

Civil PNT Utilities

**Civil GPS Service Interface Committee
U.S. States and Local Government Subcommittee
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**Timothy A. Klein
Senior Policy Advisor/RITA NDGPS Coordinator
NDGPS@dot.gov**

GPS is a Critical Component of the Global Information Infrastructure



Satellite Operations



Precision Agriculture



Surveying & Mapping



Aviation



Communications



Disease Control



Power Grids



Trucking & Shipping



Oil Exploration



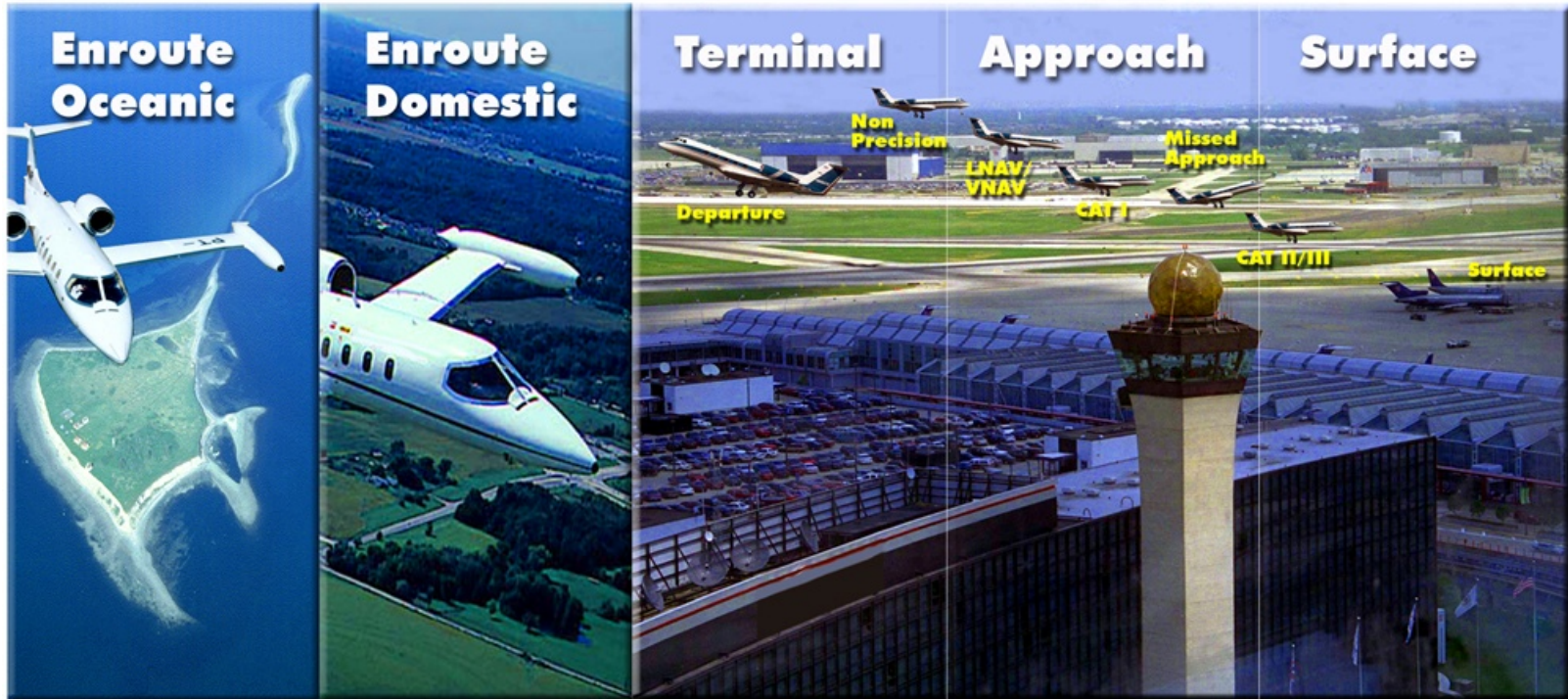
Fishing & Boating



Personal Navigation

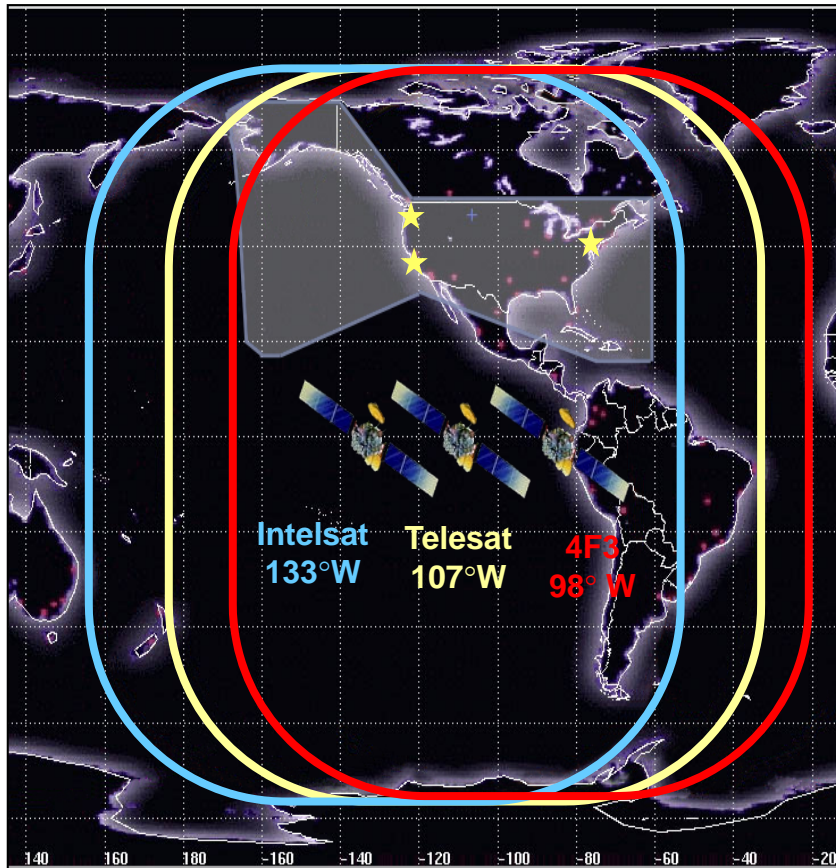
FAA GPS Augmentation Programs

WAAS



LAAS

WAAS Architecture



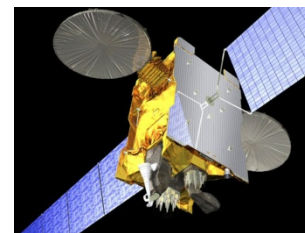
38 Reference Stations



3 Master Stations



4 Ground Earth Stations

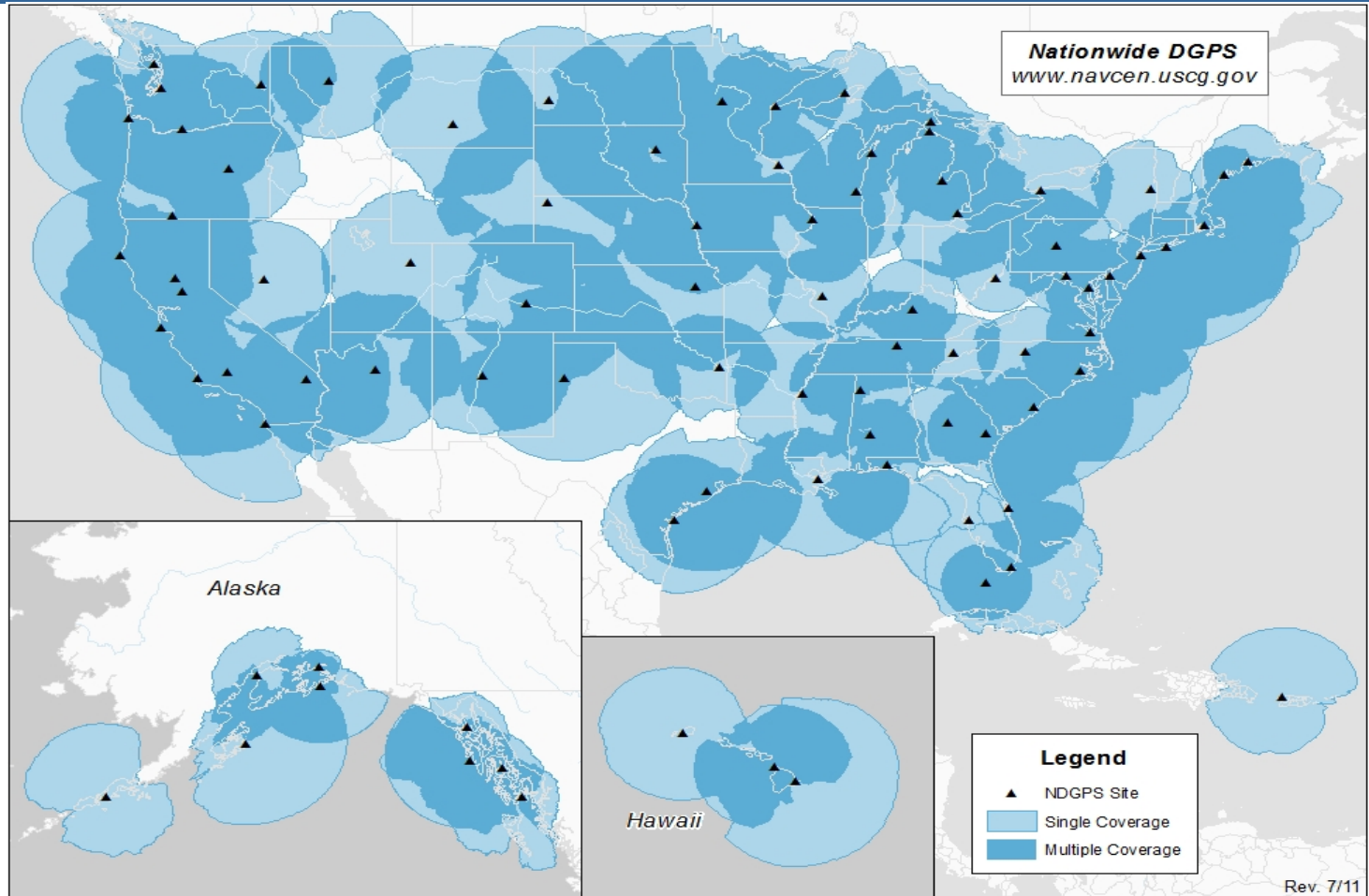


(2+1) Geostationary Satellite Links



2 Operational Control Centers

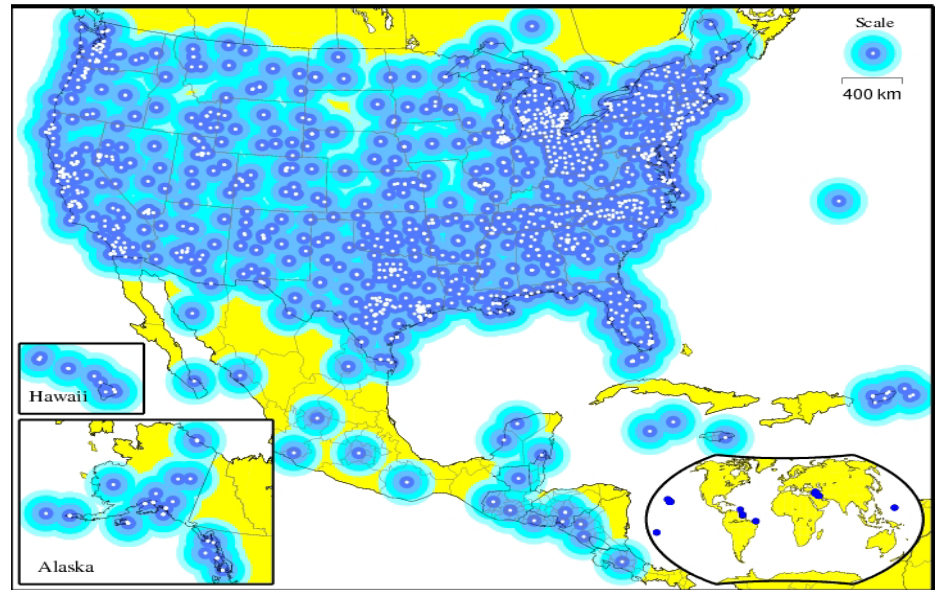
Nationwide Differential GPS



- Expansion of maritime differential GPS (DGPS) network to cover terrestrial United States
- Built to international standard adopted in 50+ countries

National Continuously Operating Reference Stations (CORS)

- Enables highly accurate, 3-D positioning
 - Centimeter-level precision
 - Tied to National Spatial Reference System
- **1,800+** sites operated by 200+ public, private, academic organizations



- NOAA/NGS's **Online Positioning User Service (OPUS)** automatically processes coordinates submitted via the web from around the world
- **NGS Real-Time GNSS Website** (beta version)
- **Leveling Online Computations User Service (LOCUS)** simplifies the office processing and adjustment of geodetic leveling

GPS-Based Applications are Critical to Major DOT Initiatives



Aviation – NextGen

Reliable and accurate positioning worldwide
Reduced delays
More fuel-efficient routes
Increased system capacity with enhanced safety



Rail – Positive Train Control

Reduced probability of collisions
Increased efficiency and capacity
Rapid rail structure and conditioning mapping



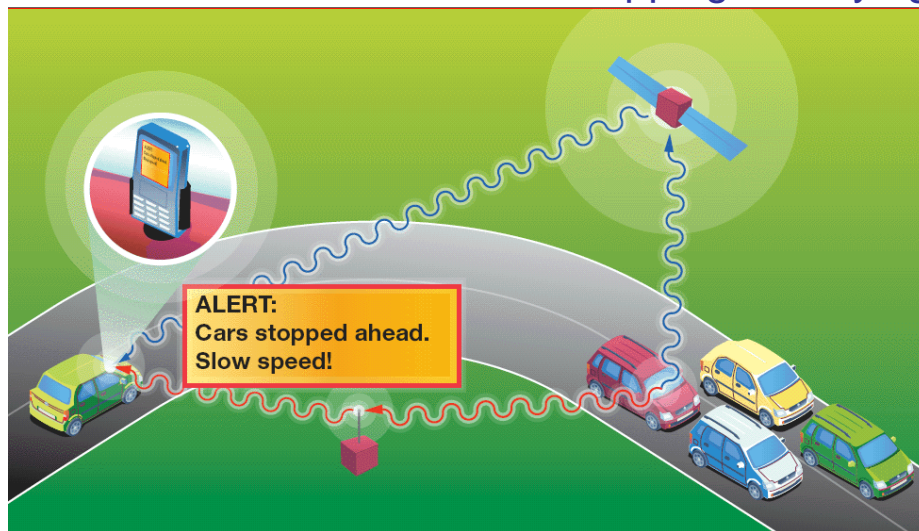
ITS/Connected Vehicle

Enable crash prevention among vehicles and between vehicles and infrastructure

Increased mobility and reduced environmental impact

What Are We Trying to Get to?

- Intelligent Transportation Systems (ITS) Safety Applications for all Surface Modes of Transportation
 - Leverage technology to make vehicles discoverable to other vehicles, infrastructure, and pedestrians
 - Enable 360° situational awareness to the vehicle and driver
- Intelligent Railroad Systems
 - Assessing HA-NDGPS for meeting requirements
 - Positive Train Control
 - Track Defect Location
 - Automated Asset Mapping/Surveying



Where are State DOTs Trying to Get to?

- GPS Enforcement of Designated Truck Routes
 - Illinois State Legislature required study
 - Illinois DOT study makes eight recommendations for truck GPS systems
 - Vertical clearance
 - Weight restrictions
 - Communications and enforcement of truck GPS systems
- Automated Vehicle Location (AVL) Systems for Data Collection
 - 2011 VDOT Survey
 - Road weather management systems
 - Near-real-time road conditions
 - Mapping noxious weed control
 - Tracking incarcerated workers



Easy to Purchase GPS Jamming Devices

- Growing market for low-cost GPS jammers
 - Concern over being tracked using GPS, particularly among those driving a company or fleet vehicle
- Many devices are battery-operated or can be plugged into a cigarette lighter
- Sold as “privacy protectors”



\$99



\$99



\$320



\$129



\$145



\$30



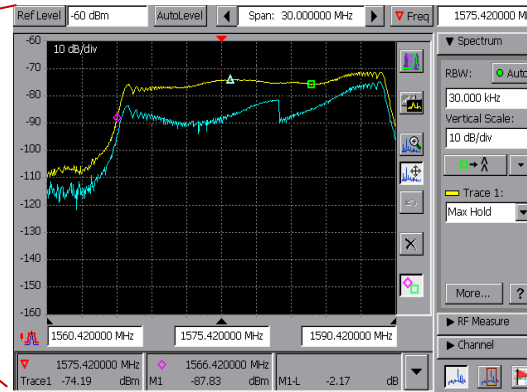
\$430



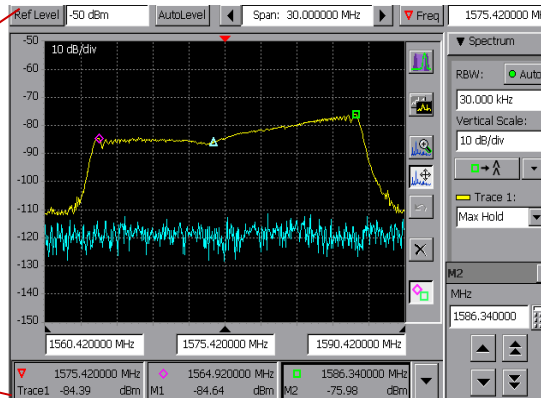
\$79



Affect of GPS Jamming Devices



**RFI source
“Locked-on” and
pursued.**



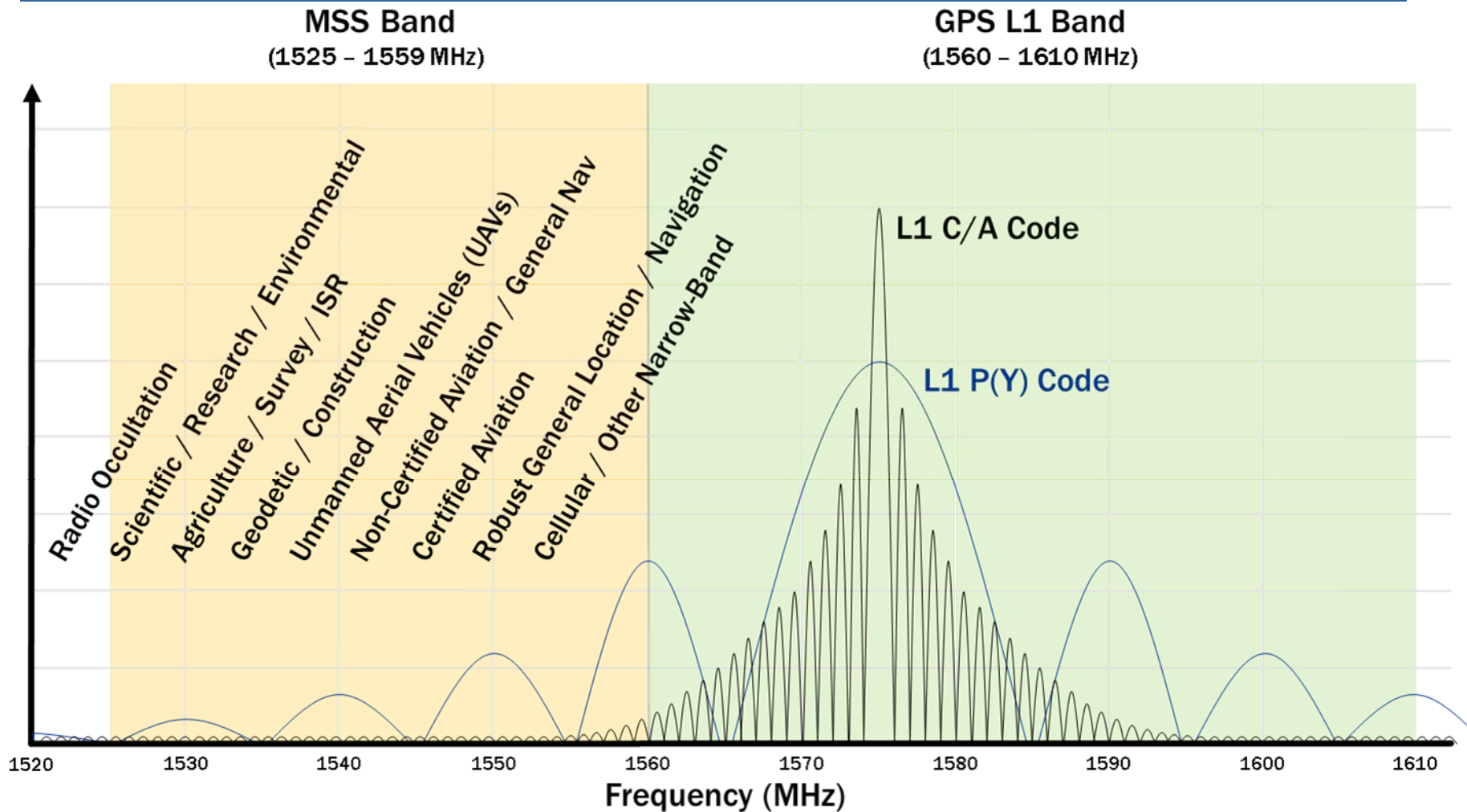
**On Site ON-OFF
tests confirms
GPS RFI source.**

DOT GPS Spectrum Protection Plan

- **January 13, 2012 National Space-Based Positioning, Navigation, and Timing (PNT) Executive Committee (EXCOM) co-chair letter to National Telecommunications and Information Administration (NTIA) proposed to draft new Global Positioning System (GPS) spectrum interference standards:**
 - **Inform future proposals for non-space, commercial uses in the bands adjacent to the GPS signals.**
 - **Ensure such proposals are implemented without affecting existing and evolving uses of space-based PNT that are vital to economic, public safety, scientific, and national security needs.**



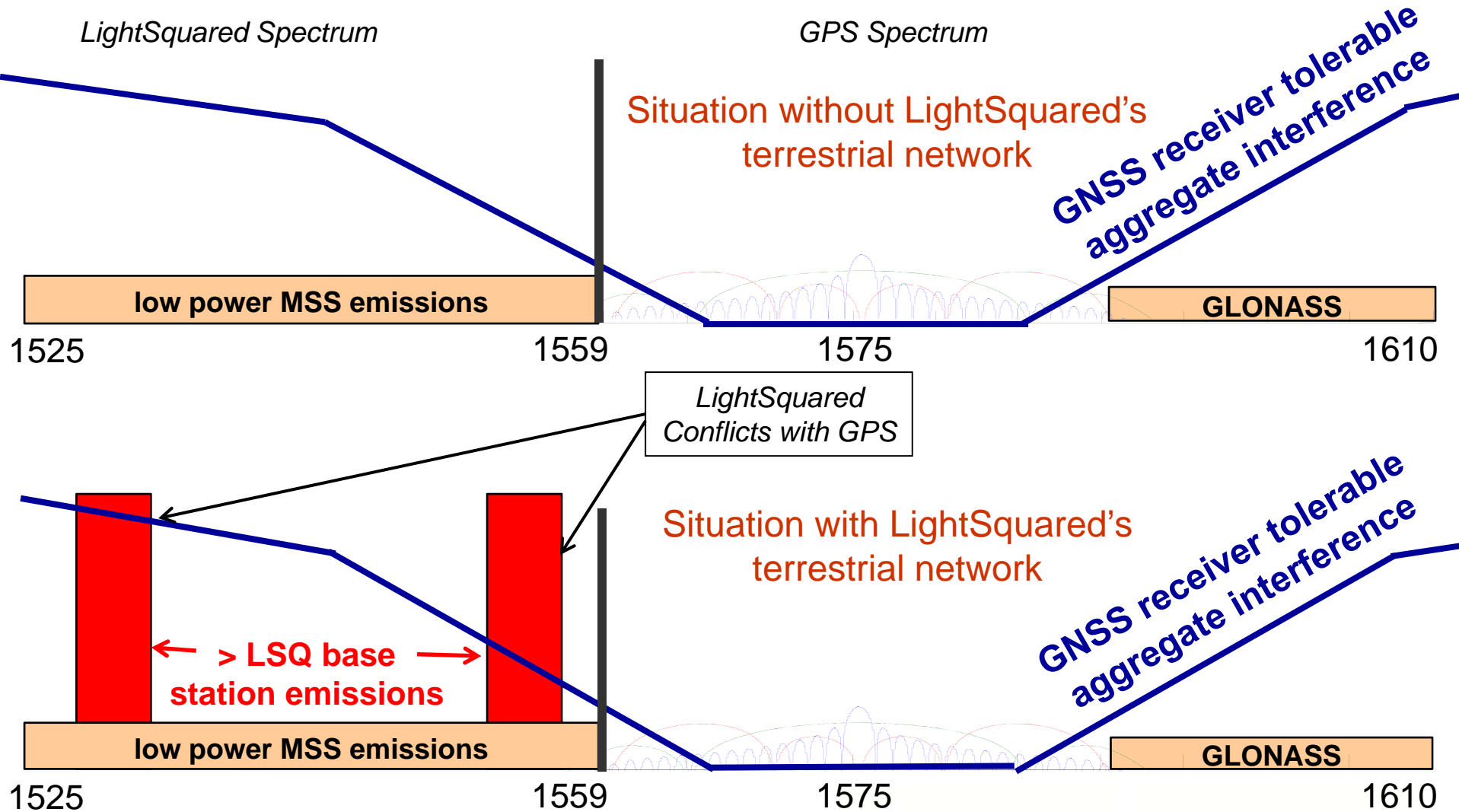
GPS L1 Signal Spectrum Use



Notional – For Discussion Purposes Only (Not to Scale)



Illustration of Concerns with LightSquared



DOT GPS Spectrum Protection Plan - Status

- Deputy Secretary Tasking to FAA and RITA:
 - Collaborate to develop a spectrum protection plan which provides a framework to define the processes and assumptions for development of GPS spectrum protection criteria on behalf of GPS civil users.
- GPS Spectrum Protection Plan will identify the processes for:
 - Deriving adjacent-band power limits, as a function of offset frequency, necessary to ensure continued operation of all applications of GPS services.
 - Determining similar levels for future GPS receivers utilizing modernized GPS and interoperable Global Navigation Satellite System (GNSS) signals.
- GPS spectrum protection criteria will ensure continued use of existing space-based PNT services vital to economic, public safety, scientific, and national security needs, while also considering modernized GNSS signals.
 - Criteria will Inform future proposals for non-space, commercial uses in the bands adjacent to the GPS/GNSS signals.