United Nations A/AC.105/851

General Assembly

Distr.: General
13 May 2005

Original: English

Committee on the Peaceful Uses of Outer Space

Report on the United Nations/Australia Training Course on Satellite-Aided Search and Rescue

(Canberra, 14-18 March 2005)

Contents

V.05-84366 (E) 230505 240505

I. Introduction

A. Background and objectives

1. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), in its resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development", recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States, at both the regional and international levels, by emphasizing the development and transfer of knowledge and skills in developing countries and countries with economies in transition.[1]

2. At its forty-seventh session, in 2004, the Committee on the Peaceful Uses of Outer Space endorsed the programme of conferences, symposiums, training courses and workshops planned for 2005.[2] Subsequently, the General Assembly, in its resolution 59/116 of 10 December 2004, endorsed the United Nations Programme on Space Applications for 2005.

3. The present report contains a summary of the programme content of the United Nations/Australia Training Course on Satellite-Aided Search and Rescue. Organized by the Office for Outer Space Affairs of the Secretariat as one of the activities of the United Nations Programme on Space Applications undertaken in 2005, the training course was co-sponsored by the Australian Maritime Safety Authority. The course was held in Canberra from 14 to 18 March 2005.

4. Search and rescue (SAR), utilizing state-of-the-art space technology services, is receiving worldwide attention. Most of the space-faring countries and territories have included SAR as one of their important space programme elements. The International Satellite System for Search and Rescue (COSPAS-SARSAT) provides distress alert and location information for mariners, aviators and land-based users and supports the SAR objectives of the International Civil Aviation Organization and the International Maritime Organization (IMO). The system is available to any country on a non-discriminatory basis and is free of charge for the end-user in distress.

5. 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. On 1 July 1988, those four States signed the International COSPAS-SARSAT Programme Agreement, which ensured the continuity of the system and its availability on a non-discriminatory basis. Since then, a number of other States have associated themselves with the system.

6. As a humanitarian SAR programme, COSPAS-SARSAT has been in place for over 20 years. It has provided critical assistance in terms of real-time or near real-time information support that has helped in the rescue of an estimated 18,537 persons in 5,309 SAR incidents from September 1982 to May 2005.

7. The COSPAS-SARSAT system comprises:

(a) A space segment consisting of satellites operating in low-Earth orbit (LEOSAR system) and geostationary orbit (GEOSAR system);

(b) A ground segment consisting of satellite receiving stations, known as LEOLUTs (local user terminals in a LEOSAR system) and GEOLUTs (local user terminals in a GEOSAR system), and data distribution centres, called mission control centres;

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

8. Currently, COSPAS-SARSAT is comprised of more than 1 million beacons, 10 satellites (five in low-Earth orbit and five in geostationary orbit), 60 ground receiving stations (44 LEOLUTs and 16 GEOLUTs) and 26 mission control centres. Approximately 680,000 121.5 MHz and 376,000 406 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, an increasing number of beacons are carried by non-mandated users.

9. Countries and organizations may participate in the management and the operation of the system through their association with the COSPAS-SARSAT programme. There are now 37 countries and organizations formally associated with the programme, including the four parties to the international COSPAS-SARSAT Programme Agreement (Canada, France, the Russian Federation and the United States), which provide and operate the space segment of the system.

10. From January to December 2003, the COSPAS-SARSAT system provided assistance in rescuing 1,414 persons in 366 SAR incidents, including aviation distress (93 persons in 45 SAR incidents); maritime distress (1,235 persons in 269 SAR incidents); and land distress (86 persons in 52 SAR incidents). The 406 MHz system was used in 183 of these incidents (926 persons rescued) and the 121.5 MHz system was used in the other 183 SAR incidents.

11. The purpose of the COSPAS-SARSAT system is to provide distress alert and location data. The end goal is timely and accurate delivery of the alert from the mission control centre to the appropriate SAR point of contact. Each mission control centre distributes COSPAS-SARSAT messages according to a plan set out in the system document entitled "COSPAS-SARSAT Data Distribution Plan", which defines the COSPAS-SARSAT ground communication network. COSPAS-SARSAT messages are sent in formats that permit the data to be automatically processed and transmitted. These message formats are referenced in the document entitled "COSPAS-SARSAT Mission Control Centres Standard Interface Description".

12. The LEOSAR system relays signals from 121.5 MHz beacons to LUTs, where the signals are processed to determine the location of the distress incident. LUTs forward the alert information to a COSPAS-SARSAT mission control centre for onward transmission to the appropriate SAR service. Because the satellite payloads cannot process the 121.5 MHz analogue signals to record them when out of LUT coverage, both the beacon and the LUT must be simultaneously visible to the satellite. This restriction limits detection to an area of about 6,000 km, centred on each LUT.

13. The relative movement between the satellite and the beacon imparts a Doppler frequency shift on the beacon signal, which is received by the LUT and then processed to calculate the location of the beacon. The use of low-altitude satellites

allows the low-powered transmissions of the 121.5 MHz beacons to be detected. In contrast to the 406 MHz beacons, the 121.5 MHz beacons have less stringent frequency requirements and do not provide identification information in their transmitted signal. This results in poorer location accuracy and does not provide SAR services with the ability to identify the specific beacon.

14. Operating on the internationally recognized aviation distress frequency, 121.5 MHz beacons provide a significant alerting service worldwide for commercial and general aviation. Even though 121.5 MHz beacons are not accepted in the Global Maritime Distress and Safety System of IMO for the satellite emergency position-indicating radio beacon alerting function, numerous pleasure craft and fishing vessels use these beacons extensively. In 2003, the COSPAS-SARSAT 121.5 MHz system was used in 183 SAR incidents, both on land and at sea, and provided assistance in the rescue of 488 persons.

15. In October 2000, in response to a request from IMO and decisions of the International Civil Aviation Organization, the COSPAS-SARSAT Council decided to plan and prepare for the termination of 121.5 MHz satellite alerting services on 1 February 2009. The Council also invited administrations and international organizations to note the planned phase-out date and the recommendations listed in the COSPAS-SARSAT phase-out plan for 121.5/243 MHz satellite alerting services.

16. The 406 MHz LEOSAR system provides complete coverage of the globe and operates using the same Doppler principle for beacon location as that described above for the 121.5 MHz LEOSAR system. COSPAS-SARSAT digital 406 MHz beacons have been specifically designed for use with the LEOSAR system and provide improved performance in comparison with the older 121.5 MHz analogue beacons. Specifically, the 406 MHz beacons include a digital message that allows the transmission of encoded data, such as a unique beacon identification, while the greater stability of the carrier signal at 406 MHz results in more accurate Doppler positioning. Because LEOSAR coverage is not continuous, users in distress may have to wait for a satellite to pass within the range of visibility of their beacon before a LEOSAR distress alert is produced.

17. Geostationary satellites orbit at a fixed position relative to the Earth, thereby providing continuous coverage of a specific geographical area. GEOSAR coverage is limited to about 75 degrees latitude and the GEOSAR system does not provide an independent location capability. To take full advantage of the real-time geostationary satellite alerting capability, the 406 MHz beacons have been designed to transmit position data derived from global navigation satellite systems (GNSS) in the distress messages with an accuracy of 100 metres. This allows geostationary satellites to combine immediate alerts with precise locations. Low-Earth polar-orbiting satellites are also capable of receiving these signals, thereby providing global coverage and reducing overall rescue time.

18. In making the decision to terminate the satellite processing of 121.5 MHz signals from 1 February 2009, COSPAS-SARSAT recognized that, because of the higher costs, some users might not voluntarily replace their 121.5 MHz beacons with 406 MHz models. As part of the 121.5 MHz phase-out activities, COSPAS-SARSAT has investigated technologies and possible changes to the beacon specification that would enable 406 MHz beacons to be produced at a lower cost without affecting system performance.

19. Tests conducted by COSPAS-SARSAT in 2003 demonstrated that improvements in LUT processing technology allowed a relaxation of the 406 MHz beacon medium-term frequency stability requirements without degrading the location accuracy of distress alerts. Therefore, with a view to facilitating the development of lower-cost beacons, the COSPAS-SARSAT Council approved the changes to the 406 MHz beacon specification medium-term frequency stability requirements in October 2004.

20. In July 2003, the United States approved the use of the personal locator beacon (PLB) to assist SAR efforts in the continental United States. PLB is a small hand-held device that emits a signal at 406 MHz that can be detected anywhere in the world using the COSPAS-SARSAT satellite distress alert system. The beacons are designed to be carried by individuals rather than on boats or aircraft and can only be activated manually. Each PLB has a built-in, low-power homing device that transmits on a frequency of 121.5 MHz. This enables rescuers to home in on a beacon once the 406 MHz satellite system has located those in need of rescue within a range of about 3-4 kilometres. Some newer PLBs also have integrated Global Positioning System (GPS) units. GPS-encoded signals dramatically improve accuracy of location to within 100 metres. It is estimated that 37,000 121.5 MHz and 8,500 406 MHz PLBs are in circulation.

21. Another new development for COSPAS-SARSAT is the introduction of a Ship Security Alert System (SSAS). The 406 MHz SSAS consists of two elements: a transmitter for initiating SSAS alerts and a methodology for the distribution of SSAS alert messages in the COSPAS-SARSAT ground segment. This new system contributes to IMO efforts to strengthen maritime security and suppress acts of terrorism against shipping. Modifications have been made to the COSPAS-SARSAT system to provide discreet security alerts and the COSPAS-SARSAT 406 MHz SSAS now complies with IMO requirements.

22. A specific 406 MHz beacon coding protocol is used to differentiate between a ship security alert and a distress alert. The specification agreed for the SSAS beacon provides for accurate GNSS-encoded location information in the beacon message and requires the inclusion of the vessel Maritime Mobile Service Identity number for the beacon identification. The specification prohibits the use of a homing device in order to make beacon transmissions covert.

23. The COSPAS-SARSAT specification only deals with the electrical and transmission requirements that ensure the compatibility of the SSAS beacon with the satellite processing system. Administrations, preferably through IMO, should define additional requirements for 406 MHz SSAS beacon activation and installation.

24. SSAS alerts within the COSPAS-SARSAT ground segment will be distributed using a modified version of the standard data distribution procedure. As in normal COSPAS-SARSAT operations, all LUTs will receive the 406 MHz SSAS beacon messages and retrieve the GNSS-encoded location, and LEOLUTs will generate a Doppler location. The ship security alert data will then be passed to a mission control centre, where it will automatically be routed to the mission control centre that serves the flag State identified in the beacon message, regardless of the physical location of the beacon. That mission control centre will then deliver the ship security alert to a single point of contact identified by the flag State as its

"competent authority" under the terms of the International Convention for the Safety of Life at Sea.[3] The COSPAS-SARSAT implementation of SSAS does not permit a vessel to send a ship security alert directly to the company responsible for the ship.

25. At its forty-seventh session, in 2004, the Committee on the Peaceful Uses of Outer Space noted that COSPAS-SARSAT was a cooperative venture of great significance from both political and practical standpoints. Further information on activities of the United Nations Programme on Space Applications related to COSPAS-SARSAT is contained in the reports on the United Nations workshops on space technology for the emergency aid, SAR and satellite-aided tracking system for ships in distress, held in Maspalomas, Gran Canaria, Spain, on 24 and 25 September 1998 (A/AC.105/713) and from 23 to 26 November 1999 (A/AC.105/732); in the report on the United Nations/India Workshop on Satellite-Aided Search and Rescue held in Bangalore, India, from 18 to 22 March 2002 (A/AC.105/783); and in the report on the United Nations/United States of America Training Course on Satellite-Aided Search and Rescue, held in Miami, Florida, United States, from 2 to 6 February 2004 (A/AC.105/827).

26. The Australian Maritime Safety Authority is responsible for the management and operation of the Australian ground segment of the COSPAS-SARSAT system. Distress signals are detected and relayed back to the Rescue Coordination Centre in Canberra through ground receiver stations located at Albany, Western Australia; Bundaberg, Queensland; and Wellington, New Zealand. With mandatory carriage requirements for emergency distress beacons for certain types of marine vessels and aircraft, usage of the COSPAS-SARSAT system is growing rapidly.

27. In the Oceania region, Australia and New Zealand currently participate in the COSPAS-SARSAT system by providing mission control centres and ground segment equipment. While many countries and territories have established effective SAR services, many others have not yet discovered the benefits offered by the COSPAS-SARSAT system.

28. In order for countries and territories in Oceania to benefit from these services, there is a need for capacity-building in terms of education, training and policymaking. The main objectives of the training course were therefore:

(a) To promote awareness of the COSPAS-SARSAT programme;

(b) To enhance the formal interface with the user countries in order to improve understanding and coordination of the programme activities and operations within the Oceania region.

B. Programme

29. The training course was designed to bring together operational level SAR managers, rescue coordination centre directors, deputies and designated representatives from countries and territories in the Pacific region to discuss how an understanding of the COSPAS-SARSAT system could improve SAR response in that region. In particular, the aim was to improve the operational interface among agencies in distress situations. The course also provided an opportunity to discuss regional SAR issues and foster cooperative relationships.

30. The five-day programme was aimed at sharing information about COSPAS-SARSAT and how it could be used to support SAR operations. This was achieved through a mixture of presentations by participating countries, the COSPAS-SARSAT secretariat, Australian Search and Rescue and other invited experts.

31. The training course was also designed to provide a basic, practical understanding of the COSPAS-SARSAT system. The course focused on providing the necessary information so that COSPAS-SARSAT distress alerting could be integrated effectively into national SAR systems. This was achieved through a mixture of presentations, breakout sessions and demonstrations provided by experts from the Australian Maritime Safety Authority, the National Oceanic and Atmospheric Administration and the COSPAS-SARSAT secretariat. The presentations and case studies were designed to be as relevant as possible to Pacific Ocean operations.

32. The training course was opened with welcoming statements from representatives of the Office for Outer Space Affairs, the COSPAS-SARSAT secretariat and the Australian Maritime Safety Authority.

C. Attendance and financial support

33. Over 35 scientists, educators, decision makers and engineers from the following 17 countries and territories participated in the training course: Australia, Fiji, Kiribati, Malaysia, Nauru, New Caledonia, Niue, Papua New Guinea, Samoa, Saudi Arabia, Singapore, Solomon Islands, Timor-Leste, Tonga, Tuvalu, the United States and Vanuatu. Representatives of the COSPAS-SARSAT secretariat and the Office for Outer Space Affairs participated in the training course. Representatives from private industry also participated and included GME Electrophone of Australia and EMS Technologies Canada.

34. Funds allocated by the United Nations and Australia were used to defray the cost of logistics, air travel, accommodation and daily subsistence allowance for 13 participants from developing countries in the region.

II. Summary of presentations

35. The first part of the programme involved presentations from course participants. Presentations included material on local SAR arrangements, areas of responsibility, the use of distress beacons and point of contact details. A total of 11 presentations were given by delegates from Fiji, Kiribati, Nauru, Niue, Papua New Guinea, Samoa, the Solomon Islands, Timor-Leste, Tonga, Tuvalu and Vanuatu. In addition, presentations were made by Australia, France (New Caledonia) and the Chief of Division 14 of the United States Coast Guard, based in Hawaii. Australia also made a presentation on behalf of New Zealand.

36. It was important to include the presentations of Australia, France, New Zealand and the United States as these States can provide long-range SAR assets for response in the South Pacific region when the required SAR response action is beyond the resources of smaller Pacific island countries and territories. Many of the Pacific island countries and territories have SAR arrangements with those larger

countries. Kiribati and Tuvalu are located within the Fiji SAR region, while American Samoa, the Cook Islands, Niue, Samoa and Tonga are located within the New Zealand SAR region.

37. Although each country and territory represented has unique circumstances in terms of history, geography, administration, maritime operations, air routes, trading and communications, the training course provided an opportunity to identify common and distinct approaches that could be shared to improve safety and SAR response in the region.

38. Presentations and demonstrations were made on the components of the COSPAS-SARSAT system, including:

(a) Distress beacons;

(b) The space segment;

(c) The ground segment including LUTs and mission control centres;

(d) Data distribution and rescue coordination centre feedback;

(e) COSPAS-SARSAT rescue coordination centre message formats.

39. The training course involved a visit to the Rescue Coordination Centre in Canberra. This gave course participants the opportunity to observe and discuss aviation and maritime SAR operations, as well as the Australian mission control centre and LUT displays.

40. The programme included briefings from the Australian SAR resources personnel on fixed-wing and helicopter operations. The course participants travelled by bus to the New South Wales coastal town of Ulladulla to embark in a boat and observe a SAR demonstration involving a fixed-wing aircraft life raft drop and helicopter winching operations.

41. The course explored the linkage between the COSPAS-SARSAT system and SAR operations and covered rescue coordination centres, SAR points of contact, intelligence-gathering in SAR, direction-finding operations and beacon false alerts. A particular feature of this section of the course was the activation of a distress beacon and the observation of a satellite pass, the Doppler curve being detected and the resultant distress alert being displayed in a rescue coordination centre message format. This was an opportunity to demonstrate various aspects of the COSPAS-SARSAT system and indicate the features important to SAR operations.

42. Participants were provided with an opportunity to study the technology used in SAR and to explore the future of the COSPAS-SARSAT system, including presentations on Medium Earth Orbit SAR, low-cost beacons, SSASs employing COSPAS-SARSAT and rescue coordination centre technologies (SAR planning tools, web tools, incident management systems and drift planning tools).

43. The final day of the course consisted of breakout sessions to explore the important aspects of beacon registration and the options for establishing national databases versus using the International Beacon Registration Database. The final breakout session was used to emphasize the important points to take home from the training course, including a clear understanding of distress alert distribution in the Pacific region and an understanding of subject indicator-type formats.

44. A questionnaire was distributed among the participants; after being processed and analysed, the results were discussed during the final breakout session.

45. As per the request of Malaysia, the Office for Outer Space Affairs provided assistance to Malaysia to initiate the process of joining the COSPAS-SARSAT system. Malaysia was invited to attend the training course and held consultations with various representatives during the course on the technical and legal aspects of becoming a signatory to the COSPAS-SARSAT system.

III. Observations and recommendations

A. General observations

46. The training course was considered successful and well organized. A particular feature of this course was the interaction between participants in a relatively informal atmosphere, as the group was small enough to facilitate active participation and networking.

47. In general, all participants improved their understanding of the COSPAS-SARSAT system, with some participants being exposed to the system for the first time. The training course provided an opportunity for participants to develop working relationships that will continue in the operational environment. The interaction between countries and territories and the country coordinating the SAR service in which they were located was notable. These discussions continued beyond the formal course hours.

48. The Rescue Coordination Centre Australia has already received feedback suggesting a follow-up activity in some island countries and territories.

49. The case studies involving rescue coordination centre actions and the rationale relating to particular distress beacon alerts were well received by participants. The national SAR reports were considered valuable by many and provided the basis for comparison and discussions.

50. The opportunity for participants to update SAR point of contact details was valuable.

B. Recommendations

51. Participants recommended that mutual cooperation and communication among participating countries and territories be promoted. Participants highlighted the value of cooperation in establishing beacon databases in South-West Pacific countries and territories. It was suggested that better-resourced countries could assist small Pacific island States with SAR resources and the development of procedures. Countries and territories within each search and rescue region should develop plans and procedures for SAR operations within that region.

52. Future training in COSPAS-SARSAT and SAR, with sponsorship provided by developed countries, was recommended. It was also suggested that follow-up workshops be conducted in the region to identify the SAR capabilities of each country or territory.

53. Regular communication exercises should be conducted to ensure that all contact information is up to date. It was suggested that the next training course be held in the Pacific islands and be extended to two weeks' duration, to include SAR planning methods, manual methods and/or computer training.

C. Conclusion

54. The Office for Outer Space Affairs and the Australian Maritime Safety Authority conducted a highly successful training course on satellite-aided SAR for the benefit of Pacific island countries.

55. Through the cooperation and participation of Pacific island States, the secretariat of COSPAS-SARSAT and partners from industry, the training course met its intended objectives.

Notes

[1] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1, sect. I, para. 1 (e) (ii), and chap. II, para. 409 (d) (i).

[2] *Official Records of the General Assembly, Fifty-ninth session, Supplement No. 20* (A/59/20), para. 71.

[3] United Nations, *Treaty Series*, vol. 1184, No. 18961.