

d. SIT format.

e. Message source or destination (MF#2, MF#5, document C/S A.002).

f. Beacon identification (MF#22, document C/S A.002).

g. Mobile identification (MMSI, ship call sign, aircraft registration, 24-bit aircraft address).

h. Country code.

The database interrogation modes shall be either (a) + (e) or (b) + any one of the items from the above list.

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3.11 Test and Exercise Co-ordination and Reporting

An MCC shall be able to participate in tests and exercises following a request from another MCC. The procedure defined in document C/S A.001 (DDP) shall be applied.

An MCC shall also be capable of collecting and reporting alert data using formats and techniques agreed with the Cospas-Sarsat Joint Committee.

3.12 Interference Control

An MCC shall co-operate with other States participating in Cospas-Sarsat and with the International Telecommunication Union (ITU) through appropriate national channels, in locating and removing interference in the frequency bands used by Cospas-Sarsat.

MCCs are encouraged to collect 406 MHz repeater data from its associated LUT(s) to assist in locating 406 MHz interferers in their LUT coverage area(s). An MCC shall report on detected interferers in accordance with guidance provided in document C/S A.003.

3.13 Orbitography/Reference Beacon Operation

When a State provides an orbitography beacon as part of the Cospas-Sarsat orbitography network, as defined in System document C/S T.006, or a reference beacon, a designated MCC shall act as operational point of contact for communications with other Cospas-Sarsat MCCs regarding the operation of this beacon.

The State providing an orbitography or reference beacon may assign operational responsibility for the beacon to the designated MCC, which includes: control of activation, verification of location, monitoring performance and reporting outages.

An MCC shall be capable of receiving data resulting from orbitography or reference beacon transmissions.

3.14 Reporting Requirements

An MCC should be designed to allow the extraction of data used for reporting on system status and performance. The information provided on a periodic basis is documented in C/S A.003 and includes data on availability, beacon activations reported to RCCs/SPOCs, detected sources of interference, and data required for analysis of SAR events.

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4. FUNCTIONAL REQUIREMENTS

Document C/S A.001 (DDP) contains detailed information on data distribution procedures. These procedures are part of the functional requirements imposed on Cospas-Sarsat MCCs. The basic functional and processing requirements, which are further described in the sections below, of an MCC are to:

a. receive data from its associated LUTs and other MCCs;

b. validate alert messages based on format and content;

c. selectively process data;

d. match distress alert signals emanating from the same beacon source;

e. resolve Doppler ambiguity;

f. geographically sort distress alert data to determine the appropriate recipient of the alert data;

g. filter redundant distress alert data;

h. provide notification of country of beacon registration (NOCR) for 406 MHz beacons as required; and

i. process ship security alerts.

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4.1 Data Acquisition

An MCC shall be capable of receiving, without any loss of data, all uncorrupted messages sent by Cospas-Sarsat LUTs and MCCs and by SAR authorities via any of the networks to which it is connected. Incoming data shall be time tagged with the time of receipt (co-ordinated universal time (UTC)) and stored. Data received electronically shall be stored electronically. In all cases, incoming data shall be accessible to the operator for the period specified in section 5.

4.2 Data Validation

4.2.1 MCCs shall validate received SIT messages for proper data format and consistency using the guidelines provided in documents C/S A.001 (DDP) and C/S A.002 (SID). An MCC shall be capable of requesting retransmission of any message that is believed to be in error.

4.2.2 An MCC shall validate 406 MHz alert data received from LUTs and MCCs according to Annex III/B of document C/S A.001 (DDP) to ensure that alert data transmitted by the MCC corresponds to a real transmission, and to ensure that the alert was not a system processing anomaly generated by factors such

as the incorrect application of System time, invalid error correcting codes or invalid 406 MHz beacon message formats.

An MCC shall validate 121.5 MHz alert data received from its associated LUTs. Only validated locations are to be transmitted, except for specific national procedures. However, MCCs may, under bilateral agreements, decide to exchange 121.5 MHz locations before validation.

4.3 Process Data Selectively

4.3.1 An MCC shall have the capability to process data selectively (filter or transmit data to a specified destination), based on a specified source of data (LUT/MCC), satellite, frequency band, 406 MHz beacon user class (test, orbitography, or operational protocols), or the location/identification characteristics of a transmitting beacon (121.5 MHz or 406 MHz).

4.3.2 An MCC shall be capable of suppressing alert data transmission for a particular beacon when requested to do so by a receiving MCC, SPOC or RCC.

4.4 Position Matching

An MCC shall attempt to match distress alert signals emanating from the same beacon source in order to improve position accuracy or to resolve Doppler ambiguity.

4.4.1 An MCC shall use the criteria contained in Annex III/B of document C/S A.001 (DDP) to match 406 MHz alert data.

4.4.2 An MCC shall match 121.5 MHz alert data according to national procedures. The matching process may involve a number of technical parameters such as frequency, distance, and sweep period.

4.5 Ambiguity Resolution

Ambiguity resolution is the process of determining which of the two computed Doppler solutions for each transmitting beacon is the real position and which is the image. An MCC shall confirm a beacon position by resolving Doppler ambiguity.

4.5.1 An MCC shall use the criteria contained in Annex III/B of document C/S A.001 (DDP) to resolve Doppler ambiguity for 406 MHz alert data.

4.5.2 An MCC shall resolve 121.5 MHz Doppler ambiguity according to national procedures for matching.

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4.5.3 Typically, MCCs do not exchange data after ambiguity is resolved. However, in certain instances it is necessary to continue forwarding alert data to an MCC. In order to support this requirement, an MCC shall have the capability to continue transmission of alert data for selected beacons.

4.5.4 Ambiguity at a national level may also be resolved, subject to confirmation by SAR forces, using any additional information such as a request for assistance with indication of a probable search area, relation of locations to a 406 MHz beacon message, overflight reports, correlation of land/sea positions with beacon type (i.e., ELT/EPIRB/PLB), overdue reports, etc.

4.6 Geographic Sorting of Alert Data

An MCC shall maintain the capability to geographically sort beacon locations for its service area and those areas required by its communication links as described in document C/S A.001 (DDP). Each MCC service area shall be sub-divided into Cospas-Sarsat SPOC service areas, as required for application of national procedures.

4.7 Filtering Redundant Alert Data

Redundant alert data for the same beacon event is filtered at an MCC. An MCC shall filter 121.5 MHz alert data from its associated LUTs and from other MCCs according to its own criteria. MCCs shall filter 406 MHz alert data according to criteria defined in Annex III/B of document C/S A.001 (DDP). However, MCCs shall not filter redundant data for the McMurdo Station and Longyearbyen orbitography beacons and other designated beacons (see document C/S A.001, Annex II/E) used as part of the Cospas-Sarsat QMS continuous monitoring and assessment process. Additionally, 406 MHz alert data shall follow the procedures for determining better quality alert data for the same beacon event as contained in the DDP.

4.8 Notification of Country of Beacon Registration (NOCR)

In addition to the distribution of alert data, MCCs shall provide notification of a 406 MHz distress alert within their service area to all States. MCCs shall follow the procedures contained at Annex III/B of document C/S A.001 (DDP).

4.9 Ship Security Alert

MCCs shall process ship security alerts according to the logic in Annex III/B of document C/S A.001 (DDP). Routing of ship security alerts shall be based on the country code contained in the beacon message. Ship security alerts shall be exchanged using the formats and data content for 406 MHz alert messages as contained in document C/S A.002 (SID).

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- END OF SECTION 4 -

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5. PERFORMANCE REQUIREMENTS

The following performance requirements apply to the processing of alert data, alert messages and System information and narrative messages. More specific performance standards may be assigned by national authorities in accordance with their national SAR needs.

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5.1 Availability

The MCC shall be available to perform its functions 99.5% of the time over a period of one year.

5.2 Communication Links

MCCs shall implement procedures (e.g., Positive Delivery Notification, Channel Checks, Automatic Resends, Checksums and Sequential Message Numbers) as needed, to ensure that the communication network specifications in C/S A.005 are met.

5.2.1 LUT/MCC

5.2.1.1 An MCC shall receive all data transmitted by a LUT within ten (10) minutes from the completion of LUT processing 99% of the time.

5.2.1.2 The ratio of messages lost in data transfer shall be less than 0.1%.

5.2.2 MCC/MCC

5.2.2.1 An MCC shall implement data communication links and networks that allow it to transfer data to other MCCs within 15 minutes 99% of the time.

5.2.2.2 The ratio of messages lost or corrupted in data transfer between MCCs shall be less than 0.1%.

5.2.2.3 A communication network with other MCCs shall be available 99% during each calendar day.

5.2.3 MCC/SPOC

The MCC to SPOC communication networks shall be available 95% during each calendar day.

5.3 Alert Data Processing Capacity

5.3.1 An MCC shall be capable of receiving and processing, on one satellite pass, a minimum of 20 locations at 121.5 MHz and 100 locations at 406 MHz[1] from its associated LUTs.

5.3.2 An MCC shall be capable of receiving and processing from other MCCs the number of alert messages as determined by a forecast of the volume of alert traffic at 406 MHz and 121.5 MHz. The forecast shall take into account:

a. the actual and forecast volumes of regional beacon populations at 406 MHz and 121.5 MHz;

b. the actual and forecast volumes of the global 406 MHz beacon population; and

c. the data distribution procedures outlined in the "Cospas-Sarsat Data Distribution Plan" (C/S A.001).

5.4 System Information Processing Capacity

An MCC shall be capable of receiving and sending a minimum of 15 System information messages per day.

5.5 Cospas-Sarsat QMS Continuous Monitoring and Objective Assessment Capacity

An MCC shall transmit solution data in accordance with the QMS continuous monitoring and objective assessment process described in section 9 of document C/S A.003.

An MCC shall transmit solution data received for the McMurdo Station and Longyearbyen orbitography beacons (document C/S A.001, Annex II/E) from each of its associated LEOLUTs to its associated nodal MCC in a SIT 122 or SIT 125 format, as appropriate.

An MCC shall transmit solution data received for appropriate reference beacons (document C/S A.001, Annex II/E) from each of its associated GEOLUTs to its nodal MCC in a SIT 122 format.

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[1] The requirement of section 5.3.1 only identifies the minimum MCC alert data processing capabilities and does not reflect the 406 MHz beacon capacity specified for LUTs in document C/S T.002 "LEOLUT Performance Specification and Design Guidelines".

5.6 Processing Time

MCC processing time is the time elapsed between the receipt of data at an MCC and the transfer to another MCC, SPOC or national RCC of the outgoing message to the communication link. An MCC shall process all alert data within 15 minutes 99% of the time.

5.7 Processing Integrity

5.7.1 The MCC computation shall contribute no more than 0.2 km to the position error of locations received from a LUT or an MCC.

5.7.2 An MCC shall geographically sort beacon locations and distribute all alert messages to the correct MCC, RCC or other SPOC to within the tolerance of ± 25 km of the agreed boundary of MCC service area or SRR.

5.7.3 The MCC shall maintain a time reference accurate to within ± 25 seconds.

5.7.4 An MCC shall not corrupt transiting data.

5.8 Access to Archived Information

An MCC shall maintain access to beacon data and alert messages. The following times shall apply.

5.8.1 MCCs shall archive alert data and messages for at least 30 days.

5.8.2 MCC shall respond to requests for archived data and messages from other MCCs, SPOCs, or RCCs within 60 minutes.

5.8.3 MCCs shall respond to requests for alert data, and messages covering the preceding 48-hour period within 30 minutes.

5.9 Additional Timing Requirements

An MCC shall be designed to allow for the following timing requirements.

5.9.1 10 minutes to suppress alert data.

5.9.2 60 minutes to complete backup procedures such that continuous delivery of alert messages is not interrupted for longer than one hour.

5.9.3 15 minutes to forward a request for information to the national beacon register.

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5.9.4 15 minutes to forward retrieved information to the requesting authority.

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6. SPECIFICATIONS FOR NODAL MCCs

In addition to the requirements contained in the preceding sections, nodal MCCs shall comply with the following operational, functional, performance and co-ordinating requirements.

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6.1 Operational Requirements

6.1.1 General

A nodal MCC shall be staffed with on-site personnel 24 hours a day to maintain the nodal function.

6.1.2 Communications

A nodal MCC shall have access to as many types of communication links as required by the Data Distribution Region (DDR) communication structure, and as required by the nodal MCC network structure. The nodal MCC shall have the capability to send and receive data simultaneously on each communication medium that is used. This may be implemented by having more than one independent communications link, multiple lines supporting one communication link or by having one or more communications service which supports simultaneous reception and transmission of data.

6.1.3 Quality Management System (QMS) Continuous Monitoring and Objective Assessment

A nodal MCC shall monitor the operation of the Cospas-Sarsat System within its DDR and take appropriate action when an anomaly is detected. Monitoring includes a verification of receipt of data from MCCs within its DDR within a reasonable time (e.g., some message(s) should be received from an MCC within any eight hour period). If any anomaly is detected, the nodal MCC shall report the problem to the MCC involved for action.

A nodal MCC shall implement the analysis and reporting process detailed in document C/S A.003, section 9. This analysis and reporting capability shall meet the following requirements:

6.1.3.1 LEOLUT

6.1.3.1.1 For each LEOLUT in the nodal MCC's DDR, collect all solutions from operational LEO satellites for the designated orbitography beacons for the analysis time period. The minimum required fields for each solution are:

a. Latitude Side A

b. Longitude Side A

c. Latitude Side B

d. Longitude Side B

e. Number of Points

f. Window Factor

g. Cross Track Angle (CTA)

h. Satellite

i. Time of Closest Approach (TCA)

j. 15 Hex Beacon Id

6.1.3.1.2 Generate a set of passes (satellite and times frame) within the analysis period when the orbitography beacon was visible to operational LEO satellites for at least 120 seconds (4 beacon bursts). The minimum required fields for each pass are:

a. Satellite

b. Time of First Visibility (AOS)

c. Time of Last Visibility (LOS)

6.1.3.1.3 Perform LEOLUT Location Accuracy analysis as follows:

a. Identify and record the type of each solution as nominal or marginal (see section 5.1 of document C/S T.002 for definitions)

b. Compute and record the location error (minimum error Side A or Side B) with respect to the known location of the orbitography beacon

c. Compute daily for each LEOLUT in the DDR and each operational LEO satellite, a LEOLUT / LEOSAT accuracy ratio, using the nominal Doppler solutions received during the last three days for the McMurdo and Longyearbyen beacons (i.e., between Day -3, 00:00 UTC and Day 0, 00:00 UTC). The accuracy ratio is defined as follows:

R.X (i,j) = N Loc (E ≤ X km) / N Loc, where

N Loc = total number of Doppler locations with nominal solutions, obtained for the McMurdo and Longyearbyen beacons during the time period Day -3, 00:00 and Day 0, 00:00

N Loc (E ≤ X km) = number of Doppler locations with nominal solutions obtained for McMurdo and Longyearbyen during the time period Day-3, 00:00 and Day 0, 00:00 with a distance to the true position of the McMurdo or Longyearbyen beacons less than or equal to X km

R.X (i,j): X km accuracy ratio for LEOLUT(i) and LEOSAT(j)

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Note: the computation should be performed at Day 0 + 14:00 hour (UTC) to take into account the maximum delay between the last LEOSAT(j) pass over McMurdo and Longyearbyen during the period and the actual tracking of LEOSAT(j) by LEOLUT(i). This period is based on analysis showing that 99% of solutions were received by the LUT within 14 hours of satellite detection.

d. LEOLUT accuracy ratios shall be computed for X = 5 km, 10 km and 20 km.

6.1.3.1.4 Perform LEOLUT Availability Analysis as follows:

Compute daily, for each LEOLUT in the DDR and each operational LEO satellite, a LEOLUT / LEOSAT availability ratio, using the data received during the last three days for both the McMurdo and Longyearbyen beacons (i.e., between Day -3, 00:00 UTC and Day 0, 00:00 UTC). The availability ratio is defined as follows:

Av (i,j) = N available (i,j) / N expected (i,j), where

N available (i,j) = number of orbits of LEOSAT(j) over McMurdo and Longyearbyen beacons between Day -3, 00:00 UTC and Day 0, 00:00 UTC for which valid alert messages with a Doppler location were produced by LEOLUT(i).

N expected (i,j) = number of orbits of LEOSAT (j) over McMurdo plus number of orbits of LEOSAT (j) over Longyearbyen between Day -3, 00:00 UTC and Day 0, 00:00 UTC, where the beacon was visible to the satellite for at least 120 seconds.

Note: the computation should be performed at Day 0 + 14:00 hour (UTC) to take into account the maximum delay between the last LEOSAT(j) pass over McMurdo and Longyearbyen during the period and the actual tracking of LEOSAT(j) by LEOLUT(i).

6.1.3.2 GEOLUT

a. For each GEOLUT in the nodal MCC's DDR, collect all solutions for the designated reference beacon for the analysis time period.

b. Decode the 30 hexadecimal beacon message to determine the validity of the message. If the first protected field of the beacon message is not valid (per document C/S T.009, section 4.2.4), then the associated alert message should not be counted as received.

c. Compute the total number of received messages for the analysis period, per section 9 of document C/S A.003.

d. Perform GEOLUT Availability Analysis as follows:

Compute daily, for each GEOLUT in the DDR a GEOLUT / GEOSAT availability ratio, using the valid alert messages received for each 20 minute slot

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on Day 0 between 00:00 UTC and 24:00 UTC for the designated orbitography or reference beacon. The availability ratio is defined as follows:

Av (i,j) = N available (i,j) / N expected (i,j), where

N available (i,j) = number of 20 minute time slots for which GEOLUT(i) produced valid alert messages for the time period Day 0, 00:00 UTC and Day 0, 24:00 UTC for the designated orbitography or reference beacon

N expected (i,j) = 72 (for one designated orbitography/reference beacon in the satellite footprint).

Note: the computation should be performed at Day 0 + 30 minutes in order to allow time for transmission to the nodal MCC.

6.1.4 Back-up Procedures

A nodal MCC shall develop a detailed back-up plan which will be documented in the annexes of document C/S A.001 (DDP). The continuation of the distribution of alert data normally provided by the nodal MCC could be implemented through bilateral arrangements with other MCCs within the same DDR, or with other nodal MCCs. MCCs that assume the role of a back-up nodal MCC shall ensure that the minimum agreed operational functionality of the failed node is retained in contingency situations.

6.2 Functional Requirements

6.2.1 Validation

A nodal MCC shall validate all messages according to the document C/S A.002 (SID) to ensure that the correct message formats are used in the Cospas-Sarsat System. If a nodal MCC detects a message with an incorrect format or an incomplete message that has been generated by an MCC located in its DDR, the nodal MCC shall filter the anomalous message from the distribution system and notify the MCC which generated the message.

6.2.2 Data Processing

6.2.2.1 A nodal MCC shall be capable of receiving and processing alert data from other nodal MCCs, from other MCCs within its DDR, in addition to alert data received from its national or associated LUTs.

6.2.2.2 A nodal MCC shall maintain the integrity of data transiting its system.

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6.2.3 Geographical Sorting of Alert Data

A nodal MCC shall maintain the capability to geographically sort beacon locations for all MCC service areas within its DDR and for all other DDRs as necessary.

6.2.4 System Information Processing

6.2.4.1 A nodal MCC shall be capable of receiving, processing and transmitting System information. A nodal MCC shall follow the System information routing described in C/S A.001 (DDP).

6.2.4.2 A nodal MCC shall validate System information (satellite ephemeris and SARP calibration data) received from other nodal MCCs and transmit the validated information to other nodal MCCs, to MCCs within its DDR, as specified in the document C/S A.001 (DDP). System information is validated to ensure the accuracy of the alert data provided by the Cospas-Sarsat System to the SAR community. The criteria used to validate System information are provided in document C/S A.003 (System monitoring and reporting). Suspected invalid information shall be reported to the MCC which generated the original System information.

6.2.5 Narrative Information Processing

Nodal MCCs shall route SIT 915 and 925 messages in accordance with Figure III/A.8 based on the Destination MCC (Message Field 5, C/S A.002, Appendix B.1 to Annex B). When a SIT 915 or 925 message transits a nodal MCC, the nodal MCC shall set the Message Header (Message Fields 1, 2 and 3, C/S A.002, Appendix B.1 to Annex B) to reflect its transmission of the message to the Destination MCC.

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6.3 Performance Requirements

6.3.1 Availability

The nodal MCC's functions shall be available 99.5% of the time over a period of one year. A nodal MCC shall implement its backup procedures if its non-availability is expected to exceed four hours.

6.3.2 MCC/MCC Communication

The inter-nodal MCC communication availability shall be 99.5% during each calendar day (i.e., the nodal MCC must have at least one communication network available with other nodal MCCs identified in document C/S A.001 (DDP), 99.5% of the time during each calendar day).

6.3.3 Alert Processing Capacity

6.3.3.1 A nodal MCC shall be capable of processing the alert data from its associated LUT(s) and from other MCCs as outlined in document C/S A.001 (DDP) taking into account the performance requirements for alert data processing capacity contained in section 4 of this document.

6.3.3.2 The nodal MCC shall be capable of transmitting the number of alert messages as determined by the forecast of regional traffic associated with the network structure defined in C/S A.001 (DDP).

6.4 Co-ordinating Requirements

6.4.1 A nodal MCC shall co-ordinate the development of the communication links with the MCCs in its DDR. This co-ordination shall include, for example, the types of communication media to be used for intra-DDR communication, and the structure of the DDR communication network.

6.4.2 A nodal MCC shall act as the focal point within its DDR for the distribution of operational Cospas-Sarsat System information and shall provide assistance to the MCCs within its DDR on Cospas-Sarsat matters. The nodal MCC shall provide information and guidance on Cospas-Sarsat System matters, as required. The nodal MCC shall encourage within its DDR the establishment of 406 MHz registries and the registration of 406 MHz beacons.

6.4.3 A nodal MCC shall provide support and assistance to developing MCCs within its DDR. This assistance includes conducting the commissioning tests for a new MCC, reviewing and completing the commissioning report, and forwarding the commissioning report to the Secretariat for review by the Joint Committee.

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- END OF SECTION 6 -

ANNEXES TO THE DOCUMENT
COSPAS-SARSAT
MISSION CONTROL CENTRE (MCC)
PERFORMANCE SPECIFICATION
AND DESIGN GUIDELINES

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ANNEX A

LIST OF ACRONYMS USED IN C/S A.005

Cospas	Space System for the Search of Vessels in Distress
CSC	Cospas-Sarsat Council
DDP	document C/S A.001 "Cospas-Sarsat Data Distribution Plan"
DDR	Data Distribution Region
ELT	Emergency Locator Transmitter
EPIRB	Emergency Position-Indicating Radio Beacon
IA5	International Alphabet No. 5
IOC	Initial Operational Capability
ITU	International Telecommunication Union
LEOSAR	Low Earth Orbiting (LEO) satellite system for SAR
LUT	Local User Terminal
MCC	Mission Control Centre
MF	Message Field
MHz	megahertz
MMSI	Maritime Mobile Service Identity
NOCR	Notification of Country of Beacon Registration
PLB	Personal Locator Beacon
RCC	Rescue Co-ordination Centre
SAR	Search and Rescue
SARP	Search and Rescue Processor
Sarsat	Search and Rescue Satellite-Aided Tracking
SID	document C/S A.002 "Cospas-Sarsat Mission Control Centres Standard Interface Description"
SIT	Subject Indicator Type
SPOC	SAR Point of Contact
SRR	Search and Rescue Region
UTC	Co-ordinated Universal Time

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