FreeFlyer: Software for Spacecraft Mission Analysis, Design, and Operations

FreeFlyer® is a commercial off-the-shelf (COTS) software application for spacecraft mission analysis, design, and operations, supporting all phases of the mission lifecycle. Developed by a.i. solutions, FreeFlyer stands out as the most comprehensive, flexible, and powerful mission planning tool available today. FreeFlyer has successfully supported more than 225 defense, civil, commercial, and international missions. Its superior analytical capabilities are designed to solve problems - tough problems. With three versions of the product available, it is scalable to fit any requirement or budget.

A Single Comprehensive Tool with Three Available Tiers

**FreeFlyer® Design™**
FreeFlyer Design is the perfect analysis tool for mission concept development and preliminary design. It allows users to quickly and accurately evaluate trade spaces for optimum mission profiles. Tasks such as orbit design, ground station location and coverage times, and sensor modeling can be performed quickly and easily.

**FreeFlyer® Engineer™**
FreeFlyer Engineer provides comprehensive mission analysis and design functionality. It gives users added flexibility with more numerical integrators, more complex sensor and antenna modeling, and more control over propulsion system modeling. Its full-featured scripting language allows users to implement even the most complex logic for mission-unique analyses. No recompiling. No add-on modules.

**FreeFlyer® Mission™**
FreeFlyer Mission is the most advanced turnkey mission planning product on the market today, providing the ultimate in complete spacecraft mission design and operations functionality. From automation to orbit determination to seamless integration with any ground system or other third party software, FreeFlyer Mission’s flight-proven heritage makes it the best tool available for complete mission support.

**FreeFlyer® Improves Your Bottom Line**

To improve your bottom line, FreeFlyer offers:
- Scalability for design, analysis, and operations
- Complete mission support in a single tool
- Proven accuracy to safeguard mission success
- Customer-centric technical support
- Integration with satellite ground systems
- Interoperability with 3rd party and legacy tools
Trajectory Design & Spacecraft Propagation
FreeFlyer models any orbit regime including LEO, GEO, Molniya, Sun-synchronous, Lagrange Point, and interplanetary. Users can also optimize trajectories under a variety of constraints using over 150 built-in orbital design parameters and unlimited user-defined variables.

Coverage & Contact Analysis
FreeFlyer computes real-time access and coverage data including AOS/LOS times, durations, angles, distances, rates, and more for an unlimited number of objects simultaneously. Each access calculation can be constrained using sensor obscurations, antenna exclusions, and ground station masking. Revisit statistics, percent coverage, and sun/ shadow times are all easily calculated, reported, and visualized.

2D & 3D Visualizations
FreeFlyer comes complete with a powerful 2D and 3D visualization environment for displaying data on demand, providing an intuitive and interactive view of all simulation objects. Items such as orbit geometry, spacecraft position and attitude, sensor projections, ground stations and their associated masks, and ground area targets can be viewed and updated in real time.

Reporting & Plotting
FreeFlyer allows an unlimited number of customizable reports and plots to be generated on any data calculated. With over 1,300 pre-defined parameters available and unlimited user-defined variables, the data reporting and plotting capabilities in FreeFlyer are virtually limitless.

External Interfacing & Extensions Software Development Kit (SDK)
FreeFlyer is equipped with out-of-the-box interfaces for maximum interoperability, including a seamless built-in MATLAB interface. Users can connect to any database or share information with other resources via TCP/IP socket connection. In addition, the Extensions SDK included with FreeFlyer Mission allows users to integrate custom C# code with their Freedy Mission Plans. Examples range from adding custom force models for use in propagation to auto-generating Microsoft Office documents with analysis results.

Orbit Determination
FreeFlyer’s Orbit Determination capabilities allow users to perform state estimation on an unlimited number of spacecraft simultaneously and autonomously. FreeFlyer supports multiple common observation types and provides three unique algorithms for state estimation. A tracking data simulator and consider analysis capabilities are also included for pre-launch OD analyses.

Maneuvering & Targeting
Users can perform launch window analysis, execute impulsive and finite burns, and model low-thrust propulsion systems with FreeFlyer’s maneuver modeling capabilities. Full customization of tanks, thrusters, and valves allows ultimate control and precision for finite burn modeling. FreeFlyer’s differential corrector targeting system also provides a robust method for maneuver and ascent planning, optimization, and calibration.

Attitude Modeling
FreeFlyer includes full spacecraft attitude modeling capabilities. Users can model three-axis stabilized, spin-stabilized, or any other attitude profile in one of several built-in or user-defined coordinate systems and perform unlimited combinations of rotation sequences. FreeFlyer also reads and writes spacecraft attitude data in multiple file formats.

Spacecraft Modeling
FreeFlyer models detailed physical properties of spacecraft including surface area, dry mass, moments of inertia, and more. Users can import any CAD model in 3ds format for detailed visualization and independently articulate model components (e.g. rotating solar arrays).

Full-Featured Scripting Language
FreeFlyer’s scripting language allows maximum flexibility for problem setup, control law implementation and product customization. Employing common logic commands such as For, If, Then, Else, and While, FreeFlyer scripting allows users to write their own equations, define their own variables for reporting and plotting, and implement even the most complex logic control. By leveraging the scripting language, the product functionality is limited only by the user’s imagination.