RCC Messages

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Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual

MCC to MCC Data Distribution
MEOSAR Data

- The current operational system only includes LEOSAR/GEOSAR data (L/G system)

- MEOSAR data will be added to the operational system, forming the LEOSAR/GEOSAR/MEOSAR (LGM) system
  - Initial operations requires commissioning of MEOLUTs and two associated MCCs (USMCC and FMCC planned)
  - Initial operations expected to start in August 2016

- Before MEOSAR operations (pre-IOC), MEOSAR data may be provided to RCCs from experimental MEOSAR only USMCC

- In this presentation, references to MEOSAR data and the LGM system are provided in *italics*

- Further information provided in presentations on national and international data distribution

MEOSAR RCC Messages

- Similar to current LEOSAR/GEOSAR messages
  - Will use SITs 170 – 179 (similar to SITs 160 – 169)
- A single Difference of Arrival (DOA) position computed by MEOLUT vs. Doppler A/B positions computed by LEOLUT
  - DOA position computed using differences in Time of Arrival (TOA) and Frequency of Arrival (FOA) data from multiple MEOSAR satellites
- Determination of real beacon position
  - Requires data from independent sources (for MEOSAR and for the operational LEOSAR/GEOSAR system)
  - deemed "Position Confirmation" vs. "Ambiguity Resolution" in LEOSAR/GEOSAR system (no A/B position ambiguity with a single DOA position)

Overview

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Summary of Alert Message Types

- Cospas-SARSAT standard Subject Indicator Type (SIT) 185 format messages
  - Defined in document Cospas-Sarsat (C/S) A.002
  - Sent by the USMCC to most of its international SAR Points of Contact (SPOCs**)**
  - Sent by the Canadian MCC (CMCC) to U.S. RCCs during USMCC backup
- USMCC National RCC format messages: SIT 160 to 179
  - Sent by the USMCC to all US RCCs and a few international SPOCs
  - SIT 160 to 169 sent in current operational (LEOSAR/GEOSAR) system
  - SIT 170 to 179 sent in pre-operational MEOSAR system and future operational LEOSAR/GEOSAR/MEOSAR (LGM) system
  - Are the main subject of this presentation

Summary of Alert Message Types

SIT 160 / *170*

- 160 / *170* Message Title: **406 BEACON UNLOCATED FIRST ALERT**

- Sent when a beacon is first detected but no encoded, Doppler *or DOA* position information is available

- Typically sent when a beacon is detected by a Geostationary satellite [Geostationary (GOES) satellites do not provide Doppler *or DOA* location]

- For US beacons, only sent if beacon is registered or associated with a special program, or the craft ID is encoded in the Beacon ID

- If US beacon registered, distributed based on homeport SRR in RGDB

- If US beacon not registered, distributed based on beacon type (EPIRBs to PacArea, ELTs and PLBs to AFRCC)

- Non-US beacons distributed to the responsible RCC based on country code in the Beacon ID; example: sent to San Juan RCC for Barbados-coded beacons

Summary of Alert Message Types

SIT 161 / 171

- 161 Title: **406 BEACON LOCATED FIRST ALERT (AMBIGUITY UNRESOLVED)**

- *171 Title:* ***406 BEACON LOCATED FIRST ALERT (POSITION UNCONFIRMED)***

- Sent when first location (encoded, Doppler *or DOA*) is available, but ambiguity is not resolved (*position is not confirmed*)

- Distribution based primarily on location

- If unlocated alert was sent, located first alert is also distributed to previous destination(s)

- Alerts for US special program beacons may be distributed specially
  - Adds to or replaces normal distribution

- When available, information on "likely Doppler image position" and the accuracy of Doppler position data can be used to help prosecute SAR cases
  - Doppler position accuracy information also provided on other SIT messages

Summary of Alert Message Types
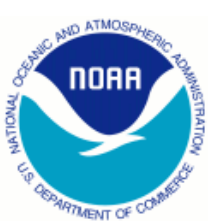
SIT 162 / 172

- 162 Title (1): **406 BEACON LOCATED FIRST ALERT UPDATE (AMBIGUITY UNRESOLVED)**

- *172 Title (1):* ***406 BEACON LOCATED FIRST ALERT UPDATE (POSITION UNCONFIRMED)***

- Sent after Doppler first alert when better A/B probability information is available from the same satellite pass

- Only sent if **new A** side probability is at least 30% higher than **previous A** side probability (e.g., **previous A** = 55%, **new A** = 85%)

- *Sent if the new DOA position is "better quality" (per Expected Horizontal Error) or the data time of a new DOA position is more than 5 minutes after the newest data time of all previously sent DOA positions (LGM)*

- Only sent prior to ambiguity resolution (*position confirmation*)

Summary of Alert Message Types

SIT 162 / 172

- 162 Title (2): **406 BEACON DOPPLER POSITION MATCH (AMBIGUITY UNRESOLVED)**

- *172 Title (2):* ***406 BEACON DOPPLER POSITION MATCH (POSITION UNCONFIRMED)***

- Sent after Doppler first alert when both Doppler locations for a new satellite pass match the Doppler locations for a different (previous) satellite pass

- When both sets of Doppler locations match, ambiguity resolution (*position confirmation*) is delayed; A/B probabilities can be used to help prosecute a SAR case

- Only sent prior to ambiguity resolution (*position confirmation)*

Summary of Alert Message Types

SIT 163 / *173*

- 163 Title: **406 BEACON POSITION CONFLICT ALERT (AMBIGUITY UNRESOLVED)**

- *173 Title:* ***406 BEACON POSITION CONFLICT ALERT (POSITION UNCONFIRMED)***

- Sent prior to ambiguity resolution (*position confirmation*), when positions for a beacon differ by more than 50 kilometers (*20 km in LGM*)

- Indicates that at least one location is inaccurate

- Position conflict due to poor quality location data or a moving beacon

- Distribution based on new location(s)

- Also distributed to all previous recipients (to allow SAR coordination)

- After position conflict, missed passes and next passes are not computed again until ambiguity is resolved (L/G only)

Summary of Alert Message Types

SIT 164 / *174*

- 164 Title: **406 BEACON NOTIFICATION OF AMBIGUITY RESOLUTION**

- *174 Title:* ***406 BEACON NOTIFICATION OF POSITION CONFIRMATION***

- Sent when Doppler (A/B) position matches different beacon event Doppler position or encoded location within 50 kilometers (L/G)

- *Sent when Doppler or DOA position matches different beacon event Doppler or DOA position or encoded location within 20 kilometers (LGM)*

- May be first alert if Doppler/*DOA* and encoded position match on same alert

- Resolved (*confirmed*) position is a merge of <u>matching</u> locations
  - *Confirmed position excludes encoded position (LGM)*
  - *Confirmed position only includes recent positions, better tracks moving beacon ([1] hour, LGM)*

- Refined encoded location matching the resolved (*confirmed*) position is usually more accurate than Doppler *or DOA* location

- For moving beacon, resolved (*confirmed*) position lags behind actual location
  - View each elemental location individually

Summary of Alert Message Types

SIT 165 / *175*

- 165 Title (1): **406 BEACON COMPOSITE POSITION UPDATE**

- *175 Title (1): **406 BEACON POSITION CONFIRMATION UPDATE***

- Sent after ambiguity resolved (*position confirmed*) when new position matches resolved (*confirmed*) position within 50 kilometers (*20 km, LGM*)

- 165 Title (2): **406 BEACON COMPOSITE UPDATE WITH POSITION CONFLICT**

- 175 Title (2): **406 BEACON CONFIRMATION UPDATE WITH POSITION CONFLICT**

- Sent after ambiguity resolved (*position confirmed)* when new position(s) differ by more than 50 km (*20 km, LGM*) from resolved (*confirmed*) position

- Repeated position conflicts without a composite (*confirmation*) position update probably means that the beacon is moving

Summary of Alert Message Types

SIT 166 (L/G)

- Message Title: **406 BEACON MISSED PASS/SITE STATUS REPORT**
- Sent when a satellite pass (at least 10 degrees above the horizon to the reported beacon position) fails to detect the beacon
  - Only sent if missed detect time is after last time beacon detected
  - Alert site closes after 3 missed passes
  - Missed pass not computed prior to ambiguity resolution if position conflict
- Sent when alert site closes due to age - 18 hours without a detection
- Sent when alert site closes due to USMCC Operator action
  - RCCs should request closure only if the beacon has been secured, and
    - at least 1 missed pass is received (if located) or 30 minutes with no message (if unlocated)
- Sent before or after ambiguity resolution
- When alert site closes in US service area, alert data sent to the IHDB
  - Site closure message sent to US SPOCs includes incident feedback request

Summary of Alert Message Types

SIT 176 (*LGM*)

- Message Title: **406 BEACON SITE STATUS REPORT**
- Sent when the beacon is not detected for 30 minutes
- No missed pass message or site closure due to missed passes
- Sent when alert site closes due to age - 2 hours without a detection
- Sent when alert site closes due to USMCC Operator action
  - RCCs should request closure only if the beacon has been secured, and
    - at least 20 minutes have passed with no message
- Sent when alert site closes due to age – site open for 72 hours
- Sent before or after position confirmation
- When alert site closes in US service area, alert data sent to the IHDB
  - Site closure message sent to US SPOCs includes incident feedback request

Summary of Alert Message Types

SIT 167 / 177

- Message Title: **406 BEACON DETECTION UPDATE**
- Sent when an unlocated alert is received:
  - With detect time at least <u>two hours</u> later than the most recent detect time sent to the RCC for the alert site (L/G)
  - *With detect time at least <u>30 minutes</u> later than the most recent detect time sent to the RCC for the alert site (LGM)*
  - *When the previous MEOSAR alert was "suspect"; i.e., uncorroborated by other alert data (LGM)*
  - That causes the missed pass counter to be reset: missed pass counter is reset when detect time is later than time of missed detection (L/G only)
- Sent to notify the RCC that the beacon is still active
- Sent before or after ambiguity resolution (*position confirmation*)

Summary of Alert Message Types
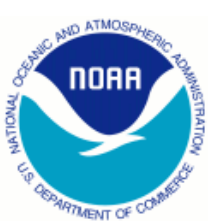
SIT 168 / 178

- Message Title: **NOTIFICATION OF COUNTRY OF REGISTRATION**
  - Acronym is NOCR
- NOCR: sent to US RCC when a US-coded 406 MHz beacon is detected outside the US Search and Rescue Region (SRR), source of the NOCR is the MCC servicing the location of the alert.
- NOCR: sent to US RCC responsible for a foreign SRR when a beacon coded for that country is detected outside its SRR (e.g., sent to CGD07 for Bahamas-coded beacon detected outside of the Bahamas SRR)
- If US beacon is registered, distributed based on homeport SRR in RGDB
- If US beacon not registered, distributed based on beacon type (EPIRBs to PacArea, ELTs and PLBs to AFRCC)
- Allows US RCC to ensure that there is a SAR response for (US) beacon
- Sent for the first alert with Doppler, *DOA (LGM)* or encoded location

Summary of Alert Message Types

SIT 169 / 179

- 169 Title: **406 BEACON ENCODED POSITION UPDATE**

- 179 Title (1):   **406 BEACON ENCODED POSITION UPDATE (POSITION UNCONFIRMED)**

- 179 Title (2):   **406 BEACON ENCODED POSITION UPDATE (POSITION CONFIRMED)**

- Sent when the position encoded in the beacon message changes by more than 3 km and less than 50 km (L/G, *less than 20 km in LGM*)

- Only sent when there is no new *DOA (LGM)* or Doppler location data

- Provides RCC with timely updates on beacon position, which may be particularly valuable in difficult SAR conditions, such as rough seas or mountainous terrain

- Alert sent by *MEOLUT (LGM)* or GEOLUT when encoded position changes

- May be sent before or after ambiguity resolution (*position confirmation*)

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual

Overview of Alert Message Structure

- Messages fields are provided in a logical, consistent format
- Key message **sections** and fields are as follows:
  - **Message header**: message number, transmit time, message type
  - **Alert Data Block:** beacon ID, site ID, position, detect time, SRR
  - **406 MHz Beacon Decode Information:** country of registration, beacon type, craft ID, special program information, encoded position resolution
  - **406 MHz Beacon Registration Data:** beacon owner, contact information, vehicle/usage information, registry contacts for non-USA beacons
  - **Supporting Information:** alert recipients, previous detections, predicted LEOSAR detections (L/G only)
  - **Message Trailer:** end of message

- ## Message number

  - On first line of message (e.g., 17127)

  - Sequential per RCC: track to ensure all messages are received

  - Reference to discuss a specific message with USMCC

- ## Subject Identifier Type (SIT) number

  - 3-digit number in second line of message (e.g., 161)

  - Along with **Message Title** (highlighted below), identifies alert message type (per summary of alert message types provided previously)

/17127 00000/3660/12 010 0939

/161/366S

****** 406 BEACON LOCATED FIRST ALERT (AMBIGUITY UNRESOLVED) ******

- **Special Message Title**

  – Provided in two cases: "UNRELIABLE BEACON (HEXADECIMAL) ID" and "SHIP SECURITY ALERT" . A sample of the latter is provided below.

  – Precedes standard message title

> /17127 00000/3660/09 270 0939
>
> /161/CGOP
>
> !!! SHIP SECURITY ALERT !!!!!!!!!!
>
> ****** 406 BEACON LOCATED FIRST ALERT (AMBIGUITY UNRESOLVED) ******

Alert Message Structure – Key Fields
2. Alert Data Block

BEACON ID
- 15 character hexadecimal code identifies the 406 MHz beacon
- Used to reference USMCC registration (RGDB) data for the beacon
- Used to discuss SAR case with SAR agencies other than US RCCs or US SPOCs

SITE ID
- 5 digit number assigned by USMCC identifies a beacon activation
- Used to discuss SAR case with USMCC, US RCCs, or US SPOCs

SITE STATUS
- Only present on SIT 166 / *176* message (Site Status , Missed Pass)
- Indicates if the site is open or closed, and if closed, the reason for closure

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/BEACON ID: XXXXX XXXXX XXXXX   SITE ID: NNNNN   [Site Status]

[Ambiguity Resolution Summary]
(NEW ALERT OR MISSED PASS INFORMATION)

Ambiguity Resolution (*Position Confirmation*) Summary (only present if ambiguity resolved / *position confirmed*)

- **LATITUDE** and **LONGITUDE** provided for composite/merged location

  - Doppler location normally accurate within 5 KM (95% for nominal solutions)

  - DOA location expected accuracy within 5 KM (MEOLUT requirements for early operations: 70% for 1 burst solutions, 90% within 20 minutes)

  - Refined encoded location matching composite usually more accurate than Doppler/*DOA* loc.

    - Refined encoded location has a precision of 4 seconds (180 meters)

    - If beacon is moving, composite location lags behind actual location

      - *Confirmed position only includes positions within last 1 hour, limits lag (LGM)*

- **DURATION** is hours between first detect time and last detect time

- Sample Ambiguity Resolution Summary below (L/G):

```
********* AMBIGUITY RESOLVED TO THE FOLLOWING POSITION  **********

LATITUDE  LONGITUDE   DURATION   PASSES  SRR   /BUFFER
38 45.5N   076 56.9W    001.5 HRS    003        AFRCC
```

Ambiguity Resolution (*Position Confirmation*) Summary (continued)

- **SRR** is the primary Search and Rescue Region (SRR)

- **BUFFER** is the secondary SRR (within 50 km buffer or overlap of primary SRR)

  - *Two buffers provided for LGM*

- **SRR** and **BUFFER(s)** in Summary are usually based on first composite location

- *Sample Position Confirmation Summary below (LGM):*

```
*************** CONFIRMED POSITION   ***************

LATITUDE  LONGITUDE   DURATION   SRR   /BUFFER/BUFF_2
38 45.5N    076 56.9W      001.5 HRS   AFRCC
```

New Alert Information – Data Solution line

- **PROB** (Probability) provided for Doppler ("**A**" and "**B**") locations

  - "**A**" side assigned to location more likely to be real (ranges from 50 to 99)

  - "**B**" side assigned to location less likely to be real (ranges from 1 to 50)

  - "**A**" side location with very high "**A**" probability (e.g., 95) may be incorrect

  - A higher "**A**" probability location is usually more accurate (e.g., 90 vs. 55)

- **SOL** (Solution) is **A** (Doppler), **B** (Doppler), *D (DOA)*, **E** (encoded), **N/A** or **U** (unlocated)

- **LATITUDE** and **LONGITUDE** provided for new Doppler, *DOA (LGM)* or encoded position

- Sample below for L/G system -

```
***************** DETECTION TIME AND POSITIONS FOR THE BEACON **************

PROB  SOL  LATITUDE  LONGITUDE   DETECT TIME  SAT  SOURCE  SRR   /BUFFER
53    A    35 25.2N  076 36.4W   27 0937 SEP  S7   CMCC    AFRCC
47    B    31 42.7N  058 40.0W   27 0937 SEP  S7   CMCC    LANTAR

DETECTION FREQUENCY: 406.0281 MHZ
```

New Alert Information – Data Solution line (Cont'd)

DETECT TIME provided in Universal Coordinated Time (UTC)

- For Doppler solutions, is computed Time of Closest Approach (TCA) of the satellite to beacon
  - May differ from individual beacon message detect times by 8 to 10 minutes
- For non-Doppler LEOSAR solutions, is last beacon message detect time
- For GOES *and MEOSAR* solutions, is first beacon message detect time

- **SAT** (Satellite): first digit is **S** (SARSAT), **C** (COSPAS), **G** (GOES), **M** (MSG), **I** (INSAT), **R** (Russian GEO)

  - Listed as "MEO" for LGM system; list of MEOSAR satellites is not provided

  - Only SARSAT and COSPAS satellites can generate Doppler locations

- **SOURCE** of the solution may be US LUT (e.g., AK1) or foreign MCC (e.g., CMCC)

- Sample below for L/G system -

```
***************** DETECTION TIME AND POSITIONS FOR THE BEACON **************

PROB  SOL  LATITUDE   LONGITUDE   DETECT TIME   SAT   SOURCE  SRR   /BUFFER
53    A    35 25.2N   076 36.4W   27 0937 SEP   S7    CMCC    AFRCC
47    B    31 42.7N   058 40.0W   27 0937 SEP   S7    CMCC    LANTAR

DETECTION FREQUENCY: 406.0281 MHZ
```

27

Alert Message Structure – Key Fields
2. Alert Data Block (Cont'd)

New Alert Information – Data Solution line (*LGM specific information*)

- **QF** (Quality Factor) estimates DOA location quality (0 - 999) – <u>used in MEO pre-operations</u>

  - Higher number means the DOA position is likely more accurate (especially above 500)

- **EE** (Expected Horizontal Error, values 0 – 150, 999) – <u>will be used in LGM in place of QF</u>

  - Error (nm) of DOA position expected within that amount with probability of 95% (+- 2%)

  - "0" means unavailable, "999" means greater than 150 nautical miles (nm)

  - Approved by C/S in Dec. 2015, <u>needs to be verified</u> as part of MEOLUT Commissioning

- **SOL** – unlocated alert is identified as "U" in LGM vs. "N/A" in L/G

- **NUM** (Number of MEO satellites) – DOA position with more satellites likely more accurate

```
***************** DETECTION TIME AND POSITIONS FOR THE BEACON **************

PROB  EE SOL  LATITUDE  LONGITUDE  DETECT TIME  SAT  NUM SOURCE SRR     BUFFER/BUFF_2
N/A    7   D    31 42.7N   058 40.0W   27 0937 SEP    MEO  005  FL-MEO LANTAR

DETECTION FREQUENCY: 406.0281 MHZ
```

New Alert Information – Data Solution line (Cont'd)

- **SRR** is primary **S**earch and **R**escue **R**egion (SRR) for the alert location

- **BUFFER** is secondary SRR(s) for alert location, either a buffer or overlap of primary SRR (50 KM buffer between SRRs for US RCCs)

- EPIRB located in US Air Force SRR with buffer in US Coast Guard SRR is shown with the Coast Guard SRR as **SRR** and the Air Force SRR is removed from SRR list

- SRR/BUFFER <u>usually</u> indicates message destinations and responsible SRRs, **however**

  - Only 2 SRRs (*3 in LGM*) are listed – see <u>Supporting Information</u> for other message destinations

  - Alert location is irrelevant for Ship Security beacons (distributed by country code)

  - US special program beacons are sent specially (adding to or replacing normal distribution)

    - Special program shown in <u>Beacon Decode Information</u> (if applicable)

  - NOCR (SIT 168 / *178*) distributed based on country code if location not in country's SRR

  - For alert manually sent by USMCC to another RCC, SRR on message is not changed

PROB	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	SOURCE	SRR	/BUFFER
N/A	E	34 32.1N	069 11.4E	22 0731 FEB	M1	NMcc	AFGHAN	/TRMCC

New Alert Information – DETECTION FREQUENCY

- Provided for Doppler, *MEOSAR* and GOES solutions

- Not provided for LEO satellite solution without Doppler location (unreliable because the impact of Doppler shift on frequency is not removed, impact especially large when the detected beacon bursts are far from the TCA)

- On MEOSAR alerts, value "406.1250" indicates that the frequency is not available

- May be used to select 3-KHz channel for 406 MHz beacon homing equipment

  (e.g., select 406.028 MHz, 406.031 MHz, or 406.034 MHz)

- 406.061 MHz and 406.064 MHz used for MEOSAR testing (not allocated for operational use)

***************** DETECTION TIME AND POSITIONS FOR THE BEACON *************

PROB	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	SOURCE	SRR	/BUFFER
53	A	35 25.2N	076 36.4W	27 0937 SEP	S7	CMCC		AFRCC
47	B	31 42.7N	058 40.0W	27 0937 SEP	S7	CMCC		LANTAR

DETECTION FREQUENCY: 406.0281 MHZ

New Alert Information – <u>LIKELY</u> IMAGE POSITION

- Data line only provided when one new Doppler position (A or B) is determined to be an image (non-real) position prior to ambiguity resolution (*position confirmation*)

- Occurs when a beacon was previously detected as an unlocated alert and exactly one new Doppler (A or B) position was not visible to the satellite that detected the unlocated alert

- When one position is an image ("A" in sample below), the other position may also be incorrect

- The determination of the "real" beacon position is independent of image determination

- This information may help SAR prosecution prior to ambiguity resolution (*position confirmation*)

- The sample below correlates to the illustration on the next page

```
*****************  DETECTION TIME AND POSITIONS FOR THE BEACON  **************

PROB  SOL  LATITUDE  LONGITUDE  DETECT TIME  SAT  SOURCE  SRR   /BUFFER
53     A    35 25.2N  076 36.4W   27 0937 SEP   S7   CMCC    AFRCC
47     B    31 42.7N  058 40.0W   27 0937 SEP   S7   CMCC    LANTAR


DETECTION FREQUENCY: 406.0281 MHZ
LIKELY IMAGE POSITION: THE A POSITION
```
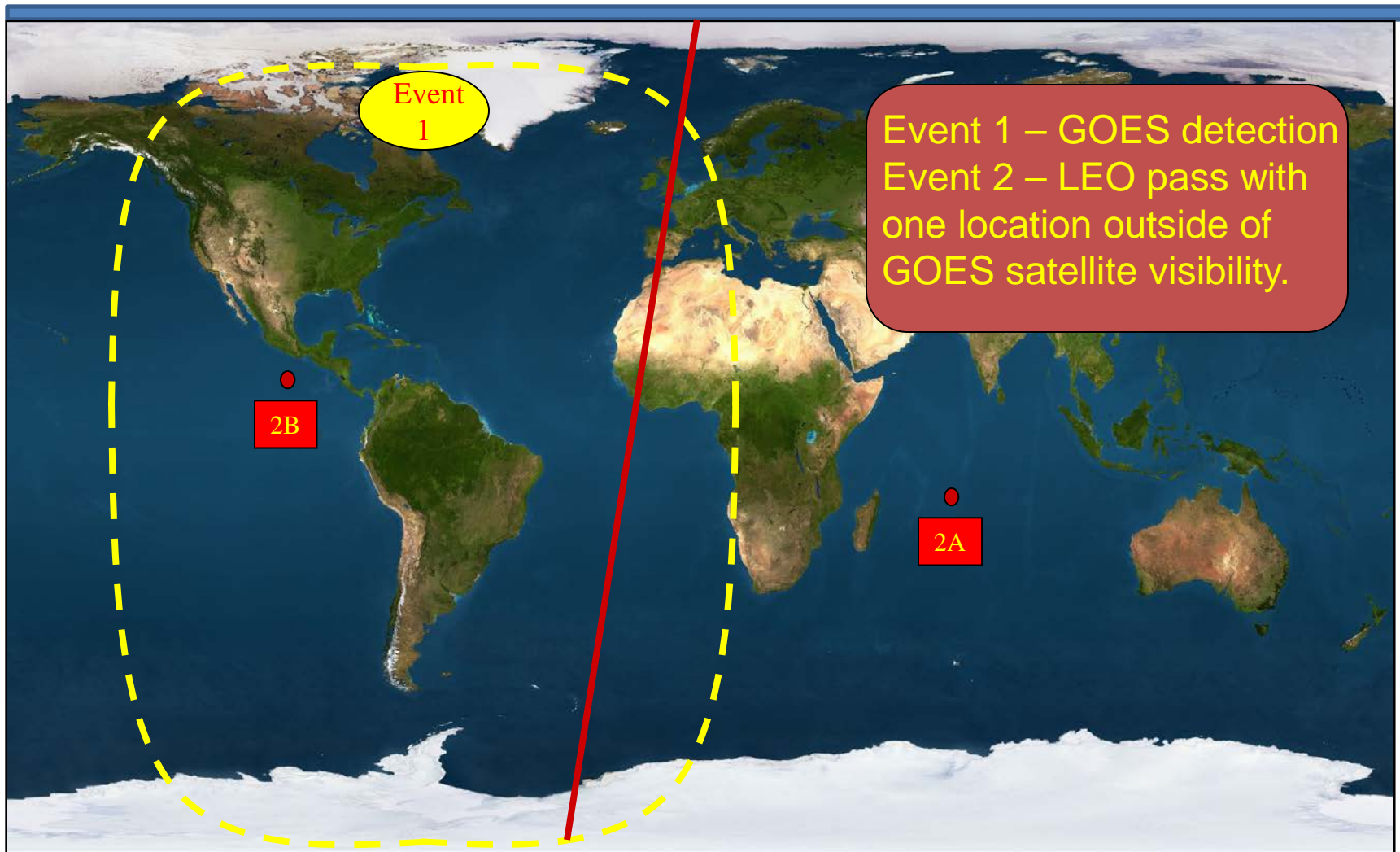
Event 1

Event 1 – GOES detection
Event 2 – LEO pass with one location outside of GOES satellite visibility.

2B

2A

Sample Image Determination with GOES Satellite (likely image is the A position)

Alert Message Structure – Key Fields
2. Alert Data Block (Cont'd)

New Alert Information – Information on Doppler Position accuracy

- Data line only provided when the USMCC determines that there is a high probability that the new Doppler position data is very accurate

- Accuracy determination based on technical parameters defined in document C/S A.002 (Appendix B.1 to Annex B) that are associated with a "nominal" Doppler solution

- Per document C/S T.005 (LEOLUT Commissioning Standard), "nominal" solutions are required to be accurate within 5 km in 95% of cases

- "Accuracy" indicator is absent if at least 1 technical parameter is poor for the Doppler solution or a large maneuver occurred in the last 24 hours for the satellite

- Information may assist SAR prosecution prior to ambiguity resolution (*position confirmation*)

```
***************** DETECTION TIME AND POSITIONS FOR THE BEACON **************

PROB  SOL  LATITUDE  LONGITUDE  DETECT TIME  SAT  SOURCE SRR   /BUFFER
75    A    35 25.4N  076 36.7W  14 0247 FEB  S12  AK1        AFRCC
25    B    31 42.1N  058 42.0W  14 0247 FEB  S12  AK1        LANTAR

DETECTION FREQUENCY: 406.0281 MHZ
HIGH PROBABILITY THAT THE NEW DOPPLER POSITION DATA IS ACCURATE WITHIN 5 KM
```

Alert Message Structure – Key Fields
2. Alert Data Block (Cont'd)

New Alert Information – MEOSAR Suspect Alerts (LGM only)

- A MEOSAR alert is identified as "Suspect" when the alert is based on a single beacon burst detected by one satellite through one antenna, with no other detection for the beacon

- RCCs should act with caution since the beacon Id or encoded position may be unreliable

- Validity of a suspect alert can be corroborated by:

  - a subsequent alert for the beacon Id

  - registration data for the beacon Id (US or foreign)

  - registration data for the encoded Craft Id (per Beacon Decode section)

  - match of reported Detection Frequency and detection frequency for the beacon model (associated with the encoded C/S Type Approval (CSTA) number provided in the Beacon Decode section)

```
*************** DETECTION TIME AND POSITIONS FOR THE BEACON  **************

PROB EE SOL LATITUDE  LONGITUDE  DETECT TIME SAT NUM SOURCE SRR   /BUFFER/BUFR_2
N/A   N/A E   08 29.5N   135 58.9E     15 1302 JUL   MEO 001  HI_MEO MARSEC

DETECTION FREQUENCY: 406.0375 MHZ
SUSPECT ALERT: SINGLE UNCORROBORATED DETECTION
```

Alert Message Structure – Key Fields
3. Beacon Decode Information

- Information based on decode of 406 MHz Beacon ID

- **COUNTRY** identifies the country or territory responsible for the beacon registration

  - C/S website provides Registry Points of Contact for non US beacons; see "Contacts" at
    http://www.cospas-sarsat.org

  - some countries registrations held in C/S International Beacon Reg. Database (IBRD)

- **MID CODE** is 3-digit number assigned by ITU and associated with the **COUNTRY**

- **BEACON TYPE** shows the beacon type as EPIRB, ELT, PLB, or SHIP SECURITY

  - Shows if beacon is serialized (no CRAFT ID for serialized beacons)
  - For location protocol beacons, indicates if NATIONAL or STANDARD (STD)
  - CATEGORY I means that the EPIRB activation method is unknown (manual or automatic)
  - CATEGORY II means that the EPIRB can only be activated manually

```
************* BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ***********
COUNTRY    : USA                      BEACON TYPE: ELT 24 BIT ADDRESS (STD)
MID CODE   : 366                      CRAFT ID : N203JP      SPECIFIC BEACON: 0
MANUFACTURER:                         MODEL    :
24 BIT ADDR : HEX=A19DFE              HOMING   : 121.5 MHZ
POSITION DEVICE: INTERNAL             POSITION RESOLUTION: NONE
```

- **CRAFT ID** provides an alternate reference for registration data (not US RGDB)

  - Craft IDs include tail Number (e.g., N203JP), radio call sign and ship station ID

  - Use the radio call sign or MID code/ship station ID to access ITU registration data:

    http://www.itu.int/online/mms/mars/ship_search.sh

- **SPECIFIC BEACON** identifies the specific beacon on a vessel or aircraft

  - Field value may be numeric or alphanumeric, depending on the beacon type

- **MANUFACTURER** and **MODEL** are only provided for US serialized user beacons

  - see http://www.cospas-sarsat.org/beacons/typeApprovedList.htm to get Manufacturer and Model and search on CSTA number, if CSTA (C/S Type Approval) number is provided in **MANUFACTURER** field

```
************* BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION **********
COUNTRY    : USA                        BEACON TYPE: ELT 24 BIT ADDRESS (STD)
MID CODE   : 366                        CRAFT ID : N203JP        SPECIFIC BEACON:  0
MANUFACTURER:                           MODEL    :
24 BIT ADDR : HEX=A19DFE                HOMING   : 121.5 MHZ
POSITION DEVICE: INTERNAL               POSITION RESOLUTION: 4 SECONDS
```

- **SERIAL NUM** provides the Serial Number, if the beacon is serialized

  - **24 BIT ADDR** provides the 24-bit address; if present, it replaces serial number

- **HOMING** identifies the beacon's homer as 121.5 MHZ, SART (SAR transponder), OTHER or NONE

- **POSITION DEVICE** indicates the device type used to provide encoded position

  - INTERNAL (device internal to beacon)

  - EXTERNAL (device external to beacon, encoded position may be incorrect if beacon becomes separated from vessel)

  - NIL (information not available – beacon not location protocol or information is unreliable)

- **POSITION RESOLUTION** is the resolution of encoded position (details on next page)

```
************ BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ***********
COUNTRY    : USA                      BEACON TYPE: PLB SERIAL (STANDARD)
MID CODE   : 366                      CRAFT ID :              SPECIFIC BEACON:
MANUFACTURER:    ACR                  MODEL    :   UNKNOWN
SERIAL NUM : 12345                    HOMING   :  121.5 MHZ
POSITION DEVICE: NIL                   POSITION RESOLUTION: 2 MINUTES
```

- **POSITION RESOLUTION**

  - Depends on beacon protocol and usability of 2 data fields in beacon message protected by error correction codes (called Protected Data Field-1 and Protected Data Field-2)

  - If encoded position is not available, the value is NONE

Beacon Protocol	Only PDF-1 usable	PDF-1 and PDF-2 usable
Standard Location	15 MINUTES (at 45 degrees latitude, equals 10.6 nm longitude and 15.0 nm latitude)	4 SECONDS
National Location	2 MINUTES (at 45 degrees latitude, equals 1.4 nm longitude and 2.0 nm latitude)	4 SECONDS
User (not National)	NONE	4 MINUTES
User – National (CSEL)	1 DEG LAT, 15 DEG LONG	2 SECONDS
User – National (SEPIRB)	1 DEGREE	2 SECONDS

- NOAA allocates groups of US coded beacons to US government **SPECIAL PROGRAMS**

  - Alerts usually distributed specially (adding to or replacing normal distribution)

- **PROGRAM** provides the name of the Special Program for a group of US beacons

  - Set to "**SEE JSETS**" if beacon registered in JSETS but not in a special program

  - Data Line only shown on message if beacon in JSETS or allocated to special program

- **PROGRAM** set to "BEACON TEST XXX…" indicates beacon test ("XXX…" describes the test)

- **PROGRAM BLOCK REGISTRATION ID** allows one beacon in the RGDB to represent a group of allocated beacons and to refer to a separate registry (e.g., JSETS)

  - If **BLOCK REG. ID** is 000000000000001, RGDB data is shown for specific beacon (if present) and "**SEE JSETS**…" is shown in next data line after **PROGRAM**

```
************   BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ***********

COUNTRY      : USA            BEACON TYPE: PLB SERIAL (NATIONAL)

MID CODE     : 366            CRAFT ID   :                   SPECIFIC BEACON:

MANUFACTURER:                 MODEL      :

SERIAL NUM  : 123             HOMING     : 121.5 MHZ

POSITION DEVICE: INTERNAL     POSITION RESOLUTION: 4 SECONDS

PROGRAM: FBI                  PROGRAM BLOCK REGISTRATION ID: XXXXXXXX81FE0
```

- **Unreliable beacon message**

  - Occurs if Beacon ID contains invalid or inconsistent information

  - Due to beacon transmission, beacon miscoding, LUT or satellite problem

  - Do not rely on C/S website Beacon Decode (invalid/inconsistent information may not be apparent from 15 hex Beacon ID provided in RCC message)

  - Alerts with unreliable beacon message distributed solely based on Doppler *(or DOA)* location

  - Does not mean that the Doppler *(or DOA)* location is poor

  - Has occurred for true distress beacon activations

  - If Detection Frequency is near 406.061 – 406.064 MHz, satellite is S11, S12 or S13, and Doppler location is near MEOSAR D&E beacon simulator, alert is likely due to MEOSAR test (call USMCC)

  - Indicated by special Message Title "UNRELIABLE BEACON (HEXADECIMAL) ID "

  - Indicated in beacon decode information as follows:

> **NO DATA PROVIDED BECAUSE THE BEACON CODING IS NOT RELIABLE**

Alert Message Structure – Key Fields
3. Beacon Decode Information (Cont'd)

- **Unreliable beacon message (satellite SARP problem, RCC actions)**

- Search and Rescue Processor (SARP-3) problem on S11, S12 and S13 causes the beacon message to be read from incorrect bits (not starting at bit 25)

- The problem occurs when:
  - A beacon transmits rapidly in self-test mode (every 10 seconds not 50 seconds)
  - A beacon transmits in an area of high interference

- RCC mitigation actions (SAR response)
  - Search RGDB (US beacons only!) using ADCD0 + the first 10 digits of beacon ID on the alert
  - Search RGDB using * and the first 14, 13, 12, 11 and 10 digits of beacon ID on the alert
  - Look for other alerts in the vicinity

- RCC mitigation actions (corrupt beacon ID identified)
  - Request beacon owner to contact beacon manufacturer
  - Probably requires a battery change
  - Beacon probably malfunctioned (rapid transmission in self-test mode, may be due to bracket design)
  - Notify USMCC Chief (Dawn.Anderson@noaa.gov) for further investigation

Alert Message Structure – Key Fields
4. Beacon Registration Data

- For <u>USA beacons</u>, based on information in **US RGDB** for Beacon ID
  - Contains three sections

- <u>Section 1</u> contains information about beacon owner and points of contact
  - Owner name, owner address, points of contact names and telephone numbers
  - Owner name "SEE JSETS" indicates that the beacon registration information is provided in the U.S. military JSETS database

- <u>Section 2</u> contains information about beacon carriage and type of use

  - For <u>ELTs</u>: aircraft information is provided, including Leasing Agent, Aircraft Manufacturer, Model, Aircraft Use, Color, Radio Equipment, Capacity, Tail Number, Airport and Airport SRRs. ELT manufacturer and model number are also provided.

  - For <u>EPIRBs</u>: vessel information is provided, including Vessel Name, Type, Length, Capacity, Radio Call Sign, Registration Number, Color, Radio Equipment, InMarsat Number, Cell Number, Number of Life Boats, Homeport, and Homeport SRRs. EPIRB Manufacturer/Model Number and Activation Type (CAT1, CAT2) are also provided.

  - For <u>PLBs</u>: Radio Equipment, Vehicle Type, Specific Usage, PLB Manufacturer, and Model Number are provided.

Alert Message Structure – Key Fields
4. Beacon Registration Data (Cont'd)

- Section 3 provides Registration Dates, Remarks (from beacon owner or RCC), and Special Status information

  - SPECIAL STATUS indicates if beacon is reported as SOLD, STOLEN, REPLACED, OUT OF SERVICE, LOST, RECODED, or DESTROYED

  - Beacons in special status are usually unavailable for normal use or not in the owner's possession

  - View SPECIAL STATUS INFO for more information on special status condition

  - Roughly half of activated US registered beacons have Special Status information

- If a USA beacon is not registered in **US RGDB**, this message section states:

  > **REGISTRATION INFORMATION IS NOT AVAILABLE IN THE USMCC DATABASE**

- For a <u>non-USA beacon</u> this message section provides point of contact information for the associated beacon registry

REGISTRATION INFORMATION AT
    [Name of Registry Contact]
    TELEX:
    AFTN:
    TELEPHONE:
    FACSIMILE:
    EMAIL:
    WEB:

- If no point of contact information beacon registry is available for non-USA beacon, this message section states

REGISTRATION INFORMATION – NIL

Alert Message Structure – Key Fields
5. Supporting Information

- **PREVIOUS PASS INFORMATION** lists previous passes that detected the beacon (L/G only)
  - Ordered by time pass first <u>received</u> at USMCC (most recent listed first)
  - Up to 4 satellite passes are listed
  - Solution Data fields (PROB, SOL, etc.) have same format as in alert data block
  - SOURCE "MULT" indicates that the pass was received from multiple sources
    - Merged (multiple source) location may differ from initial (single source) location
  - <u>After ambiguity resolved</u>, locations that do not match the composite are not reported
    - View alert data block in many messages in detect time order to identify a moving beacon
- Sample below: position conflict before ambiguity resolved

```
PREVIOUS PASS INFORMATION:

PROB   SOL   LATITUDE  LONGITUDE   DETECT TIME   SAT   SOURCE  SRR     /BUFFER
52     A     34 53.3N 136 14.2W    18 1438 FEB   S8    CMcc    PACARE
48     B     27 04.3N 101 15.6W    18 1438 FEB   S8    CMcc    MEXTEL
50     A     18 18.9N 098 29.8W    18 1347 FEB   S9    MULT    MEXTEL
50     B     05 07.0N 039 14.2W    18 1347 FEB   S9    MULT    BRMCC /FMCC
N/A    E     20 30.0N 100 30.0W    18 1356 FEB   G15   MULT    MEXTEL


NEXT TIME SIGNAL SHOULD BE DETECTED: N/A
```

Alert Message Structure – Key Fields
5. Supporting Information

- **PREVIOUS MESSAGE INFORMATION** lists previous messages sent for the beacon *(LGM)*
    - Ordered by time messages <u>received</u> at USMCC (most recent listed first)
    - Up to 4 previous messages are listed
    - Solution Data fields (EE, SOL, etc.) have same format as in alert data block
    - First alert to an RCC may show previous message information sent to another destination
    - Location data shown per original message (locations from multiple sources not merged)
    - <u>Once position is confirmed</u>, if a Doppler position matches the confirmed position, the associated incorrect Doppler position is not reported
        - View alert data block in many messages in detect time order to identify a moving beacon
- Sample below: position update after position confirmation

```
PREVIOUS MESSAGE INFORMATION:

PROB EE SOL LATITUDE   LONGITUDE   DETECT TIME SAT NUM SOURCE
85    N/A A  64 11.4N  151 22.3W   17 1023 FEB S10 N/A AK1
N/A    10 D  64 11.9N  151 21.9W   17 1025 FEB MEO 004 CMCC
N/A     4 D  64 11.6N  151 21.8W   17 1020 FEB MEO 005 FL_MEO
N/A   N/A U  N/A                   17 1019 FEB G13 N/A MD1
```

- **NEXT TIME BEACON SHOULD BE DETECTED** (L/G only)

  - Gives the next two LEOSAR satellite passes that should detect the reported beacon location(s)

  - Based on a polar orbiting (i.e., SARSAT or COSPAS) satellite pass having mutual visibility to the beacon location and a US LEOLUT scheduled to track that pass

  - **SOL** gives received solution (A, B, E or C) that is predicted to be detected

  - HIGH VISIBILITY PASS (over 10 degrees) not received is counted as "missed"

  - LOW VISIBILITY PASS (5-10 degrees) not received is <u>not</u> counted as "missed"

  - Next pass not predicted before ambiguity resolved, if there is position conflict

  - Next pass predictions only for resolved (composite) position after ambiguity resolved

```
PREVIOUS PASS INFORMATION: N/A


NEXT TIME BEACON SHOULD BE DETECTED:
SOL    DETECT TIME    SAT    SOURCE    VISIBILITY
A      15 0200 FEB    S7     AK2       HIGH
A      15 0239 FEB    S8     GU1       LOW (WILL NOT COUNT AS MISSED PASS)
B      15 0200 FEB    S7     AK2       HIGH
B      15 0240 FEB    S11    FL1       HIGH
```

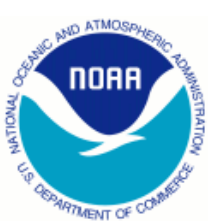• Three lines indicate the end of message:

> QQQQ
> /LASSIT
> /ENDMSG

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual

Revised RCC Message Manual

- Version 2.13 uploaded to NOAA website in Feb. 2016 (L/G)

- *Version 3.01 uploaded to NOAA website in Feb. 2016 (LGM)*

  - *Draft version, will be revised as the LGM capable USMCC is developed and tested over the next few months.*

- All revisions identified in "Document History" at the start of the manual

MEOSAR RCC Messages

- Contact Information
- Tom Griffin
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  - 301 817-4532