



SARSAT System Overview (including Space Segment)

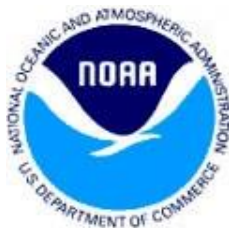
SAR Controllers Workshop 2020

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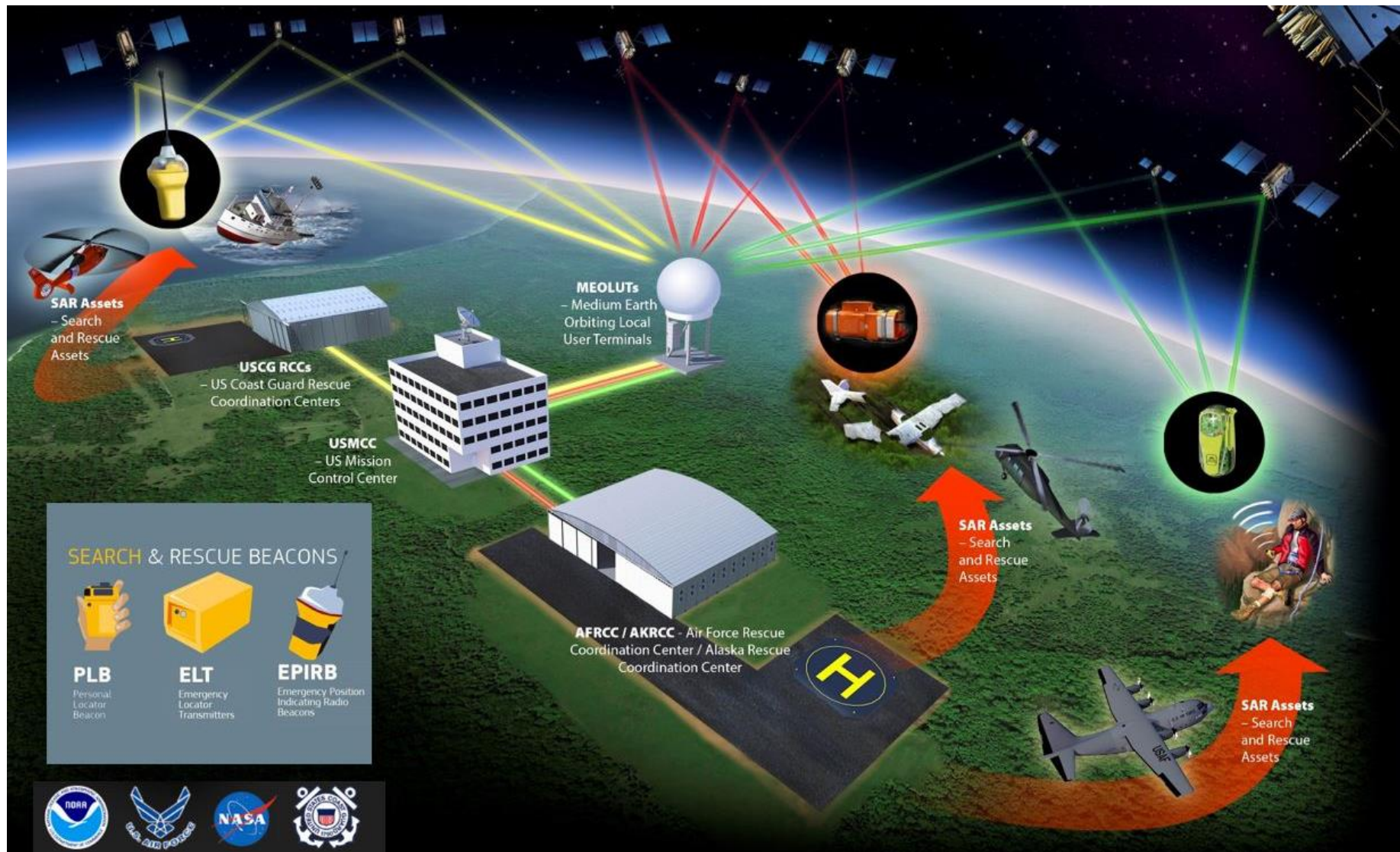
Introduction/Presentation Plan



- Provide an overview of the US operated Search and Rescue Satellite Aided Tracking (SARSAT) System
 - Space Segment description (US SARSAT controlled)
 - Ground Segment description (US SARSAT controlled)
 - Beacon Segment (User segment controlled, US SARSAT sets policy/type approval)



SARSAT System Overview



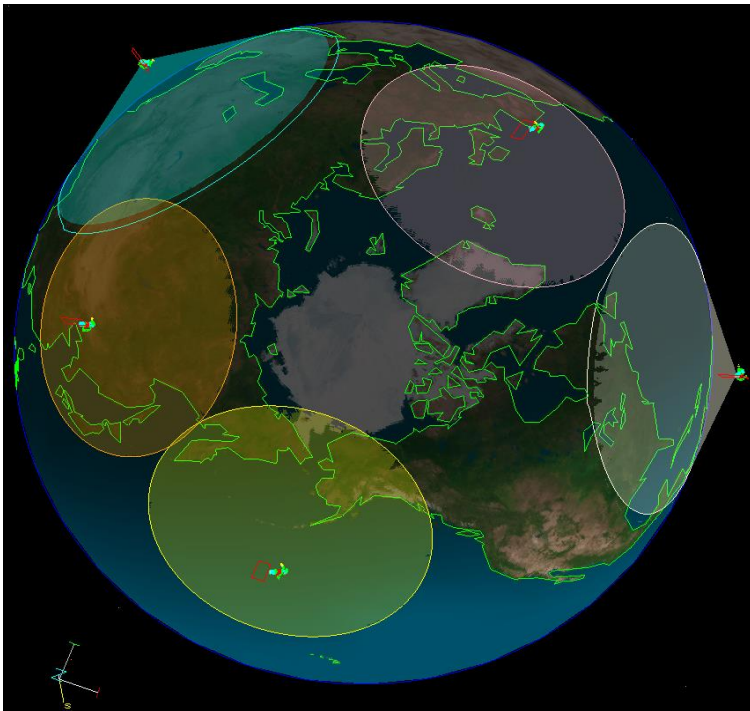


Satellite Types - LEO

There are 3 types of operational satellites with payloads used by SARSAT:

1. The US is currently operating 5 Low-Earth orbiting (LEO) satellites w SAR capabilities

Each satellite is orbiting at an altitude ~ 850 km has $\sim 6\%$ Instantaneous Field of View Coverage on the Earth & completes ~ 14 orbits/day, covering every location on the earth at least twice.





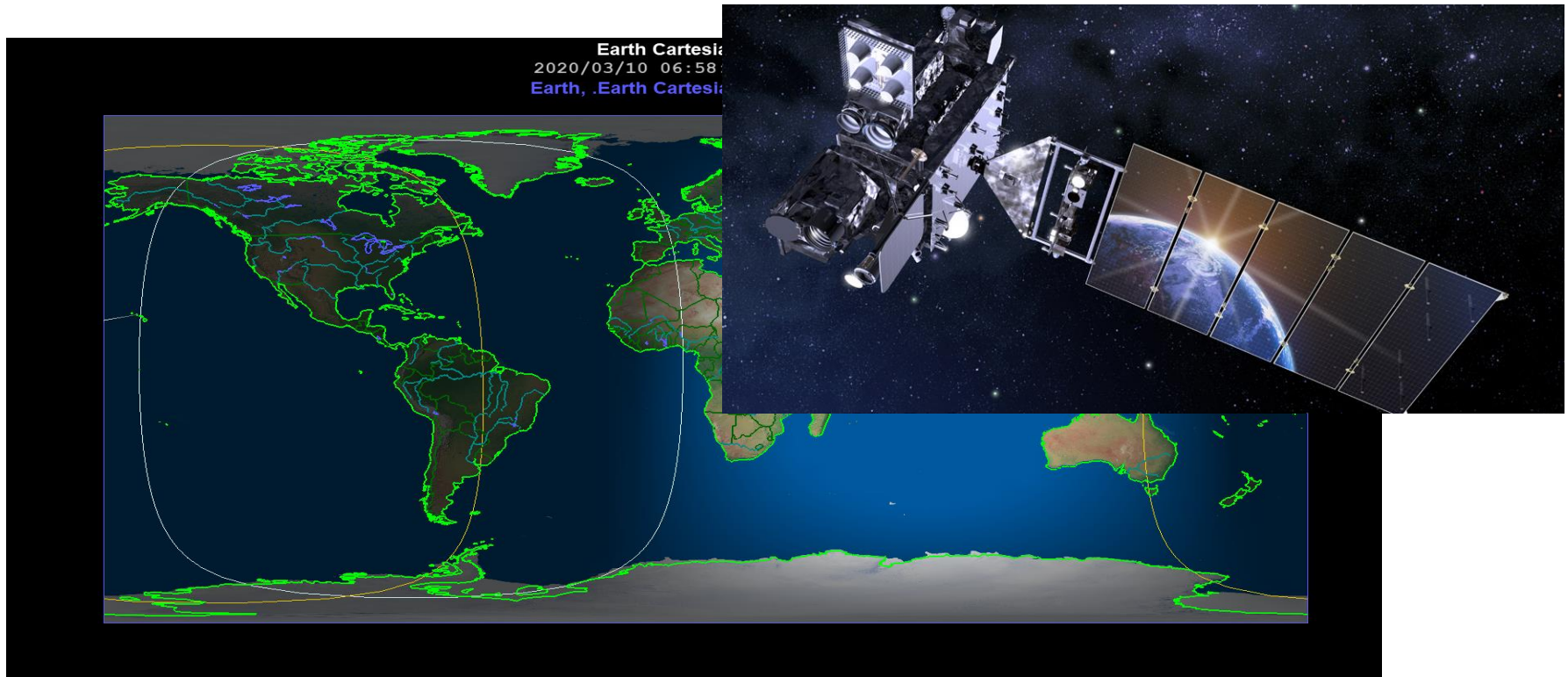
LEOSAR Space Segment Status

- LEOSAR Space Segment
 - SARSAT-13 aka Metop-B (launched SEP 12) 5 yr design, 3 years beyond its design life, and in a similar orbit plane to SARSAT-11. Has orbit adjust capability
 - SARSAT-7 aka NOAA-15 (launched in MAY 98) 2 yr design, 22 yrs on orbit, 20 yrs beyond its design life
 - SARSAT-10 aka NOAA-18 (launched MAY 05) 2 yr design, 15 yrs in orbit, 10 yrs beyond its design life, CURRENTLY not an operational asset as it interferes with
 - SARSAT-11 aka Metop-A (launched SEP 06) 5 yr design, 14 yrs in orbit, 9 yrs beyond its design life. Has orbit adjust capability
 - SARSAT-12 aka NOAA-19 (launched FEB 09) 2 yr design, 11 yrs in orbit, 9 yrs beyond its design life

Satellite Types - GEO

2. The US currently operates 2 Geosynchronous Earth orbiting (GEO) satellites which have a SAR capability

Each satellite is orbiting at an altitude ~ 36000 km & has $\sim 40\%$ Instantaneous Field of View Coverage on the Earth & completes ~ 1 orbits/day.





GEO Space Segment status

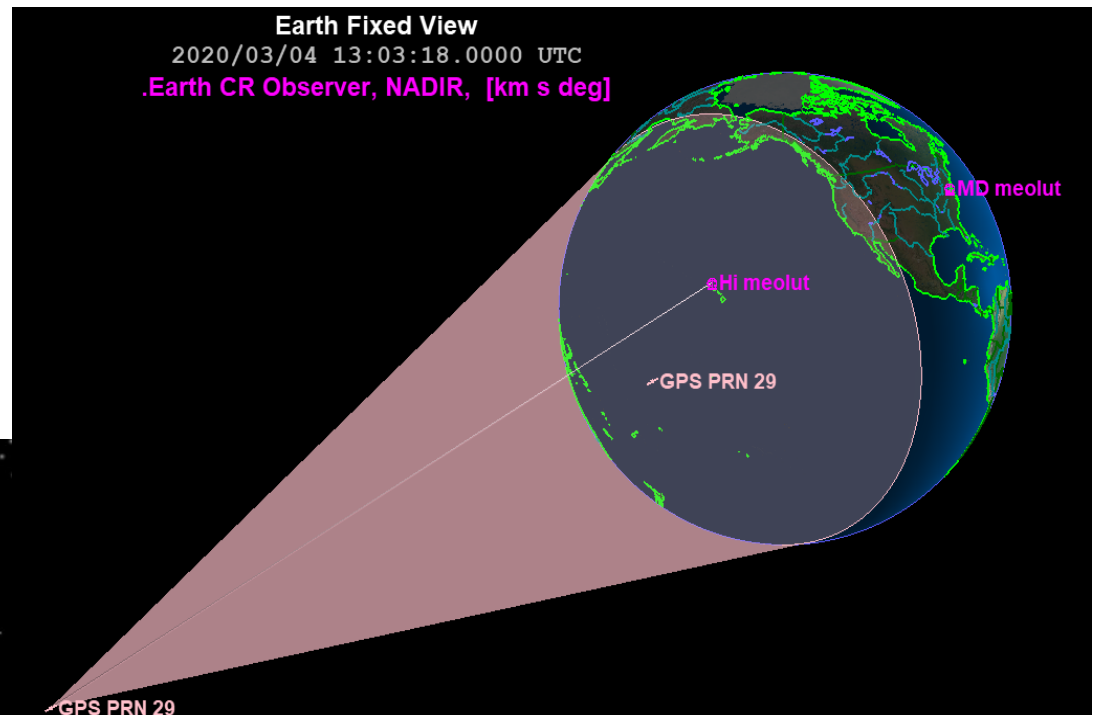
- GEOSAR Space Segment operated by the US
 - GOES-16, (launched NOV 16), 10 yrs design life, 4 yrs on orbit
 - GOES-17, (launched MAR 18), 10 yr design life. 2 years on orbit
 - GOES-15, (launched MAR 10), 10 yr design life, 10 yrs on orbit (decommissioned Jan 2020)
- Other GEOSAR assets (foreign partners)
 - Electro-1, (launched JAN 11), 10 yr design, 9 yrs on orbit
 - INSAT-3A, (launched APR 03), 12 yr design, 17 years on orbit, 5 yrs beyond design life
 - MSG 3, (launched JUL 12), 7 yr design, 8 yrs on orbit
 - Luch 5A, (launched DEC 11), 10 yr design, 9 yrs on orbit



Satellite Types - MEO

3. The US currently is operating 19 Medium Earth Orbiting (MEO) satellites (DASS)

Each satellite is orbiting at an altitude ~ 20000 km & has ~ 33% Instantaneous Field of View Coverage on the Earth & completes ~2 orbits/day. Constellation size ensures that ALL areas of the earth are covered in real-time!



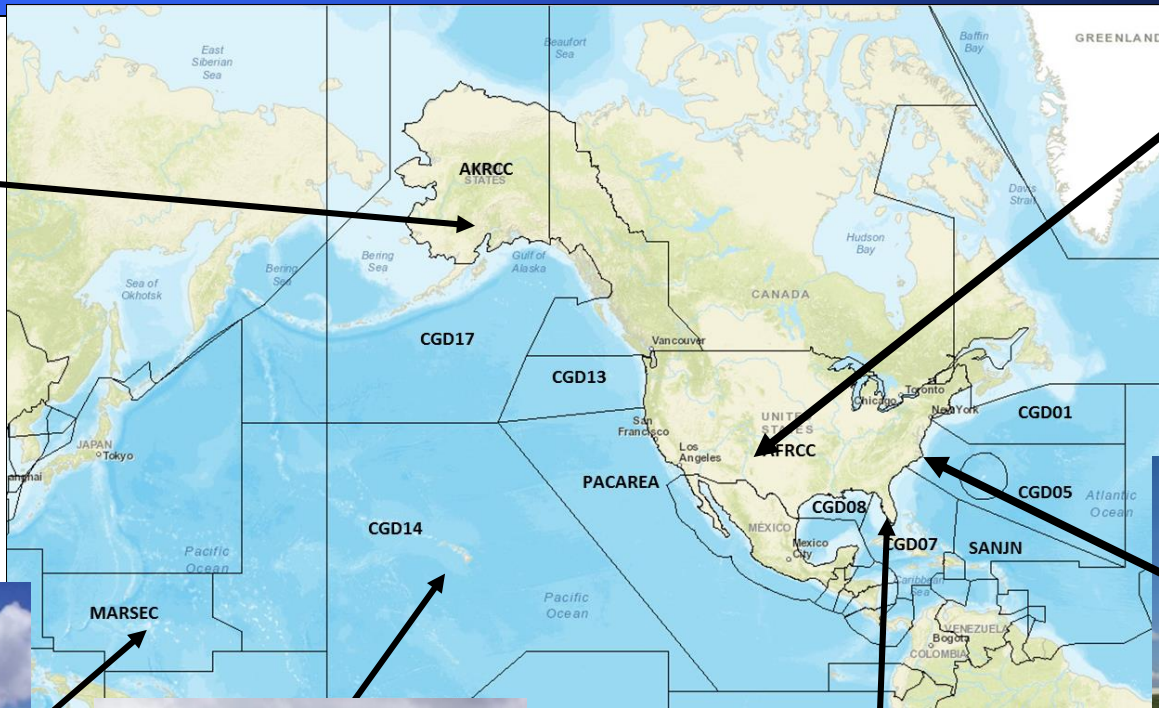
There are now 23 Galileo w an L-band SARR payload (all in use by US).
Between US and Galileo, 42 satellites! 8



US SARSAT Ground Segment



Alaska
NOAA Fairbanks, Alaska
Command and Data
Acquisition Station (FCDA)
2 LEOLUTs replaced by
2 LEO/MEOLUTs in 2019



New Mexico
SUSA MEOLUT
2 phased array's
under development



Guam
Andersen AFB
2 LEOLUTs replaced by
2 LEO/MEOLUTs in 2019



Hawaii
2 LEOLUTs replaced by
2 LEO/MEOLUTs in 2019
&
6 antenna MEOLUT



Miami
2 LEOLUTs replaced by
2 LEO/MEOLUTs in 2019
&
6 antenna MEOLUT



Maryland
US Mission Control Center
Maryland has 2 GEOLUTs & 1
test GEOLUT
&
1 Test LEOLUT
1 Test LEO/MEOLUT

Ground Segment

United States Mission Control Center (USMCC)

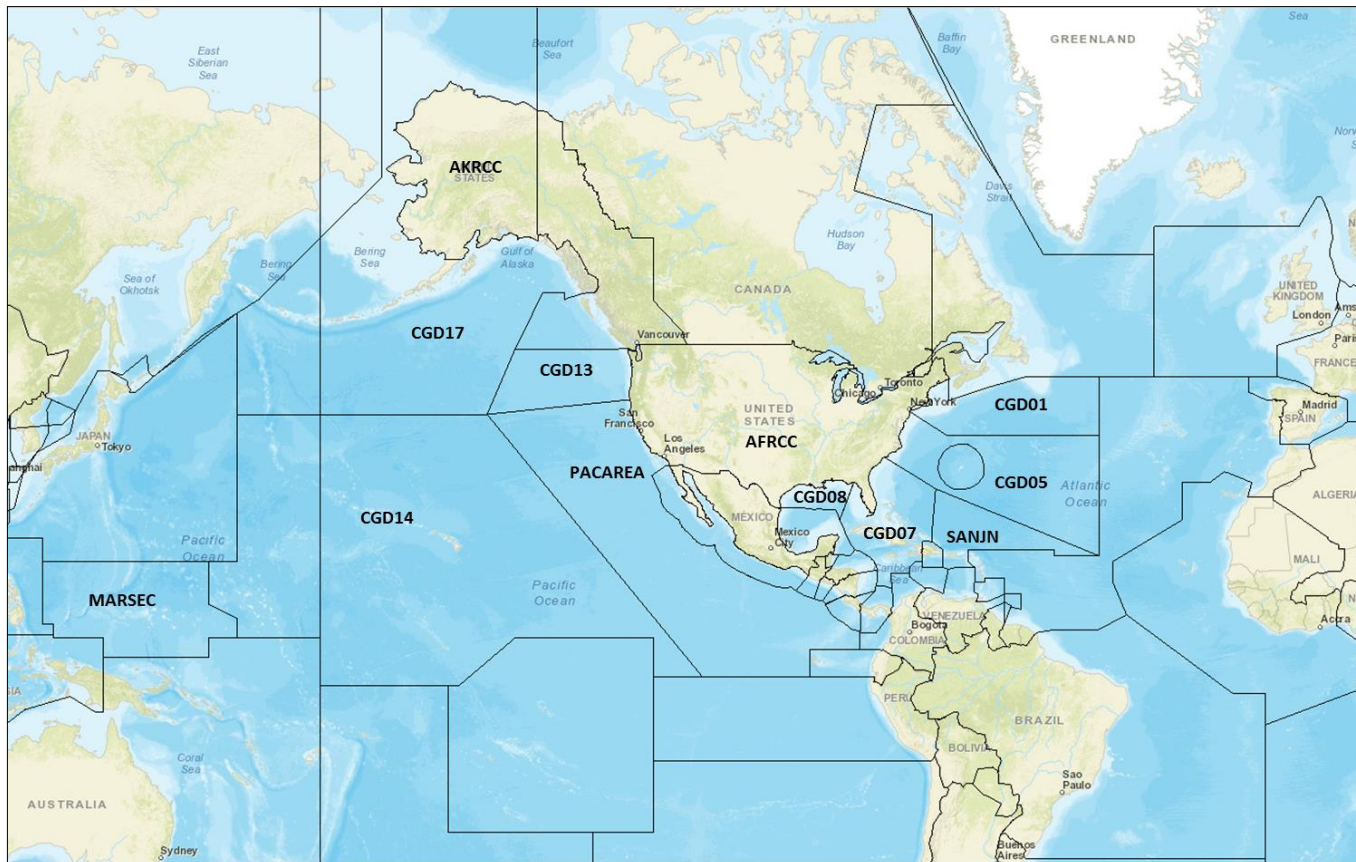
- Receives alerts from national LUTs and foreign MCCs
- Validates, matches, and merges alerts to improve location accuracy and determine the correct destination
- Correlates with NOAA registration database and append info to alert





Ground Segment

United States Mission Control Center (USMCC)
Geographically sort and then transmit alerts to appropriate
Rescue Coordination Centers (RCCs) and SAR Points of Contact (SPOC)





Ground Segment

United States Mission Control Center (USMCC)

- Filters redundant data
- Performs system support and monitoring functions
- Alert data received by the MCC is archived for access at a later time if required
- A record is created when sites close (beacon stops transmitting) in the Incident History Database (IHDB)
- The IHDB is populated by Search and Rescue Personnel and maintained by the USMCC to provide the history of why each SARSAT alert was received by USMCC
- The IHDB records tell the story of how each SARSAT alert case was handled, who handled it, and the accuracy of the information in the Registration Database



COSPAS-SARSAT Beacons

Activation:

- Manual
- Automatic (Hydrostatic/G-Switch)

Signal:

- 406 MHz (Digital)
- 121.5 MHz (Analog) Homing

Applications:

- Aviation - Emergency Locator Transmitter (ELT)*
- Maritime - Emergency Position-Indicating Radio Beacon (EPIRB)
- Personal/Land - Personal Locator Beacon (PLB)
- Security - Ship Security Alert System (SSAS)



***Most US general aviation ELTs are still 121.5 MHz, which are no longer monitored by Cospas-Sarsat**



SARSAT Beacon Totals

- More than 650,843 U.S. beacons in the NOAA Registration Database as of 21 Feb 20:
 - 119,911 ELTs
 - 259,684 EPIRBs
 - 270,984 PLBs
 - 264 SSAS
- 108,253 DoD devices registered in JSETS
- Estimated worldwide beacon population:
~1,916,512





SARSAT Rescues

As of Dec 31, 2019
340 Rescues in the United States during
Calendar Year 2019

Rescues at sea: 306 people rescued in 95 incidents
Aviation rescues: 38 people rescued in 20 incidents
Terrestrial rescues: 77 people rescued in 61 incidents



Number rescued world-wide since 1982: over 48,000

Number rescued in United States since 1982: 9,119



SARSAT Saves

Home Port - Kodiak, AK

On 12 May 2019 at 0331 UTC (2331 EDT) an Emergency Position Indicating Radio Beacon (EPIRB) was detected at 52 0.2N 174 47.7W, 79 NM east of Adak, AK. It was manually activated when the fishing vessel CLYDE, with 4 people on board, hit an uncharted rock and quickly began to take on water. Coast Guard District 17 received the alert and diverted Coast Guard Cutter (CGC) ALEX HALEY. It arrived on scene to find the CLYDE's crew in an inflatable life raft. A helicopter was launched from the ALEX HALEY to shore, where the CLYDE's crew beached their raft. All 4 crew members were transported by helicopter to Adak for medical evaluation.

- **Note1: distress was 2350 miles from HI MEOLUT and 5030 miles from FL MEOLUT**
- **Note2:Timeliness and location accuracy versus LEOSAR & GEOSAR
4 SARSAT RESCUES**

<http://fisherynation.com/coast-guard-rescues-four-who-abandoned-ship-south-of-atka-island-alaska>





Importance of Registration

- **Digital data transmitted by beacon provides nationality and type of beacon**
- **Emergency contact information and home port are listed in registration**
- **Tail number or other identifying information can be encoded into the beacon**
- **Registration Database provides additional information about the owner/operator, and can include specifics on aircraft or vessel**
- **In most cases, false alerts are resolved prior to launching SAR resources, saving taxpayer \$\$**

