

STATEMENT OF  
**KAREN L. VAN DYKE**  
**DIRECTOR, POSITIONING, NAVIGATION, AND TIMING**  
**& SPECTRUM MANAGEMENT**  
**U.S. DEPARTMENT OF TRANSPORTATION**  
BEFORE THE  
**SUBCOMMITTEE ON COAST GUARD AND**  
**MARITIME TRANSPORTATION**  
**U.S. HOUSE OF REPRESENTATIVES**  
HEARING ON

*The Federal Radionavigation Plan, H.R. 1684, the Foreign Spill Protection Act, and  
H.R. ----, the National Icebreaker Fund Act of 2015*

July 28, 2015

Chairman Hunter, Ranking Member Garamendi and Members of the Subcommittee:

Thank you for the opportunity to appear before you today to discuss the Federal Radionavigation Plan and the importance of positioning, navigation, and timing systems to America's national security, homeland security, economic security and efficiency.

Positioning, Navigation, and Timing (PNT) capabilities are critical for transportation safety, efficiency and capacity-increasing programs, including major initiatives such as the Federal Aviation Administration's air traffic control mission, Intelligent Transportation Systems (ITS), and Positive Train Control (PTC). The Global Positioning System (GPS), in particular, is used for every mode of transportation, and there are numerous safety and efficiency applications of this enabling technology that provide tremendous benefit to America's transportation infrastructure. GPS is a key technology for vehicle collision-warning and crash-avoidance systems while enabling shorter routes, increased time and fuel savings, and reduced traffic delays across all modes of transportation.

As designated by the 2004 National Security Presidential Directive (NSPD)-39, the Department of Transportation (DOT) has the lead responsibility for the development of requirements for civil applications from all United States Government civil Departments and Agencies. In addition to the transportation applications, GPS is essential for the safe and efficient operations of first responders, search and rescue,

resource management, weather forecasting, earthquake monitoring, surveying and mapping, precision agriculture, telecommunications and financial transactions.

The Deputy Secretary of Defense and Deputy Secretary of Transportation co-chair the National Executive Committee (EXCOM) for Space-Based Positioning, Navigation, and Timing, which includes representatives from seven cabinet agencies, the National Aeronautics and Space Administration (NASA), and the Joint Chiefs of Staff.

Since 1980, the Federal Radionavigation Plan (FRP) has been the official source of positioning, navigation, and timing strategy and planning for the Federal Government. It is jointly developed biennially by DOT, the Department of Defense (DoD), and the Department of Homeland Security (DHS).

The 2014 FRP contains six sections:

- Section 1 – Introduction to the Federal Radionavigation Plan: Describes the purpose, scope, and objectives of the plan, including an overview of the National PNT Architecture, and discusses PNT system selection considerations.
- Section 2 – Roles and Responsibilities: Presents DoD, DHS, DOT, and other Federal agencies' roles and responsibilities for the planning and providing of PNT services.
- Section 3 – Policy: Describes the U.S. policy for providing each Federal PNT system identified in this document.
- Section 4 – PNT User Requirements: Summarizes performance requirements for availability, accuracy, integrity, etc. for civil applications.
- Section 5 – Operating Plans: Summarizes the plans of the Federal Government to provide PNT systems and services for use by the civil and military sectors. This section also presents the research and development efforts planned and conducted by DoD, DHS, DOT, and other Federal departments and agencies.
- Section 6 – PNT Architecture Assessment and Evolution: Summarizes the activities and plans of the Federal Government to implement the National PNT Architecture.

The FRP also contains appendices covering System Parameters and Descriptions, PNT Information Services, and Geodetic Reference Systems and Datums.

Section 5.1.2 of the FRP recognizes the need to mitigate disruptions to GPS. Like all radio-based services, GPS is subject to interference from both natural and human-made sources. A loss of GPS service, due to either intentional or unintentional interference, in

the absence of any other means of navigation, would have varying negative effects on operations. As stated in the FRP, the U.S. Government encourages all GPS users to be aware of the impacts of GPS interference and incorporate or integrate alternative PNT sources where needed to ensure continued operations. The Federal Aviation Administration (FAA), for instance, is currently developing requirements and recommendations for future alternative PNT solutions that address mitigations for GPS disruptions.

Sub-sections of section 5.1.2 document sector-specific mitigations and operational procedures to mitigate vulnerabilities to GPS. The FAA currently maintains a ground-based navigation aid infrastructure that serves as the aviation backup to GPS. The ground infrastructure, as documented in the FRP, includes Very High Frequency (VHF) Omni Directional Ranging (VOR), Distance Measuring Equipment (DME), and the Instrument Landing System (ILS). The FRP also documents research into use of multi-sensor PNT systems such as inertial navigation systems, light detection and ranging (LIDAR), and map matching.

Modern transport-category aircraft with inertial systems may be able to continue navigating safely for a period of time after losing PNT position updating, depending on the route or procedure being flown. In some cases, this capability may prove adequate to depart an area with localized interference, or alternatively the flight can proceed under visual flight rules (VFR) in appropriate weather conditions. However, inertial performance without PNT updates degrades with time and will eventually fail to meet airspace requirements.

Integrated GPS/inertial avionics, as well as improvements in antennas and algorithms, could provide increased interference resistance, effectively reducing the area affected by GPS jamming or unintentional interference. Industry research is proceeding to enhance these technologies, with an expectation that they might be marketed to a broader cross section of the aviation community at some point in the future.

GPS enables the safe and efficient movement of waterborne commerce along the U.S. Marine Transportation System, and is especially critical as ports become increasingly congested with larger container ships, tankers, and passenger vessels. In the event of a GPS disruption, methods of conventional navigation, such as shipboard radar, visual aids to navigation, fathometers, and paper charts, may help maintain the flow of commerce along waterways and in ports. However, ports may have to reduce the number of allowed vessel movements, and port congestion may become even more problematic and costly, in addition to an increased risk of maritime accidents. In

addition, USCG exercises a certain amount of control over the waterways, under the authority vested in the Captain of the Port, and may close waterways or restrict marine activity during adverse conditions or special operations.

Surface transportation agencies are working with industry to ensure that safety-critical systems that use GPS and its augmentations consider the loss of these PNT services and are able to mitigate its effects. The Federal Railroad Administration (FRA) encourages an integrated approach to technology by railroads that incorporates systems that are interoperable, synergistic, and redundant. These technologies and procedures include dead reckoning from fixed points using wheel tachometers, inertial navigation systems (INS), sensor circuits, signaling systems, and dispatcher operations. These redundant systems and procedures ensure the safe and efficient operation of the railroad system during the loss or disruption of GPS.

Because it is expected that signal availability from GPS may not be adequate for surface users experiencing canopy or urban canyon obstructions, the integration of complementary and/or alternate systems that perform a verification test on the GPS navigation solution and that support continued operation in the event of degradation to the GPS signal will be employed in a multi-sensor system-of-systems configuration.

The PNT EXCOM is currently investigating use of an eLoran system to serve as a backup PNT capability to GPS. In March of 2015, the Department of Transportation invited comment from the public and industry regarding consideration of an eLoran system as a backup PNT capability to GPS.

There were approximately 200 responses to the *Federal Register* Notice. Most responses were not application-specific, other than for maritime use. The aviation community, in general, favored use of existing ground-based navigation aids.

In closing, I would like to say a few words about the Nationwide Differential GPS (NDGPS) service which augments GPS by providing increased accuracy and integrity using land-based reference stations to transmit correction messages over radiobeacon frequencies.

As discussed in Section 5.3.4 of the FRP, DHS, in coordination with DOT, is analyzing the future requirements for NDGPS to support investment decisions beyond Fiscal Year 2016. Future investment decisions might include maintaining NDGPS as currently configured, decommissioning NDGPS as currently configured, or developing alternate uses for the NDGPS infrastructure.

Discussion on the future of NDGPS, as well as on a backup PNT capability, is planned for the next meeting of the National Space-Based PNT Executive Committee in September.

Thank you and I look forward to answering your questions.

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