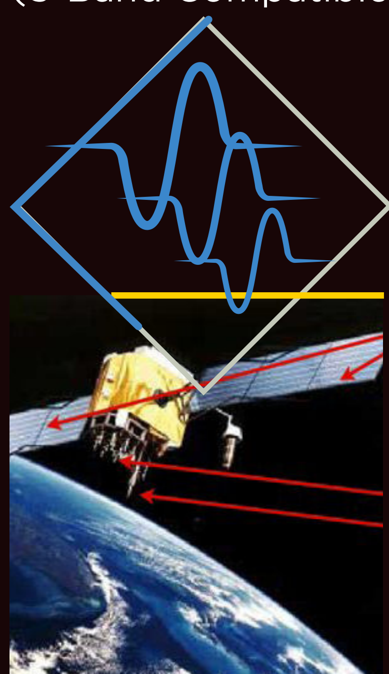
GSG-7
POWERED BY
skydel
SAFRAN

HIGH PERFORMANCE AND CAPABILITY MADE EASY.

700+
Signals

Up to 3
Simultaneous Bands
(S-Band Compatible)



1
RF Output

THE IMPORTANCE OF GNSS SIMULATION

"To efficiently perform GNSS simulation, generated signals and environments must be realistic."

Simulating a comprehensive and realistic environment encompassing satellites, atmospheric conditions, geographic locations, velocities, and both natural and man-made errors is a complex endeavor.

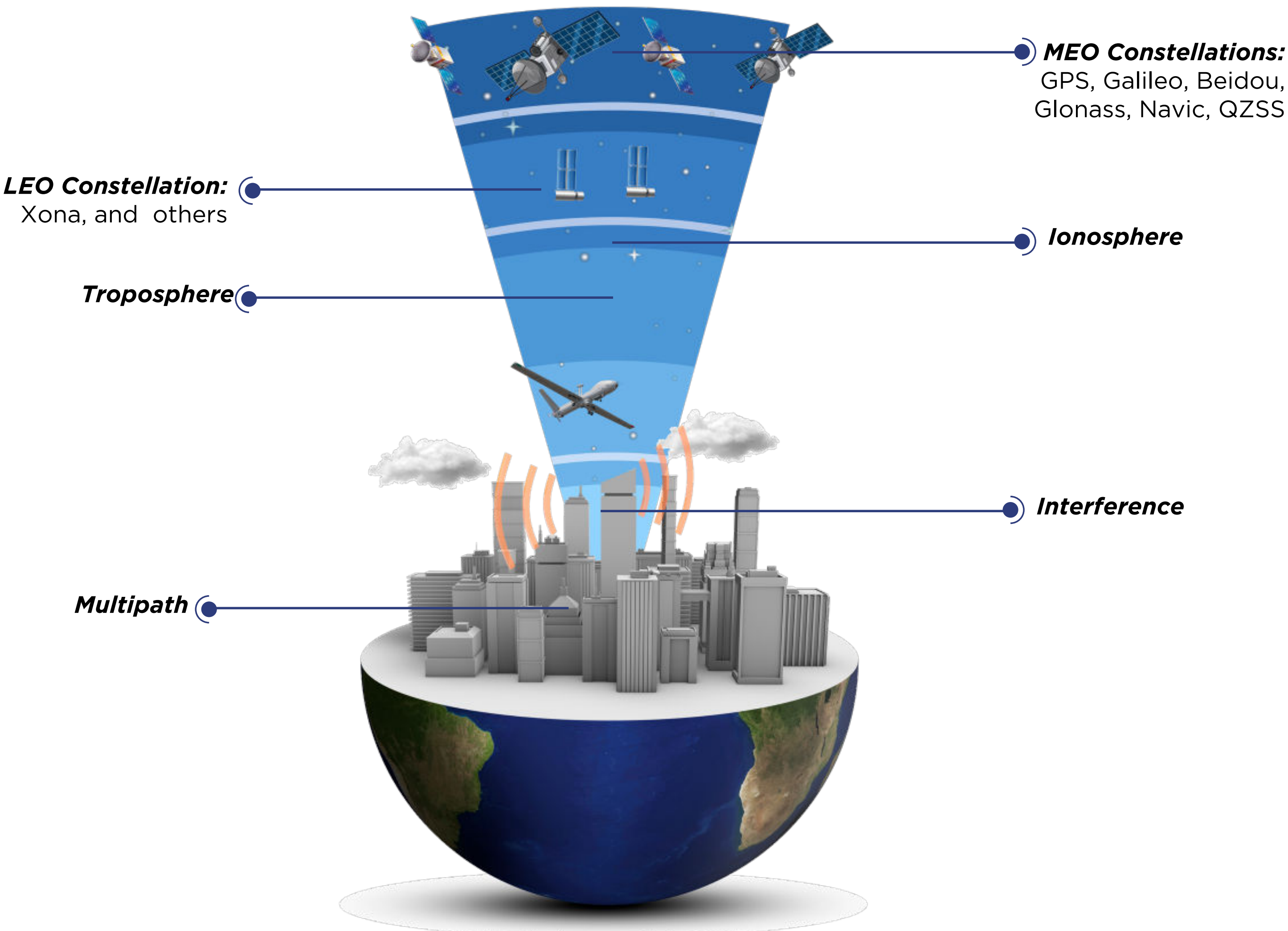
Simulation then allows us to fully control that world, thereby permitting us to verify an application or device's full functionality.

GNSS simulators are essential in the scope of GNSS system development and production. **Live sky testing** is carried out using real signals, but, while being very realistic, it suffers from many drawbacks, including:

- **Can only simulate existing signals (not future, or in-development phase ones, for instance)**
- **No repeatability**
- **Not controllable (signal power, etc.)**
- **Difficult to obtain true reference**
- **Prohibitive costs**
- **Difficult access to authorized test range (including area where a dedicated regional constellation is available)**
- **Difficult to test degraded scenarios (atmospheric disturbances, jamming...)**

So, **GNSS simulation** is useful for:

- **Developing / tuning GNSS signals with simulation to accurately test theoretical models**
- **Develop and integrate GNSS receiver(s)**
- **Develop systems using or related to GNSS technologies**
- **At production level, testing the GNSS reception on serial units, inside buildings, where GNSS signals are not often available and where repeatable and predictable tests are necessary.**



PERFECT FOR ESSENTIAL TESTING

The GSG-7 can be used in production/receiver testing, and go/no-go testing. Integrators that need to perform essential testing of hardware components would also benefit from this platform and its ability to generate the same RF signals that are broadcast by navigation satellites to test any device or system with a GPS receiver.

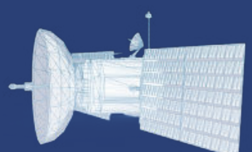
The GPU-based GSG-7 simulator is an easy to use, scenario-based instrument that combines a powerful, feature-rich platform with industry-leading value and affordability for any requirement for basic GPS/GNSS testing.

The GSG-7 is an ideal instrument for essential testing since it is able to quickly and easily create simulated satellite signals and generate real RF signals by first producing I/Q data and calculating the orbits of satellites at a user-defined time, location and trajectory.

WHAT IS ADVANCED SIMULATION?

A GNSS simulator for advanced simulation requires the ability to generate on multi-constellation / multi frequency scenarios, injecting errors using pre-defined models, and closed-loop HIL. It is also capable of on-the-fly signal editing capabilities such as signal power, number of satellites in view, and signal parameters.

Integrators and RF engineers creating test suites could also greatly benefit from an advanced simulator like the GSG-7.



CUSTOM SIGNALS

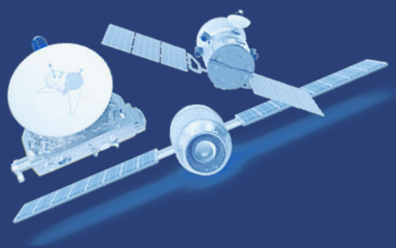
This GSG-7 allows users to create their own custom signals and attach them to GNSS satellites so they are streamed along regular GNSS signals. The purpose of this feature is to provide a tool to advanced users who want to design GNSS or non-GNSS (such as LEO constellation) signals and evaluate their performance. This feature lets users avoid the arduous task of designing an engine that will simulate the dynamics of satellites, vehicles, and all of the associated environmental effects (atmospheric, multipath, etc.).

AUTOMATION

Easy to use and comprising hundreds of commands, Skydel's API brings an unparalleled level of control over simulation, enabling you to build complex, elaborate and repeatable scenarios with open source client libraries. Benefits included:

- Can control Skydel remotely using the API
- Remote program can run on the same (or separate) PC as Skydel
- API Libraries and Examples in Python, C++, and C#
- Ideal for configuring tests, repeated tests, precise time setting, or
- repeating tests from the GUI

Skydel allows users to configure, control and extend all aspects of the simulator in seconds. All interactions can be exported as Python scripts.



MULTI-SIGNAL MULTI-FREQUENCY

With multiple satellite constellations – both global, local, and LEO — providing signals for navigation and geospatial applications, the number of signals and frequencies being emitted, augmented, and echoed is staggering. Simulating all these aspects is a challenge for FPGA-based simulators which are not capable of generating an increased number of signals in view.

Skydel-based systems like the GSG-7 have successfully overcome this technological hurdle by leveraging the immense computational power of modern GPUs (Graphics Processing Units) to simulate well up to 700 GNSS signals with maximum flexibility across multiple bands.

This capability allows GNSS engineers to create highly complex and realistic environments, with all satellites in view – even in space-based scenarios. Simulating hundreds of GNSS signals ensures comprehensive testing, optimizing receiver performance, and enhancing the resilience of navigation systems in the face of challenging conditions, ultimately resulting in more reliable and accurate positioning for a wide range of applications.

HARDWARE-IN-THE-LOOP

The GSG-7 features advanced HIL test solutions providing very low to zero-effective-latency for both open and closed-loop architectures. The enhanced visualization tools of HIL testing can monitor internal latency through real-time curves showing when the data is generated and sent to the RF signal.

- Open-loop: The output of the GNSS receiver (and sensors in general) is not used to control the vehicle's trajectory, but is imposed by the user and not necessarily deterministic since it can be updated in real-time, e.g.: for a flight simulator, in which the trajectory is piloted live by the user and sent to the GNSS simulator.
- Closed-loop: The output of the GNSS receiver (and sensors) is used in the navigation algorithms. The outputs are used to update the vehicle position sent to the GNSS simulator. The position calculated by the GNSS receiver has a direct impact on the simulated trajectory and the RF signal broadcasted to the GNSS receiver.

RTK

Some applications, such as surveying or even large-scale farming, require high positioning performance which can be achieved with RTK. Skydel generates synchronized signals from both the sky and from an RTK station. One instance of Skydel will simulate the GNSS signals for the base station while the other instance will simulate the GNSS signals for the rover. Enabling the feature is as simple as clicking on a checkbox in the user interface.

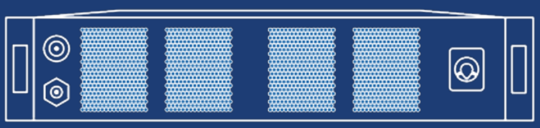
Note: On the GSG-7, RTK is accomplished using a plugin, and not with two RF outputs.

GSG-7

Safran's **GSG-7** is a positioning, navigation, and timing test solution offered through Safran's family of Skydel-based simulators.

The GPU-based GSG-7 simulator delivers the highest standard of GNSS signal testing in an easy-to-use, turnkey form factor supporting the growing need for location-aware applications and systems that require navigation or timing. With a single high-quality RF output, the GSG-7 GNSS simulator covers the entire GNSS bandwidth and features high end performance with a 1000 Hz simulation iteration rate, high dynamics, real-time synchronization, and simulation of all-in-view satellite signals.

The GSG-7 is ideal for development and integration projects that require high performance and an increased number of constellation licenses and satellites in view for a single antenna or trajectory.



Key Features:

- **700+ signals**
- **Small size – 2U Rack-Mountable or Bench Top**
- **All MF/MC Signals via Composite Port**
- **1000 Hz simulation iteration rate**
- **Available in three configurations with up to 3 SDRs**
- **Sub-nanosecond-level synchronization between RF bands**
- **On-the-fly reconfiguration of constellations and signals**
- **High-end RF quality**
- **Integrated, comprehensive automation**

EMBEDDED HARDWARE

Dedicated High-End Software-Defined-Radio(s)
CDM-7 Timing Module
Nvidia GPU
1 TB SSD Storage
Composite Port and Internal Combiner

SMALLER FORM FACTOR

2U Format
Rack-Mountable, or Bench Top
Weight: 11.5 kg (25 lbs)
Width: 48 cm (19 in)
Depth: 41 cm (16 in)
Height: 9 cm (3.5 in)

700+ SIGNAL CAPACITY

700+ Signals
All Frequencies (including S band)
All GNSS Bands
All in view not limited by channels/card
All Constellations including: GPS, Galileo, BeiDou, GLONASS, NavIC, QZSS, SBAS, Xona's PULSAR, and Custom Signals.

EASY TO USE

Skydel-Powered
Intuitive GUI
Single Composite RF Port
Control every aspect of simulation
Recreate real satellite signals in seconds
Live Sky Time Synchronization
IQ File Generation & Playback

RF QUALITY

High-end RF Quality
Best spurious and harmonics quality on the market
Simultaneous RF Bands: 1-3
Nanosecond-level synchronization between RF bands

HARDWARE-IN-THE-LOOP

Robust Hardware-in-the-loop (HIL) Integration
Test standalone or multiple DUTs
Perform closed and open loop HIL
10 ms HIL Latency
Zero effective latency

COMBINED SIGNALS

Maximum bandwidth (per radio) 100 MHz
Pseudorange accuracy - ±0.001m
Pseudorange rate - ±0.001m/s

RF Signal Level (GNSS)
- Power accuracy: +/- 0.5dB
- Simulated GNSS signal: -175 to -100dBm
- RF output power amplification: +40 to +70dB

SCALABLE AUTOMATION

Integrated Automation
Extensive API
API Supports Python, C#, and C++
All interactions are recorded and can be saved and exported to Python script
Scripts are portable

SUPERIOR TIMING

Integrated CDM-7 Timing Module
Provides 10MHz and 1PPS signals for up to five devices
Multiple operating modes:
- Internal clock (OCXO)
- External clock (10MHz and 1PPS),
- Synchronous External, or Asynchronous External

GSG-7 SCENARIOS

LEO Constellation Simulation

Let's consider a scenario where users are validating a receiver's Low Earth Orbit (LEO) constellation's signal performance — a task demanding not only the utmost accuracy and timing, but an increased number of signals.

With the GSG-7 and its ability to generate up to 700 signals, GNSS engineers can effortlessly replicate LEO constellation trajectories, real-time atmospheric conditions, and custom signals/frequencies thus ensuring precise performance assessment of LEO satellite signals.

Its expanded channel capacity allows simultaneous emulation of multiple LEO satellites' signals, mimicking dynamic satellite movement and enabling comprehensive testing of receiver tracking capabilities. Engineers gain a holistic view of their system's response to complex LEO constellations, identifying potential vulnerabilities and optimizing performance with increased accuracy.

Skydel Simulation Benefits

- **Dynamic Real-Time Simulation**: Skydel GNSS simulators offer dynamic, real-time simulation capabilities, allowing engineers to replicate the movement and behavior of LEO satellites precisely.
- **Multi-Constellation and Multi-Frequency Support**: Skydel simulators support multiple constellations (GPS, Galileo, GLONASS, BeiDou, etc.) and frequencies, providing a comprehensive testing environment for LEO constellations.
- **Scenario Reproduction and Customization**: With Skydel, users can recreate specific scenarios encountered by LEO satellites, such as orbital maneuvers, eclipses, and diverse signal obstructions.

Autonomous Vehicle Testing

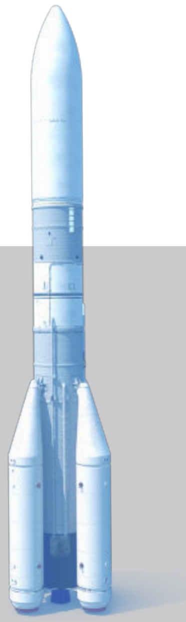
In a scenario where a GNSS engineer is tasked with developing a navigation system for an autonomous vehicle, the GSG-7's time-critical and accuracy-dependent enhanced signal fidelity and hardware-in-the-loop (HIL) capabilities become instrumental.

Engineers can emulate any location on earth, at any time. They can also replicate atmospheric interferences, and use as many signals, frequencies, and GNSS constellations as required to reproduce realistic conditions and challenging signal environments to ensure the robustness and reliability of the autonomous vehicle's navigation system.

In addition, the speed and precision of the GSG-7 shorten testing cycles, accelerating the vehicle's time-to-market while guaranteeing optimal performance under varying real-world conditions.

Skydel Simulation Benefits

- **Realistic Scenario Reproduction**: Skydel GNSS simulators allow the recreation of diverse and real-world scenarios that autonomous vehicles might encounter.
- **Hardware-in-the-Loop:** Skydel features advanced HIL test solutions providing very low to zero-effective-latency. The enhanced visualization tools of HIL testing can monitor internal latency through real-time curves showing when the data is generated and sent to the RF signal.
- **Precision and Accuracy Assessment**: Skydel simulators provide high-fidelity GNSS signal generation, enabling precise assessment of the vehicle's navigation system.
- **Dynamic and Complex Testing**: The simulator's capability to dynamically simulate moving satellites and changing signal conditions allows engineers to perform complex testing.



Space-Based Scenario

Launching space vehicles into orbit such as shuttles or satellites is complex, expensive and hazardous. Moreover, space vehicles are highly dependent on GNSS signals during their launch and also when traveling in orbit. Because they are so reliant on these signals, they become extremely vulnerable if something goes wrong – such as if they were to lose a connection with those signals or experience interference.

A GPS/GNSS simulator makes it possible to simulate the actual GPS signal that will be received by the space vehicle's navigation instruments. It enables the simulation of real-world interferences like jamming and spoofing, interactions with Earth's upper atmosphere, and adaptation to space environments when some satellites cannot be seen via line of sight.

How does the GSG-7 help with a space-based scenario?

Space Vehicle Orbital Trajectory Editor

- Skydel allows you to enter Keplerian data for vehicle trajectory.
- You can also upload pre-recorded data and modify as you wish to add "what-ifs" to your testing.
- Skydel supports ECI/ECEF trajectory importation for complex route calculations.

Spacecraft Atmospheric Condition Simulation

- Get access to a dedicated spacecraft ionospheric model.
- Simulate additional atmospheric effects to see how a flight path is affected when passing through different layers of the atmosphere.

High Dynamic Trajectories

- Skydel possesses a 1 kHZ refresh rate, which translates into real-time processing.
- Achieve perfect accuracy under any doppler conditions.

GNSS Constellations

- Simulate all satellites in view, including those seen from their back side.
- Change the power levels of individual SVIDs or all in-view simultaneously.

GNSS Satellite Antenna Model

- Enables realistic side and back radiation powers.
- Enables realistic effects when above the GNSS orbits (e.g. GEO)
- Geostationary earth orbit is a circular orbit trajectory that is geosynchronous with Earth's rotational movement. Because it matches Earth's rotation, a satellite in a geostationary orbit appears to be stationary to an observer on the ground
- Independent trajectories and antenna patterns per each GNSS vehicle.
- Skydel supports past, present and future generations of satellites.

SKYDEL

Skydel is a GNSS software-defined, GPU-based simulator that features real-time signal generation for multiple constellations and multiple frequencies. Skydel generates high-quality and fidelity GNSS signals and interferences, provides innovative and powerful test automation, includes models of errors for signal propagation and multipath for legacy constellations, supports HIL with zero efficient latency, offers high dynamics for multiple vehicle types (6 degree of freedom) and multi-antenna configurations.

Skydel is compliant with all existing GNSS constellations as well as future ones, such as Xona's PULSAR™ LEO constellation.

Skydel uses a computer's GPU to perform the modulation of the signals in real-time. The GPU generates a wide band signal with 16-bit resolution for all visible satellites. All the signals, from all the satellites, are combined in the GPU to form a single baseband stream, which is transmitted to the SDR. The SDR then converts the baseband signal to RF.

Skydel provides GNSS testing solutions that enable engineers and scientists who design and test navigation systems to validate the performance of GNSS devices in real-world conditions from the comfort of their labs.

Skydel has also integrated a “custom signal” feature that enables users to create and tune PNT signals, to support the study of signal evolutions, more realistic channel propagation models and GNSS receiver and antenna advancements technology.

With these capabilities, Skydel helps the GNSS ecosystem from signal definition to system integration and production.

SKYDEL

Advanced Simulation with Modern, Software-based Flexibility

GNSS SIMULATION SOFTWARE

Multi-constellation / Multi-frequency
- GPS, GLONASS, GALILEO, BEIDOU, SBAS.
- Support for restricted signals (GPS & Galileo).
- All-In-View simulation.

Real-time GNSS simulator
- Simulation entirely GPU-generated.
- Most parameters can be modified at runtime.

Powerful & simple automation
- Complete documentation API (Python, C#, C++).
- Innovative automatic Python Scripting generation.

Scalable platform
- Software Only, Turn-Key system
- Multiple RF Output
- Scenario Editor

Basic interference simulation
- jammer dynamics.
- Fully integrated into GNSS simulation.
- No additional H/W required.

User-defined waveforms
- Chirp, CW, BOC, AWGN, BPSK & Pulse modulation + custom IQ file.
- Combine dozens of signals.
- Real-time results on spectrum.

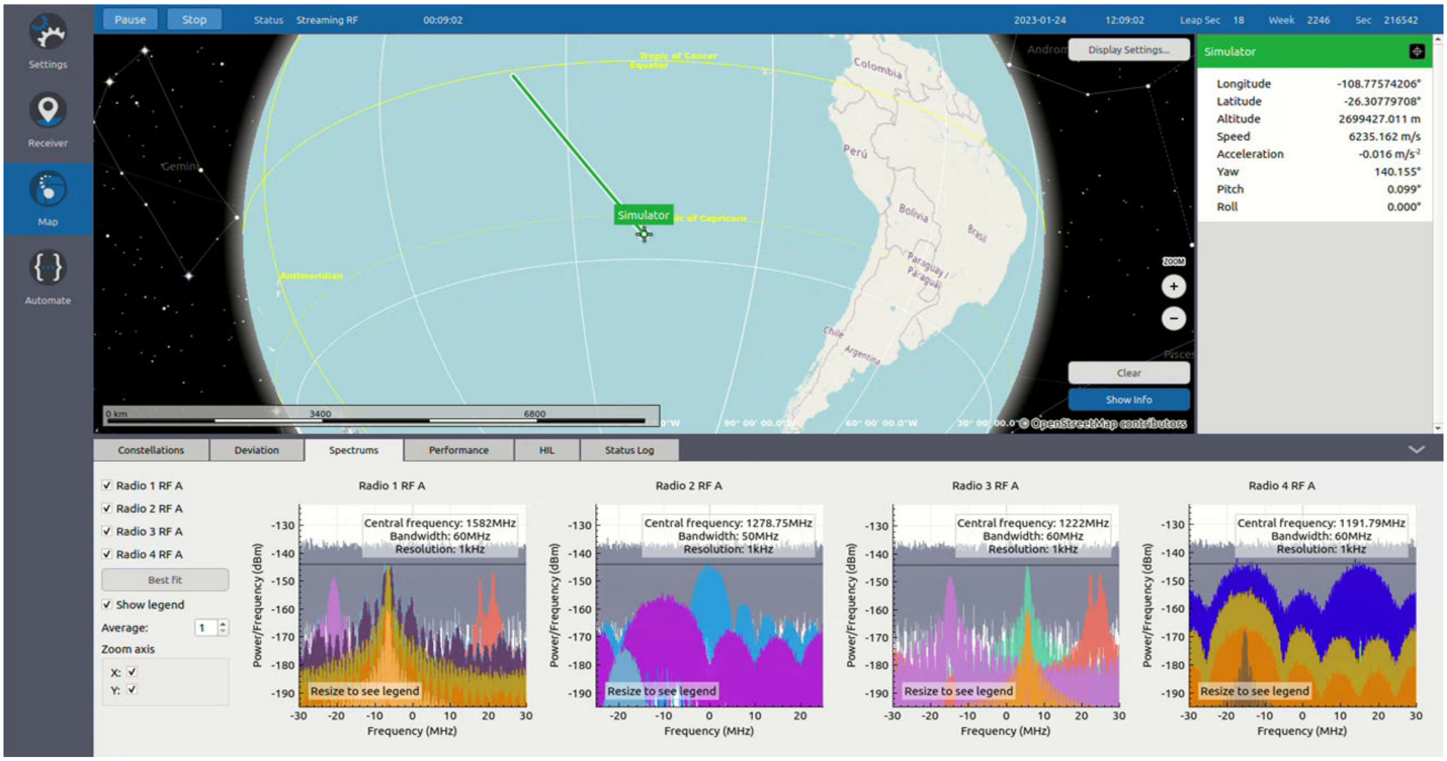
Test / Validation / Integration
- Multi-vehicles, multi-antennas.
- HIL Low Latency.
- 6 DoF and orbital trajectories.

Skydel Key Features

- All-in-view satellites simulation
- 1000Hz simulation iteration rate
- Low-latency HIL
- Live sky time synchronization
- RTK
- On-the-fly scenario reconfiguration
- Flexible licensing
- In-field software upgradability
- High-end performance (precision, resolution, ultra-high dynamic motion)
- Simulate hundreds of satellites in real-time using off-the-shelf graphics cards (GPU)
- Comprehensive and intuitive API (Python, C# and C++ open-source client)
- IQ file generation
- Scalable and highly flexible architecture using software-defined radios

Signal Propagation and Errors Simulation

- Multipath and propagation models
- Additive pseudorange ramps
- Satellite clock error modification
- Navigation message errors
- Multiple ionospheric/tropospheric models
- Antenna pattern models
- Relativistic effects
- Pseudorange/ephemeris errors
- Basic interference



POWERED BY skydel

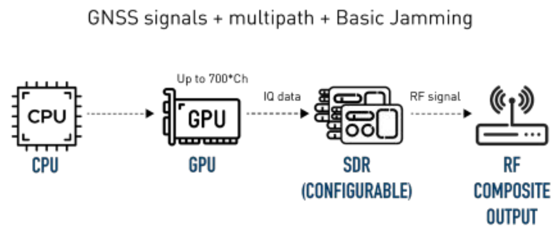
ADVANTAGES OF SDA

The Skydel simulation engine uses either a Windows of Linux-based PC's GPU to generate, in real-time, high-rate baseband signals that are converted to RF by the SDR.

This is achieved by having the GPUs parallel process simulated GNSS signals and directly stream their IQ data to the software-defined radio (SDR) in order to generate a real RF output.

The result is a simulation platform that is flexible, agile, and much more cost-effective. SDA provides the following benefits:

- **Maximum scalability and flexibility**
- **Agile/rapid software development process**
- **Innovation not limited by hardware design**
- **Based on market-proven, reliable COTS hardware**
- **Hundreds of signals generated in GPU with flexible allocation**
- **Supports user-created and open-source plug-ins**
- **On-site upgrades (software) throughout unit's lifecycle**



Better than FPGA

Another significant advantage of GPU-leveraged simulators over FPGA ones is that GPUs do not need to be pre-programmed with a firmware. Instead, signal modulation is done on-the-fly (in the software) depending on the scenario and evolution of the sky view. Unlike FPGA-based simulators, the number of simulated signals of each constellation is not static and purely dynamic.

Software Defined GNSS Simulation: The Difference

With software-defined GNSS Simulation, you gain maximum scalability and flexibility with agile, rapid development. Upgrading to the latest features requires only a simple software download and licensed software installation.

- **Lower TCO (Total Cost of Ownership) –** A lower cost of the initial system (hardware/software) and lower support costs mean you can use your budget for other projects, purchase multiple systems or add more software solutions.
- **Non-Proprietary Hardware –** Dedicated hardware is not flexible, and lacks the ability to create non-GNSS signals from same platform.
- **Software Defined Radios (SDR) –** Radios are easy to reconfigure based on test requirements. You can easily add/remove signals at click of a mouse or upgrade your systems. The result is an increase in efficiency with fast test setups, and no hardware configuration required.
- **All-Inclusive Modern Software –** All testing in a stable, responsive, easy-to-use, single package, so you can spend less time setting up, and more time simulating.
- **Automation & Integration –** Commands and info are already stored in the software. You can integrate with other systems more quickly and experience the exponential gains in productivity from automation.

GSG-7 INTERFACE

Skydel's user interface is not only intuitive, but modern, and streamlined. The Settings, Receiver, Maps, and Automation menus are quickly accessed, and subtabs contain vital information and interactive tools.

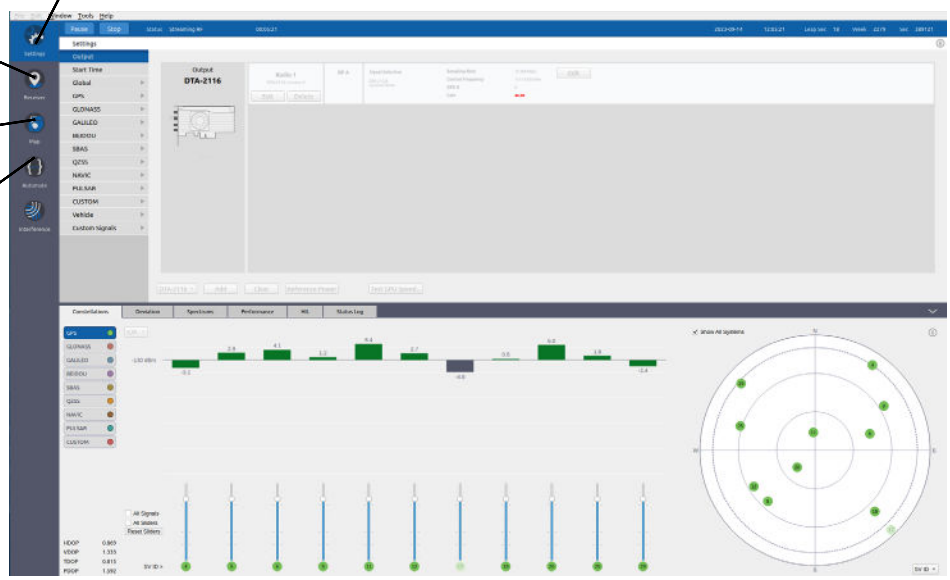
Settings:

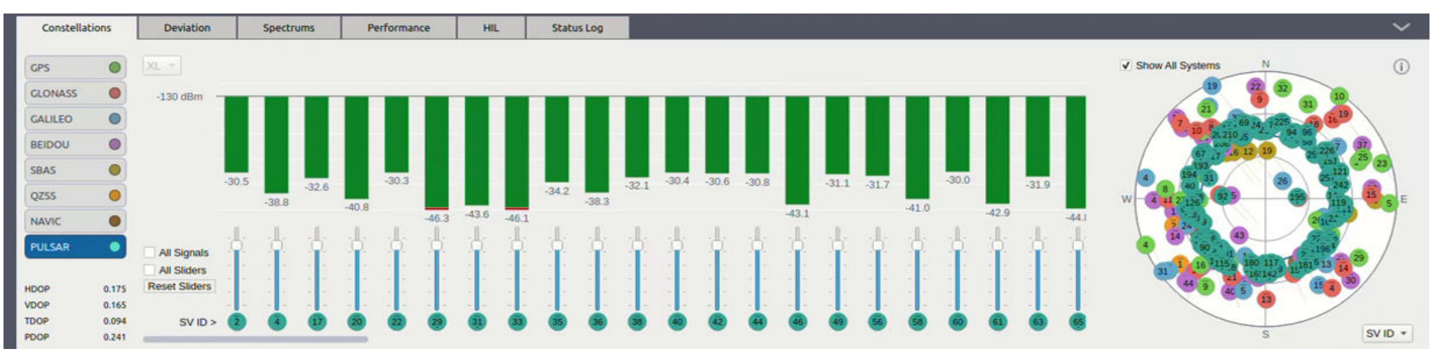
- Create a scenario
- Preset, or change settings on the fly
- Add errors, deviation, signals, echoes
- Add custom signals
- Change antenna patterns
- Control trajectory in real-time
- Log raw data

Receiver:
Connect a receiver under test to Skydel.

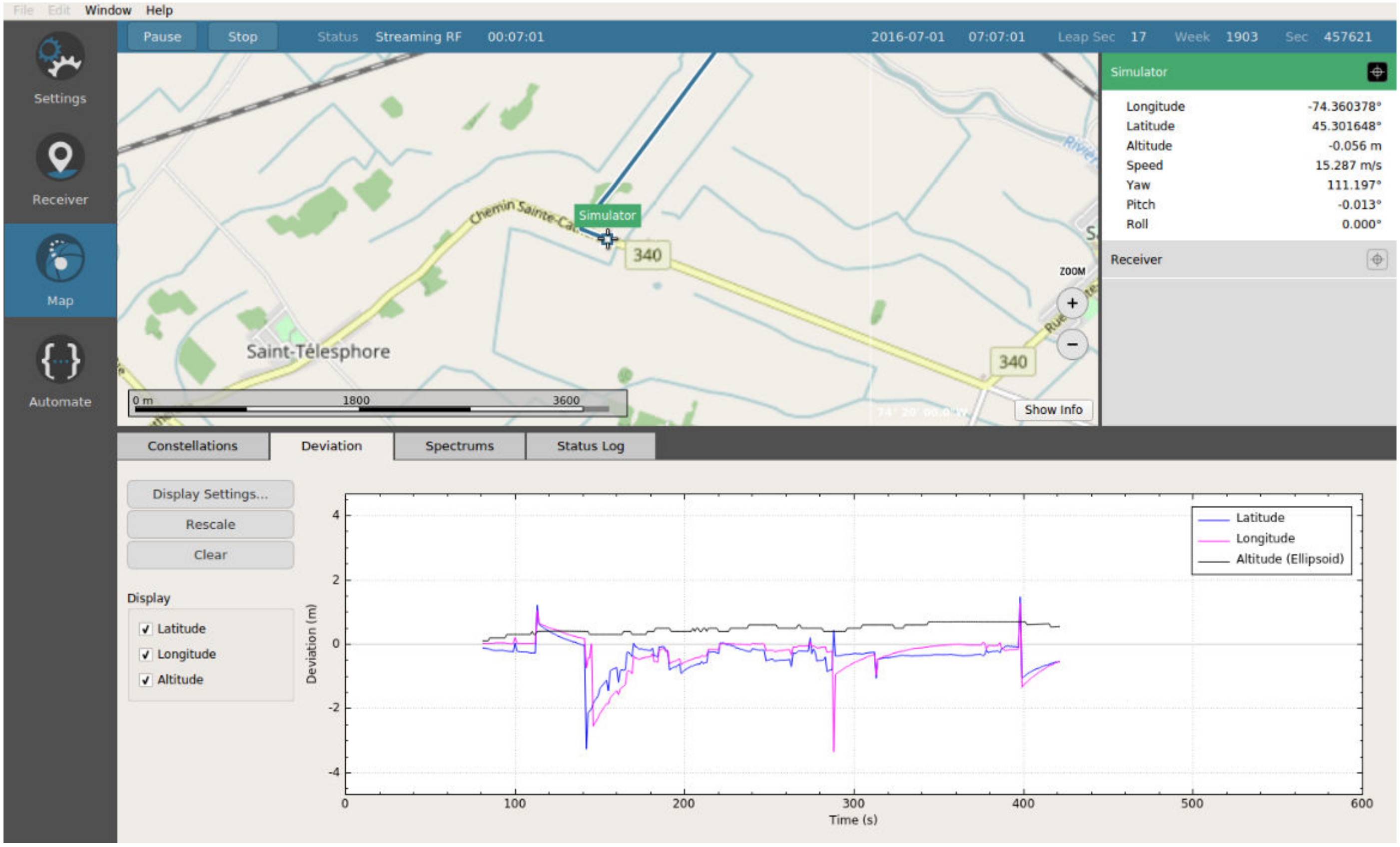
Map:
Contains the map and the information panel

Automate:
Helps you get started using the Skydel API
Save and write your own scripts to control Skydel





This **Constellations** subtab displays information about the GNSS satellites that are simulated and is divided by constellation and SV. Satellite power control as well as a Skyview allows you to define the strength if the satellite's signal and see its position.

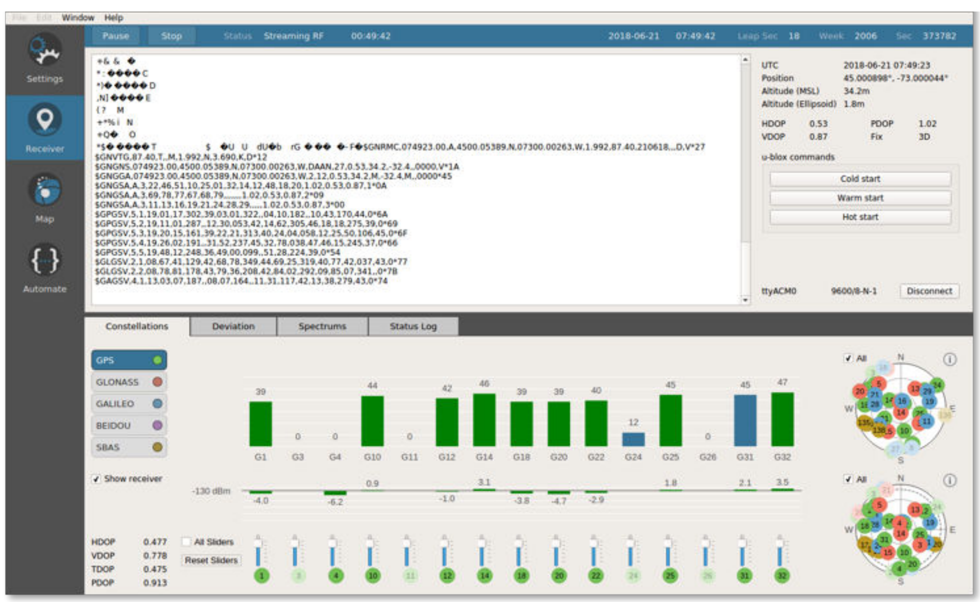


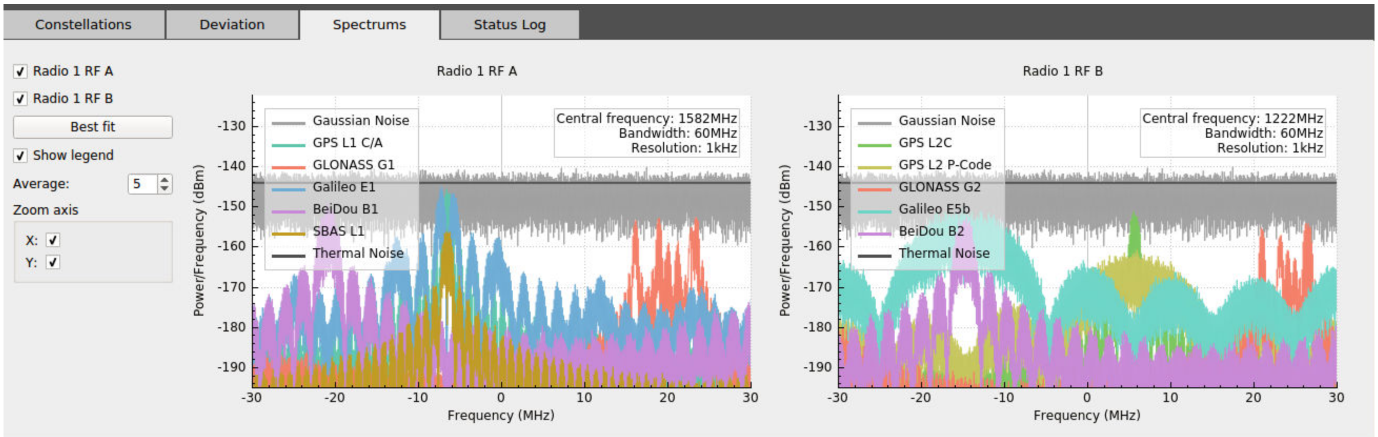
Map + Deviation:
Displays the simulated position and the receiver's position (using NMEA feed), as well as any interference and repeaters.

The **Deviation** subtab displays a graphic, in real-time, of the deviation between the position generated by the simulator and the position calculated by the receiver under test.

Receiver:
Displays DUT or reference receiver, in addition to receiver NMEA data, C/No and Skyview.

From this tab, you can modify the baud rate, data bits, parity, stop bits and flow control.

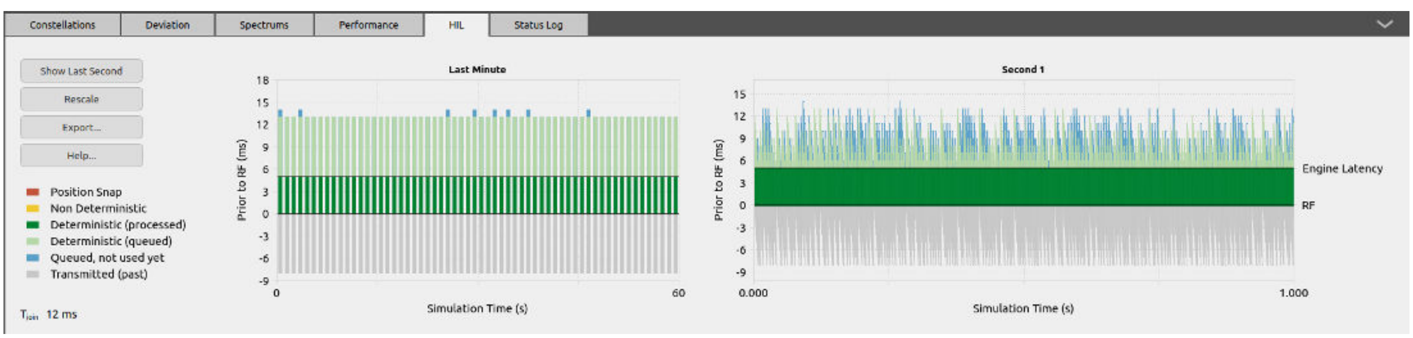




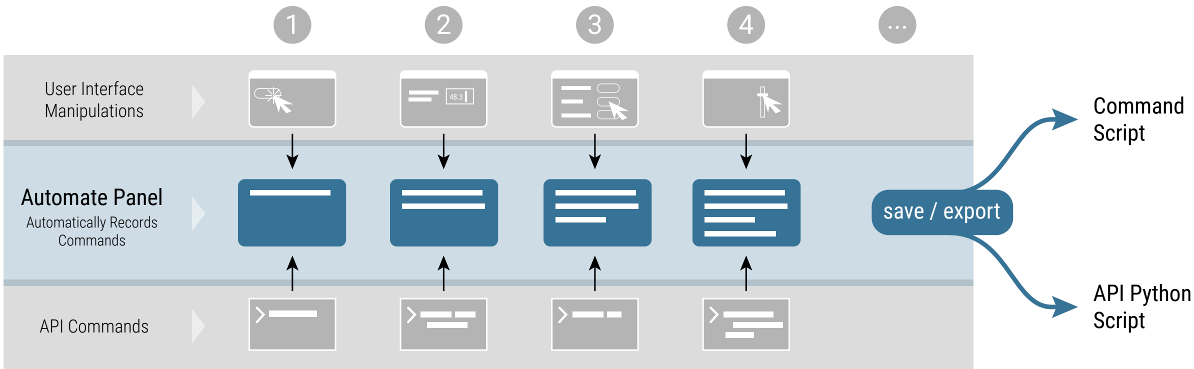
Spectrums:
Extremely useful for visualizing the content of each output, the Spectrums tab displays the spectrum based on the generated IQ data. Skydel depicts a baseband signal prior to conversion into RF.

HARDWARE-IN-THE-LOOP

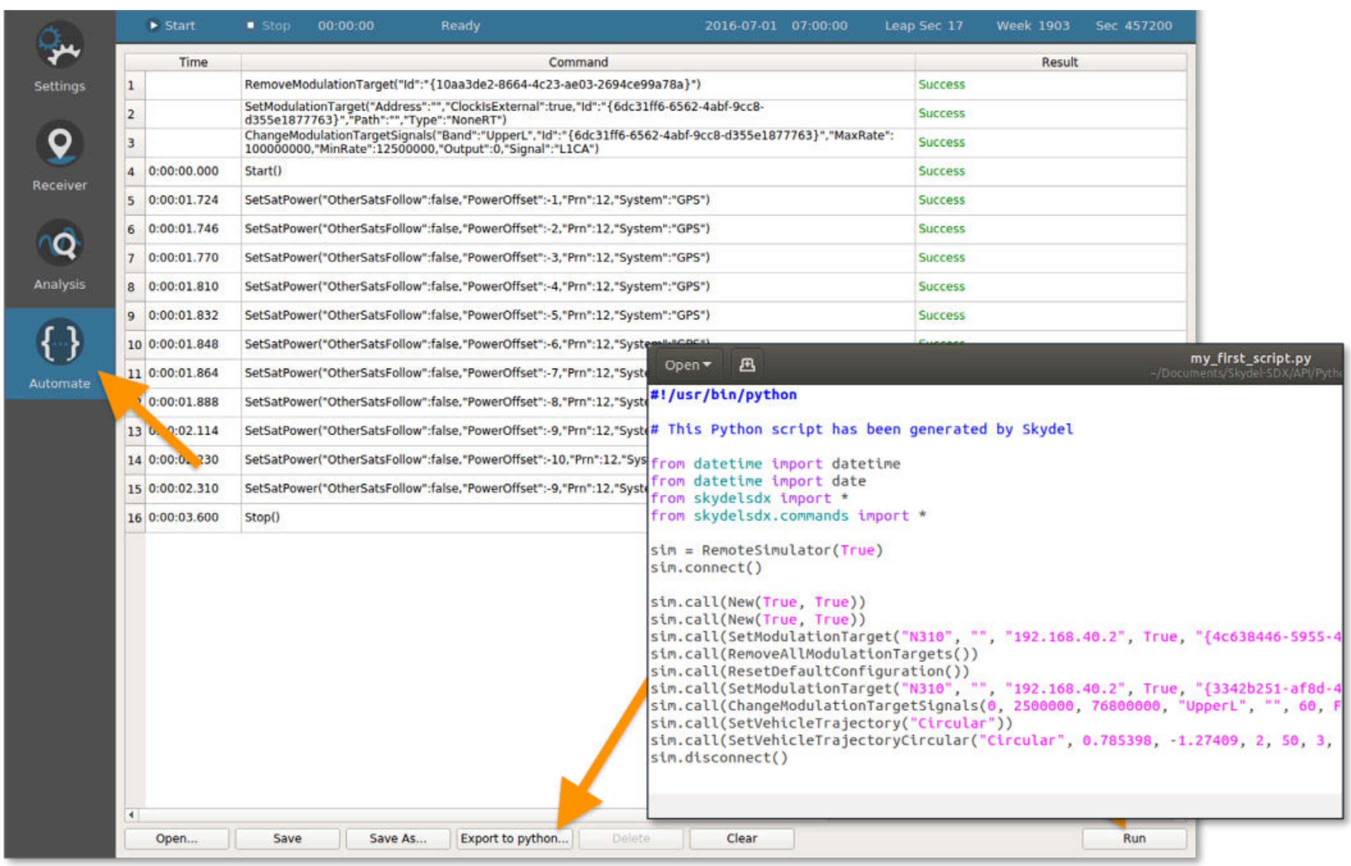
Safran's Skydel Simulation Engine is a high-end GNSS simulator that is also very flexible, scalable, and customizable. It uses software-defined radios and COTS components to outperform traditional FPGA-based simulators. Skydel features advanced HIL test solutions providing very low to zero-effective-latency.



HIL:
The enhanced visualization tools of HIL testing can monitor internal latency through real-time curves showing when the data is generated and sent to the RF signal. Users can also review the transmission of HIL packets for optimizing the entire network's latency, checking its stability (jitter), and that data is available and used at the right time in Skydel.



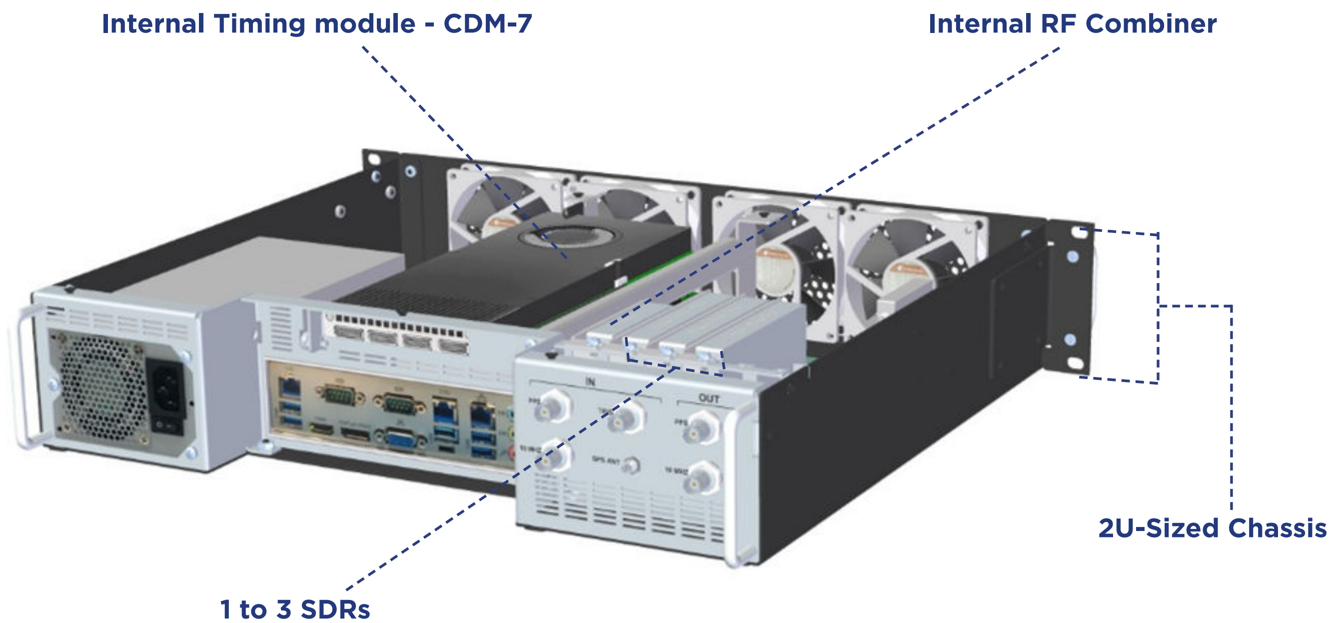
Automate: Skydel was built around the Command Design Pattern, which means that all actions (either from GUI or Remote control) are sent to the Engine using Commands. The commands are processed by the engine exactly the same way whether they come from the GUI or remote program. If your simulation is working via GUI, it will work exactly the same via the API.



1. All Skydel actions are transformed into Commands and logged into the Automate tab.
2. Skydel users are able to export all recorded commands to a Python script.
3. The script can then be launched locally or remotely to replay all the recorded commands.
4. The script can also be modified as desired (add loops, functions, change timestamps of commands).

FLEXIBLE, SCALABLE, AND POWERFUL

INSIDE THE GSG-7



The GSG-7 has been purpose-built to provide exceptional signal quality and performance, all the while taking advantage of the latest commercial-off-the-shelf (COTS) hardware.

The leveraging of commercial (non-propriatary) SDRs and GPUs permits easy customization and maintenance throughout the unit's lifecycle while reducing costs. More affordable than other options on the market, the GSG-7 delivers precision and performance for your critical programs.

The GSG-7 is available in three base configurations, and can be upgraded at any time.

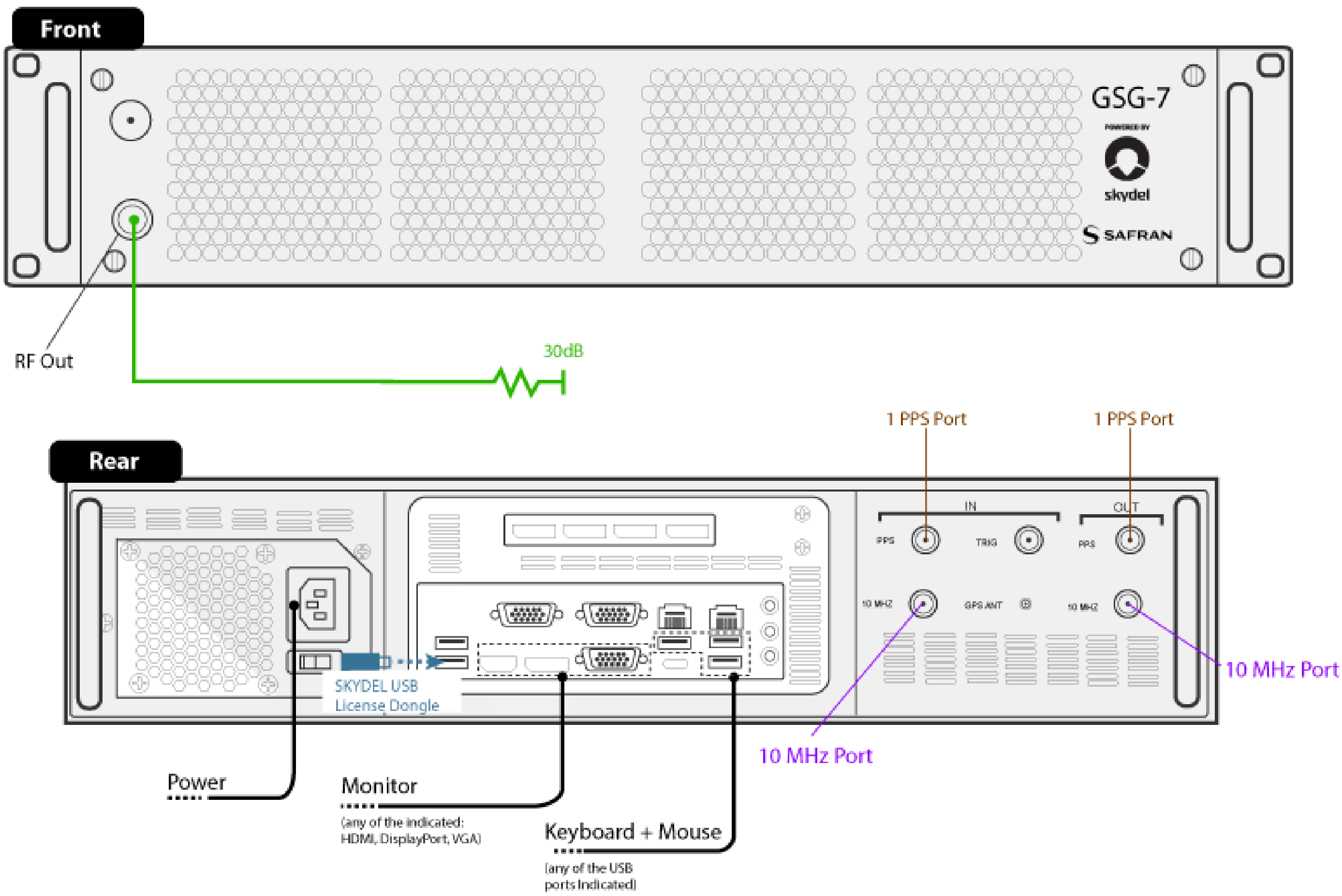
3 YEAR WARRANTY

At Safran, we stand behind our products with a comprehensive warranty designed to ensure your peace of mind. Our warranty covers the cost of in-factory repair or replacement of any defective product or component, giving you confidence in the quality and reliability of Safran solutions.

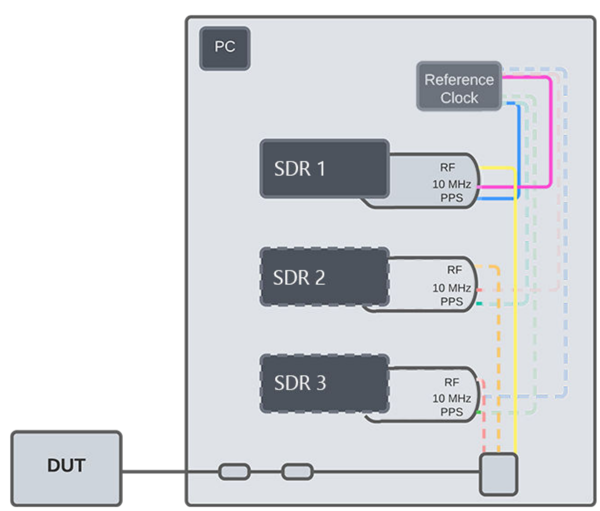
Rest assured that if any issue arises and it's determined to fall outside the warranty coverage, our dedicated team will swiftly address it at a fair and competitive price, with your approval.

Choose Safran with confidence, knowing that our commitment to excellence extends beyond our products to exceptional customer care and support.

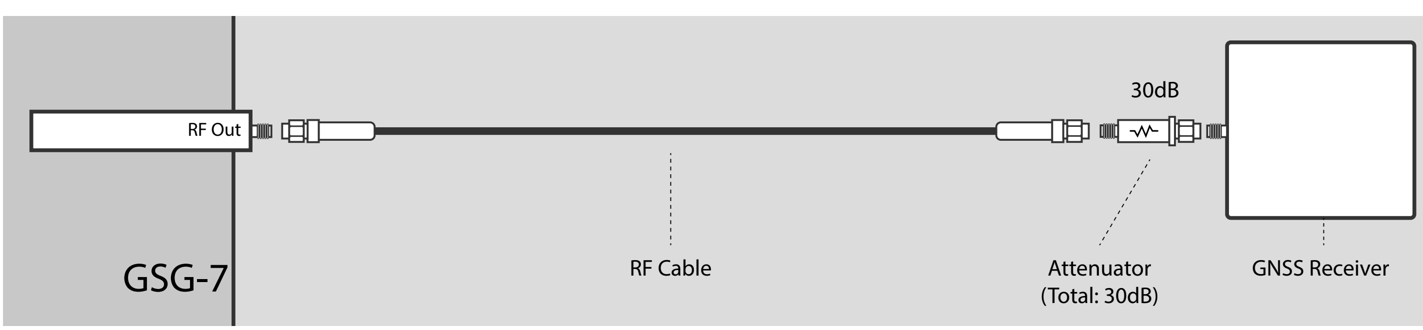
Safran warrants each new standard product to be free from defects in material, and workmanship for the duration of the warranty period after shipment in most countries where these products are sold.



Right: The GSG-7 is equipped with an internal combiner that combines GNSS signals and bands into a single RF output.



Below: This diagram is an example of an RF connection with a GSG-7. Some connections may require an attenuation. Attenuation is dependent on both output power and the GNSS receiver.



TECHNICAL SPECIFICATIONS

Constellations & Signals	GSG-7 Interfaces

• GPS: L1 C/A, L1C, L1 P(Y), L2 P(Y), L2C, L5
• Galileo: E1, E5a, E5b, E5 AltBOC, E6 HAS, PRS (Restricted Signals)
• GLONASS: G1, G2
• BeiDou:
    • BeiDou-2 (BDS-2): B1, B2
    • BeiDou-3 (BDS-3): B1C, B2a, B3I
• QZSS: L1 C/A, L1 C/B, L1S, L2C, L5, L5S
• NavIC (IRNSS): L1, L5
• SBAS (Satellite-Based Augmentation Systems): L1, L5
• Xona: PULSAR XL
• Custom Signals: User-defined signals
	• RF output: N-Type
	• 10 MHz output: BNC
	• 1 PPS output: BNC
	• 10 MHz input: BNC
	• 1 PPS input: BNC
	• Antenna input: SMA
	• HDMI, USB, Ethernet ports
	
	Timing module:
	• 10 MHz clock input
	• 10 MHz clock output
	• 1 PPS input
	• 1 PPS output
	• GNSS antenna input

RF/GNSS Signal	Specifications
Power	• GNSS maximum carrier level : -30dBm * • GNSS minimum carrier level : -135dBm ** • GNSS carrier level resolution : 0.1dB • Linearity < 0.5dB (from -100dBm to -20dBm) • Absolute Accuracy : ±0.5dB • Run to run repeatability: ±0.1dB
GNSS Bands	Simultaneous bands: 1 (GSG-711) 2(GSG-721) 3 (GSG-731) simultaneous 100MHz bands
Compatible Bands	L5,L2, E6, L1, S-band
Signal Purity	• Spurious transmission < -65 dBc • Harmonics < -45 dBc • Phase noise: < 0.003 rad RMS***
Signal Pseudorange Accuracy in RMS	±1mm RMS
Pseudorange Bias	0mm RMS

Time Alignment	• 1PPS output to RF output alignment bias <±1.2 ns • Typical 1PPS output to RF output alignment deviation < 30ps • Inter Frequency signal Alignment (as inter-SDR alignment) < 1 ns • Inter-signal alignment bias in the same band : 0s
Sampling Rate	Configurable, up to 125 Msps

** The indicated power refers to the power measured at the output of the unit (via the output RF connector). You can increase or decrease this power level using attenuators (included in the ancillary kit) or an LNA (not included). Please note that active electronics, such as amplifiers, may affect signal purity, power linearity, and accuracy.*

*** As a result of the simulated GNSS signal from Skydel, which ranges from -175 to -100 dBm in IQ data, and RF output power amplification of +40 to +70 dB.*

***** Nominal Value, which can vary based on several factors such as temperature fluctuations and power supply stability.**

Scenarios	Type of Data
Number of Signals	700 signals
Iteration Rate	1000 Hz

Dynamics	• Relative velocity : 1 500 000 m/s
	• Relative acceleration : no limits
	• Relative jerk : no limits
	• Angular rate (in rad/s) :
	  • 15pi (at lever arm of 1.5m)
	  • 60pi (at lever arm of 0.05m)

HIL Latency	• 10 ms • Zero effective latency
Scenario Duration	No limits

TIMING SPECIFICATIONS (CDM-7)

The GSG-7 internal clock module is the CDM-7. It can be configured to address different timing use cases from within Skydel. The module has three modes:

Mode	Description
Internal	This mode uses the internal OCXO of the CDM-7. No additional input required. The CDM-7 will distribute the internal 10 MHz and PPS signals.
Synchronous External	This mode requires a 10 MHz and PPS input from an external device. The CDM-7 will distribute the external 10 MHz and PPS signals.

Timing Output Specifications

Output	1PPS
Connector Type	MMCX
Output range	5 V
Output waveform	Logic-level pulse
Duty cycle	1%
Time offset between any two 1PPS outputs	< 50 ps
Signal level	TTL compatible, 4.3 V minimum, base-to-peak into 50 (TTL compatible, 2.2 V minimum, base-to-peak into high impedance)
Pulse width	Configurable Pulse width (200 ms by default)
Rise time	< 10 ns
Timing Output	
Accuracy to UTC (locked to GPS @ 1 sigma)	±25 ns
Holdover (constant temp after 2 weeks GPS lock)	
After 4 hours	1 µs
After 24 hours	25 µs
Signal Waveform & Levels	TTL (5 V_{P-P}), into 50 ohm, BNC

Output	10 MHz
Connector Type	MMCX (CDM-7)
Output range	2.5 V
Output waveform	Square wave
Duty cycle	50%
Frequency Accuracy	< 100ppb
Recommended Warm-up time	30 min
Minimum operational warm-up time	5 min
Phase Noise	-113dBc@10Hz -120dBc@100Hz -140dBc@1kHz
Harmonics	< -40 dBc
Spurious	< -70 dBc

TECHNICAL SPECIFICATIONS

Included with GSG-7

Item	Description
Documentation	Getting Started Guide Online User Manual
Ancillary Kit	• Attenuator 10dB SMA • Attenuator 20dB SMA • SMA-SMA RF Cable • SMA Female to N Male Adapter

Available Plugins for the GSG-7

- SKY-PLG-IMU – Inertial sensors emulation.
- SKY-PLG-RTK – RTCM message generation via virtual basestation.
- SKY-PLG-SDK – Plugin SDK allows the creation and integration of custom plugins for Skydel.

Optional Features for the GSG-7

- SKY-HIL – Hardware-in-the-loop mode allows input of vehicle trajectory information in real-time.
- SKY-IQFILE – IQ File, allows saving of generated IQ data to file
- SKY-CSI – Custom signal injections, allows real-time simulation of user-defined GNSS signals (custom modulation and navigation message).

Ext Warranty – Extends Hardware warranty over 3-years

SKY-SSUP – Extends Software support

Timing Component

10 MHz Reference Clock	Safran CDM-7 with on-board OCXO. Accuracy < 100 ppb

GNSS Inputs + Outputs

10 MHz clock	Input
10 MHz clock	Output
1 PPS	Input
1 PPS	Output
GNSS Antenna	Input
GNSS Signal Out Type N	Output (Front panel)

Power

Line Voltage	100-240 VAC, 50-60 Hz +/- 10% from IEC60320 (option O) connector;
Power Consumption	400W

TECHNICAL DATA

Dimensions

Size	2U
Weight	11.5 kg (25 lbs) estimated
Width	48 cm (19 in)
Depth	41 cm (16 in) estimated
Height	9 cm (3.5 in)

Environmental

Temperature	+0° C to +40° C (operating), -15° C to +50° C non-condensing @ 12,000 m (storage)
Humidity	10% to 70% (non-condensing)
Altitude	max operating: 2000 m above sea level, max transport: 4,500 m above sea level

Certifications

Safety	• Safety • EN/IEC 61010-1:2010 (third edition) • IEC 61010-1:2010/AMD1:2016 ; CAN/CSA-C22.2 No. 61010-4
EMC	• AS CISPR 11:2017, CISPR 11:2015 + A1:2016 + A2:2019, • EN61000-3-2:2018 ; EN61000-3-3:2013 ; • EN 61326-1:2013 • FCC Part 15 Subpart B:2023 Class A, ICES-003 Issue 7
Substances	• - ROHS3, 2011/65/EU Emissions

Compliance:

CE

SUPPORTING YOU EVERY STEP OF THE WAY

SAFRAN SUPPORT

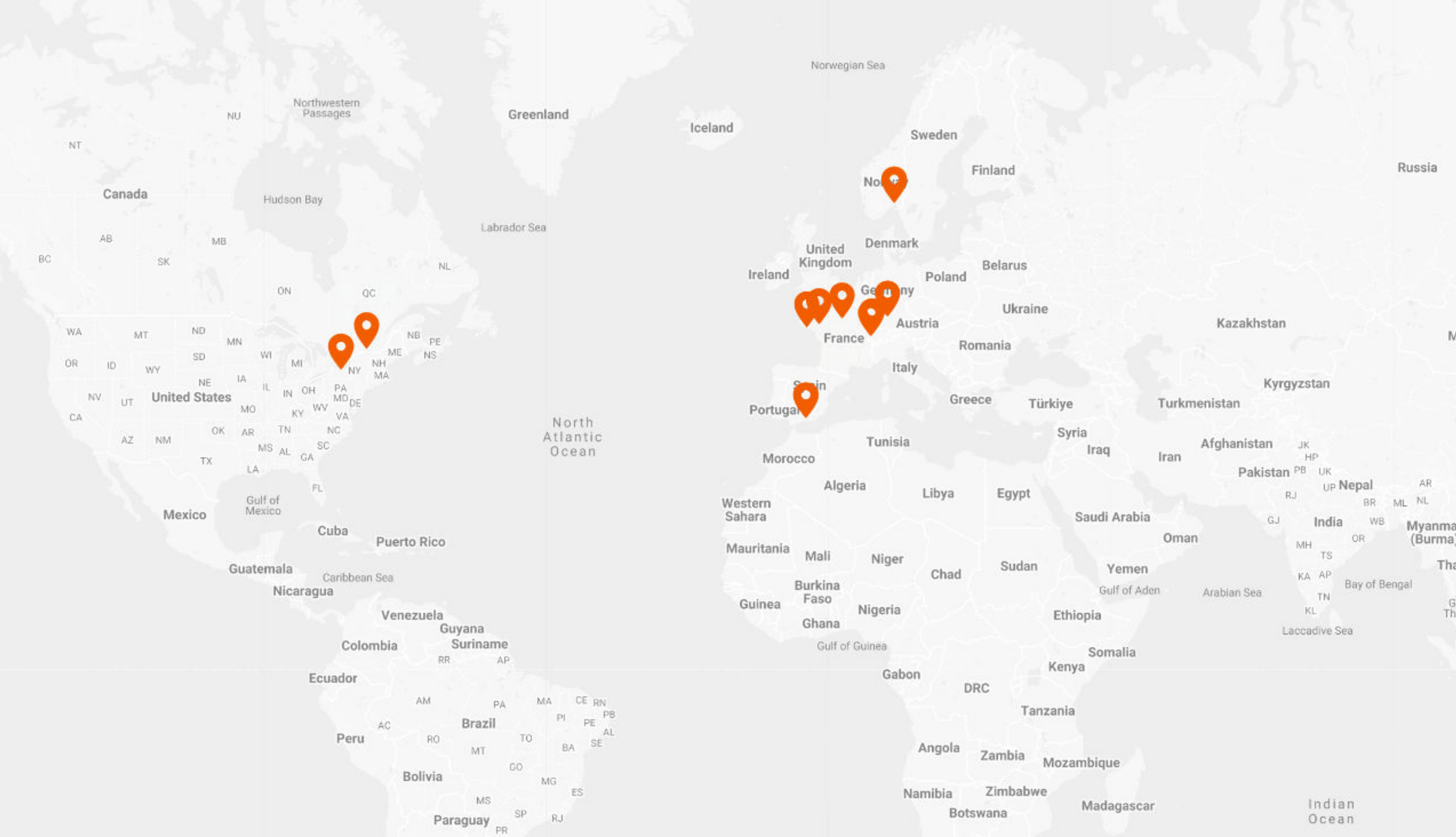
Safran's support packages, which complement our industry leading product warranties, are available to our customers to ensure maximum uptime and operational efficiency for covered equipment.

Skydel-based systems users can chose from a number of Simulation Service Plans which are designed for lab, factory, and test applications. It is recommended for all the GSG-7's due to the rapid evolution of the GNSS eco-system.

These service plans provide:

- Firmware and software updates with licenses for all new standard features
- Unlimited phone and email support
- Bi-Annual Calibrations
- Loaner Services
- Priority Service & Repair

The annual service plan may not be supported in all regions



Best in Class Support

All systems are provided with a three-year hardware warranty and one-year software support. Software support includes:

- Calibration
  Safran offers calibration services for your simulation products to ensure the accuracy of your profiles are not compromised.
- Extended Warranties
  In addition to our industry leading standard manufacturers warranty, our Service department also offers additional extended warranties to help customers bridge their budgets and keep their assets covered until the appropriate time to upgrade.
- Loaners
  If our quick turn option does not suit your needs, we also have an inventory of loaners to ensure your system stays active even during repairs.
- Online Forums
  We offer access to a wide network of users and contributors on our Online Forums for support and general inquiries. Saves time and allows users to collaborate on best practices and alternate use cases.

As with all Safran Trusted 4D products, phone and email support are always available, regardless of your support contract status.

776
250
19004

2156
657
1250
14466
1000
3050
270
3470

18120
712
1435
687
250
310
4387
7253
5370