MEOSAR & GPS
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Cospas-Sarsat (C-S) Program uses dedicated Search and Rescue (SAR) payloads onboard satellites to relay beacons signals to ground stations.

C-S system consists of three segments:

- **User Segment** – the emergency beacon transmitters
  - Marine: EPIRB (Emergency Position Indicating Radio Beacon)
  - Aviation: ELT (Emergency Locating Transmitter)
  - Land: PLB (Personal Locating Beacon)

- **Space Segment**
  - LEOSAR: Low-Earth Orbit - Provides for beacon location using Doppler processing; uses Store & Forward instrument to provide global coverage
  - GEOSAR: Geosynchronous Orbit Performs instantaneous alerting function; no locating capability unless beacon is equipped with GNSS receiver.
  - MEOSAR*: Mid-Earth Orbit (GNSS)

- **Ground Segment** – Local User Terminals (LUTs)

* MEO is not yet operational – early operational capability Dec 2015
MEOSAR Concept of Operations

Concept of Operations

Activated 406 Emergency Locator Transmitter (ELT)

Local User Terminal

GPS III Satellites

US Coast Guard Rescue Coordination Center

Mission Control Center

US Air Force Rescue Coordination Center

System Overview Diagram
The fully operational MEOSAR constellation SAR/GPS will provide world wide coverage with the ability to detect and locate emergency distress beacons accurately in as little as one beacon burst.

SAR/GPS
Search and Rescue - Global Positioning Satellite System
Global Search and Rescue System

With a footprint over seven times larger than a LEO Satellite, the MEOSAR constellation allows for real-time alerting worldwide without the need to store information in the satellite to relay at a later time. This capability equates to faster alert notices and thus more lives saved.

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SAR Response

Activated 406 Emergency Position Indicating Radio Beacon (EPIRB)
Next generation of satellite-aided SAR

- Based on the use of SAR Repeaters carried on board Global Navigation Satellite System (GNSS) satellites
- GNSS constellations consist of 24 (or more) satellites Mid Earth Orbit (GPS, Galileo, GLONASS)
- Provides
  - Multiple satellites in view of the beacon anywhere in the world at all times
  - Advanced location process using time and frequency measurements of beacon signal to triangulate its location
  - Near instantaneous beacon detection and location, globally, at all times
  - Mitigates terrain blockage due to multiple look angles from multiple moving satellites
  - Robust space segment, well maintained and highly redundant
  - Simple space segment repeater allows for development of higher performance beacon signal
• U.S. SAR Operational Space Segment
  – In 2009 USAF approved request from U.S. civil SAR community to host SAR repeaters on 24 GPS-III satellites
  – Repeater payload will be provided by Canadian Government built to C-S specifications including interoperability with Galileo and GLONASS
  – Development underway with first operational payload planned to launch on board GPS III SV-9
    • SAR/GPS PDR – held November 20, 2013
  – Distress Alert Satellite System (DASS) onboard GPS-II (16 payloads)

• USA (Coast Guard & Air Force) planning to incorporate MEOSAR data for operational use in mid-2015
Return Link Service (RLS)

GNSS-enabled enhancement

• MEOSAR enables RLS capability
  – Type-1 protocol adopted by C-S: return link message sent automatically when location of alert has been confirmed

• Galileo and GLONASS planning to use RLS
  – GPS has the capability to implement RLS but not currently in the concept of operations (SAR/GPS not fully interoperable with other GNSS)

• Upon detection of an RLS enabled beacon, the US Mission Control Center (USMCC) must forward beacon message to French MCC
  – Bit embedded in beacon message indicating RLS beacon
  – Impacts interoperability and response time to SAR incident

• GPS Modifications
  – Need authority to use bits (estimate 80 bits for Type-1 message and beacon ID);
  – SAR downlink needs to go from USMCC to GPS control center, which then sends command to GPS to insert the message into the PNT downlink