



DOT GPS/Civil PNT Update

**GPS Adjacent Band Compatibility Assessment,
NDGPS, and Complementary PNT (CPNT)**

**Space-Based PNT
Advisory Board Meeting**

October 30, 2015

Overview

- GPS Adjacent Band Compatibility Assessment
- Nationwide Differential GPS (NDGPS)
- Complementary PNT



EXCOM Co-Chair Letter to NTIA



SPACE-BASED POSITIONING
NAVIGATION & TIMING
NATIONAL EXECUTIVE COMMITTEE

JAN 13 2012



UNITED STATES OF AMERICA

The Honorable Lawrence E. Strickling
Assistant Secretary for Communications and Information
U.S. Department of Commerce
Washington, DC 20230

Dear Assistant Secretary Strickling:

At the request of the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), the nine federal departments and agencies comprising the National Space-Based Positioning, Navigation and Timing (PNT) Executive Committee (EXCOM) have tested and analyzed LightSquared's proposals to repurpose the Mobile Satellite Services (MSS) frequency band adjacent to Global Positioning System (GPS) frequencies to permit another nationwide terrestrial broadband service. Over the past year we have closely worked with LightSquared to evaluate its original deployment plan, and subsequent modifications, to address interference concerns. This cooperative effort included extensive testing and analysis of GPS receivers. Substantial federal resources have been expended and diverted from other programs in testing and analyzing LightSquared's proposals.

It is the unanimous conclusion of the test findings by the National Space-Based PNT EXCOM Agencies that both LightSquared's original and modified plans for its proposed mobile network would cause harmful interference to many GPS receivers. Additionally, an analysis by the Federal Aviation Administration (FAA) has concluded that the LightSquared proposals are not compatible with several GPS-dependent aircraft safety-of-flight systems. Based upon this testing and analysis, there appear to be no practical solutions or mitigations that would permit the LightSquared broadband service, as proposed, to operate in the next few months or years without significantly interfering with GPS. As a result, no additional testing is warranted at this time.

The EXCOM Agencies continue to strongly support the President's June 28, 2010 Memorandum to make available a total of 500 MHz of spectrum over the next 10 years, suitable for broadband use. We propose to draft new GPS Spectrum interference standards that will help inform future proposals for non-space, commercial uses in the bands adjacent to the GPS signals and ensure that any such proposals are implemented without affecting existing and evolving uses of space-based PNT services vital to economic, public safety, scientific, and national security needs.

ASHTON B. CARTER
EXCOM Co-Chair
Deputy Secretary of Defense

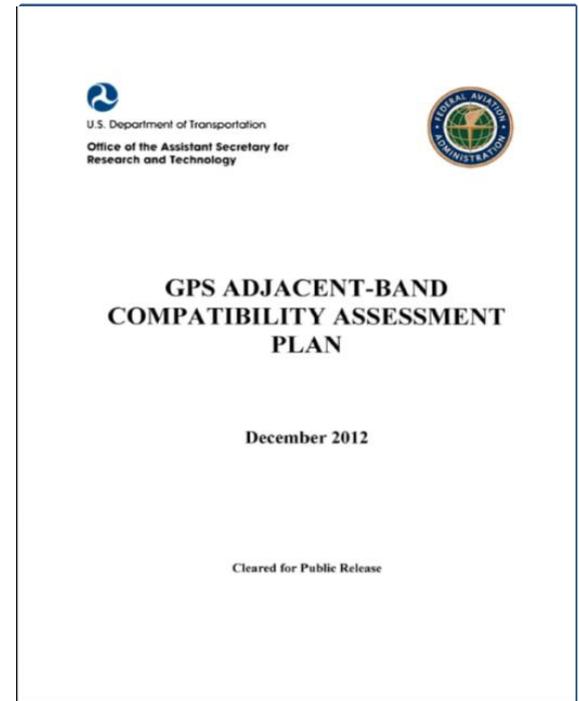
JOHN D. PORCARI
EXCOM Co-Chair
Deputy Secretary of Transportation

“. . . without affecting existing and evolving uses of space-based PNT services vital to economic, public safety, scientific, and national security needs.”



GPS Adjacent Band Compatibility Assessment

- DOT Study to Evaluate:
 - Adjacent-band power levels, as a function of offset frequency, necessary to ensure continued operation of all applications of GPS services
 - Adjacent-band power levels to ensure continued operation of all applications of GPS services by future GPS receivers utilizing modernized GPS and interoperable Global Navigation Satellite System (GNSS) signals



Approach to DOT GPS Adjacent Band Compatibility Assessment

- Certified Aviation Portion of Effort Led by FAA
- Non Aviation Certified effort (all other applications) led by DOT/OST-R Volpe Center
- DOT Extended Pos/Nav Working Group (Civil Departments and Agencies)
 - GPS Directorate, Aerospace, Mitre, Stansell Consulting, and Zeta Associates
- Conduct public outreach to ensure the plan, on going work, and assumptions are vetted and an opportunity to gain feedback
 - Hold Public Workshops
 - One-on-One Discussions with Industry
 - Open and Transparent Approach



Overview of GPS Adjacent Band Workshops

- ❑ Initial Workshop-I held on September 18, 2014
 - Overview of DOT GPS Adjacent Band Compatibility Assessment Plan and plans/timeline for implementation
 - GPS use cases and list of representative GPS receivers from government stakeholders
 - Description of GPS receiver and antenna information needed from manufacturers

- ❑ Workshop-II held on December 4, 2014
 - Industry feedback on the Adjacent Band program implementation plan
 - GPS receiver Use Case information from industry
 - Discussion of test options and associated challenges

- ❑ Workshop-III held on March 12, 2015
 - GPS/GNSS receiver test criteria
 - GPS Receiver Selection Criteria for testing



DOT GPS Adjacent Band Compatibility Assessment Test Plan

- Released in *Federal Register Notice* on September 9, 2015
- Public Workshop (IV) Held on October 2, 2015
- Comment period on draft test plan closed Oct 16, 2015
- Review comments from the comment period and update the test plan as necessary
- Release final Test Plan to public
 - Attached to the FRN/public notice
 - <http://www.gps.gov/spectrum/ABC/>



Identification of GPS/GNSS Receivers to Test

- Verify who is willing to participate
 - Receiver Manufacturers
 - Federal Departments and Agencies
 - Other Stakeholders(?)
- Based on participation, finalize set of GPS/GNSS receivers to be tested and how the receivers will be provided
- Coordinate what data can be provided, based on what is indicated in the test plan, but realized against what the actual receiver can provide
 - Address data sharing of test results
- NDAs



Next Steps

- Finalize GPS/GNSS Receiver Test Plan
- Anechoic Chamber Identification and Coordination
- Manufacturer and User Involvement Coordination
- Test Procedure Development/Design
- Develop/Validate Radiated RF Test Environment
- GPS/GNSS Receiver Testing



Schedule

- Final Test Plan released: November 2015
- NDA execution: December 2015
- Finalize list of GPS receivers to be tested: Jan 15, 2016
- Test Procedure Presentation (workshop): Late 2015 or Early 2016
- Workshop V : Late 2015 or Early 2016
- GPS/GNSS receiver testing: Mar 2016



Nationwide Differential GPS (NDGPS)



Future of U.S. NDGPS

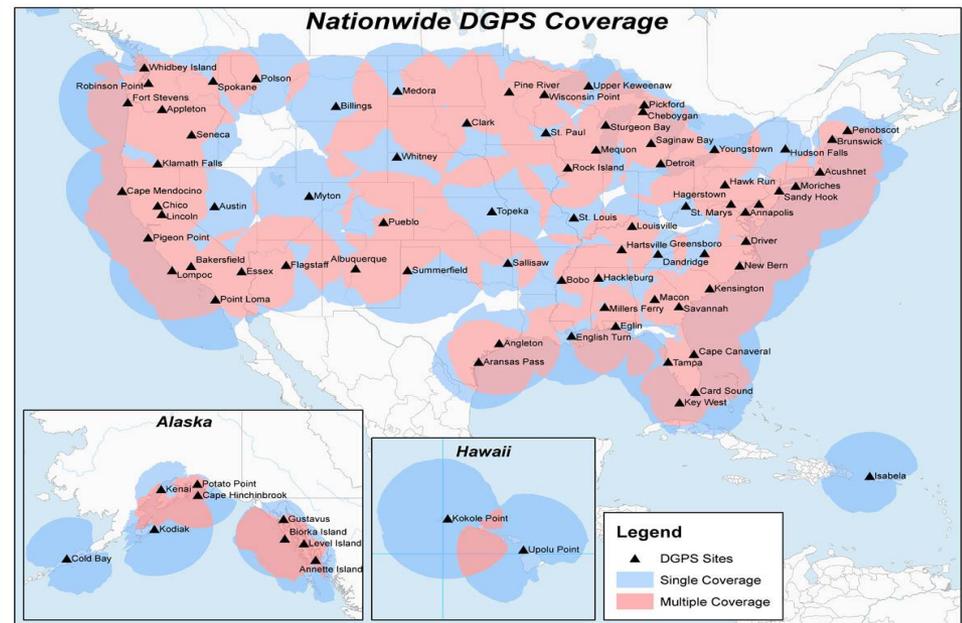
- Current system utilizes 84 broadcast sites to provide positioning accuracy of 1-3 meters across 92% of CONUS
- Few users of the NDGPS broadcast
- USCG, DOT, and US Army Corps of Engineers Plans:
 - Retain NDGPS at 21 sites for single station near-shore coverage
 - Decommission 62 sites
 - One US Army Corps of Engineers (USACE) site to remain
- Termination of NDGPS broadcast at 62 proposed sites planned for Jan. 15, 2016



Overview of U.S. NDGPS

System Description

- 84 Nationwide Remote Broadcast Sites throughout the United States and territories
 - 92% nationwide signal coverage
 - Better than 10 meter accuracy
 - 10 second integrity alarm to the user
 - Satisfies Harbor/Harbor Approach requirements
 - 99.7% availability requirement



Operations

- Redundant equipment at sites
- Redundant controls stations at NAVCEN

Stakeholders

- U.S. Army Corps of Engineers (USACE)
- Department of Transportation (DOT)
- U. S. Coast Guard (USCG)



Future of NDGPS Assessment

Contributing Factors

- Discontinuation of Selective Availability
- Lack of USCG requirements
- Widespread use of the Federal Aviation Administration (FAA) Wide Area Augmentation System (WAAS)
- Continued GPS modernization
 - Additional civil frequencies allow for correction of ionospheric error
- Reduced availability of consumer grade DGPS receivers
- Federal Railroad Administration has no NDGPS requirement for Positive Train Control
- Agriculture sector uses commercial DGPS services



2013 Federal Register Notice

- Joint DHS/USCG and DOT/RITA Federal Register Notice (FRN) Request for Public Comments [78 FR 22554; April 16, 2013]
- Targeted Outreach to User Community
- USG Requirements Assessed
- Direct Questions:
 - (1) Do you use NDGPS in its current form for positioning, navigation, and timing?
 - (2) What would be the impact if the NDGPS were to be discontinued?
 - (3) Are there alternatives that could be used to meet your PNT requirements?
 - (4) Are there alternative uses for the existing NDGPS infrastructure?
- Responses were few.....



Assessment on Comments in Docket

- Few users of the NDGPS broadcast
 - Majority of use is for maritime sector
 - Primarily Pilots for precision ship-handling
- Bottom Line:
 - Insufficient users to justify a nationwide live broadcast

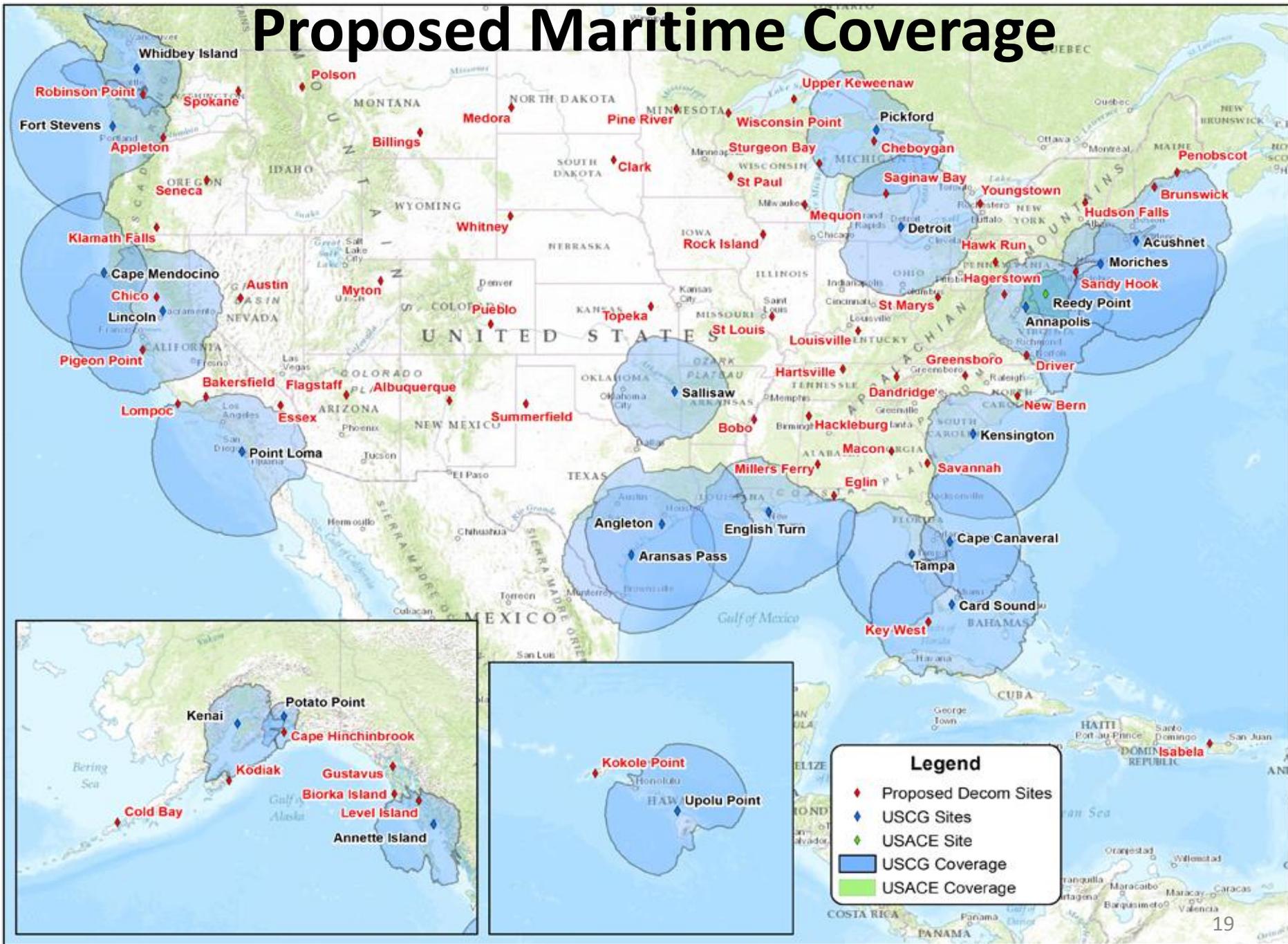


USCG, DOT, and USACE Plans

- Retain NDGPS at 21 sites for single station near-shore coverage
- Decommission 27 maritime and 35 inland sites
- One US Army Corps of Engineers (USACE) site to remain
- Live NDGPS broadcast at 62 sites to cease Jan. 15, 2016



Proposed Maritime Coverage



Next Steps

- November 16, 2015: 90-day FRN commentary period closes
- November 20, 2015: Impact analysis report assesses commentary
- December 15, 2015: Local Notice to Mariner message released with notification of sites decommissioning
- January 15, 2016:
 - Sites will be decommissioned
 - Decommissioning may be delayed for those sites with unmitigated impacts identified in the analysis of public comment
- Alternative uses for decommissioned DGPS sites will be examined



Complementary PNT (CPNT)



National PNT Architecture Recommendations (CPNT Context)



Complementary PNT

- EXCOM looked at need for complement to GPS
- Assessment driven by many factors: from policy to technology
- U.S. coverage for GPS outage from natural or man-made events
- Assessed a broad mix of terrestrial, RF, and autonomous PNT technologies
- Public stakeholder comments obtained by *Federal Register* Notice



Stakeholder Outreach

- Federal Register Notice published March 23, 2015 seeking:
 - PNT performance required for a CPNT capability
 - Availability and coverage area required for CPNT
 - Willingness to equip with an eLoran receiver
 - Current/planned availability of eLoran user equipment
- Summary of Comments (period closed May 22nd)
 - Approximately 200 responses received
 - Majority of responses were supportive of eLoran as a U.S. CPNT technology, but were not application-specific
 - Maritime community indicated it would equip with eLoran
 - Aviation community prefers existing ground-based nav aids
 - Recognition that there is a dependence on GPS augmentations that deliver better/higher accuracy
- Additional stakeholder outreach will take place



Questions?

