Cospas-Sarsat Emergency BEACONS
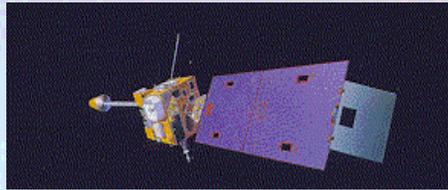
2009 COSPAS-SARSAT (C-S) UN TRAINING

19 - 23 January 2009
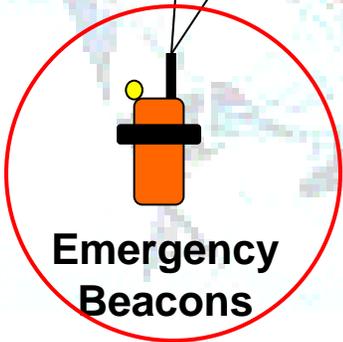
C-S Emergency BEACONS

GEO
Satellites

LEO
Satellites

Rescue Coordination Centers

Other Mission Control Centers

Mission Control Center

SAR Points of Contact

Emergency Beacons

C-S Emergency BEACONS

❖ BEACONS – THE GENERIC TERM USED FOR:

➢ EPIRBs – Emergency Position-Indicating Radio Beacons

➢ ELTs – Emergency Locator Transmitters

➢ PLBs – Personal Locator Beacons

➢ SSAS – Ship Security Alert System

C-S Emergency BEACONS

❖ From this point on we are going to focus on 406 Beacons only – the beacons that are designed to work with the Cospas-Sarsat Satellite System.

❖ The subsequent general comments about beacons may not apply to 121.5 or 243.0 MHz beacons.

C-S Emergency BEACONS

❖ Transmission frequencies

	406 MHz	121.5 MHz	243.0 MHz
EPIRBs	YES	YES — BUT	YES - BUT
ELTs	YES	YES - BUT	YES - BUT
PLBs	YES	YES - BUT	YES - BUT
SSAS	YES	Not Allowed	Not Allowed

❖ YES - BUT

➢ Yes
  • The only frequency for older analog beacons
  • 121.5 MHz used as homer on 406 MHz beacons

➢ BUT 121.5/243.0 MHz will not be detected or processed by Cospas-Sarsat after 1 February

C-S Emergency BEACONS

❖ **Emergency Beacons**

➢ <u>Brief description</u> of a 406 MHz emergency beacon

➢ <u>Beacon specifications</u> (C-S, International, National)

➢ <u>Beacon Types</u>, uses for different applications

➢ <u>Introduction</u> to 406 MHz Beacons and their advantages

➢ <u>SSAS</u>

➢ 121.5/243.0 MHz Satellite Processing <u>Phase Out</u>

C-S Emergency BEACONS

❖ <u>Brief Description</u> of a 406 MHz Emergency Beacon

- ➢ Transmits on 406 MHz (406.000 – 406.100 MHz)
- ➢ Manual activation
- ➢ Auto and Manual activation
- ➢ Transmits:
  - 0.5 second burst of data
  - Every 50 seconds ± 2.5 seconds
  - 112 bits – short message (non- location protocols only) or
  - 144 bits - long message (all location protocols)
  - First 24 bits used for synchronizing processing
  - Remaining bits (25-144) used to:
    - Provide unique identification of the beacon
    - Provide location of the beacon
    - Provide identifying information about vehicle carrying the beacon
- ➢ Location Protocol beacons transmit the beacon's location from:
    - GPS internal to Beacon, or
    - Vehicle's onboard navigation system

C-S Emergency BEACONS

❖ Beacon Specifications

➢ Cospas-Sarsat
➢ International
➢ National

❖ <u>Beacon Specifications</u> - Cospas-Sarsat (1 of 2)

➢ <u>Technical Specification</u> for Cospas-Sarsat 406 MHz Distress Beacons (T.001)

- Defines the minimum requirements to be used for the development and manufacture of 406 MHz distress beacons. It <u>ensures that the beacons are compatible with the Space and Ground segments of C-S.</u>
  - Section 2 gives the system requirements of all types of beacons
  - Section 3 deals with the beacon message content
  - Section 4 defines a set of environmental and operational requirements
  - Annex A defines beacon coding
  - Annex B provides samples of error correcting code calculations

C-S Emergency BEACONS

❖ <u>Beacon Specifications</u> - Cospas-Sarsat (2 of 2)

➢ C-S requires the beacon to operate for 24 hours

- Class 1 down to -40° C
- Class 2 down to -20° C

C-S Emergency BEACONS

❖ <u>Beacon Specifications</u> - International

➢ Carriage and technical <u>recommendations</u> are made by:

- International Maritime Organization (IMO) for maritime
- International Civil Aviation Organization (ICAO) for aviation

C-S Emergency BEACONS

❖ <u>Beacon Technical Specifications</u> – National (USA)

➢ <u>EPIRBs</u> – Radio Technical Commission for Maritime Services (RTCM)

➢ <u>ELTs</u> – Radio Technical Commission for Aeronautics (RTCA)

➢ <u>PLBs</u> – RTCM

➢ <u>SSAS</u> – RTCM

C-S Emergency BEACONS

❖ <u>Beacon Technical Specifications</u> – National (USA)

➢ Beacon Carriage/Usage Requirements – National (USA)

- EPIRBs – USCG
- ELTs – FAA
- PLBs – FCC
- SSAS – USCG

C-S Emergency BEACONS

❖ <u>BEACON Types</u>:

- ➤ EPIRBs
- ➤ ELTs
- ➤ PLBs
- ➤ SSAS

C-S Emergency BEACONS

❖Beacon type – <u>EPIRBs</u>:

➢Used primarily in the marine environment
➢May automatically activate – depending on bracket
➢Some are manual activation only
➢National administrations determine the floatation and homing requirements:
  • Must float
  • Must not leak
  • Most require a homer

C-S Emergency BEACONS

❖ Beacon type – <u>ELTs</u>

➢ Normally carried by airplanes

➢ Normally activated by G forces

➢ Maybe activated manually

➢ Fastest growing (percentage increase) beacon type in USA

- Recently overtook PLBs

➢ Highest false alert rate based on beacon population in USA

- Installation
- Testing

❖ Beacon type – <u>PLBs</u>

➤ Designed for personal use

➤ No automatic activation

➤ Maybe carried on:

- Maritime vessels,
- Aircraft, or
- One's person

➤ It is being substituted for EPIRBs and ELTs

C-S Emergency BEACONS

❖ Beacon type – <u>SSAS</u>

➢ Designed for maritime use

➢ Manually activated only

• Concealed activation

➢ No homer

❖ <u>Introduction to 406 MHz Beacons and their advantages</u>   (1 of 2)

➢ Designed to operate with satellite system
  • 121.5/243.0 MHz beacons were not

➢ Type approval process

➢ Transmits at higher power – 5 Watts

➢ Transmits a digital signal
  • Transmits a unique identification code
  • Interference is separated from distress signal

➢ More accurate Doppler location
  • Due to very stable oscillator

C-S Emergency BEACONS

❖ <u>Introduction to 406 MHz Beacons and their advantages</u> (2 of 2)

➤ Location Protocol warning –

- 406 MHz can penetrate significant jungle canopies
- GPS downlink is weak and may not penetrate the same jungle canopy

❖ Takes time for GPS to determine its position

- Some never acquire a location

❖ SSAS

➤ Provides notification of piracy or terrorism

➤ Activation is manual from a concealed location

➤ Data distribution is based strictly on the beacon's country code – not the beacon location

C-S Emergency BEACONS

❖ 121.5/243.0 MHz Satellite Processing Phase-out
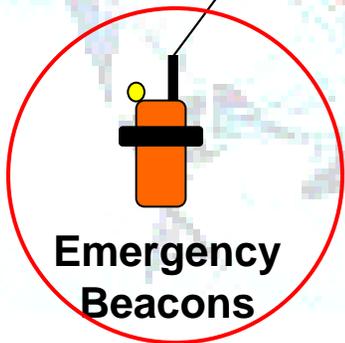
❖ 1 February 2009

C-S Emergency BEACONS

LEOSAR Processing

❖Location determination
- ➢Doppler
- ➢Encoded position

**LEO
Satellites**

**Rescue
Coordination
Centers**

**Other Mission
Control Centers**

**SAR Points
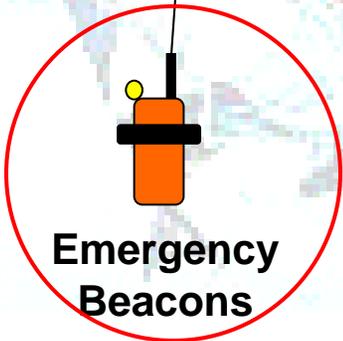of Contact**

**Mission
Control
Center**

**Emergency
Beacons**

C-S Emergency BEACONS

GEOSAR Processing

❖Location determination
  ➢Only with Location Protocol beacons
  ➢Encoded position only

GEO Satellites

Emergency Beacons

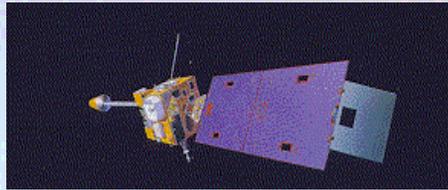**Rescue Coordination Centers**

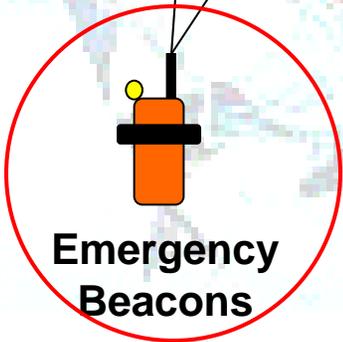**Other Mission Control Centers**

SAR Points of Contact

Mission Control Center

24

C-S Emergency BEACONS

GEO
Satellites

LEO
Satellites

**Rescue
Coordination
Centers**

**Other Mission
Control Centers**

**Mission
Control
Center**

**SAR Points
of Contact**

**Emergency
Beacons**

25

C-S Emergency BEACONS

❖Summary

➢4 Types of 406 MHz Beacons

- EPIRB
- ELT
- PLB
- SSAS

➢Advantages of 406 MHz Beacons

- Greater accuracy
- Stronger signal
- Encoded location

C-S Emergency BEACONS

❖ Summary   (2of 2)

➢ Location Protocol

  • Encoded location may not be immediate
  • GPS downlink is weak

❖ 121.5/243.0 MHz Satellite Processing Phase-out

➢ 1 February 2009