SARSAT Beacon Manufacturer's Workshop
September 28, 2012

Next Generation SARSAT Space Segment

MEOSAR

Prepared by:

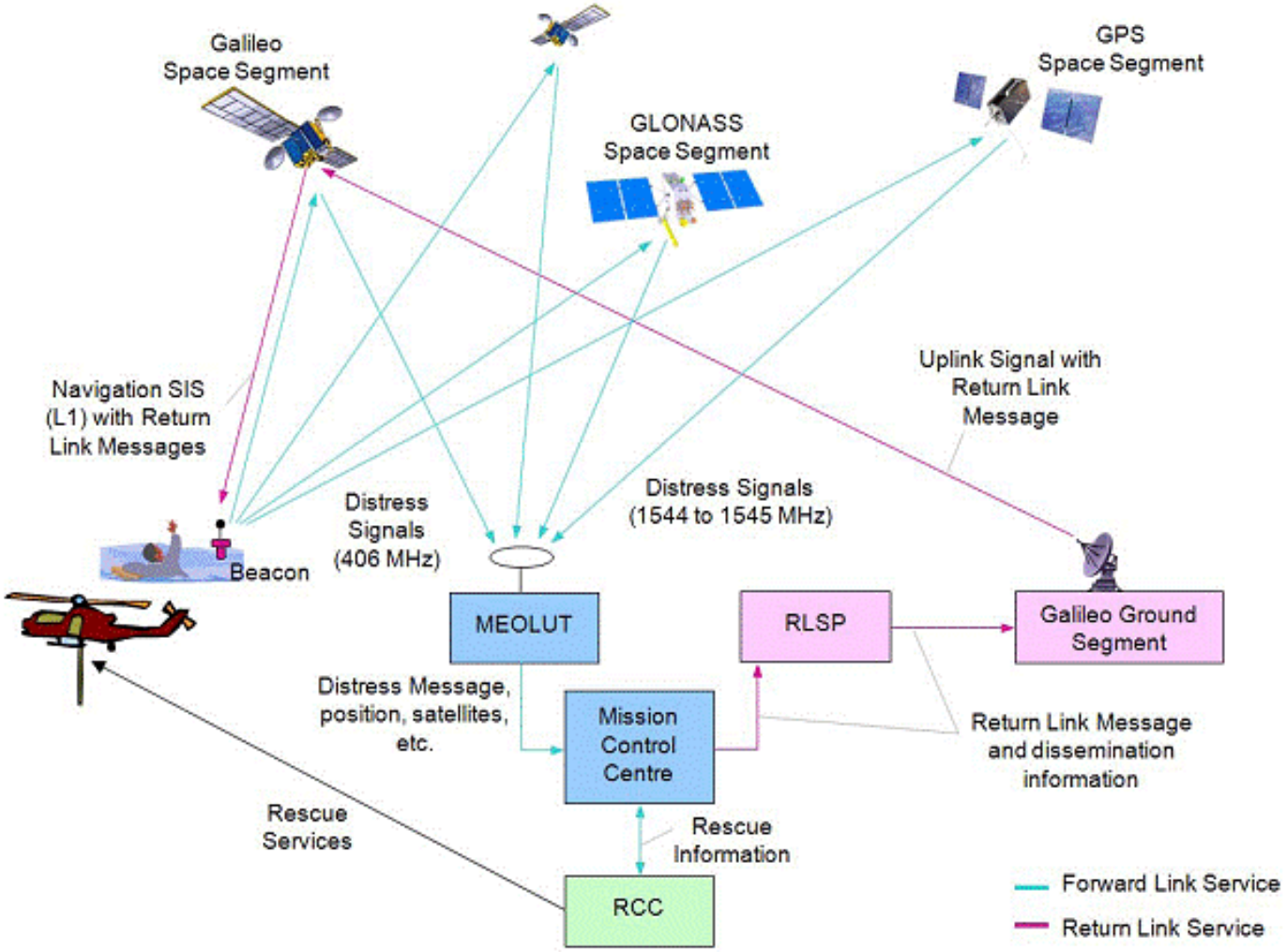
Chris O'Connors

NOAA/NESDIS

Agenda

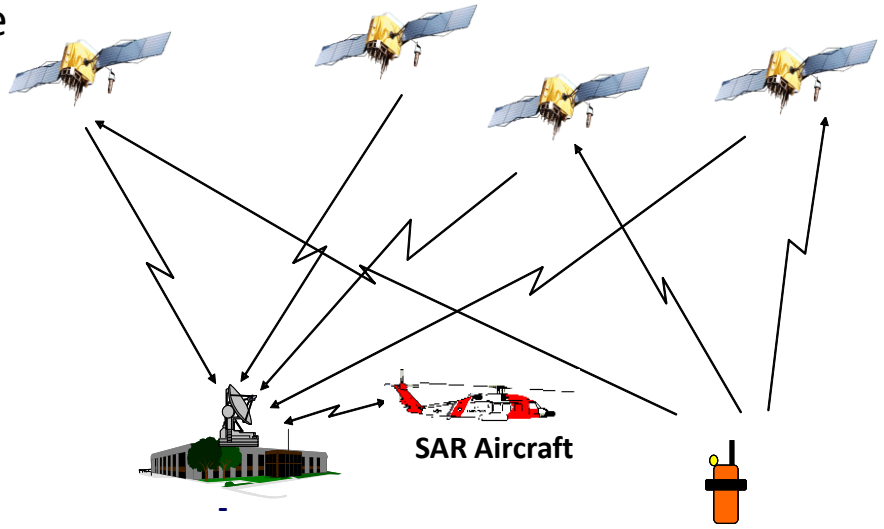
- MEOSAR Overview
- Space Segment
- Ground Segment
- MEOSAR POC
- MEOSAR Timeline
- Demonstration and Evaluation
- IOC and FOC Look Ahead

MEOSAR Overview



MEOSAR Overview

- MEOSAR Concept
  - Utilize multiple satellites with SAR repeaters, or “bent pipe”
  - Multiple antennas are used to receive the same beacon burst
  - The time difference of arrival (TDOA) and frequency difference of arrival (FDOA) is then used to determine location
  - One burst, received through 3 unique satellites, is capable of producing a location
  - Essentially, GPS location in reverse

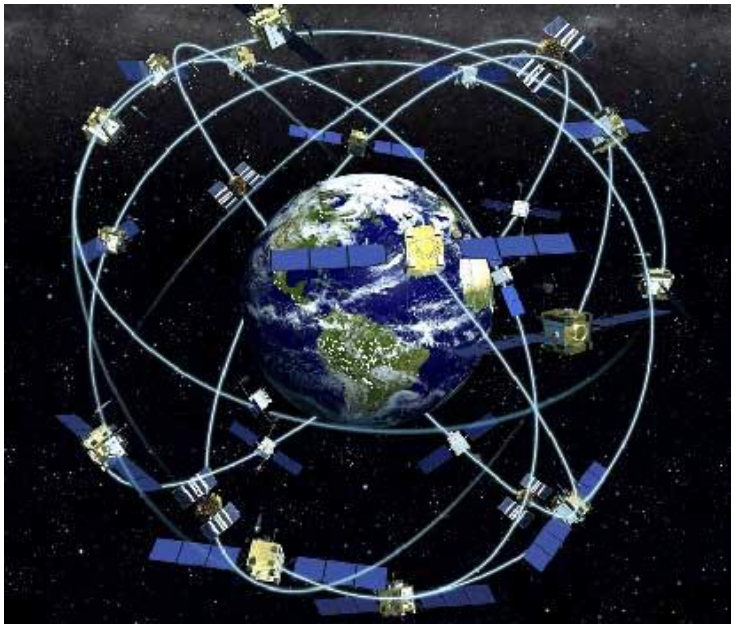


MEOSAR Overview

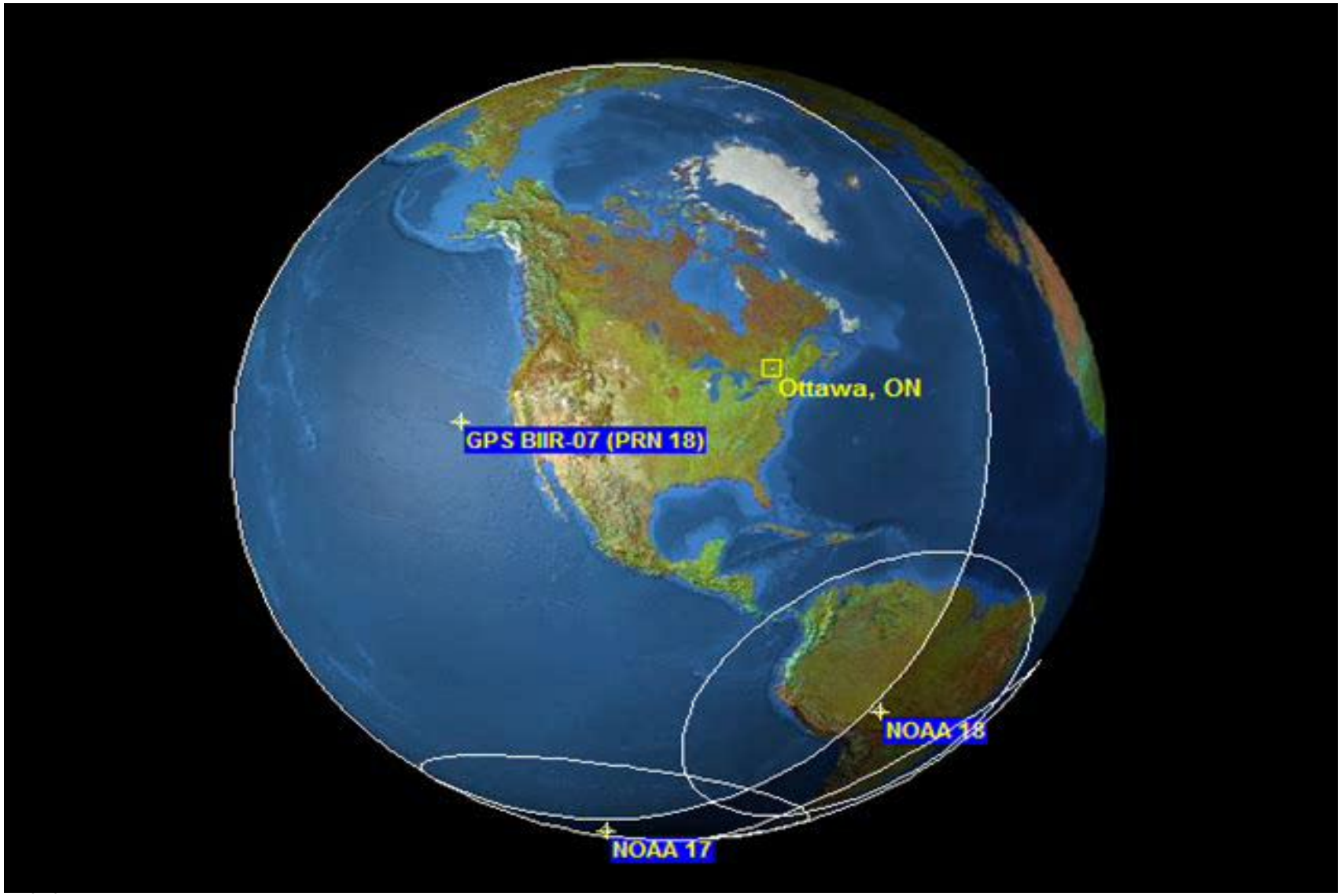
- Medium Earth Orbit (MEO) SAR / GPS
  - Various studies determined that medium-earth orbiting (MEO) satellites provide a vastly improved space-based distress alerting and locating system.
  - NASA, with USAF Space and Air Combat Command, NOAA, and USCG are developing a capability on GPS satellites– SAR/GPS
- MEOSAR provides
  - A combination of the best assets of GEOSAR and LEOSAR
  - Near instantaneous notification and location of distress
  - Near 100% Availability
  - Better location accuracy
  - Global coverage
  - Full compatibility with current and future beacons

Space Segment

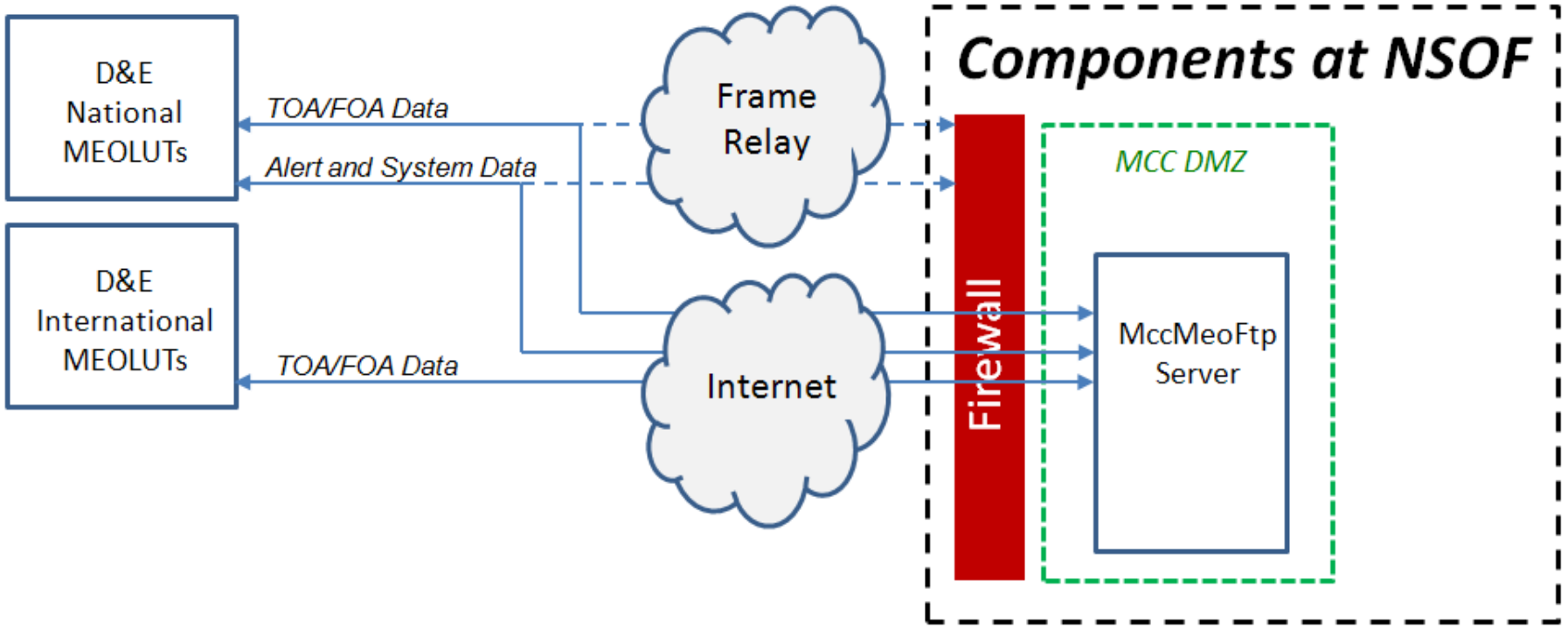
- Repeaters will be flown on Medium Earth Orbit (MEO) satellites
- Will utilize 3 Global Navigation Satellite System (GNSS) constellations
  - GPS (USA)
  - GLONASS (Russia)
  - Galileo (ESA)
- Current plan is to have 24 US MEOSAR instruments
- 72 MEOSAR instruments total



MEO vs. LEO Coverage



US MEOSAR Ground Segment Design



Ground Segment

- Prototype ground station at NASA Goddard Space Flight Center
  - 4 antennas – capable of independently tracking 4 satellites
  - Proof of Concept testing successfully completed in 2008
  - May become future operational MEOLUT
  - Full participation in MEOSAR D&E testing

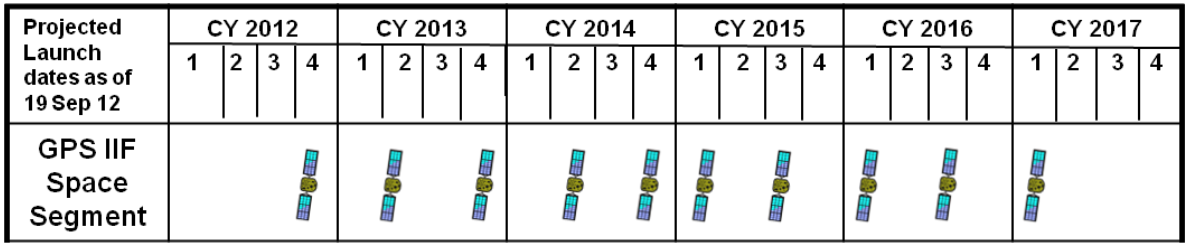
Ground Segment

- Accepted MEOLUT Wahiawa, Hawaii
  - 6 antenna – capable of tracking 6 satellites either S-band or L-band
  - Constructed in September 2011 and passed acceptance testing
- Future MEOLUT in Miami, Florida
  - 6 antenna – capable of tracking 6 satellites either S-band or L-band
  - Award by end of Sept 2012
  - Construction will begin Sept 2013, completed by Dec 2013

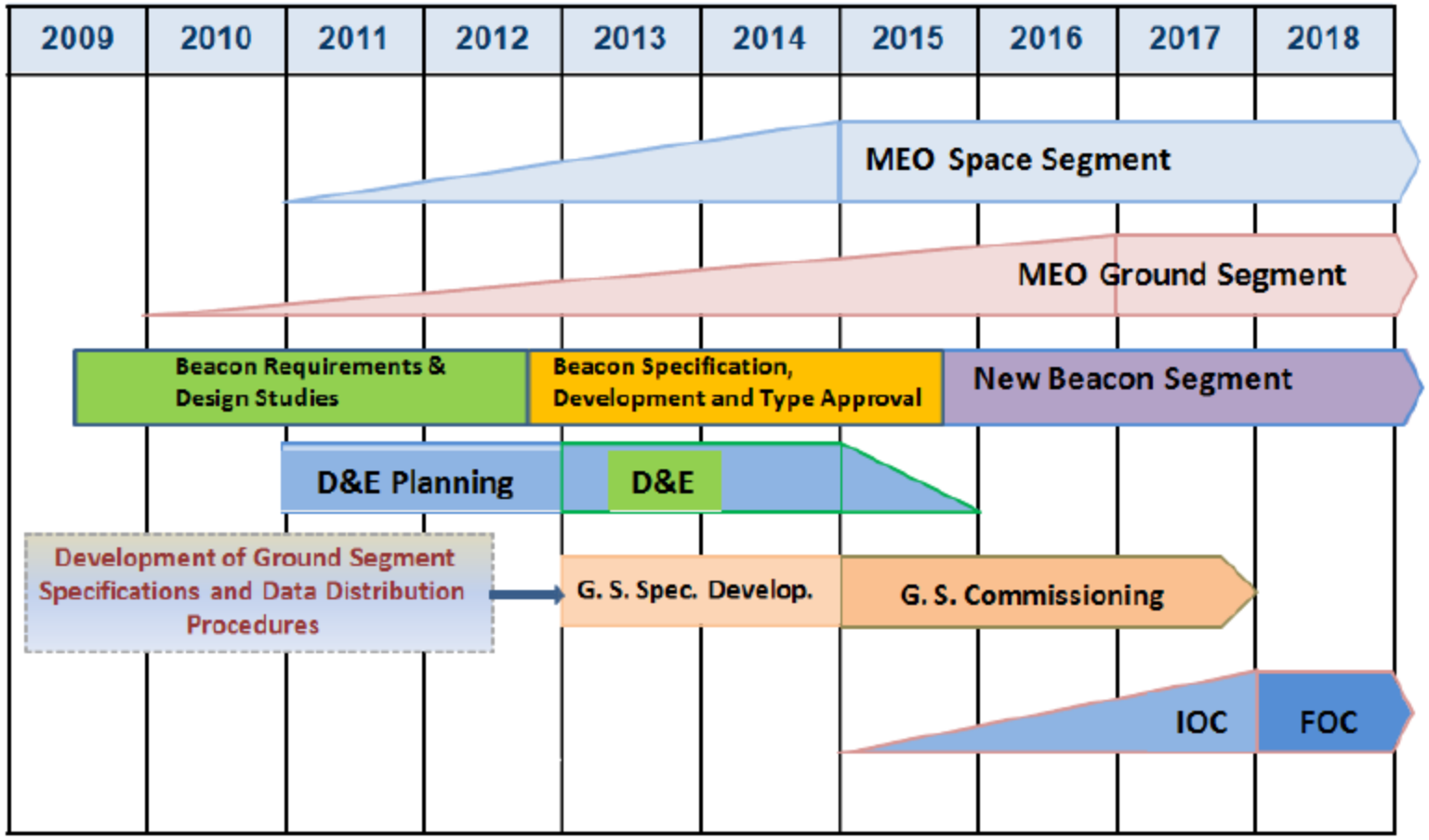
Distress Alerting Satellite System (DASS) Proof-of-Concept only

- DASS Proof-of-Concept (POC) Space Segment
  - Ten current on-orbit GPS Block IIR and IIF satellites carry DASS repeaters (Max of 20 satellites)
  - POC system uses existing GPS. Downlink at S-Band (Not ITU-allocated for SAR, but may possibly be used operationally)
- Proof-of-Concept results to date:
  - Demonstrated ability to locate beacons to greater than current Cospas-Sarsat accuracy using three or more satellites
  - System meets/exceeds theoretical capabilities
  - Tests are on-going

Figure 1: GPS IIF Launch Schedule

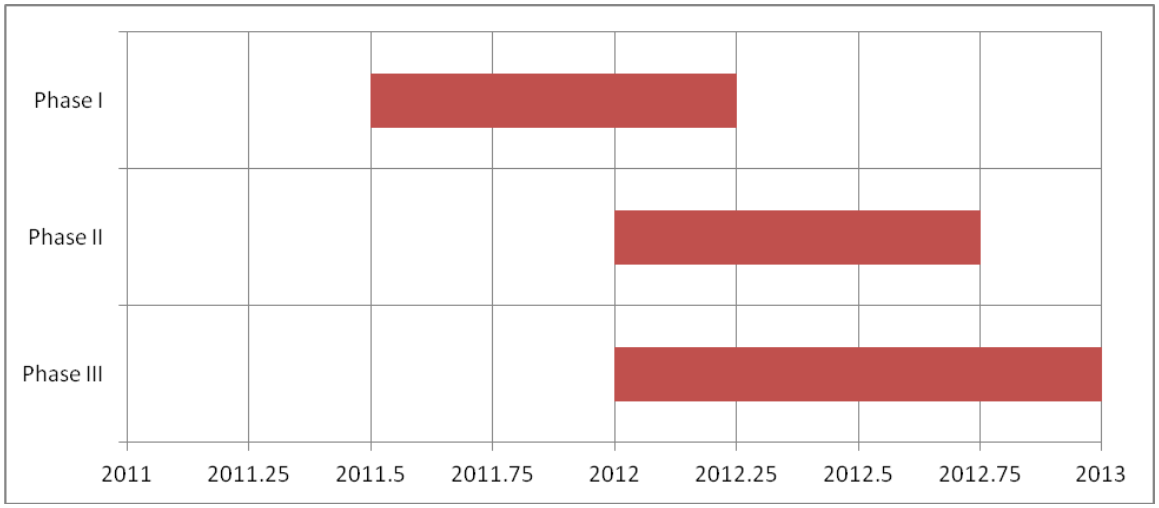


MEOSAR Timeline



US MEOSAR Timeline

- Phase I – Installation of Hawaii MEOLUT
- Phase II – Networking of Data
- Phase III – MEOSAR D&E



MEOSAR Demonstration and Evaluation (D&E)

- Goals
  - Characterize technical and operational performance
  - Evaluate operational effectiveness
  - **Provide basis for recommendations on the integration of MEOSAR system into C/S**
    - **Basis for commissioning criteria**

MEOSAR Demonstration and Evaluation (D&E)

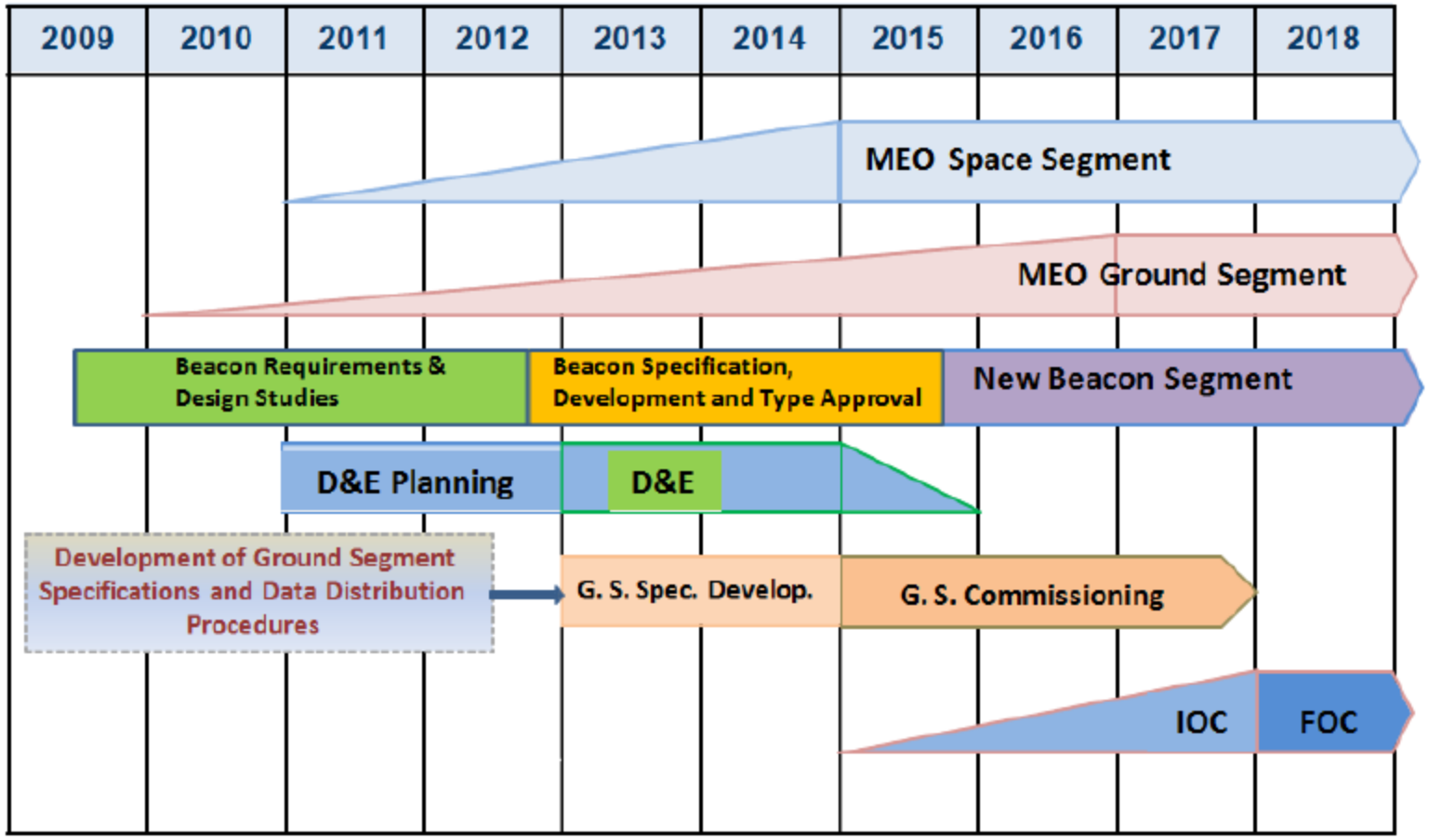
- Technical tests
  - Processing threshold and system margin
  - Impact of interference
  - Valid and complete message acquisition
  - Location accuracy
  - System Capacity
  - Networked MEOLUT advantage
  - Combined MEO/GEO performance

  * Multiple beacons needed, distributed globally, to successfully complete D&E testing

MEOSAR Demonstration and Evaluation (D&E)

- Operational Tests
  - Time advantage
  - Unique detections
  - Volume of ground segment traffic
  - SAR/Galileo RLS
  - Direct and indirect benefits of MEOSAR system

MEOSAR Timeline



MEOSAR Constellation

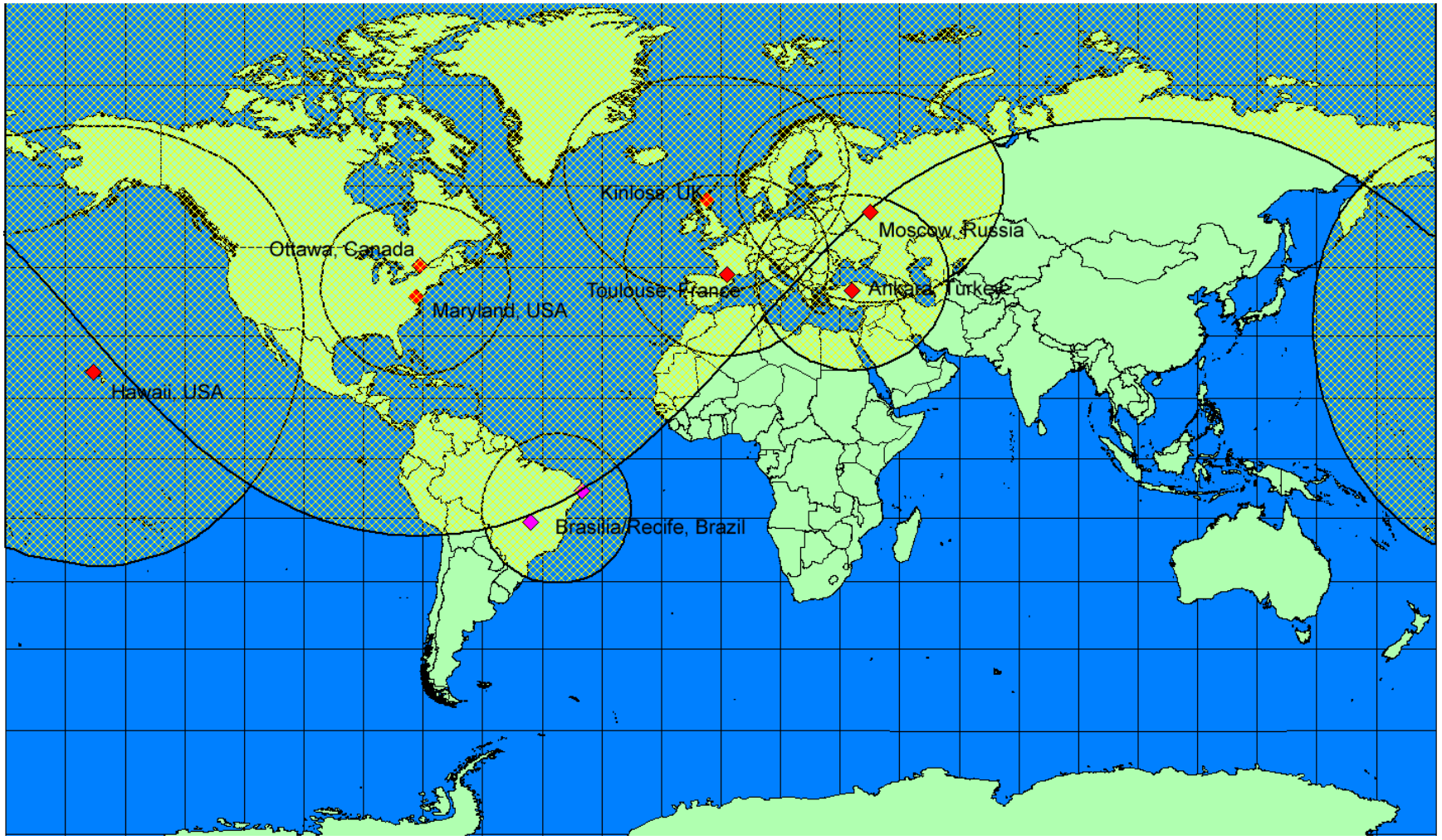
		D&E Phase I	D&E Phase II		D&E Phase III	IOC			FOC
	31 Dec 2011	31 Dec 2012	30 Jun 2013	31 Dec 2013	30 Jun 2014	31 Dec 2014	31 Dec 2015	31 Dec 2016	31 Dec 2017
DASS (S-Band) Planned	(10)	5 (15)	2 (17)	3 (20)	0 (20)	0 (20)	0 (18) †	0 (15)†	0 (14)†
DASS (S-Band) Practical	(10)	1 (11)	1 (12)	1 (13)	1 (14)	1 (15)	2 (15)†	2 (14)†	1 (14)†
SAR/GPS									
SAR/Galileo*		2 (2)	2 (4)	4 (8)	4 (12)	4 (16)	8 (24)	0 (24)	0 (24)
SAR/GLONASS	1 (1)	1 (2)	0 (2)	0 (2)	0 (2)	1 (3)	1 (4)	3 (7)	6 (13)
L-Band Total	**1**	**4**	**6**	**10**	**14**	**19**	**28**	**31**	**37**
L+S-Band Total (Practical)	**11**	**15**	**18**	**23**	**28**	**34**	**43**	**45**	**51**

* - Galileo launches based roughly on outside dates as provided in JC-26/Inf.17

† - GPS Block II satellites removed from totals after projected 12-year life

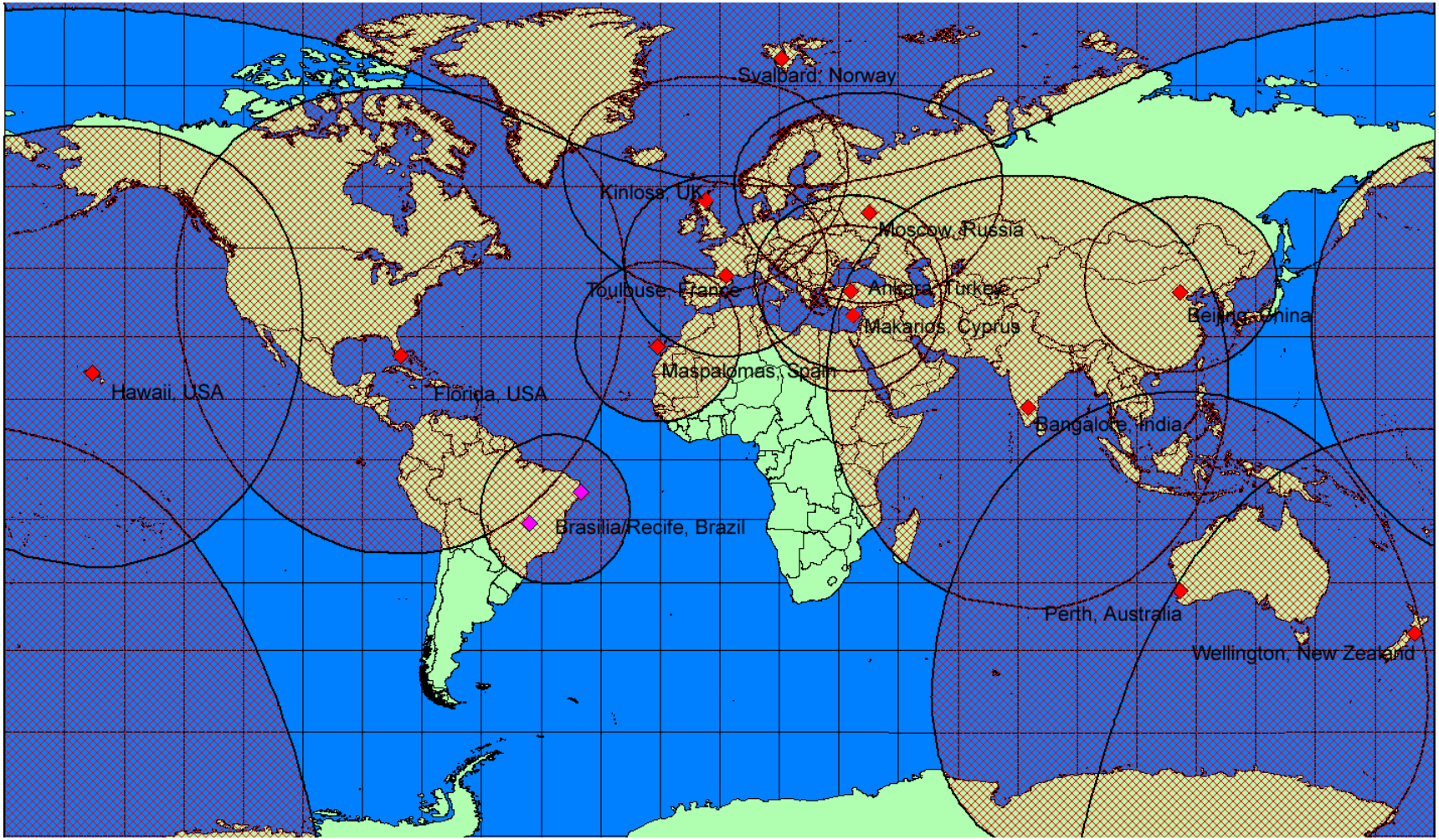
Anticipated MEOSAR Space Segment

Participating MEOLUTs D&E Phase I



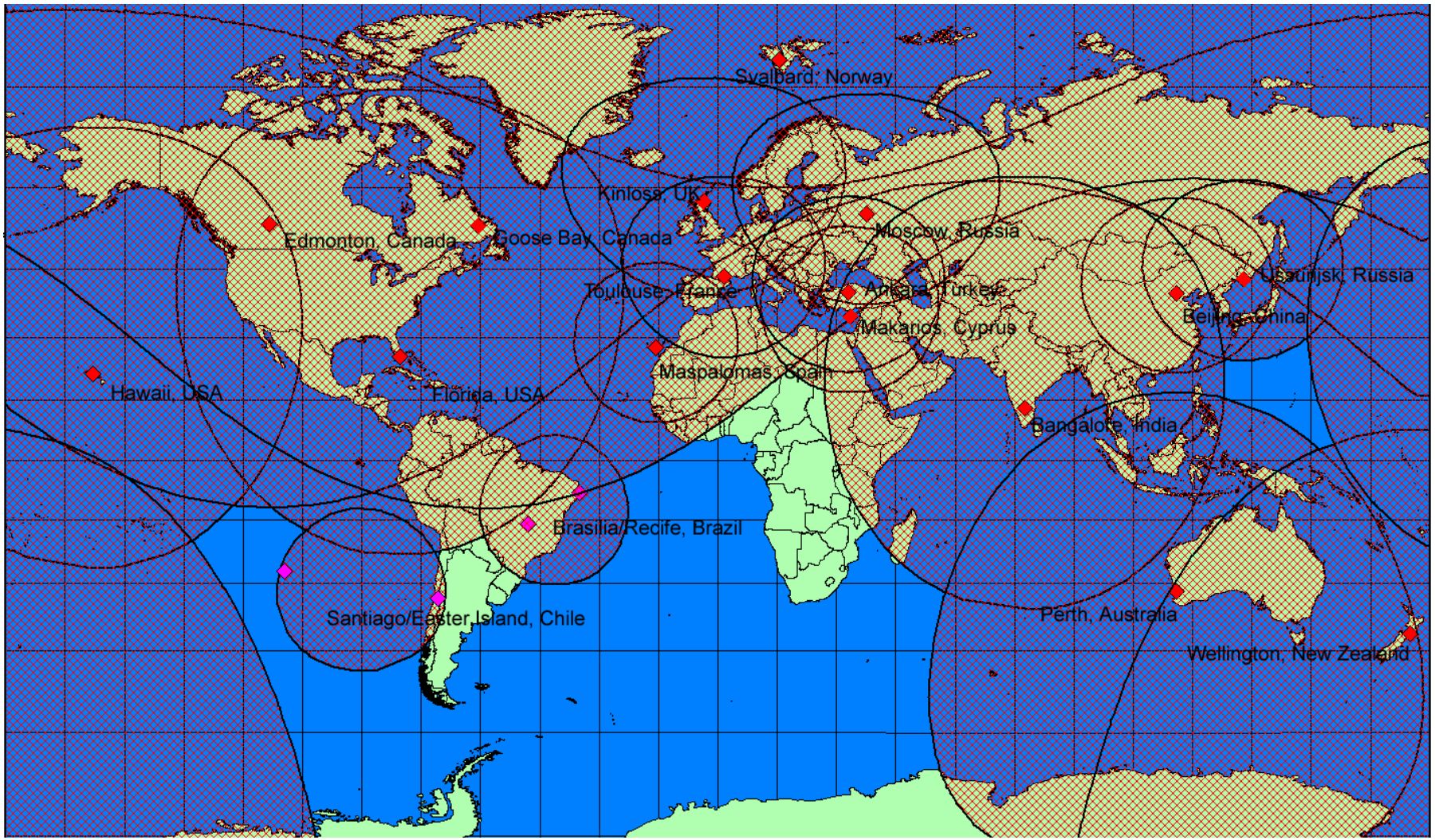
Participating MEOLUTs D&E Phase I: 1 January 2013
(Minimum 4+ L/S Band Visibility 78.0%)

MEOLUTs at IOC



MEOLUTs at IOC: 1 January 2015

Anticipated Operational MEOLUTs at FOC



MEOLUTs at FOC: 1 January 2018

MEOSAR D&E Beacon Request

- T-5 Independent 2D Location Capability for Operational Beacons
  - Requesting from manufacturer operationally coded EPIRBS, ELTS, PLBS with 121.5 MHz disabled but GPS enabled
  - 2 of each type, prefer multiple manufacturers – total of [20] beacons

Contact Information

SARSAT Program Office
NOAA Satellite Ops Facility
Suitland, MD 20746

www.sarsat.noaa.gov

Christopher O'Connors
301-817-3846
Christopher.O'Connors@noaa.gov