Second Generation Beacon (SGB) Update

Beacon Manufacturers Workshop
2016

Dr. Sun Hur-Diaz
NASA/Emergent Space Technologies
ANGEL Project Lead

Outline

- SGB Proof of Concept (POC) Testing Status
- Document Status
  - SGB Specification (C/S T.018)
  - Type Approval Standard (C/S T.021)
- Advanced Next Generation Emergency Locator (ANGEL)

SGB POC Testing

- POC Test Plan published and reviewed
  - Primary tests procedures for detection and location performance completed
  - Other test procedures for capacity, compatibility, 406 MHz homing, and field testing being finalized
- NASA MEOLUT upgraded to process SGBs
  - Preliminary POC-1 test performed in March
  - Final calibration in progress with testing scheduled to begin by the end of May

SGB POC - Preliminary POC-1 Results

- SGBs transmitted at 37, 34, and 31 dBm transmit power into typical monopole antenna
- Summary of results compared to system requirements contained in C/S G.008

Requirement	37dBm	34dBm	30dBm
99.9% probability of detection within 30 seconds	100%	100%	98.5%
Single burst location accuracy (<5km, 90% of the time)	Complies	Complies	Complies
Location accuracy <5 km, 95% of the time, within 30 seconds	Complies (1st burst)	Complies (1st burst)	Complies (1st burst)
Location accuracy <1 km, 95% of the time, within 5 minutes	Complies (1 burst)	Complies (4 bursts)	Requires (15 bursts)
Location accuracy <0.1 km, 95% of the time within 30 minutes	0.326 km (15 bursts)	0.649 km (15 bursts)	0.981 km (15 bursts)

SGB Specification (C/S T.018)

- Preliminary Issue B approved December 2015
- Notable updates from C/S SGB Task Group meeting in April, 2016
  - Agreed on PRN sequences
  - Frequency Stability - details still being resolved
    - Specs for carrier and chip rate frequencies
    - Modulation Error Vector Magnitude
- Major items to be resolved using POC test results
  - Beacon Transmission schedule
  - Required EIRP values and percentage of measurement points required to meet spec
  - Expectation is to resolve these items this year

SGB Type Approval Standard (C/S T.021)

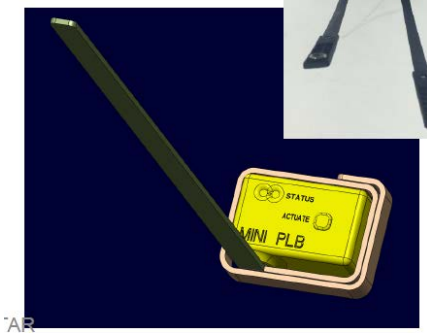
- Notable updates from TG-1
  - Revised T.018-T.021 compliance matrix
  - Agreed on EIRP measurement point distribution
  - EIRP test configuration
  - Draft updates to several sections (Navigation, Testing Overview, Testing Procedure)
- Beacon manufacturers and test facilities engaged to facilitate progress
- SGB prototype testing being used to develop test procedures for beacon signal compliance validation
- Expectation is for document issue by the end of 2017

ANGEL Development & Procurement

- Advanced Next Generation Emergency Locator (ANGEL) is an SGB PLB for NASA Orion crew survival
  - Attached to astronaut Life Preserver Unit (LPU)
  - For operation after splashdown & crew capsule egress
  - Targeting Exploration Mission 2 (EM-2) in 2020
  - 406 MHz spread spectrum satellite signal and 121.5 MHz swept-tone homing signal
- NASA has developed a prototype ANGEL beacon
- NASA plans to procure 30 ANGEL flight units
- RFP release planned this summer

ANGEL for Orion Crew Survival

SARC beacon is crew member's "last line of defense" in event of separation from capsule, fellow crew members, or life raft



Schedule Drivers

Milestone	Date
Operational Readiness Review (ORR)	12/28/2018
On-Dock (Flight units for crew rehearsals)	04/01/2019
EM-2 Launch	**10/01/2020**

ANGEL Prototype Output Signal Spectrum

- Spread Spectrum, OQPSK output