International Civil Aviation Organization
North American, Central American and Caribbean Office

WORKING PAPER

SAR/CM — IP/05
31/10/18

NAM/CAR Search and Rescue (SAR) Implementation and Civil-military Coordination Meeting (SAR/CM)
Mexico City, Mexico, 5 – 7 November 2018

Agenda Item: 1 **Global and Regional Search and Rescue (SAR) Matters**
1.2 Global and Regional Status of COSPAS-SARSAT Coordination

REPORT ON THE COSPAS-SARSAT SYSTEM STATUS

(Presented by United States)

EXECUTIVE SUMMARY	
This document provides information on the status of the International Cospas-Sarsat Programme as at 10 August 2018.	
Action:	The suggested actions are presented in Section 3
Strategic Objectives:	• Safety

1. Introduction

1.1 The Cospas-Sarsat system is evolving into a new satellite system called Medium Earth Orbit Search and Rescue MEOSAR. This includes the need for compatible ground stations and it supports the second generation 406 MHz distress beacon. The MEOSAR system was declared at the early operational capability (EOC) phase in December 2016. The International Cospas-Sarsat Programme routinely submits papers on its status to international meetings and makes presentations at various regional and global SAR meetings.

2. Cospas-Sarsat Programme Status

2.1 The International Cospas-Sarsat Programme provided information on its status to the 17-21 September 2018 session of the ICAO/International Maritime Organization (IMO) Joint Working Group on SAR. The Appendix to this paper contains the information presented to the ICAO/IMO JWG. This meeting may want to discuss the value of such status reports. The International Cospas-Sarsat Programme routinely submits papers and makes presentations on its status to international meetings. These presentations have been made to several ICAO regional forums, including this region in the past. This meeting may want to consider inviting Cospas-Sarsat to make a presentation at a future meeting.

3. Suggested Actions

3.1 The meeting is invited to:

a) note the information provided in the Appendix to this paper on the status of the International Cospas-Sarsat Programme;

b) discuss if this type of status report would be helpful for future meetings; and

c) consider inviting the International Cospas-Sarsat Programme to make a presentation to future meetings on its status and, as appropriate, address operational issues.

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APPENDIX

Extract of Report on Cospas-Sarsat System Status provided to the September 2018 session of the ICAO/IMO Joint Working Group on SAR

System operation

1 In 2017, based on preliminary information, Cospas-Sarsat alert data assisted in 934 distress incidents (876 in 2016) and 2,554 persons were rescued (2,057 in 2016). Since September 1982, the Cospas-Sarsat System has provided assistance in rescuing at least 46,361 persons in 13,598 SAR events.

2 The geographic distribution of all reported SAR events for which Cospas-Sarsat alert data was used in 2017 is presented in Figure 1 and the distribution of all SAR events (maritime, aviation and PLB) for the period from January to December 2017 is shown at Figure 2. Participants often provide recent SAR cases supported by Cospas-Sarsat for publication on the Cospas-Sarsat webpage and Facebook page; ICAO/IMO JWG participants are invited to monitor and contribute to this page.

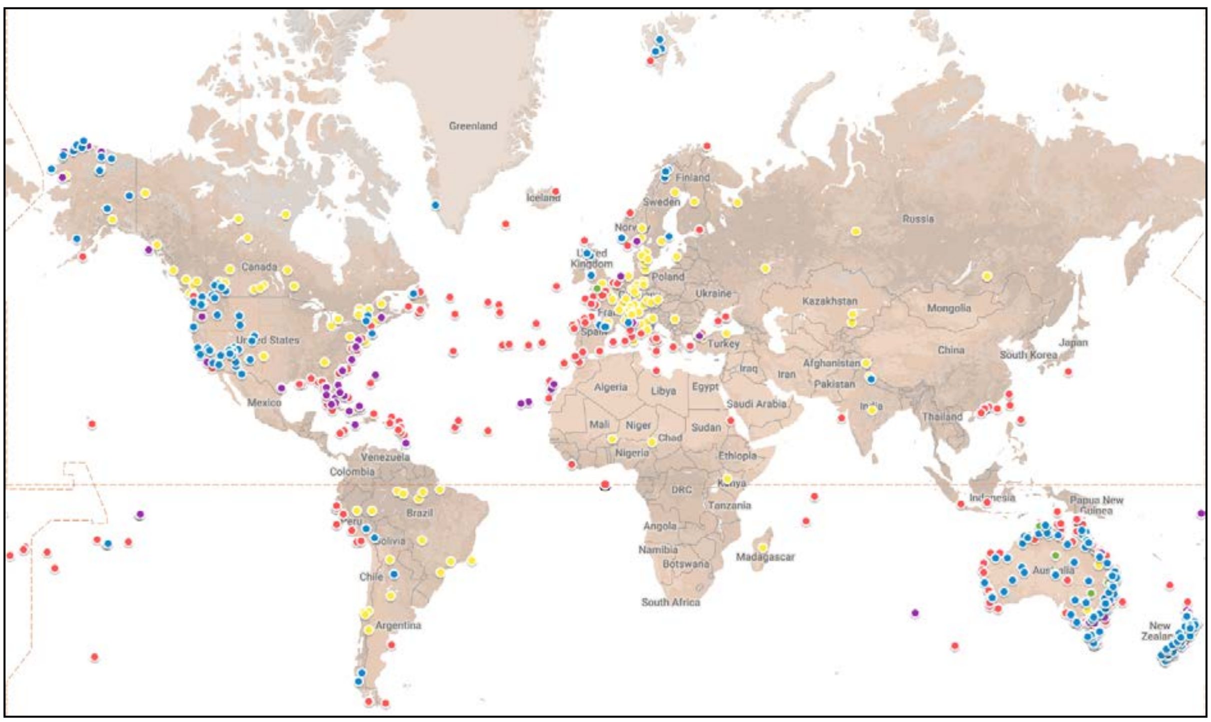

Figure 1: 2017 Distribution of SAR events*

*Legend: ELTs (yellow), EPIRBs(red), Land PLBs (blue), Aviation PLBs (green), Maritime PLBs (purple)

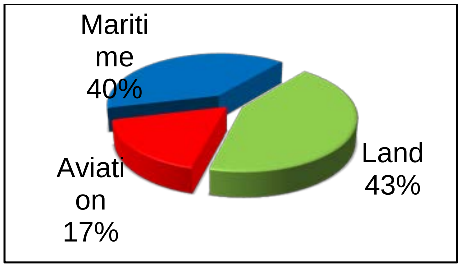

Figure 2: 2017 Type of SAR events

3 Based on the data provided by Participants, Cospas-Sarsat calculates two false alert rates, identified for convenience as the "SAR false alert rate" and the "beacon false alert rate". The SAR false alert rate, which characterises the impact of false alerts on SAR services, is the percentage of false alerts plus undetermined alerts (no person in distress found; no beacon found) over the total number of alerts transmitted to SAR authorities. Table 1 below shows the evolution of the false alert rate computed from a SAR perspective. Table 2 below shows the evolution of the 406 MHz beacon false alert rate (ratio of false plus undetermined alerts over the estimated beacon population) since 2013. In 2017, the SAR false alert rate was 96.8%, i.e. about one real alert in 31 alerts received.

Year	*Rate*
2013	95.0%
2014	96.5%
2015	96.3%
2016	96.7%
2017	96.8%

Table 1: SAR false alert rate

Year	EPIRBs	ELTs	PLBs	ALL
2013	0.9%	5.1%	0.4%	1.2%
2014	0.8%	4.5%	0.4%	1.2%
2015	0.7%	4.2%	0.4%	1.1%
2016	0.8%	4.2%	0.4%	1.1%
2017	0.9%	4.4%	0.4%	1.3%

Table 2: 406 MHz beacon false alert rate

4 Figure 3 shows the number of SAR events and persons rescued with the assistance of Cospas-Sarsat alert data for the period from January 1994 to December 2017.

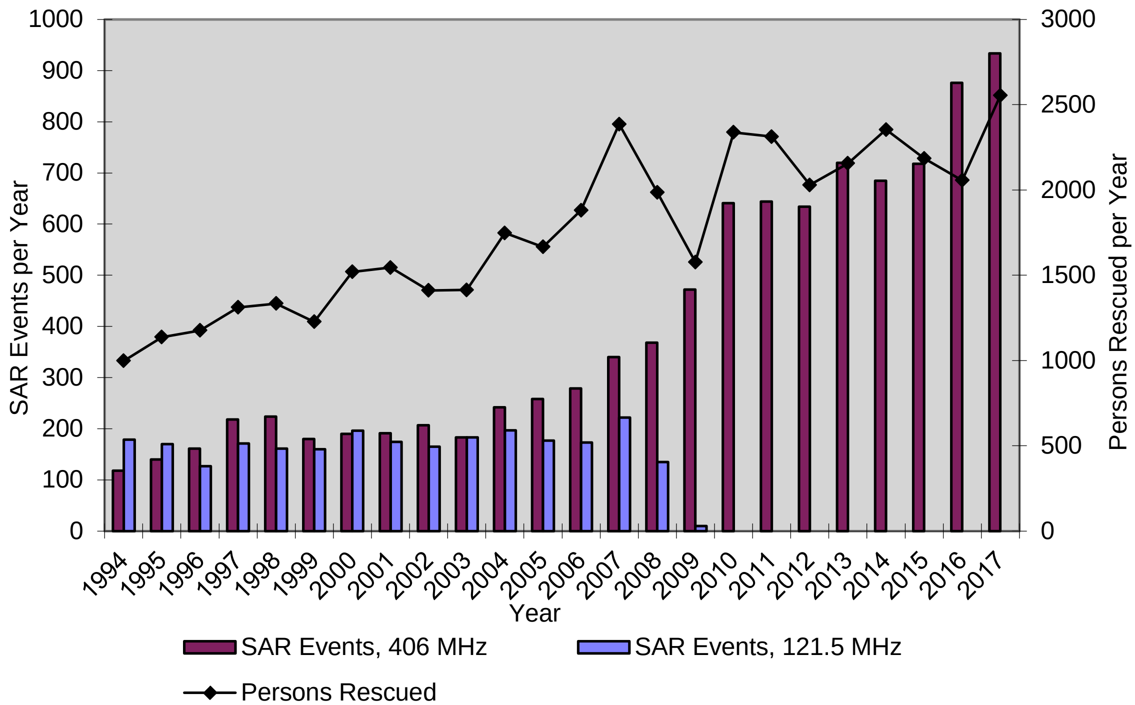

Figure 3: Number of SAR events and persons rescued with the assistance of Cospas-Sarsat alert data (January 1994 to December 2017)

406 MHz beacons

5 Based on estimates made by Administrations using a formula based on beacons registered modified by a calculated registration rate, there were just over 2 million (2,098,678) beacons operating at 406 MHz in use worldwide at the end of 2017, an increase of about 5% over that reported in 2016 (1,997,403).

6 Based on an annual survey of beacon manufacturers, the ratio of production of beacons capable of acquiring position data from GNSS satellites (such as GPS, Glonass and Galileo) and encoding this position information into the transmitted alert data ("location protocol beacons") was 65.4% in 2017 (74% in 2016, 70.5% in 2015 and 66.7% in 2014). We now estimate that about 59% of beacons deployed globally are coded with location protocols.

7 A performance measure instituted by Cospas-Sarsat in 2009 assesses "percentage of detected beacons that are registered" using data collected from Participants. This data is shown in Table 3.

Year	EPIRB	ELT	PLB	Totals

	Number of beacons registered / Number of detections	Percent (%)	Number of beacons registered / Number of detections	Percent (%)	Number of beacons registered / Number of detections	Percent (%)	Number of beacons registered / Number of detections	Percent (%)
2013	5,362 / 7,126	75.2	6,997 / 10,867	64.4	1,135 / 1,611	70.5	13,494 / 19,604	68.8
2014	4,933 / 6,414	76.9	7,007 / 10,451	67.0	1,179 / 1,582	74.5	13,119 / 18,447	71.1
2015	5,672 / 7,412	76.5	7,606 / 11,276	67.5	1,363 / 1,907	71.5	14,641 / 20,595	71.1
2016	5,875 / 7,446	78.9	7,778 / 11,356	68.5	1,629 / 2,157	75.5	15,282 / 20,959	72.9
2017	7,515 / 9,489	79.2	9,266/ 13,236	70.0	2,119 / 2,829	74.9	18,900 / 25,554	74.0

Table 3: Percentage of detected beacons that are registered (2013 - 2017)

8 Cospas-Sarsat operates the International 406 MHz Beacon Registration Database (IBRD, https://406registration.com/) which is freely available to users residing in nations that do not provide their own national registration facilities. By allowing their beacon users to register beacons in the IBRD, Administrations help to facilitate proper registration by beacon owners while avoiding administrative costs and inconvenience to their governments. Administrations may also avail themselves of the facility to upload their national beacon registration data to the IBRD to ensure that it is available 24/7 to other SAR services when they receive alerts from active beacons in their SAR area of responsibility. The IBRD is available for 406-MHz beacon registration for 165 Administrations (national and territorial). As at 1 August 2018, there were 77,397 beacons registered in the IBRD (71,372 at 1 August 2017) from 147 Administrations. Since 2015, on average 402 SAR users per month have logged into the IBRD to search for beacon registration information.

9 Cospas-Sarsat is in the process of redesigning the IBRD user interface. The user interface will be easier to understand and navigate, will provide better support for emerging SGB and RLS functionality, and should be available online by late 2018.

The System

10 As of 10 August 2018, five LEOSAR and seven GEOSAR spacecraft were in operation, supported by 57 LEOLUTs, 27 GEOLUTs and 31* MCCs (Figure 4) The Nigerian ground segment is currently not operational and Nigeria is supported as a SPOC of the Spanish MCC. New ground segment equipment in Cyprus, Malaysia and Qatar is currently under development.

Figure 4: Locations of commissioned mission control centres

11 The MEOSAR system was declared at the early operational capability (EOC) phase in December 2016 and its space segment currently comprises 15 fully operational Galileo satellites and 19 GPS DASS satellites (with an S-band downlink). A Russian Glonass satellite is available for test and development. The full MEOSAR constellation will comprise more than 70 satellites. The MEOSAR system is currently supported by three commissioned MEOSAR-capable MCCs (in France, Norway and the United States). Sixteen additional MCCs plan commissioning by the end of 2018. Thirteen MEOLUTs (with up to 80 channels) are commissioned at EOC and seven additional MEOLUTs (with up to 34 channels) are available for testing. At least 18 more MEOLUTs are planned for between 2018 and 2020.

12 Full details of the operational space and ground segments are available on the Cospas-Sarsat website (https://cospas-sarsat.int).

Performance measurement: Cospas-Sarsat assisted SAR events

13 As part of its Quality Management System, and to meet the goals and objectives of its strategic plan, Cospas-Sarsat developed a set of performance measures. Because the purpose of Cospas-Sarsat is to assist in the saving of lives, a performance measure of the evolution of the number of SAR events annually where Cospas-Sarsat assisted and provided the only alert was developed to evaluate the relevance of the System. Figure 5 provides twenty-five years of data and clearly indicates the continued relevance of the Cospas-Sarsat System; further details with all alerts by environment are in Figure 6.

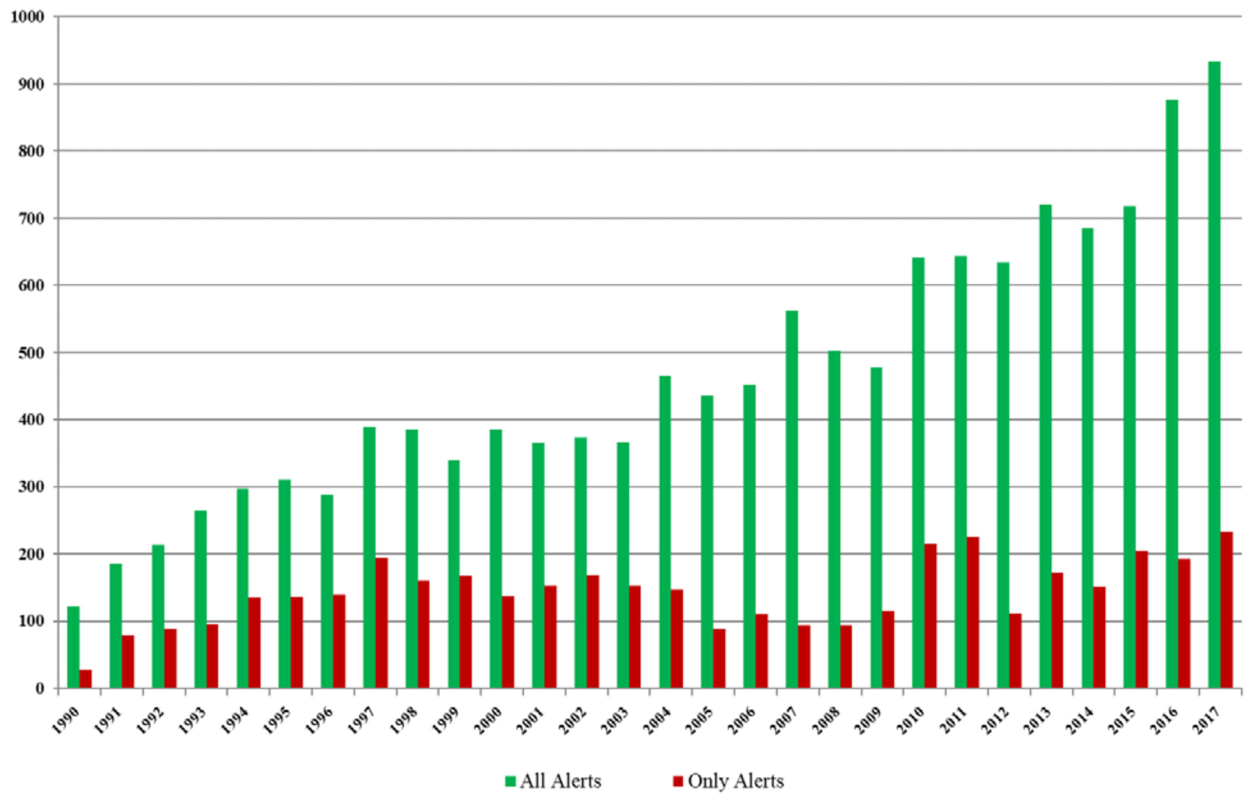

Figure 5: Annual Number of SAR events where Cospas-Sarsat assisted or provided the only alert (1990 - 2017)

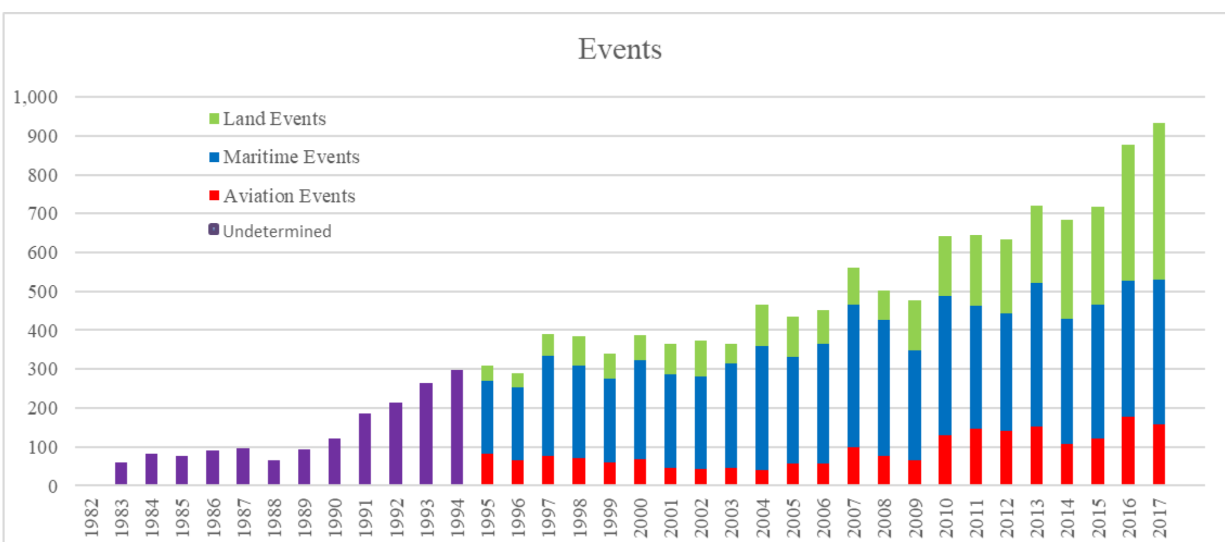

Figure 6a: Annual number of SAR events by environment (1982-2017)

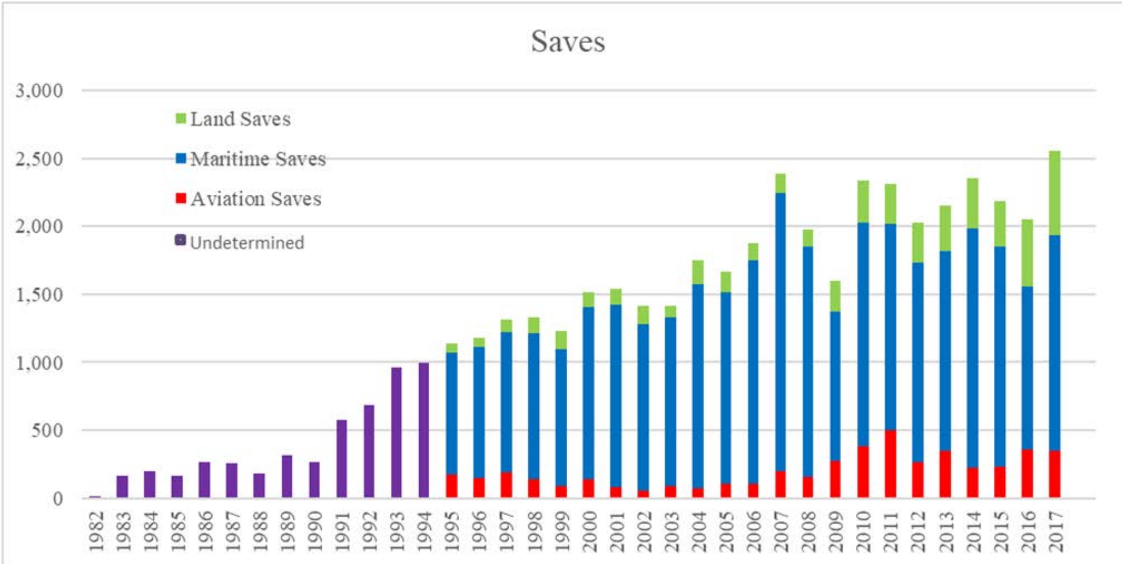

Figure 6b: Annual number of lives saved by environment (1982-2017)

SPOC Communication

14 As a result of actions taken to address the matter of non-responsive SPOCs, Cospas-Sarsat started in 2008 regular testing of MCC/SPOC communications. COMSAR 13 requested Cospas-Sarsat to report on these MCC/SPOC communication tests. The following information is a summary of results for the period October 2008 to August 2018. For that period, 22 of 31 operational MCCs reported results of MCC/SPOC communication tests results (some MCCs do not support SPOCs outside of their country and therefore are not required to conduct these tests). In 2017, the last year for which there is complete data, 2,860 unique tests were conducted and a total of 25,005 unique tests have been conducted for the entire test period.

	2013	**2014**	**2015**	**2016**	**2017**	**Number[1] 2018**	**Percent * 2018**
Number of SPOCs tested by MCCs	160	152	157	163	157	154	
Non-responsive SPOCs (no response to tests)	10.6%	12.5%	12.1%	7.98%	11.46%	17	11.03%
Rarely-responsive SPOCs (less than 20% successful tests)	8.75%	3.9%	4.46%	7.36%	8.28%	8	5.19%
SPOCs with low success ratio (between 20 and 50% successful tests)	11.25%	9.2%	7.0%	7.98%	5.09%	14	9.09%

[1] 2018 incomplete (approximately 1/3 of expected) results as reported through August 2018

Insufficiently-responsive SPOCs	**30.60%**	**25.6%**	**23.56%**	**23.32%**	**24.84%**	39	**25.32%**

Table 4: SPOC communication test results (2013 - August 2018)

15 For the purpose of the statistics in Table 4, a success means that the requested positive feedback (not an automatic acknowledgement) was received from the SPOC. Non-responsive SPOCs were those SPOCs which did not provide any response. When available, several communication links (e.g. AFTN, Fax, Phone, E-mail, FTP, Telex, X.25) were tested each month. In many cases, each available link was tested separately and counted as a unique test. The list and map of non-responsive SPOCs are provided in Table 5 and Figure 7, respectively.

Non-responsive SPOCs (No response to tests)	**Rarely responsive SPOCs** (Less than 20% successful tests)	**SPOCs with low success ratio** (Between 20 and 50% successful tests)
Benin (Republic of) Central African Republic Chad (Republic of) Congo (Republic of the) Djibouti (Republic of) Equatorial Guinea (Republic of) Eritrea Gabonese Republic Guinea (Republic of) Guinea-Bissau (Republic of) Kuwait (State of) Mali (Republic of) Palestine (In accordance with Resolution 99 Rev. Antalya, 2006) Sao Tome and Principe (Democratic Republic of) South Sudan Syrian Arab Republic Tajikistan Yemen (Republic of)	Botswana (Republic of) Cameroon (Republic of) Cape Verde (Republic of) Côte d'Ivoire (Republic of) Ethiopia (Federal Democratic Republic of) Gambia (Republic of the) Ghana Liberia (Republic of) Mauritania (Islamic Republic of) Rwanda (Republic of) Senegal (Republic of) Sierra Leone Sudan (Republic of the)	Hungary (Republic of) Kazakhstan (Republic of) Moldova (Republic of) Romania Somali Democratic Republic Suriname (Republic of) Togolese Republic Turkmenistan

Table 5: 2017 List of non-responsive SPOCs

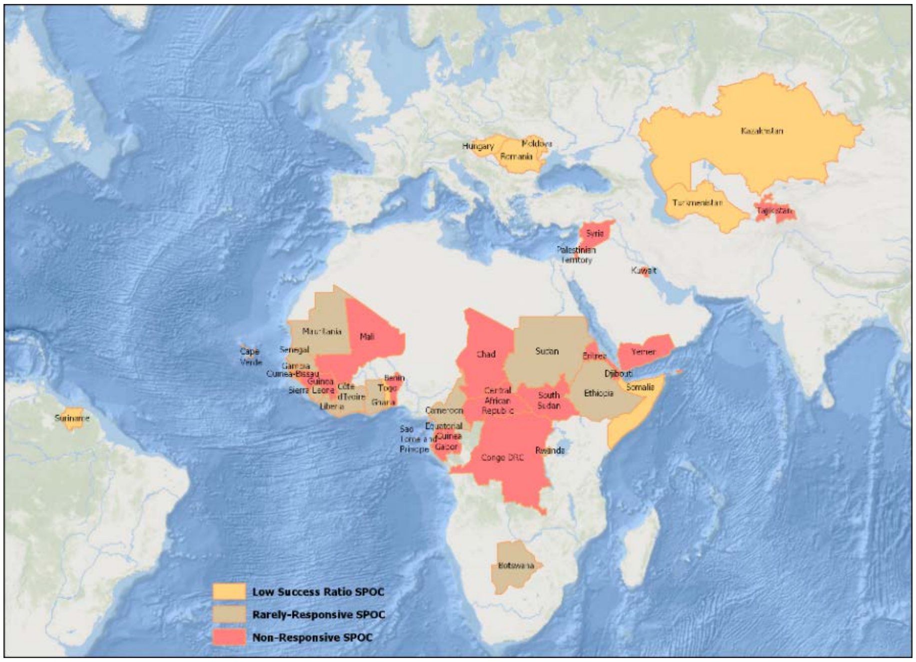

Figure 7: 2017 Map of non-responsive SPOCs

16 Results for 2017, and available results for 2018, indicate that the percentage of SPOCs that are insufficiently responsive or non-responsive to communication tests SPOCs rates remains consistent with prior years. Kuwait, which had an 82% response rate in 2016, was non-responsive in all 11 tests conducted by its supporting MCC (Saudi Arabia) in 2017. In a change from previous years, in 2017 Botswana (10 tests/ 1 response) and Rwanda (10/1) joined the list of rarely responsive SPOCs, and Kazakhstan (30/14) had a low success ratio.

17 In 2015, the Cospas-Sarsat and ICAO Secretariats jointly developed a draft model agreement for use by MCCs and their SPOC to assist in addressing the issue of poor SPOC communications. In June 2016, the first agreement was concluded between the Italian MCC and Serbia SPOC, followed by an agreement in August 2018 with the Sudan SPOC. The UKMCC concluded an agreement with the Ireland SPOC in February 2018. The model agreement can be found on the Cospas-Sarsat website (https://www.cospas-sarsat.int/en/documents-pro/document-templates).

Beacon developments

18 In response to ICAO's development of the Global Aviation Distress and Safety System (GADSS), Cospas-Sarsat is developing specialized ELTs for distress tracking (DT). An ELT(DT) is expected to be activated on an aircraft in flight, moving at speeds up to 1,000 km/hour while it is transmitting. An ELT(DT) will transmit a sequence of cancellation messages if it is deactivated by the same means by which it was activated.

19 In 2018, an experts' working group made progress on second generation beacon and ELT (DT) specifications, which will be further reviewed by the Joint Committee. This includes:

.1 an agreement to recommend a minimum duration of continuous operations for ELT-DTs of 370 minutes;

.2 the development of specifications for the use of an external aircraft electrical power source and development of a test methodology to verify compliance with this new allowed power source;

.3 an amended methodology to verify the performance of GNSS receivers for ELT-DTs;

.4 a proposed acceptance process for beacon approval test facilities wishing to extend their test capabilities to address ELT-DTs, RLS, SGBs;

.5 developed beacon message processing requirements for GEOLUT processing ELT(DT)s; and

.6 proposed changes to SGB message bit assignments.

System enhancements

20 Future enhancements to System operations (Figure 8) continue to focus primarily on development of technical specifications for the next-generation space segment (MEOSAR), ELTs for (in-flight) distress tracking (ELT(DT)s), the Return Link Service (RLS) and second-generation beacons (SGBs). Task Group meetings on development of the technical (April 2018) and operational (June 2018) specifications and documentation to support these developments took place. To rapidly progress towards the 2021 Global Aviation Distress and Safety System (GADSS) implementation deadline, at the CSC-60 session in June 2018, the Council exceptionally approved revisions to the beacon and MEOLUT specifications contained in eight technical documents.

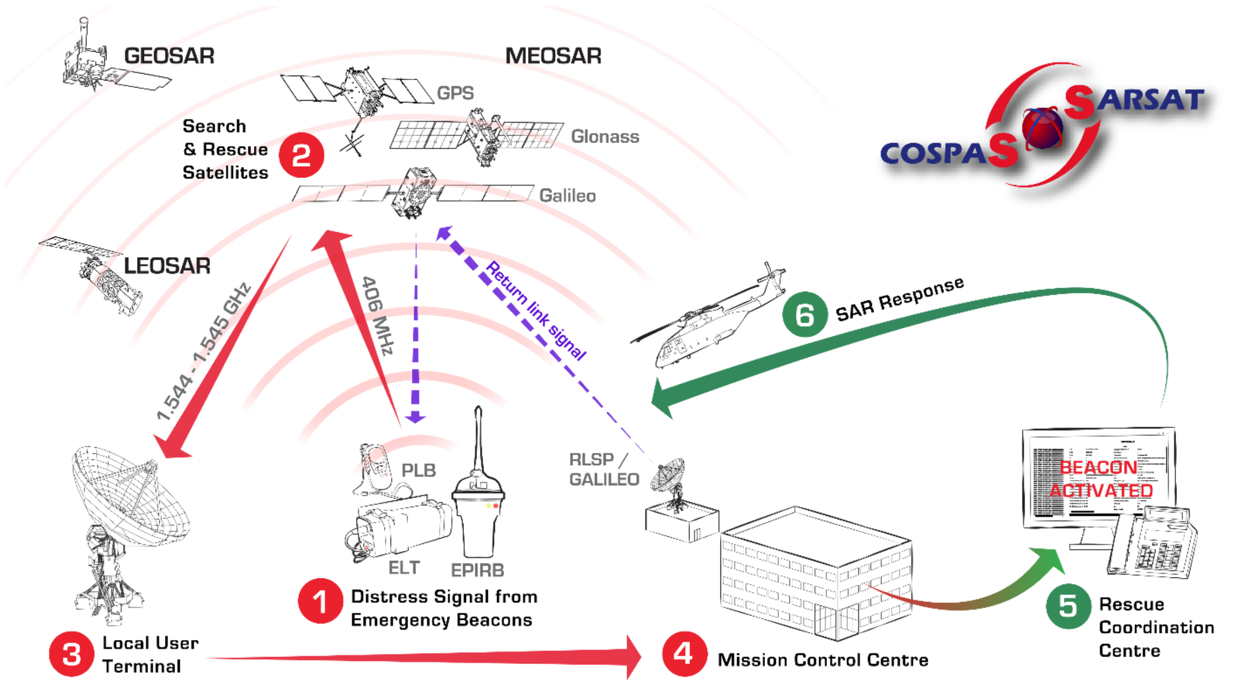

Figure 8: The Cospas-Sarsat System concept

21 The technical specifications for Second Generation Beacons (SGBs) have been issued alongside a preliminary type approval standard for these new beacons. Both the SGB and current generation beacon standards now include specifications for the Return Link Service (RLS) and the MEOLUT specification now addresses moving beacons (e.g. beacons adrift at sea). Cospas-Sarsat has been working with RTCA and EUROCAE to develop revised ELT specifications which would include new beacon types such as SGB ELTs and ELT(DT)s, which should be approved by those organizations by the end of 2018, with the associated minimum performance standards put into effect by the United States FAA and EASA in early 2019. Cospas-Sarsat ground segment specifications have also been modified to address processing of SGBs, ELT(DT)s and RLS beacons (December 2018); the implementation status will be assessed at the JC-32 meeting in October 2018.

RCC training material and public relations

22 In order to support use and understanding of new System developments at the RCC level, a new issue of document C/S G.007, "Handbook on Distress Alert Messages for Rescue Coordination Centres (RCCs), Search and Rescue Point of Contacts (SPOCs) and IMO Ship Security Competent Authorities", which includes the MEOSAR system, was revised in February 2018. A series of training videos designed for use alongside the RCC Handbook in SAR training courses has been developed and is available free-of-charge on YouTube (https://cospas-sarsat.int/en/search-and-rescue/programme-videos-en).

Status of the MEOSAR system development

23 Operational MEOSAR alert data distribution to SPOCs and RCCs began after the Council, at the CSC-57 meeting in December 2016, declared the MEOSAR system at early operational capability (EOC). The MEOSAR system should attain the global coverage required for First Generation Beacon (FGB) Full Operating Capability (FOC) in 2020, with initial deployment of enhanced second generation 406 MHz Distress Beacons (SGB) anticipated in 2019. MEOSAR is backward compatible with current generation (document C/S T.001 compliant) beacons and will provide a return link service to acknowledge the reception of the distress message. The SGB design is optimized for the MEOSAR system and will provide improved detection and location accuracy and enhanced data fields.

24 A 2018 task group progressed MEOSAR system evolution by developing:

.1 detailed alert distribution procedures for ELT-DTs and SGBs;

.2 amendments to SGB message protocols; and

.3 awareness of the EC conduct of MEOSAR D&E test O-5 (Return Link Service):

  .1 96.5% of RLM messages received within 15 minutes with an incomplete constellation (requirement of 99% is expected to be achieved with the full constellation of 24 satellites);

  .2 new international test campaign using RLS beacons worldwide proposed to validate the end-to-end system (possibly considering more challenging environments); and

  .3 RLS beacon testing phases to be conducted in early 2019, before the RLS operational declaration.

— END —