UNITED NATIONS
Office for Outer Space Affairs

United Nations/Abdus Salam International Centre for Theoretical Physics Workshop on the Use of Global Navigation Satellite Systems for Scientific Applications

Organized jointly by
The Office for Outer Space Affairs and the Abdus Salam International Centre for Theoretical Physics

Co-organized and co-sponsored by
The International Committee on Global Navigation Satellite Systems

Hosted by
The Abdus Salam International Centre for Theoretical Physics

1 - 5 December 2014

Trieste, Italy

INFORMATION NOTE

1. Background Information

Global Navigation Satellite Systems (GNSS) provide an enabling technology that can make major contributions to economic growth and social betterment worldwide. GNSS data were now used in a wide range of areas, which included mapping and surveying, monitoring of the environment, precision agriculture and natural resources management, disaster warning and emergency response, aviation, maritime and land transportation. In addition, GNSS signals have been successful in sounding the atmosphere and ionosphere, ocean, land surfaces, including soil moisture, and the cryosphere becoming a powerful new tool for scientific applications.

In the past few years, different institutions have begun to deploy several instruments of a different kind (for example, GNSS receivers, ionosondes, magnetometers) in many low-latitude countries in Africa, South America and South-East Asia, over which the ionosphere had remained less known because of the scarce distribution of ionospheric sensors. As a consequence, the new sets of data now available are expected to make possible improvements in ionospheric modelling efforts, particularly considering data assimilation techniques. Additionally, some specific phenomena that take place in this region can be utilized. Since the ionosphere is the major error source in GNSS receivers, an improved knowledge of the low-latitude ionosphere would mitigate the ionospheric effects on GNSS positioning applications (e.g. for precision agriculture, environmental monitoring, civil aviation) in the same geographic region.

Efforts to build capacity in space science and technology are considered a major focus of the Office for Outer Space Affairs and are of specific interest to the International Committee on GNSS (ICG) with

particular reference to GNSS and its applications. Such efforts aim to provide support to creating a knowledgeable workforce necessary for the advancement of science applications of GNSS, particularly in developing countries. Additional information is available at:
http://www.unoosa.org/oosa/en/SAP/centres/index.html

Development projects, applications, services or products requiring georeferencing, require a uniform coordinate reference system. Most countries have some form of national reference frame or system. These reference frames/systems are usually based on local origin or datum point, which restrict their use to a particular country. This makes cross-border mapping, development and planning projects difficult. This therefore calls for the establishment of a common and uniform continental reference coordinates frames/systems. Additional information is available at:
http://www.unoosa.org/oosa/en/SAP/gnss/icg/regrefsys.html

Starting in 2009, the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy) and the Institute of Scientific Research of Boston College (United States) in cooperation with the Office for Outer Space Affairs have been conducting activities that focus on building capacity on satellite navigation science and technology for Africa. Over the course of these activities, the participants have been taught by international experts in GNSS on topics ranging from global positioning systems to navigation to terrestrial reference systems and frames. The activities also included sessions on space weather and ionospheric research in an effort to initiate space science research programmes in Africa, and support existing groups and projects in the field GNSS and ionosphere.

The following are the workshops and training courses on the use of GNSS for scientific applications that were carried out between 2009 and 2013:

- Workshop on satellite navigation science and technology for Africa, Trieste, Italy, 23 March - 9 April 2009 (see A/AC.105/950, paras. 10 - 11);
- Workshop on satellite navigation science and technology for Africa, Trieste, Italy, 6 - 24 April 2010 (see A/AC.105/996, paras. 13 - 14);
- Workshop on science applications of GNSS in developing countries, 11 – 27 April 2012 followed by a seminar on the development and use of the ionospheric NeQuick model, Trieste, Italy, 30 April - 1 May 2012 (see A/AC.105/1034, paras. 14 - 17);
- Workshop on GNSS data application to low-latitude ionospheric research, Trieste, Italy, from 6 to 17 May 2013 (see A/AC.105/1060, paras. 13 - 15).

A five-day **Workshop on the use of GNSS for scientific applications to be held in Trieste, Italy, from 1 to 5 December 2014** is being organized by the United Nations Office for Outer Space Affairs in cooperation with the Abdus Salam International Centre for Theoretical Physics (ICTP) as part of the 2014 activities of the United Nations Programme on Space Applications. The Workshop will be hosted by ICTP in Trieste, Italy. This Workshop will bring together the results of the previous workshops and training courses and will seek to provide further follow up to projects and recommendations referred to in the workshops indicated above. It will be an opportunity to build upon the results of each workshop contributing to defining a plan of action and the definition of functional partnerships in the long-term while also strengthening existing strategies at the regional levels.

The Workshop will discuss state-of-the-art applications with emphasis on the scientific exploration of the Earth's environment using global navigation satellite systems and review on-going and planned initiatives as well as new research programmes utilizing GNSS ground- and space-based measurements to observe ionospheric and space weather phenomena. Cooperative efforts and international partnerships for capacity-building, training and research, including the activities of the ICTP will also be presented. It will also be an opportunity to discuss proposals to be forwarded to the ICG and its Working Groups.

2. Objectives and Expected Outcomes

The Workshop will contribute to international cooperation by providing opportunity to exchange updated information on the use of GNSS technology and its applications.

The specific objectives of this Workshop are:

- Increase awareness among decision makers and representatives of research and academic community about on-going activities and trends in the use of GNSS technology, applications and services;
- Review of the results of the previous workshops, carried out between 2009 and 2013, and development of a plan of action for all participating countries that would contribute to the wider use of GNSS technology and its applications;
- Review of on-going and planned initiatives as well as case studies that could contribute to the wider use of GNSS technology and its applications, including the possibility of one or more national, regional and international pilot projects, in which interested institutions could incorporate the use of GNSS technology;
- Identify a functional partnership that could be established in order to promote the use of GNSS and its applications, as well as recommend how such a partnership could be established through voluntary actions that could include Governments, international organizations and other relevant stakeholders;
- Define recommendations and findings to be forwarded as a contribution to the ICG.

3. Preliminary programme of the Workshop

The Workshop programme will include plenary sessions and sufficient time for discussions among participants to identify the priority areas where pilot projects should be launched and examine possible partnerships that could be established. A half-day technical tour will be arranged by the Local Organizing Committee during the Workshop. As a preliminary suggestion the following thematic sessions will be organised:

I. **Policies and strategies for promoting sustainable development**

This session will provide an overview of the current status of global and regional navigation satellite systems and satellite-based augmentation systems that provide continuously optimized location and time information, transmitting a variety of signals on multiple frequencies available at all locations on planet Earth. These are Global Positioning System (GPS) and Wide-Area Augmentation System (WAAS) of the United States, GLObal NAvigation Satellite System (GLONASS) and System of Differential Correction and Monitoring (SDCM) of the Russian Federation, European Satellite Navigation System (GALILEO) and the European Geostationary Navigation Overlay Service (EGNOS) of the European Union, COMPASS/BeiDou Navigation Satellite Systems (CNSS) of China, Indian Regional Navigation System (IRNSS) and GPS Aided Geo-Augmented Navigation (GAGAN) of India, and Quasi-Zenith Satellite System (QZSS) of Japan.

II. **GNSS-based application areas:**

This session will cover case studies focusing on but are not limited to the use of GNSS for civil aviation, including future GNSS requirements for aviation, and transportation (roads, highways, rail); positioning and navigation systems operation in the marine environment, including waterway navigation, harbor entrance/approach, ocean and harbor control of vessels; development and implementation of precision agriculture or site-specific farming and accurate tracking of environmental disasters such as fires and oil spills, flood prediction and, crustal and seismic monitoring; surveying and mapping; timing and telecommunications.

III. **GNSS reference station system and services:**

This session will focus on geodetic framework, based on continues observation and analysis of GNSS data; realization of the regional reference frames. The session will also discuss issues

from the international perspective to the local government perspective regarding reference frames and development of geodetic infrastructure.

IV. **National, regional and international initiatives/experiences in GNSS implementation:**

This session will first present the current status of the follow-up projects and initiatives emanated from the workshops/training courses/schools. Next, the presenters will make proposals for joint experiments/demonstration projects.

V. **GNSS and space/atmospheric weather monitoring:**

This session will focus on instrument arrays in operation, data analysis and modelling; atmospheric effects on GNSS signals and GNSS based systems, atmospheric monitoring (troposphere) to improve numerical weather predictions, and space weather monitoring (ionosphere) for space situation awareness.

VI. **Capacity building, training and education in the field of GNSS:**

This session will update on education and training in global navigation and related applications, strengthening a specialized master's programmes for long-term professional education and support to PhD programs.

VII. **Discussion sessions:**

This session will provide an opportunity to discuss issues and concerns relating to the use of GNSS and to define a framework for a mechanism of regional cooperation. Participants will define activities that would contribute to increasing the use of GNSS technology in the region, and the format for a regional network that would enable the creation of partnerships.

4. Working Methods

Participants of the Workshop are requested to deliver a presentation paper and materials covering information on the use of GNSS technology, case studies/projects in GNSS applications in their respective countries. Each speaker will be allocated 20 minutes for the presentation. It is also necessary to submit an abstract of presentation with a maximum of 600 words including the following details: Paper Title, Author (s) Name(s), Affiliation(s), and e-mail address for the presenting author.

Presentations made at the workshop will be published on the website of the Office for Outer Space Affairs (www.unoosa.org) approximately two weeks after the Workshop.

5. Sponsorship of the Workshop

The Office for Outer Space Affairs of the United Nations and ICTP are responsible for organizing the Workshop. The United State of America and the European Commission through the ICG are co-sponsors of the Workshop. **Sponsorship of the Workshop is still open to the ICG membership and other interested entities.**

6. Expected participants

The Workshop is being planned for a total of 75 participants including scientists, engineers, university educators, and policy-and-decision makers and senior experts from the following groups: international, regional, national and local institutions, United Nations agencies, intergovernmental and non-governmental organizations, research and development institutions, and also from industry.

7. Participation requirements

Participants should be in senior managerial or decision-making responsibility at governmental agencies, national and regional institutions, intergovernmental and non-governmental organizations or industry. **Equally qualified female applicants are particularly encouraged.**

8. Language of the Workshop

The working language of the Workshop will be English.

9. Financial support

Within the limited financial resources available, a limited number of selected participants will be offered financial support to attend the Workshop. This financial support will defray the cost of travel (a round trip air ticket – most economic fare – between the airport of international departure in their home country and Trieste, Italy) and/or the room and board expenses for the duration of the Workshop. The co-sponsors of the Workshop will jointly select participants on a competitive basis. Successful applicants will be notified from 22 September 2014.

10. Deadline for Submission of Applications and Abstracts

The completed application form together with the presentation abstract should be submitted on-line, to the Office for Outer Space Affairs, **no later than Friday, 22 August 2014.** Only complete applications with all the requested information and signatures will be considered by the Workshop Organizing Committee. Please note that on-line application form is available on the web site of the Office for Outer Space Affairs at the following address:

http://www.oosa.unvienna.org/oosa/en/SAP/act2014/trieste-gnss/index.html

All candidates are strongly encouraged to apply for the Workshop online, as it helps to streamline the processing of applications as well as helps applicants to save their time.

Alternatively, the fully completed application form and all other required documents may be scanned and submitted in electronic format (.doc or .pdf) by email to the United Nations Office for Outer Space Affairs (unpsa@unoosa.org).

In exceptional cases if there is no access to electronic mail, the completed application may also be sent by postal mail or forwarded through the Office of the Resident Representative of the United Nations Development Programme (UNDP) in the applicant's country to the United Nations Office for Outer Space Affairs, Vienna International Centre, P.O. Box 500, 1400 Vienna, Austria.

11. Life and Health Insurance

Life/major health insurance for each of the selected participants is necessary and **is the responsibility of the candidate or his/her institution or Government.** The co-sponsors will not assume any responsibility for life and major health insurance, nor for expenses related to medical treatment or accidents.

12. Further Information and Contact Details

For information regarding the submission of nominations for attendance and funding, please contact **Mr. Ahmed Osman**, United Nations Office for Outer Space Affairs, at the following e-mail address: ahmed.osman@unoosa.org

For information regarding the programme, presentations/abstracts and speakers of the Workshop, please contact **Ms. Sharafat Gadimova**, United Nations Office for Outer Space Affairs, at: sharafat.gadimova@unoosa.org and **Prof. Sandro Radicella**, Telecommunications/ICT Development Laboratory, Abdus Salam International Centre for Theoretical Physics, at: rsandro@ictp.it

The focal point for Abdus Salam International Centre for Theoretical Physics, Trieste, Italy will be **Mr. Bruno Nava**, who can be contacted at: smr2617@ictp.it