Educational tools for GNSS

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Outline

1 – Master on Navigation

2 – NAVKIT

3 – Signal Generator / Analysis

4 – Software receiver

5 – SAT SURF / SAT SURFER

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Master on Navigation and related applications

The one-year Master is a joint initiative of

with the cooperation of

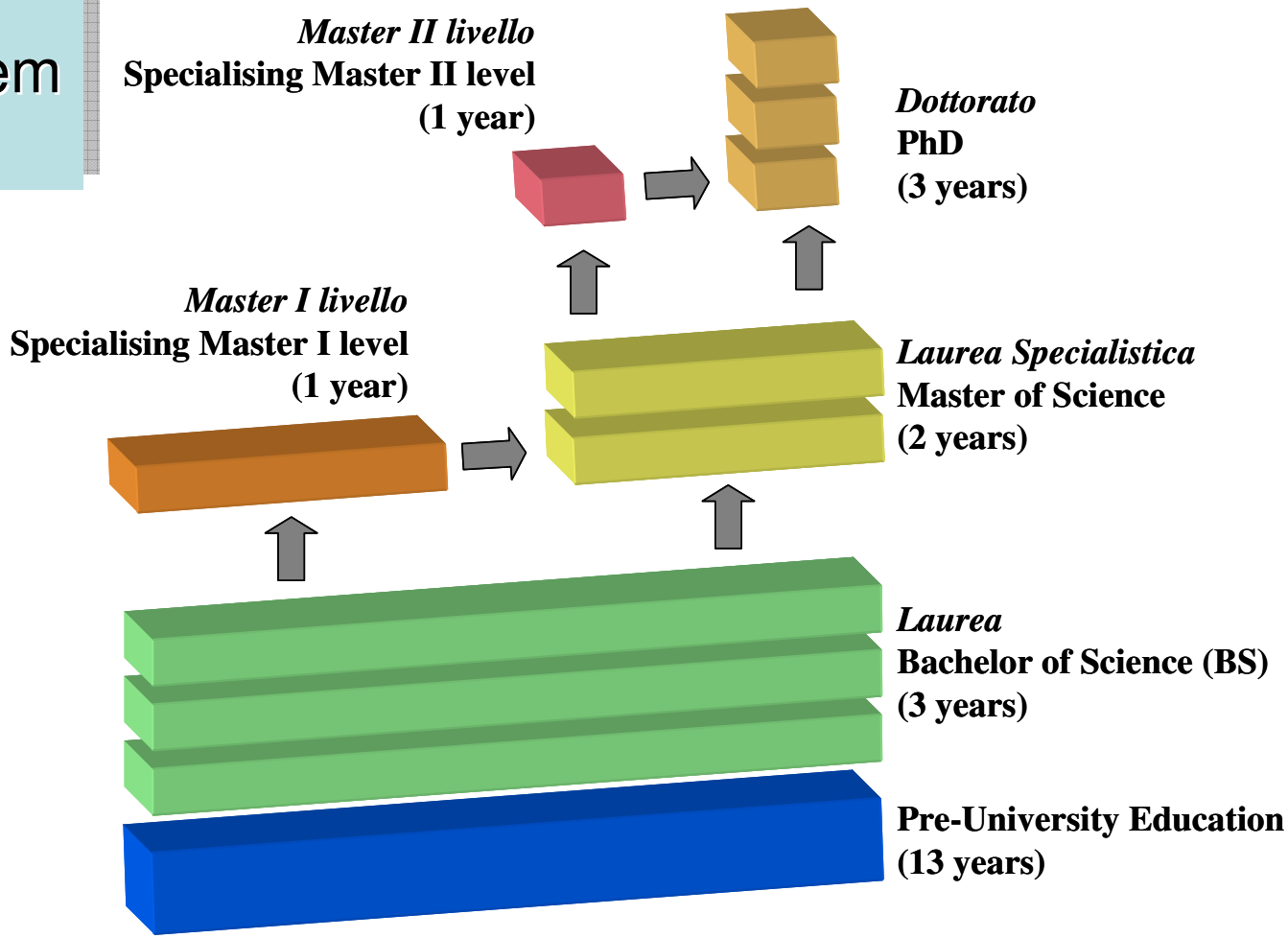
INRIM and UN OOSA

United Nations

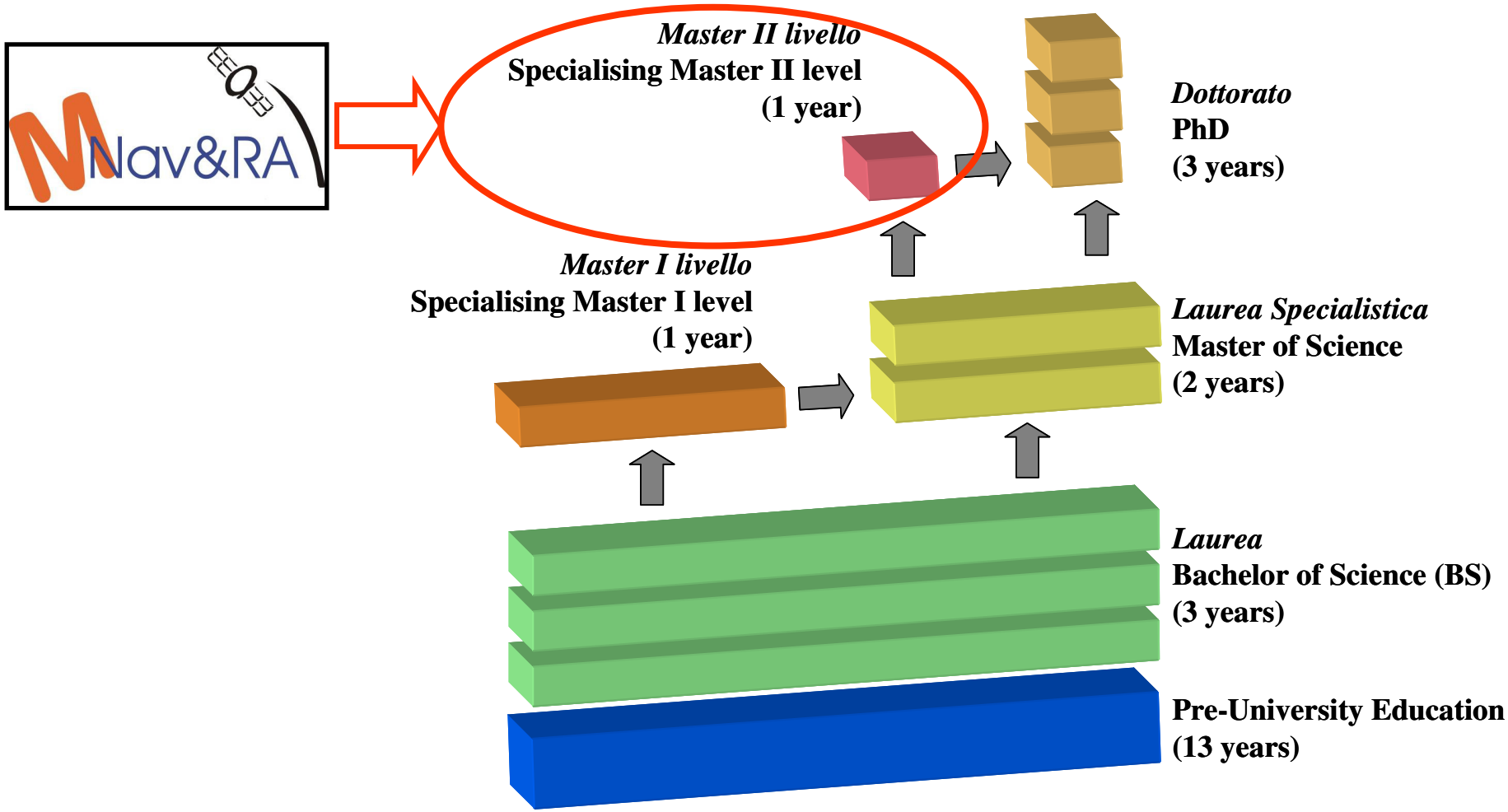
Office for Outer Space Affairs

Structure of Education in Italy

The Italian University system after 1999



Specializing 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

ASIAN-Zhong Guò Projects

Country
China - 3
Indonesia - 1
Vietnam - 1

National funds

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

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What is NavKIT

- NAVKIT is a tool for autonomous training on satellite navigation subjects
- NAVKIT has been developed as a task of the ERIG project “Education Research and Innovation in GNSS” funded by the GNSS Supervisory Authority within the VI FP

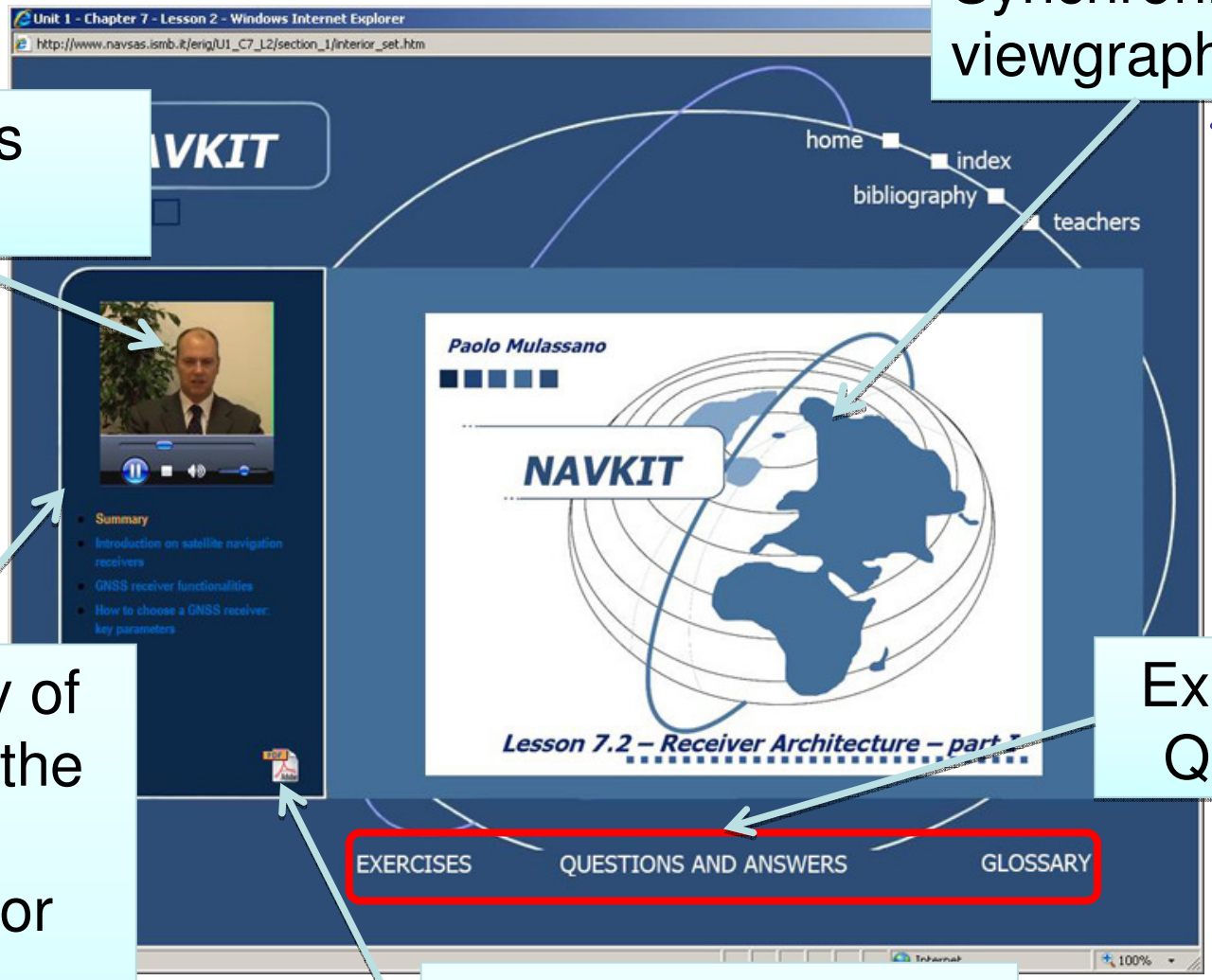
- The tool can be accessed via Web (www.navsas.eu) or can be installed as an application on your own PC

What is NavKIT

- The tool is designed for students but also for technicians and professionals in need of a starting training in the field
- It allows to learn the basic concepts of satellite navigation by means of a multimedia approach
  - ✓ Videos (lectures)
  - ✓ Exercises fully solved step by step
  - ✓ Self evaluation tests
  - ✓ Frequently asked questions

Synchronized viewgraphs

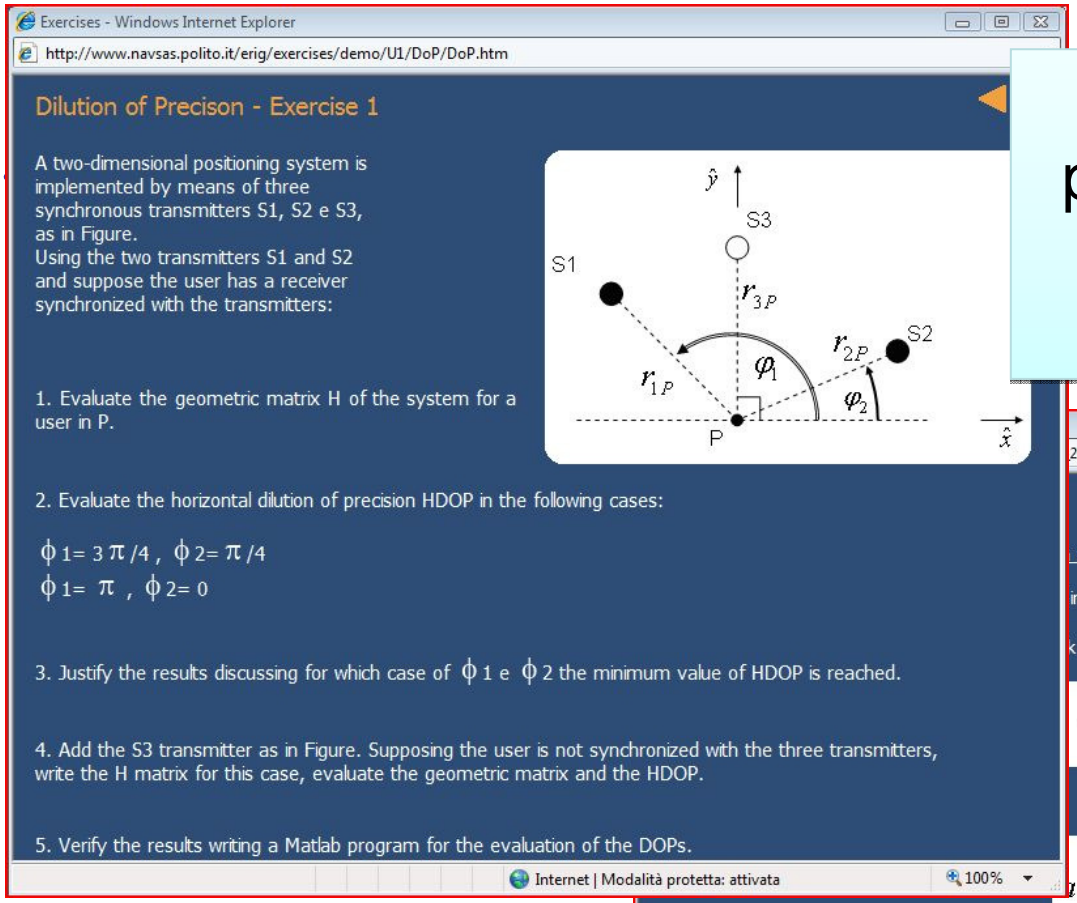
Teacher's video

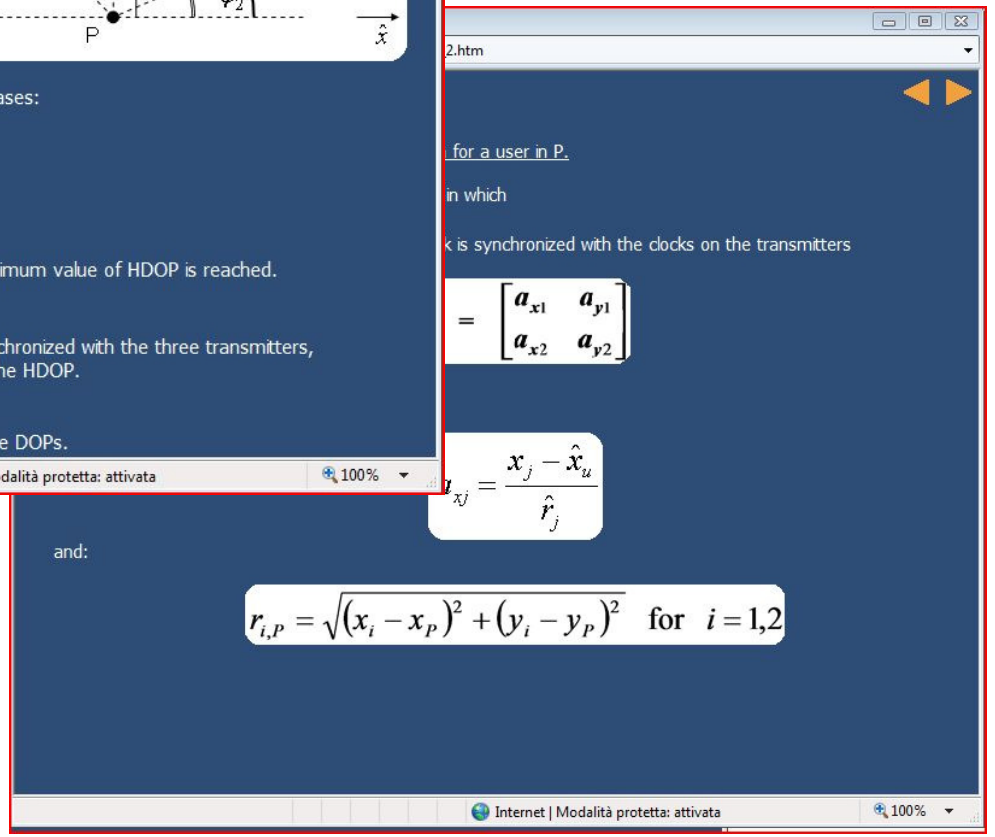


Possibility of selecting the various sections for play and replay

Exercises & Questions

Printable version of the viewgraphs





Exercises on positioning problems and processing of satellite signals

Methodologies for problem solving

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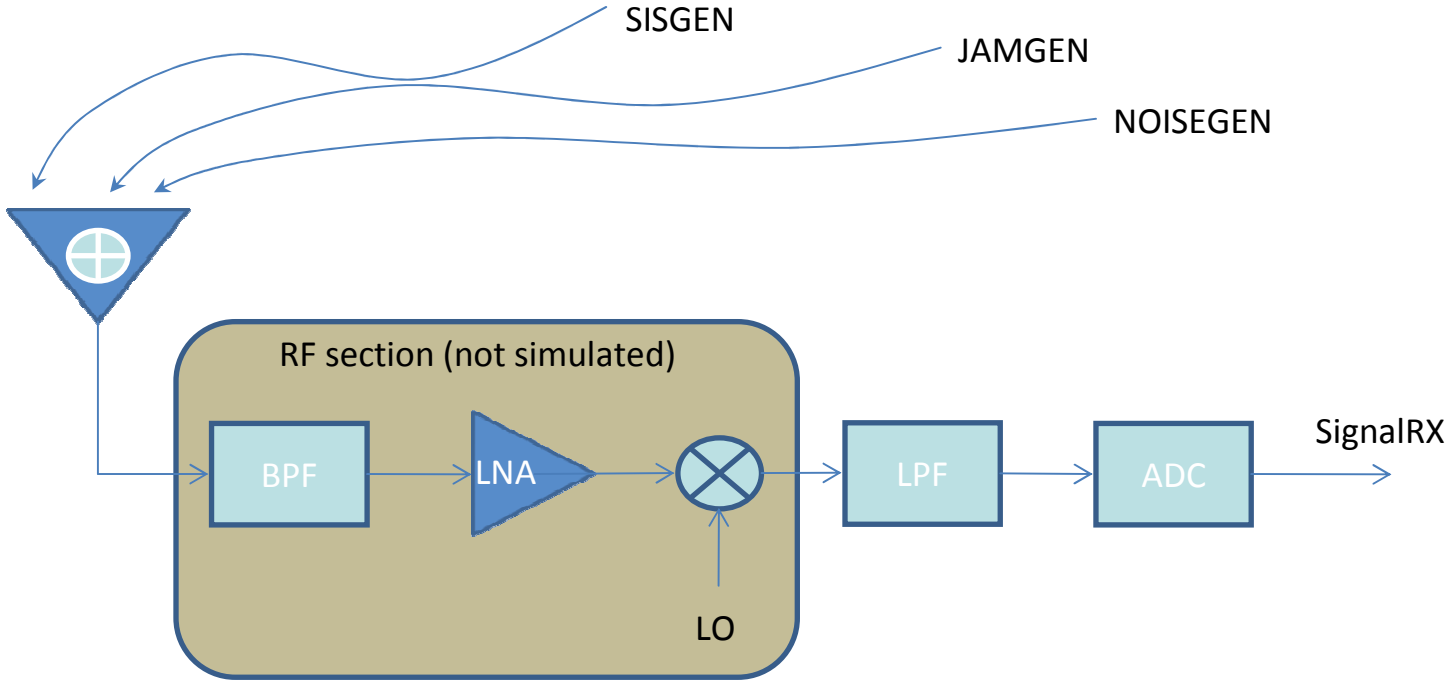
SW package: Signal Generator



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

SWAN: SISGEN & JAMGEN

SIS Modulations

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

Interference Types

- **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 Analysis Tool

MONMIS module executes measurements at different points of the receiver chain or at the receiver's ADC stage and shows the results.

- Spectral Analysis
- Path Loss
- Group delay
- Pulse Shaping
- Power flux density
- Tracking jitter
- Code interference

QCFUN module executes measurements and compares the results with ideal situations (measurements with no anomalies).

- *Modulation analysis*
  - Correlation;
  - Discrimination function;
  - Spectrum;
  - RMS bandwidth;
- *Interference analysis*
  - Spectral threshold
  - Spectral Separation Coefficient
- *Multipath analysis*
  - Multipath Error Envelope;
  - Running Average.

Signal generator (student edition)

- Available free of charge

- To have the free package for students contact:

  davide.margaria@polito.it

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GPS/Galileo/EGNOS SW-Receiver

NavSAS started its R&D activities applying advanced signal processing strategies to Galileo and GPS receivers

TODAY on Galileo receiver

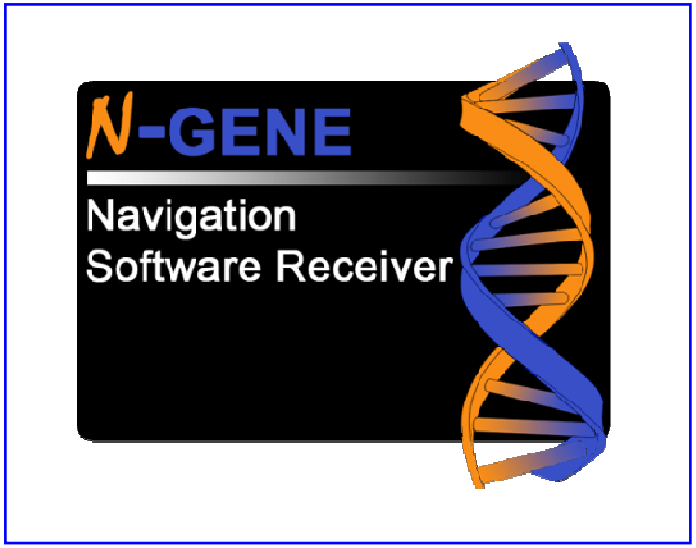
The first

release of the

N-GENE fully

SW real time receiver

is ready!



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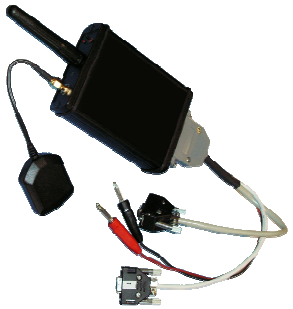
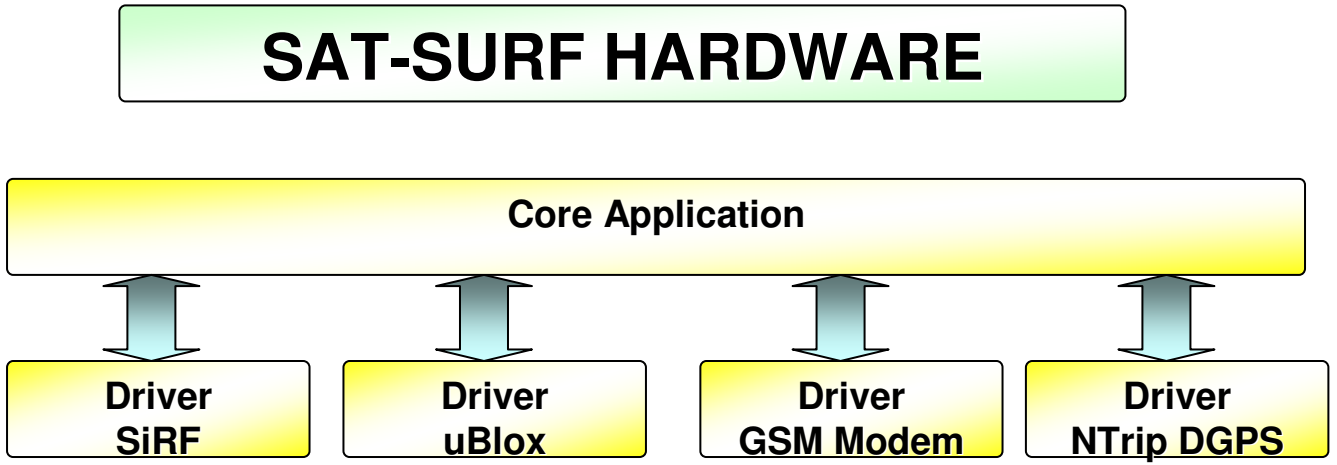
SAT-SURF & SAT-SURFER

A Tool for Practical Training on
Satellite Navigation

SAT-SURF Architecture

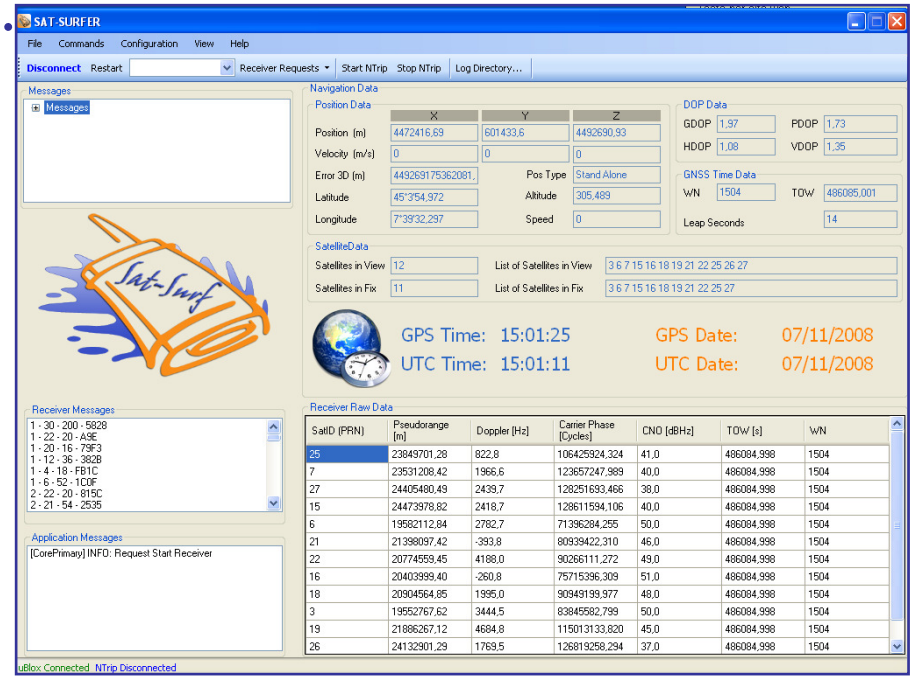




1 – Embeds different GPS modules depending on the user needs:
- uBlox Modules
- SiRF Modules

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

SAT-SURF & SURFER Features



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

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

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

Partnership

- SAT-SURF and SAT-SURFER have been designed and developed by the NavSAS Group and represents a technology transfer example;
- SAT-SURF is manufactured and distributed by SAET s.r.l., a high-tech Italian SME;
- SAT-SURFER has been written by the NavSAS Group.

www.navsas.eu

www.saetsrl.com

For information visit:

www.navsas.eu

Thank you

for attention