AGI’s MSAF is an open, commercially available environment for rapid and re-usable modeling, simulation and analysis across an enterprise

- Multi-domain, mission-driven analytics & modeling (supports Systems of Systems)
- Efficient re-use/creation of best of breed GOTs, custom and COTs tools
- Automated, scalable analytics for engineering and/or operational decisions
- Visually intuitive and robust interrogation and communication tools

The MSAF software enables analytics across key elements systems lifecycle

- Acquisition, engineering, training & mission operations
- Course of Action (COA) development, mission planning and event prediction
- Supports program & portfolio decision-making (Cost, Risk, Schedule, Capability....)

AGI software has improved efficiencies & effectiveness of analytical decision making

- Commercial model driving interoperability, extensibility and total ownership cost advantages
- Multiple DOD & industry agencies standardizing on STK
- Available and accepted analysis, collaboration and decision-making support tools
Analytical Graphics introduction

- **Industry standard software**
  - Model your system
  - Analyze your mission
  - Convey your results

- **Offices in US, Europe and Asia**

- **Founded in 1989**

- **40,000+ registered installations**

- **700+ buying organizations**

- **STK (FREE Offering)**

- **Desktop, server and development API’s**
Efficiency, effectiveness and agility of MS&A activities

• Standalone users
• Custom tools & models
• Lengthy cycle times

• Enterprise discoverability, consistency & usage
• Rapidly composed & executed analysis
• Intuitive & interactive decision support
• Multi-domain & mission enabled environment
• Efficient use of trade studies, simulations & decision calculus

Also see “DMMF – Results of Feasibility Study”, Frank Mullen, 2/21/2013
MSAF Core Goals

- **Model-based enterprise M&S framework**
  - Multi-level, Mission-driven simulation engine
  - Engineering through campaign-level linkages
  - Trade studies through Live, Virtual & Constructive simulation

- **Improved enterprise M&S efficiency and effectiveness**
  - Multi-role support for technology SMEs, Systems Engineers, data analysts, decision makers
  - Scalable & distributed computational environment
  - Collaboration support
  - Data discovery

- **Deliver capabilities today which support trends in methods & needs**
  - Re-use capabilities (IP) currently available and in-use within the industry
  - Allow for industry wide scalability & collaboration
  - Leverage commercial software before custom SW or FOS, per 2009 DSB Study
  - Deliver future capability – relying on adaptable API and data models
  - Support evolution of M&S architectures, tools, models and methodologies

- **Evolve capabilities along a visible, industry-needs-driven path**
Decomposition, Integration, and Orchestration

Process control, Translation, and Traceability

Role-based Web-Portal

Decision Maker
- Scenario Design
- Analysis / Trade space
- Results View

System Designer
- Architecture
- Definitions
- Configurations

Detaile Engineering

System Performance

Systems of Systems

Simulation and Analysis Synchronization Environment
Temporal and Geospatial State - Commonality

Data, Models, and Analysis Repository
Orchestration Governance: Model Schema, Data Model, Assumptions, and Integration Rules
Supplementary Models: Manufacturing, Costing, Optimization, Approximation, and trade algorithms
MBSE Architecture System Definitions: Structure and Parametric, Behavior, and Requirements

Architecture Execution - (Sequence, State, and Activity)
• Visual environment for process integration
• Graphically link analyses together
• Perform trade studies
The workflow

- Define measures of effectiveness
- Discover and/or build models
- Combine into system of systems model
- Run simulations and evaluate performance
- Convey results

Model
Simulate
Analyze
Leverage expertise

Synchronization

Orchestration

Cluster Computing

Tool Integration

Data Management

Data Interaction

Modeling Simulation and Analysis Framework

Mission Engineer  Design Engineer  System Engineer  Configuration Mgr  IT Manager  Decision Makers

Capability Acquisition  Ops Analysis  System Design  User-specific Workflows  Test & Evaluation  Operational Planning  Wargaming  Training & Rehearsal
The use cases

- **Model-driven, mission-based simulations**
  - Simulate mission threads
  - Vet system performance in the definition phase
  - Compose system and Systems of Systems models
  - Manage and explore existing tools, data or models
  - Serve interactive analysis to the entire community

- **Applied to:**
  - Acquisition decision-making
  - Product development
  - Test and evaluation
  - Training and simulation
  - Course of action planning
  - Operations analysis
- Improved enterprise communication of analysis and results
- Efficiently and consistently employ model-based analytical methods
- Discoverable & managed collaboration environment
- User-driven workflows to improve execution efficiency
- Provide intuitive results and capability assessment visualizations
Portfolio Assessment

Link model-based simulation to decision calculus

MSAF Reporting

Program Portfolio View

<table>
<thead>
<tr>
<th>Block/Option</th>
<th>Priority</th>
<th>Status/Trend</th>
<th>Value</th>
<th>Cost</th>
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Block/Option A Assessment

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MSAF Analysis

Link model-based simulation to decision calculus

MSAF Reporting
Leverage existing GOTs, COTs & custom IP

**COTS Tools**
- Scalable Networks – Qualnet
- Mathworks - Matlab
- Anark Core – data file exchange
- Opnet - NG using HLA
- Lightwave – IGES,STEP conversion
- SystemVue by Agilent
- LabVIEW
- DOORS
- IBM Rational
- HFSS – antenna models
- Xplane
- Real Flow – Importing wave motion
- RTLogic - Channel Simulator
- Elekrobit - PropSim
- Rhode & Schwartz - RF Channel Simulator
- Spirent – GNSS Simulator.
- CAST - Navigation
- MSoft Excel, PowerPoint
- Harpoon 3 Naval Warfare sim.
- Virtual Sim Tasker - VirtualSim CGF
- FuzzyTech. Fuzzy Logic Engine Controller
- Sharepoint - collaboration
- Pheonix Integration - Model Center
- ESRI.
- TruePlanning – Cost estimation system
- CARPET - a radar simulation tool that generates radar parameters

**GOTS Analysis and Operations Tools & Data**
- FalconView - comms analysis
- DCGS-AF
- EADSIM
- Navy’s Missile Planning Tool by APL
- JMPS - by Gnostech
- Naval Sim System by Metron
- NETWARS - Cyber Hacking
- SEAS (http://teamseas.com/)
- NASA SPICE and CCDS
- GPS Almanacs
- TLE data
- BVI - BattleSpace Visualization tool
- GDM (INSCOM )
  - coming soon....
- ESAMS – by Booz Allen Hamilton
- HF RAD - OTH Radar model
- NORAD - Operational Risk Assessment tool.

**Hardware/ Software/ Protocols**
- Touch Table
- Next Computing
- Scalable Display Technologies
- Max Vision
- MS Surface
- Droid OS
- Sys ML
- Magnolia Forge.
- Google Earth - KML import/export
- MS Virtual Studio - through JAVA, Com, .NET APIs
- TCP/IP API - network based interactions
- DIS/HLA/TENA

**Third Party Applications** (also sold as a separate product by the source company)
- Remcom – Urban comms modeling
- Alion - TIREM
- VT Mak – SimMetrics
- AER – Weather Data
- SDL – Electro Optic Sensor Modeling
- Satsoft – Antenna Design
- ASI - Satellite Simulation
- SAIC – Missile modeling

**Data Providers, formats and Imagery**
- Scribe Workbench
- Simulize - Flight Control
- JP2, NITF, etc
- DTED, DEM...
- Navteq - urban data
- ITU - satellite payload data
- NCG
- NMEA
- AIS Data
- Shapefile import/export
Off the Shelf Plug-ins

**Product Design**
- Given design parameters, predicts performance characteristics:
  - How much will it weigh?
  - How high can it fly?
  - What will it cost?
- Useful for designing hardware
- Wrap your code or use plugins:
  - Matlab
  - Mathcad
  - Excel
  - Fluent
  - Nastran
  - ANSYS
  - LS-DYNA
  - Price
  - Seer
  - CAD

**System/Mission Simulation**
- Given performance characteristics, predicts how a system will react to various stimulus over time:
  - Hit rate?
  - Access times?
  - Throughput?
- Useful for designing systems
- Wrap your code or use plugins:
  - Flames
  - Magic Draw
  - ProModel
  - Rhapsody
  - STK
  - Extend
  - Vensim
  - Aceit
  - Arena
  - Pro/E
  - SolidWorks
### Industry Scalability - Current STK customers

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| Industry Scalability - Current STK customers |

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Collaborative multi-access, multi-role environment
- Web-accessible, cloud-utilized, virtual instantiations

Integration, Aggregation, and Abstraction
- Access and integration of disparate and distributed models

Problem-space decomposition and model orchestration
- Model assembly via information/data model mappings

Common, synchronized simulation infrastructure
- Temporal and spatial state management

Composite Execution and Simulation
- Complex trade space analysis (cost, capability, resiliency (risk), etc.)
- What-if, mission architecture/course-of-action discovery and assessment

Data discovery, management, and evolution
- Searchable, scalable and federated configuration managed repositories
What are among the most used GOTs tool(s) in your organization?
Wrap-up

Our mission is as an industry resource to enhance Engineering productivity

- Your feedback is needed
- Your collaboration is welcome
- Your support is desired
- Questions???
Use Cases
**Background**  
Marine Corps artillery regiment upgrade “Firefinder” radar system to G/ATOR system. Initial approach was 1:1 replacement (38 systems).

**Approach**  
- Use STK to conduct Counter Battery Radar (CBR) study.
- Incorporate optimal system placement.
- Assess effectiveness against threat scenarios

**Outcome**  
- **>25%** reduction in number of systems required (38 → 28)
- Saved **$295M** excluding reduction in operational costs
Problem
– Determine optimal mix of airborne assets to improve kill-chain effectiveness

Solution
– STK sensors, platforms, scenarios, visualizations combined with in-house models via MATLAB and Ruby

Outcome
– Reduced typical study time from one year to one month

“STK has enabled A9 to quickly respond to some of the most challenging questions in the DoD.”
— Timothy Booher, senior analyst, USAF
**Problem:** The Missile Defense National Team is building a C2BMC training system that will teach operators to make quick and accurate threat engagement decisions.

**Solution:** STK software is used to generate trajectories and missile tracks from realistic sensors to be played into the C2BMC operational systems.

**Outcome:** STK scenarios can be easily constructed to train the C2BMC user. The solution is deployed to STRATCOM.

**AGI COTS technology allowed the MDNT to build an operational trainer in months, on time and budget with minimal risk.**
Improved Training – NSAWC

Problem: Manually intensive procedures for pre-flight planning and post-flight learning

Solution: Use STK MSAF for accurate, efficient and visually intuitive learning experience

Outcome: Integrated training mission model that allows instructors to model all aspects of the flight and review outcomes with students using a dynamic 3D environment.

“Cost avoidance for re-flyys and mission failure is off the charts”

(Retired Naval Aviator)