BEACON AIDS SEARCH AND RESCUE OPERATION AFTER SOYUS-FG ROCKET BOOSTER FAILURE

The operation of space technology, in particular of spacecraft carrying cosmonauts and astronauts, is associated with a risk to human life at every stage of the flight, and is especially risky during emergency situations, when the spacecraft's crew is exposed to extreme conditions. In order to reduce the time spent searching for landing capsules and to reduce the risk to the lives of the cosmonauts, after 2010 all Soyuz spacecraft landing modules were equipped with Cospas-Sarsat 406 MHz emergency beacons.

On 11 October 2018 at 11:40:15 (Moscow Standard Time), a Soyuz-FG rocket carrying the Soyuz MS-10 manned transport spaceship took off from Baikonur Cosmodrome aimed for the International Space Station (ISS). This 1,839th launch of the Soyuz-type spacecraft was intended to deliver Roscosmos cosmonaut Alexey Ovchinin (Russia), NASA astronaut Nick Hague (USA), to the ISS.

Nick Hague (left) and Alexey Ovchinin (right) before the start of "Soyuz MS-10"
Photo by NASA/Elizabeth Weissinger

Two minutes 45 seconds after liftoff, at an altitude of 80 km, the Soyuz MS-10 commander Alexey Ovchinin reported a failure of the rocket booster. Ten seconds later, when the rocket booster and its payload reached a height of 93 km and was 350 km away from the launch area, the rocket booster divided into separate modules, and the Soyuz MS-10 landing module began an emergency landing.

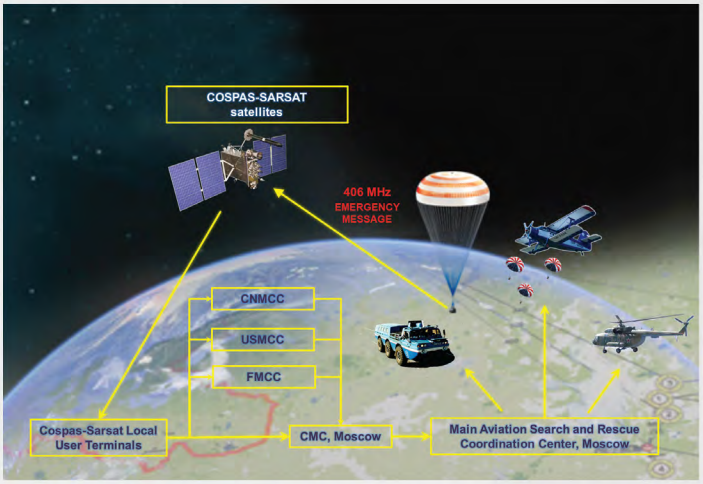
After separation from the rocket, the landing module of Soyuz MS-10 and its crew continued in free flight along a ballistic trajectory, completed a parachute descent and landed about 40 km away from the city of Zhezkazgan, Kazakhstan – about 400 km from the launch pad.

The landing module was equipped with two 406 MHz emergency beacons fit with internal GLONASS/GPS navigation receivers.

The first radio-beacon was automatically activated when the principal parachute was opened, and from 11:46 until 11:59, for the duration of the parachute descent of the landing module, emergency signals were received by the MEOSAR system. After landing, the second 406 MHz beacon was automatically activated. The emergency signals from the 406 MHz beacons contained the encoded position of the landing module during parachute descent and after landing (47°33'55.8'' N, 67°55'48'' E). All alert messages were rapidly processed by the MEOSAR system, distributed to CMC (Russian MCC in Moscow) and forwarded to the Main Aviation Coordination Search and Rescue Centre in Moscow, which conducted the SAR mission planning and coordination.

The landing trajectory of the SOYUZ MS-10 landing module based on the position data provided by the 406 MHz beacons. The landing position of the landing module is marked with a red dot.

BEACONS IN SPACE



Overview of the alert transmission for organizing SAR support during emergency landing of the Soyuz MS-10 spacecraft landing module.

One An-26 aircraft, four Mi-8 helicopters, and the “Blue Bird” SAR amphibious vehicles, as well as paratroopers, assisted in the SAR mission. At 13:10, about one hour after landing, the Soyuz MS-10 crew was successfully retrieved from the landing module.

“SOYUZ MS-10” landing module after landing.

Roscosmos cosmonaut Alexei Ovchinin (right) and NASA astronaut Nick Hague (left) at lunch after landing.

The timely delivery of the Cospas-Sarsat alerts and the accuracy of the location encoded in the emergency messages helped to quickly locate and evacuate the joint Russian and American crew of the Soyuz MS-10 spacecraft.

After several months of rehabilitation and preparation and a subsequent successful launch of the Soyuz MS-12 spacecraft on 14 March 2019, Alexey Ovchinin and Nick Hague, as well as NASA astronaut Ms Christine Cook, started their work aboard the ISS.

This was the first time when emergency information delivered by the Cospas-Sarsat System was used for the purposes of search and rescue of a spacecraft’s crew after landing.

PARTICIPATING COUNTRIES AND ORGANIZATIONS

2020

Algeria
Argentina
Australia
Brazil
Canada
Chile
China (P.R. of)
Cyprus
Denmark
Finland
France
Germany
Greece
Hong Kong (China)
India
Indonesia
Italy
ITDC
Japan
Korea (Rep. of)
Malaysia
Netherlands (The)
New Zealand
Nigeria
Norway
Pakistan
Peru
Poland
Qatar
Russia
Saudi Arabia
Serbia
Singapore
South Africa
Spain
Sweden
Switzerland
Thailand
Togo
Tunisia
Turkey
UAE
UK
USA
Vietnam

Total: 45

COSPAS SARSAT

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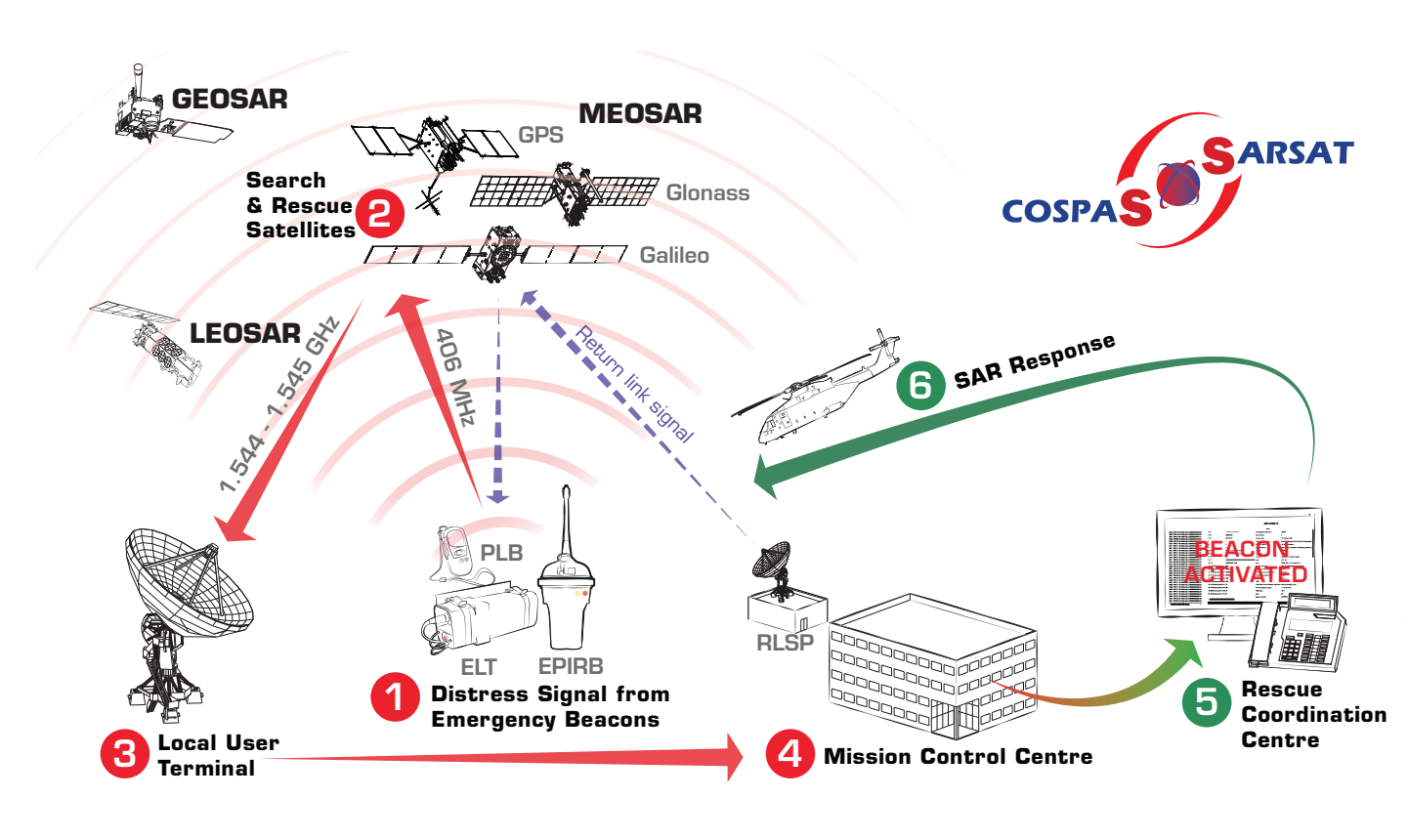
HOW DOES THE COSPAS-SARSAT SYSTEM WORK?



The Cospas-Sarsat System provides distress alert and location information to search and rescue (SAR) services throughout the world for maritime, aviation and land users in distress. The System is comprised of:

- Satellites in low-altitude earth orbit (LEOSAR), geostationary orbit (GEOSAR) and medium altitude earth orbit (MEOSAR) that process and/or relay signals transmitted by distress beacons.
- Ground receiving stations, called “local user terminals” (LUTs), which process the satellite signals to locate the beacon.
- Mission control centres (MCCs) that distribute the distress alert information to SAR authorities.

The Cospas-Sarsat System detects distress beacons that operate at 406 MHz.

COSPAS-SARSAT PEOPLE & EVENTS

33rd Joint Committee Meeting – June 2019, Doha, Qatar

Task Group on SGBs and SGB/FGB ELT(DT)s – April 2019, Montréal, Canada

Open Meeting of the Sixty-First Session of the Cospas-Sarsat Council – February 2019, Montréal, Canada

Task Group Meeting on MEOSAR System Evolution – June 2018, Prague, Czech Republic

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COSPAS-SARSAT PEOPLE & EVENTS

32nd Joint Committee Meeting – October 2018, Montréal, Canada

Experts Working Group Meeting on SGBs and SGB/FGB ELT(DT)s – April 2018, Montréal, Canada

Western Data Distribution Region Meeting – November 2019, Lima, Peru

Central Data Distribution Region Meeting – April 2019, Athens, Greece

South Central Data Distribution Region Meeting – Mars 2019, Maspalomas, Spain

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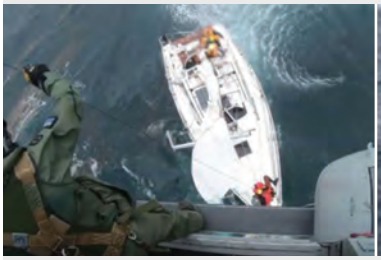
2019 NOTABLE SAVES



FAST MEOSAR CONFIRMATION OF EPIRB POSITION AIDS FRENCH MCC 4 LIVES SAVED

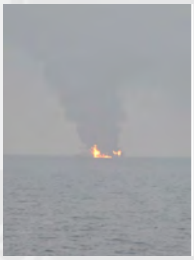
On 29 July 2019 at 16:51 UTC, the French MCC received an alert from an EPIRB via two GPS II and seven Galileo MEOSAR satellites.

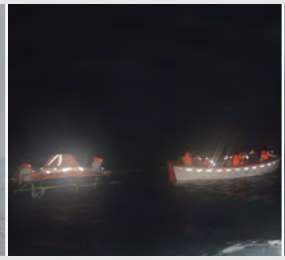
An accurate position was confirmed immediately by comparing the independent MEOSAR position to the GNSS-encoded position, faster than might have been possible with LEOSAR.

Less than 30 minutes after the MEOSAR alert was relayed to the French MRCC, with valuable additional information registered in the French database, a French Navy helicopter CAIMAN was tasked to the location and the ship CAP FINISTERE was diverted.

Arriving on scene in the middle of the Bay of Biscay, they found the capsized and dismasted 10-meter HIVA OA caught in rough weather battling against harsh winds of up to 50 knots and a 6-metre swell.

At 19:16 UTC, the rescue helicopter winched the four crew members in extreme conditions and transported them to Brest Hospital.





EVACUATION OF CARGO VESSEL ABLAZE IN RED SEA 31 LIVES SAVED

On 8 April, 2019, at 00:54 UTC, Saudi Arabian Mission Control Center received a SIT 915 MEOSAR message from the Spanish MCC as an initial distress signal detected from a 406 MHz EPIRB with coordinates around 91 nautical miles west of Jizan port in Saudi Arabia.

The distress signal was broadcast from a Panama-flagged Cargo vessel.

A distress alert message with the location was immediately sent to Jeddah Maritime Rescue Coordination Center (JMRCC) which conducted checks and analysis of the provided coordinates and information.

31 sailors were evacuated from the ship as a fire broke out, grew, and the vessel continued burning in international waters in the Red Sea.

There were no casualties; the entire crew was rescued safely, and the Saudi Border Guards and Royal Saudi Naval Forces provided the required assistance; medical care, and the necessary hospitality.

SOLO PILOT CRASHED IN WATER SOUTHEAST OF NEW ORLEANS 1 LIFE SAVED

On 15 September 2019 at 1646 UTC an ELT was detected at 28 51.8N 89 17.9W, 88 miles southeast of New Orleans, LA. It was activated after an aircraft, with 1 person on board, crashed in the water. Coast Guard District 8 received the alert, launched a helicopter to the beacon location, and issued an Urgent Marine Information Broadcast. The pilot of the plane was found in the water, surrounded by debris. He was hoisted up into the helicopter, and transported in stable condition to a local area hospital for treatment.

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2019 NOTABLE SAVES

406 MHz ALERTS REVEAL JAPANESE FISHING CREW'S LIFE RAFT 6 LIVES SAVED

Six Fishermen with a 406 beacon were rescued after a fishing boat capsized. All six aboard were rescued from the Pacific Ocean on 7 September 2019 when their boat capsized off Japan's northernmost main island of Hokkaido.

JAMCC detected several 406 MHz alerts from the fishing boat OTORI MARU No.18, which was taking on water approximately 17 nm off the southern coast of Hokkaido. JAMCC delivered the alerts directly to the responsible MRCC. The MRCC immediately responded by dispatching two patrol vessels and two patrol aircraft from the Japan Coast Guard base in Hokkaido to investigate the EPRIB signal.

The fishing boat had capsized when the aircraft arrived on scene and found six people in a life raft. The Coast Guard vessel arrived on scene and retrieved all six. Fortunately, no crew were missing or injured.

The 406 MHz EPIRB provided the sole information throughout the case. If the 406 MHz alert had not been sent, awareness of the accident would have been delayed.

AUSTRALIANS CLING TO HULL AFTER RETRIEVING EPIRB 1 LIFE SAVED

JRCC Australia detected a beacon offshore Jumpinpin Bar, Gold Coast registered to a 5-metre cabin vessel with two persons on board.

They tasked a helicopter and the water Police to respond after the couple activated a 406 EPIRB about 7:30pm on Thursday 26 September 2019.

The master of the boat could hear the EPIRB emitting a noise and swam down under the hull four times over three hours to locate the EPIRB and brought it to the surface, undoubtedly saving their lives.

SAR video showed a man holding his EPIRB and shielding another person with his body on the overturned boat as it sank lower in the ocean and water lapped at the edges of the hull.

The helicopter located the overturned vessel with two people clinging to the hull. As it was after dark, the water Police recovered the two survivors who were transferred ashore for treatment for hypothermia.

PLB ACTIVATED BY KAYAKER IN SCOTLAND STRANDED ON ROCK 1 LIFE SAVED

On 27th April 2019, at 10:40 UTC, a PLB alert with a position detected by MEOSAR was received at the UKMCC. The position was on the north coast of Scotland near the small village of Bighouse, in an area of rocky waters. A lone kayaker had become separated from his kayak after falling in the water. He was able to swim to a nearby rock in the water, where he activated his PLB. UKMCC passed the alert to Shetland Coastguard, who tasked the Thurso RNLI All Weather Lifeboat. Using the encoded GNSS position and the 121.5 MHz homing signal from the beacon, the kayaker was located by the lifeboat and recovered safely onboard with only a few minor injuries. The casualty was taken ashore and passed to a waiting ambulance to be checked over.

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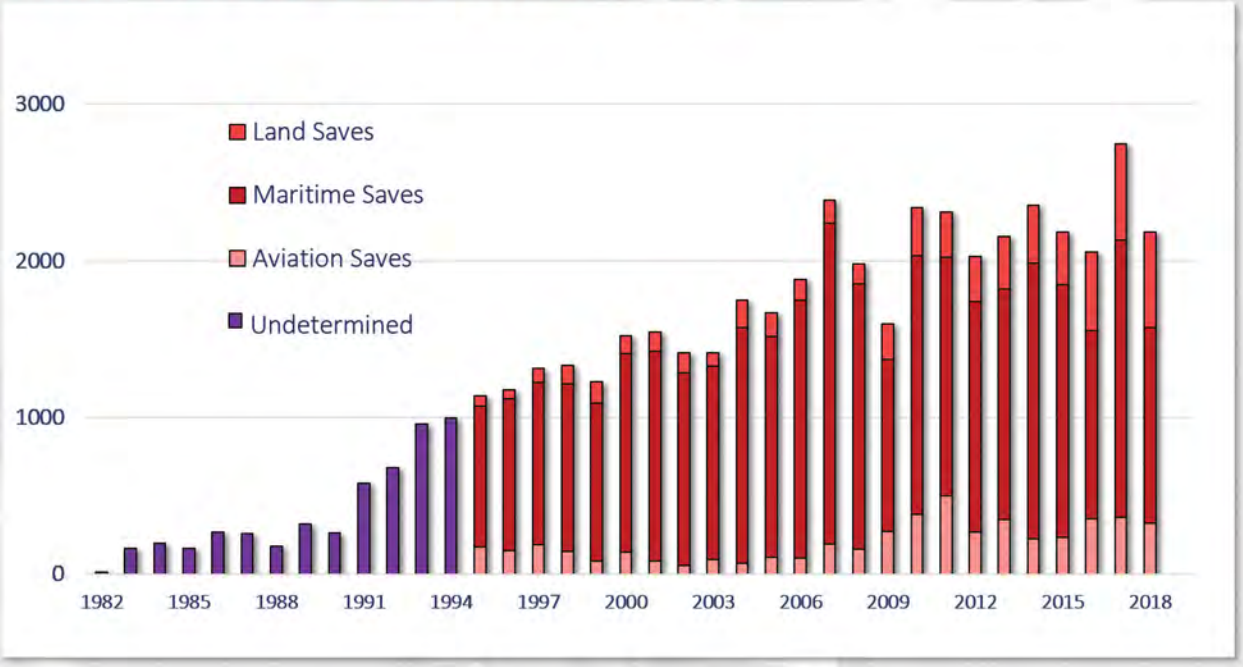
2018

STEADY GROWTH AND EXPONENTIAL SUCCESS



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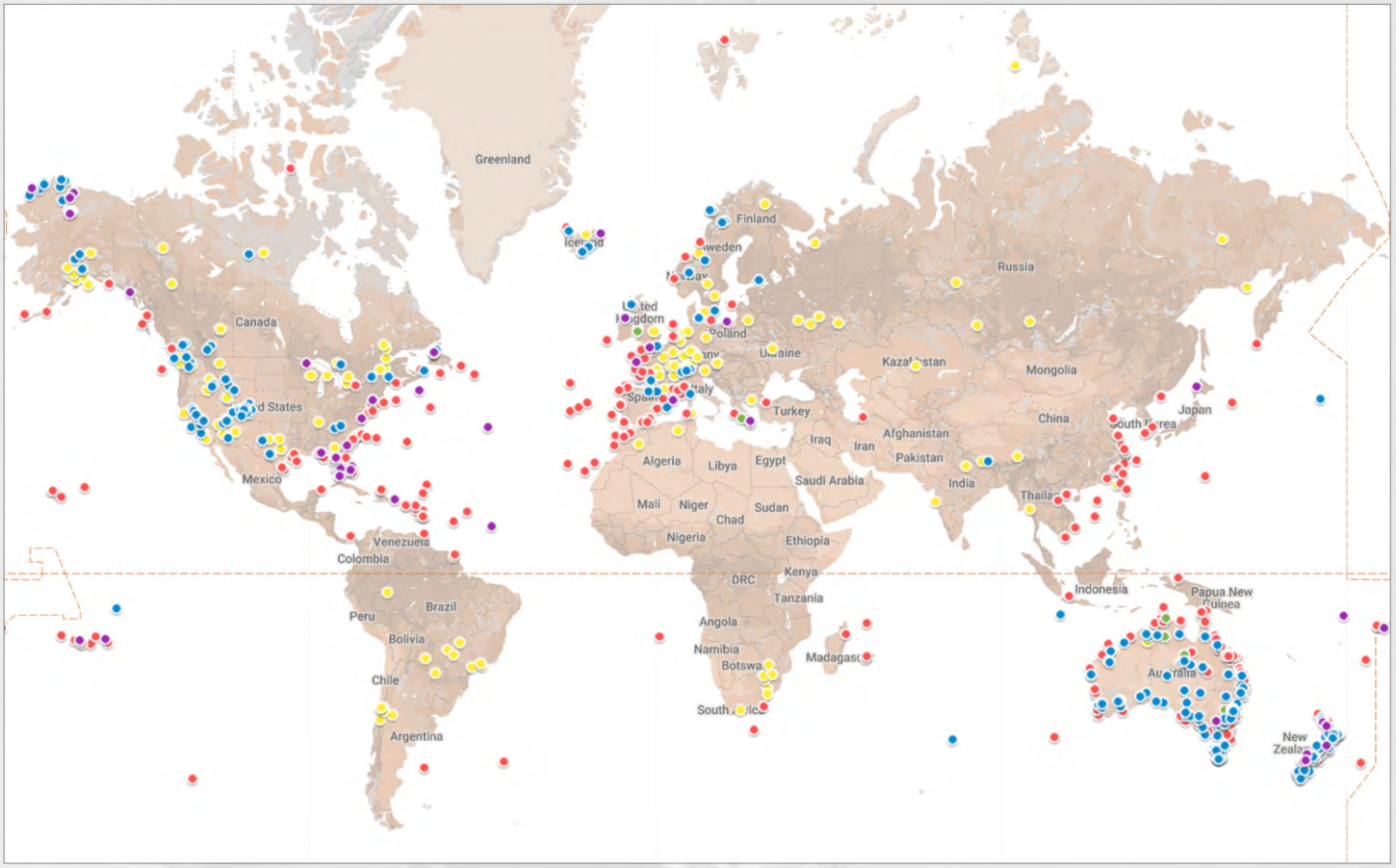
WE SAVE LIVES

2018 SAR EVENTS

LEGEND: Yellow (ELTs), Red (EPIRBs), Blue (Land PLBs), Green (Aviation PLBs), Purple (Maritime PLBs).



SAR OPERATIONS (Year 2018)

From January to December 2018, the Cospas-Sarsat System provided assistance in rescuing 2,185 persons in 904 SAR events

Type of Distress	SAR Events	Persons Rescued
Aviation	160	326
Maritime	358	1,246
Land	396	613
TOTAL	**904**	**2,185**

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ABOUT US

Life-saving technology is all around us, whether it is the latest tools and techniques in a hospital, or safety features in modern automobiles. Sometimes these technologies are little known, or a bit complex to readily understand. But they nonetheless SAVE LIVES!

Such is the International Cospas-Sarsat Programme. Although having a somewhat awkward name, and not always being well known, WE SAVE LIVES! In fact, as of 2019, **we have helped to save more than 50,000 people in about 15,000 search-and-rescue (SAR) events.** And this is an undercount, because Cospas-Sarsat statistics include only cases where a reliable "after action" report has been prepared and submitted through reporting channels to the Cospas-Sarsat Secretariat, the administrative arm of the Programme located in Montréal, Québec, Canada.

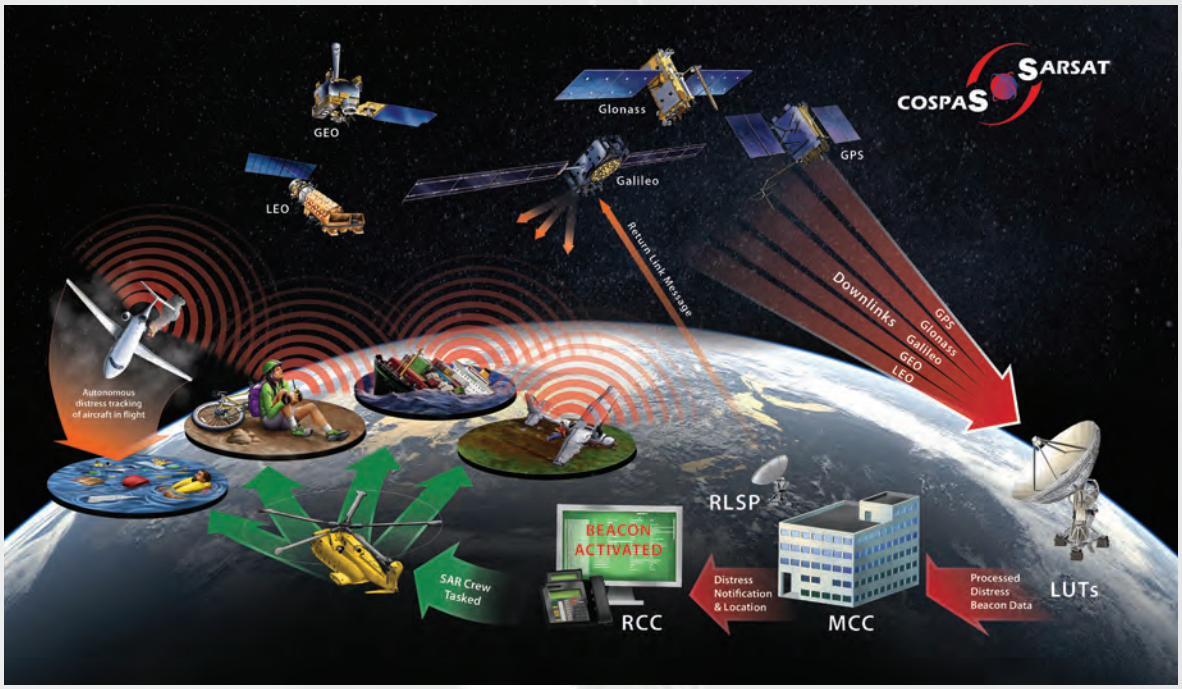
How does Cospas-Sarsat do it? Forty-five countries and agencies have joined together in unprecedented cooperation to build and launch SAR receivers into space and to operate satellite ground stations to listen for signals from compatible distress beacons anywhere on Earth. The distress alerts received from beacons are relayed to a government agency that can take action for rescue, as well as the "home" country of the beacon.

Cospas-Sarsat compatible distress beacons are all around you, though you probably don't notice them. They are in the cockpits of airplanes, and in aircraft survival rafts. They are on almost every ship traversing international waters, and often on the lifejackets of crew. They are on many pleasure craft, in some cases as a matter of obligation by a national government. They can be in the backpacks of hikers, climbers and snowmobilers in remote areas, who know that a Cospas-Sarsat beacon may be the only way to summon help in a life-threatening emergency.

Compatible beacons (those that operate at 406 MHz), made by dozens of different manufacturers, can be purchased from many types of vendors: retail stores, on-line and/or as original equipment on an aircraft or vessel. Cospas-Sarsat itself does not make or sell beacons, though we review independent laboratory testing of all beacon models to ensure that they meet our rigorous specifications.

Originally conceived by Canada, France, the former Soviet Union (succeeded in the Programme by the Russian Federation) and the United States, they and the other 41 participating States and agencies have dedicated themselves to the humanitarian service of detecting and distributing these life-saving distress alerts free of charge to any of the over 200 countries and territories on Earth.

ABOUT US



If you have read this far, you might be interested in a few more details.

The Cospas-Sarsat receivers in space generally are “secondary” payloads placed by several governments and intergovernmental agencies aboard weather and navigation satellites. There are more than 50 of them. Shared platforms in space help to keep the costs low.

Most of the participating States and agencies install and operate on the ground at their own expense, receiving antennas to capture the distress signals relayed by the satellites. These ground stations, or “local user terminals”, not only receive the distress message (and any beacon location data that might be encoded in the message), they also are connected to powerful computers that can locate a beacon based on the characteristics of the received signal. Cospas-Sarsat is unique in being able to accurately locate an activated distress beacon both from location information that is reported by certain kinds of beacons, and well as independently from the signal characteristics.

The States and agencies with ground stations share among one another the data received from an activated beacon by means of routing computers (and human operators) called mission control centers (MCCs). This ensures that the alert gets to an MCC that can further relay the information to the search-and-rescue point of contact closest to the emergency, as well as to the “home” country of the beacon.

These operational relationships are shown in the diagram above.

Cospas-Sarsat not only dramatically improves the chances of persons in distress being rescued but also, because a beacon normally can be located with good accuracy, it makes more efficient use of government resources that otherwise might be spent on needless searching, while reducing the time that rescuers might be at risk when searching in dangerous environments.

It is through this extraordinary cooperation among governments around the world that Cospas-Sarsat is able to detect, locate and act on a distress alert sent by a Cospas-Sarsat compatible beacon. This is the way that COSPAS-SARSAT SAVES LIVES.

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NOTES FROM THE CHAIR

A FEW WORDS FROM THE COUNCIL CHAIR

MICHAEL DONALD
Canada
2019-2020 Council Chair

This message is meant to be brief so I'm unable to mention every accomplishment within the Programme over the last year. However there are some developments that are noteworthy as they will improve the quality, timeliness and delivery of 406 MHz distress alert and location data to Search and Rescue authorities. Ultimately, as these initiatives are implemented, they will increase the likelihood that even more lives will be saved using the Cospas-Sarsat System.

Notably, the MEOSAR system is approaching Initial Operating Capability (IOC). The fundamental benchmark that will determine when the MEOSAR system reaches IOC remains the meticulous task of commissioning the necessary primary elements of the MEOSAR ground segment, specifically the nodal Mission Control Centres. We eagerly anticipate reaching the MEOSAR IOC milestone.

Secondly, great strides have been made toward completing the specifications for the Emergency Locator Transmitter for Distress Tracking (ELT-(DT)) that will meet the new performance requirement as part of ICAO's global safety system initiative. These new ELT(DT)s will automatically activate in-flight when defined anomalous flight parameters are met, and then provide timely notification and location data if needed. Providing location prior to an aircraft's potential collision with terrain is revolutionary and will increase the effectiveness, suitability and appeal of these 406 MHz beacons.

Another programmatic advancement is in the Second Generation Beacon initiative. SGB specifications are nearing completion and will be ready well in time for when MEOSAR becomes fully operational. SGBs will provide numerous benefits such as providing more information to the SAR authorities and better resolution of the distress location. Perhaps most importantly, SGBs will allow for future innovation and expansion of capabilities as the System grows and evolves.

Finally, perhaps the most significant work completed this year was the effort to support the entry into service at IOC level of Galileo's Return Link Service (RLS). This phase of operations will allow for the development and regional deployment of RLS beacons – essential steps in the progress of this initiative.

On a personal note, I'm very proud of all who have committed their time and effort toward achieving these advancements in the Programme. This effort comes not only during our formal meetings but also intersessionally through multi-lateral correspondence groups where much of the preliminary hard work is done. I would especially like to thank those Administrations that have provided chairpersons and experts to this cooperative effort which has been essential to the Programme's continued success.

NOTES FROM THE HEAD OF SECRETARIAT

A FEW WORDS FROM THE HEAD OF SECRETARIAT

STEVEN LETT
Head of Secretariat

Breathtaking is the current pace of innovation at the International Cospas-Sarsat Programme. The Programme has a storied history of making the seemingly impossible into the possible. And that commitment continues to this day.

Cospas-Sarsat simultaneously is tackling the leading-edge developments of new constellations of satellites, specifications for new generations of distress beacons that will be smaller, yet more versatile, and the introduction of the "return link service" that will provide confidence to a person in distress that their call for help has been heard.

Cospas-Sarsat is working with United Nations partners – the International Maritime Organization and the International Civil Aviation Organization – to adopt specifications for beacons that will help speed a response for incidents ranging from a sailor lost overboard to a commercial airliner in distress.

I am proud to lead the multinational team of the Cospas-Sarsat Secretariat that provides daily support to the Programme's founding Party States of Canada, France, the Russian Federation and the United States of America, and to the other 41 States and agencies that comprise the Cospas-Sarsat family of humanitarian cooperation. Our contribution helps strengthen their success.

The demands of so much activity occurring simultaneously sometimes can be stressful, but the anticipation of more lives being saved is a powerfully-satisfying reward. The team that I lead is comprised of some of the globe's top performers in their areas of expertise. Almost every day they conceive of a new way of looking at a problem, and a clever solution for addressing it. For that I am very grateful – not just for myself, but for their direct contributions to the Programme's life-saving mission.

As the world enters the decade of the 2020s, mariners, aviators, their passengers, and people engaged in recreational activities in remote areas can rest confident that with a Cospas-Sarsat compatible beacon, an advanced and reliable means to summon help in a life-threatening emergency is right at their fingertips.