MEOSAR

MEDIUM EARTH ORBITING SEARCH & RESCUE

SARSAT (Search and Rescue Satellite Aided Tracking) has helped save over 39,000 + people in distress in the United States and around the world for over 34 years. Whether that distress is a sinking ship, a downed aircraft or an injured mountain climber - if they carry and activate their COSPAS-SARSAT distress beacon - we can determine their location. The newest satellite constellations to provide this life-saving service are called MEOSAR (Medium Earth Orbiting Search and Rescue). Every second counts in a rescue situation. These next generation satellite systems bring faster and vastly improved satellite detection and location coverage to ships, aircraft and outdoor enthusiasts around the globe, who need to be rescued, resulting in more lives saved. The United States contribution to the international COSPAS-SARSAT program is managed by NOAA in cooperation with the US Air Force, the US Coast Guard and NASA.

SAR Assets – Search and Rescue Assets

USCG RCCs – US Coast Guard Rescue Coordination Centers

MEOLUTs – Medium Earth Orbiting Local User Terminals

USMCC – US Mission Control Center

AFRCC / AKRCC - Air Force Rescue Coordination Center / Alaska Rescue Coordination Center

SAR Assets – Search and Rescue Assets

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How MEOSAR Hears Your Call For Help

Activating a distress beacon alerts authorities that you are in distress and tells them where you are. The beacon signal is picked up by three or more different MEOSAR satellites within 50 seconds of activation. Through Trilateration, a process of determining an unknown location using ranges from other known locations (or satellites), your location is calculated. With MEOSAR, distances are determined by measuring the TDOA (Time Difference of Arrival) and the FDOA (Frequency Difference of Arrival) between the beacon transmission and each satellite. Within a few minutes, the closest Rescue Coordination Center is alerted that a distress has been detected in their Area of Responsibility. They are given the coordinates of the activated beacon as well as any other registration information associated with the beacon ID. This information is passed on to local SAR (search and rescue) authorities who are tasked to come to your assistance.

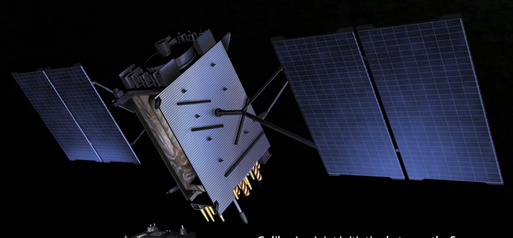
MEOSAR Satellite Constellations

Satellite Search and Rescue standards are set and overseen by COSPAS-SARSAT of which the United States is a major contributor. SAR instruments are currently flying on board MEO satellites in the constellations below, and many more satellites are planned for the near future to improve world-wide service.

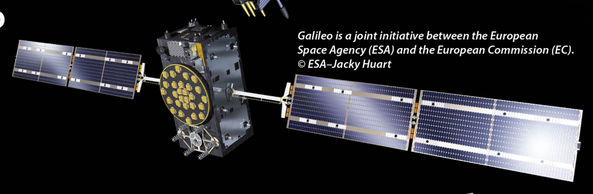
Initially they will compliment the existing LEOSAR (Low Earth Orbiting) and GEOSAR (Geostationary) satellites. Once fully operational, the MEOSAR system will exceed the individual advantages of each of the other satellite systems, with near instantaneous detection and accurate beacon location.

The United States, Europe and the Russian Federation all plan to include SAR payloads on their GNSS (Global Navigation Satellite Systems) constellations moving forward. GNSS is the term used to define the main function of MEO satellites, which is navigation.

GPS III



Galileo



Galileo is a joint initiative between the European Space Agency (ESA) and the European Commission (EC). © ESA–Jacky Huart

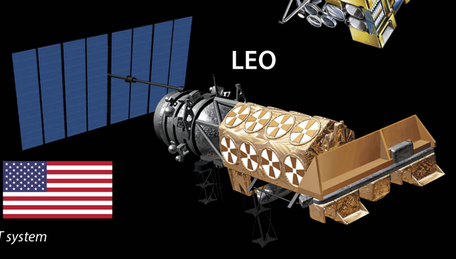
GLONASS K2

MEOSAR SATELLITE SYSTEM BENEFITS:

- Near instantaneous detection & location
- Global coverage
- System is automated
- 24 / 7 system availability
- Mitigates terrain masking in GOES
- Reduces rescue response time
- Robust space segment / highly redundant
- Satellite repeater intentionally simple to allow for future beacon innovation

GOES*

LEO



Other COSPAS-SARSAT Satellites

All satellites that carry SAR payloads can receive and transmit the signal from a COSPAS-SARSAT 406 MHz distress beacon. It does not matter where in the world the beacon was purchased. GEOSAR and LEOSAR satellites reliably relay valuable information regarding distress beacons, but are not as fast as the more advanced MEOSAR satellites.

** not shown – Electro, INSAT, Louch and MSG geostationary-type satellites which are also part of the COSPAS-SARSAT system*

COSPAS-SARSAT Distress Beacons

Distress Beacons are powerful radio transmitters that broadcast an electronic SOS into space. There are three types of distress beacons… EPIRBs (Emergency Position Indicating Radio Beacons) for marine applications; ELTs (Emergency Locator Transmitters) for aviation applications; and PLBs (Personal Locator Beacons) for terrestrial applications. Each type of beacon has unique activation features, depending on their application, but all send the same 406 MHz signal. There are over 1.6 million registered beacons world-wide including 489,000 + beacons currently in the US alone.

A further benefit… If that beacon's ID is registered (which is required by FCC regulations and is the responsibility of the purchaser), SAR authorities will know who is in trouble and what type of environment they are operating in. This can make the rescue even faster, easier and safer.

Look for future technical improvements and capabilities to beacons as the MEOSAR system becomes fully operational.

For More Information on SARSAT:

Experimental MEOSAR Versus LEO/GEOSAR Performance Comparison

On 4 May 2016 at 21:26 UTC (Coordinated Universal Time) a 406 MHz COSPAS-SARSAT EPIRB (Emergency Position-Indicating Radio Beacon) was activated at sea approximately 700 NM (805 miles) west of the Galapagos Islands. Besides saving lives, this distress situation provided real-world beacon signal reception for analysis of the experimental MEOSAR System. That data illustrates clear and distinct differences in the detection and locating capabilities of each type of satellite. The two columns below compare and contrast each satellite constellation's performance.

MEOSAR

- **21:26 UTC** - EPIRB was activated.
- **21:26 UTC** - MEOSAR satellites detect activated beacon with a Time Difference of Arrival (TDOA) position.
- **21:26 UTC** - Beacon signal data downloaded to USMCC (Mission Control Center) at Suitland Maryland.
- **21:26 UTC** - Coast Guard District 11 (PACREA, Alameda, California) notified
- **21:32 UTC** - An updated TDOA position was received and provided even more precise location information (diminishing the Expected Error factor by over 50%) which narrowed the search area significantly.
- **21:46 UTC** - 20 minutes after the initial beacon activation, MEOSAR satellites confirm the location of the activated beacon.

LEO/GEOSAR

- **21:26 UTC** - EPIRB was activated.
- **21:26 UTC** - GEOSAR satellite detects activated beacon. No location is given.
- **22:25 UTC** - LEOSAR detects activated beacon.
- **22:25 UTC** – Coast Guard District 11 (PACREA, Alameda, California) notified.
- **23:43 UTC** – 2 hrs. 17 minutes after the initial beacon activation, a second LEOSAR satellite confirms location of activated beacon.

As a result of distress signal reception, Coast Guard District 11 (PACAREA) diverted the AMVER Vessel Sea Lynx to the SARSAT coordinates and located the fishing vessel Ciudad de Portoviejo. The vessel had sustained an engine room fire which consumed the ship right up to the waterline. All 21 crewmembers successfully abandoned the vessel. They were taken on board the Sea Lynx and transported to the Galapagos Islands.