Education tools for GNSS

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Politecnico di Torino

Italy

NavSAS research group

NavSAS is a joint research group of ***ISMB*** and ***Politecnico di Torino*** University operating in the satellite navigation and localization sectors.

- NavSAS staff consists of 28 researchers.
- Research is focused specifically on advanced technologies for GPS / EGNOS / Galileo receivers and applications.
- See http://www.navsas.eu & http://www.galileoblog.eu

Outline

1 – Master on Navigation

2 – NAVKIT

3 – Signal Generator / Analysis

4 – Software receiver

5 – SAT SURF / SAT SURFER

Master on Navigation and Related Applications

The one-year Master is a joint initiative of

Istituto Superiore Mario Boella

with the cooperation of

INRIM Galileo Ferraris and UN OOSA

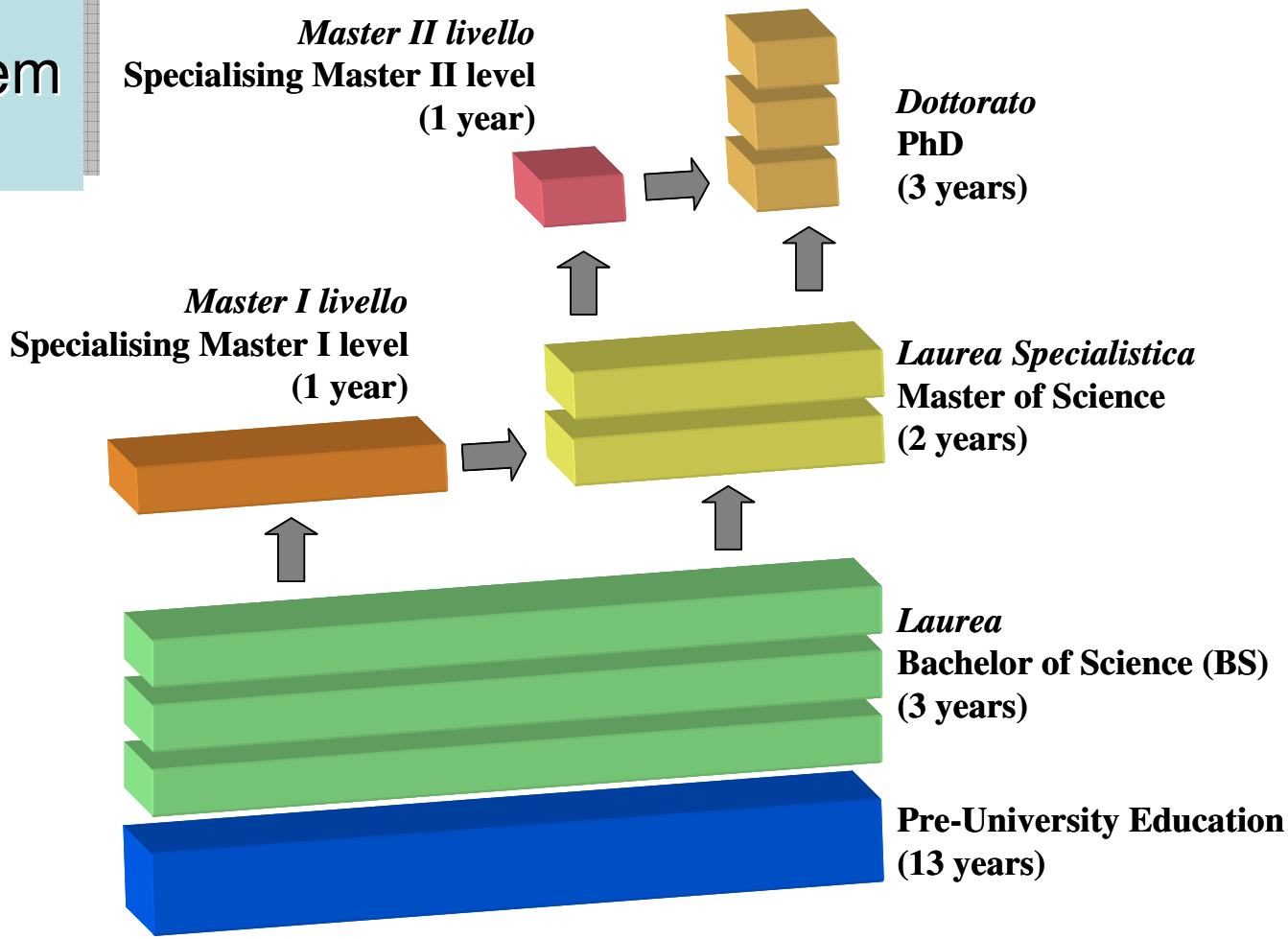
Istituto Elettrotecnico Nazionale GALILEO FERRARIS

United Nations

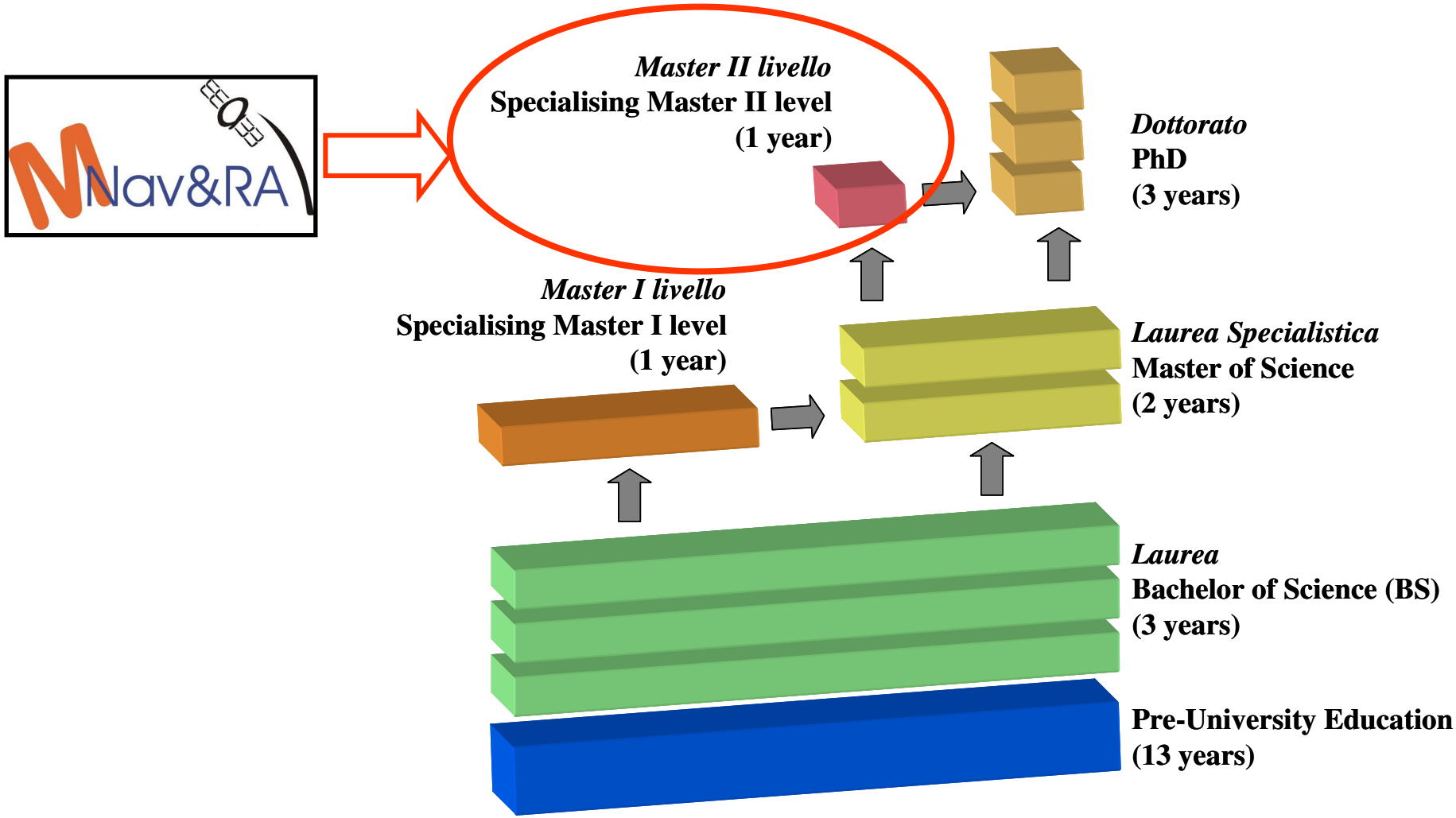
Office for Outer Space Affairs

Structure of Education in Italy

The Italian University system after 1999



Specializing Master



Overview of the Master Program

Requirements for Admission

Students with a 5-year university curriculum

Degree on:

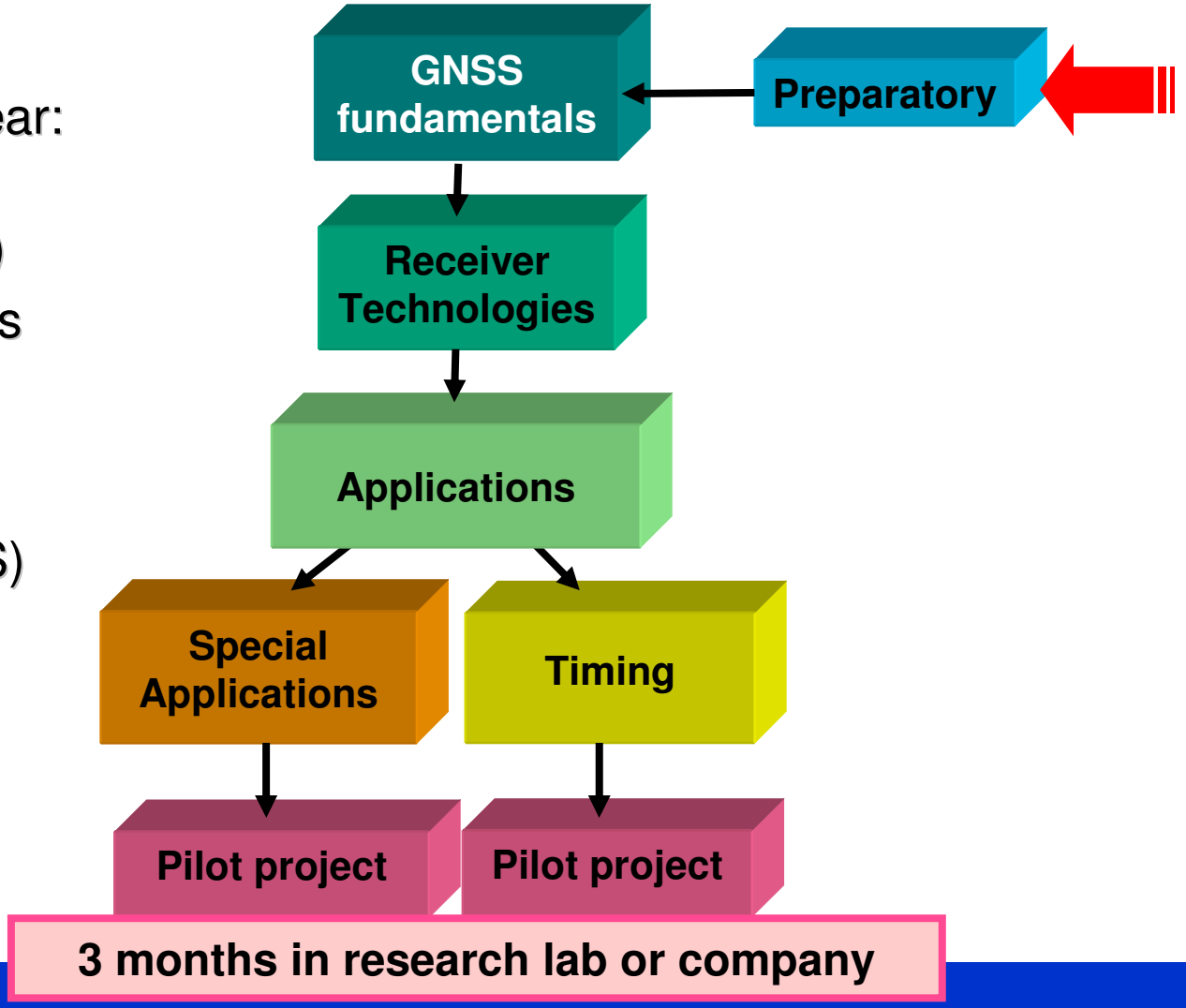
- Information Technology
  - Electronic Engineering
  - Communications Engineering
- Aerospace Engineering
- Environmental Engineering

Good knowledge of English language

Overview of the Master Program

The Masters lasts 1 year:

- 12 classes over 3 quarters (50 ECTS)
- The fourth quarter is devoted to an internship to be carried out in a company (30 ECTS)



Details on UN/Italy Fellowship

"Istituto Superiore Mario Boella (ISMB) and Politecnico di Torino of Italy have established a Long Term Fellowship Programme which will provide scientists and specialists from developing countries with an opportunity to receive a Master Degree in Navigation and Related Applications."

United Nations Vienna, June 2004

The fellowship is therefore the possibility for ***students selected by United Nations*** to attend the Master

Details on UN/Italy Fellowship

The agreement among Politecnico di Torino, ISMB and UN-OOSA covers the following aspects:

Master Organization	The Masters programme has been organised with the co-operation of officers of UN-OOSA
Contribution to the Master Curriculum definition	The program of the courses has been prepared by the Masters Scientific Committee and discussed with the UN-OOSA representatives
Master Promotion	The Masters and the Fellowship initiatives are promoted through the UN web site and in all the UN Educational Centres in the world

Details on UN/Italy Fellowship

The agreement among Politecnico di Torino, ISMB and UN-OOSA covers the following aspects:

Student Selection	4-5 students are selected yearly by UN through the UN Regional Educational Centres
Financial Support	The students that are selected by UN receive a scholarship by ISMB to attend the Master

The first five editions

UN/ISMB Project

Country - Students	
Algeria - 1	Madagascar - 1
Egypt - 1	Mexico - 1
Georgia - 1	Mongolia - 1
Ghana - 1	Nigeria - 2
Haiti - 1	Pakistan - 3
Iran - 1	Sri Lanka - 1
Jordan - 1	Vietnam - 2

ALPIP-Meftia Projects

Country	
Argentina - 4	Ecuador – 2
Brazil - 2	Mexico – 1
Colombia - 1	Peru - 1

JEAGAL Project

Country
China - 6
Vietnam - 4

Italian National funds

Country	
Bangladesh - 1	France - 2
China - 1	Italy - 16
Colombia - 2	Lebanon – 1
Ecuador – 2	Pakistan – 3

ASIAN-Zhong Guò Projects

Country
China - 3
Indonesia - 1
Vietnam - 1

Some comments…

- Students actively participate to the course activities
- Seminars offered by industries and international bodies were enthusiastically welcome by the students
- Students coming from so different countries and cultures succeeded in interact and integrate their experience with very positive results in intellectual and cultural exchanges
- About all the graduated students are now working in the field

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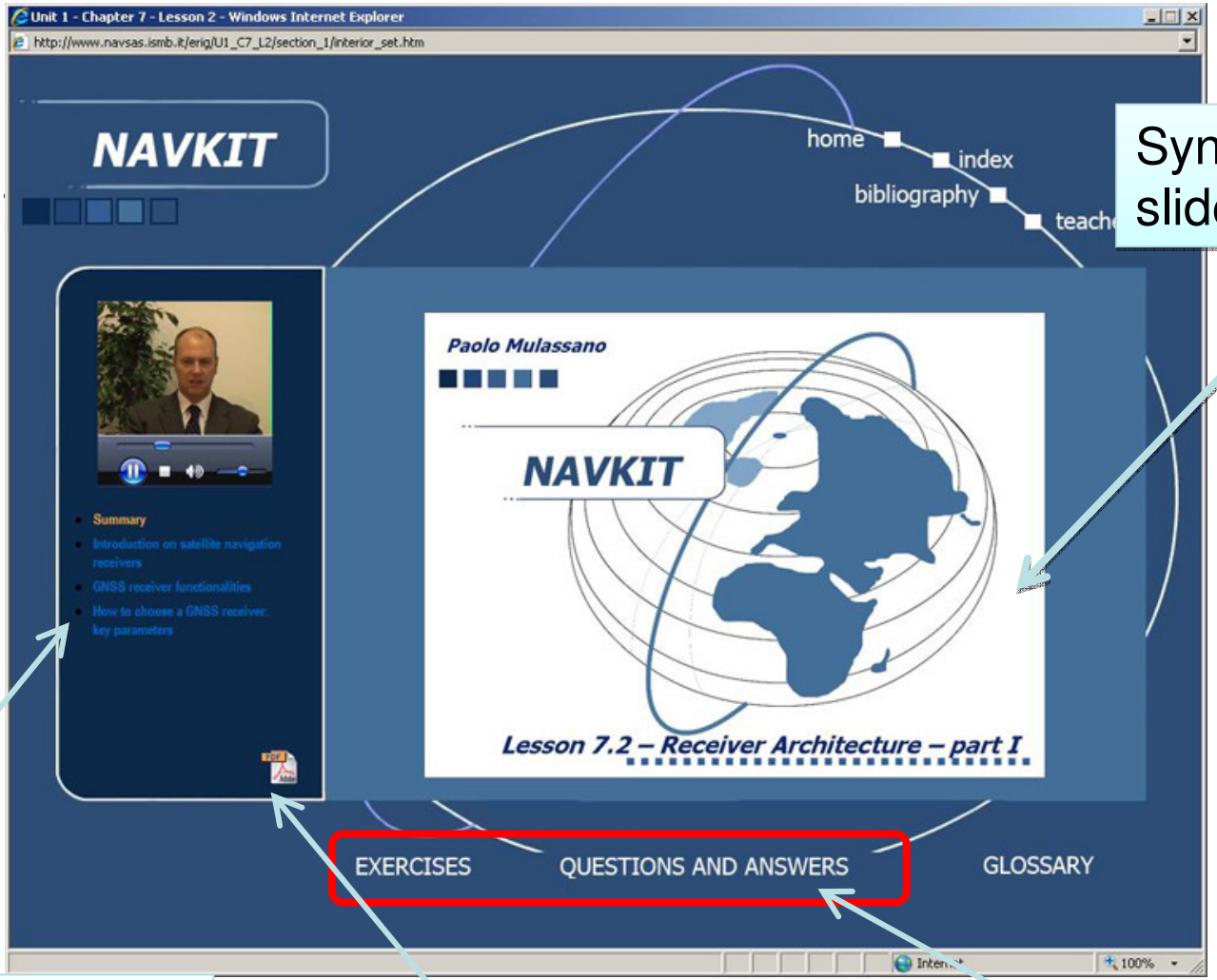
What is NavKIT

- NAVKIT1.1 is a tool for autonomous training on satellite navigation subjects
- The tool can be accessed via Web (www.navsas.eu) or can be installed as an application on the PC
- NAVKIT1.1 is the output of a task of the ERIG project "Education Research and Innovation in GNSS" funded by the GNSS Supervisory Authority within the VI FP

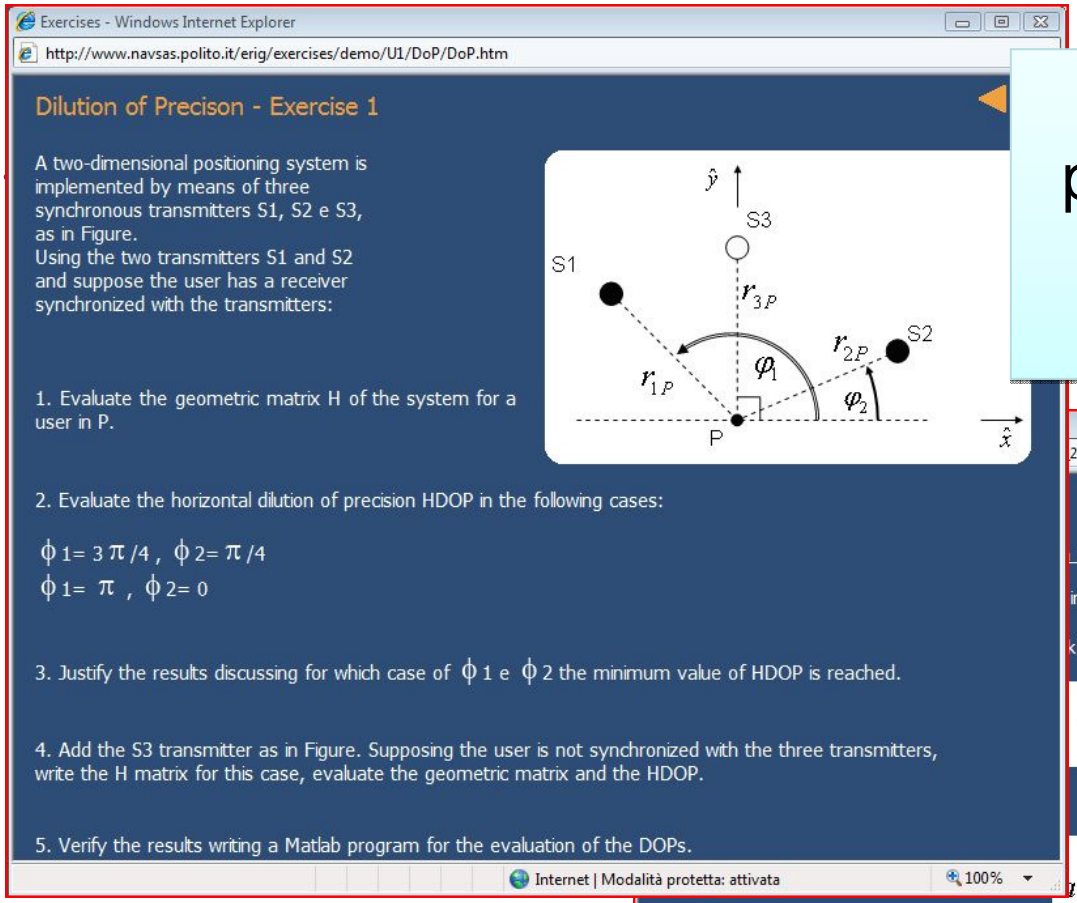


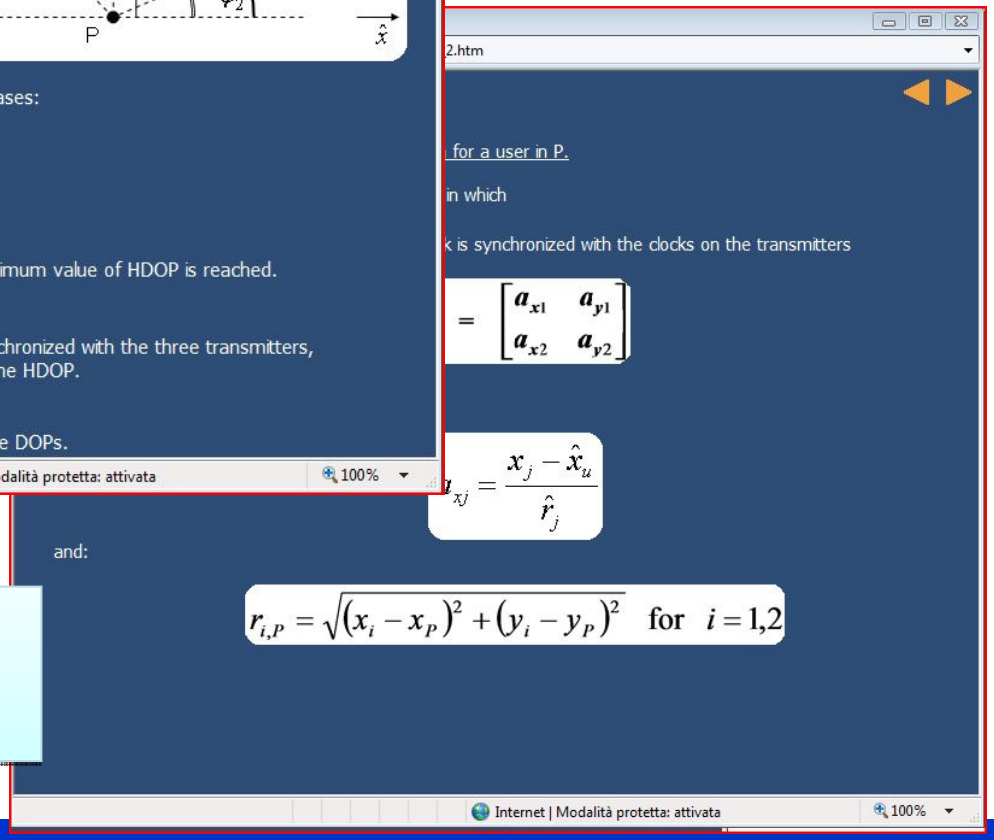
Synchronized slides

Sections can be selected for play and replay

Printable version of slides

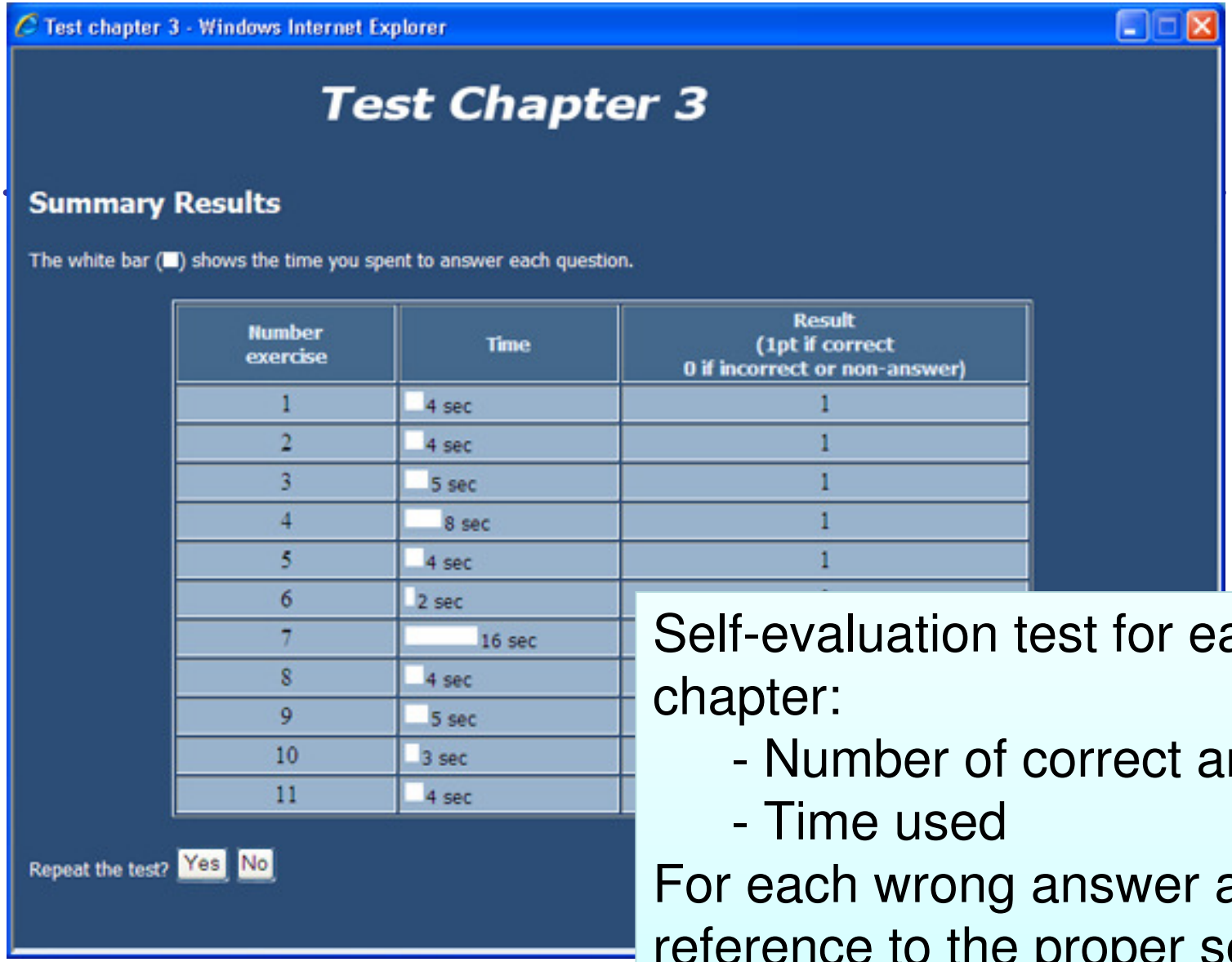
Exercises & Questions





Exercises on positioning problems and processing of satellite signals

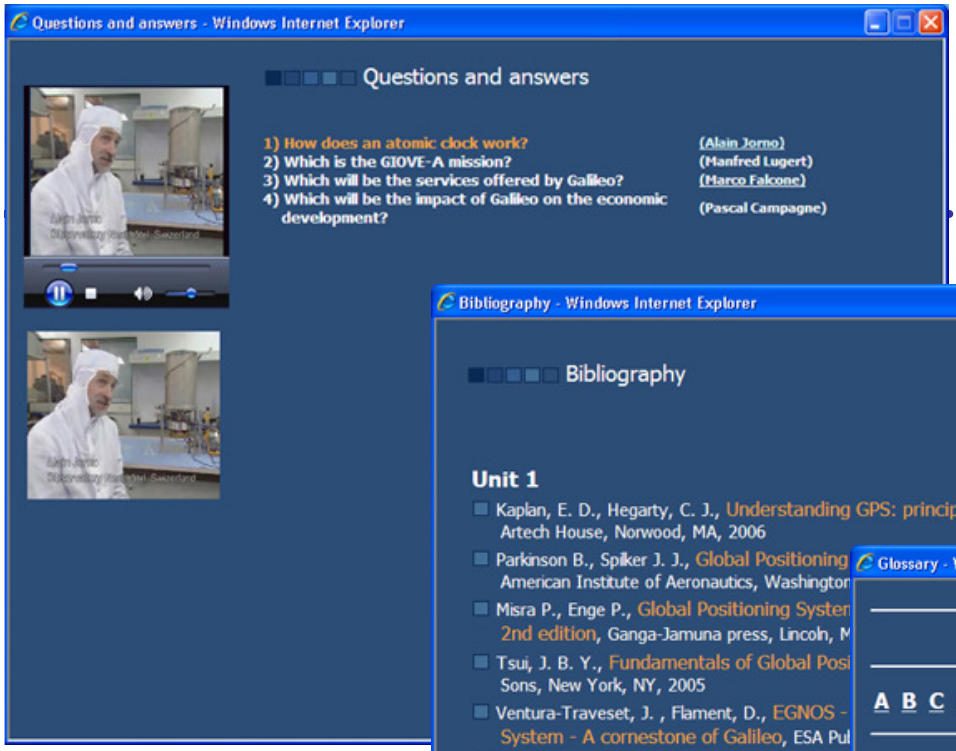
Methodologies for problem solving



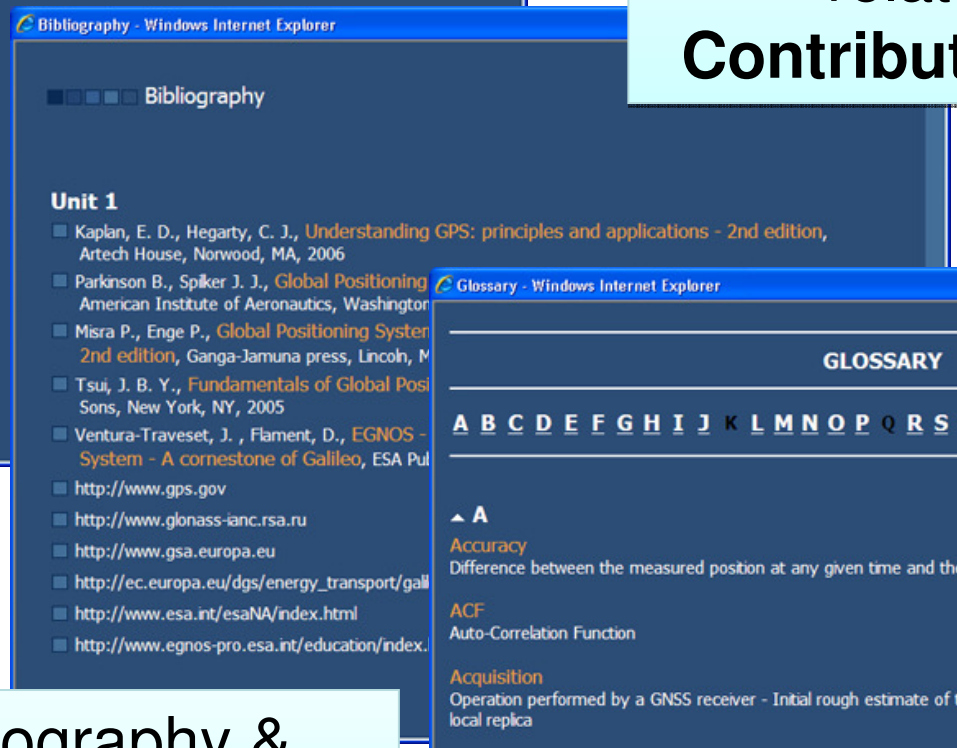
Self-evaluation test for each chapter:

- Number of correct answers
- Time used

For each wrong answer a reference to the proper section of the lessons is provided



Section of questions and answers on general topics related to GNSS **Contributions by experts**



Bibliography & Glossary

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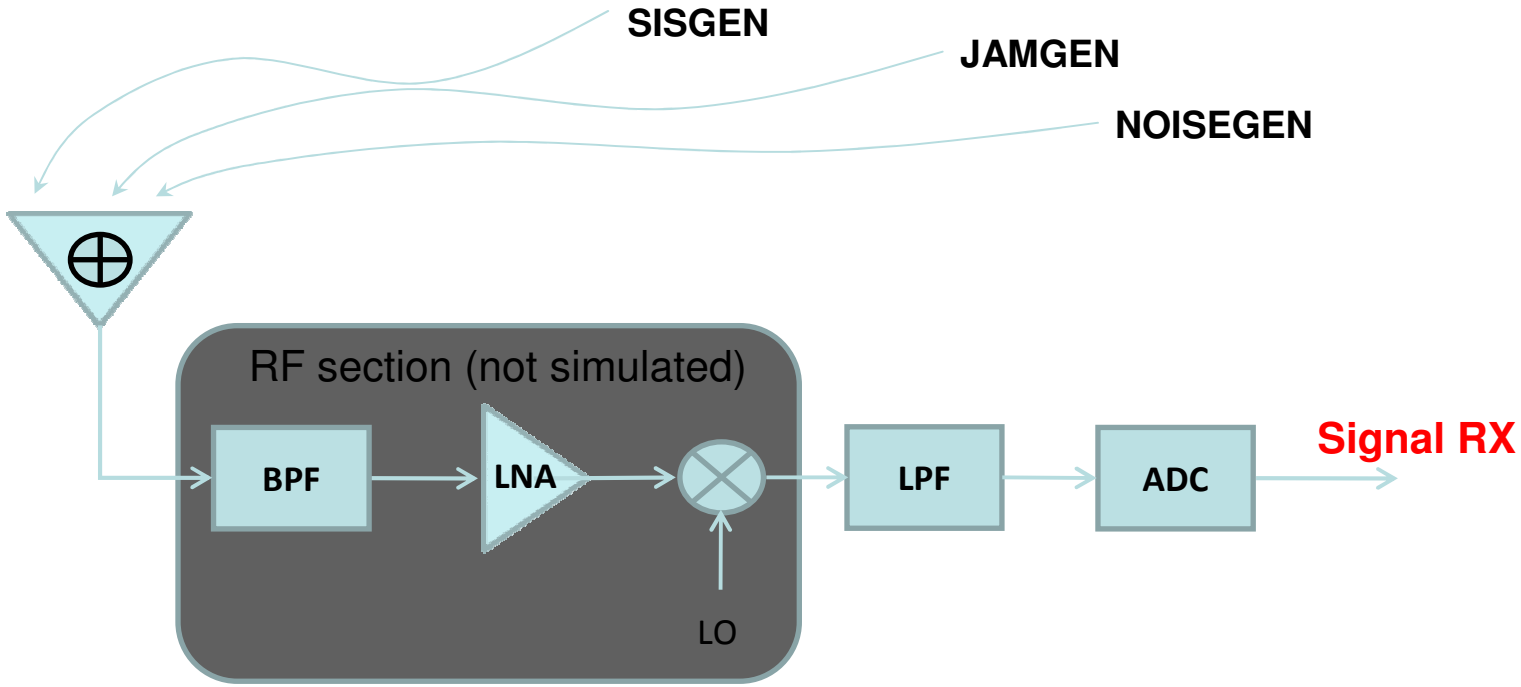
SW package: Signal Generator



The signal generator is a software package which simulates the received signal at the output of the front-end analog to digital converter

SW package: Signal Generator

SIS Modulations

- GPS
  - L1
  - L2
  - L5
  - L1C
  - L2C
- Galileo
  - E1-BOC
  - E1-MBOC
  - E5
  - E6
- EGNOS

Analysis Tools

Interference

- **Intra/Inter-system interference (IS):** one ore more signals among GPS, Galileo, and EGNOS;
- **Multipath (MP):** one ore more attenuated and delayed versions of the SIS;
- **Narrowband interference (CW):** continuous wave (CW) signal;
- **Wideband interference (WB):** wideband signal modeled as filtered white noise.

Signal generator (student edition)

The student edition of the Signal generator is available **free of charge!**

Please contact Davide Margaria (davide.margaria@polito.it)

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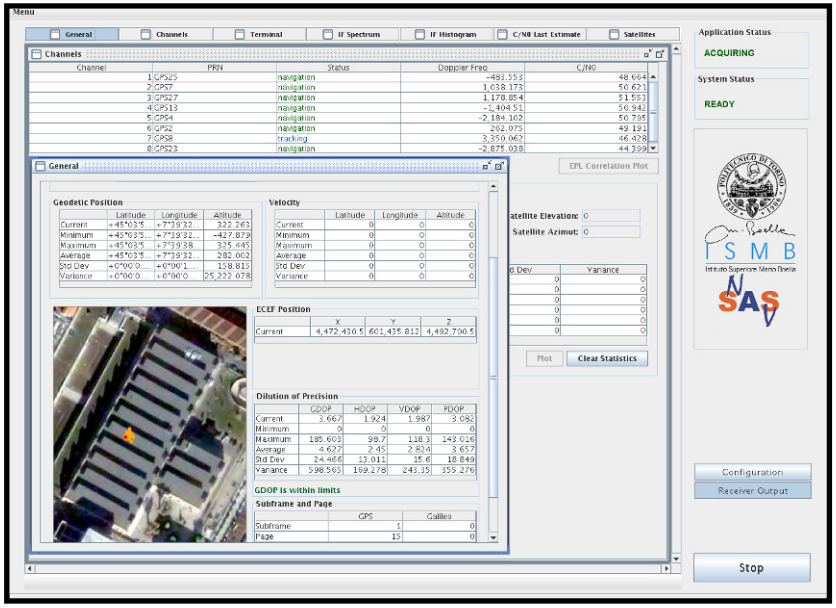
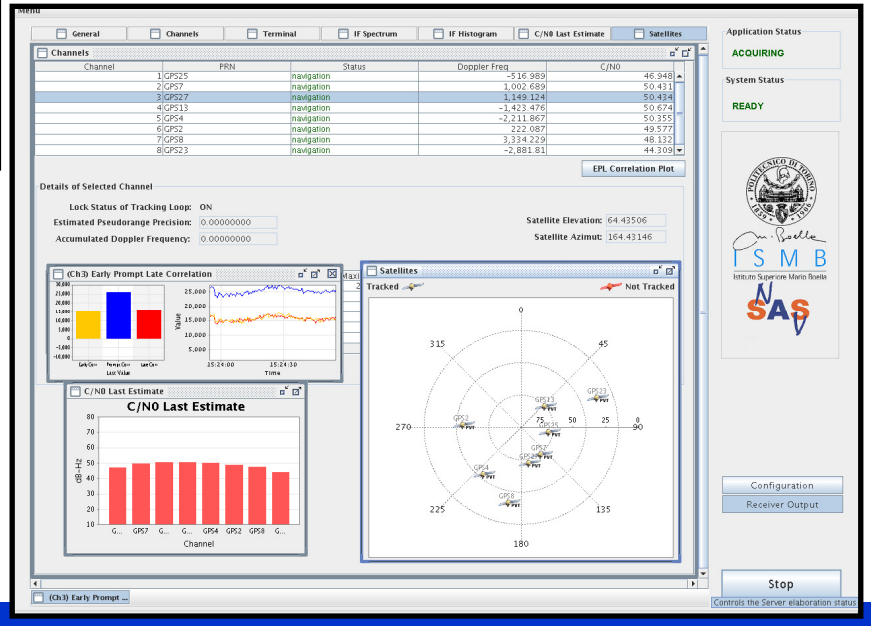
N-GENE Software Receiver



- **GPS L1 8 bits quantization at a sampling rate of** 17.5103 MHz
- **Galileo E1, GIOVE-A & GIOVE-B** signals, upgradable to Multiplexed Binary Offset Code (MBOC) easily
- **EGNOS, WAAS &A-GPS**

- Position Accuracy: r.m.s<10 m using code-based measurements and without applying carrier smoothing techniques
- Time to First Fix in Cold Start mode lower than 45 seconds
- Up to 20 channels



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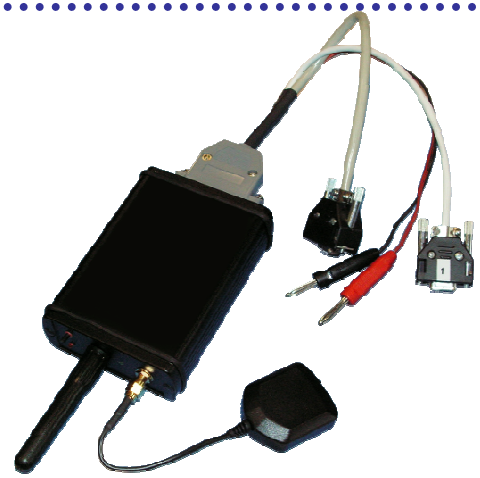
SAT-SURF & SAT-SURFER

A Tool for Hands-On Training on Satellite Navigation

SAT-SURF & SURFER Features



1 – It allows to log all the raw GPS and GSM data (both binary and NMEA Protocols)

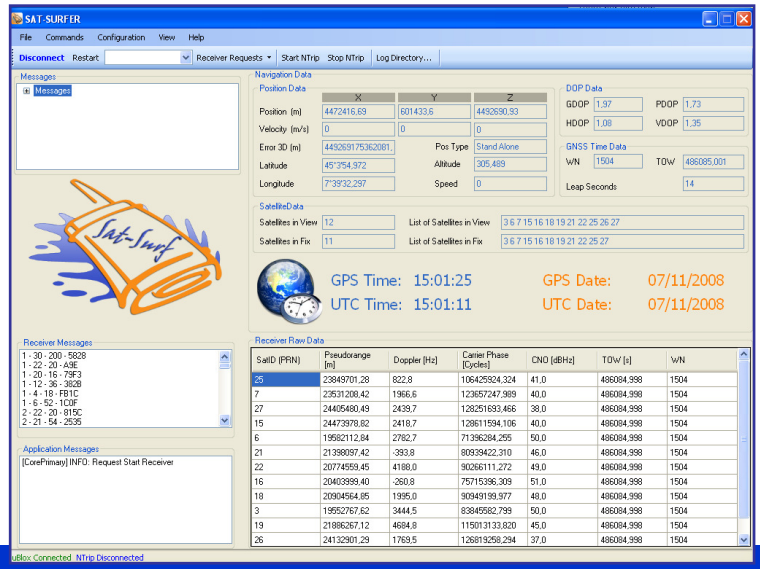
2 – It embeds different GPS modules depending on the user needs:

- uBlox Modules
- SiRF Modules

3 – Equipped with a quad-band GSM/GPRS modem (worldwide coverage) for NAV/COM integration

4 – Raw data storage in the various file formats for an easy post-processing:

- ASCII, Excel® & MATLAB® files
- RINEX 2/3 Log



Contacts

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www.navsas.eu

Visit our non-official blog on Galileo!
www.galileoblog.eu

Thank you!