



## Beacon Manufacturers Workshop (BMW)

May 12, 2017

Clearwater, Florida

### MINUTES

#### NOTES:

This document covers Workshop highlights.

Complete Workshop presentations and other information are posted on the NOAA SARSAT website ([www.sarsat.noaa.gov](http://www.sarsat.noaa.gov)) under the 'SARSAT Meetings' tab.

#### 1. Opening

The Chair, Mr. Jesse Reich (NOAA/SARSAT), welcomed the attendees, commented on topics that would be covered, and introduced Mr. Dann Karlson (NOAA/NESDIS) who was attending on behalf of the NOAA SARSAT Program Manager.

About 50 persons attended; enclosure (1) lists the Workshop participants.

#### 2. Prior Action Items

The Workshop reviewed its prior action items; the only action that remained open (BMW-2015-AI.3) is shown in enclosure (2).

#### 3. Cospas-Sarsat

Mr. Dany St-Pierre (Cospas-Sarsat Secretariat) provided updates on the Cospas-Sarsat (C/S) Program status and evolution.

Of the C/S Participants, 27 were ground segment providers. The System included 54 operational LEOLUTs, 22 operational GEOLUTs, 7 commissioned MEOLUTs (with 15 more planned or under development), and 30 operational MCCs (including 14 LEO-GEO-MEO (LGM) MCCs).

MEOSAR, which had been in an early operational capability (EOC) phase since December 2016, uses time and frequency differences of arrival (TOA/FOA) to determine locations rather than Doppler shift that LEOSAR uses. MEOSAR initial operation capability (IOC) phase would be declared when system performance standards could be met. Final operational capability (FOC) was expected to be declared within about three years when real-time global coverage would be available. A timeline was available in Annex 1 of the MEOSAR Implementation Plan (R.012).

Mr. St-Pierre noted availability of an updated Glossary (C/S Document G.004).

A Task Group (TG-1/2017) on second generation beacons (SGB) and distress tracking emergency locator transmitters (ELT-DTs) had developed amendments for C/S technical documents. Some of these documents were expected to be approved in May and would provide for ELT-DTs to support the developing International Civil Aviation Organization (ICAO) Global Aeronautical Distress and Safety System (GADSS) requirement for in-flight distress alerting.

The documents included:

- T.001 (Specification for Cospas-Sarsat 406 MHz Distress Beacons)
- T.002 (Local User Terminal Performance Specification and Design Guidelines)
- T.007 (Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard)

- T.008 (Cospas-Sarsat Acceptance of 406 MHz Beacon Type Approval Test Facilities)
- T.009 (Cospas-Sarsat GEOLUT Performance Specification and Design Guidelines)
- T.018 (Specification for Second-Generation Cospas-Sarsat 406-MHz Distress Beacons)
- T.019 (Cospas-Sarsat MEOLUT Performance Specification and Design Guidelines)
- T.020 (Cospas-Sarsat MEOLUT Commissioning Standard)
- T.021 (Type Approval Standard for Second-Generation Cospas-Sarsat 406-MHz Distress Beacons)

TG-2/2017 would be developing operational documents for use of SGBs and ELT-DTs for consideration by the Joint Committee (JC-31) in October 2017 and Council (CSC-59) in February 2018. Meanwhile:

- The MEOSAR ground system would be maturing
- The MEOSAR demonstration and evaluation (D&E) technical and operational tests would be completed
- SGB proof-of-concept tests (POC) would be completed
- ELT-DTs would be tested
- Additional LEOSAR satellites and LUTs would be added
- MEOSAR performance specifications and commissioning standards would be completed

Cospas-Sarsat was improving its International Beacon Registration Database (IBRD), which currently held data on over 67,000 beacons for 142 national administrations. When the new IBRB is completed in 2018, it would provide for:

- Next-generation beacon registration
- Mobile friendly interface
- Mix National Data Provider (creation)/Owner (update)
- Email address validation
- New decode program
- Quick registration
- Shared beacons
- Optional medical data
- Photos
- Temporary activity
- A new interface for SAR services

The C/S Secretariat had been developing a series of new training videos; these were expected to be approved by the Council and May and would then be available on YouTube.

The Chair asked about how interactive rescue data that Mr. St-Pierre had shown might be made more widely available. Some of this information was protected due to privacy concerns. *The Chair stated that the USA would examine with the other C/S Parties how more detailed rescue data could be made available on the C/S website.*

#### **4. MEOSAR Update**

Mr. Chris Caporale (NOAA/ERT) commented on MEOSAR from the USA perspective.

The USMCC had been forwarding operational MEOSAR data to U.S. RCCs since EOC began in December 2016 with the coverage provided by the Hawaii, Florida and Toulouse MEOLUTs. Generally, MEOSAR had been providing both encoded and confirmed independent locations in actual SAR cases well before LEOSAR locations were available.

NOAA planned to install replacement LEOLUTs with stations that would be able to track MEOSAR satellites when no LEOSAR satellites are in view to provide additional channels for the MEOLUTs. The first of these LEO/MEOLUTs would be installed in July at NOAA Suitland to use for testing, and then two would be placed at each Florida, Hawaii, Guam and Alaska site between July 2017 and May 2018.

The USA was also improving its analysis for locating slow-moving EPIRBs.

The algorithms for choosing the best satellites to track was being improved and involved lots of factors; so far, this scheduling was not being coordinated with other countries. The additional MEO channels would affect how satellite selections are optimized in the future.

With the current MEO space and ground segments, MEOSAR had been meeting the C/S detection requirement 73% of the time and the 5km location accuracy requirement 37% of the time worldwide; performance was expected to increase to nearly 100% and 97%, respectively, by January 2018 as the MEOSAR system expands. Global MEOSAR coverage was expected to be complete when a MEOLUT is installed in South Africa in 2020.

#### **5. SGB updates to Cospas-Sarsat Documents**

Mr. Chris Hoffman (RTCM) reported that the Council had approved its specifications for SGBs (C/S T.018), that the SGB proof-of-concept (POC) was in progress, and that the SGB demonstration and evaluation (D&E) had not yet begun.

T.018 had been amended to include requirements for ELT-DTs. A temperature Class 0 (-55°C to +70°C) was added along with provisions for the return link service (RLS). First generation beacons (FGBs that comply with T.001) are narrow-band beacons while SGBs use spread spectrum. T.018 provides for an optional 406 MHz homing signal and leaves requirements for other homing signals, such as 121.5 MHz, up to national administrations.

The SGB type approval standard (T.021) was still in draft form.

#### **6. Type Approval Process for SGBs**

Mr. Ed Thiedeman (USCG) stated that the beacon type approval process had been improved since the last Workshop for both FGBs and SGBs, which would benefit all manufacturers; however, additional work was needed. Some challenges related to test methods for certain measurements and how to test self-test indicators for residual battery capacity. T.008 and T.021 needed to be finalized.

Mr. Hoffman added that RTCM had considered various types of beacon antennas, but that the need to transmit on both 406 and 121.5 MHz seemed to limit the choice to monopole antennas that all manufacturers use.

## 7. SGB Test Results and Coverage

Dr. Lisa Mazzuca (NASA) pointed out that NASA had a six-antenna real-time R&D MEOLUT that it uses for tests; it mimics the USA operational MEOLUTs. However, unlike operational MEOLUTs, NASA's processes SGB signals.

NASA had developed a prototype SGB designed to capitalize on MEOSAR to improve C/S detection probability, location accuracy and system capacity and was being used to perform nine SGB POC tests. When the next SGB beacon is built, NASA planned to conduct field tests in various environments. NASA wanted to continue testing with the newer prototype in time to have results available for the Joint Committee (JC-31); however, results for in-flight beacons might not be available by then.

Dr. Mazzuca commented on the POC tests indicated in the table below.

POC-1 had used 16 beacons transmitting at two-second intervals at various power levels. Detection had been good at 27 dBm and excellent above that. Location had been accurate to within about 200 meters even with just a few beacon bursts. POC-2 had also produced good accuracies within 30 seconds of beacon activation, but did not quite meet the stringent C/S requirements. POC-3 far exceeded C/S requirements even at low beacon power levels, and almost met the requirement for 100-meter accuracy within 30 minutes at higher powers. Tests 4-6 would be performed with a new small beacon that would be desirable to purchase. POC tests had shown that SGBs would generally perform better than FGBs and had produced location accuracies down to about 150 meters.

POC Test Case Title	POC Test ID	Definition
Single Burst Throughput	POC-1	Characterize the relationship between the beacon output power and the probability of a MEOLUT producing a valid message for each beacon burst.
Increased performance after the first 30 seconds of beacon transmission	POC-2	Characterize the beacon detection and location performance within the first 30 seconds of beacon transmission.
Independent Location Capability	POC-3	Characterize the independent 2D location performance as a function of the number of bursts since beacon activation.
System Capacity and Compatibility	POC-4	Determine the number of simultaneously active SGBs that can be properly processed. Also determine compatibility with MEO processing of First Generation Beacons (FGBs).
SGB Homing	POC-5	Measure the ability to meet the requirements for on-scene locating and homing.
Field Tests	POC-6	Perform a variety of field tests with prototype SGBs to further characterize MEOSAR system performance.
LEO / GEO Compatibility	POC-7	TBS
Cancellation Function	POC-8	TBS
ELT Activation in Flight	POC-9	TBS

**Actions:**

*NASA to distribute to BMW attendees the MEOSAR D&E Phase II T1 test data*

*NOAA to post on the NOAA/SARSAT website any available performance data for various elevation angles for monopole antennas*

NASA expected SGBs to be commercialized by early 2019. The USA was working to help ensure that test labs would be available for SGB type approval testing. NASA posited the question of whether the operational requirements could be slightly relaxed for location accuracy of SGBs in C/S G.008 so that SGBs with lower power levels could be cost-effectively produced.

France was preparing an SGB MEOLUT; once some French test results were available, the USA and France could begin work on a C/S SGB Test Plan. SGB tests would be finished in time to help finalize T.018 and T.021

## **8. Galileo Return Link Service (RLS)**

Mr. St-Pierre explained that RLS would involve two types of acknowledgements:

- Type 1 - Galileo would send the return link message (RLM) to the beacon when the alert is detected and located
- Type 2 - the RLM would be sent to the beacon based on instructions from a rescue coordination center (RCC).

His presentation diagramed how RLS would work. MEOSAR D&E Test O-5 would deal with RLS later in 2017; this test would be coordinated by CNES in France, the SAR/Galileo Data Service Provider (SGDSP). O-5 would be done in four steps of increasing complexity, eventually testing messages from nodal and non-nodal MCCs outside Europe.

The presentation further covered O-5 test scenarios and expected timeframes for deployment of IOC RLS, ELT-DT operational facilities and RLS-capable beacons in 2018. By the end of 2020, SAR Galileo would have fully operational space and ground segments, including abilities to process all types of RLS messages and SGB signals.

## **9. RTCM Standards and Related FCC Rules**

### *Standards*

Mr. Chris Hoffmann (RTCM) explained that the primary role of RTCM Special Committee 110 (SC-110) is to develop and maintain standards for 406 MHz EPIRBs and PLBs, and 406 MHz Ship Security Alert Systems (SSAS). SC-110 is also involved in:

- Considering new technology, ideas and other related matters of interest to its members e.g. AIS EPIRB, C/S MEOSAR system
- Supporting C/S, particularly the Joint Committee (JC) meetings
- Developing input towards Second Generation Beacon Standards for MEOSAR
- Preparing EPIRB and PLB AIS standards

AIS stands for automatic identification system.

The EPIRB standard (RTCM 11000.4 Amendment 1), published July 2016, addresses differences from the IEC standard; 11000.4 addresses:

- 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 an AIS homing signal

The latest amendment to 11000.4 updates the maritime scenarios used to test the correct functioning of the internal navigation (Global Navigation Satellite System (GNSS)) receiver.

The PLB Standard (RTCM 11010.2), published July 2008, had been amended five times:

- Amendment 1 added internal navigation device test methods and test procedures
- Amendment 2 updated Amendment 1
- Amendment 3 introduced mandatory internal GNSS, altitude test, and wet self-test
- Amendment 4 updated GNSS timing requirements
- Amendment 5 updated the maritime scenarios used to test correct functioning of the GNSS receiver

Amendment 1 to the Satellite Emergency Notification Device (SEND) standard (RTCM 12800.0 published August 2011), added a Patent annex, and Amendment 2 clarified the distress alert transmission schedule and the message format for alerts to RCCs.

Amendment 1 to the Maritime Survivor Locator Device (MSLD) standard (RTCM 11901.1 published June 2012) permitted both ‘open loop’ and ‘closed loop’ digital select calling (DSC) devices. The standard covers devices that: transmit on 121.5 MHz; operate on VHF DSC Channel 70; use active signalling; or transmit on VHF AIS frequencies. A further update is required to address ITU-R M.493-14.

### ***FCC Rules***

FCC rules published in FCC Docket 16-119 on December 15, 2016, with an effective date of January 17, 2017 updated 47 CFR Parts 25, 80 and 95 and affects SENDs, AIS SARTs, EPIRBs, PLBs and MSLDs.

No device can be marketed or sold as a SEND in the USA unless it complies with the RTCM 12800.0 standard from January 17, 2017. Part 80 requires that AIS SARTs comply with IEC 61097-14 and IMO’s MSC.246(83) from February 27, 2017.

Some standards are newer than allowed by the FCC rules, but Mr. Ghassan Khalek (FCC) indicated that the latest standards would be adopted when the relevant rules are updated, and that these standards can be used if waivers are requested.

Part 80 requires that EPIRBs comply with RTCM 11000.3 dated June 2012 (the updated standard with mandatory internal GNSS and hands-free function, but without AIS locating and homing):

- All new EPIRBs must be approved to the new standard beginning February 27, 2018
- No EPIRB can be manufactured, imported or sold in the USA that does not comply with the new standard after January 17, 2020

- All EPIRBs on board Part 80 Sub-Parts R, S and W vessels (cargo vessels, small passenger vessels and GMDSS ships) must be fitted with an EPIRB that complies with the new rule beginning January 17, 2023

Part 95 requires that PLBs comply with RTCM 11010.2 dated June 2012 with Amendments 1 and 2 (including GPS scenario testing, but not mandatory GPS, updated self-tests, etc.). New PLBs must be approved to the new standard beginning February 27, 2018. No PLB can be manufactured, imported or sold in the USA that does not comply with the new standard after January 17, 2020.

Part 95 requires that MSLD devices manufactured, imported or sold in the USA (as defined by the frequencies in RTCM 11901.1) must comply with this standard beginning February 27, 2017. Existing MSLD devices manufactured, imported or sold in the USA (as defined by the frequencies in RTCM 11901.1) must comply with this standard beginning January 17, 2018.

*The Chair indicated that some of these dates can be provided on the NOAA/SARSAT website along with relevant links to the rules.*

## **10. EPIRB-AIS ID Issue**

Mr. Nobuo Aritake (ARIB) pointed out that an EPIRB-AIS has a unique hex-ID for the EPIRB and a non-unique ID for AIS. The AIS ID does not identify the ship or person that might be in distress, so if the EPIRB GNSS receiver fails, the AIS signal is of little value for SAR. Also, if signals are received from the EPIRB and AIS, SAR personnel might be confused about whether the signals are for the same incident.

RTCM had developed a means in its standard to relate the two IDs, and the C/S Secretariat had proposed including the AIS IDs in the EPIRB registration. Japan believed that for both FGBs and SGBs the RTCM standard should stipulate that part of the AIS message should transmit the EPIRB hex-ID so the signals can be matched, and that Cospas-Sarsat should ask administrations to record AIS IDs in EPIRB databases. Further, SGBs should transmit the AIS-ID in the EPIRB signal rotating field.

These measures would be intended to mitigate potential confusion for SAR personnel. Beyond that, confusion aboard ships that display active AIS data in the vicinity could be helped by having 'EPIRB Active' alerts included in the displayed AIS data.

Japan intended to recommend that IMO make administrations aware of the potential problem discussed above, and to seek revision of ITU's recommendation M1371. Mr. Hoffman supported revising M1371 and pointed out that ITU WP-5b was currently working on this recommendation.

## **11. ELT(DT) Updates to Cospas-Sarsat Documents**

Mr. St-Pierre stated that because reliable operation of ELTs after an impact with the ground had always been problematic, especially for large aircraft, C/S had been investigating use of MEOSAR to detect and locate an ELTs signal activated prior to an impact. C/S G.008 now includes triggered-in-flight requirements for SGB ELTs.

Also, ICAO introduced GADSS requirements for distress tracking (DT) by January 2021 with a location accuracy of 6 nm. C/S was seeking to address GADSS requirements by enabling FGB and SGB ELT-DTs to be available for airframe manufacturers by early 2019; some testing had been completed with fast-moving beacons that supported the technical feasibility of ELT-DTs, and more tests were planned.

ELT-DTs would:

- Use GNSS as a primary means for beacon location determination
- Be moving at high speed when triggered in flight, so latency of the GNSS data is an important factor in location accuracies
- Operate over a wider temperature range (low minimum temperature)
- Ideally provide 3-D location data to include aircraft altitude
- Operate inflight up to 20 hours
- Not provide a homing capability while inflight
- Be automatically triggered based on input from aircraft avionics
- Stop transmission of distress signals following deactivation commands provided by the same means as the one used for activation (manual or automatic)
- Send a cancellation message in case of voluntary deactivation
- Be expected to operate shortly after beacon activation.

ELT-DT data would likely need to be provided to aircraft operators and/or air traffic services units (ATSU's) and/or a central data repository facility as required by ICAO, and not just to RCCs.

Implementing ELT(DT)s as part of the Cospas-Sarsat System requires changes to FGB T.001 and SGB T.018 beacon specifications, type approval procedures (T.007 and T.008), MEO, LEO and GEO LUT specifications, and MCC specifications. Changes to all these documents had been, or soon would be, submitted to the Council for approval.

## **12. Beacon Type Approval for ELT(DT)s**

Mr. Eric Harpell (C/S Secretariat) explained that a few new tests had been added to T.001 and T.007 to address FGB ELT-DTs, and that similar provisions would be added to T.018 and T.021 for SGB ELT-DTs. T.001 and T.007 had been submitted to CSC-58 for approval. T.008 was being updated for consideration by JC-31. T.018 had been approved by CSC-57 and changes to accommodate ELT-DTs had been submitted to CSC-58 for approval, but T.021 required further development for ELT-DTs. T.008 had been updated to account for SGBs but required more work.

Mr. Harpell reviewed details on the following topics; this information is available in the presentations for this meeting which are posted on the NOAA/SARSAT website:

- Changes to T.001 related to FGB ELT-DTs that had been either approved by CSC-58 or proposed by TG-1/2017
- Summary of type approval changes for T.007 related to FGB ELT-DTs
- Changes T.018 related to SGB ELT-DTs

There were five accepted beacon test facilities certified for T.001 beacons as shown on the Cospas-Sarsat website:

- Cospas-Sarsat Beacon Certification Facility, Fort Huachuca, AZ, USA
- Test Center MAYAK BINCOS , Moscow, Russia
- Test Center "TC NIIR", Moscow, Russia (New)
- Testing center "Omega", Sevastopol, Ukraine
- TÜV SÜD Product Service, Fareham, Hampshire, UK



### **13. SGBs/Spread Spectrum Homing**

Mr. Thiedeman advised that work was continuing to finalize characteristics of the 406 MHz homing signal and that a single beacon signal coding bit related to homing would be sufficient, as amplifying information could be retrieved from the beacon registration database (RGDB) and forwarded in the alert message to the RCCs.

Mr. Thiedeman introduced 1<sup>st</sup> Class Cadet Kristen Logan (USCG Academy) to provide an update on research done at the Academy over the past two years to prove the concept of homing on spread spectrum signals. The objective was to facilitate future commercial development of portable or drone-mounted direction-finding (DF) equipment.

The project involved a method to DF (find the angle of arrival) on a wideband 406 MHz EPIRB distress signal using an antenna array of four elements in conjunction with the MULTiple Signal Classification (MUSIC) Algorithm. The physical layer of the system includes four Universal Software Radio Peripherals (USRPs) that communicate with GNU Radio Companion (GRC), a software development platform that receives the signals from the four antennas. Data collected through the antennas, USRPs, and GRC, are then delivered to an office data base. A script picks up the data and continually calculates the direction of approach.

Results had shown that the system could consistently DF on signals that range from angles -45 degrees to 45 degrees off the array's orthogonal axis. Worst case errors were five degrees and measurement repeatability was within three degrees. Processing was real-time. The concept, now proven, could be applied to beacon or cell phone signals.

### **14. Beacon Registration and False Alerts**

Mr. Eric Foster (NOAA/ERT) discussed USA beacon registration and false alert issues.

He began by asking manufacturers to encourage buyers of 'national use' beacons (government agencies) to contact NOAA about special coding and processing, avoiding false alerts, beacon testing and registration, and replacements of batteries and beacons.

He then emphasized the importance of manufacturers using checksums to help validate registrations. The Chair stated that a requirement to use checksum would probably be written into the beacon standards.

Manufacturers and service centers could help resolve issues with beacon IDs and labeling and with registration currency.

Mr. Foster reviewed improvements NOAA had made to the SARSAT registration database (RGDB) to ease access, reduce errors, keep beacon owners better informed and help prevent false alerts. NOAA had also begun printing beacon decals on registration-related correspondence.

The numbers of false alerts were growing for all types of beacons, totaling over 1,000 in 2016; ELTs accounted for 60% of these though only 18% of registered beacons were ELTs. Only 84 out of 6,749 ELT activations in 2016 were due to actual distress situations. Over 90% of the false activations had been due to mishandling, and especially due to improper testing such as activating the beacon in lieu of using the self-test feature.

Mr. Foster urged manufacturers to work with NOAA to prepare better ELT test instructions that include pictures and quick guides. Apparently, variations among ELT models contributes to confusion among maintenance personnel.

NOAA processes tens of thousands of registration renewals each month and most of these (about 70%) are done online by owners. In addition, almost 44,000 new beacons had been registered in 2016; half of these were PLBs. Of all beacons in the RGDB, about 37% were PLBs, 18% were ELTs, and 44% were EPIRBs. Ownership transfers are not counted as new registrations.

Mr. Foster had statistics on beacon usage in Florida that had been affected by promotion efforts and a new Florida carriage requirements. He offered to post these and to check the RGDB for beacon attrition rates.

***Actions:***

***NOAA to post beacon registration growth statistics in the state of Florida on the NOAA/SARSAT website***

***NOAA to examine the registration database for information on attrition rates for beacon types and report results to the next BMW***

**15. Cospas-Sarsat Manufacturers Survey**

Mr. Andrey Zhitenev (C/S Secretariat) highlighted preliminary results of the annual beacon manufacturers survey of 45 responding manufacturers:

- Total 2016 beacon production had increased 2.3% to over 200,000
- EPIRB and ELT production had dropped slightly to 96,000 and 22,000, respectively, while the PLB population had grown 11.4% to 83,000
- This growth brought the estimated total worldwide beacon population to about 1.8 million, with the ELT population being lowest and EPIRBs remaining the highest
- About half of the manufacturers had produced more than 500 beacons in 2016
- 75% of the beacons produced in 2016 were location protocol beacons, but ELTs accounted for only about 7% of those
- C/S estimated that 63% of the global beacon population uses location protocol
- Manufacturers predicted that they would collectively produce 11% more beacons in 2017 than they had in 2016
- C/S had processed 164 type-approval submissions in 2016 and expected to receive 17 type-approval applications and 27 change notices from manufacturers in 2017

**16. Review of Action Items**

Enclosure (2) is a list of action items that remain open from this and prior BMW meetings.

**17. Closing Remarks**

The Chair thanked the BMW attendees for participating, expressed appreciation to RTCM for hosting the meeting, gratefully recognized McMurdo for its hospitality, and thanking Lisa Hessler and her team for their work in executing this meeting.

The Chair encouraged everyone to not lose sight of all the lives being saved.

RTCM expected to hold its 2018 annual meeting jointly with NEMA in the September timeframe at a different Florida venue.

The Workshop was adjourned.

Enclosures:

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

Enclosure (1)

## **List of Participants**

2016 Beacon Manufacturers Workshop  
May 12, 2017  
Clearwater, FL

<b>NAME</b>	<b>ORGANIZATION</b>
Allen, Don	Astronics DME LLC
Aritake, Nobuo	Association of Radio Industries and Businesses (ARIB)
Bastiani, Sergio	Astronics DME LLC
Blankenship, Stephanie M.	McMurdo Group
Caporale, Christopher	NOAA/ERT
Ch'en, Daniel R.	Microwave Monolithics Inc.
Corbett, Shane P.	USCG Academy
Cox, Bill	ACR Electronics, Inc.
Crilly, Paul B.	USCG Academy
Crockett, Terry	McMurdo Group
Duffy, Kate	RTCM
Eggen, Øyvind	Jotron AS
Foster, Eric	NOAA/ERT
Fuechsel, Jack	GMDSS Task Force
Fuhrmann, David	AFRCC
Gonzalez, Pablo	Astronics DME LLC
Greenway, Debbie	Rakon
Harpell, Eric	Cospas-Sarsat Secretariat
Hessler, Lisa	NOAA/ERT
Hoffman, Christopher	ACR Electronics, Inc.
Igarashi, Kiyoshi	Association of Radio Industries and Businesses (ARIB)
Johnson, Johnny	Emerging Lifesaving Technologies
Karlson, Daniel	NOAA/NESDIS
Keene, Ken	NOAA NMFS SEFSC
Khalek, Ghassan	Federal Communication Commission
Kohout, Stefan	QuartzCom Ltd.

Lariviere, George	Whiffletree Corporation Inc.
Lavoie, Alexandre	Transport Canada
Lemon, Dan	NOAA/ERT
Logan, Kirsten P.	USCG Academy
Mazzuca, Dr. Lisa	NASA/GSFC
McDonald, Mike	Colorado Search and Rescue Board
Mirza, Naveed	ACR Electronics, Inc.
Ortenzio, CDR Aaron	U.S. Coast Guard
Reich, Jesse	NOAA/SARSAT
Rissone, Christian	Agence Nationale des Fréquences (ANFR)
Santram, Naresh	International Registries Inc. (Republic of the Marshall Islands)
Sims, Ruth	McMurdo (a brand of Orolia)
Smith, Claudia	Globalstar
Smith, Sharon	NOAA/ERT
Stankovic, Dan	ACR Electronics, Inc.
St-Pierre, Dany	Cospas-Sarsat Secretariat
Takahashi, Masaaki	Icom America, Inc.
Taylor, Stuart	Techtest Ltd.
Taylor, Yvonne	NOAA/ERT
Thiedeman, Edwin	U.S. Coast Guard
Van Amerongen, Boris	McMurdo Group
Zhitenev, Andryey	Cospas-Sarsat Secretariat

Enclosure (2)

**SARSAT Beacon Manufacturer’s Workshop  
Open Action Items from 2017 and Prior Meetings**

<b>Action Item #</b>	<b>Description</b>	<b>Status</b>
<b>BMW-2015-AI.3</b>	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 had been liaising with the FAA and would continue this work to provide clarification of ELT testing procedures Beacon and antenna testing are not always done correctly. The FAA guidance should be updated. RTCA SC-229 had been reviewing antenna testing.</i>
<b>BMW-2017-AI.1</b>	NASA to distribute to BMW attendees the MEOSAR D&E Phase II T1 test data	<i>Open</i>
<b>BMW-2017-AI.2</b>	NOAA to post on the NOAA/SARSAT website any available performance data for various elevation angles for monopole antennas	<i>Open</i>
<b>BMW-2017-AI.3</b>	NOAA to post beacon registration growth statistics in the state of Florida on the NOAA/SARSAT website	<i>Open</i>
<b>BMW-2017-AI.4</b>	NOAA to examine the registration database for information on attrition rates for beacon types and report results to the next BMW	<i>Open</i>