RCC Messages
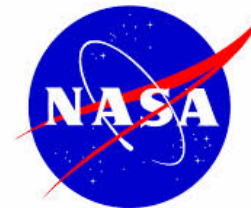
SAR Controllers Training 2017
28 Feb - 2 March 2017
Tom Griffin
ERT, Inc.
USMCC Systems Analyst
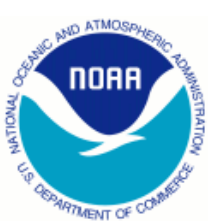
Overview

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

MCC to MCC Data Distribution MEOSAR Data

- The current operational system includes LEOSAR/GEOSAR/MEOSAR data (LGM system)
  - LGM early operations began 13 December 2016 and
    - includes 3 MEOLUTs (in Florida, Hawaii and France)
    - includes all LEOLUTs and GEOLUTs in the previous L/G system
    - Includes LGM USMCC and LGM FMCC and all other L/G MCCs in previous LGM system
    - Per Coast Guard policy, MEOSAR data is secondary to LEOSAR and GEOSAR data in LGM early operations

MEOSAR RCC Messages

- Similar to previous LEOSAR/GEOSAR messages
  - Uses SITs 170 – 179 (similar to previous 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
  - deemed "Position Confirmation" vs. "Ambiguity Resolution" in previous LEOSAR/GEOSAR system

Overview

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

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 U.S. RCCs during USMCC backup
- USMCC National RCC format messages: SIT 170 to 179
  - Sent by the USMCC to all US RCCs and a few international SPOCs
  - Are the main subject of this presentation

Summary of Alert Message Types

SIT *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 *171*

- **406 BEACON LOCATED FIRST ALERT (POSITION UNCONFIRMED)**
- Sent when first location (encoded, Doppler or DOA) is available, but 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 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 the **new A** side probability is at least 15% higher than **previous A** side probability (e.g., **previous A** = 55%, **new A** = 70%)

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

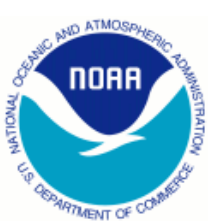- Only sent prior to position confirmation

Summary of Alert Message Types

SIT 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, position confirmation is delayed; A/B probabilities can be used to help prosecute a SAR case

- Only sent prior to position confirmation

Summary of Alert Message Types

SIT 173

- 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)
- More position conflict alerts due to less accurate DOA positions expected for moving beacons (including beacons bobbing due to ocean waves) in LGM early operations
  - MEOLUT commissioning for DOA accuracy was performed with stationary beacons
  - US / C-S is researching ways to improve DOA location accuracy for moving beacons

Summary of Alert Message Types

SIT *174*

- 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 <u>matching</u> encoded, DOA and Doppler locations
  - Confirmed position only includes recent positions (detect time in last hour) to better track moving beacons
  - MCC algorithm can re-establish confirmed position from new data when new positions consistently do not match the confirmed position (per Moving Beacon presentation)

- 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 (described later)

- For moving beacon, confirmed position lags the actual location
  - View each elemental location individually

Summary of Alert Message Types

SIT 175

- 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 conflicts without confirmation position update probably means that the beacon is moving
- If repeated position conflicts for alert site with DOA position for beacon in open sea
  - DOA positions may be inaccurate due to beacon motion
  - Per US Coast Guard policy, give priority to Doppler position over DOA position

Summary of Alert Message Types

SIT 176

- Message Title: **406 BEACON SITE STATUS REPORT**

- Sent when the beacon is not detected for 30 minutes

- Sent when alert site closes due to age –
  - 2 hours without a detection, if the beacon was detected by a USA MEOLUT with DOA position or a USA GEOLUT, or
  - 6 hours otherwise

- 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 177

- Message Title: **406 BEACON DETECTION UPDATE**
- Sent when a new alert is received and the new alert is not sent due to location (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 "suspect"; i.e., uncorroborated by other alert data
- Sent to notify the RCC that the beacon is still active
- Sent before or after position confirmation

Summary of Alert Message Types

SIT 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 or encoded location
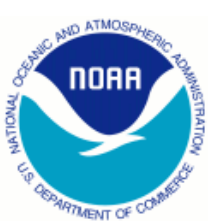
Summary of Alert Message Types

SIT 179

- 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 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

- May be sent before or after 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 messages
  - **Message Trailer:** end of message

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

  – Precedes standard message title

/17127 00000/3660/17 004 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 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 176 message (Site Status)
- Indicates if the site is open or closed, and if closed, the reason for closure

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

[Position Confirmation Summary]
(NEW ALERT INFORMATION)

***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 (actual DOA location accuracy often poorer for moving beacons)

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

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

    - Between encoded position updates (every 5 to 20 minutes, or less frequently), encoded position may lag actual location for moving beacons

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

      - Confirmed position only includes positions within last 1 hour, limits lag

- **DURATION** is hours between first and last detect times for the site

Position Confirmation **Summary** (continued)

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

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

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

- Sample Position Confirmation Summary below:

```
*************** 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), or **U** (unlocated)

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

- Sample below -

```
*************** 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
```

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 and MEOSAR solutions, is last beacon message detect time
- For GEOSAR 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)

  - 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 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

  - Next (second) generation beacons will provide the time of encoded position update

- **Encoded Position Updates** - per document C/S T.001

  - encoded position may be updated as frequently as every 5 minutes (update not required for older beacons)

  - encoded position should be cleared 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, 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 may lag (not accurately reflect) the actual beacon position

For beacons first submitted for C/S type approval after 1 Nov. 2015

New Alert Information – Data Solution line

- **EE** (Expected Horizontal Error, ranges from 0 - 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

  - Currently not reliable for moving beacons (set to "N/A" on alerts to US Coast Guard RCCs)

  - Provided to US Air Force RCCs and to LGM MCCs

  - Not currently provided to SPOCs (per C/S requirement)

- **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 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 3 SRRs 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 178) distributed based on country code if location not in country's SRR

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

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

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 detected beacon bursts are far from the TCA)

- Also not provided for MEOSAR solutions without DOA location for the same reason

- May be used to 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)

```
***************** 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

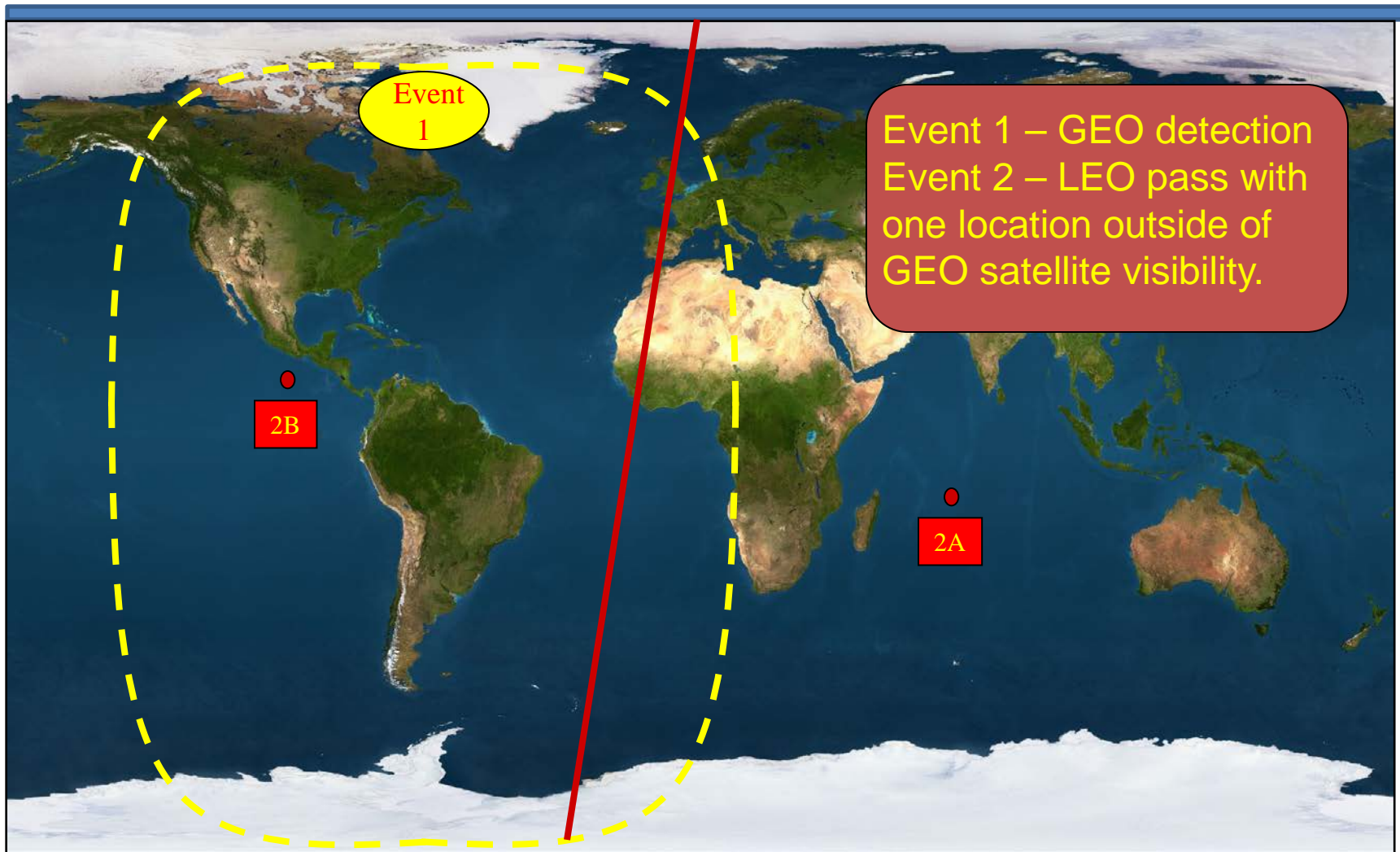## New Alert Information – <u>LIKELY</u> IMAGE POSITION

- 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)

Event 1

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

2B

2A

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

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
```

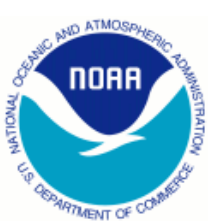# Alert Message Structure – Key Fields
2. Alert Data Block (Cont'd)

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 (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 prior to position confirmation

```
***************** 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
```

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 used)

```
***************** 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 MEOSAR Alerts

- 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 (for the encoded C/S Type Approval (CSTA) number provided in the Beacon Decode section)

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

- LEO or GEO alert with 1 detection (NUM=1) may be suspect, but there's no rule to flag it

```
**************** 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

- 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) location
  - 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
```

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** 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, usability of 2 data fields in 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 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;

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

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**

  - 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**

```
************   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 (Elizabeth.Creamer@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.

- 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 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 <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 MESSAGE INFORMATION** lists previous messages sent for the beacon
  - Ordered by time messages <u>received</u> 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)
  - <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 help 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
```

• Three lines indicate the end of message:

    QQQQ
    /LASSIT
    /ENDMSG

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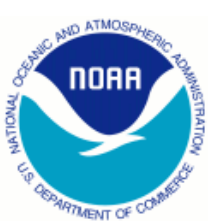
- MEOSAR Data / MEOSAR RCC messages
- Summary of alert message types
- Overview of alert message structure
- Revised RCC message manual

Revised RCC Message Manual

- Version 3.05 uploaded to NOAA website in Feb. 2017

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

MEOSAR RCC Messages

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