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**Developing GNSS Applications in Morocco:
Projects, Research and Training**



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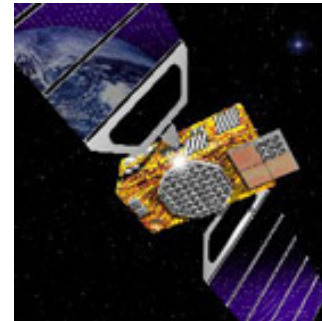
Introduction:

- During these last years, the technology and the applications of GNSS knew a spectacular evolution.
- The determining factors:
 - Technological development,
 - Software engineering progress, Materials prices decreases,
 - Demand of the customers, Competition,
 - Training and awareness.



GNSS technology is currently being used in a wide range of sectors:

- ▶ High precision applications
- ▶ Land transport
- ▶ Maritime transport
- ▶ Aviation transport
- ▶ Multimode transport
- ▶ Safety of life
- ▶ Mass market
- ▶ Professional



- A number of studies and demonstrations have shown that all of these sectors will significantly benefit from the use of GNSS.
- Benefits include improved navigation coverage, accurate and also reliable information.
- ▶ To maximize benefits of the use of GNSS applications and to support sustainable development.



Action Plan must be put in place to succeed the development in this domain:

- ✓ To allow the country to have its local qualified competence in the GNSS field and to exploit fully the benefit brought by this technology.
- ✓ Actions must be adapted to the specificities of the country and take into account its objectives and constraints (technology transfer, human resources, infrastructures, cost, etc.).

GNSS in Morocco

- ✓ **Action Plan**
- ✓ **Projects**
- ✓ **Research**
- ✓ **Training**

Managing GNSS Projects in Morocco:

- Moroccan government created in 2007 an *Economic Interest Group (GIE Galileo Morocco Group)* whose main goal is to initiate and to encourage training, research and application/services development in the GNSS field.

- The GIE comprising:
 1. Telecommunication Regulatory National Agency (ANRT).
 2. Airport National Authority (ONDA).
 3. National Centre of Scientific and Technical Research (CNRST).
 4. Al Akhawayn University in Ifrane (AUI).
 5. Federation of Moroccan ICT companies (APEBI).



Mission of the GIE :

- ***GIE Galileo Morocco Group*** is the official Moroccan interlocutor on GNSS program (especially GALILEO) with foreign partners (EU, MENA).

- Main missions of the group:
 - promote training and research on GNSS and encourage experience exchanges in this field
 - initiate, promote and encourage projects in the field of GNSS
 - assist GNSS service provider companies in developing added value applications and services
 - conclude agreements of partnership.



Reminder:

- ✓ December 2006, Morocco and the EU signed an agreement of structural multilateral, industrial and scientific cooperation relating to the applications of the GALILEO system.
- ✓ Morocco became the 5th country having signed such an agreement with the EU, and the only African country.
- Involvement in several projects and events organized by EU on Galileo and EGNOS

A first survey realized by the **GIE** revealed:

- 1 The existence of local competence in various specialties related to the GNSS (Creating Moroccan GNSS competence DB):
 - ☒ Remote Sensing and Geographical Information Systems
 - ☒ Satellite Communications
 - ☒ Signal Processing and Image Processing
 - ☒ Propagation, Antennas and Radiation
 - ☒ Coding and Communication
 - ☒ Real Time and Embedded Systems
 - ☒ Very High Frequency Systems
 - ☒ Navigation Systems
 - ☒ Positioning and Logistics
 - ☒ Meteorology
 - ☒ Geodesy
 - ☒ Mechanics of Satellites
 - ☒ ...

2 Actors are dispersed in different organisms (universities, administrations and enterprises).

- EMI Mohammadia School of Engineering
- INPT Institut national des postes et télécommunications
- AUI Al Akhawayne University in Ifrane
- IAV Agronomical Sciences and Veterinary Medicine
- AIAC Mohammed VI International Academy of Civil Aviation
- EHTP Hassania School of Public works
- ENSIAS School of Computer Science and Systems Analysis
- CRTS Royal Centre for Remote Sensing
- CNRST National Centre of Scientific and Technical Research
- ENSA (Tanger, Marrakech, Fes, ...)
- FST (Fes, Tanger, Marrakech, ...)
- ...

③ Main Applications of GNSS in Morocco:

- Transport (Aviation, Road, Railway, Maritime)
- Logistics
- Fishing
- Topography
- Telecommunications
- Civil engineering
- Agriculture

➔ **GIE** started a several activities focusing on **capacity building**, specifically, in co-organizing workshops, training, initiating research projects in the academic institutes, developing application and services, and establishing partnerships with actors in other countries.

Main Activities of GIE :

- Cooperate in training programs and develop GNSS educational curricula.
- Promote research activities.
- Participate in international committees and working groups (EU-AU EGNOS).
- Participate in GNSS projects:
 - National projects: Fleet management, Meteorology, Assistance to the blind persons, Management of natural disasters, ...
 - European projects:
 - **METIS**: Transportation of dangerous goods, Multimodal transport, e-Tourism, ...
 - **Med-Tracking**: Partner as Actor and end-users: GIE, ONDA, ONCF, Poste, ...
 - **EGRESS-4A**: EGNOS Receiver Evaluation and extension for Africa



Action Plan 2007-2011:

- ✓ Promote GNSS Services & applications in public and private sectors.
- ✓ Disseminate knowledge on GNSS technology.
- ✓ Initiate Research and Development on GNSS applications in Universities and Research Institutions
- ✓ Propose wide range of courses on the GNSS (undergraduates, post-graduates, professionals, regular courses/short term courses).
- ✓ Establish partnerships with others national and international actors.
- ✓ Maintain effective communication between all the partners.
- ✓ Participate in structuring projects: Road safety, Management of natural disasters, ...

1- Projects:

METIS (MEdiTerranean Introduction of GNSS Services)

- METIS is a project, funded by EU in the framework of the Euro-MED GNSS-I Program, managed by the European GNSS Supervisory Authority (GSA) and run by a consortium of private/public organizations from European and Mediterranean countries.
- METIS (July 2006 - December 2009) has performed activities in support of the implementation of GNSS services in the MEDA countries: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestinian Authority, Syria, Tunisia and Turkey

METIS performed 3 main activities:

➤ Elaborating GNSS Regional Plan:

- Propose Euro-Mediterranean roadmap to facilitate the introduction of EGNOS and the future Galileo, in the MEDA region, in the decade 2009-2019.
- METIS first GNSS Regional Plan workshop was organized by Al-Akhawayn University and by ONDA at Casablanca on July 2007.

➤ Implementing Training & Awareness program:

- METIS implemented a program of training and promotion events that gathered the interest of the MEDA stakeholders.
- The activity included training and seminars, promotion events and workshops organised in different MEDA countries.
- The first METIS Master Training and Awareness took place in Al Akhawayn University on March 2007. The goals were to provide the necessary knowledge and background and to train the future trainers in other countries of the MEDA region.

➔ CBA Study for morocco and MEDA countries

➤ **Running several real-life GNSS Service Demonstrations:**

- METIS run 9 real-life demonstrations, conceived as proof-of-concept of EGNOS applications and benefits in various domains.
- The demonstrations were carried out with the involvement of MEDA stakeholders, belonging to 3 or more countries (Wide Area Demonstrations), or one country (Local Area Demonstrations).
- Morocco participated in 5 demonstrations:

Project	Actors	Countries	Topic
Dangerous Goods	<ul style="list-style-type: none"> •GIS Provider •Explosive and hydrocarbon goods transport •Ministère de l’Energie et des Mines •Direction de la Protection Civile 	Morocco Algeria Tunisia	Dangerous Good Road
Freight Multimodal Transportation	<ul style="list-style-type: none"> •Freight Forwarded •Shipping Liner •International Multimodal Transport Operator 	Tunisia Algeria Morocco	Freight and remote asset Tracking & Tracing
MEDaCoN Mediterranean Data Collection Network	<ul style="list-style-type: none"> •University •Public / Private Research Centres 	Morocco Algeria Tunisia Egypt Jordan Israel Turkey Palestine	Tool for supporting educational activities and test of local services
Mobile surveillance and control in Airport	<ul style="list-style-type: none"> • Technology Provider • National Airports Authority 	Morocco	Aviation
e-Tourism	<ul style="list-style-type: none"> • University • Office of Tourism 	Morocco	LBS & Mass Market

Objectifs:

- Aims to perform concrete actions in support of the EGNOS service extension to areas covered by the Arab Civil Aviation Commission (ACAC) and the Agency for Aerial Navigation Safety in Africa and Madagascar (ASECNA) by promoting and demonstrating the benefits of a civil aviation in a real environment, and also by taking the necessary actions to develop a suitable framework for a solid EGNOS extension process in the ACAC and ASECNA regions.
- SIRAJ intends to achieve a definitive regional action plan focusing on involving the major players in the process and demonstrating the benefits of EGNOS to the major regional stakeholders.
- Funded by EU.

PARTNERS:

- *IT* Telespazio Italy
- *FR* Egis Avia
- *ES* Navya Solutions
- *Org* Arab Civil Aviation Commission: [ACAC](#)
- *Org* Agency for Aerial Navigation Safety in Africa and Madagascar [ASECNA](#)
- *ES* Spanish Aerospace Training Organisation: SENASA
- *MA* Moroccan Airports Authority: ONDA

Med-Tracking Project

Development of logistical and tracking of goods (intermodal: Sea, Air, Road, and Railway in supply chain)

- This initiative has been financed by “in Med-Invest”
- The aim of project, 2009-2010, is to establish a list of recommendations and axes of research/development and of innovation which will take into account and include precise objectives such as: To give security to products transport in the Mediterranean zone thanks to a better acquaintance, a better management and a better localisation of transported products.
- Propose by 2013-2015 the Med-tracking tailored to the demands of the market and providing an application for the benefit of the transport business in the Mediterranean
- Realize a Tracking system of “supply chain” whose improves the management and the routing of containers and the safety of transportation in Mediterranean-Sea.
- With the support of local authorities, end-users in the Mediterranean countries and the RMEI (network of 53 Mediterranean engineering schools).

EGRESS-4A: EGNOS Receivers Evaluation and extension for Africa

Project to be launched during 2011 with 4 European Partners

- Define EGNOS compatibility levels and categorize EGNOS compatible equipments per applications
- Identify the way forward for EGNOS usage deployment in Africa
- Studying low cost effective EGNOS equipment to answer specific application matters.
- Validate feasibilities, identify risks and propose mitigation per EGNOS applications
- Awareness improvement to all stakeholders

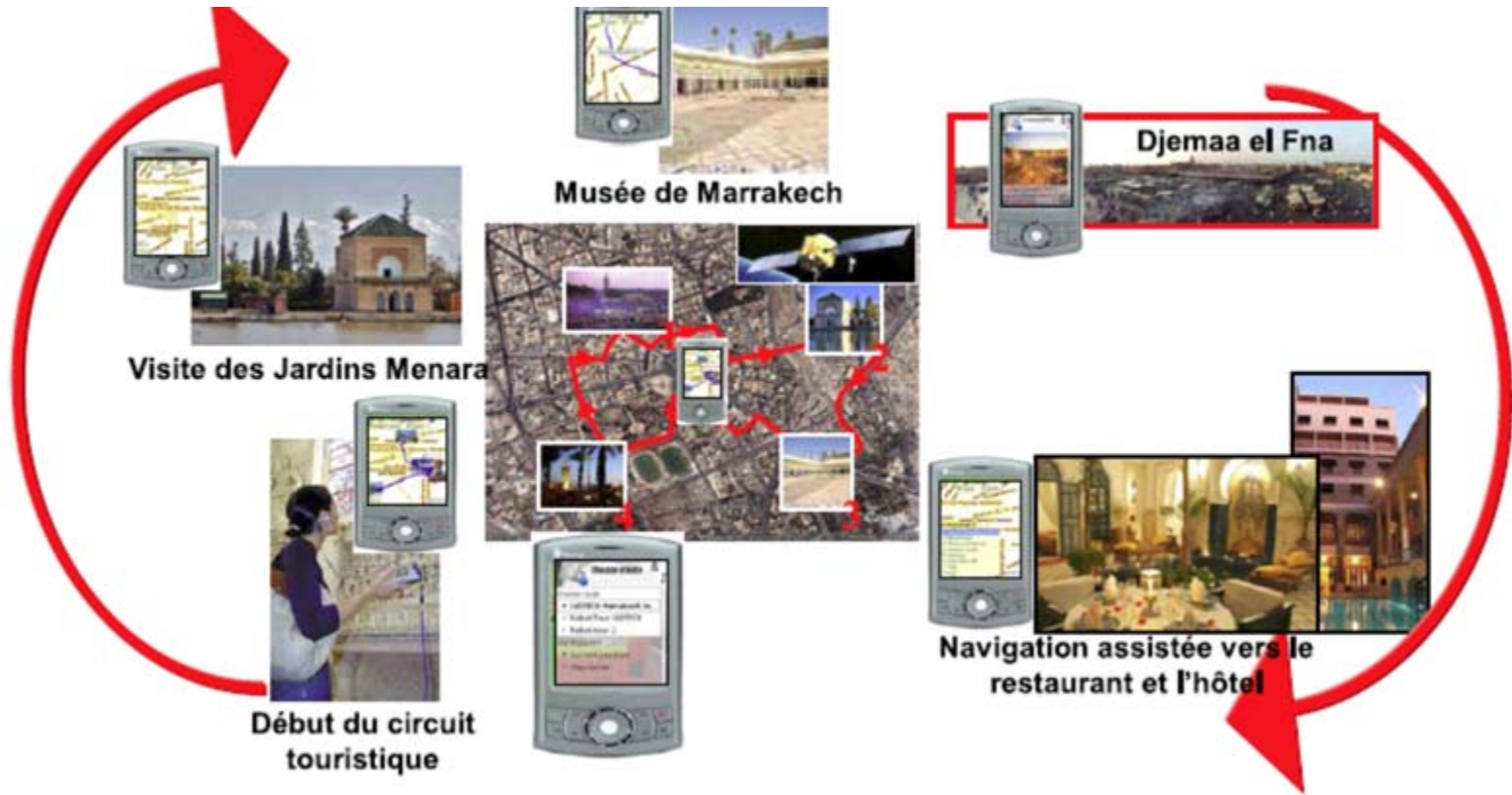
e- Tourisme:

A pilot project realised in Marrakech by Moroccan company Cad Tech an TAS

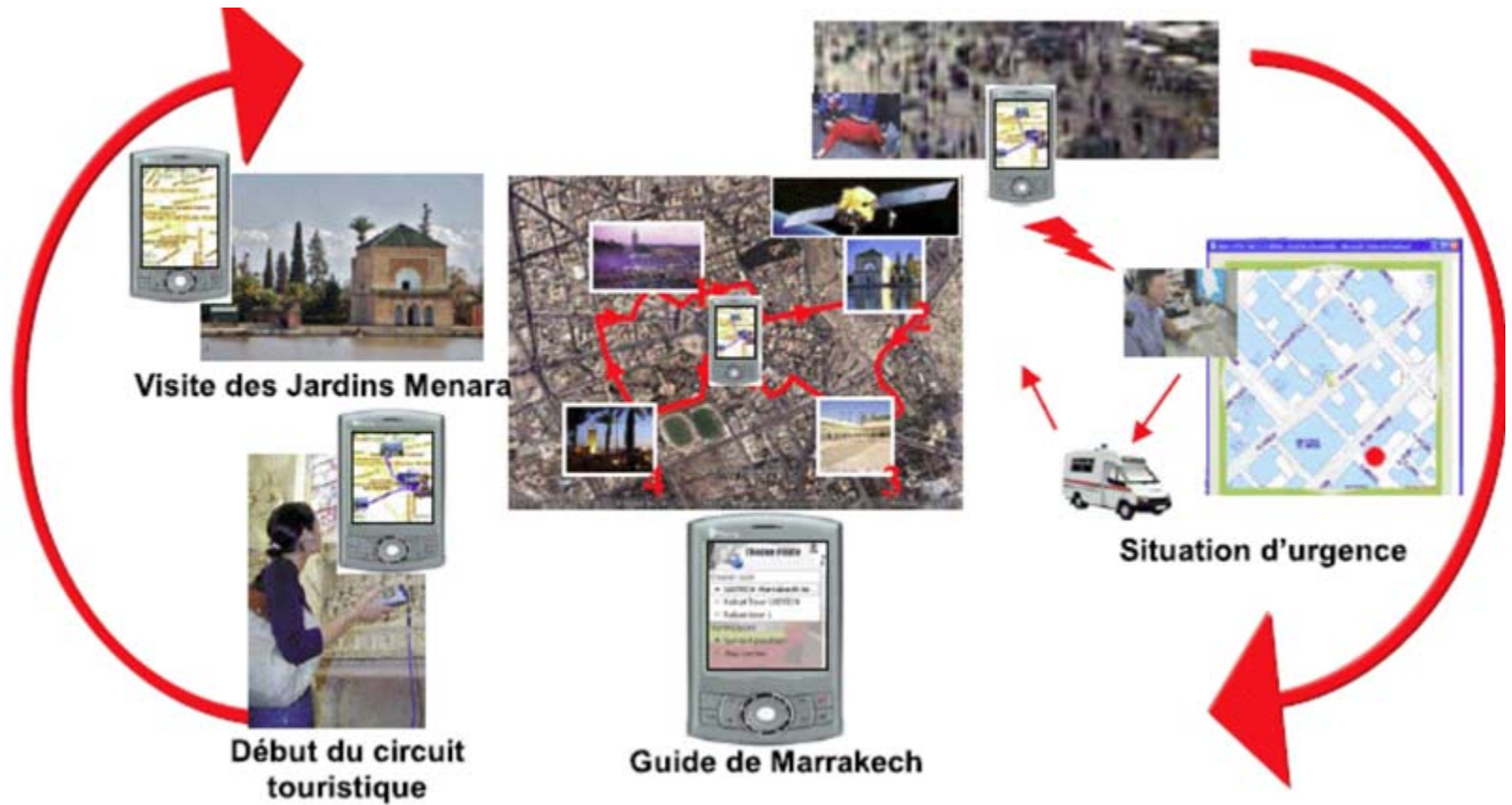
Objectif:

- Improve the comfort and the interest of the tourists
- Improve the security of the tourists (emergency call and localisation)
- Optimize the trip of tourist visits
- Improve the organization and the profits of the tourist operators

e- Tourisme:



e- Tourisme:



Management of fleets / tracking

- Urban transport
- Distributions of goods
- Transportation of fund
- Post administration (messaging and packet)
- Railway administration (train and containers)
- Ambulances
- Custom administration (containers)
-

Network of permanent GPS stations

14 Permanent GPS stations of Agence Nationale de la Conservation Foncière du Cadastre et de la Cartographie (Agency involved with topographical cartography, and high order geodetic control surveys)

EGNOS Reference and Integrity Monitoring Stations (RIMS) at Agadir airport.

2- Research:

Objectif:

- Initiate and develop research in university on GNSS technologies and applications.
- Reinforce the formation by research
- Constitute teams of local researchers.

Meteorology:

The use of GPS data for meteorological forecasting (Mohamadia School of Engineering)

Management of natural disasters

The use of GPS and Satellite images for the detection of the inundation and the management of the emergency interventions (University of Tetouan)

e- Tourism:

Pilot projects initiated by AUI in Ifrane and Azrou

Assisting blind people:

- The goal of the 'GNAV ' project (Automatic Navigation Guide for blinds) is to provide users with navigation system adapted to blinds.
- The system will have a simplified, light and portable architecture.
- Offer to the users a simplified control panel and several necessary services for their displacements notably the selection of the cartography.
- The system will provide optimal itinerary toward a destination with an excellent localisation precision.
- The project is conducted by the university of Tangier

- **GPS Receivers in underwater environment**
- **Indoor positioning: Wifi, zigbee, ...**
- **Convergence of wireless technologies: GPS, GSM, Wifi, ...**
- **Low cost receivers**
- **Robustness of the coding of GNSS Signal**
- ...

3- Training:

Objectives:

- Understand the fundamental theory of GNSS.
- Understand various applications of GNSS.

Goals:

- Provide short term experts.
- Training of trainers.

Forms:

- Classroom course.
- Education by research.
- Distance learning.

✳ Training, awareness and pilot projects are the key for the success of GNSS Application development

- ✓ Training of trainers,
- ✓ Modification of academic syllabus,
- ✓ Infrastructure and materials,
- ✓ Financial aspect
- ✓ Exchange of ideas between decision-makers,
- ✓ Collaboration with regional and international institutions.



CRASTE-LF

- ▶ The Regional African Centre for Space Science and Technology Education in French Language (CRASTE-LF) was created in Rabat, Morocco on October 1998. The affiliation to the UN took place on November 2003.
- ▶ 13 Member Countries.
- ▶ 12 Postgraduate courses.
- ▶ Long-term programs have benefited for about 150 participants from 17 African countries.
- ▶ 12 workshops and training courses.



The Main Courses Programs

- Remote Sensing And Geographic Information Systems,
- Satellite Communications,
- Satellite Meteorology and Global Climate,
- Space and Atmospheric Sciences

Target Public

Academics (Professors,...) Researchers,
Engineers, Administrators and
Managers

Recovering Sectors Universities,
Research Institutes, Professional
and Private Institutes and
Administrations



International Training Courses in GNSS on Satellite Navigation and Location Based Services

To be able to organize the Postgraduate training in GNSS.

The Centre organized the GNSS courses for 4 weeks from September 28 to **October 24, 2009, Supporting by UNOOSA, ICG and others National and International Institution.**

Duration : 4 Weeks

Location: The Course will be conducted by CRASTE_LF

Number of Trainees: 35

Objective : Capacity Building in GNSS Applications, and to make the participants aware of the potential of Satellite Navigation Technology and its applications.

Target Public: Trainees from Institutions work and use Space Tools from Africa Region and speaking in French, they have high level education.

Partener:

ONDA

- ▶ The **National Airport Authority** has a multi-disciplinary training and research centre in the field of civil aviation: **Mohammed VI International Civil Aviation Academy**.
- ▶ The Academy offers high quality multi-disciplinary training and benefits from support from the leading international bodies.
- ▶ It accommodates 4 specialized training institutes:
 - Institute of Air Traffic Services.
 - Institute of Aviation Safety Systems.
 - Institute of Aviation Management.
 - Institute of Civil Aviation Security.
- ▶ The International Civil Aviation Organisation **ICAO** has established a special cooperation with the ONDA through the TRAINAIR program.
- ▶ The Academy has benefited from the accreditation of its Safety institute as a sub-regional centre reporting directly to the ICAO head office in Montréal.

INPT – AIMAC : Master on GNSS

- Propagation, antennes et rayonnement
- Codage et communication
- Théorie de l'Information et Codage
- Communications Numériques
- systèmes et Outils de développement
- Systèmes Temps Réel et Systèmes Embarqués
- Réseaux de Communication
- Hyperfréquences et Systèmes d'acquisition
- Composants μondes
- Capteurs – RFID
- Traitement d'images et Télédétection
- Codage de l'image
- Systèmes de Télécommunications
- Télécoms mobiles
- Télécoms/satellite
- Architecture distribuée
- SIG
- Bases de données multimédia
- Systèmes de navigation
- Géodésie
- Systèmes de navigation par satellite
- Techniques de positionnement
- Positionnement et logistique
- Projet de Fin d'Etudes

Conclusion:

- ✓ Training, awareness and pilot projects are the key for the success of GNSS application development.
- ✓ Several projects have been realized thanks to the cooperation between actors.
- ➔ Improve cooperation between public and private sector
- ➔ Improve regional and international cooperation

- ✳ GIE stays attentive to all initiatives to strengthen the development of the GNSS in Morocco and its region.
- ✳ GIE is held ready to conclude cooperation agreements with actors in other countries and with regional and international institutions for the development and the promotion of the GNSS and its applications.

Thanks for your attention

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