



Editorial

>> Marc Cheves, PS

Take It to the Limit

FARO User Conference

The FARO user conference was excellent, in part because of the outstanding line-up of speakers. With nearly 300 attendees (more than expected), the first annual event was an unqualified success. In his Introduction to 3D Documentation, FARO's Chief Technology Strategist Bernd Becker stressed that even though the work products can be beautiful, they're not art, but rather reality. The reality theme echoed through the entire conference. Becker also discussed the FARO's latest software products, including its new octree database. This database will allow the loading of four billion points in 10 seconds.

Of particular note in the presentations was one on 3D Printing by Abe Reichental from 3D systems. This technology has rapidly dropped in price, is being used in primary schools, and is attracting both boys and girls. Reichental believes 3D printing will give children a better future, and indeed, will no longer limit creativity to artists. By introducing children to CAD modeling, we will be producing the spatially-enabled workers of tomorrow. He added, this technology will encourage entrepreneurs and garage-startups. I was shocked to learn that these printers can now print metal through a process known as sintering. They can even print using chocolate!

Also of note was a keynote by Tom Kurke of Geomagic on intellectual property. It seems that, in some cases, scanners need to obtain permission before scanning. Takeaways were: 1) ask questions (who, if anybody, owns the copyright? Buildings built after 1990 are copyrightable), 2) if possible, transfer liability, and 3) double check before scanning scenes in which sculpture or art appears. It seems that, once again, technology has outpaced the law, but the operative word is: CYA.

Gonzalo Martinez from Autodesk discussed the democratization of data and gave a great example of what cloud computing will bring: today, 1 computer might take 10,000 seconds to derive an answer at a cost of 25 cents. Tomorrow, using the cloud, 10,000 computers will take one second, still at a cost of 25 cents.

Notwithstanding his recent appointment as CEO of CyArk, the organization heavily involved in heritage preservation, Tom Greaves spoke about new technologies such as low-powered handheld technology that uses radar and other sensors to see thru walls. He mentioned the coming explosion in indoor mapping with \pm centimeter resolution, and said that this will be a ten times larger market than outdoor mapping. He discussed the explosion of 3D video and we learned that the inexpensive Kinect from Microsoft is being used for facial recognition. We also learned that 3D modeling is being used to replace traditional wind-tunnel testing and automobile crash testing.

Speaking about CyArk, Greaves said one of the initiatives is an outreach to children, in an effort to get them "off the television screen." With computer gaming, he said the challenge is competing for their minds. In a follow-up conversation with Greaves, he said he sees a growth in the need for 3D professionals. This new career requires not only surveying and metrology knowledge, but also skills in modeling, photography and photogrammetry, IT skills for such things as database management, and project management. These, plus "domain expertise" in such fields as automotive, transportation, civil works such as water treatment plants, or other disciplines will result in great demand for this new kind of well-rounded professional.

And as for the success of FARO's Focus 3D scanner, I learned that there had been a six-month delay in delivery of units. I asked Becker (whom I wrote about in 2004: http://www.amerisurv.com/PDF/TheAmericanSurveyor_Cheves-VisitToFARO_March2007.pdf) about the delay and he explained that orders were much greater than anticipated. Not a bad thing in my opinion, and evidence that the scanning market is very healthy.

To give you an example of the types of attendees, I sat in on a Forensic session. The presenter asked the audience how many of them were already involved in using



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PUBLISHER Allen E. Cheves
allen.cheves@chevesmedia.com

EDITOR Marc S. Cheves, PS
marc.cheves@chevesmedia.com

ASSOCIATE EDITOR Joel Leininger, PS
ASSISTANT EDITOR Jacalyn Cheves
ASSOCIATE PUBLISHER Jason Metsa

CONTRIBUTING WRITERS

Joe Betit, PS	Jerry Penry, PS
Shawn Billings, PS	Al Pepling, PS
J. Anthony Cavell, PS	Walt Robillard, Esq., PS
C. Barton Crattie, PS	Fred Roeder, PS
Dr. Richard L. Elgin, PS, PE	Angus W. Stocking, PS
Gary Kent, PS	Patrick Toscano, PS
Wendy Lathrop, PS	John Wilusz, PS, PE
Dan Martin	Robert Young, PS
John Matonich, PS	Rj Zimmer, PS

The staff and contributing writers may be reached via the online Message Center at amerisurv.com

GRAPHIC DESIGN LTD Creative, LLC
WEBMASTER Joel Cheves

AUDIENCE DEVELOPMENT Edward Duff
ACCOUNT EXECUTIVE Richard Bremer

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scanning for forensics. Nobody raised their hand. Next he asked how many were involved in prosecution. Again, nobody raised their hand. This told me that the audience was composed of scanners who were looking to expand their offerings by branching out into accident and crime scene investigation. My point is that people are getting into scanning and are looking at ways to do more.

And as I've been saying for years, it's not enough to just buy technology. You need the right people and a top-down commitment to finding ways to make money with technology. With land development in the toilet, it's incumbent on surveyors to find other ways to make money, and scanning is certainly one of those ways. One of the most exciting presentations to me showed how companies are using scanning during construction. If something, say, a pillar, is built in the wrong place, and it can be caught at the right stage, it can eliminate all kinds of re-work costs.

UltraCam User Group Meeting

We used to say, "The sky's the limit." But boundaries continue to be pushed. Following the International LiDAR Mapping Forum held in January in Denver, I drove to Boulder to attend the Microsoft UltraCam User Conference. Held in Microsoft's beautiful Bing building downtown, the event was attended by more than 30 UltraCam sensor users. I was honored to be in the same room with the guys who fly the planes and process the deliverables.

What amazing progress in less than a decade! We were in attendance at the ASPRS annual show in Anchorage in 2003 when the first UltraCam camera was introduced by Vexcel. The introduction created a buzz because the first camera was priced at roughly half of the competing Zeiss and Leica cameras. With its latest offering, the UltraCam Eagle, the company has come a long way as far as what the camera and software will do. And digital photography brings with it something film can't: dynamic range. That is, with film, dark areas are dark, period. With digital images, you can "see into the shadows," making a greater amount of information available.

Alexander Wiechert, Microsoft Business Manager for the Vexcel Imaging subsidiary that develops and distributes the UltraCam products, and Michael Gruber, Chief Scientist gave the opening presentations. Wiechert provided a short

history of the evolution of the camera since 2003. By 2006, the company had sold 47 cameras, by 2008, 101, and as of January of this year, 213. If you count upgrades to existing cameras, the total is 258. Wiechert said the company estimates it has a fifty percent market share of digital photogrammetric aerial cameras on a world-wide basis. The first U.S. customer for the UltraCam Eagle, introduced at ASPRS last May, is Keystone Aerial Surveys Inc. In all, 14 UltraCam Eagles have been sold world-wide.

With each succeeding model, the resolution of the cameras increased. The first had a PAN image footprint width of 9,000 pixels, but the UltraCam Eagle has a PAN image footprint of more than 20,000 pixels across the flight strip. When the aerial digital cameras first came out, people were concerned with adequate data storage and ample speed to transfer the digital information to the storage device. As always, technology improved, and those concerns are no more.

The UltraCam Group has established a business model that helps to supply Microsoft's Bing Maps with up-to-date imagery. In response to an inquiry from me about industry rumors surrounding camera pricing, Jerry Skaw, UltraCam Sales and Marketing Manager, said, "UltraCam customers that are selected to support the Bing Maps Global Ortho imagery program are "loaned" non-commercially-available versions of the UltraCam, the UltraCamG. They are paid for their services. The only tie to the commercial UltraCam business is that being an experienced UltraCam user (and owner) is a requirement."

The UltraCam Eagle sports all kinds of improvements including the UltraNav FMS/GPS/INS, or direct georeferencing and flight management system. Vexcel Imaging partnered with Applanix on the development of the OEM product, and everything is now integrated. Joe Hutton from Applanix explained that the new IMU will require less ground control points, and that future GNSS signals will allow $\pm 2\text{cm}$ robust positions in the air. Just like surveying equipment, cables can be a weak link, and in an effort to improve overall system reliability, most of the cables connecting system components have been eliminated with the new integrated design. Although testing is still taking place, the company states that at an 800 meter flying height, a 5cm GSD can be achieved. Because

of flying height restrictions in parts of the world, the standard 80mm lenses can be replaced with 210mm lenses. The two different lens systems allow customers the versatility to fly low-altitude and high-altitude projects.

Gruber discussed how the camera design has improved over time. Early models, in addition to the plethora of cables, had 14 computer boards: the Eagle has two. This helps reliability. Starting with the UltraCamLp model, UltraCam systems have shifted towards solid state storage. Gruber explained how the camera's nine CCDs work, and claimed that the UltraCam approach is superior. In addition to PAN data, four of the sensors gather red, green and blue, and infrared. With its 20K by 13K CCD sensors, each image is 260 Megapixels.

Something else that impressed me at the UltraCam event was the soon-to-be-released UltraMap 3.0 software. Microsoft has found a way to generate point clouds from the digital image, and the attendees saw impressive applications. In talking with some of the attendees, I learned that this capability will not replace traditional aerial LiDAR because it doesn't deliver the same kind of product, but, at densities of up to 300 points per square meter versus a handful per m² with traditional LiDAR, I'm sure it'll have applications. To achieve the density, the software uses a "multi-ray" photogrammetric approach to match pixels from 12 "looks" at the ground. Wiechert claimed that this capability could replace traditional aerial LiDAR, but admitted that the traditional approach is better for such things as power lines and seeing thru forest canopy. Wiechert said, "Some traditional LiDAR applications will remain the domain of LiDAR while others may be served more efficiently by our photogrammetric approach." Skaw added, "This is an industry changer. Some LiDAR-served applications will go to the photogrammetry bucket, but not all. Some will stay in the LiDAR bucket."

Also new in UltraMap 3.0 will be digital surface models, created directly from the dense point clouds produced from the image. Wiechert claims the results are highly accurate, edges are sharp, and even complex scenes such as roof structures or tree canopies are highly detailed.

Digital aerial photogrammetry has come a long way. And with companies like Microsoft and its Vexcel Imaging subsidiary, the sky's not the limit anymore. 