ANALYTICAL GRAPHICS, INC. (AGI) offers a set of commercial off-the-shelf (COTS) software tools to analyze and visualize the physical and operational aspects of complex, integrated missile defense systems—from design and simulation, through deployment.

- Model any missile threat and defense systems
- Simulate detection grids
- Calculate placement of any sensor
- Measure system-wide communications architectures
- Analyze integrated missile defense effectiveness
- Visualize assets in a dynamic, interactive 3-D environment
AN AEROSPACE STANDARD

STK is a standard software analysis tool in the national security and space communities relied upon for critical engineering and command and control tasks, such as spacecraft maneuvering and close approach analysis. AGI software technology is used in systems engineering; command center operations; and operational performance assessment, studies, exercises, training, and anomaly resolution.

COMMERCIAL REUSABLE TECHNOLOGY

AGI produces independently validated and verified software that can be used as out-of-the-box desktop applications, deployed on servers in an enterprise architecture, or embedded into other applications. The software tools are immediately available to provide accurate, detailed analysis for missile defense scenarios.

SCIENTIFICALLY ACCURATE

AGI software combines complex computational algorithms with precision graphics to analyze and visualize all phases of missile defense. The software suite provides a robust set of analytical tools to perform trade studies, as well as rocket exterior ballistics, communications, radar, laser, sensor distribution, detection probability, intercept, and sensor-to-shooter analysis. These tools can include user-defined custom sensors, platforms, threat missiles, and intercept platforms.

INTEGRATED DEVELOPMENT SUPPORT

AGI software is customizable and componentized so that it may be used in software development projects as a part of larger systems. This approach reduces software risk, maximizes reuse potential, and allows organizations to focus on the proprietary components aligned with core organization competencies—a winning approach in a competitive and high-risk engineering environment.
AGI SOFTWARE’S CORE COMPETENCY IS SCIENTIFIC ANALYSIS. Missile defense system design requires precise analysis to support a spiral development acquisition approach. AGI software empowers users with the tools they need to perform such analysis with accurate modeling and visualization of missile defense systems during all research and development phases.

**THREAT AND INTERCEPT MISSILE SYSTEM MODELING**

- Analyze simultaneous positions relative geometry and attitude motion
- Process post-burnout tracking data to predict trajectory, re-entry, and target coordinates
- Measure proposed systems with physics-based tracking data simulator
- Calculate missile intercept points
- Model single, multi-stage, and MRV platforms
- Analyze kinetic energy and powered-intercept platforms for all missiles phases
- Import external data from other applications such as STAMP and DICE

**COMMUNICATIONS ARCHITECTURE ANALYSIS**

- Perform time-based, geometrically dynamic communications analysis
- Model wired and wireless links and transactions that affect information accuracy
- Analyze electromagnetic environmental factors
- Analyze and visualize land, sea, air, and space assets with environmental effects and terrain
- Model interceptor communications architectures
- Analyze signal-to-noise ratios
- Conduct bit error rate analysis
- Compare alternate sensor-to-shooter network

**SCIENTIFIC AND MATHEMATICAL TOOLS**

- Determine vehicle states-of-motion and orientation with reports and detailed 3-D images
- Analyze coverage to calculate sensor dwell, gap, and user-defined figure-of-merit
- Calculate precision geometry for object-to-object time-based relationships
- Interface to MATLAB® and other engineering software applications
- Report and graph exterior ballistic and electromagnetic data
- Calculate re-entry angles
- Analyze radar cross-sections of targets
- Determine probability of detection or access user-defined algorithms
- Calculate GPS dilution-of-precision
TAKE SPACE TO THE BATTLE. Missile defense operations inherently consist of prolonged periods of inactivity and continuous monitoring. An acute awareness of real-time accurate sensor placement, space asset positional predictions, situational awareness, communication constraints, and sensor visibility analysis are vital in order to respond to an attack in seconds. AGI produces deployable components that can be used right out of the box or embedded in applications for 4-D visualization, callable libraries of aerospace calculations, celestial object locations, and intervisibility prediction. Entire command center user interfaces can, and have been, built around AGI software components.

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REAL-TIME OPERATIONS

- Visualize real-time missile and satellite telemetry to display position, attitude, and key trigger events
- Predict real-time AOS/LOS time and pointing
- Determine range safety based on real-time visualization and radar measurements
- Display EKV sensor field-of-view and real-time radar/sensor pointing

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POST-FLIGHT ANALYSIS

- Process predicted and actual flight trajectories, attitude history, and sensor history
- Analyze various geometry aspects of flight test
- Analyze range deltas and range-rate histories
- Create reports and graphs of missile attitude dynamics
- Analyze system performance (radar, communications links)
**AGI PROVIDES INTEGRATED ANALYSIS AND VISUALIZATION SOFTWARE.** Missile defense systems involve complex automation, integration, and communication requirements combined with precise geometry and inter-object analysis across land, sea, air, and space assets. A true value of the AGI COTS approach is the unique ability to accurately model across traditional system, program, and service boundaries in numerous defense and commercial initiatives.

**LAND**

- Analyze terrain masking for precise periods of visibility
- Calculate Sun angle sensor interference
- Perform communications constraint analysis for global communications system
- Model ground sensors
- Position intercept systems to maximize success

**SEA**

- Analyze placement of sea-based detection and intercept platforms
- Visualize and analyze optimal search angles for AEGIS patrol assets
- Calculate ship superstructure masking for communications interference
- Perform GPS navigational accuracy analysis
- Model shipboard sensors
**AIR**

- Perform manned aircraft/UAV/dirigible trade study analysis
- Model aircraft sensors and perform aircraft body masking analysis
- Analyze Airborne Laser assets
- Analyze complex aircraft to space communications links
- Assess navigation accuracy for guided munitions

**SPACE**

- Model satellite early detection systems
- Perform satellite communications and constraint analysis
- Calculate intelligence, surveillance, and reconnaissance sensor coverage
- Perform coverage analysis of various constellation configurations against various missile threat profiles and distributions
- Design and model sensors through sensor configurations, and parametric and constraint analyses
BALLISTIC MISSILE TECHNICAL COLLECTION

RIVERSIDE RESEARCH INSTITUTE

Riverside Research Institute (RRI) leverages several STK modules, including STK/Radar and STK/X, to support the Ballistic Missile Technical Collection (BMTC) mission, a DoD program that evaluates alternatives for collecting data on non-U.S. ballistic missile tests. AGI’s software technologies are used to support the sensor performance evaluation for the BMTC. STK/Radar is employed to capture proposed sensor parameters and visualize the performance of alternative collectors against future missile threats, which were generated in STK. RRI also uses the STK/X module to embed STK analyses within a Web browser interface that enables their government customer to easily view, interact with, and leverage the complex output.

MDA TESTING

STEPAL

With the use of STK software, analysts at STEPAL (System Test & Evaluation Planning Analysis Lab) in Huntsville, AL, are able to graphically depict systems’ elements and investigate questions relating to the executability of future test events for the Missile Defense Agency (MDA). Trajectories, antenna patterns, facilities, and vehicle locations along with their sensor parameters are inserted into scenarios where they are modeled and analyzed in an integrated, four-dimensional manner. The Multiple Track Object feature is used to import, model, and analyze the impact of debris location to test events. Modeling each object to such detail provides mission planners with early insight into conflicts and issues before they begin to impact schedules and budgets.

ADVANCED WARFARE ENVIRONMENT (AWARE)

U.S. ARMY SMDBL

The U.S. Army Space and Missile Defense Command Battle Lab (SMDBL) in Huntsville, AL, has created a battlespace management system, Advanced Warfare Environment (AWarE), that evaluates innovative technologies for the warfighter. Developed by a team from Science Applications International Corporation (SAIC), the AWarE system uses STK to analyze and visualize tactical data feeds. SAIC engineers embedded STK into AWarE via the STK/X module, and use STK/Connect to help bring the raw feeds into STK/Advanced Visualization Option (STK/Advanced VO), where they are rendered as dynamic 3-D outputs.

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AGI provides software to more than 30,000 national security and space professionals for integrated analyses of land, sea, air, and space assets. Key application areas include: battlespace management, geospatial intelligence, space systems, and national defense programs. For additional information about AGI or its commercially available software technologies, including its free flagship product STK and AGI Viewer freeware, e-mail info@agi.com or explore www.agi.com.

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