

# **Spectrum Issues Working Group**

- **Charter/Mission – Pending**
  - Monitoring issues affecting spectrum allocated for GPS as well as other space to ground, ground to space, and ground to ground uses of radio frequencies
  - Interface with IRAC agency representatives
- **Federal Management of Spectrum**
- **GPS and GNSS Spectrum Concerns**
- **Federal Strategic Spectrum Plan – March 08**

# CHECKS & BALANCES SPECTRUM MANAGEMENT SYSTEM

**COMMUNICATIONS ACT OF 1934**

**NTIA**

**(On behalf of President)**

- National Defense
- Law Enforcement & Security
- Transportation
- Resource Mgt Control
- Emergencies
- Other Services

**FCC**

**(Independent Agency)**

- Business
- State & Local
- Entertainment
- Commercial
- Private

**COORDINATION**

**ADVISORY**

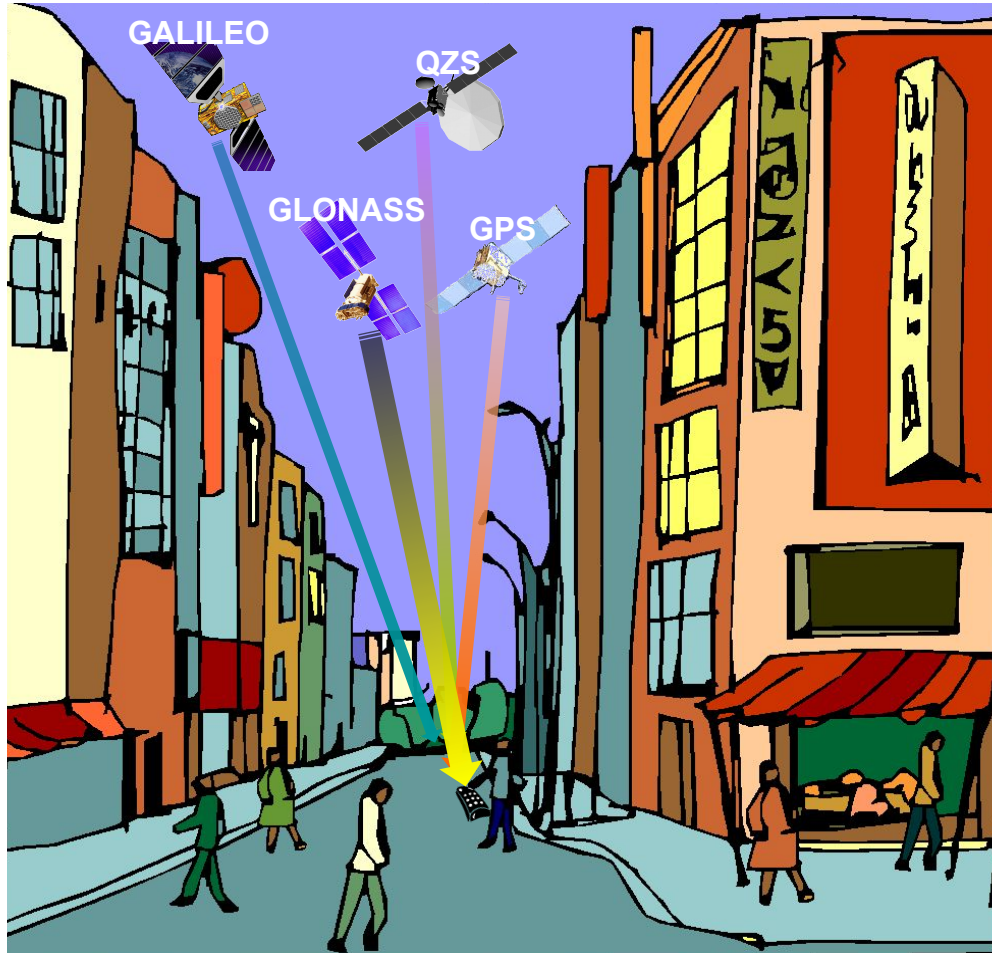
**LIAISON**

**INTERDEPARTMENT RADIO ADVISORY COMMITTEE (IRAC)**

**20 Govt Departments/Agencies as Members**

**NTIA Chairs IRAC & Subcommittees**

# Goal of Civil Interoperability

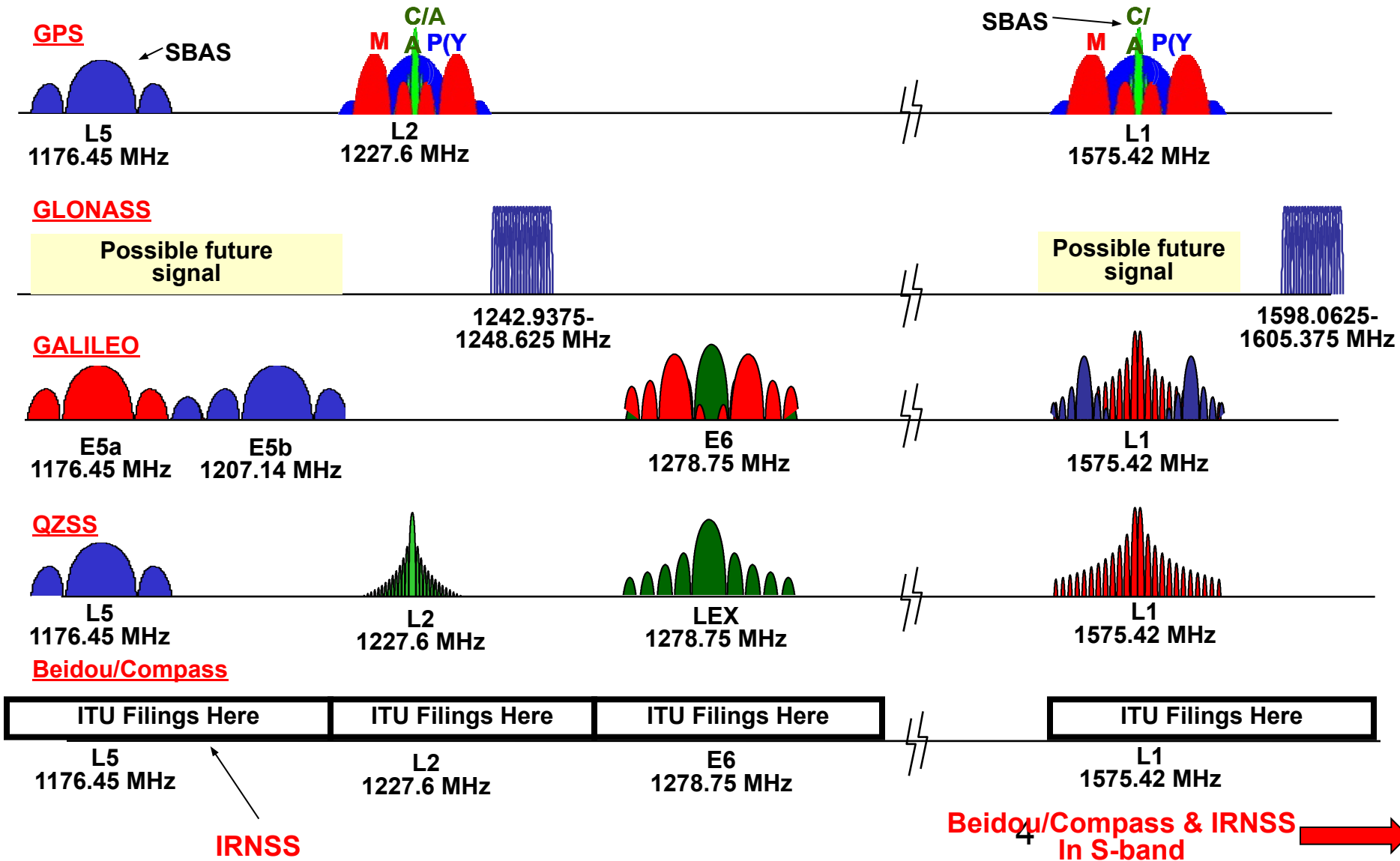


Ideal interoperability provides users a PNT solution using signals from different GNSS systems

- No additional receiver cost or complexity
- No degradation in performance

Interoperable = Better Together Than Separate

# GNSS Frequency Bands & Signals



# ICG Providers Forum

## Definition of Compatibility

**Compatibility** refers to the ability of space-based positioning, navigation, and timing services to be used separately or together without interfering with each individual service or signal.

- Radiofrequency compatibility should involve thorough consideration of detailed technical factors, including effects on receiver noise floor and cross-correlation between interfering and desired signals. The International Telecommunications Union (ITU) provides the framework for discussions on radiofrequency compatibility.
- Compatibility should also involve spectral separation between each system's authorized service signals and other systems' signals.
- Any additional solutions to improve compatibility are encouraged

# Radio Frequency Compatibility

- Ensures that signals do not unacceptably interfere with use of other signals
- Requires thorough consideration of detailed technical factors, including
  - Effects on receiver noise floor
  - Crosscorrelation between interfering and desired signals
- International Telecommunication Union (ITU) provides framework
- Details are best worked bilaterally between providers

# ICG Providers Forum

## Definition of Interoperability

**Interoperability** refers to the ability of open global and regional satellite navigation and timing services to be used together to provide better capabilities at the user level than would be achieved by relying solely on one service or signal.

- Ideal interoperability allows navigation with signals from at least four different systems with no additional receiver cost or complexity.
- Common center frequencies are essential to interoperability, and commonality of other signal characteristics is desirable.
- Multiple constellations broadcasting interoperable open signals will result in improved observed geometry, increasing end user accuracy everywhere and improving service availability in environments where satellite visibility is often obscured.
- Geodetic reference frames and system time standards should also be considered.
- Any additional solutions to improve interoperability are encouraged.

*Department of Agriculture*

*Department of Commerce*

*Department of Defense*

*Department of Energy*

*Department of Homeland  
Security*

*Department of the Interior*

*Department of Justice*

*Department of State*

*Department of Transportation*

*Department of the Treasury*

*Department of Veterans Affairs*

*National Aeronautics and Space  
Administration*

*National Science Foundation*

*Broadcasting Board of  
Governors*

*U.S. Postal Service*

**SPECTRUM MANAGEMENT  
FOR THE 21<sup>ST</sup> CENTURY  
THE PRESIDENT'S SPECTRUM  
POLICY INITIATIVE**

**FEDERAL STRATEGIC SPECTRUM PLAN**



**U.S. DEPARTMENT OF COMMERCE**

**CARLOS M. GUTIERREZ, SECRETARY**

**MEREDITH A. BAKER, ACTING ASSISTANT SECRETARY  
FOR COMMUNICATIONS AND INFORMATION**

**March 2008**



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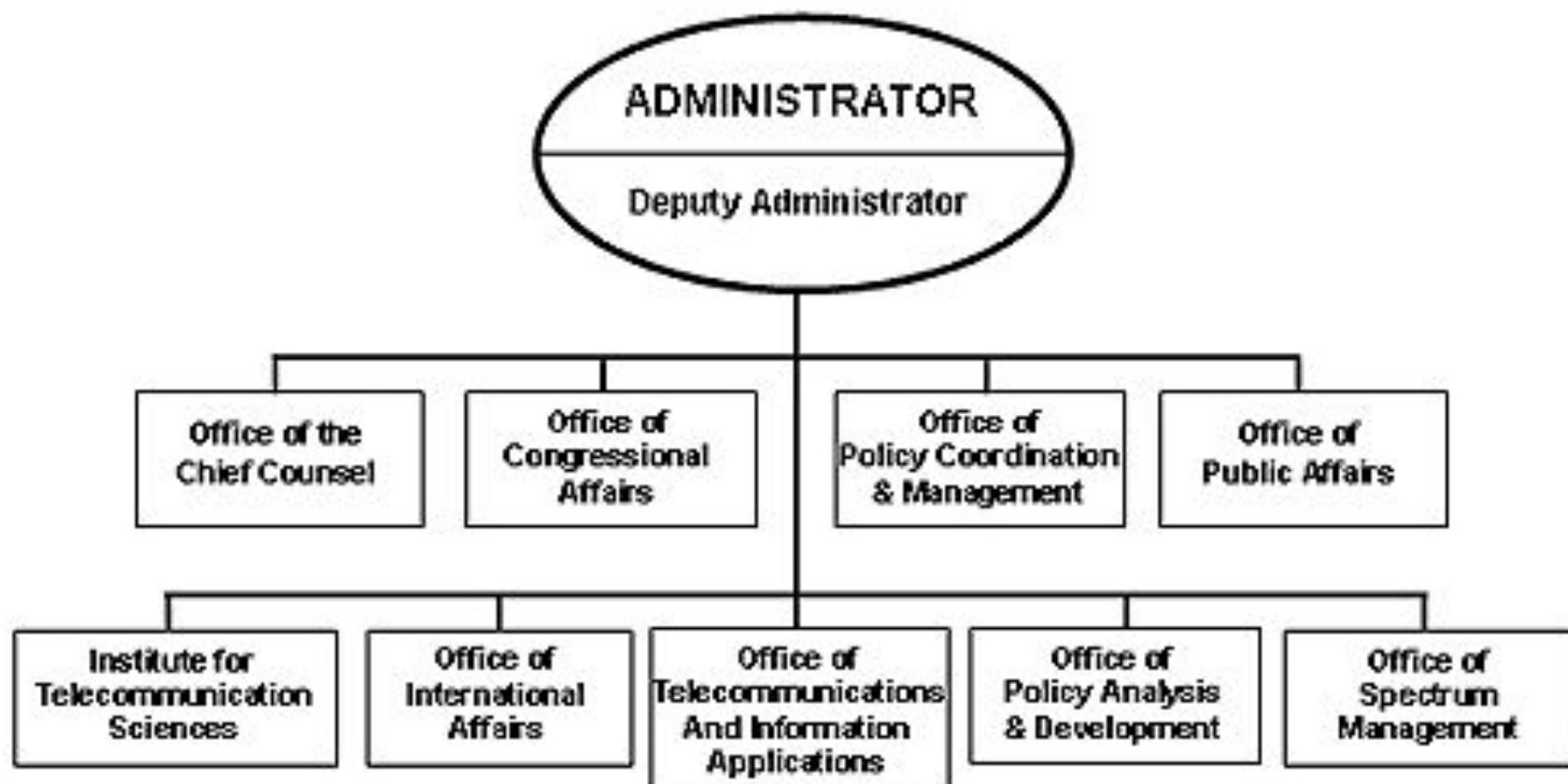
# On-Line Spectrum Management Resources

- NTIA Office of Spectrum Management Web Site
  - <http://www.ntia.doc.gov>
  - *NTIA Manual of Regulations & Procedures for Federal Radio Frequency Management* available for download in Adobe Acrobat Portable Document Format (PDF) <http://www.ntia.doc.gov/osmhome/redbook/redbook.html>
    - Chapter 4. Allocations, Allotments and Plans
    - Chapter 5. Spectrum Standards
    - Chapter 10. Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC)
- ITU Web Site
  - <http://www.itu.int>
  - Overview of the ITU *Radio Regulations* <http://www.itu.int/sns/radreg.html>
- FCC Web Site
  - <http://www.fcc.gov/>
  - FCC's Table of Frequency Allocations <http://www.fcc.gov/oet/spectrum/table/fcctable.pdf>

**BACKUP SLIDES**

U.S. DEPARTMENT OF COMMERCE

**NATIONAL TELECOMMUNICATIONS  
AND INFORMATION ADMINISTRATION**



# Main Benefit of Interoperability Geometry

- More Satellites □ Better Geometry □ Improves:
  - **Satellite coverage** □ navigate where could not before
  - **Dilution of Precision** □ accuracy is better everywhere
    - Eliminates DOP holes (with open sky)
  - **RAIM\*** □ integrity checked everywhere, all the time
    - Eliminates RAIM holes (with open sky)
  - **Phase ambiguity resolution** for survey and machine control applications
    - \* Receiver Autonomous Integrity Monitoring

# Important for Interoperability

Essential (cost driver)

Important (no time bias or filter issues)

- Common Center Frequency

- Like L5 & E5a

- Same Antenna Polarization

- Common Signal Spectrum

- Identical receiver time delay with common spectrum

- Same coherent integration period for acquisition

- Usually related to symbol rate

- Different Desirable (ASIC gate count) symbol rates may require separate search correlators for acquiring signals

# Other Interoperability Factors – System Time

- System time offset may affect interoperability, depending on the circumstance
- This is why system time offset parameters will be part of future GPS, Galileo, and QZSS messages
  - Permits use of only one or two extra satellites
- Conversely, GPS and GLONASS receivers function well without a time offset message
  - Receivers compute and remember time offset, to high precision, if 2+3 or more satellites are in view
    - Time offset is a slowly changing solution variable