GNSS in Maritime and Education in Egypt
GNSS IN MARITIME

- Ships
- Ports
- Waterways

GNSS maritime applications will help to improve:
- Navigation.
- Ship operations.
- Traffic management.
- Seaport operations.
- Inland waterways.
- Casualty analysis.
- Offshore exploration and exploitation and fisheries.
CONTAINER SHIPS

Cruise Liner
VLC – very large crude carrier
Navigation in Narrow Channels

- Marginal ships operation.
- Bridge clearance.
- Narrow fairways, canals.
Oil & Gas – At a Glance

Heavy left carrier
GNSS to assist in dredging operations
SHIPS EQUIPMENT & GNSS

- GNSS NAVIGATION SYSTEM
- ECDIS
- AIS
- VDR
- RADAR
- DP
- GMDSS
- EPIRB
- COMMUNICATION SYSTEMS
GNSS accuracy can support AIS alarming system to prevent ships collision.

AIS is mandatory system for SOLAS ships, performance of the system depends on the accuracy, provided by GNSS/GPS/EGNOS, The system enables ship to identify particulars, direction, position in coastal and heavy trafficked areas.
GMDSS
GLOBAL MARITIME DISTRESS SAFETY SYSTEM

VDR AND EPIRB

MEDUSA National Workshop - Cairo 2014
MARITIME USER’S REQUIREMENTS

- Availability
- Accuracy
- Reliability
- Continuity
- Accessibility
- Integrity
EGYPT’s WATERWAYS

Suez Canal

Inland Navigation
River Nile
GNSS/DGPS Coverage In Egypt

- Mersa Matruh
- Alexandria
- Port Said
- Ras Gharib
- Quseir
- Ras Umm Sid

Map of GNSS/DGPS coverage in Egypt with selected locations marked.
GNSS EDUCATION

- Why we need to teach
- What we teach
- How we teach
Several centers are supported by The UN Program on Space Applications, two of them in Africa.

- The French media in Morocco.
- The English media in Nigeria.

Each of the centers provides postgraduate education, research and application programs in GNSS technologies.
The objective of the centres

- To increase cooperation between stakeholder partners and industry.

- Enhance the capabilities of member States, at the regional and international levels, in various disciplines of space science and technology that can advance their scientific and economic development.
UN GNSS Course implemented on two phases.

Phase 1
- Development and enhancement of the knowledge and skills of university educators and research and application scientists in both the physical and natural sciences as well as in analytical disciplines.

Phase 2
- Focuses on ensuring that the participants make use of the skills and knowledge gained in phase 1 in their pilot projects.
The course consists of nine modules covering specific areas of GNSS (theory, technology and applications).

The duration of the course is **36 weeks**, followed by one year of pilot project work in the participant’s home country.
## GNSS Module Topic Duration in hours

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>540</td>
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<tr>
<td>I: Fundamentals</td>
<td>60</td>
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<td>II: Position determination techniques</td>
<td>60</td>
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<tr>
<td>III: Technologies: augmented systems</td>
<td>80</td>
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<td>IV: Sensors and embedded system design</td>
<td>60</td>
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<tr>
<td>V: Receivers</td>
<td>80</td>
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<tr>
<td>VI: GNSS/INS integrated navigation</td>
<td>80</td>
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<tr>
<td>VII. GNSS applications</td>
<td>80</td>
</tr>
<tr>
<td>VIII. Space weather and GNSS</td>
<td>40</td>
</tr>
<tr>
<td>IX: Lab. experiments, field visits, project work</td>
<td>540</td>
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<tr>
<td>30hr week x36=1080</td>
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</tbody>
</table>
Module I. Fundamentals

- Concepts of global navigation satellite systems (GPS, GLONASS, Galileo, BeiDou etc.)
- Time systems, Transformation between reference systems.
- Satellite orbits: Orbital motion, determination of satellite position, visibility and ground tracks.
- Propagation of EMW. Antennas, signal modulation, and multiple accesses.
Mod.II. Position Determination

- GNSS measurements: Pseudo-Ranges, carrier phase and Doppler;
- Position determination techniques;
- Single point position technique;
- Satellite constellation and DOP: satellite geometry, calculations on dilution of precision (DOP).
Errors in GNSS measurements:

Effects of errors:

Error mitigation techniques:

Augmented systems:

GNSS networks:

GNSS impact factors and its mitigation
Mod. IV. Sensors and Embedded System

- Sensors and transducers

- Embedded systems: Cell phones, pagers, answering machines, televisions, CD/DVD players, video game, GNSS devices, network routers, fax machines, cameras, music synthesizers, planes, spacecraft, boats, and cars.
Mod. V. GNSS Receivers

- Receiver architecture:
- Signal tracking:
- Navigation algorithm:
- Inertial navigation systems.

- INS error dynamics:

- GNSS / INS integration:

- General sensor fusion concepts.
Module VII. GNSS Applications

- Geospatial databases
- GNSS navigation:
  - Navigation and communication:
  - GNSS applications for remote sensing
Module VIII. Space weather and GNSS

- Interference with solar radiation.
- Different view in precise (geodesy, DGPS)
- Ionosphere, monitoring, measurement and modeling: 

Mod. IX. Lab. Experiments, Field visits, Project-work (540 hours)
GNSS Education in Egypt

- University courses consist of one postgraduate semester mainly oriented to civil engineering and surveying.

- The Arab Academy for Science and Technology and Maritime Transport delivers courses based on IOM guide line for both graduate and undergraduate courses.
GNSS IMO COURSE (20 hours)

- Principles of operation of GNSS aboard ship
- States that the system will provide continuous world-wide position-fixing capabilities
- The intended level of accuracy of GNSS
GPS Systems

- The basic principles GPS
- The system configuration
- The frequencies that are used
- C/A & P codes
- Position measurement
- Dilution of Precision (DOP) Errors of GPS
- States describes the accuracy obtainable with GPS and how the accuracy can be downgraded
- Explains WGS 84
DGPS – Differential GPS (1 HOUR)

- Describes the basic principle of Differential GPS
- Describes how DGPS stations can transmit the corrections
- Describes the Regional Satellite Navigation Systems such as EGNOS.
GALILEO (1 HOUR) IMO

- The principle of Galileo as the European Augmentation system.
- Describes Galileo components
- States the services provided by the Galileo system.
Describes the principle of GLONASS
Different constellation of GLONASS and GPS.
Advantage of the receiver integration capable of both GLONASS and GPS.
Limitation of GLONASS
Awareness and out of box education

- The national and international conferences and workshops has the objective of:
  - Meeting main GNSS stakeholders;
  - Gathering inputs in terms of GNSS state of play, GNSS service provision chain, key players and relevant role/responsibilities, regulatory framework, decision-makers and authorities.
CONCLUSION 1

Reliable GNSS serve fleet management, enabling to locate specific shipments, and environmental hazards,

EGNSO Augmentation can provide,

- A reliable safe, and accurate navigation in any phase,
- Integrity information for Safety-of-Life,
- Increased performance with integrated GPS/GALILEO,

- Improved SAR services
- Aiding in Emergencies Situations.
There is an urgent need to set up a framework for higher education in Egypt addressing different educational initiatives.

Awareness raising and capacity building in the field of GNSS enhance ties of top level stakeholders and facilitate the use of GNSS in Egypt.

Further more Egypt should set up and announce its own Radio Navigational Plan.
THANK YOU