



# editorial



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## Knowing What We Don't Know

I recently attended the Teledyne Optech Imaging & LiDAR Solutions conference in Toronto. The well-attended meeting showcased much of what we covered in the 3D *Pioneers* article our April 2014 issue. Of particular interest to me in that article was how, under the tagline *Everywhere You Look*, the synergy between Teledyne and Optech continues to provide multiple benefits for customers.

In his keynote, Lewis Graham, owner and CTO of GeoCue Group, discussed the implementation of unmanned aerial systems and made a very salient point: when pitching the idea to a client, it's not enough to demonstrate that costs will be the same with replacement technology. The only way to make a client abandon established processes is to show dramatic cost savings. William Tompkinson of Insightful Dimensions in the UK informed the audience that in the UK, firms with UAV capability increased from 130 to 549 in 18 months, and that France and Canada alone have more than 1,000 commercial operators.

Perhaps borrowing from the title of the Don Rumsfeld book, *Known and Unknown*, Don Carswell, president of Teledyne Optech, gave a fascinating keynote about the dangers of thinking nothing will ever be needed, or that we have reached limits. He used the famous quotes from Edison saying we would never use AC current, and Darryl Zanuck about how television wouldn't last more than six months. Two I hadn't heard came from Bill Gates: "We will never need a 32-bit operating system," and "There's nobody getting rich writing software that I know of."

Carswell further amplified his remarks by invoking Arthur C. Clarke's famous Three Laws: 1) When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is most probably wrong; 2) The only way of discovering the limits of the possible is to venture a little way past them into the impossible; and 3) Any sufficiently advanced technology is indistinguishable from magic. Carswell said, "Assumptions about the unnecessary or impossible sometimes pervade an industry. We become limited by what we know to be impossible, e.g., flight, space travel, good government."

Carswell's example of impossible was the challenge of getting around the speed of light limitation. He credited Teledyne and its extensive R&D network with helping Optech get around the challenge. Carswell's *mea culpa* stated, "There is no need for more than 4 LiDAR measurements per square meter." In following up, I learned that today's Teledyne Optech aerial gear provides unlimited returns with lower accuracy waveform and 8 returns per square meter with high accuracy discrete technology. Carswell mentioned that, with UAVs, impossible is a rapidly moving and receding thing. Regulations are still being developed (particularly in the U.S.). Pere Molina from GeoNumerics commented that "Technology must move regulations, not the other way around." An example of this is a system developed in Germany that electronically "tethers" an aerial platform to a moving ground platform. Both platforms do what they do best, but Carswell pointed out that the FAA has specifically disallowed this approach as a way to get around the "the UAV must remain in sight" requirement.

One of the problems with terrestrial LiDAR is shadows. That is, areas occluded, or rooftops, etc. Optech has found that because aerial LiDAR does not have the same accuracy as terrestrial LiDAR, the best approach will be UAV cameras in the air using photogrammetry, and LiDAR on the ground. Even with reduced accuracy, the aerial data will still be useful for modeling in areas where there is no data at all. Carswell used as an example an open pit mine with high walls. Using terrestrial, oftentimes there are occluded areas: these can be easily picked up with a UAV. We had an article about this sensor fusion (*Open Pit Mines*) in our February 2014 issue. ■