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COSPAS-SARSAT - International satellite system for search and rescue

Cospas-Sarsat is an international, humanitarian search and rescue (SAR) system that uses space-based technology to detect and locate 406 MHz emergency beacons (portable radio transmitters) carried by ships, aircraft, or individuals venturing into remote areas, often inaccessible by mobile phone. It consists of a network of satellites, ground stations, mission control centres (MCCs), and rescue coordination centres (RCCs) that work together when a 406 beacon is activated.

The programme began as a joint effort of Canada, France, the United States, and the former Soviet Union in 1979. Currently over 40 nations (including Poland) and two SAR organisations are formally associated with the programme, all with the common goal of saving lives.

Here's how it works. When someone in a distress situation sets off their 406 beacon, the signal is received by a satellite and relayed to the nearest available ground station. The ground station, called a Local User Terminal, or LUT, processes the signal (that is, it converts it into useful data) and calculates the 406 beacon's position. This position is forwarded to the closest MCC along with identification data and other information extracted from the beacon signal. The MCC then automatically performs matching and merging of alert messages with other received messages, geographically sorts the data, and then transmits an alert message to the closest RCC based on the geographic location of the beacon signal. The RCC is responsible for organizing the search and rescue (SAR) team that will carry out the rescue if the distress is deemed authentic.

What contributes to the effectiveness and efficiency of the Cospas-Sarsat System is the fact that it sets very strict technical specifications and protocols for all ground system and satellite system receiver and transmitter components. It also is responsible for setting beacon standards including bandwidth, signal strength, battery life and performance requirements specific to beacon type.

Beacon types vary by user application. 406 ELT (Emergency Locator Transmitter) beacons are for aviation use. EPIRBs (Emergency Position Indicating Radio Beacon) for maritime use, and PLBs (Personal Locator Beacon) for personal use during wilderness activities (e.g. hiking, trekking). Most beacons can be activated manually by a person pressing a button. Most ELTs are designed to be activated automatically by a physical shock, such as in a crash, and most EPIRBs are designed to be automatically activated by contact with water. PLBs, which can be smaller than a cell phone, usually have only a manual activation capability.

The signal frequency (406 MHz) has been designated internationally for use only for distress. Embedded in this frequency is a unique digital code called a HEX ID. The HEX ID identifies the type of beacon and, if the beacon is registered, important information that can include: who the beacon owner is, the type of aircraft or vessel the beacon is associated with (for ELTs and EPIRBs), emergency points of contact, flight plans, float plans, wilderness trip plans, and other important details that help search and rescue specialists determine the best course of action. Beacon registration is a mandatory requirement in many countries.

Three types of satellites have been used so far by the Cospas-Sarsat System: LEOSAR (low earth-orbiting) satellites, GEOSAR (geostationary) satellites, and MEOSAR (medium earth-orbiting) satellites.

The primary mission of LEOSAR satellites is to monitor Earth's weather, environment, and climate. But in fact, they were the first category of satellites to carry SAR instrument

payloads when the idea of Search and Rescue Satellite-Assisted tracking (SARSAT) was implemented back in the early 1980s. Since polar-orbiting LEOs are close to the Earth, they "see" less territory because of the limited field of view from the antennas onboard each satellite.

With the LEOSAR system providing coverage of the polar regions, GEOSTATIONARY (GEO) satellites are much higher and circle the Earth over the equator at the speed matching the Earth's rotation. When we observe them, they seem to be stationary. This allows them to hover continuously over a fixed spot on the surface. They orbit the Earth at the altitude of 36,000 km and are capable of continually viewing large areas of our planet, except for the polar regions, which are beyond their coverage. For decades GEOSAR and LEOSAR systems' search and rescue capabilities were complementary.

In 2004 the Cospas-Sarsat Programme initiated the development of the Medium-altitude Earth Orbiting Satellite System for Search and Rescue (MEOSAR system). MEOSAR search and rescue payloads are carried on GNSS (Global Navigation Satellite System) satellites that orbit the Earth at an altitude between 19,000 and 24,000 km. They include GPS, GLONASS, and GALILEO satellites. GPS is operated by the United States, GLONASS by Russia and Galileo by the European Space Agency. The large number of MEOSAR satellites allows each distress message to be relayed at the same time by several satellites to several ground antennas, improving the likelihood of quick detection and improving the accuracy of the location determination.

The Cospas-Sarsat system provides consistent worldwide coverage no matter where the 406 beacon was purchased, registered, or activated. With the press of a button a distress message can be sent to the appropriate search and rescue authorities, regardless of the weather or terrain conditions, from anywhere on the Earth.

Adapted from: https://www.sarsat.noaa.gov/, January 2025

TASK 1.

Discuss the questions:

1. How does space technology contribute to modern telecommunications?

2. What would happen if we lost satellite coverage?

3. How could the use of satellites improve search and rescue operations compared to traditional methods?

4. What do you know about how search and rescue organizations work in your country?

TASK 2.

Read the text and decide if the following statements are TRUE, FALSE or NOT GIVEN:

1. Cospas-Sarsat only works in areas with sufficient mobile phone reception.

2. The programme was initiated in cooperation of over 40 nations and two search and rescue organisations.

3. When a beacon is activated, its signal is relayed by satellites to ground stations, which process the signal and determine the beacon's location.

4. EPIRBs have to meet higher performance requirements than PLBs.

5. All types of beacons described in the text are activated automatically, regardless of the situation.

6. The signal frequency (406 MHz) is internationally reserved for use solely in emergency situations.

7. Beacon registration is always obligatory as it provides critical information for search and rescue efforts.

8. 'LEOs' covering polar regions were first satellites equipped with technology used in search and rescue.

9. GEOs orbit the Earth at higher altitudes than LEOSAR and MEOSAR satellites and provide continuous coverage of large areas.

10. With the development of the MEOSAR system the number of successful rescue operations has increased significantly.

TASK 3.

Complete the sentences with the appropriate words:

efficiency / receiver / bandwidth / beacon / distress /inaccessible / coverage / accuracy / portable / remote

1. The satellite provides _____ to areas that are otherwise unreachable by mobile networks.

2. The _____of the signal needs to be wide enough to transmit data quickly and reliably.

3. They were stranded in a _____ area, far from any help.

4. The ship sent a _____ signal after losing power during the storm.

5. The new system improves the _____ of search and rescue operations.

6. Emergency kits often include a _____ power bank to keep devices charged during blackouts.

7. The signal was picked up by a _____ on the nearest ground station.

8. The _____ of the location coordinates is crucial for a successful rescue mission.

9. He carried a _____ to ensure he could call for help during his hike.

10. The village was _____ due to heavy snow, so supplies were delivered by air.

TASK 4.

Match the verbs from the text with the definitions:

1. to track	a. to receive and pass on (e.g. a message, a signal)
2. to relay	b. to follow the movement or progress of someone or something
3. to deem	c. to undertake a risky or daring journey
4. to carry out	d. to consider or judge something in a particular way
5. to convert	e. to change something into a different form or use
6. to venture	f. to differ or change in some aspects, such as size or amount
7. to develop	g. to contain or insert, make something an essential part of something else
8. to extract	h. to perform or complete a task or duty as instructed
9. to embed	i. to remove or take out something from a larger whole
10. to vary	j. to invent something or bring something into existence