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

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ICG Executive Secretariat
United Nations Office at Vienna

United Nations/Croatia Workshop on the applications of Global Navigation Satellite Systems

21 – 25 April 2013

Baška, Krk Island, Croatia

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**

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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**

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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**

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

2009: Fourth Meeting of the ICG, Roscosmos, Saint-Petersburg, Russia

- **Agreed that every provider should publish documentation that describes signal and system information, policies of provision and minimum levels of performance for its open services;**
- **Endorsed a proposal for a multi-GNSS demonstration project in the Asia/Oceania region**

2010: Fifth Meeting of the ICG, Italy and the European Union, Turin, Italy

- **Addressed aspects of spectrum protection, and interference detection and mitigation;**
- **Considered the issue of integrity for all users where a particular effort is needed to make them aware of the benefits arising from the coming multi-GNSS scenarios;**

2011: Sixth Meeting of the ICG, Tokyo, Japan

- **Focused on interference detection and mitigation, open service provision and performance monitoring by multi-GNSS networks;**
- **Discussed the diverse range of applications and applications-related issues to indoor positioning, signal authentication, precise positioning, transportation, maritime and space applications;**
- **Completed development of templates describing the geodetic and timing references for the navigation satellite systems currently represented in the ICG and recommended to be published on the ICG Information Portal;**
- **Endorsed the IGS Multi-GNSS Experiment, which follows on from the ICG's previous endorsement of the Multi-GNSS campaign in Asia and Oceania.**

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

2012: Seventh Meeting of the ICG, Beijing, China

- **Made recommendations on spectrum protection and open service performance monitoring;**

- **Discussed the benefits of an interoperable GNSS Space Service Volume. It was noted that a fully interoperable GNSS Space Service Volume will result in significant benefits for future space users as it will allow for performance no single system can provide on its own. The value of multi-GNSS application demonstrations was identified.**

- **Noted significant continued progress on the geodetic and timing references for the GNSS currently represented in the ICG. Specific progress was noted in the alignment of CGS2012 for BeiDou, JGS2010 for QZSS, PZ90 for GLONASS and WGS84 for GPS to the latest realisation of the International Terrestrial Reference System in the form of ITRF2008.**

- **Providers' Forum considered the future role of the ICG**

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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

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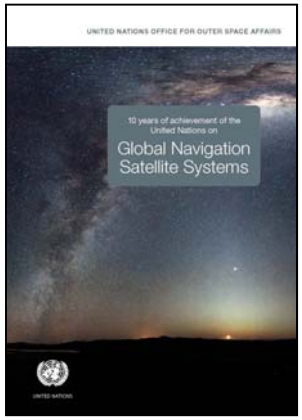
I. International Committee on Global Navigation Satellite Systems (ICG)

2007

The way forward to provide positioning, navigation and timing globally

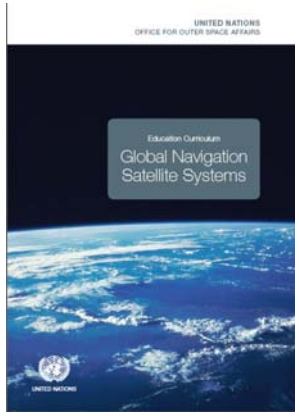
2010

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 (Arabic, English, French, Spanish)

ICG Executive Secretariat: OOSA; ICG website: www.unoosa.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 demonstration project in the Asia/Oceania region**
- **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**

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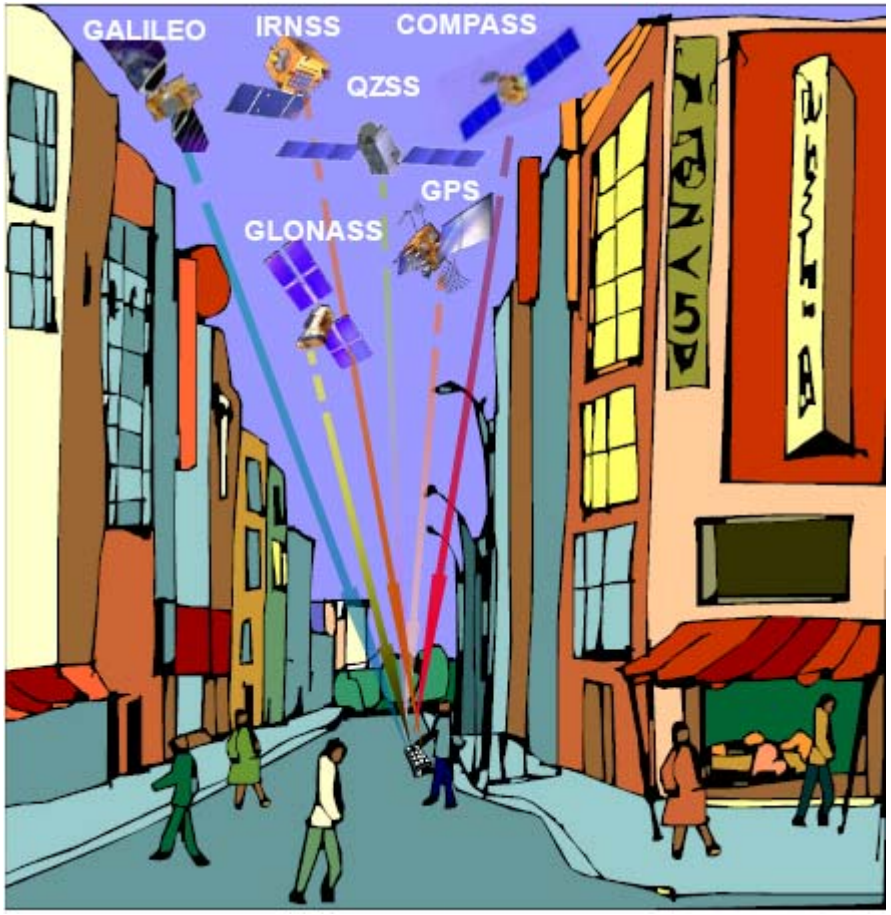

- **More than 100 GNSS satellites will be available in the near future**
- **Not only more satellites, but also more signals, better clocks, etc.**
- **The Goal of GNSS Interoperability**
  - ***Ideal Interoperability allows navigation with one signal each from four or more systems with no additional receiver cost or complexity***
- ***The basic principle of system compatibility "do no harm"***
  - ***This refers to the ability of global and regional navigation satellite systems and augmentations to be used separately or together without causing unacceptable interference and/or other harm to an individual system and/or service***

Interoperable = Better Together than Separate

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***
- ***Education Curriculum on GNSS***
- ***International centre for GNSS science, technology and education in an existing national educational and research institution. Beihang University (www.buaa.edu.cn) of China offered to host the centre. The centre might grow into a network of centres, focusing on GNSS science, technology and education, around the world — all dedicated to the advancement of GNSS research, applications and education***
- ***2013: United Nations/Croatia Workshop on the applications of GNSS, 21 – 25 April, Baska, Krk Island***

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

ISWI Website: http://www.iswi-secretariat.org/

- ***STSC: "Space Weather" agenda item***

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II. Information Dissemination and Capacity Building Programme on GNSS Applications

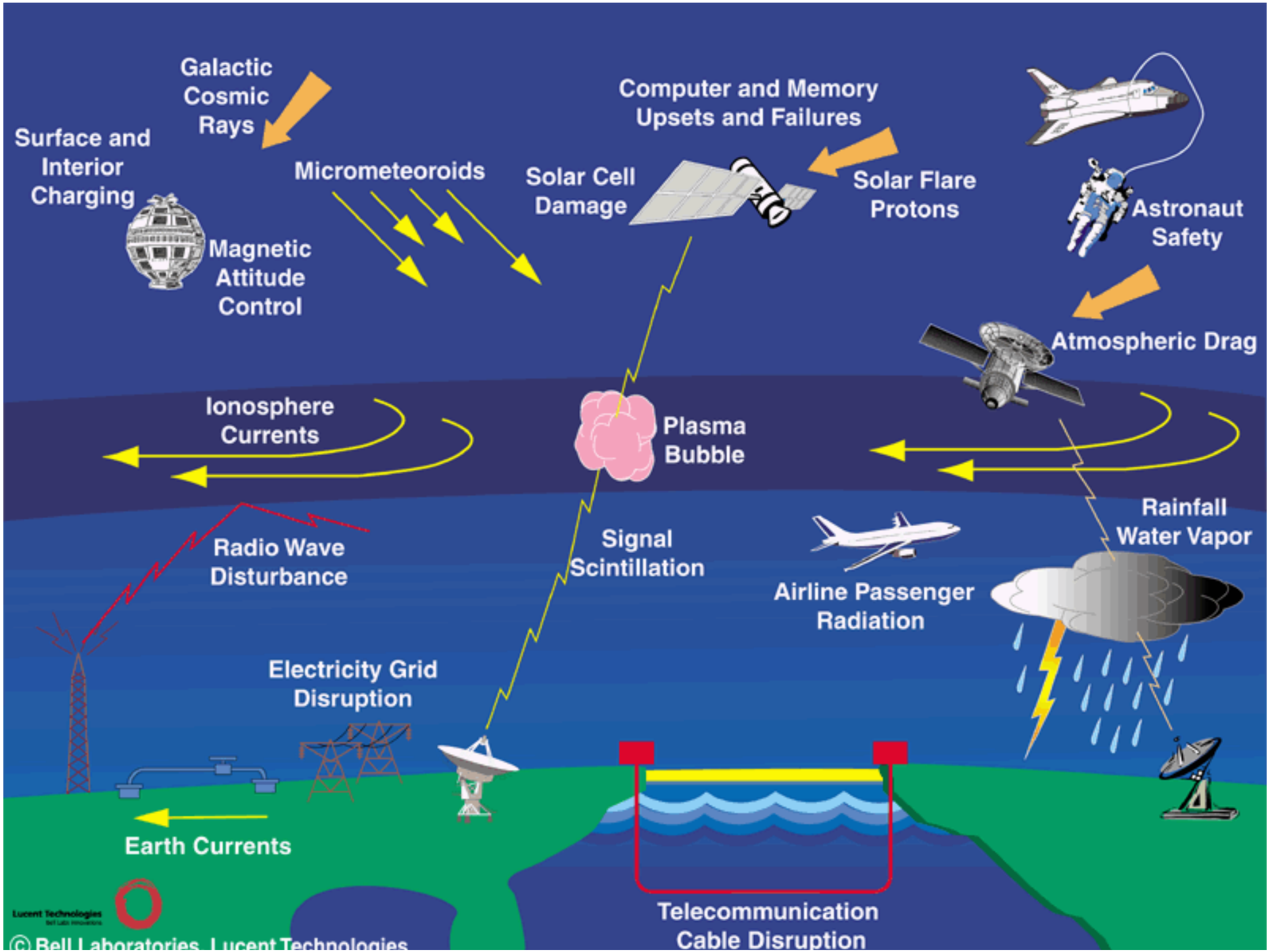
Promoting the use of GNSS technologies as tools for scientific applications, including space weather effects on GNSS:

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***
- ***Technical Seminar "Reference Frame in Practice", 21 - 22 June 2013, Manila, Philippines***

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***
- ***Workshop on GNSS Data Application to Low Latitude Ionosheric Research, 6 - 17 May 2013, Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy***


Galactic Cosmic Rays
Surface and Interior Charging
Micrometeoroids
Magnetic Attitude Control
Computer and Memory Upsets and Failures
Solar Cell Damage
Solar Flare Protons
Astronaut Safety
Atmospheric Drag
Ionosphere Currents
Plasma Bubble
Radio Wave Disturbance
Signal Scintillation
Airline Passenger Radiation
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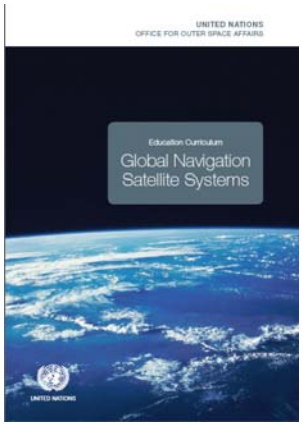
III. Regional Centres for Space Science and Technology Education, affiliated to the United Nations, as Information Centres for ICG

- ***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***



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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*

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***

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