SARSAT Overview

SAR Controllers Training 2015
3 – 5 March 2015
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SARSAT Program Manager

Agenda

- Cospas-Sarsat
- System Description
  - User Segment (Beacons)
  - Space Segment
  - Ground Segment
  - Search and Rescue (SAR) Segment
- U.S. SARSAT

Cospas-Sarsat Overview

- **COSPAS:** Cosmicheskaya Systyema Poiska Aariynyich Sudov (Russian) which translates loosely "Space System for the Search of Vessels in Distress"

- **SARSAT:** Search And Rescue Satellite Aided Tracking

Cospas-Sarsat provides, free-of-charge, distress alert and location information to search and rescue authorities anywhere in the world for maritime, aviation and land users in distress.

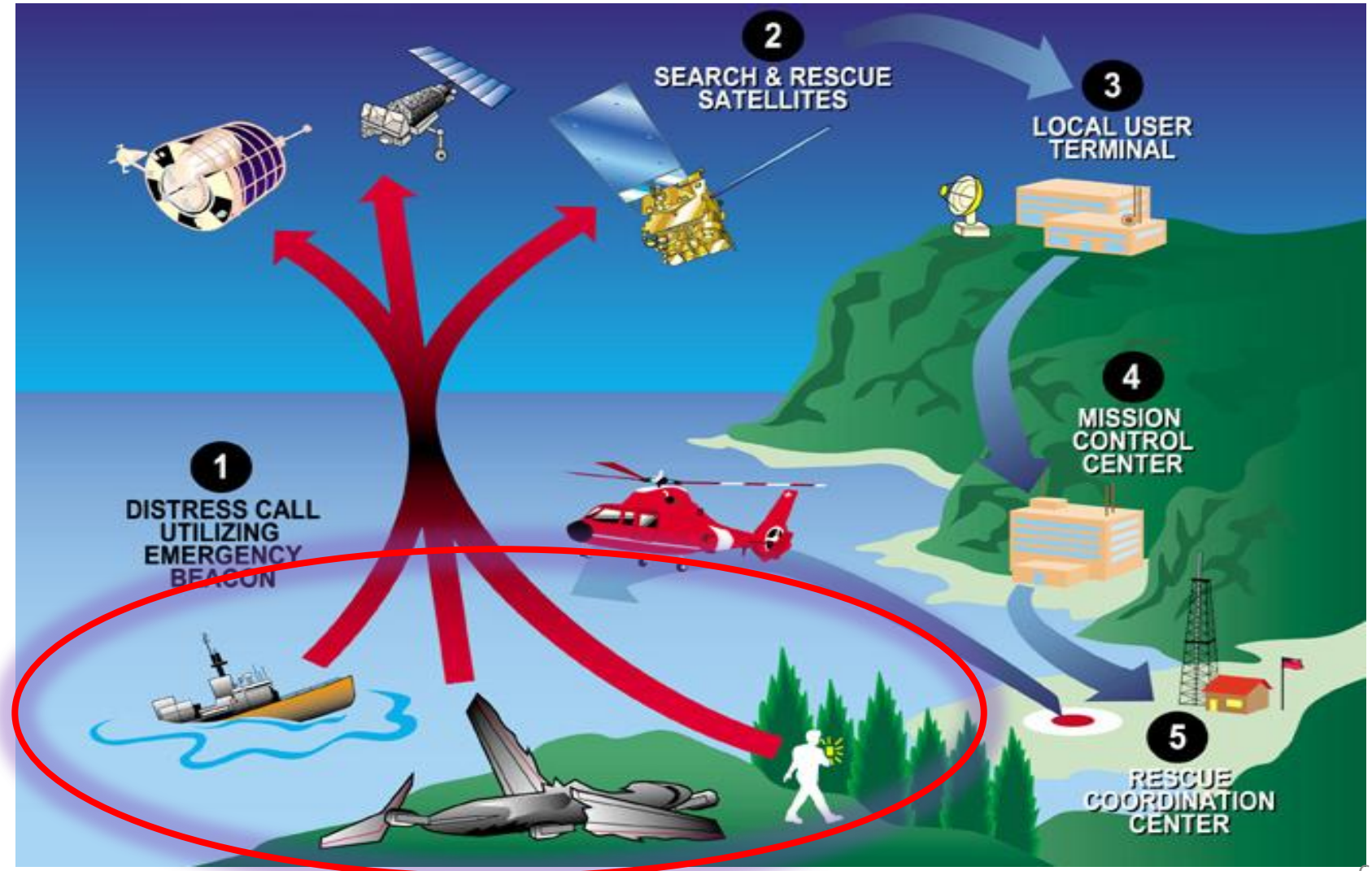
Cospas-Sarsat takes the "search" out of Search and Rescue

Cospas-Sarsat Summary

- 4 Parties to the Cospas-Sarsat Agreement
- 26 Ground Segment Providers
- 11 User States
- 2 Participating Organizations
- Space Segment
  - 6 Low Earth Orbit Search and Rescue Satellites
  - 6 Operational Geostationary Search and Rescue Satllites
- Ground Segment
  - 31 Mission Control Centers (MCCs)
  - 58 Low Earth Orbit Local User Terminals (LEOLUTs)
  - 22 Geostationary Local User Terminals (GEOLUTs)
- Over 1,200,000 Beacons

Cospas-Sarsat Participants

Cospas-Sarsat System Overview
User Segment



User Segment – Beacons

Activation:

- **Manual**
- **Automatic (Hydrostatic/G-Switch)**

Signal:

- **406 MHz (Digital)**
- **121.5 MHz (Analog) Homing**
- **Applications:**
- **Maritime - Emergency Position-Indicating Radio Beacon (EPIRB)**
- **Aviation - Emergency Locator Transmitter (ELT)**
- **Personal/Land - Personal Locator Beacon (PLB)**
- **Security – Ship Security Alerting System (SSAS)**

*** Most U.S. general aviation ELTs are still 121.5 MHz which are no longer monitored by Cospas-Sarsat**

Needs Update

United States User Segment

- **73,346* aviation users in U.S.**

  All types and uses of aircraft

- **195,026* maritime users in U.S.**

  Divided between commercial and recreational vessels

- **134,514* land-based users in U.S.**

  Recreational use plus some aviation and maritime use

- **Estimate of approximately 1,235,000 users worldwide in 2011 and 1,799,000 worldwide in 2016**

*** Registered U.S. beacons as of January 31, 2014**

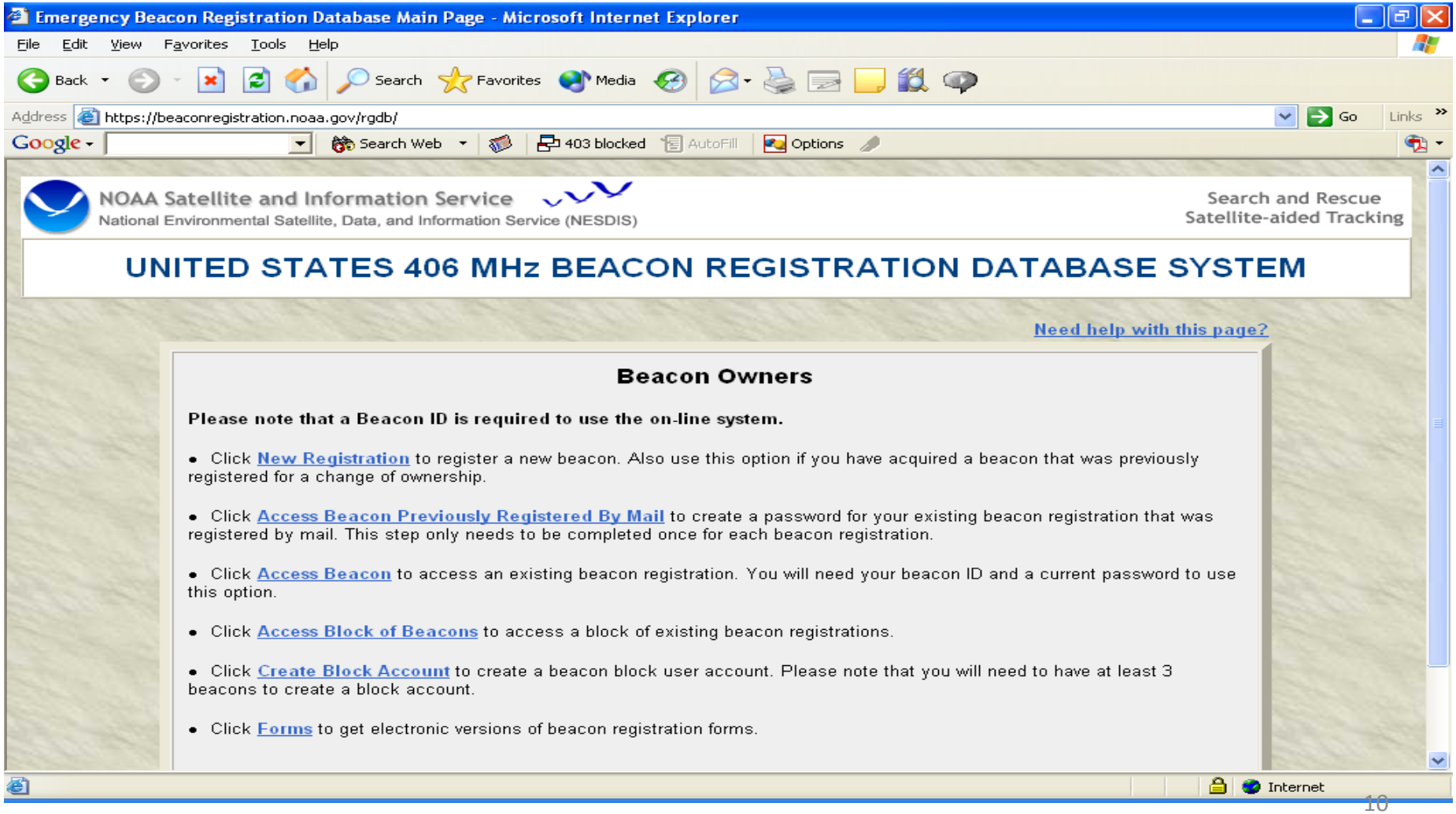
User Segment

Attributes of 406 MHz

- Every beacon has unique 15 digit hex identification
  - Unique ID allows registration with contact information
  - Non-Distress activations can be terminated with a phone call
  - Reduces stress on SAR assets
- Powerful 5 watt transmitter and digital signal increases accuracy of location by Doppler processing
- The system can discriminate between real beacon transmissions and non-beacon transmissions which reduces the resources spent on tracking interfering sources
- Global coverage provided by store and forward capability of Cospas-Sarsat LEOSAR satellites
- Increased system capacity due to short duration transmission, and spreading of frequency allocation

User Segment – Beacon Registration

www.beaconregistration.noaa.gov



Importance of Registration

Identification

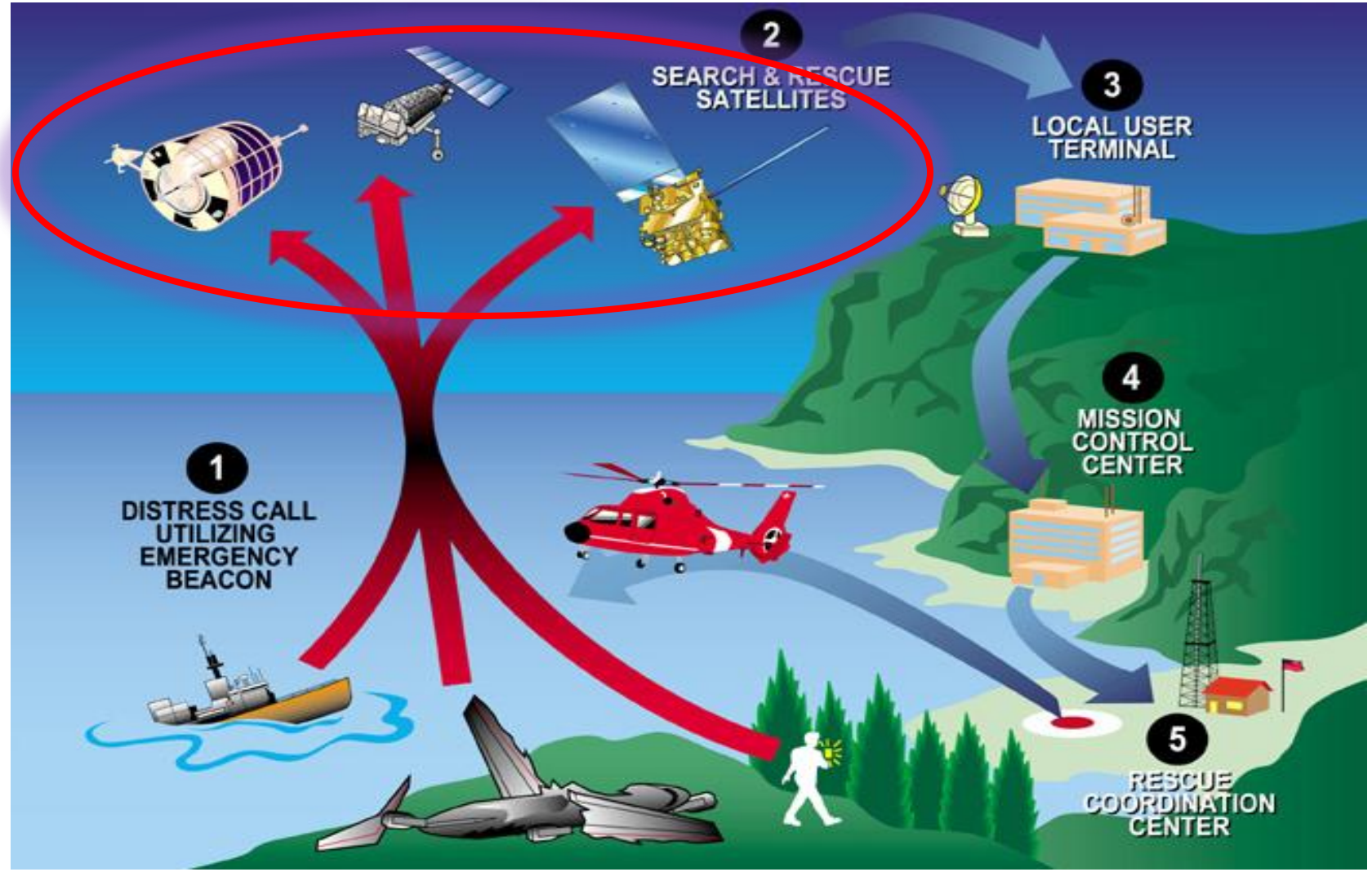
- Digital data transmitted by beacon provides nationality and type of beacon
- Tail number or other identifying information can be encoded into the beacon
- Registration Database provides additional information such as owner/operator, and can include specifics on aircraft or vessel
- In most cases, false alerts are resolved prior to launch of resources, saving taxpayer $$

Importance of Registration

Detection

- Near real-time detection of the 406 MHz transmission from an emergency beacon. Even if there is no LEO satellite in view to achieve Doppler for location, GEO satellites work to save lives in 4 ways:
  - Use of Registration Database to contact owner or emergency POC; this allows rescue forces to get more detailed information such as nature of emergency, severity of injuries, number of people involved, etc. and can help determine if alert is actual distress
  - GEOSAR satellites have continuous monitoring of nearly 1/3 the Earth's surface.
  - GEOSAR satellites have a 46-minute mean time "advantage" for first detection.

Cospas-Sarsat System Overview
Space Segment



Space Segment

Currently 2 Types of Satellites:

- **Low Earth Orbiting Search And Rescue (LEOSAR)- 6 on Orbit**

  Altitude: 500 miles in "Pole-Pole" orbit

  Performs Doppler locating function (primary means of locating…not GPS)

  Two instruments, Search and Rescue Repeater (SARR) and Search and Rescue Processor (SARP)

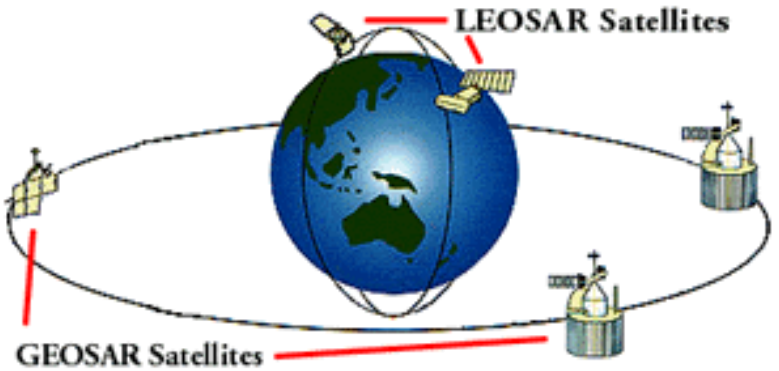
  SARP Stores & Forwards alerts continuously for 18 hours (originally 48 hours) which provides worldwide coverage and total system redundancy.

- **Geostationary Orbiting Search And Rescue (GEOSAR)- 6 on Orbit**

  Altitude: 23,000 miles in fixed orbit

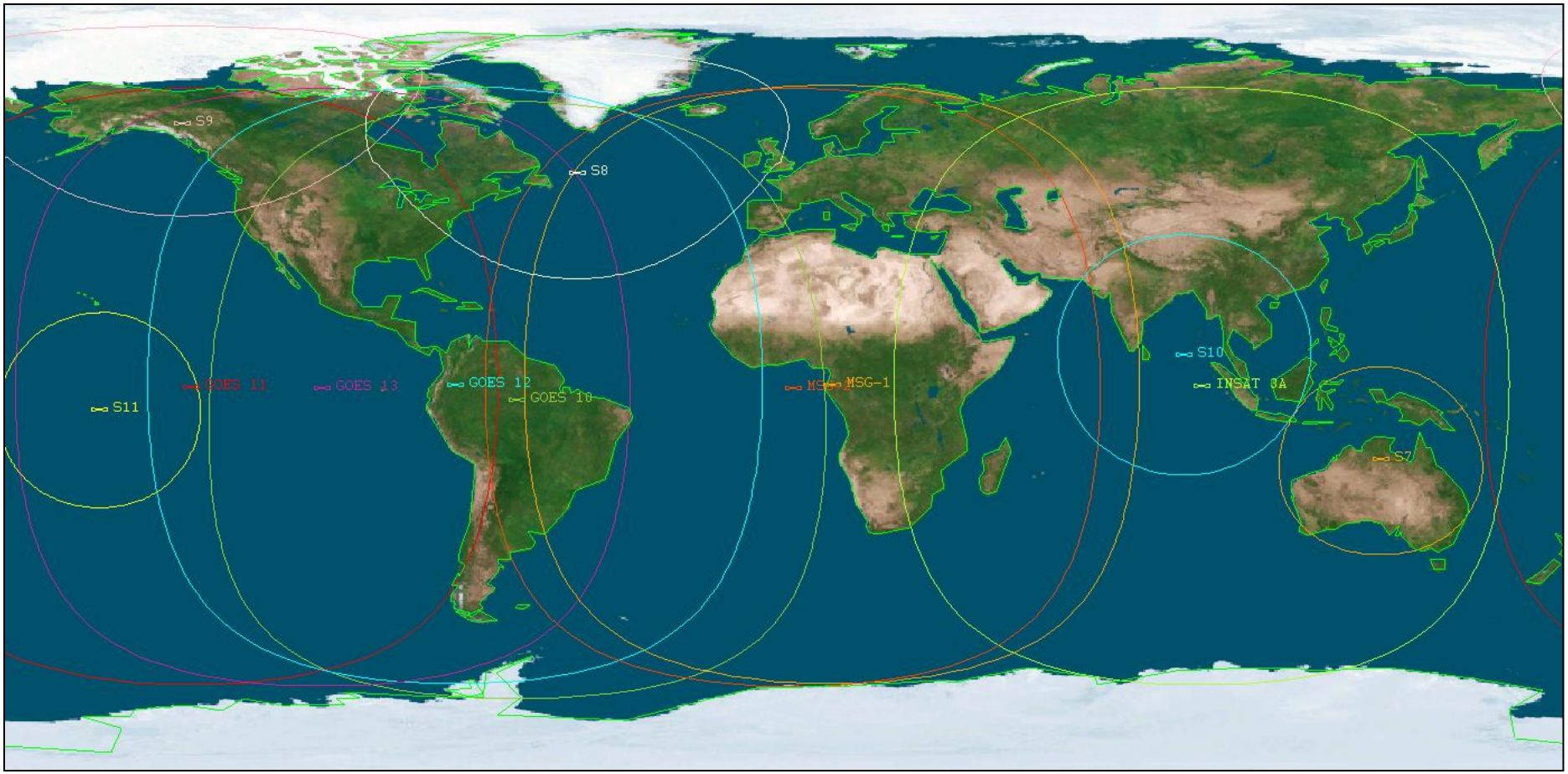
  Performs instantaneous alerting function. No locating capability unless beacon is equipped with GPS.

  Coverage from 70N – 70S



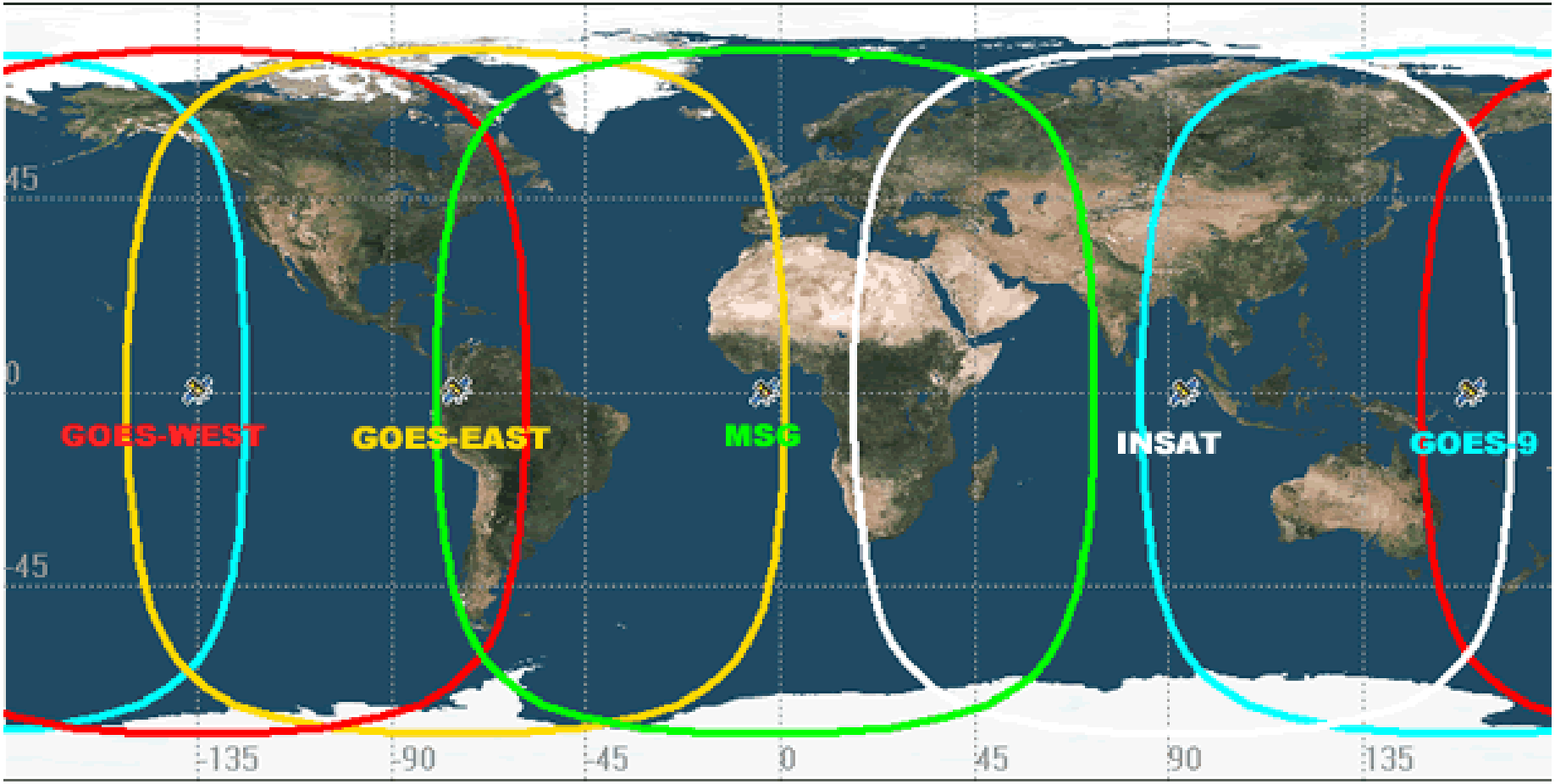
Space Segment

Typical Satellite Footprints



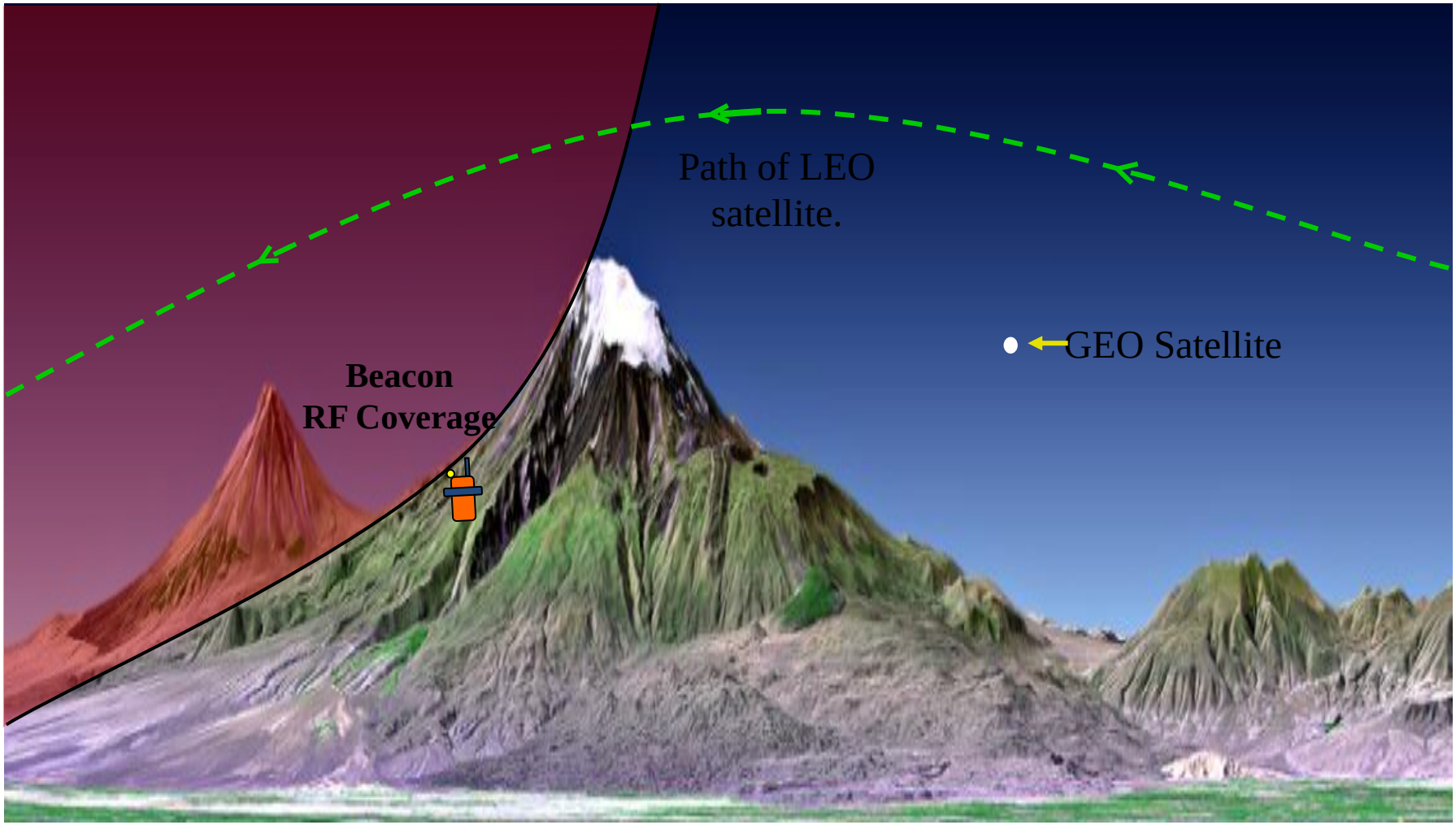
Space Segment

GEOSAR Coverage - Typical Satellite Footprint

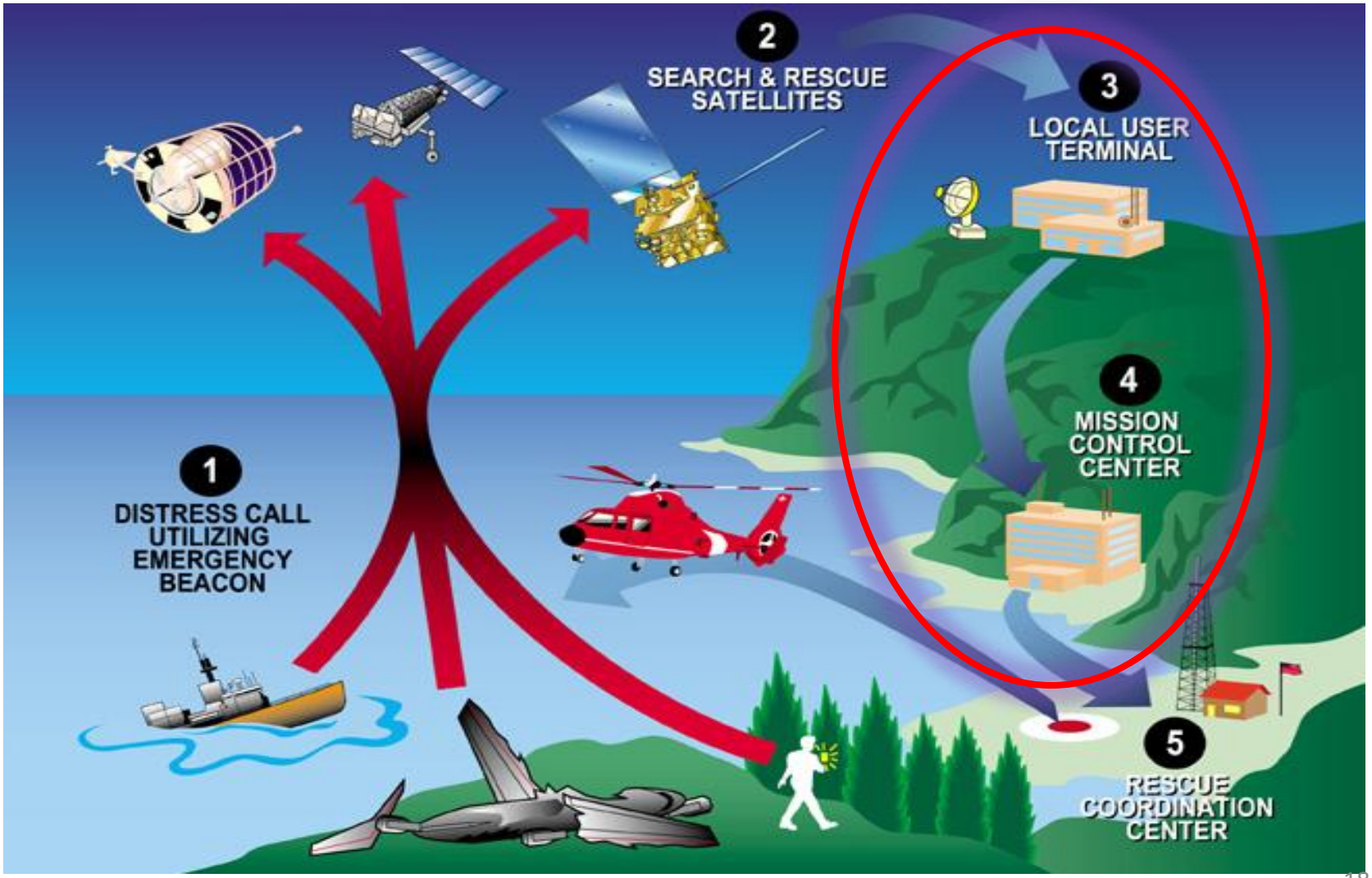


Space Segment

Field of View

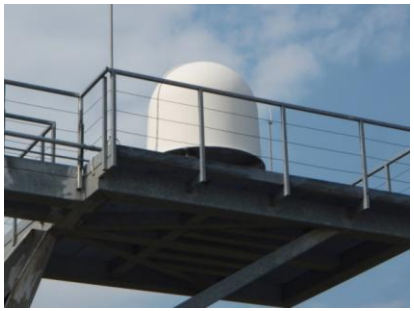


Cospas-Sarsat System Overview
Ground Segment

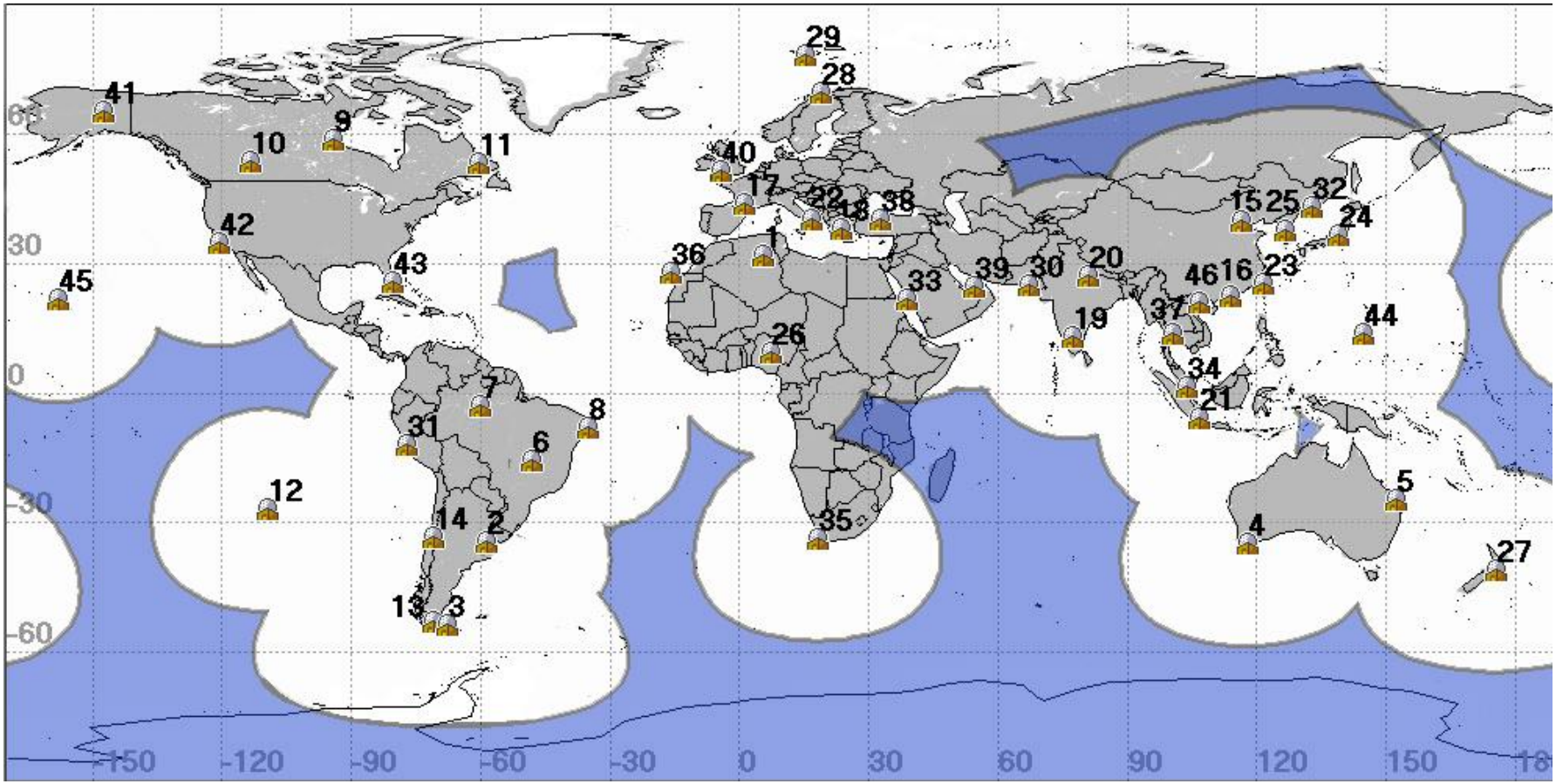


Ground Segment
LEOSAR Local User Terminals (LEOLUTs)

- Receive and process data from Low Earth Orbit (LEO) satellite search and rescue processors (SARP) and search and rescue repeaters (SARR)
- Combine LEO data with GEO data to improve Doppler processing
- Maintains accuracy by producing a correction of the satellite ephemeris each time a satellite signal is received
- Transmit collected data to the Mission Control Center



Cospas-Sarsat LEOSAR Local User Terminal Locations



Transmissions of beacons activated in the blue areas are stored when they are received by the satellite and later transmitted to a LEOLUT when the satellite passes near that ground station.

U.S. SARSAT Ground Segment

United States Dual System LUTs

Guam

California

Maryland

Miami

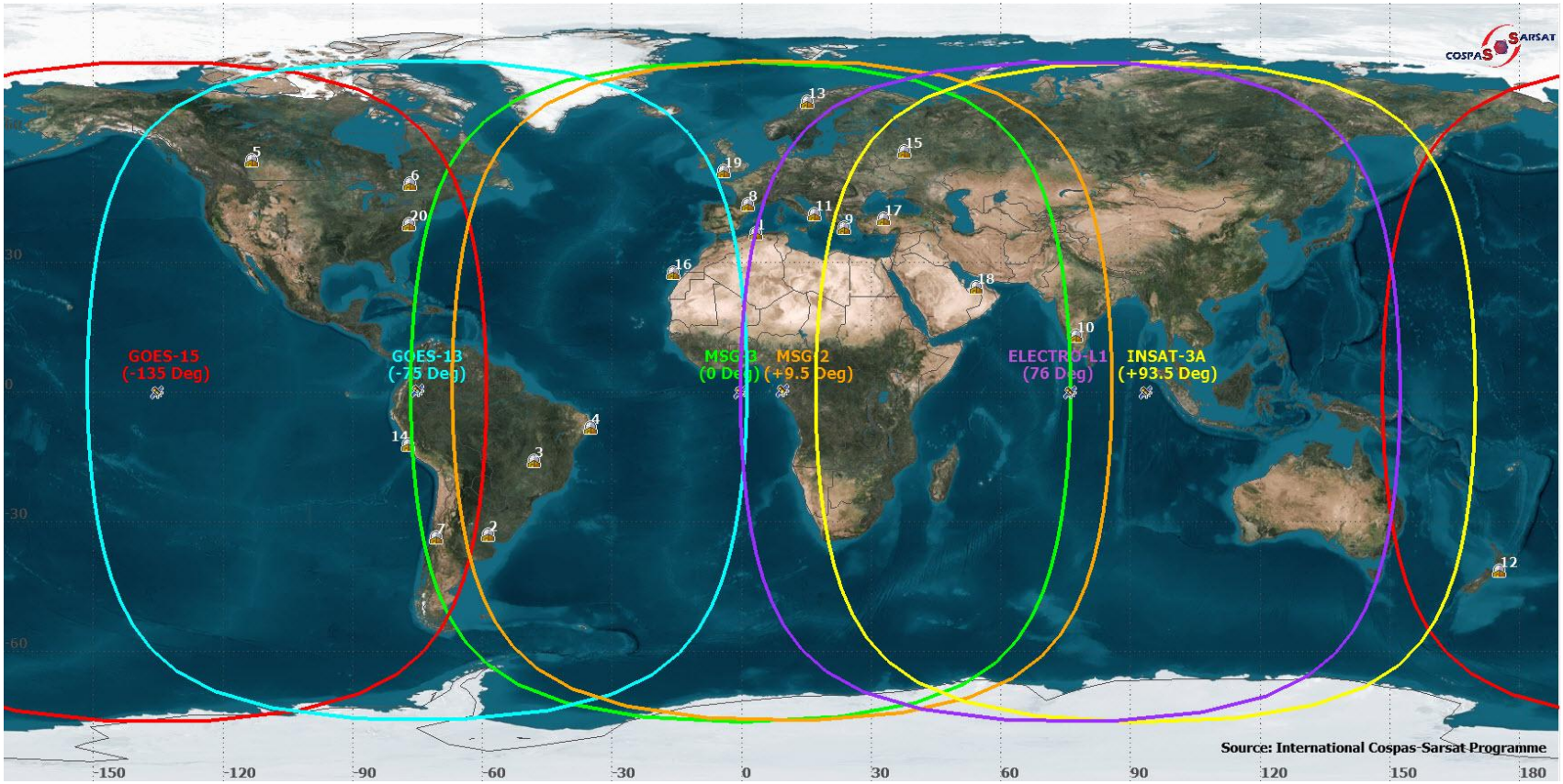
Alaska

Hawaii

Ground Segment
GEOSAR Local User Terminals (GEOLUTs)

- **Receive and process data from Geostationary Earth Orbit (GEO) satellite search and rescue repeaters (SARR)**
- **Provides beacon location information to MCC when it is included in the digital message of a 406 MHz beacon if the beacon has external or internal navigation device**
- **Transmit collected data to the Mission Control Center**

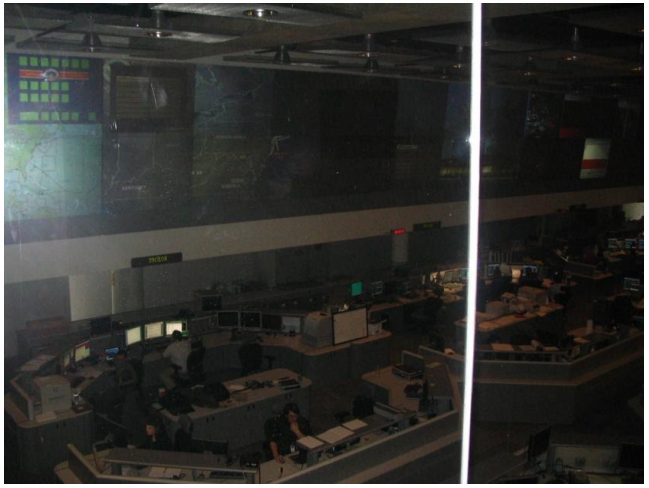
Cospas-Sarsat GEOSAR Local User Terminal Locations



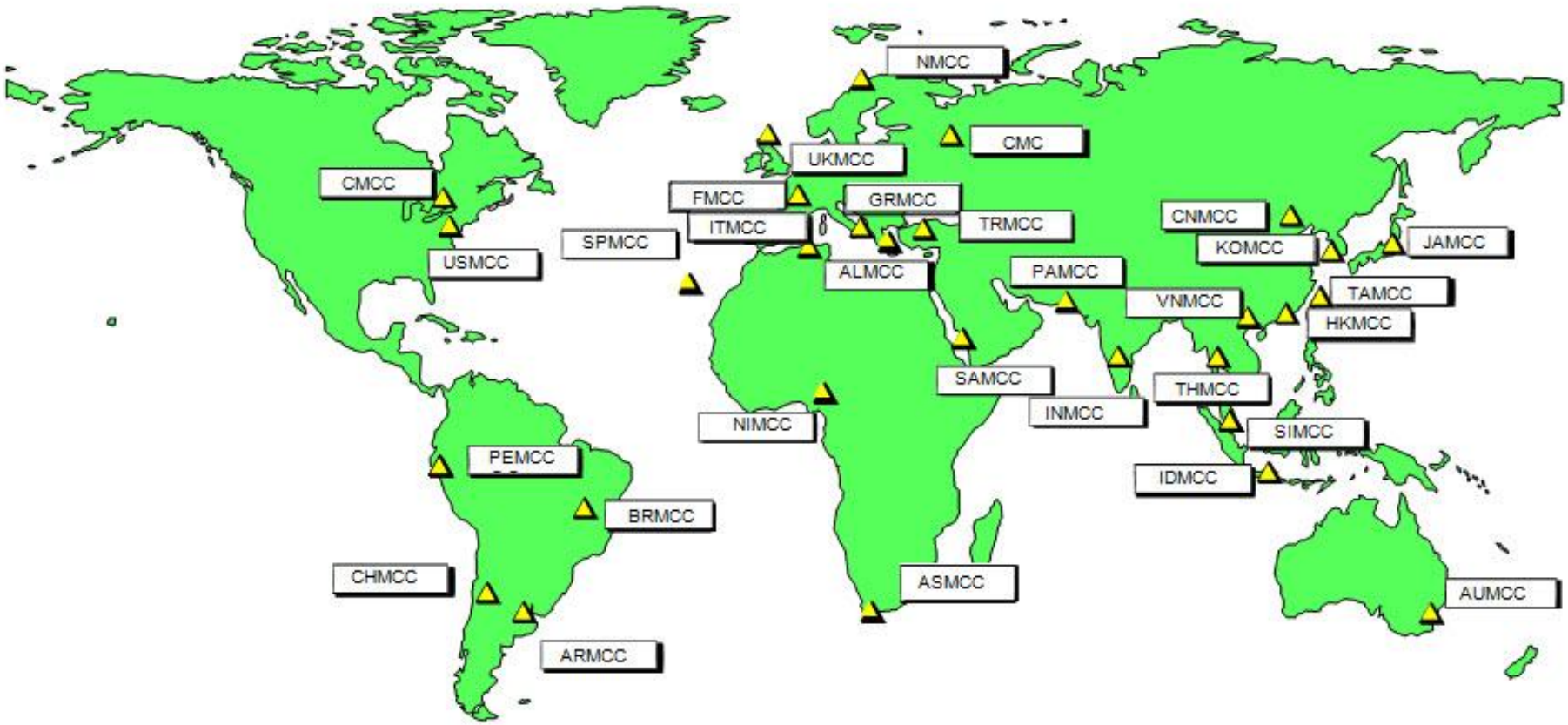
Ground Segment

Mission Control Centers (MCCs)

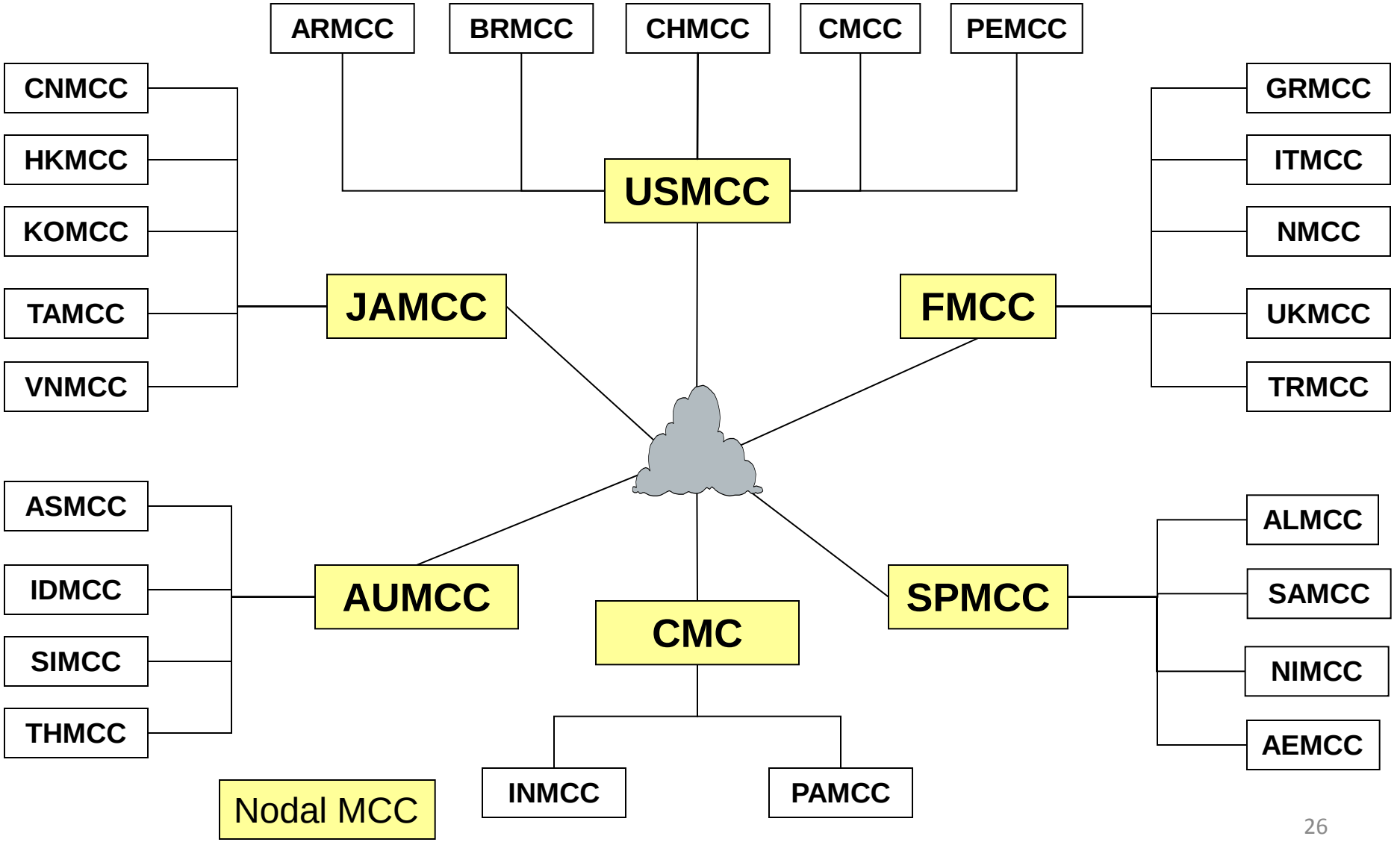
- Receive alerts from national LUTs and foreign MCCs
- Validate, match, and merge alerts to improve location accuracy and determine the correct destination
- Correlate with registration database and append info to alert
- Geographically sort and then transmit alerts to appropriate Rescue Coordination Centers (RCCs) and SAR Points of Contact (SPOC).
- Filter redundant data
- Perform System support and monitoring functions



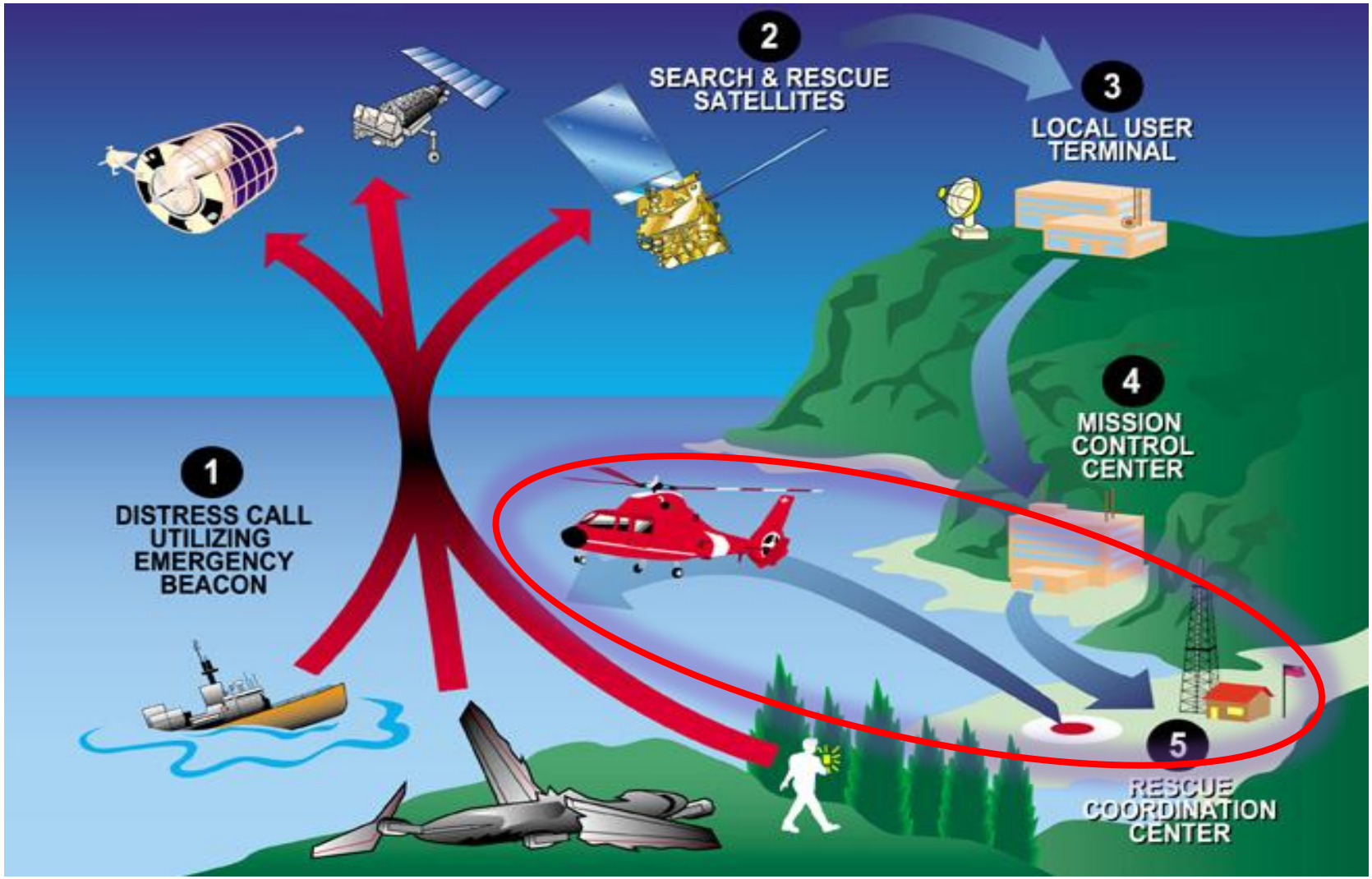
Cospas-Sarsat Mission Control Centers



MCC to MCC Data Distribution



Cospas-Sarsat System Overview
Search and Rescue Segment

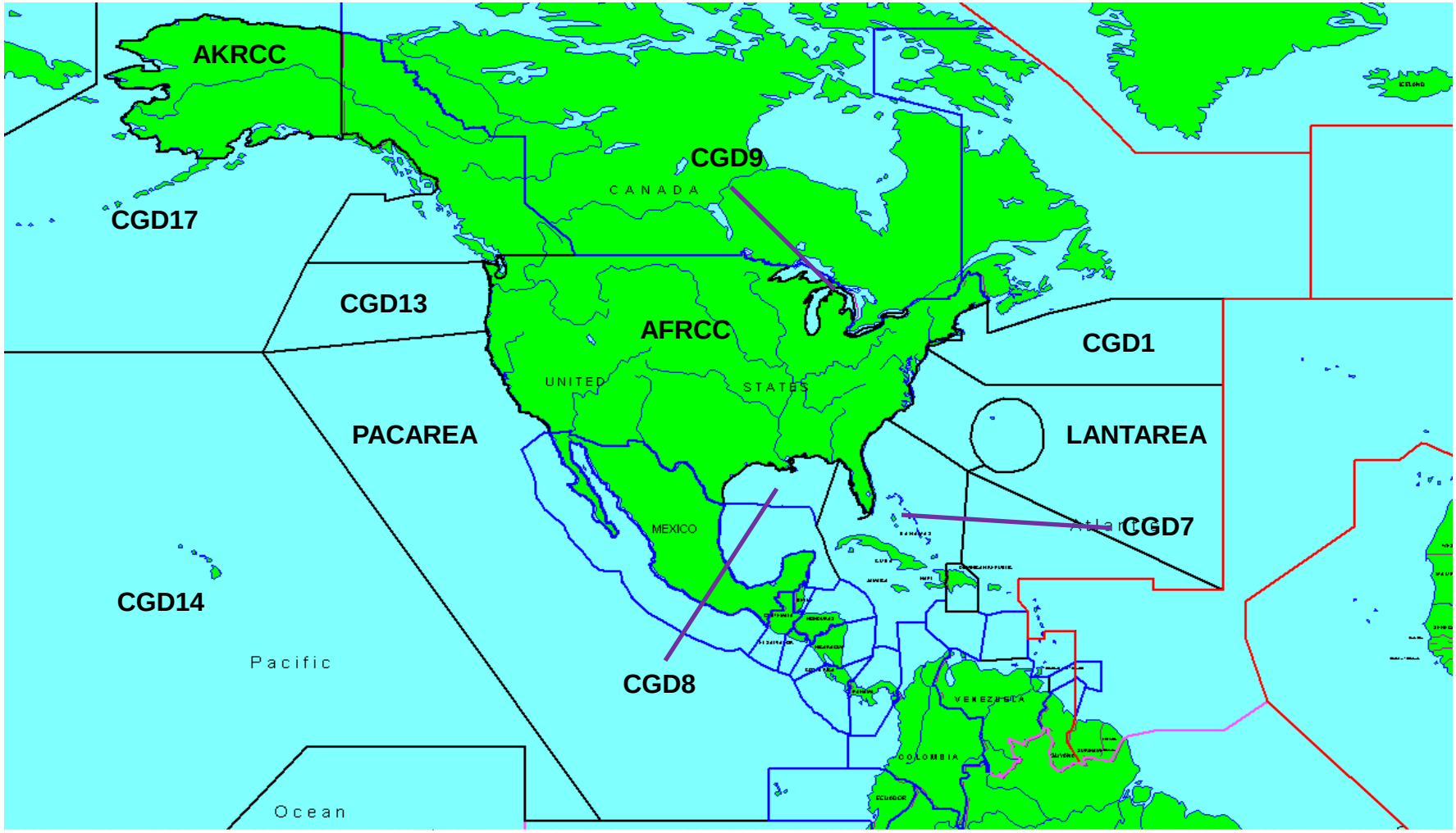


Rescue Coordination Centers

- Receive SARSAT Distress Alerts from MCCs
- Coordinate the Rescue Response

Rescue Coordination Centers

U.S. Rescue Coordination Center Coverage Areas



Cospas-Sarsat Results

Cospas-Sarsat Results

Number rescued world-wide since 1982: over *35,000*

Number rescued in United States since 1982: over *7,497*

U.S. SARSAT Rescues

CY 2014 – 240 Rescues in 110 Events

Rescues at sea:	**112** people rescued in **31** incidents
Aviation rescues:	**15** people rescued in **7** incidents
Terrestrial rescues:	**113** people rescued in **72** incidents

Questions?