In the next few years the world of search and rescue will be revolutionised with MEOSAR, offering near instantaneous signal detection with greater coverage, reliability and location accuracy ultimately saving even more lives.

**Cospas-Sarsat**

The International Cospas-Sarsat Programme is a satellite-based search and rescue distress alert detection and information distribution system, best known for detecting and locating emergency beacons activated by aircraft, ships and hikers in distress. Since its launch in 1982, Cospas-Sarsat has helped to save over 40,000 lives. What happens between an emergency beacon being activated and an actual rescue? Below is a diagram of the Cospas-Sarsat Ecosystem which shows the 5 critical stages to the search and rescue process.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>The process begins with the activation of a distress beacon (EPIRBs for maritime use, PLBs for personal use and ELTs for aviation use) in an emergency situation, sending out a 406MHz signal.</td>
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<td>2</td>
<td>The Cospas-Sarsat satellite system picks up the signal and transmits it back to a ground receiving station on earth — these are called Local User Terminals or LUTs.</td>
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<tr>
<td>3</td>
<td>The LUT processes the signal to generate a distress alert and relays it to a Mission Control Center.</td>
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<td>4</td>
<td>The Mission Control Center receives the alert and relays this with location information to a Rescue Coordination Center, often looking up the unique beacon ID number to gather information about the registered owner.</td>
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<tr>
<td>5</td>
<td>The Rescue Coordination Center alerts the appropriate emergency response teams to deploy a rescue effort.</td>
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All you need to access this free of charge ecosystem is an emergency beacon that operates on the 406 MHz frequency.
The Existing System

The Cospas-Sarsat System today includes two types of satellites: Low-altitude Earth orbit (LEOSAR) and Geostationary Earth orbit (GEOSAR), each contributing respective advantages to detection and location of distress beacons that have been activated.

The GEOSAR system constantly covers the entire Earth except the high-latitude (e.g., polar) regions, receiving distress alerts across most of the globe. However, it cannot locate the beacon unless the location is encoded in the beacon’s message from a local navigation receiver such as a GPS.

The LEOSAR system can locate a beacon without the aid of a GPS, but the LEOSAR satellites only view a small part of the Earth at any given time and may require multiple passes of a satellite resulting in delay to the search and rescue process.

Introducing MEOSAR

The Medium-altitude Earth Orbit Search and Rescue System, MEOSAR, is an advanced next generation satellite based technology that is revolutionizing the Cospas-Sarsat ecosystem.

The MEOSAR system offers the advantages of both LEOSAR and GEOSAR without their current limitations by providing transmission of the distress message, and independent location of the beacon, with near real time worldwide coverage.

To the right is the Cospas-Sarsat Search and Rescue ecosystem with MEOSAR added. As you can see, the flow of information remains the same, but the performance of that flow is greatly improved.

- Locations are calculated much more quickly because multiple satellites are receiving and relaying signals at once.
- The flow is more reliable because there will be redundancy created by the increase in satellites and antennas the system can choose from.
- The flow data will be more accurate because of more precise measurements of frequency and time.

MEOSAR will improve the speed, accuracy and reliability of the Cospas-Sarsat System as well as additional features such as a Return Link Transmission that will allow next generation beacons to provide the user confirmation that the distress message has been received.

MEOSAR Today

MEOSAR installations began in 2011 and are ongoing around the world as countries work to become MEOSAR ready in North America, South America, Asia, Asia Pacific, Europe and Africa. While these systems are in test mode of operation, the first MEOSAR rescues are already being documented such as the dramatic rescue of Don Stevens in April 2016 when he activated his McMurdo PLB after falling more than 90 feet and breaking his leg. The distress signal was relayed by the MEOSAR satellite system to McMurdo built infrastructure in only four minutes — 50 minutes sooner than the existing system — enabling a critical search operation before nightfall.
MEOSAR Complete

Once complete over the next three to five years, MEOSAR will put over 6 times the number of existing Cospas-Sarsat satellites into orbit, resulting in greater global coverage and more position accuracy. Those 72 MEOSAR satellites will immediately relay more beacon signals to ground stations — and it will relay them faster by using a new relay technique, known as bent pipe. This is a great improvement over LEOSAR which currently uses store and forward and can take 46 minutes longer on average to process a beacon signal.

MEOSAR ground stations, called MEOLUTs, can also connect to different MEOLUT locations creating layers of redundancy. This results in a highly reliable and near 100% available network to help achieve one of the key goals of MEOSAR: to determine beacon location within 100 meters, 95% of the time within 5 minutes. Another feature of MEOSAR system will be the ability to send a return link signal. Today this feature is only available through Galileo satellites and will be part of the functionality of next generation 406MHz beacons currently in development by McMurdo. McMurdo was selected by the European Commision to lead the development of next-generation search and rescue distress beacons under the Horizon 2020 HELIOS Project. With this functionality, great things are expected to improve the search and rescue process. A confirmation message can be sent back to the beacon acknowledging that the emergency signal was received. It will be possible to remotely activate a beacon, turn off a beacon transmission or even confirm if the emergency signal is an actual distress situation or a false alert.

Look For the M

MEOSAR is already demonstrating the significant impact it will have on the speed and accuracy of locating people in distress. More rescues are being documented as systems continue their test phases around the globe, demonstrating the benefits to search and rescue agencies to ultimately save even more lives, faster and with greater efficiency. McMurdo is proud to be a leader in the development and implementation of MEOSAR as part of our ongoing efforts to increase awareness, foster innovation and drive the standardization of these systems worldwide.
CASE STUDY

First life saved through next-generation MEOSAR search and rescue network

McMurdo instrumental in upgraded Cospas-Sarsat satellite system that found hiker 50 minutes faster than the existing system.

Don Stevens, a 53-year-old teacher from Wellington, New Zealand, was hiking over rugged terrain in the Tararua Range when he fell more than 90 feet, breaking his leg and leaving him unable to walk. After he activated his McMurdo FastFind 220 personal locator beacon (PLB), the distress signal was relayed by the MEOSAR satellite system to the Rescue Coordination Centre New Zealand in only four minutes — 50 minutes sooner than the existing system picked up the same distress signal.

“I wouldn’t be here if it weren’t for that beacon”

Don Stevens

McMurdo was instrumental in all phases of the rescue, from the McMurdo FastFind 220 PLB to the McMurdo designed and installed MEOSAR satellite ground stations, Mission Control Centres and Rescue Coordination Centres.

Rescue Coordination Centre New Zealand Manager Mike Hill, said: “The extra time created by receiving the signal faster was invaluable and potentially lifesaving. It meant we could get the search operation underway earlier, and that made all the difference with the limited daylight hours that are available at this time of year.”