



International Committee on  
Global Navigation Satellite Systems

# Performance Standards Dream Team – Report to ICG

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***Xi'an, China***  
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ICG International Committee on  
Global Navigation Satellite Systems

# 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



# 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 2018**



# Background

- ICG-6 (2011) WG-A(S) Recommendation 4.1 – develop a template individual GNSS providers consider when defining open service performance.
  - Goal: reach consensus on minimum common set of parameters
  - Each system use its own definitions and calculation methods
- October 2012 – WG-A(S) prepares draft template (V2)
- ICG-9 (2014) – Draft Calculation Methods for Template
- ICG-10 (2015) - WG-A(S) agrees not to have common document, but asks providers to share information
- ICG-11 (2016) “Dream Team” formed at ICG-11 in Sochi
- 2016 Survey conducted of DT members – elements to be included in Performance Standard/Service Definition
- October 2017 – Guidelines for Developing Performance Standards (draft) issued, updated June 2018 / to be adopted on November 2018 ICG-13
- **Performance Standard (PS) ~ Service Definition Document (SDD)**



# Performance Standards Workshop, Noordwijk

- Open session (Noordwijk)
  - Session on Continuity
    - Presentations by China, Europe, U.S., and Russia
    - Discussion led by Daniel Blonski
    - Next steps: the continuity leads to elaborate a proposal for discussion at the monthly meetings
  - Presentations on Service Definition Documents
    - Presentation on PS Guidelines document
    - Presentations on GPS, GLONASS, BeiDou, Galileo, QZSS
  - Technical discussion on dual frequency and range rate and acceleration, led by Sergey Kaplev



# Performance Standards Workshop, Noordwijk & Monthly Teleconference Calls

- Closed session (Noordwijk)
  - Discussion on Guidelines document, with focus on the Continuity section
  - Agreement to finalize the Guidelines and submit for approval by ICG at ICG-13 in Xi'an
    - » China representative (Li Jianwen) absent, so recommendations sent separately to him by email for approval
  - Agreement to meet by teleconference call June 14
- Subsequent Monthly Teleconference calls
  - Final review of Guidelines document
    - » Europe submitted a number of changes which are reviewed and resolved
    - » All members approve the final document and the recommendation to the ICG



# 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



# Performance Standards Guideline Document – Contents (1/4)

At a minimum, the Performance Standard should contain sections for each of the following:

**Purpose.** Description of the purpose of the document, describing why it is being produced and what it intended to provide.

**Scope.** Description of the scope of the document and what it is intended to cover given the state of the existing GNSS/RNSS service. Examples are range accuracy and availability, positioning and timing accuracy and availability, and continuity.

**Service Definition.** Definition of the service that is being provided, such as open service or standard positioning service.

**GNSS/RNSS System Overview.** Description of the GNSS/RNSS system from a high-level view, its components and capabilities.

**Service Characteristics and Minimum Usage Assumptions.** Description of the characteristics of the signal in space service, including signal interface specification requirements (including signal and message structure), performance characteristics (including signal health settings), and user equipment assumptions.





# Performance Standards Guideline Document – Contents (2/4)

## Minimum sections (continued)

**Key Terms and Definitions.** Identification and definitions for the key terms and parameters used in the Standard.

**References.** Detailed references to any of the documents mentioned in the Standard.

**Performance Standard/Service Definition.** Describe the system service commitments for parameters in each of the following categories.

Satellite domain

Range domain

Position domain

Time Domain

Continuity

Other optional standards

[**Key**] parameters - required to be included in the Standard

[*Optional*] parameters - recommendations for consideration, and may or may not be included.



# Performance Standards Guideline Document – Contents (3/4)

## Satellite domain

Slot Availability (maintenance of satellites to orbital slot parameters) [*Optional*]

Terrestrial Service Volume Coverage [**Key**]

Space Service Volume Coverage [*Optional*]

## Range domain

Range Accuracy (all signals) [**Key**]

Range Accuracy (by Age of Data) [*Optional*]

Range Integrity [*Optional*]

Range Availability [**Key**]

Range Rate Accuracy [*Optional*]

Range Acceleration Accuracy [*Optional*]

Range Rate Integrity [*Optional*]

Range Acceleration Integrity [*Optional*]



# Performance Standards Guideline Document – Contents (4/4)

## **Position domain**

Section applies if position is provided as a service..

DOP Availability [**Key**]

Position Accuracy (RMS Global Average & Worst Site) [*Optional*]

Position Availability [**Key**]

## **Time domain**

Time transfer accuracy [**Key**]

UTC offset time dissemination accuracy [**Key**]

## **Continuity**

Signal in Space Continuity [*Optional*]

## **Other elements**

Broadcast Polar Motion [*Optional*]

GNSS/RNSS Time Offset [*Optional*]

UT1-UTC Offset [*Optional*]

Carrier Phase Coherency [*Optional*]



# 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 (1/2)

- Performance Standards Guidelines document submitted to WG-S who approved to forward to ICG-13
  - Recommendation – approve Guidelines at ICG-13
- DT to hold workshop in Spring 2019, hosted by United States.
- Continue to hold monthly meetings
  - Discuss and resolve questions on definitions and calculation methods
- Issue
  - Maintenance of documents developed by DT (ICG) including Guidelines document after their approval
  - DT will present some ideas on this to WG-S



## Next steps (2/2)

- Calculation Methods Guidelines
  - Set of calculation methods from existing PSs and SDDs provided by Providers representatives
  - Harmonized (in non-clear form for now) set of Calculation methods applicable to any PS and SDD
- Hints and Tips in PS and SDD development and PS and SDD parameters calculation and evaluation
  - Probably developed in future into Evaluation Guidelines



# Roadmap and General Plan

