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Report on the United Nations/Spain Workshop on Space Technology for Emergency Aid/Search and Rescue Satellite-Aided Tracking System for Ships in Distress

(Maspalomas, Gran Canaria, Spain, 23-26 November 1999)

Contents

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Abbreviations

bps	bits per second
COSPAS	Russian acronym meaning space system for the search of vessels in distress
ELT	emergency locator transmitter (aeronautical distress beacons)
EPIRB	emergency position indicating radio beacon (maritime distress beacon)
GEOLUT	a ground receiving station in the COSPAS-SARSAT system that detects, processes and recovers the coded transmissions of 406 MHz emergency distress beacons and relays the appropriate information to an MCC
GEOSAR	geostationary Earth orbit search and rescue (satellite system at 406 MHz)
Hz	hertz
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
kHz	kilohertz
LEOLUT	a ground receiving station in the COSPAS-SARSAT LEOSAR system that detects, characterizes and locates emergency beacons and forwards the appropriate information to an MCC
LEOSAR	low Earth orbit search and rescue (satellite system in polar orbit)
LUT	local user terminal (COSPAS-SARSAT ground receiving station)
MCC	mission control centre of COSPAS-SARSAT
MHz	megahertz (radio frequency)
NOAA	National Oceanic and Atmospheric Administration (United States)
PLB	personal locator beacon (distress beacon used on land)
RCC	rescue coordination centre
SAR	search and rescue
SARP	search and rescue processor (406 MHz processor of the LEOSAR system)
SARR	search and rescue repeater (406/121.5 MHz repeater of the LEOSAR system)
SARSAT	search and rescue satellite-aided tracking
SPMCC	Spanish Mission Control Centre
SPOC	SAR point of contact
SRR	search and rescue region

I. Introduction

A. Background and objectives

1. The General Assembly, in its resolution 37/90 of 10 December 1982, decided that, in accordance with the recommendations of the second United Nations Conference on the Exploration and Peaceful Uses of Outer Space,[1] the United Nations Programme on Space Applications should assist the developing countries in establishing an autonomous technological base for the development and the use of space technology by promoting the growth of indigenous capabilities. The Committee on the Peaceful Uses of Outer Space, at its forty-first session, held in June 1998, endorsed the programme of workshops, training courses and seminars proposed for 1999 by the Expert on Space Applications. The General Assembly, in its resolution 53/45 of 3 December 1998, endorsed the United Nations Programme on Space Applications for 1999.

2. The present report contains a summary of the presentations and discussions of the United Nations/Spain Workshop on Space Technology for Emergency Aid/Search and Rescue Satellite-Aided Tracking System for Ships in Distress. The Workshop was organized as part of the 1999 activities of the Office for Outer Space Affairs of the Secretariat under the United Nations Programme on Space Applications.

3. The Spanish Mission Control Centre (SPMCC) of the International Satellite System for Search and Rescue (COSPAS-SARSAT) in Maspalomas is responsible for transmitting directly any alert signal received from any of the following 20 African countries: Benin, Cameroon, Cape Verde, Central African Republic, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone and Togo. All these countries can participate effectively in COSPAS-SARSAT life-saving programmes by investing in simple radio beacons whose alert signals can be identified, located and detected in time of danger and subsequently relayed to a rescue coordination centre. The absence of such a facility in many African countries has resulted in the loss of many lives that could have been saved, a situation that led to the organization of the Workshop.

4. The Workshop was organized to provide those countries within the footprint of the COSPAS-SARSAT station in Maspalomas with an opportunity to gain the necessary knowledge to enable them to lead their national authorities into action and to ensure that their respective countries participate in the COSPAS-SARSAT programme.

5. The present report has been prepared for consideration by the Committee on the Peaceful Uses of Outer Space at its forty-third session and by its Scientific and Technical Subcommittee at its thirty-seventh session in 2000. The participants will report to the appropriate authorities in their own countries.

B. Organization and programme of the Workshop

6. The United Nations, in cooperation with the National Institute for Aerospace Technology (INTA), SPMCC and the Spanish Ministry of Foreign Affairs, organized the Workshop to address the issue of search and rescue in the area covered by the Maspalomas station and possible operations in the concerned West African countries. The Workshop was held on 23-26 November 1999, at INTA in Maspalomas.

7. At the opening session of the Workshop, Julio Melian, former Director and Coordinator, INTA, José Ortiz Ruiz del Castillo, Director of the Centro Espacial de Canarias, and Juan Manuel Salaz, Ministry of Foreign Affairs of Spain, welcomed all participants on behalf of the Government of Spain and INTA. Viktor Kotelnikov, representing the Programme on Space Applications, welcomed all participants on behalf of the United Nations.

8. The Workshop was held in three different sessions, the first two of which focused on practical programmes and related operations of COSPAS-SARSAT. During the course of the Workshop, successful examples of the use of the COSPAS-SARSAT system were presented. Subsequent round-table discussions addressed the relationship between SPMCC in Maspalomas and the individual country's search and rescue point of contact.

9. The participants visited the Maspalomas tracking station installation and received a more elaborate explanation of the work carried out at the COSPAS-SARSAT operation room. During that visit, a demonstration was conducted with the activation of a 406 MHz radio beacon and the related location calculation by the local user terminals, with an accuracy that was better than 1 kilometre. Participants also visited the Centre for Reception, Processing, Archiving and Dissemination of Earth Observation Data and Products (CREPAD), which is

co-located at Maspalomas with the COSPAS-SARSAT station.

10. The Workshop exposed the participants to COSPAS-SARSAT operations, including the procedure for distribution of alert signals, once they are received at the Maspalomas station. Participants were also informed about major disaster-related Internet Web sites.

11. The participants of the Workshop also participated in a real search and rescue training exercise under the supervision of Rafael Sanchez Pons, General de Brigada de Aviación, on board a specialized search and rescue vessel.

C. Participants

12. A total of 15 participants from 5 African countries (Cape Verde, Ghana, Mauritania, Nigeria and Togo), Spain and the Office for Outer Space Affairs attended the Workshop. Participants were professionals at the level of director and senior programme managers associated with or responsible for safety issues in connection with operating airlines of their country; the country's maritime agency and port authorities; the geological survey and land survey departments; the telecommunications industry; or the national disaster management board or bureau.

13. The Government of Spain (through INTA and the Ministry of Foreign Affairs) provided room and board for all the invited participants and was responsible for all the local logistics of the Workshop. The United Nations provided funds to cover the travel and en route expenses of the participants.

II. Observations and recommendations of the Workshop

A. Observations

14. Most of the African countries do not presently have a well-defined or designated Search and Rescue Satellite-Aided Tracking System (SARSAT) point of contact or mission control centre (MCC).

15. Most alert messages received by SPMCC are not received by the country concerned owing to the absence of a well-defined SARSAT point of contact (SPOC).

16. Most of the participating user countries do not possess the necessary communications equipment in their SPOC.

B. Recommendations

17. Having considered the problems arising from the ineffective and/or inefficient implementation of the COSPAS-SARSAT programme through SPOCs under the SPMCC service area, the Workshop made the following recommendations:

(a) Participants should endeavour to advise their countries on the need for a well-defined point of contact;

(b) In order to ensure cost-effectiveness, various country rescue coordination centres (RCCs) should immediately provide SPMCC with their telephone and fax numbers, e-mail, Inmarsat or cellular phone numbers etc. for immediate alert messages from SPMCC;

(c) User providers such as SPOCs should endeavour to send feedbacks to SPMCC whenever alert messages (real or false) are sent to them;

(d) Delegates should sensitize and encourage their Governments to participate in the COSPAS-SARSAT programme to save lives;

(e) Regular regional workshops or seminars on the COSPAS-SARSAT programme should be organized;

(f) Communication exercises should be carried out on a regular basis to check the connections between SPMCC and the SPOCs in its service area (SPMCC recommendation);

(g) Countries within the SPMCC service area wishing to participate as user State in the COSPAS-SARSAT programme should comply with the corresponding requirements;

(h) Participating countries should introduce the use of radio beacons and maintain a register on them;

(i) User providers such as SPOCs should take urgent steps to eliminate interference reported by SPMCC (SPMCC request);

(j) Countries wishing to be informed of any COSPAS-SARSAT alert message concerning vessels, aircraft etc. from their own countries (the country code is included in the 406 MHz radio beacons) in an alert situation anywhere around the world must send a letter to SPMCC requesting the Notification of Country Register (NOCR);

(k) When a NOCR is received from SPMCC, a country should report all information available from its beacon register concerning the vessel, aircraft etc. involved to SPMCC as soon as possible. SPMCC will then pass on all information to the MCC responsible within the area of the distress.

III. Summary of the Workshop

A. Spanish Mission Control Centre

18. The Spanish Mission Control Centre, located at the INTA satellite tracking station in Maspalomas, Gran Canaria, Spain, is one of the 30 ground receiving stations of the COSPAS-SARSAT global network. The station was established by the Government of Spain in 1993. In addition to COSPAS-SARSAT operations, it provides tracking, telemetry and control operations for Spain's MINISAT-01, serves as a back-up tracking, telemetry and control station for the Meteosat Second Generation (MSG) satellite of the European Organization for the Exploration of Meteorological Satellites (EUMETSAT), supports the Japanese ETS-VII satellite and acquires Earth resource data from the Land Remote Sensing Satellite (LANDSAT), the Satellite pour l'observation de la Terre (SPOT), the European remote sensing satellites (ERS-1 and -2), satellites of the National Oceanic and Atmospheric Administration (NOAA) of the United States of America and the Indian Remote Sensing satellite (IRS).

B. COSPAS-SARSAT system

19. The COSPAS-SARSAT is a humanitarian search and rescue programme that uses satellite technology to locate vehicles in distress anywhere on the globe, whether on land, sea or in the air. The COSPAS-SARSAT system rapidly locates signals from distress beacons and sends an immediate alert to rescue coordination centres. With the aid of this system, 9,204 lives have been saved worldwide (as of 8 November 1999) since it became operational in 1982.

20. COSPAS-SARSAT satellites were primarily designed to detect beacons transmitting at 406.025 MHz. They have, however, the capability to detect signals from the large number of first-generation 121.5 MHz beacons that are still operational worldwide. Additionally, the SARSAT (but not the space system for the search of vessels in distress (COSPAS)) satellites were designed to monitor the military distress frequency of 243.0 MHz of the North Atlantic Treaty Organization (NATO).

21. Originally based on a constellation of low polar orbiting satellites, since 1996 the system has been complemented by geostationary relay satellites. Designed to operate with four satellites, the system currently includes:

(a) Four American SARSAT satellites. These NOAA platforms, orbiting at an altitude of 850 km with a 98 degree inclination angle, carry a search and rescue payload of Canadian and French instruments (121.5 MHz and 406 MHz respectively);

(b) Three Russian COSPAS satellites. These Nadezda platforms, orbiting at an altitude of 1,000 km with a 98 degree inclination angle, fly Russian instruments.

22. In 1994, 406 MHz transponders were installed on several geostationary satellites to complement the COSPAS-SARSAT constellation for faster signal detection. The Indian Ocean is currently covered by the Indian telecommunications satellite INSAT-2A, the Atlantic Ocean by the American GOES-8 satellite, and the Pacific Ocean by a GOES-9 satellite. Europe and Africa will be covered as of the year 2000 by a transponder to be installed by the European Space Agency (ESA) on the second generation of Meteosat geostationary satellites.

23. The first second-generation instruments of the SARSAT system were installed on the American NOAA-K satellite launched on 13 May 1998, which was designed to collect a larger range of data than its predecessors.

24. The year 1999 was marked by the decision to start developing the third generation of SARSAT instruments to be installed on the future American NOAA and satellites of EUMETSAT.

25. Continuity of service of COSPAS-SARSAT systems is guaranteed to at least the year 2010. As part of the COSPAS-SARSAT 3 Programme, scheduled for development up to the year 2003, various agencies are working on the improvement of the operational search and rescue system.

26. In each of the world's service areas, there is one MCC to which all the ground receiving stations in the service area send the data from each satellite pass. All new events are sent to an RCC within a given service area or

they are sent to the MCC of the service area in which the event is located.

27. With the development of the system, more emergency beacons became available on the market. Aeronautical distress beacons continued to operate exclusively at 121.5 MHz, but maritime beacons were being built that operated at 406 MHz. Maritime search and rescue specialists immediately realized the benefits of 406 MHz beacons and, in 1990, took steps to bring them into widespread use. As a result, today there are over 33,000 maritime distress beacons in the NOAA 406 MHz Registration Database.

28. The COSPAS-SARSAT organization also continued to grow. The four original member countries (Canada, France, the former Union of Soviet Socialist Republics and the United States) have now been joined by 27 other countries and organizations that operate 35 ground stations and 19 MCC worldwide. COSPAS-SARSAT continues to be a model of international cooperation.

1. Satellite configuration

29. The COSPAS-SARSAT satellite constellation is composed of search and rescue satellites in low Earth orbit (LEOSAR) and geostationary orbit (GEOSAR).

30. The nominal system configuration of the LEOSAR satellite constellation is four satellites: two COSPAS and two SARSAT. The Russian Federation supplies two COSPAS satellites placed in near-polar orbits at 1,000 km altitude and equipped with search and rescue (SAR) instrumentation at 121.5 MHz and 406 MHz. The United States supplies two NOAA meteorological satellites placed in sun-synchronous, near-polar orbits at about 850 km altitude and equipped with SAR instrumentation at 121.5 MHz and 406 MHz provided by Canada and France.

31. Each satellite makes a complete orbit of the earth around the poles in about 100 minutes, travelling at a velocity of 7 km per second. The satellite views a “swath” of the Earth’s surface of approximately 6,000 km wide as it circles the globe, having an instantaneous field of view about the size of a continent. When viewed from the Earth, the satellite crosses the sky in about 15 minutes, depending on the maximum elevation angle of the particular pass.

32. The current GEOSAR constellation is composed of two satellites provided by the United States, referred to as GOES East (GOES E) and GOES West (GOES W), and one satellite provided by India (INSAT-2A).

2. Mission control centres

33. MCCs have been set up in most countries operating at least one ground receiving station, which is called a local user terminal (LUT). Their main functions are: (a) to collect, store and sort the data from LUTs and other MCCs; (b) to provide data exchange within the COSPAS-SARSAT system; and (c) to distribute alert and location data to associated RCCs or SPOCs. Most of the data received by MCCs fall into two general categories: alert data and system information.

34. Alert data is the generic term for COSPAS-SARSAT 406 MHz and 121.5 MHz data received from distress beacons. For 406 MHz beacons, alert data comprise the beacon location and the coded information.

35. System information is used primarily to keep the COSPAS-SARSAT system operating at peak effectiveness and to provide users with accurate and timely alert data. It consists of satellite ephemeris (information that allows the satellite position to be determined) and time calibration data used to determine beacon locations, the current status of the space and ground segments and coordination messages required to operate the COSPAS-SARSAT system.

36. All MCCs in the system are interconnected through appropriate networks for the distribution of system information and alert data. To ensure the reliability and integrity of data distribution, COSPAS-SARSAT has developed MCC performance specifications and MCC commissioning procedures. Reports on MCC operations are provided by MCC operators on an annual basis. Worldwide exercises are performed from time to time to check the operational status and performance of all LUTs and MCCs and data exchange procedures.

3. Ground receiving stations: local user terminals

37. There are two types of LUTs in the COSPAS-SARSAT system, those that are designed to operate with the LEOSAR satellite constellation are referred to as LEOLUTs, and those that operate with the GEOSAR satellite constellation are referred to as GEOLUTs.

38. LEOLUT and GEOLUT operators are expected to provide the SAR community with reliable alert and location data, without restrictions on use and distribution of the information. The COSPAS-SARSAT parties providing and operating the space segment supply LEOLUT and GEOLUT operators with system data required to operate their LUTs. To ensure that data provided by LUTs are reliable and can be used by the SAR

community on an operational basis, COSPAS-SARSAT has developed LUT performance specifications and procedures.

39. The configuration and capabilities of each LEOLUT may vary to meet the specific requirements of participating countries, but the downlink signal formats of COSPAS and SARSAT LEOSAR spacecraft ensure interoperability between the various spacecraft and all LEOLUTs meeting COSPAS-SARSAT specifications.

40. The capability of a LEOLUT is determined, for the most part, by the LEOSAR satellite channels it was designed to process. Data from a possible four channels may, depending upon the specific satellite being tracked, be available for processing. Some satellites support all the channels described below and some support only a limited set of them, as follows:

(a) The 406 MHz Search and Rescue Processor (SARP) satellite channel transmits received 406 MHz beacon data that has already been partially processed by the satellite to determine the identification, time of transmission and frequency for each distress beacon transmission burst. Because of the onboard memory capability of the SARP channel, it provides global (yet not continuous) coverage for distress beacons that operate at 406 MHz;

(b) The 406 MHz Search and Rescue Repeater (SARR) channel receives 406 MHz beacon transmission bursts and immediately retransmits them on the satellite downlink. Since there is no memory associated with the repeater channel, this type of processing supports only local mode coverage (i.e. the distress beacon and the LEOLUT must be simultaneously within the view of the satellite for a period of time). Furthermore, since the satellite does not process the data, all the processing is performed by the LEOLUT;

(c) The 121.5 MHz and 243 MHz SARR channels operate in a fashion similar to the 406 MHz SARR channel; however, 121.5/243 MHz beacons do not include identification information.

41. For the 121.5 MHz, 243 MHz and 406 MHz signals received via their respective SARR channel, each transmission is detected and its Doppler frequency shift is calculated. A beacon position is then determined using these data. In the case of 406 MHz distress beacons, the LUT is also able to provide identification information associated with the beacon.

42. Processing the SARP channel 2.4 Kbps data (i.e. those generated from 406 MHz transmissions) is relatively straightforward since the Doppler frequency is measured and time-tagged onboard the spacecraft. All 406 MHz data received from the satellite memory on each pass can be processed within a few minutes of pass completion. In order to improve location accuracy, a correction of the satellite ephemeris is produced each time a LUT receives a satellite signal. The downlink carrier is monitored to provide a Doppler signal using the LUT location as a reference, or highly stable 406 MHz calibration beacons at accurately known locations are used to update the ephemeris data.

43. GEOLUTs are ground receiving stations in the COSPAS-SARSAT system that receive and process 406 MHz distress beacon signals that have been relayed by a COSPAS-SARSAT geostationary search and rescue satellite. Owing to the extremely large continuous coverage footprint provided by each geostationary satellite, GEOLUTs are able to produce near instantaneous alerting over extremely large areas. Owing to the fact that the satellite remains stationary with respect to distress beacons, GEOLUTs are not able to determine beacon locations using Doppler processing techniques. However, new types of 406 MHz beacons are available that allow for the encoding of position data in the transmitted 406 MHz message, thus providing for quasi-real-time alerting with position information via the GEOSAR system.

4. COSPAS-SARSAT radio beacon

44. There are three types of radio beacon: aviation emergency locator transmitters (ELTs), maritime emergency position indicating radio beacons (EPIRBs) and personal locator beacons (PLBs). The beacons transmit signals that are detected by COSPAS-SARSAT polar-orbiting spacecraft equipped with suitable receivers, and the signals are then relayed to COSPAS-SARSAT local user terminals, which process the signals to determine the location of the radio beacon that is transmitting the signals. Alerts are then relayed, together with location data, via an MCC either to another MCC or to the appropriate SAR point of contact or RCC.

45. The beacon is the weakest link in the COSPAS-SARSAT system. It is susceptible to damage upon impact, it can also be submerged in water or it may not have been mounted properly. Sometimes the beacon operates for only a short time before it is consumed by fire or it sinks.

46. The 406 MHz beacon signal has a greater chance of being detected in such instances because only 50 seconds are needed to be potentially detected by the GEOSAR system. The 121.5/243 MHz beacon has only a 20 per cent chance of having a satellite overhead; if it fortunately happens to be in this situation, it must operate a minimum of four minutes for an accurate location to be possible.

47. It is estimated that, worldwide, there were about 156,000 406 MHz beacons at the beginning of 1998 and that there are currently about 600,000 121.5 MHz beacons. The 406 MHz ELTs currently cost about $2,800 and 121.5 MHz ELTs cost less than $500, which is the greatest advantage of 121.5 MHz ELTs. Most of the 121.5 MHz beacons are used aboard aircraft, and they are required to meet national specifications based on standards of the International Civil Aviation Organization (ICAO). The 121.5 MHz system operates in local mode only. The overall coverage provided by the COSPAS-SARSAT system in local mode is determined by the number and positions of LUTs, each covering an area with a radius of approximately 2,500 km.

48. Of all alarm signals registered for all beacons, 90 per cent are false ones, which is very costly. The 406 MHz beacon has a high false alarm rate, but 99 per cent are solved by a telephone call. False alarms of 121.5/243 MHz beacons can interfere with real distress alarms from people in need of assistance.

49. There now exists a new 406 MHz beacon that can be plugged into a global positioning system (GPS) terminal; when activated, the GPS signal is transmitted to a GEOSAR and forwarded to an MCC. RCCs then know who is in distress and where they are located within minutes, rather than within hours, as in the case of the 121.5/243 MHz beacon.

50. Equipment required to home in on 406 MHz is still under development and is difficult to use on aircraft because the signal only pulses every 50 seconds. To counter the problem, many beacons also contain the low-powered 121.5 MHz frequency which is much easier to home in on when close to the signal (at a distance of approximately 10 km).

51. A recent study has shown that the average response time for 406 MHz beacons is about 46 minutes owing to the GEOSAR system. Once a beacon is activated, the geostationary satellite detects it immediately. Within a couple of minutes, an MCC operator who controls that beacon service area has the alert. Accordingly, the operator sends the registration information to the appropriate RCC and an immediate investigation ensues. Although no position is transmitted, the registration data can provide enough information to initiate a rescue, and the position is forwarded to the en-route rescue operation once it arrives.

52. The 406 MHz beacons have many advantages over the conventional 121.5 MHz ones. When a 406 MHz beacon is activated, it transmits a coded digital signal to the satellite. The code includes the beacon's unique identification, the country in which it is registered (numeric code) and the type of beacon (ELT, EPIRB, PLB) and it may include the method of activation (manual or automatic) and location information (second-generation beacons only).

53. The 121/243 MHz beacon can not be detected with a geostationary system because it does not have a unique identifier. The 46-minute response time advantage becomes even larger when compared to the response time of the 121.5/243 MHz beacon because a confirming source is usually needed prior to investigation.

54. A GEOSAR satellite usually notifies MCC within minutes of activation. Upon notification of an active 406 MHz beacon, MCC uses the beacon code to retrieve owner information from a database and forwards it to the appropriate RCC or, in the case of a PLB, to the designated authority. The database includes the name or call sign of the vessel or aircraft, a description of the vessel, the company or individual who owns the beacon, a 24-hour contact name and phone number, and other pertinent data that might be of use to SAR personnel.

55. The 121.5/243.0 MHz ELTs do not generally have such a capability. A few 121.5 MHz ELTs have been built with the aircraft call sign encoded within the signal. LEO satellites are subjected to multiple sources of spurious noise within the 121.5 and 243.0 MHz bands. The noise may be produced by electrical equipment or radio signals that interfere on the emergency frequencies.

56. As a result, a vast quantity of positions produced by LEO may have absolutely nothing to do with an active ELT. Compounding the problem is a limitation within the system. LEO satellites can determine a position perpendicular to its track, at a distance away from its path over the surface of the Earth; unfortunately, the equipment can not determine whether the source is to the left or to the right, thus two possible positions are produced.

57. Data from a subsequent satellite pass is processed by MCC software; if a position from the pass matches the original position, within designated parameters, a "confirmed ELT" position is produced. A LEO satellite

provides very accurate location data through the next LUT that tracks that satellite, but this may occur after a considerable time period, thus delaying SAR action. RCCs will begin taking action on a single position if other corroborating evidence is received, such as a report that an aircraft is known to be missing in the area, or if aircraft report of hearing an ELT on 121.5 MHz.

5. 406 MHz GEOSAR system

58. Over the past few years, COSPAS-SARSAT has been experimenting with 406 MHz receivers on geostationary Earth orbiting (GEO) satellites. The experiments have proven the capability of GEOSAR to provide immediate alerting and identification of 406 MHz beacons. GEO satellites are not able to use Doppler location processing since they have no relative motion between them and the emergency beacons.

59. Therefore, they are not able to determine a location for a beacon. They can, however, provide immediate alerts. This is a valuable tool for SAR personnel, since it allows them to begin their initial verification of the alert using the beacon registration database. The process often yields a general location of the vessel or aircraft in distress, and SAR assets can be readied or dispatched to that general area. Ideally, a SARSAT or COSPAS polar- orbiting satellite will overfly the beacon within the next hour and calculate a Doppler location, which will be forwarded to the SAR personnel who may already be en route.

60. Since every few minutes saved in reaching the scene of distress amounts to an increased chance of survival, the early warning capability of GEOSAR provides a valuable tool to increase the effectiveness of the COSPAS-SARSAT system and, ultimately, save more lives. It only works, however, if the beacon is registered.

61. The next logical step in utilizing the immediate alert capabilities of GEOSAR is to give the satellites some way of determining not only the identification but also the location of a distress beacon activation. This would provide immediate alerting and locating, something COSPAS-SARSAT has been in need of from its inception.

62. Specially made emergency beacons determine their location using GPS. The location is then encoded into the signal that is transmitted by the beacon. When the signal is received by an MCC, it is treated much the same way as one received from SARSAT and COSPAS satellites.

63. An MCC determines which RCC should respond and immediately transmits a message to that RCC. Thus, as long as an EPIRB is within view of a satellite (basically anywhere from 70 degrees north to 70 degrees south), a distress message reaches rescue personnel immediately. Since they know the exact location and identification of the EPIRB, the response will be extremely quick.

6. Discontinuation of 121.5 MHz service

64. The international COSPAS-SARSAT programme has announced that it will terminate satellite processing of distress signals from 121.5 and 243 MHz emergency beacons. Although the use of emergency beacons at these frequencies is not under the purview of the COSPAS-SARSAT programme, mariners, aviators and other persons will have to switch to emergency beacons operating at 406 MHz in order to be detected by satellites.

65. The COSPAS-SARSAT programme is currently working on the details, including the time-frame, of the termination of 121.5 and 243 MHz satellite alerting services. While no effective date has been set for this action, it is expected to occur far enough in the future to avoid a crisis situation for persons now using such beacons.

66. Guidance from the International Maritime Organization (IMO) and ICAO influenced the COSPAS-SARSAT programme’s decision. These two specialized agencies of the Untied Nations system are responsible for regulating the safety of ships and aircraft, respectively, in international transit, and handle international standards and plans for maritime and aeronautical search and rescue. Over 180 countries are members of IMO and ICAO.

67. The high number of 121.5 MHz false alerts that inundate SAR authorities is another major factor influencing the decision to stop satellite processing. False alerts have an adverse impact on the effectiveness of life-saving services. While 406 MHz beacons cost more, they provide search and rescue agencies with the more reliable and complete information that they need to do their job more efficiently and effectively.

7. Year 2000 compliance

68. COSPAS-SARSAT has implemented a comprehensive programme to ensure the system’s compatibility with all aspects of the year 2000 rollover. Current and future COSPAS-SARSAT satellite constellations (both low-Earth orbit and geostationary segments) are now believed to be year 2000 compliant.

69. Furthermore, administrations that provide the ground segment components of the system have implemented programmes to achieve year 2000 compliance of the system components for which they are responsible. Moreover, the COSPAS-SARSAT Council has emphasized to responsible administrations the importance of ensuring that nationally approved 406 MHz beacons are year 2000 compliant. In addition, COSPAS-SARSAT has also contacted all manufacturers of COSPAS-SARSAT type approved beacons and received their confirmation that their approved beacons are year 2000 compliant.

70. COSPAS-SARSAT makes use of commercial communications systems to distribute distress alert information to the COSPAS-SARSAT ground-segment operations and to organizations responsible for handling distress alerts. COSPAS-SARSAT participants have made efforts to obtain confirmation from the providers of commercial services that they will be year 2000 compliant.

71. As COSPAS-SARSAT does not control the commercial communications systems however, assurances cannot be provided that the distribution of COSPAS-SARSAT distress alerts will not be affected. Thus, COSPAS-SARSAT participants have developed, to the extent feasible, contingency plans that will be implemented if communication difficulties arise as a result of year 2000 problems.

Notes

[1] See *Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-21 August 1982* (A/CONF.101/10 and Corr.1 and 2), part one, para. 430.