



**Beacon Manufacturers Workshop (BMW)
September 20, 2019
Portsmouth, Virginia**

MINUTES

NOTES:

Complete Workshop presentations and other information are posted on the NOAA SARSAT website (www.sarsat.noaa.gov) under the 'SARSAT Meetings' tab; some of the presentations include additional information not included in these minutes.

1. Opening

The Chair, Mr. Mickey Fitzmaurice (NOAA), welcomed the participants. Panelists and other participants introduced themselves. Enclosure (1) lists the Workshop participants and their professional affiliations.

The Chair also thanked RTCM for hosting the meeting and Mr. Hoffman (RTCM/ACR) welcomed the participants on behalf of RTCM.

Minutes of the 2018 Workshop were accepted by the meeting.

The Chair called attention to a 406 MHz beacon promotion poster available in print or online.

Special Mention:

During the meeting, the Chair recognized the contribution of Mr. Dan Lemon on his retirement from the SARSAT Program. Mr. Lemon has been an integral part of the SARSAT Program since 1982, first serving as the USCG Chief, Coordination Division, Office of Search and Rescue, and then as a subject matter expert to the NOAA SARSAT team since 2006. Mr. Fitzmaurice noted the many accomplishments in the program including his invaluable support for the Beacon Manufacturer's Workshop.

2. Prior Action Items

The Workshop reviewed prior action items and noted that two had been completed; those that remained open are included in enclosure (2).

The following points were made during discussion of BMW-2018-AI.1 that obligated NASA to provide, if possible, MATLAB tools for measuring signal characteristics:

- Mr. Watson (NASA) said that if the NASA software is released to the public, the public would be responsible for any further modifications to it
- Mr. Hoffman entertained the idea of Cospas-Sarsat taking and maintaining the MATLAB code so all labs would use the same software
- Mr. Watson questioned whether all labs should necessarily be required to use the same software, and if they did, whether they would all manage it the same

way? It was also noted that using different processing could provide some useful cross-checks between results of the different labs

- The Chair pointed out that it's a challenge to obtain clearances for release of government software, and that the matter of NASA publishing periodic changes should be considered apart from the Workshop

3. Cospas-Sarsat Update

Mr. St Pierre (Cospas-Sarsat) covered several topics of interest to manufacturers. He began by reviewing the mission, objective and strategy of the Cospas-Sarsat Program, and showed a list of the 45 countries participating in Cospas-Sarsat (which represent 75% of the world's population).

Participants include the four Parties (Canada, France, Russia and the U.S.). The number of countries contributing to the System's ground segment (local user terminals (LUTs) and mission control centers (MCCs) had grown to 32.

Cospas-Sarsat System

The space segment includes LEO, MEO and GEO (low, medium and geosynchronous orbits, respectively) satellite constellations that relay signals from distress beacons via the ground system to SAR authorities. MCCs receive distress alerts from LUTs or other MCCs and distribute them to appropriate SAR authorities worldwide.

The system had grown to the point that multiple satellites were typically available to detect and relay a beacon signal at any time, and multiple LUTs were typically available to process and forward the signal. The number of space and ground components was continually growing.

In September 2019, a rough snapshot of the rapidly growing operational system included:

- Five LEO satellites, nine GEO satellites and 38 MEO satellites
- 59 LEOLUTs, 26 GEOLUTs and 17 MEOLUTs
- 30 MCCs, five of which were at early operational capability (EOC) for the MEO system (MEOSAR)

MEOSAR, which was intended to replace LEOSAR as the main the Cospas-Sarsat system, is expected to include satellites from multiple constellations: the U.S. SAR/GPS System (L-band downlink) and Distress Alerting Satellite System (DASS, S-band); the European SAR/Galileo System (L-band); the Russian Glonass System (L-band); and possibly the Chinese SAR/Beidou System. The MEO satellites operational so far were from SAR/DASS and SAR/Galileo. By the end of 2021, the number of MEO satellites was expected to reach 60 and to grow to 80 by 2030.

MEOSAR was intended to:

- Reduce time to deliver distress alerts and positions
- Allow better tracking of moving beacons
- Accommodate more flexibility in beacon design
- Allow more services to be provided

Distress Beacons and Rescues

The estimated population of beacons in use worldwide had grown to about two million, nearly double the number in 2010. [The presenter did not break down the population by beacon type.]

Cospas-Sarsat had enabled the rescue of about 50,000 persons so far, including 2,185 in 2018 (average of about six rescues per day). The 2018 rescues entailed about 15% aviation saves, 28% land saves, and 57% maritime saves.

The Chair noted that many lives are saved each day that are not attributed to Cospas-Sarsat because the beacon alert was the not the first means of notification received for the distress; however, the System still receives and processes alerts for these cases and often contributes in various ways to the rescue.

Cospas-Sarsat is working on:

- ELT(DT)s for triggered-in-flight tracking of aircraft when distress situations occur; these would enhance the chance of locating an aircraft accident site; other organizations with requirements for ELT(DT)s include the International Civil Aviation Organization (ICAO), the European Union Aviation Safety Agency (EASA), and the Radio Technical Commission for Aeronautical Services (RTCA)
- 406 MHz second generation beacons (SGBs) that operate with a spread spectrum rather than on a narrow-band, first generation beacons (FGBs) that SGBs are expected to replace; Cospas-Sarsat specs for FGBs are in Document T.001, and for SGBs are in Document T.018; SGBs provide more accurate distress locations, less susceptibility to interference and the possibility of additional information to aid search and rescue (SAR) operations
- Return link service (RLS) distress beacons intended to provide an acknowledgement to the beacon user that the beacon's signal had been received and the location confirmed

Mr. St Pierre also covered additional developments under consideration that can be seen in his presentation.

Beacon type approval test labs for FGBs would have to comply with additional requirements and be accepted by Cospas-Sarsat for testing SGBs and ELT(DT)s; some labs were expected to be available to conduct tests in early 2020. However, manufacturers can submit applications for these new beacons to be reviewed in parallel to the Cospas-Sarsat certification process of the labs for testing the new beacons.

Background on ELT(DT)s

ELT(DT)s are intended to be tracked by the MEOSAR system when the ELT is activated in flight to help locate the aircraft accident site in case no post-crash alert is received. The incentive for Cospas-Sarsat to develop provisions for ELT(DT)s for large aircraft derived largely from EASA and ICAO requirements (CAT.GEN

MPA.210 and ICAO Annex 6, Section 6.18, respectively). ICAO provides for locating the accident site within six nm.

EASA requirements become applicable on January 1, 2023, and EASA would provide implementing guidance in RMT.0400 to be available around Oct/Nov 2019.

ICAO was developing requirements for a Location of an Aircraft in Distress Repository (LADR) to make alerts available from autonomous distress tracking (ADT) technologies such as ELT(DT)s and would be discussing whether to delay the equipment carriage effective date it had set at January 1, 2021. ADT and LADRs are part of ICAO's Global Aeronautical Distress and Safety System (GADSS).

National rules and standards applicable to ELT(DT)s include:

- RTCA DO-204B approved in late 2018
- FAA TSO 126c (incorporates DO-204B by reference) was approved in March 2019 with an effective date of September 7, 2020
- EUROCAE ED-62B expected to be approved by the end of 2019
- EASA ETSO C126c (incorporates ED-62B by reference) expected to be published around the beginning of 2020

Cospas-Sarsat was expected to approve changes to its ELT(DT) specs this year related to FGB and SGB ELT(DT) coding, post-crash data transmission rates for ELT(DT)s designed to withstand crashes, and provisions for ELT(DT)s combined with automatic ELTs.

The Cospas-Sarsat Secretariat could be contacted for more information on any of the topics discussed above.

4. MEOSAR/MCC Updates and Plans for IOC

MEOSAR was being implemented in the following stages:

- Early operational capability (EOC, current stage)
- Initial operational capability (IOC)
- Full operational capability (FOC)

Mr. Foster (NOAA/ERT) discussed what's ahead for MEOSAR as it approaches IOC.

MEOSAR Status

There were 18 MEOLUTs commissioned or approved worldwide so far, two recommended for approval, and two more being tested, and there were plans for about 21 more installations by the end of 2021.

GPS planned to launch seven more DASS satellites, Galileo had launched four satellites that were being checked out, and Beidou (BDS) had launched two in 2018 that might be accepted into the System, with four more planned by 2020.

The declared amount of global coverage of MEOSAR had grown from 37% at the beginning to 2017 to near 100% coverage. (Coverage indicates where beacons could be located to within 5km 95% of the time.)

NOAA had been installing hybrid LEO/MEO LUTs. These supplemental hybrid units would bridge the LEO-MEO transition by providing a 4th generation LEO capability when LEO satellites are within view, and at other times providing additional system antennas for MEOSAR. Installations planned for Alaska and Guam this year would feed additional MEO data to the MEOLUT in Hawaii. Hawaii and Florida each already have two LEO/MEOLUTs, and NASA had one in Maryland.

NOAA expected to have its first operation MEOLUT with a low-maintenance phased-array antenna in New Mexico by mid-2020, referred to as the Southwest U.S. (SUSA) MEOLUT. This unit would be able to track many more (about 44) S- and L-band satellites simultaneously, expand coverage in the South Pacific, and help the Hawaii and Florida with coverage during hurricanes. NOAA would be installing a duplicate phased-array MEOLUT in Maryland that could be used operationally but would mainly be used for development and testing software changes prior to operational deployment.

Mr. Foster pointed out that the value of saving a single human life (based on federal guidance for the value of a life for regulatory purposes) would pay for the cost of a MEOLUT.

All U.S. LUTs can network with each other, effectively enabling them to function as a single unit.

LGM MCCs had been commissioned in the U.S., France, Norway, Australia and Spain. 15 more had been installed and were available for testing, and 16 more were planned (six of which the U.S. would be commissioning). Commissioning is a lot of work.

IOC Status

The U.S. hoped to reach IOC status this year, but the schedule might slip a little. The U.S. ground system was ahead of schedule for most IOC requirements, but faced challenges related to expected horizontal error (EHE), accurately locating slow moving beacons, reducing the number of suspect alerts at the MEOLUTs (these were not being forwarded to the MCC, so were not affecting operations), and quality management system (QMS).

EHE relates to the proportion of time that results are within requirements, and it gets tighter with time, so success reduces with time from the first beacon signal. This requirement might be unnecessarily stringent.

Other than France, most other countries were not as prepared as the U.S. for IOC. Other countries were unprepared to process SGB alerts. Networking enhances coverage but might flood the system with data that most countries are unprepared to process and distribute.

Requirements for IOC and FOC are essentially the same, the difference being the FOC requirement for global coverage, which would soon be complete.

5. RTCA SC-229 and Related Efforts

Mr. Pack (ACR/Artex) discussed the work of some entities involved with aircraft and ELTs. He had co-chaired the RTCM Special Committee (SC-229) that had developed DO-204B, *Minimum Operational Performance Standard for Aircraft Emergency Locator Transmitters 406 MHz ELTs*.

RTCA

DO-204B had been finished in December 2018, but SC-229 had been changed from a monitoring to an active status to address some minor changes needed in the standard. Once the changes go through a final review and comment (FRAC) and get approved, the standard would be published as Change 1, likely in December 2020.

DO-204B included material on, inter alia, triggered-in-flight ELTs, SGBs, and crash robustness. RTCA and EUROCAE participated together in the work so that the European standard and DO-204B would be harmonized.

EUROCAE

The European Organisation for Civil Aviation Equipment deals with aviation standards. It had formed a Special Committee (WG-98, SC1) to develop a *Minimum Aviation Systems Specifications Aircraft for Emergency Locator Transmitter Return Link Service* covering the function to trigger ELT transmission from the ground and define high-level concepts and functional interface requirements between the ELT and the ground.

The Galileo RLS is intended to provide two types of services: Type 1 is an auto-acknowledgement of an ELT alert which Cospas-Sarsat plans to support; and Type 2 services provide for manual acknowledgements, messaging, remote activation/deactivation of an ELT and possibly other functions.

One issue for Type 2 services is who would be authorized to remotely activate an ELT (operator, pilot, RCC, etc.); a cyber-security team was looking into this.

Remote activation of an in-flight ELT could be used for these confirmed scenarios:

- 1 – hijacking
- 2 – non-cooperative crew (e.g., incapacitation, suicide)
- 3 – high risk of inflight aircraft destruction (e.g., fire, bomb warning)
- 4 – unexpected and unexplained crew/aircraft behavior

The MASP was expected to be published in 2020 and made applicable in 2023.

The MASPS would also be useful in the ICAO context (Annex 6, GADSS) and Cospas-Sarsat environment; it would address the high-level definition of acknowledgement and of compatible ELTs.

ARINC

Aeronautical Radio, Inc. (ARINC) develops industry standards that point to equipment standards; it had an Airline Electrical Engineering Committee (AEEC) looking at the ICAO GADSS and related FAA/commercial aviation authority requirements to see which architectures, connectors, ground system requirements and so forth (end-to-end system requirements) would be needed for them.

ARINC had published a report on autonomous distress tracking (ADT, Report 680) in May 2019 that considered not only ELT(DT) technology, but also Iridium, Inmarsat and automatic dependent surveillance - broadcast (ADS-B) that might satisfy GADSS.

ARINC also planned to publish a report (680) in the 3rd quarter of 2020 on timely recovery of flight data (TRFD). 680 would address auto-deployable flight data recorders (ADFDRs) with ELTs with the objective of continuous or event-triggered flight data streaming. The next meeting on this would be in November at the NTSB.

FAA

In March, the FAA had issued technical standard order (TSO) C-126c that provides guidance on use of RTCA DO-204B. As soon as ELT(DT)s are approved, they could be installed on aircraft.

FAA Advisory Circular (AC) 91-44B addresses acceptable means to show compliance with the FAA rules on ELTs (14 CFR 92.207). The AC in part attempts to improve the ability of ELTs to function reliably and to reduce false alerts.

The FAA was also looking at which technologies, including ELTs, could be potentially used to comply with the FAA Authorization Act of 2018 (House Resolution 302, Section 305) on aircraft data access and retrieval systems. ELTs could also contribute to compliance with 14 CFR 121 on extended operations (ETOPS) aircraft as the result of HR 302. The FAA was examining methods to improve detection and retrieval of flight data, ADFRs, triggered flight data, distress tracking, etc.

EASA

The FAA's European counterpart, EASA, would be issuing ETSO-C126C regs that correspond to TSO C-126c by the end of the year with an effective date of January 1, 2023. It had also issued a provision (CAT.GEN.MPA.210) requiring aircraft to be equipped with a robust means of accurately locating a severely damaged crashed aircraft, and a public notice (June 2019) on means of compliance with MPA.210.

EASA says that an ELT(DT) alone is insufficient; it says the aircraft must be equipped with a crash-survivable ELT with a 121.5 MHz homing signal or have an ELT(AF) that locates the end of flight with a 2D accuracy of 200 meters or better. SAR authorities do not want to lose the homing signals that ELTs provide.

A crash-survivable ELT(DT) would need to be Class 0 or 1; otherwise, a non-crash-survivable ELT(DT) could be installed along with a Class 0 or 1 ELT(AF)(AP). This

introduces a challenge of finding suitable battery chemistries for such low temperatures.

ICAO

ICAO Annex 6 would change in 2021 to require either: 2 ELT's, one of them automatic; or 1 ADT system and one ELT (not necessarily automatic). The objective is to have a means to accurately determine the location of the end of flight to within 6nm; however, the requirement is not technology specific.

This runs the risk of losing 121.5 MHz homing, which the ICAO-IMO Joint SAR Working Group really wants to keep; there are strong advocates to keep 121.5 MHz homing or another globally accepted homing capability. [IMO is the International Maritime Organization.]

This JWG also does not support RLS Type 2 functionalities and decided to no longer work on implementing it without tasking to do so from ICAO or IMO.

Russia intended to introduce for consideration at the ICAO Assembly meeting in late September the possibility of delaying GADSS ADT implementation until 2023.

Industry

Mr. Pack suggested that industry wanted to know when Cospas-Sarsat would type approve ELT(DT)s and SGBs so they could be certified for aircraft installation, since TSO C-126C allows them.

Industry reps argued that manufacturers need Cospas-Sarsat to develop and publish achievable schedules and milestones. Such schedules would be affected by the need to finalize Documents T.018 (SGB specs) and T.021 (SGB type approval standard), MEOLUT and MCC ELT(DT) and SGB processing implementation, and an SGB data distribution plan.

6. SGBs

Mr. Watson explained that NASA develops new technologies to support SAR, such as beacons, ground stations and space payloads; it's the R&D arm working as part of the USCG-USAF-NOAA-NASA SARSAT team. It supports national and international work of the U.S. SARSAT team. NASA's long list of initiatives had included studies and tests on ELT survivability to improve ELT standards and work on equipment to use for homing on 406 MHz signals.

SGBs

NASA was a key contributor to completion of the Cospas-Sarsat proof-of-concept and D&E for SGBs and had developed a marketable SGB PLB (ANGEL beacon) that was being tested for type approval and had led development of SGB ground system capabilities. The ANGEL beacon was expected to be the first SGB that would be submitted to Cospas-Sarsat for approval.

Type Approval Status (SGBs and Test Labs)

Cospas-Sarsat had established a technical panel that would work in coordination with the Secretariat to conduct the type approval reviews for SGBs and ELT(DT)s concurrently with the review of test facility applications for extended capabilities; *extended capabilities* refer to test capabilities for ELT(DT)s and SGBs.

The technical panel established a review methodology for the test facilities' applications to extend capabilities, focusing on T.018 and T.021 traceability and coverage within test procedures.

EPG's application for approval as a test lab was under review by the technical panel. [EPG refers to a U.S. Lab at the Electronic Proving Grounds in Arizona.] As part of upgrading its capabilities, EPG had installed a computer-controlled articulated gantry arm with ground planes for testing linear and RHCP antenna EIRPs. EPG was about ready for use the gantry for ANGEL beacon tests. EPG intends to streamline the beacon approval process by automating some of its testing.

Other type approval labs were expected to apply for approvals within the next few months. These labs would be looking for SGB test beacons to use for test procedure development and possible cross-checking of results among labs.

The Chair credited the USCG for funding EPG's prep work.

ANGEL is an acronym for Advanced Next Generation Emergency Locator. NASA worked with ACR Electronics to develop this beacon, not only for purposes stated above, but also to serve as a PLB for the NASA Orion crew survival; the SGB PLBs would be attached to astronaut life preservers for use after splashdown and crew egress at sea from a capsule into a raft, which would also have an ANGEL beacon attached.

SAR/GPS

SAR/GPS satellites are 22 future USAF GPS IIIF satellites that will have SAR payloads provided by Canada and built by MDA, a Canadian company that specializes in robotic arms and equipment for space applications. NASA was providing engineering expertise for mission assurance. SAR/GPS would replace the S-band DASS constellation with launches planned to begin in 2026.

ELT Survivability and Reliability

NASA had provided extensive input during the development of ELT standards to help ensure that future ELT installations would survive crashes and transmit reliably. NASA's work to this end included use of:

- Crash reports
- Historic performance trends
- Previous beacon improvements
- Failure mode identification
- Nonlinear dynamics analysis of severe but survivable airplane crash scenarios

- Laboratory and full-scale experiments
 - Crash safety
 - Vibration
 - Fire/flame
 - Full-scale crashes of a helicopter and three fixed-wing aircraft

[Mr. Watson's presentations include pictures/videos of above.]

The RTCM DO-204B and EUROCAE E-62B ELT standards incorporated NASA's recommendations for ELT installation and testing to maximize survivability and reliable operations and were adopted by FAA's TSO C-126c. A key provision is that ELT installation manuals must adhere to provisions of DO-204B. Sections 2, 3, 4 and 6.2 were particularly impacted by NASA's work.

406 MHz Direction Finding

With current equipment, SAR forces would be unable to direction-find (DF) on the SGB spread spectrum satellite signal like they do today with FGBs. The 406 MHz signals could be used by SAR forces to get within range for 121.5 MHz homing.

The USCG uses the Rockwell Collins DF-500 to DF on signals it can tune to, including the FGB satellite signal. NASA had been working with Collins (previously Rockwell Collins) to develop the DFR-500 to detect and DF on the SGB spread spectrum satellite signal, and on low power 406 homing signals. Testing was aimed identifying appropriate beacon transmit power levels for 406 MHz local homing.

[See Mr. Watson's presentation for details on locating various types of signals and on flight tests.]

7. RTCM SC-110

Mr. Hoffman (RTCM) provided information about RTCM, a non-profit international organization that focuses on maritime communications and navigation, differential GPS, distress alerting, and standards development. RTCM also supports pertinent work of national and international non-RTCM committees and disseminates important legislative and regulatory info to its members. He emphasized the value of RTCM membership, especially for manufacturers.

RTCM SC-110

SC-110's primary role is to develop and maintain standards for Emergency Beacons – 406 MHz EPIRBs, PLBs and 406 MHz Ship Security Alert Systems (SSAS). It is also involved in:

- New technology, ideas and related matters of interest to its members e.g. AIS EPIRB, C/S MEOSAR system, ELT(DT)s
- Work of Cospas-Sarsat, particularly its Joint Committee (JC) meetings
- Input toward SGB standards for MEOSAR
- New EPIRB and PLB AIS standards

RTCM SC-136

SC-136, essentially a sub-group of SC-110, works on improving the beacon type approval process. SC-136 was focused on matters related to C/S T.001 and T.007 and was likely to get involved in T.021 in the future. RTCM members, the Cospas-Sarsat Secretariat and others participate.

Cospas-Sarsat Activity

RTCM had been granted Observer Status to enable its participation in various meetings and work of Cospas-Sarsat to represent the interests of beacon manufacturers. RTCM had participated in the Open Council, a Task Group on SGBs and ELT(DT)s, the Joint Committee, and an Expert Working Group on RLS so far during 2019.

EPIRB Status

Federal Communications Commission (FCC) rules had incorporated by reference RTCM's EPIRB standard 11000.3. The FCC requires all EPIRBs sold in the U.S. to comply with 11000.3 from January 17, 2020.

Not yet adopted by the FCC is RTCM's current standard, 11000.4, Amendment 1; however, RTCM had petitioned the FCC to adopt 11000.4 and meanwhile the FCC was issuing waivers to manufacture beacons to this standard. RTCM 11000.4 addresses differences with the standard of the International Electrotechnical Commission (IEC) (IEC 6097-2) in the areas of:

- Mandatory internal navigation device
- Internal navigation device timing
- GNSS self-test
- Inadvertent activation
- Incorrect mounting
- Ergonomics requirements and tests
- Cold thermal shock tests
- Options for AIS homing signals

RTCM was supporting work to update IEC 61097-2.

In response to a question, Mr. Hoffman explained that all beacons must meet a waterproof requirement. What is unique about PLBs intended for use in a maritime environment is that that must have AIS. AIS is not supposed to be used on land, except that any means can be used to call for help in emergencies. Any PLB with AIS requires USCG approval, but without AIS it only requires FCC approval.

Mr. Khalek (FCC) advised that EPIRBs complying with 11000.3 could be sold from January 17, 2020. M11000.4 was pending final FCC approval, but waivers were being granted for its use.

Mr. Jackson (USCG) added that foreign flag ships entering U.S. ports can carry EPIRBs complying with IMO's standard, but if they purchase one in the U.S., it would need to meet U.S. requirements. EPIRBs imported, manufactured or sold must meet the RTCM standard.

Mr. Khalek (202 316-5638 or Ghassan.khalek@fcc.gov) or Mr. Jackson (202 372-1391 or martin.l.jackson@uscg.mil) could be contacted about U.S. beacon approval questions.

PLB Status

RTCM's standard adopted by FCC Rules was RTCM 11010.2 including Amendments 1 and 2. The FCC required all PLBs sold in the U.S. to comply with 11010.2 from January 17, 2020.

RTCM had petitioned the FCC to adopt its current standard, RTCM 11010.3 published in June 2018, which addresses:

- Two Generations of PLBs
 - First Generation PLBs complying with C/S T.001 and approved to T.007
 - Second Generation PLBs complying with C/S T.018 and approved to T.021
- Two Categories of PLBs
 - Category 1 PLBs designed for use in and around water and which must float
 - Category 2 PLBs designed principally for use on land and which are not required to float
- Three Classes of PLB
 - Class 0 - -55C to +70C, Class 1 - -40C to +55C, Class 2 -20C to +55C
- Three Groups of PLB
 - Group 1 PLBs include a 121.5 MHz homing transmitter
 - Group 2 PLBs – reserved for future use
 - Group 3 PLBs include a 121.5 MHz homer and an AIS Locating Transmitter

PLBs have: a GNSS receiver; a GNSS position update at least every five minutes; RLS capability (this is optional); a 121.5 MHz homing transmitter with a duty cycle of at least 33%; and an AIS locating signal (optional, but the FCC would require for use in maritime environments).

8. Homing and Intelligent Transmit Scheduling (HITS)

CDR Boyle (USCG) reported that NASA had been testing 406 MHz DF feasibility as discussed above, but that so far Cospas-Sarsat had not reached consensus to include 406 MHz homing signals in its beacon specs, so the topic had been tabled. The replacement DF equipment and antenna would be the same size as the equipment now used. Wide support among SAR authorities worldwide remains for keeping 121.5 MHz homing signals. The USCG would like to be able to home on FGB and SGB alerting signals.

9. IMO/GMDSS

EPIRBs are part of IMO's Global Maritime Distress and Safety System (GMDSS).

CDR Boyle reported that IMO had approved a revised EPIRB performance standard and that Cospas-Sarsat was taking IMO's changes into account in updates to T.001 and T.018.

IMO's revised Performance Standards for Float-Free EPIRBs (MSC Resolution 471(101)):

- Requires GNSS with a more rapid refresh rate that was different than Cospas-Sarsat's
- Requires an Automatic Identification System (AIS) locating signal (30-meter accuracy assuming a three-knot drift)

- Provides for a reduced 121.5 MHz duty cycle
- Requires a flashing light visible to both eye and night vision devices
- Has a compliance date of June 1, 2022

IMO would be updating related Circulars:

- MSC/Circ.1039: Guidelines for Shore-based Maintenance of Satellite EPIRBs
- MSC/Circ.1040: Guidelines on Annual Testing of 406MHz Satellite EPIRBs

IEC was updating 61907-2 to reflect the provisions of MSC Resolution 471(101).

10. ICAO/GADSS

CDR Boyle summarized certain ICAO GADSS requirements as follows:

- International transport aircraft would need automatic tracking (AT) position reports every 15 minutes, and autonomous distress tracking (ADT) position reports every minute in ocean areas
- GADSS is intended to ensure that a downed aircraft can be located within a 6 nm radius
- GADSS provides for a location of an aircraft in distress repository (LADR) to provide position and location data for aircraft in actual or potential distress; the LADR would be supported and used by data provided and retrieved by the aircraft operators, air traffic services units, rescue coordination centers and others (availability of data in the LADR would not be considered a means of distress alerting)
- Cospas-Sarsat would need a data distribution plan that accommodates the LADR
- The ICAO-IMO JWG had reaffirmed need for a post-crash homing signal to be part of GADSS and affirmed that Lat/Long data should conform to the format specified in the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual)
- The ICAO Assembly (ICAO's highest body) would be considering GADSS matters, including implementation guidance and schedule
- ICAO might reconsider the GADSS implementation date of January 2021

ICAO had asked ICAO to host the LADR, which so far it had not agreed to do.

Mr. Hoffman pointed out that Cospas-Sarsat would need a new coding protocol to meet LADR requirements.

11. Return Link Service (RLS)

This topic was discussed above, but CDR Boyle pointed out that the USCG wanted global coverage and more robust specs for RLS before the system becomes operational and said that the U.S. SARSAT Program would not be supporting sale of RLS beacons until these improvements materialized. Mr. Turner added that RLS beacons would not be registered in the RGDB before they can be sold.

So far, Cospas-Sarsat and the FCC were not approving RLS beacons; however, if a distress alert were received from an RLS beacon within the U.S. SAR regions, it would be treated like other beacon alerts.

Mr. Turner (NOAA) stated that the U.S. ground segment was being prepared to process alerts from RLS beacons, and experience was being gained because all the issues were not yet fully understood. The U.S. wants U.S. citizens who might be in distress to be covered globally. The U.S. does not want beacons to be sold with features that might not work. The U.S. was trying to lean forward to be ready as soon as it can be and was working hard to help address USCG concerns. RLS implementation would be costly for both governments and manufacturers.

The Chair added that the global ground system (and their respective back facilities) should be able to recognize RLS coding when the beacons are introduced so the signal can be processed back to the user.

Mr. Hoffman agreed that a system should not be implemented that might not work but stressed that manufacturers needed to have a reasonable idea of when the system would be ready.

12. Beacon Stats/RGDB

Mr. Mathur (NOAA/ERT) discussed the U.S. SARSAT beacon registration database (RGDB) operated by NOAA. The RGDB contained registrations for about 630,000 beacons (40% EPIRBs, 41% PLBs and 18% ELTs, and relatively few ship security alerting system (SSAS) beacons). New PLBs were being registered at a rate about twice that of EPIRBs and ELTs, i.e., about 25,000 per year.

About 50,000 registrations had been renewed monthly in recent months, with about 80% of those being done by owners on the RGDB website. Registration statistics were available on the NOAA website.

For ownership changes:

- The new owner's registration information is stored in the RGDB until NOAA confirms the transfer of ownership
- The RGDB automatically notifies the current registered owner by email after the pending registration is submitted and provides a 1-click option to release the registration to the pending owner
- The RGDB automatically contacts the new owner of the beacon when their email or postal address is provided by the current registered owner to encourage complete registration

Some RGDB improvements included:

- Challenge questions allow quick, secure access
- Real-time entry checks highlight data inconsistencies and errors
- Registration reminder emails have embedded links allowing owners to easily renew with no changes or log in to update their information

- Registrations are uploaded and archived electronically, allowing workflow monitoring from input to quality check, improving accuracy and providing immediate access to records
- The RGDB website address is now provided on the NOAA decal for all beacon types

Mr. Mathur noted that for checksums:

- NOAA's OMB-approved registration form contains a 5-digit checksum field, which is used by the RGDB to verify the 15-hexadecimal UIN
- The checksum is not provided by all manufacturers at this time
- Currently, owners can enter a registration in the RGDB regardless of whether the checksum value is correct, incorrect, or absent to minimize owner confusion and frustration and increase compliance (to register)
- The RGDB includes real-time checks that flag mismatches of the UIN and checksum values
- Registrations entered with mismatches prompt the RGDB to automatically send an email or letter to the owner asking them to verify the UIN, allowing early determination of errors
- Standards are being updated to require all manufacturers to provide checksum values for new EPIRBs and PLBs
 - In preparation, NOAA requests that manufacturers start generating checksum values for new beacons.
 - The checksum value should be printed on both the manufacturer decal that is affixed to the beacon and the decal affixed to the new registration form.
 - For questions on implementing the checksum contact Mr. Jesse Reich (301 817-4509 or jesse.reich@noaa.gov)

Mr. Mathur asked beacon manufacturers to:

- Provide owners with the latest NOAA registration form, found at: <https://beaconregistration.noaa.gov/RGDB/forms>
- Affix a legible UIN label to the blank registration form and ensure that it matches the UIN on the enclosed beacon
- Use a font such as **Consolas** for all UIN labels to help owners distinguish between "0" and "D" and "8" and "B" and therefore help reduce UIN errors during the registration process: 0 1 2 3 4 5 6 7 8 9 A B C D E F
- Include the model, serial number, and checksum on beacon labels
- For beacon servicing:
 - When servicing a beacon, check the NOAA decal registration expiration date and remind the owner to properly renew with NOAA if expired
 - When replacing a beacon, ensure the owner is aware that the new UIN must be registered with NOAA and the old UIN registration must be updated with the correct disposition of the old beacon
 - Include a registration form with the new UIN whenever a beacon is reprogrammed

- Inform the owner in writing that an ELT programmed with a 24-bit address or tail number UIN must be reprogrammed if installed in a different aircraft
- When a U.S. Government agency orders beacons, ask the buyer to contact NOAA to ensure that special coding and processing are considered, and to educate the buyer about alert distribution, false alerts, beacon testing and servicing

To mitigate potentially serious problems and help save lives, so NOAA can follow up with owners, manufactures should notify NOAA immediately of any of the following situations:

- Duplicate UIN encoded into any beacons
- UIN errors on forms or beacons
- Beacon recalls

Landfill or garbage activations had been an increasing problem for SAR forces; they occur when beacons are thrown away with their batteries installed. The RGDB website provides a link to the COSPAS-SARSAT beacon disposal guidelines. Beacon manufacturers play an important role in helping NOAA inform beacon owners about proper beacon disposal. The following ideas might be viable:

- Consider a “buy-back” or “core-charge” incentive program for current owners who purchase new beacons
- Consider that service center locations near high-traffic areas (e.g., Florida and California) might help increase proper disposal of old beacons
- Increase distribution of beacon registration forms and handling information to buyers of used beacons

Mr. Mathur believed that registered beacons represent about 80% of U.S. beacons based on analysis of activated beacons that are registered (not including DOD beacons). Every two years, every user is contacted to verify registration accuracy. DOD had been reducing its use of national coding protocols in favor of standard protocols (DOD registers its own beacons apart from the RGDB. SGBs for government users might require some changes.

FCC rules intended to purge use of 121.5 MHz beacons were expected to increase the numbers of registered ELTs. This change was being publicized in several ways.

The Chair pointed out that false alert rates remain high, but that registration helps to deal with that problem.

13. C/S Beacon Manufacturers Survey

Mr. Zhitenev (Cospas-Sarsat) made comments about the annual survey of beacon manufacturers conducted this year; these included:

- 47 manufacturers had participated from the U.S., Canada, Australia, Asia and Europe

- The survey had included more detailed beacon categories and questions about plans to produce SGBs, ELT(DT)s, and RLS beacons
- The web-based survey had eased submissions and results analysis; 40% of responders had used the web to submit results
- 47% of responders had increased production volumes in 2018
- Three new manufacturers planned to develop beacons for approval
- 19 manufacturers had produced 499 or fewer beacons and 21 had produced 500 or more beacons
- 2018 production had included 24,863 ELTs, 95,434 EPIRBs and 79,354 PLBs
- About 1.9 million beacons were estimated to be in use at the end of 2018, representing about a 1% growth
- Beacons had been assumed to have about a ten-year design life, but 15 years was more typical of ELTs
- 87% of beacons produced in 2018 used location protocols, and more than half of all beacons in service had location protocols
- Manufacturers' production projections for 2019 were for 82,000 EPIRBs, 26,000 ELTs and 102,000 PLBs
- In 2018, the Secretariat reviewed 117 applications for type approval (28 full applications; others were change notices and pre-applications)

14. Beacon False Alerts/Outreach

LT Aaron Colohan (NOAA) led a presentation and discussion of false alerts and outreach. He said that the improved detection performance of MEOSAR has also increased the detection of non-distress alerts that were previously missed, and these alerts continue to be most prevalent with ELTs.

False alerts challenge and limit SAR resources, unnecessarily expending funding while frustrating SAR personnel. They also adversely affect the ability to respond to actual distress situations and erode confidence in the System. Note, that each beacon activation is treated as a distress alert unless, and until, it is determined to be a false alert.

The USMCC detected 8,150 ELT non-distress activations in 2018. This means that only 1.7% of ELT alerts, 2.1% of EPIRB alerts and 15.2% of PLB alerts were for persons in actual distress. Many of the ELT false alerts were around or near airports. (what does this sentence mean that wasn't said in the first two sentences of this paragraph?).

NOAA continued to sponsor the Aviation Team of Experts in 2018 as a means of government industry collaboration to reduce ELT false alerts and increase ELT registration. The FAA, AOPA, ACR, NOAA and NASA are among those participating in the ATE. The FAA had been willing to move forward on regulations to help.

ATE initiatives included:

- Posters and flyers for distribution to the public
- Work with manufacturers on new avenues for awareness

- Work with the FAA on beacon-related regulations
- Information alignment ensure accurate understanding of the Cospas-Sarsat System
- Media outreach online, in print and at events

False alerts were caused by:

- Improper testing due to confusion or ambiguity in instructions for ELTs
- Inadequate understanding of regulations on ELT requirements and testing
- Lack of cohesion in the regulations concerning ELTs and 406MHz Beacons (14 CFR 91.207 / 47 CFR 87.199)
- Lack of awareness of 406MHz ELT testing requirements and risks
- Improper ELT disposal
- Invalid or missing registration info

The main outreach efforts since the last BMW included:

- EAA AirVenture, Oshkosh WI (600,000 participants)
- Miami Boat Show
- Beacon Manufacturers Workshop
- Social Media outreach with #406day
- Media interaction via interviews and articles
- Aviation Team of Experts
- AOPA Fly-in (AOPA had welcomed NOAA for the first time)

Promoting beacon registration was also part of the SARSAT outreach. These are some reasons registration is important:

- Digital data transmitted by beacons provides nationality and beacon type and aids in tracking
- Emergency contact info and home port are listed in registration
- Tail number and identifying info can be added to registration
- Registration can include info about the owner/operator, specifics on aircraft or vessel, capability of the beacon and/or medical concerns of the owner, which allows for a more coordinated, timely and prepared search and rescue response
- Often, false alerts are resolved prior to dispatching limited resources, protecting those resources for responding to actual cases situations, saving tax dollars, and protecting search and rescue crews

LT Colohan pointed out that pilots were often unaware of the cost of responding to false alerts and many did not understand why Cospas-Sarsat was superior to other popular systems on the market. Also, people still use 121.5 MHz ELT test methods with 406 MHz ELTs.

Mr. Hoffman said that in Europe, instructions from both aircraft and ELT manufacturer was out of date.

Ove 600,000 at Oshkosh. 406 Day is in April pushing message via social media in short bites.

NOAA does a lot of show-and-tell, so LT Colohan welcomed contributions of non-functional equipment models to help keep his displays current and so he can represent products of various manufacturers.

15. Q&A Panel

The Chair moderated a panel to address some questions that had been submitted ahead. Several of these related to manufacturer needs to know schedules. Points made by the panel and other participants included the following:

- It was premature to announce firm dates and schedules for introduction of RLS operations, commencement of SGB and ELT(DT) type approvals, availability of labs to test new beacons, and expected IOC and FOC commence dates, all of which would need to be determined by the Council
 - RLS operations might not start until after 2020
 - Approved labs for ELT(DT)s and SGBs would probably be available in early 2020, and reviews of these beacons could be conducted in parallel with reviews of the labs
 - There were remaining challenges for the global system to be ready for IOC and a lot of work remaining to make it so; though the U.S. and France would probably be ready in early 2020, it would take months longer for the rest of the system to come on line for IOC
 - Since the requirements for IOC and FOC were essentially the same except that FOC had a global coverage requirement, the IOC and FOC dates might not be too far apart, but it might not happen before 2021
 - EPG's lab application was well into its Cospas-Sarsat review, and it would apparently be ready soon to commence beacon tests
 - Russia was projecting that its nodal MCC would be commissioned by December 2020; all nodal MCCs must be commissioned as a key element for global coverage
 - ELT(DT)s only require relay of encoded locations, so global processing of those signal might happen before beacons that require independent locations
 - A JC-33 paper had summarized when participants expected to have commissioned ground system components
- Requests to labs to test SGBs and ELT(DT)s might provide an incentive for the labs to become capable of doing the tests
- Manufacturers need to know they can market a beacon before spending perhaps hundreds of thousands of dollars to develop it
- MEOSAR, even in the current stage of operations, was providing much better detections, locations and speed than LEOSAR; it was performing better by almost any metric, even in the EOC stage
- Time-to-location was considered MEOSAR's primary benefit

- Aircraft manufacturers want independent locations that SGBs would provide so they can avoid changing their ELT antennas
- SGB performance was proving to be phenomenal; detection rates were higher with lower power, errors were fewer, SGBs use the existing space segment better, locations are much more accurate, rescues happen sooner, and search radii were much smaller
- SGBs provide good locations even in bad weather when GNSS might not work
- Often there are available rescue resources around that do not have homing capability, so the accuracy of SGBs could make a big difference
- The aviation community would need to be educated about the benefits of SGBs over FGBs to facilitate the change; one key benefit is that SGBs are 90% more accurate and would provide the best chance of survival
- A list that compares FGB and SGB merits and capabilities would be valuable on many occasions; however, a comparison boiled down to one sentence would be especially useful

16. New Actions

There were no new action items identified for this meeting.

17. Wrap-up

Mr. Turner stated that the BMW was a big help to NOAA, and he trusted it was to the manufacturers as well. He noted that the questions received for the panel had had been covered as well as possible, and he invited anyone with further questions or comments to feel free to contact the NOAA/SARSAT staff.

After expressing appreciation again to all participants, to the Secretariat staff, to RTCM, and to the meeting support staff, the Chair adjourned the meeting.

Enclosures:

1. List of Participants
2. List of Open Action Items

Enclosure (1)

List of Participants

Beacon Manufacturers Workshop
September 20, 2019
Portsmouth, VA

NAME	ORGANIZATION
1. Boyle, CDR Erin	USCG
2. Caporale, Chris	NOAA/ERT
3. Colohan, LT Aaron	NOAA
4. Cox, William	ACR Electronics
5. David Watson	NASA
6. Eggen, Øyvind	Jotron AS
7. Ezer, Igal	Elbit Systems
8. Fitzmaurice, Mickey	NOAA
9. Foster, Eric	NOAA/ERT
10 Fuechsel, Jack	GMDSS Task Force
11 Fuhrmann, Dave	Air Force Rescue Coordination Center
12 Griffin, Sean	GME
13 Harpell, Eric	Cospas-Sarsat Secretariat
14 Haynsworth, Joseph	USCG
15 Hessler, Lisa	NOAA/ERT
16 Hiner, Eric	Astronics DME
17 Hoffman, Christopher	ACR Electronics, Inc.
18 Izhaky, Dudi	Elbit Systems
19 Jackson, Martin	USCG
20 Khalek, Ghassan	FCC
21 Khorrami, Jeff	Orolia/McMurdo
22 Knox, Al	NOAA
23 Lavoie, Alexandre	Transport Canada
24 Lemon, Dan	NOAA/ERT
25 Lenyo, Tom	Astronics DME
26 Lett, Steven	Cospas-Sarsat

27 Lorentzen, Ronald	Emergency Beacon
28 Mathur, Apurve	NOAA/ERT
29 McCurry, Chris	Dukane Seacom
30 McDonald, Mike	Colorado Search and Rescue Board
31 Nguyen, John	ACR Electronics
32 Nolan, Simon	Ocean Signal Limited
33 Pack, Thomas	ACR Electronics, Inc.
34 Pulgarin, Felipe	Racon
35 Reich, Jessie	NOAA
36 Smith, Sharon	NOAA/ERT
37 Soglo, Per	Jotron AS
38 St-Pierre, Dany	Cospas-Sarsat Secretariat
39 Takahashi, Masaaki	Icom America, Inc.
40 Taylor, Stuart	Techtest Ltd
41 Taylor, Yvonne	NOAA/ERT
42 Turner, Mark	NOAA
43 Wendlandt, Ed	RTCM
44 White, Bob	Imanna Lab
45 Zhitenev, Andryey	Cospas-Sarsat Secretariat

Enclosure (2)

SARSAT Beacon Manufacturer's Workshop
Open Action Items from 2019 and Prior Meetings

Action Item	Description	Status
BMW-2015-AI.3	USA SARSAT Program to review with the FAA whether its guidance for testing beacons could be improved to reduce false alerts occurring during maintenance	<i>Open. NOAA Corps SARSAT officer (LT Colohan) had been liaising with the FAA and would continue this work to update the FAA's guidance for ELT test procedures. Also, RTCA SC-229 had been reviewing antenna testing.</i>
BMW-2017-AI.1	NASA to distribute to BMW attendees the MEOSAR D&E Phase II T1 test data	<i>Open. Mr. Dave Watson would provide.</i>
BMW-2017-AI.2	NOAA to post on the NOAA/SARSAT website any available performance data for various elevation angles for monopole antennas	<i>Open. Waiting for the EPG to finish the antenna tests so the results can be published.</i>
BMW-2018-AI.1	NASA to provide to beacon manufacturers, if possible, the MATLAB tools developed by NASA to measure SGB signal characteristics	<i>Open. NASA was still working through the software release process. The material would be posted once approved for release.</i>