

SEARCH AND RESCUE

National Aeronautics and
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MEOSAR & GPS
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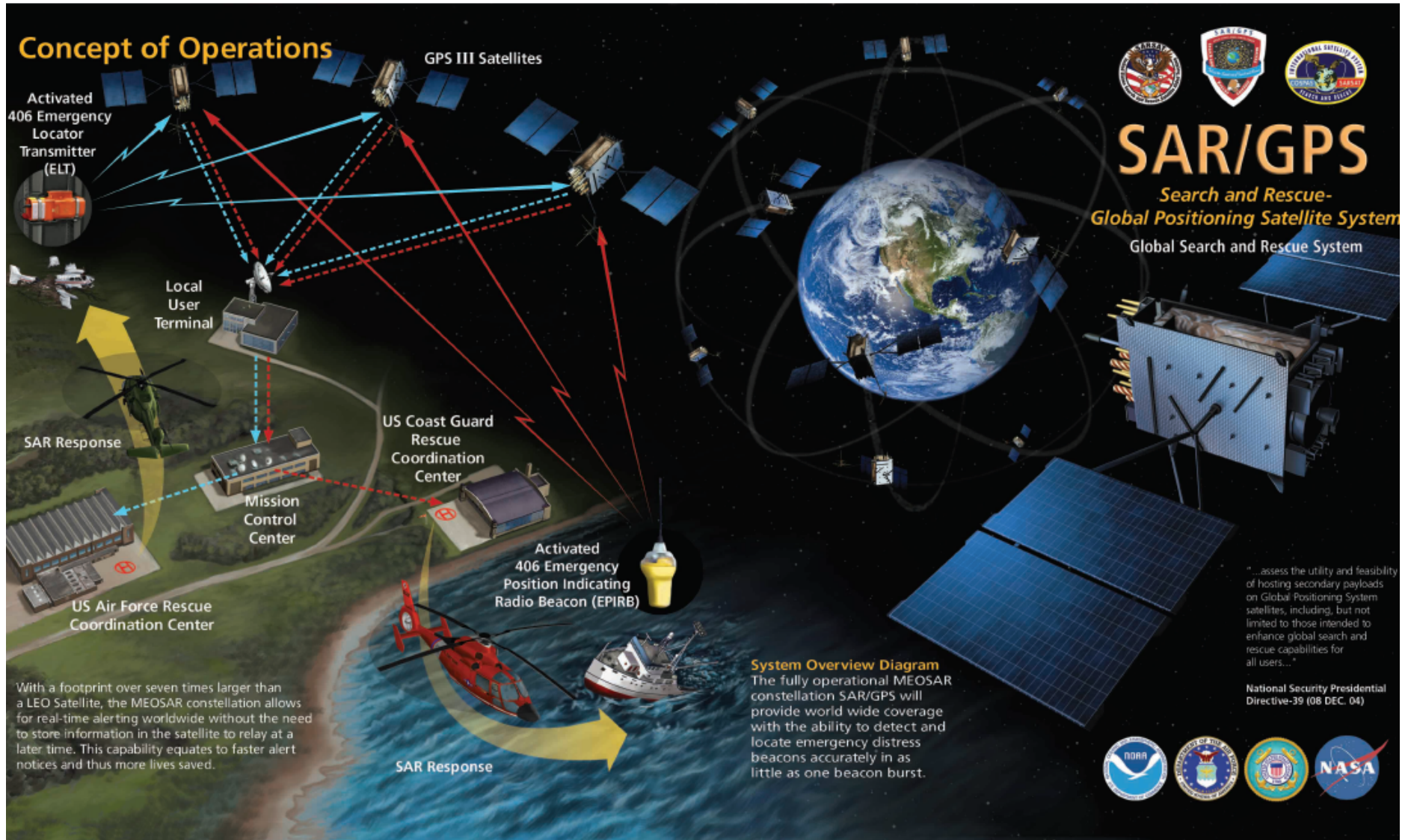
Cospas-Sarsat System Overview



- 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



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



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