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Other matters

COSPAS-SARSAT

Working paper submitted by Canada, France and the United States of America*

I. Introduction

1. The International Satellite System for Search and Rescue (COSPAS-SARSAT) is a satellite and ground system designed to provide distress alert and location information from emergency beacons to assist search and rescue (SAR) operations at sea, in the air or on land. It has provided assistance in the rescue of more than 11,000 persons since its inception in 1982. COSPAS-SARSAT was initially developed under a memorandum of understanding among agencies of Canada, France, the former Union of Soviet Socialist Republics and the United States of America, signed in 1979.

2. On 1 July 1988, the four partner States providing the space segment signed the International COSPAS-SARSAT Programme Agreement, which ensures the continuity of the system and its availability to all States on a non-discriminatory basis. In January 1992, the Government of the Russian Federation assumed responsibility for the obligations of the former Union of Soviet Socialist Republics. A number of States, non-parties to the agreement, have also associated themselves with the programme.

3. Through their association with the programme, States can contribute ground receiving stations that enhance COSPAS-SARSAT distress alerting capabilities and/or participate in international COSPAS-SARSAT meetings dedicated to the worldwide coordination of system operations and programme management.

4. The objectives of COSPAS-SARSAT are to ensure the long-term operation of the system, provide distress alert and location information on a non-discriminatory basis and support the search and rescue objectives of the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO).

5. The system comprises:

* On behalf of the COSPAS-SARSAT partners.

(a) A space segment operating in low-Earth orbit (LEO) and geostationary orbit (GEO);

(b) A ground segment consisting of satellite receiving stations, known as local user terminals (LUT), and data distribution centres, known as mission control centres (MCC);

(c) Emergency radio beacons operating at 121.5 MHz and/or 406 MHz, the characteristics of which comply with appropriate provisions of the International Telecommunication Union (ITU) and COSPAS-SARSAT specifications.

6. The activities of the Committee on the Peaceful Uses of Outer Space, specifically those related to reviewing the scope of international cooperation in peaceful uses of outer space and encouraging continued research and dissemination of information on outer space matters are of mutual interest to the Committee and COSPAS-SARSAT.

II. Description of the system

7. Search and rescue instruments provided by Canada and France are flown on the polar-orbiting satellites of the National Oceanic and Atmospheric Administration (NOAA) of the United States of America. This comprises the SARSAT portion of the COSPAS-SARSAT space segment. The Russian Nadezhda series of polar-orbiting satellites also carry the search and rescue instruments that make up the COSPAS portion of the space segment. Additionally, search and rescue instruments are carried on the NOAA geostationary operational environmental satellites (GOES) series of satellites and on the Indian INSAT-2B satellites.

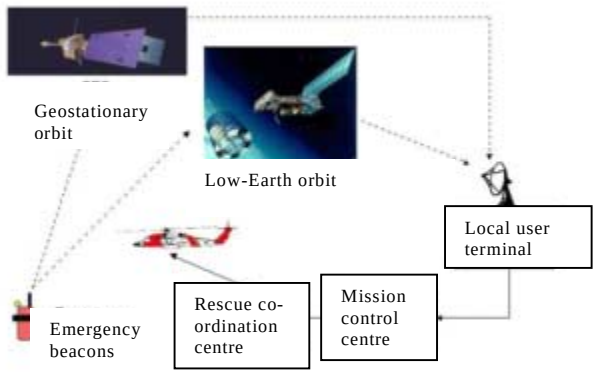
8. These instruments are capable of detecting signals on the Earth's surface transmitted from emergency beacons referred to as emergency locator transmitters (ELTs), emergency position-indicating radio beacons (EPIRBs) or personal locator beacons (PLBs). ELTs are used primarily on aircraft, EPIRBs on maritime vessels and PLBs by individuals on land.

9. ELTs, EPIRBs, and PLBs may operate on the 121.5, 243 or 406 MHz frequencies. The 121.5/243 MHz beacons transmit an analog signal that does not contain any information about the beacon or user. Alternatively, the 406 MHz beacons transmit a digital code that contains information about the type of beacon. Each 406 MHz beacon in the world has a unique identifier. The unique identifier allows for additional information, the registration data, to be linked to each beacon. After receipt of ELT, EPIRB or PLB signals, the satellite relays the signals to the LUT.

10. The LUT, after computing the location of the emergency beacon using Doppler processing, transmits an alert message to its associated mission control centre (MCC). The MCC performs matching and merging of alert messages with other messages received, sorts the data geographically and subsequently transmits a distress message to another MCC, an appropriate search and rescue authority such as a national rescue coordination centre (RCC) or a foreign SAR point of contact (SPOC).

11. A system overview is presented in figure I.

Figure I
Overview of the COSPAS-SARSAT system



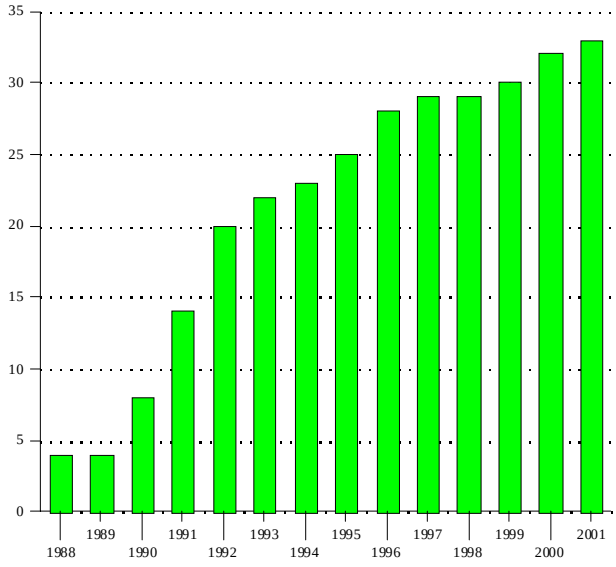
III. Status

12. The number of States formally associated with COSPAS-SARSAT reached 33 in 2001. The current COSPAS-SARSAT member States are highlighted in figure II.

Figure II
States associated with COSPAS-SARSAT

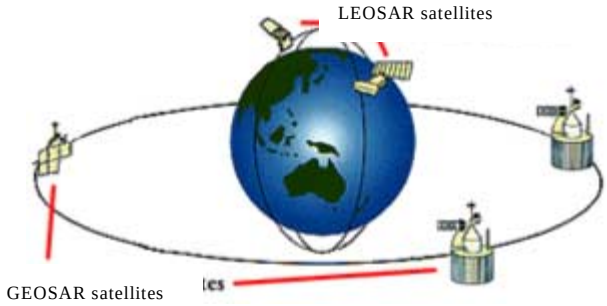
13. Figure III shows the continued increase in the number of member States since the International COSPAS-SARSAT Programme Agreement was signed in 1988. In addition to the 33 States associated with the programme, two participating organizations also provide ground segment equipment.

Figure III
Growth in the number of COSPAS-SARSAT member States, 1988-2001



14. The COSPAS-SARSAT space segment includes satellites in LEO and GEO. Satellites in LEO and their corresponding ground receiving stations are known as the LEOSAR system, while satellites in GEO and their corresponding ground receiving stations constitute the GEOSAR system. Figure IV shows the relationship between the LEOSAR and GEOSAR orbits.

Figure IV
LEOSAR and GEOSAR satellites



15. When the two systems are combined COSPAS-SARSAT is able to provide a robust capability by providing:

(a) Global LEOSAR coverage;

(b) Near-instantaneous GEOSAR coverage;

(c) Independent LEOSAR Doppler positioning;

(d) High probability of detection/location with the LEOSAR system anywhere on land or at sea, even in situations where obstacles block the beacon transmission to a GEOSAR satellite;

(e) High system capacity.

16. The satellites in the two types of orbit are considered complementary. While the geostationary satellites offer near-instantaneous detection of 406 MHz emergency beacons, they do not provide Doppler locating capabilities and their field of view is limited to the area between 70° N and 70° S.

17. The LEO satellites provide global coverage and Doppler locating capabilities but have an inherent delay given their orbital characteristics and field of view. The current satellite configuration is provided in tables 1 and 2.

18. COSPAS-SARSAT estimates that approximately 600,000 121.5 MHz emergency beacons and 250,000 406 MHz emergency beacons are currently in use worldwide. While many of those beacons are carried by aircraft and maritime vessels in response to national

and international carriage requirements, a growing number are carried by non-mandated users.

Table 1
Status of the LEOSAR space segment

COSPAS-SARSAT payload	*Satellite*	*Launch date*
COSPAS-6	Nadezhda-3	1991
COSPAS-8	Nadezhda-5	1998
COSPAS-9	Nadezhda-6	2000
SARSAT-3	NOAA-10	1986
SARSAT-4	NOAA-11	1988
SARSAT-6	NOAA-14	1994
SARSAT-7	NOAA-15	1998
SARSAT-8	NOAA-16	2000

Table 2
Status of the GEOSAR space segment

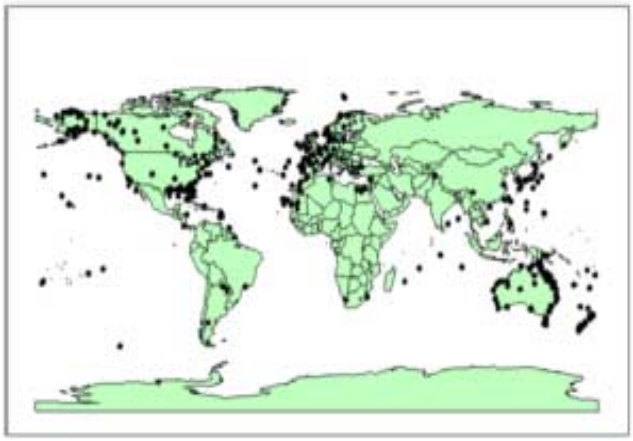
Satellite	*Launch date*	*Position*
GOES-East	1994	75° W
GOES-West	1997	135° W
INSAT-2B	1993	93.5° E

19. International emergency beacon carriage requirements are developed by the appropriate organs of ICAO and IMO. Annexes 6 and 10 of the ICAO Convention on Civil Aviation[1] specify the 406 MHz ELT carriage requirements for aircraft that fall under the Convention. A COSPAS-SARSAT EPIRB operating at 406 MHz can be used to comply with IMO guidance that vessels covered by the International Convention for the Safety of Life at Sea[2] carry an EPIRB.

20. The COSPAS-SARSAT space and ground segments provide global coverage for 406 MHz emergency beacons and regional coverage for emergency beacons operating at 121.5 MHz. There are currently 38 LUTs that track and process alert data from the LEO satellites, 7 LUTs that track and process alert data from GEO satellites and 22 MCCs to relay the information to search and rescue authorities.

21. The COSPAS-SARSAT system has provided assistance in rescuing 11,227 persons in 3,361 SAR events from September 1982 to December 1999. From January to December 1999, the system provided assistance in rescuing 1,227 persons in 340 SAR events. Figure V provides the location of the SAR events in 1999.

Figure V



Location of SAR events, 1999

IV. New developments

A. Space segment

22. The parties to the COSPAS-SARSAT agreement continue to plan for the long-term operation of the space segment. The SARSAT partners (Canada, France and the United States) are planning for the carriage of search and rescue instruments on the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) polar-orbiting METOP programme and the United States National Polar-orbiting Operational Environmental Satellite System (NPOESS). The NPOESS programme envisions satellites launched in three or more orbital planes and is planned as a follow-on to the current NOAA series of satellites.

23. The United States also plans to carry search and rescue instruments on its follow-on series of GOES satellites starting in the year 2010.

24. The Government of the Russian Federation is analysing plans that feature small dedicated platforms to carry the COSPAS instrument after 2006. The Russian Federation plans to complement its polar-

orbiting system with a geostationary capability on board the Luch series of satellites.

25. COSPAS-SARSAT is also working to formalize EUMETSAT and India's contribution of search and rescue instrumentation on their Meteosat second-generation and INSAT-3 series of geostationary satellites. Following successful testing and integration, those two series will expand geostationary coverage in the eastern hemisphere.

26. Future space segment plans include the study of placing search and rescue instruments in a mid-Earth orbit on board global navigation satellite systems such as the United States Global Positioning System (GPS) and the proposed European Galileo system. Search and rescue instruments in that orbit could significantly enhance current operations.

B. Beacons

27. In order to make effective use of search and rescue instruments in geostationary orbits, new 406 MHz emergency beacons have been introduced with the capability to accept position information from internal or external navigation devices such as GPS receivers. This has the potential to provide near-instantaneous alerting and locating via the GEOSAR system.

C. Phasing out of 121.5 MHz satellite alerting

28. At present, 121.5 MHz emergency beacons are available at a lower cost than 406 MHz emergency beacons, but this outdated technology has serious limitations and cannot be improved. It is the source of a large number of false alerts and the absence of identification information significantly increases the workload of search and rescue services. That situation led to a request by IMO for termination of satellite processing of 121.5 MHz signals.

29. In 1999, the Council of ICAO adopted amendments to the annexes of the Convention on International Civil Aviation requiring all new aircraft from 2002 and all aircraft from 2005 under the jurisdiction of the Convention to carry an ELT operating at 406 MHz. The ICAO Council also agreed that COSPAS-SARSAT processing of 121.5 MHz ELTs could be discontinued from 2008.

30. In response to the request of IMO and the decisions of ICAO, the COSPAS-SARSAT Council decided at its twenty-fifth session, in October 2000, to plan and prepare for the termination of 121.5 MHz satellite alerting on 1 February 2009. The COSPAS-SARSAT Council also approved a phase-out plan for 121.5/243 MHz satellite alerting services to help guide phase-out activities.

D. New frequency channels

31. The 406.0-406.1 MHz band has been set aside by ITU for low-power satellite emergency position-indicating radio beacons transmitting from the Earth to space. At present COSPAS-SARSAT emergency beacons transmit at 406.025 MHz, thereby using only a small portion of the 406 MHz band.

32. In anticipation of an increase in the number of 406 MHz emergency beacon users due to the phasing out of 121.5 MHz satellite alerting and the potential impact on system capacity resulting from lack of frequency spreading, COSPAS-SARSAT is reviewing its long-term frequency management plans. As a first step, COSPAS-SARSAT has decided that 406 MHz beacons submitted for type approval after 1 January 2002 must transmit at 406.028 MHz instead of the current 406.025 MHz frequency.

33. COSPAS-SARSAT is also preparing a comprehensive 10-year 406 MHz frequency management plan. The frequency management plan will require a detailed capacity model, forecast of beacon population and procedures for informing with sufficient advance notice appropriate administrations, international organizations, manufacturers and users. The frequency management plan will also identify new channels for use in the 406 MHz band.

E. International 406 MHz registration database

34. The effectiveness of 406 MHz emergency beacons is significantly improved when the beacons are properly registered and the registration information is available to search and rescue authorities. Search and rescue authorities have expressed concern that a

number of national administrations do not have proper facilities to maintain and disseminate registration information.

35. In order to address those concerns, COSPAS-SARSAT is evaluating the potential benefits and practical aspects of maintaining a centralized registration database for those States which do not maintain national registration databases. The initial analysis shows that COSPAS-SARSAT could maintain such a database, but obstacles such as funding and operations still need to be overcome.

V. Areas for cooperation between COSPAS-SARSAT and the Committee on the Peaceful Uses of Outer Space

36. Since its inception, COSPAS-SARSAT has been dedicated to providing alert and location information to all search and rescue services on a non-discriminatory basis. However, not all States are able to utilize the system fully. Many States do not have the appropriate national infrastructure to receive and respond to distress alert messages from COSPAS-SARSAT. In addition, the cost of emergency beacons has prohibited users in many States from purchasing the required equipment.

37. That situation is slowly changing. The cost of emergency beacons continues to decrease, affording many more users access to the system. Furthermore, in response to ICAO and IMO guidelines, many States are establishing the necessary search and rescue infrastructure to receive and respond to distress alert messages properly.

38. In parallel, COSPAS-SARSAT continues to introduce the system to new States and to others that have not adequately established search and rescue systems. In that respect, workshops sponsored, or co-sponsored, by the Office for Outer Space Affairs under the United Nations Programme on Space Applications offer much-needed assistance.

39. COSPAS-SARSAT looks forward to closer cooperation with the Committee on the Peaceful Uses of Outer Space and the Office for Outer Space Affairs in assisting States, especially those still developing, in meeting their ICAO and IMO obligations, and in helping educate the appropriate national administrations on the benefits and proper use of the system.

40. In order to promote cooperation, COSPAS-SARSAT invites the Committee:

(a) To consider adding the activities of COSPAS-SARSAT to its agenda;

(b) To consider whether COSPAS-SARSAT and the Committee on the Peaceful Uses of Outer Space could benefit from representation of the Office for Outer Space Affairs at COSPAS-SARSAT meetings;

(c) To consider other areas to promote cooperation between COSPAS-SARSAT and the Committee on the Peaceful Uses of Outer Space.

Notes

[1] United Nations, *Treaty Series*, vol. 15, No. 102.

[2] Ibid., vol. 1184, No. 18961.