UNITED NATIONS
Office for Outer Space Affairs

International Committee on
Global Navigation Satellite Systems

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UNOOSA Space Technology Curricula: the GNSS case

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Background

- 2001 – 2004: Action Team on GNSS (Italy and the United States) – *in implementation of the recommendations of UNISPACE-III, 1999, Vienna*
  - An international framework to support operational coordination and exchange of information among system operators and national and international user communities would be important
  - The assumption was that current and future system operators would soon move from a competitive to a collaborative mode where there is a shared interest in the universal use of GNSS services regardless of the system
- 2005: Establishment of the ICG (noted by UNGA 61/111 of 14 December 2006)
  - Promote the use of GNSS and its integration into infrastructure, particularly in developing countries;
  - Encourage compatibility and interoperability among global and regional systems
- Main challenge is to provide assistance and information for those countries seeking to integrate GNSS into their basic infrastructure, including at governmental, scientific and commercial levels

Membership

- Members: 9 nations and the European Union

Current and future core, regional or augmentation systems providers: China (BeiDou), EU (Galileo/EGNOS), Russia (GLONASS/SDCM), United States (GPS/WAAS), India (IRNSS/GAGAN), and Japan (QZSS/MSAS)

State Members of the United Nations 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: 21 organizations

International & 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 be engaged in ICG work

Annual Meetings

- UNOOSA (2006), India (2007), United States (2008), Russian Federation (2009), Italy & European Union (2010), Japan (2011), China (2012), United Arab Emirates (2013), European Union (2014), United States (2015), Russian Federation (2016), **Japan (2017),** China (2018), India (2019), Vienna (2020)
- 2006: Terms of Reference and Workplan
- **Systems, Signals and Services (United States & Russian Federation):** Focused discussion on compatibility and interoperability, encouraging development of complimentary systems; Exchange detailed information on systems and service provision plans
- **Enhancement of GNSS Performance, New Services and Capabilities (India, China and European Space Agency):** Focused discussion on system enhancements (multipath, integrity, interference, etc.) to meet future needs
- **Information Dissemination and Capacity Building (UNOOSA):** Focused on education and training programmes, promoting GNSS for scientific exploration (space weather specifically)
- **Reference Frames, Timing and Applications (IAG, IGS & FIG):** Focused on monitoring and reference station networks

Providers' Forum

- **2007: Establishment**
- Members: Current and future global and regional satellite navigation systems and Satellite-based Augmentation Systems (SBAS) providers

PF provides ways and means of promoting communication among system providers on key technical issues and operational concepts such as the GNSS spectrum protection, orbital debris, and orbit de-confliction

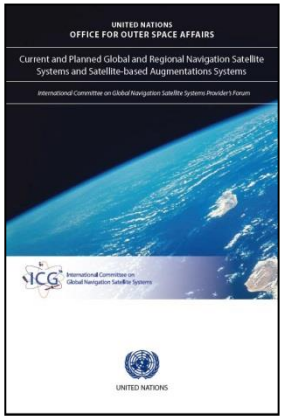
- Scientific and Technical Subcommittee of UNCOPUOS (UN GA Res. 62/217 of 1 February 2008) started consideration of an agenda item "Recent developments in GNSS"
- **2008: Terms of Reference and Workplan**
- Agreement that all GNSS signals and services must be compatible and open signals and services should be interoperable to the maximum extent possible in order to maximize benefit to all GNSS users;
- Consensus reached on 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*
- **2017: Eighteenth Meeting, 6 June 2017, Vienna, Austria**
- Open Service Information Dissemination, Open Service Performance, Spectrum Protection (interference detection and mitigation)

UNOOSA: Executive Secretariat (ICG and Providers' Forum)

ICG Publications

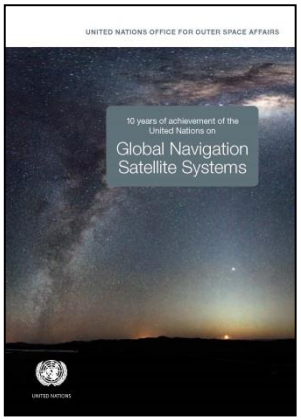
2007

The way forward to provide positioning, navigation and timing globally



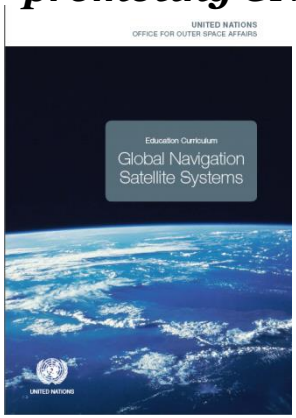
2010

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

Education Curriculum on GNSS: ST/SPACE/59

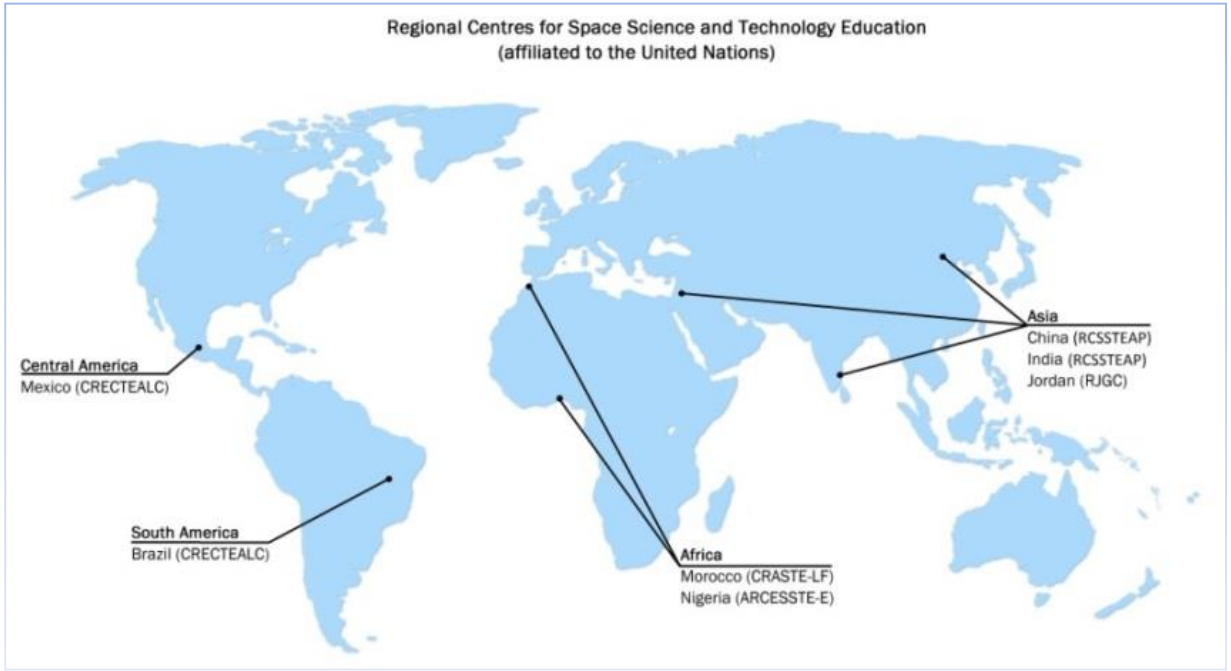
- Developed taking into account the outlines of GNSS courses taught at the university level in a number of developing and industrialized countries.

- The incorporation of elements of GNSS science and technology into university-level education curricula served a dual purpose:

  - to enable countries to take advantage of the benefits inherent in the new technologies, which, in many cases, are spin-offs of space science and technology;

  - to introduce users to concepts of high technology in a practical way and help create national capacities in science and technology in general

Information Centres for ICG



United Nations-affiliated Regional Centres for Space Science and Technology Education

Africa: *Morocco and Nigeria*

Latin America and the Caribbean: *Brazil/Mexico*

Asia and the Pacific: *India and China*

Western Asia: *Jordan*

- ***The Technical Level***: explore the benefits of GNSS technologies for regions and to spread their applications; exchange information and knowledge
- ***The Cooperative level***: facilitate collaboration with the GNSS providers (seminars/trainings and educational material), as well as communication and outreach to the wider community through the ICG information portal

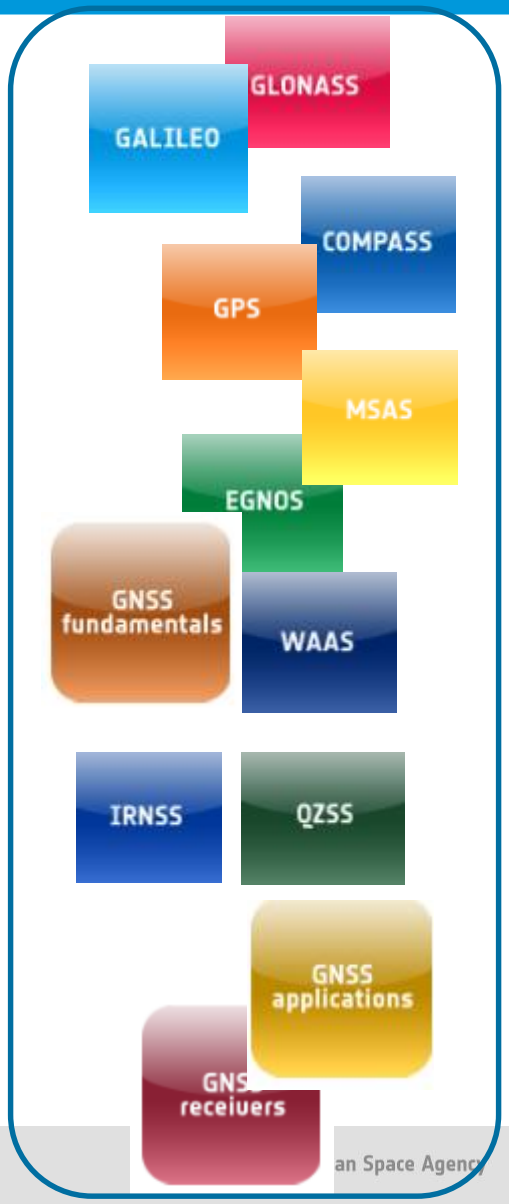
Education Curriculum on GNSS: Course outline

- 9- month post-graduate courses: 540 hours and 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, Space weather
- 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 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.

http://www.unoosa.org/res/oosadoc/data/documents/2012/stspace/stspace59_0_html/st_space_59E.pdf

NAVIPEDIA: Status

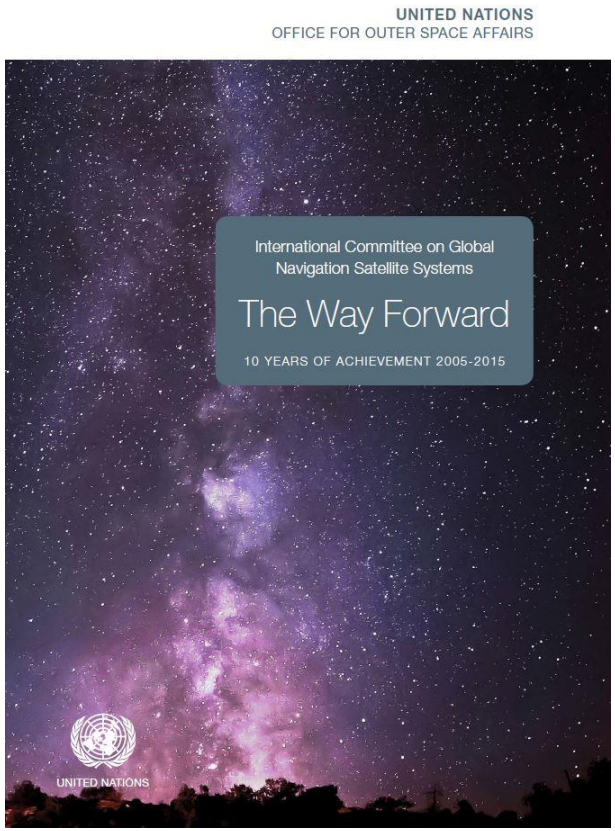
- In line with ICG2012 recommendation on NAVIPEDIA, ESA has been maintaining and developing further NAVIPEDIA with up-to-date information.
- NAVIPEDIA is today extensively used by universities and Galileo application developers.
- NAVIPEDIA is also used as reference as part of the European Satellite Navigation Conference (ESNC) for the GNSS application developers
- An APP version of NAVIPEDIA (for both Android and iOS operational systems) is currently under development. This should be ready by the end of 2016.
- By October 2016, **more than 1 million visits** received on NAVIPEDIA website so far s(www.navipedia.org)
- Most visited articles are on GNSS fundamentals and GNSS applications.



www.navipedia.org

ESA UNCLASSIFIED - For Official Use

2015: The Way Forward



"The establishment of ICG in 2005 ushered in an unprecedented era of cooperation for the United Nations. Over the past decade, ICG has achieved tangible and wide ranging progress", *United Nations Secretary General , Ban Ki-moon*.

"Looking ahead, as co-chairs of the Action Team on GNSS, we believe that ICG will continue to strengthen its role as a major player in the multilateral arena, given that satellite positioning becomes more and more a multinational cooperative venture", *Co-chairs of the Action Team on GNSS (2001 – 2004)*

"ICG has encouraged tangible international cooperation, and leading global satellite operators have coordinated their GNSS services to provide global coverage in satellite-based PNT, for the benefit of all", *Director, Office for Outer Space Affairs*

http://www.unoosa.org/oosa/en/ourwork/icg/documents/publications.html

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Programme on GNSS applications

- **United Nations Regional Workshops/training courses**
  - These activities increase awareness among decision and policy makers of the benefits of GNSS, and develop regional and national pilot projects on GNSS applications

    http://www.unoosa.org/oosa/en/ourwork/psa/gnss/workshops.html

- **Promoting the use of GNSS technologies as tools for scientific applications**
  - These activities are to provide technical knowledge on the operational and practical aspects and issues relating to reference frames, in particular to facilitate a regional forum for geodetic agencies, improve data sharing (GNSS leveling, tide gauge, gravity)

    http://www.unoosa.org/oosa/en/ourwork/icg/activities.html

Programme on GNSS applications

- **United Nations/Italy Long-term Fellowship Programme: Master in Navigation and Related Applications (MNA), Politecnico di Torino, Turin, Italy, October 2017**
  - The curriculum is structured to meet effectively work market demands for high-level technicians endowed with a broad vision of the navigation/localization sate-of-the-art

    http://www.unoosa.org/oosa/en/ourwork/psa/gnss/fellowships.html

- **International Centre for Theoretical Physics (ICTP), Italy & Boston College, USA**
  - The series of activities are carried out since 2009 in order to give theoretical and practical training on the physics of space weather and its main effects on the GNSS operations with particular emphasis on the low latitudes ionospheric processes:

    https://www.ictp.it/scientific-calendar.aspx

ICG Information Portal

WWW.UNOOSA.ORG

WWW.UNOOSA.ORG/OOSA/EN/OURWORK/ICG/ICG.HTML

Conclusion

- ICG has encouraged tangible international cooperation, and leading global satellite operators have coordinated their GNSS services to provide global coverage in satellite-based positioning, navigation and timing, for the benefit of all.
- The establishment of ICG serves as a model for how the United Nations can undertake action to follow up on global conferences and yield tangible results within a fixed time frame.

UNITED NATIONS
Office for Outer Space Affairs

UNISPACE+50 in 2018

UNISPACE+50 high-level segment

20-21 June 2018

as part of the 61st session of the Committee

(20-29 June 2018)

Special events and symposia

18-19 June

Vienna International Centre

Vienna, Austria

THANK YOU

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