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KEYNOTE ADDRESS

ADDRESSING THE CHALLENGES OF AEROSPACE AND DEFENSE INITIATIVES USING SOFTWARE ANALYSIS TOOLS

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Aerospace engineers and operators have to manage tremendously complex geometries that change over time. Not long ago, engineers performed this detailed analysis with pencils, paper, slide rules, and sheer brainpower. The introduction of the calculator accelerated the industry's growth and, soon after, the evolution and integration of computers dramatically increased efficiency and productivity.

Aerospace, defense, and intelligence professionals are now poised to take the community to a whole new level through mission-specific software technology advancements. By leveraging sophisticated analysis tools, which incorporate dynamic two- and three-dimensional visualization to significantly aid in understanding and comprehending the information, users can attain new heights of productivity. Complex problems that once took weeks or months to complete, now take only seconds or minutes when employing software capabilities. In many cases, analyses that were impossible to even contemplate are now quickly and easily completed, and their results have yielded major advancements in the industry and the world.

This keynote address will discuss and demonstrate how commercially available software tools are currently used by the aerospace and defense communities to make missions and programs a reality. Six major themes will be discussed with each demonstrating examples of real-world success stories such as those highlighted below:

Defense and intelligence programs – Command centers worldwide use the Constant Sentinel software system to depict the location and status of surveillance assets and the targets they generate. All fused into a single coherent display, the situational awareness provided helps commanders allocate resources, spot trends, and make decisions faster than our enemies can react.

Anomaly resolution and deorbits – Software technology played an integral role in the explanation and visualization safely deorbiting the Mir space station. In the Moscow mission control center, different software packages were integrated to create three-dimensional animations of the reentry process and confirm astrodynamic calculations. To help the world better understand this historic event, CNN used software to broadcast 3-D animations worldwide to illustrate the entire deorbit sequence, as well as to provide a live simulation of the orientation and location of Mir throughout its final orbits, reentry, and debris break up.

Commercial space applications –Space Imaging's IKONOS 2 operations center employs the power of software within its scheduling processes to determine time periods when the satellite can satisfy requests for high-resolution imagery. Various constraints on these times, such as ambient lighting and imaging geometry, are mod-

eled with highly accurate software. This system enables Space Imaging to maximize the number of user requests that can be satisfied.

Science missions – The NASA Microwave Anisotropy Probe (MAP) is orbiting deep in space to explore the origins of the universe. This mission was the first ever to position a spacecraft at the Lagrange L2 position, at which the forces of the Sun, Earth, and Moon all balance. This condition allows the spacecraft to remain on station for a long period of time while expending very little fuel for stationkeeping. Using software to plan the sophisticated maneuvers necessary to guide MAP to this location was and still is the key to the mission's success.

Satellite navigation - The accuracy of the GPS navigation system is a time-dynamic function of the geometry between its satellites and receivers. When operations take place in mountainous areas, satellite-to-ground line-of-sight may be blocked the earth's terrain. This may result in reduced accuracy or even preventing the user from any position-fix whatsoever. Analysis software is used to calculate the accuracy of GPS navigation over time, which enables planners to optimize the precise timing of operations.

General public awareness – Two- and three-dimensional analysis tools helped investigators understand details of the September 11 terrorist attack and assess possible future countermeasures. Actual FAA radar data was used to accurately recreate the events and model the flight paths of hijacked airlines as well as the responding military aircraft. This software provided a graphical timeline of all aircraft movements to the highest levels of NORAD and US Space Command, and was used as an interactive tool for forensic examination of the associated events.

AUTHOR BIOGRAPHY

PAUL L. GRAZIANI is the President and Chief Executive Officer of Analytical Graphics, Inc. (AGI). He is one of three founders of AGI; the producer of commercially available analysis and visualization software used by more than 27,000 aerospace, defense, and intelligence professionals worldwide. Graziani started his career at General Electric Space Division in 1980, where he held a number of software and engineering roles. From 1986 to 1988, he led a significant research and development project on 3-D graphics for a large classified satellite system.

In January 1989, Graziani left GE to start AGI in his living room. He and two other founders created Satellite Tool Kit (STK), the company's flagship product. Using computer graphics to translate raw data into manageable information, STK offers a revolutionary approach to space systems analysis. Graziani served as President of AGI from 1989 to 1991, and then assumed the role of Chief Technology Officer. He has served as President and CEO from 1994 to the present.

In the 13 years since AGI's founding, Graziani has been integral to raising $3 million in equity investment and more than $1.5 million in debt financing for the company. The employee ranks have grown from the three original founders to nearly 120 employees in the Malvern, PA, headquarters and six field offices in the United States and abroad. The product line has grown to include a full suite of flexible, integrated software developed by AGI and a team of business partners to meet the needs of space, defense, and intelligence professionals. STK has been widely embraced by leading government, commercial, and educational organizations and has become the de facto industry standard throughout the world for space systems software.

Graziani has received recognition and awards from business and space organizations including Ernst & Young Entrepreneur of the Year regional finalist; American Institute of Aeronautics & Astronautics (AIAA) Greater Philadelphia Section Aerospace Professional of the Year; and SpaceVest CEO of the Year. He also holds one patent. The company Graziani leads—AGI—has also earned numerous honors such as being included in various "fastest growing" lists; ranked in the Top 100 U.S. desktop software firms; singled out as one of the Top 50 space companies in the world; and lauded as one of the 25 best companies to work for in America.

Graziani serves on the board of directors of the Space Foundation, Colorado Springs, CO, and Megadata, Bohemia, NY, as well as the advisory boards for the Galaxy Explorers and Penn State Great Valley. He earned his B.S. in Biology from LaSalle College in 1980, and resides with his wife and three children in Wayne, PA.