



# ***U.S. GPS International Activities Update***



**MUNICH  
SATELLITE NAVIGATION  
SUMMIT**

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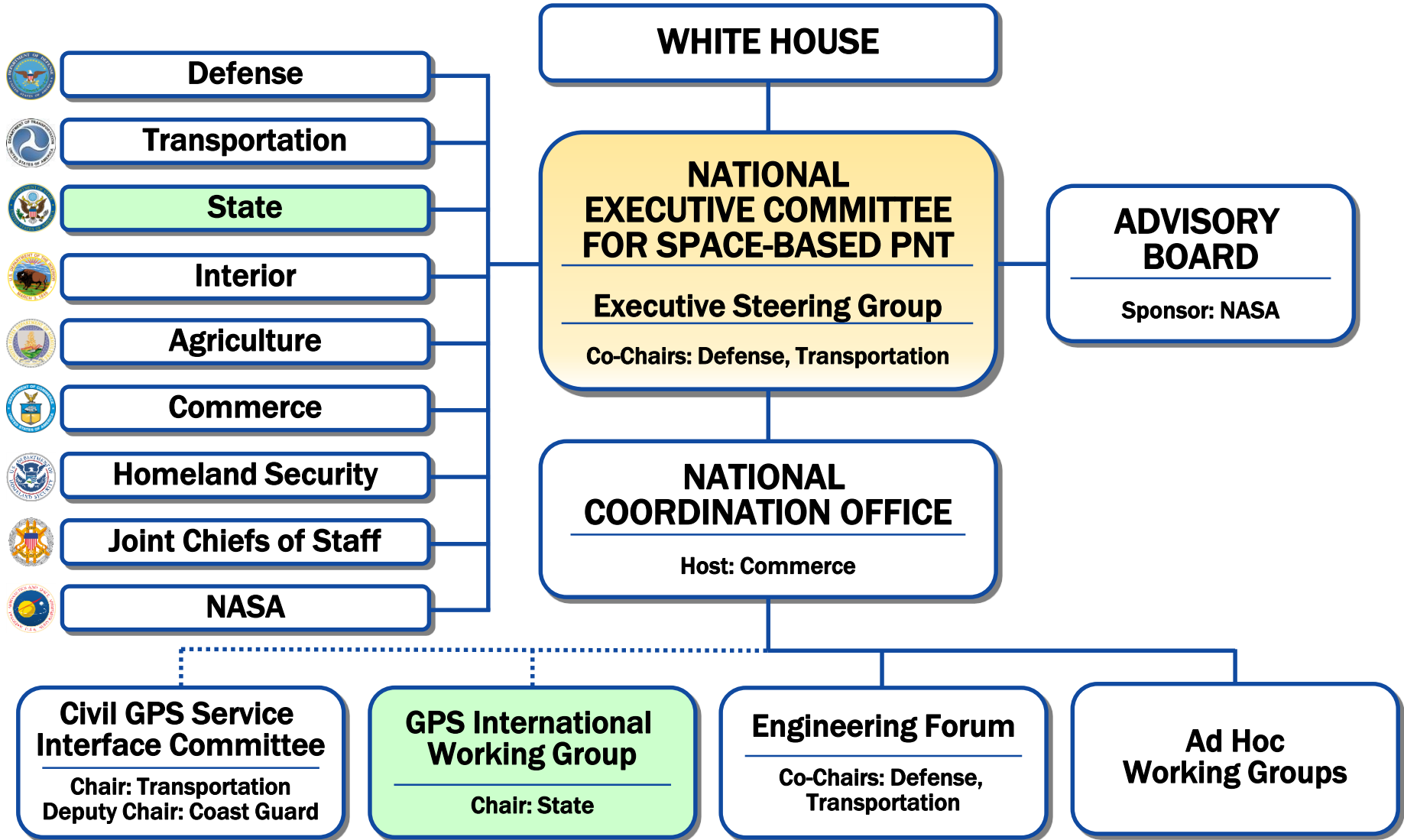
# ***U.S. National Space Policy***

## ***Space-Based PNT Guideline: Maintain leadership in the service, provision, and use of GNSS***

- Provide civil GPS services, free of direct user charges
  - Available on a continuous, worldwide basis
  - Maintain constellation consistent with published performance standards and interface specifications
  - Foreign PNT services may be used to augment and strengthen the resiliency of GPS
- Encourage global *compatibility* and *interoperability* with GPS
- Promote *transparency* in civil service provision
- Enable *market access* to industry
- Support international activities to detect and mitigate harmful interference



# National Space-Based PNT Organization





# Global Perspective

- Global Constellations
  - **GPS (24+3)**
  - GLONASS (24+)
  - GALILEO (24+3)
  - BDS/BEIDOU (27+3 IGSO + 5 GEO)



- Regional Constellations
  - QZSS (4+3)
  - IRNSS/NAVIC (7)
  - **Korea – KPS (7)**
- Satellite-Based Augmentations
  - **WAAS (3)**
  - MSAS (2)
  - EGNOS (3)
  - GAGAN (3)
  - SDCM (3)
  - BDSBAS (3)
  - KASS (2)
  - **Australia SBAS**



# *U.S. Objectives in Working with Other GNSS Service Providers*

- Ensure **compatibility** — ability of U.S. and non-U.S. space-based PNT services to be used separately or together without interfering with each individual service or signal
  - Radio frequency compatibility
  - Spectral separation between M-code and other signals
- Achieve **interoperability** – ability of civil U.S. and non-U.S. space-based PNT services to be used together to provide the user better capabilities than would be achieved by relying solely on one service or signal
- Promote fair competition in the global marketplace

***Pursue through Bilateral and Multilateral Cooperation***



# *Bilateral Cooperation*

## Europe

- GPS-Galileo Cooperation Agreement signed in 2004
- Working Group on Next Generation GPS/Galileo Civil Services meets twice per year
- EU waiver of FCC Part 25 rules discussed by Working Group on Trade & Civil Applications – see next slide
- On-going PRS access negotiations

## Japan

- Comprehensive Dialogue held in Tokyo, July 2018
- Civil Space Dialogue held in Washington, May 2017
- Technical Working Group (TWG) discusses GPS and QZSS compatibility and interoperability
  - ITU coordination is ongoing – Most recent meeting in February 2019



# ***U.S. Federal Communications Commission (FCC) Part 25 Rules – Galileo Waiver Request***

- FCC rules require licensing of receive-only Earth stations (receivers) operating with Non-U.S. Licensed Space Stations
- NTIA (on behalf of Executive Branch) has outlined criteria it will apply in recommending waiver of these rules (2011)
- EU Waiver Request Submitted to State in 2013
  - NTIA submitted the EC's request to the FCC, on behalf of the Executive Branch, **in 2015** and recommended granting the request
- FCC issued a public notice in January 2017 inviting interested parties to comment on the waiver request
- On November 15, 2018 the **Commissioners approved a waiver authorizing the use of Galileo signals in the United States** within two frequency bands

## **Chairman Pai's Statement:**

*<https://docs.fcc.gov/public/attachments/FCC-18-158A2.pdf>*



# *Bilateral Cooperation (continued)*

## China

- GNSS Plenary meeting held May 2018 in Harbin, China
- Working Groups meet as needed
  - Public Joint Statement on Civil Signal Compatibility and Interoperability signed in November 2017

## India

- U.S.–India Joint statement signed in 2007
- U.S.-India Civil Space Joint Working Group (CSJWG) met October 2017 in Washington
  - Agenda included GNSS discussions
- Next meeting scheduled to occur before the end of 2019 in Bangalore





# ***Additional Bilateral Dialogues***

- *Canada:* Civil GNSS meeting held in Washington, D.C. - March 21, 2019
- *Australia:* Joint Delegation Statement on Cooperation in the Civil Use of GPS in 2007
  - Regular discussions about Australia’s plans for SBAS
  - U.S.-Australia Civil Space Dialogue held on November 30, 2018
  - Australia became a member of the ICG at the 13<sup>th</sup> meeting
- *Republic of Korea:* 2nd bilateral Civil Space Dialogue held in Seoul – April 2016
  - Discussion about Korea’s development of their SBAS
  - Planning underway for discussions related to KPS in 2019
- *Indonesia:* 1<sup>st</sup> Civil Space Dialogue to occur April 4, 2019 in Washington, D.C. – GNSS applications to be discussed



# *International Committee on Global Navigation Satellite Systems (ICG)*

- Emerged from 3rd UN Conference on the Exploration and Peaceful Uses of Outer Space July 1999
  - Promote the use of GNSS and its integration into infrastructures, particularly in developing countries
  - Encourage compatibility and interoperability among global and regional systems
- Members include:
  - **GNSS Providers:** (U.S., EU, Russia, China, India, Japan)
  - Other Member States of the United Nations
  - International organizations/associations



<http://www.unoosa.org/oosa/en/ourwork/icg/icg.html>



# ***13<sup>th</sup> Meeting of the International Committee on GNSS (ICG)***

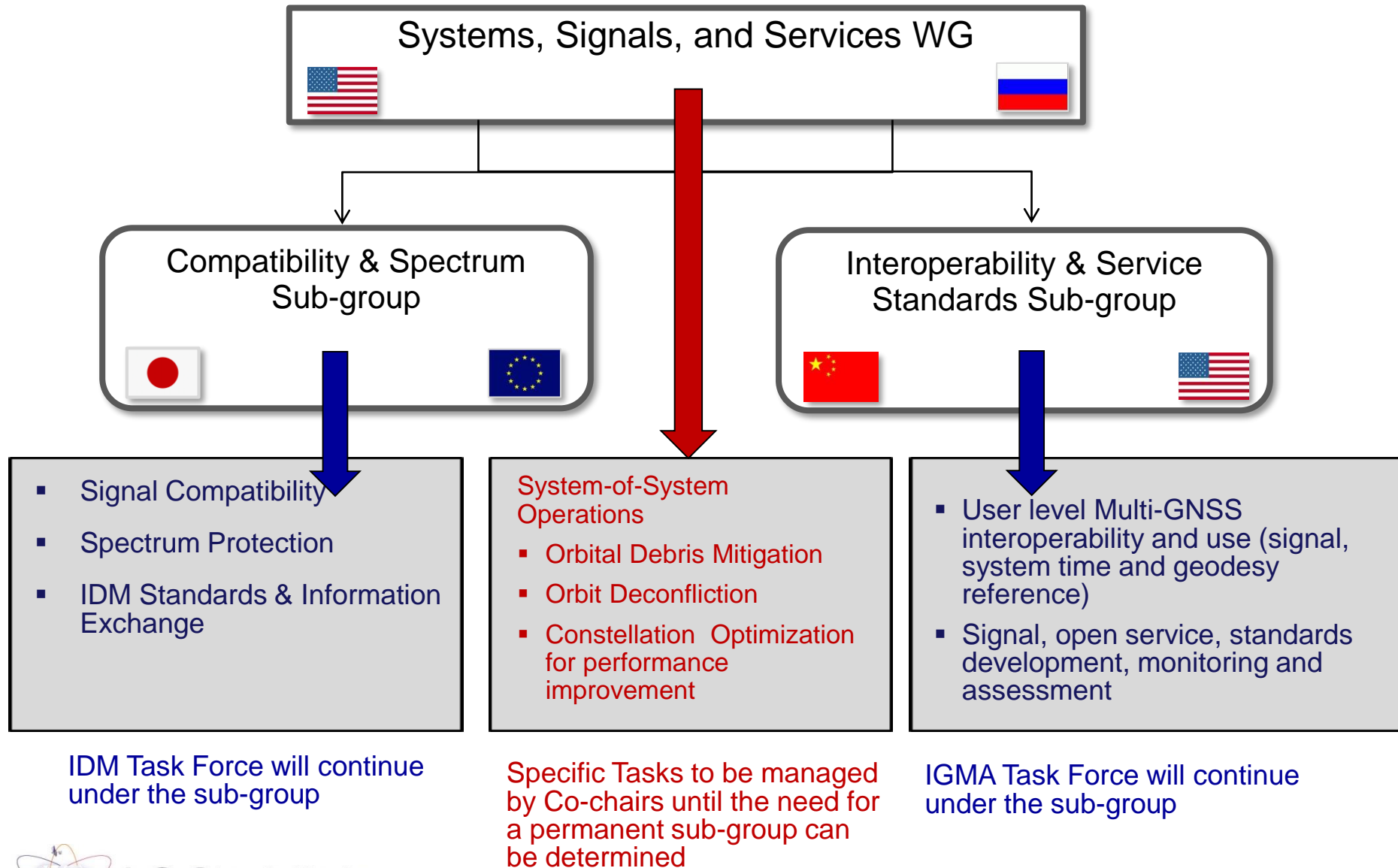


***Xi'an, China: 4-9 November 2018***

- More than 200 participants
  - Representatives from 27 countries/organizations
  - Representation from all 6 GNSS Providers
- Agenda included:
  - Meeting of the Providers' Forum
  - System Provider Updates
  - Applications and Experts Session
  - Meeting of all four Working Groups
- New Membership approval: Australia



# Systems, Signals, and Services WG (WG-S)





# ***GNSS Interference and Spectrum Protection***

## Core Area of Focus of the ICG

- Primarily discussed within the Working Group on Systems, Signals and Services (WG-S)
- Subgroup on Compatibility and Spectrum Protection established in 2010
- Task Force on Interference Detection and Mitigation (IDM) established in 2013
- IDM Workshops have been held since 2012 – organized by the ICG
  - 7th IDM Workshop took place May 2018 as part of Baska GNSS Conference in Croatia
- Spectrum Protection Educational Seminars organized by ICG Experts – Focused on the importance of protecting GNSS spectrum
  - 3<sup>rd</sup> Seminar held March 2018 in Argentina



# *Recommendations Related to Interference and Spectrum Protection*

## **Recent Recommendations Adopted by the ICG**

2014	ICG Members to join efforts in ITU-R and WRC-2015 for GNSS spectrum protection from IMT
2014	Evaluate existing and emerging IDM capabilities and consider developing, testing and implementing these or similar capabilities
2014/2017	Crowdsourcing capabilities analysis for IDM
2015/2016/ 2017	UN regional workshops on GNSS spectrum protection and IDM
2015/2016	Campaign of Protection of RNSS operations – GNSS providers and GNSS user community member states promote spectrum protection
2015/2016	UN COPUOS STSC multi-year agenda item focused on National Efforts to protect RNSS Spectrum, and develop IDM capability
<b>2017</b>	<b>Encourage national regulators to use the protection criteria in relevant ITU-R Recommendations</b>



# *Interoperability and Service Standards*

## Timing Workshop held in June 2018 – Focus on GNSS time offsets

- ICG is considering several technical proposals and discussing ways to test multi-GNSS time interoperability
- ICG is looking at ways to improve GNSS time synchronization with UTC

## Performance Standard Template

- Workshop held in May 2018 hosted by Galileo Reference Center in Noordwijk, Netherlands
- “Guidelines” document being developed as a template for all providers to consider when developing their performance standard

## International GNSS Monitoring and Assessment (IGMA)

- IGMA Workshop held in May 2018 in Noordwijk, Netherlands
- Discussions focused on the multi-GNSS monitoring trial project established in 2016 between the ICG and IGS



# *Recommendations Related to Interoperability*

<b>Recent Recommendations Adopted by the ICG</b>	
2011/2012	Open Service GNSS performance parameters, including Definitions and Calculation Methods
2012/2013	Interoperability Workshops with industry
2014/2015	National service monitoring center websites to connect to ICG internet portal
2014/2016	Performance Monitoring Workshops
2015	Joint trial project with IGS to demonstrate a global GNSS Monitoring and Assessment capability (WG-D & S)
2016	<ol style="list-style-type: none"><li>1. Protection from Provider Signal Patents</li><li>2. Workshop to discuss system time and offsets (held in 2017 with WG-D)</li></ol>
2016/2017	2 <sup>nd</sup> Workshop to discuss system time and offsets (held in 2018 with WG-D)
<b>2018</b>	<b>"Guidelines for Developing Performance Standards" as a template for open service performance standards</b>



# ICG-13 Recommendation 13S-2

## IADC MEO/IGSO Study

- **The ICG recommends** that the IADC, in coordination with system providers and WG-S, conduct a study focused on Medium Earth Orbit and inclined Geosynchronous orbit debris mitigation and the current plans of GNSS providers
  - Considering options for GNSS satellites (MEO/IGSO disposal like:
    - Stable Disposal(Graveyard Orbit)
    - Unstable Disposal (eccentricity growth)
    - Active de-orbit (use of solar sails, low thrust propulsion)
  - To analyze for each option for all GNSS (MEO/IGSO) for the next 200 years:
    - Risk of collision with own GNSS satellites
    - Risk of collision with satellites of other GNSS satellites
    - Risk of collision with GEO and IGSO satellites
    - Risk of collision with LEO satellites
- The IADC will be asked to report progress annually to the ICG through WG-S
- System Providers will continue to exchange information on their GNSS orbital debris mitigation plans in WG-S and identify experts to participate in the IADC study





# *Other Important ICG Activities*

## Space Service Volume

- **United Nations booklet “The Interoperable GNSS SSV” – prepared by GNSS Providers through WG-B – published in early 2018 and highlighted at ICG-13**

[http://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace75\\_0.html/stspace75E.pdf](http://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace75_0.html/stspace75E.pdf)

- Outreach efforts continue on benefits of an interoperable space service volume and development of space-based user equipment

## Search and Rescue

- Discussion about compatibility and interoperability of MEOSAR systems

## Precise Point Positioning (PPP)

- Workshop proposed by WG-D focused on multi-GNSS PPP based on plans by regional and global service providers



# *Summary*

- U.S. policy encourages the worldwide use of civil GPS services and cooperation with other GNSS providers
  - **Compatibility, interoperability, and transparency in civil service provision** are priorities
  - Pursued through bilateral and multilateral dialogues
- The ICG, with strong U.S. participation, continues to pursue a **Global Navigation Satellite System-of-Systems** to provide civil GNSS services that benefit users worldwide
  - Priorities include continued focus on spectrum protection, interference detection and mitigation, and transparent provision of interoperable civil services



***THANK YOU !***

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# *Progress at ICG in GNSS Civil Service Provision*

## ✓ Providers Forum

### ✓ Providers Forum System Report

#### ✓ Principles of Compatibility, Interoperability, and Transparency

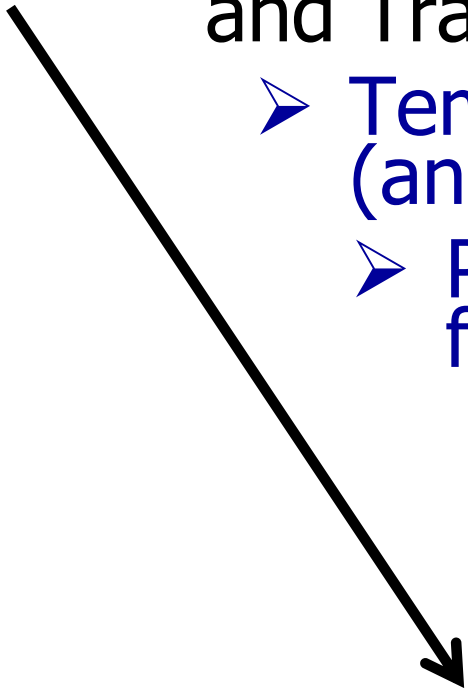
#### ➤ Templates for Performance Standards (and ICDs)

#### ➤ Postulated Performance Standards for future services

#### ➤ ***Service Assurances or Commitments***

#### ➤ Monitoring of service performance

#### ➤ Interference monitoring





# *ICG Meetings*

## **Past ICG Meetings**

- ICG-1: UN Vienna, Austria – November 2006
- ICG-2: Bangalore, India – September 2007
- ICG-3: Pasadena, CA, USA – December 2008
- ICG-4: St Petersburg, Russia – September 2009
- ICG-5: Turin, Italy – October 2010
- ICG-6: Tokyo, Japan – September 2011
- ICG-7: Beijing, China – November 2012
- ICG-8: Dubai, UAE – November 2013
- ICG-9: Prague, Czech Republic – November 2014
- ICG-10: Boulder, CO, USA – November 2015
- ICG-11: Sochi, Russia – November 2016
- ICG-12: Japan – December 2017
- **ICG-13: China – 2018**

## **Future Meetings**

- ICG-14: India – 2019
- ICG-15: UN Vienna, Austria - 2020





# ***E911 ruling related to Multi-GNSS***

- On January 29, 2015 the FCC adopted rules to help emergency responders better locate wireless callers to 911
- The Fourth Report and Order on [Wireless E911 Location Accuracy Requirements](#), did not authorize the use of any non-U.S. satellite signal in conjunction with the 911 system
- Wireless providers seeking to use non-U.S. RNSS satellites for e911 in conjunction with GPS (multi-GNSS) should:
  1. Conduct testing to ensure that operating with multi-GNSS signals does not inadvertently introduce vulnerabilities that could impair e911 performance or compromise data integrity.
  2. Certify that proper authorizations are in place to permit the use of foreign GNSS signals.
  3. Coordinate plans for foreign assisted GNSS signal integration with the Public Safety and Homeland Security Bureau to confirm that signals are interoperable with GPS.
  4. Certify that the devices have been tested to determine their ability to detect and mitigate the effects of harmful interference.





# ***FCC Part 25 Rule Evaluation Criteria & EU Galileo Waiver Request***

- Considerations (criteria):
  1. Grant of a waiver is in the public interest
  2. System complies with United Nations Space Debris Mitigation guidelines
  3. Grant of a waiver is consistent with U.S. international trade and other treaty obligations
  4. Waiver request is limited to receive-only RNSS (which includes positioning) and standard time and frequency satellite services
  5. Operation of the RNSS signals offered by the foreign RNSS system has been found compatible with U.S. government systems operating in the specified RNSS frequency bands
- EU Waiver Request Submitted to State **in 2013**
  - NTIA submitted the EC's request to the FCC, on behalf of the Executive Branch, **in 2015** and recommended granting the request
  - FCC issued a public notice on **06 January 2017** inviting interested parties to comment on the waiver request
    - 13 Comments - closed 21 February 2017
    - 4 Reply Comments - closed 23 March 2017