

Revolutionizing Aerospace Simulations, HIL & Digital Twins

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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



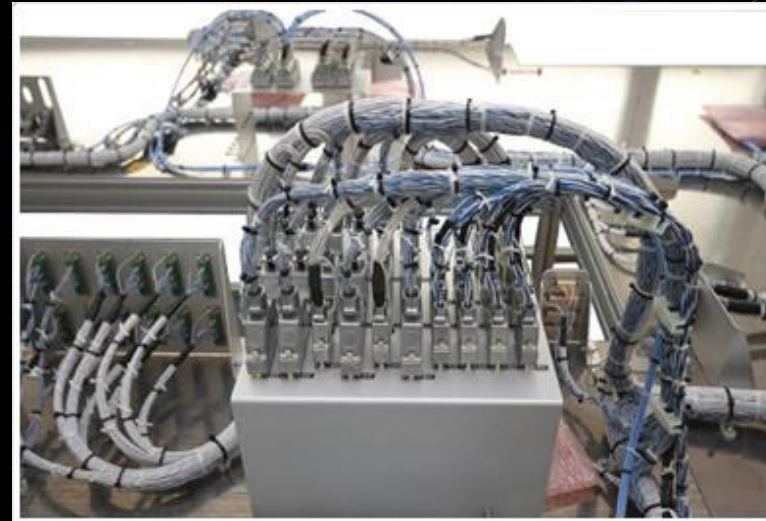
Dynamic development environment for flight SW, GNC and Payload SW



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

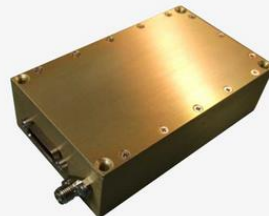


Magnetometers

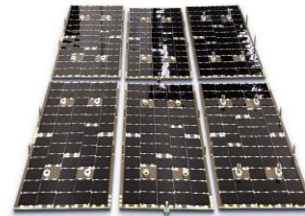


Cameras

Laser range Finders



GNSS

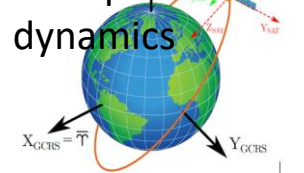


Solar Panels

Ground segment



Environment and space dynamics



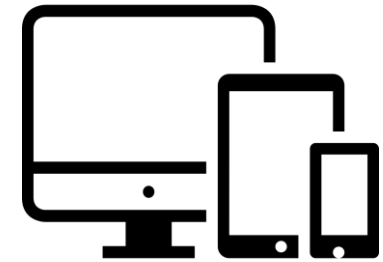
Open architecture / REST API / Micro services / Harness the power of cloud computing



Cloud Computing



Micro Services



Web user interface



Open API 3.0



Kafka messaging



Software Development Kit

Automatic code generation tool and web user interface

The Simulation Dashboard provides a central hub for managing simulations. It features a 'Simulation Control' section with buttons for LAUNCH, PAUSE, STEP, TERMINATE, and ABORT, along with a 'Set Speed' and 'Real Time' toggle. Below this, 'Time Information' shows UTC and Local times, while 'Session Information' displays user and simulation details. A 'Log Statistics' table tracks the number of Fatal, Error, and Warning messages.

| # Fatal | # Errors | # Warnings | Total |
|---------|----------|------------|-------|
| 0 | 0 | 0 | 0 |

Simulation Dashboard

The Models list interface displays a table of simulation models. The table includes columns for Class Name, Simulation, Stage, Order, Step Frequency, Inputs, and Outputs. A search bar and 'Add New Model' button are at the top. The table lists models like Car, CustomManualModel, Earth, Environment, Moon, Sun, Altair (3), and Earth, each with associated simulation parameters and a 'View Code' link.

| Class Name | Simulation | Stage | Order | Step Frequency | Inputs | Outputs | View Code |
|-------------------|---------------|-------|-------|----------------|--------|---------|-----------|
| Car | Mika | 1 | 1 | 20 Hz | 1 | 1 | View Code |
| CustomManualModel | Trains | 1 | 2 | 20 Hz | 0 | 0 | View Code |
| Earth | Trains | 1 | 1 | 50 Hz | 1 | 1 | View Code |
| Environment | DemoSatellite | 1 | 1 | --- | 1 | 1 | View Code |
| Moon | DemoSatellite | 1 | 1 | 1 Hz | 1 | 1 | View Code |
| Altair (3) | DemoSatellite | 1 | 1 | 1 Hz | 1 | 1 | View Code |
| Earth | Trains | 1 | 2 | 50 Hz | 0 | 0 | View Code |
| Environment | Beresheet2 | 1 | 1 | --- | 1 | 1 | View Code |
| Moon | Beresheet2 | 1 | 1 | 1 Hz | 1 | 1 | View Code |
| Sun | Beresheet2 | 1 | 1 | 1 Hz | 1 | 1 | View Code |
| Altair (3) | Beresheet2 | 1 | 1 | 1 Hz | 1 | 1 | View Code |

Code generation tool

This interface is designed for monitoring and controlling a UAV. It includes a 'Uav [0] Position' map showing the UAV's location on a street map. Below the map, 'Uav [0] Position Data' provides numerical values for North, East, and Down coordinates. The 'Uav [0] Engine Data' section features three gauges for Fuel left (lb), Engine (rpm), and Battery charge (%). Control buttons for 'Send loiter command', 'Send landing command', 'Send loiter command', and 'Fly on route command' are also present.

Custom User Defined Screens

The Data Monitor Tool provides a hierarchical tree view of simulation data. It shows the structure of the simulation, including systems like Uav(0), FlightDynamics, Engine, Payload, and MissionComputer. The 'Uav(0)' system is expanded to show its internal state, including position and velocity data.

```
Uav(0)  
  FlightDynamics  
    InitialConditions  
      InitialPositionMetersNed  
      InitialVelocityMetersPerSecondNed  
    InternalState  
      CurrentPositionMetersNed  
        x: 12,378.426  
        y: 117.514  
        z: 13,344  
        x: 78.426  
        y: 13,344  
        z: -5,415  
  FlightControlSystem  
  Engine  
  Payload  
  MissionComputer
```

Data Monitor Tool

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 Docker
- 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 Docker 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.

