

# Civil PNT Utilities

**Civil GPS Service Interface Committee  
U.S. States and Local Government Subcommittee  
Seattle, WA  
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# GPS.gov

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- **Official U.S. Government information about GPS and related topics**
  - **Systems Modernization**
  - **Applications**
  - **Governance**
  - **Presentations**
  - **International Activities**
  - **Technical Documentation**
    - [Federal Radionavigation Plan \(FRP\)](#)
    - [Interface Control Documents](#)
    - [Performance Standards and Specifications](#)
    - [GPS Satellite Simulator Working Group](#)
    - [Semi-Codeless/Codeless Civil Access Commitments](#)



# 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



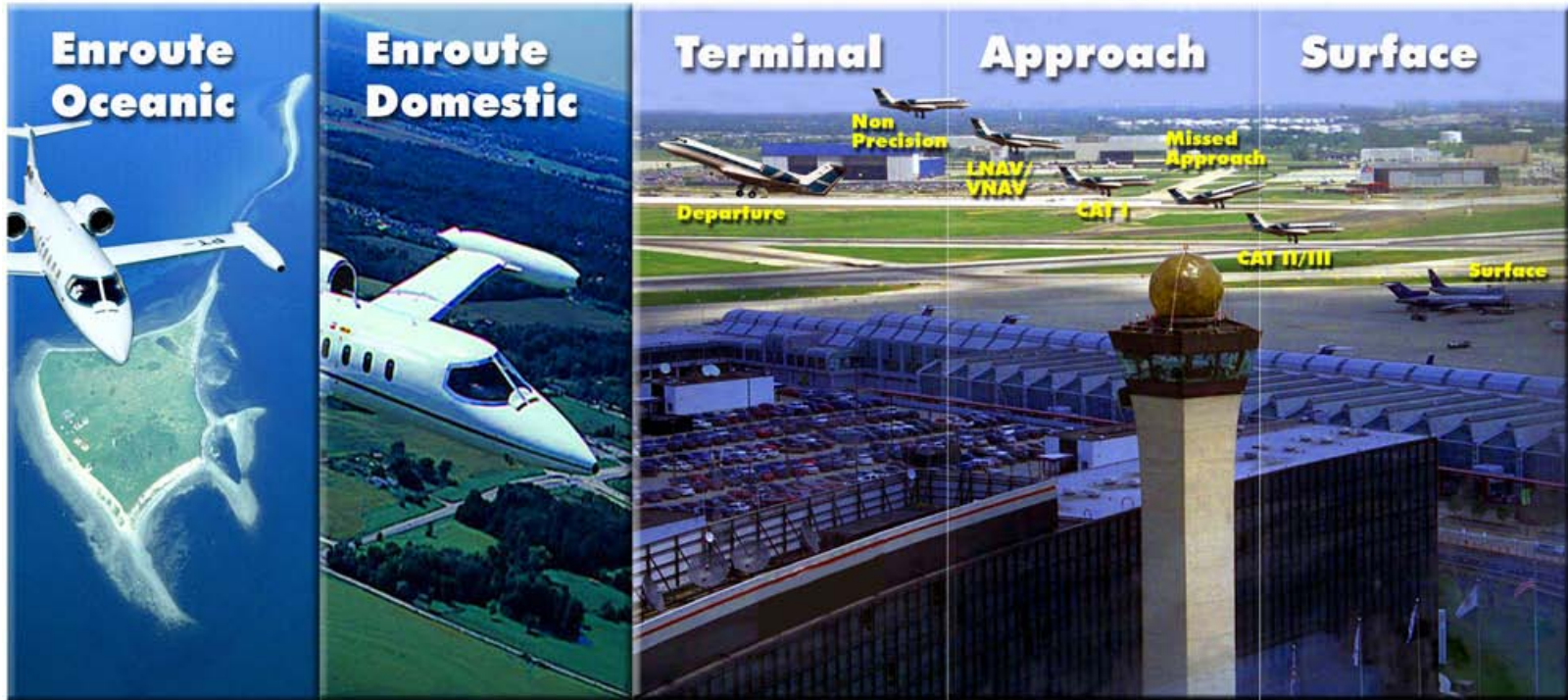
Fishing & Boating



Personal Navigation

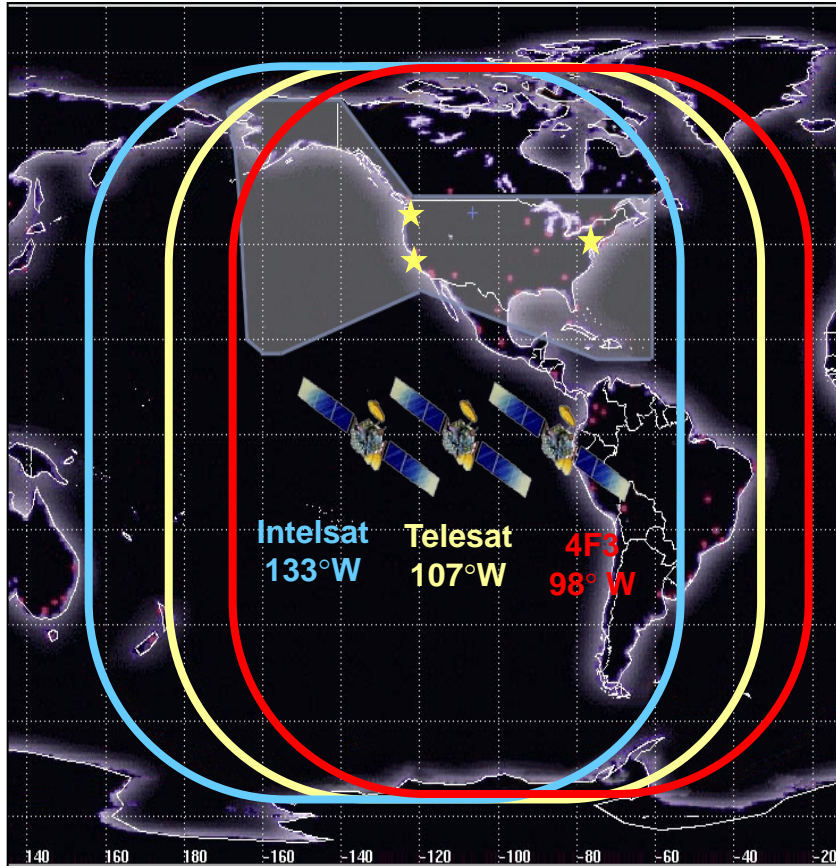
# FAA GPS Augmentation Programs

## WAAS



## LAAS

# WAAS Architecture



38 Reference Stations



3 Master Stations



4 Ground Earth Stations

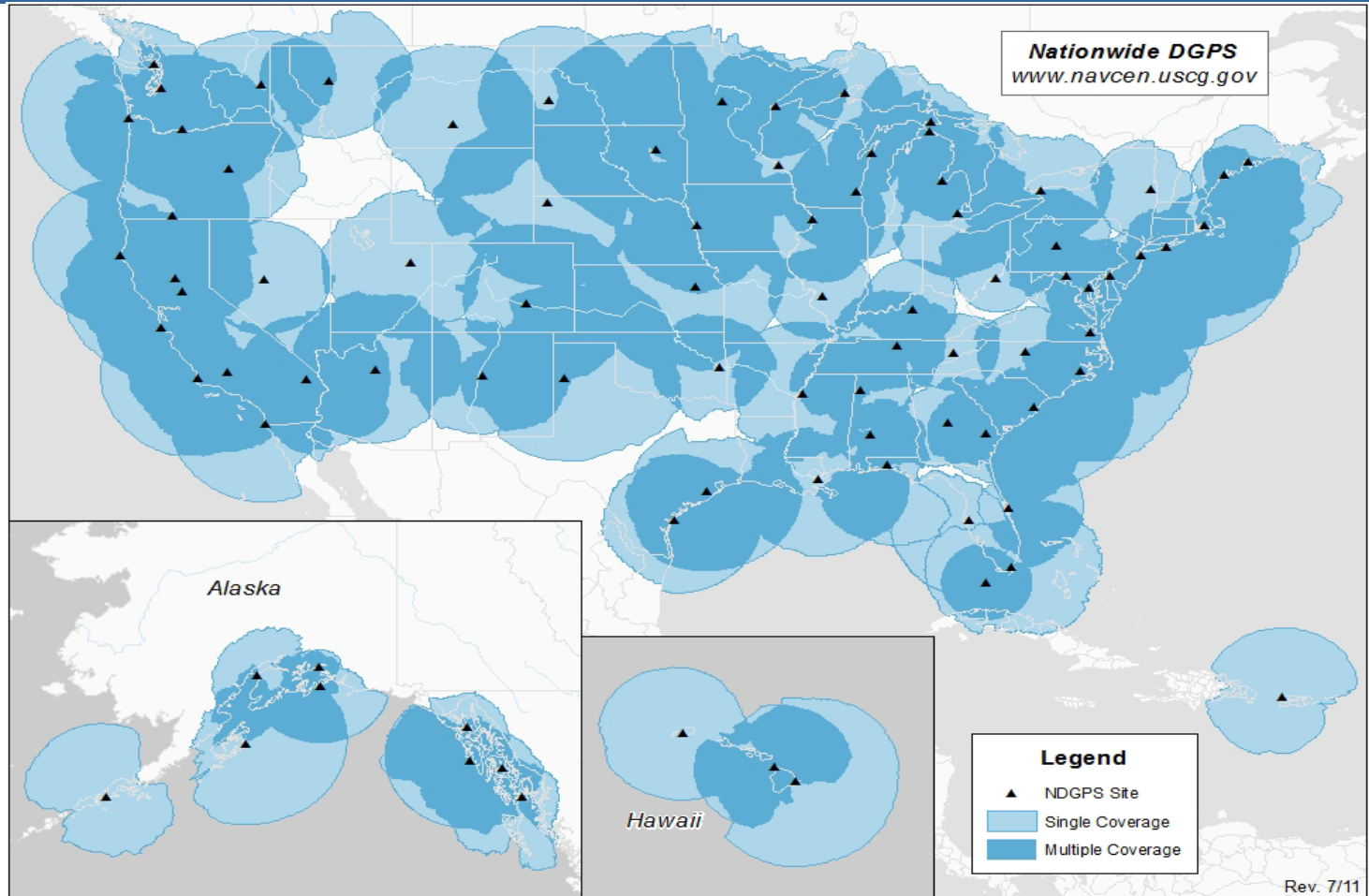


(2+1) Geostationary Satellite Links



2 Operational Control Centers

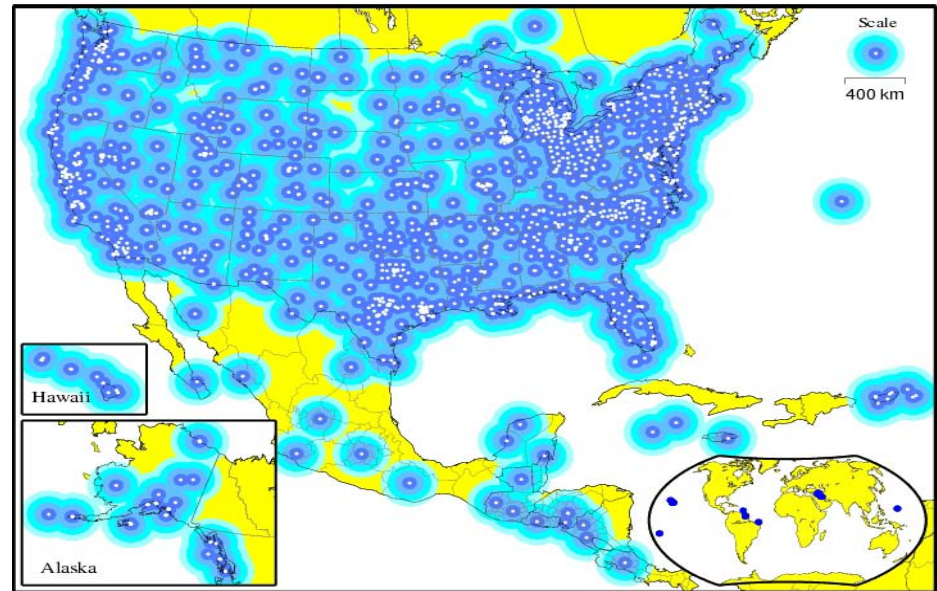
# Nationwide Differential GPS



- 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

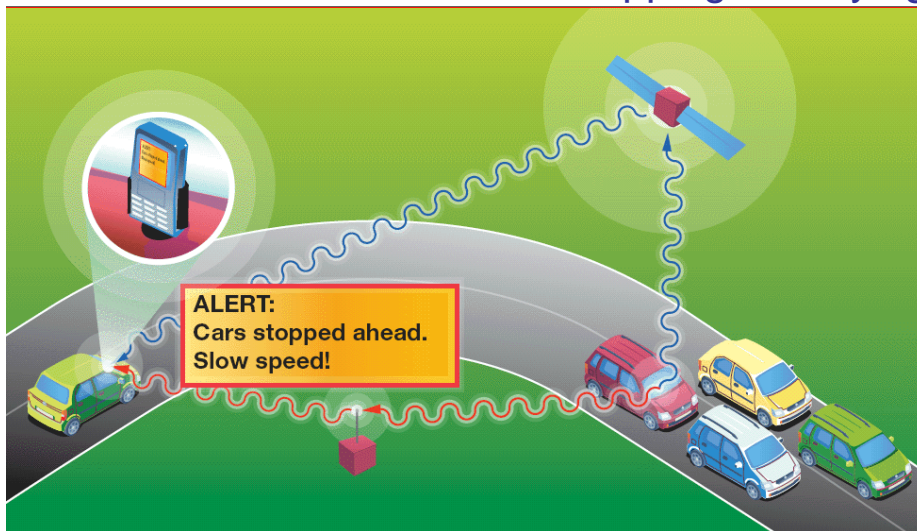
Increased mobility and reduced environmental impact





# 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
  - Increase track and locomotive safety
    - 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



# Recent State and Transit Initiatives

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- Arkansas State Highway and Transportation Department
  - Installing GPS devices in each of the Department’s 2,400 vehicles
  - First state agency to outfit all of its vehicles with GPS devices
    - Real-time vehicle diagnoses/immediate maintenance
    - Accountability for use, speed
    - Cost about \$700,000; pay for itself in about eight months with fuel savings
- Washington State Ferries – largest ferry transit system in the U.S.
  - “Routine” maritime uses: vessel location, navigation, draft depth measurement
  - Recently added GPS customer services
    - Vessel Tracker (“Where’s Your Ferry?”)
    - Added GPS-derived estimated ferry arrival times, overlaid on tracking map
  - Researching Wireless-Over-Water (WOW) mobile safety and security application
- WashDOT Use of GPS Truck Data
  - Identifying and ranking traffic bottlenecks; performance measures
  - Real-time rerouting for freight movements around Port of Seattle

# 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” or “personal protective devices”



\$99



\$99



\$320



\$129



\$145



\$30



\$430



\$79

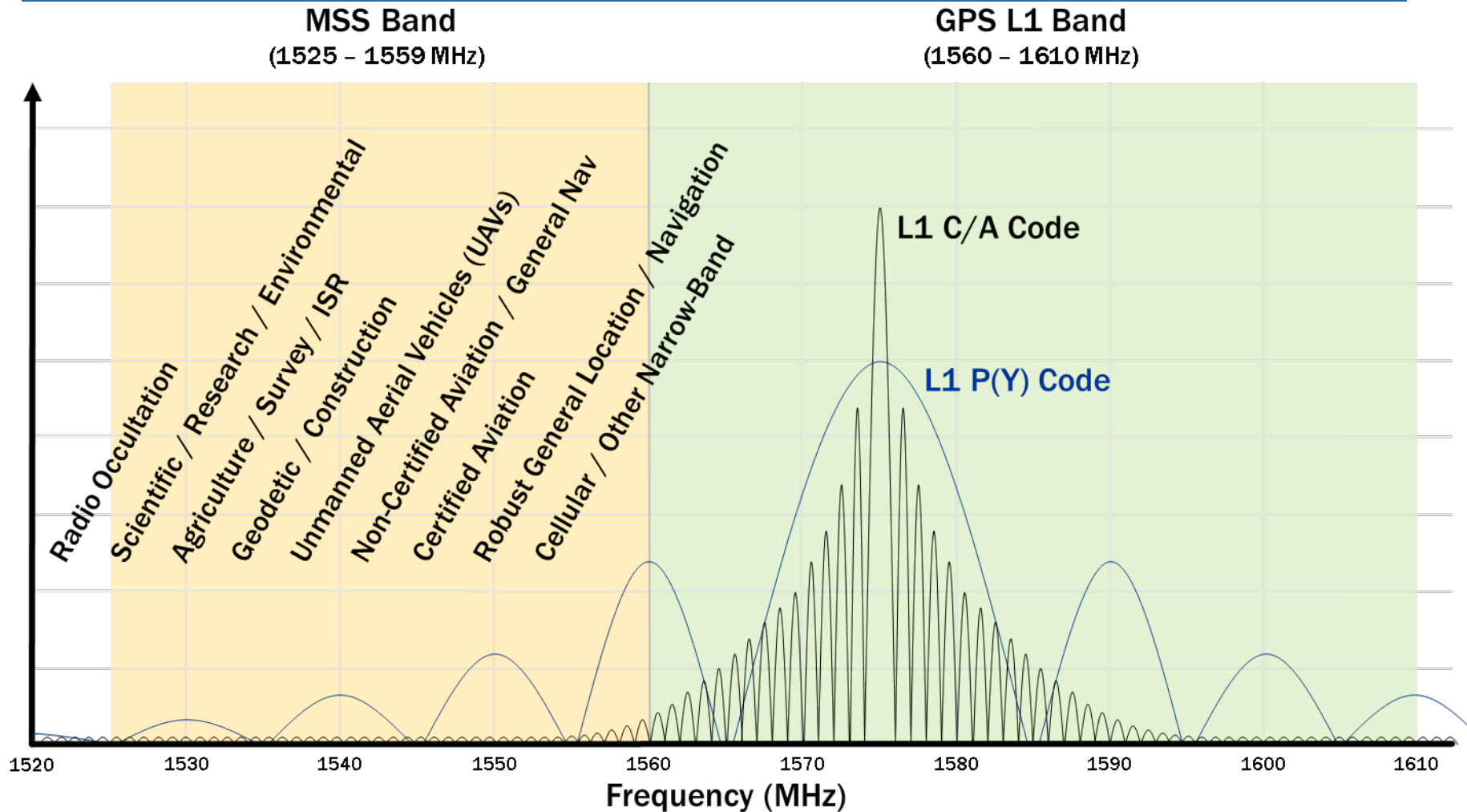
# Response to LightSquared – DOT GPS Spectrum Protection Plan

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- **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.**



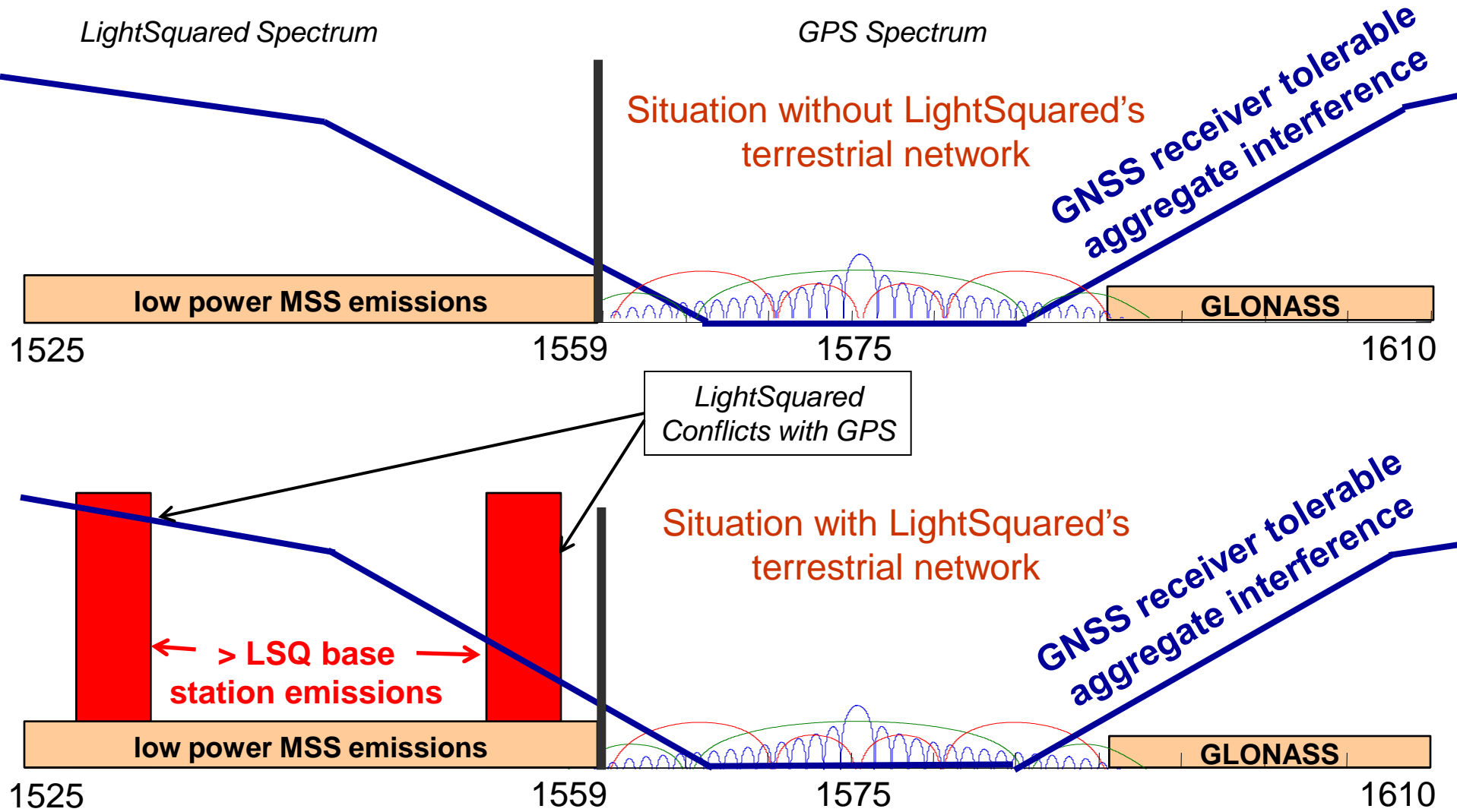
# GPS L1 Signal Spectrum Use



**Notional – For Discussion Purposes Only (Not to Scale)**



# Illustration of Concerns with LightSquared



# DOT GPS Spectrum Protection Plan - Status

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- 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.

