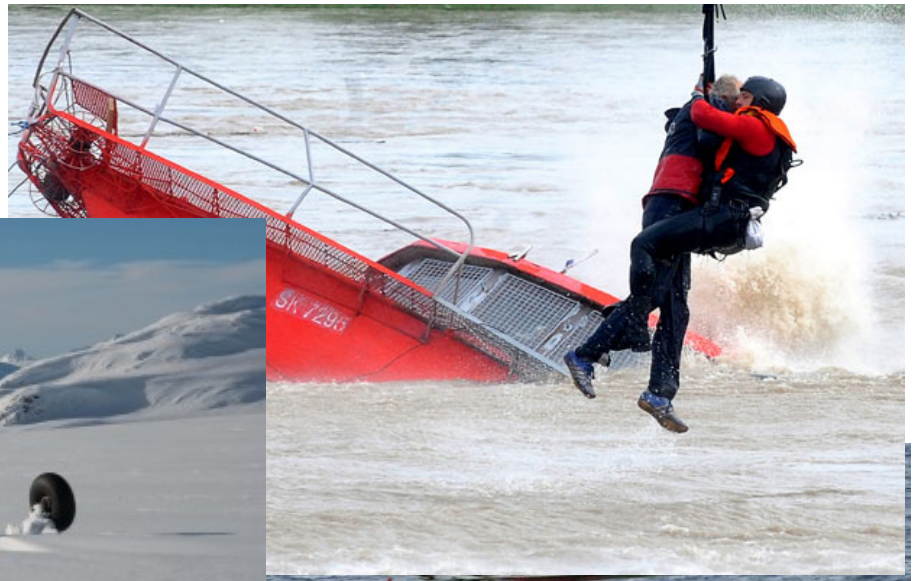
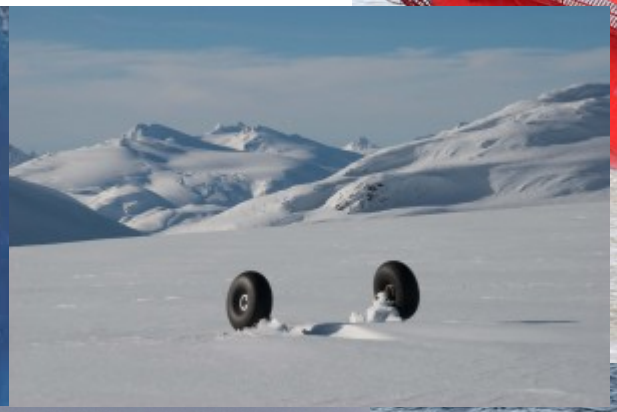
SARSAT Search and Rescue

World-wide: over *37,196 rescues*

United States: over *7,347 rescues*





Chris O'Connors DSB Chief, SARSAT PM
NOAA/NESDIS/OSPO/SPSD
NOAA Satellite Conference, April 30, 2015

Background / History

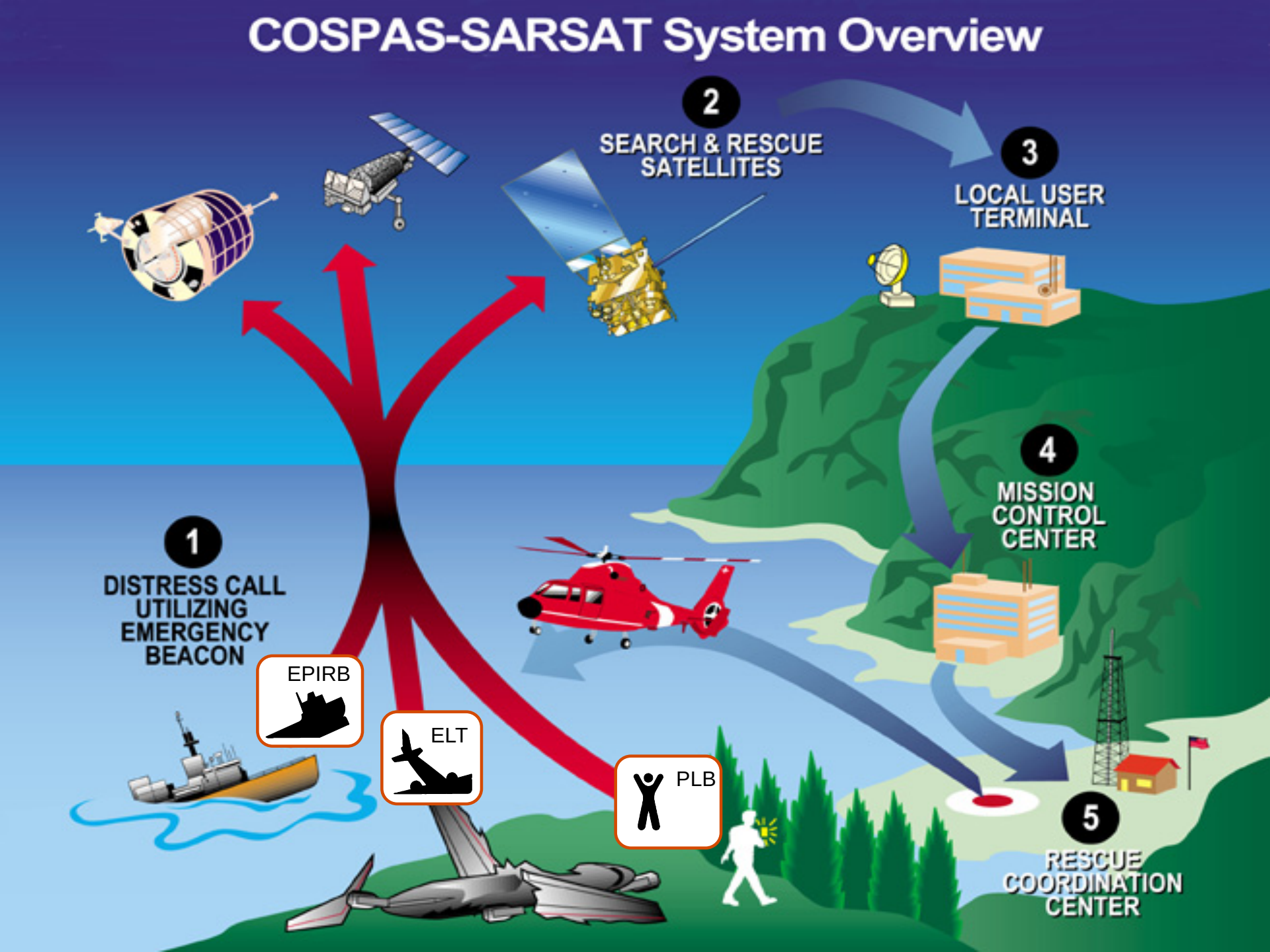
1967	16-year old girl dies after two months waiting for rescue
1970	Congress mandates carriage of 121.5 ELT on general aviation aircraft
1972	Congressmen Boggs and Begich lost in Alaska plane crash
1975	Apollo-Soyuz Test Project
1982	COSPAS-SARSAT first rescue
1985	COSPAS-SARSAT Declared Operational
1998	Geostationary space segment becomes operational
1998	Cospas-Sarsat announces termination of 121/243 MHz service starting in 2009
2009	Termination of 121.5 and 243 MHz processing by space segment

Cospas-Sarsat System Overview

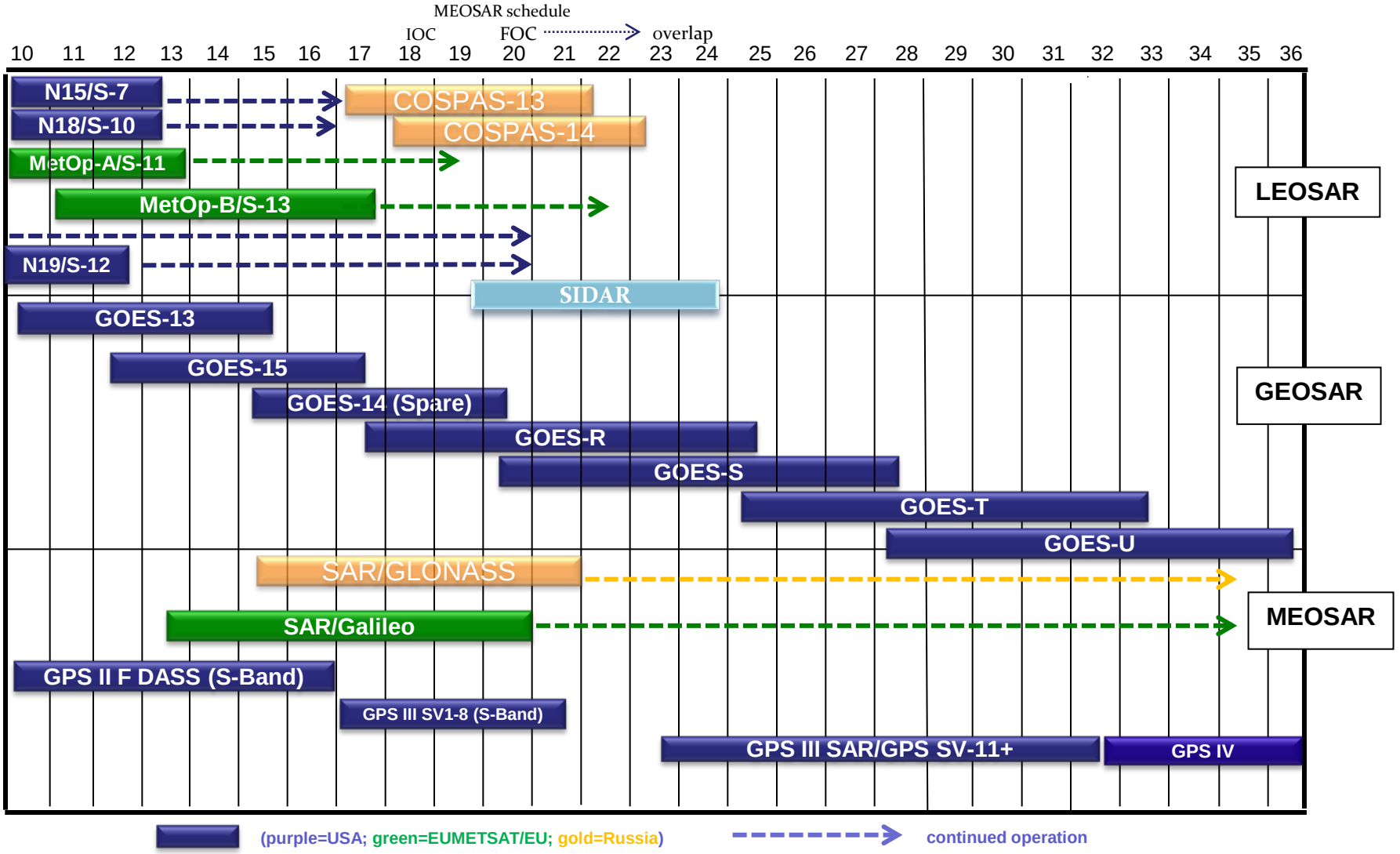
- Cospas-Sarsat (C-S) Program uses dedicated Search and Rescue (SAR) payloads onboard satellites to relay beacons signals to ground stations
- C-S system consists of three segments:
  - User Segment – the emergency beacon transmitters
    - Marine: EPIRB (Emergency Position Indicating Radio Beacon)
    - Aviation: ELT (Emergency Locating Transmitter)
    - Land: PLB (Personal Locating Beacon)
  - Ground Segment – Local User Terminals (LUTs)
  - 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 SAR – Under development**

C-S Participants

- 43 countries and organizations
- Cooperates with International Maritime Organization (IMO), International Civil Aviation Organization (ICAO) and the International Telecommunications Union (ITU)


COSPAS-SARSAT System Overview
2
SEARCH & RESCUE SATELLITES
3
LOCAL USER TERMINAL
4
MISSION CONTROL CENTER
1
DISTRESS CALL UTILIZING EMERGENCY BEACON
EPIRB
ELT
PLB
5
RESCUE COORDINATION CENTER

SARSAT Space Segment



Current
U.S. Local User Terminals (LUTs)

Alaska
NOAA FCDA
2 LEOLUTs

Guam
Andersen AFB
2 LEOLUTs

Hawaii

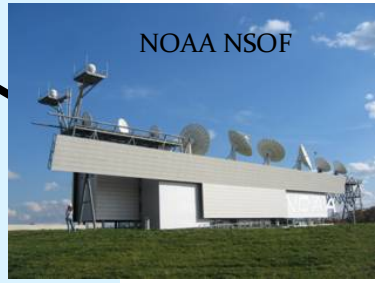
USCG COMMSTA Honolulu
2 LEOLUTs
6 antenna MEOLUT

California
Vandenburg AFB

Miami

USCG COMMSTA Miami
2 LEOLUTs
6 antenna MEOLUT

Maryland*



***Maryland has 3 GEOLUTs**
&
1 LEOLUT
US Mission Control
Center

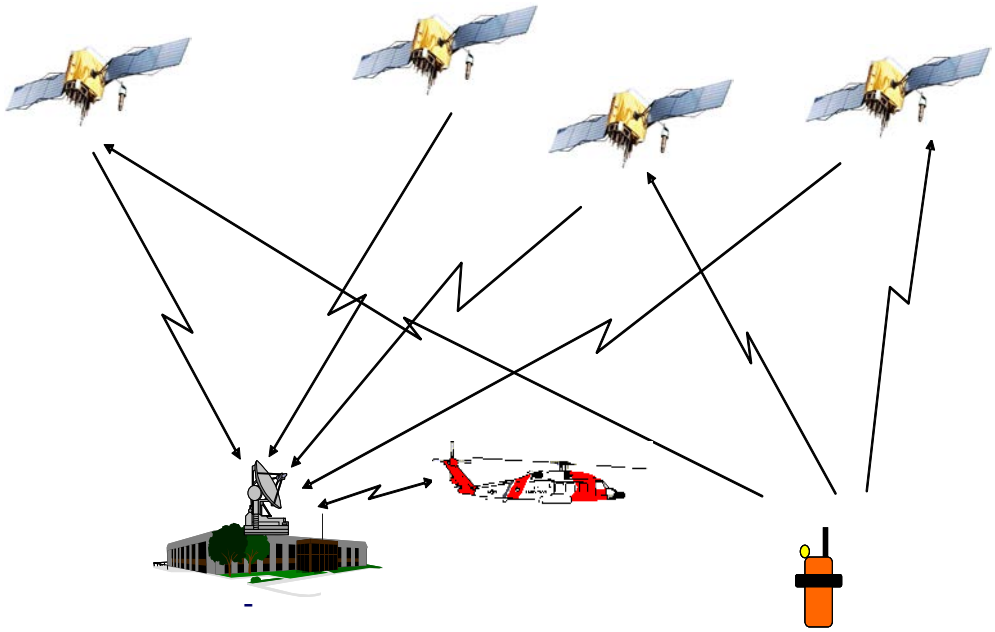
SPACE SEGMENT COMPARISON

Current SARSAT systems requires 4 Low Earth Orbiting (LEO) satellites

- Beacon detection
  - within 10 min with GEOSAR
  - A few minutes to 2 hours on LEOSAR
- Location determined within 1-2 hours with 5 km accuracy

Search and Rescue Global Position System (SAR/GPS) Medium Earth Orbiting Search and Rescues (MEOSAR) vastly improves capability

- Instantaneous Notification & Location
- Global Coverage
- 100% Availability
- No Terrain Blockage
- Improved Accuracy
  - 1st Gen 1KM
  - 2nd Gen 100-500m



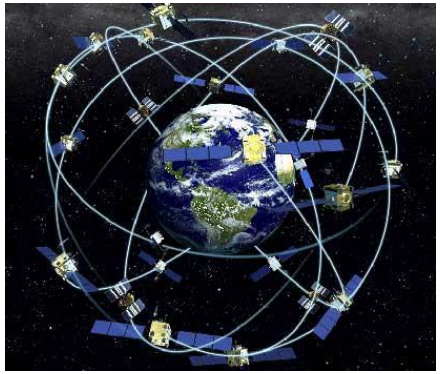
Distress Alerting Satellite System (DASS) Proof-of-Concept includes repeater on GPS IIR, IIR-M, and IIF SVs

- Leveraging existing capability on GPS
- Provides demonstration capability
- 17 satellites in orbit with SAR capability

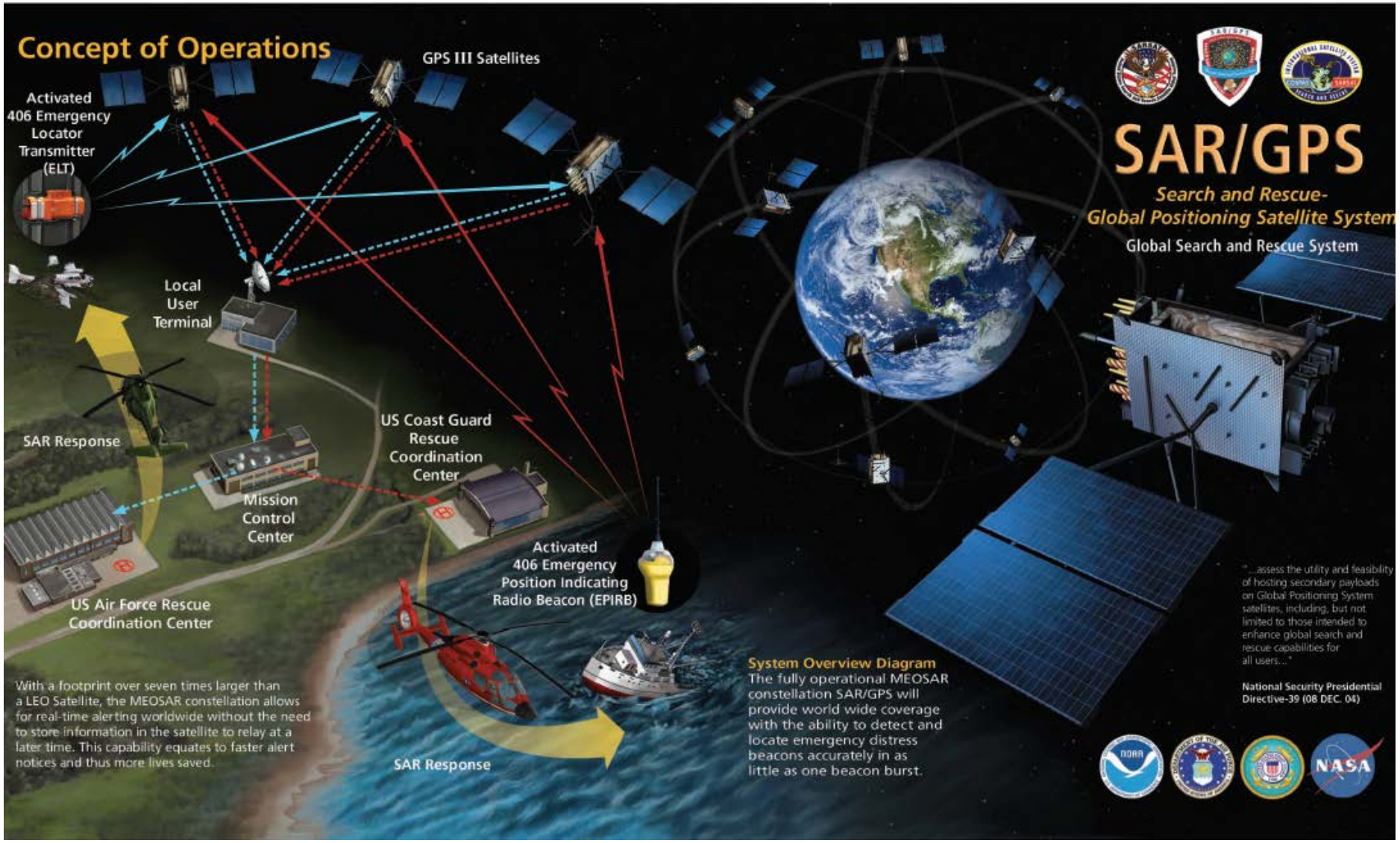
MEOSAR

Next generation of satellite-aided SAR

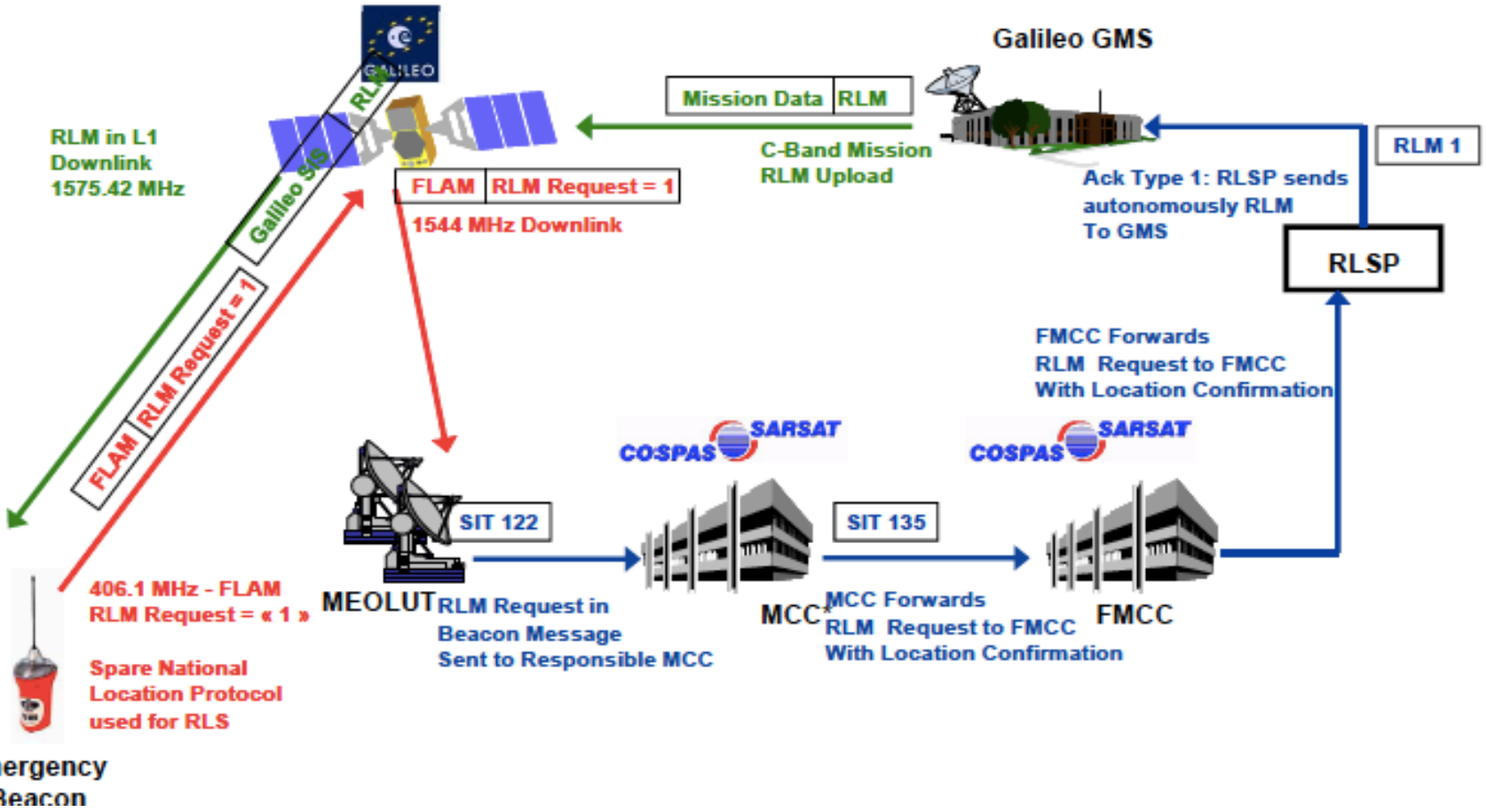
- Based on the use of SAR Repeaters carried on board Global Navigation Satellite System (GNSS) satellites
- Global Navigation constellations consist of 24 (or more) satellites Mid Earth Orbit (GPS, Galileo, GLONASS)
- Provides
  - Near instantaneous beacon detection and location, globally, at all times
  - Advanced location process using time and frequency measurements of beacon signal to triangulate its location
  - 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



MEOSAR Concept of Operations



Return Link Acknowledgment Service End-to-End Loop (RLM Type-1)



Message sent by the distress beacon (specific RLS protocol on the 406 MHz uplink signal) to the RLS Provider (RLSP) to indicate it has a Return Link capability

Second Generation 406 Beacons

Project Goals

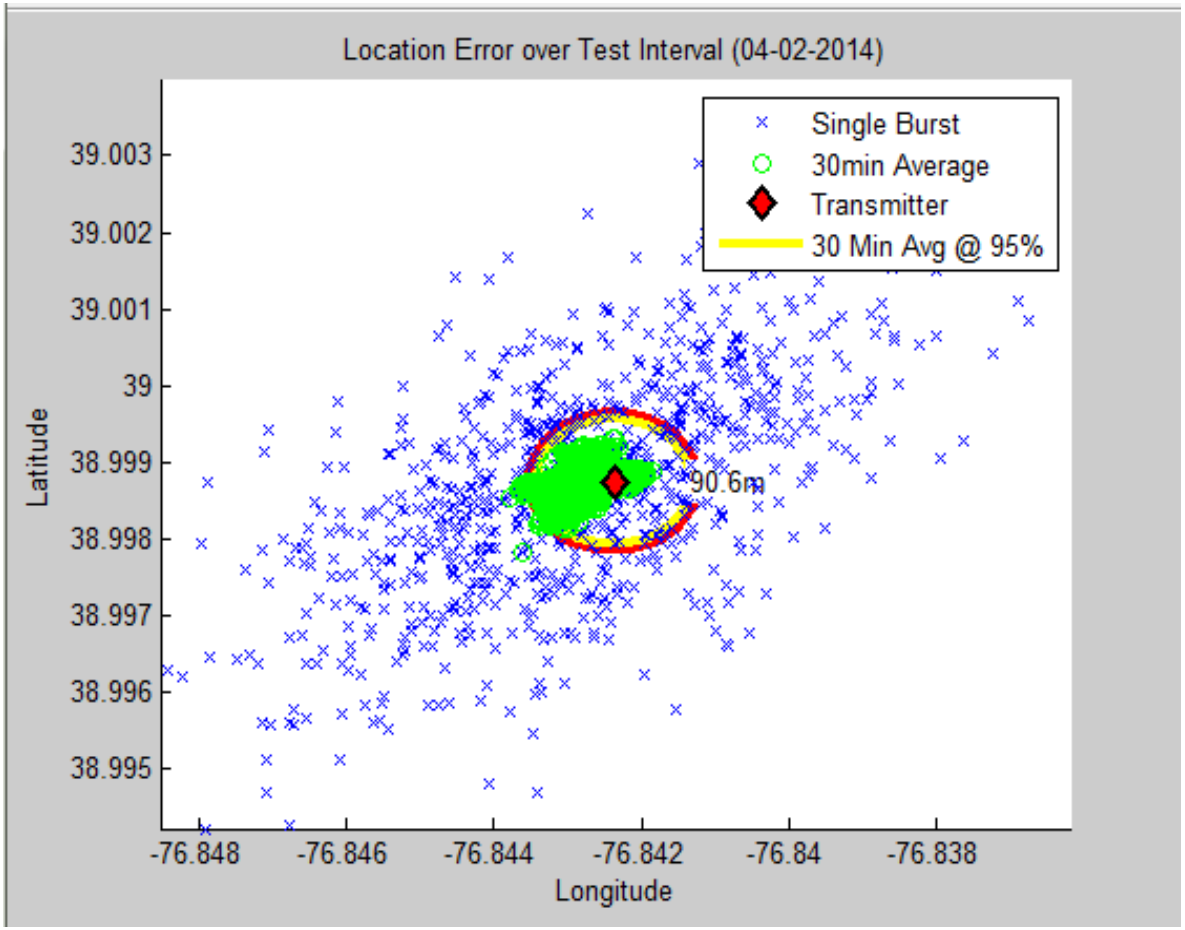
- Capitalize on MEOSAR space segment and improve system performance to meet or exceed C/S requirements, including:
  - Detection probability, location accuracy and system capacity
  - Reduce cost and complexity of beacons
  - Collaborate with manufacturers to obtain the most competitive end product

Progress to date

- Technology selected - Spread Spectrum (similar to cell phones)
  - Improved detectability
  - Enhanced location performance
- Expanded message content
  - Additional data fields
  - Two-way messaging capability (under discussion)

SGB Current Results

SGB locations over 2-day duration



- NASA prototype beacon signal transmitted over 48hr period (1 burst every 50 sec) through DASS;
- Locations collected at NASA MEO ground station

Location accuracy meets C/S SGB requirements for location accuracy:

➔shows that at least 95% of the results of the 30 minute average are within the 100m (red) circle

➔order of magnitude improvement from first generation beacons

Support Search and Rescue
Get Lost!

http://www.sarsat.noaa.gov

http://www.cospas-sarsat.int