LEOSAR GEOSAR and the new MEOSAR

COSPAS-SARSAT brief overview and history

The early SAR history started in the 1960s when light aircraft and some marine vessels started carrying small, battery-operated radio transmitters, operating at the international distress frequency of 121.5 MHz already used by commercial aviation and 243 MHz ,already used by used by Military (both being analog systems)and where prepared for digital 406 MHz, that could be activated in an emergency distress situation. Such transmitters, called Emergency Locator Transmitters (ELTs) on aircraft, and Emergency Position Indicating Radio Beacons (EPIRBs) on ships, emitted a low-power signal that could be picked up by a receiver in a nearby air traffic control tower or by an aircraft in the vicinity, thus providing only line-of-sight coverage if one was searching in that location. - By the mid-1970s, more than 250,000 distress beacons were in service in Canada, Europe and the USA. Lives of aviators and mariners were being saved thanks to these transmitters, but there was still room for improvement, particularly as it was now the `space age'.

On February 1, 2009 an era of emergency beacon support ended: the 121.5 and 243 MHz emergency beacons were phased out for satellite distress alerting, (the 121,5 MHz is still in use for homing) and where only supporting 406.025 MHz for alerting purposes. The decision to stop satellite processing of 121.5 / 243 MHz signals is due to problems in this frequency band which inundate search and rescue authorities with poor accuracy and numerous false alerts, adversely impacting the effectiveness of lifesaving services.

LEOSAR satellites

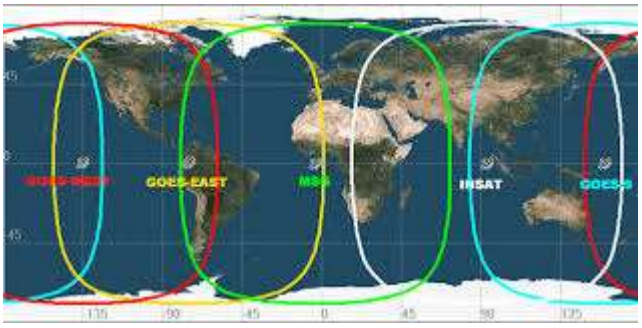
These original 4 satellites (2xCOSPAS and 2xSARSAT) where launched in a period starting from 1982, in 1985 the COSPAS-SARSAT system was officially in operation. Currently there are 5 operational LEOSAR satellites active. Whereas one (Cospas-14) is only is available for LUTs with adjusted parameters.

This system is nearly bullet proof, and is still in use today. However, the LEOSAR configuration has inherent time delays, ranging from minutes to hours, in detecting and relaying distress signals because the low altitude satellites (< 1000 km) view only a small portion of the Earth at any instant as they circle the globe. The LEO system could not be made much better for 121.5 MHz beacons, due to technical limitations of the beacons and the radio channel.

The original LEO system also carried payloads that allowed for the implementation of new digital distress beacons operating at 406 MHz, far superior to the original analog 121.5 MHz beacons. Beacons with the 406.025 MHz signal transmit digitally encoded information which may include beacon identification (which allow COSPAS-SARSAT services to access registration data bases providing additional information on the unit in distress), The new beacons at 406.025 MHz permit the distress location to be automatically computed (doppler shift) by the satellite system ten times more accurately (to within 2 km) and the beacon user to be identified, whereas the old 1960s technology

beacons at 121.5 MHz gave only an approximate location (to within 20 km) and no user identification, since the 'wow, wow, wow' sound of the signal was similar for all these beacons.

GEOSAR Satellites



Because their geostationary orbit does not provide a relative motion between a distress beacon and a GEOSAR satellite, there is no opportunity to use the doppler effect to calculate the location of a beacon. Therefore, the GEOSAR satellites only can relay a beacon's distress message. If the beacon is a model with a feature to report its location (e.g., from an on-board GPS receiver) then that location is relayed to SAR authorities. While the inability to independently locate a beacon is a drawback of GEOSAR satellites, those satellites have an advantage in that the present constellation well covers the entire Earth in real time, except for the polar regions with near instantaneous detection of a beacon.

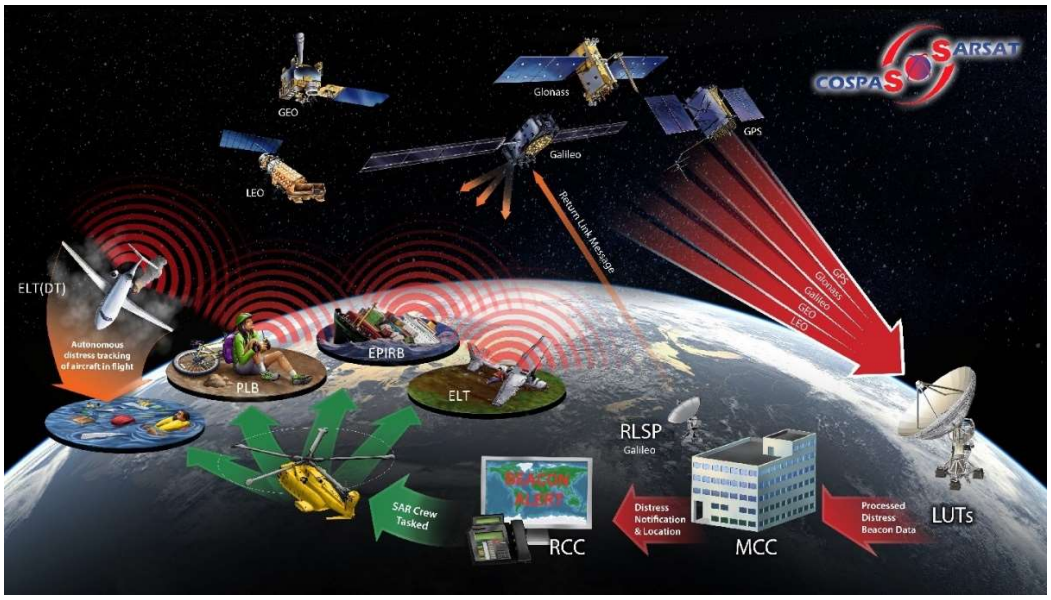
Currently there are 9 geostationary satellites deployed and active for SAR purposes. The SAR payloads are mounted on the GOES (environmental satellite from the USA), MSG (Meteo satellites by the EU), ELECTRO (Meteo satellites by Russia), LUCH (Voice and data relay satellite by Russia) and INSAT (Multifunctional satellite by India)

MEOSAR Satellites

The most recent space segment augmentation for Cospas-Sarsat is MEOSAR MEOSAR blends the advantages of the LEOSAR and GEOSAR systems, while avoiding the drawbacks. Over time there will be more than 70 MEOSAR satellites, and the MEOSAR system will become the dominant space-segment capability of Cospas-Sarsat. In addition to the large number of satellites, the MEOSAR system benefits from relatively large satellite footprints and sufficient satellite motion relative to a point on the ground to allow the use of Doppler measurements as part of the method of calculating a distress beacon's location. MEOSAR consists of SARR transponders (payloads) aboard the following navigation-satellite constellations: the EU's Galileo, Russia's Glonass, and the US' Global Positioning System (GPS). The GPS SAR system is known as the Distress Alerting Satellite System (DASS) by NASA. The system has been developed with backward compatibility in mind.

Additionally, the Galileo component of the MEOSAR system will be able to download information back to the distress radio-beacon by encoding "Return Link Service" messages into the Galileo navigation data stream. Currently it is planned that this capability will be used to activate a means of indication on the beacon to confirm receipt of the distress message. In time I will make a separate item on RLS functionality.

Overview of entire system



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Abbreviations:

COSPAS: Cosmicheskaya Sistema Poiska Avariynyh Sudov

SARSAT: Search And Rescue Satellite-Aided Tracking

LEOSAR: Low Earth Orbiting Search And Rescue

MEOSAR: Medium Earth Orbiting Search and Rescue

GEOSAR: Geostationary Search And Rescue

SARR: Search And Rescue Repeater (immediate relay, no storage for later transmission when in view of LUT)

SARP: Search and Rescue Processor (capable of storing information)

RLS: Return Link Service

LUT: Local User Terminals

MCC: Mission Control Centre

RCC: Rescue Coordination Centre

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