

## STK Premium (Air)

Advanced flight performance modeling, mission planning, and simulation of complex aircraft systems.

### STK Premium (Air) adds advanced modeling of aircraft platforms and payload systems to STK Pro.

With these capabilities, you can enhance your understanding of aircraft performance, evaluate mission metrics, and conduct feasibility studies against proposed system designs within STK's multidomain system of systems mission modeling environment. STK Premium also adds analytical tools to improve your understanding of system performance.

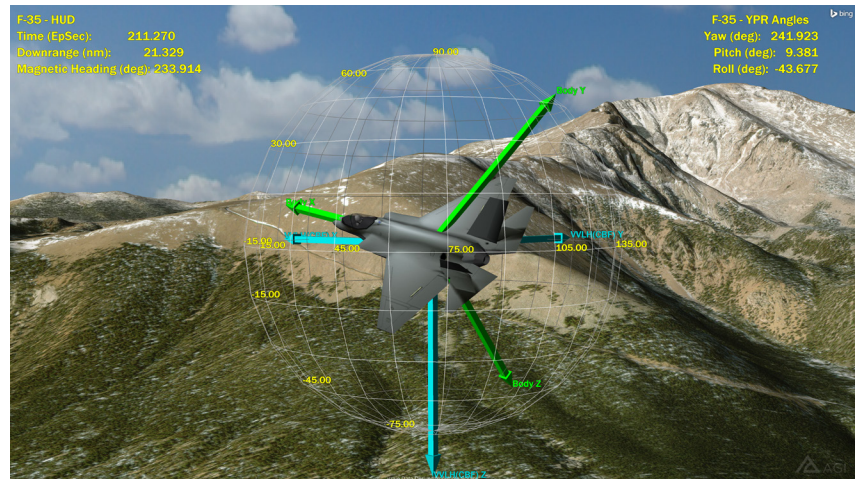
### Core Functionalities

**Analytical** capabilities include:

- ModelCenter's advanced optimization algorithms and trade study tools
- Electro-optical infrared (EOIR) sensor performance and image prediction
- High resolution global terrain, imagery, and map data
- Parallel computing
- Analysis of live or simulated real-time data feeds, including interoperability with VR-Link Toolkit

**Air systems modeling** capabilities include:

- Advanced aircraft mission planning and route design
- Performance-based flight characteristics of aircraft platforms
- Aerodynamic analysis across full flight envelopes
- Pre-defined, common flight procedures
- Integration with aeronautical datasets (navaids, waypoints, airports, runways, etc.)
- 3D editing of mission routes
- Wind and atmosphere models
- Support for hypersonic systems
- Powerplant designs (turbofan, turbojet, etc.)



### Use Cases

- **Aircraft Mission Planning.** Design complex aircraft flight routes while applying advanced aircraft platform models and performance constraints to understand design limitations and validate requirements.
- **Defensive System Evaluation.** Analyze detection system capabilities across multiple domains against realistic threat flight profiles, thermal signatures, and radar detectability.
- **Hypersonic Modeling.** Use ramjet and scramjet engine models and 6DOF dynamics to model hypersonic and extra-atmospheric trajectories.
- **Trade Studies.** Perform automated trade studies and solve complex problems with advanced optimization algorithms.
- **Real Time Data Integration.** Bring live flight data into STK for visualization and direct analysis of exercises or tests.
- **Electro-Optical and Infrared Sensor Systems.** Model the detection, tracking, and imaging performance of electro-optical and infrared sensors to support concept development, design, field testing, and operations. Simulate accurate sample data for the development of image analysis and evaluation techniques, algorithms, and tools.
- **Multidomain Concept of Operations.** Plan space, air, and terrestrial assets in a single mission environment.



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## Aircraft Systems Modeling Capabilities

### / Aviator

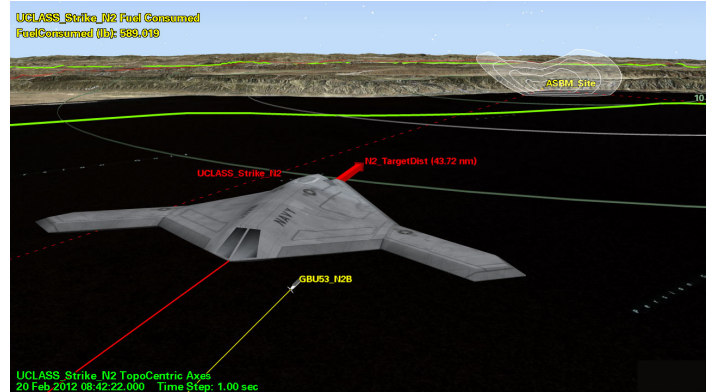
With STK's *Aviator* capability, you can model advanced aircraft platforms and create highly accurate performance-based flight routes. With *Aviator*'s 3D flight planning tool and its catalog of flight procedures and maneuver strategies, you can create complex flight routes quickly and easily. *Aviator* enables you to quickly evaluate a system's ability to achieve mission objectives and analyze its interactions with other systems across STK's multidomain modeling environment.

### / Sample Use Cases

- Create high-fidelity aircraft flight plans.
- Evaluate aircraft capabilities against mission objectives.
- Flight-following and formation designs.
- Integrate *Aviator* capabilities into early test and evaluation efforts.
- Explore payload performance against an aircraft's full flight envelope.
- Model hypersonic trajectories.
- Plan advanced flight profiles while considering the effects of wind, atmosphere, and fuel budget.
- Model a launch from a moving platform and transition from an air domain to sub-orbital and back.
- Simulate operational workflows for training and flight test coordination.
- Support test range activities by digitally modeling range assets and test flight plans and support real-time situational awareness during testing.

### / Key Value Points

- Includes more than two dozen predefined aircraft flight procedures.
- Supports common aviation catalog data, such as DAFIF and ARINC424.
- Enables you to simulate adding or removing fuel during flight.
- Supports computational fluid dynamics (CFD) data, such as temperature distribution exported from Ansys Fluent fluid simulation software, to ensure that the digital aircraft model represents real-world CFD and wind-tunnel analysis.
- Supports optimizing trajectories with midcourse guidance strategies for both offensive and defensive intercept systems.
- Enables you to consider structural and human factor limits during route design.



### / Core Capabilities

- **Aircraft Performance Modeling.** Create aircraft performance models from templates to rapidly customize platform designs.
- **Model Flight Procedures.** Takeoff/landing, holding patterns, point-to-point navigation, VTOL flight, airway routing, formation flying and more.
- **Advanced Maneuver Strategies.** Aileron rolls, loops, pulls, vertical/horizontal autopilot, smooth turn/acceleration, etc.
- **Flight Phases.** Segment flight operations into phases to create containers for procedures, aircraft actions, and performance models.
- **3D Route Editing.** Add, move, and alter waypoints and flight procedures in the 3D graphics window.
- **Catalogs.** *Aviator* organizes aircraft, airports, nav aids, runways, VTOL points, and waypoints in catalogs. You can add, modify, and delete items from the catalogs to make it easier to reuse the same elements for multiple missions.
- **Wind Models.** Wind models in *Aviator* can change the ground speed, flight path angle, and altitude rate of an aircraft and can produce a difference between the heading and course of an aircraft (also known as a crab angle).
- **Atmosphere Models.** *Aviator* references atmosphere models that define air density and affect the behavior of all aircraft performance models.
- **Hypersonic/Thermodynamic Propulsion.** Complex propulsion models incorporate an extensible fuel model system that handles the thermodynamic properties of air and fuel mixtures (dual spool turbojet/turbofan, sub/super/hypersonic).
- **Guidance Strategies.** Model guided flight without future knowledge of the target object's route, so that the aircraft reacts in simulated real-time to the target object's maneuvering.

## Advanced Analytical Capabilities

### / Analyzer and Optimizer

STK's *Analyzer* capability integrates the engineering analysis capabilities of ModelCenter with STK. Explore the design space of your systems with parametric studies, carpet plots, Design of Experiments (DOE) tests, Monte Carlo-based probabilistic analysis, and optimization algorithms.

STK's *Optimizer* capability is a collection of optimization algorithms that you can use within *Analyzer*, including gradient based optimizers, genetic algorithms, multiobjective algorithms, and other heuristic search methods.

### / Sample Use Cases

- Optimize maneuvers to minimize fuel usage.
- Maximize an asset's collection time over an area of interest.
- Understand how launch errors could affect the orbit of your satellite and its mission.
- Determine how the number of orbit planes and satellites in a constellation will affect coverage.
- Maximize signal-to-noise ratio with optimal antenna properties.

### / Key Value Points

- Plots are interactive and customizable.
- An algorithm wizard makes it easy to choose the algorithms that will work best for a problem.
- Computations can be scaled with parallel computing.
- Enables you to perform analyses easily, without programming or scripting.
- Capable of solutions that would be infeasible with a brute force approach.

### / Terrain, Imagery, and Maps

STK's *Terrain, Imagery, and Maps (TIM)* datasets provide a locally hosted (offline) alternative to streaming datasets such as Microsoft Bing's imagery services. *TIM* datasets contain STK high resolution mapping data for the entire globe.

### / Datasets included

- Shuttle Radar Topography Mission (SRTM) 4.1
- National Elevation Dataset (NED)
- EarthSat NaturalVu
- Relational World Data Bank (RWDB II)

### / Key Value Points

- Provides offline availability of high-resolution terrain, imagery, and maps
- Enables you to accomplish faster analysis of terrain-masking for line-of-sight and sensor intersections on terrain.



Image from Terrain, Imagery, and Maps

## / Real-Time Tracking Technology (RT3) and Distributed Simulation (DSim)

STK's *RT3* capability ingests live and simulated vehicle track data feeds into STK for visualization and analysis and provides tools to filter tracks, define events and alerts, and archive live data for playback. It also includes a software development kit (SDK) to customize *RT3* or integrate it with third-party applications.

STK's *DSim* capability expands *RT3*'s capabilities to include distributed simulation data feeds using an IEEE-compliant interface that connects *RT3* with VR-Link Toolkit by VT MÄK.

### / Sample Use Cases

- Monitor a live test or exercise directly within STK.
- Automatically populate a scenario with a group of objects and their routes.
- Evaluate thousands of entities using STK's multitrack objects.
- Quickly filter through large datasets to make operationally viable decisions.
- Specify event criteria using conditional logic on position and associated data and get notified when events occur.
- Automate standard responses by assigning actions to event definitions.
- Create DIS and HLA compatible data feeds from STK.

### / Included Data Feed Readers

- Link 16
- DIS and HLA
- STANAG 4609 - NATO Digital Motion Imagery Standard
- STANAG 4607 - NATO Ground Moving Target Indicator Format
- NMEA (National Marine Electronics Association)
- NRTI (Near Real Time Interface)
- TENA (Test and Training Enabling Architecture)
- COT (Cursor on Target)
- ESRI Tracking Server

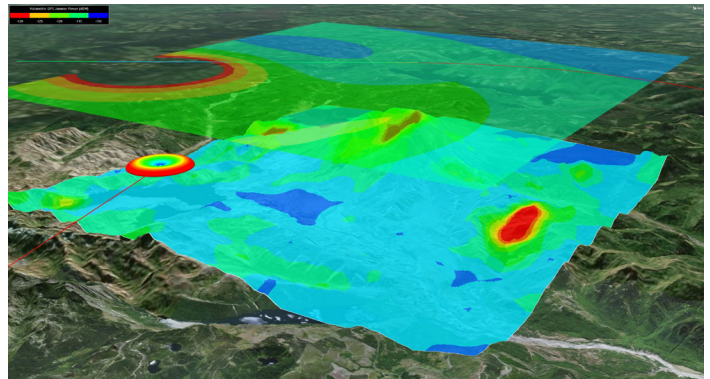
## / Parallel Computing

As the level of detail required for a calculation grows, so does the amount of time and memory needed to compute it. STK's *Parallel Computing* capability accelerates computations by enabling STK to distribute its most resource intense tasks across multiple computing cores. STK Premium includes the ability to scale using up to 16 local cores, with additional cores, server, cluster, and cloud options available with additional licensing.

*Parallel Computing* also includes Software Development Kits (SDK) for .NET, Java, and Python. These SDKs make it easy to parallelize the execution of custom models and algorithms.

### / Key Value Points

- Reduces design time and maximizes fidelity.
- The number of cores is configurable, ensuring control over reused worker processes.
- Automatically turns on and off for all supported computations.
- The Integrated Job Monitor tracks status and progress of parallel jobs as they execute.

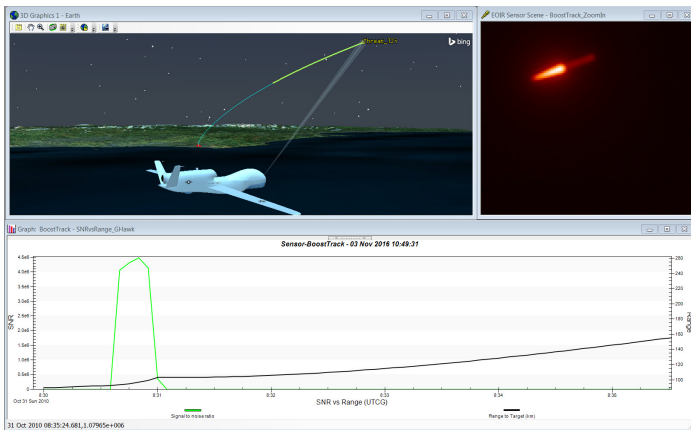


## / EOIR

STK's *EOIR* capability models detection, tracking, and imaging performance of electro-optical and infrared sensors. Its radiometric sensor model goes beyond simple geometry to consider the full, time-dynamic physics-based interactions of sensor, target, and environment. *EOIR* is faster and more accessible than complex, stand-alone sensor models.

### / Sample Use Cases

- Support the design, development, and operation of imaging systems.
- Simulate accurate sample data and truth-values for the development of image analysis and evaluation techniques, algorithms, and tools.
- Rapidly develop prototypes for proposals and presentations that are validated against program mission requirements.



### / Core Capabilities

- Target modeling. Model optical and thermal properties of aircraft, satellites, and missiles by specifying shape, dimensions, surface material, and surface temperature.
- Synthetic scenes. Synthesize sensor scenes with 27 optical materials and thermal models of planets, stars, solar radiance, and missiles.
- Multisensor architecture analysis. Create up to twelve independently specified and steered sensors.
- EOIR sensors. Use up to 36 bands per sensor to simulate a multiband sensor or different settings of a system. Define spatial, spectral, optical, and radiometric properties on a per-band basis.
- Atmospheric models. Use a simple atmospheric model to calculate transmission, scatter, and thermal path radiance or increase fidelity with the included MODTRAN-based atmospheric model — one of the highest fidelity, community standard atmospheric models available.
- Clouds. Configure the thin layer cloud model with multiple time-dynamic layers and cloud characteristics, such as percent cloud cover, temperature, emissivity, and radiance.
- Earth surface. Calculate reflectance, emissivity, and temperature texture using the included low to moderate spatial resolution global spectral material map of the earth, broken into the 17 IGBP Global Land Cover types.
- Stars. Leverage STK's database of more than two million high quality star records to model precise position and spectral irradiance.
- Celestial bodies. Include thermal and optical properties of Earth, the Moon, the Sun and other planets, including diurnal, latitudinal, and seasonal variations.
- Customization. Create your own custom models, materials, target signatures, and thermal profiles.
- Export capabilities. Export sensor output images for use in external image processing algorithms or sensor modeling tools.