THE American Surveyor
A FOOT IN THE PAST... AN EYE TO THE FUTURE
November 2007

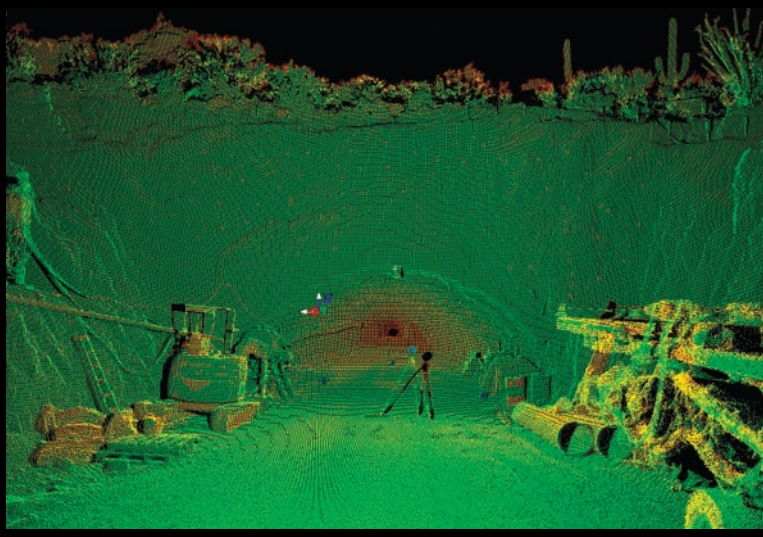
The Quad Father

Trimble Sweden
A visit to the factory

Surveying Art
Seattle artist takes to grids

New Scanning Technology
There's info between the shots

Riegl Z360 scanner at tunnel entrance to Saguaro Ranch



Scan of tunnel entrance

Surveying Revolutionized

Surveyor Richard Darling's company purchased their first scanner, a Riegl Z360, in 2002 to assist a luxury home developer in creating a unique entrance into the Saguaro Ranch Master Planned Community in Tucson, Arizona. The plan was to create 3D real life dimensional models of rocks, outcrops, and other topography for architects and builders. The developer wanted the entrance to be an incredible tunnel through a beautiful mountain into the magnificent saguaro forest where his multimillion dollar lots were to become the homes of celebrities, famous athletes, Fortune 500 business owners, and others. Darling bought the 3D laser scanner to provide the developer and the tunnel contractor with the additional information necessary to speed up the tunnel construction process and get it right the first time.

Darling continued to utilize scanning for topography, but soon needed a longer range scanner to monitor three miles of cliff before, during, and after underground mining in central Arizona, so they purchased an Optech ILRIS 3D scanner.

>> By Marc Cheves, LS

Leica ScanStation at New Mexico's El Malpais National Monument

Scan of El Malpais' historic ruins

with True Color 3D Scanning

The Optech reaches to approximately 1200 meters, colors the point cloud using a 6-megapixel camera, and provides the long range necessary for large projects.

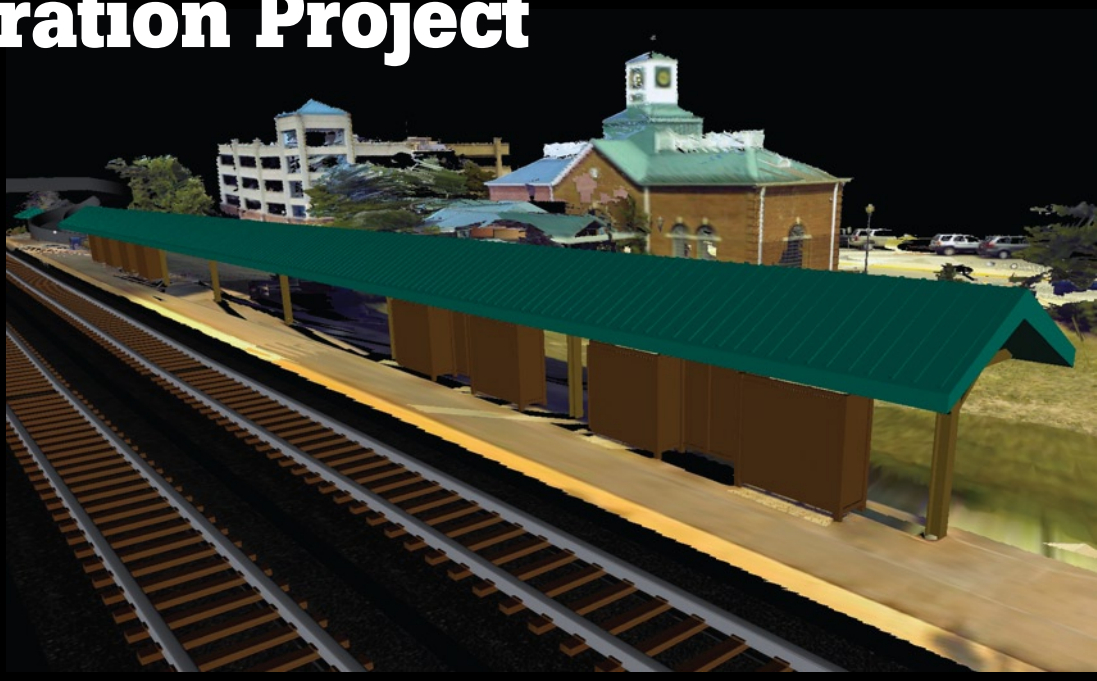
Darling then had a need for a scanner that could also be used to gather accurate survey control for forensic and industrial plant work so they added a Leica ScanStation to their tool bag. The ScanStation produces clean point cloud data and has point cloud coloring via photographs. It also has the ability to register the data in the field with excellent results, which reduces post processing time.

What was missing for many projects Darling worked on was the ability to "wrap" color high-resolution photographs onto a mesh. They were providing clients with extremely accurate, very rapid data acquisition, but the colors were RGB from ambient light or photographs. Darling had scanned a wide variety of subjects – the historic San Xavier Mission, the petroglyphs at Malpais archaeological ruins, cracks on historic buildings, highways, bridges, and much more – but they could not perfect the color details in a 3D world.

Then came InteliSum, Inc. (ISI) with its state-of-the-art 3D scanning technology that adds a 28-megapixel camera and true color/texture around each LIDAR point. ISI has patented the Life Dimensional/3D (LD3) system in which each pixel (Inteli-Pixel™) has the visual quality of a digital photograph, XYZ coordinate values, and a GPS position. Though Darling had seen some attempts by other software manufacturers to drape color over LIDAR point clouds, the clarity had always been lost until ISI LD3 technology was available.

Darling now provides clients with true color and texture 3D GPS controlled data for historical and prehistoric buildings

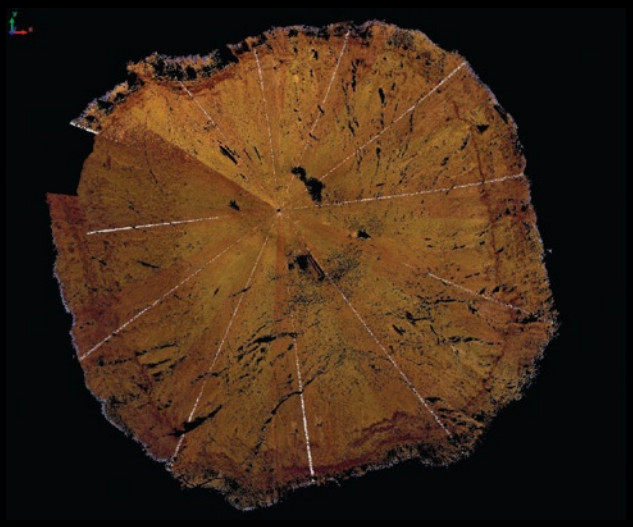
Demonstration Project



In a demonstration project for the DC-area's largest firm, Dewberry Inc., InteliSum employees gathered data on the Virginia Railway Express station in Woodbridge, Virginia. The work was performed to support the design of a pedestrian walkway from the parking garage over the railway. Once all the scans were stitched together, intelligent information could be derived for any pixel in the scene.

InteliSum co-founder and CTO Bob Vasisth explains how the technology works to Dewberry Senior Land Surveyor Joe Betit.

Optech scanner in Meteor Crater, Arizona

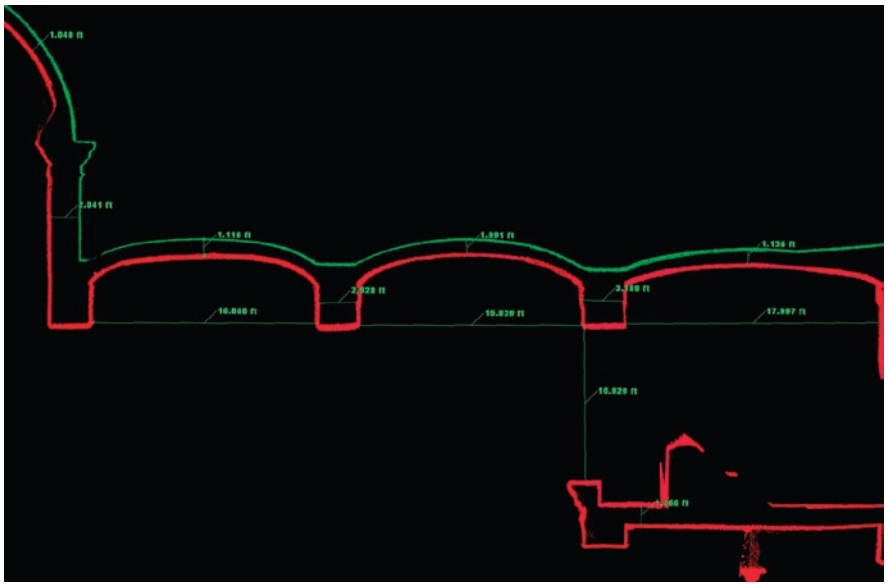


Scan of meteor crater

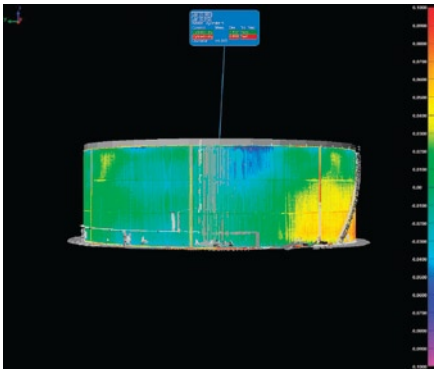
Point cloud of San Xavier Mission

and art work, geologic features, architectural structures, airports, stadiums, race tracks, power plants, water canals, and more. And new doors continue to open. Darling recently had the opportunity to work with scientists from NASA, scanning Meteor Crater. Following the project, they received this note:

"*Just wanted to express my profound thanks for your professionalism and can-do attitude. The experience of your team and the 110% application of it under less than kind conditions at Meteor Crater were outstanding. Hats off to Rich, Ryan, Curtis, and Mark for going full out to achieve a quality outcome for*



Cross-section of scan at San Xavier Mission



Geometric Dimensioning & Tolerancing

our NASA customer. We look forward to completing the processing of the data and turning it into one of a kind product that should greatly benefit NASA's interests in the area of lunar analog studies. Thanks and excellent work."

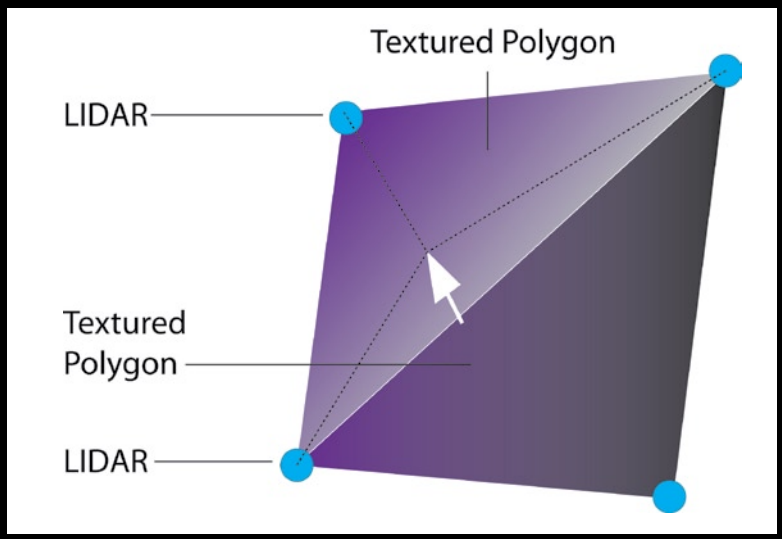
Richard B. Brown
Stennis Space Center, MS 39529

3D technology will continue to revolutionize both the survey and computer industries. Engineers will be designing more and more in 3D media as time goes on, and surveyors will be using 3D scanning to provide the data to design from as we do now in our 2D maps and as-builts. 3D scanning is just another measurement device in the surveyor's toolbox. It is not magic and it still requires a high level of understanding of basic survey measurements. The data produced is only as good as the control we attach to it.

Proof that 3D is here now and here to stay is the fact that NASA is working with Microsoft to bring 3D to Kennedy Space Center with a 3D software version of the space shuttle Endeavor. The photosynth viewer, developed by Microsoft Live Labs, will allow an unprecedented level of detail in examining the shuttle and its surrounds. As quoted on MSN.com (08/06/07), "It's much like a 3D video game - people can explore, walk around or fly around the shuttle," said Adam Sheppard, group product manager for Microsoft Live Labs.

About the Companies

Richard Darling is President of Darling Environmental & Surveying, Ltd. In Tucson, Arizona. The company has recently formed a strategic alliance with **InteliSum, Inc. (ISI)** of Salt Lake City, Utah, with Darling providing the service and InteliSum providing the software.



HOW INTELISUM TECHNOLOGY WORKS

InteliSum's LD3 Camera captures real world objects and scenes by combining: (1) LiDAR data consisting of XYZ coordinates; (2) digital photograph data consisting of pixels containing color and grid location; and (3) GPS data consisting of longitude, latitude and altitude. With these components, the LD3 System produces an LD3 scene with intelligence, where each pixel has the visual quality of a digital photograph, an XYZ coordinate and a GPS position.

The InteliSum software system fuses LiDAR data, digital image and GPS into Inteli-pixels through control, logging, co-registration, concatenation, transformation, and compilation processes. Multiple views of an object, scene or site are compiled to produce the LD3 scanner files. Each LD3 file contains the geographic coordinates and attributes of a site allowing its spatial relationship to the real world site and other LD3 data sets to be assessed. InteliSum has developed its patented interpolation technique by implementing ray tracing algorithms. In order to assign XYZ values to each pixel in the digital image, ray racing is used to calculate the intersection of each image pixel at a point of interest, allowing 3D data to be accurately quantified at any location in between LiDAR points.

A new application made available with ISI technology is called, "Desktop Surveying." Desktop Surveying is the ability to perform traditional field survey activities in the office using a desktop computer. Since all survey-related information required for a project is embedded in each Inteli-Pixel, design iterations and decisions can be made in a time/cost efficient manner with high accuracy.

InteliSum's software suite consists of four components: Viewer, Executive, Designer and Modeler. LD3 Viewer is a free software application, which can be shared along with LD3 files in order to view LD3 photos, wire frame and point cloud data in 3D. LD3 Executive incorporates 3D survey tools into the Viewer functionality, along with the ability to create annotations and save JPG files. LD3 Designer and LD3 Modeler provide complete functionality for desktop surveying, data manipulation, 3D object insertion and co-registration of datasets.

InteliSum's unique ability to fuse LiDAR-derived XYZ coordinates, GPS information and RGB data into each and every pixel of its life dimensional imagery is a revolutionary step forward in laser scanning and surveying. This imagery supports rapid, accurate, cost-effective survey and 3D modeling. As a result, clients are able to obtain information in greater detail, with higher accuracy and at lower cost than traditional laser survey and 3D modeling.