COSPAR's contribution to the Scientific Application of GNSS

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Committee on Space Research

5-th Meeting of the International Committee on Global Navigation Satellite Systems

Turin, Italy, 18-22 October 2010

COSPAR – Committee on Space Research

- Created by ICSU in 1958
- First Space Science Symposium in Nice in January 1960
- Interdisciplinary scientific organization
- COSPAR's objective is to promote an international scientific research in space, open to all scientists
- All kinds of research carried out with the use of space means (including balloons)
- Members: 45 countries and 13 Intern. Scientific Unions

Activities

- Biennial Scientific Assemblies
- Journal Advances in Space Research
- COSPAR Information Bulletin – Space Research Today
- Capacity Building Workshops
- Colloquia and Symposia,
- Participation in the UN and other intergovernmental organizations on space research
- Promotion of large international collaborative programs and projects of space research

COSPAR Scientific Commissions

- SC A on Space Studies of the Earth's Surface, Meteorology and Climate
- SC B on Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System
- SC C on Space Studies of the Upper Atmospheres of the Earth and Planets Including Reference Atmospheres
- SC D on Space Plasmas in the Solar System, Including Planetary Magnetospheres
- SC E on Research in Astrophysics from Space
- SC F on Life Sciences as Related to Space
- SC G on Materials Sciences in Space
- SC H on Fundamental Physics in Space

COSPAR Panels

- Technical Panel on Satellite Dynamics (PSD)

- Panel on Technical Problems Related to Scientific Ballooning (PSB)
- Panel on Radiation Belt Environment Modelling (PRBEM)
- Panel on Space Weather (PSW)

Panel on Satellite Dynamics

- Responsible for orbital problems
- Discussion of GNSS during scientific sessions:
- In 2006 Beijing 15 papers
- In 2008 Montreal 17 papers
- In 2010 Bremen 14 papers
- Topics: GNSS orbits, LEO orbits, geodynamics
- In charge of collecting the information from all COSPAR groups and presentation to ICG

ICG/COSPAR Meeting in Montreal

- Associated with the 37th COSPAR Scientific Assembly the ICG Expert Meeting on GNS Systems and Services has been held in Montreal, July 15, 2010
- Prof. R.-M. Bonnet, COSPAR President, welcomed the cooperation, stressing scientific value of GNSS

COSPAR Colloquium

- 2nd International Colloquium - Scientific and Fundamental Aspects of the Galileo Programme, 14 - 16 October 2009, organized at University of Padova
- Organized for commemoration of Galileo Galilei discovery of Jupiter's moons
- Organizers: ESA, University of Padova and COSPAR.
- LOC Chairman - Prof. Cesare Barbieri

Objectives of the Colloquium

- The purpose of this colloquium was to review the various possibilities to use navigation satellites such as Galileo for scientific purposes, and to investigate how these scientific requirements can contribute to make the most of the present systems, and define their future evolutions.

Topics of the Colloquium – Earth Sciences

1. Geodesy
2. Geodynamics / Earth rotation
3. Global and regional Tectonics
4. Reference Frames
5. Ionosphere / Space Weather
6. Troposphere / Meteorology
7. Atmospheric tomography
8. Earthquakes
9. Gravity field
10. Oceanography
11. Remote sensing / GNSS reflectometry

Colloquium conclusions – Earth Sciences

In Earth Sciences geodesy and geodynamics are the fields making most use of the GNSS data. With the new GNSS systems in sight, in particular Galileo, the accuracy of modelling of the dynamical processes of the solid Earth can be improved by a factor of 10, leading to better understanding and prediction of the geophysical phenomena. Another problem of the modelling of the fast changing processes in the ionosphere and the troposphere is better solved through continuous tracking of the growing number of satellites using tomography solution to the state of the atmosphere. New techniques in reflectometry are also developing for remote sensing research of the ocean surface.

Topics of the Colloquium – Physics

1. Space-Time symmetries
2. Fundamental constants
3. Relativistic reference frames
4. Equivalence Principle
5. General Relativity
6. Astrometry, VLBI, Pulsar Timing
7. Atomic physics for clocks
8. Astronomy at the quantum limit
9. Quantum non-locality and de-coherence

Colloquium conclusions – Physics

Physics Session was dominated by problems of relativity. As a matter of fact, the GNSS constellation is probably the best practical example of the four- dimensional space-time. Measurements are in time domain, while the results – the position and velocity vector – are in the Euclidean space. Therefore, practical application of the relativity frame is in the case of GNSS possible and useful. Taking into account the high precision of the time scale and time measurements, this technology enables tests of relativity as well.

Topics of the Colloquium – Metrology

1. Atomic Clocks (Optical and Maser)
2. Galileo timing system
3. Time scales and offsets
4. Inter-satellite links
5. Precise Orbit determination
6. Signal propagation aspects

Colloquium conclusions – Metrology

Metrology of time is the critical issue of GNSS. The background of timing metrology in modern astrometry, new concepts of clocks, like optical pumping and cold atom clocks were presented and discussed. New methods of time transfer including laser signals were also presented. Special attention was given to the report about positive performance of the on-board clocks of the Giove B satellite. One of which is the Passive Hydrogen Maser (PHM) clock, the only hydrogen maser space qualified.

Effects of the Colloquium

- 102 papers presented
- ESA Galileo Science Opportunity Document prepared
- Special Issue of the Advances in Space Research in preparation: 53 manuscripts delivered, 27 accepted, other in review procedure.
- First volume planned in January 2011, Editor Dr. P. Willis

Unforgetable impressions

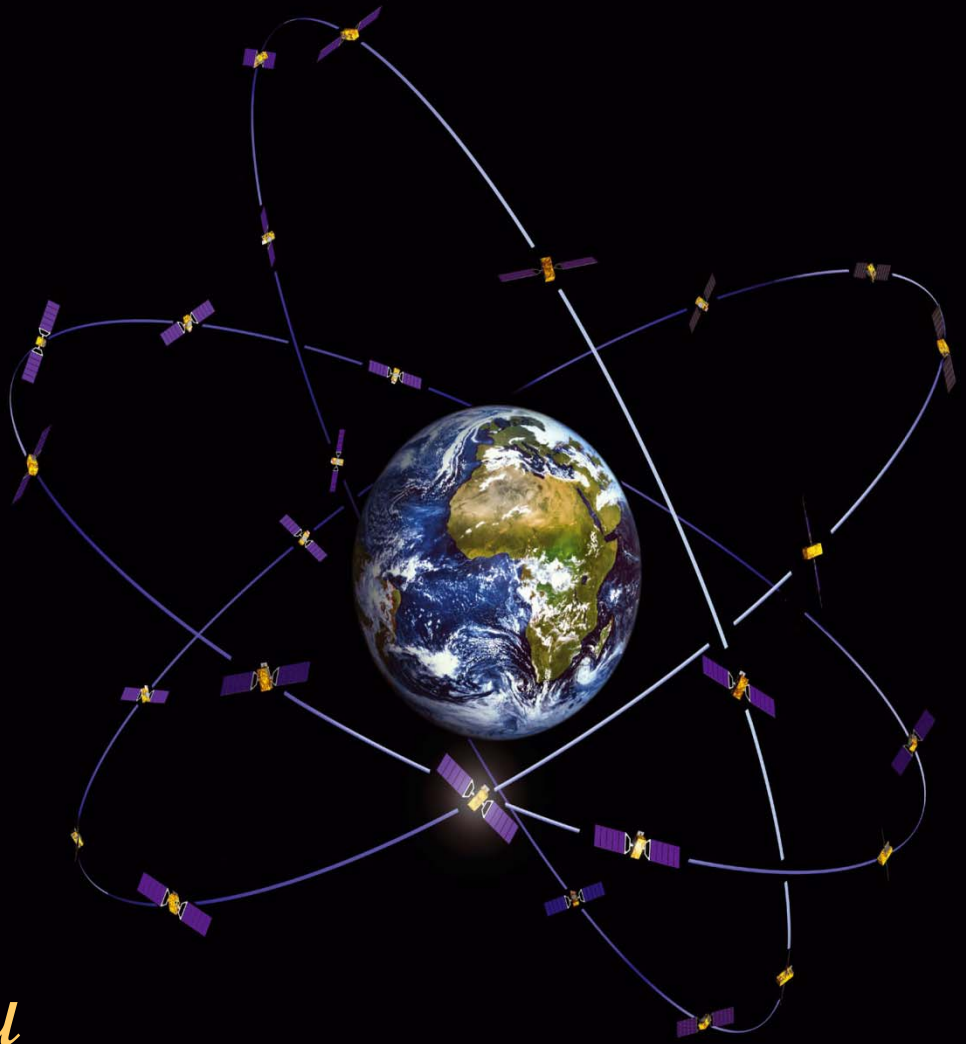
Next COSPAR Scientific Assembly

39th COSPAR

Mysore, India

July 14-22, 2012

invites you



Thank you

for your attention