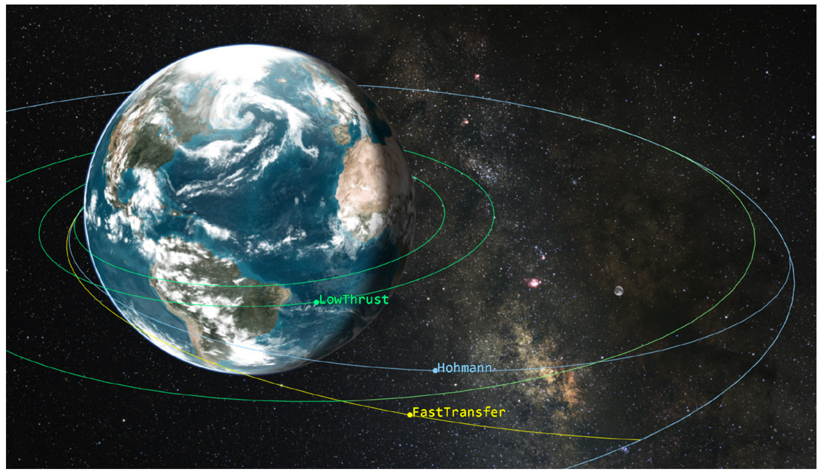
STK Astrogator

AGI
/An Ansys Company

Adds advanced spacecraft trajectory modeling and maneuver planning capabilities to STK.

Used for over two decades by space professionals, STK Astrogator provides everything mission planners need to develop, optimize, and validate flight-ready trajectory solutions and reveals mission-critical insights that can decrease overall program costs. The combination of GUI-driven workflows and 3D visualization makes creating and understanding complex missions simple. You can easily integrate custom engine models, force models, and propagation variables that are fit to your exact mission specifications. STK Astrogator has been used on missions ranging from LEO to GEO, from the Sun to Arrokoth, and many places in between.



Use Cases

- Create and analyze high-fidelity spacecraft trajectories in any regime, including:
  - LEO, GEO, GTO, HEO
  - Lunar/cislunar
  - Libration points
  - Deep space
- Model impulsive or finite spacecraft maneuvers.
- Support early-phase design and planning, trade studies, proposals, or internal research.
- Collaborate with other subsystem teams to analyze mission impacts and iterate new trajectories quickly.
- Conduct force model or aggregate launch analysis.
- Support ongoing spacecraft operations with maneuver planning or trajectory refinement.
- Integrate STK Astrogator into your flight dynamics system.
- Derive intelligence from realistic simulations of third-party spacecraft, including advanced maneuvers such as rendezvous and proximity operations, station-keeping, or formation flying.

Key Value Points

- **Includes industry-standard models and optimization engines** to solve both common and unique astrodynamics problems.
- **Produces repeatable, accurate results** suitable for operational space missions.
- **Enables you to create customized and automated workflows** tailored to your needs.
- **Comprehensive reporting and analysis tools** make deriving insights as easy as creating a trajectory. Because it is directly integrated with STK, you have immediate access to a full all-domain modeling and analysis environment – something that is unavailable with most dedicated trajectory design software products.
- **Amazing visualization capabilities** enable you to communicate with team members and decision makers using precise data and engaging images and animations.

Core Capabilities

- **Segmented trajectory design**. STK Astrogator uses a series of segments to define the complete trajectory and generate the final ephemeris. Examples of individual segments include: Initial State, Launch, Follow, Maneuver, Propagate, Target Sequence, etc.
- **Maneuver simulation**. Capabilities include maneuver pointing and thrusting strategies that can be executed in an impulsive or finite sense, as well as a mechanism for optimizing the pointing of finite maneuvers.
- **High-fidelity force models**. Includes accurate force models that you can customize to tailor propagations to your mission requirements.
- **Advanced search and optimization**. A collection of search profiles – differential corrector and SNOPT and IPOPT optimizers – helps you quickly and accurately discover the best trajectories to achieve your mission goals.
- **User scripting**. Includes built-in scripting for individual sequences and a high-level API to orchestrate entire

simulations. Internal scripting supports JScript, VBScript, or MATLAB (the API supports additional languages).

- **Highly customizable variables**. You can define your own engine models, propagators, central bodies, fuel tank characteristics, calculations, constraints, stopping conditions, and more.
- **Conditional responses**. Subroutines within automatic sequences enable conditional responses based on user-defined criteria.
- **Thorough reporting and graphing**. Includes multiple data products and views, including maneuver summaries, hundreds of built-in calculation objects, execution logs, and user-defined variable accounting.

Technical Details

Orbit propagation

- Includes several numerical integration schemes, including a Runge-Kutta-Fehlberg 7/8 scheme, a Gauss-Jackson integrator, and more.
- Includes numerous standard atmospheric density models to support orbital drag modeling for propagation at relevant altitudes, including Jacchia-, MSIS-, and DTM-based models; also includes a user plugin point for density models.
- Includes non-Earth atmospheric density models such as Mars-GRAM.
- Includes several solar radiation pressure models including Bar-Sever, N-Plate, and spherical models, as well as a plugin point for user models. Also included are options for thermal pressure and albedo modeling.
- Includes high-fidelity geopotential gravity modeling that accounts for tides with configurable degree and order options.
- Third-body effects are available for numerous bodies and planetary systems.
- Includes lower-fidelity models for initial design and analysis, including two-body gravity and a native implementation of the circular restricted three-body model.

Maneuver modeling

- Offers mechanisms for automatically transitioning between impulsive and finite maneuver models.
- An optimal finite maneuver provides an interface and tool set to numerically optimize the thrust-pointing angle along a finite maneuver using orthogonal collocation.
- Implements a modular, separated pointing and thrusting system for maneuver modeling that enables combinations of pointing strategies with multiple engine models.
- Engine models can be used as single units or combined as a thruster set to support complex thrusting geometries consistent with mounting and constraints.
- Pointing and thrusting strategies include multiple options as well as user plugin points to support unique spacecraft configurations.

Learn more
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