AGI’s visualization capability is now in component library form. Simply add it to your own application to put our analytical 3D graphics at your fingertips.

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JOE SHEEHAN JOINS AGI AS NEW PRESIDENT

As of March 2009, Joe Sheehan brings his expertise to AGI as its new president, focused on operational and financial strategic planning, as well as organizational development. AGI’s founder, Paul Graziani, will remain CEO, turning over the presidential reins to Sheehan so that he can spend more time on customer and community relations. Prior to AGI, Joe spent 12 years with TruePosition Inc., helping the company grow from a startup to a mature operating business with $260M+ in annual sales.

“I’m very excited to be joining AGI. It is a fantastic company with great people and state-of-the-art products that provide tremendous value. AGI has a long track record of success. I look forward to helping them continue this,” says Sheehan.

Adds Graziani, “We are really excited to have Joe join our team to help us continue in our goal of making the space and national security communities dramatically more efficient. We witnessed some very positive signs for our business this past year. Joe’s experience will help us capitalize on those opportunities and allow me to focus more time externally.”

To read the full press release as well as other recent AGI news, visit agi.com/media.

AGI celebrated “Space Day” with a class of local elementary school students at its Exton, PA, headquarters on May 7. This grassroots effort to inspire interest in space among today’s youth was started in 1997 by Lockheed Martin (spaceday.org). Each year, AGI invites area children for a half-day of hands-on activities and lessons from real rocket scientists, always capped off (weather permitting) by a rocket launch.

Charlie Company of the 1st Battalion, 111th Infantry of the 56th Stryker Brigade Combat Team, Pennsylvania National Guard, received its second shipment of donations from AGI in June. AGI has committed to supporting the company for the remainder of its deployment in Iraq.

To subscribe to InView or read past issues, visit www.agi.com/inview.

Comments or suggestions are welcomed at editor@agi.com.
SATELLITE CONJUNCTION ANALYSIS AND MITIGATION

The February 2009 Iridium 33-Cosmos 2251 satellite collision increased awareness of and attention to conjunction assessment. In particular, the event underscored the global space community’s need for rapid full catalog conjunction assessment capabilities. While many organizations perform such analysis for a few satellites, there is not one that routinely performs “all-on-all” conjunction assessments and publishes the results. AGI has such capabilities.

PROBLEM:
Immediately following the Iridium-Cosmos collision, AGI’s astrodynamicists and engineers worked to accelerate all-on-all conjunction assessment runs, with the intent of executing the runs in just a few hours. Prior to February, no one was performing all-on-all conjunction analysis; it was viewed as a significant operational challenge to assess approximately 12,000 satellite objects against each other. (Note that while the official catalog may include thousands more objects, the publically released catalog is around 12,000.)

Since the overall catalog is only published a few times each day, the AGI team’s goal was not necessarily to complete an all-on-all analysis within minutes, but rather to get it done within a reasonably shorter time than the period of the catalog updates. The conjunction analysis tool in STK, STK/CAT, is already fast due to some of its patented approach and filtering processes, but was not natively designed to be multi-threaded or to rapidly process such large sets of satellites.

SOLUTION:
Recognizing that full-catalog conjunction assessment would be performed using high-quality ephemeris data, not TLEs (two-line element sets, orbital elements that describe the orbit of an Earth satellite), AGI first created test sets of data—12,000 ephemeris files. This ephemeris was representative, even though it was derived from a set of TLEs, since the goal was simply to use ephemeris data for the process, and not to perform any specific analysis of any actual set of data. Engineers then built a “Parallel CAT” tool external to STK that efficiently managed the 12,000 x 12,000 data set and cut the problem into manageable pieces. Each piece was doled out to an available core on the machine, running a separate copy of STK/CAT. Whenever a core finished one piece and became free, Parallel CAT would assign another piece to that core until all the necessary pieces had been completed. Upon completion of the individual STK/CAT pieces, Parallel CAT effectively concatenated the results into a single report.

RESULTS:
Using this innovative approach with a commonly available Windows-based PC, AGI was able to complete a five-day conjunction assessment run on a 12,000 satellite catalog in less than an hour. This performance was achieved on a dual quad-core PC (less than $4,000). In the future, as the catalog size grows significantly or some other need arises requiring faster conjunction assessment turnaround time, AGI plans to evolve this solution to make it even faster.

RESOURCES:
- AMOS Technologies Conference: Sept. 1-4, Maui, HI
- agi.com/ssa and agi.com/iridium-cosmos

On May 16, middle and high school students gathered in The Plains, VA, for AIA’s seventh annual Team America Rocketry Challenge (rocketcontest.org). Sponsors including AGI were there to cheer on the contenders, including the team from Madison West High School in Wisconsin who took home the title of national champion.

AGI started the summer with a bang, literally, when it concluded its annual family picnic— with highlights such as food, face painting, team contests and swimming—with a fireworks extravaganza courtesy of Wes “FX” Bradley (aka “The Voice of AGI”).

At the 2009 National Space Symposium, AGI showed how its software performs all-on-all conjunction analysis for more than 12,000 space objects using ephemeris for five days in less than an hour. At 76% complete, more than 54 million possible conjunctions are assessed, with 3,800 already identified.
**Insight3D**

**Bringing 3D to the Masses**

WE HAVE BEEN TALKING ABOUT IT SINCE IT WAS JUST A BRIGHT IDEA IN A DEVELOPER’S BRAIN, AND NOW, STANDALONE 3D IS A REALITY. THE INSIGHT3D VISUALIZATION LIBRARY, PART OF THE AGI COMPONENTS FAMILY, ISN’T YOUR STANDARD 3D GLOBE. IT ADDS UNIQUE VALUE VIA TIME, CAMERA, OBJECT AND API.

**WHAT IS INSIGHT3D?**
The Insight3D Visualization Library is a set of .NET interfaces around AGI’s 3D engine. Developers can use C# or VB.NET to construct lightweight yet powerful 3D applications built for performance and visualization accuracy. By coupling AGI’s time-tested rendering engine with the Dynamic Geometry Library and other AGI Components, developers can extend their current visualization capabilities.

**WHY USE INSIGHT3D?**
Insight3D allows users to create powerful 3D applications that give them control over:

- Smooth animation
- Camera manipulation
- Static and dynamic primitives
- Object picking
- Globe inlays
- And more

In addition to building new applications with Insight3D, developers can add the Insight3D control to an existing application—enhancing the application by rendering data in an interactive 3D environment.

You might be thinking—this concept isn’t new. Google Earth, Virtual Earth, World Wind … these globes already exist to illustrate spatial data. How Insight3D differs is best attributed to four different categories: Time, Camera, Object and API.

**Time**
The management of time-dependent data was at the forefront of Insight3D development. True vehicle motion, for example, is not discretized over time nor should it be rendered that way. Rendering objects (primitives) fluidly over time is made simple with the Scene Manager which manages the objects and updates the scene as primitives change.

**Camera**
The camera object fully controls the viewer’s position and orientation. When the camera is initialized with point or vector objects, it automatically moves when the point or vector change. This enables the view to be locked on a vehicle, for example. The camera sets view parameters such as field of view, near plane distance and far plane distance. It also takes snapshots of the 3D window and records videos.

**Object**
One reason why Insight3D is excellent at managing time and the camera view is because it treats items rendered to the 3D scene as objects. Illustrating data over time is not about rendering different data at each time step, but rather rendering the same objects’ new geometry as a function of time. For example, a developer does not need to render a new marker for each update, but rather simply update the marker position.

**API**
The Insight3D API is a set of managed .NET interfaces designed for building and deploying powerful 3D applications. Insight3D provides low-level access to the rendering engine, and thus gives developers full control over what and how primitives, images and overlays are rendered. Additionally, the Insight3D API allows for manipulation of the camera—and therefore the viewer’s position and orientation.
**Q&A WITH DERON OHLARIK**

He’s not verbose. Perhaps that’s why he cranks out so much product. He’s Deron Ohlarik, Insight3D team member and one of AGI’s oldest employees (in servitude, not years). Here, Deron tackles your burning questions:

1. **Is Insight3D another virtual globe?**

Using Insight3D, you can visualize lines, markers, points, surface polygons, 3D models, text, imagery, terrain, 2D screen overlays and more. Many of these are typical of virtual globes, but dig a little bit deeper.

With Insight3D for example, you can easily create a line that follows a great arc, the shortest distance between two points on the globe. How is that special? First, some virtual globes may not be able to do this. Second, if they can, the great arc is likely computed on a sphere rather than, like Insight3D, on an ellipsoid that better represents the Earth. For many applications, accuracy matters. Realize that Insight3D is integrated with AGI’s Dynamic Geometry Library to provide many high-fidelity geometric operations that you just don’t get with basic virtual globes. Additionally, objects can be animated and also interacted with through picking and flexible camera control in ways not possible with other virtual globes.

So, no, Insight3D is definitely not just another virtual globe.

2. **Is it free?**

For development, yes. Just download the AGI Components SDK from the AGI Developer Network and start coding. To deploy your application, there is a licensing fee.

3. **Is the software frequently updated?**

As part of AGI Components, Insight3D takes on that versioning system. So instead of 1.0, the first release of Insight3D is 2009 r3, which means release 3 of 2009. Our versioning system implies multiple releases a year, and that’s correct. Releases on the order of months rather than years means that new features and bug fixes get into your hands sooner. Additionally, we get feedback sooner, which allows us to fulfill your needs in a timely manner as we plan future releases.

4. **Where can I learn more?**

Check out Insight3D.com for product information. The Support section has links to our documentation, the Insight3D discussion forum, contact information and a link to our blog. Our blog is where you want to go for technical details, what we’re working on and where we’re headed.

5. **This all sounds vaguely familiar. Why?**

Because we’ve talked about Insight3D in the past 3-4 issues of InView. Back then, we called it by the codename “Point Break.”

6. **What’s next?**

Next up is a documentation update and bug fixes release. Also, expect a series of blog entries that will give you in-depth detail of some of our favorite features. Next up for you is to download Insight3D, right?
3 dB: What is it Worth to Your Mission?

Communications Modeling with AGI Software

If you’re unfamiliar with communications analysis, 3 dB (short for decibels) is probably a meaningless acronym. Those designing and relying upon communication systems, however, understand that 3 dB is a factor of two that, in terms of communications performance, can mean the difference between mission success and failure.

Net-centric warfare, information dominance and spectrum management challenges have increased the complexity and importance of designing and operating communications systems. AGI software supports these needs with two unique benefits: accurate representation of operational communications performance and illustration of how that performance affects the mission.

Operational Communications Performance Modeling

Accurately representing operational performance yields more confidence and productivity during conceptual design, requirements specification, field tests and real-time operations of communications systems. Achieving this accuracy depends on modeling salient attributes of the specific architectures and environments in which real communication systems operate. Local terrain, antenna obstructions, gimbal rate limits, platform kinematics, Doppler shifts, spatial distribution and directivity of interference sources as well as other factors can significantly influence actual performance.

Spreadsheet link analyses and other communications-centric tools ignore, abstract or worst-case these attributes, misrepresenting performance.

AGI’s communications modeling uses physics and mathematical models to accurately represent these attributes. For example, when planning a field test of an air-to-ground radio link, the outcome can be significantly impacted by seemingly simple decisions such as where to locate the antenna on the aircraft, how to fly the aircraft, where to conduct the test and where to locate the ground antenna. AGI communications accurately considers these and other factors to better plan the test and ensure test objectives are met without wasting range time and other expensive resources once in the field.

Assessing Communications Performance in Mission Context

AGI software puts communications performance in the context of the larger mission it supports. Designing, evaluating or operating communications in isolation can adversely affect overall mission satisfaction. For example, when designing the communications link for an unmanned aerial vehicle system that will return live video to field commanders in mountainous terrain, it would be a mistake to do so without an understanding of how the aircraft, optical sensor and communications combine to deliver surveillance coverage. Examining the communications link in isolation could lead to unnecessarily constraining the aircraft to higher altitudes, necessitating a heavier, higher-resolution camera that reduces mission duration and increases system cost.

With AGI software it is possible to avoid such suboptimal mission architectures by modeling the aircraft, optical sensor and communications link as a system and directly measuring resulting mission-level performance. This facilitates rapid trade studies that could indicate a lower operating altitude is possible and a small enhance in power budget for the communications link could dramatically increases surveillance coverage.

Accurately representing operational performance and putting that performance in the context of the overall mission is what sets AGI communications modeling apart from alternatives. The recent introduction of the Communications Library for AGI Components is just one more way to leverage these benefits.

To learn how AGI communications modeling can be applied to your mission, contact us at info@agi.com, 1.800.220.4785 or visit agi.com/comm.

STK computes link performance and includes several methods for interpreting the data, including reports, graphs and dynamic 3D displays.

STK analyzes the communication performance over the entire link, such as a Bent-pipe relay from a ground control station to a UAV operating outside line-of-sight range.
DO MORE WITH STK 9 DATA

In the March 2009 edition of InView we described some new data features in STK 9, such as satellite data synchronization and high-resolution terrain and imagery. Now we want to describe in more detail how these features can improve your STK scenarios.

Satellite Data
When working with satellite orbital data, careful attention is required to get just the right data for your analysis. In STK 9, we have added some nice new features which make it much easier to find just the data you need while exposing some powerful capabilities many users weren’t even aware of.

When you created a new scenario in STK 8, the default time for that scenario was around the time STK 8 was released, unless you manually modified it. You needed to remember to set this time when setting up your scenario. Then, when you wanted to add a satellite to that scenario, STK 8 would use the latest data on your system, which you also needed to remember to update. Even so, if you were doing analysis for some time in the past, the data used wouldn’t necessarily match the scenario time period.

In STK 9, that process is much more straightforward. To begin with, whenever you create a new scenario, the first thing you will be asked for is the start and stop time for your analysis period. This step ensures that your time interval is set up properly right from the start. It also gives you an opportunity to name and describe your scenario.

Setting the time is even more important in STK 9, though, when you go to add orbital data. That’s because STK 9 will (by default) go online to get all of the TLEs (two-line element sets) for your analysis period—and use all that are available. Did you realize that STK can switch between numerous TLEs? Well, it can ... and now you can exploit that capability quite easily.

These new features should make it much easier to match the right orbital data to your analysis period.

Terrain and Imagery
With STK 9 we wanted to offer more access and convenience when searching for high-quality terrain and imagery. Even though many users have their own sources of data, we frequently hear requests for readily available terrain and imagery, usually at the highest possible resolution. We figured it was time to upgrade our data module, STK/Terrain, Imagery & Maps (STK/TIM).

STK/TIM as well. The visual improvement, combined with the new terrain data, was dramatic. In addition to improving terrain-based analyses, STK/TIM provides a big improvement in situational awareness. Find out more about STK/TIM at agi.com/tim.

We hope you’re already learning about these great new features yourself, but if not, visit agi.com/stk9 today to download the software and get going!

For terrain data, we usually rely on SRTM (Shuttle Radar Topography Mission), but this had limitations due to voids in mountainous areas. That changed when we discovered the International Centre for Tropical Agriculture (srtm.csi.cgiar.org) where GIS experts had seamlessly filled the voids with auxiliary elevation data. We added this global 90-meter resolution dataset to STK/TIM and also added NED (National Elevation Dataset), which has a resolution of 30 meters and covers the U.S. These datasets provide significant improvements to analysis accuracy for sensor swaths, geographic masking, terrain-following trajectories, communication modeling, dynamic line-of-sight and lighting conditions.

For imagery and maps, the challenge was far greater, as these datasets can be truly vast. We decided to look at streaming solutions akin to the ubiquitous Web map and chose to connect to the Microsoft Virtual Earth™ service. The ability to stream four imagery layers from Virtual Earth was added into STK/TIM as well. The visual improvement, combined with the new terrain data, was dramatic. In addition to improving terrain-based analyses, STK/TIM provides a big improvement in situational awareness. Find out more about STK/TIM at agi.com/tim.

We hope you’re already learning about these great new features yourself, but if not, visit agi.com/stk9 today to download the software and get going!
SIGNATURE ANALYTICS WINS NEW MISSILE DEFENSE BUSINESS WITH AGI SOFTWARE

In missile defense operations, optimal allocation of interceptors against multiple threats is critical. To address this, Signature Analytics LLC, Alexandria, VA, under contract to the Missile Defense Agency, conducted a six-month Phase 1 feasibility study to demonstrate the benefit of mathematical allocation algorithms.

The defense contractor wrote custom code to integrate STK, STK/Analyzer, STK/Scheduler and STK/Missile Modeling Tools into a weapon allocation solution. Using AGI’s broad analysis software base, Signature Analytics quickly demonstrated the value of the approach and was selected for a follow-on contract award.

"Without AGI software, it would have been impossible to do what we did in such a short amount of time." — Signature Analytics lead developer, Jerry Ruckstuhl.

Signature Analytics’ “Defender” code computed battlespace access constraint and fed weapon-target access into STK, which ingested the data and quickly provided visualization and analysis of the missile battle scenario.

Defender algorithms computed optimization details, shot opportunities, target priorities, resource costs, engagement lethality and collateral damage risk that STK/Scheduler used to produce optimized engagement solutions. AGI’s Interceptor Flight Tool (IFT)—a module included in STK/Missile Modeling Tools—received engagement feasibility requests from Defender and returned results that Defender could evaluate for optimal allocation.

AGI’s off-the-shelf capability eliminated the time and cost of developing the majority of the software code, which allowed Signature Analytics to focus on its expertise and produce a solution in six months. “Without AGI software, it would have been impossible to do what we did in such a short time," says Dr. Shaoann Shon, Signature Analytics principal investigator. “Because of it, we were able to examine many threat scenarios and conduct rapid prototyping of missile defense engagement scheduling in a short study.”

To learn more about custom solution development with AGI software, go to agi.com/engine.