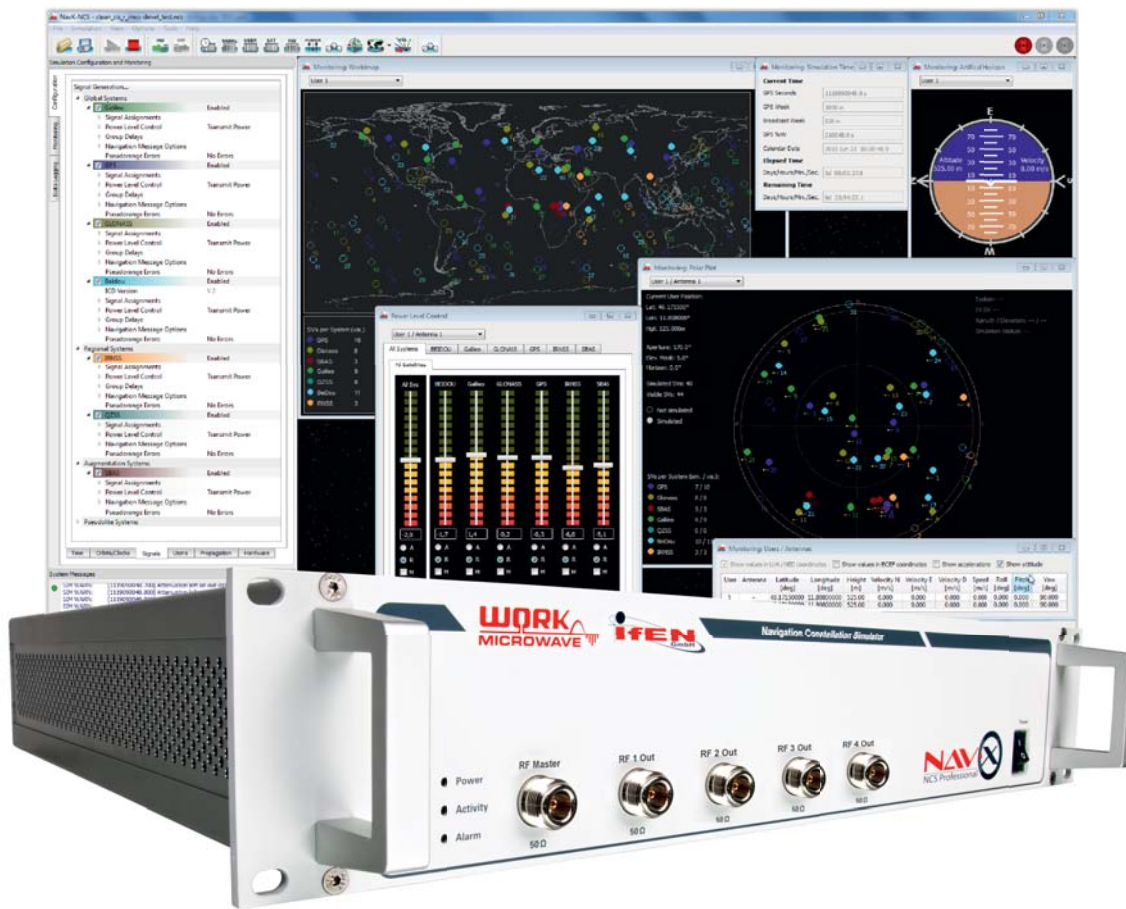


# GPS/GNSS Simulator



## NavX<sup>®</sup>-NCS Professional Simulators

Flexibility | Scalability | Usability



Turning our test expertise into your success.

IFEN's Multi-GNSS, Multi-Frequency and Multi-RF Output Simulators are pushing the boundary in flexibility, scalability and usability.

# NavX<sup>®</sup>-NCS Professional

## Features

### Scalability & Flexibility

- 12 - 108 signal channels (up to 9 MERLIN simulation engines)
- Optional internal noise generator
- Free mapping of MERLIN modules to constellations / frequencies
- Extension of signal capability by software license

### Connectivity

- Remote control capability via Ethernet control interface
- 1 PPS out and 10 MHz reference in / out
- External event trigger input

### Usability and Control

- Advanced graphical user interface (GUI) for scenario definition, simulation configuration and control
- Intuitive operation allows easy modification of variables from preset defaults
- Full constellation, user and vehicle motion control
- Flexible user trajectory generation (pre-defined, from file, via editor or remote motion data)
- Data logging to a file during scenario run-time for analysis (RINEX navigation & observation, navigation messages, SBAS corrections, RTCM correction data, user data)
- Start on external trigger

### Comprehensive Simulation

- Space and user segment
- Extensive signal propagation modelling (multipath, ionosphere, troposphere, terrain)
- Antenna patterns
- Differential GNSS corrections

The NavX<sup>®</sup>-NCS Professional is a high-end, powerful but easy to use satellite navigation testing and R&D device. It is fully capable of multi-constellation / multi-frequency simulations of Global Navigation Satellite System (GNSS) based safety-of-life, spacial and professional applications. The NavX<sup>®</sup>-NCS Professional is the leading solution on the market providing all frequencies for GPS, GLONASS, Galileo, BeiDou, IRNSS, QZSS, SBAS and beyond in one box.

The outstanding performance features of the NavX<sup>®</sup>-NCS Professional are beyond the capabilities of any other signal generator on the market today. Furthermore, the extra complexity and cost of using additional signal generators or intricate architectures involving several hardware boxes is avoided, while improving reliability without compromising on functionality.

## Benefits

### ► Ready for Today – Prepared for Tomorrow

With up to 108 signal channels, current multi-GNSS receivers can be tested with just one NavX<sup>®</sup>-NCS Professional. For more demanding applications with up to 216 signal channels two NavX<sup>®</sup>-NCS Professional devices can easily be synchronized.

### ► Future-Proof Investment

The NavX<sup>®</sup>-NCS Professional hardware can generate all existing GNSS signals including the already available Galileo, BeiDou-2 and IRNSS signals and also cope with modulation and signal structures yet to be developed. Thus, the NavX<sup>®</sup>-NCS Professional is an assured investment for years to come.

### ► Custom Made ... for You

You can configure the NavX<sup>®</sup>-NCS Professional with just what you require today. No need to be tied to features you may never need. Add new capabilities as your testing requirements grow.

### ► No Testing Down-Time

Because we know that time is money the NavX<sup>®</sup>-NCS Professional can, unlike other existing simulators, be quickly and simply upgraded by a software license. No need to send your simulator back to us. Tell us what you need, and in a matter of minutes you'll be up and running with a new GNSS system, frequency option, etc.

### ► Unique RF Output Structure

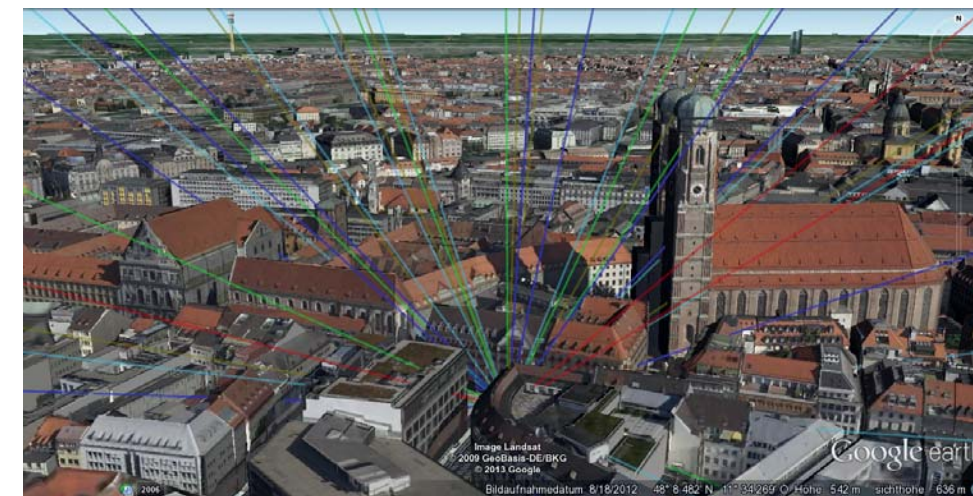
As an option up to 4 fully independent but also phaseable RF outputs can be installed. Today or subsequently, along with your requirements. The (possibly fifth) original output delivers a monitor RF signal that summarizes all others.

### ► Remote Motion Data / Hardware in the Loop

The high-performance signal generation empowers 6 degrees of freedom (6DOF) Remote Motion Data streaming in real-time. NavX<sup>®</sup>-NCS's interface is therefore fully capable of Hardware in the Loop (HiL) applications.

The NavX<sup>®</sup>-NCS Professional GNSS simulator consists of a signal generation hardware and a control computer including the pre-installed Windows<sup>®</sup>-based 'NCS Control Center'. This is a flexible and powerful software for simulation configuration, interactive control and monitoring.

The NavX<sup>®</sup>-NCS Professional can also be connected to other external hardware or integrated into existing test environments via its Ethernet remote control interface, which offers full flexibility for a wide variety of applications.



Visualization of NavX<sup>®</sup>-NCS simulation data



NavX<sup>®</sup>-NCS Control Center

## Applications

Discover the perfect test solution for all types of GNSS applications. The innovative multi-constellation / multi-frequency simulation capability in combination with the Multi-RF output option sets new standards in the field of GNSS simulation. Designed to deliver maximum flexibility, users are no longer faced with limitations.

### Dual-RF Output Applications

- Antenna Diversity  
Two antennas of the same type but with different orientation at the same receiver.
- Heading Determination  
Two antennas with the same orientation at one receiver.
- Differential GNSS  
Static reference receiver and mobile rover.
- Dual Tracking  
Two antennas with different gain patterns optimised for special visibility at the same receiver.

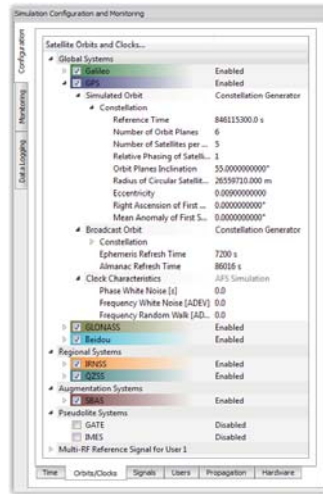
### Multi-RF Output Applications

- Attitude Determination  
3 or 4 antenna based attitude determination.
- Formation Flying  
Spacecraft formation flying with up to 4 spacecrafts.
- Radio Occultation (RO) and Precise Orbit Determination (POD)  
3 antenna approach with Dual-Frequency and Multi-GNSS capability.  
1 zenith antenna for POD, 1 velocity-direction antenna and 1 anti-velocity antenna for RO.
- CRPA Applications  
Test your steered antenna beam array applications with 4 antennas for multipath mitigation, interference suppression, anti-spoofing and more. You need more than 4 antennas for your sophisticated CRPA application? Ask us for a solution.

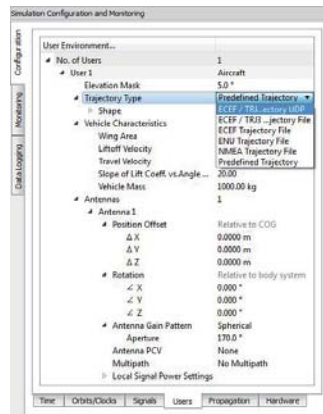


# GPS/GNSS Navigation Constellation Simulator

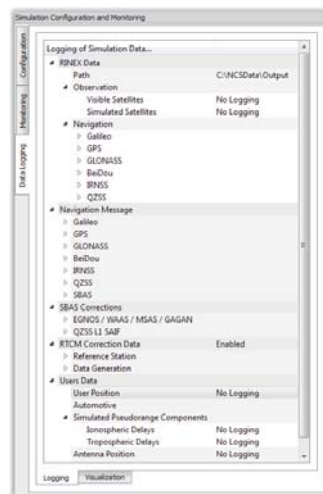
## NCS Control Center Software Simulation Capabilities



Fully flexible constellation editor



Comprehensive user trajectory generation



Outstanding data logging

### Supported GNSS and Augmentation System Capability

- GPS (L1, L2/L2C, L5; C/A & P-Code)
- GLONASS (G1, G2; C/A & P-Code)
- Galileo (E1 BOC/CBOC, E5ab AltBOC, E6; OS, CS, SoL, PRS-Noise)
- BeiDou (B1, B2; Open Service)
- IRNSS (L5, S-Band; SPS, RS-Noise)
- QZSS (L1; C/A, SAIF & IMES)
- SBAS (L1, L5; EGNOS, WAAS, MSAS, GAGAN, SDCM)

### Configuration and Control

- Time, date and user position
- Support of user trajectories
- Pre-configured simulations available
- Low-latency, high-rate remote control capability

### Space and User Segment

- Import of YUMA and legacy (AGL) almanac files
- Import of RINEX navigation files
- Import of navigation message content from file
- Definition of orbit parameters per satellite
- Single-step constellation generator
- Simulation of feared events
- Definition of satellite clock characteristics
- Definition of antenna patterns
- Definition of various user vehicle motion models (6DOF)
- Definition of arbitrary elevation masks

### Signal Propagation

- Definition of terrain obstructions
- Configuration of various multipath scenarios
- Definition of tropospheric and ionospheric influences

### User Trajectories

- Predefined user trajectories available
- Import of NMEA files

### Analysis and Interactive Control

- Display and monitoring of simulation data during run-time
- Interactive control of signal parameters during run time
- Export of various simulation data to file

## Signal Specifications

### Frequency Bands

#### Frequency Bands

• GPS L1	1,575.42 MHz
• GPS L2 / L2C	1,227.60 MHz
• GPS L5	1,176.45 MHz
• Galileo E1	1,575.42 MHz
• Galileo E5ab	1,191.79 MHz
• Galileo E6	1,278.75 MHz
• GLONASS G1	1,602.00 MHz
• GLONASS G2	1,246.00 MHz
• BeiDou B1	1,561.10 MHz
• BeiDou B2	1,207.14 MHz
• IRNSS L5	1,176.45 MHz
• IRNSS S	2,492.03 MHz
• QZSS L1	1,575.42 MHz
• SBAS L1	1,575.42 MHz
• SBAS L5	1,176.45 MHz

### Modulation Schemes

- BPSK, QPSK, BOC, CBOC, FDMA
- AltBOC, Tri-Phase Interplex (CASM)

### Hardware Flexibility

- Up to 9 carriers in a single chassis
- Up to 108 physical channels per chassis
- One to four independent RF outputs per chassis (for simulation of multiple antennas simultaneously)

### Signal Dynamics

• Max. velocity (LOS)	± 22,800 m/s
• Max. acceleration	± 1,570 m/s <sup>2</sup>
• Max. jerk	± 15,600 m/s <sup>3</sup>

### Signal Accuracy

• Pseudorange	< 1.0 mm RMS
• Pseudorange rate	< 1.0 mm/s RMS
• Interchannel bias	zero
• Intermodule bias	< ± 1.0 ns

### Signal Quality

• Spurious (max.)	< -70 dBc
• Harmonics (max.)	< -40 dBc
• Phase noise (max.)	0.005 rad RMS
• Frequency stability (24h)	< ± 5 × 10 <sup>-10</sup>

### Nominal RF Signal Levels

• RF signal output (max.)	- 90 dBm
• RF signal output (min.)	- 170 dBm
• RF monitoring port	- 60 dBm
(Not affected by optional internal noise generator)	

### Signal Level Control

• Dynamic Range	80.0 dB
• Resolution	0.1 dB
• Accuracy	± 0.1 dB RSS

### Internal Noise Generator (Optional)

• Noise Level (max.)	-110.0 dBm/Hz
• Noise Level (min.)	-174.0 dBm/Hz
• Resolution	0.1 dB
• Accuracy	± 0.1 dB

## Hardware Features

### Input Interfaces

• Power supply	85 – 264 VAC, 40-70 Hz
• Ethernet control	RJ45
• 10 MHz reference (sine wave)	BNC
• Hardware trigger input	BNC

### Output Interfaces

• 1 - 5 RF signal outputs (front side)	N
• RF monitoring port (rear panel)	SMA
• 10 MHz reference (sine wave)	BNC
• 1 Pulse Per Second (1 PPS)	BNC



NavX-NCS Professional front (with 1 RF output)



NavX-NCS Professional rear

### Plug-In Signal Generation Engines

• MERLIN	up to 9 modules
• Channels per engine	12



MERLIN signal generation modules

### Physical Parameters Simulator Chassis

• Mounting	19" rack mounting, 2 HU
• Size (H x W x D)	86 x 483 x 570 mm (3.4" x 19" x 22.6")
• Weight	< 10 kg (< 31 lb)
• Power consumption	< 120 W
• Operating Temperature	+10° to +55° C
• Storage Temperature	-40° to +70° C

### Controller PC

• Controller PC HW	INTEL based
• Operating System	MS Windows® 7
• Control SW	NCS Control Center



NCS Controller PC

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