Revolutionizing Aerospace Simulations, HIL & Digital Twins

November, 2024

Sim Dot Space is the most advanced, modern, commercial aerospace Simulation, Digital Twin & HIL framework

Reduce development costs and time, improve quality, models toolkit

Open Architecture, REST API, Web User Interface, Kafka, Micro Services

Runs on Windows / Linux / Docker / Kubernetes / HPC / VM

Reduce IT costs and improve centralized cyber security

Reuse and integrate all your existing simulation assets, e.g Matlab

Unified Digital Twin simulation / dynamic HIL / Training simulation

Easily scales up from a single satellite to large constellations

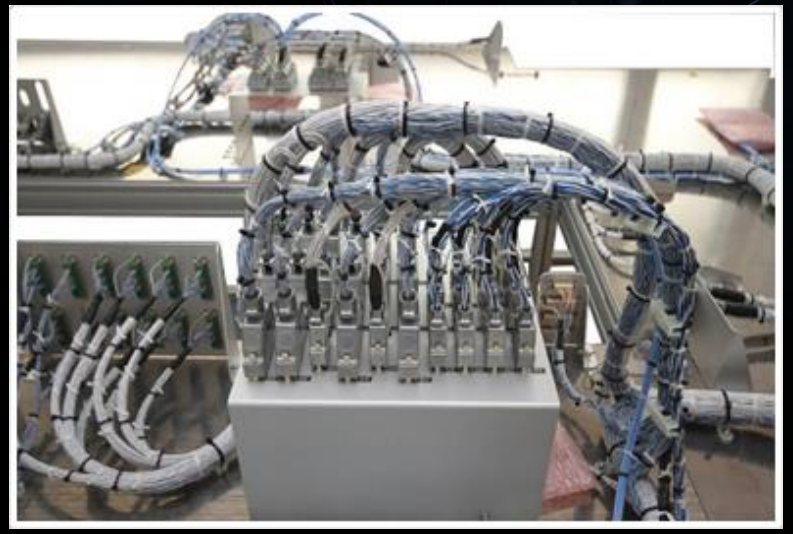
Field Proven (TRL9) in both earthbound and Lunar missions

Unified solution for the entire project lifecycle

High-level simulation for analysis and algorithm development

Dynamic development environment for flight SW, GNC and Payload SW

Digital Twin / Training Operation & Maintenance Simulation (TOMS)



Hardware In The Loop (HIL) dynamic hybrid lab

Extensive toolkit with ready to use models

Antennas

Thrusters

Transceivers

Batteries

Sun sensors

IMUs

Star Trackers

Reaction Wheels

Magnetorquers

OBC

PCDU

Magnetometers

Cameras

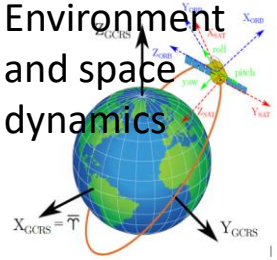
Laser range Finders

GNSS

Solar Panels

Ground segment

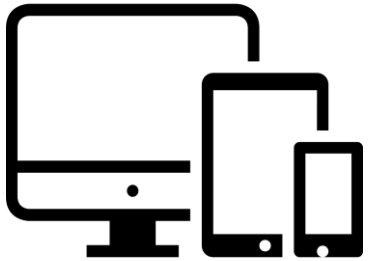
Environment and space dynamics



Open architecture / REST API / Micro services / Harness the power of could computing

Cloud Computing

Micro Services



Web user interface

Swagger™

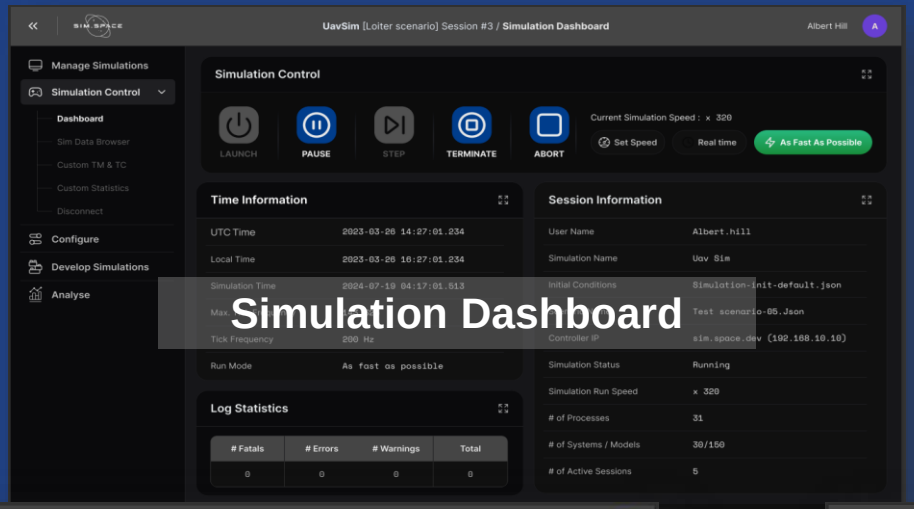
Open API 3.0

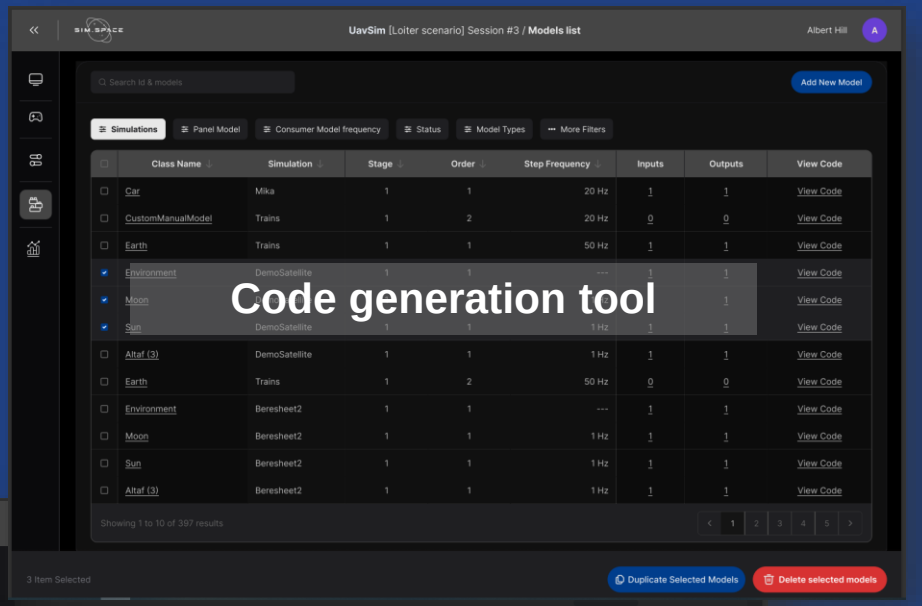
kafka

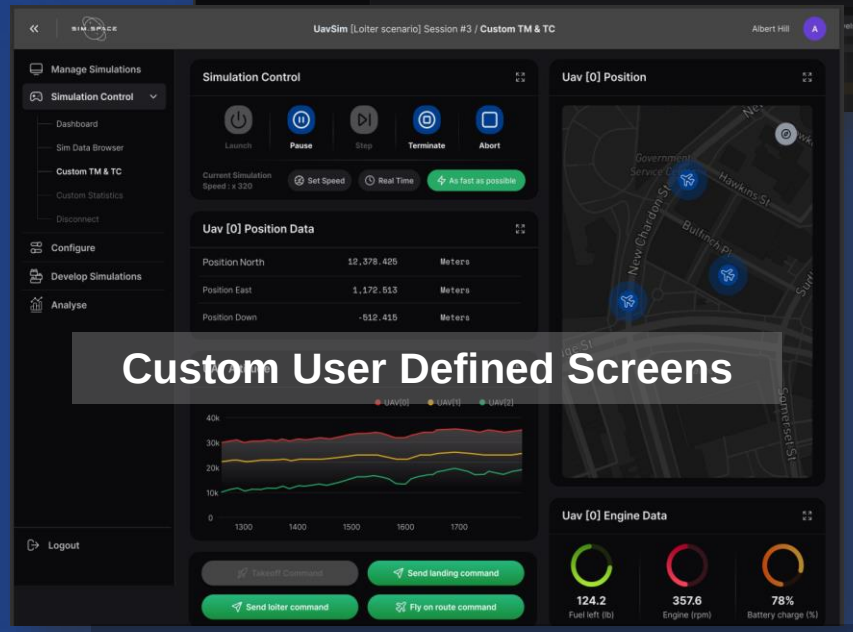
Kafka messaging

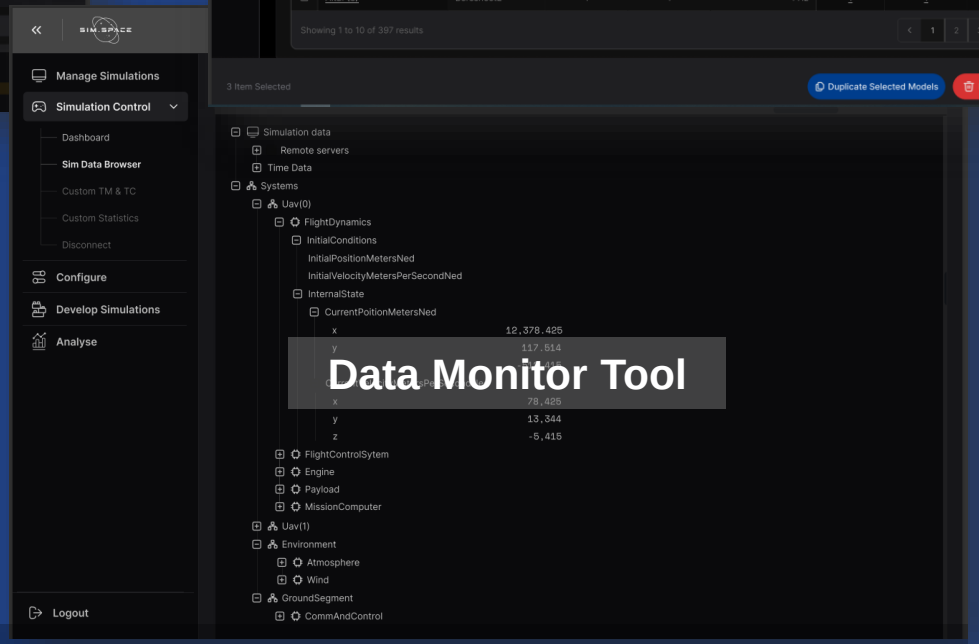
Software Development Kit

Automatic code generation tool and web user interface









Runs on all environments and architectures

Sim Dot Space Framework Main Features

Rapid Simulation Development

- Simulation code generator tool
- Comprehensive training material including sample code, unit tests, and documentation
- Extensive field-proven high-fidelity generic space-related algorithmic models' toolkit library, fully extendable by customer
- Extensive mathematical & physics library

Micro-services & parallel processing

- Scalable from a simulation of a single satellite, to a constellation of thousands of satellites
- Parallel processing via container orchestration platforms, such as Kubernetes / Openshift
- Parallel processing via HPC
- Distributed parallel processing on server cluster
- Distributed processing via Dockers
- Distribution down to the single model level

Simulation Execution features

- Simulation control via web user interface
- Command line simulation execution
- Batch simulation execution
- Step by step simulation execution
- Continuous execution until end conditions
- Fast forward or slow-motion execution
- Real-time simulation execution
- Execution of multiple concurrent instances
- Ability to reproduce any specific run
- Monte-Carlo execution and analysis
- Save "Snapshot" of simulation
- Restore simulation from saved "Snapshot"
- Scenario scripting and automation
- Configurable model fidelity levels
- Configurable model debug level
- Configurable model execution frequencies
- Configurable model Enabled / Disabled

Open Simulation Architecture

- Open simulation architecture via REST API
- Runs on both Windows and Linux
- Simulations and models data publishing via Kafka for simply integration
- Flexible IDE (Visual Studio, Eclipse, etc.)
- Simply integration of existing customer simulation assets (such as models developed in Matlab / Simulink or other modeling tools)
- Orchestration of entire existing customer simulations (such as a constellation of existing customer satellite simulations)

Dynamic Hardware in The Loop (HIL)

- Extensive set of ready-to-use hardware interfaces (serial, analog, digital I/O, etc.)
- Software controlled switching of HIL hardware configurations and power
- Hard real-time using external clock / counter
- Configurable per-model testing mode: Digital model, Real Hardware or Augmented
- Combined hardware and software models
- Unified digital simulation and HIL environment

Digital Twins

- Real-time synchronization of data between the physical satellite and its digital twin
- High fidelity representation of the entire system (energy and power, communication, sensors, actuators, dynamics, environment, data processing, etc.)
- Predictive and performance analysis via Monte Carlo
- Ability to model and simulate various scenarios, such as operational conditions, maintenance, and failure modes

Flexible execution topology

- Sub-systems and models can run in a single process or as separate processes
- Sub-systems and models can be executed across multiple bare metal machines or Virtual machines
- Sub-systems and models can be executed in Dockers or Pods
- Sub-systems and models can run in on GPUs (such as AI/ML models)
- Sub-systems and models can run in software / hardware emulators (such as flight software)

Debugging logging and recordings

- Visual debug, using any debugger
- Pause the entire simulation upon break-point
- Execution time, CPU load and memory analysis
- Log collection (across distributed architecture)
- Global and per model log level configuration
- Configurable model(s) recorded data
- Configurable model(s) recording frequency
- Event based and/or conditional recordings
- Multiple concurrent recordings
- Data recording and (open loop) playback

Miscellaneous

- Built in Unit-Testing framework
- Freedom from end-use limitations
- Bidirectional interface to 3D visualization
- Multi-project development and run-time simulator environment
- Integration to configuration control tools
- Flexible licensing (Perpetual, Leased, Node locked, Network, License borrowing)

Sim Dot Space Business Model

- Sim Dot Space framework (SDK, API, extensive aerospace models library and toolkit, code generation tool, sample code, documentation, 3D visualization tool, training and support) is provided as a software license (developer license, run time license, HIL license, etc.)

- Sim Dot Space also provides simulations / HIL / TOMS / digital twins development projects as turn-key fixed price projects

- In addition, Sim dot space offers professional services with such projects, such as models development, hardware integration, etc.