

GNSS Space Service Volume – User Perspective

Prof. Dr.-Ing. Werner Enderle
Dr. Erik Schoenemann

ESA/ESOC

Munich Summit 2017
Session: GNSS Space Service Volume
2017-03-16, Munich, Germany

Interoperable GNSS SSV – Users Perspective



Benefits to User - Technology Aspects

- Enabler for new mission-and service concepts
 - Navigation for low thrust profiles for raise of Orbit altitude (e.g. LEO -> GEO)
 - Relative Navigation for Satellite Formation Flying
 - GEO co-location, more satellites in a box
 - Earth and Space Weather prediction
 - New science missions
- Development of GNSS Receiver core technology, applicable for a variety of missions
- Use of multiple antennas provides the capability for determination of Orbit, precise Time and Attitude, based on only one sensor and all of this information is available on-board
- Impact on avionics architecture, use of same sensor concept for a wide range of mission types from LEO to GEO and beyond

Benefits to User - Performance Aspects

- Visible number of GNSS satellites above LEO altitude allows for nearly continuous on-board generation of Position, Velocity and Time (PVT)
- Improved relative geometry between GNSS and space User results in higher accuracy Orbit Determination for Users
- Availability of multi-frequencies, multi-signals and multi constellations allows the development of new positioning concepts/algorithms tailored towards specific mission needs
- Development of new improved Precise Orbit Determination (POD) concepts with increased accuracy for
 - Absolute and relative POD (e.g. Formation Flying)
 - on-ground and also on-board implementation
 - New algorithms can rely more on observations rather than on dynamic modelling

Interoperable GNSS SSV – Users Perspective



Benefits to User – Operational Aspects

- Development of new operations concepts with reduced Ground interaction
- Increase of on-board autonomy will request new Ground Operations concepts
- Increase of robustness of spacecraft navigation and operations, due to the fact that the GNSS receiver is not depending on only one specific GNSS
- Ground Segment - standardised operational concept for spacecraft navigation for multi mission scenario from LEO to HEO
- Increase in spacecraft operations resiliency

ESA Activities related to Interoperable GNSS SSV – User Perspective



ID	Activity	Objectives	Initiator	Status
1	Various ESA studies related to the use of GNSS for support to Lunar Missions	Identification of GNSS receiver requirements and architectural design	ESA-ESTEC	Started in 2011
2	AGGA4 (Advanced Galileo and GPS ASIC) – GAMIR Space receiver development (multi constellation, multi freq.)	Aimed to develop and qualify an EM version of receiver	ESA-ESTEC	Start in 2012 Completed in 2015
3	GNSS Space Service Volume Extension – Phase 1	Impact analysis and identification of technology and operational drivers	ESA-ESOC	Started in 2016
4	GNSS Space Service Volume Extension – Phase 2	Detailed Req identification and development of new POD concepts for GNSS SSV and beyond	ESA-ESOC	Start in 2018
5	On-Board Precise Orbit Determination – New POD Concepts	Development of new on-board POD concepts	ESA-ESOC	Started in early 2017
6	Next Generation of Space Receiver – AGGA5	Identification of new Requirements – multi constellation	ESA-ESTEC	Start expected in 2017

