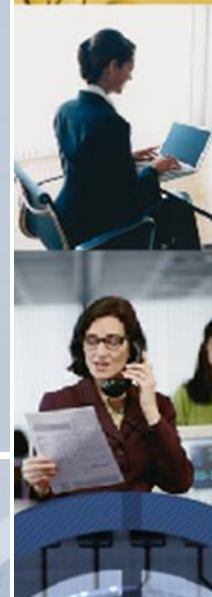


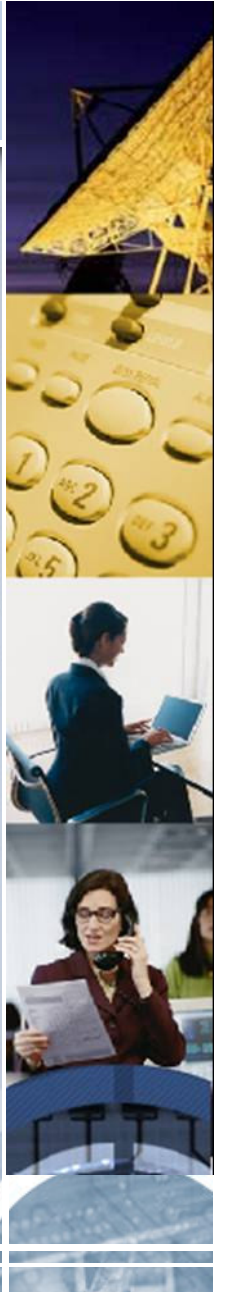


The role of MCC's in the Cospas Sarsat system and distress beacons and their significance to the Cospas Sarsat system.

Derek Cooper
Network Centre Operations - Maritime
Telkom SA Limited
November 2006



DISTRESS BEACONS



Distress Beacons

- Radio beacons are used for alerting authorities during a pending or actual distress situation.
- Beacons are automatically or manually activated.
- Beacons are used in maritime, aviation and land based distress situations

Types of Distress Beacons

- **Emergency Locator Transmitters (ELT's)**
- **Aviation use**
- **Emergency Position Indicating Radio Beacons (EPIRB's)**
- **Maritime use**
- **Personal Locator Beacons (PLB's)**
- **For applications which are neither aviation or maritime**

Beacon Types

121.5/243 MHz Analog signal
Approximately 555,000 world-wide

406 MHz Digital signal
Approximately 429,000 world-wide and
growing.

Manual or Automatic Activation

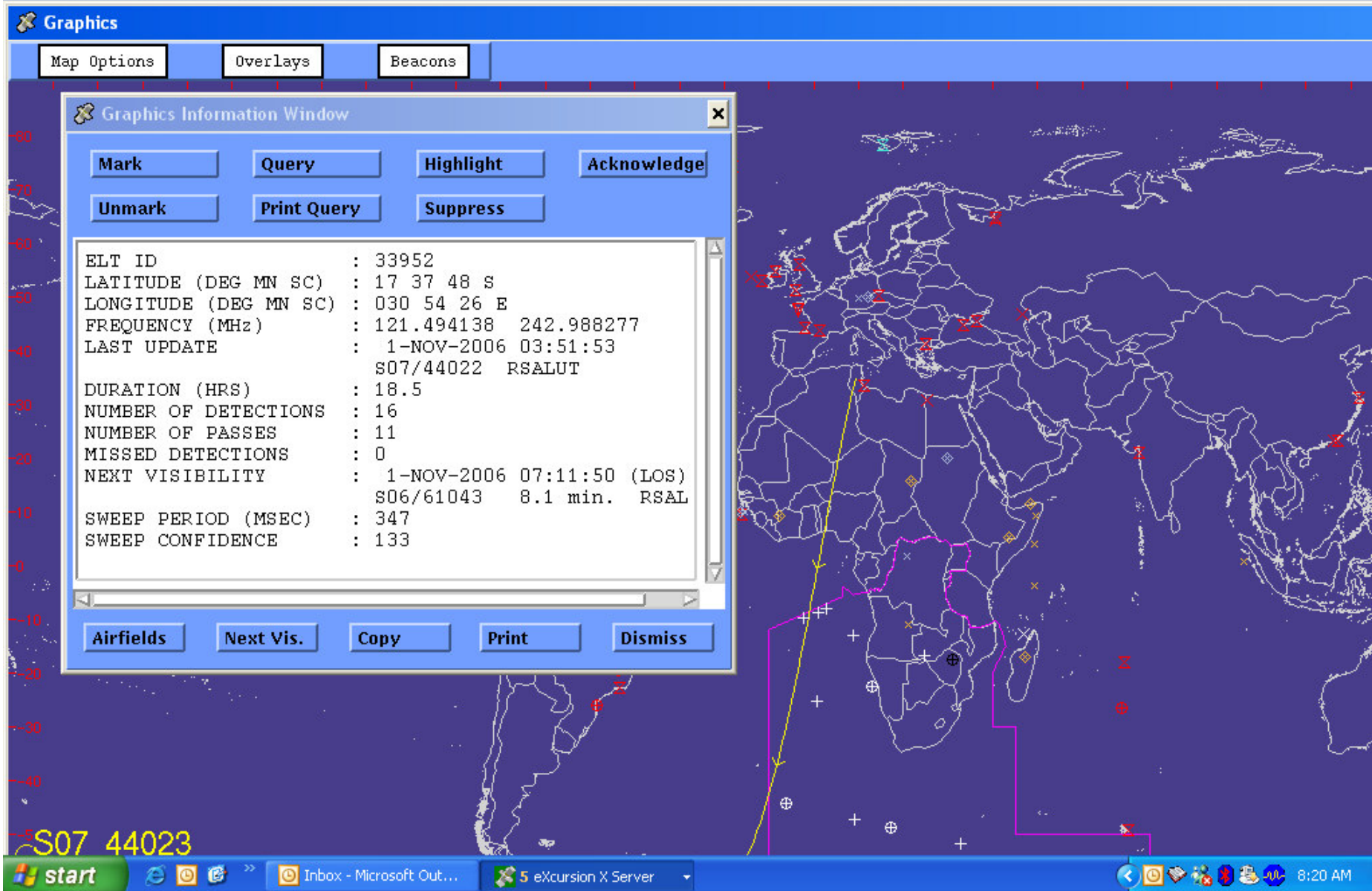
PHASE-OUT OF 121,5 / 243 MHz BEACONS

- **The Cospas-Sarsat Organization under guidance of the International Civil Aviation Authority (ICAO) and the International Maritime Authority (IMO) made the decision to cease satellite processing on 121.5 /243 MHZ. The 406 MHz system has superior capabilities.**
- **Gradual phase-out of beacons over +/- 7 years.**
- **Final Termination of 121.5 / 243 MHz – 1 February 2009**

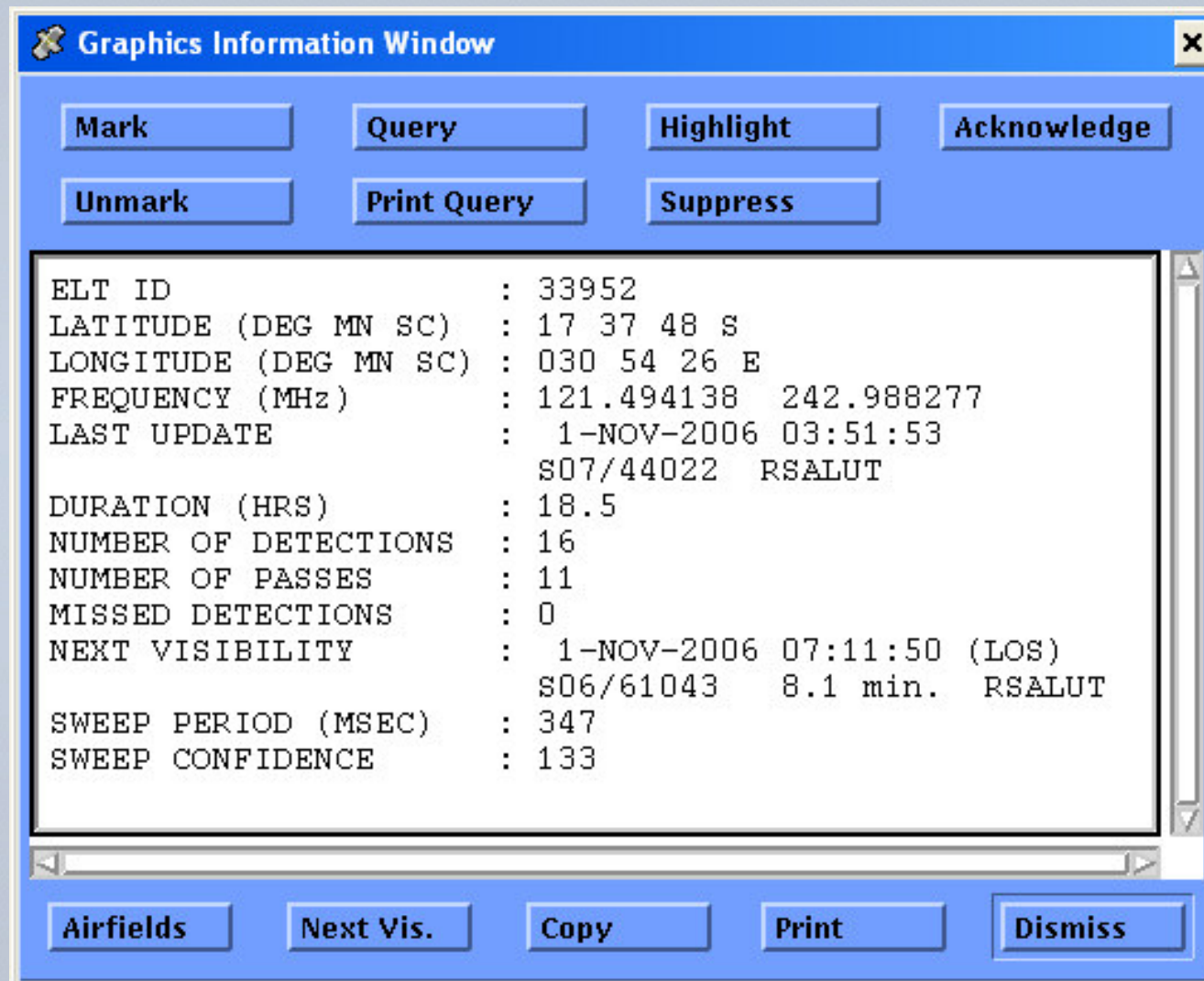
ADVANTAGES of 406 MHz BEACONS

	406 MHz Beacon	121.5 MHz Beacon
Signal	Digital: unique identification, registration data provides information on the owner/vessel or aircraft	Analog: no data encoded, higher false alert rate
Signal Power	5 Watts pulse	0.1 Watts continuous
Coverage	Global	Regional
Position Accuracy	Within 5 km (Doppler), 100m if GNSS (GPS) position is encoded in message	Within 20 km (Doppler only)
Alert Time	GEO alert within 5 minutes	Waiting time for LEO satellite pass 45 minutes average
Doppler Position Ambiguity	Resolved at first satellite pass	Two passes required to resolve position ambiguity

121.5 MHz Beacon Detection



121.5 MHz Beacon Detection



A screenshot of a software window titled "Graphics Information Window". The window has a blue header bar with a close button (X) in the top right corner. Below the header, there are two rows of buttons: "Mark", "Query", "Highlight", "Acknowledge" in the first row, and "Unmark", "Print Query", "Suppress" in the second row. The main area of the window is a white text box containing a list of beacon detection data. At the bottom of the window, there is a blue bar with five buttons: "Airfields", "Next Vis.", "Copy", "Print", and "Dismiss".

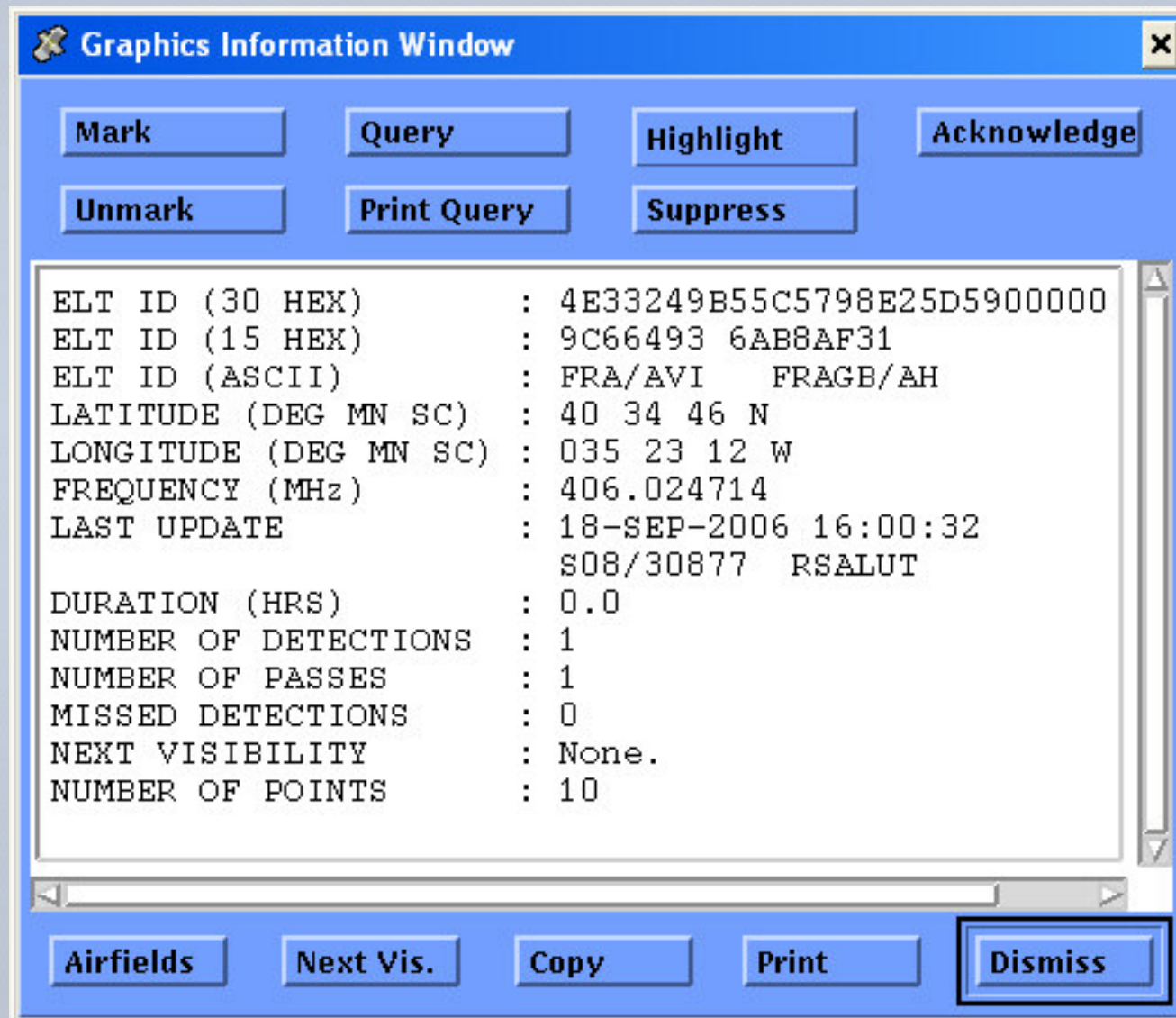
ELT ID	:	33952
LATITUDE (DEG MN SC)	:	17 37 48 S
LONGITUDE (DEG MN SC)	:	030 54 26 E
FREQUENCY (MHz)	:	121.494138 242.988277
LAST UPDATE	:	1-NOV-2006 03:51:53
		S07/44022 RSALUT
DURATION (HRS)	:	18.5
NUMBER OF DETECTIONS	:	16
NUMBER OF PASSES	:	11
MISSED DETECTIONS	:	0
NEXT VISIBILITY	:	1-NOV-2006 07:11:50 (LOS)
		S06/61043 8.1 min. RSALUT
SWEEP PERIOD (MSEC)	:	347
SWEEP CONFIDENCE	:	133

243 MHz Beacon Alert

 Graphics Information Window 

ELT ID	:	31135
LATITUDE (DEG MN SC)	:	05 22 03 S
LONGITUDE (DEG MN SC)	:	018 31 06 E
FREQUENCY (MHz)	:	243.003712
LAST UPDATE	:	19-SEP-2006 09:00:14
		S09/22017 RSALUT
DURATION (HRS)	:	0.0
NUMBER OF DETECTIONS	:	1
NUMBER OF PASSES	:	1
MISSED DETECTIONS	:	0
NEXT VISIBILITY	:	20-SEP-2006 07:53:42 (LOS)
		S06/60450 5.9 min. RSAL
SWEEP PERIOD (MSEC)	:	503
SWEEP CONFIDENCE	:	89

406 MHz Beacon Info



A screenshot of a software window titled "Graphics Information Window". The window has a blue header bar with a close button (X) on the right. Below the header, there are two rows of buttons: "Mark", "Query", "Highlight", "Acknowledge" in the first row, and "Unmark", "Print Query", "Suppress" in the second row. The main area of the window contains a text box with the following information:

ELT ID (30 HEX)	:	4E33249B55C5798E25D5900000
ELT ID (15 HEX)	:	9C66493 6AB8AF31
ELT ID (ASCII)	:	FRA/AVI FRAGB/AH
LATITUDE (DEG MN SC)	:	40 34 46 N
LONGITUDE (DEG MN SC)	:	035 23 12 W
FREQUENCY (MHz)	:	406.024714
LAST UPDATE	:	18-SEP-2006 16:00:32
		S08/30877 RSALUT
DURATION (HRS)	:	0.0
NUMBER OF DETECTIONS	:	1
NUMBER OF PASSES	:	1
MISSED DETECTIONS	:	0
NEXT VISIBILITY	:	None.
NUMBER OF POINTS	:	10

At the bottom of the window, there is a row of buttons: "Airfields", "Next Vis.", "Copy", "Print", and "Dismiss". The "Dismiss" button is highlighted with a double border.

Principle of Operation LEO / GEO Satellites

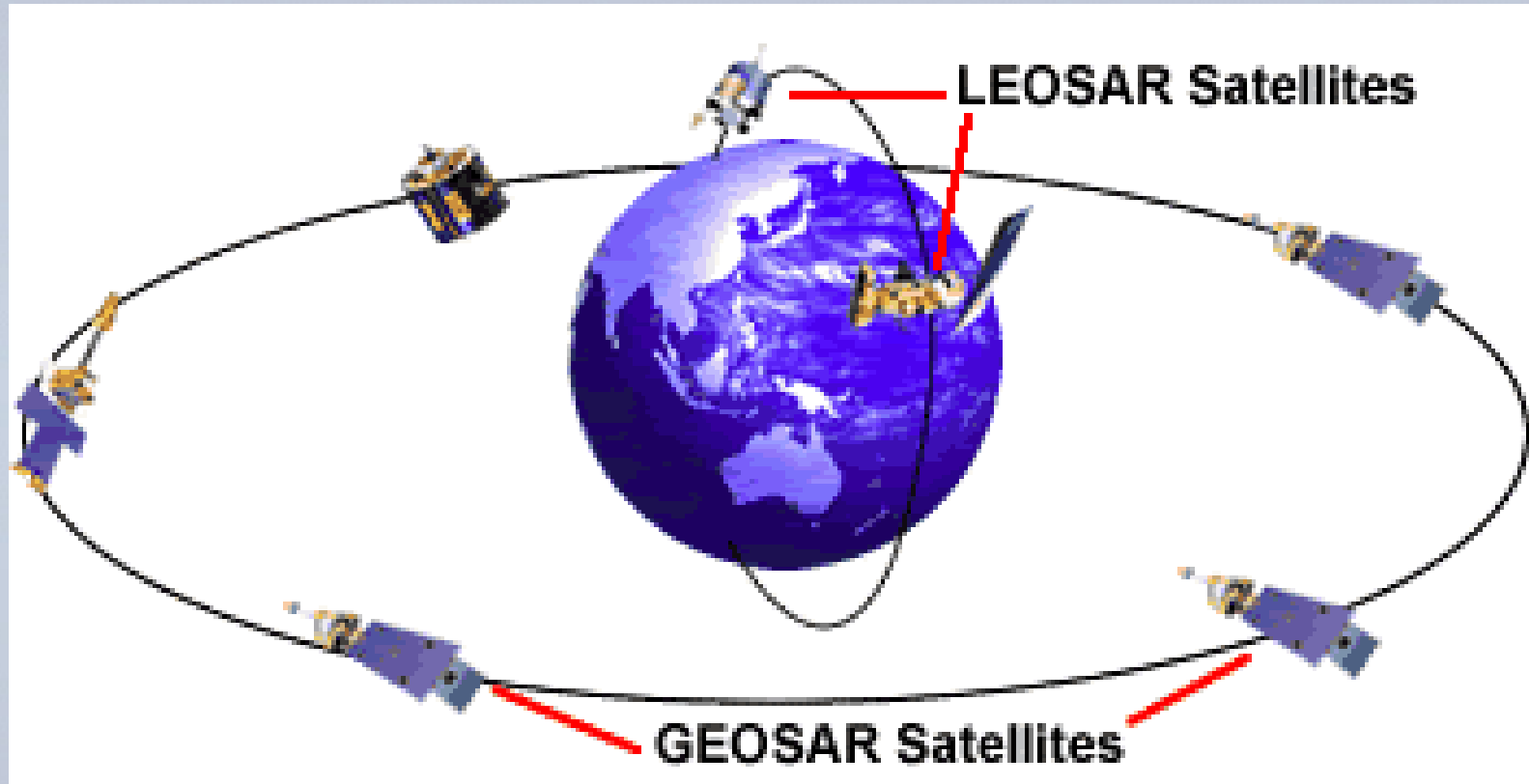
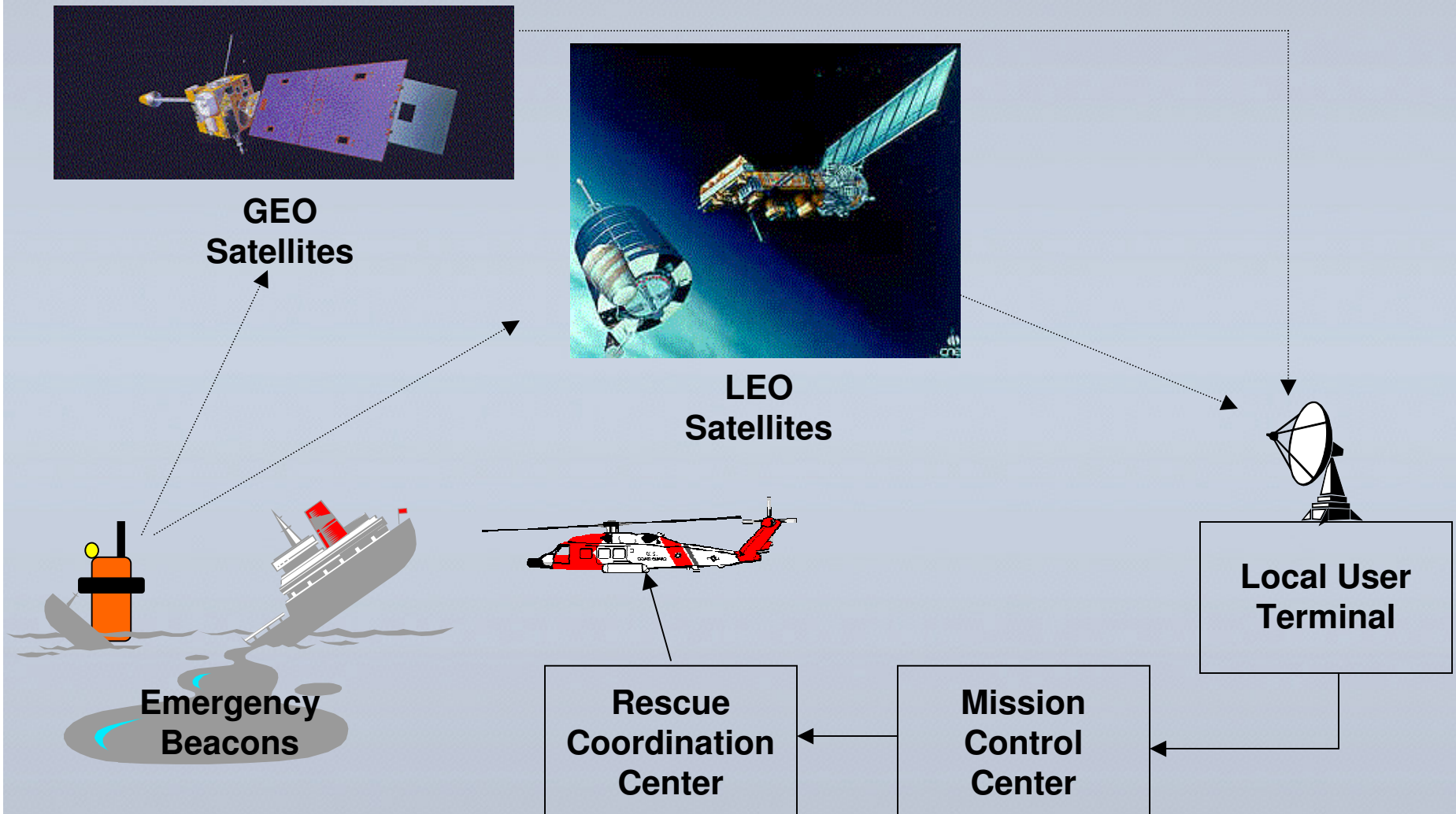


Image Courtesy of Cospas-Sarsat.org

Typical Distress Scenario



Service Areas of Commissioned Mission Control Centres Worldwide

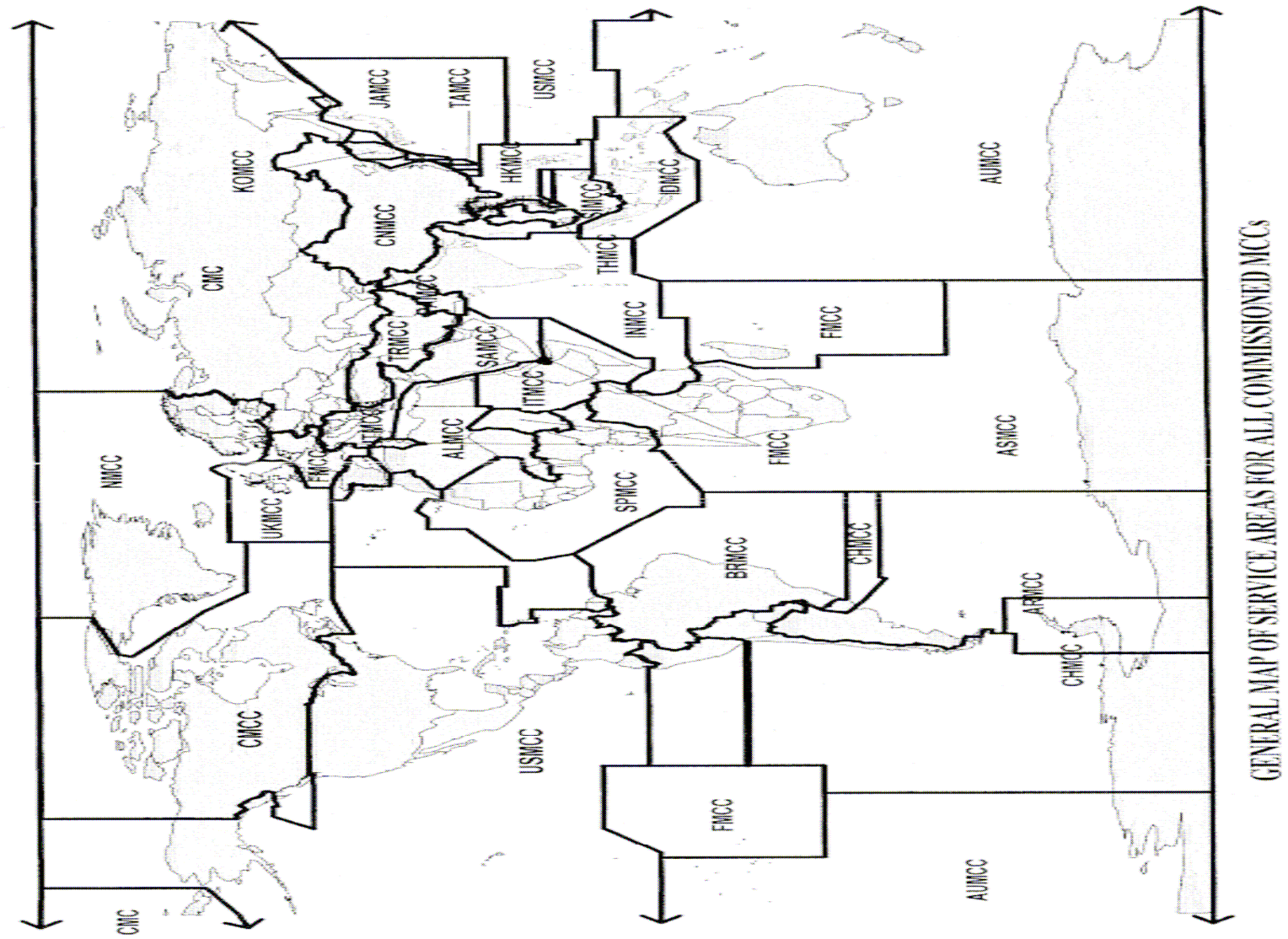


Image Courtesy of Cospas-Sarsat.org

ASMCC

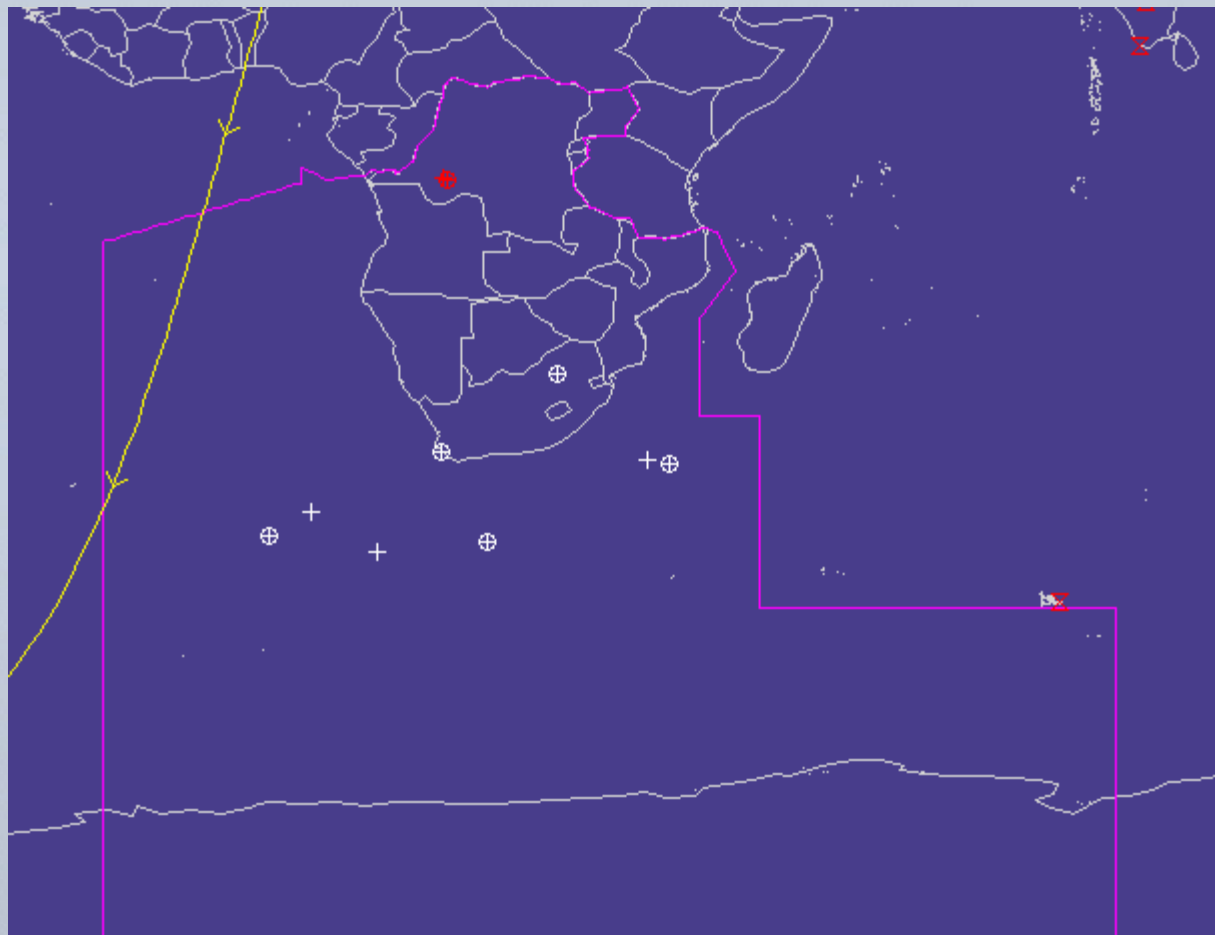
South African Mission Control Centre

ASMCC – South African Mission Control Centre

- Based in Milnerton, Cape Town – Commissioned 7 May 2001
- Operated by Telkom SA on behalf of the South African National Department of Transport (NDOT)
- Staffed 24 / 7 by trained personnel
- Receives and distributes alert data to the Maritime Rescue Co-ordination Centre (MRCC) – Cape Town
- Receives and distributes alert data to the Aeronautical Rescue Co-ordination Centre (ARCC) – O R Tambo International Airport - Johannesburg
- Receives and distributes alert data via the our Nodal MCC Australia (AUMCC) for further dissemination worldwide.

South African Mission Control Centre Service Area

- ASMCC is responsible for monitoring and distributing alert data within the defined Cospas-Sarsat Service area.



ASMCC



Mission Control Centre (MCC)

- Receive data from national LUTs and foreign MCCs
- 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
- Transmit alert messages to search and rescue authorities

SPOC's Supported by the ASMCC through the South African ARCC / MRCC

- Angola
- Botswana
- Burundi
- Democratic Republic of Congo
- Lesotho
- Malawi
- Mozambique
- Namibia
- Rwanda
- South Africa
- St Helena
- Swaziland
- Uganda
- Zambia
- Zimbabwe

Local User Terminal (LUT)



Satellite Tracking Antenna



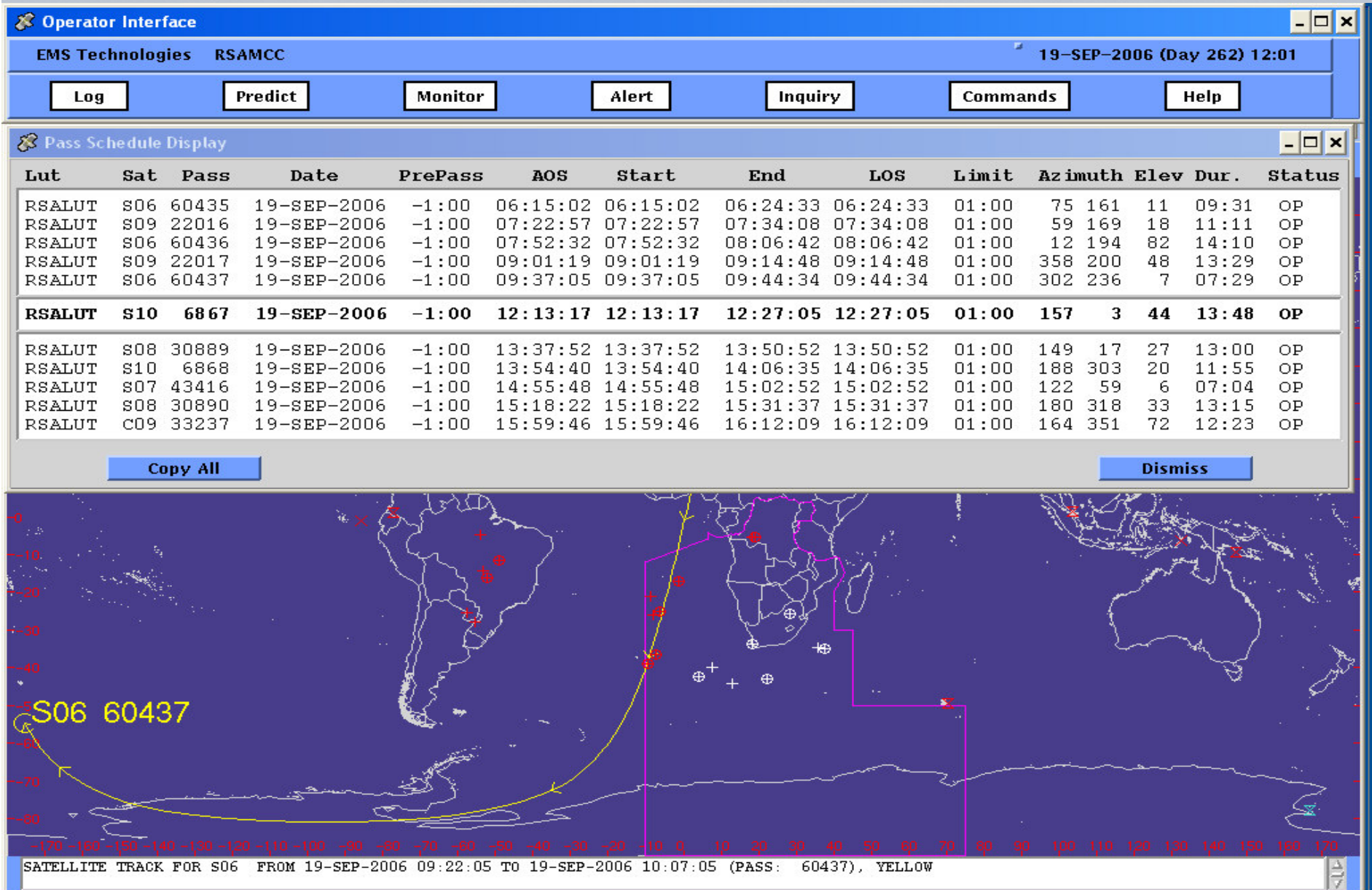
Satellite Tracking Antenna



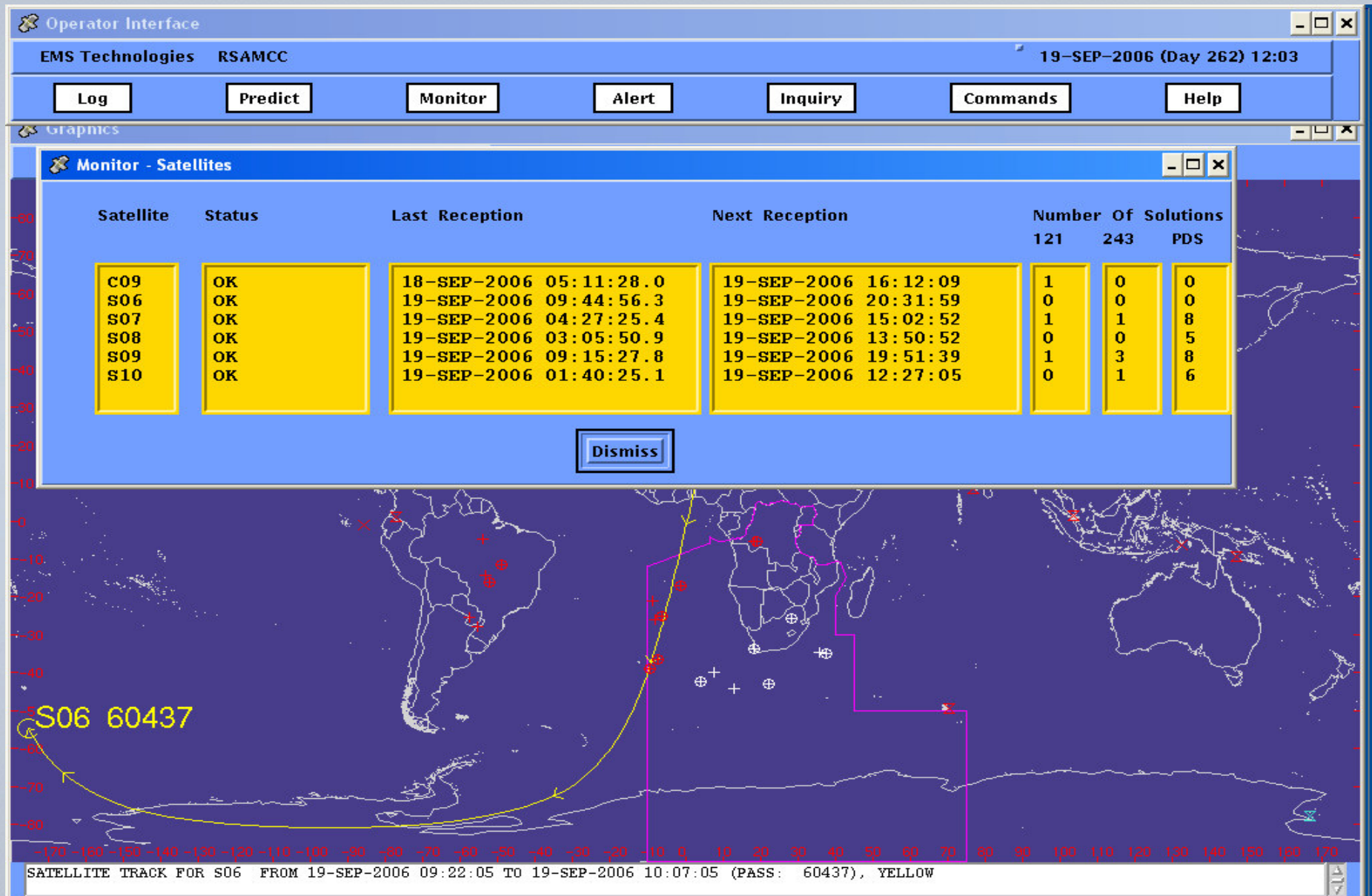
Local User Terminal (LUT)

- Track Cospas and Sarsat satellites
- Recover beacon signals from satellites
- Perform Doppler processing to determine geographic location
- Send resulting Doppler solutions to associated Mission Control Center

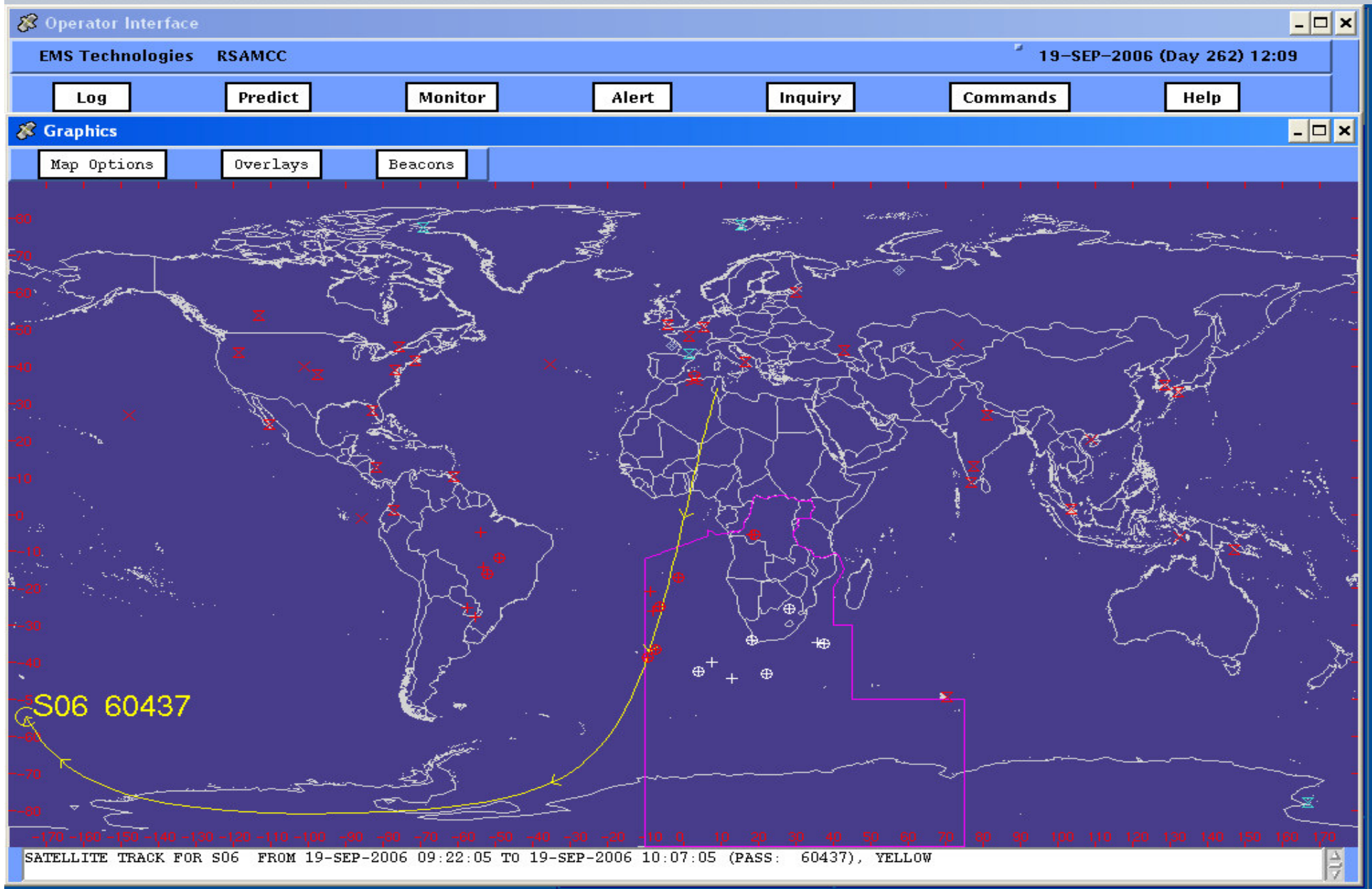
Satellite Tracking Pass Schedule



Satellites Tracked by the ASLUT



ASMCC Screen Capture 19 Sept 2006



LEOSAR Coverage

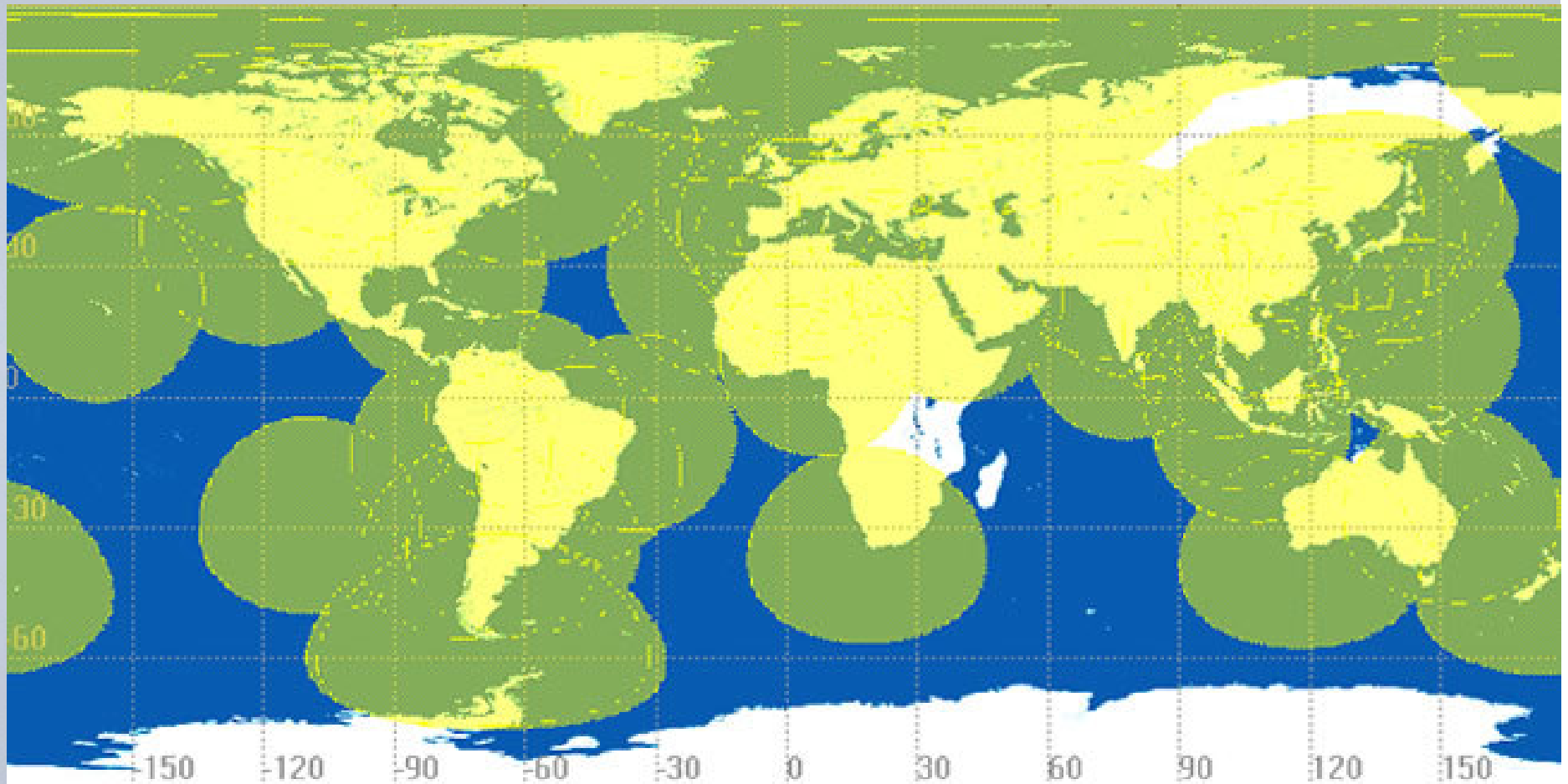


Image Courtesy of Cospas-Sarsat.org

GEOSAR SATELLITE COVERAGE

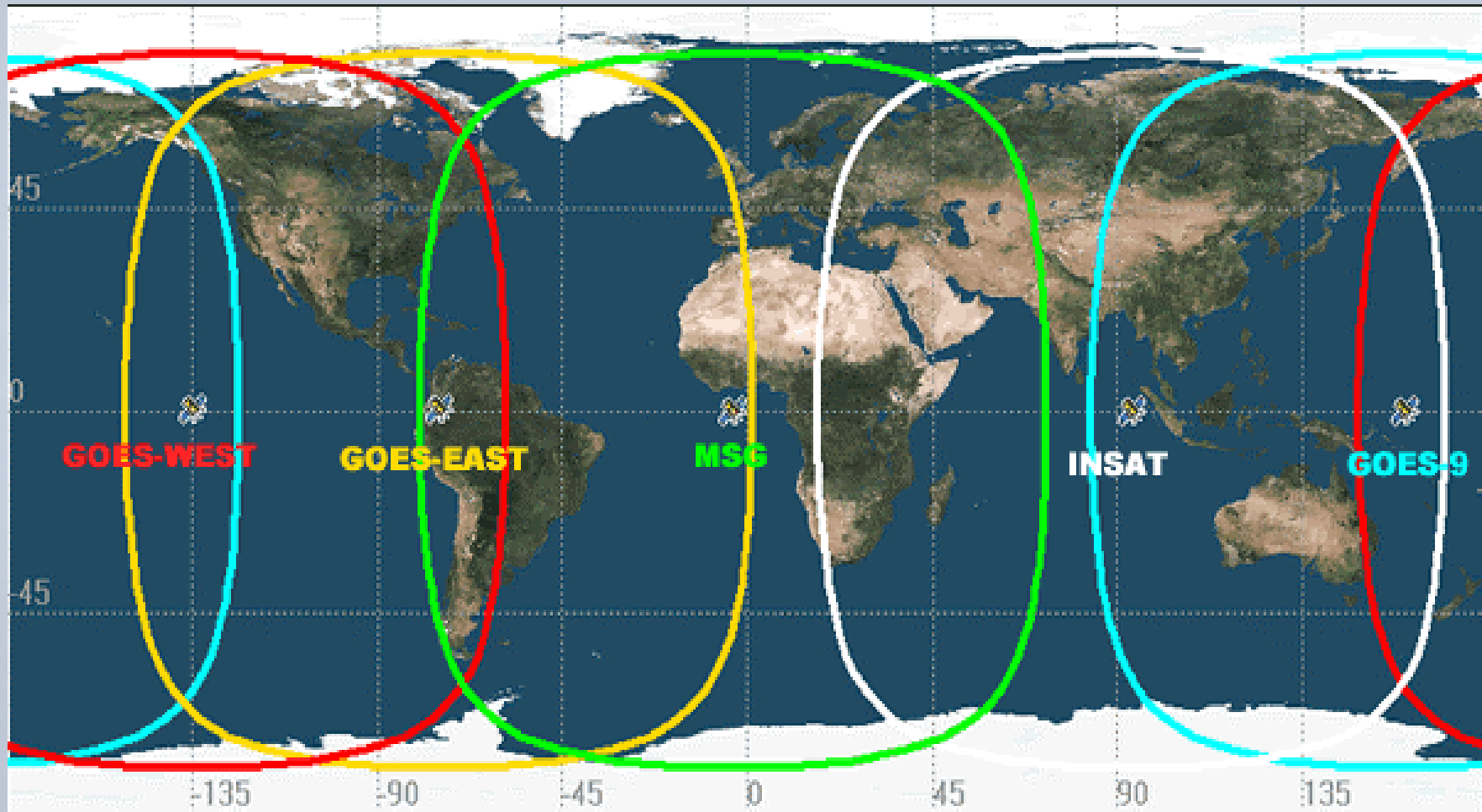


Image Courtesy of Cospas-Sarsat.org

ELT Alert - Botswana

14 Sept 2006 - Actual Incident

Example of an actual aircraft incident Botswana – Call sign A2AEP – 14 Sept 2006

- Un-located alert received from United Kingdom
Geostationary Satellite Local User Terminal

AUMCC_ASMCC_31756.TXT;1 14-SEP-2006 12:32:21.88

RSAMCC \$ type AUMCC_ASMCC_31756.TXT;1

/31756 00000/5030/06 257 1230

/122/6010/261/01

/2322/-00532.1 004.7 +05.44/06 257 1227 09.27/02

/A6341C26377FDFFEAD79F583E0FAA8

/LASSIT

/ENDMSG

Beacon Decoded

- Beacon message decode for : A6341C26377FDFFEAD79F583E0FAA8

- Beacon Identifier : BOT/LOC/STD ELT 011209783
- 15 Hex Identifier : 4C68384C6EFFBFF

- FIELD: Description | BITS | VALUE
- Message format flag : Long | 25 | 1
- Protocol : Location | 26 | 0
- Country code : 611 <BOTSWANA> | 27-36 | 1001100011
- Standard protocol : ELT - serial | 37-40 | 0100
- Certificate number : 0112 | 41-50 | 0001110000
- Serial number : 09783 | 51-64 | 10011000110111
- Coarse location fields (Default) | 65-85 | 01111111110111111111
- 21-Bit BCH code : 1AB5E7 | 86-106 | 110101011010111100111
- Fixed bits field (valid) | 107-110 | 1101
- Encoded Position Data Source : External | 111 | 0
- Auxiliary radio device : Included | 112 | 1
- Second protected data field (Default) | 107-132 | 11010110000011111000001111
- 12-Bit BCH code : AA8 | 133-144 | 101010101000
- Number of bit errors in the first protected data field : 0
- Number of bit errors in the second protected data field : 0
- A 6 3 4 1 C 2 6 3 7 7 F D F F
- 1010 0110 0011 0100 0001 1100 0010 0110 0011 0111 0111 1111 1101 1111 1111
- 1110 1010 1101 0111 1001 1111 0101 1000 0011 1110 0000 1111 1010 1010 1000
- E A D 7 9 F 5 8 3 E 0 F A A 8

MariTel - [Beacon Register - f550a]

System SOLAS General info Codes and Beacons ShipShore ShoreShip Globe Incoming SAFREP Broadcasting

2006-10-10 06:43:00

TYLEEJE Logged in @ LIVE

Callsign:	A2AEP		Name:	CESSNA U206G	
MMSI No:			HEX ID:	4C68384C6EFFBFF	
ASCII Code:	BOT/LOC/STD ELT 011209783		SelCall:		
SAT A		SAT B		SAT C	SAT M
Manufacturer	ARTEX 9783		Beacon Type:	ELT	
PLB Reg Serial No:			Type Ind:	9783	
Type:	AIRCRAFT				
Last Modified	2005-11-29	Reg. Date:	2005-02-14	No. Persons on board:	
Phone:	(+267) 7130-7684		Fax:		
Other:	(+267) 390-0297				
Owner:	Flying Mission Service (Pty) L				
Address:	P. O. Box 1022	Country:	BOTSWANA		
	Gaborone	Remarks:	Cont person R Macleod alt D Lott 267 7165-7992 W		

New Insert Update Delete Close

CAPS NUM

Message sent to ARCC.09480;1

14-SEP-2006 13:20:05.86

- RSAMCC \$ type ARCC.09480;1
- 1. **DISTRESS COSPAS-SARSAT INITIAL ALERT**
- 2. MSG NO: 09480 ASMCC REF: 4C68384C6EFFBFF
- 3. DETECTED AT: 14 SEP 06 1315 UTC **BY SARSAT S10 (Tracked by ASLUT)**
- 4. DETECTION FREQUENCY: 406.0245 MHz
- 5. **COUNTRY OF BEACON REGISTRATION: 611/ BOTSWANA**
- 6. STANDARD-SHORT/STANDARD LOCATION :
 - ELT- CSTA CERTIFICATE NO & SERIAL NO: 0112 09783
- 7. EMERGENCY CODE: NIL
- 8. POSITIONS:
 - RESOLVED - NIL
 - **DOPPLER A - 19 38 S 023 17 E PROBABILITY 91 PERCENT**
 - **DOPPLER B - 25 21 S 002 17 W PROBABILITY 09 PERCENT**
 - ENCODED - 000 00 00 N (DEFAULT)
 - - 000 00 00 E (DEFAULT)
- 9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE
- 10. NEXT PASS TIMES (UTC):
 - RESOLVED - NIL
 - DOPPLER A - 14 SEP 06 1449
 - DOPPLER B - 14 SEP 06 1449
 - ENCODED - NIL
- 11. HEX ID: 4C68384C6EFFBFF HOMING SIGNAL: 121.5 MHZ
- 12. ACTIVATION TYPE: NIL
- 13. BEACON NUMBER ON AIRCRAFT OR VESSEL NO:
- 14. OTHER ENCODED INFORMATION: NIL
 - BEACON MODEL - ARTEX INC, USA: C406-1, C-406-2
- 15. OPERATIONAL INFORMATION: NIL
- 16. REMARKS: NIL
- RCC406.FMT
- END OF MESSAGE

Message to ARCC.09481;1

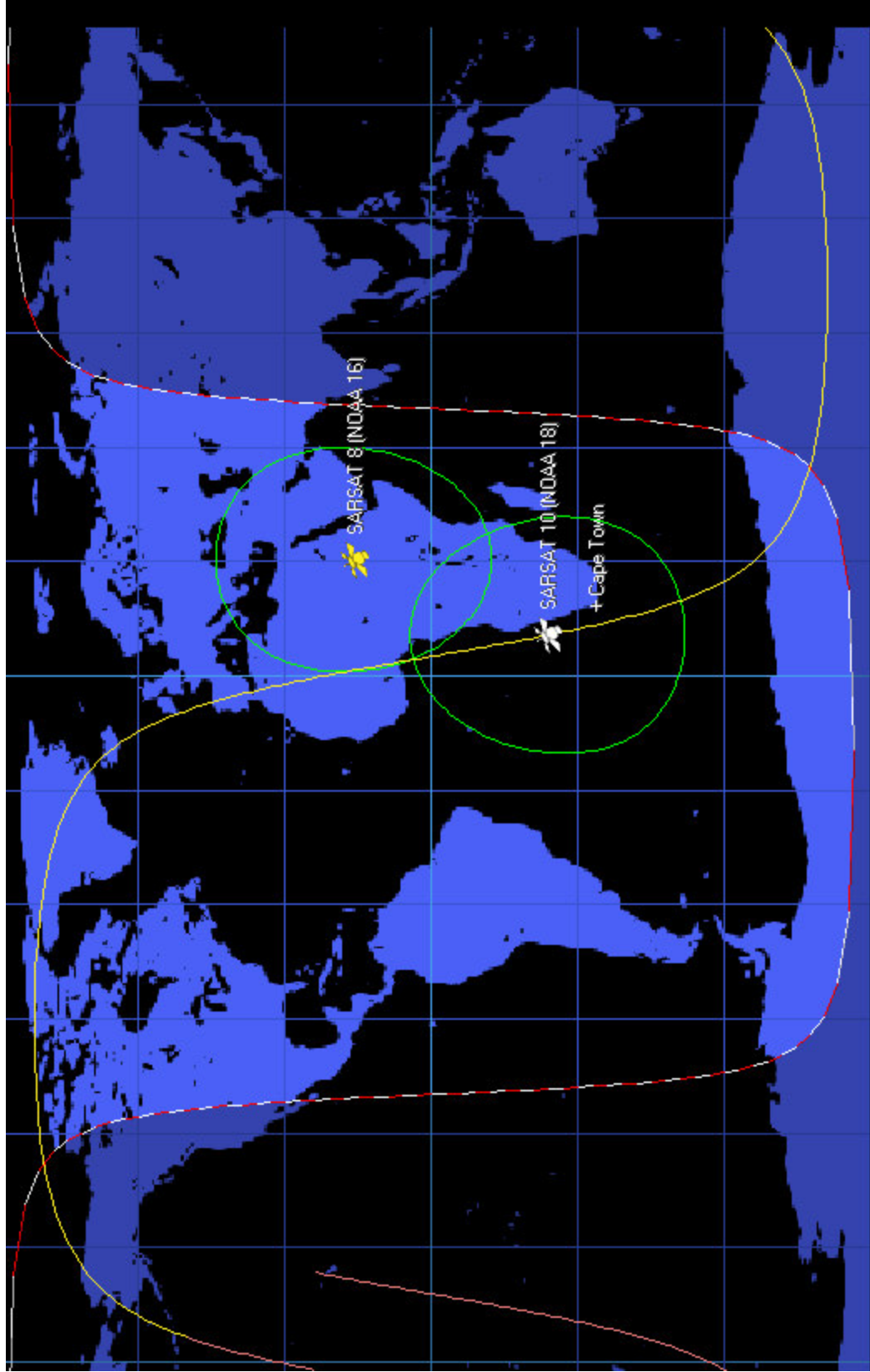
14-SEP-2006 13:28:44.02

- RSAMCC \$ type ARCC.09481;1
- **1. DISTRESS COSPAS-SARSAT POSITION RESOLVED ALERT**
- 2. MSG NO: 09481 ASMCC REF: 4C68384C6EFFBFF
- 3. DETECTED AT: 14 SEP 06 1315 UTC **BY SARSAT S8 (Tracked by Jeddah, Saudi Arabia)**
- 4. DETECTION FREQUENCY: 406.0245 MHz
- **5. COUNTRY OF BEACON REGISTRATION: 611/ BOTSWANA**
- 6. STANDARD-SHORT/STANDARD LOCATION :
 - ELT- CSTA CERTIFICATE NO & SERIAL NO: 0112 09783
- 7. EMERGENCY CODE: NIL
- 8. POSITIONS:
 - **RESOLVED - 19 38 S 023 17 E**
 - **DOPPLER A - 19 38 S 023 17 E**
 - DOPPLER B - NIL
 - ENCODED - 000 00 00 N (DEFAULT)
 - - 000 00 00 E (DEFAULT)
- 9. ENCODED POSITION PROVIDED BY: EXTERNAL DEVICE
- 10. NEXT PASS TIMES (UTC):
 - RESOLVED - 14 SEP 06 1449
 - DOPPLER A - NIL
 - DOPPLER B - NIL
 - ENCODED - NIL
- 11. HEX ID: 4C68384C6EFFBFF HOMING SIGNAL: 121.5 MHZ
- 12. ACTIVATION TYPE: NIL
- 13. BEACON NUMBER ON AIRCRAFT OR VESSEL NO:
- 14. OTHER ENCODED INFORMATION: NIL
 - BEACON MODEL - ARTEX INC, USA: C406-1, C-406-2
- 15. OPERATIONAL INFORMATION: NIL
- 16. REMARKS: NIL
- RCC406M.FMT
- END OF MESSAGE

Messaging Sequence

- **Un-located** alert received from UK Geostationary Satellite
Local User Terminal -14-SEP
12:32:21.88
- **Initial Alert** Message sent to ARCC.09480;1 -14-SEP
13:20:05.86
- **Resolved Alert** - Message to ARCC.09481;1 -14-SEP
13:28:44.02

- ☐ COSPAS 6 (NADEZHDA)
- ☐ COSPAS 8 (NADEZHDA)
- ☒ COSPAS 9 (NADEZHDA)
- ☐ COSPAS 10 (NADEZHDA)
- ☐ GOES 8
- ☐ GOES 9
- ☐ GOES 10
- ☐ GOES 11
- ☐ GOES 12
- ☐ MSG-1
- ☒ SARSAT 10 (NOAA 18)
- ☐ SARSAT 4 (NOAA 11)
- ☐ SARSAT 6 (NOAA 14)
- ☐ SARSAT 7 (NOAA 15)
- ☒ SARSAT 8 (NOAA 16)
- ☐ SARSAT 9 (NOAA 17)



Cape Town: 18° 30' 00" E, 33° 52' 48" S 2006-09-14 13:15:00 (UTC)

Satellites Data

Load TLE

Show ne

SIM

AUTO-OFF

U

13:15:00

2006-09-14

Mode

☐ Real time
 ☒ Simulation

2006-09-14 13:15:00

1 minutes

<<< < > >>>

Time

☐ Local
 ☒ UTC



Call Sign A2-AEP



Call Sign A2-AEP



Call Sign A2-AEP



Thank You