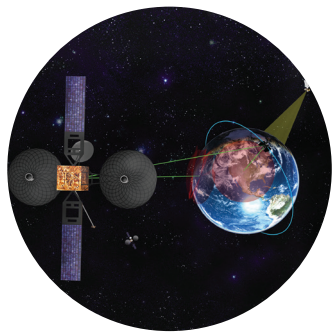


Leverage the power and flexibility of FreeFlyer®
Astrodynamics Software in your next mission.

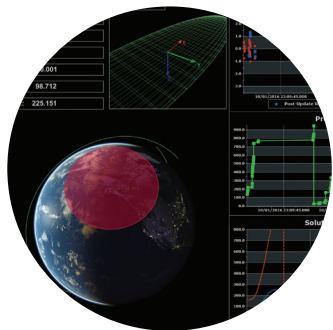
SOFTWARE FOR SPACE MISSION DESIGN, ANALYSIS AND OPERATIONS

FreeFlyer® provides complete astrodynamics functionality for missions of any size, any scale, any orbit regime. With customizable interfaces and cross-platform use, FreeFlyer supports the full life cycle of your mission.



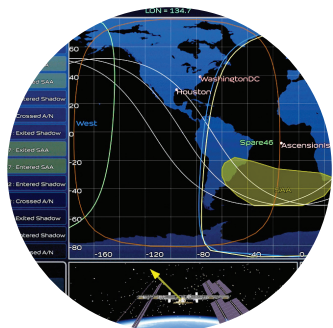
DESIGN

Design satellite orbits in any regime, define constellation parameters, target maneuvers, and simulate the full mission life cycle from launch to nominal operations to disposal.



ANALYSIS

Analyze any mission requirements, including spacecraft and ground sensor coverages. Generate fuel consumption reports and perform parametric trade studies. Augment FreeFlyer's internal algorithms with user-defined math functions and custom computations, or use the native MATLAB API.



OPERATIONS

Automate satellite operations for both routine and complex flight dynamics tasks. Integration with ground system databases, 3rd party TT&C software, and custom / legacy code via the FreeFlyer Runtime API with interfaces for C/C++, C#, Java, and Python.

AT A GLANCE

Core Functionality:

- Spacecraft Propagation
- Coverage & Contact Analysis
- Maneuver Modeling & Targeting
- Orbit Determination
- Attitude Modeling
- Custom Math & Algorithms
- External Interfacing

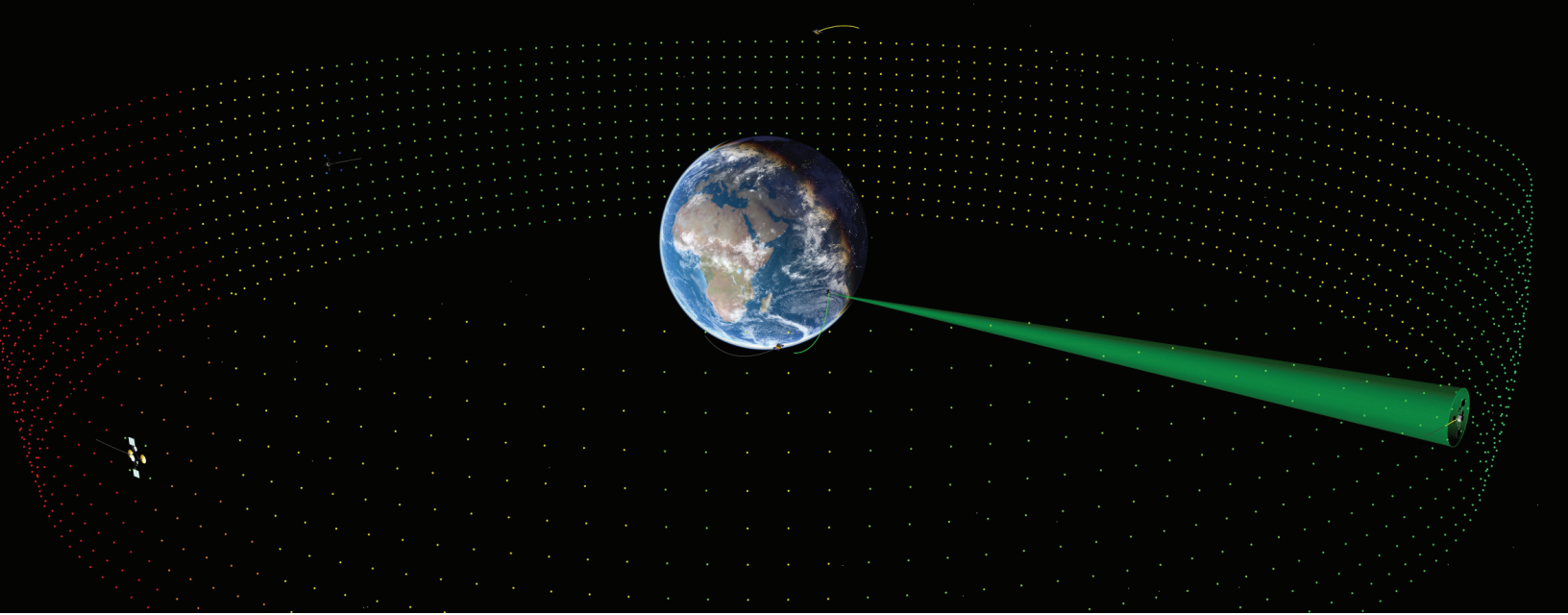
Heritage:

- USAF Programs
- NASA Science Missions
- NOAA Science Missions
- International Space Station
- NASA Orion
- Commercial Satellite Programs (U.S. and Abroad)

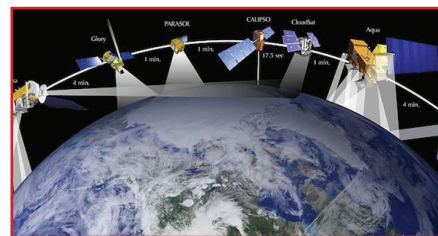
Operationally Proven For:

- Space Situational Awareness
- Orbital Debris/Collision Avoidance
- Ground System Integration
- Automated Operations
- Mission Design & Analysis
- Wargame Strategies
- Constellations

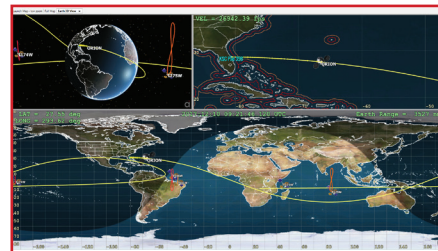




FreeFlyer[®] is a commercial off-the-shelf (COTS) software application for space mission design, analysis, and operations. FreeFlyer stands out as the most powerful tool of its kind by providing users with a robust scripting language for solving all types of astrodynamics problems. FreeFlyer has been validated, flight-tested, and proven accurate. It is used for spacecraft analysis and operations by NASA, NOAA, USAF, DoD, and commercial satellite providers.



Experience our multi-domain operations capabilities for space and missile defense.



Custom visualizations bring situational awareness to your mission controllers.

FREEFLYER FEATURES

Generating Output

- Customizable 2D and 3D OpenGL visualizations of your mission.
- Fully tailorable cartesian and polar plots for use with mission parameters.
- Total control over output layout, which means you can deliver a consistent high-quality output experience.
- Data can be reported to consoles, tables, or exported via custom reports.
- Custom visualization foreground and background elements give full control over the way output looks and what is displayed.

FreeFlyer Scripting

- Scripting language gives you full control over the inputs, outputs, and logical flow of an astrodynamical simulation.
- Integrated development and execution environment includes auto-complete, text color controls, and indenting controls.
- In-script interfaces with MATLAB[®] and TCP/IP sockets.
- Matrix math, mathematical functions, and coordinate system conversion functions simplify script design.
- User-defined functions, macros, and lists enable systems to be complex yet not overwhelming.

Interfacing with External Resources*

- Custom force modeling and custom object definitions via FreeFlyer Extensions.
- Runtime Application Program Interface (API) for use with other C/C++, C#, Java, MATLAB[®], and Python applications.
- Read and write arbitrary plain text and binary file types with the FileInterface object.
- Interfaces with ODBC databases created in MySQL[®], Microsoft Access[®], Oracle[®], and more.
- Customizable user interfaces to manage operations script flow and allow operators to conveniently input information at runtime.

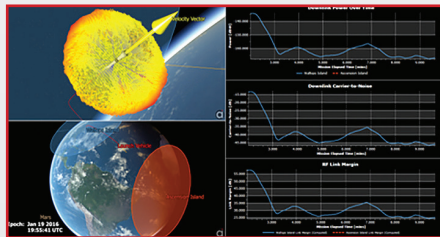
FREEFLYER CAPABILITIES

Spacecraft Propagation

- Fixed or variable step propagation using numerous propagators and ephemeris types.
- Full force modeling capability includes Solar System, atmospheric drag/lift, solar radiation pressure, IRI, and custom celestial bodies.
- Detailed spacecraft modeling includes fuel tanks, thrusters, collision avoidance calculations, and full attitude modeling.
- Formation support gives constellation customers an efficient way to model and analyze multi-spacecraft problems.

Coverage and Contact

- Nearly 500 pre-defined ground station geodetic and masking profiles for full customization options.
- Easy-to-use visibility calculations that factor refraction among spacecraft, sensors, ground stations, and celestial bodies.
- Easily gather field of view, elevation, azimuth, range, range rate, cross track, and along track information about your system.
- Point Groups provide coverage and revisit statistics for constellation design.



RF Link Object for two-way communications with 3D Visualization of antenna gain pattern

Maneuvering and Targeting

- Impulsive and finite burn types fully supported.
- Modeling for mono- and bi-propellant blow down systems.
- Electric and chemical propulsion modeling support.
- Built-in multi-variable targeting tool with differential corrector capability.

Interplanetary

- Support for a multitude of coordinate systems that apply across celestial objects.
- Define custom celestial objects to represent asteroids, moons, or other gravitationally interacting bodies.
- B-plane analysis, rotating libration point, and rotating-pulsating system support.
- Dynamically control parameters of the solar system to adjust propagation for the specifics of a mission.

Orbit Determination*

- Extended and unscented Kalman filters, batch least squares, and square root information filter methods for orbit determination solutions.
- Spacecraft state estimation with receiver and transponder modeling and covariance propagation.
- Tracking data simulator and editor can be used to manage outliers and view multiple measurement types simultaneously.
- Ground-based, TDRS, GPS point solution, spacecraft-to-spacecraft, and BRTS tracking data options supported.

Note: *Orbit determination and interfacing with external resources functions are only available with the FreeFlyer Mission tier.



FreeFlyer used in the ISS NASA Mission Control Center (Houston, Texas)

CA / SSA Applications

Automated collision screening

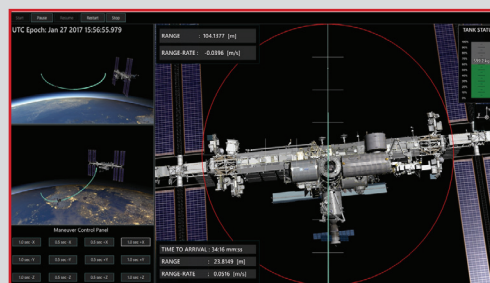
- 1 vs. All screening via TLE full catalog or subset
- Conjunction assessment 1 vs. 1 via CDM ingestion

Built-in methods for each conjunction event:

- Time of Closest Approach (TCA)
- Probability of collision (Pc)
- Along-track, cross-track, radial miss distances
- Monte Carlo state sampling
- 3D Conjunction geometry analysis and visualization
- Maneuver planning for collision avoidance

Support rendezvous and proximity operations

- Module docking / satellite servicing
- BMC2 scenarios

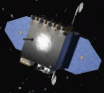


Modeling visiting vehicle proximity operations at the International Space Station



NOTABLE SUPPORTED MISSIONS

Solar Dynamics Observatory



BEO

Libration Point
Deep Space Missions
Interplanetary Transfers



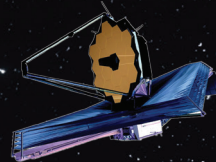
GATEWAY

MMS



GEO

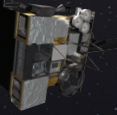
Communications
Space Situational Awareness



James Webb Space Telescope

36,000 km

Classified Missions



NOAA GOES Fleet

MEO

GPS Orbit Determination
Highly Elliptical Orbits

20,000 km

GPS Constellation

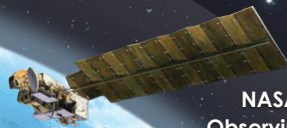


LEO

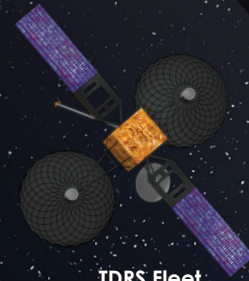
Earth Observation
Earth Science Missions
Commercial Constellations

2,000 km

International Space Station



NASA Earth Observing System



TDRS Fleet

GROUND

Warfighter Support

Comm/ISR/GPS Coverage



Landsat 7, 8, 9

Contact us at Sales@ai-solutions.com for a free evaluation, and a customized demonstration to see what **FreeFlyer**® can do for your mission

 **a.i. solutions**
ai-solutions.com



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