Success Story

Advanced Visualization for Improved Urban Security

The Challenge:
Improve urban security operations by ensuring that security planners and other key personnel have access to the most accurate and up to date information regarding the urban environment

The Solution:
Powerful SGI® visualization hardware combined with Harris RealSite™ virtual urban cityscapes and InReality™ viewing software to enable planners to view a highly accurate virtual representation of an urban environment in real time

The Result:
Security planners can locate personnel and security monitoring equipment, choose routes for motorcades, and respond to myriad security-related events with greatly improved effectiveness using the latest information displayed as part of a highly accurate and realistic 3D representation of the urban environment

In the wake of the 9/11 terrorist attacks, urban and metropolitan area security has become increasingly important. Security planners for high-profile events such as gatherings of world leaders are turning to advanced visualization technology to improve their preparedness.

The power of this technology was displayed at the Summit of the Americas held in Quebec City, Canada, in April 2001. This gathering of 34 international leaders was the largest security operation ever undertaken by the Canadian government.

During the summit, Canada's Defense Research Establishment Valcartier (DREV) demonstrated a unique set of tools for three-dimensional situational awareness developed by Florida-based Harris Corporation's Government Communications Systems Division (GCSD) and powered by computer equipment provided by SGI. An accurate and highly realistic three-dimensional virtual cityscape of Quebec City was created using Harris RealSite and InReality software. This realistic digital model of the city was exhibited to security planners in the command-and-control center as they went about their work deploying monitoring equipment and personnel and tracking developing events.

According to Major Michel Gareau, military advisor for DREV, "DREV was pleased to demonstrate the potential of advanced command-and-control systems at the Summit of the Americas. Situational awareness is critical to operational success and it was clear to all participants that this technology can have a big impact. Harris and SGI products worked flawlessly, and security personnel were impressed with the rapidity and level of detail this solution provided. Anyone who entered the command center was immediately attracted to the large-scale projected display of the city."

The flexibility of RealSite and InReality software, including the ability to view an urban environment from any perspective, accurately calculate distances, and determine heights, is attracting the attention of a wide variety of organizations

"DREV was pleased to demonstrate the potential of advanced command-and-control systems at the Summit of the Americas. Situational awareness is critical to operational success and it was clear to all participants that this technology can have a big impact. Harris and SGI products worked flawlessly, and security personnel were impressed with the rapidity and level of detail this solution provided. Anyone who entered the command center was immediately attracted to the large-scale projected display of the city."

—Major Michel Gareau, Military Advisor for DREV

involved in urban security planning, scene familiarization, ongoing security monitoring, and mission simulation. Since the Summit of the Americas, Harris has been engaged by a number of metropolitan areas and government agencies to perform similar work. Harris's unique approach to visualizing urban geographies, combined with the compute and graphics power of SGI systems, are the keys to unlocking these capabilities.

RealSite: Creating Realistic Virtual Cityscapes

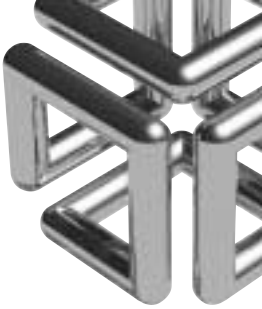
Traditional approaches to urban modeling rely on labor-intensive manual reproduction of the physical features of an urban area using architectural software or similar tools. This approach is extremely time-consuming and—as a result—often prohibitively expensive. The resulting models are prone to inaccuracies and often don't reflect the real appearance of the urban environment—making them impractical for many applications.

According to Joe Nemethy, product manager for RealSite, "Harris has developed a technique that largely circumvents the traditional manual process of urban modeling. Using satellite imagery or aerial photography, we create geospatially accurate and highly realistic virtual cityscapes for our customers. Customers may either purchase an existing model from the growing RealSite library or contract with Harris to create a custom digital representation of the area of interest. In either case, the customer receives a finished product that they can begin using immediately."

The key to RealSite's accuracy and efficiency is the use of multiple photographic images as inputs. Overlapping images are matched, allowing the height of each structure or building to be computed with high precision. Accurate representations of building shapes are then generated automatically by the software.

Imagery from photographs is used in the virtual cityscape as much as possible to ensure accuracy and realism. This requirement makes graphics systems like SGI® InfiniteReality4™, with 1GB of onboard memory to store image details, highly desirable for the display of large cityscapes. Interactivity while viewing a complicated environment is enhanced through the use of a Harris patented clip-mapping process to manage the high-resolution imagery needed for visualization. The resolution of imagery on a displayed cityscape is automatically adjusted to provide an optimal level of detail. High-resolution imagery is used for close-up views, while lower-resolution images are used for structures viewed at a distance.

According to Nemethy, "The entire RealSite model creation process for the Summit of the Americas, covering 4 square kilometers of the city with terrain extending to 10 square kilometers, was completed in



"The entire RealSite model creation process for the Summit of the Americas, covering 4 square kilometers of the city with terrain extending to 10 square kilometers, was completed in only three weeks using an eight-processor SGI Onyx 3200 system to render the model."

—Joe Nemethy, Product Manager for RealSite

only three weeks using an eight-processor SGI Onyx 3200 system to render the model. The Canadian government commissioned aerial photographs of the downtown area; pictures were taken at oblique angles to provide improved imagery for the sides of buildings. The result was a very accurate and realistic representation of the city."

Today, Harris uses the computing capability of its commercial image processing facility in Melbourne, Florida, to produce its RealSite models. This facility features an eight-processor SGI® Onyx® family system for compute and visualization and a 28-processor SGI® Origin® system for the most complicated rendering. The facility also has over 12TB of SGI storage to accommodate vast quantities of images and models.

InReality: Advanced Situational Awareness Capabilities

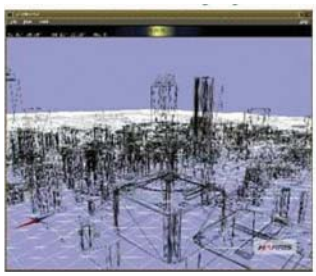
A completed virtual cityscape can be output in various formats compatible with most leading graphics applications. Harris created its InReality viewer, based on standards such as SGI® OpenGL Performer™ and MPI OpenFlight®, to meet many of the specific needs of urban security personnel. Harris offers two versions of InReality—a high-resolution version running on the SGI Onyx family platform and a Windows® OS-based version available for desktop systems and laptops that offers a simplified cityscape and fewer features. At the Summit of the Americas, an eight-processor SGI® Onyx® 3200 system was exhibited in the command-and-control center, providing the computational and graphics capabilities to view the entire cityscape in great detail. Although not available at the time, SGI now offers Visual Area Networking (VAN), giving users the ability to share high-resolution imagery created by Onyx family systems with less capable systems at dispersed locations, to increase coordination between groups and enhance command and control.

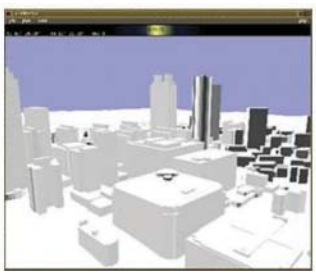
An important requirement for situational awareness is the ability to navigate a cityscape controlling the viewpoint and location smoothly and intuitively. InReality viewer software features built-in navigation controls that allow a user to "fly" to a desired point of view. For example, a user at one end of the city, on the top of a roof, can click the mouse on his or her current location and drag a line-of-sight to another building that might be several blocks away. When the mouse is released, InReality uses camera motion to fly to the new location. A user can also record a path for later playback. These movies can be used to record the chosen path of a motorcade or for other training and familiarization purposes. As users work with a model, they have the option to create a variety of annotations to note the position of important features, vehicles, equipment, and personnel.

Because RealSite is geospatially accurate to within 1 m, InReality also provides advanced measuring capabilities. A user can interactively measure between any two points and get an instant readout of distance and location. This feature can be used to easily find the height of a building, the length of a stretch of highway, or the distance between two roof tops (along with line-of-sight information) to assist in placement of monitoring equipment, communications equipment, and/or personnel.

SGI Onyx Systems Deliver Unparalleled Visual Realism

The SGI Onyx family platform delivers the real-time immersive visualization capabilities that make a command-and-control center with Harris RealSite models and InReality Viewer come to life. The patented NUMAflex™ architecture of SGI Onyx systems allows a system to be tailored to the specific needs of the application, with a balance of compute and graphics capability. Because of their design, Onyx systems have a unique ability to scale in place to accommodate





growth and changing requirements. A single system can be configured to drive multiple displays, or the output from multiple graphics pipes can be used to create a single view with extremely high resolution and interactivity.

SGI® Reality Center™ facilities couple SGI Onyx family systems with large-scale immersive display environments such as freestanding desk displays, wall displays, or room displays in which outputs can be projected on multiple surfaces. Reality Center creates an immersive environment where individuals or teams can gather to absorb themselves in the details of a virtual cityscape to improve situational awareness and facilitate security planning.

Innovation to Meet Future Requirements

While RealSite and InReality coupled with SGI hardware already provide significant benefits for urban security applications, development is continuing. The ability to automatically update the location of vehicles based on GPS data is one feature that is currently being added. The ability to replace static imagery with data from live video, such as that gathered by an unmanned aerial vehicle is also being investigated.

Harris is looking at new ways of acquiring high-resolution data to increase the functionality and scope of its virtual cityscapes. For example, in many situations, security personnel would like to have information about the insides of buildings and parking structures. They may also want to know what's beneath buildings and streets (sewers, etc.) or be able to view underwater details to improve port security. Harris is currently researching ways to incorporate information from diverse sources—including original plans and blueprints and information obtained with ground-penetrating and water-penetrating LIDAR—into RealSite.

SGI is also developing products that will have immediate benefits for users of RealSite models and InReality. As mentioned above, VAN allows the advanced graphics output of an Onyx family system to be viewed in real time by inexpensive clients such as laptops and wireless tablet computers. A remote user can have complete control of InReality running on an SGI Onyx system, or the image can be viewed by multiple systems with shared control. Using this capability, a person working in a command-and-control center with the latest situational information can share visual information with remote personnel. This might be used to show the location of a developing situation (such as a riot) along with the best route options to avoid the conflict.

SGI is also working with Harris and other partners to develop a solution for decision support and communications called the Threat Operation and Training Center (OTC). The OTC is a decision-making tool that is a unique combination of computing, graphics, and display technology designed to provide faster time to insight. The OTC is being designed to provide a command center for a sustained response to a large-scale crisis, as well as to provide a continuous training environment to assure preparedness. Based on SGI Reality Center products and technology, the OTC will collect and fuse 2D and 3D data from multiple sources and enable decision makers to analyze, predict, and review actions for rehearsal and operations.

An Alliance for Success

Because of the increased importance of security in the post-9/11 world, SGI and Harris have formed an alliance to develop solutions to enhance homeland security. SGI brings to the relationship unparalleled experience with high-performance computing, immersive visualization, advanced software development, and the management of large data sets. SGI has extensive experience in the design and deployment of computing infrastructures to take advantage of these capabilities. Harris's GCSD produces and supports state-of-the-art, highly reliable communications and information systems that solve the mission-critical communications challenges of military and government customers. Together, SGI and Harris have an immense range of experience and capabilities to effectively harness technology for improving urban security.

Innovation

sgi®

Corporate Office
1600 Amphitheatre Pkwy.
Mountain View, CA 94043
(650) 960-1980
www.sgi.com

North America 1(800) 800-7441
Latin America 1(650) 933-4637
Europe (44) 118.925.75.00
Japan (81) 3.5488.1811
Asia Pacific (65) 6771.0290

3422 (2/14/2003)

J14171