Success Story

SGI Helps TerraPoint Measure the Earth with Precision

At the Texas headquarters of TerraPoint, a group of visitors from Mitsubishi Corporation in Japan, wearing stereo CrystalEyes® goggles, gathers before a Silicon Graphics® Octane® workstation. They need precise digital measurements of the entire city of Tokyo, including the tiny lanes and buildings of the old city, from which they will derive the data-mapping products they offer their customers. They're interested in TerraPoint's precise digital models of terrain and urban landscapes, but they have doubts about its ability to resolve the details they want. Then the workstation screen displays a high-level view of a model of New Orleans, Louisiana. The operator uses the mouse to fly the visitors down into the French Quarter, and the group suddenly finds itself looking into an alley so narrow that one could easily touch both walls simultaneously. There is an appreciative intake of breath from the visitors.

Mitsubishi and Japan Space Imaging: Tokyo in Detail

TerraPoint light detection and ranging (LIDAR) data is highly desirable for building 3D urban simulation models. It provides approximately 450,000 data points per square kilometer, with typical accuracy of 60 cm or better in the XY plane and 30 cm or better in the vertical dimension. Space Imaging recently pointed out to its foreign affiliates that where U.S. Geological Survey data is not available, LIDAR data could be a more efficient solution than stereo-pair analysis for building digital elevation models. Mitsubishi Corporation's Satellite Information Systems Unit hired TerraPoint to map all of the urban areas of Japan for its 3D project. Mitsubishi will sell LIDAR-derived data products to a variety of clients, including Japan Space Imaging, which serves customers in automotive, government, and other markets.

"We're very impressed with the quality of TerraPoint data," said Aki A. Yamaura, general manager of the Satellite Information Systems Unit of Mitsubishi. "It gives us a very attractive product to offer to our clients for use in a number of applications, including telecommunications, television, and entertainment."

TerraPoint: High-Fidelity Digital Earth Surface Data

TerraPoint LLC, a Transamerica Group company, was formed to convert LIDAR technology developed by NASA and the Houston Advanced Research Center to commercial applications that deliver precision digital terrain data. TerraPoint Airborne Laser Topographic Mapping System (ALTMS), carried along a flightline at 140 knots by a dedicated twin-engine aircraft, directs 20,000 laser pulses a second to the ground from a height of 3,000 feet. The pulses are reflected back to the aircraft by ground features. The ALTMS measures with great precision the time it takes for each pulse to return to the aircraft. Onboard systems record the LIDAR terrain data, global positioning systems (GPS) data, and data from a highly sophisticated inertial measurement unit (IMU).

On the ground, LIDAR, GPS, and IMU data from the flightline is downloaded to a pair of SGI® Origin® 200 servers. TerraPoint runs internally developed postprocessing software on the SGI Origin 200 servers to merge the three inputs into a single data set. The GPS data fixes the aircraft's geographic position in the XYZ planes; the IMU data describes the aircraft's pitch, yaw, or roll. Together they provide a precise measurement of ground features that has attracted customers worldwide whose businesses demand high-resolution modeling and mapping of terrain features.

The SGI Contribution: Compute Power, Throughput, and Massive Storage Capability

TerraPoint projects generate huge amounts of data. "For a 20-mile-long flightline, you're probably talking about a gigabyte of data," says TerraPoint Data Processing Manager Dan Phillips. "We can have 16GB per day coming into our shop for processing. We flew the entire state of Connecticut, about 5,000 square miles; that data is absorbing a terabyte of storage." "We need a very high-end processing system to handle these big data sets," says TerraPoint President Dan Cotter, who became used to big geographic databases during his 11 years with the U.S. Federal Emergency Management Agency. "Draw times are important. The labor cost of visual quality control becomes significant if you have to wait 10 or 15 minutes. So rendering speed is one reason why we acquired SGI technology." TerraPoint currently operates two SGI Origin 200 servers and uses 12 Octane workstations and 12 Silicon Graphics® O2® workstations for image processing. The company has just acquired an additional 4TB SGI® Fibre Channel RAID for a total of 6TB of storage, which is deployed in a storage area network environment to provide high-speed data access between the servers and the workstations.

TerraPoint uses the image-processing capabilities of its SGI® IRIX® OS workstations to demonstrate its technology by running dramatic 3D fly-throughs in ESRI ArcView. "This is an important SGI capability," says Phillips. "Visitors realize that we're not showing them a canned presentation, but that SGI provides the ability to move through 3D data in real time."

Refining the Data on SGI® Origin® Family Servers

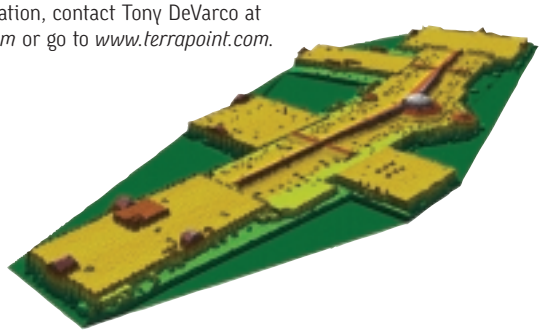
The one-meter-diameter footprint of the TerraPoint LIDAR pulse may be reflected partly from the ground, a building, a tree, or some other surface. The ALTMS can record up to four different returns for each pulse, and the compute power of the SGI Origin 200 servers is needed to process these signals into useful form. "We use our software and the SGI Origin 200 servers to derive a bare-earth model from these multiple return signals," says Senior Applications Developer Dr. Aiju Ding, who developed TerraPoint feature extraction algorithms. "We then use SGI Origin 200 to extrude the aboveground features. Apart from a final quality-control check, this process is entirely automated." The technique produces very crisp cityscapes such as those displayed here.

TerraPoint can deliver data to its clients in a variety of file formats that are viewable with many off-the-shelf software packages, including ESRI ArcView, Bentley Microstation, ERDAS Imagine, SpectraPrecision TerraVista and TerraModel, and Autodesk AutoCAD.

The Future: Leveraging SGI Technology

TerraPoint selected SGI technology for its throughput, massive storage capability, and compute power. But SGI will play another critical role in TerraPoint's growth. Much of TerraPoint's future business will come from customers in overseas markets who need orthorectification data to enhance satellite and other aerial imagery. And because all of the Space Imaging ground stations around the world use SGI technology, TerraPoint will be working closely with SGI during its expansion. "We want to set up regional data processing centers," says Steve James, vice president of International Operations for TerraPoint. "We're very interested in working with SGI and its vendors to provide orthorectification support for imagery and photogrammetry providers." The power of the SGI platform gives TerraPoint the ability to exploit its technology more fully and to increase its competitive edge worldwide.

For more information, contact Tony DeVarco at *tdevarco@sgi.com* or go to *www.terrapoint.com*.



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