Corrupt Beacon IDs

SAR Controllers Training 2014
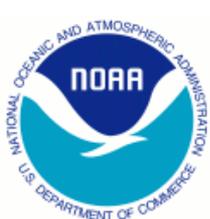
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Alerts with "Unreliable Beacon Type"

- "Unreliable Beacon Type" identifies alerts with a corrupt beacon ID

- Are only sent when there is a Doppler location

- Occurs when the beacon ID fails validation checks for:
  - Country code
  - BCH (uncorrectable bit errors)
  - Fixed bits
  - Invalid radio call signs
  - Invalid ship station ID
  - Aircraft ID

Alerts with "Unreliable Beacon Type" (Cont'd)

- Until recently, they were considered an artifact of:
  - Beacon transmission
  - Beacon miscoding
  - LUT processing
- Recently we discovered they were also an artifact of satellite processing. The discovery was due to:
  - Good work and persistence by the Coast Guard RCCs
  - A beacon with "Unreliable Beacon Type" that transmitted for a long time
  - MCC analyst observed that the beacon was only reported by certain satellites
    - S11
   - S12
    - And S13 after its launch

Further Investigation (1 of 2)

	|				
Unreliable Beacon IDs that Match to a Registered Beacon					
Year	S11/SARP3 Alert Site Solutions	S12/SARP3 Alert Site Solutions	S7 - S10 SARP2 Solutions	S7 - S12 SARR & SARR/SARP Combined Solutions	Alert Sites from Solutions	Additional Information
2011	270	234	0	0	31	
2010	148	575	0	0	33	
2009	207	370	0	0	36	S12 Ops as of 3/25/2009
2008	450	Not Ops			30	
2007	255	Not Ops	0	0	16	S11 Ops as of Jan 2007
2006	Not Ops	Not Ops	0	0	0	

The table above shows unreliable beacon IDs that were linked to a USA registered beacon only came from SARP3 satellites.
Note: There probably are beacons with other than USA country codes that are not included here.
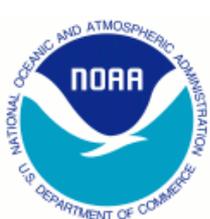
Further Investigation (2 of 2)

Total Alert Sites with Unreliable Beacon IDs							
	2011	2010	2009	2008	2007	Avg. per Year	Launch Date
Total with Bad IDs	1403	964	1250	1115	791		
Total Sites	26403	26771	24610	20056	17389		
% Sites with Corrupt IDs by satellite	5.31	3.60	5.08	5.56	4.55		
G11	345	256	352	271	123		
G12	0	161	463	397	240		
G13	541	166	0	94	0		
I3	0	0	1		1		
M2/M1	0	0	1		11		
S10	121	93	146	136	127	124.6	May-05
S11	361	192	237	283	234	261.4	Oct-06
S12	259	224	149			*241.5	Feb-09
S7	131	82	136	152	88	117.8	May-98
S8	130	82	123	160	86	116.2	Sep-00
S9	137	97	142	179	102	131.4	Jun-02

The table above shows the distribution of solutions with unreliable beacon IDs by year and satellite since 2007.
Note: The number of solutions with unreliable beacon IDs from S11 & S12 are approximately double those from S7 – S10.
Average for S12 based only on data for 2010 and 2011.

What We Learned

- Corrupt beacon IDs are also caused by the Search and Rescue Processor (SARP) on S11, S12, & S13 (SARP-3)

- The method of identifying the start (first bit) of the beacon message was changed on SARP-3

- The problem occurs when:
  - A beacon transmits rapidly (transmission every 10 seconds instead of the expected every 50 seconds)
  - A beacon transmits in an area of high interference

- SARP-3 incorrectly identifies the start of the beacon message at a bit downstream of the correct bit, bit 25

The information below is presented to support discussion explaining the pros and cons of inserting "ADCDO" and "*" in front of 15 hex beacon ID on the alert message.

A	D	C	D	0	2	1	1	7	1	4	2	0	0	1
1010	1101	1100	1101	0000	0010	0001	0001	0111	0001	0100	0010	0000	0000	0001

					2	1	1	7	1	4	2	0	0	1	4	A	3	6	B
					0010	0001	0001	0111	0001	0100	0010	0000	0000	0001	0100	1010	0011	0110	1011

# Mitigation - Suggested RCC Actions

- Gather information
  - Beacon location
  - Attempt to get registration information
    - Search RGDB using ADCD0 + the first ten of the ID on the alert
    - Search RGDB using an * + the first 14, 13, 12, 13, and 10 of the ID on the alert
    - Look for other beacon IDs in the general vicinity
   - Suggestions from audience?

Mitigation - Cautions

- Do not consider any information gained from decoding an "Unknown" beacon on the Cospas-SARSAT website to be reliable, therefore
  - You are not given any information in the beacon decode section of the alert message
  - You cannot consider the decode on the Cospas-SARSAT website reliable
    - You will not have the additional bits that are used for error checking
  - Registration information is included in the alert message if the corrupt beacon ID matches a beacon that is registered in the US RGDB
    - Don't rely on the registration information being correct for that beacon
  - The beacon may not be a US-coded beacon and may not be in the US RGDB
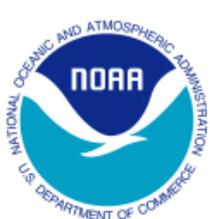
Actions When Corrupt Beacons are Identified

- Request owner to contact beacon manufacturer
  - Probably requires a battery change
  - Beacon probably malfunctioned:
    - Transmitted continuously in self-test mode
    - Transmitted at short intervals
    - Bracket design may have caused rapid transmission in self-test mode

- Contact the USMCC Chief by email so further investigation is performed: sam.baker@noaa.gov
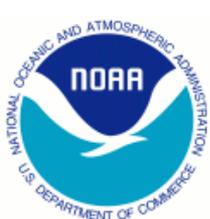
Conclusion

- If the alert is for an unknown beacon ID
  - Don't believe the Cospas-SARSAT decode
  - Try the procedure using ADCD0 in the front and checking the RGDB
  - We now have 3 satellites (S11, S12, & S13) that may cause an "unknown beacon ID"
- Questions?