# International Committee on Global Navigation Satellite Systems (Icg): A System of Systems

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**Key words**: ICG, positioning, regional reference frames, capacity building.

## SUMMARY

Following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in 1999, the United Nations General Assembly endorsed the "Vienna Declaration: Space Millennium for Human Development." The Vienna Declaration called for action to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility among, space-based navigation and positioning systems. The International Committee on Global Navigation Satellite Systems (ICG) held its first meeting in Vienna on 1- 2 November 2006 to review and discuss matters relating to global navigation satellite systems (GNSS) and their applications. The ICG work plan includes compatibility and interoperability; enhancement of performance of GNSS services; information dissemination and capacity building; interaction with national and regional authorities and relevant international organizations; and coordination. The ICG members cooperate, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing and value-added services. In particular, they cooperate to the maximum extent practicable to maintain radio frequency compatibility in spectrum use between different GNSS systems in accordance with the International Telecommunication Union (ITU) Radio Regulations. The United Nations Office for Outer Space Affairs, as the Executive Secretariat of the ICG develops a wide range of activities focusing on capacity building, specifically, in deploying instruments for the international space weather initiative (ISWI), developing a GNSS education curriculum, and utilizing regional reference frames that support sustainable development, particularly in developing nations. In the coming year, the United Nations will assist the process of the establishment of the ICG Information Centres for training and information dissemination on global applications of GNSS and their socio-economic benefits for humanity will be assisted.

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## 1. INTRODUCTION

Global Navigation Satellite Systems (GNSS) consist of satellites, ground stations and user equipment and are utilized worldwide across many areas of society. Global Navigation Satellite Systems, operating in different constellations, are the United States' Global Positioning System (GPS), the Russian Federation's Global Navigation Satellite System (GLONASS), Europe's European Satellite Navigation Systems (GALILEO), and China's Compass/BeiDou. Regional Navigation Satellite Systems (RNSS), providing signal coverage over a number of nations or region, are India's GPS Aided Geo Augmented Navigation (GAGAN) and Japan's Quasi-Zenith Satellite System (QZSS). In an attempt to build a system of GNSS systems in the coming decade, the ICG was established in 2005 under the umbrella of the United Nations. The ultimate goal of ICG is to achieve compatibility and interoperability of GNSS systems thereby saving costs through international cooperation and making positioning, navigation, and timing available globally for societal benefits, including monitoring all aspects of environment and security (A/AC.105/879, 2006).

Following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in 1999 (A/CONF.184/6, 1999), the United Nations General Assembly endorsed "The Space Millennium: Vienna Declaration on Space and Human Development." The Vienna Declaration called for action to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility among, space-based navigation and positioning systems. In response to that call, in 2001, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) established the Action Team on Global Navigation Satellite Systems (GNSS) to carry out those actions under the chairmanship of Italy and the United States of America.

The Action Team on GNSS consisted of 38 member States and 15 inter-governmental and non-governmental organizations and recommended that an International Committee on GNSS (ICG) be established to promote the use of GNSS infrastructure on a global basis and to facilitate exchange of information (ST/SPACE/24, 2004).

Following workshops for the regions of Africa, Asia and the Pacific, Western Asia, Latin America and the Caribbean, Europe, international preparatory meetings and actions at the inter-governmental level (A/AC.105/846, 2004), the ICG was established in December 2005. The ICG is an informal, voluntary forum where governments and interested non-governmental entities can discuss all matters regarding GNSS on a worldwide basis. The ICG

promotes international cooperation on issues of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services.

The goal of the ICG is to promote the greater use of GNSS capabilities to support sustainable development and to promote new partnerships among committee members and institutions, particularly taking into account interests of developing nations. The ICG website: www.icgsecretariat.org

## 2. INFORMATION DISSEMINATION AND CAPACITY BUILDING: PROGRAMME ON GNSS APPLICATIONS

### 2.1 International Space Weather Initiative

The United Nations Basic Space Science Initiative (UNBSSI) and its series of workshops dedicated to basic space science is a long-term effort to promote the development of astrophysics and space science as well as efforts towards regional and international cooperation in this field on a worldwide basis, particularly for the benefit of developing nations. A first series of workshops dedicated to basic space science was held from 1991 to 2004 for Asia and the Pacific, Latin America and the Caribbean, Africa, and Western Asia. Among the major recommendation emanating from the workshops was that small astronomical facilities should be established in developing nations to enable and support research and education programmes at the university level. Based on this recommendation astronomical telescope facilities were inaugurated in 7 nations and educational materials for teaching and observing programmes for optical telescopes were developed or adopted from existing resources and planetariums were established in 20 nations. From 2005 to 2009, the UNBSSI workshops were dedicated to the International Heliophysical Year 2007 (Davila, Gopalswamy, Haubold, Thompson, 2007) and contributed to the deployment of 14 ground-based world-wide instrument arrays (GPS receivers, radio antennas, magnetometers, cosmic ray detectors) for research on climate change, space weather, and ionospheric phenomena. Currently, more than 1000 instruments are operational in these instrument arrays (ST/SPACE/43, 2008). These instrument arrays will be utilized to constitute the International Space Weather Initiative in the period of time from 2010 to 2012.

### 2.2 Regional Workshops on the Applications of Global Navigation Satellite Systems

Regional Workshops on Applications of GNSS were held in Zambia (A/AC.105/876, 2006) and China (A/AC.105/883, 2007) in 2006, Colombia (A/AC.105/920, 2008) in 2008, and Azerbaijan in 2009 to address applications of GNSS for socio-economic benefits. These workshops address, *inter alia*, space technology applications such as: remote sensing, precision agriculture, aviation, transport and communications, and e-learning. The workshops aim at initiating pilot projects and strengthening the networking in the regions. The workshops also address the areas of natural resources management and environmental monitoring by applying GNSS technologies to thematic mapping, forest management and water resources management.

The use of GNSS could benefit various areas of the agricultural sector, ranging from basic rural cadastre and surveying to advanced precision agriculture. Agroclimatic and ecologic-economical zonings, crop inventory, monitoring and forecasting are only a few examples of agricultural activities where positioning is of paramount importance. In the area of climate change, different factors and mechanisms drive land use and land cover transformation. In many cases, climate, technology and economics appear to be determinants of land use change at different spatial and temporal scales. At the same time, land conversion is an adaptive feedback mechanism that farmers use to smooth the impact of climate variability, especially in extremely dry and humid periods. Satellites have for several years been an indispensable resource in global observation of the Earth and weather systems. They bring undeniable added value to global climate models but much remains to be done in developing finer-scale models capable of use in a regional or national setting. Space-based systems such as GNSS has demonstrated its ability to make precise and detailed observations of key meteorological parameters, whose measurement stability, consistency and accuracy should make it possible to quantify long-term climate change trends. In the area of transport domain, a number of studies have already shown that civil aviation will significantly benefit from the use of GNSS. These benefits include: improved navigation coverage in areas currently lacking in conventional aids, accurate and reliable information about aircraft positions and routes enables safe and efficient management of air traffic, and thereby safety on airport approaches. Road transport applications can automatically revise a route to account for traffic congestion, changes in weather or road works. Similarly, at sea GNSS technologies can provide efficient route planning, collision avoidance and increased efficiency in search and rescue situations. For rail transport, GNSS offers enhanced cargo monitoring and assists track surveying. In addition, communication systems, electrical power grids, and financial networks all rely on precision timing for synchronization and operational efficiency. For example, wireless telephone and data networks use GPS time to keep all of their base stations in perfect synchronization. This allows mobile handsets to share limited radio spectrum more efficiently.

### 2.3 Regional Reference Systems and Frames

All regions (Africa, Latin America and the Caribbean, Western Asia, Europe, and Asia and the Pacific) are embracing the use and applications of GNSS technologies, particularly the Global Positioning system (GPS) in the various geo-information applications, services, and products. With the increased use and application of GNSS and the requirements to relate the GPS solutions with the already existing mapping products based on local and national coordinates reference systems, there is an urgent need to establish and determine the transformation data to and from such systems to GNSS reference systems. This will be achieved on full realization of the regional reference frames known as African Geodetic Frame (AFREF), Geocentric Reference System for the Americas (SIRGAS), Reference Frame Sub-Commission for Europe (EUREF) and the European Position Determination System (EUPOS), and the Asia Pacific Regional Geodetic Project (APRGP). The Executive Secretariat of ICG is utilizing the aforementioned Regional Reference Frames as the next to top level cooperation partners in the implementation of ICG projects at the regional level. This corresponds to the United Nations Economic and Social Commissions for Africa, Latin America and the Caribbean, Europe, Asia and the Pacific, and Western Asia. Accordingly the

ICG Executive Secretariat initiated a cooperation between the ICG and the Regional Reference Systems in 2008 (Proceedings, 2009). Cooperation between ICG and Regional Reference Systems has vast potentials for geodesy, mapping, surveying, geo-information, natural hazards mitigation, earth sciences, *etc*. As one element of the Programme on GNSS Applications this cooperation, also facilitated through the Regional Centres, may provide a major springboard for the transfer and enhancement of skills and knowledge in surveying, geodesy and especially GNSS with its applications.

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## BIOGRAPHICAL NOTES

Since 2004, S.Gadimova has been with the United Nations Office for Outer Space Affairs in Vienna, Austria. She is involved in the organization of the United Nations activities related to global navigation satellite systems, particularly the development of the International Committee on global navigation satellite systems and the activities of the United Nations affiliated Regional Centres for Space Science and Technology Education.

Since 1988 H. Haubold has been with the United Nations Office for Outer Space Affairs, firstly in New York and latterly in Vienna, Austria, since 1993. His principal responsibility is with the establishment of the UN-affiliated Regional Centres for Space Science and Technology Education in Africa, Asia and the Pacific, and Latin America and the Caribbean. At the United Nations he spearheaded the development of education curricula in remote sensing and GIS, satellite meteorology and global climate, satellite communications, and space and atmospheric science. Since 1991 he is the principal organizer of the series of annual UN/ESA/NASA Workshops on Basic Space Science and the International Heliophysical Year.

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