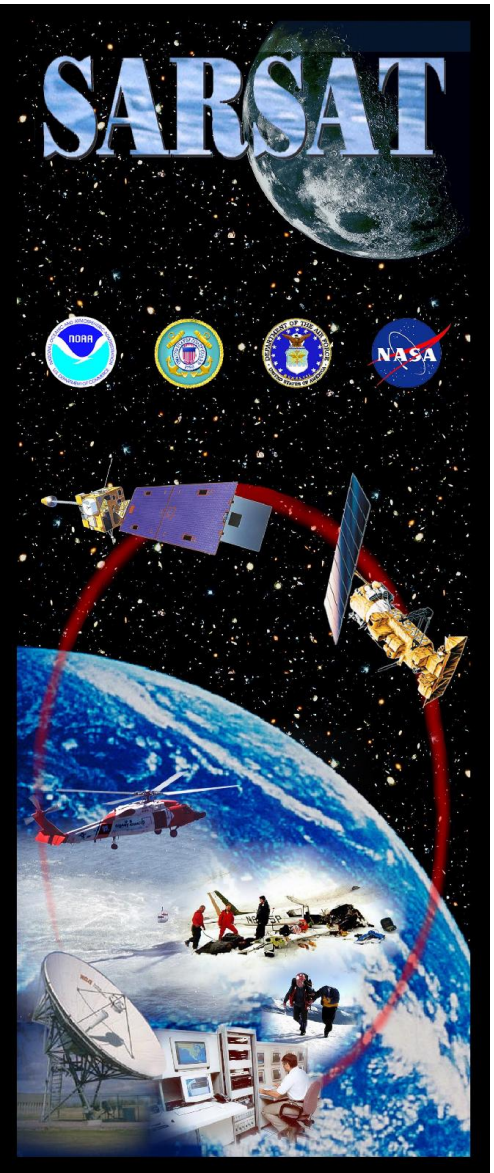


Search and Rescue Satellite-Aided Tracking (SARSAT)

Distress Alerting Satellite System (DASS)

Oct 2008

COSPAS-SARSAT

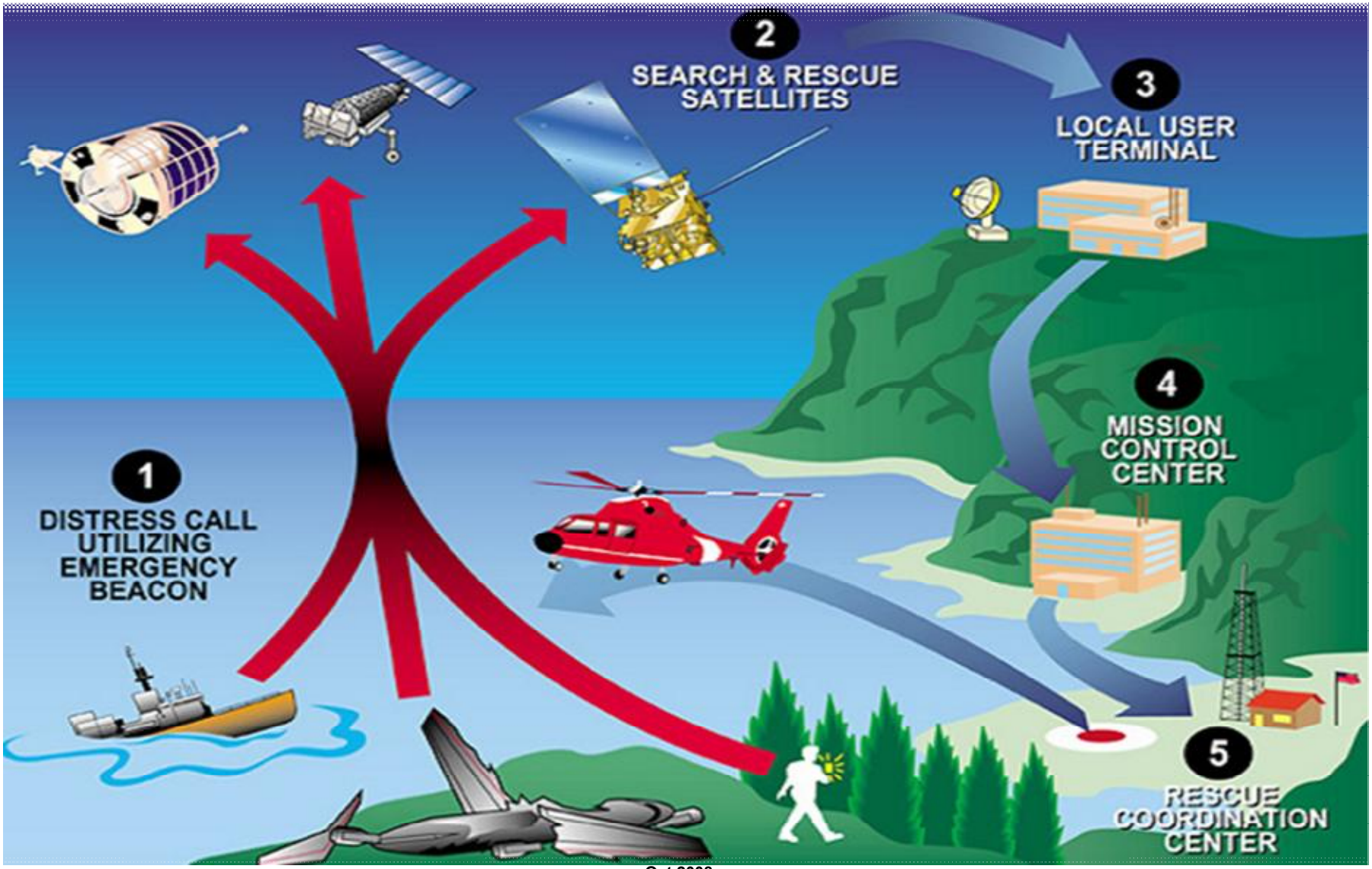
The Cospas-Sarsat Program protects life and property by providing accurate, timely, and reliable distress alert and location information to search and rescue authorities.

COSPAS = **Cosmicheskaya Systyema Poiska Aariynyich Sudov**

Which loosely translates into: "The Space System for the Search of Vessels in Distress"

SARSAT = **Search And Rescue Satellite Aided Tracking**

Cospas-Sarsat: Current System



Cospas-Sarsat Space Segment

2 Types of Satellites:

- ***Low Earth Orbiting Search And Rescue (LEOSAR)- 5 on Orbit***

  - Altitude: 500 miles in "Pole-Pole" orbit

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

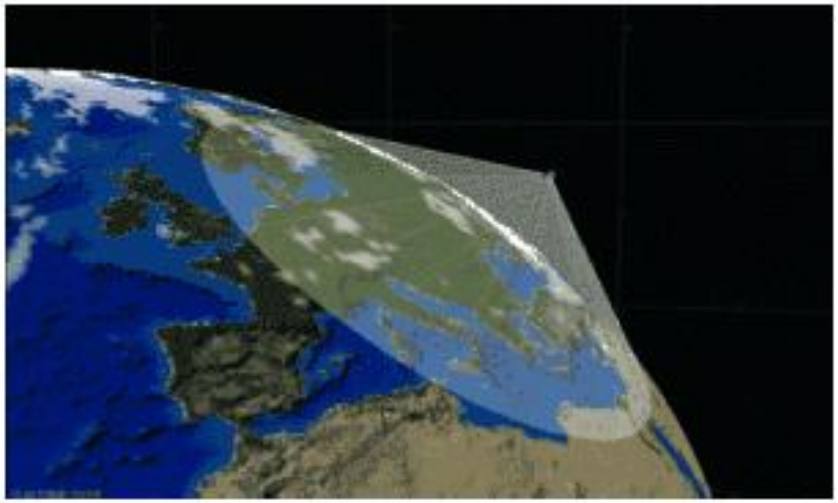
  - Stores & Forwards alerts continuously for 48 hours (provides worldwide coverage and total system redundancy)

- ***Geostationary Orbiting Search And Rescue (GEOSAR)- 4 on Orbit***

  - Altitude: 23,000 miles in fixed orbit

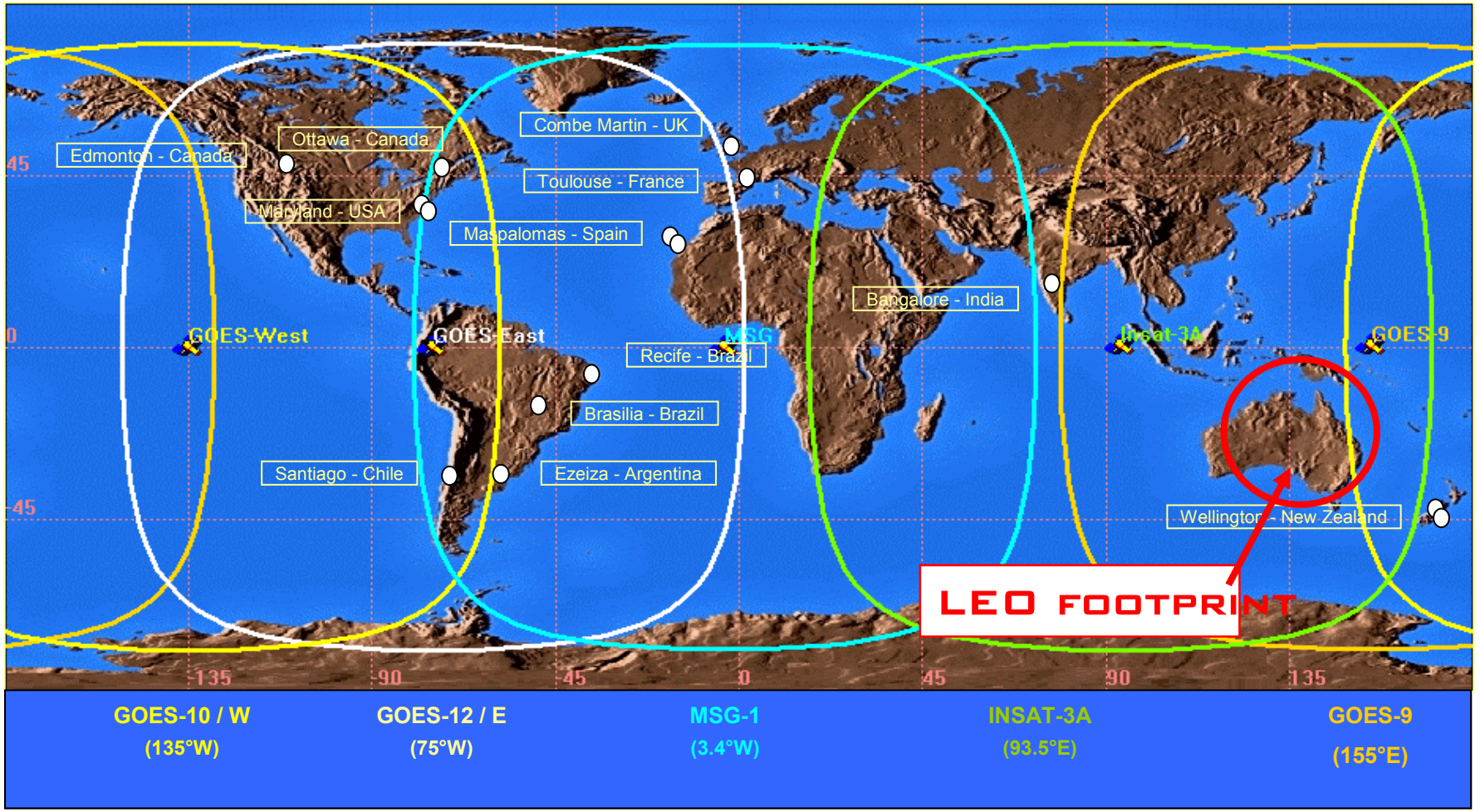
  - Performs instantaneous alerting function. No locating capability unless beacon is equipped with GPS.

  - Coverage from 70N – 70S



LEOSAR Instantaneous View of the Earth, a Circle of about 3000 km Radius

Typical Satellite Footprints



LEOLUTS and GEOLUTS

(Cospas-Sarsat Ground Stations)

LEOSAR Local User Terminals

(LEOLUT)

- Track COSPAS and SARSAT satellites (POES & METOP)
- Recover beacon signals
- Perform error checking
- Perform Doppler processing
- Send alert to Mission Control Center

GEOSAR Local User Terminals (GEOLUT)

- Track GOES, MSG, & INSAT satellites
- Recover beacon signals
- Perform error checking
- Send alert to Mission Control Center

Mission Control Centres (MCCs)

- **Receive alerts from national LUTs and foreign MCCs.**
- **Validate, match and merge alerts to improve location accuracy and determine the correct destination.**
- **Query 406 MHz Registration Database and transmit registration info with distress alert.**
- **Transmit alerts (SIT msgs) to Rescue Coordination Centers (RCCs) and SAR Points of Contact (SPOC) and filters redundant data.**
- **Most MCC functions are handled automatically…no manual intervention = efficiency!**

USMCC

Suitland, Maryland

Emergency Beacons

- **Two types: 121.5/243 MHz and 406 MHz**
- **Four applications:**
  - **Emergency Position Indication Radio Beacons (EPIRB)** ***for Maritime Uses***
  - **Emergency Locator Transmitters (ELT)** ***for Aviation Uses***
  - **Personal Locator Beacons (PLB)** ***for Remote Area Personal Use***
  - **Ship Security Alerting System (SSAS)** ***for Shipboard Terrorism/Piracy Alerting (covert)***

- **More than 50K current military users**
- **Government** users
  - **DEA, Secret Service, NASA, DOE, DOD, etc.**
- **Most General Aviation (GA) aircraft require ELTs**
  - **More than 200,000 GA aircraft**
  - **600,000 pilots, 6-8 million passengers [annual]**
  - **31 million hours flown [annual]**
- **Most commercial fishing vessels carry EPIRBs**
  - **Ranked one of the most hazardous occupations in U.S.; 150 deaths per 100,000 workers [annual]**
- **12 million potential recreational users in the US**
  - **PLBs became commercially available 1 July 2003**

- SARSAT on average, contributes to the rescue of 300 persons in the U.S. and 1,300 persons internationally
  - *CY 2007: 353 rescues*
  - *FY 2008: 308 rescues in the U.S. with SARSAT*
- Over 22,000 lives saved worldwide since 1982
- Anticipate more than 1 million distress beacons operational by 2010

Termination of 121.5/243 MHz Satellite Alerting

- International Termination of 121.5/243 MHz Satellite Alerting Occurs On:

  February 1, 2009

- U.S. Termination of 121.5 MHz EPIRBs - 3 Phases
  - Certification of new 121.5 EPIRBs ceased in 1999
  - Sales and manufacture of 121.5 MHz EPIRBs ceased on February 1, 2003
  - Operation/Use of 121.5 MHz EPIRBs became *prohibited* on January 1, 2007

- 121.5 MHz ELTs will still be in use on general aviation aircraft after 2009…Challenge, voluntary transition by pilots ASAP!

Cospas-Sarsat Limitations

LEO satellite constellation: <u>systemic limitations</u>:

- Limited number of satellites.
  A single failure can cause an unacceptable gap in coverage
- Delays in confirmation of location.
  LEOs require at least 2 satellite passes to resolve ambiguity in Doppler location
- Long time interval between satellite passes.
  Delays calculation of distress beacon position and SAR service's response to the distress

Cospas-Sarsat Limitations

GEO satellite constellation: systemic limitations:

- Unable to provide independent location information.
- A limited number of GEOs, if one satellite fails, SARSAT would be unable to provide real time coverage to a significant portion of the world.
- GEOs are in synchronized orbit; subject to terrain masking by terrestrial features that can prevent distress beacon visibility.

Cospas-Sarsat Limitations

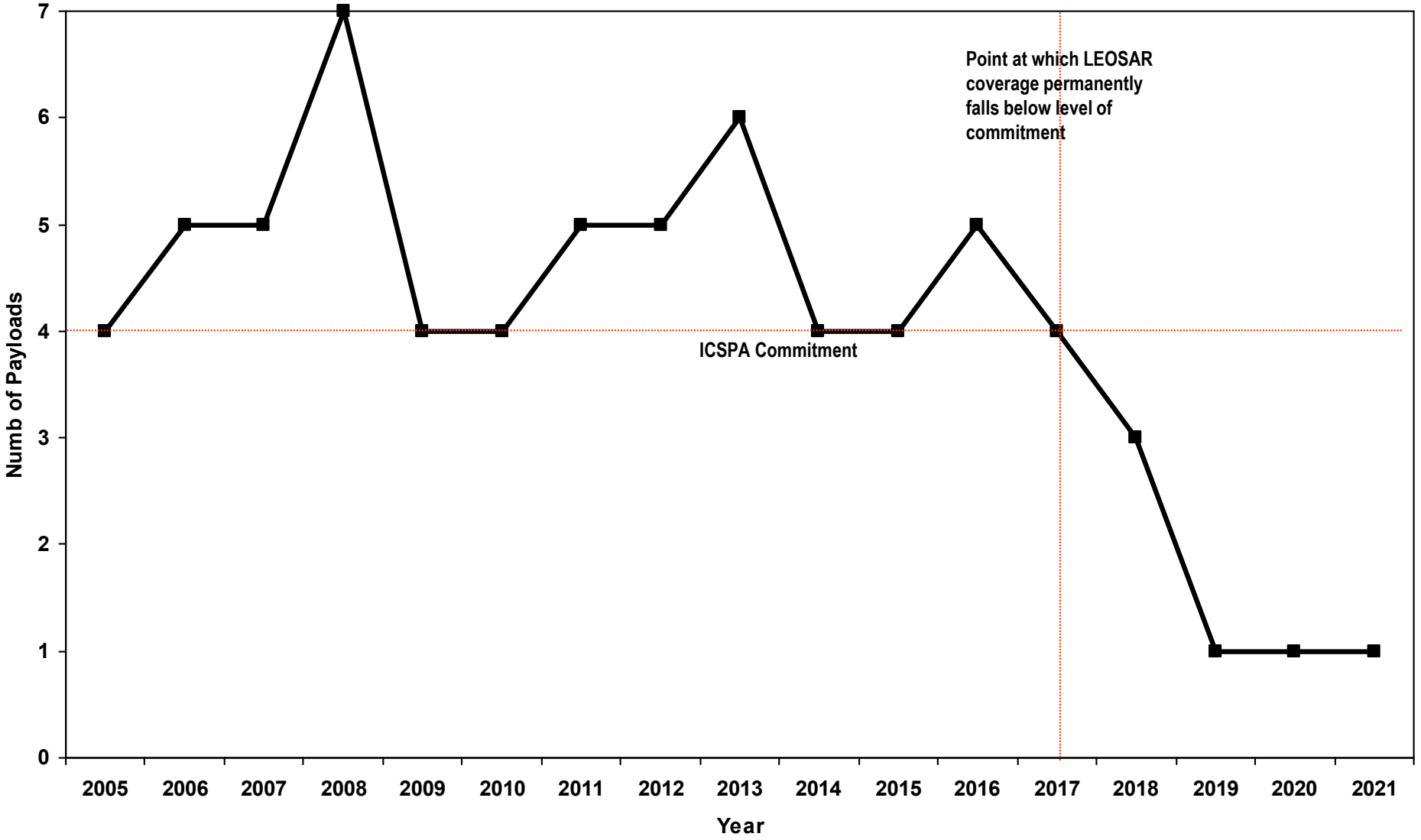
- In addition to these limitations:

  French Govt has decided to provide only a limited number of SAR instruments in the future. Through NPOESS C2.

  The result will be a degradation of the current SARSAT service beginning in 2017 and complete failure by 2020.

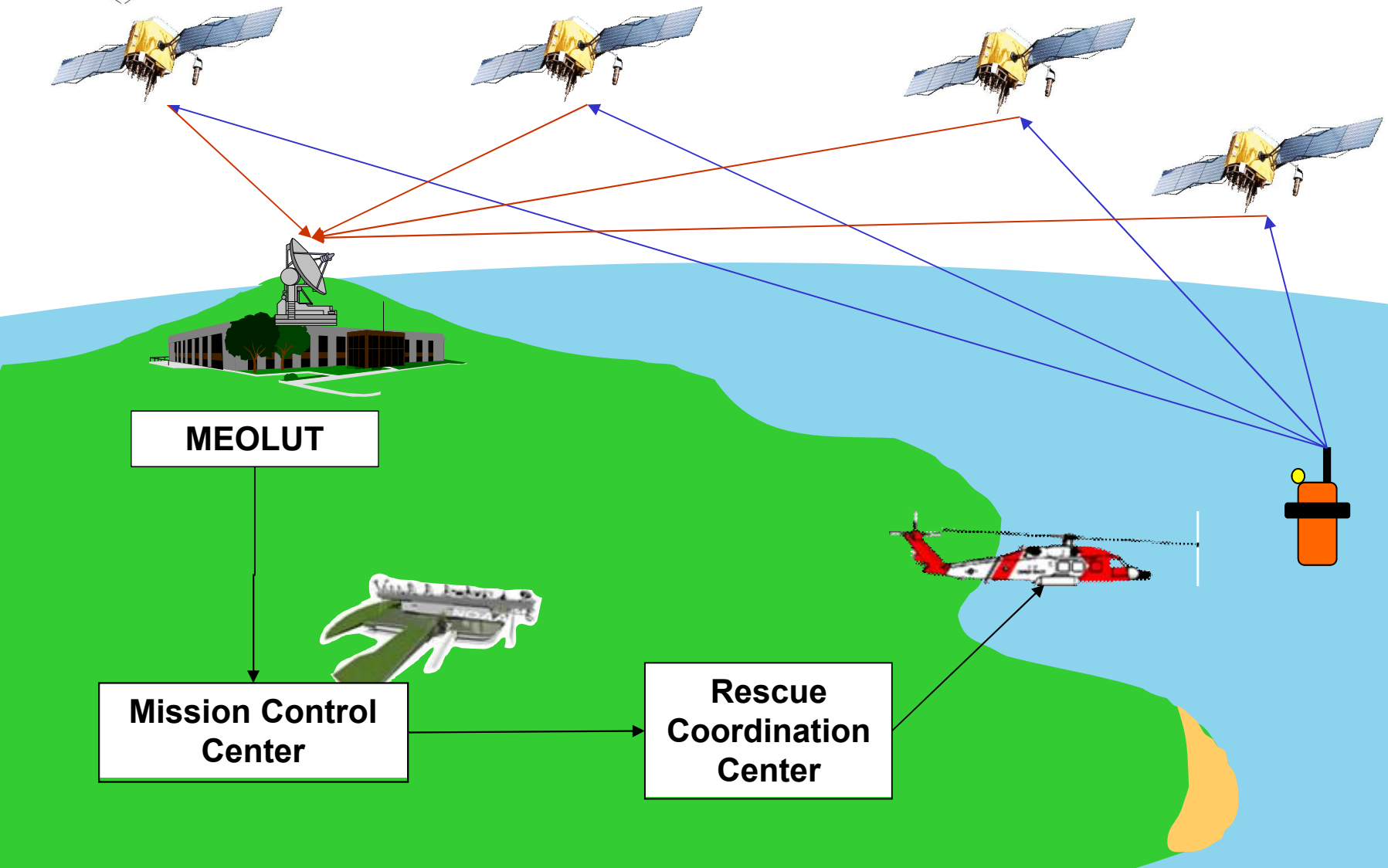
  This will leave millions of beacon users without a means to signal a distress.

Maximum Number of 406 MHz LEOSAR Payloads



CSC-41

Cospas-Sarsat of Tomorrow: Distress Alerting Satellite System (DASS)



Expected Benefits from DASS

- ## Quicker Alerting

  Time required to produce a distress beacon location will be significantly reduced from approx 47 minutes to 12 minutes allowing SAR responders to rescue survivors quicker – resulting in more lives saved.

- ## More accurate positions

  Error in locating a distress beacon will be reduced fm an average of 3.1km to 1.7km, resulting in reduced search times, quicker rescue, fewer resources wasted.

- ## Less costly

  By operating just one satellite constellation, life-cycle costs to build/operate the system are expected to be more than $2.5M less than the current system.

Expected Benefits from DASS

- Free from terrain masking
  GPS satellites will be in non-synchronous orbit in relation to the Earth; satellite beacon detection will occur fm continually changes angles. As a result, terrain masking will be eliminated.
- High levels of space and ground segment redundancy and availability

DASS

- GPS Block III satellites to host DASS payloads
  - Canada offered to build 406 repeater for DASS payloads ($70M-$90M)
- 24-satellite GPS constellation will provide at least 4 DASS repeaters continuously in view worldwide
- Full compatibility with all existing and future Cospas-Sarsat beacons
- DASS will be fully interoperable with EU and Russian proposed MEO satellites/ground stations