Cospas-Sarsat Emergency BEACONS

2009 COSPAS-SARSAT (C-S) UN TRAINING

19 - 23 January 2009
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
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

<table>
<thead>
<tr>
<th></th>
<th>406 MHz</th>
<th>121.5 MHz</th>
<th>243.0 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPIRBs</td>
<td>YES</td>
<td>YES - BUT</td>
<td>YES - BUT</td>
</tr>
<tr>
<td>ELTs</td>
<td>YES</td>
<td>YES - BUT</td>
<td>YES - BUT</td>
</tr>
<tr>
<td>PLBs</td>
<td>YES</td>
<td>YES - BUT</td>
<td>YES - BUT</td>
</tr>
<tr>
<td>SSAS</td>
<td>YES</td>
<td>Not Allowed</td>
<td>Not Allowed</td>
</tr>
</tbody>
</table>

**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
  - Brief description of a 406 MHz emergency beacon
  - Beacon specifications (C-S, International, National)
  - Beacon Types, uses for different applications
  - Introduction to 406 MHz Beacons and their advantages
  - SSAS
  - 121.5/243.0 MHz Satellite Processing Phase Out
Brief Description 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
Beacon Specifications - Cospas-Sarsat (1 of 2)

Technical Specification 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 ensures that the beacons are compatible with the Space and Ground segments of C-S.
  - 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
Beacon Specifications - 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
Beacon Specifications - International

- Carriage and technical recommendations are made by:
  - International Maritime Organization (IMO) for maritime
  - International Civil Aviation Organization (ICAO) for aviation
Beacon Technical Specifications – National (USA)

- **EPIRBs** – Radio Technical Commission for Maritime Services (RTCM)
- **ELTs** – Radio Technical Commission for Aeronautics (RTCA)
- **PLBs** – RTCM
- **SSAS** – RTCM
C-S Emergency BEACONS

Beacon Technical Specifications – National (USA)

Beacon Carriage/Usage Requirements – National (USA)
- EPIRBs – USCG
- ELTs – FAA
- PLBs – FCC
- SSAS – USCG
C-S Emergency BEACONS

- BEACON Types:
  - EPIRBs
  - ELTs
  - PLBs
  - SSAS
Beacon type – EPIRBs:

- 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
Beacon type – ELTs
- 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
C-S Emergency BEACONS

- Beacon type – PLBs
  - 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 – **SSAS**
  - Designed for maritime use
  - Manually activated only
    - Concealed activation
  - No homer
Introduction to 406 MHz Beacons and their advantages

- 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
Introduction to 406 MHz Beacons and their advantages

- 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
C-S Emergency BEACONS

- 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

- Location determination
  - Doppler
  - Encoded position

LEOSAR Processing

- 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
C-S Emergency BEACONS

GEO Satellites

LEO Satellites

Rescue Coordination Centers

Other Mission Control Centers

SAR Points of Contact

Mission Control Center

Emergency Beacons
Summary

- 4 Types of 406 MHz Beacons
  - EPIRB
  - ELT
  - PLB
  - SSAS

- Advantages of 406 MHz Beacons
  - Greater accuracy
  - Stronger signal
  - Encoded location
Summary

- Location Protocol
  - Encoded location may not be immediate
  - GPS downlink is weak

121.5/243.0 MHz Satellite Processing Phase-out

1 February 2009