



NASA Search and Rescue Beacon Manufacturer's Workshop

October 7, 2020

Cody Kelly
Deputy for National Affairs
NASA Search and Rescue Office
Goddard Space Flight Center



- NASA's Role in SAR
- Second-Gen Beacon (SGB) Testing Status
 - C/S Program Level
 - EPG Status
 - ANGEL Beacon Testing
- Space Segment Involvement:
 - SAR/GPS Status
- Advanced Projects
 - 406 MHz Homing
 - LADR

NASA'S ROLE IN SEARCH AND RESCUE



- Innovate and develop new technologies to improve search and rescue hardware for national/international use in emergencies
 - Emergency beacons for use in distress
 - Ground stations that monitor and distribute data to rescue forces
 - Space payloads that detect the emergency signal and relay to Earth
- Technical arm for United States satellite-aided SAR Program (SARSAT)
 - Work with US Coast Guard, Air Force, and National Oceanic and Atmospheric Administration (NOAA)
- Agencies form a delegation and represent USA on international level
 - COSPAS-SARSAT Program
 - 42+ countries work together to obtain full Earth coverage of beacon detections and rescues



SGB Testing Status

Testing the Emerging Beacon Segment



- Proof of Concept and D&E phases are completed nationally
- International System Test being developed
- An SGB PLB (ANGEL) was developed
- ANGEL is completing type approval testing at EPG
- The build out of SGB compatible ground system capabilities is underway

Type Approval Status



- C/S established a technical panel, *“in coordination with the Secretariat to conduct the type approval reviews for SGBs and ELT(DT)s concurrently with the review of test facility applications for extended capabilities....”*
- The technical panel has established a review methodology for the test facilities’ applications to extend their capabilities.
 - Focused on T.018 and T.021 traceability and coverage within the test procedures.
 - EPG’s application is currently in review.
- ANGEL is anticipated to be the initial SGB submitted for type approval.

- EPG submitted the application to extend their test facility capabilities for SGB and SGB ELT(DT)s at the end of May 2019
- Providing “quick looks” to beacon manufacturers for SGB and SGB ELT(DT)s in development.
- The review of EPG’s test procedures is complete. The next phases are a virtual site visit and a test report. ECD 2nd Quarter of 2021.
- EIRP Testing:
 - C/S is reviewing data from EPG and other labs to select a standard ground plane diameter and receive antenna height for EIRP testing.

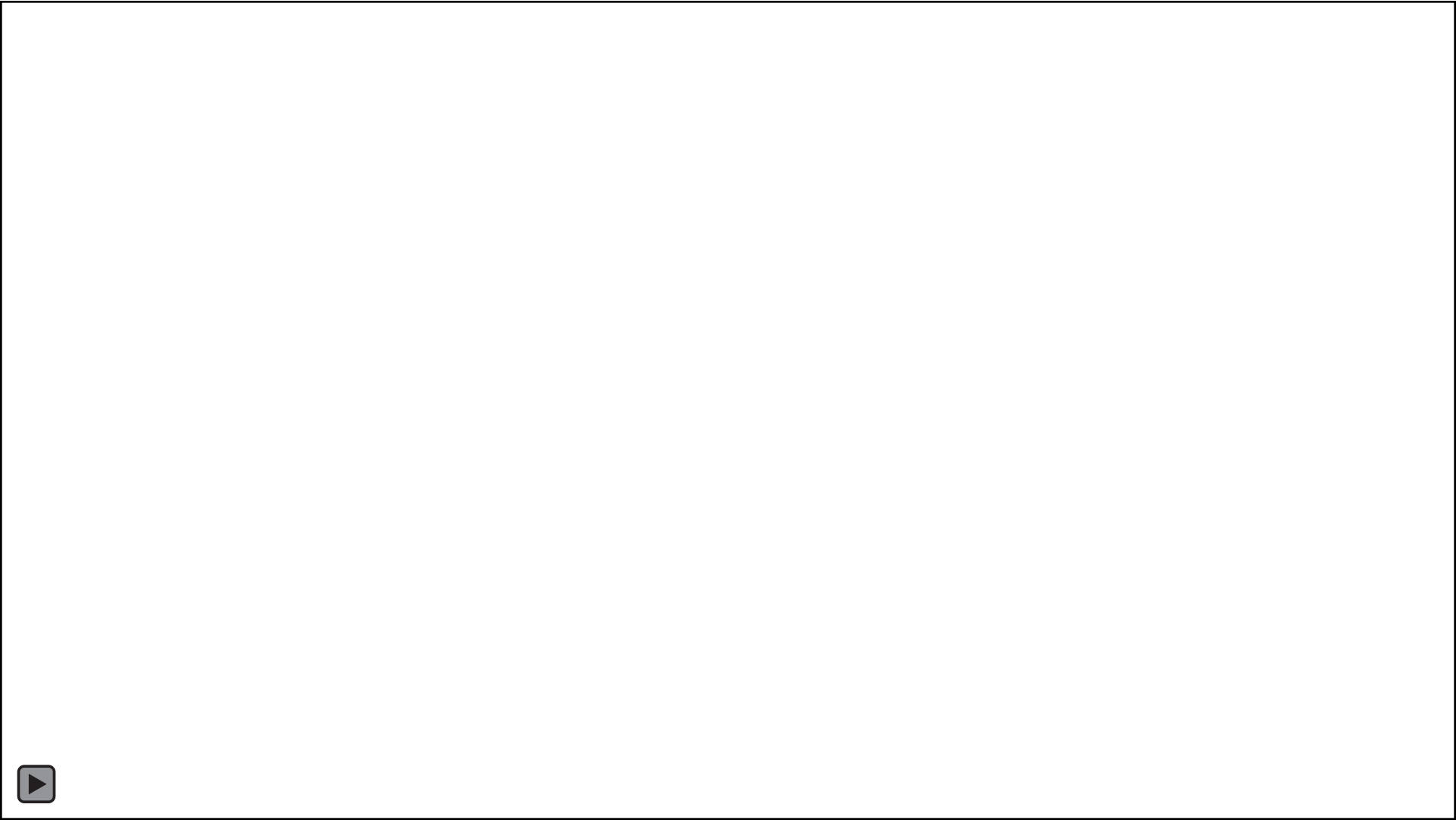




- TUV has submitted an application to extend their capabilities to include FGB ELT(DT)s.
- The experts panel has completed the review of TUV's test procedure and has completed one virtual site visit.
- TUV and the rest of the labs indicate that they plan to submit applications for SGB and SGB ELT(DT) testing in 2021.
- The experts panel has developed test procedure review processes and virtual site visit plans for FGB ELT(DT), SGB, and SGB ELT(DT) applications with the intent of providing faster reviews for follow on applications.
- There is interest in the availability of SGB, SGB ELT(DT), and FGB ELT(DT) test beacons to support lab test procedure development and possible cross-check testing between labs.

- “Advanced Next Generation Emergency Locator”
- Develop / certify SGB PLB for NASA Orion Crew Survival use
 - Attached to astronaut Life Preserver Unit (LPU)
 - For operation after splashdown and crew egress from capsule
 - 406 MHz signal and 121.5 MHz swept-tone signal
- ANGEL currently finishing C/S Type Approval at EPG in support of Artemis – 2 human lunar mission
- Rescue Environments ANGEL Compatibility Testing (REACT) Phase I conducted at USCG Rescue Swimmer Training Facility in October 2019
- REACT Phase II (flight-like operational testing) to occur following Artemis-1 un-crewed lunar mission recovery operations





SAR/GPS Status

Fielding the Future Space Segment

- Contracts were awarded in 2019:
 - USAF to LM for 22 GPS III F SVs
 - Canadian DND to MDA for the SAR repeater payload
- NASA is providing engineering expertise for mission assurance
- Design and engineering is underway
 - GPS III F SV CDR was held in February 2020
 - Repeater PDR was held in August 2020
- Launches are planned to start in 2026, replacing the existing DASS constellation



Advanced Projects / Development

SGB DF Background

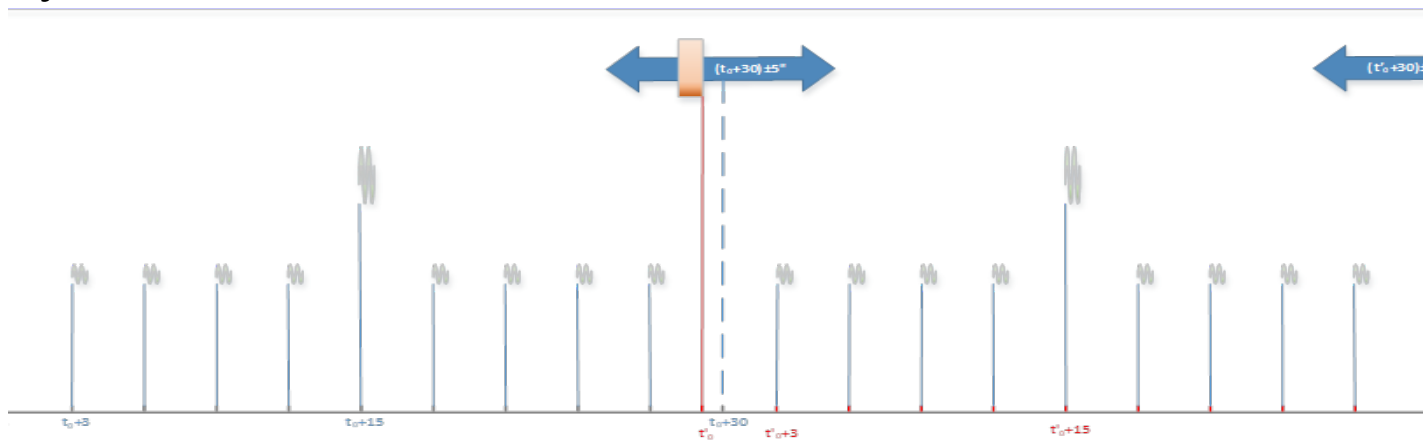


- With current equipment, SAR forces will not be able to DF on the SGB spread spectrum satellite signal, like they do today with FGBs.
- 406 MHz homing is used by SAR forces to get within range for 121.5 MHz homing
- The current model used by the USCG is the Rockwell Collins DF-500. It can DF any signal that it can tune to and receive, including the FGB satellite signal
- NASA is contracted with Rockwell Collins to develop the DFR-500 to detect and DF on the SGB spread spectrum satellite signal, and the low power 406 MHz homing signals.
-
- NASA completed a series of tests with the DFR-500 to evaluate SGB 406 MHz homing performance.

SGB DF Signals



- Three different 406 MHz SGB signals for the DFR to locate
 - (A) 5W Spread spectrum SGB to satellite message, which the DFR can detect and DF at greater than 100 nm
 - (B) 100 mW (nominal) High Power Continuous Wave (CW) homing signal, which repeats every 15 seconds, detectable at 30 nm
 - (C) 25 mW (nominal) Low Power CW homing signal, which repeats every 3 seconds, detectable at 8 nm

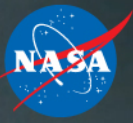


Satellite signal. Burst duration: 1"

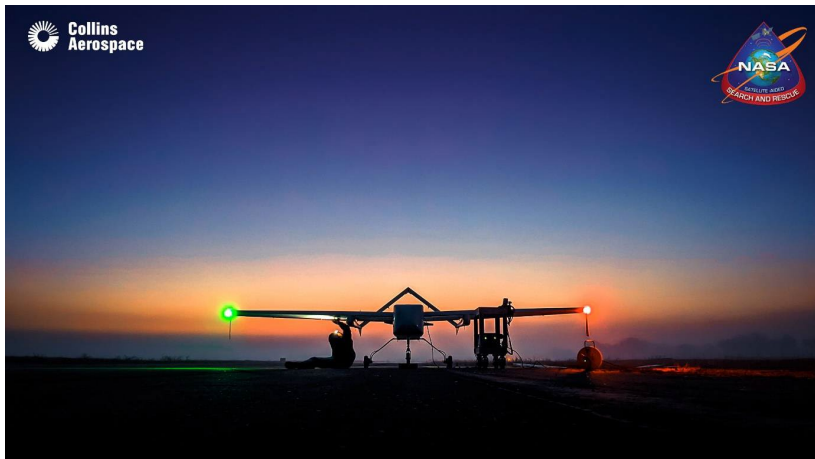
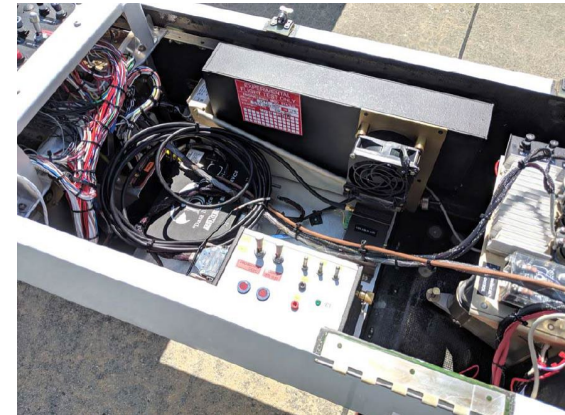
« High power » Homing Signal
(E.g. 50mW)
Burst duration: 400-500ms

« Low power » Homing Signal
(TBD mW)
Burst duration: 400-500ms

UAS SAR & SGB DF Receiver



- DFR-500 performance was field tested on NASA's Sensor Integrated Environmental Remote Research Aircraft (SIERRA) Unmanned Aerial System (UAS)
- Valuable lessons learned for Ops Concepts of UAS as SAR DF platform



- SGB ELT(DT) designed to meet GADSS ADT requirements, including submission to LADR
- NASA participates in development of GADSS documents, including LADR functional specification
- Developed prototype LADR interface using simulated MCC data to contribute data to the LADR prototype under development by ICAO
- Continuing engagement with ICAO to insure SGB ELT(DT) is ready to meet their needs

