Education by research in GNSS in Turin

Prof. Letizia Lo Presti
Politecnico di Torino

UN/OOSA Workshop, Lusaka 26-30 June
Overview

- NAVSAS group and research activities
- Master in Navigation and Related Applications
- The internship projects
- The JEAGAL Project: a prototype of world-wide cooperation
Overview

NAVSAS group and research activities

• Master in Navigation
• The internship project
• The JEAGAL Project
Navigation Signal Analysis and Simulation Group

A Joint Research group focused on the Galileo user segment
NavSAS Skills

- NavSAS has been established in 1999, as a spin-off of the TLC group of Politecnico di Torino.

- About 20 researchers

- Research activities are mainly focused on:
  - receiver (GPS and Galileo) technologies. NavSAS is one of the major academic R&D groups operating in this field
  - Galileo receiver SDR implementation
  - GNSS Local Element technologies
  - NAV/COM hybridization
  - Advanced signal processing for GNSS (e.g. Multi-path rejection)
  - Innovative Interference monitoring and mitigation strategies

- NAVSAS has a strong scientific background proved by more than 70 publications on navigation topics
Participation to committees

Participation to committee and working groups

- **Galileo Signal Task Force**
- **CGALIES** working group for E-112
- **GALILEAN Network**
- **International Pseudolite** working group
- **Review** of European projects and journal papers
- **Chairman** of conference sessions
## Participation to GJU projects

<table>
<thead>
<tr>
<th><strong>GARDA</strong></th>
<th>Galileo receiver</th>
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<tbody>
<tr>
<td><strong>GILT</strong></td>
<td>Local Element</td>
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<tr>
<td><strong>ARTUS</strong></td>
<td>Professional receiver</td>
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<tr>
<td><strong>GIRASOLE</strong></td>
<td>Safety-of-life receiver</td>
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<td><strong>GR-POSTER</strong></td>
<td>Mass market receiver</td>
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<td><strong>GREHDA</strong></td>
<td>Satellite receiver</td>
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<tr>
<td><strong>POP-ART</strong></td>
<td>Alpine rescue</td>
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Structure of Education in Politecnico

Master in Navigation and Related Applications

Age

First level Master

Second level Master

UN/OOSA Workshop, Lusaka 26-30 June
A joint initiative of
Politecnico di Torino and Istituto Superiore Mario Boella
with the cooperation of IEN Galileo Ferraris and UN OOSA

The objective is to disseminate knowledge, a key element for the future exploitation of Galileo
Requirements for Admission

- Students with a 5 years curriculum

Degree on:
- Information Technology
  - Electrical Engineering
  - Communications Engineering
- Aerospace Engineering
- Environmental Engineering
The Master lasts 1 year:

- 12 classes over 3 quarters
- The fourth quarter is devoted to an internship to be carried out in a company

The overall program includes 80 Educational European Credits (ECTS)
Fellowship program

• UN-OOSA, ISMB and Politecnico di Torino have developed a long-term fellowship program which will provide students/specialist from developing countries and countries with economy in transition with an opportunity to receive a Master degree in GNSS

• Students will receive a financial support for the tuition fee and for other expenses during their studies
Fellowships in the First Edition

Through the Information Technology School of Politecnico di Torino

ISMB/UN (5)
CRF (2)
Motorola (1)
CSP (1)
CPPG (3)
ALPIP (3)
ASIAN (2)

Comitato Promotore Programma Galileo

ISMB (fellowship), UN (travel expenses)

ISMB/UN (5)
CRF (2)
CSP (1)
Motorola (1)

Private sector

More than 60 applications received
Students from **9 different countries** will be trained on GNSS

<table>
<thead>
<tr>
<th>Country</th>
<th>Project</th>
<th>Students</th>
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<tr>
<td>Ghana</td>
<td>ISMB/UN</td>
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<td>Iran</td>
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<tr>
<td>Algeria</td>
<td>ISMB/UN</td>
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<tr>
<td>Nigeria</td>
<td>ISMB/UN</td>
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<tr>
<td>Mexico</td>
<td>ALPIP</td>
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<tr>
<td>Ecuador</td>
<td>ALPIP</td>
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<th>Country</th>
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<th>Students</th>
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<tr>
<td>China</td>
<td>JEAGAL</td>
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<tr>
<td>Vietnam</td>
<td>JEAGAL</td>
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<th>Country</th>
<th>Project</th>
<th>Students</th>
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<tr>
<td>Jordan</td>
<td>Other</td>
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Web sites

- http://didattica.polito/master/navigation
- http://www.oosa.unvienna.org
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**Intership Projects**

Students will spend 4 months (internship) in a research lab or a company operating in the field of navigation with the goal to develop a specific pilot project.

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UN/OOSA Workshop, Lusaka 26-30 June
Pilot Projects in the II Edition

- "Use of GPS/Galileo receivers for railway applications"
  - Analysis of safety requirements and integrity levels
  - Risk analysis and mitigation actions to determine the Safety Integrity Level for the user terminal equipment
  - Validation of the proposed safety design for the GNSS subsystem

- "Indoor Positioning Using WLAN Radio Signals and GNSS signals"
  - Analysis of existing solutions
  - Study of possible improvements with the Galileo signals
Pilot Projects in the II Edition

- “GPS-GALILEO/INS integrated navigation systems for maritime applications”
  - Analysis of existing solutions and their drawbacks
  - Study of an innovative algorithm to determine the ship attitude matching real-time requirements

- “Integer Ambiguity Resolution of the Integrated navigation system based on GPS/Galileo”
  - Analysis of GNSS signal structure and parameters relevant to ambiguity resolution
  - Applications of the nonlinear particle filtering to obtain improved solutions
Pilot Projects in the II Edition

• “Effects and Mitigation of Multipath on GPS and Galileo Signals”
  – Characterization of GPS and Galileo signals
  – Multipath effects on code and carrier phase measurements
  – Analysis of antenna-based mitigation methods

• “Switch Strategies of Location-based Services in Combined GNSS and B3G Mobile systems Environment”
  – Analysis of solutions based on existing Communication systems
  – Study of innovative solutions
Pilot Projects in the II Edition

• “Development of a GNSS-based map-aided positioning system in urban environment”
  – Creation of a digital map of the city
  – Development of the application using the Java programming language

• “Navigation payload design for NIGCOMSAT1”
  – Analysis of possible applications of the navigation payload in the field of search & rescue
  – Design and configuration of the navigation payload
“Development of a GIS for installations of an Electricity Network using GNSS signals”
- Field measurements using GPS receivers
- GIS software development
- Integration of network data in the developed application

“Performance Analysis of Code and Carrier Tracking with Galileo Software Receiver”
- Review of existing techniques
- The impact of Galileo and modernized GPS signals
- Development of a software tool for performance evaluation

Photo: ESA - P. CARRIL
Pilot Projects in the II Edition

- “Estimation of clocks for Timing in GSTB-V1”
  - Analysis of main characteristics of timing aspects in the Galileo system
  - Analysis of clocks characteristics in the Galileo system
  - Analysis of the results of GSTB-V1

- “Assessment of stability on the Experimental Galileo System Time scale to UTC/TAI”
  - Analysis of needs of time accuracy and stability in Galileo
  - The Galileo EPTS
  - EGST performance assessment
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JEAGAL project (2005-2007)

EU-Asia Information Technology & Communication Program

A Galileo ‘train-the-trainer’ program for China and Vietnam

Italy (Politecnico di Torino)
Spain (Univ. Politecnica de Catalunya)

China (Nanjing SouthEast University)
Vietnam (Hanoi Univ.)
The JEAGAL Project

Main Activities

• Four workshops held in the two Asian countries for technicians and decision-makers

• The training of ten Asian technicians attending the Master in Navigation and Related Applications in Turin

• The setup of laboratories on Galileo in the Asian partner Universities

• The preparation of related educational material

• Starting date: 1st March 2005
• Duration: 24 months
Lectures in Asia

Nanjing

Hanoi

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Dissemination activities

- Scientific conferences

- ISMB Navigation Laboratory and NavSAS group: [www.navsas.polito.it](http://www.navsas.polito.it)

- Short seminars tailored to a specific audience (decision makers, high school teachers, potential users, etc.)

- Interview with journalists (for newspaper articles and/or television shows)
Thank you!