

## IT'S BEEN OVER 40 YEARS SINCE THE COSPAS-SARSAT "EXPERIMENTAL" SYSTEM HELPED SAVE THE FIRST OF MANY THOUSANDS OF LIVES.

It seems like only yesterday (but it's actually been over 14,000 yesterdays!) and the Cospas-Sarsat System, and the world, have changed a lot since then. Back then, fax machines were common in offices, and personal computers and CDs were just being developed, while other things like MP3 players, DVDs, and laptop computers were still futuristic. The Internet, WiFi, email, texting, smartphones, tablets and flat screen TVs were still farther in the future.

### THE FIRST SYSTEM SAVE

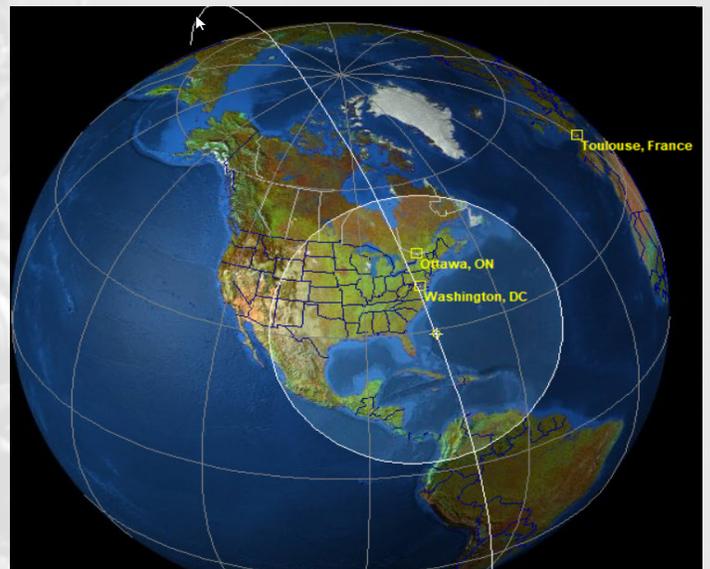
The first Cospas-Sarsat aviation rescue occurred in the mountains of northern Canada in September 1982, followed by the first maritime rescue in the Atlantic Ocean a few weeks later. The young pilot in that first rescue went on to be a commercial airline pilot for 35 years, flying millions of nautical miles, and having a family where three of his children became aviators.



*Location of the crash site of the light aircraft, northern British Columbia, Canada, 9 September 1982*

### LEOSAR

In 1982, there was only one LEOSAR satellite in orbit, Cospas-1, and a few ground stations (LEOLUTs) and Mission Control Centres (MCCs) installed on three continents, with operators working in three different languages and in different time zones. A means had to be developed to exchange distress alert data among them. The common language found was numbers, so messages were defined with fixed structures and formats, and the alert numbers were dropped into the correct slots (latitude, longitude, satellite identifier, time of day in UTC, etc.).



*Cospas satellite on its polar-orbit trajectory and associated footprint on the Globe*

That system was not yet called LEOSAR because there were no other orbits used for Search and Rescue satellites. But one single satellite was able to scan the entire planet twice a day and relay analogue 121.5 MHz signals from distress beacons transmitting in the vicinity of available LUTs, which would then approximate the beacon location based on the Doppler shift of the signal.

## COSPAS-SARSAT LEOSAR SYSTEM RESPONSE

This basic service was a quantum leap for detecting and locating aeronautical and maritime distress events. Search time was often reduced from days to mere hours, as previously distress signals were only heard by overflying aircraft or coastal stations, which could be few and far between. Sometimes signals were never heard at all. Reports of overdue aircraft not arriving at their destination often led to long and costly searches, and as hours passed, chances of finding survivors rapidly diminished.



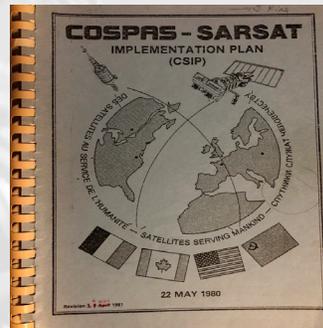
*Wreckage of a plane in a desolate area, where survival conditions are difficult*

Additional LEOSAR satellites were launched over time and LEOLUTs and MCCs were installed on many continents, extending the real-time coverage area and reducing the wait time between satellite passes. Some SAR forces were skeptical of this new gimmick, but gradually came to accept the Cospas-Sarsat service as a valuable new asset. Eventually a common question became, “When is the next satellite pass?”

By the mid-1980s, the “experimental” satellite system was working well and helping save many lives, so ways had to be found to continue the service and develop further improvements. The early challenges were overcome by the drive and determination of the founding countries and others around the world that had grown to rely on Cospas-Sarsat.

## FROM 121.5 MHZ TO 406 MHZ

The early Cospas-Sarsat designers had visions of an even more sophisticated “global safety net” for aviators and mariners around the world. Satellite detection and location of signals from 121.5 MHz distress beacons provided a much-improved service, but a “better mousetrap” was also designed into the initial satellites and LUTs. Building a brand-new type of distress beacon that was specifically designed for satellite detection would greatly enhance performance.



*May 1980 Cospas-Sarsat Implementation Plan (CSIP)*



*121.5 MHz aviation ELTs in the 1970's*

By 1985, this new system, modelled on the French ARGOS satellite system, had been successfully tested with 50 prototype 406 MHz beacons scattered around the world, and was declared operational. Beacon manufacturers started building high-tech digital beacons to the new specifications, including more stable frequency oscillators, and the beacon population numbers quickly grew.

## THE INTERNATIONAL COSPAS-SARSAT PROGRAMME AGREEMENT

Between 1985-1990, those 50 prototype beacons had multiplied to 40,000 operational beacons, and an intergovernmental agreement was signed ensuring Programme continuity for the long term. The Cospas-Sarsat Council, Joint Committee and Secretariat were established. IMO adopted 406 MHz EPIRBs as part of the future Global Maritime Distress and Safety System (GMDSS), and ICAO adopted aviation requirements for dual 406 MHz and 121.5 MHz ELTs.



*Different models of EPIRBs designed for use in maritime environment to support GMDSS*

## GEOSAR IS BORN

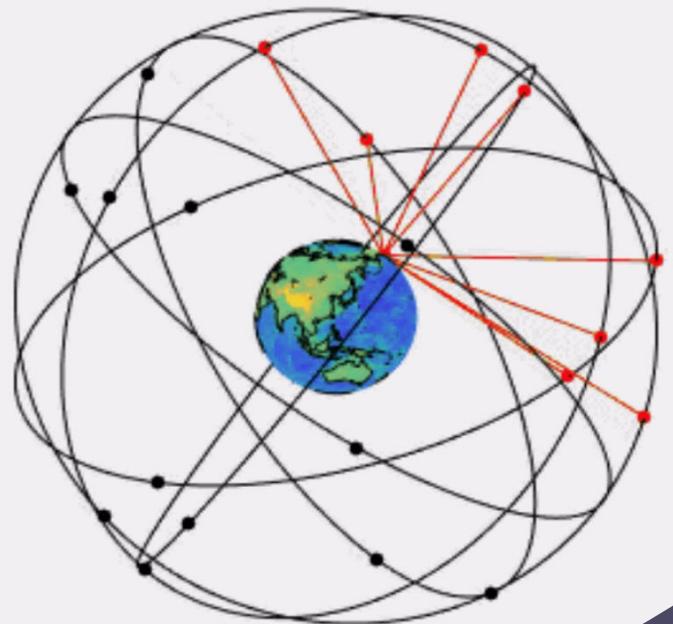
The visionaries were still at work finding ways to overcome the inherent time delay for LEOSAR satellites to pass over a distress location as they orbited the Earth every 100 minutes. More acronyms like GEOSAR and GEOLUT were the answer, and soon a few geostationary satellites carrying 406 MHz SAR payloads were hovering over the equator around the globe, continually viewing almost entire hemispheres. Near instantaneous detection of distress alerts overcame the LEOSAR delay time issue, but these geostationary satellites did not impart a Doppler shift, so GEOLUTs could not independently compute the beacon location.

Fortunately, some new cousins were starting to take up residence in space, and those novel GPS satellites, and eventually other GNSS satellites, were able to tell Earthlings where they were on the planet. That location information was soon being encoded into new distress beacon bursts which could then broadcast their location in addition to their identification, thereby overcoming the GEOSAR limitation.

Again, the early designers had planned for this as they already had a placeholder in the beacon distress message for location data, more than a decade before it became available and feasible to use. More satellites, more LUTs and MCCs, and more beacons meant reception of distress alerts went from hours down to minutes, leading to even more lives being saved. Beacon owners adventuring on land were also welcomed into the user community when smaller handheld devices called Personal Locator Beacons (PLBs) hit the market in the 1990s.

## AND THEN THERE WAS MEOSAR

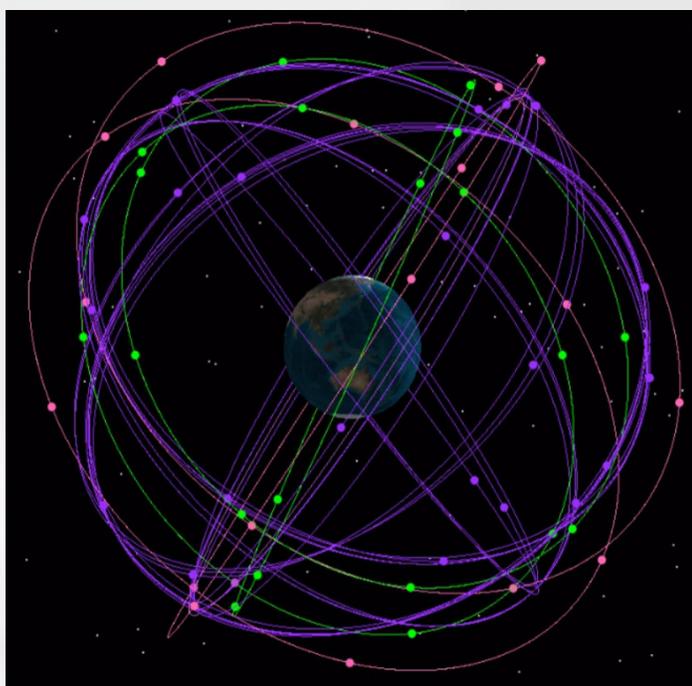
The combined LEO/GEO global coverage was very impressive, but the visionaries had not yet gone to sleep, and dreamed of even more enhancements for 406 MHz beacons, believing that the system was still not perfect.



*Early MEOSAR constellation diagram*

MEOSAR and MEOLUTs providing global coverage were the new buzz words by the end of the 1990s, when the total beacon population was almost one million, including 650,000 analogue 121.5 MHz and 300,000 digital 406 MHz beacons.

Unlike 121.5 MHz beacons which all transmitted a similar 'wow-wow-wow' analogue signal, every 406 MHz beacon digital transmission includes a country code and identification code, so every 406 MHz beacon in the world transmits a different, unique message. Beacon users were (and are still) urged to register their beacons in a national or international registration database (406registration.com), along with supplementary contact information and a description of their aircraft or vessel. Upon beacon activation, SAR forces can obtain data to plan their SAR mission, or to quickly resolve a false alarm, saving valuable time and resources.



MEOSAR constellations offer global coverage and redundancy

Over the next decade, MEOSAR evolved, with SAR payloads riding piggy-back on several GNSS navigation satellites. The benefits this brought for 406 MHz beacons meant that the older, analogue 121.5 MHz system were becoming less useful, so plans were made to phase them out by 2009.

Users gradually switched to 406 MHz beacons, as alerting and location times went down to a few minutes, and MEOSAR opened the door to yet more services with more acronyms, such as Second-Generation Beacons (SGBs), Return Link Service (RLS), and ELTs for autonomous Distress Tracking while the airplane is in flight - ELT(DT)s.

Today, with the LEOSAR and GEOSAR systems still operational, and 50 MEOSAR satellites in orbit and more being built, the System has provided more than 40 years of service.

The Cospas-Sarsat distress alerting service for the two million distress beacons deployed worldwide can now be considered complete.

But wait... the visionaries foresee even more enhancements, so who knows where the next 40 years will take us?

STAY TUNED!

*NB. The book published in 2016 by the International Astronautical Federation (IAF) on the History and Experience of the Cospas-Sarsat Programme is available at <https://www.cospas-sarsat.int/en/documents-pro/documents/history-and-experience-of-the-programme>.*

*With special thanks to our volunteer Programme historian, Mr. Jim King (Canada) for this article, and his work on a forthcoming Cospas-Sarsat History video documentary, expected to be available in 2024.*

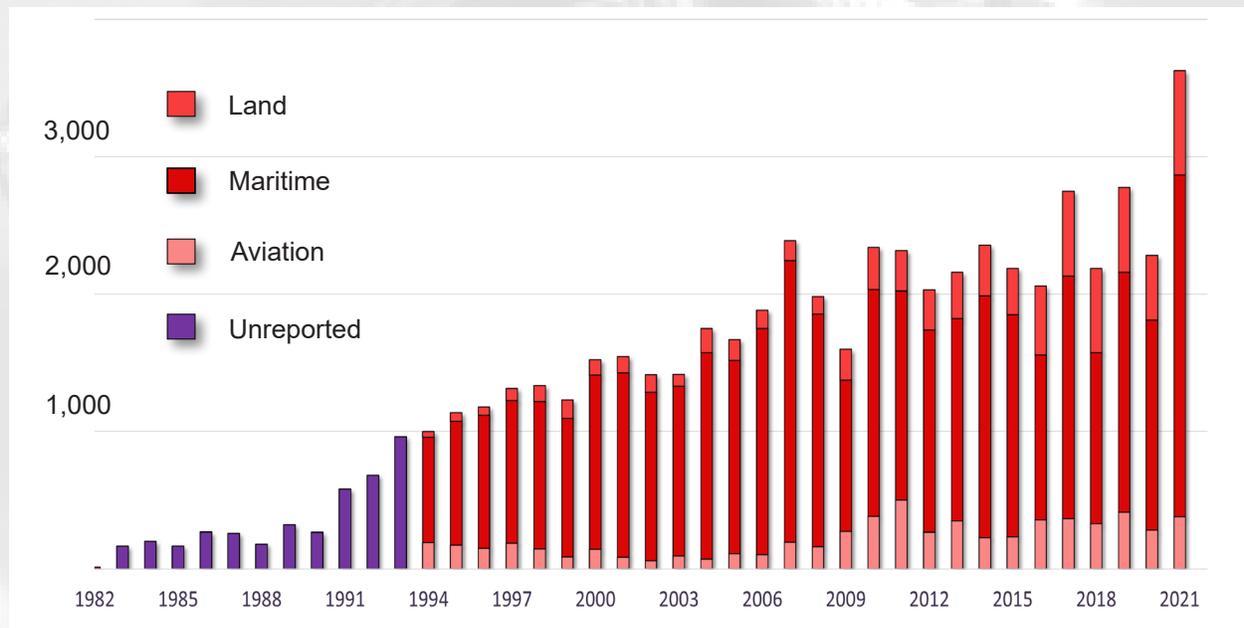
# WE SAVE LIVES

2021

1,149 SAR Events



## STEADY GROWTH AND EXPONENTIAL SUCCESS



Since September 1982, the Cospas-Sarsat System has provided assistance in rescuing at least 57,413 persons in 17,663 SAR events.



# WE SAVE LIVES

## 2021 SAR EVENTS

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



### SAR OPERATIONS (Year 2021)

From January to December 2021, the Cospas-Sarsat System provided assistance in rescuing 3,623 persons in 1,149 SAR events.

Type of Distress	SAR Events	Persons Rescued
Aviation	206	379
Maritime	429	2,487
Land	514	757
Total	1,149	3,623



# 2022 NOTABLE SAVES

## PERSONAL LOCATOR BEACON (PLB) HELPS SAVE DIVERS NEAR MIRI, MALAYSIA

8 LIVES SAVED

On 30 September 2022, a group of eight divers were rescued after a PLB was activated approximately 13 nautical miles southwest of Miri, Malaysia. The PLB was activated at 0450UTC after the divers had drifted far from their dive boat due to a strong underwater current.

The MYMCC, currently under development but in use nationally, received the emergency signal then alerted the Maritime Rescue Sub Centre, Kuching. Several assets from various agencies were deployed for the rescue mission led by Malaysia Coast Guard (MCG).

The victims were found safe but dehydrated and cold by MCG approximately 2.5 hours after the SAR mission was initiated. The divers expressed their gratitude to the rescue agencies and acknowledged the effectiveness of the PLB and the reliability of the Cospas-Sarsat System in providing assistance and saving lives.



Source: borneotravelnetwork.com

Divers in Sibuti Coral Reefs National Park, Miri, Malaysia.

Malaysia Maritime Enforcement Agency (MMEA) Miri deputy director (operation) Commander Maritime Eizanizam Muhammad said, "Currently, with the monsoon season around the corner, the unstable weather conditions and strong winds could pose a risk to divers. Hence, the PLB plays an essential role that at times of emergency, it sends out signals to the MYMCC and allows them to locate the victims immediately."

## TWO HYPOTHERMIC MARINERS RESCUED IN AUSTRALIA

2 LIVES SAVED

On 12 June 2022, an emergency beacon was activated approximately 7 km off Fraser Island, 111 km east of Bundaberg and was notified to Joint Rescue Coordination Centre (JRCC) Australia, operated by the Australian Maritime Safety Authority (AMSA).



Source: AMSA

The two survivors sitting on the hull.

As the registered owner of the beacon was not immediately contactable and the nature of distress was unknown, JRCC Australia tasked a rescue helicopter to the area and requested Hervey Bay Water Police provide a surface response.



Source: AMSA

Australian Maritime Safety Authority / Joint Rescue Coordination Centre Australia

The rescue helicopter located two people on an upturned hull. They were winched to safety and taken to Hervey Bay Hospital suffering hypothermia.

ISSUE 30

# 2022 NOTABLE SAVES

## PILOT EXPERIENCES ENGINE FAILURE AND ACTIVATES ELT IN FLIGHT

1 LIFE SAVED

On 6 April 2022 at 0418 UTC a Piper PA 28-A lost engine power in Northern Quebec at 11,000 feet, over 160 NM from their destination, with very little land below them that would be safe to touch down on. The pilot, who was the sole occupant, turned the aircraft around, attempting to glide to the closest airport at Havre Saint-Pierre, Quebec. Unfortunately, it was too far, and the pilot had to conduct a forced landing on a frozen lake 45 NM north of Havre Saint-Pierre.

The ELT had been turned on in the air and was detected by Cospas-Sarsat satellites, providing the initial alert and an accurate position for rescue agencies of where the aircraft had touched down. 413 Squadron in Greenwood, Nova Scotia, deployed a C-130 Hercules aircraft and a CH-149 Cormorant Helicopter to the scene.



An RCAF CC-130J, and the Badge of the 413 Squadron.

The Hercules arrived at 0735 Z and deployed SAR technicians to provide medical aid; thankfully the pilot was uninjured.

The Cormorant helicopter arrived at 0920 Z hoisted up the SAR techs and pilot, and transported them to Halifax, Nova Scotia.



The CH-149 Cormorant arriving on scene.



A CH-149 Cormorant in flight.

# 2022 NOTABLE SAVES

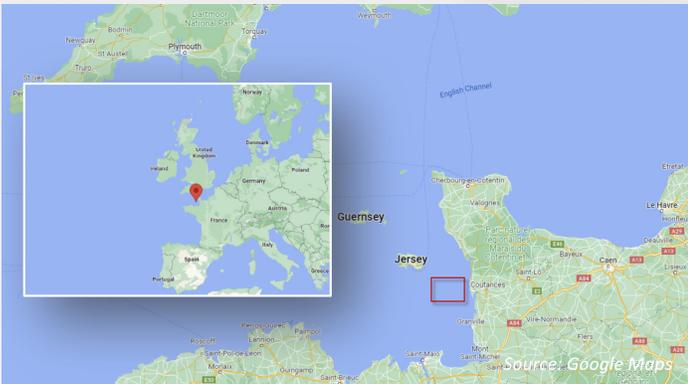


A Piper PA-32.

## AIRCRAFT CRASHES AT SEA NEAR JERSEY AFTER A LOSS OF ENGINE POWER

2 LIVES SAVED

On 3 November 2022 at 1400 UTC, the FMCC MEOLUT received an alert from a UK coded 406 MHz PLB located between the UK island of Jersey and the little town of Granville (France).



The rescue area, between Jersey (UK) and Granville (France).

The FMCC immediately sent the alert and registration data to the responsible French SAR point of contacts. The distress situation had been confirmed by Jersey air traffic control to the Jersey coastguards.

Numerous maritime assets (Royal National Lifeboat Institution (RNLI) Jersey) and air assets (EC145 Dragon 50 from French Civil Security and aircraft diverted by ATC Jersey) were sent to the area.

Rescue video is available at <https://rnli.org/news-and-media/2022/november/04/jersey-rnli-volunteer-crews-rescue-two-people-from-light-aircraft-ditched-in-sea>



EC-145 Dragon 50 French Sécurité Civile.

At 1439 UTC, an RNLI Jersey lifeboat came in sight of a life raft 6 NM southeast of Jersey, using the auxiliary 121.5 MHz radio homing signal from the beacon.



Rescuing the pilots from their life raft.

The two PA-32 crew members had taken shelter in a lifeboat, activating their PLB after their successful ditching. The RNLI volunteers picked up the two survivors less than one hour after the crash. In this event, the use of the PLB was essential and decisive in directing the rescue and saving the two people on board.



An unexpected visitor joining the rescuers during the SAR operation.

# 2022 NOTABLE SAVES

## PLB ASSISTS IN RESCUE OF YOUTH GROUP IN UTAH CANYON

19 LIVES SAVED

On 10 June 2022 at 0735 UTC, a PLB was activated in Sandthrax Canyon, Utah, USA by members of a youth group who had become stranded. The canyon is typically rated for advanced climbers, and the group included a large number of 10- and 11-year-old children who were unable to exit once they entered the confined space, plus two accompanying adults.



Source: [canyoneeringusa.com](http://canyoneeringusa.com)

*"Difficult up climbing and moderately difficult sideways climbing is required." say canyoning-specialized websites.*

The Air Force Rescue Coordination Center received the alert and notified the Garfield County Sheriff's Office, which launched a Utah Department of Public Safety helicopter to the coordinates.



Source: USMCC

*Members of the group, stuck in the narrow canyon, filmed by the rescuer helmet camera.*

Once the group was located, it was found that they had been stuck for almost 30 hours and needed to be hoisted approximately 130 feet (40 meters) to safety.



Source: USMCC

*The hoisting operation above the deep canyon. Image courtesy of Utah Department of Public Safety.*

Due to the narrowness of the canyon, the full rescue took nearly an hour and a half. By the time the 17 children were returned to their camp, they were all dehydrated but otherwise uninjured.

Video of the rescue operation is available at <https://www.youtube.com/watch?v=SfvMrx5yYqc>

# NOTES FROM THE CHAIR

## A FEW WORDS FROM THE COUNCIL CHAIR



**ANDREY  
KUROPYATNIKOV**  
Russian Federation  
2022 Council Chair

In June 1982, over 40 years ago, the first Soviet low-altitude earth orbiting (LEO) Cospas satellite equipped with a search and rescue repeater was launched. In September of the same year, the first rescue took place in British Columbia, Canada. Since then, over 17 thousand search and rescue operations have been carried out, and more than 57 thousand people have been rescued worldwide. Over the years since, the Cospas-Sarsat System has been continuously improved. In addition to the LEOSAR segment, the Cospas-Sarsat system introduced geostationary satellites (GEOSAR) capable of relaying Cospas-Sarsat beacon signals with minimal delay and covering almost the entire Earth except the polar regions.

The deployment of Cospas-Sarsat transponders onboard of the Global Navigation Satellite Systems (GNSS) spacecraft GLONASS, Galileo and GPS, became an important step in the development of the Cospas-Sarsat System, ensuring global coverage of the Earth surface, precise location data and minimum delay in receiving a distress signal.

In November 2022 the declaration of Intent between the Co-Operating Agencies of the International Cospas-Sarsat Programme and the Maritime Safety Administration of the People's Republic of China for Co-Operation on the Cospas-Sarsat Medium-altitude earth orbit search and rescue satellite system (MEOSAR) was signed.

As the result, the MEOSAR constellation was augmented with six BeiDou GNSS satellites.

Taking into account the currently deployed MEOSAR constellation, as well as the high degree of readiness of the ground segment, the declaration of MEOSAR Initial Operation Capability (IOC) is expected for the 68th session of the Cospas-Sarsat Council in April 2023. Meanwhile, MEOSAR data has been already successfully used to save lives for several years.

The scope of application of the Cospas-Sarsat emergency radio beacons and emergency locator transmitters (ELT) is progressively expanding all over the world. The landing modules of the Soyuz manned spacecraft are also equipped with Cospas-Sarsat ELTs

One of the highest priorities of System development was the implementation of a new type of beacon - the ELT(DT) - with the function of tracking an aircraft in distress. ELT(DT)s are designed in accordance with the International Civil Aviation Organization (ICAO) to the Global Aeronautical Distress and Safety System (GADSS) requirements being currently developed. ELT(DT)s will be installed on aircraft to transmit accurate aircraft position in case of an emergency situation in flight.

Upgrades to the Cospas-Sarsat Ground Segment made it possible for the Council at its 67th session to decide to allow first generation ELT(DT)s to operate starting 1 January 2023.

Reliable operation and constant development of the Cospas-Sarsat System became possible due to international cooperation and joint work of engineers and specialists from different countries.

The Cospas-Sarsat System remains one of the most successful international space projects and serves the humanitarian purpose of saving lives

ISSUE 30

# PARTICIPATING COUNTRIES AND ORGANIZATIONS

2023

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

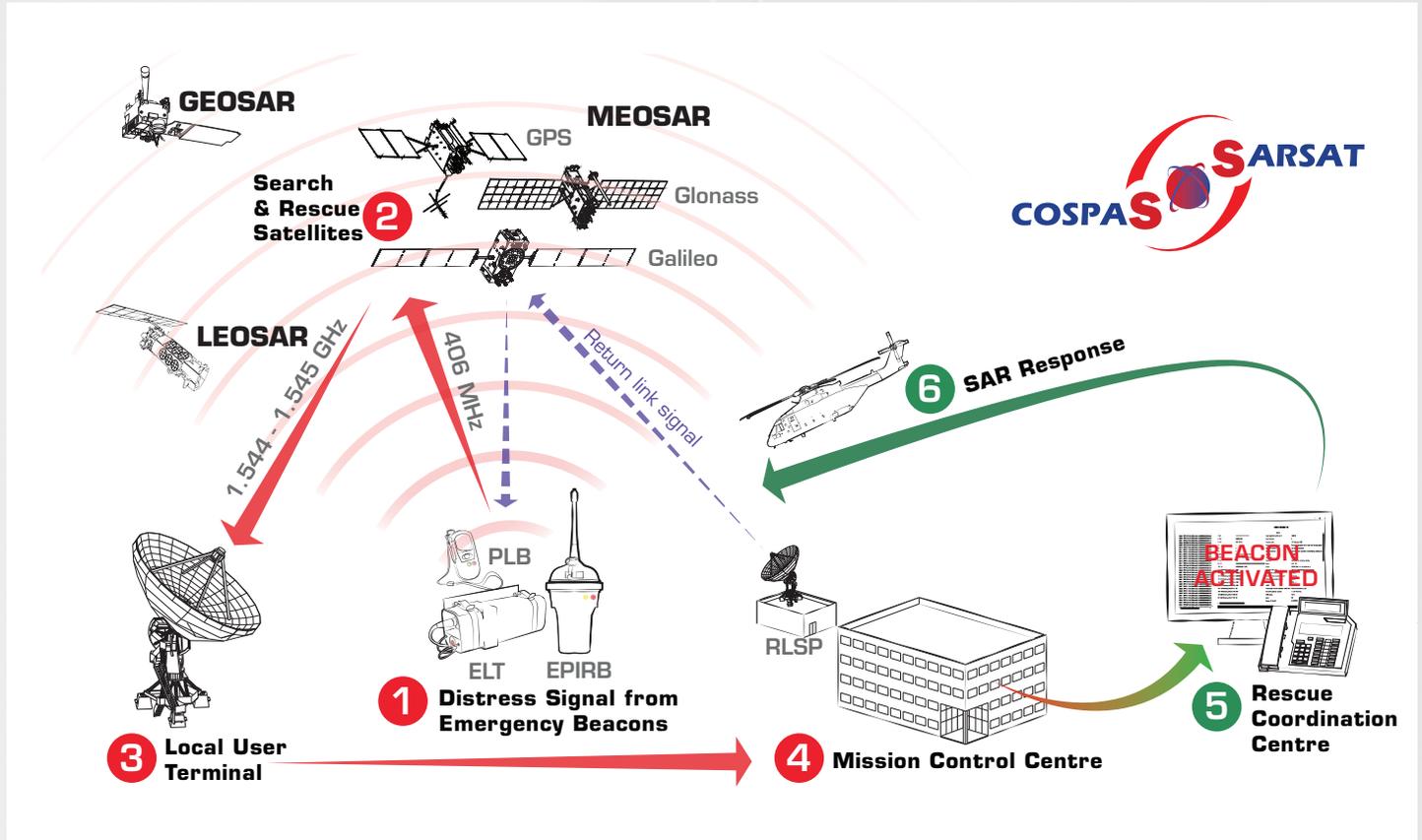
Norway  
Pakistan  
Peru  
Poland  
Qatar  
Russian Federation  
Saudi Arabia  
Serbia

Singapore  
South Africa  
Spain  
Sweden  
Switzerland  
Thailand  
Togo  
Tunisia

Turkey  
UAE  
UK  
USA  
Vietnam  
**Total: 45**



# 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.