



SEARCH AND RESCUE

MEOSAR & GPS ICG WG-B Vienna Austria, June 2016

Dr. Lisa Mazzuca, Mission Manager
NASA Search and Rescue Office
Goddard Space Flight Center



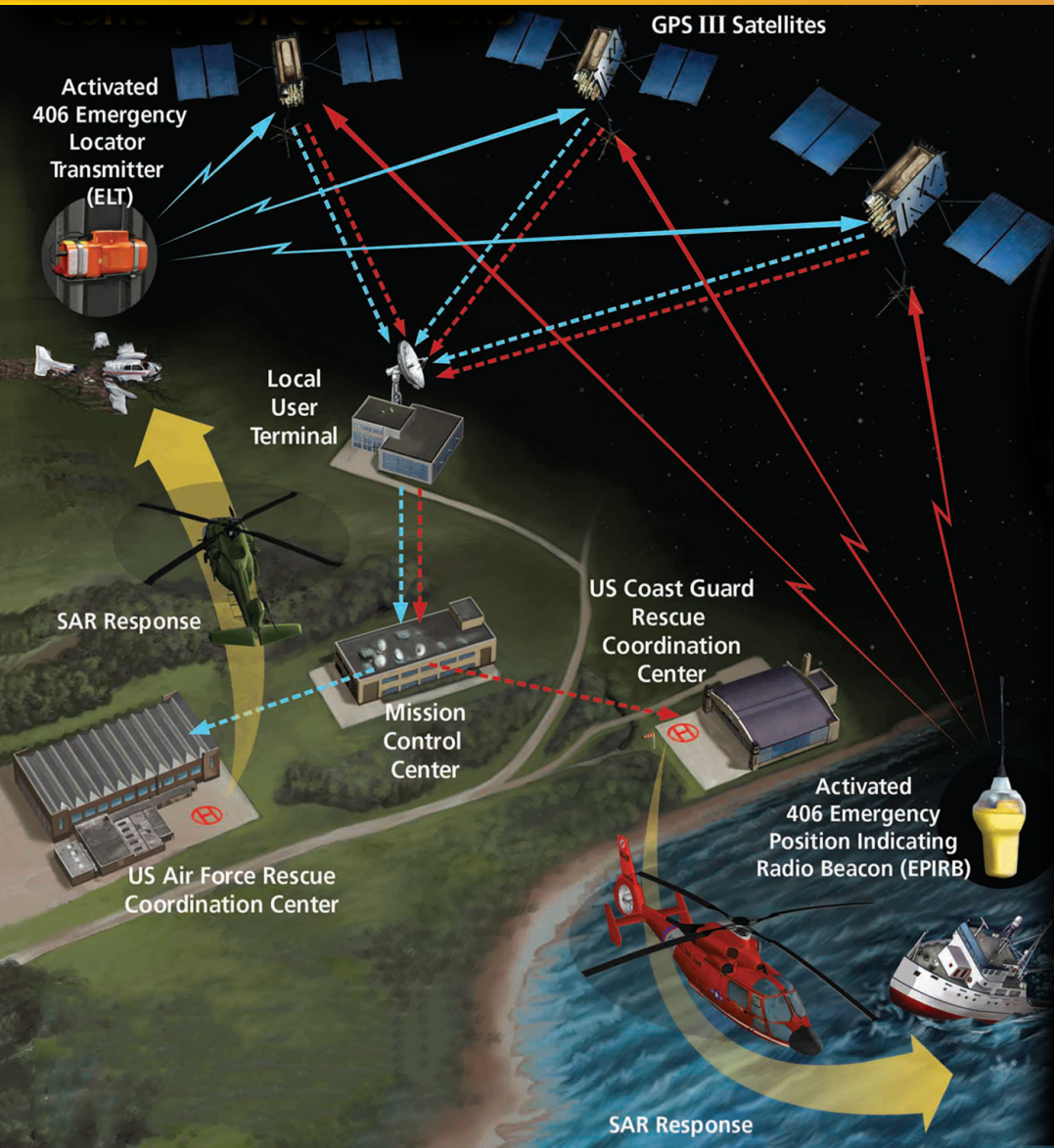
Overview



- Cospas-Sarsat System
- GNSS-enabled Medium Earth Orbit SAR (MEOSAR)
- MEOSAR launch schedule
- SAR GPS payload
- MEOSAR ground coverage
- MEOSAR operational capability phases
- Current status



MEOSAR: CONCEPT OF OPERATIONS



SAR/GPS

*Search and Rescue-
Global Positioning Satellite System*

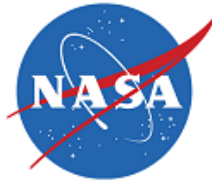


MEOSAR: NEXT GENERATION OF SATELLITE-AIDED SAR



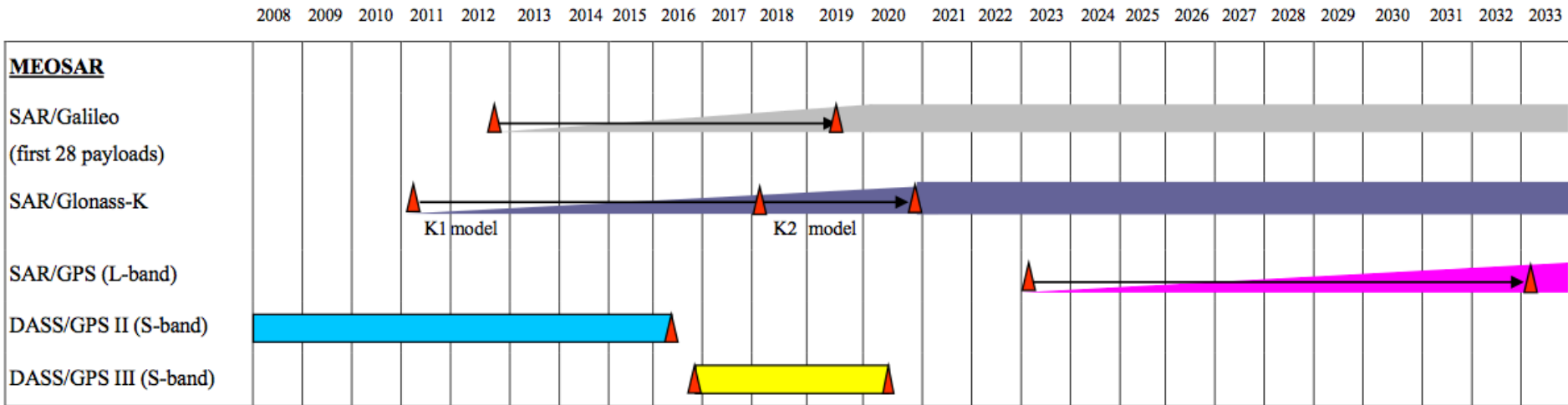
- For USA, based on the use of SAR Repeaters carried onboard GPS
- Benefits...
 - Multiple satellites in view of the beacon anywhere in the world at all times
 - Advanced location process using time and frequency measurements of beacon signal to triangulate its location
- Near instantaneous beacon detection and location, globally, at all times
- Mitigates terrain blockage because of multiple look angles from multiple moving satellites
- Simple space segment repeater allows for development of higher performance beacon signal





MEOSAR Launch Schedule

Figure 1: MEOSAR Space Segment Tentative Launch Schedule



- SAR/Galileo: The first 30 Galileo satellites carrying a total of 28 SAR payloads deploying between 2012 and 2019
- SAR/Glonass-K: SAR payloads planned to be carried on the Russian GNSS Glonass-K1 and Glonass-K2 satellites
- SAR/GPS: launch-ready date is 2023. After first launch, a GPS constellation of 24 satellites with SAR payloads should be in place within 10 years
- SAR/GPS/DASS: currently 20 DASS payloads onboard GPS. Planned 8 more payloads (Block III)



GPS and SAR



- U.S. SAR Operational Space Segment
 - Repeater payload will be provided by Canadian government built to C-S specifications including interoperability with Galileo and GLONASS
 - Development underway with first operational payload planned to launch on board GPS III SV-11
 - SAR/GPS PDR – held November 20, 2013
 - Payload provider decided to not extend vendor contract and will post an RFP this summer
 - Mitigates GPS schedule moving to the right
 - NASA role is safety and mission assurance oversight for payload build and integration into GPS



MEOSAR Payload Description

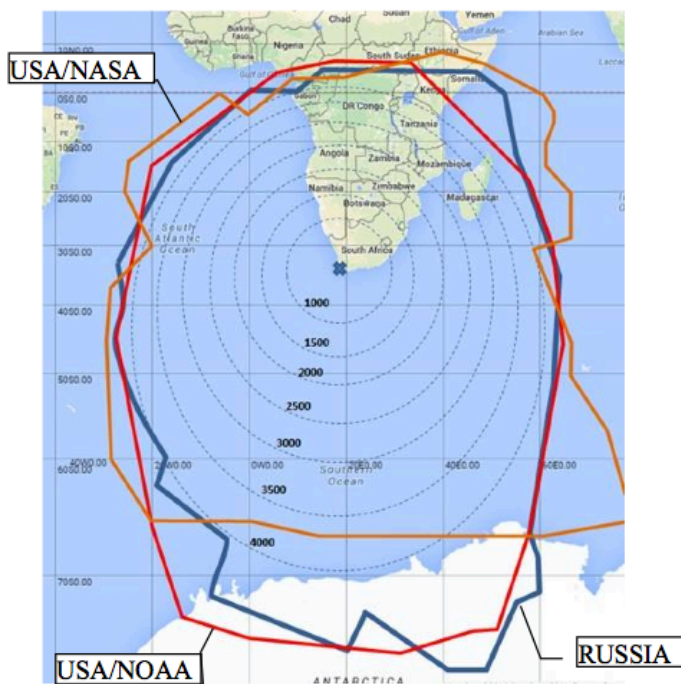


- Cospas-Sarsat Program writing Payload Description document for current suite of GNSS payloads. Areas include:
 - Interoperability parameters: modulation of downlinks, downlink frequencies, downlink EIRPs and polarization, repeater bandwidth
 - Functional descriptions
 - Spectrum characteristics
 - Repeater coverage area
 - Repeater performance and transmitter parameters



MEOSAR Coverage Area

- Cospas-Sarsat Program analyzing multiple simulations to show ground footprints of MEOLUTs around the world to ensure full Earth coverage
 - France, Russia, and USA producing independent computer models to compare against



6-antennas, no beacon elevation limitation, 10 min performance

Parameter	Criteria/Value
Space Segment	List of satellites with their payload properties.
Ground Segment	List of Antennas (and their properties) along with their associated MEOLUT.
Networking (yes/no)	Stand-Alone or as commissioned
MEOLUT Minimum Elevation Angle	5 degrees
Beacon Minimum Elevation Angle	5 degrees
Beacon Motion	Static beacons
Number of Bursts	13 transmitted bursts
Allowable Wait Time	10 minutes (after first burst transmission)
Start Time	A given day and time
Length of Simulation	At least 10 days
Simulation Step Size	Maximum 15 minutes
Grid Size	Range of the latitude, longitude, typically covering the whole Earth
Grid Resolution	220km x 220km, which corresponds to 2 degrees at the equator
Number of Satellites required to locate	at least 3



MEOSAR Operational Capability Phases



- Cospas-Sarsat Program transition to MEOSAR will occur in phases:
 - EOC: Early Operational Capability
 - Allow for distribution of MEOSAR alert data for operational use at a given MEOLUT once commissioned
 - USA has commissioned its first MEOLUT and will commission the second this month
 - IOC: Initial Operational Capability
 - Declaration by MEOSAR satellite providers and Cospas-Sarsat that, prior to full deployment, alert data from the MEOSAR system can be used operationally and shared with other Mission Control Centers (MCCs). The MEOSAR system need not necessarily provide global coverage
 - FOC: Full Operational Capability
 - Full Earth ground station coverage
 - Full complement of L-Band MEO spacecraft payloads



MEOSAR Current Status



- Once Hawaii MEOLUT commissioned this month, USA will be the first nation to use MEOSAR data operationally (distribute to the USA Rescue Coordination Centers for all detected alerts)
- France also working to commission their MEOLUTs
- Demonstration and Evaluation of the MEOSAR system continues to progress
 - Completed second of three testing phases
 - Phase II includes GPS/DASS and available L-Band payloads
 - Phase III will test system performance with only L-Band payloads