



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## ***International Committee on Global Navigation Satellite Systems and its Programme on the Applications of Global Navigation Satellite Systems***

---

Sharafat Gadimova

ICG Executive Secretariat  
United Nations Office at Vienna

***50<sup>th</sup> Session of Scientific and Technical Subcommittee***

***11 – 22 February 2013***

***Agenda item 9 “Recent developments in global navigation satellite systems”***

***Vienna, Austria***



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## Overview

---

- i. International Committee on Global Navigation Satellite Systems (ICG)**
  - ◆ **Annual meetings of the ICG and its Providers' Forum**
  - ◆ **Multi-GNSS monitoring**
- ii. Information dissemination and capacity-building programme on GNSS applications**
  - ◆ **Regional Workshops on the applications of GNSS and International Space Weather Initiative (ISWI)**
  - ◆ **Promoting the use of GNSS technologies as tools for scientific applications, including space weather effects on GNSS**
- iii. Regional Centres for Space Science and Technology Education (affiliated to the United Nations) as Information Centres for ICG**
  - ◆ **GNSS Educations Curriculum, and Glossary of GNSS terms**



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## ***I. International Committee on Global Navigation Satellite Systems (ICG)***

***A forum to discuss Global Navigation Satellite Systems to benefit people around the world***

- ◆ **2005: Establishment of ICG (noted by UNGA 61/111 of 14 December 2006)**
  - ◆ Promote the use of GNSS and its integration into infrastructures, particularly in developing countries
  - ◆ Encourage compatibility and interoperability among global and regional systems
- ◆ **ICG Membership:**
  - ◆ ***Members: 9 nations & the European Union***
  - ◆ Current and future core, regional or augmentation system providers (China (BeiDou), EU (Galileo/EGNOS), Russian Federation (GLONASS/SDCM), USA (GPS/WAAS), India (IRNSS/GAGAN), and Japan (QZSS/MSAS))
  - ◆ State Members of the UN with an active programme in implementing or promoting a wide range of GNSS services and applications (Italy, Malaysia, United Arab Emirates)
    - ◆ ***Associate Members and Observers: 18 organizations***
  - ◆ International and regional organizations and associations dealing with GNSS services and applications (UN system entities, IGOs, NGOs)

***ICG participation is open to all countries and entities that are either GNSS providers or users of GNSS services, and are interested and willing to actively engage in ICG activities***



## ***I. International Committee on Global Navigation Satellite Systems (ICG)***

---

### **2006 – 2012: ICG Annual Meetings**

- ◆ UNOOSA (2006), India (2007), USA (2008), Russia (2009), Italy & EU (2010), Japan (2011), China (2012)

### **2006: Terms of Reference and Work plan**

- ◆ **Compatibility and Interoperability (USA and Russian Federation)**
  - ◆ Focused discussion on compatibility and interoperability, encouraging development of complimentary systems
  - ◆ Exchange detailed information on systems and service provision plans and views on the ICG work plan and activities
- ◆ **Enhancement of GNSS Services Performance (India and ESA)**
  - ◆ Focused on system enhancements (multipath, integrity, interference, etc.) to meet future needs
- ◆ **Information Dissemination and Capacity Building (OOSA)**
  - ◆ Focused on training/workshops, promoting scientific applications, space weather
- ◆ **Reference Frames, Timing and Applications (IAG, IGS and FIG)**
  - ◆ Focused on monitoring and reference station networks



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## ***I. International Committee on Global Navigation Satellite Systems (ICG)***

---

---

**2013: Eighth Meeting of the ICG, Dubai, United Arab Emirates, 10 – 14 November**

- ◆ **ICG-8 Local Host and Chair: Emirates Institution for Advanced Science and Technology**
  - ◆ **Agenda:**
    - ◆ **Plenary Sessions: *Providers/Regional System and Service Updates***
    - ◆ **Providers' Forum Sessions**
    - ◆ **GNSS Science and Technology applications**
    - ◆ **Working Group Meetings: *Progress on implementing ICG Work Plan within established working groups***
    - ◆ **Exhibits: *Industries***
- 
- 

- ◆ **Preparatory meetings:**
  - ◆ **Scientific and Technical Subcommittee, 18 February**
  - ◆ **Committee on the Peaceful Uses of Outer Space, 10 June**

***ICG would welcome your participation in and contribution to the ICG-8 meeting***

**2014: Ninth meeting of the ICG, European Union and ESA**



UNITED NATIONS  
Office for Outer Space Affairs



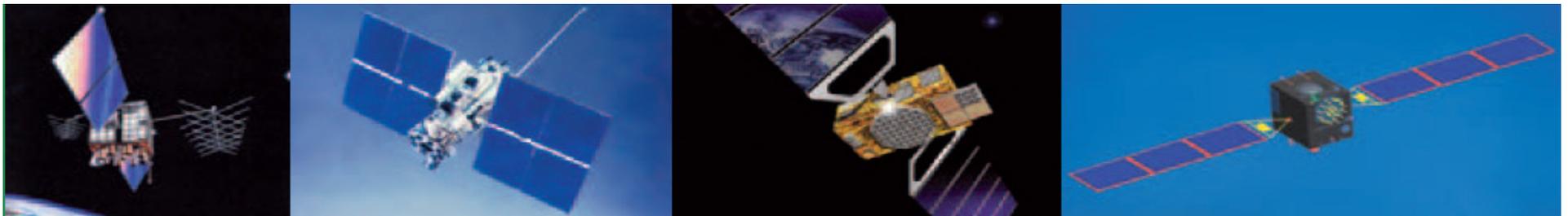
International Committee on  
Global Navigation Satellite Systems

## ***I. International Committee on Global Navigation Satellite Systems (ICG)***

---

### **Providers' Forum**

- ◆ **2007: Establishment**
- ◆ **Members:** China (Compass/BeiDou), India (GAGAN/IRNSS), Japan (QZSS/MSAS), Russian Federation (GLONASS), USA (GPS), EU (Galileo/EGNOS)
- ◆ **2008 : Terms of Reference and Work plan**
- ◆ Agreement that all GNSS signals and services must be **compatible** and open signals and services should also be **interoperable** to the maximum extent possible
- ◆ **Principle of Transparency** – every GNSS provider should publish documentation that describes the signal and system information, the policies of provision and the minimum levels of performance offered for its open services
- ◆ **Ninth Meeting, 10 June 2013**
- ◆ **Tenth Meeting, 10 – 14 November 2013**





UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## ***I. International Committee on Global Navigation Satellite Systems (ICG)***



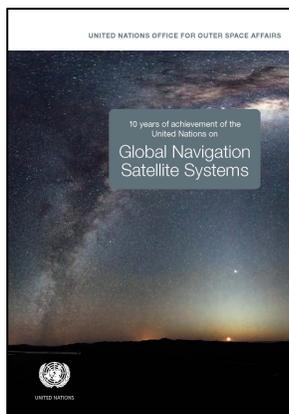
**2007**

***The way forward to provide positioning, navigation and timing globally***



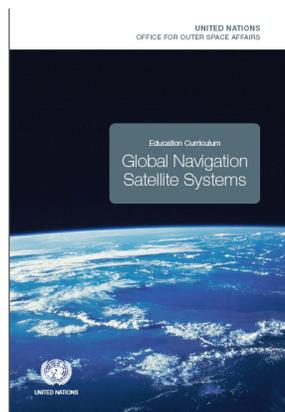
**2010**

***Report on planned or existing global navigation satellite systems and on relevant policies and procedures***



**2011**

***Achievements of providers and users of positioning, navigation, and timing services, under the umbrella of the United Nations, in promoting GNSS over the past 10 years***



**2012**

***Education Curriculum and Glossary of GNSS Terms***

***ICG Executive Secretariat: OOSA; ICG website: [www.icgsecretariat.org](http://www.icgsecretariat.org)***



## ***I. International Committee on Global Navigation Satellite Systems (ICG)***

---

### **Multi-GNSS Monitoring**

*To test, validate and demonstrate multiple constellation applications and their benefits in the early deployment stage of multi-GNSS and modernized signals*

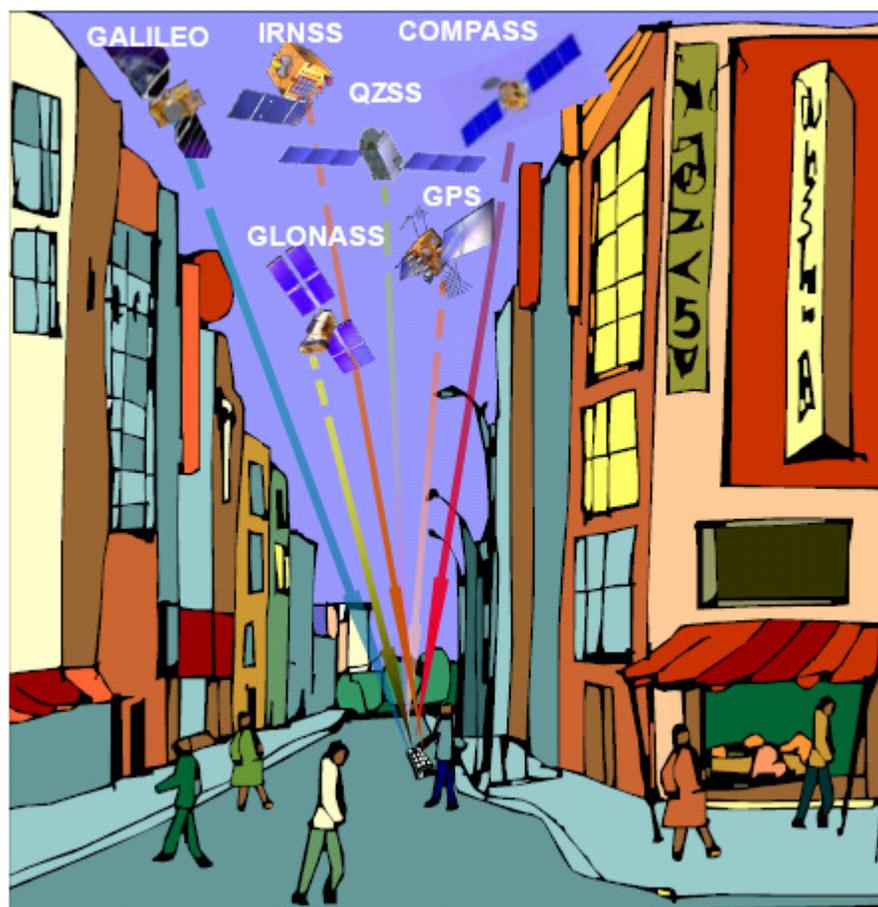
- ◆ **Multi-GNSS Asia: Multi-GNSS Monitoring Network (MGM-net)**
- ◆ **International GNSS Monitoring and Assessment Service (iGMAS)**
- ◆ **M-GNSS Global Experiment (MGEX)**

#### **Important multi-GNSS benefits:**

- ◆ **Multi-GNSS use could provide not only an increment in the number of navigation satellites but also additional signals and frequencies**
- ◆ **Multi-GNSS use is a method to reduce the vulnerability and increase the reliability and robustness of GNSS services**
- ◆ **Incremental increase in the number of visible satellites using the same frequency could support Receiver Autonomous Integrity Monitoring (RAIM) technologies**



## I. International Committee on Global Navigation Satellite Systems (ICG)



- ◆ More than 100 GNSS satellites will be available in the near future
- ◆ Not only more satellites, but also more signals, better clocks, etc.
- ◆ **The Goal of GNSS Interoperability**
  - ◆ *Ideal Interoperability allows navigation with one signal each from four or more systems with no additional receiver cost or complexity*

**Interoperable = Better Together than Separate**



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## **II. Information Dissemination and Capacity Building Programme on GNSS Applications**



---

### **Regional Workshops on the Applications of GNSS:**

- ◆ ***Zambia and China (2006), Colombia (2008), Azerbaijan (2009), Moldova (2010), UAE (2011), Latvia (2012)***
  - ◆ ***increase awareness among decision and policy makers of the benefits of GNSS and develop regional and national pilot projects on GNSS applications, and strengthen the networking of GNSS related institutions in the regions***
- ◆ ***United Nations/Croatia Workshop on the applications of GNSS, 21 – 25 April 2013, Baska, Krk Island***
  - ◆ ***Tutorials: RINEX-based GNSS performance data analysis***
  - ◆ ***Thematic and discussion sessions : New capabilities in efficiency and safety across all modes of transportation: aviation, maritime, rail and highway***
    - ◆ ***Applications in surveying and mapping, geodesy, science and timing, environment, agriculture, and remote sensing with GNSS and integrated sensors***
    - ◆ ***Space and atmospheric weather: observation of space weather phenomena through the deployment of ground-based world-wide instrument arrays such as GPS receivers, magnetometers, solar telescopes, very low frequency (VLF) monitors, solar particle detectors, and data analysis and the sharing of recorded data***



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

## ***II. Information Dissemination and Capacity Building Programme on GNSS Applications***

---

### **International Space Weather Initiative:**

***A programme of international cooperation to advance the space weather science by a combination of instrument deployment, analysis and interpretation of space weather data from the deployed instruments in conjunction with space data, and communicate the results to the public and students***

***A follow-up activity to the Basic Space Science Initiative (BSSI) and the International Heliophysical Year 2007 (IHY2007), but focusing exclusively on space weather***

***Status and results of the instrument arrays, data recording and data analysis are being reported annually to COPUOS that mandated the organization of three workshops:***

- ◆ ***2010: UN/Egypt Workshop, 6 – 10 November, Helwan University: Western Asia***
- ◆ ***2011: UN/Nigeria Workshop, 17 – 21 October, Abuja: Africa***
- ◆ ***2012: UN/Ecuador Workshop: 8 – 12 October, Latin America and the Caribbean***
- ◆ ***International Centre for Space Weather Science and Education, Space Environment Research Centre (SERC), Kyushu University, Japan***  
***[http://www.serc.kyushu-u.ac.jp/index\\_e.html](http://www.serc.kyushu-u.ac.jp/index_e.html)***

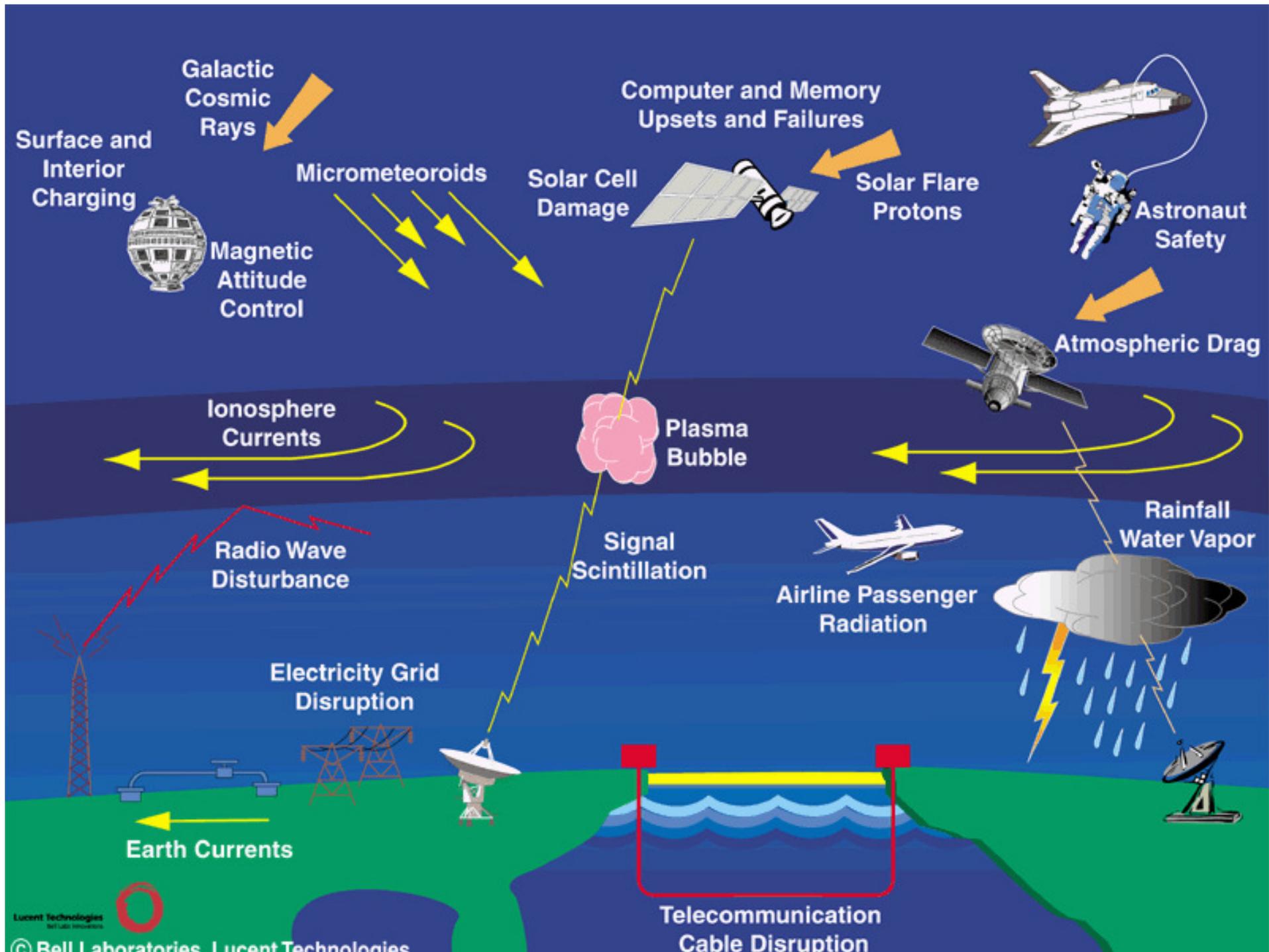
**ISWI Website: <http://www.iswi-secretariat.org/>**



## ***II. Information Dissemination and Capacity Building Programme on GNSS Applications***

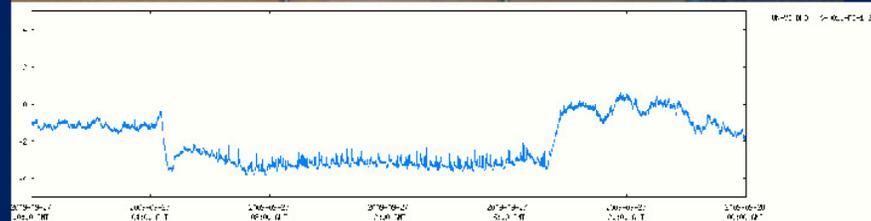
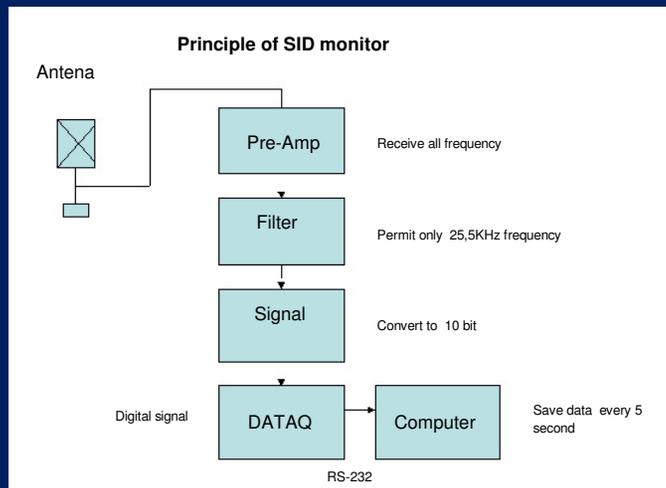
### **Promoting the use of GNSS technologies as tools for scientific applications, including space weather effects on GNSS:**

- ◆ ***Reference Frames and Timing***
- ◆ ***The objective and goals: to provide technical knowledge on the operational and practical aspects and issues relating to references frames, more specifically,***
  - ◆ ***facilitate a regional forum for geodetic agencies, improve data sharing (GNSS, levelling, tide gauge, gravity) and dense regional reference frame***
- ◆ ***Space Weather Effects on GNSS***
- ◆ ***Ionospheric modelling is an effective approach for correcting the ionospheric range error and improving the GNSS positioning accuracy***
  - ◆ ***The abundance of GPS measurements from worldwide distributed GPS reference networks, which provide 24-hour uninterrupted operational services to record dual-frequency GPS measurements provides an ideal data source for ionospheric modelling research;***



# Instrument Programme

## Sudden Ionospheric Disturbance Monitor (SID) operated by OOSA





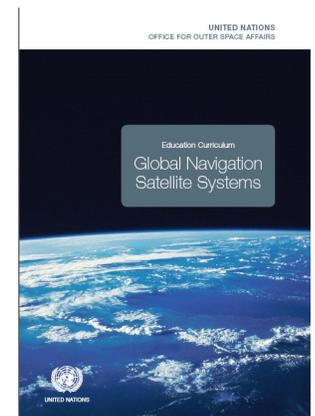
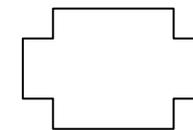
UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

### ***III. Regional Centres for Space Science and Technology Education, affiliated to the United Nations, as Information Centres for ICG***

- ◆ ***Africa: Morocco and Nigeria***
- ◆ ***Latin America and the Caribbean: Brazil and Mexico***
- ◆ ***Asia and the Pacific: India***
- ◆ ***Western Asia: Jordan (2012)***
- ◆ ***Remote Sensing & GIS, Satellite Meteorology & Global Climate, Satellite Communications, Space & Atmospheric Science and [Global Navigation Satellite Systems](#)***





### ***III. Regional Centres for Space Science and Technology Education, affiliated to the United Nations, as Information Centres for ICG***

---

#### **GNSS Education Curriculum, and Glossary of GNSS Terms:**

- ◆ ***GNSS Education Curriculum*** produced on the basis of GNSS course outlines as used at the university level in a number of developing and industrialized countries
- ◆ ***9-months postgraduate course (540 hours of theory & 540 hours of laboratory experiments, field visits, project works, and 1 year thesis).***
- ◆ ***The course is recommended, but not limited, to graduate in***
  - ◆ ***Electronics & Communications Engineering; Geomatics, Computer Software Engineering***
  - ◆ ***Indicative topics are arranged under the following topics: Fundamentals; Position Determination Techniques, Technologies (Augmented systems), Embedded System Design and Sensors, GNSS Receivers, GNSS/INS Integrated Navigation, GNSS Applications, Laboratory experiments, field visits, project work***
- ◆ ***Glossary of GNSS Terms*** produced as a direct response to the needs of the GNSS user community in the framework of the ICG Providers' Forum workplan. The purpose of the glossary of terms is to provide definitions of terms as they are used in the context of the United Nations General Assembly documentation in the A/AC.105/ series on the meetings of the ICG that had been held since 2005. Some of the definitions were arrived at after considerable debate within the ICG Provider's Forum membership, and some continue to be debated. Therefore, it is intended to be read in conjunction with the ICG documents, which are available in all official languages of the United Nations and can be downloaded from the webpage of OOSA



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

### ***III. Regional Centres for Space Science and Technology Education, affiliated to the United Nations, as Information Centres for ICG***

---

#### ***Information Centres for ICG***

- ◆ **ICG Executive Secretariat and GNSS providers see two areas where they can assist the process of the development and progress towards the further development of ICG Information Centres:**
  - ◆ **Technical Level: to include various GNSS technologies**
  - ◆ **Cooperative Level: to include possible collaboration with industry leaders and linkages with current and planned system and augmentation system providers. This would be facilitated through collaboration with the Providers' Forum (seminars/trainings and supportive material), as well as communication and outreach to the wider community through the ICG information portal, mailing lists, brochures and newsletter**



UNITED NATIONS  
Office for Outer Space Affairs



International Committee on  
Global Navigation Satellite Systems

**Executive Secretariat of the  
International Committee on  
Global Navigation Satellite Systems**

**United Nations Office for Outer Space Affairs  
PO Box 500, 1400 Vienna, Austria**

**Phone: +43 1 26060 5479  
Fax: +43 1 26060 5830  
E-mail: [oosa@unvienna.org](mailto:oosa@unvienna.org)**

**Web: <http://www.icgsecretariat.org>**