Mission Design Simulator

Test spacecraft autonomy before flight.

Spend your engineering time on the mission, not on the tools.



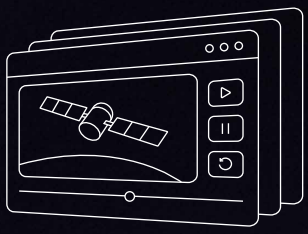
BLACKSWAN SPACE

Autonomy is becoming a must. Simulating it is still hard.

Refuelling, inspection and large constellations depend on spacecraft that act on their own. Every autonomous manoeuvre has to be proven on the ground first.

YOUR BEST ENGINEERS END UP STUCK BUILDING TOOLS

Months go into an in-house simulator instead of your own product or service.



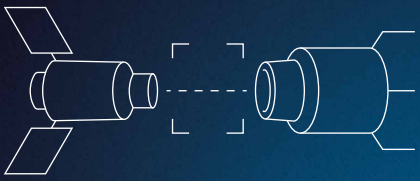


THERE'S ALMOST NO REAL DATA TO LEARN FROM

Vision and AI systems need images of spacecraft in orbit that match your mission. Almost none exist.

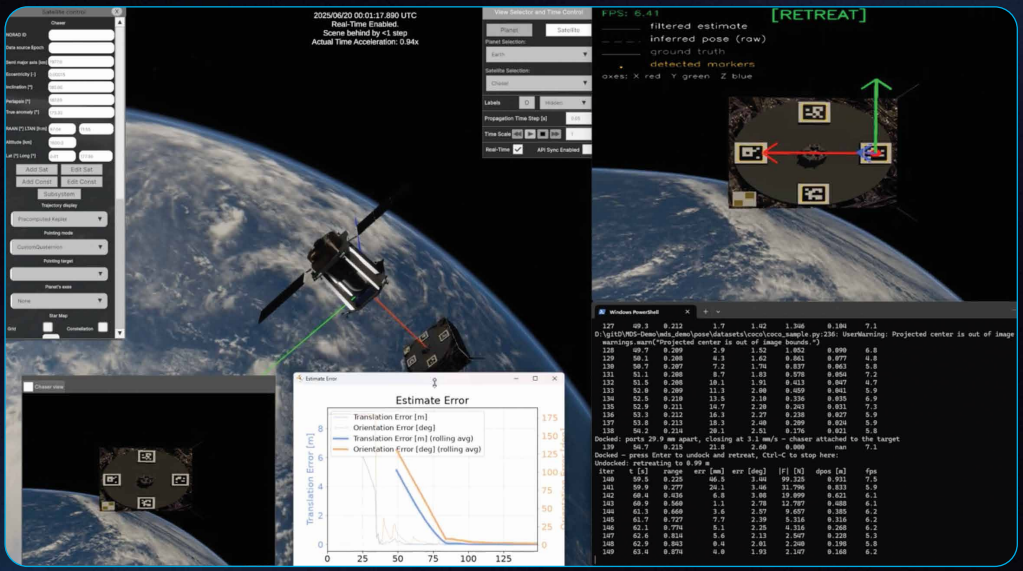
EVERY MISSION IS A ONE-SHOT BET

Untested docking, refuelling or station-keeping algorithms put years of work and millions in hardware at risk.



Your mission, simulated long before launch.

Mission Design Simulator (MDS) is a ready-to-use, real-time and photorealistic simulator for designing and testing autonomous space missions.



KEEP YOUR TEAM ON THE MISSION

No simulator to build or maintain, and a faster path to launch.

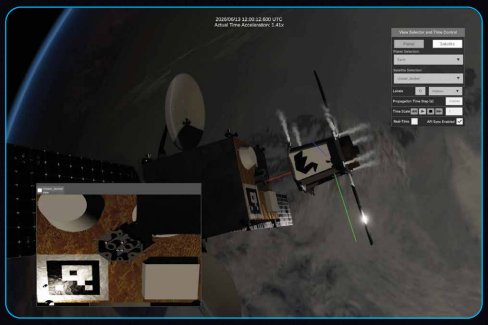
TRAIN ON DATA YOU CAN'T COLLECT IN ORBIT

Realistic images with controlled lighting, distance and camera settings, to train and test vision systems.

CATCH EXPENSIVE MISTAKES ON THE GROUND

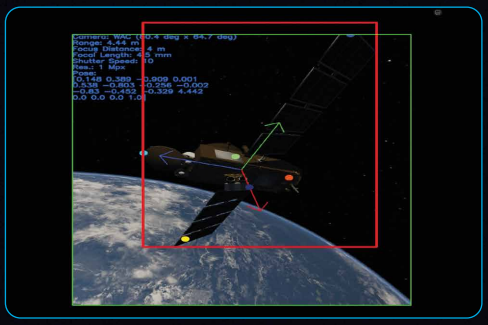
Run nominal and off-nominal cases in real time, including fallbacks you hope you never see.

What will you test first?



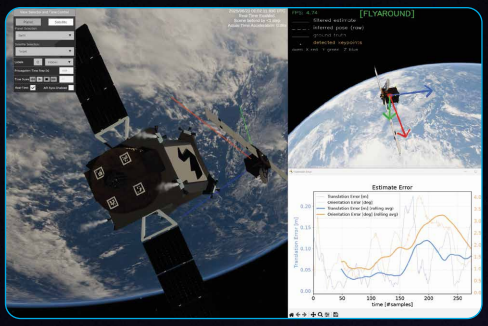
RENDEZVOUS AND DOCKING

Simulate the full approach in nominal and off-nominal conditions, with an onboard camera view and your GNC in the loop.



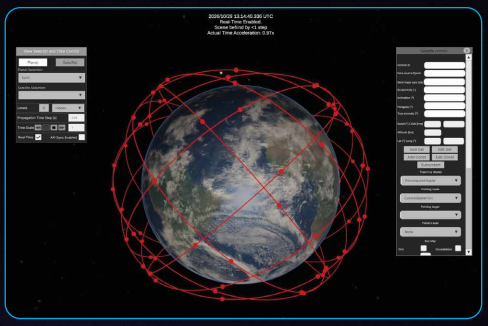
VISION AND AI TRAINING DATA

Generate labelled images with ground truth from your mission profile, then run your trained model in the simulation.



REAL-TIME FLIGHT SOFTWARE TESTING

Connect your software, or your hardware, in the loop and see how it performs before launch.



CONSTELLATION DESIGN AND ANALYSIS

See results straight away, without reruns. Compare coverage and catch orbit drift early, around Earth, the Moon or Mars.

Why teams choose MDS

01 EVERYTHING IN ONE LOOP

Orbital dynamics, ray-traced imagery and your GNC in one real-time simulation.

02 WORKS WITH YOUR TOOLS

Language-agnostic API with Python, MATLAB and Simulink support.

03 BUILT WITH ESA, POWERED BY TUDAT

Developed under ESA contracts, with TU Delft's world-class Tudat propagation engine.

04 SHAPED BY ITS USERS

Customer feedback becomes new features, fast.

CUSTOMERS AND PARTNERS

AURIA

VILNIUS TECH

orbital KURS

DELTA ORBIT

deimos

nano avionics

esa

Key features for engineers

MISSION SIMULATION

- Real-time and faster-than-real-time simulation
- Orbital mechanics with SGP4, Tudat and a specialised VLEO propagator
- Monte Carlo analysis
- Mega-constellation design, coverage and access
- Fuel-optimal Maneuver Calculator and station-keeping monitor
- Moving ground assets and ground stations

AUTONOMY TESTING

- RPO and docking with GNC in the loop
- Multi-body dynamics and space robotics
- Ray-traced synthetic images with depth and ground truth
- Lighting and camera effects: Earth albedo, flare, blur
- Real-time inference for trained vision models
- Software- and hardware-in-the-loop (SIL / HIL)

INTEGRATION AND DATA

- Language-agnostic API with Python, MATLAB and Simulink support
- JSON scenes and scenario templates
- 3D model import and export
- TLE / OMM, CelesTrak, Space-Track
- Ephemerides and CSV export, Grafana, mission reports

```python
from mds_api import mds_api, mds_constellations
mds_api.clear_scene()
mds_constellations.create_walker_constellation(
    constellation_name="Demo", mass=1000, i=45, t=36, p=4, f=2,
    raan=0, orbit_radius=6378e3 + 700e3, central_body="Earth", ta_offset=150)
mds_api.set_time_scale(2)
```

Full documentation: *blackswanspace.com/go/docs*

See it on your own mission

BOOK A DEMO

30 minutes with our engineers, focused on your mission.

- **Free 14-day trial** with ready-made mission templates: ***blackswanspace.com/go/trial***
- Annual and monthly licences, with special offers for startups and universities



blackswanspace.com/go/demo

"We struggled for years to build an integrated simulation environment from open-source projects, at times putting more effort into simulators than into our own product. MDS is now our trusted simulator for testing and demonstrating scenarios with hundreds of autonomous satellites."

— Kenneth Center, PhD, VP of Advanced Solutions, Auria Space

BLACKSWAN SPACE



MAKING SATELLITES AUTONOMOUS

We build the software and hardware that let spacecraft think and act on their own: Mission Design Simulator to design and test autonomy on the ground, and our plug-and-play RPO Kit to bring autonomous navigation to orbit.

info@blackswanspace.com | blackswanspace.com

Lithuania:
J. Jasinskio Street 14B,
LT-01121 Vilnius

United Kingdom:
128 City Road,
London EC1V 2NX

United States:
1700 Washington Avenue,
Golden, CO 80401