



U.S. GPS International Activities Update

**National Space-Based Positioning Navigation
and Timing (PNT) Advisory Board: 22nd
Meeting**

Redondo Beach, CA

***Office of Space and Advanced Technology
U.S. Department of State***

05 December 2018



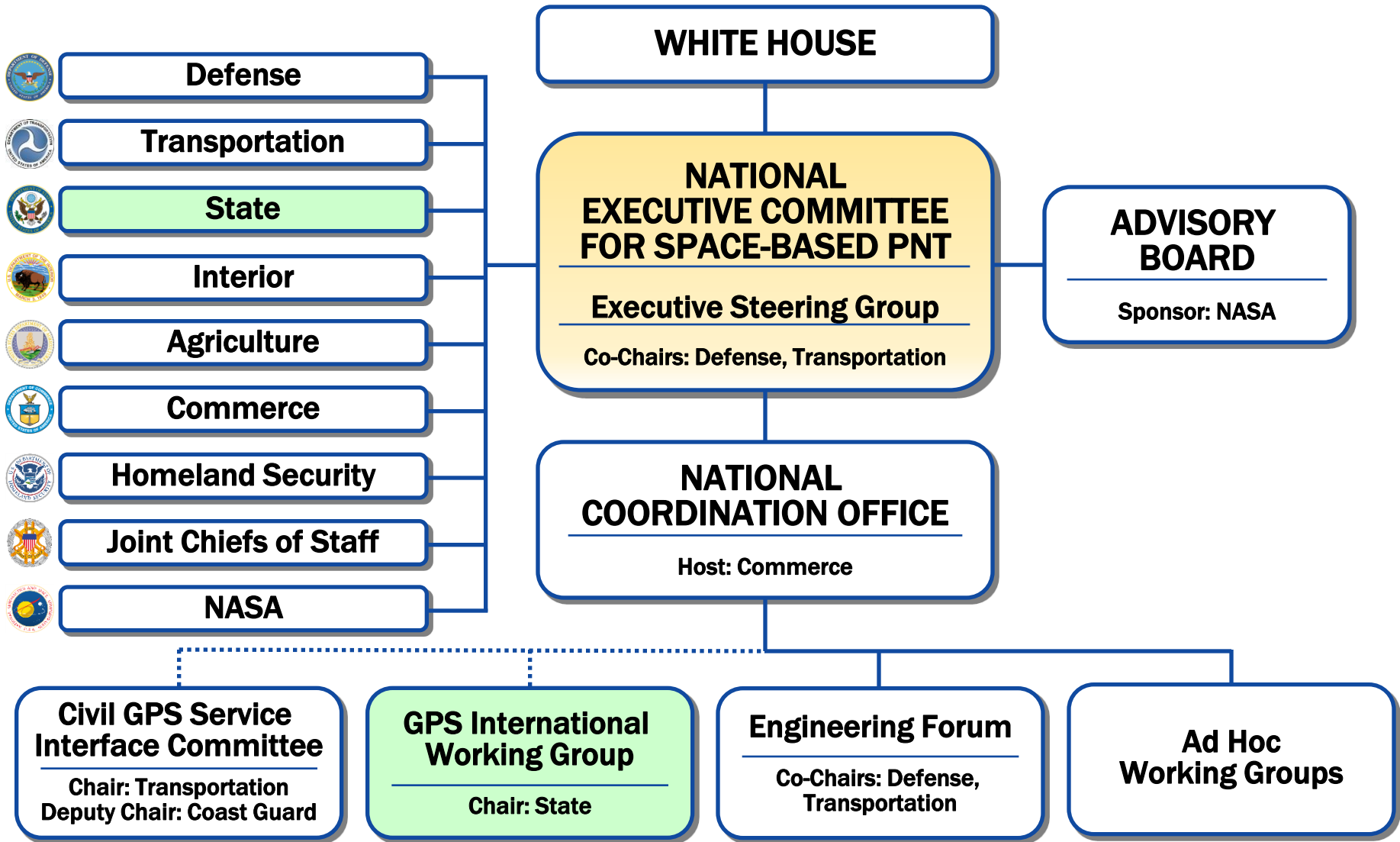
U.S. National Space Policy

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





GNSS: A *Global Navigation Satellite System of Systems*

- 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)

- 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 June 2018



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
- 3 Working Groups established – meet as needed
 - Public Joint Statement on Cooperation 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



Additional Bilateral Dialogues

- *Australia:* Joint Delegation Statement on Cooperation in the Civil Use of GPS in 2007
 - Regular discussions about Australia’s plans for SBAS development
 - U.S.-Australia Civil Space Dialogue just held on November 30
 - Australia became a member of the ICG at the 13th meeting
- *Canada:* Civil GNSS meeting held in Ottawa – November 2017
 - Also included meeting on space weather
 - Next meeting is scheduled for February 2019
- *Republic of Korea:* 2nd bilateral Civil Space Dialogue held in Seoul – April 2016
 - Discussion about Korea’s development of their SBAS
 - Follow-on meeting to take place in 1st half of 2019



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>



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





13th 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





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
 - 3rd 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
2017	Encourage national regulators to use the protection criteria in relevant ITU-R Recommendations



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)

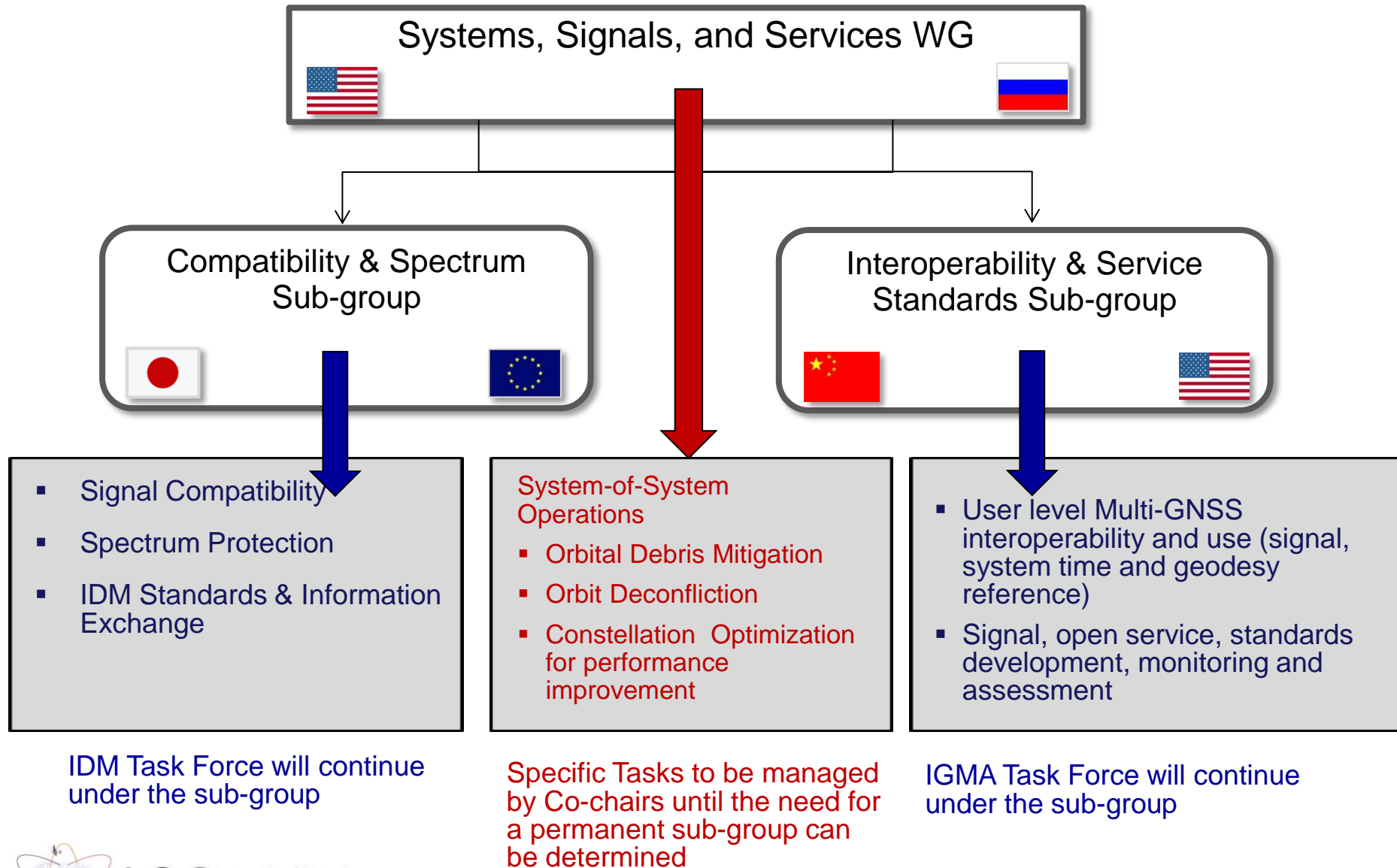
- IGMA Workshop held in May 2018 in Noordwijk, Netherlands
- Discussions focused on the multi-GNSS monitoring trial project established in 2016 between the ICG and IGS



Recommendations Related to Interoperability

Recent Recommendations Adopted by the ICG	
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">1. Protection from Provider Signal Patents2. Workshop to discuss system time and offsets (held in 2017 with WG-D)
2016/2017	2 nd Workshop to discuss system time and offsets (held in 2018 with WG-D)
2018	"Guidelines for Developing Performance Standards" as a template for open service performance standards

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



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

- **Completion of booklet on space service volume by GNSS Providers – published in early 2018**

http://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace75_0.html/stspace75E.pdf

- Continued outreach effort 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



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