SPACE-BASED POSITIONING
NAVIGATION & TIMING
NATIONAL COORDINATION OFFICE

Status Report: LightSquared/GPS Interference Issue

for the

National Geospatial Advisory Committee
Shepherdstown, WV
October 4, 2011

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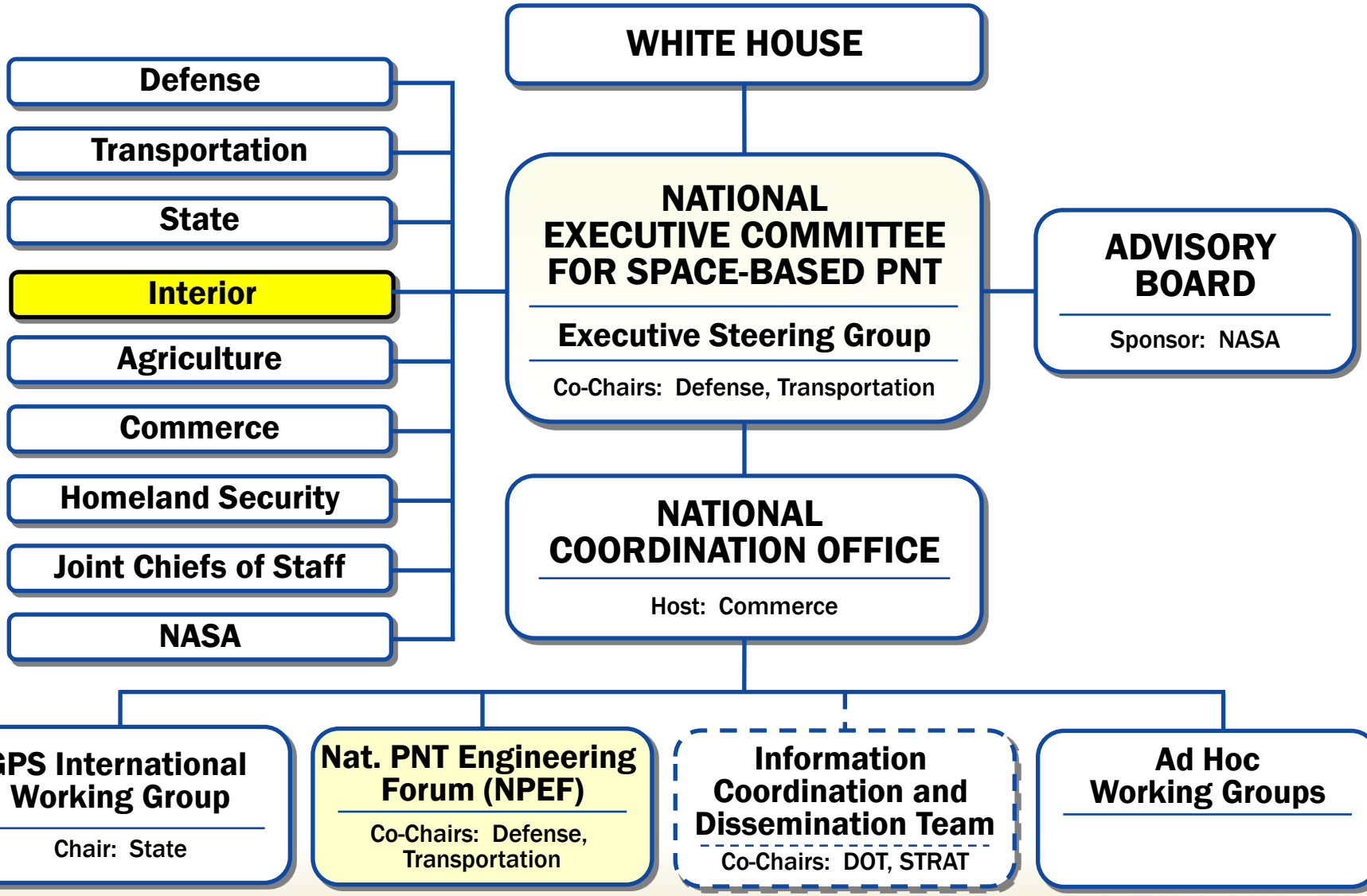
Outline

- U.S. Space-Based PNT Organization
  - National Space-Based PNT Advisory Board
- U.S. Space-Based PNT Policy
- LightSquared Interference Issue
- Questions

U.S. Space-Based PNT Organizational Structure



National Space-Based PNT Advisory Board

- Provides independent advice and recommendations on PNT
- 25 members (including 5 international members)
  - Co-chaired by Dr. James Schlesinger & Dr. Brad Parkinson
  - Gov. Jim Geringer New Member (2011) – Known to many in Geospatial Community

U.S. GPS Policy History

- 1983: President announces civilian access to GPS following KAL 007
- 1996: First U.S. GPS Policy establishes joint civil/military management
- 1997: U.S. law provides civil GPS access free of direct user fees

- 2004: President issues U.S. Policy on Space-Based PNT
- 2004: Agreement signed on GPS-Galileo Cooperation
- 2010: New National Space Policy provides high-level PNT guidance

Maintain Leadership in the service, provision, and use of GNSS
–detect and mitigate harmful interference

Aside: Broadband Policy Memo

2010: "Unleashing the Wireless Broadband Revolution"

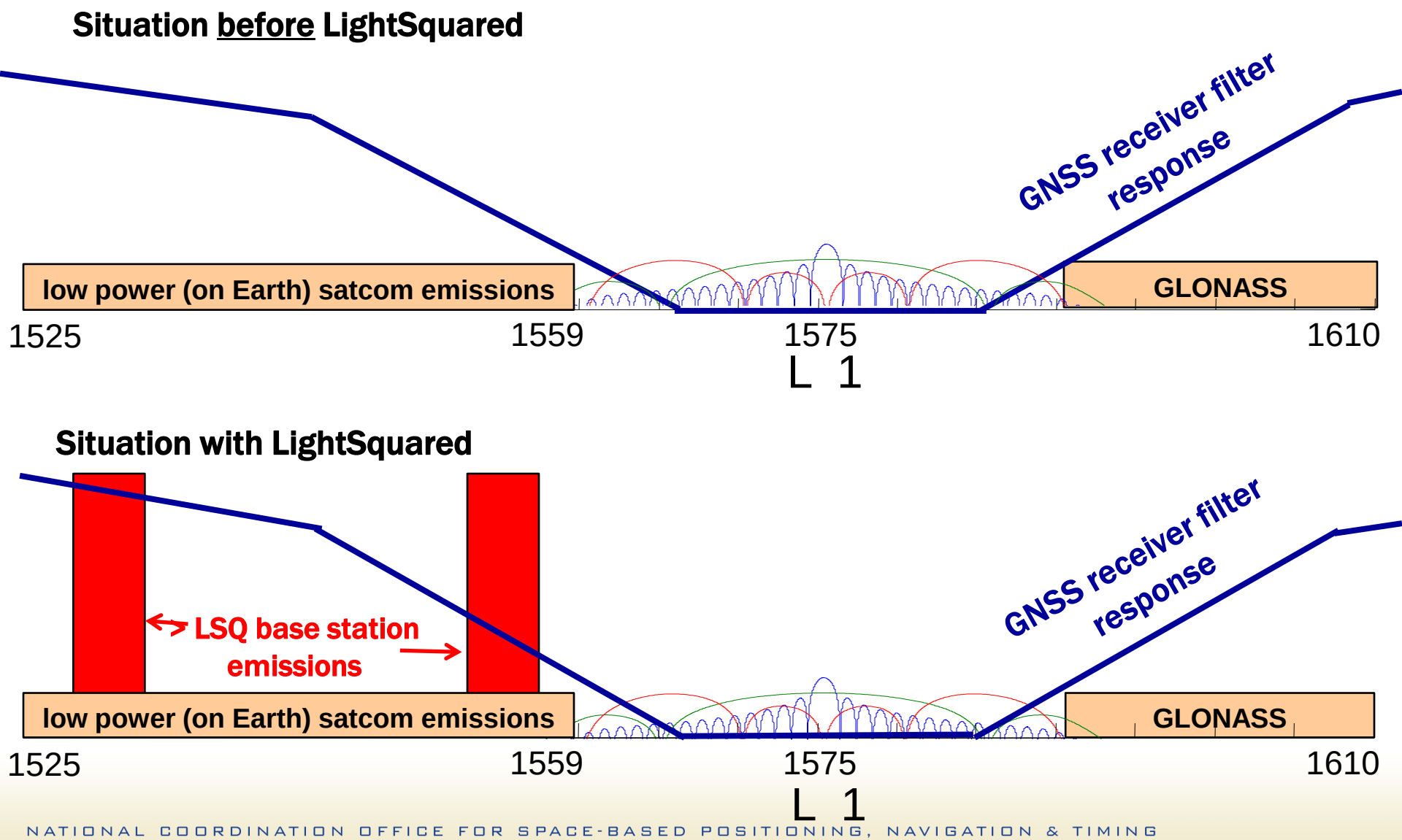
What is LightSquared?

- New Telecom company formed Mid 2010
  - Formerly SkyTerra
  - FCC approved SkyTerra transfer order Mar 2010
- Company formed to create a nationwide 4G LTE (Long Term Evolution) open wireless broadband network
- First wholesale-only broadband network
- Intends to provide coverage to 92% of USA by 2015
- Key Asset
  - Mobile Satellite Service /Ancillary Terrestrial Component license for 1525–1559 MHz; 1626.5-1660.5 MHz

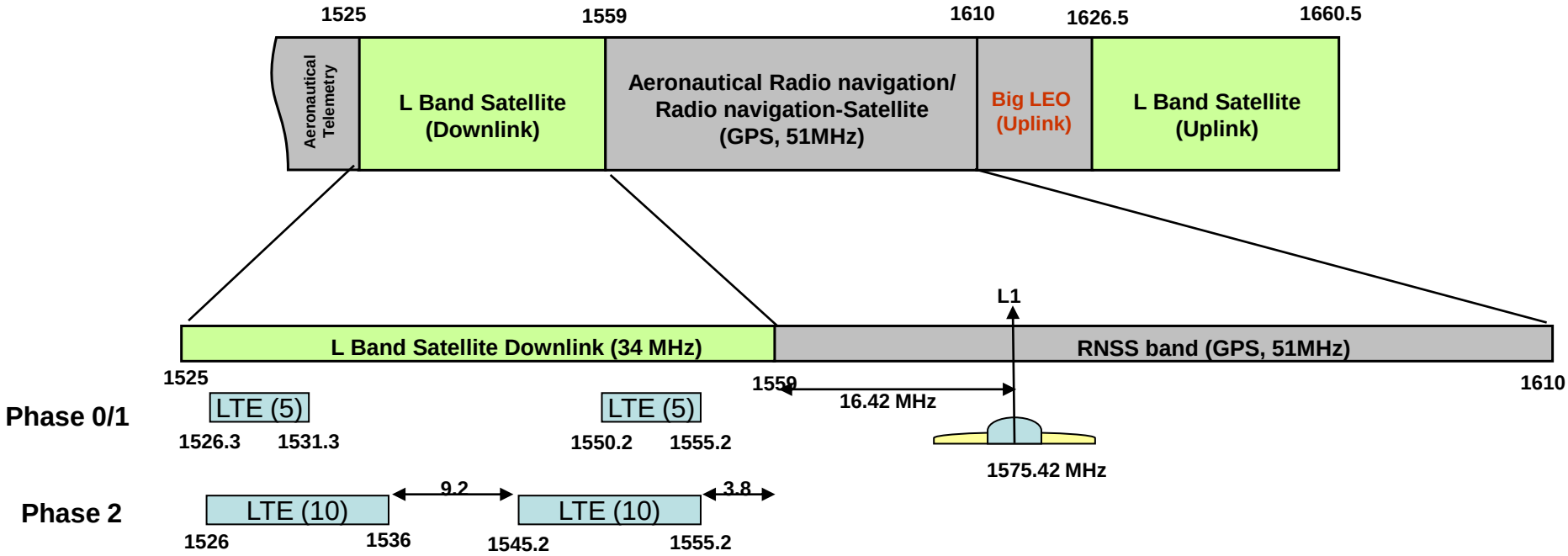
LightSquared Interference to GPS

- 26 Jan 2011: FCC Waiver to LightSquared (LSQ) for a Terrestrial Broadband in Mobile Satellite Service Spectrum adjacent to Spectrum used by GPS
  - FCC has condition on Waiver that harmful interference concerns to GPS be resolved
  - Technical Working Group (TWG) to examine interference issues
- Testing Shows Widespread Harmful Interference to GPS devices (NPEF, RTCA, TWG)
- 30 June: LSQ submits TWG Report and New Plan to FCC
- FCC sought comments until 15 August
- 9 Sept: NTIA Requests further testing by NPEF
- 13 Sept: FCC Says Additional Tests are Necessary

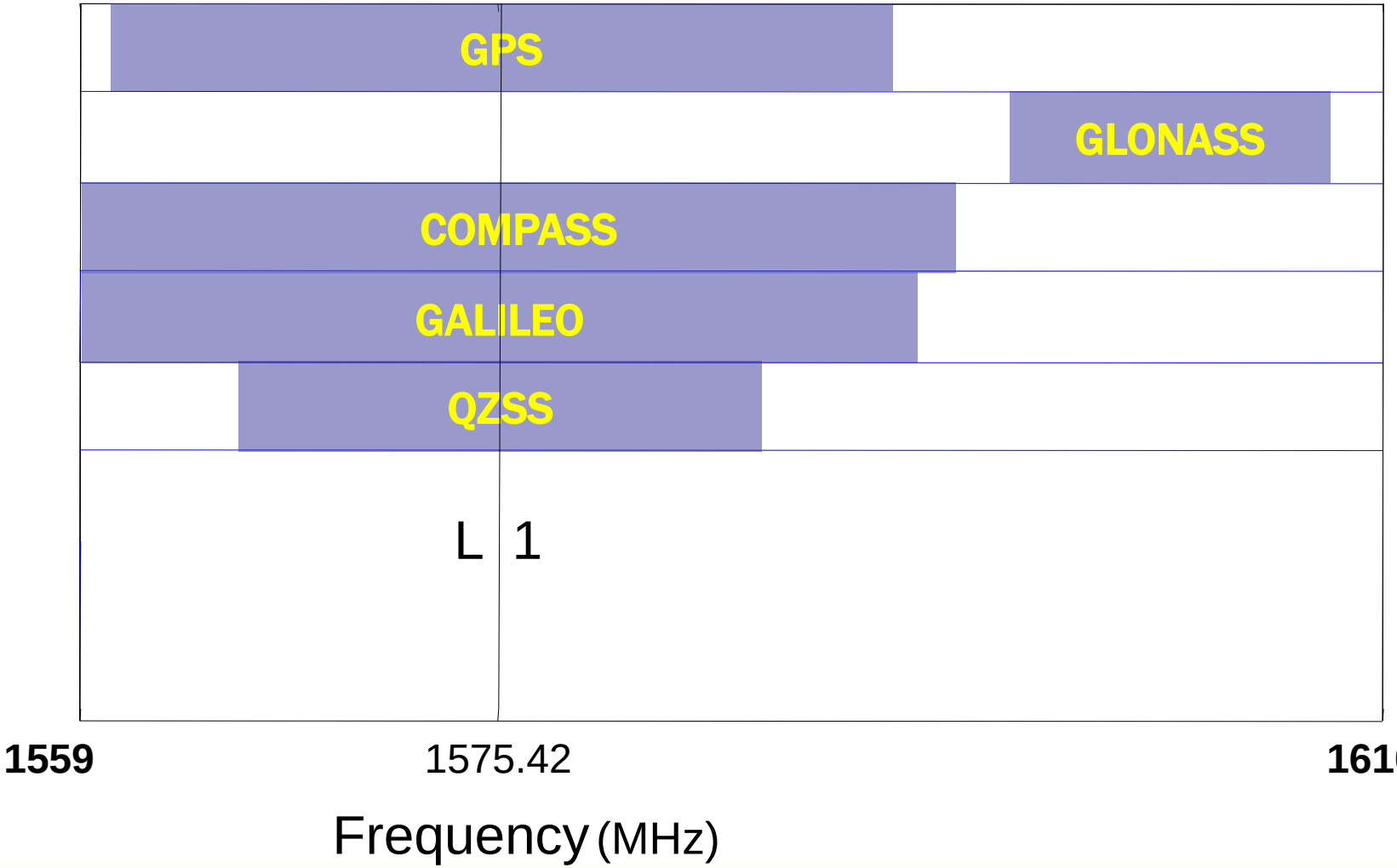
Illustration of Concerns with LightSquared



LightSquared Spectrum Plans



Upper L Band Spectrum for Global Navigation Satellite Systems



DOI Responses to LSQ Issue

- Dec 16 , 2010– DOI Raised LightSquared GPS interference concern at the NCO (email from FCC to the Federal Geodetic Control Subcommittee)
- Jan 3, 2011– DOI Letter to NTIA: Interference issues should be investigated before a waiver is granted
- July 7– DOI Impact Memo to NTIA: GPS is vitally important. DOI replacement costs estimated at $250-500 Million
- August 8– DOI Position Letter from Deputy Secretary Hayes to NTIA: Do not approve LSQ plan. More testing on Low 10 MHz is needed.

DOI responses to LSQ issue

- Sept 9– Responded to NTIA request for GPS High Precision and Timing receiver inventory

High Precision	6,050
Timing	14,020
Specialized	170
Total	**20,240**

DOI Surveyor Comments

"my comments echo the sentiments of other surveyors – both federal and private"

- Survey grade GPS is a critical component of our every-day work
- Invested over $200,000 in the past 5 years
- GPS made it possible for us to accomplish many jobs in a large geographic area
- GPS is our 'bread and butter', and our livelihood
- Quite alarmed
- The power belted out is simply incompatible with low power GPS
- Our DOI units, and hundreds of thousands just like them, could be rendered totally useless!

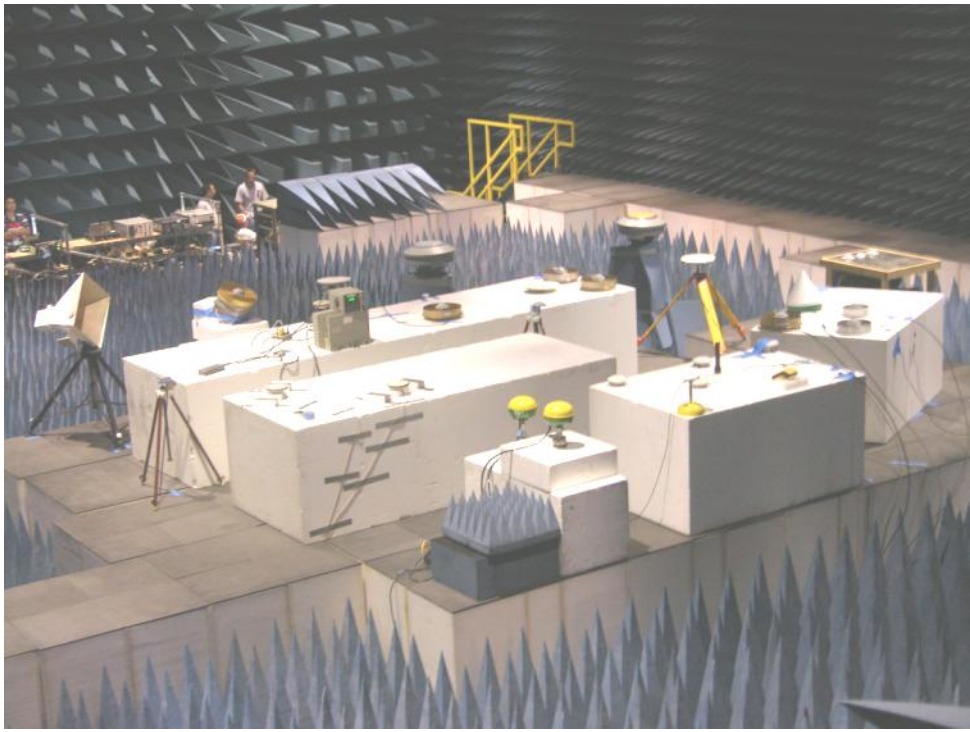
Congressional Hearings

- 23 June: House Transportation and Infrastructure Committee
- 8 Sept: House Science Committee
  - David Applegate DOI/USGS Testified
- 15 Sept: House Armed Services Committee, Strategic Forces Subcommittee
- More Hearings Likely

Note: Several different bills introduced in 2011 include language related to the FCC's authorization of a terrestrial broadband network that could interfere with GPS applications.

New NPEF Testing

- Targeted Testing
  - Navigation/Cellular Devices
  - Low 10 MHz
  - Testing facilities are scheduled /Planning underway
  - Hand set (LSQ Cell Phone) simulation to be included
  - Completion end of November/early December



- Testing is open for participation
  - DOI is making plans to participate in the Testing
  - Collaborating/pooling resources with USDA
- Anticipate additional testing for High Precision and Timing Receivers in early 2012

Where to get more information?

www.pnt.gov/interference/lightsquared/

GPS Tracker for Policy Makers (Monthly)
http://www.pnt.gov/congress/newsletter/

Questions?

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Back-ups

Just in Case

June 2010 Space Policy

- Maintain Leadership in the service, provision, and use of GNSS
  - Provide civil GPS service, free of direct user charges
  - Foreign PNT services may be used to complement GPS
  - Encourage Global compatibility and interoperability with GPS
  - Support International Activities to detect and mitigate harmful interference

2003 Versus Today

Parameter	2003-2004	2005-2007	Today
Purpose	**Provide Mobile Satellite-like services**	**Provide Mobile Satellite-like services**	**Provide terrestrial wideband internet access**
Coverage	**Ancillary (indoors, urban canyons, etc)**	**Ancillary (indoors, urban canyons, etc)**	**Everywhere**
Handsets	**Dual mode satellite-terrestrial only**	**Dual mode satellite-terrestrial only**	**Dual mode or terrestrial-only**
Number of towers allowed	**1725 - 2415**	**No Limit**	**No Limit (40,000 planned)**
Power per antenna sector	**245 Watts**	**1500 Watts**	**Up to 15,000 Watts**
Bandwidth per sector	**600 kHz**	**600 kHz**	**20 MHz**

FCC Commissioner Adelstein (Jan 2003): "our decision should not allow a Mobile Satellite Services (MSS) system with an ancillary terrestrial component to evolve into a terrestrial system with an ancillary mobile satellite component"

LightSquared's New Plan

- Re-order the phasing of their system. Initially deploying with the lower frequency of their two channels
- Reduce their power to a maximum of roughly 1500 watts per tower for initial deployment.
- "Standstill" for operating their second, higher frequency channel.

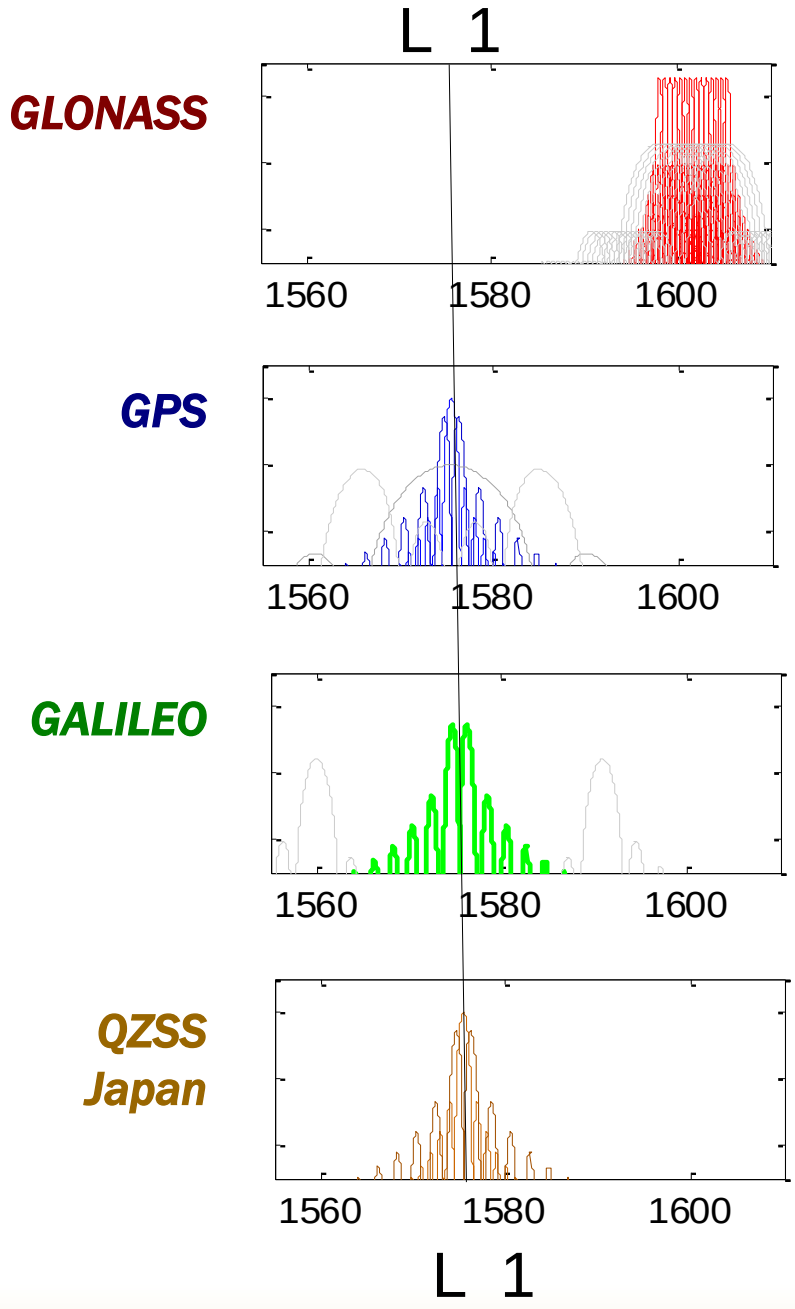
TWG test results Summarized

Sub-Team	Impact as planned	Mitigation	10 MHz lower spectrum only
Aviation	• Incompatible • Complete Loss	• Filters not available to test • Receiver modification takes a long time • Shift to a different frequency would eliminate all concerns	• Lower 5 Mhz likely would be compatible • Lower 10 Mhz needs further study
Cellular	• Causes GPS failure • Significant number of devices impacted • LSQ may not be able to operate	• Not possible	• Within grasp
General Location & Navigation	• Widespread Harmful Interference • Safety of life must be preserved • Positional accuracy degrades • LSQ—operation in upper band of spectrum not viable	• Filters do not exist • Only option is to shift to a different frequency	• Many devices still impacted • LSQ questions these results • Two points of view about what constitutes Harmful Interference. • LSQ favors a more probabilistic approached based on user experience • LSQ—data shows 10 Mhz low is a viable option • LSQ—filters will work

TWG test results Summarized (continued)

Sub-Team	Impact as planned	Mitigation	10 MHz lower spectrum only
High Precision, Timing, & Networks	• Harmful Interference over long ranges • Harmful co-channel interference (Starfire and Omni Star—private GPS augmentation services) • LSQ handsets operated close(1m) to GPS device causes harmful interference • Interference to GNSS and WAAS • Good precision measurements require greater receiver band width	• Nothing Feasible • Timing only, if LSQ restricted to high or low part of band • Does not foresee any possibility that wide band GPS receivers would be compatible with LSQ signals • Different frequency for terrestrial LSQ • LSQ—receiver design at fault and causes overload • Filtering option problematic • LSQ—why won't filtering work? No technical and operational obstacles (especially lower 10Mhz)	• Harmful Interference • LSQ—Timing receivers performed well • LSQ—Receiver side mitigation needs further work, options appear viable and need to be worked jointly with GPS community • LSQ –questions what constitutes Harmful Interference • LSQ—worst case test approach exaggerates interference, more probabilistic approach needed
Space Receivers	• Harmful Interference	• Not possible to mitigate receivers in space	• Harmful Interference • Needs further study, options not fully tested

Upper L Band Spectrum for Global Navigation Satellite Systems



International Concerns on LightSquared: Galileo

- "Deep Concerns"
- "Considerable potential to cause harmful interference to Galileo"
- "Grave threat to providing Galileo service covering US"
- Galileo interoperable with GPS
- No Galileo receivers tested

EUROPEAN COMMISSION
DIRECTORATE GENERAL FOR ENTERPRISE AND INDUSTRY

Director general

Brussels, 19. 07. 2011
ENTR/GP1/PF/DH/ses ARES (2011) 800745

Mr Julius Genachowski
Chairman
Federal Communications Commission
445 12th Street, SW
Washington, DC, 20554
United States of America

Dear Mr Genachowski,

I am writing to express our deep concerns about the LightSquared system that is proposed for operation in frequencies immediately below the radionavigation-satellite service (RNSS) allocation at 1559-1610MHz. This band is the core band used by global satellite navigation systems including GPS and you are no doubt aware that Europe is at the advanced planning stage for its own system, Galileo, which will be operational by 2014/15, and that will also use this RNSS allocation.