RCC Messages

SAR Controllers Training 2022
26 - 28 April 2022
Tom Griffin
ERT, Inc.
USMCC Systems Analyst

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual
- Key planned RCC message changes (summary)
- Information on Distress Tracking ELTs (i.e., ELT(DT)s) and Second Generation Beacons (SGBs) is shown throughout the presentation in blue
  - These new beacon types are planned to be operational in Jan 2023
  - An ELT(DT) may be either a First Generation Beacon (FGB) or an SGB
- Other planned RCC message changes are shown in blue
- This presentation summarizes the RCC message manual (RCC Survey)

MCC to MCC Data Distribution MEOSAR Data

- The current operational system includes LEOSAR/GEOSAR/MEOSAR data (LGM system)
- LGM early operations began December 2016 and
  - includes 16 MEOLUTs (including Florida, Hawaii, France, Norway, Spain, Australia, New Zealand, Japan, Chile, UK and Cyprus)
  - includes LEOLUTs and GEOLUTs from the previous L/G system
  - includes 16 LGM MCCs (including 5 nodal MCCs - USMCC, FMCC, SPMCC, AUMCC and JAMCC) and 16 L/G MCCs
    - List of MCCs (as LGM or L/G capable) in Annex 3 of RCC Message Manual
    - Current list of MCC capability provided on C/S web site:
      - https://www.cospas-sarsat.int/en/system/meosar-system-status/mcc-configuration
      - List on C/S web site published more often than the RCC Message Manual
      - RCCs can use current list to ensure that L/G MCC sends alert to its RCC for US beacon
  - Per Coast Guard policy, MEOSAR data is secondary to LEOSAR and GEOSAR data in LGM early operations

MEOSAR RCC Messages

- First Generation Beacons (FGBs) use SITs 170 – 179
- Second Generation Beacons (SGBs) use SITs 370 – 379
- 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
- MCC determination of the beacon position
  - requires position data from independent sources matching within 20 km
  - currently deemed “Position Confirmation”
  - per recent C/S decision, the term “MCC Reference Position” will replace the term “Confirmed Position”, to clarify that the MCC does not know the actual beacon position
    - This change will affect some RCC message titles and field titles

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual
- Key planned RCC message changes (summary)

Summary of Alert Message Types

- Cospas-SARSAT standard Subject Indicator Type (SIT) 185 format messages
  - Defined in document Cospas-Sarsat (C/S) A.002
  - Further described in document C/S G.007 (Handbook on Alert Messages for RCCs and SPOCs)
  - Sent by the USMCC to most of its international SAR Points of Contact (SPOCs)
  - Sent by the Canadian MCC (CMCC) to US RCCs and SPOCs during USMCC backup
- USMCC National RCC format messages
  - Sent by the USMCC to all US RCCs and a few international SPOCs
  - The main subject of this presentation
  - Further described in the RCC Message Manual
  - SIT 170 – 179 (FGBs) and SIT 370 – 379 (SGBs)

Summary of Alert Message Types

SIT *170 / 370*

- 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 (GOES) satellite; 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 for countries in the US service area are sent 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 *171 / 371*

- **406 BEACON LOCATED FIRST ALERT (POSITION UNCONFIRMED)**
- Sent when first location (encoded, Doppler or DOA) is available, but position is not confirmed by independent data
- Distribution based primarily on location
- If an 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
  - There is no Doppler location for SGBs

Summary of Alert Message Types

SIT 172 / 372

- 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 (no Doppler location for SGBs)
- Only sent if the **new A** side probability is at least 15% higher than **previous A** side probability (e.g., **previous A** = 55%, **new A** = 70%)
- For non-ELT(DT)s, sent if the new DOA position is "better quality" per Expected Horizontal Error (EHE)* or the latest data time of a new DOA position more than 5 minutes after the newest data time of all previously sent DOA positions
- ELT(DT)s – sent if DOA position and detect time is at least 3 seconds from the detect time for all other alerts with DOA position, in the first 30 seconds of activation. After 30 seconds from activation, new DOA position sent based on 10 minute threshold
- Only sent prior to position confirmation

* The EHE is only reliable for moving beacons (e.g., beacons at sea) if the MEOLUT is commissioned for "slow moving beacon" location accuracy, and is provided in messages to SPOCs and USCG RCCs only if the MEOLUT meets requirements for "slow moving beacon" location accuracy. The EHE is always provided in messages to USAF RCCs.

Summary of Alert Message Types

SIT 172

- Title (2): **406 BEACON DOPPLER POSITION MATCH (POSITION UNCONFIRMED)**
- Sent 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, position confirmation is delayed; A/B probabilities can be used to help prosecute a SAR case
- Only sent prior to position confirmation

SIT 172 / 372

- Title (3): **406 BEACON DOA POSITION MATCH (POSITION UNCONFIRMED)**
- Sent for a distress tracking ELT (ELT(DT)) when DOA and encoded position in the new alert match within 20 kilometers
  - Position is never confirmed for ELT(DT)s, which are assumed to be fast moving
  - DOA position will only be provided for ELT(DT)s if the MEOLUT is commissioned for fast moving beacon location accuracy (related C/S specifications are not finalized)

Summary of Alert Message Types

SIT 173 / 373

- Title: **406 BEACON POSITION CONFLICT ALERT (POSITION UNCONFIRMED)**
- Sent prior to position confirmation, when positions for a beacon differ by more than 20 kilometers
- 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
- ELT(DT)s – position conflict can only occur for DOA and encoded position in the same alert (no reference to previous position data in EL(DT) alerts)
- Position conflict alerts due to less accurate DOA positions occur for moving beacons (including beacons moved by ocean waves) in LGM early operations for MEOLUTs not commissioned for slow moving beacon location accuracy
  - Some MEOLUTs are only commissioned for DOA accuracy with stationary beacons
  - MEOLUTs in Florida, France, Spain, Norway and Cyprus are commissioned for slow moving beacon location accuracy (this commissioning expected soon for the Hawaii MEOLUT)

Summary of Alert Message Types

SIT *174 / 374*

- Title: **406 BEACON NOTIFICATION OF POSITION CONFIRMATION**
- Sent when Doppler or DOA position matches different beacon event Doppler or DOA position or encoded location within 20 kilometers
- May be first alert if Doppler/DOA and encoded position match on same alert
- Confirmed Position merges matching encoded, DOA and Doppler locations
  - Confirmed Position computed by USMCC only includes recent positions (detect time in last hour) to better track moving beacons
  - USMCC algorithm re-establishes the Confirmed Position from new data when new positions consistently don't match the current Confirmed Position
  - MCC computed "Confirmed Position" may differ from actual beacon location
- Refined encoded location matching the confirmed position is usually more accurate than Doppler or DOA location
  - However, encoded position may lag behind actual location for moving beacon because the encoded position is not updated frequently (discussed later)
- For a moving beacon, the confirmed position lags behind the actual location
  - View each elemental location (*caution - DOA position accuracy poorer if moving beacon*)

Summary of Alert Message Types

SIT 175 / 375

- Title (1): **406 BEACON POSITION CONFIRMATION UPDATE**
- Sent after position confirmed when new position matches confirmed position within 20 kilometers
- Title (2): **406 BEACON CONFIRMATION UPDATE WITH POSITION CONFLICT**
- Sent after position confirmed when new position(s) differ by more than 20 km from confirmed position
- New encoded position compared to previous encoded position if available
- Repeated position conflict alerts without confirmation position update probably means that the beacon is moving
- If repeated position conflicts occur for an alert site with DOA position for a beacon in the open sea
  - DOA positions may be inaccurate due to beacon motion. EHE sent to USCG RCCs only if the MEOLUT is commissioned for slow moving beacon location accuracy.
  - Per US Coast Guard policy, give priority to Doppler position over DOA position

Summary of Alert Message Types

SIT 176 / 376

- Message Title: **406 BEACON SITE STATUS REPORT**
- Sent when the beacon is not detected for 35 minutes
- Sent when alert site closes due to age –
  - 2 hours without a detection, if the beacon was detected by a MEOLUT with DOA position or by a GEOLUT, or
  - 6 hours without a detection otherwise
  - 36 hours since alert site opened (regardless of time since last detection)
  - 15 minutes if no new alert after cancellation (ELT(DT) and SGB only)
- 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 before or after position confirmation
- When alert site closes with location in US service area (or with no location for beacon coded for country in US service area), alert data sent to the IHDB
  - Site closure message sent to US SPOCs that receive alerts in SPOC message format includes incident feedback request

Summary of Alert Message Types

SIT 177 / 377

- Message Title: **406 BEACON DETECTION UPDATE**
- Sent when a new alert is received that does not contain "new" location data (i.e., location is redundant or not available), and
  - the detect time is at least 30 minutes later than the most recent detect time sent to the RCC for the alert site or
  - the only previous MEOSAR alert was "uncorroborated" by other alert data
- Sent to notify the RCC that the beacon is still active (or now corroborated)
- Sent before or after position confirmation
- Sent for ELT(DT) if the detect time is at least 3 seconds from the detect time of all other alerts, within the first 30 seconds of beacon activation

Summary of Alert Message Types

SIT 178 / 378

- 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), an NOCR is initiated by 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, ELT(DT)s and PLBs to AFRCC)
- Allows US RCC to ensure that there is a SAR response for (US) beacon
  - Caution: if NOCR from a MEO alert and the beacon location is serviced by a L/G only MCC, the alert may not be sent to the responsible RCC! Use current MCC list per slide 2: https://www.cospas-sarsat.int/en/system/meosar-system-status/mcc-configuration
- Sent for the first alert with Doppler, DOA or encoded location

Summary of Alert Message Types

SIT 179 / 379

- Title (1): **406 BEACON ENCODED POSITION UPDATE (POSITION UNCONFIRMED)**
- 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 20 km
- Sent when first refined encoded position is received (regardless of distance from previously sent coarse encoded position)
- Only sent when there is no new DOA or Doppler location data
- Provides RCC with timely updates on beacon position - may be particularly valuable in difficult SAR conditions, such as rough seas or mountain areas
- Alert sent by MEOLUT or GEOLUT when encoded position changes
- ELT(DT) – sent if there is encoded position and detect time is at least 3 seconds from the detect time for all other alerts with encoded position, within the first 30 seconds of beacon activation. After 30 seconds from activation, new encoded position sent based on 10 minute threshold

Summary of Alert Message Types

SIT 179 / 379

- Title (3): **406 BEACON USER CANCELLATION**
  - Sent when user cancellation is confirmed (based on the MCC receipt of 3 separate cancellation messages detected within 110 seconds, with no intervening non-cancellation message)
  - The USMCC alert site closes if no new alert is received within 15 minutes of user cancellation
  - May only occur for FGB ELT(DT)s and SGBs
- Title (4): **406 BEACON ROTATING FIELD UPDATE**
  - Sent when new or updated rotating field information is available in the SGB message based on a 10 minute threshold and no other condition (e.g., new position data) requires a new alert
  - Beacons transmit rotating fields (i.e., within different sets of encoded beacon message fields) in order to provide more types of encoded information than can fit in the fixed beacon message size.

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual
- Key planned RCC message changes (summary)

Overview of **RCC** Alert Message Structure

- Message 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, US special program information, encoded position resolution
  - **406 MHz Beacon Registration Data:** beacon owner, contact information, vehicle/usage information for USA beacons; registry contacts for non-USA beacons
  - **Supporting Information:** alert recipients, previous messages
  - **Message Trailer:** end of message
  - Messages fields are provided in a logical, consistent format

Overview of **SPOC** Alert Message Structure

- Message field layout differs from RCC messages
- Key content differences
  - **Message header**: SIT number always 185 (Title gives message type)
  - **Alert Data Block:** SRR, DOA Expected Horizontal Error not provided
    - Altitude given for DOA position (altitude reliability is not commissioned)
  - **Beacon Decode Information:** no US special program information
  - **406 MHz Beacon Registration Data:** no USA beacon registration data
  - **Supporting Information:** no information provided on alert recipients, previous alert messages

Alert Message Structure – Key Fields
1. Message Header

- **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., 171)
  - Along with **Message Title** (highlighted below), identifies alert message type (per summary of alert message types provided previously)

/17127 00000/3660/17 010 0939

/171/366S

****** 406 BEACON LOCATED FIRST ALERT (POSITION UNCONFIRMED) ******

Alert Message Structure – Key Fields
1. Message Header (Cont'd)

- **Special Message Title**

  – Provided for "UNRELIABLE BEACON (HEXADECIMAL) ID", "DISTRESS TRACKING ELT" and for "SHIP SECURITY ALERT". A sample of the latter is provided below.

  – Precedes standard message title

/17127 00000/3660/17 004 0939

/171/CGOP

!!! SHIP SECURITY ALERT !!!!!!!!!!

****** 406 BEACON LOCATED FIRST ALERT (POSITION UNCONFIRMED) ******

Alert Message Structure – Key Fields
2. Alert Data Block

BEACON ID

- 15 character hexadecimal code identifies the FGB (see sample below)
- 23 character hexadecimal code identifies the SGB (**XXXXXX XXXXXX XXXXXX XXXXX**)
- 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 176 / 376 message (Site Status)
- Indicates if the site is open or closed, and if closed, the reason for closure
- In the SIT 376 and revised SIT 176, Site Status provided on next line with title "STATUS"
- New status "CLOSED – USER CANCELLATION" for ELT(DT)s and SGBs

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

[Position Confirmation Summary]
(NEW ALERT INFORMATION)

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

***Position Confirmation* Summary** (only present if position confirmed)

- **LATITUDE** and **LONGITUDE** provided for composite/merged location
  - Doppler location normally accurate within 5 KM (95% for nominal solutions)
  - DOA location required accuracy within 5 KM for early operations: 70% for 1 burst solutions, 90% within 20 minutes (DOA location accuracy for MEOLUTs not commissioned for slow moving beacon accuracy is often poorer for moving beacons)
  - Refined FGB encoded location (or SGB encoded location) matching confirmed position usually more accurate than Doppler/DOA location
  - Refined FGB encoded location has a precision of 4 seconds (180 meters)
  - SGB encoded location has a precision of 18 meters
  - Between encoded position updates (FGBs not ELT(DT)s update every 5 to 20 minutes, or less frequently), encoded position may lag behind actual location for moving beacons
  - If beacon is moving, confirmed (composite) position lags behind actual location
  - USMCC Confirmed position only includes positions within last 1 hour, limits lag

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

***Position Confirmation* Summary** (continued)

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

- **BUFFER** provides up to 2 secondary SRRs, within specified buffer (normally 50 km) or overlap of primary SRR

- **SRR** and **BUFFER(s)** in Summary usually based on first confirmed position

- Sample Position Confirmation Summary below:

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

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

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

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), or **U** (unlocated)
- **LATITUDE** and **LONGITUDE** provided for new Doppler, DOA or encoded position
- Sample below *(detect times provided with minutes of hour, per current format)* -

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

PROB	EE	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	NUM	SOURCE	SRR	BUFFER/BUFF_2
53	N/A	A	35 25.2N	076 36.4W	27 0937 SEP	S7	007	CMCC	AFRCC	
47	N/A	B	31 42.7N	058 40.0W	27 0937 SEP	S7	007	CMCC	LANTAR	

DETECTION FREQUENCY: 406.0281 MHZ

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

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

DETECT TIME in Universal Coordinated Time (UTC) – *currently* truncated to minutes (HHMM)

- 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 and MEOSAR solutions, is last beacon message detect time
- For GEOSAR solutions, is first beacon message detect time
- In revised messages, will be provided to seconds of the minute (HMMMSS) for all FGBs and SGBs

- **SAT** (Satellite): first digit is **S** (SARSAT), **C** (COSPAS), **G** (GOES), **M** (MSG), **I** (INSAT), **R** (Russian GEO)
  - Set to "MEO" for MEOSAR satellites; the list of MEOSAR satellites is not provided
  - Only SARSAT and COSPAS satellites can generate Doppler locations
- **NUM** is number of detections (for LEOSAR/GEOSAR data is number of beacon bursts)
  - If "2" on Doppler alert, 2 LEOSAR bursts + GEOSAR frequency used, "A" probability set to 50
- **SOURCE** of the solution may be US LUT (e.g., AK1) or foreign MCC (e.g., CMCC)

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

PROB	EE	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	NUM	SOURCE	SRR	BUFFER/BUFF_2
53		N/A	A	35 25.2N	076 36.4W	27 0937 SEP	S7	007	CMCC	AFRCC
47		N/A	B	31 42.7N	058 40.0W	27 0937 SEP	S7	007	CMCC	LANTAR

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

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

DETECT TIME for Encoded Position

- Is time of satellite detection, does not directly provide the time of encoded position update
- An updated refined position means the position was updated since time of previous refined position
  - A FGB refined position following a coarse position does not imply update in position, but may merely mean that the LUT has now succeeded in decoding all position data in the beacon message
  - Check the associated detect times to assess beacon movement
  - SGBs provide the time of encoded position update

- **Encoded Position Updates** - per document C/S T.001 (FGBs)
  - encoded position may be updated as frequently as every 5 minutes (update not required for older beacons*)
    - encoded position should be cleared from beacon message if it is not updated within 4 hours
    - after initial position, encoded position update required at least every 30 minutes until activation + 6 hours*
    - from 6 to 24 hours after activation, encoded position update required at least every 60 minutes*

- Beacon may fail to update the encoded position to reflect its new position because the beacon is unable to obtain sufficient satellite data due to obstructions of the beacon's view of the sky
- In short, the encoded position will lag behind the actual position if the beacon is moving

** Updates only required for beacons first submitted for C/S type approval after 1 Nov. 2015*

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

New Alert Information – Data Solution line (new detect time format in red)

- **EE** (Expected Horizontal Error, ranges from 0 to 999)

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

  - "0" means unavailable, "999" means greater than or equal to 999

  - Always provided to US Air Force RCCs and to LGM MCCs

  - Provided to USCG RCCs (and SPOCs) only if MEOLUT commissioned for slow moving beacon location accuracy; otherwise set to "N/A".

- **NUM** (number of detections) - for MEOSAR alerts, each beacon burst detected by an antenna is counted separately (e.g., 2 bursts each detected by 3 antennas = 6 detections)

  – DOA position with more detections 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 093701 SEP MEO 005 FL-MEO LANTAR

DETECTION FREQUENCY: 406.0281 MHZ

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

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 usually indicates message destinations and responsible SRRs, **however**
  - Only 3 SRRs are listed – see Supporting Information 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 Beacon Decode Information (if applicable)
  - NOCR (SIT 178) distributed based on country code if location not in the country's SRR
  - For alert manually sent by USMCC to another RCC, the SRR on message is not changed

PROB EE SOL LATITUDE LONGITUDE DETECT TIME SAT NUM SOURCE SRR /BUFFER/BUFF_2
N/A N/A E 34 32.14N 069 11.40E 22 0731 FEB MEO 002 FMCC AFGHAN/TRMCC

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

New Alert Information – DETECTION FREQUENCY

- Provided for Doppler, MEOSAR and GEOSAR solutions

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

- May be used to help correlate an "unreliable beacon ID" alert with another alert in the vicinity

- 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)

******** Always set to 406.050 MHz for SGBs (whole 406 MHz band use for "spread spectrum" SGBs)

PROB EE SOL LATITUDE LONGITUDE DETECT TIME SAT NUM SOURCE SRR BUFFER/BUFF_2
53 N/A A 35 25.2N 076 36.4W 27 0937 SEP S7 007 CMCC AFRCC
47 N/A B 31 42.7N 058 40.0W 27 0937 SEP S7 007 CMCC LANTAR

DETECTION FREQUENCY: 406.0281 MHZ

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

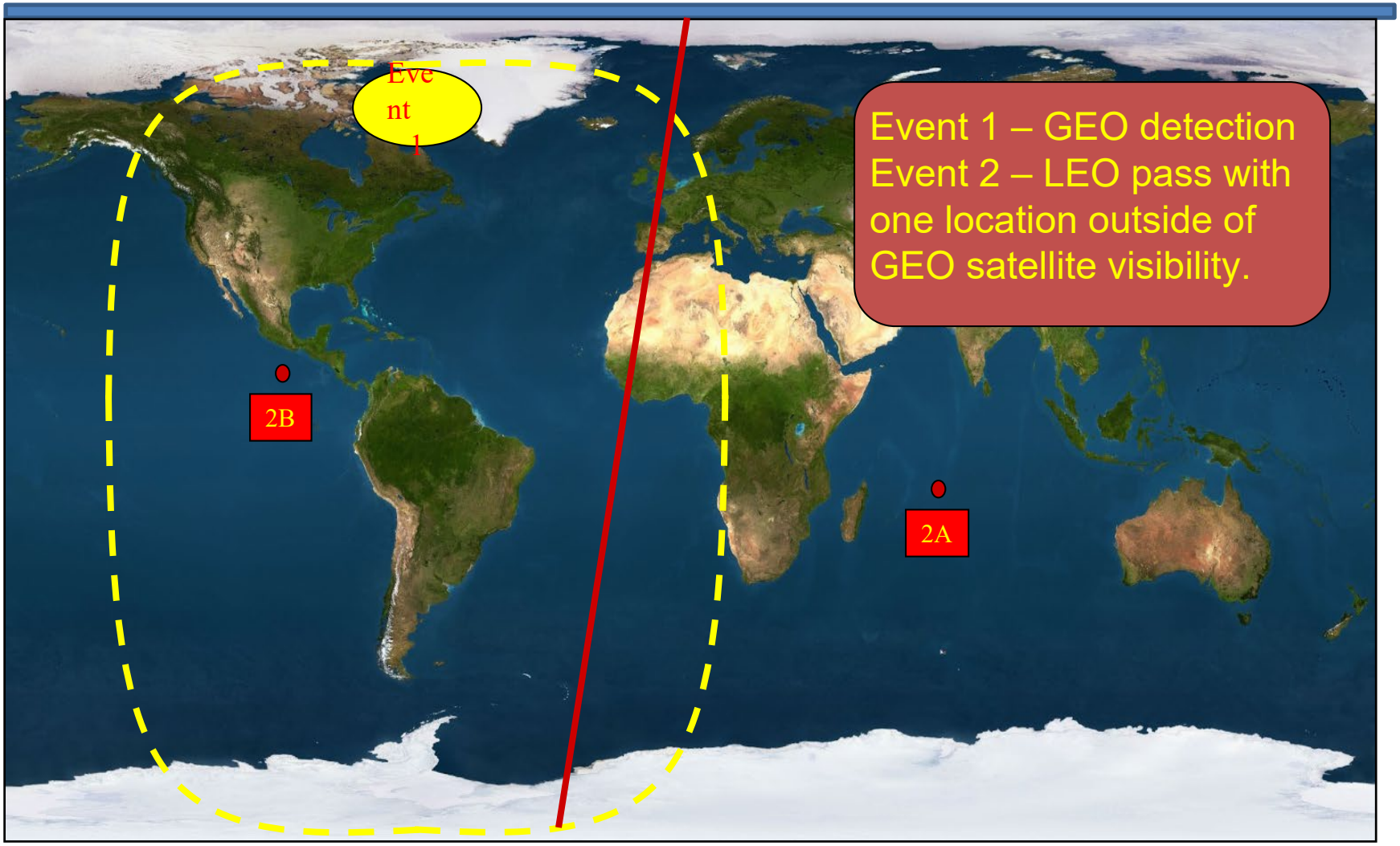
New Alert Information – <u>LIKELY</u> IMAGE POSITION

- Data line only provided when one new Doppler position (A or B) is determined to be an image (non-real) position prior to 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 position confirmation
- The sample below correlates to the illustration on the next page

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

PROB EE SOL LATITUDE LONGITUDE DETECT TIME SAT NUM SOURCE SRR
BUFFER/BUFF_2
53 N/A A 35 25.2N 076 36.4W 27 0937 SEP S7 007 CMCC AFRCC
47 N/A B 31 42.7N 058 40.0W 27 0937 SEP S7 007 CMCC LANTAR
DETECTION FREQUENCY: 406.0281 MHZ
LIKELY IMAGE POSITION: THE A POSITION

Alert Message Structure –
2. Alert Data Block (Likely Image Position)



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

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

New Alert Information – MEOSAR First Detect Time

- First Detect Time for MEOSAR alert provided in new line after DETECTION FREQUENCY
- Last Detect Time for MEOSAR alert provided as DETECT TIME in alert solution data line (e.g., 14 0247 UTC FEB in sample below)
- USA MEOLUTs compute DOA position using data with time span up to 20 minutes (i.e., the FIRST DETECT TIME may remain the same, while the Last Detect Time changes for 20 minutes)
  - more detections (i.e., larger NUM) usually results in a more accurate DOA position
- Update of FIRST DETECT TIME (to a time after the previous Last Detect Time) likely indicates that the MEOLUT has started to compute DOA position anew; this may correspond to a noticeable change in the DOA position

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

PROB EE SOL LATITUDE LONGITUDE DETECT TIME SAT NUM SOURCE SRR
/BUFFER/BUFF_2
N/A N/A D 35 25.4N 066 36.7W 14 0247 FEB MEO 044 FL_MEO CGD05

DETECTION FREQUENCY: 406.0281 MHZ
FIRST DETECT TIME: 14 0228 FEB

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

New Alert Information – Information on Doppler Position accuracy

- 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 (red text in sample below is for nominal solution)
- "NEW DOPPLER POSITION ERROR MAY EXCEED 5 KM DUE TO TECHNICAL PARAMETERS" set if at least 1 technical parameter is poor for the Doppler solution (i.e., solution not nominal)
- "NEW DOPPLER POSITION ERROR MAY EXCEED 10 KM DUE TO SATELLITE MANEUVER" set if a large satellite maneuver occurred in the last 24 hours, whether or not solution is nominal
- Information may assist SAR prosecution

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

PROB	EE	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	NUM	SOURCE	SRR	/BUFFER/BUFF_2
75	N/A	A	35 25.4N	076 36.7W	14 0247 FEB	S12	011	AK1		AFRCC
25	N/A	B	31 42.1N	058 42.0W	14 0247 FEB	S12	011	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 – Information on Doppler / DOA Position accuracy

- Statement "NEW DOPPLER POSITION DATA SUSPECT – OUTSIDE REPORTING SATELLITE FOOTPRINT" is provided if the USMCC determines that *either the A or B* Doppler position is outside the footprint of the reporting LEOSAR satellite
- Statement "NEW DOA POSITION DATA SUSPECT – OUTSIDE REPORTING SATELLITE FOOTPRINT" is provided if the USMCC determines that the DOA position is outside the footprint of any reporting MEOSAR satellite
- Positions outside of satellite footprint positions should be treated with caution
- Encoded position outside of satellite footprint is filtered (not included in message)

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

PROB	EE	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	NUM	SOURCE	SRR	/BUFFER/BUFF_2
75	N/A	A	35 25.4N	076 36.7W	14 0247 FEB	S12	011	AK1		AFRCC
25	N/A	B	31 42.1N	058 42.0W	14 0247 FEB	S12	011	AK1		LANTAR

DETECTION FREQUENCY: 406.0281 MHZ
NEW DOPPLER POSITION DATA SUSPECT – OUTSIDE REPORTING SATELLITE FOOTPRINT
NEW DOPPLER POSITION ERROR MAY EXCEED 5 KM DUE TO TECHNICAL PARAMETERS

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

New Alert Information – Suspect (Uncorroborated) MEOSAR Alerts

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

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

  - however, uncorroborated MEOSAR alerts have led to SARSAT rescues

- Per document C/S A.001, uncorroborated MEOSAR alerts are sent if the MEOLUT meets "processing anomaly" requirements, if the beacon known to be registered or is an ELT(DT)

- 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)
  - finding that the encoded C/S Type Approval Certificate (TAC) number provided in field "MANUFACTURER" of the Beacon Decode section is allocated (per C/S website)
    - if TAC not allocated, the alert is likely a system anomaly (not a real beacon)
  - match of reported Detection Frequency (if available) and the detection frequency for the beacon model (per C/S website)
  - Florida MEOLUT now commissioned for low "processing anomaly" rate. Hawaii MEOLUT

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

New Alert Information – Suspect MEOSAR Alerts (cont'd)

- Sample provided below: see last line starting with "SUSPECT ALERT"

- "UNCORROBORATED MEOSAR ALERT" also sent to SPOCs in SIT 185 message

- LEOSAR or GEOSAR alert with 1 detection (NUM=1) may also be suspect, but there is no MCC rule to flag it

  - Can take similar actions to corroborate alert (e.g., check registration data, TAC #).

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

PROB EE SOL LATITUDE  LONGITUDE  DETECT TIME SAT  NUM SOURCE SRR   /BUFFER/BUFF_2
N/A    N/A E   08 29.53N 135 58.33E    15 1302 JUL   MEO 001  HI_MEO MARSEC

DETECTION FREQUENCY: 406.0375 MHZ
FIRST DETECT TIME: 15 1302 JUL
SUSPECT ALERT: SINGLE UNCORROBORATED DETECTION
```

Alert Message Structure – Key Fields
3. Beacon Decode Information

- Based on decode of 406 MHz Beacon Message per document C/S T.001 (FGB) and C/S T.018 (SGB)
- **COUNTRY** identifies the country or territory responsible for the beacon registration

  - C/S website provides Registry Points of Contact for non US beacons; see "406 MHz Beacon Registers" under "Contact Lists" at https://www.cospas-sarsat.int

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

- **MID CODE** is 3-digit number assigned by ITU and associated with the **COUNTRY**
- **BEACON TYPE** shows the beacon type as EPIRB, ELT, ELTDT, PLB, or SHIP SECURITY

  - CRAFT ID only present for non-serialized beacons
  - NATIONAL, STANDARD (STD) or RETURN LINK indicates location protocol
  - CATEGORY I means that the EPIRB activation method is unknown (manual or automatic)
  - CATEGORY II means that the EPIRB can only be activated manually
  - Starts with "SGB" for SGBs
  - *Gives controlled (reliable) information on beacon type coded in the beacon message vs. free form RGDB information provided by beacon manufacturer or beacon owner*

**** 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

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

- **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 (decoded) for US serialized user beacons
  - see https://www.cospas-sarsat.int/en/beacons-pro/experts-beacon-information/approved-beacon-models-tacs to get Manufacturer and Model and search on TAC number, if TAC (C/S Type Approval Certificate) number is provided in the **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

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

- **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** for FGBs, identifies the homer as 121.5 MHZ, SART (SAR transponder), OTHER or NONE
  - For SGBs, the value is YES (available or active) or NIL (not available or not active)
- **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/GNSS position (details on next two pages)

**** 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

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

- **POSITION RESOLUTION - FGBs**

  - Depends on beacon protocol, usability of 2 data fields in 406 MHz beacon message protected by error correction codes (called Protected Data Field-1 and Protected Data Field-2), and coding logic for rounding value in PDF-1 (rounded in new beacon logic, not rounded in old beacon logic)

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

  - If PDF-2 is usable or newer beacon has PDF-1 value rounded, the uncertainty (i.e., maximum difference of the position sent to RCC vs. position processed by beacon) is half the resolution;

    - for older beacons when only PDF-1 is usable, the uncertainty is twice the resolution

- **POSITION RESOLUTION - SGBs**

  - When encoded/GNSS position is available, it is always provided with 18 meter resolution

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

- **FGB POSITION RESOLUTION (cont'd) –** values (upper case) and uncertainty below

Beacon Protocol	Only PDF-1 usable POSITION RESOLUTION value, Uncertainty*	PDF-1 and PDF-2 usable
Standard Location	15 MINUTES (at 45 degrees latitude, equals 10.6 nm longitude and 15.0 nm latitude). Uncertainty: 30 minutes (7 minutes 30 seconds if newer coding methodology used)	4 SECONDS Uncertainty: 2 seconds
National Location	2 MINUTES (at 45 degrees latitude, equals 1.4 nm longitude and 2.0 nm latitude). Uncertainty: 4 minutes (1 minute if newer coding logic used)	4 SECONDS Uncertainty: 2 seconds
Return Link Service (RLS)** and ELT(DT)	30 MINUTES (at 45 degrees latitude, equals 21.2 nm longitude and 30.0 nm latitude). Uncertainty: 15 minutes	4 SECONDS Uncertainty: 2 seconds
User (not National)	NONE	4 MINUTES Uncertainty: 2 minutes
User – National (CSEL)	1 DEG LAT, 15 DEG LONG	2 SECONDS Uncertainty: 1 second
User – National (SEPIRB)	1 DEGREE	2 SECONDS Uncertainty: 1 second

* Considering both latitude and longitude, the maximum uncertainty is about 1.41 times the value reported in the table.
** RLS beacons provide return link information from ground stations via satellites to the beacon.

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

- **ACTIVATION TYPE** (*new field*) has 4 possible values:
  - MANUAL
  - UNKNOWN
  - AUTOMATIC BY BEACON (G-SWITCH/PROBABLE CRASH), and
  - AUTOMATIC BY EXTERNAL MEANS (AVIONICS)
  - The last two values only occur for ELT(DT)s
- **AIRCRAFT OPERATOR DESIGNATOR** – (i.e., 3LD) provided for ELT(DT) when available
  - 3LD is a key to access the ICAO Location of Aircraft in Distress Repository (LADR) for ELT(DT)s

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY      : USA              BEACON TYPE: SGB ELTDT
MID CODE     : 366              CRAFT ID   :                    SPECIFIC BEACON:
MANUFACTURER: TAC 43567         MODEL      :
SERIAL NUM   : 123              HOMING     : 121.5 MHZ
POSITION DEVICE: NIL            POSITION RESOLUTION: 18 METERS
ACTIVATION TYPE: AUTOMATIC BY BEACON(G-SWITCH/PROBABLE CRASH)
AIRCRAFT OPERATOR DESIGNATOR: QAN
```

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

- **CRAFT ID TYPE** – only available for SGBs (when vessel/craft information encoded)

- Craft ID type encoded in SGB separately from the beacon type (EPIRB, ELT, ELT(DT) or PLB)

- If MMSI, a 2d field EPIRB-AIS ID provides the AIS Id (see example below). Prefix "974" applies to all AIS IDs and is not encoded in the beacon message

- If 24 BIT ADDRESS, a 2d field AIRCRAFT OPERATOR DESIGNATOR (3LD) may be available

- If AIRCRAFT OPERATOR, a 2d field AIRCRAFT OPERATOR SERIAL NUMBER is provided

- Other values are RADIO CALL SIGN, TAIL NUMBER and SYSTEM TEST

- There is no 2d Craft Id field for these other CRAFT ID TYPEs

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY      : USA              BEACON TYPE: SGB EPIRB
MID CODE     : 366              CRAFT ID   : 123456            SPECIFIC BEACON:
MANUFACTURER: TAC 12345         MODEL      :
SERIAL NUM   : 4133             HOMING     :
POSITION DEVICE: NIL            POSITION RESOLUTION: 18 METERS
CRAFT ID TYPE: MMSI
EPIRB-AIS ID: 974 2468
```

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

- NOAA allocates groups of US coded beacons to US government **SPECIAL PROGRAMS**
  - Special program beacon 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**
- *[…] in sample message indicates that some details have been excluded*

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY     : USA              BEACON TYPE: PLB SERIAL (NATIONAL)
MID CODE    : 366              CRAFT ID   :                    SPECIFIC BEACON:
MANUFACTURER:                  MODEL      :
[…]
PROGRAM: FBI                   PROGRAM BLOCK REGISTRATION ID: XXXXXXXX81FE0
```

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

- **Return Link Service** – notifies a 406 MHz beacon that an associated alert was sent to an RCC
  - only available if BEACON TYPE is "RETURN LINK" (e.g., "EPIRB RETURN LINK")
  - only sent once the position is confirmed
  - intended to inform persons in distress that a SAR authority is responding to the distress
  - RLS PROVIDER indicates the satellite constellation that provides the return link service (i.e., the RLSP)
    - listed as GALILEO, GLONASS (future possibility) or UNKNOWN
  - TYPE-1 means the beacon can receive automatic acknowledgement from the RLSP
  - TYPE-2 (not supported by C/S) means the beacon can receive manual acknowledgement from the RLSP
  - After TYPE-#, "CAPABLE" means acknowledgment not received, or "RECEIVED" means ack received

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY      : FRANCE            BEACON TYPE: PLB RETURN LINK
MID CODE     : 227               CRAFT ID   :                    SPECIFIC BEACON:
MANUFACTURER:                    MODEL      :
SERIAL NUM   : 135               HOMING     : 121.5 MHZ
POSITION DEVICE: INTERNAL        POSITION RESOLUTION: 4 SECONDS
[...]
RLS PROVIDER: GALILEO
RLM TYPE-1 RECEIVED (AUTOMATIC ACKNOWLEDGEMENT)
```

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

- **FGB ELT(DT)** – additional information

  - if available, GNSS (encoded) position altitude information provided in meters and feet

  - per C/S, the term GNSS POSITION replaces ENCODED POSITION

  - if available, encoded position currency information is provided in format

  UPDATE TIME WITHIN [AAAA] OF DETECTION TIME" where "[AAAA]" is

  "0 – 2 SECONDS", "2 – 60 SECONDS" or "1 MINUTE TO 4 HOURS"

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY     : FRANCE          BEACON TYPE: ELTDT A/C DESIGNATOR
MID CODE    : 227             CRAFT ID   :                    SPECIFIC BEACON:
MANUFACTURER:                 MODEL      :
SERIAL NUM  : 135             HOMING     : 121.5 MHZ
POSITION DEVICE: INTERNAL     POSITION RESOLUTION: 4 SECONDS
ACTIVATION TYPE: AUTOMATIC BY EXTERNAL MEANS (AVIONICS)
AIRCRAFT OPERATOR DESIGNATOR (3LD): QAN
ALTITUDE OF GNSS LOCATION: BETWEEN 1600 AND 2200 METERS (BETWEEN 5200 AND 7200 FEET)
UPDATE TIME WITHIN 0 - 2 SECONDS OF DETECTION TIME
```

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

- **SGBs** – additional information

- TIME OF GNSS POSITION UPDATE: DD MON HHMMSS (ELT(DT)s only)
- TIME SINCE GNSS LOCATION GENERATED: nnnn MINUTES
- ALTITUDE OF GNSS LOCATION: nnnnn METERS (yyyyyyy FEET)
- ELAPSED TIME SINCE ACTIVATION: nn HOURS (if available, for values up to 63 hours)
- REMAINING BATTERY CAPACITY: BETWEEN nn AND nnn PERCENT (if available)
- BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE (if available, a separate SIT 956 message would provide related C/S maintained info based on TAC number)

```
**** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION ****
COUNTRY     : FRANCE            BEACON TYPE: SGB ELTDT
MANUFACTURER: TAC 234           MODEL:
[…]
TIME OF GNSS POSITION UPDATE: 25 APR 130459
TIME SINCE GNSS LOCATION GENERATED: 0 MINUTES
ALTITUDE OF GNSS LOCATION: 13072 METERS (42887 FEET))
ELAPSED TIME SINCE ACTIVATION: 0 HOURS
REMAINING BATTERY CAPACITY: BETWEEN 10 AND 25 PERCENT
BEACON CHARACTERISTICS PER TAC DATABASE PROVIDED IN A SEPARATE MESSAGE
```

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

- **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 the 15 hex or 23 hex Beacon ID provided in RCC message)
  - Alerts with unreliable beacon message are sent 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 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 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
  - Beacon probably requires a battery change
  - Beacon probably malfunctioned (rapid transmission in self-test mode, may be due to bracket design)
  - Notify USMCC Chief (Elizabeth.Creamer@noaa.gov) for further investigation

Alert Message Structure – Key Fields
4. Beacon Registration Data

- For USA beacons, contains 3 sections based on information in **US RGDB** for Beacon ID
- Section 1 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
- Section 2 contains information about beacon carriage and type of use
  - For ELTs: aircraft information is provided, including Leasing Agent, Aircraft Manufacturer, Model, Aircraft Use, Color, Radio Equipment, Capacity, Tail Number, Fixed Survival Craft Description, Deployable Survival Craft Description, Airport and Airport SRRs. ELT manufacturer and model number are also provided.
  - For EPIRBs: 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 PLBs: Radio Equipment, Vehicle Type, Specific Usage, PLB Manufacturer, and Model Number are provided.
- Review "free form" info provided by beacon owner (e.g., about the Survival Craft) in the context of the controlled/reliable info about BEACON TYPE in Beacon Decode section.

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
  - DATE FIRST REGISTERED only refers to the registration by the current beacon owner
  - SPECIAL STATUS indicates if beacon is reported as SOLD, STOLEN, REPLACED, OUT OF SERVICE, DUPLICATEID, 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
  - A significant portion (15 - 20%) of US registered beacons have Special Status information
- *If REMARKS ends with "See RGDB", then the information is truncated on the message (limit is 255 characters), and the RCC should access the RGDB to see the entire field*
- If a USA beacon is not registered in **US RGDB**, this message section states:

REGISTRATION INFORMATION IS NOT AVAILABLE IN THE USMCC DATABASE

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

- For a non-USA beacon this message section provides point of contact information for the associated beacon registry
- The C/S International Registration Database (IBRD) WEB address is www.406registration.com
  - the IBRD is maintained by the C/S Secretariat (not available 24x7)
  - for countries with beacons in the IBRD and no national registry, AFTN and TELEPHONE contact information is provided for the USMCC (available 24x7)

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

- **USMCC PROCESSING TIME –** time message initially sent by USMCC
  - If more than 1 minute before the Send Time in Message Header, then the message was probably resent manually by USMCC personnel
- **THIS ALERT MESSAGE IS BEING SENT TO**
  - lists all destinations for the USMCC for this message
  - lists final MCC destinations from the USMCC (not intermediate nodal MCC destinations)
  - use this list and the SRRs for the new alert to coordinate SAR response with other agencies
    - some destinations may not be in USMCC destination list (per US and C/S distribution rules)
    - some alert messages (e.g., 406 BEACON DETECTION UPDATE) sent by USMCC are not defined in C/S
- **ALERT MESSAGES FOR THIS BEACON PREVIOUSLY SENT TO**
  - lists all destinations for the USMCC for previous messages for this beacon activation (alert site)
    - may be used to contact SAR agencies that are already working on a SAR case
    - set to "N/A" on the first alert sent for a beacon activation

```
**** SUPPORTING INFORMATION ****
USMCC PROCESSING TIME: 15 0104 FEB
THIS ALERT MESSAGE IS BEING SENT TO:
  AFRCC,CGD08,CGD07
ALERT MESSAGES FOR THIS BEACON PREVIOUSLY SENT TO: N/A
```

Alert Message Structure – Key Fields
5. Supporting Information (Cont'd)

- **PREVIOUS MESSAGE INFORMATION** lists previous messages sent by USMCC for the beacon
  - Ordered by time messages received at USMCC (most recent listed first)
  - Up to 5 previous messages are listed
  - Solution Data fields (EE, SOL, etc.) have same format as in alert data block
  - SRR and BUFFER fields only shown prior to position confirmation (see sample below)
  - First alert to an RCC may show previous message information sent to another destination
  - Location data shown per original message (locations from multiple sources are not merged)
  - Once position is confirmed, if a Doppler position matches the confirmed position, the associated incorrect Doppler position is not reported (e.g., no "B" solution in sample below)
  - *Would exclude the initial alert used to confirm position*, if the initial alert used to confirm position was redundant (and thus not sent by USMCC) when it was received by the USMCC
  - View alert data block in many messages in detect time order to help identify a moving beacon
- Sample below: position update after position confirmation (no "B" SOL, no SRR. *HHMM time shown*)

```
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 G16 N/A MD1
```

Alert Message Structure – Key Fields
6. Message Trailer

- 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
- Key planned RCC message changes (summary)

Revised RCC Message Manual

- Version 3.12 uploaded to NOAA website in February 2022
  - See http://www.sarsat.noaa.gov/documentation.html
- This version includes updates for –
  - the sending uncorroborated MEOSAR alerts (section 3.2.7)
  - the sending of EHE (section 3.2.3.2)
  - A change in the time gap to send a SIT 176 “no detection” message from 30 to 35 minutes
  - Annex 3 to identify LGM capable MCCs
  - Document History at start of Manual identifies all revisions
- Version 3.13 will describe updates for ELT(DT)s and SGBs
- USCG and USAF liasons are notified when the RCC message manual is updated (Response to RCC Survey)

Overview

- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual
- Key planned RCC message changes (summary)

Key Planned RCC Message Changes - SGBs

- Use SIT 370 – 379 (similar to SIT 170 – 179 for FGBs)
- Includes 23 Hex ID (format 6 + 6 + 6 + 5) vs 15 Hex ID for FGBs
- Beacon Type indicates SGB
- Encoded (GNSS) position resolution is 18 meters
- New fields include GNSS position update time and altitude, remaining battery capacity, and time since beacon activation
- Vessel ID info includes the AIS ID for MMSI vessel type
- Activation type may be MANUAL or AUTOMATIC BY BEACON for EPIRBs
- SIT 956 message will provide operational characteristics based on TAC (implementation date TBD)
- Rotating Field Update (SIT 379) sent for SGB rotating field update
- User Cancellation of beacon activation sent as SIT 379
  - User cancellation sent as SIT 179 for FGB ELT(DT)
  - Alert site closed 15 minutes after cancellation if no new alert

Key Planned RCC Message Changes - ELT(DT)s

- New alert is sent if the detect time is at least 3 seconds from the detect time for all other alerts in the first 30 seconds of activation. After 30 seconds, new alerts are sent every 10 minutes
- Position is never confirmed for ELT(DT)s, assumed to be fast moving
  - Title is DOA Position Match if encoded and DOA positions match in an alert
  - DOA position will not be provided until the MEOLUT is commissioned for fast-moving beacon accuracy (related MEOLUT specifications are TBD)
- Field AIRCRAFT OPERATOR DESIGNATOR (i.e., the 3LD) provided when available for an ELT(DT)
- Activation type (new field) indicates if activation is automatic by beacon (likely crash), by avionics or manual
- Seconds of minute in detect time – enables RCC to sequence alerts
- FGB info on GNSS position currency and altitude is limited (compared to SGB info) due to FGB message limitations
- Special alert header “!!! DISTRESS TRACKING ELT !!!”, Beacon Type ELTDT

Key Planned RCC Message Changes - Other

- Seconds of the minute included in all detect times (but will not be included for FGBs that are not ELT(DT)s until SAROPS is upgraded)
- Activation Type (new field) may be indicated as Manual or Unknown for FGBs that are not ELT(DT)s
- Per C/S updates, “MCC Reference Position” will replace “Confirmed Position”, to clarify that the MCC does not know the actual beacon position. Related changes to some message titles.
- Per C/S updates, the term “GNSS position” will be used on the RCC message instead of “Encoded position”

RCC Messages

- Contact Information
- Tom Griffin
  - Tom.Griffin@noaa.gov
  - 301 817-4532