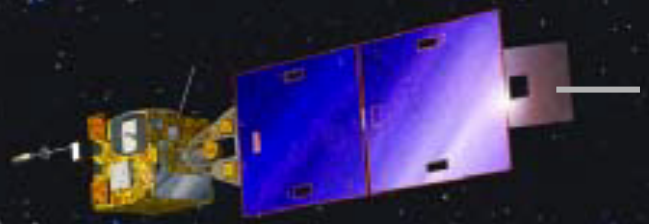
Gulf Satellite Aided Search and Rescue Seminar

Abu Dhabi, UAE

6-8 March 2011



Mission Control Centres
COSPAS-SARSAT

Emilia Melián
Head of Spanish MCC
Cospas-Sarsat Programme

OUTLINE MCCs COSPAS - SARSAT

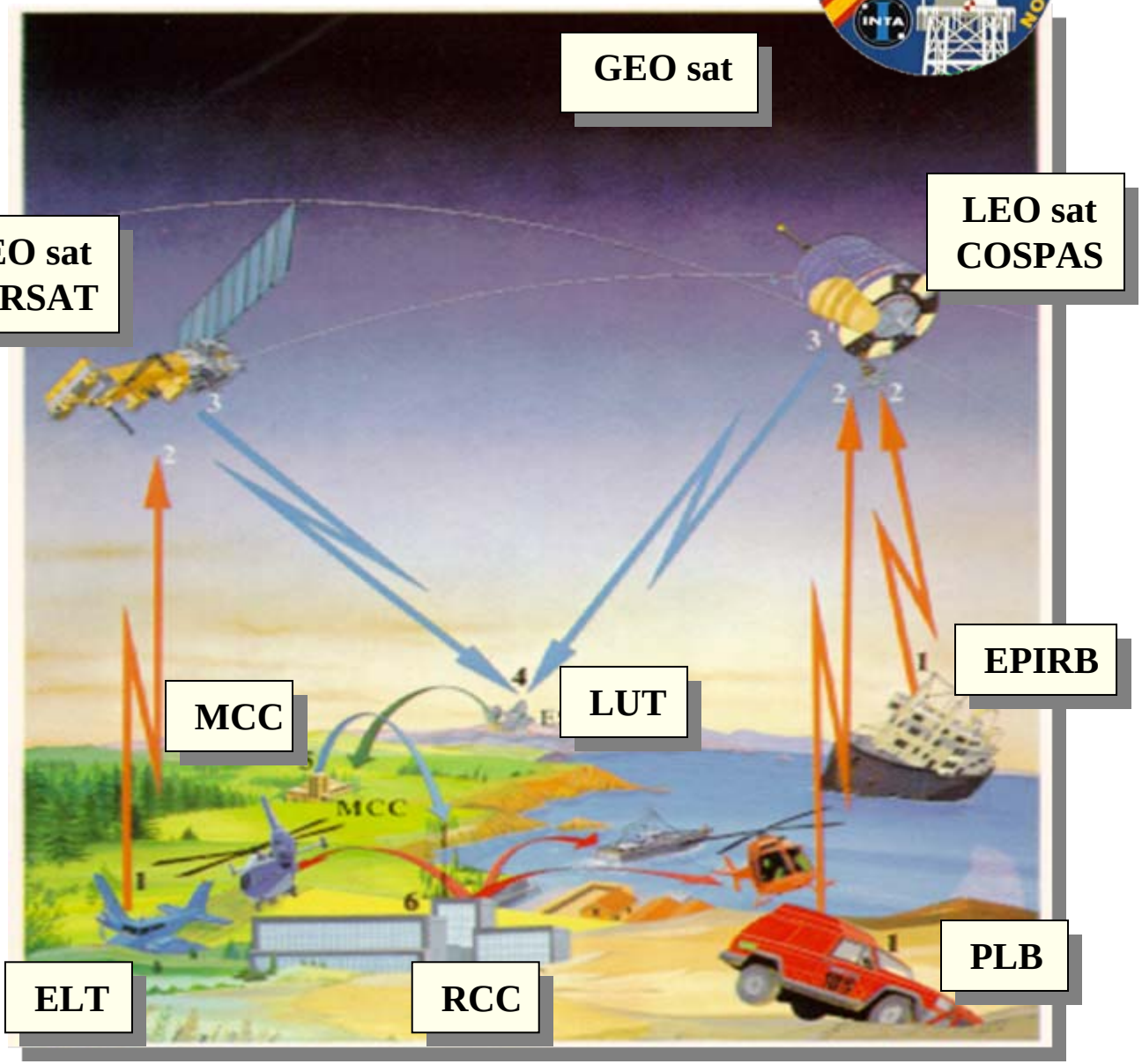
- ➔ Cospas-Sarsat Program
  - Basic Concept (brief-review)
  - System Elements
    - Emergency Beacons
    - Space Segment
    - Ground Segment
- ⇨ Cospas-Sarsat MCCs
  - MCC Overview
  - System Operation
  - MCC Functions and Operations
  - MCC Data Distribution Region
  - MCC Communication Network
  - Nodal MCC Function and Supports
  - South Central DDR – MCC Service Area
  - MID Region Geosorting
  - Alerts Distribution Procedure
  - Message Format - SIT
  - Communication Standards
  - MCC Reports
- ⇨ Conclusions

BASIC CONCEPT OF THE C/S SYSTEM

GEO	Geostationary Earth Orbit
LEO	Low Earth Orbit
sat	Satellite

LUT	Local User Terminal
MCC	Mission Control Center
RCC	Rescue Coordination Center

ELT	Emergency Locator Transmitter
EPIRB	Emergency Position Indicating Radio Beacon
PLB	Personal Locator Beacon

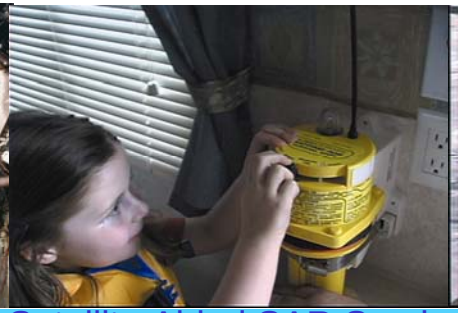


Assistance in rescuing from SEP/1982 to DEC/2009


- **SAR EVENTS: 7.746**
- **PERSONS RESCUED : 28.375**
  - **Maritime distress (79%): 22.365**
  - **Aviation distress (12%): 3.437**
  - **Land distress (9%): 2.573**

(December 2010)



C/S SYSTEM ELEMENTS

3 - GROUND SEGMENT

1 - EMERGENCY BEACONS

2 - SPACE SEGMENT

EMERGENCY BEACONS

The radio beacon segment is formed by the emergency beacon designed to transmit distress signals.

The emergency beacons transmit signals on **406 MHz**.

Most 406 MHz beacons include a 121.5 MHz homing transmitter.

Position information can also be included in the message of some 406 MHz beacons.

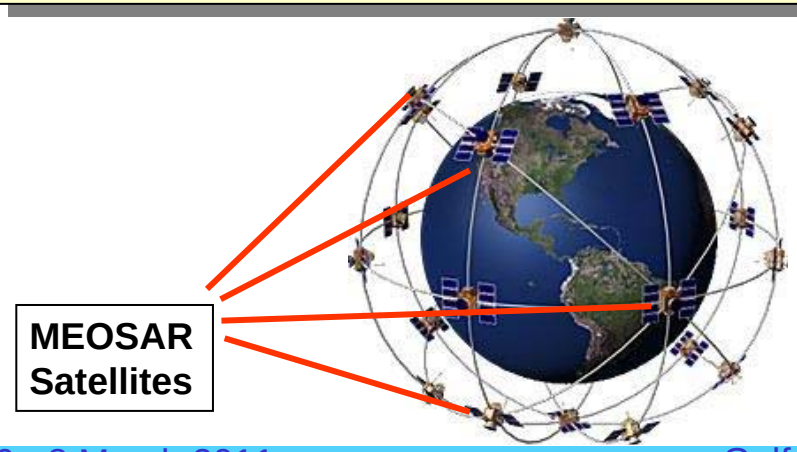
- **EPIRB** Emergency Position Indicating Radio Beacon
  Maritime use
- **ELT** Emergency Locator transmitter
  Aeronautical use
- **PLB** Personal Locator Beacon
  Personal use

SPACE SEGMENT

The space segment is formed nowadays by two types of satellites:

- Low Earth Orbit Satellite System Search and Rescue (LEOSAR) (polar orbit)
- Geostationary Satellite System Search and Rescue (GEOSAR) (geosynchronous orbit)

The space segment is developing to use Medium Earth Orbit Satellite System Search and Rescue (MEOSAR) (medium orbit)



MEOSAR Satellites

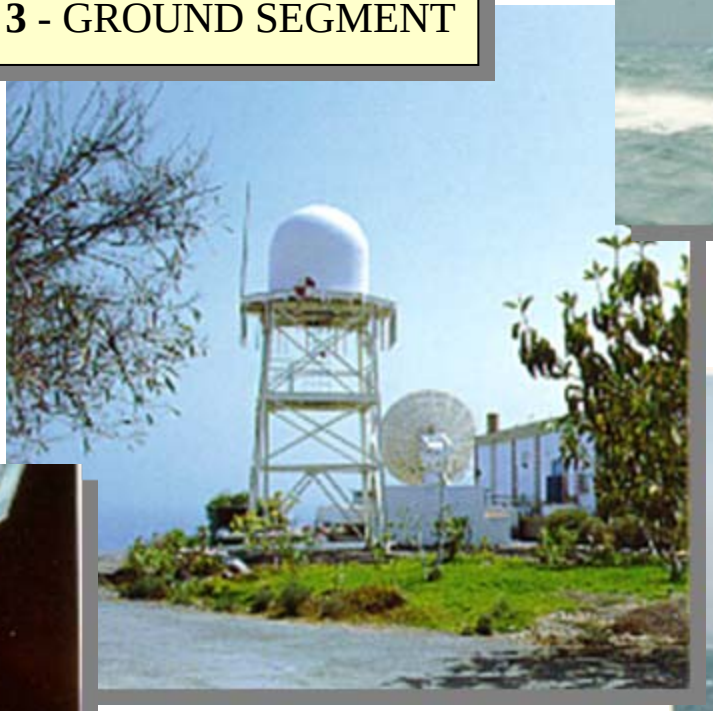
GEOSAR Satellites

LEOSAR Satellites

C/S SYSTEM ELEMENTS

2 - SPACE SEGMENT

3 - GROUND SEGMENT



1 - EMERGENCY BEACONS

GROUND SEGMENT

The ground segment is formed by two main elements:

- **Local User Terminal (LUT)**

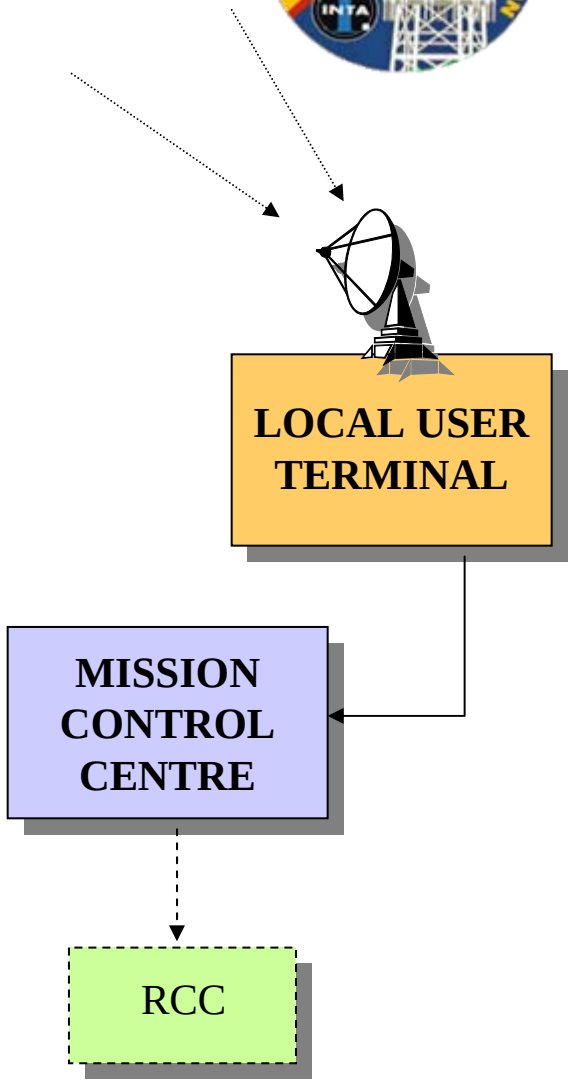
The LUT receives and processes distress alerts from emergency beacons relayed by the SAR satellites.

  - **LEOLUT** – LEOSAR LUT
  - **GEOLUT** – GEOSAR LUT

- **Mission Control Centre (MCC)**

The **MCC** collects, stores and sorts the **data** from LUTs and other MCCs, and distributes alerts and location data to associated RCCs or SPOCs through the Cospas-Sarsat MCC network.

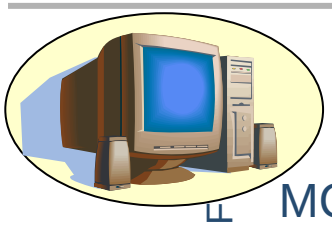
The **MCC** provides **data** exchange within the Cospas-Sarsat system.



OUTLINE MCCs COSPAS - SARSAT

- ⇨ Cospas-Sarsat Program
  - Basic Concept (brief-review)
  - System Elements
    - Emergency Beacons
    - Space Segment
    - Ground Segment
- ➔ Cospas-Sarsat MCCs
  - MCC Overview
  - System Operation
  - MCC Functions and Operations
  - MCC Data Distribution Region
  - MCC Communication Network
  - Nodal MCC Function and Supports
  - South Central DDR – MCC Service Area
  - MID Region Geosorting
  - Alerts Distribution Procedure
  - Message Format - SIT
  - Communication Standards
  - MCC Reports
- ⇨ Conclusions

MCC OVERVIEW



MCCs

Network IF

LUTs

Network IF

MCC equipment

Network IF

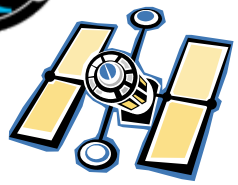
MCC staff

RCC/SPOC

- Hardware
- Software → automatic
- Communication Interfaces
  FTP-VPN, AFTN,
  X.25, Fax, Phone
  - LUT → MCC
  - MCC → MCC
  - MCC → RCC/SPOC

- 24H/7D
- Operations
- Maintenance
- System monitoring
- System Test
- Communication Test
- Report on operations
- QMS

SYSTEM OPERATION



EPIRB
ELT
PLB

406 MHz

LUT

MCC

SPOC → RCC → SAR

RCC
National → **SAR**

other
MCC → RCC → SAR

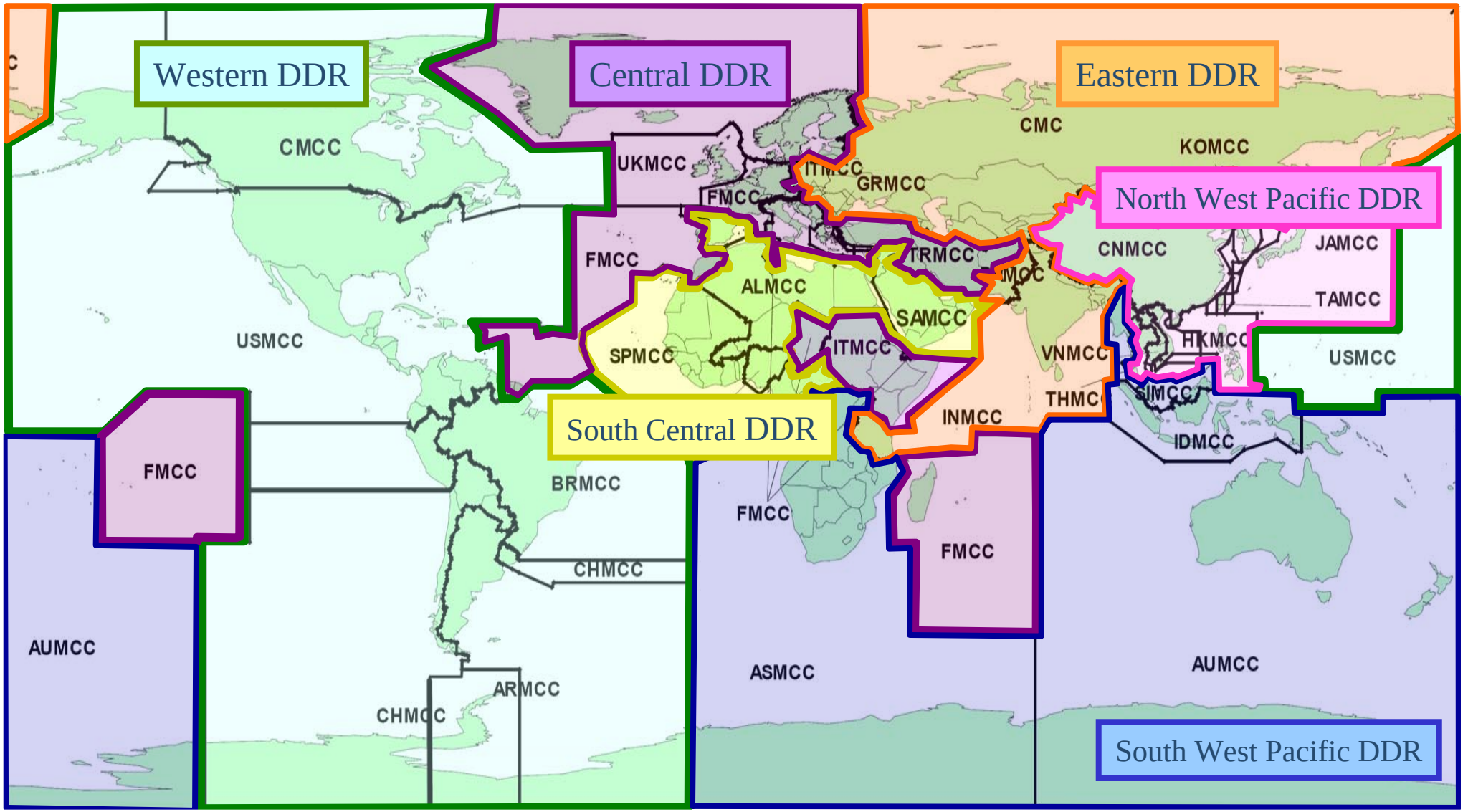
other
MCC → SPOC → RCC → SAR

MISSION CONTROL CENTER (MCCs)

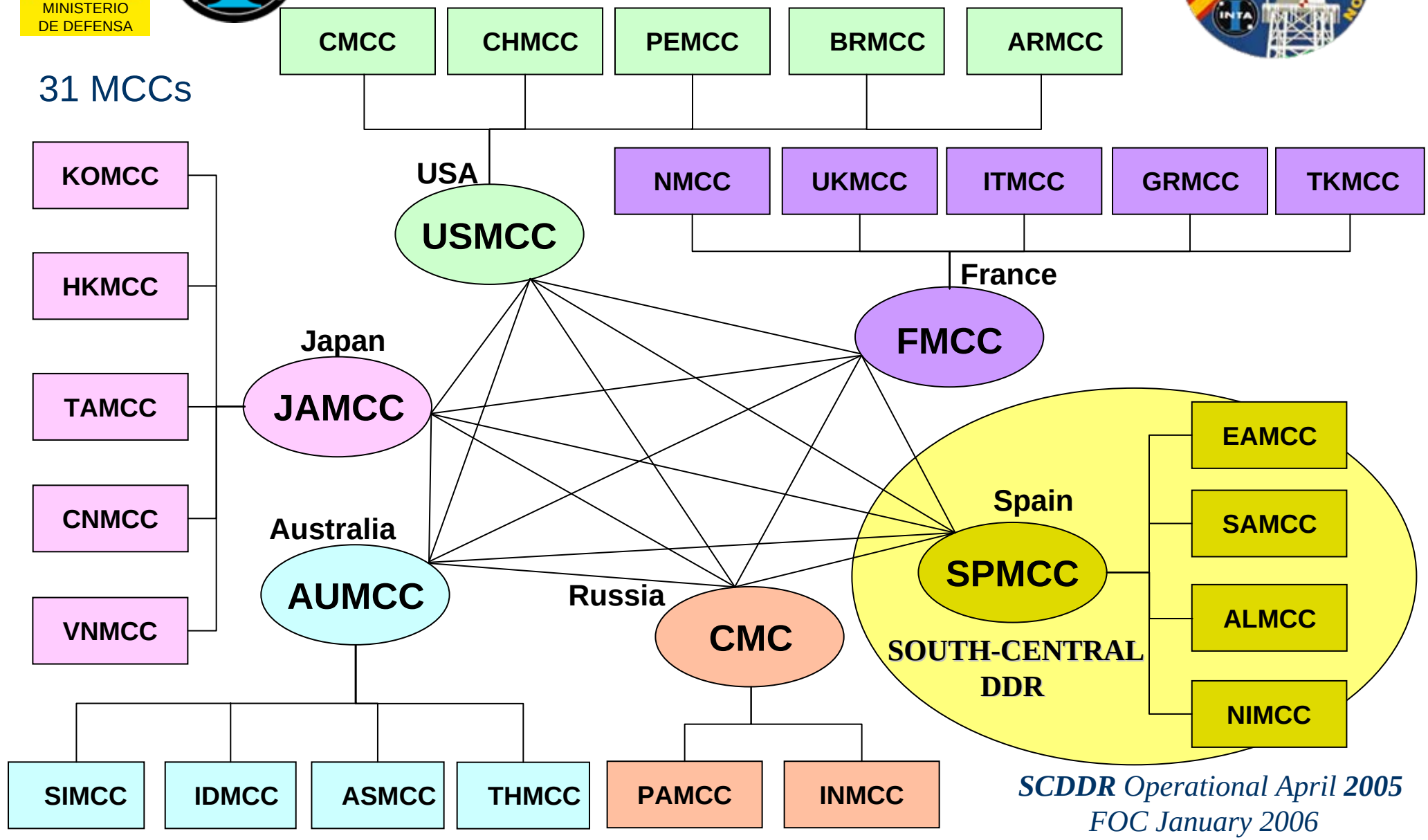
MCC functions and operations

- Receive alert data from national LUTs and foreign MCCs.
- Validate and attempt to match signals coming from the same beacon source.
- Merge beacon signals from the same source to improve location accuracy.
- Geographically sort data to determine appropriate recipient of alert message.
- Query 406 MHz Registration Database and include this information in the alert message.
- Transmit alert messages to Search And Rescue Authorities (RCCs / SPOCs).
- Filter redundant alert data.
- Most MCC functions are handled automatically, no manually to increase the efficiency.

DATA DISTRIBUTION REGION



MCC COMMUNICATION NETWORK

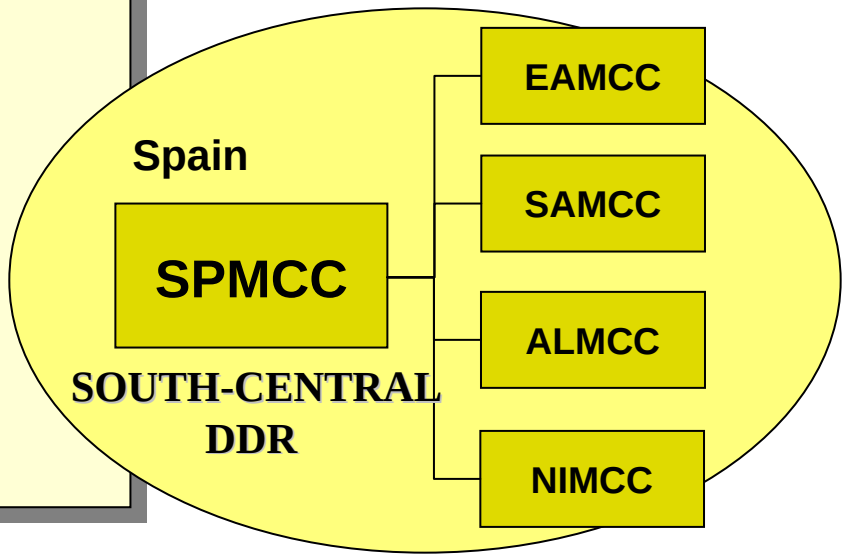


*SCDDR Operational April **2005***
FOC January 2006

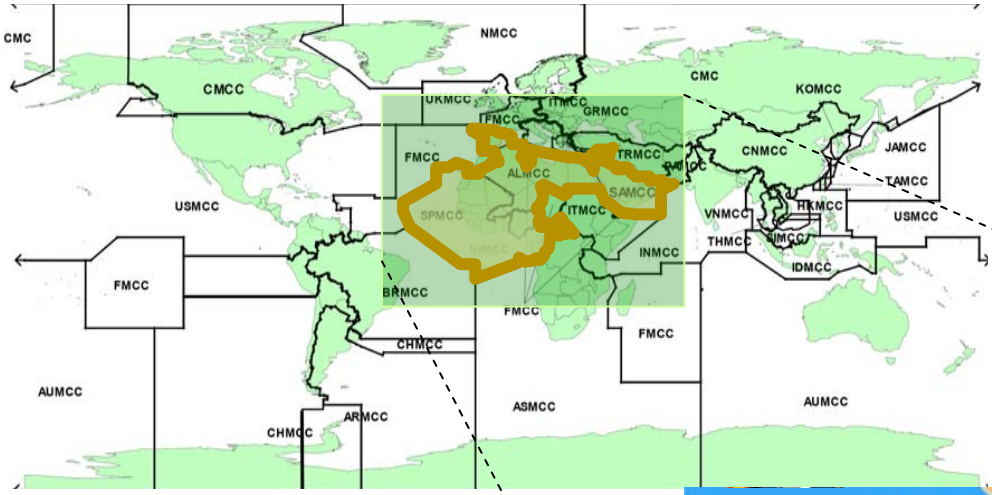
NODAL MISSION CONTROL CENTER (MCCs)

NODAL MCC functions and supports

- Coordinate activities in its DDR.
- Act as a focal point for MCCs in its DDR.
- Provide support and assistance to developing MCCs.
- Monitor operational status of MCCs in its DDR.
- Act as a communication hub.
- MCC Commissioning.
- MCC backup.
- Reporting on DDR System Test Results.



SOUTH-CENTRAL DDR
MCC SERVICE AREA



SPAIN

- Benin
- Cameroon
- Cape Verde
- Central Africa Rep.
- Congo
- Gabon
- Gambia
- Ghana
- Guinea
- Guinea Bissau
- Guinea Equatorial
- Ivory Coast
- Liberia
- Mali
- Mauritania
- Sao Tome & Principe
- Senegal
- Sierra Leone
- Togo

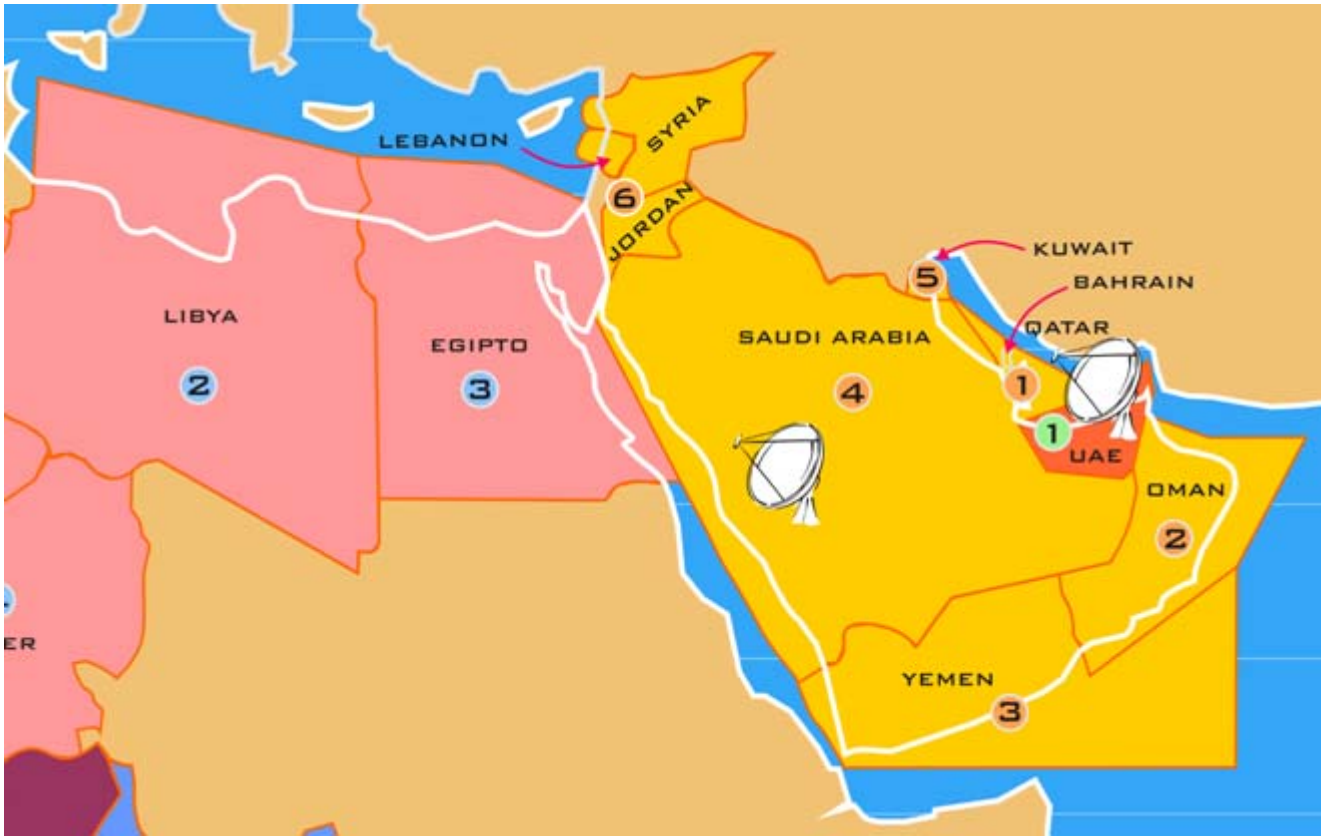
- Algeria - ALMCC
- Burkina Faso
- Egypt
- Libya
- Niger

- Nigeria - NIMCC

- Saudi Arabia - SAMCC
- Bahrain
- Jordan
- Kuwait
- Lebanon
- Oman
- Qatar
- Syria
- Yemen

- UAE - AEMCC

MID REGION GEOSORTING



- Algeria - ALMCC
- Burkina Faso
- Egypt
- Libya
- Niger
- Saudi Arabia - SAMCC
- Bahrain
- Jordan
- Kuwait
- Lebanon
- Oman
- Qatar
- Syria
- Yemen
- UAE - AEMCC

ALMCC SERVICE AREA

1 ALGERIAN SPOC
2 LYBIA
3 EGYPT SAR CENTRE
4 NIAMEY
5 RSC OUAGADOUGOU

SAMCC SERVICE AREA

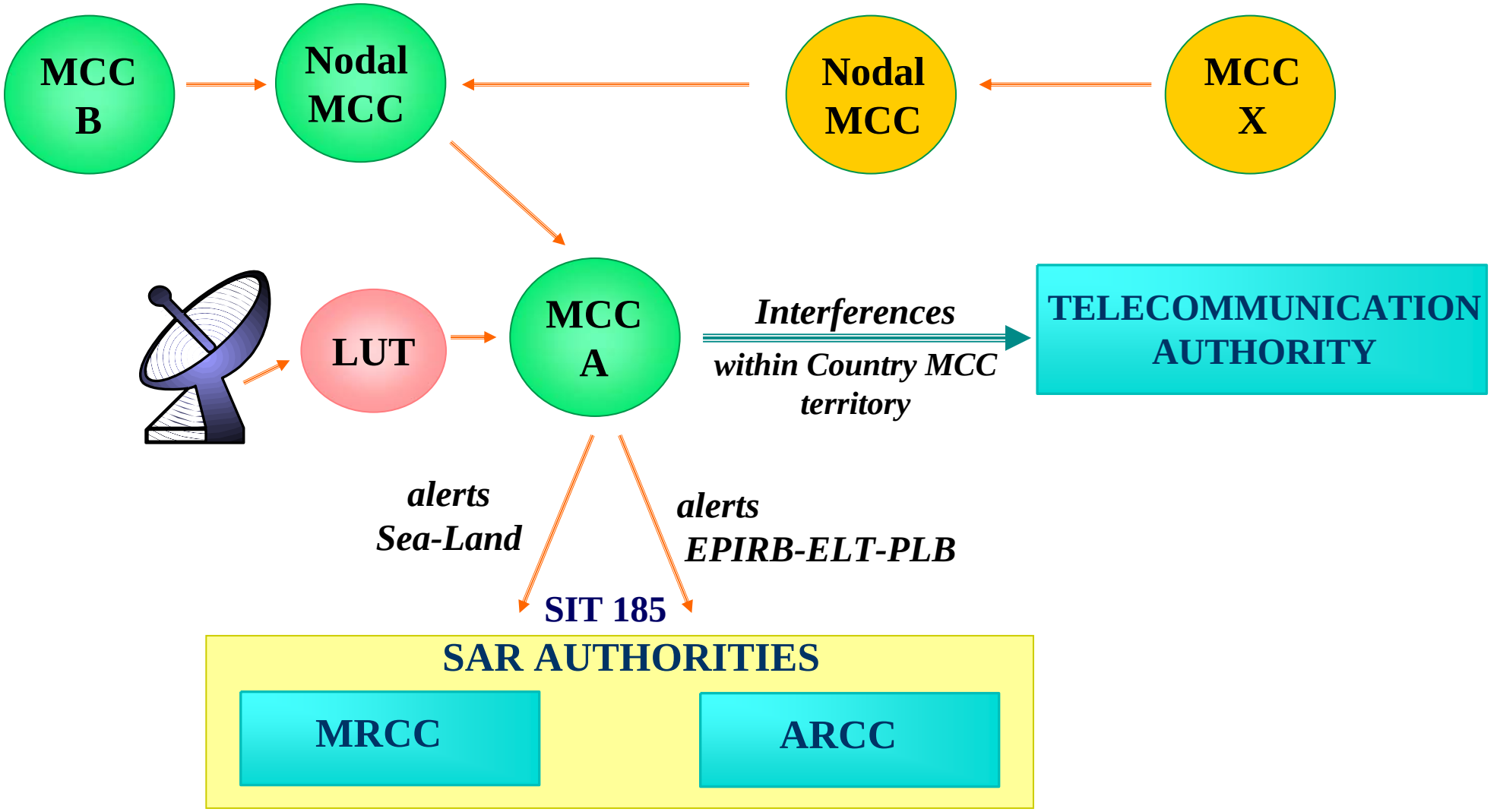
1 RCC/ ACC BAHRAIN
2 RCC/ACC MUSCAT
3 RCC/ACC SANAA
4 SAUDI SPOC
5 RCC KUWAIT
6 RCC AMMAN

AEMCC SERVICE AREA

1 RCC EMIRATES

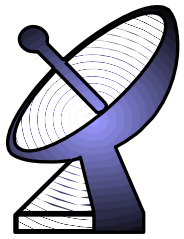
ALERTS DISTRIBUTION PROCEDURE

INSIDE MCC SERVICE AREA



ALERTS DISTRIBUTION PROCEDURE

OUTSIDE OF MCC SERVICE AREA



LUT

MCC

NOCR

Notification Of Country Registration

MCCs

alerts

alerts

SIT 185

SPOC SERVICE AREA

SOUTH-CENTRAL REGION

Nodal MCC

Nodal MCC

MCC X

MCC Y

OTHER REGIONS

MESSAGE FORMAT
SIT - SUBJECT INDICATOR TYPES

Alert messages

They are exchanged between MCCs according to standardized message formats, SIT nnn, that can be classified according to the subject matter being transmitted:

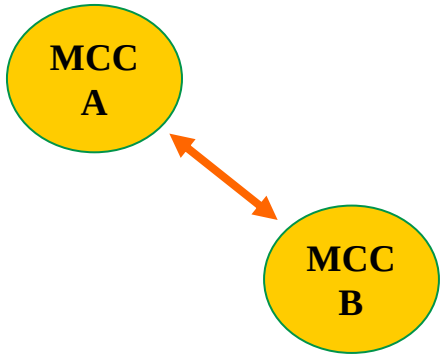
- MCC – MCC

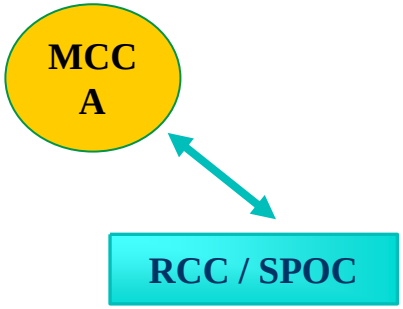
(Subject Indicator Type)		SIT
Unlocated / Encoded Only	.....	122
Located – 1st Alert	.....	125
Located – Resolved Alert	....	127
NOCR	.....	133

- MCC – SPOCs ..... Cospas-Sarsat Alert..... 185
- Narratives / System Information: 915, 605
- System Messages: Orbit vectors update (daily) 215
  SARP calibration (weekly) 415, 417

MESSAGE FORMAT

Subject Indicator Types for Alert Messages





SIT		Meaning	Page
121	406 INTERFERER NOTIFICATION	This message is used for notification of 406 MHz interferer signals.	C-8
122	406 INCIDENT (NO DOPPLER)	A 406 MHz alert message with no Doppler positions. An encoded position may or may not be available.	C-9
123	406 POSITION CONFLICT (ENCODED ONLY)	A 406 MHz alert message with no Doppler positions for which the encoded position differs by more than the match criteria from all previous positions.	C-9
124	406 AMBIGUITY RESOLUTION (ENCODED ONLY)	A 406 MHz alert message with no Doppler positions that identifies the resolved position of a 406 MHz alert.	C-9
125	406 INCIDENT	A beacon alert message computed from 406 MHz incident data. The message contains Doppler positions.	C-10
126	406 POSITION CONFLICT	A beacon alert message computed from 406 MHz incident data. The message contains Doppler and/or encoded position(s) which may differ from previous position(s) by the match criteria.	C-10
127	406 AMBIGUITY RESOLUTION	A 406 MHz alert message with Doppler positions that identifies the resolved position of a 406 MHz alert. It may or may not contain an encoded position.	C-10
132	406 NOTIFICATION OF COUNTRY OF REGISTRATION (ENCODED ONLY)	This message is used between MCCs to notify the country of registration of a 406 MHz beacon (NOCR). This message contains only an encoded position.	C-9
133	406 NOTIFICATION OF COUNTRY OF REGISTRATION	This message is used between MCCs to notify the country of registration of a 406 MHz beacon (NOCR). This message contains Doppler positions. It may or may not contain an encoded position.	C-10
185	COSPAS-SARSAT ALERTS	This message is used for alert messages and as NOCR message between MCCs and SPOCs.	C-11 to C-21

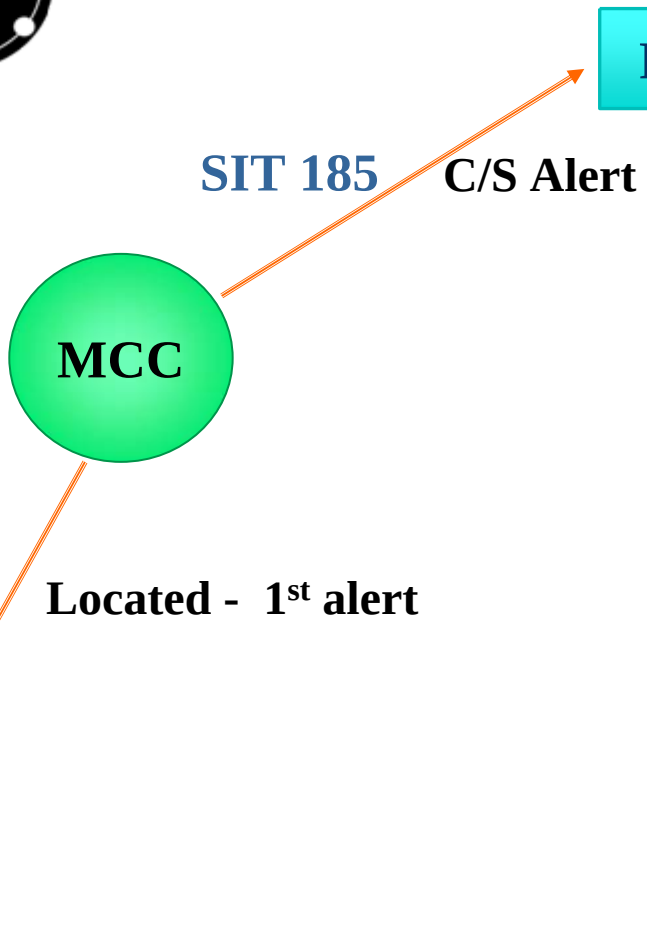
MESSAGE FORMAT

SIT for System Information

SIT for Narrative Messages

SIT		Meaning	Page	
215	ORBIT VECTORS	Sarsat or Cospas spacecraft orbit position and time message.	C-22	ORBIT
216	ORBIT VECTORS	Sarsat or Cospas spacecraft orbit position and time message. Used in special conditions (e.g., after a satellite manoeuvre) when it is required that orbit vectors at the MCC and its associated LUTs be initialized. See C/S A.001, section 3.7.5.	C-22	
415	SARP CALIBRATION	Time and frequency calibration for a SARP.	C-23	SARP
416	SARP TELEMETRY	SARP telemetry from a Sarsat spacecraft.	C-24	
417	SARP-3 CALIBRATION	Time and frequency calibration for a SARP-3.	C-25	
425	SARP OUT OF LIMIT	Warning message to indicate abnormal performance of the SARP.	C-24	
435	SARP COMMAND	Command request for the SARP.	C-26	
445	SARP COMMAND VERIFICATION	Verification of the execution (or non-execution) of a SARP command as requested by command message.	C-24	
510	406 MHz SARR FREQUENCY CALIBRATION OFFSET	Offset between actual and 406 MHz SARR-provided beacon frequencies.	C-27	SARR
515	SARR TELEMETRY	SARR telemetry from a Sarsat spacecraft.	C-24	
525	SARR OUT OF LIMIT	Warning message to indicate abnormal performance of the SARR.	C-24	
535	SARR COMMAND	Command request for the SARR.	C-26	
545	SARR COMMAND VERIFICATION	Verification of the execution (or non-execution) of a SARR command as requested by a SARR COMMAND message.	C-24	
605	SYSTEM STATUS TO ALL MCCs	Narrative message transmitted to all MCCs to indicate changes in System status. System status messages include System element and System function failures, scheduled maintenance, integration or testing of new System elements, and the commissioning of new equipment or new capabilities of existing equipment.	C-24 & C-28 to C-32	STATUS
721 and 722	Reserved for MEOSAR			LUTS
915	FOR MCC INFORMATION TRANSMISSION TO A SINGLE MCC	Narrative message for MCC to MCC operator. This is a free format message, except when a specific format is defined (Note 1).	C-24	NARRATIVE
925	406 BEACON REGISTRATION INFORMATION	This message is used between MCCs to provide 406 MHz beacon registration information.	C-33	

MESSAGE FORMAT




```
/12029 00000/2270/11 060 0851
/125/2240/009/01
/2711/-9/-00220.7 013.3 +00.00/11 060 0849 09.61/1
/9/04.994/0000/05
/4E04682EA0E1A68CF383D000000000
/+224/+37.357/-006.051/084 011.9 001.2/51/11 060 0856/1/004.6 001.0
/+605/+34.959/+006.012/303 012.6 001.2/49/11 060 0856/1/004.8 000.9
/LASSIT
/ENDMSG
```

```
/13280 00000/2240/11 060 0851
/185/MADR
1.  DISTRESS  COSPAS/SARSAT INITIAL ALERT

2.  MSG NO 00000  SPMCC REF 97426

3.  DETECTION AT 01 MAR 2011 0849 UTC BY SARSAT 09

4.  DETECTION FREQUENCY  406.025 MHZ

5.  COUNTRY OF BEACON REGISTRATION  224/SPAIN

6.  USER CLASS  MARITIME  /IDENTIFICATION  051370

7.  EMERGENCY CODE  N/A

8.  POSITIONS
          RESOLVED    - NIL
          DOPPLER A   - 37 21.4N 006 03.1W    PROB 51
          DOPPLER B   - 34 57.5N 006 00.7E    PROB 49
          ENCODED     - NIL

9.  NIL

10.  NEXT PASS TIMES
          RESOLVED    - NIL
          DOPPLER A   - S8  01 MAR 2011 0906
          DOPPLER B   - S11  01 MAR 2011 1043
          ENCODED     - NIL

11.  HEX ID  9C08D05D41C34D1      HOMING SIGNAL:  121.5

12.  ACTIVATION TYPE - MANUAL

13.  BEACON NUMBER ON AIRCRAFT OR VESSEL NO. 0

14.  OTHER ENCODED INFORMATION NIL

15.  OPERATIONAL INFORMATION

          A. REGISTRATION DATA

REGISTRATION INFORMATION AT SPMCC (EPIRBS, ELTS, PLBS)
FAX: (34.928) 727107
AFTN: GCMPZSZX
EMAIL: SPMCC@INTA.ES
TELEPHONE: (34.928) 727104/727105/727106

16.  REMARKS - NIL
```

COMMUNICATION STANDARDS

Communication standards MCC-MCC (at least two):

- File Transfer Protocol over Virtual Private Network (FTP-VPN).
- Aeronautical Fixed Telecommunications Network (AFTN).
- Aeronautical Message Handling System (AMHS) is the upgraded AFTN.
- X.25 Communications, packet data network.

Nodal MCC-MCC Communication Test (annually)

MCC	SPMCC	
AEMCC	FTPV	(in place)
	AFTN	(in place)
	Email*	(in place)
ALMCC	FTPV	(in place)
	X.25	(in place)
	AFTN	(in place)
NIMCC	FTPV	(in place)
	AFTN	TBD
	Link3 dd mmm	
SAMCC	FTPV	(in place)
	AFTN	(in place)
	Email*	(in place)

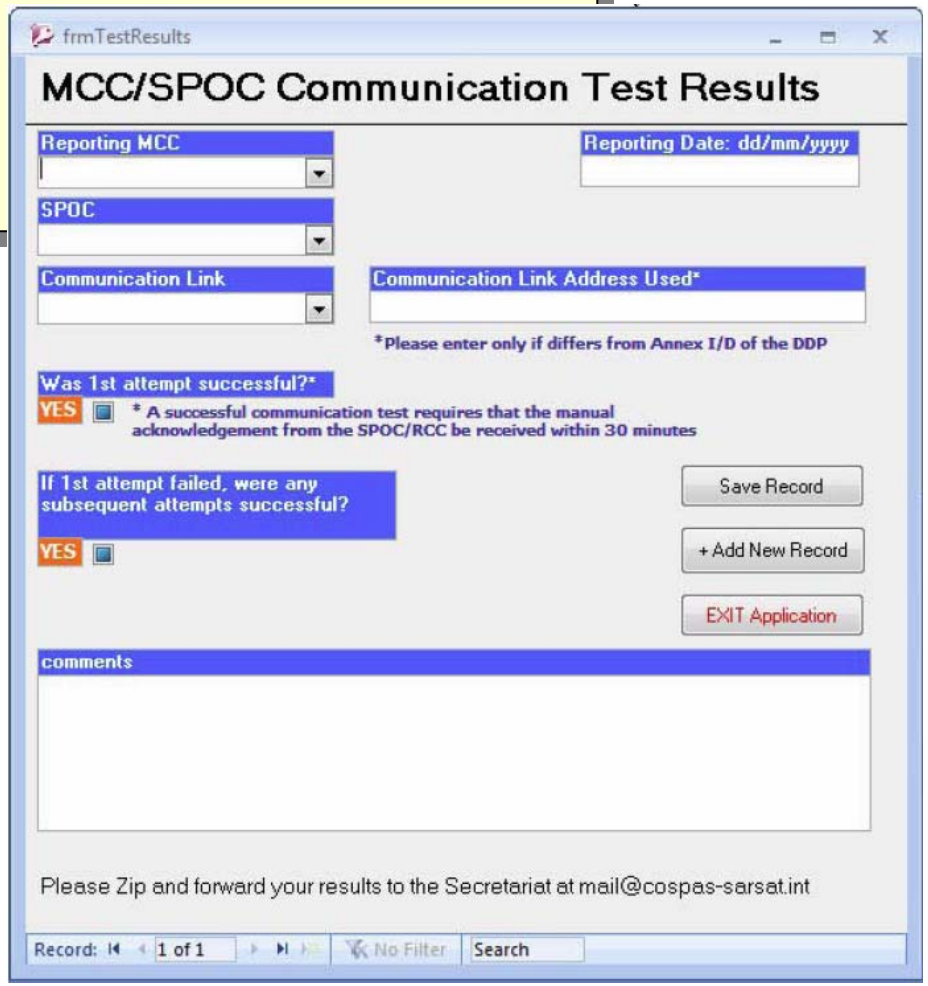
South Central DDR Communications Activation/Verification Check List

MCC - SPOC COMUNICATIONS

Communication standards MCC-SPOC preferable automatic comms.:

- Aeronautical Fixed Telecommunications Network (AFTN)
- FAX
- Email
- Phone (not for alert messages)

MCC-SPOC Communication Test (monthly)
C/S A.003, Annex I



MCC REPORTS

- National Status Report (annually) - C/S A.003, Annex B-1
  - Availability figure
  - False/real alerts and other statistics
- Real distress in MCC service area (quarterly) - C/S A.003, Annex B-2
- 406 MHz Interferences (monthly) - C/S A.003, Annex C
- Processing Anomalies (annually) - C/S A.003, Annex G
- MCC-SPOC Communication Test (monthly) - C/S A.003, Annex I
- Ground Segment System Test (annualy) - C/S A.003, Annex J
- Nodal MCC-MCC Communication Test (annually)
- QMS monitoring (Nodal MCC role) (daily) - Update C/S Website status

MCC STATUS TABLES

MCC Status

Central DDR Last Update: 02-12-2010 07:58:35

MCC Name	Country / Region	Operational Status	Comments
FMCC	France	F	
GRMCC	Greece	F	
ITMCC	Italy	F	
NMCC	Norway	F	
TRMCC	Turkey	F	
UKMCC	United Kingdom	F	

Eastern DDR Last Update: 12-17-2009 03:57:42

MCC Name	Country / Region	Operational Status	
CMC	Russian Federation	F	
INMCC	India	F	
PAMCC	Pakistan	F	

North West Pacific DDR Last Update: 02-17-2011 17:51:27

MCC Name	Country / Region	Operational Status	
CNMCC	China	F	
HKMCC	Hong Kong, China	F	
JAMCC	Japan	F	
KOMCC	Korea (Republic of)	F	
TAMCC	Chinese Taipei	F	
VNMCC	Vietnam	F	

South Central DDR Last Update: 12-16-2010 09:24:30

MCC Name	Country / Region	Operational Status	Comments
AEMCC	United Arab Emirates	F	FOC achieved on December 1, 2010
ALMCC	Algeria	F	
NIMCC	Nigeria	BU	Backed up by SPMCC.
SAMCC	Saudi Arabia	F	
SPMCC	Spain	F	

South West Pacific DDR Last Update: 04-26-2010 02:43:53

MCC Name	Country / Region	Operational Status	Comments
ASMCC	South Africa	F	
AUMCC	Australia	F	
IDMCC	Indonesia	F	
SIMCC	Singapore	F	
THMCC	Thailand	F	

Western DDR Last Update: 04-28-2010 11:15:21

MCC Name	Country / Region	Operational Status	Comments
ARMCC	Argentina	F	
BRMCC	Brazil	F	
CHMCC	Chile	F	
CMCC	Canada	F	
PEMCC	Peru	F	
USMCC	United States	F	

Backed up	BU
Fully Operational	F
Not Operational	NO

NODAL SPMCC

July 10th 1992:
Foreign Affaire Minister nominate INTA as Official Organism responsible of the Association to International Cospas-Sarsat Program.

January 1st 1993:
Start off LUT/SPMCC operations.

Location:
Maspalomas, Gran Canaria, Spain.

Currently:
SPMCC has a service Area of twenty African countries and their associated Atlantic Search and Rescue Regions

SPMCC assumes the Nodal MCC responsibilities for the South-Central DDR.

SPMCC acts as backup to France as Nodal MCC for the Central Region and its particular Service Area.

Operational Staff: 9 expert engineers + 1 head MCC

Timetable: 24 hours a day (all year round)

Technical equipment:
1 LEOLUT
2 GEOLUTs (GOES-East , MSG-2)
MCC

Coverage Area:
3500 Km. radio (from the North of Ireland to the Equator and from the Adriatic Sea to near the Brazilian Coast)

Results: **2.056** human lives in the Spanish Search and Rescue Areas at **492** events (6.203 out of Spanish SAR)
Total Contribution **8.259** human lives *(December 2010)*

OUTLINE MCCs COSPAS - SARSAT

- ⇨ Cospas-Sarsat Program
  - Basic Concept (brief-review)
  - System Elements
    - Emergency Beacons
    - Space Segment
    - Ground Segment
- ⇨ Cospas-Sarsat MCCs
  - MCC Overview
  - System Operation
  - MCC Functions and Operations
  - MCC Data Distribution Region
  - MCC Communication Network
  - Nodal MCC Function and Supports
  - South Central DDR – MCC Service Area
  - MID Region Geosorting
  - Alerts Distribution Procedure
  - Message Format - SIT
  - Communication Standards
  - MCC Reports
- ➔ Conclusions

CONCLUSIONS

Cospas-Sarsat is a Program in constant evolution with humanitarian, economic and prestige benefits.

Efficiency:

- More than **28.375** persons saved over 28 years (1013 lives/year)
- More than 23.365 persons saved on Maritime Distress (79%)

Cooperation:

- Promote collaboration between countries and local/international organizations.
- Technical cooperation is also encouraged.

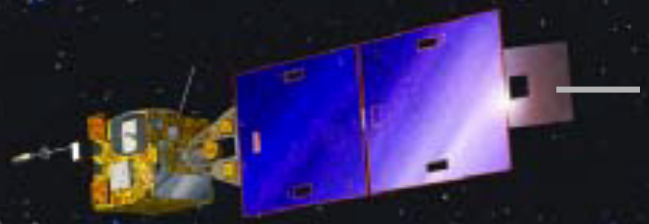
Close Future:

- System improvement based on MEOSAR development.
- SAR/Galileo will incorporate return link service.

Gulf Satellite Aided Search and Rescue Seminar

Abu Dhabi, UAE

6-8 March 2011



Mission Control Centres
COSPAS-SARSAT

Emilia Melián
Head of Spanish MCC
Cospas-Sarsat Programme