



RCC Messages

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Overview

- **Summary of Alert Message Types**
- **Overview of Alert Message Structure**
- **Revised RCC Message Manual**



Summary of Alert Message Types

- **Cospas-Sarsat Standard Indicator Type (SIT) 185 Format messages**
 - Defined in document Cospas-Sarsat (C/S) A.002
 - Sent by USMCC to most of its international SAR Points of Contact (SPOCs)
 - Sent by the Canadian MCC (CMCC) to U.S. RCCs during USMCC backup
- **USMCC National RCC Format messages (SIT 160 to 169)**
 - Sent by USMCC to all US RCCs and a few international SPOCs
 - Are the subject of this presentation



Summary of Alert Message Types

SIT 160

- Message Title: **406 BEACON UNLOCATED FIRST ALERT**
- Sent when a beacon is first detected but no encoded or Doppler position information is available
- Typically sent when a beacon is detected by a Geostationary satellite
 - Geostationary (GOES) satellites do not provide Doppler location
- For US beacons, only sent if beacon is registered or associated with a Special Program, or the craft identification is encoded in the Beacon Id
- If US beacon registered, distributed based on homeport SRR in RGDB
- If US beacon not registered, is distributed based on beacon type
 - EPIRB to PacArea, ELT or PLB to AFRCC
- Non US beacons distributed to the responsible RCC based on country code in the Beacon Id
 - Example: sent to San Juan RCC for Barbados coded beacons



Summary of Alert Message Types

SIT 161

- Message Title:
406 BEACON LOCATED FIRST ALERT (AMBIGUITY UNRESOLVED)
- Sent when a beacon is first detected with encoded or Doppler position information available, but ambiguity is not resolved
- Distribution based primarily on location (SRR)
- If unlocated (SIT 160) alert was sent, located first alert is distributed to previous destination(s)
- Alerts for US Special Program beacons may be distributed specially – adds to or replaces normal distribution



Summary of Alert Message Types

SIT 162

- Message Title (1):
406 BEACON LOCATED FIRST ALERT UPDATE (AMBIGUITY UNRESOLVED)
- Sent after Doppler first alert (SIT 161) when better A/B probability information is available from the same satellite pass
- Only sent if **new A** side probability is at least 30% higher than **previous A** side probability (e.g., **previous A** = 55%, **new A** = 85%)
- Only sent prior to ambiguity resolution



Summary of Alert Message Types

SIT 162

- Message Title (2):

406 BEACON DOPPLER POSITION MATCH (AMBIGUITY UNRESOLVED)

- Sent after Doppler first alert (SIT 161) when both Doppler locations for a new satellite pass match the Doppler locations for a different (previous) satellite pass
- When both sets of Doppler locations match ambiguity resolution is delayed – A/B probabilities can be used to help prosecute SAR case
- Only sent prior to ambiguity resolution
- This new RCC message was implemented in January 2012



Summary of Alert Message Types

SIT 163

- Message Title:
406 BEACON POSITION CONFLICT ALERT (AMBIGUITY UNRESOLVED)
- Sent prior to ambiguity resolution, when Doppler or encoded positions for a beacon differ by more than 50 kilometers from another position for the beacon
- Indicates that at least one location is inaccurate
- Due to poor quality location data or a moving beacon
- Distribution based on new location(s)
- Also distributed to all previous recipients (to allow SAR coordination)
- After position conflict (SIT 163), missed passes and next passes are not computed again until ambiguity is resolved



Summary of Alert Message Types

SIT 164

- Message Title:

406 BEACON NOTIFICATION OF AMBIGUITY RESOLUTION

- Sent when the ambiguity in Doppler (A/B) position is resolved by independent position data from another Doppler solution or encoded location that matches within 50 kilometers
- May be first alert for a beacon when Doppler and encoded position match on the same alert
- Resolved (composite) position is a merge of all matching locations
- Encoded location matching the resolved position is usually more accurate than Doppler location
- If a beacon is moving, the resolved position lags behind actual location
 - view each (non-composite) location individually



Summary of Alert Message Types

SIT 165

- Message Title (1):
406 BEACON COMPOSITE POSITION UPDATE
- Sent after ambiguity resolved when new Doppler or encoded position matches resolved position within 50 kilometers
- Message Title (2):
406 BEACON COMPOSITE UPDATE WITH POSITION CONFLICT
- Sent after ambiguity resolved when Doppler or encoded positions differ by more than 50 kilometers from the previous resolved position
- Repeated Position conflicts (without a Composite Position Update) probably means that the beacon is moving



Summary of Alert Message Types

SIT 166

- Message Title: **406 BEACON MISSED PASS/SITE STATUS REPORT**
- Sent when a satellite pass (at least 10 degrees above the horizon to the reported beacon position) fails to detect the beacon
 - Only sent if missed detect time is after last time beacon detected
 - Alert site closes after 3 missed passes
- Sent when alert site closes due to age - 18 hours without a detection
- Sent when alert site closes due to USMCC Operator action
 - RCCs should request closure only if the beacon has been secured
- Sent before or after ambiguity resolution



Summary of Alert Message Types

SIT 167

- Message Title: **406 BEACON DETECTION UPDATE**
- Sent when an unlocated alert is received:
 - with detect time at least two hours later than the most recent detect time sent to the RCC for the alert site
 - that **causes the missed pass counter to be reset** (when detect time is later than time of missed detection)
- Sent to notify the RCC that the beacon is still active
- Sent before or after ambiguity resolution



Summary of Alert Message Types

SIT 168

- Message Title: **USA 406 BEACON DETECTED OUTSIDE US AOR**
- NOCR: sent to US RCC when a US country coded 406 MHz beacon is detected outside the US Search and Rescue Region (SRR)
- NOCR: sent to US RCC responsible for a foreign SRR when a beacon coded for that country is detected outside its SRR
 - For example, sent to CGD07 for Bahamas coded beacon
- If US beacon registered, distributed based on homeport SRR in the RGDB
- If US beacon not registered, is 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 or encoded location



Summary of Alert Message Types

SIT 169

- Message Title: **406 BEACON ENCODED POSITION UPDATE**
- Sent when the position encoded in the 406 MHz beacon message changes by more than 3 kilometers and less than 50 kilometers
- Only sent when there is no new Doppler location data
- Provides RCC with timely updates on beacon position, which may be particularly valuable in difficult SAR conditions, such as rough seas or mountainous terrain
- Primary source is Geostationary (GOES) satellite
 - GOES alert is sent to the MCC whenever encoded position changes
- May be sent before or after ambiguity resolution



Overview

- **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 noted below
- **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
- **406 MHz Beacon Registration Data:** Beacon owner, contact information, vehicle/usage information
- **Supporting Information:** Alert recipients, previous detections, predicted detections
- **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., **161**)
- Along with **Message Title** (**highlighted** below), identifies alert message type (per Summary of Alert Message Types provided above)

/17127 00000/3660/12 010 0939

/161/366S

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



Alert Message Structure – Key Fields

1. Message Header (cont'd)

Special Message Title

- Only present for “Ship Security Alert” and “Unknown Beacon Type”
- Precedes line with standard Message Title

/17127 00000/3660/09 270 0939

/161/CGOP

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

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



Alert Message Structure – Key Fields

2. Alert Data Block

BEACON ID

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

SITE ID

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

SITE STATUS

- Only present on SIT 166 message
- 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**]

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



Alert Message Structure – Key Fields

2. Alert Data Block (cont'd)

Ambiguity Resolution Summary (only present if ambiguity has been resolved)

- **LATITUDE** and **LONGITUDE** provided for composite/merged location
 - Doppler location normally accurate within 5 KM
 - Encoded location matching composite usually more accurate than Doppler location
 - Refined encoded location has a precision of 4 seconds (180 meters)
 - If beacon is moving, composite location lags behind actual location
- **DURATION** is hours between first detect time and last detect time
- **SRR** is the primary Search and Rescue Region (SRR)
- **BUFFER** is the secondary SRR
- **SRR** and **BUFFER** in Amb. Res. Summary are usually based on first composite location

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

LATITUDE	LONGITUDE	DURATION	PASSES	SRR	/BUFFER
38 45.5N	076 56.9W	001.5 HRS	003	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)
 - Even high “**A**” probability (e.g., 95) location may be incorrect
 - A higher “**A**” probability location is usually more accurate (e.g., 90 vs. 55)
- **SOL** (Solution) is **A** (Doppler), **B** (Doppler), **E** (encoded), **N/A** (unlocated)
- **LATITUDE** and **LONGITUDE** provided for new Doppler or encoded position

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

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

DETECTION FREQUENCY: 406.0281 MHZ

Alert Message Structure – Key Fields

2. Alert Data Block (cont'd)



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

DETECT TIME provided in Universal Coordinated Time (UTC)

- For Doppler solutions, is Time of Closest Approach (TCA) of the satellite to beacon
 - May differ from beacon message detect times by 8 to 10 minutes
- For non-Doppler LEOSAR solutions, is last beacon message detect time
- For GOES solutions, is first beacon message detect time
- **SAT** (Satellite): first digit is **S** (SARSAT), **C** (COSPAS), **G** (GOES), **M** (MSG), **I** (INSAT)
 - Only SARSAT and COSPAS satellites can generate Doppler locations
- **SOURCE** of the solution may be US LUT (e.g., AK1) or foreign MCC (e.g., CMCC)

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

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

DETECTION FREQUENCY: 406.0281 MHZ

Alert Message Structure – Key Fields

2. Alert Data Block (cont'd)



New Alert Information – Data Solution line

- **DETECTION FREQUENCY**

- provided for Doppler solutions (from LEO satellites) and GOES solutions
- not provided for LEO satellite solution without Doppler location
- 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)
- New message field implemented in January 2012

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

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

DETECTION FREQUENCY: 406.0281 MHZ

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 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 2 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 distributed specially (in append or replace mode)
 - Special program shown in Beacon Decode Information (if applicable)
 - NOCR (SIT 168) distributed based on country code if location not in country's SRR
 - For alert manually sent by USMCC to another RCC, SRR on message is not changed

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



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
 - Registration Information provided in the alert message for US registered beacons
 - C/S website provides Registry Points of Contact for non US beacons: see “Contacts” at <http://www.cospas-sarsat.org>
- **MID CODE** is 3 digit number assigned by ITU and associated with the **COUNTRY**
- **CRAFT ID** provides an alternate reference for registration data (not RGDB)
 - Craft Ids include Tail Number (e.g., **N203JP**), Radio Call Sign and Ship Station Id
- **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, if CSTA (C/S Type Approval) number is provided in **MANUFACTURER**

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



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
- **BEACON TYPE** shows the beacon type as EPIRB, ELT, PLB or SHIP SECURITY
 - Also shows if beacon is serialized (no CRAFT ID for serialized beacons)
 - For location protocol beacons, indicates if NATIONAL or STANDARD (STD)
 - CATEGORY I means that the EPIRB can be activated either manually or automatically
 - CATEGORY II means that the EPIRB can only be activated manually
- **HOMING** identifies the beacon's homer as 121.5 MHZ, SART (SAR Transponder), OTHER or NONE

```
***** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION *****
COUNTRY   : USA                CRAFT ID   :
MID CODE  : 366                HOMING    : 121.5 MHZ
MANUFACTURER: ACR              MODEL     : UNKNOWN
SERIAL NUM : 12345             BEACON TYPE: EPIRB SERIAL CATEGORY I
```



Alert Message Structure – Key Fields

3. Beacon Decode Information (cont'd)

- NOAA allocates groups of US coded beacons to US government **SPECIAL PROGRAMS**
 - Alerts usually distributed specially (in addition to, or instead of, 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 allocated to special Program
- **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           CRAFT ID      :
MID CODE     : 366          HOMING        : 121.5 MHZ
MANUFACTURER:              MODEL         :
SERIAL NUM   : 2336        BEACON TYPE: PLB SERIAL (NATIONAL)
```

PROGRAM: FBI

PROGRAM BLOCK REGISTRATION ID: XXXXXXXX81FE0



Alert Message Structure – Key Fields

3. Beacon Decode Information (cont'd)

- **Unreliable beacon message (unknown Beacon Type)**
 - Occurs if Beacon Id contains invalid or inconsistent information
 - Alerts with unreliable beacon message distributed solely based on Doppler location
 - Does not mean that Doppler location is poor
 - May occur for a true distress beacon activation

 - Indicated by special Message Title “Unknown Beacon Type”
 - Indicated in Beacon Decode information as follows:

NO DATA PROVIDED BECAUSE THE BEACON CODING IS NOT RELIABLE

Alert Message Structure – Key Fields

4. Beacon Registration Data



- Based on information in **US RGDB** for Beacon Id
 - Contains three sections
- 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 JETS” 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, 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.

Alert Message Structure – Key Fields

4. Beacon Registration Data (cont'd)



- Section 3 provides Registration Dates, Remarks (from beacon owner or RCC) and Special Status information
 - SPECIAL STATUS indicates if beacon is reported as SOLD, STOLEN, REPLACED, OUT OF SERVICE, LOST, RECODED or DESTROYED
 - Beacons in special status are usually unavailable for normal use or not in the owner's possession
 - View SPECIAL STATUS INFO for more information on special status condition
 - Roughly half of activated US registered beacons have Special Status information
- If the beacon is not registered in **US RGDB**, then this message section states:
REGISTRATION DATA IS NOT AVAILABLE IN THE USMCC DATABASE

Alert Message Structure – Key Fields

5. Supporting Information



- **PREVIOUS PASS INFORMATION** lists previous passes that detected the beacon
 - Ordered by time pass first received at USMCC (most recent listed first)
 - Up to 4 satellite passes are listed
 - Solution Data fields (PROB, SOL, etc.) have same format as in Alert Data Block
 - SOURCE “MULT” indicates that the pass was received from multiple sources
 - Merged (multiple source) location may differ from initial (single source) location
 - After ambiguity resolved, locations that do not match the composite are not reported
 - View Alert Data Block in different messages to detect a moving beacon
- Sample below: Position conflict before ambiguity resolved

PREVIOUS PASS INFORMATION:

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

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

Alert Message Structure – Key Fields

5. Supporting Information (cont'd)



- **NEXT TIME BEACON SHOULD BE DETECTED**

- Gives the next two satellite passes that should detect the reported beacon location(s)
- Based on a polar orbiting (i.e., SARSAT or COSPAS) satellite pass having mutual visibility to the beacon location and a US LUT scheduled to track that pass
- **SOL** gives received solution (A, B, E or C) that is predicted to be detected
- **HIGH** VISIBILITY PASS (over 10 degrees) not received is counted as “missed”
- **LOW** VISIBILITY PASS (5-10 degrees) not received is not counted as “missed”
- Next pass not predicted before ambiguity resolved, if there is position conflict
- Next pass predictions only for resolved (Composite) position after ambiguity resolved

PREVIOUS PASS INFORMATION: N/A

NEXT TIME BEACON SHOULD BE DETECTED:

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



Alert Message Structure – Key Fields

6. Message Trailer

- Three lines indicate the end of message:

QQQQ

/LASSIT

/ENDMSG



Overview

- **Summary of Alert Message Types**
- **Overview of Alert Message Structure**
- **Revised RCC Message Manual**



Revised RCC Message Manual

- References to 121 MHz Processing removed
 - 121 MHz Phase out occurred in Feb. 2009
- Common sections of messages described only once
 - Old version repeated descriptions per message
- Improves field descriptions (e.g., SRR and message destination)
- Improves description of data distribution procedures
- Provides current sample messages

- This presentation was based on revised version
- Revised version expected to be ready for review in May 2012