The IGS/IGMA Monitoring Pilot Project

Urs Hugentobler[1], Tim Springer[2] , Satoshi Kogure[3]

[1]Technische Universität München
[2]ESA/European Space Operations Centre
[3]National Space Policy Secretariat

IGS Workshop
Paris, July 03, 2017

Why Monitoring?

- GNSS landscape is undergoing a fundamental transition

- New constellations, new signals, new frequencies, new services

- Benefits by using all systems as a *single system of systems*

- User need: Homogeneous common monitoring of all systems

- Monitoring of system status and broadcast performance using *identical algorithms and procedures* for all systems

- Monitoring by international organization based on agreed-on procedures, overarching monitoring of individual systems by the system providers

GPS   GLONASS   Galileo   BeiDou   QZSS   IRNSS

IGS WS, Paris, 03 July 2017

IGMA Task Force

- IGMA (International GNSS Monitoring and Assessment) Task Force was established within Working Group A of ICG (International Committee on GNSS) at ICG-6 in Tokyo 2011.

- Co-chaired by ICG and IGS, members are system provider representatives

- Tasks:

  - Determine *service parameters* to monitor and determine gaps in current and planned monitoring and assessment methodologies

  - Propose *organizational approach* avoiding duplication of existing activities, i.e., using existing infrastructure.

  - Explore methods to *disseminate results*

- ICG urged IGS to commence a Pilot Project and monitoring and assessment activities to join the IGS Pilot Project

IGS MGEX Tracking Network

IGS

June 2017

- 198 GAL
- 147 BDS
- 98 QZSS
- 204 total
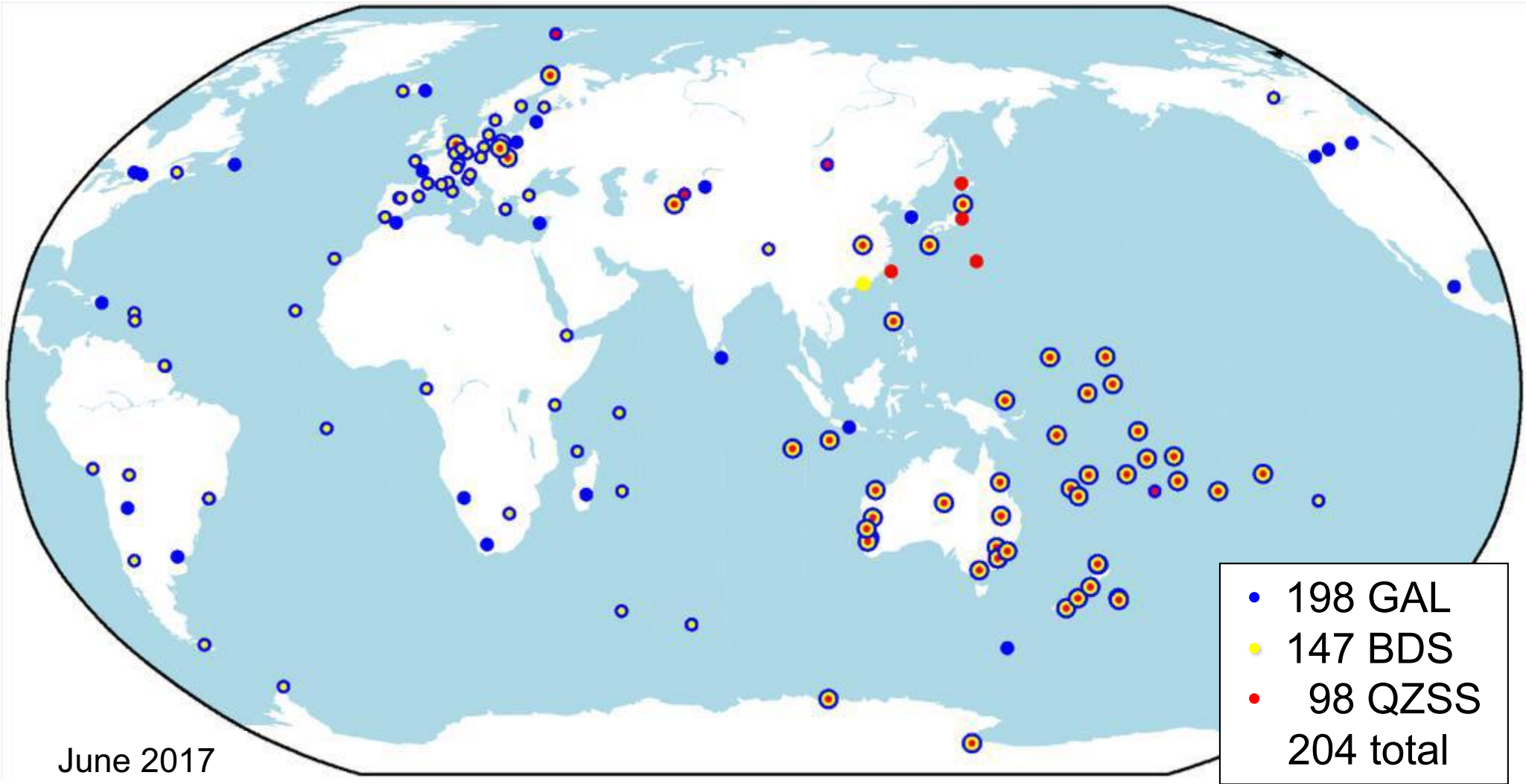
IGS IGMA Joint Pilot Project CfP

- Terms of Reference for IGMA-IGS Joint Trial Project prepared

- Two parallel CfP – IGMA and IGS – issued in Summer 2016

- IGS Call for Participation seeking for:

  - Observing sites

  - Data Centers

  - Monitoring Analysis Centers

  - Monitoring Analysis Center Coordinator

- Monitoring Working Group and Pilot Project installed within IGS at December 2016 GB meeting

Tasks of IGS PP

- Contribution to Joint IGS-IGMA Trial Project

- Monitoring of all GNSS with *same methodology*:
  GPS, GLONASS, Galileo, BeiDou, QZSS; later also NAVIC

- Start with restricted set of monitoring parameters:
  - Broadcast orbits and clocks
  - SIS User Range Error
  - SIS UTC Offset Error
  - PDOP for defined sites

- Initially offline, with target to near-realtime and realtime

- *Common understanding* of monitoring parameters and algorithms

- Assessment of *alternative monitoring* parameters and algorithms,
 procedures for combination

- Evaluate user needs

IGS IGMA Proposals

1 Richard Langley, University of New Brunswick, Canada

2 Rafal Sieradzki, Pawel Wielgosz, University of Warmia and Mazury in Olsztyn, Poland

3 Sungpil Yoon, Kevin Choi, National Geodetic Survey, Silver Spring, USA

4 Anna Maria Baron Isanta, Joel Grau Bellet, Ernest Bosch Llopart, Institut Cartogràfic i Geològic de Catalunya, Barcelona, Spain

5 Carey Noll, CDDIS, GSFC, NASA, Greenbelt, USA

6 Joao Monico, Universidade Estadual Paulista, Presidente Prudente, Brasil

7 Jan Douša, Pavel Václavovic, Pavel Novák, Research Institute of Geodesy, Topography and Cartography, Onrejov, Czech Republic

8 Peter Steigenberger, Oliver Montenbruck, Deutsches Zentrum für Luft- und Raumfahrt, Oberpfaffenhofen, Germany

9 Furqan Ahmed, Srinivas Bettadpur, The University of Texas at Austin, USA

10 Yanming Feng, Charles Wang, Queensland University of Technology, School of electrical Engineering and computer science, Brisbane, Australia

11 Zhiguo Deng, GFZ German Research Centre for Geosciences, Potsdam, Germany

12 Yuki Hatanaka, Geospatial Information Authority of Japan (GSI), Tsukuba, Japan

13 Werner Enderle, ESA/ESOC, Darmstadt, Germany

14 Qile Zhao, Min Li, Chuang Shi, Wuhan University, GNSS Research Center, China

15 Junping Chen, Shanghai Astronomical Observatory, Tonji University, China

16 Irma Rodriguez Perez, Guillermo Tobias Gonzalez, GMV, Madrid, Spain

17 Ahmed Mohamed Ali, Dubai Municipality, United Arab Emirates

IGS IGMA Proposals
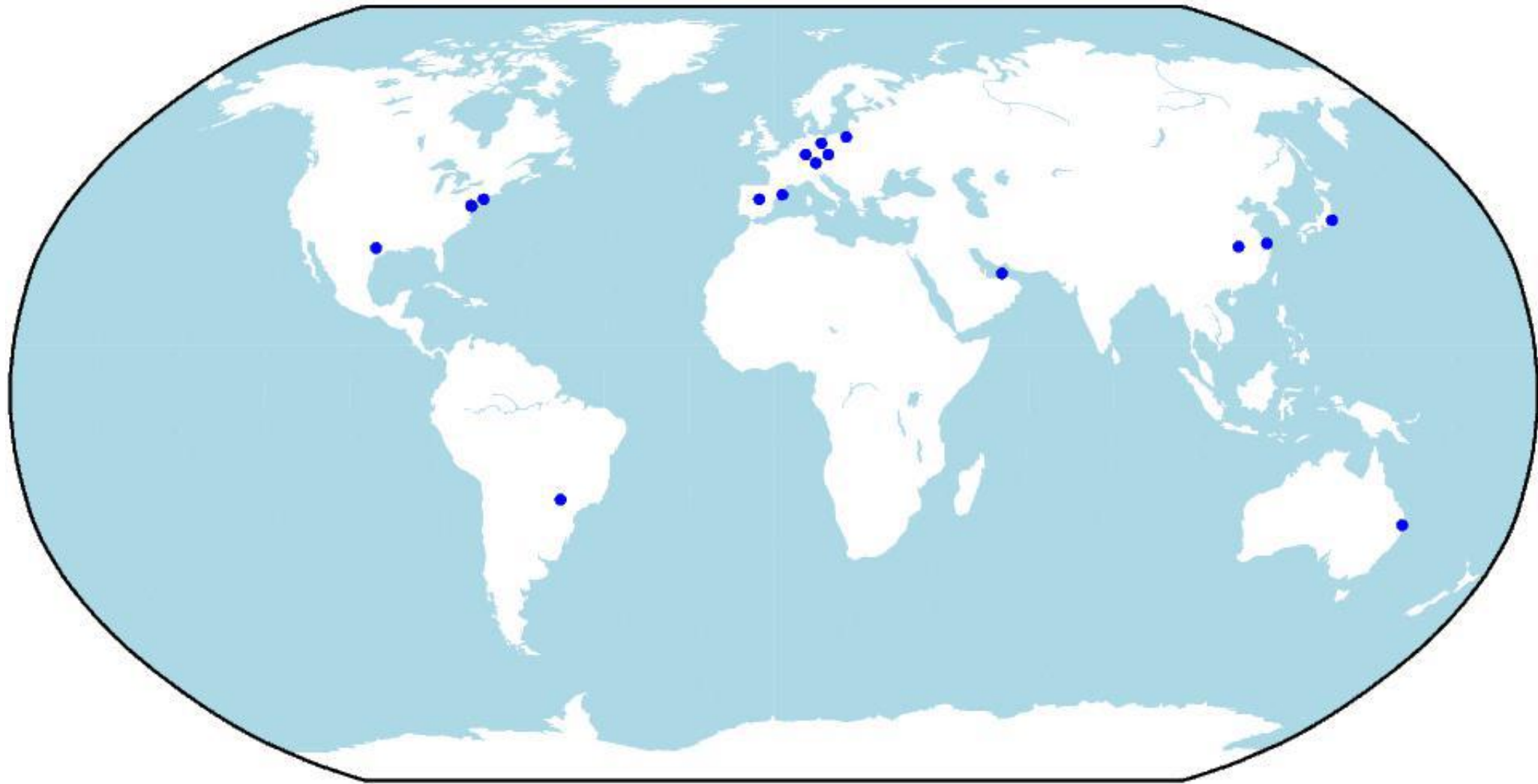
IGS IGMA Proposals

Proposal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sites	X	X	X	X		X			X			X	X	X	X		
Data Center				X	X								X	X			
Analysis				X		X	X	X	X	X	X		X	X	X	X	X
parameters																	
• Broadcast orbits				x			x	x	x	x	x		x	x	x	x	x
• Broadcast clocks				x			x	x	x	x	x		x	x	x	x	x
• SIS User Range Error				x			x	x	x	x			x	x	x	x	x
• SIS UTC Offset Error				x					x	x			x	x	x	x	x
• PDOP for defined sites				x		x	x		x	x			x	x	x	x	x
for																	
• BDS				x			x	x		x	x		x	x	x	x	x
• GALILEO				x		x	x	x	x	x			x	x	x	x	x
• GLONASS				x			x	x	x		x		x	x	x	x	x
• GPS				x		x	x	x	x	x	x		x	x	x	x	x
• QZSS							x			x	x		x	x	x	x	x
ACC													X	X			

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Organization, Schedule

- Monitoring Analysis Center Coordinator: Tim Springer, ESOC/ESA

- Website for WG and PP and mailing list set up at IGS CB

- Kickoff at IGS Workshop in July 2017

- Termination of PP if

  - PP is able to monitor desired parameters and to generate publicly available useful products,

  - processes are defined for defining new parameters and for registering new Analysis Centers,

  - Organizational structure within or outside IGS is established for operating a GNSS Monitoring and Assessment Service,

  - IGMA or IGS is ready to implement a fully operational monitoring service or determined that such a service is not feasible.

Prerequisites and First Steps

Required:

- Routinely available IGS Multi-GNSS orbit and clock products

- Satellite and operations information from system providers, e.g. PCO

- Availability of complete broadcast information for all GNSS

- Traceability of time of first reception of broadcast information within network

Steps:

- Review of available orbit and clock solutions for defining reference solutions, review available tools

- Prepare raw bits navigation message data base supporting all GNSS and extend RINEX standard for decoded navigation messages including non-standard data broadcast

- Development and comparison of algorithms and tools for SIS User Range Error and PDOP

Conclusions

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- CfP for Joint IGMA-IGS Pilot Project for GNSS Monitoring and Assessment was issued

- 17 groups are ready to participate within the IGS, about half are new

  - 10 providing monitoring stations

  - 4 providing data center capabilities

  - 12 providing analysis center capabilities

- Monitoring Analysis Center Coordinator: Tim Springer, ESOC/ESA

- Initial tasks:

  - Identification of reference solutions

  - Preparation of complete and traceable nav message data base

  - Development and comparison of monitoring algorithms and methodologies, discuss exchange formats

- Kick-off at Workshop, first results by Dec 2017
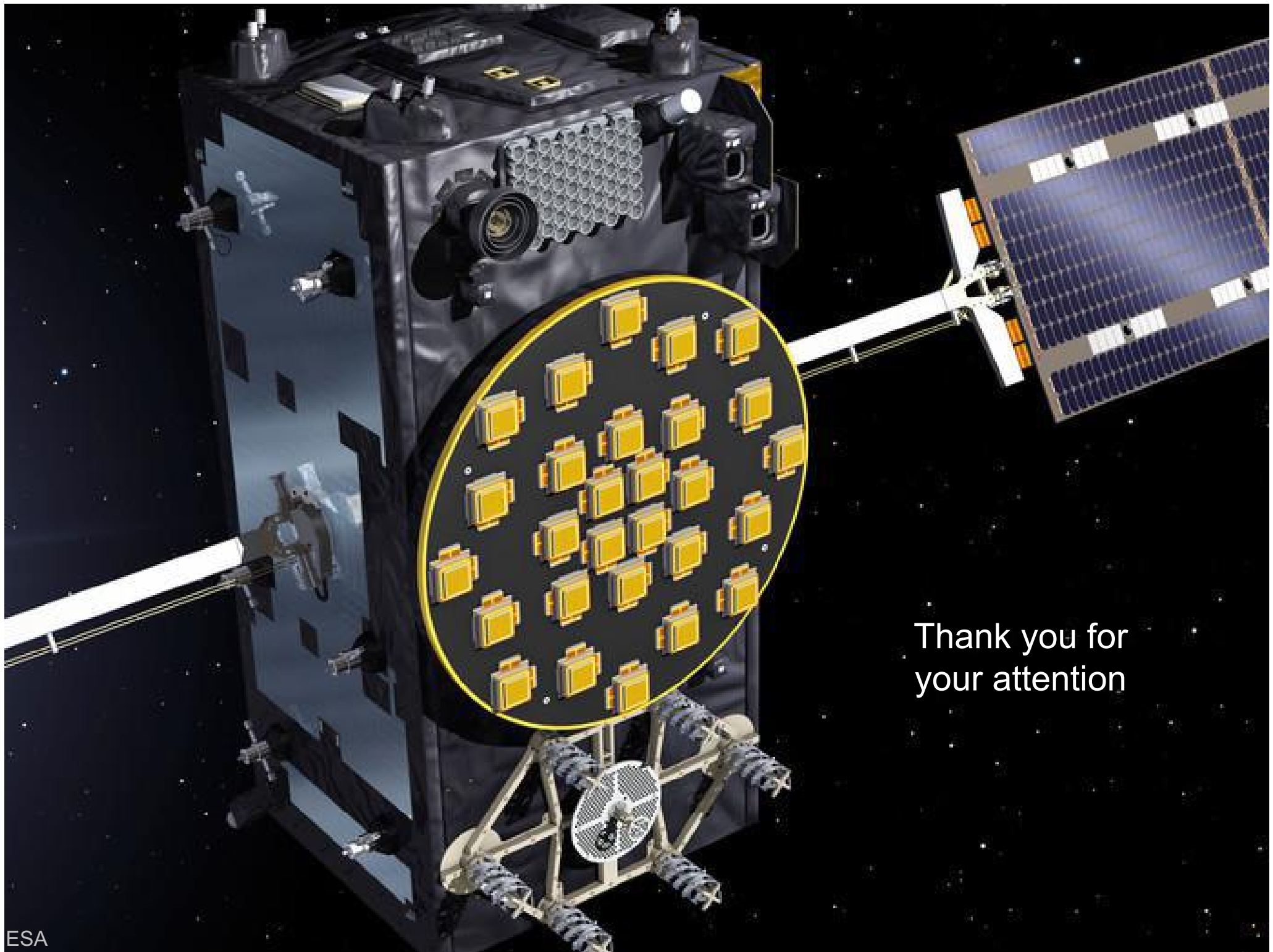
Thank you for your attention

ESA