



International Committee on  
Global Navigation Satellite Systems

# ICG Working Group on Systems Signals and Services (WG-S) ICG-13 Meeting

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## ***Interoperability and Service Provision Subgroup Report***

***Xi'an, China  
07 November 2018***



ICG International Committee on  
Global Navigation Satellite Systems

# Interoperability & Service Provision Subgroup

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# OPEN SERVICE INFORMATION SHARING



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# Work Plan - Open Service Performance Standards

- Consistent with the principle of transparency in the provision of open services, ***each individual Provider will strive to publish and disseminate all signal and system information necessary to allow manufacturers to design and develop GNSS receivers.***
- The Subgroup will ***develop a template to promote common terminology and definitions in individual GNSS Open Service Signal Specifications*** as published in Interface Standards and Interface Control Documents.
- The Subgroup will ***also develop a template that each individual GNSS provider may consider using in their publication of signal and system information***, the policies of provision, and the minimum levels of performance offered for open services used on the Earth and in outer space (Open Service Performance Standards).



# Proposed Way Forward – from ICG-11 (2016)

- **Part of the Sub-Group, to include representatives from each Provider, will focus on:**
  - developing and updating their Systems' Performance Standards
  - reporting their progress and any problematic issues at WG-S meetings
  - participating in creating a Performance Standard Template for all GNSS considering it as a reference document defining parameters (and calculation methods) all providers agreed on to be used for monitoring and assessment as well as the guidelines for new GNSS or RNSS providers.
- **The collaboration with International GNSS Monitoring and Assessment Task Force should also be continued**



# Sub-Group Members focused on Performance Standards – Dream Team

- Alexey Bolkunov (co-lead), Igor Silvestrov , Sergey Kaplev - Russian Federation
- John Lavrakas (co - lead), Andrew Hansen - United States
- Hillar Tork, Rafael Lucas-Rodriguez, Daniel Blonski, Peter Buist - European Union
- Satoshi Kogure, Masaharu Kugi – Japan
- Jianwen Li, Du Juan - China



# Status of GNSS ICDs and Open Service Performance Standards

	GPS	GLONASS	BDS	Galileo	NavIC	QZSS
Interface Control Documents/ Specifications	✓	✓	✓	✓	✓	✓
	IS GPS 200-H, 705D, 800D	ICD 5.1 for L1&L2 FDMA (2008) ICD 1.0 for L1, L2&L3 CDMA (2017)	ICD 2.1 Open Service signals B1C & B2a (test version)	ICD 1.3	ICD 1.0	IS-QZSS-PNT-001 IS-QZSS-L1S-001 IS-QZSS-L6-001 IS-QZSS-TV-001 (*4 of 5 Svs.)
Open Service Performance Standards	✓	Draft for L1&L2 service is in approval stage	✓	Galileo OS Service Definition Document v1.0 Dec 2016		✓
	SPS PS 4 <sup>th</sup> edition (L1-only)	English Draft Provided to WG	OS PS 1.0			PS-QZSS-001
Web Access	<a href="http://GPS.gov">GPS.gov</a>	<a href="http://GLONASS-IAC.RU">GLONASS-IAC.RU</a>	<a href="http://en.beidou.gov.cn/">en.beidou.gov.cn/</a>	<a href="http://gsc-europa.eu">gsc-europa.eu</a>	<a href="http://irnss.isro.gov.in/">irnss.isro.gov.in/</a>	<a href="http://qzss.go.jp/en/technical/ps-is-qzss/ps-is-qzss.html">qzss.go.jp/en/technical/ps-is-qzss/ps-is-qzss.html</a>

# Current Activities and Progress

- Prepare a draft Performance Standard Guidelines document - **completed**
- Develop definitions (including continuity) and calculation methodologies - **ongoing**
- Consider additional documents that can be issued for optimizing PS creation and monitoring procedures - **ongoing**
- Increase collaboration with IGMA – **Holding monthly joint meetings; held joint workshop in May**





# Roadmap & Scorecard – GNSS Performance Standards Guidelines

Item	Status	Comments
Recommend draft content for Performance Standards	Complete	Draft Performance Standard Template prepared and provided in 2012 (DDST-2012)
Draft Calculation Methods applicable with DDST-2012	Complete	Draft Calculations Methods Document prepared and provided in 20145
Collect inputs on minimum common set	Complete	Survey conducted in Dec 2016
Finalize minimum common set	Complete	Resolved at Sep 2017 meeting
Each GNSS/RNSS provide definitions for terms	In progress	Ongoing. Discussed on monthly teleconference calls (MTC)
Each GNSS/RNSS identify calculation methods	In progress	Ongoing. Discussed on MTCs
Finalize set of definitions	In progress	Ongoing
Issue Performance Standard Guideline Document (“Guidelines for Developing Performance Standards”)	Complete	Recommendation for WG-S and ICG-13
Set of Calculation Methods used in PSs and SDDs	Under discussion	To be discussed on MTCs and ICG-13
Hints and Tips on PSs and SDDs (or their new revisions) development and parameters estimation and evaluation	Under discussion	To be discussed on MTCs and ICG-13
Calculation methods Guidelines	Under discussion	To be discussed on MTCs and ICG-13
Further tasks and challenges, including maintaining of issued documents	Under discussion	To be discussed on MTCs and ICG-13



# Proposed Recommendation for ICG-13

## Performance Standard Template

Recognizing that WG-S set a goal to develop a template for individual GNSS providers to consider in defining open service performance, and to reach consensus on a minimum common set of parameters to be implemented in each performance standard; Also recognizing that the Performance Standards Guideline Document (“Guidelines for Developing Performance Standards”) has been developed and thoroughly reviewed by WG-S members in a deliberate and steady process over several years, and developed a document that can help guide service providers in the development and revision of their performance standards.

### **ICG Recommendation:**

The ICG recommends adoption of the “Guidelines for Developing Performance Standards” document as a template for all providers to consider when developing their performance standard (or their revisions or updates).



# Next steps

- Continue to hold monthly meetings
  - Discuss and resolve questions on definitions and calculation methods
- Issues requiring further discussion
  - Maintenance of documents developed by DT (ICG) including Guidelines document after their approval
  - Calculation Methods Guidelines
  - Hints and Tips in PS and SDD development and PS and SDD parameters calculation and evaluation

## **Performance Standards Workshop**

**To be hosted by the UN in Vienna, in conjunction with the ICG-13 Planning Meeting and Providers' Forum Meeting in June 2019**



# PERFORMANCE MONITORING



# IGMA Task Force

- Co-Chairs:
  - Satoshi Kogure, CAO, Japan
  - Shuli SONG, China
  - Allison Craddock, IGS
- Members:
  - Igor Silvestrov, Alexey Bolkunov, Russia
  - LI Jianwen, China
  - Yoshihiro Iwamoto, Japan
  - Karen Van Dyke, John W. Lavrakas, Andrew J. Hansen, United States
  - Hillar Tork, Werner Enderle, Peter Buist, European Union



# Work Plan – Service Performance Monitoring

- ***The Providers Forum has agreed*** to consider the development and discussion of proposals ***to widely monitor the performance of their open signals*** and provide timely updates to users regarding critical performance characteristics such as timing accuracy, positioning accuracy and service availability
- ***The Working Group***, through the Interoperability and Service Standards Subgroup, ***will support this activity by translating open service performance standards into parameters for multi-GNSS monitoring.*** Recommendations on the necessary monitoring infrastructure and organizational approaches may be made to Providers and international organizations in coordination with other ICG working groups as necessary and appropriate



# Existing Civil Service Monitoring Information Sources

Name	Country	URL
Information Analysis Center	Russia	<a href="http://glonass-iac.ru/en/">http://glonass-iac.ru/en/</a>
US Coast Guard Navigation Center William J. Hughes Technical Center WAAS Test Team	U.S.	<a href="http://www.gps.gov/">http://www.gps.gov/</a>
European GNSS Service Centre	EU	<a href="http://www.gsc-europa.eu/">http://www.gsc-europa.eu/</a>
CSNO TARC	China	<a href="http://www.csno_tarc.com">http://www.csno_tarc.com</a>
QZ-vision	Japan	<a href="http://sys.qzss.go.jp/dod/en/">http://sys.qzss.go.jp/dod/en/</a>
	India	
IGS portal	IGS	<a href="http://igs.org/">http://igs.org/</a>



# 2. IGMA ICG-IGS joint Trial Project

## ➤ Basic Idea of the Trial Project

Phased Approach was adopted

Initial phase of the Trial Project

- Post Processing
- System level performance monitoring with limited parameters for each single constellation

+ User level performance monitoring

+Real-time Processing

+ Assessment function

+ multi-GNSS performance monitoring and assessment

Future Expansion





# 3. IGMA Activities and Progress

## Providers' Nomination Status SUMMARY

Country	Signed CL	Category	Organization Name
Russia	X	MAC	PNT Center in TSNIMASH
		Monitoring site(2)	Klyuchi, Korolyov
		Data Center	PNT Center in TSNIMASH
U.S.	X	MAC	DOT/Volpe Center
		Monitoring site(6)	Boston, Honolulu, Los Angeles, Miami, Juneau, and Merida
		Data Center	USCG
EU	X	MAC	GSA/Galileo Reference Centre
		Monitoring site	To be provided
		Data Center	To be provided
China	X	MAC	RISM/NTSC
		Monitoring site(3)	Shanghai, Lhasa, and Urumqi
		Data Center	TARC/CSNO
Japan		To be provided	To be provided

# IGMA and Performance Standard WS

- Date: May 14-15, 2018
- Venue: Galileo Reference Centre (GRC), Noordwijk, The Netherlands
- Participants: GPS, GLONASS, Galileo, BDS and QZSS, IGS representatives around 30 attendees
- Agenda;
  1. Methodologies for agreed 4 params in TP ToR
  2. Data format
  3. Continuity Definition
  4. Service Definition Document
  5. IGMA TF meeting
  6. PS “Dream Team” meeting

} IGMA Part

} PS Part

} Closed session



# Workshop Conclusion

- Need further discussion
  - TF members agreed to continue monthly tereconf
  - Each parameter will be discussed and to make common definition and updated ToR Annex
- Next short-term goal is to update ToR before ICG-13
- No new recommendation at ICG-13 related to IGMA



# Next Steps

1. Speed-up activities!
2. Improve agreement
  - Remain with centre of mass assumption for broadcast
  - Make sure all differences become well below the 0.1 m level
3. Obtain information on broadcast reference points
  - Preferably in Antex format
  - Repeat exercise with offsets
    - Satellite attitude also comes into play

Goal: to achieve this by April 2019

**IGMA Workshop – Held in Conjunction with PS Workshop  
To be hosted by the UN in Vienna, in conjunction with the ICG-13  
Planning Meeting and Providers' Forum Meeting in June 2019**



# INTEROPERABILITY



# Work Plan - Interoperability

- As with the ***principle of compatibility, the principle of interoperability and its definition was adopted at the first Providers Forum meeting and updated at the third meeting.*** Consistent with this principle and its definition, the working group, through a subgroup co-chaired by the United States and China, will consider the perspective of various user applications and equipment manufacturers, and will:
  - ***Continue efforts to interact with industry experts and user community representatives in order to solicit input*** on improving the overall open service provided by global and regional navigation satellite systems in a manner that allows for effective multi-GNSS use at the user level;
  - ***Maintain a focus on the open service signal development*** and broadcast plans of the system providers; and,
  - In cooperation with Working Group D, ***consider the role of system time and geodetic reference frames in enabling interoperable multi-GNSS service***



# ICG-12 RECOMMENDATION 12S-3

## 2<sup>nd</sup> System Time Workshop

- The workshop participants concluded that all System Providers should continue to improve the alignment of their individual system times with UTCk to benefit users
- It was also recognized that currently, the only GNSS to GNSS system time offsets (G2GTOs) that are being broadcast are relative to GPS system time
- The participants identified a number of possible approaches for system time interoperability, including:
  1. System time offsets are calculated at the user receiver level – No Action from System Providers
  2. System Providers broadcast additional GNSS to GNSS system time offsets (G2GTOs)
  3. The development of a GNSS Ensemble time, such as the MGET proposal, with the broadcast of individual system time offsets relative to the ensemble time
- ***Recommendation: Conduct a second System Time Workshop in 2018 in coordination with WG-D***

**SUCCESSFULLY COMPLETED – 20 JUNE 2018**



# Next Steps

**WORKSHOP ACTION:** Participants are encouraged to reach consensus on a summary of the outcomes from the 20 June 2018 Timing Workshop and present the findings to the WG-S at its next meeting.

**[Potential Interoperability Subgroup Meeting to be held in early 2019 to discuss the agenda for a Third timing Workshop]**





End of slides